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Airpack B.V. - Air Compressor –
Integrated Methanol and Ammonia Plant
17735-COM Technical Operating and Maintenance Manual

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Technical Operating and Maintenance Manual

Document No. 17735-59

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Integrated Methanol and Ammonia Plant

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- E Troubleshoot Local Push Button Station
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Integrated Methanol and Ammonia Plant

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Integrated Methanol and Ammonia Plant

Direct sunshine is not allowed on complete package.

Only genuine spare parts are allowed to be used on our package. Violating this rule automatically will refrain us from any guarantee, even with other defective is found than by the non-genuine part.



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Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION A

GENERAL DATA



Vendor doc. Number
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P.O. NO.:
LIDCO-PO-NEC-278-6019

Vendor:
Airpack Nederland B.V.

**INTEGRATED METHANOL AND AMMONIA PLANT**Rev.: 02
Date: 20-10-2025**GENERAL DATA**

Customer	: Lavan Industry Development Company (LIDCO)
Contractor	: Nargan Company
Agent	: HSE Group
Purchase order number	: LIDCO-PO-NEC-278-6019
Equipment	: Instrument Air Package
Equipment tag number(s)	: K-020
Airpack reference	: 17735-COM
Serial no.	: T-2023-00799
Year built	: 2023
Quantity of packages	: 1
Compressor model	: TRZ 400
Compressor outlet capacity	: 35 Nm ³ /hr
Compressor suction pressure	: 9,5bar(a)
Compressor discharge pressure	: 30 bar(g)
Power supply motor LP	: 400V / 50Hz / 3ph.
Speed e-motor LP	: 1485 rpm
Manufacturer	: Airpack Nederland B.V. Phone: + 31 111 415 455 Fax : + 31 111 413 338 E-mail : airpack@airpack.nl

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
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SECTION B

SAFETY PRECAUTIONS



Vendor doc. Number

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P.O. NO.:

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Vendor:

Airpack Nederland B.V.



The warranties agreed for this equipment are exclusive and all other warranties, whether express, oral, implied or otherwise, including but not limited to the implied warranties of merchantability and fitness for a particular purpose, are hereby expressly disclaimed. Correction of nonconformities within the applicable warranty period set forth above provides the exclusive remedies with respect to the quality of or any defect in products or services delivered or performed hereunder. Notwithstanding anything else, the total liability, in the aggregate, of seller, its affiliates, and subcontractors, and their respective employees and agents shall be limited to the price paid by the purchaser to seller for the specific product/service giving rise to the claim. Under no circumstances shall seller, its affiliates, or subcontractors, or their respective employees or agents be liable for any consequential, incidental, indirect, special or punitive damages (whether for lost profits or revenue, work stoppage, downtime costs, lost business, or otherwise), even if advised of the possibility of such damages or if such damages are foreseeable.

This equipment is designed as per agreed specifications and recommendations of Airpack Nederland B.V and is delivered 'as is'. Technical recommendations waived by the buyer and their consequences are excluded from warranty. A warranty period has been agreed in the contract and is only valid as long as:

- The product is operated at agreed design considerations;
- The product is operated and maintained as described in the operating manual supplied by Airpack Nederland BV;
- The owner uses genuine Airpack Nederland BV parts and consumables.

The warranty is limited to defects resulting from faulty design, materials and workmanship only. Normal wear and tear, misuse and improper fitting are excluded from this warranty.

If, during any warranty period the user:

- (a) makes any design change to the equipment without prior consent of Airpack Nederland BV or;
- (b) uses replacement parts other than those supplied or approved in writing by Airpack Nederland BV; or
- (c) carries out any repairs or replacements using unqualified staff;

This warranty shall, on the happening of any such event, immediately be rendered null and void.

All decisions relating to warranty work made by Airpack Nederland BV will be binding and final.

Please be aware that disregarding instructions in the operating manual, using non-genuine spare parts and making unauthorized modifications, may result in serious damage to the machine, your environment, and yourself!

All parts purchased that are claimed to be defective must be returned at the customer's risk and freight paid to Airpack headquarters.

This warranty does not cover consequential damages resulting from failure of parts or equipment or subsequent expenses or losses. This warranty is extended only to the first user of

	INTEGRATED METHANOL AND AMMONIA PLANT	Rev.: 02 Date: 20-10-2025
	Safety precautions	

the equipment purchased from Airpack Nederland BV and may not be transferred to any other person.

1 Basic operation and designation use of the machine/plant

- 1.1 The machine/plant has been built in accordance with state-of-the-art standard and the recognized safety rules. Nevertheless, its use may constitute a risk to life and limb of the user or third parties, or cause damage to the machine and to other material property.
- 1.2 The machine / plant must only be used in technically perfect condition in accordance with its designated use and the instructions set out in the operating manual, and only by safety-conscious persons who are fully aware of the risks involved in operating the machine/plant. Any functional disorders, especially those affecting the safety of the machine/plant, should therefore be rectified immediately.
- 1.3 The machine/plant is designed exclusively for the compression of the medium (air/gas) specified under "Technical data" of the operating instructions manual considered contrary to its designation use. The manufacturer/supplier cannot be held liable for any damage resulting from such use. The risk of such misuse lies entirely with the user. Operating the machine within the limits of its designation use also involves observing the instructions set out in the operating manual and complying with the inspection and maintenance directives.

2 Organizational measures

- 2.1 The operating instructions must always be at hand at the place of use of the machine/plant, e.g. by stowing them in the tool compartment or tool-box provided for such purpose.
- 2.2 In addition to the operating instructions, observe and instruct the user in all other generally applicable legal and other mandatory regulations relevant to accident prevention and environmental protection.

These compulsory regulations may also deal with the handling of hazardous substances, issuing and/or wearing of personal protective equipment.
- 2.3 The operating instructions must be supplemented by instructions covering the duties involved in supervising and notifying special organizational features, such as job organisation, working sequences or the personnel protective equipment.
- 2.4 Personnel entrusted with work on the machine must have read the operating instructions and in particular the chapter on safety before beginning work. Reading the instructions after work has begun is too late. This applies especially to persons working only occasionally on the machine, e.g. during maintenance.
- 2.5 Check at least from time to time whether the personnel is carrying out the work in compliance with the operating instructions and paying attention to risks and safety factors.

- 2.6 For reasons of security, long hair must be tied back or otherwise secured, garments must be close-fitting and no jewellery –such as rings- may be worn. Injury may result from being caught up in the machinery or from rings catching on moving parts.
- 2.7 Use protective equipment wherever required by the circumstances or by law.
- 2.8 Observe all safety instructions and warnings.
- 2.9 See to it that safety instructions and warnings attached to the machine are always complete and perfectly legible.
- 2.10 In event of safety-relevant modifications or changes in the behaviour of the machine/plant during operation, stop the machine / plant immediately and report the malfunction to the competent authority/person.
- 2.11 Never make any modifications, additions or conversions which might affect safety without the supplier approval. This also applies to the installation and adjustment of safety devices and valves as well as to welding work on pipe lines and receivers.
- 2.12 Spare parts must comply with the technical requirements specified by the manufacturer. Spare parts from original equipment manufacturers can be relied to do so.
- 2.13 Never modify the software of programmable control systems.
- 2.14 Hose pipes are subject to a quality check (pressure and visual examination) by the operator in appropriate intervals even if no safety-relevant defects have been detected.
- 2.15 Adhere to prescribed intervals or those specified in the operating instructions for routine checks and inspections.
- 2.16 For execution of maintenance work, tools and workshop equipment adapted to the task on hand are absolutely indispensable.
- 2.17 The personnel must be familiar with the location and operation of the fire exiting users.
- 2.18 Observe all fire-warning and fire-fighting procedures.

3 Selection and qualification of personnel – basic responsibilities

- 3.1 Any work on and with the machine/plant must be executed by reliable personnel only. Statutory minimum age limits must be observed.
- 3.2 Employ only trained or instructed staff and set out clearly the individual responsibilities of the personnel for operation, maintenance and repair.
- 3.3 Make sure that only authorised personnel works on or with the machine.
- 3.4 Define the machine operator's responsibilities given the operator the authority to refuse instructions by third parties that are contrary to safety.

- 3.5 Do not allow persons to be trained or instructed or persons taking part in a general training course to work on or with the machine / plant without being permanently supervised by an experienced person.
- 3.6 Work on the electrical system and equipment of the machine / plant must be carried out only by a skilled electrician or by instructed persons under the supervision and guidance of a skilled electrician and in accordance with the electrical engineering rules and regulations.
- 3.7 Work on gas-fuelled equipment (gas consumers) may be carried out by specially trained personnel only.

4 Safety instructions governing specific operational phases

4.1 Standard operation

- 4.1.1 Avoid any operational mode that might be prejudicial to safety.
- 4.1.2 Take the necessary precautions to ensure the machine is used only when in a safe and reliable state. Operate the machine only if all protective and safety-oriented devices, such as removable safety devices, emergency shut-off equipment and sound-proofing elements are in place and fully functional.
- 4.1.3 Check the machine at least once per working shift for obvious damage and defects. Report any changes (incl. changes in the machine's working behavior) to the competent organization / person immediately. If necessary, stop the machine immediately and lock it.
- 4.1.4 In the event of malfunctions, stop the machine immediately and lock it. Have any defects rectified immediately.
- 4.1.5 During start up or setting the machine in motion, make sure that nobody is at risk.

4.2 Special work in conjunction with utilization of the machine and maintenance and repairs during operation; disposal of parts and consumables.

- 4.2.1 Observe the adjusting, maintenance and inspection activities and intervals set out in the operating instructions, including information on the replacement of parts and equipment. These activities may be executed by skilled personnel only.
- 4.2.2 Brief operating personnel before beginning special operations and maintenance work, and appoint a person to supervise the activities.
- 4.2.3 In any work concerning the operation, conversion or adjustment of the machine and its safety – oriented devices or any work relate to maintenance, inspection and repair, always observe that start-up and shut-down procedure set out in the operating instructions and the information on maintenance work.
- 4.2.4 Ensure that the machine area is adequately secured.

- 4.2.5 If the machine/plant is completely shut down for maintenance and repair work, it must be secured against inadvertent starting by
- locking the principal control elements and
 - attaching a warning sign to the main switch
- 4.2.6 To avoid the risk of accidents, individual parts and large assemblies being moved for replacement purposes should be carefully attached to lifting tackle and secured. Use only suitable and technically perfect lifting gear and suspension systems with adequate lifting capacity. Never work or stand under suspended loads.
- 4.2.7 The fastening of loads and the instruction of crane operators should be entrusted to experienced persons only. The marshaller giving the instructions must be within sight or sound of the operator.
- 4.2.8 For carrying out overhead assembly work always use specially designed or otherwise safety-oriented ladders and working platforms. Never use machine parts as a climbing aid. Wear a safety harness when carrying out maintenance work at greater heights. Keep all handles, steps, handrails, platforms, landing and ladders free from dirt.
- 4.2.9 Clean the machine, especially connections and threaded unions, of any traces of oil, fuel or preservatives before carrying out maintenance / repair. Never use aggressive detergents. Use lint-free cleaning rags.
- 4.2.10 Before cleaning the machine with water, steam jet (high pressure cleaning) or detergents, cover or tape up all openings which – for safety and functional reasons – must be protected against water, steam or detergents penetration. Special care must be taken with electric motors and switch gear cabinets.
- 4.2.11 Ensure during cleaning of the machine that the temperature sensors of the fire warning and fire-fighting systems do not come into contact with hot cleaning against as this might activate the fire-fighting system of the plant.
- 4.2.12 After cleaning, remove all covers and tapes applied for that purpose.
- 4.2.13 After cleaning, examine all pipe lines for leaks, loose connections, chafe marks and damage. Any defects found must be rectified without delay.
- 4.2.14 Always tighten any screwed connections that have been loosened during maintenance and repair.
- 4.2.15 Any safety devices removed for maintenance or repair purposes must be refitted and checked immediately upon completion of the maintenance and repair work.
- 4.2.16 Ensure that all consumables and replaced parts are disposed safely and with minimum environmental impact.

5 Warning of special dangers

5.1 Electric energy

- 5.1.1 Use only original fuses with the specified current rating. Switch off the machine immediately if trouble occurs in the electrical system.
- 5.1.2 Work on the electrical system or equipment may only be carried out by a skilled electrician himself or by specially instructed personnel under the control and supervision of such electrician and in accordance with the applicable electrical engineering rules.
- 5.1.3 If provided for in the regulations, the power supply to parts of machines and plants, on which inspection, maintenance and repair work is to be carried out must be cut off. Before starting any work, check the de-energized parts for presence of power and ground or short circuit them in addition to insulating adjacent live parts and elements.
- 5.1.4 The electrical equipment of machines is to be inspected and checked at regular intervals. Defects such as loose connections or scorched cables must be rectified immediately.
- 5.1.5 Necessary work on live parts and elements must be carried out only in the presence of a second person who can cut off the power supply in case of danger by actuating the emergency shut-off or main power switch. Secure working area with a red – and – white safety chain and a warning sign. Use insulated tools only.

5.2 Gas, dust, steam and smoke

- 5.2.1 Carry out welding, flame-cutting and grinding work on the machine/plant only if this has been expressly authorized, as there may be a risk of explosion and fire.
- 5.2.2 Before carrying out welding, flame-cutting and grinding operations, clean the machine/plants and its surroundings from dust and other inflammable substances and make sure that the premises are adequately ventilated (risk of explosion).

5.3 Pneumatic equipment

- 5.3.1 Work on pneumatic equipment may be carried out only by persons having special knowledge and experience in pneumatic systems.
- 5.3.2 Check all lines and screwed connections regularly for leaks and obvious damage. Repair damage immediately. Penetrating compressed nitrogen respectively gases and cause injury and fire.
- 5.3.3 Depressurize all systems sections and pressure pipes to be removed before carrying out any repair work.
- 5.3.4 Compressed nitrogen lines must be laid and fitted properly. Ensure that no connections are interchanged. The fittings, length and quality of the hoses must comply with the technical requirements.

5.4 Noise

- 5.4.1 During operation, all sound baffles must be closed.

5.4.2 Always wear the prescribed ear protector.

5.5 Oil, grease and other chemical substances

Observe the product-related safety regulations when handling oil, grease and other chemical substances.

6 Transport of machinery and equipment (changing placed of operation)

- 6.1 For loading only use lifting gear and tackle of sufficient capacity.
- 6.2 Appoint a competent marshaller to assist in the lifting operations.
- 6.3 Lift machinery and equipment properly with suitable lifting gear and only in accordance with the operating instructions (fixing points for lifting tackle, etc.).
- 6.4 Only use suitable means of transport of adequate carrying capacity.
- 6.5 Fasten the loads safely using the suitable fixing points.
- 6.6 For transport provide the machine with transport protection if necessary. Before putting the machine into operation please remove the transport protection properly.
- 6.7 Carefully refit and fasten all parts to be removed for transport purposes before re-commissioning the machine.
- 6.8 Cut off the external power supply of the machine even if only minor changes of place are envisaged. Properly re-connect the machine even if only minor changes of place commissioning.
- 6.9 For re-commissioning only proceed in accordance with the operating instructions.

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
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SECTION C

Main Components (Start-up, Shutdown, Commissioning, Pre-commissioning)

- 1 Compressor
- 2 Motor
- 3 Inter / after cooler



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EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION C-1


**Main Components (Start-up, Shutdown, Commissioning,
Pre-commissioning)
COMPRESSOR**



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Vendor:
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C-1. Emergency instrument air compressor

C-1.1 Safety

All important safety aspects for the protection of personnel, and safe and faultfree operation, are presented in this section. Only the risks that have been determined by the risk assessment can be addressed. Should further risks arise due to working conditions, the location of use or interfaces with third-party components, then these must be defined and these operating instructions must be supplemented with the relevant safety notes.

C-1.1.1 Using the machine


C-1.1.2 Intended use

- The machine may only be used if it is in perfect technical condition.
- The machine is exclusively intended for the compressing of the gas (process medium) described in the "Technical data" in the appendix with the operating parameters described therein.
- The specifications of these operating instructions are to be complied with.
- Intended use requires compliance with all national regulations regarding work safety, accident prevention and environmental protection.
- Operation no longer than the service life of the machine: 10 years.

Any other use of the machine above and beyond that described here constitutes improper use and may lead to hazardous situations.

C-1.1.3 Type of use

Personal use of the machine is forbidden by the manufacturer on grounds of safety. The machine is designed for commercial or industrial continuous operation and intermittent operation, taking into account the notes in the documentation.

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	Compressor	

C-1.1.4 Foreseeable misuse

If the machine is used incorrectly, dangerous situations may arise. For this reason, the following use of the machine is not permitted:

- Operation with other process media / gases other than those described in the section "Technical data" in the appendix.
- Operation under operating parameters different to those described in the sections "Technical data" in the appendix.
- Operation in negative pressure/ overpressure ranges.
- Operation with non-permitted lubricating oil.
- Operation with spare parts not approved by Mehrer Compression GmbH.
- Operation with bypassed/circumvented protective equipment.
- Faulty interface connections (gas, electricity, perhaps also cooling water, etc.).


C-1.1.5 Limits and restrictions to use

The machine must

- Only be used in approved work environment conditions.
- Not be operated in areas in which a significant risk of electromagnetic interference cannot be safely ruled out.
- Not be operated in chemically, biologically or radioactively contaminated atmospheres.
- Only be operated with the parameters specified in the "Technical data" presented in the appendix.

C-1.2 Symbols/pictograms

Significance of information and warning symbols which are used in these operating instructions depending on the design and purpose of use, are hung up on the compressor block / the compressor unit or around a compressor system or which are of significance for activities associated with them.

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C-1.2.1 Warning signs



Warning about danger

Electrical voltage



The pictogram warns of danger posed by electric shock and is found on live components.

Explosive atmosphere



The pictogram is found on machines suitable for areas at risk of explosion and warns of potentially explosive atmospheres caused by compressed gas.

Discharge of hot and corrosive gases



The pictogram is found on machines in areas in which hot and/or hazardous gases may be discharged.

Automatic start-up




The pictogram is found on the machine and warns of automatic start-ups.

Hot surfaces



The pictogram is placed on machine components which could become hot during operation. There is a risk of burns.

Low temperatures

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The pictogram warns of the freezing of cooling circuits in the event of too low ambient temperatures on machines with water cooling.

Suspended loads



The pictogram is placed on the packaging and warns of heavy suspended loads.

C-1.2.2 Instruction signs



Follow operating instructions!



Wear hearing protection!



Wear eye protection!



Wear foot protection!




Wear hand protection!



Wear head protection!



Earth before use!

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C-1.2.3 Prohibition signs



Unauthorised access denied!



No open flames; no fire, open ignition source, or smoking!



Keep mobile phones switched off!



Keep switched off!

C-1.2.4 Safety labels / danger zones on the machine


Hot surfaces

Surface temperatures of over 200°C can develop on the compressor block. This danger exists on the following compressor block components:

- Cylinder
- Cylinder head
- Valve cover
- Pressure ports
- Gas inlet/outlet of each compression stage

Operating or auxiliary equipment (oil, cooling water) may reach up to 70°C in operation.

For this reason, allow hot components and operating equipment to cool down during maintenance and repair work and, if necessary, wear heat-resistant protective gloves.

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C-1.3 Staff qualification

Inadequate qualifications

WARNING



Risk of injury due to inadequate qualifications!

Improper handling due to inadequate qualifications and knowledge may lead to significant personal injury and property damage.

- Only allow qualified personnel to perform activities on the machine.

C-1.3.1 General personnel requirements




Generally, the qualifications of the users must conform with the national regulations in the various life stages of DIN EN ISO 12100.

Only persons who perform their work reliably and whose response capability is not compromised (e.g. due to medication, alcohol, drugs, etc.) are allowed.

When choosing personnel, the job-specific age requirements that apply at the location of use must be complied with.


"Qualified personnel" here refers to individuals who

- Are familiar with the safety concepts of the machine.
- Have been trained, instructed and qualified in handling the machine as personnel and know the contents of the operating instructions relating to operation and use.
- Have received the appropriate training from qualified personnel.
- Based on their occupational qualifications, experience and training, as well as their knowledge of the relevant standards, legislation, accident prevention regulations and operating conditions, have been authorised by the person responsible for the safety of the machine to perform the required tasks and, in so doing, can detect and prevent possible hazards.

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C-1.3.2 Groups of people

User groups	Work task	Requisite qualifications	Notes
Qualified personnel (Qualified specialist personnel)	Electrical, mechanical and pneumatic servicing	Minimum completed, recognised and special occupational qualifications with several years' professional experience.	The machine may only be serviced by qualified personnel taking account in particular of the safety notes documented in the operating instructions.
Trainees	None		Deploying trainees alone on the machine is forbidden on safety grounds. Trainees who perform activities properly on the machine as part of their training must always be under the management and supervision of a superior.
Children	None		Deploying children on the machine is forbidden on safety grounds.
Elderly people	All activities, including activities with the necessary proof of qualification	Depending on the activities: no qualification to minimum completed, recognised and special occupational qualifications with several years' professional experience.	The use of elderly people on the machine is permitted when taking special consideration of the safety regulations and the qualification profile of the elderly people.
People with physical or mental deficiencies	All activities, including activities with the necessary proof of qualification	No qualification to minimum completed, recognised and special occupational qualifications with several years' professional experience.	In certain cases, harmless deployment must be checked and approved by the user as part of hazard identification and risk assessment, paying special consideration to the limitations in question.

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C-1.3.3 Qualifications

Qualified technical staff

Someone who, based on their qualified training, their knowledge of pressurebearing parts and their experience as well as their knowledge of countryspecific guidelines, applicable standards and policies, is able to assess the tasks they have to perform and to recognise potential hazards, is considered qualified technical staff. Authorised specialist personnel are familiar with the hazards of working in explosive atmospheres. They know about the necessary protective measures and are able to detect potential hazards. Qualified technical staff are required to participate in the Mehrer Service Academy for the relevant compressor type.

Electrical specialist

Someone who, based on their qualified training, knowledge and experience as well as their knowledge of relevant standards, is able to assess the tasks they have to perform and to recognise potential hazards, is considered an electrical specialist; as described in DIN VDE 1000-10 or EN 50110-1, for example.

Trained personnel

Trained personnel have been educated by the operator within an instruction about the tasks they have been assigned and about potential hazards in case of improper behaviour. Technical staff will supervise these activities for proper execution.

C-1.3.4 Unauthorised persons


WARNING



Danger for unauthorised persons!

Unauthorised persons who do not meet the personnel requirements described do not know of the dangers in the work area.

- Keep unauthorised persons away from the work area.
- If necessary, address these people and direct them out of the work area.
- Work interruption while unauthorised persons are in the work area.

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C-1.4 Obligations of the operator

Operator


The operator is any entity which operates the machine itself for commercial or economic purposes or transfers it to a third party for use and who bears legal product responsibility for the protection of users, personnel or third parties during operation.

The operator obligates itself to only allow personnel to work on the machine who

- Have been sufficiently trained with respect to the tasks to be performed.
- Are familiar with the basic regulations on safety, health and environmental protection and have received training from qualified personnel on how to handle the machine safely and properly.
- Have read, understood and implement the safety instructions in this document.

Please note the following instructions in the interest of all parties involved:

- In addition to this document, make generally applicable, statutory and other binding regulations on work safety, accident prevention and environmental protection available, and instruct personnel employed on the machine on these matters.
- Supplement this documentation with instructions which take account of company-specific conditions; e.g. with regard to work organisation, work processes, personnel deployed (including supervisory and reporting obligations).
- Train the member of personnel employed on the machine regarding the fire alarm and fire-fighting options, as well as the location and the operation of fire extinguishers.
- Clearly define staff responsibilities for installation, operation, maintenance, etc.
- Check that staff are working safely and in a hazard-conscious way at regular intervals.
- Take measures to ensure that the machine is only operated in a safe and functional state.
- Ensure the machine undergoes maintenance at the maintenance intervals stated in this document.
- Do not perform any repair work without prior consultation with the manufacturer.
- Do not perform any structural modifications or program changes without the prior written consent of the manufacturer.
- Use strict regulations to enforce the rule that personnel not trained on the residual risks of the machine with the aid of safety information must not enter the machine's danger zone.
- The operator must devise an effective lightning protection plan with overvoltage protection in the electrical machine on site.
- The machine must only be operated taking into account the ambient conditions defined in the technical data.
- Provide all personnel active on the machine with personal protective equipment.
- Only trained personnel may work on the machine.

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C-1.5 Requirements of the personnel

Prior to commencing work, all persons charged with working on this machine commit themselves to

- Observe the basic regulations on occupational safety and accident prevention
- Read the safety and warning notes in this documentation.

Please note the following instructions in the interest of all parties involved:

- Refrain from any unsafe working procedures.
- Pay attention to all the danger and warning signs on the machine.
- In addition to this document, pay attention to generally applicable, statutory and other binding regulations on work safety, accident prevention and environmental protection.
- Pay attention to fire alarm and fire-fighting options and make yourself aware of where fire extinguishers are located and how to use them.
- Wear protective clothing appropriate to the work you are performing.
- Loose long hair, loose clothing and jewellery, including rings, are forbidden.
- Only perform work on which you have received adequate training.
- Do not perform any work when safety or protective equipment has been bypassed or removed.
- Switch the machine off immediately when a safety hazard to the machine arises, secure it against reactivation and notify superiors and/or safety representatives without delay.
- Do not perform any repair work without prior consultation with the manufacturer or the operator.
- Do not perform any structural modifications or program changes without the prior written consent of the manufacturer.
- Ensure that other people not working on this machine (and who consequently are not aware of the dangers associated with the machine) cannot enter the danger zones.
- Notify personnel using these safety notes if work in/on the machine is unavoidable.

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C-1.6 Personal Protective Equipment (PPE)

The wearing of personal protective equipment is intended for your own safety. For some activities, the wearing of personal protective equipment is required to minimise health hazards.

Direct personnel protection

- Tie back long hair; do not wear loose clothing or jewellery including rings. There is a risk of injury from these getting caught or jammed.
- Personal protective equipment must be used in accordance with the requirements and regulations.

Safety shoes



When working on the machine, wear safety shoes to protect against heavy falling objects and slipping on slippery surfaces.

Gloves that protect against mechanical hazards



Wear gloves that protect against mechanical hazards for the specified activity to protect against sharp edges.

Gloves that protect against thermal hazards



For the relevant activities, wear gloves that protect against thermal hazards to protect the hands from touching hot surfaces.

Hearing protection



Wear hearing protection to protect against hearing damage.

Eye protection



Wear eye protection to protect the eyes from parts flying around and liquid spray.

Protective helmet




Wear a protective helmet for activities requiring one to protect the head against falling objects.

The personal protective equipment listed in the table below for the different life phases are recommendations from the manufacturer.



In addition to the guidance in these instructions, local accident prevention regulations and national work safety regulations apply.

Stage	Activity	PPE
Transport		Safety shoes Protective gloves Protective helmet
Installation		Safety shoes Protective helmet
Commissioning		Safety shoes Protective goggles
Operation	Checks	Safety shoes Protective goggles Hearing protection
	Troubleshooting	Safety shoes Protective goggles Protective gloves
Maintenance		Safety shoes Protective goggles Protective gloves
Disassembly		Safety shoes Protective gloves Protective helmet

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C-1.7 Residual risks

The machine is state of the art. Potential safety risks were eliminated as far as possible during the design of the machine. However, due to the condition of the machine, supplies power, the auxiliary and operating resources used and the emissions generated, residual risks may remain for personnel.

WARNING!



Ignoring residual risks

Ignoring the residual risks may lead to harm to health, bodily injury or, in the worst cases, to fatality.

- For this reason, please remember to pay attention to the residual risks of the machine in order to eliminate hazards.

C-1.7.1 Electrical hazard

DANGER!



Risk of fatality due to electric shock!

Death or serious injury posed by touching live parts.

- Only have work on electrical equipment performed by electrical specialists.
- Switch off the main switch of the compressor unit and secure it against reactivation prior to commencing maintenance, repair or cleaning work.
- Prior to working on live components, check that they have been de-energised.
- The system's electrical equipment must be checked regularly. Eliminate defects immediately; such as loose connections or damaged cables.

C-1.7.2 Hazards in areas at risk of explosion

Potentially explosive atmospheres

DANGER!




Risk of fatality: potentially explosive atmosphere!



Death or serious injury due to explosion.

- No open flames; no fire, open ignition source, or smoking!
- Unauthorised access denied!
- Stay in potentially explosive areas only as long as is necessary for performing your work.
- Keep mobile phones switched off!
- Immediately leave the danger zone in the event of a gas alarm.
- Comply with the emergency plan drawn up by the owner.

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C-1.7.3 Danger due to pressure-bearing parts


WARNING!



Risk of injury from discharging gases!

Gases in the components are pressurised and can cause injuries when discharged suddenly.

- Switch off the main switch and secure it against reactivation prior to commencing maintenance, repair or cleaning work.
- Only have work on non-electrical equipment performed by qualified specialist personnel.
- Depressurise the compressor block/unit and check the status at the pressure gauges prior to opening the compressor unit.
- Visually inspect pipes and hose lines regularly. Defects such as leaks or damage must be resolved immediately.
- Check screw connections regularly. Resolve defects such as leaks or damage immediately.

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C-1.7.4 Mechanical hazards

Moving parts

WARNING!



Risk of injury from moving parts!

Jamming or catching due to moving parts.

- Do not reach into moving components or work on moving components during operation.
- Only operate the compressor block/unit with installed and functional movable guards.
- Pay attention to overrun times. Ensure the system is at a standstill before opening the protective equipment.
- Tie back long hair; do not wear loose clothing or jewellery.

Sharp edges / corners

CAUTION!



Risk of injury from sharp edges or corners!

Sharp edges or corners could lead to skin injuries.

- Work carefully.
- Wear protective gloves when working on sharp edged objects.

C-1.7.5 Noise hazards

Noise

WARNING!




Hearing damage due to noise!

The machine does not generate a noise area requiring warnings.

Irrespective of this, complying with the protective measures mentioned here is recommended, because even low noise levels can cause hearing damage over the long term.

- Wear hearing protection when standing in the location of use.

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C-1.7.6 Hazard posed by thermal influences

Hot surfaces / operating resources

WARNING!



Risk of burns due to hot surfaces / operating resources!

Machine parts and operating resources reach high temperatures in operation which may lead to burns in the event of skin contact.

- Before touching, check the temperature of machine parts and operating resources, and allow them to cool down if necessary.
- Wear protective gloves if working on hot surfaces is necessary.

C-1.7.7 Further dangers

Constructive changes

WARNING!



Malfunctions caused by design changes!

Design changes to the compressor block/unit may lead to malfunctions or damage.

- Only perform changes to the compressor block/unit following consent from and agreement with the manufacturer.


Incorrect spare parts and accessories **WARNING!**



Incorrect spare parts and accessories!

Machine parts are subject to considerable stresses. Spare parts not approved by Mehrer Compression GmbH may be unable to withstand this type of stress. Failing non-approved components may cause serious injuries.

- Use only spare parts approved by Mehrer Compression GmbH.

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Operating resources

WARNING!



Risk of injury due to operating resources!

Bodily contact with or swallowing lubricant or coolant may lead to injuries.

- Adhere to the safety notes of the safety data sheets.

Slipping, tripping and falling


CAUTION!



Risk of injury from slipping, tripping or falling!

Objects, tools or dirt lying on the floor may lead to slipping, tripping or falling.

- Ensure cleanliness and tidiness at the work location!
- Remove objects no longer in use.
- Remove any dirt immediately!
- Highlight tripping points with yellow-black marking tape.

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C-1.8 Environmental protection

ATTENTION!



Environmental hazard due to incorrect handling of environmentally harmful substances!

Due to incorrect handling of environmentally harmful substances, especially in the case of incorrect disposal, huge damage can be caused to the environment.

- It is imperative the notes in this section are heeded.
- If environmentally harmful substances accidentally get into the environment, take appropriate measures immediately; if necessary, a responsible authority must be notified of the damage.
- Collect, transport and store environmentally harmful substances in suitable containers.

The following environmentally hazardous substances are used:

Gases


The gases used may be poisonous and must not get into the environment. Note the safety data sheets of the respective manufacturer and dispose of the gases accordingly.

Lubricants

Lubricants such as oils and greases contain poisonous substances which must not get into the environment. Disposal must take place in accordance with locally applicable regulations at the location of use by a specialist disposal operation.

Machine parts

Replaced machine parts may be soiled by greases or oils and may contain poisonous substances as a result. They must not get into the environment. Disposal must take place in accordance with locally applicable regulations at the location of use by a specialist disposal operation.

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C-1.9 Behaviour in an emergency

Emergency plan

What to do in an emergency must be laid out in an in-house emergency plan. Personnel active on the compressor block/unit must be aware of this emergency plan and there must be regular training on what to do in an emergency.

Fire extinguishing equipment

The operator must keep suitable fire extinguishing equipment in the immediate vicinity and train employees on how to use it.

First aid

First aid equipment must be kept available in the immediate vicinity of the compressor block by the operator.

Emergency Off

In the event of emergencies, shut down the machine/system as quickly as possible. Press the Emergency-Off button to do this.

C-2. Packaging and transport

Shipping

If no contractual agreements are in place, Mehrer Compression GmbH shall decide on the best shipping method, taking account of dimensions, weight, sensitivity, costs and destination.

C-2.1 Safety

Tipping load


WARNING!



Risk of injuries from tipping loads!

Crushing and serious injuries may be caused by loads tipping over.

- Always secure components sufficiently against tipping over.
- Only use suitable lifting gear.
- Only move loads under supervision.

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Eccentric centre of gravity

WARNING!



Risk of falling down due to eccentric centre of gravity!

Package items may have an eccentric centre of gravity. If attached incorrectly, the package item may tip over and cause fatal injuries.

- Observe the markings on the package items.
- Raise loads carefully and check whether they are tipping or not. If necessary, adjust the attachment.

Improper transport


ATTENTION!



Damage due to improper transport!

Large-scale property damage may result from improper transport.

- Proceed carefully when unloading, during delivery and for in-house transport, and observe the notes and symbols on the packaging.
- Only transport in the installation position.
- Only remove packaging just before assembly.

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C-2.2 Packaging

Packaging

Provided there are no other contractual agreements for the packaging, preservation method and packaging type are defined to ensure that the machine will not suffer any damage from supposed environmental influences.

The packaging is designed to protect the machine up until assembly. Therefore, it must not be destroyed or damaged and only removed shortly before assembly.

Country-specific regulations are taken into consideration as per the export book of reference from the Hamburg Chamber of Commerce, "K und M – Konsulats- und Mustervorschriften" (K and M – Guide to Consular and Import Documentation Requirements).

Operating equipment filling

The compressor block is filled with the appropriate standard oil quantity ex works.

Pipe connections

All open pipe connections must be sealed for transport using dummy plugs or flanges.

Disposing of packaging material

Packaging material is to be disposed of in accordance with statutory regulations and local provisions.

C-2.2.1 Packaging symbols

The notes arranged on the packaging should provide all necessary specifications regarding package item handling. The following symbols may be arranged on the package items.

Top




Transport and store package items so that the arrows always point upwards. Refrain from rolling, turning, extreme tipping or tilting and any other form of handling.

Centre of gravity



This sign indicates the location of the centre of gravity.

Fragile package item

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The package item must be handled carefully – do not tie it up or allow it to fall.

Keep away from water



Protect the package item against high ambient humidity and moisture. Cover it and keep it dry during storage and transport.

Stacking prohibited



Do not stack the package items on top of each other.

No forklift transport



The package item must not be transported from this side with a forklift.

Transport with a forklift




The package item may be transported from this side with a forklift.

Top-heavy



The package item is top-heavy.

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C-2.2.2 State of disassembly

Compressor blocks

Compressor blocks are never dismantled. Accessory parts such as fittings, pipework, pulsation dampers, separators, etc. are also enclosed separately, if necessary.

Weight

The weight of the individual packaging units is presented in the shipping papers and in the section "Technical data".

C-2.3 Transport

Transport equipment and lifting gear must be designed both in concept and construction according to the load values (dims/weight) of the component to be transport in each case.

National regulations, regulatory frameworks and ordinances are to be observed. Complying with guidelines helps to prevent bodily harm or machine damage.

Personnel qualification

Only sufficiently qualified personnel may transport the compressor block. This means in particular that only instructed and qualified personnel may operate cranes, ground conveyors, other lifting devices, or attach loads.

C-2.3.1 Transporting with fork lifts or lift trucks

Compressor blocks and associated components which are supplied bolted onto wooden boards so as to be picked up from below can usually be loaded, transported and positioned at an installation location with an appropriate forklift or lift truck.

Conditions

If the following conditions are met, the machine or the package item can be transported with a forklift or lift truck:

- Only use an intact forklift with a carrying capacity of at least 1.5 times the weight of the machine.
- The driver of the forklift must be authorised to do so.

Lifting the machine / package item

1. Move underneath the corresponding contact points of the package item with the forks of the forklift or lift truck.
2. Move inwards until the forks protrude from the opposite side.
3. Ensure that the package items cannot tip over if the centre of gravity is eccentric.

WARNING!

Compressor block is top-heavy and can tip over

- Secure against tipping over accordingly.

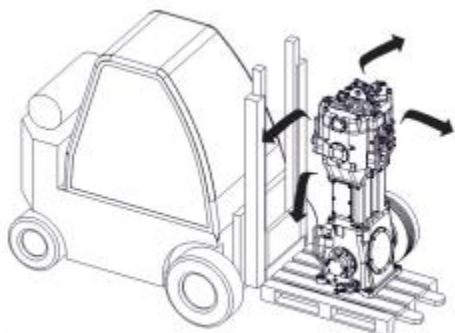



Fig. 4-1: Transporting with fork lifts or lift trucks

4. Lift the package item and commence with the transport. Drive slowly!

C-2.4 Storage

The following storage conditions are to be met;

- Store in a protected location – not outdoors.
- Store in a dry and dust-free condition.
- Do not subject to aggressive media.
- Protect against solar radiation.
- Prevent mechanical shocks.
- Storage temperature of +10°C to +40°C.
- During storage, regularly check the general condition of all parts and the packaging. If preservation was requested due to seaworthy packaging or upon customer request, then this must be freshened up and renovated if necessary.
- Prevent extreme temperature fluctuations to prevent condensation.

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C-2.4.1 Corrosion

Corrosion is understood as the slow oxidation of metal surfaces under the influence of a surrounding humid medium. Corrosion (except for oxide layer formation) is not possible without the presence of water.

Measures against corrosion:

- Avoid precipitation, steam condensation, hygroscopic salts on steel surfaces.
- Keep dry (rel. humidity below 65%)
- Damp-proof barrier

The risk of corrosion can be avoided by using barrier films and drying agents that decrease the humidity inside the packing. As per DIN 55 473, the use of drying agents pursues the following target: "The package item is to be protected against humidity during transportation and storage, in order to avoid corrosion, mildew and similar affects."


Since the drying agent's absorption capacity is limited, this is only possible if the package item is enclosed in a steam-tight and welded blocking layer. This is a so-called climatic packing or sealed packing. If the blocking layer is not steam-tight, steam can penetrate from the outside at any time, so that the drying agent gets saturated relatively quickly, without diminishing the relative humidity inside the packing.

C-2.4.2 Condensation

Besides the direct influence of humidity from rain, it is important to take notice of any signs of condensate and to prevent it.

Condensation water often develops unnoticed and might result in unnoticed corrosion inside the machine.

Condensate can only develop, when humid, warm air cools down on cold surfaces: Hot air can absorb more humidity, i.e. evaporated water, than cold air. This is why water contained in warmer air precipitates on cold metal surfaces to form condensate. This, for instance, occurs when a machine (compressor block) is moved in winter from an unheated storage room to a heated workshop with relatively high humidity.

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C-2.4.3 Preservation for transport at sea or long-distance overland with storage period

During transportation, handling and storage, goods are exposed to much higher levels of stress than at the location of use. This stress might, for example, result in extreme temperature fluctuations that can lead to a risk of condensation formation.

Especially during sea transportation, damages may result due to the high salt content in water and air – the so-called marine salt aerosols.

Therefore, machines are to be protected accordingly.

Protection measures

1. The cooling water must be drained from compressors that **do not have a secondary cooling system** and the cooling water circuit must be rinsed with glycol to remove any cooling water residues. When ready, close the cooling water connections.

You do not need to drain the coolant from the cooling circuit if the compressor is equipped **with a secondary cooling system**.


2. Place compressor block/unit on wooden boards or wooden box bottom.

When screwing the compressor block/unit onto the bottom, place **the film as per DIN 55530 or DIN 55531**, in such a way that the screws themselves are also hermetically sealed.

3. Add **drying agent as per DIN 55474** and seal compressor block/unit in film hermetically. The required amount of drying agent should be calculated accordingly, so that a **relative humidity of 40% is not exceeded**.



Prevent contact points between drying agent bags and metallic or other surfaces. Attach drying agent bags so they are as freely suspending as possible.

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Standards to Follow

- **DIN 55530:** Films for packaging - Barrier films made of low density polyethylene (PE-LD). Choose a barrier film with low steam permeability (SP), optionally: Low density (LD-PE) PE films for moderate temperatures (Climate E: 20 °C – 85 % rel. humidity) and short periods of transportation and storage.
- **DIN 55531:** Films for packaging - Composite aluminium films. Composite aluminium films for all climates (Climate B: 20 °C – 90 % rel. humidity) and long periods of transportation and storage.
- **DIN 55474:** Auxiliary means of packaging - Desiccants in bag - Application, calculation of the required number of desiccant units.

Checks

- The relative humidity within the protective film can be checked by means of suitable humidity indicators.
- The protective film's integrity should be checked regularly (visual check). Rodents (such as mice) have a special liking for protective films and drying agents. The storage place should therefore be kept as free as possible from such animals.

Should any damage to the protective film be detected during these checks, the drying agent must be replaced and the goods must be tightly sealed again.


C-2.4.4 Preservation of a compressor block integrated into a system for lengthy downtimes

Without prior commissioning

If there is a risk of corrosion due to longer periods of standstill before initial commissioning, inner parts of the compressor blocks (valves) susceptible to corrosion must be especially protected.

To do this, please proceed as follows:

1. Lock suction and pressure sockets with dummy flange (or sheet metal vane if a pipeline is connected) between two gaskets, in a way, that the sockets are locked in front of and behind the compressor block.
2. Take off the suction-side and pressure-side valve covers of the compressor block and remove the suction and pressure valves.
3. Turn the crankshaft to bring all pistons to approx. the same height, meaning half lift position.
4. Hang a 50 g bag of drying agent (i.e. silica gel) inside each valve opening.
5. Reattach valve covers so that the compressor block is closed.
6. Put the disassembled valves and corresponding amount of drying agent into a protective film to ensure a max. rel. humidity of 40% and weld film in accordance with DIN 55530 or DIN 55531.
7. Attach the following safety signs to the machine:

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Prior to commissioning

- Remove drying agent bag from valve chamber.
- Install suction and pressure valves.
- Connect suction and pressure ports.

This treatment lasts for approx. ¼ year and then must be repeated.

After previous use

If the compressor block is shut down, then it must be purged beforehand. Purging allows for the compressor block to be dehumidified and prevents corrosion through condensation. Provided nothing else is specified, dry nitrogen should be used for purging. The more humid the gas, the earlier machine dehumidification should be performed.

DANGER!



Displacement of breathing air due to discharging nitrogen!

Risk of suffocation!


- Ensure that the nitrogen is discharged safely.

If the compressor block is to be shut down over long periods of time (several months), please proceed as follows:

1. Purge the compressor block as described in section 5 "Commissioning".
2. When taking compressor blocks out of service in areas at risk of frost, the condensate / cooling water must be drained at all drain points. The cooling water circuit of water-cooled compressor blocks must be purged with glycol before they are shut down or stored in areas at risk of frost.
3. Then go ahead with steps 1 to 7 as in the previous section "Without prior commissioning".
4. Drain oil out of the crankcase and wipe the crankcase interior dry with a lint-free cloth.



In the event of any questions regarding shutdown and preservation, contact customer services at Mehrer Compression GmbH. The contact data is located at the start of the instructions.

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C-3. Installation and Commissioning

In this section the proper set-up, installation and commissioning of the machine are described.

Personnel

- Installation and commissioning may be performed by the operator. A service engineer from Mehrer Compression GmbH may be called on upon special request.
- Work on the non-electrical equipment of the compressor block must only be performed by specialist personnel qualified for that purpose.
- Work on electrical components must only be performed by electrical specialists

The qualifications are described in section 3 "Safety".

C-3.1 Safety

Falling loads

DANGER!




Danger posed by falling loads

Serious injuries or death from falling loads.

- Do not step under suspended loads.
- Maintain a sufficient safety distance to suspended loads.
- Prior to transportation, compare weight per piece and bearing capacity of the lifting equipment and mechanisms.
- Use only specified sling points.

Personal protective equipment

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WARNING!



Injury during transport!

Hazardous situations may arise during transport tasks which may lead to injuries.

- Wear personal protective equipment during transport work.
 - Helmet: Industrial helmet
 - Safety shoes
 - Cut-resistant gloves
- Pay attention to accident prevention guidelines and / or other national guidelines.

Welding, cutting and grinding work


WARNING!



Risk of fire / explosion

Welding, cutting and grinding work may cause fires or explosions.

- Only perform welding, cutting and grinding work following the express consent of the operator.
- Prior to commencing welding, cutting or grinding work, clean the surroundings of dust and flammable substances.
- Ensure adequate aeration in the work area.

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Frost damage

ATTENTION!



Property damage due to frozen cooling fluid

Temperatures below the freezing point may cause frost damage to the compressor block.

- Comply with the permissible temperature range for installation (see "Technical data" in the appendix section)
- If the temperature range cannot be kept to during installation and commissioning, add adequate antifreeze to the cooling media. The secondary cooling circuits are filled with an antifreeze cooling fluid (–25°C) at the factory.

Overhead installation work

CAUTION!



Machine parts used as climbing aids for overhead installation work.


Injuries due to falling from height in the event of overhead installation work where machine parts are used as climbing aids.

- Do not use machine parts as climbing aids.
- Use safety-compliant climbing aids and work platforms.
- For maintenance work at great heights, wear fall protection devices.
- Keep handles, steps, rails, platforms and ladders free of dirt, snow and ice.

Notice

The notes provided below relate to the seamless functioning of the compressor block and the conditions necessary for this.

The safety-related requirements for the set-up and operation of the compressor block determined by the type of gas to be compressed are to be observed by the operator.

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C-3.1.1 Supplementary measures for operation in areas at risk of explosion

Risk of explosion

WARNING!




Risk of explosion due to inadequate implementation of protective measures

In order to prevent the risk of explosion and potentially serious injuries, certain protective measures must be taken when operating the machine in areas at risk of explosion.

- Only allow specially trained specialist personnel to perform work in areas at risk of explosion.
- Ensure the requirements described below are met.

Minimising the risk of explosion

- Ensure that there is adequate ventilation.
- Ensure that all electrical components are designed for areas at risk of explosion.
- Only allow specially trained specialist personnel to perform work in areas at risk of explosion.
- Only use instruments and tools which do not generate any sparks.


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C-3.2 Requirements for the installation location

C-3.2.1 Ambient conditions

The following should be ensured for the installation of the machine throughout its time of use:

- Ensure machine stability.
- The installation area must have adequate load-bearing capacity for the weight of the machine. This is listed in the "Technical data" in the appendix section.
- Comply with the temperature range stipulated in the specifications in the technical data.
- Ensure adequate ventilation.
- For outdoor installation: Provide a weather-protection roof.
- Spatial requirements: ensure sufficient space for maintenance work in all directions.

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C-3.2.2 Room ventilation

General information

Guidelines for choosing operation rooms are compiled in VDMA standard sheet 4363. It also contains specifications on calculating room ventilation for compressors.

The following lists a selection of some important instructions:


- The operating space should be clean, free of dust, dry and cool.
- Sunlight should be allowed to enter. If possible, a location in the building's northern side should be selected.
- At the installation site, avoid heat-radiating lines and units (if they are unavoidable, insulate them well).
- To prevent frost damage and potential intensified rust damage from heavy internal condensation forming, ensure that the room temperature stays above +5°C.
- We recommend closing any potentially present air intakes and air outlets.
- To perform maintenance and regular checks on the pressure vessels by technical inspection authorities (TÜV or TUA), ensure the site is easily accessible.
- Ambient temperatures above +40°C are to be prevented, because the compressor block is increasingly subjected to thermal stresses at high temperatures. In addition to high strain on the components, and the shorter maintenance intervals associated with this, the compressor can also incur serious damage.
- If it is not possible to prevent ambient temperatures of over +40°C, only compressor blocks specially equipped for this purpose are to be used. You can find the exact usage limits in the "Technical data" in the appendix to these instructions.
- Compressor blocks must be set up so that neither explosive nor chemically unstable substances, or even hot discharge air from other compressor blocks/units/machines, can be sucked in through the intake opening of the compressor.

The ventilation of the room should always ensure that a temperature of +40°C is not exceeded.

Thermal dissipation

The water quantity that is generated during compression and has to be dissipated approximately equates to the drive power of the compressor block. The power loss of the motor must also be factored in.

If a compressor block requires 11 kW of drive power, for example, and if the gas to be compressed is cooled down to suction temperature, this will mean a thermal output of approximately 11 kW is to be dissipated.

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Water-cooled compressor blocks

In the case of water-cooled compressor blocks, only a proportion (up to 2%) of the heat generated is dissipated by radiation to the surroundings. The power loss of the motor is also factored in, which is up to 8% of the drive power.

C-3.2.3 Installation in areas at risk of frost

When compressor blocks/units are installed in areas at risk of frost, the following general notes are to be observed for air- and water-cooled compressors which compress gases with a relative humidity greater than 10%.

Lubrication

When lubricating the compressor block, you must ensure that the oil viscosity – and potentially the ambient temperature – is adjusted, or oil heating must be provided.

Condensate

Condensate is produced during the compression and cooling of atmospheric air or humid gases.

ATTENTION!




Damage caused by freezing condensate / residues of cooling water.

Significant damage may be caused to the compressor block due to the freezing of condensate / residues of cooling water. Condensate/residues may lead to cracks on / in the following assemblies:

- Yoke
 - Cylinder block
 - Cylinder head
-
- Prevent the ambient temperature from falling below +5°C during operation or when at a standstill, because otherwise the condensate / residues of cooling water will freeze.
 - In the event of ambient temperature below +5°C, measures must be taken to prevent freezing condensate / cooling water on the assemblies mentioned.

Coolant

The antifreeze of the compressor cooling circuit (primary cooling circuit) can be ensured using a water-glycol mixture. An ex-works recommendation is presented in the "Technical data" section.

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Decommissioning

When taking compressor blocks out of service in areas at risk of frost, the condensate / cooling water must be drained at all drain points. The cooling water circuit of water-cooled compressor blocks must be purged with glycol before shutdown or storage in areas at risk of frost. (See "Draining cooling water" section 5.6.3 and "Preservation for storage periods", section 4.5.3 or "Preservation for lengthy downtimes" section 4.5.4)

C-3.3 Installation

C-3.3.1 Attachment

There are 4 holes on the drive unit of the compressor block for fixing the compressor block to the foundation. The compressor block is to be installed in an upright position using 4 fixing screws. The diameter of the holes is specified on the dimensional drawing; the thread size and the tightening torque under "Compressor block tightening torques". Both are in the "Appendix" section of these operating instructions.

Specifications

Component	Feature	Value
Foundation	Evenness	0.5 above the support surface width of the compressor block
Fixing screws	Strength class	8.8

C-3.3.2 Pipeline/hose line connection

Notes for the connection of pipelines and hose lines are described in this section.


DANGER!



Risk of suffocation posed by leaks!

Faulty connection of the connection pipes may lead to leaks.

- Use fitting screw connections for the pipe connection.
- Check the leak-tightness of the connection once the pipe connection is complete.


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Connection pipes

The connection positions of the supply and discharge pipes are indicated in section 3 "Product description" and in the dimensional drawing in the appendix of these operating instructions. The requisite nominal values of the connections can be found on the dimensional drawing and the P&ID.

Pipelines

- Supply pipes originating from the container are to be dimensioned based on the maximum volume flow rate.
- Connecting pipes between the compressor block/unit and containers connected on the suction and pressure sides are usually designed as rigid pipelines.
- Galvanised steel piping and rust-free steel can be used for pipeline material.
- The nominal width of the connecting pipe between compressor block/unit and pressure vessel is based on the nominal connection width on the compressor block/unit.
- Establishing the connection using (sufficiently heat-resistant) expansion joints, so as to prevent strain caused by vibrations, is recommended.
- The pipelines must be supported to absorb reactive forces.
- The enclosed instructions "Notes on pipeline construction in the context of piston compressors" must be observed.
- Pipelines must be free of welding work and dirt residues prior to commissioning.

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C-3.3.3 Electrical connections

The electrical installation of the machine must be performed on site and must satisfy the requirements of standard EN 60204-1.

For operation in areas at risk of explosion, the requirements of standard EN 1127-1 must also be met.

Electrical current **DANGER!**



Risk of fatality due to electric shock!


Serious injuries through to fatality.

- Have work on electrical equipment and devices performed exclusively by electrical specialists, as described in the section "Safety", under "Personnel qualification".

Additional notes

Furthermore, the following **notes** must be observed:

- The electrical fusing of the machine must meet the specifications under "technical data" and the specifications in the circuit diagram.
- If the machine is not equipped with an electrical main switch, this must be installed by the operator so that all electrically conductive parts of the machine are carrying no current following shutdown.

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C-3.3.4 Drive

V-belt drive

For compressor blocks, the drive disc of the compressor block is contained within the scope of delivery. The necessary specifications of the compressor block (power requirement, compressor speed, diameter of drive disc of the compressor block, etc.) are contained in the "Technical data" and on the dimensional drawing. Design and installation must be performed at the customer's taking applicable standards and regulations into account.

The following must be considered for the set-up calculation:

- The drive disc of the compressor block is to be designed as per DIN 2211.
- A V-belt profile as per DIN 7753 is to be provided for the V-belt drive.
- The calculation and design of the V-belt drive is to be performed in accordance with the specifications of the V-belt manufacturer.

C-3.3.5 Process-relevant components

For the integration of the compressor block as a component of a complete machine, we recommend the installation of the following components so as to ensure reliable operation.

ATTENTION!




Process gas contaminated by fluid component parts and solids!

Property damage to the valves and/or the components of the compression chamber of the compressor block. Condensate can lead to what is known as a 'water hammer' and damage the valves.

- Remove fluid components (condensate) and solids from the process gas before the entry of gas into the compressor block.

Suction filter

A suction filter must be installed in front of gas inlet stage 1 of the compressor block in order to prevent the ingress of dirt particles into the compressor block. We recommend the use of filter cartridges which remove solid particles from a size of 50 µm and/or smaller from the process gas.

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Steam trap

If condensate is anticipated on the suction side or during cooling after compression, one must ensure that no condensate can reach the compression chamber of the compressor block. Otherwise, this will lead to a so-called 'water hammer' and cause serious damage to the valves. In order to prevent this, steam traps must be installed at the appropriate points before and after the gas inlet of the different stages.

C-3.3.6 Interfaces and other measures

Interfaces

WARNING!



Danger posed by interfaces!


Significant potential for danger can arise from emerging interfaces when integrating the machine into a complete machine. As a result of inadequate evaluation of these interfaces and the resulting measures, serious injuries and property damage may occur.

- It is imperative that a risk assessment is conducted.
- Take suitable measures for averting danger.

Further measures

For integration in a complete machine, the following additional measures must be taken:

- Perform a risk assessment for newly emerged interfaces.
- Deduce appropriate protective measures from the risk assessment and apply them to the complete machine.
- Protective measures that have already been taken must not lose their function through integration into a complete machine.
- The machine must be integrated into the emergency-off concept of the complete machine.
- Produce documentation of the overall system.
- prior to commissioning, the operator must ensure that the complete machine into which the machine is integrated or of which the machine represents a component, satisfies the basic safety requirements and conditions of all relevant directives.

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C-3.4 Purging (inertisation)

Hazardous gases

According to EN 1012-3 "Safety requirements – Process gas compressors", these are gases with chemical, radioactive or biological properties (e.g. flammable, explosive, chemically unstable, pyrogenic, corrosive, irritating, poisonous, carcinogenic, etc.) which cause harm through reactions inside the compressor, through dispersal or through reactions with the environment. A dangerous gas could be a mixture of gases with these properties.

Special notes


In this section, special notes for compressor blocks are provided for compressing gases or vapours with dangerous properties.

To be observed by the operator

Putting up the operating guidelines:

- Taking the safety data sheets applicable to the gas to be compressed into account, the owner/operator must produce written operating guidelines for the safe handling of the gas to be compressed in a comprehensible form and language for every compressor block. The operating guidelines must be brought to the attention of personnel in appropriate fashion at the location of operation. The operating instructions must be accessible to the personnel at any time.
- For the operation and servicing of compressor blocks for compressing gases or vapours with dangerous properties, the owner/operator must put up additional instructions on the prevention of hazards and make personnel aware of them, in addition to the operating guidelines mentioned in paragraph 1.
- Personnel must follow these operating guidelines.

For equipping, setting up and operating compressor blocks for compressing gases or vapours with dangerous properties, all accident prevention regulations and their implementation regulations, the terms of all technical rules and guidelines and all other instructions and specifications for securely handling media to be compressed must be complied with.

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C-3.4.1 Special safety notes for dangerous gases

Emissions

DANGER!



Emissions of gases or vapours with dangerous properties due to leaks!

Formation of dangerous, explosive atmospheres.

- Protective measures to be taken in accordance with the regulations, guidelines and ordinances (e.g. explosion protection guidelines, regulations on electrical systems in spaces at risk of explosion, etc.) applicable in each case.

Explosive mixture

DANGER!



Generation of explosive mixtures!

May lead to explosion with risk of fatality to personnel.

- Shutdown of compressor blocks and thus interruption to the compression process prior to reaching the explosion limits. E.g. through negative pressure safeguards in the suction pipe against the intake of air.

Emergence of explosive gas/air mixtures


DANGER!



Development of explosive gas/air mixtures or vapour/air mixtures when opening and before starting up after opening due to air contact!

May lead to explosion with risk of fatality to personnel.

- Purge compressor blocks for flammable gas or vapours prior to opening and prior to start-up after opening to prevent explosive gas/air or vapour/air mixtures from forming.

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Effective ignition sources

DANGER!



Development of effective ignition sources around gasconducting components!

May lead to explosion with risk of fatality to personnel.

- Ensure that compressor blocks are operated so that effective sources of ignition around gas-contacted areas of the compressor block and its equipment parts are prevented during operation, when starting up, shutting down and when at a standstill.
- If this cannot be ruled out, appropriate protective measures must be taken; e.g. setting up endangered parts of the compressor blocks in protective chambers with adequately effective pressure relief equipment.
- The installation location of the compressor block must be declared as being part of the danger zone.
- No unauthorised access to the danger zone!

Disintegration, polymerisation or peroxidation


DANGER!



Operating conditions which could lead to disintegration, polymerisation or peroxidation!

May lead to explosion with risk of fatality to personnel.

- Operate compressor blocks for the compression of chemically unstable gases or vapours so that operating conditions which lead to disintegration, polymerisation or peroxidation cannot arise.
- In addition to defining appropriate operating conditions (pressure and temperature), additional protective measures may be necessary. Seeking the advice of competent bodies (e.g. employer's liability insurance associations) is recommended in this regard.

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Conveying harmful gases

DANGER!



Discharge of gases and vapours harmful to humans when opening gas-carrying components!

Explosions, damage to health through to fatality.

- Take protective measures for the safe dissipation of gases and vapours and/or decontamination.


When opening compressor blocks and related system parts by means of which gases or vapours with dangerous properties have been conveyed, danger may arise from residues or deposits of such substances.

Before opening a compressor block or its related system parts (e.g. when taking measures for maintenance, inspection or repair), the dangerous substance must therefore be removed from the compressor block or system component. If this is not possible through purging, for example, or only possible to an inadequate extent, other protective measures must be taken to prevent subjecting personnel working on the equipment to danger.

The protective measures necessary must be determined on a case-by-case basis, whereby when assigning maintenance, inspection or repair work to third parties, such persons are instructed by the contracting entity regarding measures previously taken (e.g. compressor block purged) and are to be informed of dangers still to be anticipated due to substances or substance residues that may still be present when opening.

Due to the potential dangers when opening compressor blocks and the related system parts, this instruction must be complete and comprehensive. It can therefore only be in written form.

Since such work could be to remove these substances – in the case of radioactive substances for example – or these substances could develop during this time, additional requirements (e.g. notification, approval and labelling obligations) or the potentially required medical supervision of the personnel charged with such tasks may be pointed out.

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C-3.4.2 Requirement: safe dissipation of gases

Hazardous discharging gases

DANGER!



Contact with discharging gases with hazardous properties!

Injuries or risk of fatality in the case of physical contact or inhalation.

- Conduct away discharging gases or vapours with hazardous properties safely.

Discharge possibilities of hazardous gases


Discharge options exist for compressor blocks e.g. on safety equipment, shaft and rod seals, drain and relief equipment. The requirement for safe dissipation is fulfilled if gases or vapours are collected right at the point of discharge and channelled away or, if this is not possible, there is sufficient ventilation of the installation room.

Additional requirements of related local ordinances and legislation at the location of installation must be complied with.

Drain, vent and relief pipes

For drain, vent and relief pipes, the following applies:

- Gases discharged from drain, vent and relief pipes are to be channelled away safely.
- Drain, vent and relief pipes for readily flammable, poisonous or oxidising gases must not flow into rooms.
- Drain, vent and relief pipes for readily flammable gases must be designed for the forces of explosion if explosive gas/air mixtures can develop in them.
- The vent line must discharge in a depressurised manner. Discharge against a counter-pressure is not permitted.
- The vent line must be routed so that drainage is possible at the deepest point. For this purpose, the pipe should slope downwards slightly after the safety valve. An immediate rising of the pipe after a safety valve is not permitted.
- A guard against rain, dirt and animal habitation should be introduced at the end of a vent line if required.

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C-3.4.3 Purging procedure

Important notes

If the operator cannot rule out sources of ignitions being present in downstream processes, then the compressor block must also be purged before the first start-up, after each instance of maintenance and before each subsequent start-up; otherwise safe operation cannot be guaranteed.

Prior to initial commissioning, prior to and after maintenance work and when putting back into operation.

During normal operation, process gas can ingress into the yoke and the crankcase of the compressor block. If the process gas is a flammable, toxic or corrosive gas, then it must be displaced before opening the compressor block. To do this, an inert gas – frequently dry nitrogen – is channelled into the compressor block.


This displacement is referred to as "purging".

The nitrogen displaces the process gas in the interior of the compressor block. Thus, after the purging process, only the smallest quantities of the process gas are located in the yoke and the crankcase. When opening the compressor block, these quantities pose no danger to the people and the environment in the vicinity.

Since air can get inside the crankcase and in the yoke of the compressor block during maintenance, and the oxygen contained within the air could get into the compression chamber from there when the compressor block starts up, there is a danger that an ignitable mixture may develop in the compression chamber. Prior to initial commissioning and all further instances of recommissioning (after a lengthy downtime), air could have got insides of the compressor block, which in turn could lead to critical situations in the compression chamber and the extended piping.

This is why prior to initial commissioning, after every instance of maintenance and every time the system is put back into service, the following areas must be purged / inerted:

- Compressor block interior (crankcase and yoke)
- Gas-carrying area of the compressor block (cylinder) / compressor unit (all gas-carrying components)

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The purging processes are described below.



The positions of the connections and components used in the action steps are specified in section 3 "Product description".

System state

Component	State	Reference
Main switch	OFF and secured against reactivation	Overall system operating instructions
Compressor block	Depressurised	Overall system operating instructions

Compressor operation with purging gas

ATTENTION!



Compressor operation with purging gas!


Serious damage to the compressor block. Do not operate compressor blocks with purging gas. The suction and pressure valves of the compressor block are designed for the process medium. Operation with other gases leads to valve damage.

- Do not switch the compressor block to compression operation during the purging process.

Purging the compressor block interior

Perform the following actions for purging the compressor block interior:

1. Connect the external purging gas pipe (nitrogen pipe) to the "purging gas inlet" ball valve on the crankcase.
2. Ensure that the "purging gas outlet" is connected to the vent line.
3. Open the "purging gas inlet" ball valve.
4. Introduce the purging gas and check the purging gas pressure. This must be a maximum of between 1.1 to 1.5 bar abs, if nothing other is stated.

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WARNING!

Excessive purging gas pressures lead to damage to the seal pair of the oil gland or to the radial shaft seal rings. This may cause a process gas leak in normal operation.

➤ **Purging gas pressure** must not exceed between 1.1 to 1.5 bar abs, if nothing other is stated.

The purging gas reaches the yoke from the crankcase via an internal non-return valve. From here, it flows through the leakage gas pipe with non-return valve out of the yoke through the safety valve vent line safely into the open.

5. Perform purging process for 5 minutes. This duration has proven to be sufficient in practice.
6. Close the "purging gas inlet" ball valve.
7. The connection to the external purging gas pipe can be removed.
8. Purging process is complete.

When starting up, the process gas must be initiated immediately.

Purging gas-carrying areas

- The compressor block / the compressor unit must be disconnected from the gas supply for maintenance and repair work.
- Shut-off valves must be provided for this before and after the compressor block/unit.
- Also, shutting purging gas connections are to be introduced between the separation points before and after the compressor block/unit.
- Measure the process gas concentration at the purging gas outlet. Maintain purging process until a process gas concentration of < 2.0 vol. % is measured.

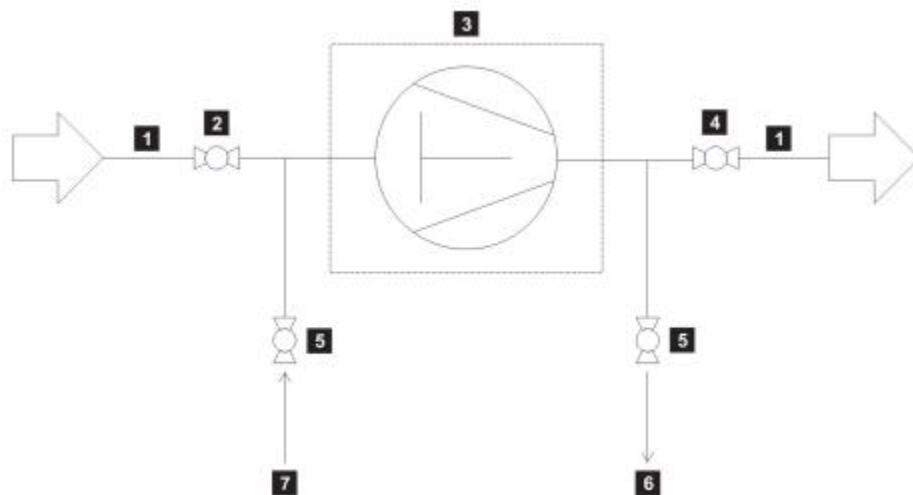



Fig. 5-4: Purging gas connections of the gas-carrying area

Pos.	Component
1	Gas pipe
2	Shut-off valve (suction side)
3	Compressor block / compressor unit
4	Shut-off valve (pressure side)
5	Purging gas shut-off valve
6	Purging gas connection (outlet)
7	Purging gas connection (inlet)

Purging gas-carrying areas

In order to purge the gas-carrying area of the compressor block, note the following steps:

1. Purge the cylinder through the gas pipes for **1 min. at 3 to 4 bar abs.**
2. When starting up, introduce the process gas immediately.

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C-3.5 Commissioning

Requirement

Checking the scope of delivery prior to commissioning in accordance with section 4 is a requirement.

DANGER!

Purging in the case of dangerous gases prior to commissioning



Contact with dangerous gases!

Dangerous gases can cause explosions in the event of contact with the air. Furthermore, there is a risk of fatality in the event of bodily contact and inhalation.

- **Purging** of the compressor block which is designed for the compression of a dangerous gas prior to initial commissioning, prior to and after maintenance work and at the time of recommissioning, as described in the section 5.5.

C-3.5.1 Checks prior to commissioning (compressor block and unit)

ATTENTION!




Damage to the compressor block due to excessive pressure ratio or excessively high temperature!

In the event of a **test operation** with air or nitrogen, one must therefore observe:

- The **pressure ratio** may be **max. 4**.
- The **discharge temperature** at the compressor block must not exceed **max. 180°C**.

		Reference	Commissioning	
	Testing			
1	Determine the guidelines and standards conformity of the overall system in which the compressor block / compressor unit is integrated.		➤	
2	Ensure that prescribed leak-tightness tests of the overall system have been successfully performed (pressure test as per operator regulations).		➤	
3	On-site electrical connections for correct configuration and, in the case of operation in areas at risk of explosion, for suitability for operation in areas at risk of explosion.	5.3.3	➤	
4	Check the earthing / potential equalisation of all parts.		➤	
5	Ensure that pipelines / hose lines are properly connected.	5.3.2	➤	
6	Check oil filling / oil level of the compressor block.	5.6.2	➤	
7	Check coolant filling / coolant level. (In the case of water-cooled compressor blocks)	5.6.3	➤	
8	Check turning direction of the compressor block. Turning direction must match the turning direction arrow on the compressor block.		➤	
9	Check the turning direction of the fan. (In the case of air-cooled compressor blocks / air coolers)		➤	
10	Discharge cock on the pressure vessel must be opened.		➤	
11	Check prescribed settings of measurement, control and switching devices.		➤	
12	Ensure that filling and drain screws, as well as vent/drain valves that are present, are tightly shut.		➤	
13	Shut-off valve in the suction and pressure pipe (if present) must be opened.		➤	
14	Pressure gauge and pressure shut-off valves (if present) must be opened.		➤	
15	Purging gas pipe (if present) must be shut.		➤	

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C-3.5.2 Check oil fill / oil level

The oil level is checked at the oil inspection glass in the event of a standstill of the compressor block.

Maximum: Oil inspection glass centre level

Minimum: Oil inspection glass quarter level

C-3.5.3 Checking coolant filling

Prior to each commissioning of compressor blocks, one must ensure that all liquid-cooled components are properly supplied with liquid.

Coolant

Clean water that is not too hard must be used as a coolant and for treating with antifreeze. The following is not appropriate: Mine water, sea water, brackish water, salt water and industrial wastewater. Also note the specifications of the "Technical data" in the appendix to these instructions in this regard.

ATTENTION!




Damage due to insufficient cooling!

Insufficient cooling of the compressor block's compression chambers, or none at all, may lead to serious damage and even to the destruction of the compressor block after just brief operation.

- This is why an automatic temperature monitoring facility is essential for the cooling water. Water-cooled compressor blocks are usually equipped with a temperature monitoring device which ensures that the compressor block is automatically shut down in the event of excessive cooling water temperatures.
- If the automatic temperature monitoring is not part of the order, appropriate temperature monitoring devices must be installed at the location.
- Do not exceed the maximum permissible pressure of 2 bar for the cooling water.
- The maximum permitted cooling water discharge temperature of 55°C in the compressor block must not be exceeded.
- In the event of the risk of frost, adequate antifreeze must be ensured for the entire cooling system.



The positions of the connections and components used in the action steps are specified in section 3 "Product description".

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Filling / draining

Prior to commissioning, the coolant chambers of the compressor block must be filled with coolant through the supply pipe provided for this purpose.

1. Shut the venting taps / drain taps.
2. Open temperature control fully.

NOTICE

Air pocket formation

- Allow coolant to flow in quickly.

3. The coolant chambers of the compressor block are properly filled and vented once coolant flows toward the cooling water outlet through the vent pipe (if present).
4. Shut the temperature control and then open again with approx. 2 turns.

Precise temperature adjustment can only be made when the machine is running.

Draining / venting

The coolant of the compressor block may have to be partially or fully drained for maintenance or repair work.

WARNING!



Hot coolant!

Risk of burns.

➤ Only drain coolant when it is in a cool state.

1. Open the coolant drain cock and discharge the requisite amount of coolant into a suitable container through a hose to be attached to the drain cock.

2. If no coolant flows out after opening the coolant drain cock, a vent cock must be opened at the cooling water outlet.

Before refilling, shut the coolant drain taps and venting taps once more.

Draining coolant fully,

additional steps must be performed for a complete draining of coolant.

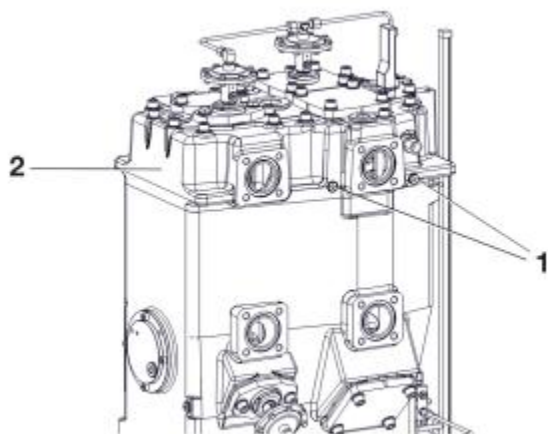



Fig. 5-5: Drain screws, TZW 60/60.1 and TZW 70/70.1

Pos.	Component
1	Drain screw
2	Cylinder head

1. Drain coolant from the compressor block as per the previous section "Draining / venting".

NOTICE

Attention! Coolant discharging.

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- Prior to opening the drain screws, prepare suitable hose connections or ball valves to prevent immediate emptying.

2. Detach drain screws [1] from the cylinder head [2] and, if necessary, immediately attach hose connection or ball valve and place a suitable container under its outlet.
3. Once emptied fully, detach the hose connection / ball valve.
4. Seal and install drain screws with Teflon tape or "LOCTITE thread sealant 572" into the drain holes.


Before refilling, shut the coolant drain taps and venting taps once more.

C-3.5.4 Starting and checking when starting (compressor block and units)

		Reference	Commissioning	
	Testing			
1	Switch on the main switch.		➤	
2	Switch on the control current switch.		➤	
3	Check oil pressure and oil temperature.	5.6.6	➤	
4	Cooling function check.	5.6.7	➤	
5	Compressor control system function check.		➤	

Intermittent control

For intermittent control, the machine is switched off upon reaching the final pressure and the solenoid relief valve opens. For idling control, the compressor block continues running in a depressurised state.

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ATTENTION!



Damage to the pressure valves due to long-lasting load-free operation!

If the machine has a gripper control for idling operation (suction valve lifting), the duration of load-free operation (gripper control active) may be **max. 5 minutes**.

In the case of 50%-setting and double-acting machines, the suction valves on the cover side and the crank side must thus be actuated for idle mode **every 5 minutes in alternation!** If this value is exceeded, one must assume damage to the pressure valves.

If the machine has a bypass valve for idling operation (pressure / suction side short-circuit), the duration of idling operation is not limited.

When lowering the pressure to the activation point, the compressor block starts up again / goes to load run; if necessary, correct the pressure setting of the pressure switch.

C-3.5.5 Check oil pressure and oil temperature

The oil pressure is pre-set to the set pressure at the factory.

1. Check oil pressure and temperature.

The specifications regarding oil pressure and oil temperature are listed in the technical data in the appendix section.

ATTENTION!



Oil pressure too low!

Even short-term operation with too little oil pressure may cause severe subsequent damage to the compressor block.


- Ensure the oil pressure stays above the minimum admissible oil pressure.
- Install oil pressure switch for monitoring.

• **Start-up:**

The drive motor of the compressor block may only start once the oil pump has built up the prescribed oil pressure.

• **After-run:**

The oil pump must lag for approx. 1 minute when the drive motor of the compressor block is switched off (i.e. continue to convey oil).

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C-3.5.6 Cooling function check

1. Ensure that coolant flow is present.
2. If there is no coolant flow then the compressor block may need to be vented, because air pockets may have formed.

C-4. Operation

This section describes the safe and efficient operation of the machine.

C-4.1 Safety

Protective equipment



Risk of fatality due to tampered or defective protective equipment!

Danger zones may become accessible or dangers may not be able to be averted by protective equipment which has been tampered with or is defective. This leads to serious injuries or fatality.

- Only operate the compressor block/unit with fully attached and functional protective equipment.
- Emergency-Off buttons must be accessible at all times.


Fault conditions



Risk of injury posed by operation in a faulty state!

Damage, defects or deficiencies to the compressor block/unit may pose a threat to personnel.

- Check the compressor block/unit for outwardly noticeable damage, defects or deficiencies once per shift.
- Shut the compressor block/unit down immediately and secure it against reactivation.
- Report any damage, defects or deficiencies that arise immediately to superiors.

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Malfuncions



Risk of injury posed by malfunctions of the compressor block/unit!

Malfuncions may lead to personnel being endangered.

- Shut the compressor block/unit down immediately in the event of malfunctions and secure it against reactivation.
- Notify superiors.
- Eliminate the cause of faults prior to reactivation.

Unexpected start-up



Risk of injury posed by unexpected compressor block/unit start-up!

Unexpected start-up of the compressor block/unit may lead to injuries.

- Prior to activating the compressor block/unit, ensure that no persons are endangered (especially from a remote start-up release from a control room).

C-4.2 Activities prior to use


Prior to using the machine, carry out the following activities:

1. Ensure correct installation of all protective covers.
2. Ensure that there is no external damage to the machine.
3. Ensure that there is no damage to the electrical connections.
4. Ensure that there are no longer people in the danger zone / performing work in the danger zone.

5. When compressing dangerous gases:

Ensure that the compressor block and gas-carrying pipelines and components have been purged and cleaned properly prior to operation. (Proper cleaning required for applications with oxygen.)

6. Ensure that a successful test run has been performed prior to operation, see section 5 "Commissioning".

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C-4.3 During operation

During operation of the machine, no personnel are required around the machine or in its immediate vicinity. The machine is operated via the control system for the overall system (operating instructions for the overall system).

Nevertheless, the following notes and checks are important for safe and efficient operation and are to be performed.

C-4.3.1 Notes on load-free operation

Intermittent control

For intermittent control, the machine is switched off upon reaching the final pressure and the solenoid relief valve opens. For idling control, the compressor block continues running in a depressurised state.

ATTENTION!



Damage to the pressure valves due to long-lasting load-free operation!

If the machine has a gripper control for idling operation (suction valve lifting), the duration of load-free operation (gripper control active) may be **max. 5 minutes**.

In the case of 50%-setting and double-acting machines, the suction valves on the cover side and the crank side must thus be actuated for idle mode **every 5 minutes in alternation!**

If this value is exceeded, one must assume damage to the pressure valves.


If the machine has a bypass valve for idling operation (pressure / suction side short-circuit), the duration of idling operation is not limited.

C-4.3.2 Checks during operation



Check when the machine is running!

Document the checks.

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WARNING!



Injury hazard from touching hot surfaces or contact with hot operating resources!

During operation, machine parts and operating resources reach high temperatures. Contact with machine parts or operating resources may cause burns.

- Avoid touching the hot surfaces of axes and motors to prevent burning your skin.
- Wear protective gloves if working on hot surfaces is necessary.

During machine operation, the following operating parameters are to be checked and logged on a daily basis:

Compressor lubrication:

- Oil level
- Oil pressure

Compressor cooling (in the case of water-cooled compressor blocks)

- Cooling water discharge temperature (humid gases: 50°C, dry technical gases: 40°C)
- Cooling water discharge temperature max. 55°C


ATTENTION!



Condensation from process medium

Serious damage to the compressor block, especially to the gas-carrying components.

- The temperature of the coolant in the compressor block must be higher than the dew point of the gas to be compressed.
- To prevent condensation in the compressor block, the cooling water inlet temperature must be at least 5°C above the gas inlet temperature.

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Condensate discharge:

- Yoke ball valve

Suction and pressure pipe:

- Gas inlet temperature per compression stage
- Gas discharge temperature per compression stage
- Gas inlet pressure per compression stage
- Gas discharge pressure per compression stage

See the rating plate of the compressor block and the "Technical data" in the appendix section for information on the operating parameters.

The operating parameters are to be checked both on the measuring instruments on the compressor block (pressure gauge and thermometer) and on the measuring instruments installed on site.


Faults can only be detected promptly, and dangers thereby prevented, with regular checks.

C-4.4 Intermittent operation

For the intermittent operation of compressor blocks/units for the compression of humid and/or corrosive gases, the notes in this section are to be followed.

At a standstill / after switching off the compressor block, residual quantities of the process gas may be left behind in the compressor block interior and the gas-carrying areas of the compressor block/unit. These residual quantities may lead to corrosion.

In order to prevent damage when at a standstill during the course of intermittent operation of compressor blocks for the compression of humid and/or corrosive gases, please pay attention to the following note.

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ATTENTION!



Corrosion to compressor block components caused by humid and/or corrosive gases!

Considerable corrosive damage during a standstill (standstill damage) to the compressor block may lead to functional impairments and premature wear to the seal elements (piston and guide rings, packing rings of the gland).


- Block off the suction side to prevent further gas supply.
- Prior to the standstill, purge the compressor block interior and gas-carrying area of the compressor block/unit / compressor system with nitrogen (see section 5).

C-4.5 Shutting down in an emergency

In dangerous situations, machine movements must be stopped as quickly as possible and the power supply must be switched off.

In the event of danger, do the following:

1. Trigger the machine's emergency-off function.
2. Remove people from the danger zone and initiate first-aid measures.
3. Make emergency calls; notify the ambulance and fire brigade.
4. Notify the superior at the location of use about the fault.
5. Switch off the machine at the main switch and secure it against reactivation.
6. Ensure unobstructed access routes for rescue vehicles.
7. Should the severity of the emergency require it, notify the competent authorities.
8. Entrust specialist personnel with troubleshooting.

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WARNING!

Risk of fatality posed by premature reactivation.

➤ Prior to reactivation, make sure that personnel are no longer in the danger zone.
9. Check the system prior to recommissioning and make sure that all the safety equipment is installed and functional.

Note on compressing dangerous gases

Explosion with risk of fatality to personnel!

➤ **Purge** compressor blocks for flammable gases or vapours **prior to opening and prior to start-up after opening** to prevent explosive gas/air or vapour/air mixtures from forming.

C-4.6 Operational disruptions

In this section, the possible causes of faults and troubleshooting are described. If faults occur with increasing frequency, adjust the maintenance intervals according to actual loads.

In the event of faults which cannot be resolved using the following notes, contact the manufacturer (see the contact data at the start of the operating instructions).

What to do in the event of faults


Local safety regulations apply in all cases to the operation of the machine, irrespective of the instructions below.

Safety shutdown

Prior to commencing work on troubleshooting, installation, servicing or repair

- Render the **machine currentless** (shut down at the main switch)
- **and**, in the case of work on pressurised parts, also render the system **depressurised**.
- For machines **in areas at risk of explosion**, the compressor block and gas-carrying pipes must be **purged prior to work** (see section 5).

We strongly recommend **a lockable in situ interrupter**, which prevents unintentional machine reactivation in the event of repairs or troubleshooting

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C-4.6.1 Safety


Personnel

- Some work must only be performed by specially qualified specialist personnel or exclusively by the manufacturer, which is specifically emphasised in the description of the individual faults.
- Work on the electrical system must strictly only be performed by electrical specialists.

Personal protective equipment

Wear protective equipment for all fault work:

- Safety shoes
- Eye protection

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DANGER!

Emergence of explosive gas/air mixtures



Development of explosive gas/air mixtures or vapour/air mixtures when opening and before starting up after opening due to air contact!

May lead to explosion with risk of fatality to personnel.

- Purge compressor blocks for flammable gas or vapours prior to opening and prior to start-up after opening to prevent explosive gas/air or vapour/air mixtures from forming.


Explosions



Explosions!

The introduction of ignition sources, such as sparks, naked flames and hot surfaces may lead to explosions in areas at risk of explosion.

- Prior to commencing work, obtain a work permit in writing.
- Only use tools which are approved for use in areas at risk of explosion.
- Only perform troubleshooting work free of potentially explosive atmospheres.

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WARNING!

Unexpected start-up



Risk of injury posed by unexpected compressor block/unit start-up!

Unexpected start-up of the compressor block/unit may lead to injuries.

- Prior to activating the compressor block/unit, ensure that no persons are endangered (especially from a remote start-up release from a control room).

Uncontrolled start-up



Uncontrolled start-up of the machine!


Injuries to personnel.

- Install a lockable in situ interrupter, which prevents unintentional machine reactivation in the event of repairs or troubleshooting.



In the case of assembly work for servicing, repair or fault resolution, please note the specifications of the relevant assembly instructions of the accessory components. They are located in a separate folder "Accessory instructions".

In all other respects, we refer you to the relevant accident prevention regulations of the respective employer's liability insurance associations.

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C-4.6.2 What to do in the event of operational disruptions

As a rule:

1. In the event of faults posing an immediate danger to personnel or property, trigger the emergency-off function of the machine immediately.
2. Determine the cause of the fault.
3. Immediately notify the superior at the location of use about the fault.
4. If troubleshooting necessitates working in the danger zone, switch the machine off and secure it against reactivation.
5. Have the fault resolved by authorised specialist personnel or, if authorisation for resolution is provided in the fault table, resolve it yourself.

C-4.6.3 Faults / troubleshooting

Q: Qualified technical staff


T: Trained personnel

E: Electrical specialist

The qualification of personnel to which the above abbreviations refer is described in section 2 "Safety".

Occurrence / fault	Possible cause	Troubleshooting	Resolved by
Falling pressure or low volume flow	Suction filter soiled	Clean filter insert, replace after lengthy operation	I
	Pipelines or valves leaking	Search and seal leak points with leak-detecting spray	I
	Suction/pressure valves are leaking	Remove valves and check; replace if necessary	Q
	Valve lifting mechanism not working	Remove valve lifting mechanism; check for smooth running; lubricate with PFPE lubricant, or replace diaphragm	Q
	Piston rings worn	Replace piston rings	Q

Occurrence / fault		Possible cause	Troubleshooting	Resolved by
Oil pressure too low		insufficient oil in the crankcase	Top up oil	I
		Excessively thin oil in the crankcase	Oil does not conform to manufacturer recommendations (technical data); replace oil and replace with an appropriate one	I
		Oil screen / oil filter blocked	Clean or replace oil screen / oil filter	I
		Enlarged bearing play (connecting rod, crankshaft)	Set oil pressure higher with regulating screw	I
Compressor block becomes hot (Higher gas discharge temperature is normal)	General	Pressure valves are leaking	Remove valves and check; replace if necessary	Q
		Piston rings are worn	Replace piston rings	Q
	Air-cooled compressor blocks	Blower V-belt tension too low or V-belts are defective	Re-tighten V-belt; replace if necessary	I
		Protective grating in front of blower dirty	Clean protective grating	I
		Inadequate ventilation	Ensure decent cooling air supply	I
		incorrect rotation direction	Ensure that the cooling air from the fan is blowing in the direction of the compressor block	I
	Water-cooled compressor blocks	Strainer in cooling water supply pipe blocked	Clean strainers	I
		Thermostatic valve misaligned or defective	Check thermostatic valve; replace if necessary	Q
		Insufficient pressure in the cooling water supply pipe	Ensure higher pressure: At least 1.5 to 2 bar	I


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Occurrence / fault		Possible cause	Troubleshooting	Resolved by
		Excessive cooling water temperature	Ensure lower temperature or higher flow rate; if necessary, connect compressor block and cooler separately.	Q
		Deposits in the cooling water spaces of the compressor block	Detach and clean compressor block	Q
Compressor block starts up with difficulty		Start-up relief not working	Check relief device	Q
		Non-return valve leaking	Detach and clean non-return valve	Q
Motor protection switches off due to overloading		Compressor block running against excessively high pressure: <ul style="list-style-type: none"> • pressure pipe throttled • Pressure switch set too high • Excessive pressure in suction pipe 	Check pressure ratios	Q
		Line voltage too low	Check voltage directly on the motor or switching device	E
		Drive unit bearing or crosshead seized up (Compressor disc only rotates with difficulty)	Check components; replace if necessary	Q
		Jamming of piston rings due to excess temperatures (Compressor disc only rotates with difficulty)	Check components; replace if necessary	Q
Compressor block runs unevenly		V-belt loosened	Re-tensioning V-belt	I

Table 6-1: Fault table



If a fault occurs with the compressor block which is not described here, please refer to customer services at Mehrer Compression GmbH. The contact data is presented in section 7 "Maintenance".

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C-4.6.4 Commissioning following operational disruption resolution

Once the operational disruption has been resolved, take the following steps:

1. Check firm fitting of previously released screw connections and secure if necessary.
2. Ensure the proper functioning of all previously removed covers and protective equipment.
3. Remove tools and work materials from out of the work area.
4. Clean the machine/work area and, if necessary, remove discharged substances (liquids, processing material, etc.) and dispose of them in an environmentally friendly manner.
5. Ensure the correct installation of all the machine's safety equipment and that it is working properly.
6. Machines for the compression of **dangerous gases** must be purged prior to reactivation **in accordance with section 5 "Purging"**.

Note on compressing dangerous gases

Explosion with risk of fatality to personnel!


- **Purge** compressor blocks for flammable gases or vapours **prior to opening and prior to start-up after opening** to prevent explosive gas/air or vapour/air mixtures from forming.

7. Put the machine back into operation in accordance with the notes in the section "Commissioning".

Premature reactivation

Risk of fatality posed by premature reactivation of the machine!

- Prior to the reactivation of the machine, ensure that people are no longer in the danger zone / are no longer performing work in the danger zone.

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C-4.7 Safety

Important

The safety information and notes in section 2 "Safety", the safety notes in this section and the warning notes immediately after the action steps must be read and understood.

Personnel

- Provided nothing else is indicated, the maintenance work described here can be performed by the service personnel of the operator.
- Inspections, wear checks and work on the pressurised and/or gascarrying components with which the compressor block must be opened must only be performed by qualified specialist personnel as described in section 2. The maintenance and installation instructions, as well as all safety and accident prevention regulations should be observed in this regard.

Personal protective equipment

- Safety shoes
- Protective gloves

Pressurised components



Unexpected pressure equalisation when opening pressurised components!

Injuries due to flinging around or the unexpected discharge of pressurised gases.

- Prior to maintenance or repair work, take the machine out of service completely, depressurise it and secure it against reactivation.
- Only allow wear checks and work on pressurised components of the machine to be performed by qualified specialist personnel.


Faulty maintenance



Incorrectly performed maintenance work!

Improper maintenance work may cause injuries.

- Comply with stipulated maintenance intervals.
- Ensure to correctly re-install removed components.
- Pay attention to stipulated tightening torques when installing components.

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Securing against reactivation



Unauthorised reactivation of the machine

Unauthorised machine reactivation during maintenance and repair work could lead to injuries to maintenance personnel.

- Prior to maintenance or repair work, switch off the machine on the main switch and secure it against reactivation.

Hot surfaces and operating resources



Hot surfaces and operating resources due to operation!

During operation, machine parts and operating resources reach high temperatures. Contact with machine parts or operating resources may cause burns.

- Prior to starting work, check temperature of surfaces or operating resources; if necessary, wait for them to cool down.
- Wear protective gloves if working on hot surfaces is necessary.


Incorrect spare parts and accessories



Incorrect spare parts and accessories!

Compressor block components are subject to considerable stress. Spare parts not approved by Mehrer Compression GmbH may be unable to withstand this type of stress. Failing non-approved components may cause serious injuries.

- Use only spare parts approved by Mehrer Compression GmbH.

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Overhead installation work



Machine parts used as climbing aids for overhead installation work.

Injuries due to falling from height in the event of overhead installation work where machine parts are used as climbing aids.

- Do not use machine parts as climbing aids.
- Use safety-compliant climbing aids and work platforms.
- For maintenance work at great heights, wear fall protection devices.
- Keep handles, steps, rails, platforms and ladders free of dirt, snow and ice.

Environmental protection

Dispose of materials, machine parts and accumulated work materials properly in accordance with local rules and regulations. (See also section 2 "Safety" – "Environmental protection")


C-4.7.1 Special notes regarding dangerous gases and operation in areas at risk of explosion

DANGER!

Explosive atmosphere



Potentially explosive atmospheres!

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Death or serious injury due to explosion.

- No open flames; no fire, open ignition source, or smoking!
- Unauthorised access denied!
- Stay in areas at risk of explosion only as long as is necessary for performing your work.
- Keep mobile phones switched off!
- Immediately leave the danger zone in the event of a gas alarm.
- Comply with the emergency plan drawn up by the owner.

Explosion due to discharging gases



Risk of explosion when opening process gas-conveying components of the compressor block.

When opening process gas-carrying components of the compressor block, residual quantities of the process gas are discharged. They may create an explosive atmosphere.

- Prior to commencing with maintenance and repair work, process-gas-carrying components must be purged to displace the process gas.
- Check adequate purging.
- Only have work on the compressor block performed by qualified specialists.

C-4.8 Maintenance preparations


Prior to commencing maintenance work, depressurisation must be performed. Compressor blocks for the compression of dangerous gases must also be purged.

C-4.8.1 Depressurising compressor block

Prior to commencing with maintenance work on the compressor block, pressure must be released. Appropriate valves for blocking and relieving the compressor block in the overall system in which the compressor block is installed must be arranged on site.

System state

Component	State	Reference
Main switch	OFF and secured against reactivation	Overall system operating instructions
Compressor block	Pressurised	-

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Personal protective equipment

- Safety shoes
- Eye protection

Repressurisation



Repressurisation inside the compressor block after depressurisation has been performed!

Risk of injury posed by pressurised components.

- Keep shut-off valves of the gas supply pipes shut during maintenance work.
- Keep ball valves in open position for pressure relief during maintenance work.

C-4.8.2 Purging the compressor block


Prior to commencing maintenance work the crank drive and the gas-carrying area of the compressor block must be purged (inerted) with purging gas.

The purging process must be performed for every compressor block individually.

System state

Component	State	Reference
Main switch	OFF and secured against reactivation	Overall system operating instructions
Compressor block	Depressurised	7.2.1

The action steps for the purging process are described in section 5.

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C-4.9 Maintenance plan

The sections that follow describe the maintenance work that will ensure that the system operates in an optimum way and free of faults.

Maintenance intervals

The intervals specified in the maintenance plan are recommendations which are influenced by the operating conditions (suction and final pressure), as well as the gas to be compressed (purity, humidity [humid, dry with dew point up to "bone dry"]).

The maintenance plan specifies the maintenance intervals for the first 8,000 operating hours. After this point, the inspections are to be conducted in line with experience gained thus far regarding spare part wear.

Recommended first inspection

After **2,000 operating hours**, the first inspection of the compressor block should take place. The level of wear of the individual assemblies (valves, pistons, oil and gas gland) and the general condition of the compressor block is assessed.

Adapting maintenance intervals

If increased wear is identified during the regular inspections, then the maintenance intervals should be adapted appropriately to the actual incidence of wear in consultation with the manufacturer.


Personnel

The definitions of personnel qualifications are described in section 2 of these operating instructions.

Symbol	Meaning
TP	Trained person
QP	Qualified specialist personnel with special training
E	Electrical specialist
I	Approved inspection body / for the inspection of competent personnel as per national regulations


Other symbols

Symbol	Meaning
MD	(M ehrer D ocumentation) Reference to description in the supplier documentation of the components in the "Accessories instructions" folder


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In the event of questions regarding maintenance work and intervals, contact the manufacturer; see the contact data for customer services at the start of this section.

	Actions required after operating hours:		Reference	Daily	50,000	2,000	every 4,000	every 8,000	every 12,000	every 20,000
	Latest due after months:							every 12		every 60
Qualification	Component	Taks								
TP	Operating parameters	Checking	Section 6	*	*		*			
TP	Compressor block	Check for noises and running behaviour		*	*		*			
TP	Compressor block	Drain condensate	7.3.1	*	*		*			
TP	Oil	Check fill level and condition	7.3.2	*	*		*			
QP	Oil	Change	7.3.3		*		*			
QP	Oil filter	Change	7.3.3		*		*			
QP	Control unit, valve control unit	Checking			*	*	*			
QP	Suction valve lifting	Lubrication			*		*			
QP	Suction and pressure valves **) / (***)	Inspection			*		*			
QP	Valve chambers	Inspection for deposits			*		*			
QP	Piston	Check ring grooves							*	
QP	Piston and guide rings **) / (***)	Inspection			*		*			
QP	Piston rod	Inspection							*	

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	Actions required after operating hours:		Referen ce	D a i l y	5 0 0 0	2 0 0 0	e v e r y 4 0 0 0	e v e r y 8 0 0 0	e v e r y 12 0 0 0	e v e r y 40 0 0 0
	Latest due after months:							e v e r y 12		e v e r y 60
Qualification	Component	Taks								
QP	Gas gland *) / **)	Inspection				*		*		
QP	Non-return valve purging gas outlet / leakage gas, yoke	Checking						*		
QP	Non-return valve for leakage gas return to suction side	Checking						*		
QP	Cylinder liner	Inspection								*
QP	Cylinder and Cylinder head	Check cooling water chambers and clean if necessary								*
QP	Oil gland *) / **)	Inspection						*		
QP	Crankcase	Remove covers and check bearings visually						*		
QP	Screw connections of piston	Change screws								*
QP	All bearings	Check visually								*
QP	Crosshead	Inspection and change bolts								*
QP	Oil pump	Check								*
QP	Oil pressure regulator	Functional test								*
QP	Screw connections	Re-tightening	7.3.4			*		*		*

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	Actions required after operating hours:		Referen ce	D a i l y	5 0 0 0	2 0 0 0	e v e r y 4 ,0 0 0	e v e r y 8 ,0 0 0	e v e r y 12 ,0 0 0	e v e r y 40,000
	Latest due after months:							e v e r y 12		e v e r y 60
Qualification	Component	Taks								
QP	V-belt (if installed)	Re-tightening			*	*	*			
QP	V-belt (if installed)	Check; re-tighten or replace if necessary				*	*			
QP	Coupling (if installed)	Check wear				*		*		

*) If increased wear is detectable during the inspection, the maintenance intervals are to be shortened.

**) If the components are heavily worn, they must be replaced.

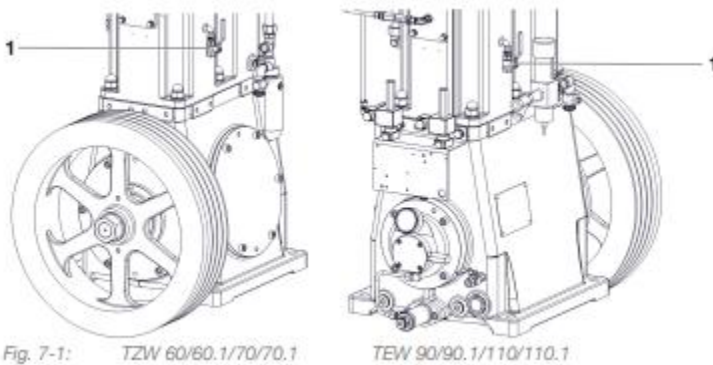
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C-4.9.1 Drain condensate

System state

Component	State	Reference
Main switch	ON	Overall system operating instructions
Compressor block	Pressurised	-


Condensate may accumulate in the yoke if there are humid gases.



Pos.	Component
1	Condensate drain cock

The following steps are to be performed for the condensate drain:

1. Keep the collection tank under the ball valve.
2. Open the condensate drain cock [1].
3. Wait until no more condensate discharges.
4. Shut the condensate drain cock [1]. 5. Condensate is drained.

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C-4.9.2 Check oil level and condition

System state

Component	State	Reference
Main switch	OFF	Overall system operating instructions
Compressor block	Pressurised	-



Perform this check while the machine is shutdown.

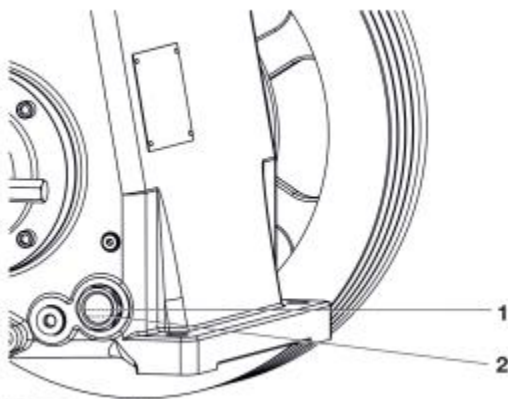


Fig. 7-2: Oil level


Pos.	Component
1	Maximum
2	Minimum

Oil level

Visual inspection of fill level (check in oil inspection glass):

Maximum: Oil inspection glass centre level

Minimum: Oil inspection glass quarter level

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ATTENTION!

!

Incorrect oil level!

An excess or lack of oil may cause severe damage to the compressor block.

➤ Check oil level as per the maintenance plan.

Condition

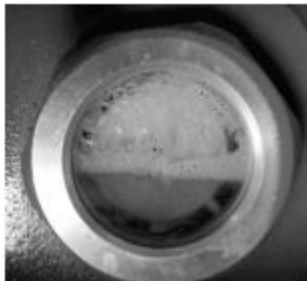



Fig. 7-3: Condition: Example of condensate in oil

In the event of changes to the condition of the oil, the lubricating properties of the oil no longer exist.

The condition of the oil is checked and read from the oil inspection glass.

Occurrence	Possible cause	Measures
Milky, cloudy oil, foaming	Cooling water discharge temperature too low	Check process, oil change (section 7.3.3, p.7-16), clean drive unit, clean yoke chamber, clean valve nests, if possible: purge compressor with nitrogen to dry it (inertisation)
	Oversaturated gas	
	Steam trap not working	

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C-4.9.3 Oil change

System state

Component	State	Reference
Main switch	OFF and secured against reactivation	Overall system operating instructions
Compressor block	Depressurised	7.2.1

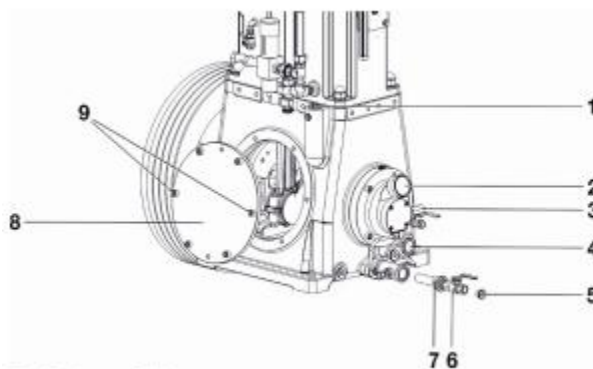




Fig. 7-4: Oil change

Pos.	Component
1	Oil filler port
2	Oil pressure manometer
3	Pressure regulator
4	Oil inspection glass
5	Oil drain cock
6	Oil drain screw
7	Filter insert
8	Crank drive side cover
9	Screws

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The following steps are to be performed for the oil change:

1. Take the compressor block out of service and make all preparations, as described in the section "Maintenance preparations".
2. Detach the screws [9] on crank drive side cover [8] and remove crank drive side cover [8]
3. Place a collection tank under the oil drain screw [5] / oil drain cock [6] or connect a hose and discharge into a collection tank.
4. Open the oil drain screw [5].
5. Open the oil drain cock [6].
6. Wait until the oil has fully drained from the crank drive.
7. If necessary, clean the crank drive interior with a lint-free cloth.
8. Detach the filter insert together with the oil drain cock [7], check it for dirt and clean it if necessary.
9. Attach filter insert [7] and oil drain cock [6].
10. Shut the oil drain cock [6].
11. Dispose of used filter elements and used oil in an environmentally friendly manner in accordance with the respective local rules and regulations that apply.
12. Mount the oil drain screw [5] and crank drive side cover [8] and tighten the screws [9] as per the torque tables in the appendix.
13. Open oil filler port [1] and top up with the oil and oil quantity specified in the sections "Technical data" and "Operating parameters".

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ATTENTION!



Unsuitable lubricants!

Serious damage to the compressor block due to use of unsuitable lubricants.

- Only use lubricant in accordance with the specifications in the "Technical data" in the appendix to these instructions.



Incorrect oil quantity!

An excess or lack of oil may cause severe damage to the compressor block.

- Only top up oil quantity in accordance with the specifications in the "Technical data" in the appendix to these instructions.

14. The fill level height of the oil should be in the middle of the oil inspection glass [4].


15. Check oil pressure after machine has reached its operating temperature; readjust, if necessary.

Oil pressure	Value	
Min. permissible oil pressure	0.4	bar gauge
Max. permissible oil pressure	1	bar gauge

C-4.9.4 Re-tighten cylinder / valve covers, pressure flange, screws

System state

Component	State	Reference
Main switch	OFF and secured against reactivation	Overall system operating instructions
Compressor block	Depressurised	7.2.1

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The following steps are to be taken for retightening screws:

1. Ensure the compressor block is switched off and depressurised.
2. Use a suitable torque wrench to retighten the screws of the cylinder head, the suction and pressure valves and the flange connections of the gas inlet/outlet according to torque tables in the "Appendix" section.
3. Screws are attached.

C-4.10 Measures after maintenance is finished

Once maintenance is finished, but before the recommissioning of the compressor block, the following steps are to be taken:

1. Ensure the firm fitting of the screw connections.
2. Clean the machine/work area and, if necessary, remove discharged substances (liquids, processing material, etc.) and dispose of them in an environmentally friendly manner.
3. Remove tools and work materials from out of the work area.
4. Ensure the proper functioning of all previously removed covers and protective equipment.
5. In the case of compressor blocks that are **installed in areas at risk of explosion or which compress dangerous gases**, the gas-carrying area and the crank drive must be purged before reactivation **in accordance with section 5 "Purging"**.

Risk of explosion


Risk of explosion with risk of fatality to personnel!

- **Purge** compressor blocks for dangerous gases or vapours **prior to opening and prior to start-up** after opening to prevent explosive gas/air or vapour/air mixtures from forming.
6. Put the machine back into operation in accordance with the notes in the section "Commissioning".

Premature reactivation

Risk of fatality posed by premature reactivation of the machine!

- Prior to the reactivation of the machine, ensure that people are no longer in the danger zone / are no longer performing work in the danger zone.
7. After a successful test run and commissioning as per section 5, the compressor block can be approved for operation.

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C-5. Decommissioning and disposal

Once the service life is over, the machine must be taken out of service, dismantled and disposed of in an environmentally friendly manner.

C-5.1 Safety

Personnel

- Decommissioning and disassembly may only be performed by qualified specialist personnel.
- Work on electrical components must only be performed by electrical specialists.


Pressurised components



Risk of injury when opening pressurised components!

Opening pressurised components may cause injuries from sudden pressure equalisation. Potential hazards include being forcefully pushed away or suddenly discharged pressurised gas.

- Prior to commencing disassembly work, switch off the system in which the compressor block is integrated at the main switch and secure it against reactivation.
- Prior to commencing with disassembly work, place the compressor block and the pressurised components into a depressurised state and ensure it is in such a state.
- Only have work on the compressor block performed by qualified specialists.

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Hot surfaces and operating resources



Touching of hot surfaces or contact with hot operating resources!

During operation, machine parts and operating resources reach high temperatures. Contact with machine parts or operating resources may cause burns.

- Prior to starting work, check temperature of surfaces or operating resources; if necessary, wait for them to cool down.
- Wear protective gloves if working on hot surfaces is necessary.


Falling parts



Falling parts during disassembly!

Some compressor block components are very heavy. When their fixings are loosened, they may fall down and cause serious physical injuries.

- Prior to the screw connections loosening, secure components against falling down.

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C-5.1.1 Special notes on dangerous gases

Discharging dangerous gases



Risk of explosion when opening the process gas-conveying components!


When opening process gas-conveying components, residual quantities of the process gas are discharged. They may create an explosive atmosphere.

- Prior to commencing disassembly work, render components carrying process gas inert using purging gas to displace the process gas.
- Check for sufficient inert rendering.
- Only have work on the compressor system performed by qualified specialist personnel.

C-5.2 Decommissioning

Keep to the following steps for safe decommissioning:


1. Switch off the compressor block via the control system of the overall system and secure it against reactivation.
2. Place the compressor block in a depressurised condition and check this condition.
3. In the case of compressor blocks that are **installed in areas at risk of explosion or which compress dangerous gases**, the gas-carrying area and the crank drive must be purged before disassembly **in accordance with section 5 "Purging"**.

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Risk of explosion

Risk of explosion with risk of fatality to personnel!

- Purge compressor blocks for dangerous gases or vapours prior to opening to prevent explosive gas/air or vapour/air mixtures from forming.
- 4. Disconnect all process and supply media from their interfaces to the compressor system.
 - Process gas
 - Control air (compressed air)
 - Purging gas
- 5. Disconnect energy supplies physically and discharge stored residual energy.
 - Electrical power supply
- 6. Remove auxiliary and operating resources and dispose of them in an environmentally friendly manner.
 - Oil
 - Cooling fluid (for water-cooled compressor blocks)
- 7. Disassemble the compressor block taking account of applicable local work safety and environmental protection regulations.
- 8. Clean components properly in order to remove residues from auxiliary and operating resources or the process medium.

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C-5.3 Disposal

ATTENTION!



Environmental damage due to incorrect disposal!

Electrical scrap, electronic components, lubricants and other auxiliary materials are subject to special waste handling and must only be disposed of by approved specialist operations in accordance with applicable statutory regulations.

C-5.3.1 Auxiliary/operating resources

Auxiliary and operating resources must be disposed of in accordance with the applicable statutory regulations.

C-5.3.2 Components, assemblies and individual parts

Sort the components, assemblies and individual parts into material groups for disposal.

- Metallic scrap
- Electrical scrap
- Plastics

Dispose of the material groups in accordance with applicable statutory regulations.

Your local municipal authorities or specialist disposal operations will provide information on environmentally friendly disposal.

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION C-2

**Main Components (Start-up, Shutdown, Commissioning,
Pre-commissioning)
MOTOR**



Vendor doc. Number
17735-19

P.O. NO.:
LIDCO-PO-NEC-278-6019

Vendor:
Airpack Nederland B.V.

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C-2 Main motor

C-2.1 Safety information

C-2.1.1 Information for those responsible for the plant or system

This motor has been designed and built in accordance with the specifications contained in Directive 14/35/EU ("Low-Voltage Directive") and IS 12615, and is intended for use in industrial plants. Please observe the country-specific regulations when using the motor outside India. Follow the local and industry-specific safety and setup regulations.

- Planning and configuration work and all work carried out on and with the motor is only to be done by qualified personnel.
- The operating instructions must always be available for all work.
- The technical data as well as the specifications relating to the permissible installation, connection, ambient and operating conditions are taken into account at all times.
- The specific setup and safety regulations as well as regulations on the use of personal protective equipment are observed.

NOTE:

Use the service and support provided by the local service center for planning, installation commissioning and service work.

C-2.1.2 The 5 safety rules

To ensure your own personal safety as well as to avoid material damage, always comply with the safety-relevant instructions when carrying out any work. Also carefully comply with the 5 safety rules according to EN 50110-1 "Working in a no-voltage state" in the specified sequence.


5 safety rules

1. Disconnect the system

Also disconnect the auxiliary circuits, for example, anti-condensation heating.

2. Secure against reconnection
3. Verify absence of operating voltage
4. Ground and short-circuit
5. Provide protection against adjacent live parts.

To energize the system, apply the measures in reverse order.

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C-2.1.3 Qualified personnel

All work at the motor must be carried out by qualified personnel only. For the purposes of this documentation, qualified personnel is taken to mean people who fulfil the following requirements.

- Through appropriate training and experience, they are able to recognize and avoid risks and potential dangers in their particular field of activity.
- They have been instructed to carry out work on the motor by the appropriate person responsible.

C-2.1.4 Safe handling

Workplace safety depends on the attentiveness, care, and common sense of the personnel who install, operate, and maintain the motor. In addition to the safety measures cited, as a matter of principle, the use of caution is necessary when you are near the motor. Always pay attention to your safety.

to prevent accidents:

- General safety regulations in the country where the motor is deployed.
- Manufacturer specific and application specific regulations.
- Special agreements made with the operator.
- Separate safety instructions supplied with the motor.
- Safety symbols and instructions on the motor and its packaging.

Danger as a result of stationary parts under voltage (live parts)

Live parts represent a hazard. Touch protection against active (live) parts is no longer guaranteed if covers are removed. The minimum clearance and creepage distances may be violated when coming close to live parts. Touching or coming close to them can result in death, serious injury or material damage.

- Ensure that all live parts are suitably covered.
- Switch off and disconnect the motor first if you want to remove covers. Observe the "5 safety rules".

Risk of injury due to rotating parts

Rotating parts are dangerous. Touch protection against rotating parts is no longer guaranteed if covers are removed. Touching rotating parts can result in death, serious injury or material damage.

- Ensure that all rotating parts are reliably covered.
- Switch off and disconnect the motor first if you want to remove covers. Observe the "5 safety rules".
- Only remove covers when the rotating parts have come to a complete standstill.

Risk of burns due to hot surfaces

Individual motor parts can become hot in operation. Burns can result when coming into contact with these parts.

- Never touch motor parts during operation.
- Allow the motor to cool before starting work on the motor.

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- Check the temperature of parts before touching them. If required, wear suitable protective equipment.

Health hazard due to chemical substances

Chemical substances required for the setup, operation and maintenance of motors can present a health risk.

- Observe the product information provided by the manufacturer.

Flammable substances hazard

Chemical substances required for the setup, operation and maintenance of motors may be flammable. These substances can ignite if handled incorrectly. They can cause burns and property damage.

- Observe the product information provided by the manufacturer.

Noise emission

During operation, the motor's noise emission levels can exceed those permitted at the

- Ensure that nobody is in the area of increased noise emission during motor operation.
- Take steps to reduce noise so that the motor can be operated safely within your system.

The following measures may help to reduce noise.

Covers

Noise insulation

Hearing protection measures

Prevention of hearing damage

If the permissible sound pressure level is exceeded, hearing damage can occur when operating three-phase motors at their rated power. The permissible sound pressure level is 70 dB(A).

C-2.1.5 Electromagnetic fields when operating electrical power engineering installations

Electrical power equipment generate electromagnetic fields during operation. Potentially lethal malfunctions can occur in medical implants, e.g. pacemakers, in the vicinity of electrical power equipment. Data may be lost on magnetic or electronic data carriers.

- Protect the personnel working in the plant by taking appropriate measures, such as
- erecting identifying markings, safety barriers and warning signs and giving safety talks.
- Observe the nationally applicable health and safety regulations.
- It is forbidden for people with pacemakers to be close to the motor.
- Do not carry any magnetic or electronic data media.

C-2.1.6 Electrostatic sensitive devices

Material damage due to electrostatic discharge

Electronic modules contain components that can be destroyed by electrostatic discharge. These components can be damaged or destroyed if they are not handled correctly. To protect equipment against damage, follow the instructions given below.

- Only touch electronic modules if you absolutely have to work on them.
- The body of the person concerned must have been electrostatically discharged and grounded immediately before any electronic modules are touched.
- Electronic modules should not be brought into contact with electronically insulating materials, such as:

Plastic films

Plastic parts

Insulating table supports

Clothing made of synthetic fibers

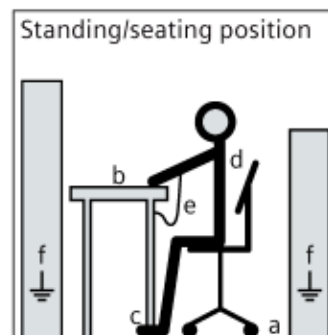
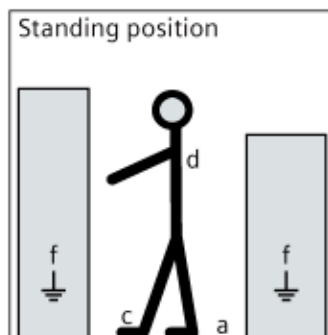
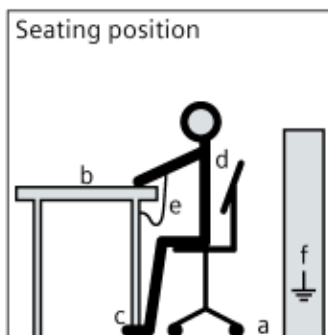
- Always place electrostatic sensitive devices on conductive bases.
- Always pack, store and transport electronic modules or components in conductive packaging, such as:

Metalized plastic or metal containers

conductive foam materials

domestic aluminium foil

The ESD protective measures required for components that can be destroyed due to electrostatic discharge are shown in the following drawings:



a = conductive floor surface b = ESD table

d = ESD overall

e = ESD wristband

c = ESD shoes

f = cabinet ground connection

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C-2.1.7 Electromagnetic compatibility

This motor is designed in accordance with IEC/EN 60034, and when used as specified, it complies with the requirements of European Directive 2014/30/EU regarding Electromagnetic Compatibility.

C-2.1.8 Interference compatibility

By selecting suitable signal cables and evaluation units, ensure that the interference immunity of the motor is not diminished.

C-2.1.9 Influence on the line power supply through a strongly irregular torque

A strongly irregular torque, for example with the drive of a reciprocating motor, forces a nonsinusoidal motor current. The emerging harmonics can have an impermissible influence on the line power supply via the connection lines.

C-2.1.10 Interference voltages when operating the converter

When a converter is in operation, the emitted interference varies in strength depending on the converter (manufacturer, type, interference suppression measures undertaken). On motors with integrated sensors (e.g. PTC thermistors), interference voltages caused by the converter may occur on the sensor lead. This can cause faults which can result in eventual or immediate death, serious injury or material damage.

- Comply with the EMC information provided by the manufacturer of the converter. This is how you prevent the limit values stipulated by IEC/EN 61000-6-2 IEC/EN 61000-6-4 for the drive system (consisting of the motor and converter) from being exceeded.
- You must put appropriate EMC measures in place.

C-2.1.11 Special designs and construction versions

Before carry out any work on the motor, determine the motor version. If there are any deviations or uncertainty, contact the manufacturer, specifying the type designation and serial number (see the rating plate), or contact the Service Center.

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C-2.2 Description

C-2.2.1 Area of application

WARNING

This motor is not designed for hazardous areas. An explosion can occur if the motor is operated in these areas. This can result in death, serious injury or material damage.

- Never operate this motor in hazardous areas.

The rotating electrical motors of this series are used as industrial drives. They are designed for a wide range of drive applications both for line operation as well as in conjunction with frequency converters. They are characterized by their high power density, extreme robustness, long service life and outstanding reliability.

Correct and intended use of the motors

These motors are intended for industrial installations. They comply with the harmonized


standards of the series EN / IEC 60034 (VDE 0530). It is prohibited to use these motors in

hazardous zones if the marking on the motor rating plate does not explicitly permit line or converter operation. If other/more wide-ranging demands (e.g. protection so that they cannot be touched by children) are made in special cases – i.e. use in non-industrial installations – these conditions must be ensured by the customer.

NOTE

Motor directive

Low-voltage motors are components designed for installation in machines in accordance with the current Machinery Directive. Commissioning is prohibited until it has been absolutely identified that the end product is in conformance with this Directive. Comply with standard EN / IEC 60204-1.

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C-2.2.2 Installation

The regulations and standards used as the basis for designing and testing this motor are stamped on the rating plate. The motor design basically complies with the following standards:

Table 3- 1 Applicable general regulations

Feature	Standard	
Dimensioning and operating behavior	EN / IEC 60034-1	IS 12615, IS/IEC 60034-1
Procedure for determining the losses and the efficiency of rotating electrical motors and inspections	EN / IEC 60034-2-1	IS 12615
Degree of protection	EN / IEC 60034-5	IS/IEC 60034-5
Cooling	EN / IEC 60034-6	-
Type of construction	EN / IEC 60034-7	IS 2253
Dimensions of three-phase foot-mounted induction motors	-	IS 1231
Dimensions of three-phase flange-mounted induction motors	-	IS 2223
Terminal markings and direction of rotation	EN / IEC 60034-8	IS/IEC 60034-8
Starting characteristics of rotating motors	EN / IEC 60034-12*	IS 12615
Vibration severity grades	EN / IEC 60034-14	IS 12075
Efficiency classification of three-phase squirrel-cage induction motors	EN / IEC 60034-30-1	IS 12615
IEC standard voltages	IEC 60038	IS 12360
Code of practice for earthing	-	IS 3043
Code of practice for installation and maintenance of induction motors	-	IS 900

C-2.2.3 Cooling and ventilation

C-2.2.3.1 General

The motors of this series have a closed primary (internal) cooling circuit and an open secondary cooling circuit (surface cooling). The surface cooling varies depending on the version.

C-2.2.3.2 Motors with a fan

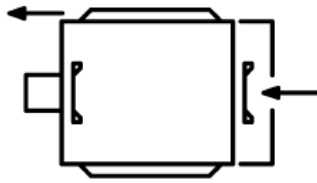
Self-ventilation (standard): Cooling method IC 411 according to EN / IEC 60034-6

Located at the ND end of the stator housing is an air intake cowl that guides the external air on its way to the motor. The external air is drawn in through openings in the air intake cowl and flows axially across the outer cooling ribs of the motor frame. The fan wheel for the external flow of cooling air is attached to the motor shaft. The fan wheels are bidirectional.

Check the cooling effect below rated speed in the case of frequent switching or braking – or if the speed is controlled continually below the rated speed.

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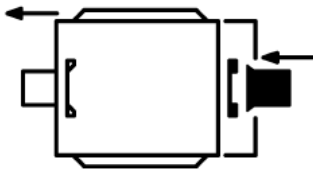
IC411 IC4A1A1



Forced ventilation (optional): Cooling method IC 416 according to EN / IEC 60034-6

Cooling that does not depend on the speed is achieved by means of a unit that is independent of the motor operating state (forced ventilation). This unit is closed to the the cooling air flow required for cooling the motor.

IC416 IC4A1A6



C-2.2.4 Bearings

In order to support the motor shaft and maintain its position in the non-moving part of the

function of a location bearing that transfers axial and radial forces from the rotating motor shaft to the non-moving part of the motor. The second rolling bearing is implemented as a floating and support bearing in order to allow thermal expansion inside the motor and transfer radial forces.

The nominal (calculated) useful life of the bearings according to ISO 281 is at least 50,000 hours if the motor is coupled via a direct flexible coupling. However, the achievable useful life of the bearings can be significantly longer in the case of lower forces (e.g. operation with self-aligning couplings).

Rolling bearings with permanent lubrication are maintenance-free.

The motor is equipped with grease-lubricated rolling bearings.

- In the standard version, the bearings of motors up to shaft height 200 are permanently lubricated.
- The bearings of motors from shaft height 225 and above are equipped with a button head grease nipple.

C-2.2.5 Balancing

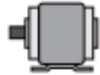





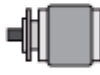


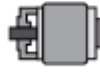


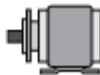
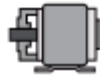
As standard, the motor is designed with vibration severity level A. The rotor is dynamically balanced with a half feather key (code "H").


Vibration severity level B can be ordered as option, and stamped on the rating plate.

C-2.2.6 Types of construction/method of installation

The type of construction of the motor is stated on the rating plate.

Table 3- 2 Type of construction

Basic type of construction code	Diagram	Other methods of installation	Diagram
IM B3 (IM 1001)		IM V5 (IM 1011)	
		IM V6 (IM 1031)	
		IM B6 (IM 1051)	
		IM B7 (IM 1061)	
		IM B8 (IM 1071)	
IM B5 (IM 3001)		IM V1 (IM 3011)	
		IM V3 (IM 3031)	
IM B14 (IM 3601)		IM V18 (IM 3611)	
		IM V19 (IM 3631)	
IM B35 (IM 2001)			
IM B34 (IM 2101)			

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C-2.2.7 Degree of protection

The motor has a type of protection as stamped on the rating plate, and can be installed in dusty or humid environments.

C-2.2.8 Environmental conditions

Limit values for the standard version

Ambient temperature	-20 °C to +50 °C
Installation altitude	≤ 1000 m
Air with normal oxygen content, usually	21 % (V/V)

The standard motors are not suitable for use in corrosive atmospheres, atmospheres with a high salt content, or outdoor applications.

Limit values for the special versions

If the environmental conditions are different from the details listed here, then the values on the rating plate or in the catalog will apply.

C-2.2.9 Optional built-on and built-in accessories

Motors can be equipped with the following integrated components/devices:

- Temperature sensors integrated in the stator winding in order to monitor the temperature and protect the stator winding from overheating.
- Anti-condensation heating for motors whose windings are subject to a risk of condensation due to the climatic conditions.

Motors can be equipped with the following mounted components/devices:

- Brake
- Rotary pulse encoder
- Separately driven fan (forced ventilation)
- Measuring nipple for SPM shock pulse measurement for bearing monitoring.


NOTE:

Further documents

Observe all of the other documents provided with this motor.

Supplementary devices

Depending on the order, various supplementary devices can be installed or mounted. These include sensors for bearing temperature monitoring or winding monitoring, for example.

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C-2.3 Preparing for use

Good planning and preparation of motor applications are essential in terms of keeping installation simple and avoiding errors, ensuring safe operation, and allowing access to the motor for servicing and corrective maintenance.

This chapter outlines what you need to consider when engineering/configuring your plant in relation to this motor and the preparations you need to make before the motor is delivered.

C-2.3.1 Safety related aspects to consider when configuring the plant

A number of residual risks are associated with the motor. These are described in Chapter "Safety information and related sections.

Take appropriate safety precautions (covers, barriers, markings, etc.) to ensure the motor is operated safely within your plant.

C-2.3.2 Observing the operating mode

Observe the motor's operating mode. Use a suitable control system to prevent overspeed's, thus protecting the motor from damage.

C-2.3.3 Motor without final paint coating

For motors, which are only delivered with primer, you must paint them to comply with the applicable guidelines for the specific application. The primer alone does not provide adequate corrosion protection.

Please contact Airpack for recommendations relating to the paint finish.

C-2.3.4 Delivery


Checking the delivery for completeness

The drive systems are put together on an individual basis. When you take receipt of the delivery, please check immediately whether the items delivered are in accordance with the accompanying documents. Siemens will not accept any claims relating to items missing from the delivery and which are submitted at a later date.

- Report any apparent defects/missing components to the appropriate SIEMENS office immediately.

scope of delivery as well as the optionally available operating instructions so that these documents are always easily accessible.

as a loose item with the delivery is provided to enable the motor data to be attached on or near the motor or installation.

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C-2.3.5 Transport and storage

C-2.3.5.1 Safety instructions for transport

Observe the following when carrying out any work on the motor:

- Comply with the general safety instructions (Page 11).
- Comply with the applicable national and sector-specific regulations.
- When using the motor within the European Union, comply with the specifications laid down in EN 50110-1 regarding safe operation of electrical equipment.

The information required to correctly attach, lift and transport the motor - such as weight, centre of gravity and attachment points - is provided here:

- Motor dimension drawing and the associated explanations or the technical data
- Transport data
- Rating plate and lifting plate, if available
- Shipping parts list
- Packaging

Danger when incorrectly lifting and transporting

Danger of death, serious injury, or substantial material damage caused by tipping or falling transported goods. Comply with the following safety instructions:

- All work must be performed with due caution and care.
- Comply with any notes in the shipping papers.
- Carefully comply with all of the handling information and markings on the packages

according to ISO 780.

equipment, transport equipment and industrial trucks.

Danger due to incorrect attachment and lifting

- Ensure that suitable lifting equipment is available.
- Only hoist the goods using the designated hoisting points and/or at marked positions. The attachment points are not dimensioned for additional loads.
- Use suitable strap guiding or spreading devices.
- If not specified otherwise in the transport data, always transport the motor in the position associated with its specific type of construction.

Danger due to damaged attachment points

- Carefully check the attachment points provided on the motor, e.g. attachment eyes, lifting lugs or ring bolts for possible damage. Replace any damaged attachment points.
- correctly attached.

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Danger when incorrectly transporting the motor suspended from cables or ropes

If you transport the motor suspended from cables or ropes, the cables or ropes can break, e.g. as a result of damage. Further, if not adequately attached, the motor can swing. This can result in death, serious injury, or material damage.

- Use additional, suitable lifting equipment for transport and during installation.
- Two cables alone must be able to carry the complete load.
- Prevent the lifting equipment from sliding by appropriately securing it.
- When using 2-cable lifting equipment, ensure that the maximum angle of inclination is $\leq 45^\circ$ according to ISO 3266 (DIN 580).
- Align the eyebolts so that the cables used for lifting are aligned with the planes of the eyebolts.

The motor can slide or topple over if it is not correctly lifted or transported. This can result in death, serious injury or material damage.

- Use all the lifting eyes on the motor.
- When using the lifting eyes on the motor, do not attach any additional loads or weight.
- Any eyes that are screwed in must be tightly fastened.
- Eyebolts must be screwed in right up to their supporting surface.
- Comply with the permissible eyebolt loads.
- When necessary, use suitably dimensioned lifting equipment, for example hoisting slings (EN1492-1) and webbing load restraints (EN12195-2).

Danger if the motor falls

The attachment points on the motor are designed for the weight of the motor only. If a machine set is lifted and transported at a single motor, this can fracture the attachment point. The motor or machine set may fall. This can result in death, serious injury or material damage.

the individual motors.

on the base plates, for

the lifting lug.

it is lifted.

WARNING:

Danger to life as a result of a motor falling

If the lifting gear or load handling attachments were to fail, the motor could fall. This can result in death, serious injury or material damage.

- In order to gain easy and safe access to the underside of the motor, place it in a secure and raised position.

NOTE:

When lifting the motors for transport, only lift them in a position that corresponds to their basic construction type.

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C-2.3.5.2 Transport

If any transport locks are in place, remove them before commissioning. Store the transport locks or disable them. Use the transport locks when transporting the motors again or reactivate the transport locks.

The motors are packed in different ways depending on how they are transported and their size. If not otherwise contractually agreed, the packaging corresponds to the packing guidelines according to ISPM (International Standards for Phytosanitary Measures).

C-2.3.5.3 Storage

Storing outdoors

NOTE:

Damage to the motor

Damage can occur if incorrectly stored.

Take all precautions to protect the motor under extreme climatic conditions, e.g. salt-laden and/or dusty, moist/humid atmospheres.

Choose a dry storage location which is safe from flooding and free from vibration.

Repair any damage to the packaging before putting the equipment into storage if this is necessary to ensure proper storage conditions. In order to ensure protection against ground moisture, locate motors, equipment and crates on pallets, wooden beams or foundations. Prevent equipment from sinking into the ground. Do not impede air circulation under the stored items.

the equipment against the weather must not come into contact with the surfaces of the equipment. Use wooden spacer elements to ensure that air can circulate freely around the equipment.

Storing indoors

The storage rooms must provide protection against extreme weather conditions. They must be dry, free from dust, frost and vibration and well ventilated.

Bare metal surfaces

For transport, the bare surfaces (shaft ends, flange surfaces, centering edges) should be coated with an anti-corrosion agent which will last for a limited amount of time (<6 months). Apply suitable anti-corrosion measures for longer storage times.

Condensation drain hole

Open any condensation drain holes to drain the condensation depending on the environmental conditions, every six months at the latest.

Storage temperature

Permissible temperature range: -20 °C to +50 °C

Maximum permissible air humidity: 60%

For motors that have a special design regarding the ambient temperature in the operating state or the installation altitude, other conditions could apply regarding the storage temperature. In this case, refer to the motor rating plate for data on the ambient temperature and installation altitude.

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Storage time

Turn the shaft once every year to avoid bearing brinelling. Prolonged storage periods reduce the useful life of the bearing grease (aging).

Open bearings

- For open bearings, e.g. 1Z, check the status of the grease when stored for longer than 12 months.

lubricating properties or is polluted. The consistency of the grease will change if condensation is allowed to enter.

- For closed bearings, replace the DE and NDE bearings after a storage time of 48 months.

NOTE:

Storage

The motor can be damaged if you use it or store it unprotected outdoors.

- Protect the motor against intensive solar radiation, rain, snow, ice and dust. Use a superstructure or additional cover, for example.
- If required, contact the service center, or technically coordinate outdoors use.

C-2.3.5.4 Securing the rotor

Depending on the version, the motor is fitted with a rotor shipping brace. This protects the bearings against damage due to shock and vibration during transport or storage.

NOTE:

Motor damage due to vibrations

Not using the rotor shipping brace can cause damage to the motor if it is jolted during

- If the motor is fitted with a rotor shipping brace, this should always be used when transporting the motor. The rotor shipping brace must be attached during the transport.

storing, as the rotor shipping brace cannot completely absorb these forces.

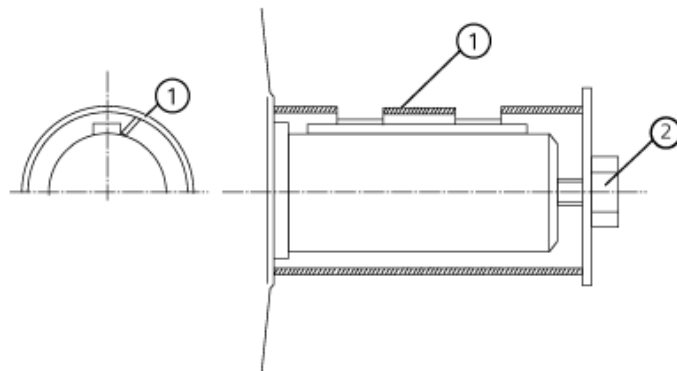
- Do not remove the rotor shipping brace until you are ready to push on the output element.

pulley, the bearings can be damaged during transport. In this case, make sure that the customer

- For motors with a vertical type of construction:
 - Do not remove the rotor shipping brace until the motor is in a vertical position.
 - If a motor has to be transported in a horizontal position, the rotor must be fixed in position before the motor is turned onto its side. Vertical motors can be supplied in the horizontal position from the manufacturing plant.

Alternative rotor bracing

- If you transport the motor after the output element has been pulled on, then you must axially fix the rotor in another way.



① Sleeve

② Shaft screw and washer

Figure 4-1 Axial fastening of the rotor

Thread in the shaft extension	Tightening torque
M16	40 Nm
M20	80 Nm
M24	150 Nm
M30	230 Nm

Tightening torques for other rotor shipping brace types

The thread in the shaft extension indicates the rotor weight. This indirectly specifies the

Thread in the shaft extension	Preload
M16	13 kN
M20	20 kN
M24	30 kN
M30	40 kN

Axial preload force for other rotor shipping brace types

Storing the rotor locking device

Store the rotor locking device in a safe place. It must be remounted if the motor is removed and shipped on further.

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C-2.3.5.5 Commissioning after storage

C-2.3.5.5.1 Insulation resistance and polarization index

Measuring the insulation resistance and polarization index (PI) provides information on the condition of the motor. It is therefore important to check the insulation resistance and the polarization index at the following times:

- Before starting up a motor for the first time
- After an extended period in storage or downtime
- Within the scope of maintenance work

The following information is provided regarding the state of the winding insulation:

- Is the winding head insulation conductively contaminated?
- Has the winding insulation absorbed moisture?

As such, you can determine whether the motor needs commissioning or any necessary

- Can the motor be put into operation?
- Must the windings be cleaned or dried?

C-2.3.5.5.2 Regreasing rolling bearings after storage periods of up to two years

For motors with regreasing systems, briefly lubricate both bearings after commissioning

Grease type, grease quantity and relubrication intervals for the regreasing system are

C-2.3.5.5.3 Releasing the rotor shipping brace before commissioning

If one is being used, release the rotor shipping brace before commissioning.

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C-2.3.5.6 Ensure adequate cooling

WARNING:

Overheating and failure of the motor

Death, severe injury or material damage can occur if you do not carefully observe the

- Do not obstruct ventilation.
 - Prevent the air expelled by neighbouring equipment from being immediately sucked in again.
- above, protect the air intakes from the ingress of foreign bodies and water.
- If the shaft extension is facing upwards, liquid must be prevented from entering by moving along the shaft.

WARNING:

Damage caused by small parts falling in

Material damage and injury can occur if the fan is destroyed and therefore the motor

- For types of construction with the shaft extension facing downwards, prevent small parts from falling into the fan cover by providing suitable covers.
- Ensure that the cooling air flow is not reduced as a result of covers and that the minimum air clearances are maintained.

For motors with separately driven fan, install an interlock circuit that prevents the main motor being switched on if the separately driven fan is not operational.

Table 4- 1 Air guidance

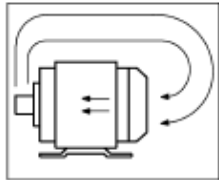
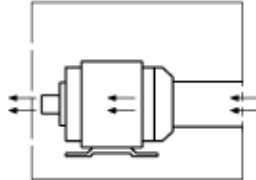
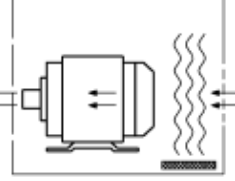
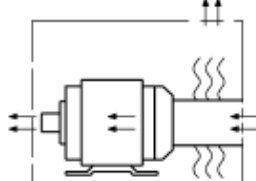
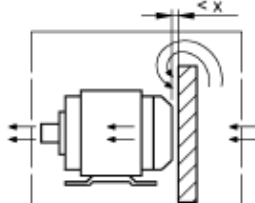
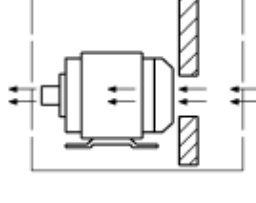
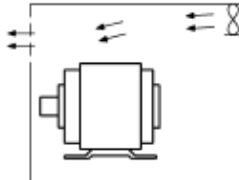
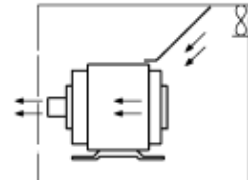
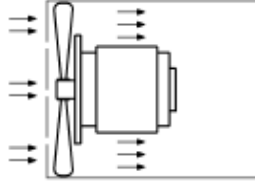
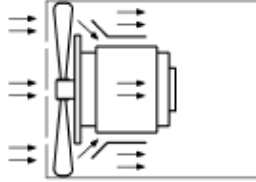
Incorrect	Correct
	
	
	
	
	

Table 4- 2 Minimum dimension "x" for the distance between adjacent modules and the air intake of the motor

Shaft height	x mm
71	15
80 ... 100	20
112	25
132	30
160	40
180 ... 200	90
225 ... 250	100
280 ... 315	110

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C-2.3.5.7 Interlock circuit for anti-condensation heating

If the anti-condensation heating is operated while the motor is running, this can increase the temperatures inside the motor.

- Install an interlock circuit that switches off the anti-condensation heating once the main motor is switched on.
- Only switch on the anti-condensation heating after the motor has been switched off. Comply with the data stamped on the plate of the anti-condensation heating, if available.

C-2.3.5.8 Noise emission

Prevention of hearing damage

If the permissible sound pressure level is exceeded, hearing damage can occur when pressure level is 70 dB (A).

C-2.3.5.9 Voltage and frequency fluctuations during line operation

Unless otherwise stated on the rating plate, the permissible voltage/frequency fluctuation corresponds to Zone B in IEC / EN 60034-1. Permissible fluctuations that go beyond this are indicated on the rating plate – or for some versions, on a supplementary plate. Operate the motor in continuous operation in Zone A.

Prolonged operation in Zone B is not recommended:

tolerances for voltage and frequency can lead to an impermissibly high temperature rise of the winding. This can result in long-term damage

- Limit exceptions of this sort with regard to the values that arise, how often, and for how long they occur.
- Where possible and within a reasonable time take corrective actions such as reducing the power. In this way you can avoid that the service life of the motor is reduced as a result of thermal aging.

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C-2.3.5.10 Rotational speed limit values

Danger as a result of resonance within certain speed ranges

At over-critical speeds, motors encounter resonance within certain speed ranges. Such vibrations can reach impermissibly high levels. This can result in death, serious injury or material damage.

- The controller must ensure that those speed ranges are blocked when the converter is in operation. Please note the data on the blocked speed ranges specified in the Electrical Data.

Motor damage due to excessively high speeds

Excessive rotational speed can lead to serious damage to the motor. This can result in death, serious injury or material damage.

- Avoid operation above the permissible speed by using the appropriate control function.

Data.

C-2.3.5.11 System inherent frequencies

Excessively high vibration levels and system resonances can damage the machine set.

set in such a way that no system resonances can arise and result in the permissible vibration levels being exceeded.

10816-3 must not be exceeded.

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C-2.3.5.12 Electromagnetic compatibility

NOTE:

If the torque levels are very unequal (e.g. when a reciprocating compressor is being driven), a non-sinusoidal motor current will be induced whose harmonics can have an impermissible effect on the supply system and cause impermissible interference emissions as a result.

Note

Converter

- If operated with a frequency converter, the emitted interference varies in strength, depending on the design of the converter (type, interference suppression measures, manufacturer).
- Avoid that the specified limit values stipulated for the drive system (consisting of the
 - You must observe the EMC information from the manufacturer of the converter.
 - The most effective method of shielding is to conductively connect a shielded motor supply cable to the metal terminal box of the motor (with a metal screw connection) over a large surface area.
 - On motors with integrated sensors (e.g. PTC thermistors), disturbance voltages caused by the converter may occur on the sensor cable.

When used in accordance with their intended purpose, and operated on a line supply with characteristics according to EN 50160, the enclosed motors comply with the requirements of the EC Directive regarding electromagnetic compatibility.

Immunity to interference

The motors fulfill the requirements of interference immunity in conformity with EN / IEC 61000-6-2. For motors with integrated sensors, e.g. PTC thermistors, the operating company must ensure sufficient interference immunity by selecting a suitable sensor signal cable (possibly with shielding, connected in the same way as the motor feeder cable) and a suitable evaluation unit. When operating the motors from a converter at speeds higher than the rated speed, carefully comply with the mechanical speed limits (safe operating speed EN / IEC 60034-1).

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C-2.3.5.13 Converter operation

C-2.3.5.13.1 Parameterizing the converter

- If the design of the motor requires connection to a particular converter type, the rating plate will contain corresponding additional information.
- Correctly parameterize the converter. Parameterizing data can be taken from the motor rating plates. You can find parameter data here:
 - In the operating instructions for the converter.
 - In the SIZER engineering tool
 - In the SINAMICS Configuration Manuals.
- Do not exceed the specified maximum speed limit n_{max} .
- Set the skip frequency band between 38 Hz and 48 Hz (both inclusive) for SH 315 two-pole 1LE7 motors when operating on VFD.
- Check that the motor is cooled sufficiently for commissioning purposes.

C-2.3.5.13.2 Converter input voltage

The insulation system of SIMOTICS motors always complies with the requirements of stress category B (IVIC B = high stress). If voltage peaks higher than those specified according to IVIC B can occur, contact the Service Center.

- For a line supply voltage (converter input voltage) up to max. 480 V, and when controlled from a SINAMICS G/SINAMICS S converter with uncontrolled/controlled infeed: Comply with the guidelines for configuring motor and converter.
- Operation with a converter from another manufacturer: Comply with the permissible voltage peaks according to IEC 60034-18-41 in accordance with stress category B, dependent on the particular line voltage (converter input voltage) and the motor insulation system.

NOTE:

Material damage caused by an excessively high supply voltage

The insulation system will be damaged if the supply voltage is too high for the insulation

- Comply with the peak voltages as laid down in the guidelines above.

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C-2.3.5.13.3 Reducing bearing currents during operation with converter (low voltage)

Taking the following actions will reduce the bearing currents:

- Ensure that the contacts are made over a large area. Solid copper cables are not suitable for high-frequency grounding because of the skin effect.

Equipotential bonding conductors:

Use equipotential bonding conductors:

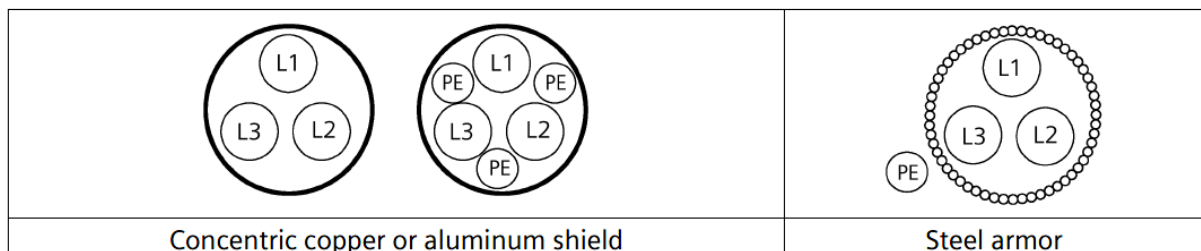
- between motor and driven machine
- between motor and converter
- between the terminal box and the RF grounding point at the motor enclosure.

Selecting and connecting the cable:

As far as possible, use symmetrically arranged, shielded connection cables. The cable

conductivity.

- The shield is connected at both ends, at the motor and converter.
- To ensure good discharging of high-frequency currents, provide contacting over a large surface area:
 - at the motor, for instance with EMC glands at the cable entries.
- If the cable shield is connected as described, then it ensures the specified equipotential bonding between the motor enclosure and converter. A separate RF equipotential bonding conductor is then not necessary.



- If the cable shield is not connected due to special secondary conditions, or not adequately connected, then the specified equipotential bonding is not provided. In this particular case, use a separate RF equipotential bonding conductor:
 - Between the motor enclosure and protective ground rail of the converter.
 - Between motor enclosure and driven machine
 - Use braided flat copper straps or high-frequency cables with finely-stranded conductors for the separate RF equipotential bonding cable.
 - Ensure that the contacts are made over a large area.

Measures to reduce bearing currents

To specifically reduce bearing currents, you must consider the system as a whole, which comprises the motor, converter, and driven machine. The following measures support you when reducing bearing currents and help to avoid damage:

- In the overall system, set up a properly meshed grounding system with low impedance.

output.

harmonic

- The operating instructions for the converter are not part of this documentation. Refer to the configuration information for the converter.

NOTE:

Motor within itself does not induce shaft circulating current to cause bearing failure. Any bearing failure with fluting marks is not to be attributed to motor as a cause. Care must be taken while operating motor with converter to ensure the strict adherence to EMC guidelines by considering motor as a part of a complete system (motor + drive +

C-2.3.5.13.4 Insulated bearings for converter operation

If the motor is controlled from a low-voltage converter, depending on the motor type, an insulated bearing can be fitted at the NDE.

NOTE:

Insulated bearing at NDE is a generally recommended practice. Refer to IEC TS 60034-25 to plan effective countermeasures for reducing bearing currents.

An insulated speed encoder can be optionally mounted.

Comply with the information provided on the motor plates relating to bearing insulation and possible jumpers.

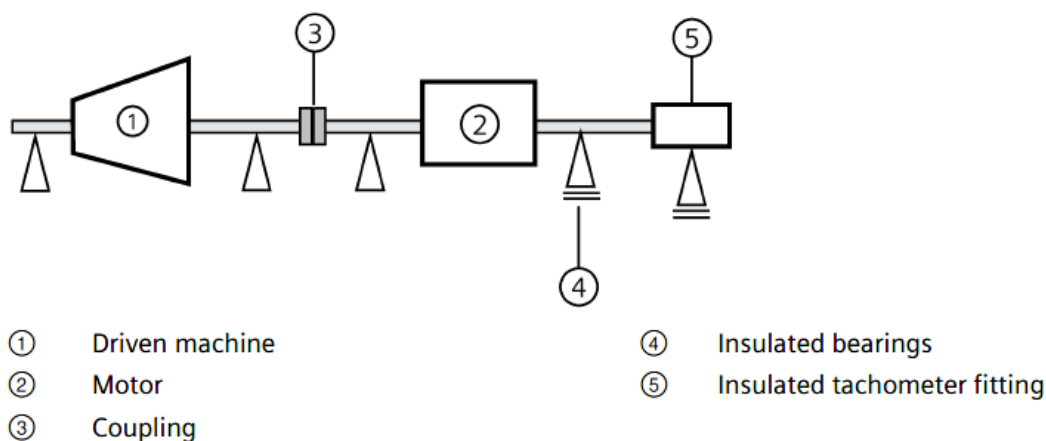


Figure 4-2 Schematic representation of a single drive

NOTE:

Bearing damage

The bearing insulation must not be bridged. Bearing currents can damage bearings.

- Do not bridge the bearing insulation for subsequent installation work, such as the installation of an automatic lubrication system or a non-insulated vibration sensor.
- Where necessary, contact Airpack Nederland.

If you connect two motors in series in "tandem operation", install an insulated coupling between the motors.

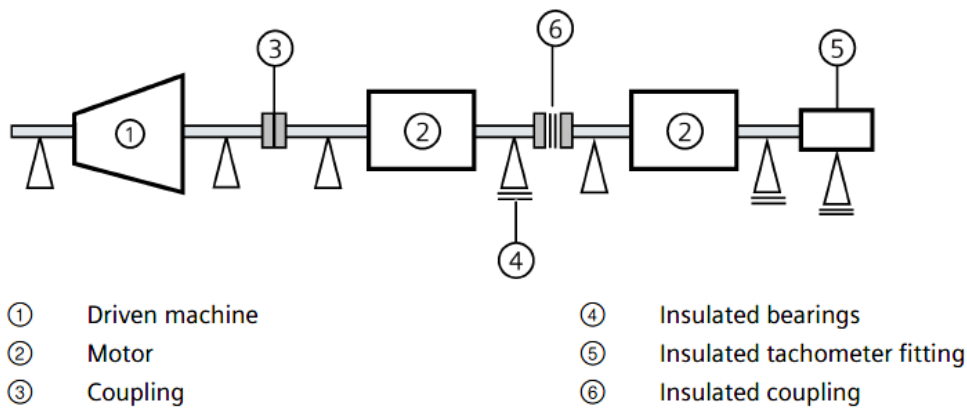


Figure 4-3 Schematic representation of a tandem drive

NOTE:

Bearing damage

Bearing currents can flow if the coupling between the motors of the tandem drive is not insulated. This can damage the DE bearings of both motors.

- Use an insulated coupling to couple the motors.
- As an alternative for machine operation with low-voltage converter, insulated bearing at DE can be fitted depending on motor type, but a non-conductive coupling is recommended.

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C-2.4 Installation

Observe the following when carrying out any work on the motor:

- Comply with the general safety instructions.
- Comply with the applicable national and sector-specific regulations.
- When using the motor within the European Union, comply with the specifications laid down in EN 50110-1 regarding safe operation of electrical equipment.

C-2.4.1 Safety instructions for installation

Injury and material damage caused by inappropriate fastening material

If screws of an incorrect property class have been selected or if they have been fastened to an incorrect tightening torque, they may break or become loose. This will cause the motor to move, which could damage the bearings. The rotor could smash into the motor enclosure and motor parts could be flung out of place. This can result in death, serious injury or material damage.

- Comply with the required property classes for screwed connections.
- Tighten the screwed connections to the specified tightening torques.

Injury and material damage caused by incorrect motor alignment

If the motor has not been properly aligned, this will mean the fastening parts are subjected to stress/distortion. Screws may become loose or break, the motor will move, motor parts could be flung out of place. This can result in death, serious injury or material damage.

Material damage caused by improper handling

Mounting parts such as temperature sensors or speed sensors are attached to the motor and could be ripped off or destroyed as a result of improper handling. This could lead to motor malfunctions, extending even to total loss of the motor.

- Where necessary, use suitable steps when performing installation work on the motor.
- attachments as steps.

Loss of conformity with European directives

In the delivery state, the motor corresponds to the requirements of the European directives. Unauthorized changes or modifications to the motor lead to the loss of conformity with European Directives and the loss of the associated warranty.

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C-2.4.2 Preparing for installation

C-2.4.2.1 Requirements for installation

The following requirements must be satisfied prior to starting installation work:

- Staff have access to the operating and installation instructions.
- The motor is unpacked and ready for mounting at the installation location.
- Measure the insulation resistance of the winding before starting any installation work. If the insulation resistance lies below the specified value, take appropriate remedial measures. These remedial measures may necessitate the motor being removed again and transported.

NOTE:

Note also the technical data on the rating plates on the motor enclosure.

NOTE:

Damage to the motor

To avoid material damage, before commissioning, check whether the correct direction of rotation of the motor has been set on the customer side, e.g. by decoupling from the driven load.

Damage to mounted parts and components as a result of high temperatures

The motor components get very hot during operation. High temperatures can damage parts mounted by customers, such as cables manufactured out of materials that are not heat resistant.

contact with or be attached to

- Only use heat-resistant mounting parts. The connecting cables and cable entries must be suitable for the particular application.

C-2.4.2.2 Insulation resistance

C-2.4.2.2.1 Insulation resistance and polarization index

Measuring the insulation resistance and polarization index (PI) provides information on the condition of the motor. It is therefore important to check the insulation resistance and the polarization index at the following times:

- Before starting up a motor for the first time
- After an extended period in storage or downtime
- Within the scope of maintenance work

The following information is provided regarding the state of the winding insulation:

- Is the winding head insulation conductively contaminated?
- Has the winding insulation absorbed moisture?

As such, you can determine whether the motor needs commissioning or any necessary

- Can the motor be put into operation?
- Must the windings be cleaned or dried?

Detailed information on testing and the limit values can be found here:

Checking the insulation resistance.

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C-2.4.2.2.2 Checking the insulation resistance

WARNING:

Hazardous voltage at the terminals

During and immediately after measurement of the stator winding insulation resistance,
can result in death, serious injury or material damage.

- If any power cables are connected, check to make sure line supply voltage cannot be delivered.
- Discharge the winding after measurement until the risk is eliminated, e.g. using the following measures:
 - Connect the terminals with the ground potential until the recharge voltage drops to a non-hazardous level
 - Attach the connection cable.

Measure the insulation resistance

1. Before you begin measuring the insulation resistance, read the operating manual for the insulation resistance meter you are going to use.
2. Make sure that no power cables are connected.
3. Measure the winding temperature and the insulation resistance of the winding in relation to the motor enclosure. The winding temperature should not exceed 50 °C during the measurement. Convert the measured insulation resistances in accordance with the formula to the reference temperature of 50 °C. This thereby ensures that the minimum values specified can be compared.
4. Read out the insulation resistance one minute after applying the measuring voltage.

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Conversion to the reference temperature

When measuring with winding temperatures other than 50 °C, convert the measuring value to the reference temperature of 50 °C according to the following equations from IEEE 43-2000.

(1) $R_C = K_T \cdot R_T$	R_C	Insulation resistance converted to 50 °C reference temperature
	k_T	Temperature coefficient according to equation (2)
	R_T	Measured insulation resistance for measuring/winding temperature T in °C
(2) $K_T = (0.5)^{(50-T)/10}$	50	Reference temperature in °C
	10	Halving/doubling of the insulation resistance with 10 K
	T	Measuring/winding temperature in °C

In this case, doubling or halving the insulation resistance at a temperature change of 10 K is used as the basis.

- The insulation resistance halves every time the temperature rises by 10 K.
- The resistance doubles every time the temperature falls by 10 K.

For a winding temperature of approx. 25° C, the minimum insulation resistances are 30 MΩ (U ≤ 1000 V) or 300 MΩ (U > 1000 V). The values apply for the complete winding to ground.

Twice the minimum values apply to the measurement of individual assemblies.

- Dry, new windings have an insulation resistance of between 100 and 2000 MΩ, or
- possibly even higher values. An insulation resistance value close to the minimum value
- could be due to moisture and/or dirt accumulation. The size of the winding, the rated
- voltage and other characteristics affect the insulation resistance and may need to be taken into account when determining measures.
- Over its operating lifetime, the motor winding insulation resistance can drop due to

ambient and operational influences. Calculate the critical insulation resistance value depending on the rated voltage by multiplying the rated voltage (kV) by the specific critical resistance value. Convert the value for the current winding temperature at the time of measurement, see above table.

Limit values of the anti-condensation heating insulation resistance

It is not permissible that the insulation resistance of the anti-condensation heating with

respect to the motor enclosure falls below 1 MΩ when measured at 500 V DC.

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C-2.4.2.3 Preparing the assembly area

1. Prepare a suitable assembly area (e.g. assembly stands). Make sure that the assembly area has sufficient clearance from the floor for the DE shaft end. The necessary data is provided in the motor dimension drawing.
2. Refer to the shipping documents to check that all motor components are available for assembly.

C-2.4.2.4 Lift the motor to where it will be mounted and position it

- For vertical installation, use all the eyebolts provided and when necessary, hoisting straps according to DIN EN 1492-1 and/or lashing straps according to DIN EN 12195-2 to stabilize the position.
- Prevent foreign bodies from falling into the fan cover. For vertical motor installation with the shaft end facing downwards, attach a protective canopy.
- If the shaft extension is facing upwards, the user must prevent liquid from moving along the shaft and entering the motor.
- Clean bare metal surfaces with anti-corrosion agent using white spirit to ensure proper installation and / or motor mounting.
- Do not obstruct the ventilation. Do not draw in the hot discharged air directly – also from adjacent equipment.
- Avoid exposing them to direct, intense solar radiation, rain, snow, ice, or also dust for
- extended periods. Attach a covering structure or an additional cover when using or storing outdoors.
- Do not exceed the permissible axial and radial forces.


C-2.4.2.5 Foot mounting

Note

Only authorized retrofit partners must be employed to relocate the bolted on mounting feet at the motor enclosure.

After attaching the mounting feet, you must note the following in order to avoid stressing and deforming the motor.

- Ensure that the foot mounting surfaces are aligned in one plane and are parallel to the motor shaft.
- Post-machine the foot mounting surfaces or use thin shims, for example.
- Professionally touch up damaged painted surfaces.
- Observe the information provided in Chapter "Aligning and fixing the motor"

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C-2.4.3 Aligning and fixing the motor

Observe the following when aligning and mounting:

- Ensure a flat and uniform contact surface for foot and flange mounting.
- When mounting on the wall, support the motor from below, e.g. using a bracket, or bolt it.
- Precisely align the motor when couplings are used.
- Ensure that the mounting surfaces are clean and free of any dirt.
- Remove any anti-corrosion protection using white spirit.
- Avoid installation-related resonances with the rotating frequency and twice the line frequency.
- Note any unusual noise when the rotor is manually turned.
- Check the direction of rotation with the motor uncoupled.
- Avoid rigid couplings.
- Repair any damage to the paint, this must be done immediately and correctly.

C-2.4.3.1 Measures for alignment and mounting

The following measures are required in order to compensate any radial offset at the coupling and to horizontally adjust the motor with respect to the driven load:

- Vertical positioning

For vertical mounting positions, avoid deforming the motors by placing shims under the mounting feet. Keep the number of shims low; only use a few stacked shims.

- Horizontal positioning

To position the motor horizontally, shift it sideways on the foundation and ensure that the axial position is maintained (angularity error).

- When positioning the motor, ensure that a uniform axial gap is maintained around the coupling.

- Smooth running

Preconditions for smooth, vibration-free operation:

- Stable foundation design free of any shock or vibration.

- A precisely aligned coupling.

- A well-balanced drive output element (coupling, belt pulleys, fans, ...)

Maintain the maximum permissible vibration values in operation according to ISO 10816-3.

Avoid inadmissible vibration caused by imbalance, for example (drive output element), external vibration or any resonance over the complete speed range.

It may be necessary to completely balance the motor with the drive output element or the system resonance frequency must be shifted.

Foot mounting/flange mounting

- Use the specified thread size laid down in EN 50347 / IS 1231 / IS 2223 when flanging the motor to a foundation or a motor flange.

- Mount the motor at all the foot or flanged holes provided. The choice of fixing elements depends on the foundation and is the plant operator's responsibility.

Comply

with the required property classes for screwed connections and materials for fixing elements.


- Select the correct screw length for IM B14 flanges.

- Ensure that the screw heads are in full contact with the flange surface. Use additional

flat washers (ISO 7093), especially for elongated foot mounting holes.

C-2.4.3.2 Flatness of the supporting surfaces for conventional motors

Shaft height	Flatness [mm]
≤ 132	0.10
160	0.15
≥ 180	0.20

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C-2.4.4 Installing the motor

C-2.4.4.1 Preconditions for smooth, vibration-free operation

Preconditions for smooth, vibration-free operation:

- Stable foundation design
- Precise alignment of the motor
- Correct balancing of parts to be fitted to the shaft end.
- Vibration values in compliance with ISO 10816-3

C-2.4.4.2 Aligning the motor to the driven machine and mounting

C-2.4.4.2.1 Selecting bolts

- Unless specified otherwise, use fixing screws with at least strength class 8.8 to ISO 898-1 to ensure that the motor is securely mounted and to transmit the torque-generated forces.
- When selecting the bolts and the design of the foundation, take into account the maximum forces occurring in the case of a fault such as short circuit or system transfers in phase opposition, etc. Request the foundation force values from the Service Center if required.

C-2.4.4.2.2 Horizontal types of construction with mounting feet

1. Refer to any instructions for aligning the driven machine and those of the coupling manufacturer.
2. Align the motors with coupling output to the driven machine in such a manner that the center lines of the shafts are parallel with no offset. This ensures that no additional forces affect their bearings during operation.
3. For the vertical positioning ($x \rightarrow 0$) place thin shims under the motor feet. The number of shims should be kept as low as possible, i.e. stack as few as possible. This also prevents the motor being subjected to any stress/distortion. If available, use the existing tapped holes for the forcing-off bolts to somewhat raise the motor.
4. When positioning the motor, ensure that a uniform axial gap ($y \rightarrow 0$) is maintained around the coupling.
5. Fix the motor to the foundation. The choice of fixing elements depends on the foundation and is the plant operator's responsibility.

Note

Motor expansion

When aligning, make allowance for the thermal expansion of the motor when the temperature increases.

C-2.4.4.3 Removing the rotor shipping brace

If a rotor shipping brace is attached to the motor, remove it at the last possible moment, for example, when you are ready to push on the output or drive element. Storing the rotor locking device Store the rotor locking device in a safe place. It must be remounted if the motor is removed and shipped on further.

C-2.4.4.4 Recommended alignment accuracy

The alignment accuracy required depends essentially on the configuration of the overall machine train. Observe the required alignment accuracy of the coupling manufacturer in all cases when aligning the motor.

Table 5- 1 Recommended alignment accuracy

Speed rpm	Parallel offset mm	Angular offset mm per 100 mm coupling diameter
750	0.09	0.09
1500	0.06	0.05
3000	0.03	0.025

C-2.4.4.5 Mounting the drive output elements

The rotor is dynamically balanced. For shaft extensions with feather keys, the type of balancing is specified using the following coding on the face of the drive end of the shaft extension and on the rating plate:

- "H" means balancing with a half feather key (standard)
- "F" means balancing with a whole feather key
- "N" means balancing without a feather key.

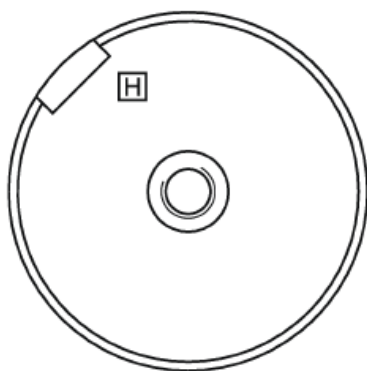


Figure 5-1 DE balancing type

WARNING:

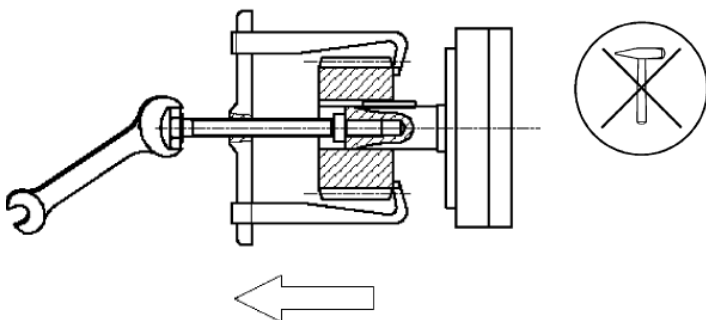
Risk of injury due to Incorrect installation or removal

The feather key may be flung out if the motor is operated without drive output elements, such as coupling, etc. Carefully comply with the required measures. This can result in death, serious injury or material damage.

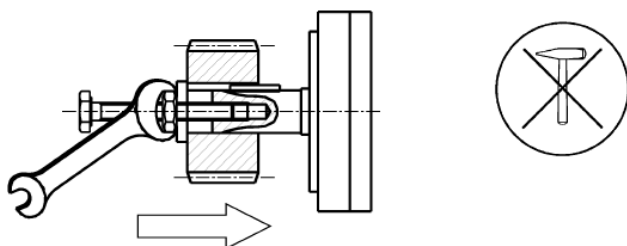
- The general touch protection measures for drive output elements must be observed.
- Only operate the motor with the drive output element mounted.
- Drive output elements may only be pulled on or pulled off with the correct equipment.
- The feather keys are only locked against falling out during shipping. For test operation or when commissioning without drive output element, carefully secure the feather key using a suitable locking element. When doing this, take into account the type of motor balancing.

Pulling on drive output elements

- Requirements:
 - The coupling and/or the drive output element must be appropriately dimensioned for the operating case at hand.
 - Observe the coupling manufacturer's instructions.
 - Make sure that the balancing type of the drive output element correctly matches the type of balance of the rotor.
 - Use only ready drilled and balanced drive output elements. Check the hole diameters and the balancing status before pulling them on. Thoroughly clean the shaft extension.
- Pulling on:
 - Heat up the drive output elements to expand them before pulling them on. Select the temperature difference for the heating process to suit the coupling diameter, fit and material. Observe the coupling manufacturer's instructions.
 - Drive output elements may only be pulled on or pulled off with the correct equipment. The drive output element must be pulled on in one continuous operation via the front thread holes in the shaft or pushed on by hand.
 - Do not use a hammer, as this will damage the bearings.



Withdrawing drive output elements



Mounting drive output elements

Only transfer radial or axial forces specified in the catalog to the motor bearings via the shaft extension. You can obtain the permissible values for axial and radial forces by contacting the Service Center or by referring to the motor catalog.

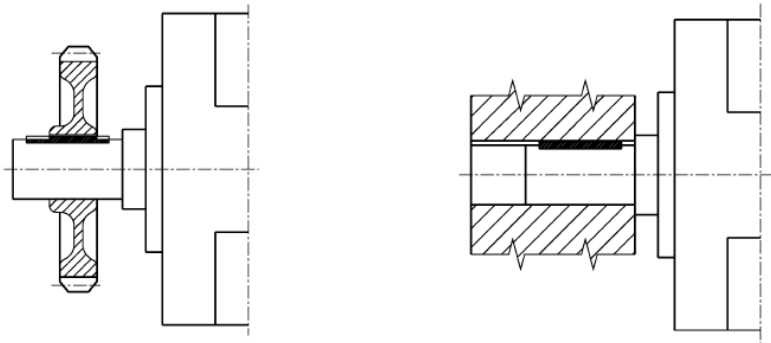
Shaft extensions with feather key

The feather key data for the shaft and drive output element must match and indicate the correct type of balancing. The drive output element must be correctly mounted. The balance quality corresponds to vibration severity grade "A" for the complete motor; vibration severity grade "B" is possible as an option. To ensure the required balance quality, it must be ensured that the feather key data on the hub and motor shaft match in the case of a shorter or longer drive output element.

- If the drive output element is shorter than the feather key with balancing type "H", then you must machine off the section of feather key protruding from the shaft contour and drive output element in order to maintain the balance quality.
- If the drive output element is longer than the feather key, when balancing the coupling, take into account that the feather key does not take up all of the coupling slot.

The following applies to all four-pole motors with a frequency ≥ 60 Hz:

- The feather key must be shortened if the coupling hub is shorter than the feather key.
- The center of gravity of the coupling half should be within the length of the shaft end.
- The coupling used must be prepared for system balancing.



Align the offset at the coupling between motors and the driven machines so that the maximum permissible vibration values according to ISO 10816-3 are not exceeded.

C-2.5 Electrical connection

Observe the following when carrying out any work on the motor:

- Comply with the general safety instructions (Page 11).
- Comply with the applicable national and sector-specific regulations.
- When using the motor within the European Union, comply with the specifications laid down in EN 50110-1 regarding safe operation of electrical equipment.

C-2.5.1 Basic rules

The following generally applies to electrical connections:

- Ensure that there is a safe and reliable PE ground connection before starting any work.
- The connecting cables can be sealed and secured at every cable entry point into the terminal box.
- Lay the connecting cables and in particular the PE conductor in the terminal box in an open arrangement so that chafing of the cable insulation is prevented.
- Connect the motor in such a way that a permanent, safe electrical connection is maintained. Avoid protruding wire ends.
- Lay and secure external auxiliary cables separately from the main cable. Elements with cable ties may be present for this purpose.
- In case of high humidity or when installed outside, water drops can move along the cable jacket and enter the motor through the cable entry and cable gland.

If you route the cable with an appropriate loop then water doesn't enter the terminal box but simply drips off.

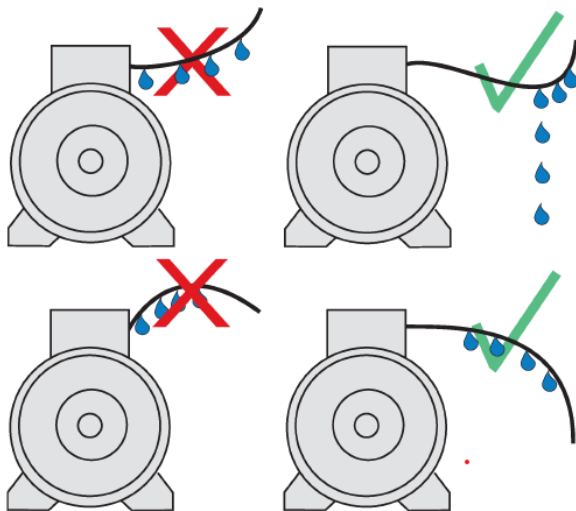


Figure 6-1 Water drip loop

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C-2.5.2 Safety instructions for the electrical connection

Hazardous voltages on electrical connections

Dangerous voltages can arise on electric motors. Death, injury or material damage can occur.

Observe the following safety information before connecting up the motor:

- Only qualified personnel should carry out work.
- Carefully follow the "5 safety rules (Page 11)".
- Disconnect the motor from the power supply and take measures to prevent it being reconnected. This also applies to auxiliary circuits.
- Check that the motor really is in a no-voltage condition.
- Ensure that there is a safe and reliable protective conductor connection before starting any work.
- If the incoming power supply system displays any deviations from the rated values in terms of voltage, frequency, curve form or symmetry, such deviations will increase the temperature and influence electromagnetic compatibility.
- Operating the motor on a line supply system with a non-grounded neutral point is only permitted over short time intervals that occur rarely, e.g. the time leading to a fault being eliminated (ground fault of a cable, IEC/EN 60034-1).

Material damage as a result of connection parts coming loose

If you use fixing elements made from the wrong material or apply the wrong tightening torque, this could impair current transfer or cause connecting parts to become loose. This could result in material damage to the motor or even in total failure, which could in turn lead indirectly to material damage to the system.

- Tighten the screwed connections to the specified tightening torques.
- Observe any specifications regarding the materials from which fixing elements must be made.
- When performing servicing, check the fastenings.

Note

Service Center

If you require support when electrically connecting up the motor, please contact the Airpack.

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C-2.5.3 Connecting the motor

Take the following criteria into account when selecting the connecting cables:

- Rated current
- Rated voltage
- If required, service factor
- System-dependent conditions, such as ambient temperature, routing type, cable cross section as defined by required length of cable, etc.
- Configuration notes
- Requirements according to IEC/EN 60204-1
- Dimensioning for bundled cable routing, e.g. according to DIN VDE 0298 Part 4 or IEC 60364-5-52
- Carefully comply with the information provided in EN / IEC 60034-1 (VDE 0530-1) regarding operation at the limits of A and B zones, especially in respect of temperature increase and deviation of the operating data from the rated data stamped on the rating plate. Do not exceed these limits. Do not use motors in zone B that are marked for zone A.
- Connect up so that a permanently safe electrical connection is guaranteed (no protruding wire ends); use the assigned cable-end fittings (e.g. cable lugs, end sleeves).

Connect up the line supply voltage and arranged the disconnecting link in accordance with the circuit diagram provided in the terminal box.

- Select the connecting cables in accordance with DIN VDE 0100 taking into account the rated current and the installation-specific conditions – e.g. ambient temperature, routing method etc. - according to DIN VDE 0298 and/or EN / IEC 60204-1.

The technical specifications stipulate the following that have to be taken into account with respect to the motor connection:

- Direction of rotation
- The number and arrangement of the terminal boxes.
- The circuit and connection of the motor winding

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C-2.5.3.1 terminal box

DANGER:

Hazardous voltage

Electric motors have high voltages. When incorrectly handled, this can result in death or severe injury.

Switch off the motor so that it is in a no-voltage condition before you open the terminal box.

NOTICE

Damage to the terminal box

If you incorrectly carry out work on or in the terminal box, this can result in material damage. You must observe the following to avoid damaging the terminal box:

- Ensure that the components inside the terminal box are not damaged.
- It must be ensured that there are no foreign bodies, dirt or moisture in the terminal box.
- Close the terminal box using the original seal so that it is dust tight and water tight.
- Use O-rings or suitable flat gaskets to seal entries in the terminal box (DIN 42925) and other open entries.
- Please observe the tightening torques for cable entries and other screws.

C-2.5.3.1.1 Circuit diagram inside the terminal box cover

Data on the connection and connecting the motor winding can be found in the circuit diagram in the cover of the terminal box.

C-2.5.3.1.2 Direction of rotation

The standard motors are suitable for clockwise and counter-clockwise rotation.

For defined directions of rotation (direction of rotation arrow), appropriately connect the line power cables.

- If you connect the line cables with phase sequence L1, L2, L3 at U, V, W or according to NEMA at T1 T2 T3, then the motor rotates in the clockwise direction.
- If you interchange 2 connections, e.g. L1, L2, L3 at V, U, W or according to NEMA at T2 T1 T3, then the motor rotates counterclockwise.

	Direction of rotation	According to IEC	According to NEMA
Line feeder cables	-	L1 L2 L3	L1 L2 L3
Terminal connection	Clockwise rotation	U V W	T1 T2 T3
Terminal connection	Counter-clockwise rotation	V U W	T2 T1 T3

Direction of rotation of the motor when viewing the DE

C-2.5.3.1.3 Terminal marking

According to IEC / EN 60034-8, the following basic definitions apply to the terminal markings for 3-phase motors:

Table 6- 1 Terminal markings using the 1U1-1 as an example

1	U	1	-	1	Marking
x					Code for split winding, where applicable. Special case for pole assignment for pole-changing motors. A lower index signifies a lower speed.
	x				Phase designation U, V, W
		x			Index for winding start (1) or end (2) or if there is more than one connection per winding
				x	Additional indices for cases in which it is obligatory to connect parallel power feed cables to several terminals with otherwise identical markings

C-2.5.3.1.4 Cable entry

Assembly and laying cables

Screw the screw-type connection (cable gland) into the cable entry or fasten with a nut.


Note

The screw-type connections must have been matched to the connecting cables used (diameter armoring, braid, shield).

For the screw-type connections, comply or exceed the requirements relating to IP degree of protection (water and dust) - as well as the temperature range in operation stamped on the rating plate.

C-2.5.3.1.5 Versions

The terminal box can be turned 4 x 90 degrees on the terminal base of the motor's housing.

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C-2.5.3.1.6 Protruding connection cables

WARNING

Risk of short-circuit and voltage hazard

A short circuit can occur if connecting cables are clamped and crushed between parts of the enclosure and the cover plate.

This can result in death, severe injury and material damage.

- During disassembly and particularly when installing the cover plate, make sure that the connecting cables are not clamped between enclosure parts and the cover plate.

CAUTION

Damage to connecting cables that are freely led out

You must observe the following note to avoid damaging connecting cables that are freely led out:

- It must be ensured that there are no foreign bodies, dirt, or moisture in the terminal base of the motor enclosure.
- Use O-rings or suitable flat gaskets to seal entries in cover plates (DIN 42925) and other open entries.
- Seal the terminal base of the motor enclosure using the original seal of the cover plate to prevent dust and water from entering.
- Please observe the tightening torques for cable entries and other screws.

C-2.5.3.1.7 Connecting protruding cables

In the case of connection cables brought out of the motor, no terminal board is installed on the terminal base of the motor housing. The connection cables are directly connected to stator winding terminals at the factory. The connection cables are color-coded or labeled. The customer directly connects individual cables in the control cabinet for their system in accordance with the labeling.

C-2.5.3.1.8 Minimum air clearances

After proper installation, verify that the minimum air clearances between non-insulated parts are maintained. Be aware of any protruding wire ends.

Table 6- 2 Minimum air clearance dependent on rms value of the alternating voltage U_{rms}

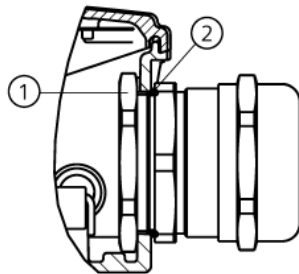
Rms value of the alternating voltage U_{rms}	Minimum air clearance mm
$\leq 250 \text{ V}$	3.0
$\leq 500 \text{ V}$	3.0
$\leq 630 \text{ V}$	5.5
$\leq 1000 \text{ V}$	8.0

Values apply at an installation altitude of up to 2000 m.

When determining the required minimum air clearance, the voltage value in the table may be increased by a factor of 1.1, so that the rated input voltage range is taken into account during general use.

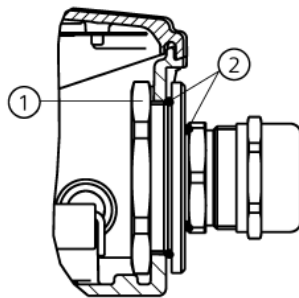
C-2.5.3.2 Cable glands

Cable glands with (sheet metal) nuts (EN 50262)



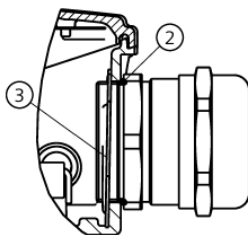
- ① Nut
- ② O ring

Cable glands with reductions and (sheet metal) nuts (EN 50262)



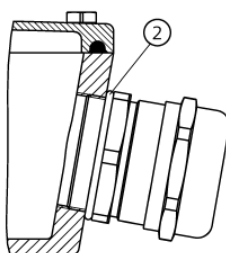
- ① Nut
- ② O ring

Mounting position of sheet metal nuts in screw-type connections



- ② O ring
- ③ Mounting position of metal-sheet nuts

Cable glands with connecting thread in the terminal box (EN 50262)



- ② O ring

C-2.5.3.3 Tightening torques

Note the information in Chapter "Tightening torques."

Cable entries, sealing plugs and thread adapters

Note the following when mounting:

- Avoid damaging the cable jacket.
- Adapt the tightening torques to the cable jacket materials.

Observe the documentation for tightening torques of the cable entries and sealing plugs for direct mounting at the motor as well as additional glands (e.g. adapters).

C-2.5.3.4 Connecting the grounding conductor

The motor's grounding conductor cross-section must comply with EN / IEC 60034-1. Please also observe installation regulations such as those specified in EN / IEC 60204-1.

Basically, there are two ways of connecting a grounding conductor to the motor.

- Internal grounding with a connection in terminal box at the location intended for this purpose and marked accordingly.
- External grounding with connection at the stator housing at the locations intended for this purpose and marked accordingly.

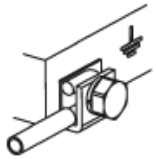
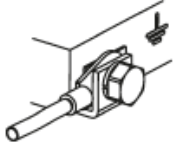
Type of enclosure grounding		Conductor cross-section mm ²
Connection of an individual conductor under the external grounding bracket.		... 10
Connection is made using a DIN cable lug under the external grounding bracket. DIN 46 234		... 25

Table 6- 3 Minimum cross-sectional area of grounding conductor

Minimum cross-section of the phase conductor for installation S [mm ²]	Minimum cross-section of the associated grounding connection [mm ²]
$S \leq 25$	S
$25 < S \leq 50$	25
$S > 50$	0.5 S

Internal ground terminal

When making connections, ensure the following:

- Ensure that the connecting surface is bare and is protected against corrosion using a suitable substance, e.g. acid-free Vaseline.
- Arrange the flat washer and spring washer under the bolt head.
- Locate the cable lug under the clamping bracket.
- Use the terminals designated for the grounding conductor in the terminal box.
- Observe the tightening torque for the locking screw.

External ground terminal

When making connections, ensure the following:

- Ensure that the connecting surface is bare and is protected against corrosion using a suitable substance, e.g. acid-free Vaseline.
- Position the cable lug between the contact bracket and the grounding bracket; do not remove the contact bracket pressed into the enclosure!
- Arrange the flat washer and spring washer under the bolt head.
- Use the marked connection location for the grounding conductor on the stator housing.
- Observe the tightening torque for the locking screw.

C-2.5.3.5 Connecting a temperature sensor/anti-condensation heater

WARNING

Hazard due to electric shock

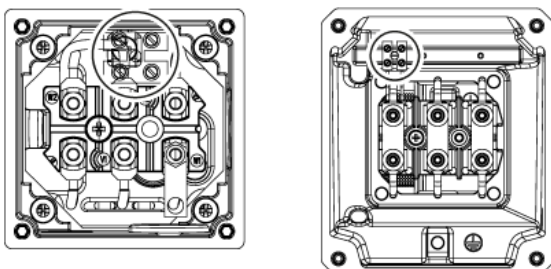
The installation of the temperature sensors for the winding monitoring with respect to the winding is implemented according to the requirements for basic insulation. The temperature sensor connections are located in terminal boxes, safe to touch, and have no protective separation. This is the reason that in the case of a fault, a hazardous voltage can be present at the measuring sensor cable. When touched, this can result in death, severe bodily injury and material damage.

- When connecting the temperature sensor to external temperature monitoring devices, when required, apply additional measures to fully comply with the requirements set out in IEC 60664-1 or IEC 61800-5-1 "Hazard due to electric shock".

Connecting optional integrated devices and equipment

In addition to the current-dependent overload protective device located in the connecting cables, use the optionally available integrated devices and equipment, for example, temperature sensors, anti-condensation heating. Depending on the terminal box version, connect the auxiliary circuits to the terminal box.

Terminal block connection



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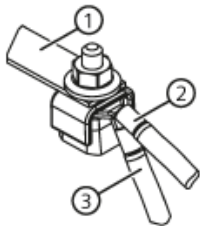
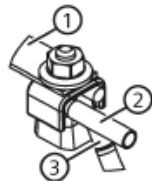
C-2.5.3.6 Conductor connection

Cross-sections that can be connected depending on the size of the terminal
(possibly reduced due to size of cable entries)

Table 6- 4 Max. conductor connection

Shaft height	Max. connectable conductor cross-section [mm ²]
71 ... 90	1.5 2.5 with cable lug
100 ... 112	4.0
132	6.0
160 ... 180	16.0
200	25.0
225	35.0 with cable lug
250 ... 280	120.0
315	240.0

C-2.5.3.6.1 Type of conductor connection

Terminal board		Max. conductor cross-section [mm ²]
Connection with cable lug DIN 46 234 Bend down the cable lug for the connection.		25
Connection of an individual conductor with terminal clamp copper cable		10

- ① Connecting bar
- ② Line supply cable
- ③ Motor connecting cable

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C-2.5.3.6.2 Connecting aluminum conductors

If you are using aluminum conductors, then comply with the following:

- Use only cable lugs that are suitable for connecting aluminum conductors.
- Immediately before inserting the aluminum conductor, remove the oxide layer from the contact areas on the conductor and/or the mating piece. Do this using a brush or file.
- Then grease the contact areas immediately using neutral Vaseline. This prevents a new oxide layer from forming.

NOTICE

Aluminum flow due to contact pressure

Aluminum flows following installation due to the contact pressure. The connection using clamping nuts can loosen as a result. The contact resistance increases, obstructing the current from being conducted. This can result in fire and material damage to the motor – or even in total failure, as well as material damage to the plant or system due to motor failure.

- Retighten the clamping nuts after approximately 24 hours and then again after approximately four weeks. Make sure that the terminals are de-energized before you tighten the nuts.

C-2.5.3.7 Connecting converters

NOTICE

Material damage caused by an excessively high supply voltage

Material damage can occur if the supply voltage is too high for the insulation system.

- Observe the values in the following tables.

SIMOTICS motors can be operated with SINAMICS G converters and SINAMICS S converters (uncontrolled and controlled infeed) when maintaining the permissible peak voltages.

The insulation system of SIMOTICS motors corresponds to the specifications laid down in IEC 60034-18-41 according to voltage stress category B (IVIC B = high stress).

Table 6- 5 Maximum voltage peaks at the motor terminals for line (DOL) motors, converter operation possible

Rated motor voltage V	Maximum peak voltage at the motor terminals		
	$\hat{U}_{\text{phase-to-phase}}$ V_{pk}	$\hat{U}_{\text{phase-to-ground}}$ V_{pk}	DC link U_{DC} V
$\leq 500 \text{ V}$	1500	1100	750

Table 6- 6 Maximum voltage peaks at the motor terminals for motors specifically designed for converter operation (e.g. VSD 10)

Rated motor voltage V	Maximum peak voltage at the motor terminals		
	$\hat{U}_{\text{phase-to-phase}}$ V_{pk}	$\hat{U}_{\text{phase-to-ground}}$ V_{pk}	DC link U_{DC} V
$\leq 500 \text{ V}$	1600	1400	750
$> 500 \text{ V to } 690 \text{ V}$	2200	1500	1080

Depending on the step height, the voltage rise times for the individual voltage steps in the line-to-ground voltage at the motor end of the cable must not fall below the following values.

Table 6- 7 Rise times as a function of voltage level

Step height V	Minimum rise time t_r ns
900	100
1050	200
1260	400

C-2.5.3.8 Final checks

Before closing the terminal box/terminal base of the motor enclosure, check the following:

- Establish the electrical connections in the terminal box in accordance with the information in this documentation.
- Maintain the air clearances between non-insulated parts as described in Chapter "Minimum air clearances".
- Avoid protruding wire ends.
- In order not to damage the cable insulation, freely arrange the connecting cables.
- Connect the motor corresponding to the specified direction of rotation.
- Keep the inside of the terminal box clean and free from trimmed-off ends of wire.
- Ensure that all seals and sealing surfaces are undamaged and clean.
- Correctly and professionally close unused openings in the terminal boxes. Observe the information in this documentation.
- Observe the information on torques in this documentation.

C-2.6 Commissioning

Observe the following when carrying out any work on the motor:

- Comply with the general safety instructions.
- Comply with the applicable national and sector-specific regulations.
- When using the motor within the European Union, comply with the specifications laid down in EN 50110-1 regarding safe operation of electrical equipment.

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C-2.6.1 Measures before commissioning

WARNING

Risk of injury due to the ejected feather key During motor test run in a no-load condition, the feather key fitted on the decoupled shaft extension may be flung out if the key is not secured or if unintentional motor movements occur. These can result in severe injury.

- Before switching on the motor, ensure that the motor is firmly fixed to the foundation.
- Before switching on the motor, ensure that the feather key is carefully secured with a suitable locking element.

C-2.6.1.1 Checks to be carried out prior to commissioning

The following list of checks to be performed prior to commissioning does not claim to be complete. It may be necessary to perform further checks and tests in accordance with the specific situation on-site.

Once the system has been correctly installed, you should check the following prior to commissioning:

- The motor is undamaged.
- The motor has been properly installed and aligned.
- The output transmission elements are set correctly for their type, e.g. alignment and balancing of couplings, belt forces in the case of a belt drive, tooth forces and tooth-flank backlash in the case of geared output, radial and axial clearance in the case of coupled shafts.
- All fixing screws, connection elements, and electrical connections have been tightened to the specified tightening torques.
- The operating conditions match the data provided in accordance with the technical documentation, such as degree of protection, ambient temperature, etc.
- Moving parts, for example the coupling, move freely.
- All touch protection measures for both moving and live parts have been implemented.
- Screwed-in lifting eyes are removed after installation or secured to prevent them from becoming loose.
- Before commissioning, attach the covers to guarantee the correct air guidance.
- Ensure that all condensation drain holes are always located at the lowest part of the motor.
- Comply with the EMC guidelines when using the PT100/PT1000 sensors to ensure the correct feedback signals from the sensors.

Note

The voltage in RTD terminals can be induced due to the magnetic interference between the power cables and the signal cables. Therefore, the signals received can be false. Touching the terminals directly can result in injury.

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Second shaft extension

If the second shaft extension is not used:

- Carefully secure the feather key to prevent it from being thrown out, and for balancing type "H" (standard type), ensure its weight is reduced to approximately 60 % of the original value.
- Using covers, carefully secure the unused shaft extension so that it cannot be touched.

Risk of losing the IP degree of protection as a result of damaged shaft sealing rings
This can result in death, serious injury, or material damage.

- Replace damaged components immediately.

C-2.6.1.2 Mechanical and electrical check

- Rotate the rotor to ensure that it does not touch the stator.
- Ensure that the bearing insulation is not bridged/jumpered.
- Using the appropriately designed and adjusted control and speed monitoring functions ensure that the permissible speeds specified on the rating plate cannot be exceeded.
- Ensure that any supplementary equipment used to monitor the motor is correctly connected and is functioning.

Electrical connection

- Carefully check the grounding and potential bonding connections.
- Connect the motor corresponding to the specified direction of rotation.
- Using the appropriate open-loop control and speed monitoring functions, carefully ensure that no higher speeds can be achieved than are permitted and specified in the technical data. For this purpose, compare the data on the rating plate or, if necessary, the systemspecific documentation.
- Comply with the minimum insulation resistances.
- Comply with the minimum air clearances.
- Correctly connect possibly available motor monitoring devices and equipment – and carefully ensure that they are functioning correctly.
- Check the correct functioning of the brakes or backstops.
- Set the values for "Alarm" and "Shutdown" at the monitoring devices.
- Carefully ensure that temperature-sensitive parts and components, e.g. cables are not in contact with the motor enclosure.

C-2.6.1.3 Converter operation

- If the motor design requires connection to a specific converter type, carefully check the supplementary data on the rating plate/supplementary plate.
- Ensure that the converter is correctly parameterized. Depending on the design, you will find some parameterization data on the rating plate of the motor. Further information is provided in the converter documentation. If necessary, contact the Service Center.
- Check that the supplementary equipment and devices to monitor the motor are correctly

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connected and are functioning correctly.

- In continuous operation, carefully ensure that the motor cannot exceed the specified upper speed limit n_{max} or fall below the lower speed limit n_{min} . The permissible acceleration time to the limit speed n_{min} depends on the parameter assignment.

C-2.6.1.4 Insulation resistance and polarization index

Measuring the insulation resistance and polarization index (PI) provides information on the condition of the motor. It is therefore important to check the insulation resistance and the polarization index at the following times:

- Before starting up a motor for the first time
- After an extended period in storage or downtime
- Within the scope of maintenance work

The following information is provided regarding the state of the winding insulation:

- Is the winding head insulation conductively contaminated?
- Has the winding insulation absorbed moisture?

As such, you can determine whether the motor needs commissioning or any necessary measures such as cleaning and/or drying the winding:

- Can the motor be put into operation?
- Must the windings be cleaned or dried?

Detailed information on testing and the limit values can be found here:

Checking the insulation resistance.

C-2.6.1.5 Testing the cooling of the motor

Check that the motor cooling is available for commissioning.

C-2.6.1.6 Commissioning a separately driven fan

The separately driven fan ensures that the motor is cooled irrespective of the motor speed or direction of rotation. The separately driven fan is only suitable for one direction of rotation.

Checks before the first test run

Before the first test run, carry out the following checks:

- The separately driven fan is correctly fitted and aligned.
- The rotor runs freely.
- All of the retaining elements and electrical connections are securely tightened.
- The grounding and equipotential bonding connections to the mains have been correctly made.
- The air flow is not impeded or shut off by flaps, covers or similar.
- If the cooling air is in open circulation, it has only weak, chemically abrasive properties and a low dust content.
- All protection measures have been taken to prevent accidental contact with moving or live parts.

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Performing the test run

1. Switch the separately driven fan motor on and off briefly.
2. Compare the direction of rotation of the separately driven fan with the specified direction of rotation. The direction of rotation of the separately driven fan is indicated with an arrow on the fan cover specifying the direction of rotation or with a terminal designation on the rating plate of the separately driven fan.
Depending on the version, the fan impeller is visible through the air inlet opening in the fan cover on the separately driven fan motor.
3. If the direction of rotation is wrong, then interchange two line cables in the separately driven fan motor terminal box.

Note

Use these operating instructions for motors with separately driven fans.

C-2.6.1.7 Setpoint values for monitoring the bearing temperature

Prior to commissioning

If the motor is equipped with bearing thermometers, set the temperature value for disconnection on the monitoring equipment before the first motor run.

Table 7- 1 Set values for monitoring the bearing temperatures before commissioning

Set value	Temperature
Alarm	115 °C
Shutting down	120 °C

Normal operation

Determine the maximum operating temperature of the bearings $T_{operation}$ taking into account the temperature, bearing load and influences of the plant on the motor in °C. Set the values for shutdown and warning corresponding to the operating temperature T_{op} .

Table 7- 2 Set values for monitoring the bearing temperatures

Set value	Temperature
Alarm	$T_{operation} + 5 \text{ K} \leq 115 \text{ °C}$
Shutting down	$T_{operation} + 10 \text{ K} \leq 120 \text{ °C}$

C-2.6.2 Switching on

Measures for start-up

After installation or inspections, the following measures are recommended for normal startup of the motors:

- Start the motor without a load. To do this, close the circuit breaker and do not switch the motor off prematurely. Switching the motor off again while it is starting up and still running at slow speed should be kept to a bare minimum, for example for checking the direction of rotation or for checking in general. Allow the motor to run to a standstill before switching it back on again.

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- Check mechanical operation for noise or vibration at the bearings or end shields.
 - If the motor is not running smoothly or is emitting abnormal noises, switch it off, and determine the cause of the fault as it runs down.
 - If mechanical operation improves immediately after the motor is switched off, then the cause is magnetic or electrical, e.g. voltage imbalance, magnetic imbalance. If mechanical operation does not improve immediately after switching the motor off, then the cause is mechanical, e.g. an imbalance in the electrical motors or in the driven machine, inadequate alignment of the machine set, operation of the motor with the system resonating (system = motor + base frame + foundations etc.).
 - If the motor runs perfectly in terms of its mechanical operation, switch on any cooling devices present and continue to monitor the motor for a while as it idles.
 - If it runs perfectly, connect a load. Check that it runs smoothly.
- Read off and document the values for voltage, current, and power.
Where possible, read off corresponding values for the driven machine and document them as well.
- Monitor the bearing temperature, winding temperature, etc. until the system reaches a steady state. Document these, provided this is possible with existing measuring instruments.

NOTICE

Damage of the motor

The motor may get damaged if the vibration values are not strictly complied with.

- In operation, maintain vibration values in accordance with DIN ISO 10816-3.

Test run

After installation or inspection, carry out a test run:

1. Start up the motor without a load. To do this, close the circuit breaker and do not switch off prematurely. Check whether it is running smoothly.

Switching the motor off again while it is starting up and still running at slow speed should be kept to a bare minimum, for example for checking the direction of rotation or for checking in general.

Allow the motor to run down before switching it on again.

2. If the motor is running smoothly and evenly, switch on the cooling equipment.

Continue to observe the motor for a while in no-load operation.

3. If it runs perfectly, connect a load.

NOTICE


Thermal overload of motors connected directly to the line supply In addition to the load torque, the ramp-up (accelerating) time is essentially influenced by the moment of inertia to be accelerated. While ramping up when connected to the line supply, the inrush (starting) current is a multiple of the rated current. This can result in thermal overload. This can damage the motor.

As a consequence, when ramping up, observe the following:

- Monitor the ramp-up time and number of consecutive starts.
- Comply with the limit values and/or ramp-up conditions specified in the catalog or the order documentation.

4. During the test run, check and document the following:

– Check whether it is running smoothly.

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- Document the voltage, current and power values. As far as possible, document the corresponding values of the driven machine.
 - If this is possible using the available measuring equipment, check the bearing and stator winding temperatures until they have reached steady-state values.
 - Check the motor for noise or vibrations on the bearings or bearing shields as it runs.
5. In case of uneven running or abnormal noise, switch off the motor. As the motor runs down, identify the cause.
- If the mechanical operation improves immediately after the motor is switched off, then the cause is magnetic or electrical.
 - If the mechanical running does not improve immediately after switching the motor off, then the cause is mechanical.
 - Imbalance of the electrical motor or the driven machine
 - The machine set has not been adequately aligned
 - The motor is being operated at the system resonance point. System = motor, base frame, foundation, ...

NOTICE

Serious damage to the motor

If the vibration values in operation are not maintained in accordance with DIN ISO 10816-3, then the motor may get damaged.

- During operation, observe the vibration values in accordance with DIN ISO 10816-3.

C-2.7 Operation

Observe the following when carrying out any work on the motor:

- Comply with the general safety instructions (Page 11).
- Comply with the applicable national and sector-specific regulations.
- When using the motor within the European Union, comply with the specifications laid down in EN 50110-1 regarding safe operation of electrical equipment.

C-2.7.1 Safety instructions for operation

Hazardous voltages at the motor

Electrical motors have hazardous voltage levels. Contact with these can result in death, serious injury or material damage.

Operating the motor on a line supply system with a non-grounded neutral point is only permissible for short periods of time that occur rarely, e.g. the time leading to a fault being eliminated. Cable ground fault EN / IEC 60034-1.

Risk of injury due to rotating parts

Rotating parts are dangerous. Touch protection against rotating parts is no longer guaranteed if covers are removed. Touching rotating parts can result in death, serious injury or material damage.

- Carefully ensure that all of the covers are closed while operational.
- First switch off and disconnect the motor if you must remove covers. Carefully comply with the "5 safety rules".
- Only remove the covers when the rotating parts have come to a complete standstill.

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Danger as a result of stationary parts under voltage (live parts)

Live parts represent a hazard. Touch protection against active (live) parts is no longer guaranteed if covers are removed. The minimum air and creepage distances may be fallen below (violated) when coming close to active parts. Touching or coming close can result in death, serious injury or material damage.

- Carefully ensure that all of the covers are closed while operational.
- First switch off and disconnect the motor if you must remove covers. Carefully comply with the "5 safety rules".
- When the motor is in operation, the terminal boxes must remain closed at all times. Terminal boxes may be opened only when the motor is stopped and in a no-voltage condition.

Faults in operation

Any changes with respect to the normal condition can indicate that the motor is not functioning correctly.

- Higher power consumption, temperatures or vibration levels.
- Unusual noise or smells.
- Monitoring devices respond.

These changes can cause faults which can result in eventual or immediate death, serious injury or material damage.

- Immediately inform the service personnel.
- If you are in doubt, immediately switch off the motor, carefully observing the system specific safety conditions.

Corrosion damage as a result of condensation

Humidity can condense inside the motor if the motor and/or ambient temperatures fluctuate, for intermittent operation or load fluctuations. Condensation can accumulate. Moisture can have a negative impact on the winding insulation or result in damage, such as corrosion.

- Ensure that any condensation can freely flow away.
- If available, remove the screw plugs to drain the water depending on the ambient and operating conditions.
- If available, reinsert the screw plugs.

If the motor is equipped with drain plugs, then the water can drain away by itself.

Risk of burn injuries as a result of hot surfaces

Individual motor parts can become hot in operation. Burns can result when coming into contact with these parts.

- Never touch motor parts during operation.
- Allow the motor to cool down before starting work.
- Check the temperature of parts before touching them. If required, wear suitable protective equipment.

Hazardous substances

Chemical substances required for the setup, operation and maintenance of motors can present a health risk. Poisoning, skin damage, cauterization of the respiratory tract, and other health damage may result.

- Read the information in these operating instructions and the product information supplied by the manufacturer.

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- Observe the relevant safety regulations and wear the personal protective equipment specified. Substances that can be easily ignited and are flammable Chemical substances required for the setup, operation and maintenance of motors may be flammable. Burns and other damage to health and material may result.
- Read the information in these operating instructions and the product information supplied by the manufacturer.
- Observe the relevant safety regulations and wear the personal protective equipment specified.

Damage to the motor or premature bearing failure

The bearings can be damaged if the following is not observed.

- It is absolutely crucial that you maintain the permissible vibration values according to ISO 10816-3 to avoid damage to the motor or even its destruction.
- Under all circumstances maintain the minimum radial load of cylindrical rolling bearings of 50 % corresponding to what is specified in the catalog.
- Take the appropriate measures to reduce bearing currents. Comply with the information in Chapter "Converter operation".

Overheating as a result of the anti-condensation heating

If the anti-condensation heating is operated while the motor is operational, this can increase the temperatures inside the motor and cause material damage.

- Install an interlock circuit that switches off the anti-condensation heating once the main motor is switched on.
- Only switch on the anti-condensation heating after the motor has been switched off. Comply with the data stamped on the plate of the anti-condensation heating, if available.

C-2.7.1.1 Safety instructions relating to ventilation and cooling

C-2.7.1.1.1 Safety instructions for forced ventilation (option)

Forced ventilation (optional): Type of cooling IC 416 in accordance with EN / IEC 60034-6

WARNING

Risk of burning

Operating the motor without a separately driven fan results in overheating. This may result in death, personal injury and material damage.

- Never commission the motor without a separately driven fan.

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C-2.7.1.1.2 Safety instructions when operating motors with fan

CAUTION

Risk of injury when touching the fan

There is a risk of injury at motors equipped with a fan cover (e.g. on motors in the textile industry), as the fan is not completely touch protected.

- Do not touch the rotating fan.
- Do not put your fingers into the larger air discharge openings.
- Prevent manual intervention by using suitable measures, e.g. appropriate housings or a protective grating.

C-2.7.1.1.3 Motors with fan for the textile industry

In order to guarantee an essentially unobstructed flow of cooling air containing fluff, remains of materials or similar dirt, motors used in the textile industry have a larger air discharge cross-section between the edge of the cover and the cooling ribs of the motor frame. These motors have a warning sticker on the fan cover.

C-2.7.2 Switching on the motor

1. If at all possible, run the motor without load and check that it is running smoothly.
2. If it runs perfectly, connect a load.

NOTICE

Thermal overload of motors connected directly to the line supply

In addition to the load torque, the ramp-up (accelerating) time is essentially influenced by the moment of inertia to be accelerated. While ramping up when connected to the line supply, the inrush (starting) current is a multiple of the rated current. This can result in thermal overload. This can damage the motor.

As a consequence, when ramping up, observe the following:

- Monitor the ramp-up time and number of consecutive starts.
- Comply with the limit values and/or ramp-up conditions specified in the catalog or the order documentation.

3. If this is possible using the available measuring equipment, check the bearing and stator winding temperatures.

C-2.7.3 Deactivating

Commission any devices provided for protection against condensation after switching off the motor. Do not immediately switch off the separately driven (external) fan after switching off the motor. First wait for the motor to cool down. This will prevent the accumulation of residual heat.

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C-2.7.4 Switching on again after an emergency switching-off

- Check the motor before recommissioning the driven machine after an Emergency Off.
- Eliminate all the causes that have led to the emergency off

C-2.7.5 Stoppage

The stoppage is a shutdown for a period of time, during which the motor is stopped but remains at the location of use. Under normal ambient conditions, e.g. the stationary motor not exposed to any vibration, no increased level of corrosion, the following measures are required.

Longer non-operational periods

- For longer non-operational periods (> 1 month), either operate the motor or at least turn the rotor regularly, approximately once per month.
- If attached, remove the rotor shipping brace before you turn the rotor.
- Carefully comply with the information in Section "Switching on" before switching on to recommission the motor.

NOTICE

Restricted motor function

If not used for longer periods of time, material damage or complete motor failure can occur. If the motor is out of service for a period of more than 12 months, then environmental effects can damage the motor.

- Apply suitable corrosion protection, preservation, packaging and drying measures.

Switching on the anti-condensation heating, if available

Only switch on the anti-condensation heating after the motor has been switched off. Comply with the data stamped on the plate of the anti-condensation heating, if available.

Taking the motor out of service

Detailed information on how to take the motor out of service is provided in Chapter "Preparing for use".


Lubricating before recommissioning

NOTICE

Dry running bearings

Bearings can be damaged if they do not have sufficient grease.

- Re-grease the bearings if they have been out of service for more than one year. The shaft must rotate so that the grease can be distributed in the bearings. Follow the instructions on the lubricant plate.
- "More information can be found in Chapter Rolling bearings".

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C-2.7.5.1 Avoidance of damage to rolling bearings during stoppages

Extended stoppages at the identical or almost identical resting position of the rotor in the rolling bearings can result in damage, such as brinelling or corrosion.

- During stoppages, regularly start up the motor for a brief period once a month. As a minimum, turn the rotor several times. If you have uncoupled the motor from the driven machine and secured the rotor with a rotor shipping brace, then remove this before turning the rotor over or starting up the motor.

Make sure that the resting position of the rotor after the rotor has been turned over is different from its previous position. Use the fitted key or the coupling halves as reference markers.

- When recommissioning, carefully comply with the information in Chapter "Commissioning".

C-2.7.5.2 Decommissioning the motor

- Record the decommissioning steps. This log will be useful upon recommissioning.
- If the motor is going to be out of service for longer than six months, then take the necessary measures for preservation and storage. Otherwise, the motor could be damaged as a result of not being operated.

C-2.7.5.3 Re-commissioning the motor

When you re-commission the motor, proceed as follows:

- Study the record made when the motor was decommissioned, and reverse the measures that were taken for conservation and storage.
- Perform the measures listed in Chapter "Commissioning".

C-2.7.6 Faults

C-2.7.6.1 Inspection in the event of faults

Natural disasters or unusual operating conditions, such as overloading or short circuit, are faults that overload the motor electrically or mechanically.

Immediately perform an inspection after such faults. Correct the cause of the fault as described in the respective remedial measures section. Repair any damage to the motor.

C-2.7.6.2 Electrical faults

Note

If you are operating the motor with a converter, the operating instructions of the converter must also be observed if electrical faults occur.

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Table 8- 1 Electrical faults

↓ Motor fails to start								
↓ Motor accelerates sluggishly								
↓ Rumbling noise during startup								
↓ Rumbling noise during operation								
↓ High temperature rise during no-load operation								
↓ High temperature rise with load								
↓ High temperature rise of individual winding sections								
Possible causes of faults						Remedial measures		
X	X		X		X	Overload	Reduce the load.	
X						Interrupted phase in the supply cable	Check the switches and cables.	
	X	X	X		X	Interrupted phase in the feeder cable after switching on	Check the switches and cables.	
	X					Mains voltage too low, frequency too high	Check the power supply conditions.	
				X		Mains voltage too high, frequency too low	Check the power supply conditions.	
X	X	X	X			X	Stator winding incorrectly connected	Check the winding connection in the terminal box.
	X	X	X			X	Winding short circuit or phase short circuit in stator winding	Determine the winding resistances and insulation resistances. Carry out repair work after consultation with the manufacturer.
					X		Incorrect direction of rotation	Check the connection.

C-2.7.6.3 Mechanical faults

Table 8- 2 Mechanical faults

↓ Grinding noise			
↓ Radial vibrations			
↓ Axial vibrations			
		Possible causes of faults	Remedial measures
X		Rotating parts grind	Establish the cause and realign the parts.
	X	Rotor or coupling not balanced.	Disconnect the rotor or coupling and rebalance. If the motor has two shaft ends, and a transmission element is only fitted to one end, secure the fitted key at the other end to prevent it from being thrown out. If the rotor has balance type "H" (standard type), the fitted key must be cut back to roughly half of its length.
	X	Rotor out of round, shaft bent	Consult the manufacturing plant.
	X	Poor alignment	Align the machine set; check the coupling. ⁽¹⁾
	X	Coupled machine not balanced	Rebalance the coupled machine.
	X	Shocks from coupled machine	Investigate the coupled machine.
	X	Uneven running of gear unit	Fix the gearing.
	X	Resonance of the overall system comprising motor and foundation	Stabilize the foundation following consultation.
	X	Changes in foundation	Establish the cause of the changes and eliminate them if necessary; realign the motor.

⁽¹⁾ Take any changes into account when warming up the motor.

C-2.7.6.4 Rolling bearing faults

Damage to rolling bearings can be difficult to detect in some cases. If in doubt, replace the rolling bearings. Use other bearings only after consultation with Airpack BV.

Table 8- 3 Rolling bearing faults

↓ Bearing overheats			
↓ Bearing "whistles"			
↓ Bearing "knocks"			
		Possible causes of faults	Remedial measures
X		High coupling pressure	Align the motor more accurately.
X		Belt tension too high	Reduce the drive belt tension.
X		Bearing contaminated	Clean or replace the bearing. Check the seals.
X		High ambient temperature	Use a suitable high-temperature grease.
X	X	Insufficient lubrication	Grease the bearings as instructed.
X	X	Bearing canted	Contact the service center.
X	X	Insufficient bearing play	Contact the service center.
	X	Excessive bearing play	Contact the service center.
X	X	Bearing corroded	Replace the bearing. Check the seals.
X		Too much grease in bearing	Remove surplus grease.
X		Wrong grease in the bearing	Use the correct grease.
	X	Friction marks on raceway	Replace the bearing.
	X	Brinelling or scoring	Replace the bearing. Avoid any vibration at standstill

C-2.8 Maintenance

Through careful and regular maintenance, inspections, and overhauls you can detect faults at an early stage and resolve them. This means that you can avoid consequential damage. Operating conditions and characteristics can vary widely. For this reason, only general maintenance intervals can be specified here. Maintenance intervals should therefore be scheduled to suit the local conditions (dirt, starting frequency, load, etc.). Observe the following when carrying out any work on the motor:

- Comply with the general safety instructions.
- Comply with the applicable national and sector-specific regulations.
- When using the motor within the European Union, comply with the specifications laid down in EN 50110-1 regarding safe operation of electrical equipment.

Note

Please contact Airpack, if you require support with service, maintenance or repair.

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C-2.8.1 Preparation and notes

Touch up any damaged paintwork

If the paint is damaged, it must be repaired in order to protect the unit against corrosion.

Note

Paint system

Contact Airpack before you repair any damage to paint. They will provide you with more information about the correct paint system and methods of repairing paint damage.

C-2.8.2 Inspection and maintenance

C-2.8.2.1 Safety instructions for inspection and maintenance

Danger as a result of stationary parts under voltage (live parts) Live parts represent a hazard. Touch protection against active (live) parts is no longer guaranteed if covers are removed. The minimum air and creepage distances may be fallen below (violated) when coming close to active parts. Touching or coming close can result in death, serious injury or material damage.

- Take the motor out of operation.
- Switch off the motor and ensure that it is in a no-voltage condition. Carefully comply with the "5 safety rules"
- Only open the terminal box when the motor is stationary and in a no voltage condition.

Risk of injury due to rotating parts

Rotating parts are dangerous. Touch protection against rotating parts is no longer guaranteed if covers are removed. Touching rotating parts can result in death, serious injury or material damage.

- Before carrying out any repair work on the motor, take it out of operation, and carefully lock it out so that it cannot be switched on again.
- Only remove the covers when the rotating parts have come to a complete standstill.

Risk of burn injuries due to hot surfaces

In operation, the temperature of individual motor parts can increase - and only decrease slowly after switching off. You can burn yourself if you touch hot surfaces.

- Allow the motor to cool before starting any maintenance and service work on the motor.
- Check the temperature of parts before touching them. If required, wear suitable protective equipment.

Danger when cleaning using compressed air

When cleaning parts of the motor using compressed air, loose parts or particles of dirt can be flung around and cause injury.

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- Installed suitable extraction measures.
- Wear personal protective equipment, such as protective glasses, gloves, overall.
- Ensure that personnel not involved in the work are not in the danger area.

Damage if the motor is not maintained

The motor can be damaged if it is not appropriately maintained. This can cause faults which can result in eventual or immediate death, serious injury or material damage.

- Maintain the motor at the specified maintenance intervals.

Damage from foreign bodies in the motor

Foreign bodies such as dirt, tools or loose components can be left by accident inside the motor after maintenance is performed. These can cause short circuits, reduce the performance of the cooling system or increase noise in operation. They can also damage the motor.

- Ensure that no foreign bodies are left in or on the motor.
- Securely attach all loose parts once you have completed the work.
- Carefully remove any dirt.

C-2.8.2.2 Inspections in the event of faults

Natural disasters or unusual operating conditions, such as overloading or short circuit, are faults that overload the motor electrically or mechanically. Immediately perform an inspection after such faults.

Note

Inspection specifications

- Carefully comply with the relubrication intervals for rolling bearings that deviate from the inspection intervals.
- When servicing a three-phase motor, it is generally not necessary to dismantle it. The motor only has to be dismantled if the bearings are to be replaced.

C-2.8.2.3 First inspection after installation or repair

Perform the following checks after approximately 500 operating hours or at the latest six months after commissioning:


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Table 9- 1 Checks after assembly or repair

Check	When the motor is running	At standstill
The electrical parameters are maintained.	X	
The permissible bearing and winding temperatures are not exceeded (Page 76).	X	
The smooth running characteristics and motor running noise have not deteriorated.	X	
The foundation has no cracks or indentations. (*)	X	X

(*) You can perform these checks while the motor is running or at a standstill.

Additional tests may also be required according to the system-specific conditions.

NOTICE
Motor damage When carrying out the inspection, if you detect any impermissible deviations from the normal state, you must rectify them immediately. They may otherwise cause damage to the motor.

C-2.8.2.4 General inspection

Check that the installation conditions are observed. We recommend that the following checks are performed after approx. 16 000 operating hours or at the latest after two years:

Table 9- 2 Checks that have to be performed during the general inspection

Checking	When the motor is running	At standstill
The electrical parameters are maintained	X	
The permissible bearing temperatures are not exceeded	X	
The smooth running characteristics and motor running noise have not deteriorated	X	
The foundation has no cracks or indentations. (*)	X	X
The motor is aligned within the permissible tolerance ranges		X
All the fixing bolts/screws for the mechanical and electrical connections have been securely tightened		X
All the potential connections, grounding connections and shield supports are correctly seated and properly bonded		X
The winding insulation resistances are sufficiently high		X
Any bearing insulation is fitted as shown on the plates and labels		X
The CABLES and insulating parts and components are in good condition and there is no evidence of discoloring		X

(*) You can perform these checks while the motor is at standstill or, if required, while running.

NOTICE

Motor damage

When carrying out the inspection, if you detect any impermissible deviations from the normal state, you must rectify them immediately. They may otherwise cause damage to the motor.

C-2.8.2.5 Assessing the rolling bearings

To assess the rolling bearings, it is generally not necessary to dismantle the motors. The motor only has to be dismantled if the bearings are to be replaced. The state of a rolling bearing can be assessed by analyzing the bearing vibration. The measured values provide an indication and can be assessed by specialists. In this case, please contact Airpack.

C-2.8.2.6 Maintenance intervals

Please note the following in order to identify faults at an early stage, rectify them and avoid follow-on damage:

- Maintain the motor regularly and carefully.
- Inspect the motor.
- Motors must be allocated a revision/inspection number after inspection.

NOTICE

Motor failure

Material damage can occur if the motor develops faults or is overloaded.

- Immediately inspect the motor if faults occur.
- An immediate inspection is especially necessary, if the three-phase motor is excessively stressed, either electrically or mechanically (e.g. overload or short-circuit).

The motors are equipped with permanently lubricated rolling bearings. The motor may be equipped with a regreasing device.

CAUTION

Skin irritations and eye inflammations

Many greases can cause skin irritations and eye inflammations.

- Follow all safety instructions of the manufacturer.

Measures, intervals and deadlines

Measures after operating period intervals or deadlines have elapsed:

Operating situations and characteristics can vary widely. For this reason, only general maintenance intervals are specified here. Maintenance intervals should therefore be scheduled to suit the local conditions (dirt, starting frequency, load, etc.).

Table 9- 3 Operating period intervals

Measures	Operating period intervals	Intervals
Initial inspection	After 500 operating hours	After 1/2 year at the latest
Relubrication (optional)	See the lubricant plate	
Clean	Depending on the degree of pollution	
Main inspection	Approximately every 16000 operating hours	After two years at the latest
Drain condensate	Depending on the climatic conditions	

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C-2.8.2.7 Re-greasing

For motors with regreasing system, relubrication intervals, grease quantity and grease grade are provided on the lubricant plate. Additional data can be taken from the main motor rating plate.

Grade of grease for standard motors UNIREX N3 - ESSO.

Below are the list of approved greases that can be used:

Table 9- 4 Approved rolling bearing greases for vertical and horizontal types of construction

Manufacturer	Grease type
Shell	Shell Gadus S2 V100 3
ExxonMobil/Esso	Unirex N3
ExxonMobil/Esso	Mobilgrease XHP 103

Note

It is not permissible to mix different types of grease. If an alternative grease is being used, make sure that the old grease has been cleaned from all grease chambers and grease paths (bearing covers, bearing, grease pipe and grease nipple).

Prolonged storage periods reduce the useful lifetime of the bearing grease. Check the condition of the grease if the equipment has been in storage for more than 12 months. If the grease is found to have lost oil content or to be contaminated, the motor must be immediately relubricated before commissioning. For information on permanently-greased bearings, please refer to the section titled Rolling bearings .

Procedure

To relubricate the rolling bearings, proceed as follows:

1. Clean the grease nipples at the drive end and non-drive end.
 2. Press-in the specified grease and amount of grease according to the data stamped on the lubrication plate.
 - Please observe the information on the rating and lubricant plates.
 - Regreasing should be carried out when the motor is running (max. 3600 rpm).
- The bearing temperature can rise significantly at first, and then drops to the normal value again when the excess grease is displaced out of the bearing.

WARNING

Rotor can fall out

If the motor is in a vertical position, the rotor can fall out while work is being performed on the locating bearing. This can result in death, serious injury or material damage.

Support or relieve the rotor when carrying out work with the motor in a vertical position.

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C-2.8.2.8 Cleaning

Cleaning the grease ducts and spent grease chambers

The spent grease collects outside each bearing in the spent grease chamber of the outer bearing cap. When replacing bearings, remove the spent grease.

Dismantle the bearing cartridges to replace the grease in the lubrication duct.

Cleaning the cooling air ducts

Regularly clean the cooling air ducts through which the ambient air flows.

The frequency of the cleaning intervals depends on the local degree of fouling.

Damage to the motor when cleaning with compressed air or water jets

- Do not direct compressed air or water jets in the direction of the shaft outlet or motor openings.
- Avoid direct impact of compressed air and water jets on sealing elements of the motor.

C-2.8.2.9 Cleaning the fan cover of motors for the textile industry

Regularly remove fluff balls, fabric remnants, and similar types of contamination from the fan cover of motors for the textile industry (particularly at the air passage opening between the fan cover and cooling fins of the motor enclosure) to ensure that the cooling air can flow without obstruction.

C-2.8.2.10 Drain condensate

If there are condensation drain holes present, open these at regular intervals, depending on climatic conditions.

WARNING

Hazardous voltage

The winding can be damaged if objects are introduced into the condensation holes (optional). This can lead to death, serious injury or material damage.

Note the following to maintain the degree of protection:

- Switch off the motor so that it is in a no-voltage condition before you open the condensation drain holes.
- Close the condensation drain holes, e.g. using T-plugs, before commissioning the motor.

NOTICE

Reduction of the degree of protection

If condensation drain holes are not closed, then this can result in material damage to the motor. In order to maintain the degree of protection, after the condensation has been drained, you must close all of the drain holes.

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C-2.8.2.11 Insulation resistance and polarization index

Measuring the insulation resistance and polarization index (PI) provides information on the condition of the motor. It is therefore important to check the insulation resistance and the polarization index at the following times:

- Before starting up a motor for the first time
- After an extended period in storage or downtime
- Within the scope of maintenance work

The following information is provided regarding the state of the winding insulation:

- Is the winding head insulation conductively contaminated?
- Has the winding insulation absorbed moisture?

As such, you can determine whether the motor needs commissioning or any necessary measures such as cleaning and/or drying the winding:

- Can the motor be put into operation?
- Must the windings be cleaned or dried?

Detailed information on testing and the limit values can be found here:

Checking the insulation resistance

C-2.8.2.12 Servicing the separately driven fan

WARNING

Injury caused by rotating parts or live (under voltage) parts Live electrical parts are dangerous. Contact with them can cause death, serious injury or material damage.

- Before carrying out any maintenance work on the separately driven fan, disconnect it from the mains, particularly before opening the terminal box.
- Make sure that the device cannot be switched back on.

Servicing the separately driven fan

However, dirt and dust deposits on the impeller and the motor, particularly in the gap between the impeller and the inlet nozzle can impair its function.

- Remove the dirt and dust deposits regularly; the intervals depend on how dirty the surrounding area is.
- Make sure that the impeller is cleaned evenly, as irregular deposits can lead to an imbalance.
- The full air flow can only be achieved when air can freely flow through the impeller.
- There must be a clearance of at least 1 x air intake diameter in the axial direction.
- A uniform gap must be maintained between the impeller and the air intake assembly.

Servicing the separately driven fan motor

- Perform an occasional visual inspection of the separately driven fan motor and check it electrically and mechanically every time the rolling bearings are replaced.
- Replace the permanently lubricated rolling bearing on the separately driven fan motor after 40000 operating hours or five years at the latest.

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	Main motor	

C-2.8.3 Corrective maintenance

Observe the following when carrying out any work on the motor:

- Comply with the general safety instructions (Page 11).
- Comply with the applicable national and sector-specific regulations.
- When using the motor within the European Union, comply with the specifications laid down in EN 50110-1 regarding safe operation of electrical equipment.

If the motor has to be transported, please observe the information and instructions in Chapter "Transport".

Note

Before commencing removal, you should mark how each of the fastening elements has been assigned, as well as how internal connections are arranged. This simplifies subsequent reassembly.

Avoid damaging the windings protruding out of the stator enclosure when assembling the end shield.

If possible, assemble the motor on an alignment plate. This ensures that the mounting feet surfaces are all on the same plane.

Sealing measures

1. Apply the necessary liquid sealant, e.g. Fluid-D, Hylomar, to the centering edge.
2. Check the terminal box seals, and if required, replace these.
3. Repair any damage to the paint, also to screws/bolts.
4. Take the necessary measures to ensure compliance with the applicable degree of protection.
5. Do not forget the foam rubber cover in the cable entry. Completely seal the holes, and ensure that cables do not come into contact with sharp edges.

C-2.8.3.1 Rolling bearings

Refer to the rating plate or the catalog for the designations of the bearings being used.

Bearing lifetime

Prolonged storage periods reduce the useful lifetime of the bearing grease. For permanently lubricated bearings, this reduces the bearing service life. We recommend that the grease is replaced after a storage time of 12 months. Replace greased bearings also in the case of closed bearings (suffix 2Z or 2 RS). After 4 years in storage, generally replace all rolling bearings and grease.

Replacing bearings

Recommended interval after which bearings are to be replaced under normal operating conditions:

Table 9- 5 Bearing replacement intervals

Ambient temperature	Principle of operation	Bearing replacement intervals
50 °C	Horizontal coupling operation	50,000 h
50 °C	With axial and radial forces	20,000 h

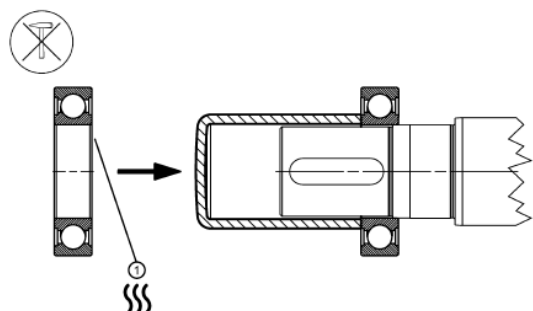
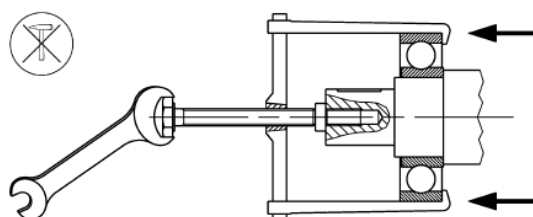
- Do not reuse bearings that have been removed.
- Remove the dirty spent grease from the bearing shield.
- Replace the existing grease with new grease.
- Replace the shaft seals when the bearings are replaced.
- Slightly grease the contact surfaces of the sealing lips.

Note

Special operating conditions

The operating hours are reduced, e.g.

- When motors are vertically mounted.
- High vibration and surge loads
- Frequent reversing operation
- Higher ambient temperatures.
- High speeds etc.



① Heat up 80 ... 100 °C

C-2.8.3.1.1 Bearing bushes

Protect the bearings against the ingress of dirt and moisture.

When fitting the bearing cartridges, observe the specified screw tightening torques

C-2.8.3.1.2 Installing bearings

Sealing the bearings

Note the following details:

- Shaft sealing rings are used to seal motors at the rotor shaft.
 - For V rings, comply with the assembly dimension.
- Use the specified bearings.
- Ensure that the bearing sealing disks are in the correct position.
- Insert the elements for bearing preloading at the correct end.
- Fixed bearings can have a locking ring or bearing cover.
- Seal the bearing cap screws with the appropriate gaskets or with grease.
- Do not interchange the position of the bearing covers (DE and NDE or inner and outer).

Danger as a result of rotor falling out

If the motor is in a vertical position, the rotor can fall out while work is being performed on the locating bearing. This can result in death, serious injury or damage.

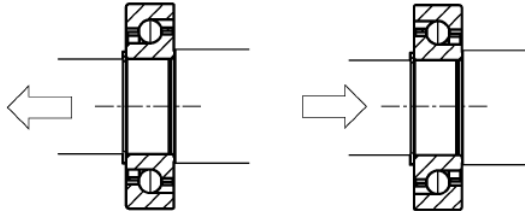
- Support or unload the rotor when carrying out work with the motor in a vertical position.

Installing rolling bearings

- Extreme caution and attention to cleanliness are vital when installing rolling bearings.

Observe the correct assembly sequence of the components.

- Attach all components with the specified tightening torques
- For individually mounted angular contact ball bearings, carefully comply with the installation position corresponding to the permissible direction of force.




- Angular contact ball bearings arranged in pairs must always be installed in strict compliance with the manufacturer's specifications.
- Always use angular contact ball bearings of the same type.

Note

For further information about mounting the rolling bearing, please refer to the catalog or the information provided by the rolling bearing manufacturer.

Procedure

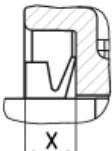

1. Replace the damaged components.
2. Remove any dirt from the components. Remove any grease and the remains of sealant or liquid threadlocker.
3. Prepare the bearing seats:
 - Lightly oil the inner ring seat.
 - Grease the outer ring seat with a solid lubricant such as Altemp Q NB 50.
 - Press the inner bearing cover onto the shaft.
4. Warm up the rolling bearing.
5. Push the inner ring of the warmed up rolling bearing onto the shaft. Avoid any blows that might damage the bearing.

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	Main motor	

6. Ensure that the rolling bearing is resting against the shaft shoulder or the 2nd bearing.
7. Fill the bearing to the top with the specified lubricating grease as stamped on the lubricant plate.
8. Warm up the grease slinger (if one is available), and push it onto the shaft.
9. Depending on the particular version, fix the bearing with a locking ring or shaft nut.
10. Support the rotor when installing the bearing housing or bearing end shield.
11. Use a suitable sealant when assembling.
12. Assemble the bearing shield or bearing housing together with the bearing shield.
13. Install the outer bearing cover (if one is available).
14. Install the sealing elements.

C-2.8.3.2 Mounting dimension "x"

Mounting dimension "x" of V rings

Shaft height	x mm	
71	4.5 ±0.6	Standard design  Special design 
80 ... 112	6 ±0.8	
132 ... 160	7 ±1	
180 ... 225	11 ±1	
250 ... 315	13.5 ±1.2	

- Extreme caution and attention to the correct positioning are vital during installation and assembly.
- Make sure the sealing surface is free of dirt and damage.
- Lightly grease the sealing lips.

C-2.8.3.3 Fan

NOTICE

Destruction of the fan

Material damage can occur by forcefully removing the fan from the shaft.

Take care not to damage the snapping mechanisms on fans that are equipped with these.

Plastic fan

- Correctly expose the breakout openings provided in the fan plate.
- Heat up the fans to a temperature of approximately 50° C around the area of the hub.
- Use a suitable tool to pull off the fan (puller).
- Locate the arms of the pulling tool in the breakout openings and slightly tension the pressure screw of the tool.
- For fans with snapping mechanisms, simultaneously release the two snap-in lugs of the fan from the annular shaft groove. Keep the snap-in lugs in this position.
- Uniformly withdraw the fan from the shaft by turning the pressure screw of the pulling tool.
- Do not apply any hammer blows to avoid damaging the rotor shaft, the fan and the bearings.
- Order the appropriate new parts if damaged.

Metal fan

- Shaft heights 71...90: Release the M5 set screw so that the fan can rotate freely on the shaft.
- Shaft height 100...315: Remove the locking ring.

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	Main motor	

- Use a suitable tool to pull off the fan (puller).
- Locate the arms of the pulling tool in the openings in the fan in the vicinity of the hub.
- Alternatively, place the pulling tool at the outer edge of the fan plate.
- Uniformly withdraw the fan from the shaft by turning the pressure screw of the pulling tool.
- Do not apply any hammer blows to avoid damaging the rotor shaft, the fan and the bearings.
- Order the appropriate new parts if damaged.

Canopy

Canopies with spacer bolts or with screwed mounting brackets Forcibly removing or separating can destroy the distance bolts, the connecting elements of the mounting bracket or the fan cover.

- Release the fixing screw on the outer surface of the canopy.
- Under no circumstances remove the spacer bolts or the mounting bracket – or forcibly separate them from one another or the cover.

Canopies with welded support brackets

- Release the fixing screws at the contact location (canopy foot - riveting nut) at the outer surface of the cover mesh.

C-2.8.3.4 Canopy, encoder under the canopy

- For screwed canopies, insert the fastening screws through the holes on the outer surface of the canopy. Tighten the fastening screws with a torque of $3 \text{ Nm} \pm 10 \%$.

C-2.8.3.5 Tightening torques

Note the information in Chapter "Tightening torques for screw and bolt connections"

C-2.8.3.6 Screw lock washers

Nuts or bolts that are mounted together with locking, resilient and/or force-distributing elements (e.g., safety plates, spring-lock washers, etc.) must be refitted together with identical, fully functional elements.

Locking and sealing elements must always be replaced!

C-2.8.3.7 Links

- Replace any corroded screws.
- Take care not to damage the insulation of live parts.
- Document the position of any rating and supplementary plates that have been removed.
- Avoid damaging the centering edges.

C-2.8.3.8 Reassembly: Miscellaneous information

- Position all rating and supplementary plates as in the original state.
- Where relevant, fix electric cables.
- Check the tightening torques of all screws, as well as those of screws that have not been released.

C-2.8.3.9 Optional add-on units

Note

Further documents

Observe all of the other documents provided with this motor.

You can find additional operating instructions here:

Service & support

Mounting a brake

Table 9- 6 Assigning standard brakes for 1LE7 motors


Shaft height	Pole	Brake maker	Model	Brake size	Brake torque (Nm)	Tightening torque for the manual release lever (Nm)
71	2	EMCO	14.458	8	8	2.8
	4...8	Intorq	BFK458	6	5	
80	2	EMCO	14.458	10	16	4.8
	4...8	Intorq	BFK458	8	10	2.8
90	2	EMCO	14.458	12	32	4.8
	4...8	Intorq	BFK458	10	20	
100	2	EMCO	14.458	14	60	12
	4...8	Intorq	BFK458	12	40	4.8
112	4...8	Intorq	BFK458	14	60	12
132	2...8	EMCO	14.458	18	150	23
160	2...8	EMCO	14.458	20	260	
180	2...8	EMCO	14.458	23	315	
200	2...8	EMCO	14.458	25	400	40
225	2...8	EMCO	14.458	25	400	

C-2.8.3.10 O-ring seal

If O-ring seals are present, you should check that they are in perfect condition and that the O-ring seals are properly seated in the grooves between the components. Replace damaged O-ring seals.

O-ring seals can be present on the following components, for instance:

- Adapters, tapers
- Entries, glands
- Bearing seals
- End shield seals
- Terminal box sealing

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C-2.8.3.11 Encoder

Note

Further documents

Observe all the manufacturer's documentations provided with the encoder.

C-2.8.3.12 Grounding brush

- Ensure that the micro-switch, if available with grounding brush unit, is connected to the drive interlock.
- Check the wearing status of the grounding brush regularly and replace it if necessary.

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION C-3

**Main Components (Start-up, Shutdown, Commissioning,
Pre-commissioning)
INTER / AFTER COOLER**



Vendor doc. Number
17735-19


P.O. NO.:
LIDCO-PO-NEC-278-6019

Vendor:
Airpack Nederland B.V.

	INTEGRATED METHANOL AND AMMONIA PLANT	Rev. 02
	Inter and after cooler	Date: 20-10-2025

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C-3 Inter, after and oil cooler

C-3.1 Introduction

C-3.1.1 General instructions

- These instructions describe how to handle the machine to ensure safe operation, optimum efficiency and long service life.
- Read this section before putting the machine into operation to ensure correct handling, operation and proper maintenance. The maintenance schedule is comprised of measures to keep the machine in good working condition.
- Keep instructions available for the operator and make sure that the machine is operated and maintenance is carried out in accordance with instructions. Record all operating data, maintenance performed, etc.
- Follow all relevant safety precautions.
- In all correspondence, mention the type and the serial number shown on the package nameplate.
- For all data not mentioned in the text, see the last page of this chapter, preventative maintenance chart and section A: General data.
- Airpack reserves the right to make changes at any time, without prior notice.

IMPORTANT:

- Never operate at higher pressure than the nominal one. The pressure can be found in section A: General Data.
- Never operate without the protectors of the moving parts in place.
- Never operate without safety devices. If dismantling any safety device for any reason, i.e. checking or repairing it, it is required that another be fitted before resuming operation.

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NOTE:

Please note that the guarantee of our package is limited to an agreed length of time, however, serious damage appearing after the guarantee expires, which can be traced back to a mistake during manufacturing will be covered under the guarantee.

However, if 'non-genuine' spare parts are used in the package, lawfully, no personal damages or other damages can be accepted as any claim or guarantee. This statement applies during the guarantee period as well as after the guarantee has expired.

Replacement part orders

To avoid errors of interpretation, the following data must be indicated in any correspondence related to Airpack compressors as well as replacement part orders:

1. Airpack project reference no.
2. Package serial no.
3. Compressor model
4. Part number as stated in the spare parts list (for ordering replacement parts)

Airpack reserves the right to modify the technical specification without prior notice and waives all legal responsibilities with respect to such modifications.

Any supplementary data concerning maintenance of your compressor can be obtained directly from:

Airpack Netherlands
Groeneweegje 25
4301 RN Zierikzee
Phone: (31) (0) 111-415455
E-mail: airpack@airpack.nl
Webpage: www.airpack.nl

WARRANTY LIMITATIONS

Please note that our packages are guaranteed for a limited period of time. However, serious damage appearing after the guarantee has expired which can be traced back to a mistake during manufacturing will be covered under our guarantee.



If spare parts are not ordered directly from Airpack Netherlands B.V., or modifications/changes are made to the machine without prior consent from Airpack Netherlands B.V., the guarantee will expire immediately. The maintenance log book must be accurate and Airpack certified maintenance must be performed according to the schedule. If correct, regular maintenance is not performed, any warranty of the package & its parts will be null and void. Airpack cannot legally be held responsible for problems, defects, or damage that may result.

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Please be aware that disregarding the WARRANTY LIMITATIONS, may result in serious damage to the machine, your environment, and yourself!

We Advise: Always order spare parts from Airpack Netherlands B.V. to ensure the safety & guarantee of your package.

C-3.1.1.1 Operational range

After cooler of this product line were developed in particular for application in the field of the industrial and maritime cooling. The present device is a high efficient After cooler on the principle of shell and tube, in compact and lightweight design. The apparatus of this product line can be adapted to different conditions of use by particular combination of material and components. The field of application include all possible uses of cooling, in particular turbines, compressors, refrigeration units, hydraulic plants, in the range of engines, gears etc. Service life of the devices is essentially influenced by proper maintenance and operation. For this reason, observe strictly these instructions.

C-3.1.1.2 Conservation

Under normal conditions are internal surfaces of the devices protected for a duration of 6 months. A post-preserving is necessary after 6 months. The preserving liquid and the note on safety can be provided by us. The used preservative is well compatible with all mineral lubricants. The removal of these substances can be done by using any known solvent (check material compatibility!). The devices should only be stored in closed rooms. Condensation through strong variation of temperature must be avoided.

C-3.1.1.3 Transportation

A damage of the device must be by all means avoided. The transportation of the unpacked device when using lifting systems has to be carried out with sufficient number of transportation straps set around the casing. Please note the dead weight of the device indicated on the current data sheet or the type plate.

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C-3.1.1.4 Structural build-up

C-3.1.1.4.1 Tube bundle

The tube bundle is the core heat transfer element of the shell and tube water cooler. It consists of a series of seamless tubes, expanded or welded into tube sheets, and arranged in a parallel configuration to maximize heat exchange efficiency. The tubes are designed to withstand the operating pressure and temperature of the service fluids. The bundle can be removed for inspection, cleaning, or replacement as required during maintenance. Materials of construction are selected based on process compatibility, typically stainless steel or copper alloys for enhanced corrosion resistance.

C-3.1.1.4.2 Shell

The shell is the cylindrical pressure vessel that houses the tube bundle. It provides containment for the shell-side fluid and directs the flow across the tubes. The shell is fabricated from carbon steel or stainless steel, designed and tested in accordance with applicable pressure vessel codes. Flow distribution baffles are installed inside the shell to improve heat transfer performance and minimize dead zones. Drain and vent nozzles are provided to allow for safe operation and maintenance.

C-3.1.1.4.3 Bonnets


Bonnets, also referred to as heads or end covers, are installed at both ends of the shell to distribute the tube-side fluid. Depending on the design, bonnets may be fixed or removable to allow tube bundle extraction. They are typically designed with inlet and outlet nozzles, inspection openings, and provisions for venting and draining. Internal partitions may be incorporated to achieve the required number of tube passes. The bonnets are sealed to the shell with bolted connections and gaskets to ensure leak-tight operation.

C-3.1.1.4.4 Seals

Sealing elements are essential to maintain the integrity of the water cooler. Gaskets, O-rings, and packing materials are applied at critical flanged joints, tube sheets, and bonnet connections. All seals are selected for compatibility with the operating fluids, temperature, and pressure conditions. Proper installation and torqueing are required to prevent leakage. During operation, seals should be periodically inspected and replaced if signs of wear, deformation, or leakage are observed.

C-3.1.1.4.5 Accessories/spare parts

Accessories and spare parts can be taken from the spare part lists. Drawing and identification numbers of components which are necessary for ordering, are also listed there. Price lists for the spare parts and not listed accessories can be requested via our Spare parts department.

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C-3.1.2 Service

C-3.1.2.1 Installation

The following items must be considered during the installation of the device:

- Protective caps fitted to connections must be removed. If there is no protective cap on a connection, check whether it has been pushed into the connection or foreign parts have penetrated the device.
- Foreign bodies must not penetrate the openings of the connections.
- The connection of the pipes must be tension-free to ensure that no inadmissibly high thermal or mechanical tensions affect the device in service.
- All circuits must be designed to avoid penetration of dirt and dust. We recommend the assembly of dirt traps and suitable filters.
- Tubes must be correctly installed so that air locks cannot built up.
- The assembly can be horizontal or vertical.
- Sufficient space should be available to ensure easy accessibility to all screw connections. Take particular care for providing enough space for remove the tube bundle. You can take the necessary space dimensions for remove the tube bundle from the sketch. It is possible to remove the tube bundle from both sides of the device.
- The direction of flow is to be taken from the enclosed sketch and from the datasheet.
- Before startup, the device must be completely bled.
- Never weld or modify the cooler.
- In case of using the device as oil cooler before startup, clean/flush the oil circuit but not the lubricated points.
- Orifice plates must only be installed at the outlet side of the device.

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C-3.1.2.2 Screw fasteners

To ensure a safe operation and a long service of fastening elements, the screw fastenings should be only torqued. The table below lists the torque figures for used screws. Through influence of various factors, the specified values may show a deviation which in individual cases require lower or higher values.

Connection shell/bonnet

Type	Screw/strength	Torque [Nm]
K12	M12 5.6	38
	M12 8.8	80
K20	M16 5.6	95
	M16 8.8	200
K25	M20 5.6	180
	M20 8.8	400

Connection / flanges

Screw/strength	Material of thread	Torque [Nm]
M12 5.6	Aluminum	30
	Red bronze	30
M16 5.6	Aluminum	75
	Red bronze	75
M24 5.6	Cast steel	100
	Cast steel	300

C-3.1.2.3 Starting up

At first the apparatus must be filled up with the intended medium, and then the entire system must be checked for leakage. For water-cooled devices use only clean water at the tube side. Before the actual starting up of the system, make sure that the cooling medium is circulated. Operating the device without flow of cooling medium is not permissible.

The use of additives in the cooling water has to be confirmed through Airpack B.V.

C-3.1.2.4 Operating instructions

During the operation, make sure by suitable means that pre-set parameters for which the devices are designed are kept.

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C-3.1.2.5 Cooling water quality

To avoid any damage on the heat exchangers, and to provide and guaranty long term functionality of the equipment, the ingredients of the cooling water should not exceed the following values:

		CuNi	1.4404
Ammoniac	Less then	2 mg/l	n.a.
Chloride	Less then	20000 mg/l	150 mg/l
Iron	Less then	0,2 mg/l	0,2 mg/l
Free carbonic acid	Less then	10 mg/l	n.a.
Manganese	Less then	0,2 mg/l	0,2 mg/l
Nitrate	Less then	50 mg/l	n.a.
Oxygen	More then	2 mg/l	n.a.
Sulfate	Less then	2000 mg/l	300 mg/l
Sulfite	Less then	1 mg/l	1 mg/l
Free chlorine	Less then	1 mg/l	1 mg/l
Suspended solids	Less then	20 ppm	20 ppm

Furthermore the cooling water has to have the following qualities.

pH-value		7-9	7-9
Max. size of dust particle		100 µm	100 µm

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION D

Electrical and Instrumentation Equipment

- 1 Pressure Gauge
- 2 Pressure transmitter
- 3 Temperature Transmitter
- 4 Thermowell + Element
- 5 Temperature gauge
- 6 Pressure Safety Valve
- 7 Hand Ball Valve
- 8 Pressure Control Valve
- 9 Check Valve
- 10 Y-Strainer



Vendor doc. Number
17735-19

P.O. NO.:
LIDCO-PO-NEC-278-6019

Vendor:
Airpack Nederland B.V.

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION D-1

ELECTRICAL AND INSTRUMENTATION EQUIPMENT PRESSURE GAUGE



Vendor doc. Number
17735-19

P.O. NO.:
LIDCO-PO-NEC-278-6019

Vendor:
Airpack Nederland B.V.



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D-1 Pressure Gauge

D-1.1 Introduction

This device may only be used to display the pressure of media which are not highly viscous, do not crystallize, do not cause chemical reactions and which are compatible with the materials of the device under the specific measuring conditions (e.g. temperature, atmosphere, immunity of the material against the measured medium, etc.). The pressure of the medium must never exceed the full scale value of the pressure gauge. Any use other than that explicitly outlined in this instruction manual is not permitted.

This device may only be mounted, commissioned, operated, maintained, shut down and disposed of by qualified, specially trained staff.

D-1.2 Precautions

WARNING

Gases or liquids under high pressure pose a greater danger. Safety pressure gauges with blow-out devices (e.g. blow-out rear walls) should be used as a precaution in the event of leaks or bursting parts under pressure, to protect persons in front of the window of the pressure gauge from escaping medium or flying parts.

- The pressure of the medium must never exceed the full scale value of the pressure gauge.
- The pressure gauges may only be used in accordance with the temperature ranges specified.
- The pressure gauges must never be used as a part of an out-of-range safety system to protect against parameters exceeding permissible limit values (equipment parts with safety function).
- **WARNING:** pressure pulses can cause considerable shortening of the operating life of pressure gauges.

Overloads cause tension in the elastic measuring element which decreases its service life and deteriorates the measuring accuracy. You should always use a pressure gauge whose full scale value is greater than the maximum static pressure which makes the device less sensitive to overload and load changes.

NOTE: If for operational reasons, the range must be smaller than the maximum operating pressure, it is possible to install an overload protection device to protect the pressure gauge from damage. However, highly viscous or polluted media may have an adverse effect on the protection device or even make it ineffective.

D-1.3 Certification

CE mark



This device is designed to meet state-of-the-art safety requirements, has been tested and left the factory in a condition in which it is safe to operate. The device complies with the applicable standards and regulations as listed in the EC declaration of conformity and thus complies with the statutory requirements of the EC Directives.

This pressure gauge meets the statutory requirements of the following EC Directives:

- Pressure Equipment Directive 97/23/EC
- Low voltage Directive 73/23/EEC
- EMC Directive 89/336/EC

And also

- EN 61010
- EMC specification as per EN 61326/A1
- NAMUR Recommendations NE 21 and NE 43

D-1.4 Maintenance

Using unsuitable spare parts and accessories may cause damage to the product. Use only genuine Airpack B.V. spare parts and accessories!

Pressure gauges are generally low-maintenance. Routine checks of the components and verification of accuracy should be performed. The general safety of a facility often depends on the reliability of indicators on the pressure gauges installed in the facility. Any pressure gauge that seems to be giving false readings must be removed immediately and tested. If the test proves it unreliable, it must be replaced with a new device. Any pressure gauge thought to have been exposed to abnormal conditions (fire, incorrect fluid, blow-out, etc.) may not be used!

Pressure gauges may only be repaired by the manufacturer. Prior to returning a pressure gauge to the manufacturer, you must completely remove the medium from the device, especially if the medium can be harmful (i.e. poisonous, caustic, flammable, etc.). When returning a device, it must be accompanied by a declaration that proper procedure has been followed and it does not pose any danger.

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION D-2

ELECTRICAL AND INSTRUMENTATION EQUIPMENT PRESSURE TRANSMITTER



Vendor doc. Number
17735-19

P.O. NO.:
LIDCO-PO-NEC-278-6019

Vendor:
Airpack Nederland B.V.



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D-2 Pressure transmitter

D-2.1 Introduction

Your Pressure Transmitter was precisely calibrated at the factory before shipment. To ensure both safety and efficiency, please read this manual carefully before you operate the instrument.

This pressure transmitter is for measuring pressure and level. The manufacturer accepts no liability for damages resulting from incorrect use or use other than that designated.

The device has been designed to operate safely in accordance with current technical, safety and EU standards. If installed incorrectly or used for applications for which it is not intended, however, it is possible that application-related dangers may arise (e.g. product overflow due to incorrect installation or calibration). For this reason, the instrument must be installed, connected, operated and maintained according to the instructions in this manual: personnel must be authorized and suitably qualified to operate and maintain equipment. The manual must be read and understood, and the instructions followed. Modifications and repairs to the device are permissible only if they are expressly approved in the manual. Pay particular attention to the technical data on the nameplate.

Assembly, electrical connection, commissioning, and maintenance of this transmitter may only be done by authorized specialists. Qualified persons are experienced in the assembly, electrical connection, commissioning, and operation of the transmitter and hold the necessary qualifications to complete such work.

The device must be stored in a dry, clean area, protected against damage from impact.

D-2.2 Precautions

DANGER

To prevent possible explosions and to maintain explosion proof, dust-ignition proof protection, observe all applicable wiring practices. Plug unused conduit opening with the provided metal pipe plug, which engages a minimum of five full threads.

Explosions can result in death or serious injury.

- Do not remove the transmitter covers in explosive environments when the circuit is live.
- Both transmitter covers must be fully engaged to meet explosion-proof requirements.
- Before connecting a communicator in an explosive atmosphere, make sure the instruments in the loop are installed in accordance with intrinsically safe or non-incentive **filed** wiring practices.
- Verify that the operating atmosphere of the transmitter is consistent with the appropriate hazardous locations certifications.

- Electrical shock can result in death or serious injury. Avoid contact with the leads and terminals!

NOTE

Airpack recommends the use of transient/surge protection in installations prone to high levels of electrical transients and surges.

NOTE:

Make sure all electrical installation is in accordance with national and local code requirements.

- With high process temperatures, care must be taken not to burn yourself by touching the instrument or its casing.
- Never loosen the process connector nuts when the instrument is installed in a process. This can lead to a sudden, explosive release of process fluids.
- When draining condensate from the pressure detector section, take appropriate precautions to prevent the inhalation of harmful vapours and the contact of toxic process fluids with the skin or eyes.
- When removing the instrument from a hazardous process, avoid contact with the fluid and the interior of the meter.
- All installation shall comply with local installation requirements and the local electrical code.

D-2.3 Certification

CE mark



This device is designed to meet state-of-the-art safety requirements, has been tested and left the factory in a condition in which it is safe to operate. The device complies with the applicable standards and regulations as listed in the EC declaration of conformity and thus complies with the statutory requirements of the EC Directives.

This pressure transmitter meets the statutory requirements of the following EC Directives:

- Pressure Equipment Directive 97/23/EC
- Low voltage Directive 73/23/EEC
- EMC Directive 89/336/EC

And also



- EN 61010
- EMC specification as per EN 61326/A1
- NAMUR Recommendations NE 21 and NE 43

D-2.4 Maintenance

Wait 10 minutes after power is turned off, before opening covers.

Grounding is always required for the proper operation of transmitters. Follow the domestic electrical requirements as regulated in each country.

WARNING:

- Never loosen the process connector bolts when an instrument is installed in a process. The device is under pressure, and a loss of seal can result in a sudden and uncontrolled release of process fluid.
 - When draining toxic process fluids that have condensed inside the pressure detector, take appropriate steps to prevent the contact of such fluids with the skin or eyes and the inhalation of vapours from these fluids.
-

DANGER

For non-intrinsically safe installations, to prevent a potential explosion in a division 1 hazardous area, de-energize transmitters before you remove threaded housing covers. Failure to comply with this warning could result in an explosion resulting in severe injury or death.

Care should be taken to prevent the build-up of drift dust or other material on the display glass and name plate. When performing maintenance, a soft and dry cloth should be used.

Parts replacement is generally limited to the electronics module assembly, housing assembly, sensor assembly, terminal block assembly, cover O-rings, and optional display. Replacements equipment or spare parts not approved by Airpack B.V. for use as spare parts could reduce the pressure retaining capabilities if the transmitter and may render the instrument dangerous.

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION D-3

ELECTRICAL AND INSTRUMENTATION EQUIPMENT TEMPERATURE TRANSMITTER



Vendor doc. Number
17735-19

P.O. NO.:
LIDCO-PO-NEC-278-6019

Vendor:
Airpack Nederland B.V.



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D-3 Temperature transmitter

D-3.1 Introduction

Before handling the temperature transmitter, it is absolutely imperative that users of this equipment read and observe the safety instructions mentioned in each section of the manual in order to ensure the protection and safety of operators, the transmitter itself and the system containing the transmitter. Airpack B.V. cannot be held liable for any damage or accidents due to actions or operation that does not adhere to the guidelines established in the manual, operation instructions, safety instructions, etc.

This device is a universal and configurable temperature field transmitter for resistance thermometers (RTD), thermocouples (TC) and resistance and voltage transmitters. The device is designed for installation in the field.

The manufacturer does not accept liability for damage caused by improper or non-designated use.

Among all factors, which may affect transmitter accuracy, environmental conditions are the most difficult to control. There are, however, ways of reducing the effects of temperature, humidity and vibration. Temperature fluctuation effects can be minimized by locating the transmitter in areas protected from extreme environmental changes.

In warm environments, the transmitter should be installed to avoid direct exposure to the sun. Installation close to lines and vessels subjected to high temperatures should also be avoided. For temperature measurements, sensors with cooling-neck can be used or the sensor can be mounted separated from the transmitter housing.

Use of sunshades or heat shields to protect the transmitter from external heat sources should be considered, if necessary.

Humidity is fatal to electronic circuits. In areas subjected to high relative humidity, the O-rings for the electronics cover must be correctly placed. Removal of the electronics cover in the field should be reduced to the minimum necessary because every time it is removed, the circuits are exposed to the humidity. The electronic circuit is protected by a humidity proof coating, but frequent exposures to humidity may affect the protection provided. It is also important to keep the covers tightened in place. Every time they are removed, the threads are exposed which leads to corrosion, since these parts cannot be protected by painting., code-approved sealing methods on conduit entering the transmitter should be employed. Contact Airpack B.V. for more information.

Measurement error can be decreased by connecting the sensor as close to the transmitter as possible and using proper wires (see Section II, Operation).

D-3.2 Precautions

CAUTION:

The products described in this document are NOT designed for nuclear-qualified applications. Using this product in applications that require nuclear-qualified hardware or products may cause inaccurate readings and will void the guarantee as it goes against the intended use.

WARNING:

Explosions may result in death or serious injury.

- Do not remove the instrument cover in explosive atmospheres when the circuit is live.
- Before connecting a field communicator in an explosive atmosphere, make sure the instruments in the loop are installed in accordance with intrinsically safe or non-incentive field wiring practices.
- Both transmitter covers must be fully engaged to meet explosion-proof requirements.
- Electrical shock could cause death or serious injury. If the sensor is installed in a high-voltage environment and a fault or installation error occurs, high voltage may be present on transmitter leads and terminals.
- Use extreme caution when making contact with the leads and terminal.
- Process leaks could result in death or serious injury:
- Install and tighten thermowells or sensors before applying pressure or process leakage may result.
- Do not remove the thermowells while in operation. Removing them may cause process fluid leaks.

D-3.3 Certification

CE mark



This device is designed to meet state-of-the-art safety requirements, has been tested and left the factory in a condition in which it is safe to operate. The device complies with the applicable standards and regulations as listed in the EC declaration of conformity and thus complies with the statutory requirements of the EC Directives.

This temperature transmitter meets the statutory requirements of the following EC Directives:

- Pressure Equipment Directive 97/23/EC
- Low voltage Directive 73/23/EEC

- EMC Directive 89/336/EC

And also

- EN 61010
- EMC specification as per EN 61326/A1
- NAMUR Recommendations NE 21 and NE 43

D-3.4 Maintenance

The transmitter has no moving parts and requires a minimum amount of scheduled maintenance. The transmitter features a modular design for easy maintenance. If a malfunction is suspected, check for an external cause before performing the diagnostics.

In general, it is recommended that the end user do not try to repair printed circuit boards. Instead he should have spare circuit boards, which may be ordered from Airpack B.V.

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION D-4

ELECTRICAL AND INSTRUMENTATION EQUIPMENT THERMOWELL



Vendor doc. Number
17735-19

P.O. NO.:
LIDCO-PO-NEC-278-6019

Vendor:
Airpack Nederland B.V.



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D-4 Thermowell

D-4.1 General

Thermowells are used to protect temperature sensors from the process conditions. Furthermore, thermowells enable the removal of the temperature sensor without having to shut down the process; and they guard against damage to either the environment or to personnel, which might be caused by escaping process media.

The thermowell has been designed and built solely for the intended use described here, and may only be used accordingly.

The technical specifications contained in these operating instructions must be observed. Should the thermowell be improperly handled or operated outside of its technical specifications, it has to be inspected immediately.

D-4.2 Safety

Before installation, commissioning and operation ensure that the appropriate thermowell has been selected in terms of measuring range, design and specific measuring conditions.

Before installation, commissioning and operation ensure that the thermowell material used is chemically resistant / neutral to the medium being measured and that it withstands the mechanical stresses from the process.

Non-observance can result in serious injury and/or damage to equipment.

For hazardous media such as oxygen, acetylene, flammable or toxic gases or liquids, and refrigeration plants, compressors, etc., in addition to all standard regulations, the appropriate existing codes or regulations must also be followed. Make sure that the thermowell is sufficiently earthed.

Residual media on dismantled thermowells can result in a risk to persons, the environment and the equipment. Take sufficient precautionary measures.

D-4.3 Mounting

During mounting (especially with ceramic thermowells) the thermowells should not be subjected to thermal shocks or mechanical impacts.

Insert the thermowell into the process adapter without forcing or damaging it. The thermowell must not be bent or altered in order to mount it.

The exception is the retrospective machining of the support ring in order that the thermowell is supported free of play within the nozzle ("interference fit"). The retrospective adjustment of a support ring with a loose fit is not permissible. In general, thermowells with a support ring are not recommended within ASME PTC 19.3 TW 2010 and are outside of the scope of the standard.

It is recommended to mount the temperature measuring instrument into the thermowell using a suitable sealing material to avoid, for example, humidity ingress.

In general, the tip of the thermowell should be placed in the middle third of the pipe, though the position may differ in special cases. It must be ensured that the measuring element (Pt100, thermocouple, bimetal, etc.) is completely exposed to the medium and is not shielded by the flange stubs. If, as a result of a small pipe diameter, this cannot be ensured, a pipe expansion can be inserted around the measuring point.

Flanged thermowells: The flange dimensions of the thermowell must match those of the mating flange on the process side. The seals used must be suitable for the process and the flange geometries (cross-check the project specification). The correct tightening torques and suitable tools (e.g. spanner) should be used for installation. For thermowells with a collar, make sure that it matches the inner diameter of the coupling and is supported by it. In the case of an interference collar, they should be adapted to the inner diameter of the coupling.

The insertion length and the diameter of the thermowell are dependent on the process conditions, especially on the flow rate of the measured medium.

D-4.4 Maintenance

Dismounting

Only disconnect thermowells once the system has been depressurized!

Risk of burns!

Let the instrument cool down sufficiently before dismounting it!

When dismounting it, there is a risk that dangerously hot pressure media may escape.

Residual media on dismounted thermowells can result in a risk to persons, the environment and equipment. Take sufficient precautionary measures.

In general, thermowells are maintenance-free.

We recommend a visual check of the thermowell for leaks and damages at regular intervals.

Make sure that the seal is in perfect condition!

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
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SECTION D-5

ELECTRICAL AND INSTRUMENTATION EQUIPMENT TEMPERATURE GAUGE



Vendor doc. Number
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P.O. NO.:
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Vendor:
Airpack Nederland B.V.



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D-5 Temperature gauge

D-5.1 Precautions

Thermometers operating below 0°C (32°F) must have a perfectly tight case to prevent entrance of moisture. "Hermetically sealed" thermometers are closed off in a dry, warm atmosphere and need no maintenance. If "bayonet ring type thermometers" show for any reason sign of stickiness when indicating a low temperature they should be brought to a dry, warm location and allow them to dry out for 24 to 48 hours with an open case. Afterwards, close the cases carefully and reinstall them.

A temperature indicator should be installed in a vibration free area. The instrument might exhibit excessive wear on the bearing surfaces of the movement. If an installed gauge fails and exhibits these symptoms it is almost certain that the wrong type of instrument has been used for that particular application and it is essential that the manufacturer is consulted.

D-5.2 Certification

CE mark



This device is designed to meet state-of-the-art safety requirements, has been tested and left the factory in a condition in which it is safe to operate. The device complies with the applicable standards and regulations as listed in the EC declaration of conformity and thus complies with the statutory requirements of the EC Directives.

This temperature gauge meets the statutory requirements of the following EC Directives:

- Pressure Equipment Directive 97/23/EC
- Low voltage Directive 73/23/EEC
- EMC Directive 89/336/EC

And also

- EN 61010
- EMC specification as per EN 61326/A1
- NAMUR Recommendations NE 21 and NE 43

D-5.3 Maintenance

The instruments need little or no maintenance. But be sure that the case is closed at all times, so that no moisture or dirt can enter the case. If the thermometer is used with a medium that may harden and build up, the thermometer should be occasionally the stem cleaned.

The function of the gauge does not require any special maintenance procedures but frequent checks must be made to ensure that the instrument is still working correctly and accurately. Any shift in temperature readings greater than twice the tolerance of the instrument must be investigated and the gauge immediately replaced if it is faulty.

The repair and recalibration of the instrument should be undertaken only by competent personnel who have at their disposal the necessary facilities.

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION D-6

ELECTRICAL AND INSTRUMENTATION EQUIPMENT PRESSURE SAFETY VALVE (PSV)



Vendor doc. Number
17735-19

P.O. NO.:
LIDCO-PO-NEC-278-6019

Vendor:
Airpack Nederland B.V.

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D-6 Pressure Safety Valve

D-6.1 Introduction

A pressure safety valve is a safety instrument which opens above a pressure set point to relieve pressure. At each opening it is essential to recalibrate this valve according to procedure mentioned in this manual below.

ATTENTION

The safety of lives and property can depend on the proper operation of the pressure relief valves. Consequently, the valves should be kept clean and should be periodically tested and reconditioned to make sure they function properly.

Pressure relief valves are precision instruments. Correct installation is essential for the safety of the facility, property, personnel, and public safety. Failure of a pressure relief valve can lead to catastrophic overpressure of equipment and/or the release of fluid under pressure. Fluids may be hazardous and all precautions should be taken to ensure safe disposal.

Valves are often on hand at the job site months before they are installed. Unless properly stored and protected, valve performance may be adversely affected.

Rough handling and dirt may damage or cause misalignment of the valve parts. It is recommended that the valves be left in their original shipping containers and that they be stored in a warehouse or at a minimum on a dry surface with a protective covering until they are used.

CAUTION

Pressure relief valves must be handled carefully and never subjected to sharp impact loads. They should not be struck, bumped or dropped. Rough handling after the pressure setting, deforms valve parts and adversely affects seat tightness and valve performance.

D-6.2 Precautions

WARNING

This product is a safety component intended for use in critical applications. The improper application, installation or maintenance of this product or the use of parts or components not manufactured by Airpack B.V. may result in malfunction or failure of this product. The advice of a qualified engineer should be sought prior to any use of this product.

Any installation, maintenance, adjustment, repair or test performed on this product must be done in accordance with the requirements of all applicable Codes and Standards.

- Make sure that the safety relief valve is isolated from the pressure source before it is removed.
- Stand clear and wear protective clothing when removing the safety relief valve to prevent exposure to any types of deposits or corrosive debris which may have been trapped inside the valve.
- Do not stand near the discharge side of a safety relief valve when testing the valve.
- Always install a safety valve vertically as the internal parts are designed to operate in that position.
- Avoid hammer blows to the valve.
- Eliminate stress on the valve body whenever possible.
- Be careful when checking a safety valve for visible leakage.

There is a risk of injury from sharp edges and burrs. For this reason all parts have to be handled with caution.

There is a risk of safety valves falling over. They always have to be secured adequately.

D-6.3 Certification

CE mark



This device is designed to meet state-of-the-art safety requirements, has been tested and left the factory in a condition in which it is safe to operate. The device complies with the applicable standards and regulations as listed in the EC declaration of conformity and thus complies with the statutory requirements of the EC Directives.

This pressure safety valve meet the statutory requirements of the following EC Directives:

- Pressure Equipment Directive 97/23/EC
- Low voltage Directive 73/23/EEC
- EMC Directive 89/336/EC

And also

- EN 61010
- EMC specification as per EN 61326/A1
- NAMUR Recommendations NE 21 and NE 43

Design, marking, production and approval of this pressure equipment corresponds to the requirements of the following regulations (directives, codes, rules and standards):

Harmonized standards:

Other regulations:

DIN EN ISO 4126-1	PED 97/23/EC	VdTUV SV 100	ASME-Code Sec. II	API RP 521
DIN EN ISO 4126-7	AD 2000-Merkblatt A2	TRD 110	ASME-Code Sec. VIII Div. 1	API Std. 526
DIN EN 12266-1	AD 2000-Merkblatt A4	TRD 421	ASME PTC 25	API Std. 527
DIN EN 12266-2	AD 2000-Merkblatt HPO	TRD 721	API RP 520	API RP 576

D-6.4 Maintenance

A visual inspection should be done when the valves are first removed from service. The presence of deposits or corrosion in the valve and in the piping should be recorded and valves should be cleaned to the extent possible prior to disassembly. Check the condition of external surfaces for any indication of corrosive atmospheric attack or evidence of mechanical damage.



External parts such as the valve body, bonnet and cap should be cleaned by immersion in a bath such as hot Oakite solution or equivalent. These external parts may be cleaned with wire brushing, provided the brush used does not damage or contaminate the base metals. Only clean stainless steel brushes should be used on stainless steel components. The internal parts such as the guide, disc holder, disc insert, nozzle ring and spindle should be cleaned by immersion in a commercial high alkaline detergent. Guiding surfaces on the disc holder and guide may be polished using a fine emery cloth. The bellows and other metal parts may be cleaned using acetone or alcohol, then rinsed with clean tap water and dried.

Check all valve parts for wear and corrosion. The valve seats on both the nozzle and disc insert must be examined to determine if they have been damaged. Most often, lapping the valve seats is all that is necessary to restore them to their original condition.

If the inspection shows that the valve seats are badly damaged, replacement will be necessary. When the time is a factor, it may be advantageous to replace damaged parts from spare parts stock, thereby permitting the replaced part to be checked and reworked at leisure. The valve spring should be inspected for evidence of cracking, pitting or deformation. The bearing surfaces on the guide and disc holder should be checked for residual product build up and any evidence of scoring. Inspection of valve components is important to ensure proper valve performance. Damaged valve parts must be repaired or replaced.

Before valve teardown is performed, a review of the previous maintenance records will assist in understanding past valve performance, settings, and maintenance requirements. A comprehensive maintenance records management system will allow proper stocking of commonly replaced items, such as gaskets and seals, and adequate stocking of major replacement parts, such as nozzles, discs, and springs. Maintenance records, when properly updated, can serve to identify the need for ordering spare parts when valve servicing shows that the useful life of a particular part has been reached. Re-matching details and installation of new parts should be recorded to aid future service activities.

After the valve is received and checked it is ready for shop inspection and repair. The valve should be carefully dismantled. If you are unfamiliar with this line of Airpack valves, carefully study the cross-sectional drawings to familiarize yourself with part terminology and location. Proper facilities should be available for segregating parts as the valve is dismantled. At each stage in the dismantling process all parts of the valve should be visually inspected for evidence of wear and corrosion. If parts are worn, replace them. See Appendix 1 for necessary tools.

WARNING

Pressure safety valve must be calibrated on set point yearly

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION D-7

ELECTRICAL AND INSTRUMENTATION EQUIPMENT BALL VALVE



Vendor doc. Number
17735-19

P.O. NO.:
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Vendor:
Airpack Nederland B.V.

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D-7 Ball valve

D-7.1. Introduction

This valve gets its name from the ball that rotates to open and close the valve. Ball valves are used in situations where tight shut-off is required.

NOTE:

This valve is intended for a specific range of pressures, temperatures and other application specifications.

Applying different pressures and temperatures to the valve could result in damage to the valve, malfunction of the control valve, or loss of control of the process. Do not expose this product to service conditions or variables other than those for which the product was intended. If you are not sure what these conditions are you should contact Airpack for complete specifications and clarification. Provide the product serial number (shown on the nameplate) and all other pertinent information.

D-7.2. Precautions

WARNING:

INCORRECT OR IMPROPER USE OF THIS PRODUCT CAN CAUSE SERIOUS PERSONAL INJURY AND PROPERTY DAMAGE.

WARNING

Devices from the manufacturer may only be installed, commissioned, operated and maintained by properly trained and authorized personnel.

This document is provided to help you establish operating conditions, which will permit safe and efficient use of this device.

D-7.3. Certification

CE mark



This device is designed to meet state-of-the-art safety requirements, it has been tested and left the factory in a condition in which it is safe to operate. The device complies with the applicable standards and regulations as listed in the EC declaration of conformity and thus complies with the statutory requirements of the EC Directives.

This ball valve meets the statutory requirements of the following EC Directives:

- Pressure Equipment Directive 97/23/EC
- Low voltage Directive 73/23/EEC
- EMC Directive 89/336/EC

And also

- EN 61010
- EMC specification as per EN 61326/A1
- NAMUR Recommendations NE 21 and NE 43

D-7.4. Maintenance

ATTENTION: during maintenance- or repair work- the valve must be completely pressure released and discharged! Disconnect all pneumatic, hydraulic and electric tubes/lines and protect them against unintentional insertion process.

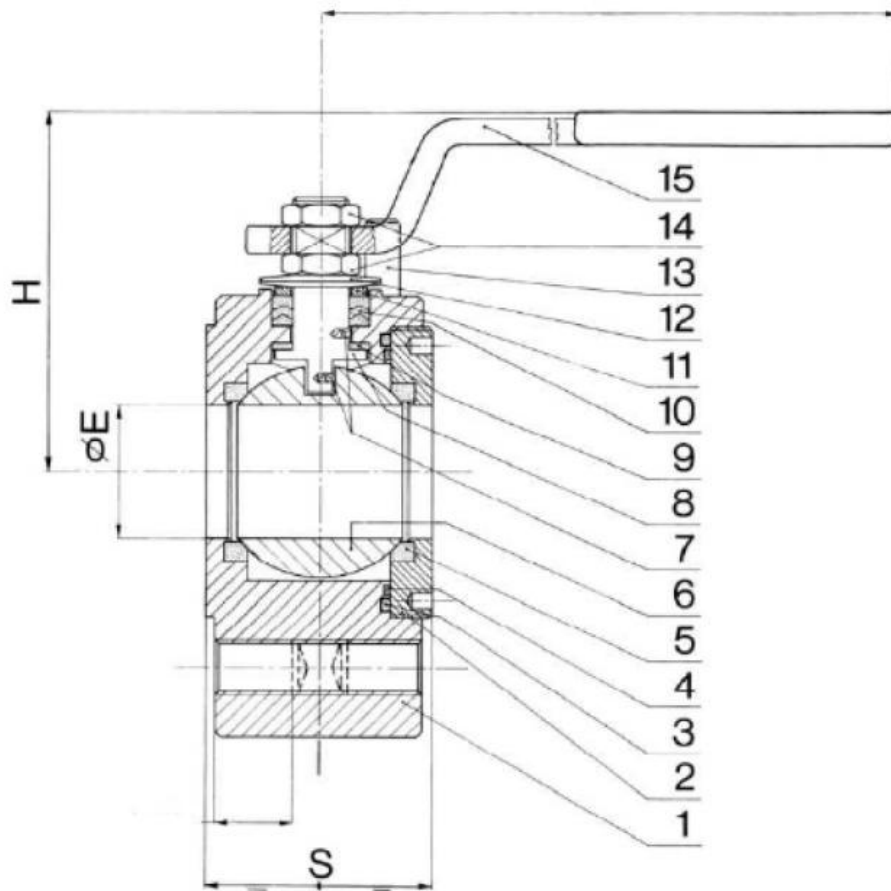
Provided that competent, trained personnel and the correct original spare parts are available, maintenance and revision of valve(s) can be carried out on site. The manufacturer's personnel are also available upon request.

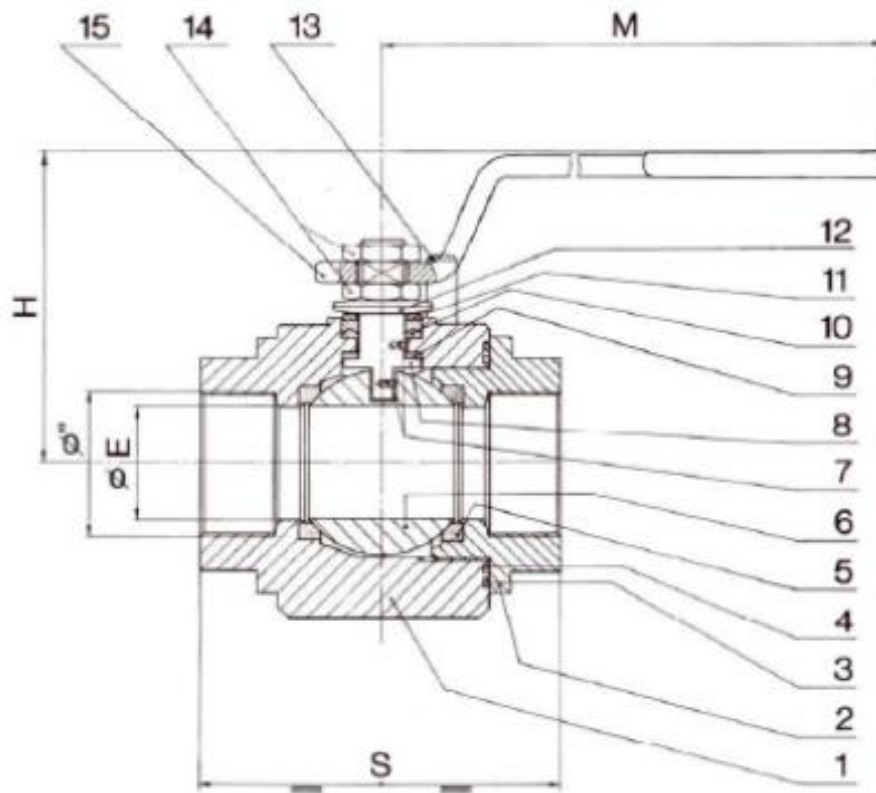
Maintenance & valve service

Ball valves do not require a lot of maintenance. However, solid or liquid particles in the gas flow may cause wear or mechanical damage to the valve plate or other valve parts.

In order to ensure a long lifetime and faultless operation, ball valves should be regularly inspected for service:

- a. Clean gas or clean air: every 16,000 to 24,000 service hours
- b. Slightly polluted gas: every 6,000 to 12,000 service hours
- c. Heavily polluted gas: every 2,000 service hours





Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION D-8

ELECTRICAL AND INSTRUMENTATION EQUIPMENT PRESSURE CONTROL VALVE (PCV)



Vendor doc. Number
17735-19

P.O. NO.:
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Vendor:
Airpack Nederland B.V.



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D-8 Pressure Control Valve

D-8.1 Introduction

NOTE

This valve is intended for a specific range of pressures, temperatures and other application specifications.

Applying different pressures and temperatures to the valve could result in damage to the valve, malfunction of the control valve, or loss of control of the process. Do not expose this product to service conditions or variables other than those for which the product was intended. If you are not sure what these conditions are you should contact Airpack for complete specifications and clarification. Provide the product serial number (shown on the nameplate) and all other pertinent information.

The pressure control valve is used to control the pressure of an air or gas system and will be activate through the PLC, computer or microprocessor, which is **gnale signalled?** By a pressure transmitter. For critical pressures it is necessary to monitor the position of the valve. In such cases, a limit/position switch will be mounted (see enclosed data sheet).

D-8.2 Precautions

WARNING:

INCORRECT OR IMPROPER USE OF THIS PRODUCT CAN CAUSE SERIOUS PERSONAL INJURY AND PROPERTY DAMAGE.

Due to the variety of operating conditions and applications for this product, the user is solely responsible for making the final proper decisions concerning the correct assembly and functioning of the product and assuring that all the performance, safety and warning requirements are met.

- Users must be trained and equipped for the handling, use, and servicing of (high) pressure products and systems.
- Users must contact their gas or liquid supplier for specific safety precautions and instructions.
- Gaseous media should be free of excessive moisture to prevent icing at high flow.
- Always wear the appropriate protective clothing, including safety glasses, gloves etc. if required.
- Follow the applicable safety and maintenance procedures.
- Obey specific local regulations.
- Do not exceed the maximum inlet and outlet pressure of the product or its accessories.
- Operate within the temperature limits and other conditions specified for the product.
- Do not drop or damage the product in any other way. This may negatively affect the performance of the product and can cause the product to malfunction.
- Venting fluids and gases can be dangerous. Vent to a safe environment away from people. Ensure adequate ventilation in accordance with local regulations.
- This product is not oxygen clean and therefore not suitable for oxygen service.

WARNING:

Personal injury could result from packing leakage. Valve packing is tightened before shipment; however the packing might require some readjustment to meet specific service conditions.

D-8.3 Certification

CE mark



This device is designed to meet state-of-the-art safety requirements, has been tested and left the factory in a condition in which it is safe to operate. The device complies with the applicable standards and regulations as listed in the EC declaration of conformity and thus complies with the statutory requirements of the EC Directives.

This pressure control valve meets the statutory requirements of the following EC Directives:

- Pressure Equipment Directive 97/23/EC
- Low voltage Directive 73/23/EEC
- EMC Directive 89/336/EC

And also

- EN 61010
- EMC specification as per EN 61326/A1
- NAMUR Recommendations NE 21 and NE 43

D-8.4 Maintenance

This product should be checked periodically for proper and safe operation. It is the user's sole responsibility to determine the frequency of maintenance based on the application.

WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts.

Before performing any maintenance operations:

- Always wear protective gloves, clothing and eyewear when performing any maintenance operations to avoid personal injury.
 - Disconnect any operating lines providing air pressure, electric power or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
 - Use bypass valve or completely shut off the process to isolate the valve from the process pressure. Relieve the process pressure from both sides of the valve.
 - Depending on the actuator construction, it will be necessary to manage the pneumatic actuator loading pressure and any actuator spring pre-compression. It is essential to refer to the relevant actuator instructions in this manual to ensure safe removal of the actuator from the valve.
 - Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
 - The valve packing box may contain process fluids that are pressurized, even when the valve has been removed from the pipeline.
 - Process fluids may spray out under pressure when removing the packing hardware or packing rings or when loosening the packing box pipe plug.
 - Check with your process or safety engineer for any additional measures that must be taken to protect against process media.
-

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION D-9

ELECTRICAL AND INSTRUMENTATION EQUIPMENT CHECK VALVE



Vendor doc. Number
17735-19

P.O. NO.:
LIDCO-PO-NEC-278-6019

Vendor:
Airpack Nederland B.V.

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D-9 Check valve

D-9.1 Introduction

NOTE:

This valve is intended for a specific range of pressures, temperatures and other application specifications.

Applying different pressures and temperatures to the valve could result in damage to the valve, malfunction of the control valve, or loss of control of the process. Do not expose this product to service conditions or variables other than those for which the product was intended. If you are not sure what these conditions are you should contact Airpack for complete specifications and clarification. Provide the product serial number (shown on the nameplate) and all other pertinent information.

D-9.2 Precautions

WARNING:

INCORRECT OR IMPROPER USE OF THIS PRODUCT CAN CAUSE SERIOUS PERSONAL INJURY AND PROPERTY DAMAGE.

WARNING

Devices from the manufacturer may only be installed, commissioned, operated and maintained by properly trained and authorized personnel.

This document is provided to help you establish operating conditions, which will permit safe and efficient use of this device.

D-9.3 Certification

CE mark




This device is designed to meet state-of-the-art safety requirements, has been tested and left the factory in a condition in which it is safe to operate. The device complies with the applicable standards and regulations as listed in the EC declaration of conformity and thus complies with the statutory requirements of the EC Directives.

D-9.4 Maintenance

PREVENTIVE MAINTENANCE

The check valve is almost wear-free, so the amount of required maintenance is low. The materials of the valve has been selected for minimum wear. However malfunction caused by wrong operation, lack of maintenance or improper use reduces valve life. All repair and maintenance work shall be performed by qualified personnel following all safety instructions. Maintenance intervals should be selected by the valve user in compliance with the application condition.

In case spare parts or replacements are required, please contact Airpack BV.

	INSTRUMENTATION	Rev.: 02 Date: 20-10-2025
	CHECK VALVE	

D-9.5 Installation

On the housing of the check valve, the correct flow direction has been mentioned, always check the flow direction before installing the check valve.
Ensure to properly align the flanges before tensioning the studbolts, otherwise the check valve will be damaged.

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION D-10

ELECTRICAL AND INSTRUMENTATION EQUIPMENT Y-STRAINER



Vendor doc. Number
17735-19

P.O. NO.:
LIDCO-PO-NEC-278-6019

Vendor:
Airpack Nederland B.V.



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D-10 Y-strainer

D-10.1 Precautions

WARNING:

INCORRECT OR IMPROPER USE OF THIS PRODUCT CAN CAUSE SERIOUS PERSONAL INJURY AND PROPERTY DAMAGE.

WARNING

Devices from the manufacturer may only be installed, commissioned, operated and maintained by properly trained and authorized personnel.

This document is provided to help you establish operating conditions, which will permit safe and efficient use of this device.

D-10.2 Certification

CE mark



This device is designed to meet state-of-the-art safety requirements, has been tested and left the factory in a condition in which it is safe to operate. The device complies with the applicable standards and regulations as listed in the EC declaration of conformity and thus complies with the statutory requirements of the EC Directives.

This solenoid valve meets the statutory requirements of the following EC Directives:

- Pressure Equipment Directive 97/23/EC
- Low voltage Directive 73/23/EEC
- EMC Directive 89/336/EC
- EAC (TR CU)

And also

- EN 61010
- EMC specification as per EN 61326/A1
- NAMUR Recommendations NE 21 and NE 43

D-10.3 Maintenance activities

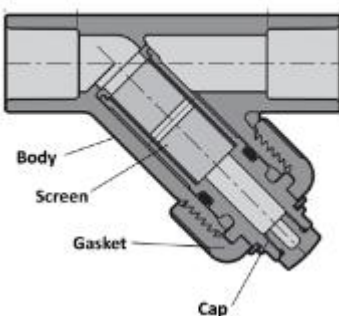
CAUTION:

Please ensure to depressurize the system before conducting any maintenance to this Y-strainer.

Maintenance on the Y-strainers is only to be done on the stand-by filters or package.

If properly installed, y strainers require very little monitoring. However, it is important to keep track of the pressure to make sure that the equipment does not get too full. This would cause the screen to break and it would need to be replaced. If the screen fails, it could damage the entire system which would quickly become a very costly problem. The filter can be easily accessed which makes for a simple cleaning process overall. Remember to close off the valve connections on either side of the y strainer before starting to clean and relieve pressure. From there, empty out the unwanted material and debris. Finally, clean the mesh filter and replace.

Y Strainer



Flow direction

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION E


TROUBLESHOOTING



Vendor doc. Number
17735-19


P.O. NO.:
LIDCO-PO-NEC-278-6019

Vendor:
Airpack Nederland B.V.

	INTEGRATED METHANOL AND AMMONIA PLANT	Rev.: 02 Date: 20-10-2025
	Preventive maintenance chart	

Maintenance Compressor

	Maintenance intervals in operating hours ¹⁾					
	DAILY	500 MONTHLY	1500 3 MONTHLY	3000 6 MONTHLY	5000 YEARLY	10000 TWO YEARLY
GENERAL MAINTENANCE WORK						
Keep the package clean	•					
Check all connections are securely fixed		•				
Check overall condition of the system		•				
ELECTRICAL / INSTRUMENTS						
Tighten electrical terminals			•			
Check pressure gauge and temperature indicator are working		•				
Check thermo elements for damage/bends		•				
Calibration of all transmitters including analysers				•	•	
Change solenoid coil						•
Spare kit for Control valve and actuators						•
Check complete electric control unit						•
COMPRESSOR						
Check all connections are securely fixed		•				
Check overall condition of the system	•					
Check the lubrication oil level and replenish as necessary	•					
Check the air filter pressure differential	•					
Check the condensate drain functionality	•					
Change the oil filter element		• (1)				
Clean the condensate strainers		•				
Check the cooler(s) for build-up of foreign matter. Clean if necessary by blowing out with air		•				
Operate the safety valves manually to verify that the valve mechanism is functioning			•			

	INTEGRATED METHANOL AND AMMONIA PLANT	Rev.: 02 Date: 20-10-2025
	Preventive maintenance chart	

	Maintenance intervals in operating hours ⁽¹⁾					
	DAILY	500 MONTHLY	1500 3 MONTHLY	3000 6 MONTHLY	5000 YEARLY	10000 TWO YEARLY
correctly and that a small amount of air is released.						
Check all hoses for sign if deterioration, cracks, hardening etc.			•			
Lubricate the main motor drive end bearing. Lubricate the main motor non-drive end bearing.				•		
Inspect the blowdown silencers and replace if necessary. Clean the gear case breathers				•		
Check the calibration of the pressure transducers. Change the air filter element (replace more frequently if local condition require)				•		
Fully inspect condensate separators, all external surfaces, and fittings. Report any excessive corrosion, mechanical or impact damage, leakage or other deterioration					•	
Rebuild blowdown valve using field kit					•	
Inspect the starter contactors, replace if required.					•	
Clean the condensate strainers.					•	
Change the lubricating oil and filter element.					•	
Remove the safety valves from compressor, inspect and re-calibrate					•	

NOTE:

(1) Only first time.

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION F

PREVENTIVE MAINTENANCE CHART



Vendor doc. Number


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P.O. NO.:

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Vendor:

Airpack Nederland B.V.

	INTEGRATED METHANOL AND AMMONIA PLANT	Rev.: 02 Date: 20-10-2025
	Preventive maintenance chart	

Maintenance Compressor

	Maintenance intervals in operating hours ¹⁾					
	DAILY	500 MONTHLY	1500 3 MONTHLY	3000 6 MONTHLY	5000 YEARLY	10000 TWO YEARLY
GENERAL MAINTENANCE WORK						
Keep the package clean	•					
Check all connections are securely fixed		•				
Check overall condition of the system		•				
ELECTRICAL / INSTRUMENTS						
Tighten electrical terminals			•			
Check pressure gauge and temperature indicator are working		•				
Check thermo elements for damage/bends		•				
Calibration of all transmitters including analysers				•	•	
Change solenoid coil						•
Spare kit for Control valve and actuators						•
Check complete electric control unit						•
COMPRESSOR						
Check all connections are securely fixed		•				
Check overall condition of the system	•					
Check the lubrication oil level and replenish as necessary	•					
Check the air filter pressure differential	•					
Check the condensate drain functionality	•					
Change the oil filter element		• (1)				
Clean the condensate strainers		•				
Check the cooler(s) for build-up of foreign matter. Clean if necessary by blowing out with air		•				
Operate the safety valves manually to verify that the valve mechanism is functioning			•			

	INTEGRATED METHANOL AND AMMONIA PLANT	Rev.: 02 Date: 20-10-2025
	Preventive maintenance chart	

	Maintenance intervals in operating hours ⁽¹⁾					
	DAILY	500 MONTHLY	1500 3 MONTHLY	3000 6 MONTHLY	5000 YEARLY	10000 TWO YEARLY
correctly and that a small amount of air is released.						
Check all hoses for sign if deterioration, cracks, hardening etc.			•			
Lubricate the main motor drive end bearing. Lubricate the main motor non-drive end bearing.				•		
Inspect the blowdown silencers and replace if necessary. Clean the gear case breathers				•		
Check the calibration of the pressure transducers. Change the air filter element (replace more frequently if local condition require)				•		
Fully inspect condensate separators, all external surfaces, and fittings. Report any excessive corrosion, mechanical or impact damage, leakage or other deterioration					•	
Rebuild blowdown valve using field kit					•	
Inspect the starter contactors, replace if required.					•	
Clean the condensate strainers.					•	
Change the lubricating oil and filter element.					•	
Remove the safety valves from compressor, inspect and re-calibrate					•	

NOTE:

(1) Only first time.

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION G

OVERALL SPARE PARTS LIST

This chapter will follow



Vendor doc. Number
17735-19

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Vendor:
Airpack Nederland B.V.

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
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SECTION H

LOGBOOK



Vendor doc. Number
17735-19

P.O. NO.:
LIDCO-PO-NEC-278-6019

Vendor:
Airpack Nederland B.V.

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
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SECTION I

PLANT MANAGER LIABILITY LIST



Vendor doc. Number
17735-19

P.O. NO.:
LIDCO-PO-NEC-278-6019

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Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
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SECTION J

LUBRICANT CHART



Vendor doc. Number

17735-19

P.O. NO.:

LIDCO-PO-NEC-278-6019

Vendor:

Airpack Nederland B.V.

	INTEGRATED METHANOL AND AMMONIA PLANT	Rev.: 02 Date: 20-10-2025
	Lubricant chart	

Refer to section C-1

Integrated Methanol and Ammonia Plant

VENKOR NAME	: Airpack NeKerlanK B.V
EQUIPMENT KESCRPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION K Documents

- 1 Vendor Print Index and Schedule
- 2 Piping & Instrument Diagram
- 3 General Arrangement Drawing
- 4 3D model (STP)
- 5 Wiring Diagram
- 6 I/O List
- 7 Outline Dimensional Drawings
- 8 Inspection & Test Plan (ITP)
- 9 Utility Consumption
- 10 Main Motor Data Sheets
- 11 Equipment Data Sheet
- 12 Inter / After Cooler Data Sheet
- 13 Instrument Data Sheets
- 14 Commissioning and Start-up Spares
- 15 FAT Procedure
- 16 NDE procedure
- 17 Package Nameplate Drawing
- 18 Hydrotest procedure
- 19 Surface Preparation and Painting Procedure
- 20 Index of Vendor Data Book
- 21 Index of Instruction and Operating Manual
- 22 Control philosophy and Interlock Description
- 23 Preservation, Packing & Shipping Procedure
- 24 Detail Drawings for Coolers



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Airpack Nederland B.V.

Integrated Methanol and Ammonia Plant

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- 45 Instrument Cable schedule**
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Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION K-1

DOCUMENTS; VENDOR PRINT INDEX AND SCHEDULE



Vendor doc. Number




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Airpack Nederland B.V.

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**Airpack B.V. - Air Compressor –
Integrated Methanol and Ammonia Plant
17735-COM Vendor Print Index and Schedule (K020)**

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3	X	X	X	X	X	28	X	X				53						78					
4	X	X	X	X	X	29	X	X				54						79					
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P/O NO. :		LIDCO-PO-NEC-278-6019		ISSUE DATE :		3-Jan-24						CODE 1 : APPROVED.											
EQUIPMENT NAME		High Pressure Air Compressor										CODE 2 : APPROVED WITH COMMENTS. (VENDOR TO AMEND AND SUBMIT THE "FOR APPROVAL")											
				MR NO. :		N278-000-ME-MR-1020-001						CODE 3 : COMMENTED. (VENDOR TO AMEND AND SUBMIT THE "FOR APPROVAL")											
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3	N-278-VD-6019-PR-GAD-0003	General Arrangement Drawing (incl foundation load details)	Eng	2023-09-29																			
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5	N-278-VD-6019-IN-DIA-0005	Wiring Diagram (including Terminal Diagram) for LCP Panel and Junction Box	Eng	2023-08-25																			
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8	N-278-VD-6019-GN-ITP-0008	Inspection & Test Plan (ITP)	Eng/Ins	2023-07-21																			
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15	N-278-VD-6019-GN-PRC-0015	FAT Procedure (incl full unit mechanical run test procedure)	Eng/Ins	2023-08-11																			
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Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION K-2




DOCUMENTS; PIPING AND INSTRUMENT DIAGRAM



Vendor doc. Number
17735-19

P.O. NO.:
LIDCO-PO-NEC-278-6019

Vendor:
Airpack Nederland B.V.

	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT						
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Airpack B.V. - Air Compressor –

Integrated Methanol and Ammonia Plant

17735-COM Piping & Instrument Diagram (K020)

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03	06-12-2023	Issued for Approval	S.K.	J.J.	S.K.
02	02-11-2023	Issued for Approval	T.T.	S.K.	J.J.
01	14-09-2023	Issued for Approval	S.K.	J.J.	S.K.
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Piping & Instrument Diagram

Document No. 17735-03

Project No.	Vendor Doc.	P.O. No.	Department	Document Type	Serial No	Revision
N278	VD	6019	PR	PID	0002	08

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ABBREVIATIONS

CV = CHECK VALVE

FG = FLOW GAUGE

FT = FLOW TRANSMITTER

LPS = LOCAL PUSHBUTTON STATION

LG = LEVEL GAUGE

PAH = HIGH PRESSURE ALARM (TRANSMITTER)

PAHH = HIGH PRESSURE TRIP (TRANSMITTER)

PAL = LOW PRESSURE ALARM (TRANSMITTER)

PALL = LOW PRESSURE TRIP (TRANSMITTER)

PCV = PRESSURE CONTROL VALVE

PDAH = HIGH PRESSURE DIFFERENTIAL ALARM (TRANSMITTER)

PDAHH= HIGH PRESSURE DIFFERENTIAL TRIP (TRANSMITTER)

PDAL = LOW PRESSURE DIFFERENTIAL ALARM (TRANSMITTER)

PDALL = LOW PRESSURE DIFFERENTIAL TRIP (TRANSMITTER)

PDG = PRESSURE DIFFERENTIAL GAUGE

PDIT = PRESSURE DIFFERENTIAL INDICATING TRANSMITTER

PDT = PRESSURE DIFFERENTIAL TRANSMITTER

PG = PRESSURE GAUGE

PIT = PRESSURE INDICATING TRANSMITTER

PRV = PRESSURE REDUCING VALVE

PSV = PRESSURE SAFETY VALVE

PT = PRESSURE TRANSMITTER

SG = SIGHT GLASS

XY = SOLENOID VALVE

TAH = HIGH TEMPERATURE ALARM (TRANSMITTER)

TAHH = HIGH TEMPERATURE TRIP (TRANSMITTER)

TAL = LOW TEMPERATURE ALARM (TRANSMITTER)

TALL = LOW TEMPERATURE TRIP (TRANSMITTER)

TCV = TEMPERATURE CONTROL VALVE

TG = TEMPERATURE GAUGE

TIT = TEMPERATURE INDICATING TRANSMITTER

TRV = THERMAL RELIEF VALVE

TT = TEMPERATURE TRANSMITTER

TW = THERMOWELL

HE = HEATER

JB = JUNCTION BOX

B = BLOWER

VAH = HIGH VIBRATION ALARM (TRANSMITTER)

VAHH = HIGH VIBRATION TRIP (TRANSMITTER)

XI = ANNUNCIATOR (HORN)


VT = VIBRATION TRANSMITTER

FIT = FLOW INDICATED TRANSMITTER


TIC = TEMPERATURE INDICATED CONTROL

PIC = PRESSURE INDICATED CONTROL


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
BALL VALVE




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
Y-STRAINER




PRESSURE SAFETY VALVE




VENT




SIGHT GLASS




COMPRESSOR STAGE




GATE VALVE




REDUCER




PRESSURE CONTROL VALVE




CHECK VALVE




SIGNAL




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
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
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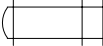
FAN




OIL HEATER




VESSEL




SHELL / TUBE WATER COOLER




MOTOR



ELECTRICAL PANEL LIGHT INDICATOR




ELECTRICAL PANEL PUSH BUTTON




SELECTOR SWITCH


LINES




BELT




SHAFT




COOLING WATER LINE




ELECTRICAL LINE



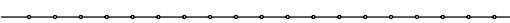
GAS/AIR LINE






OIL LINE

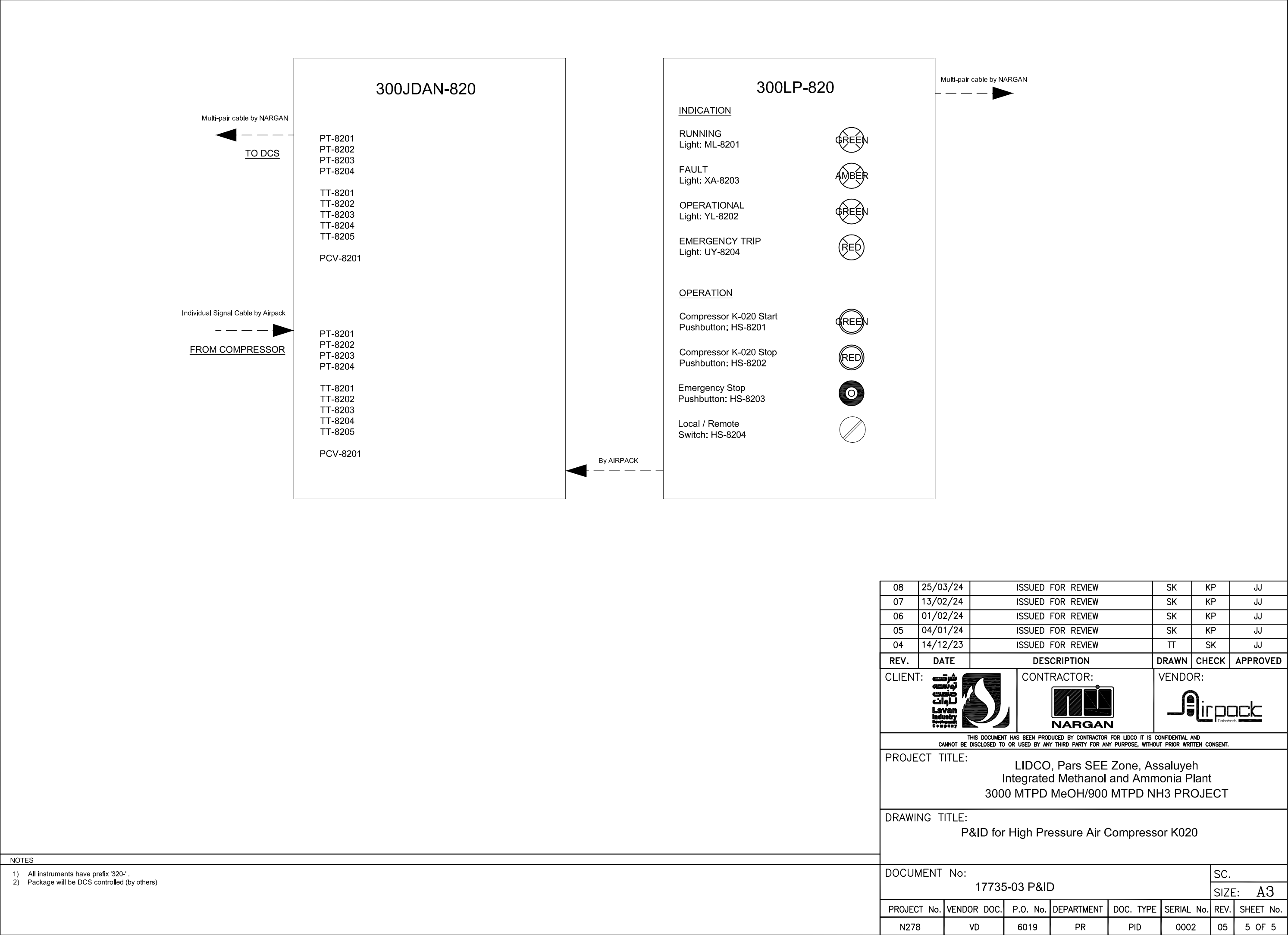


HEAT PROTECTED PIPING



SIGNAL

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07	13/02/24	ISSUED FOR REVIEW	SK	KP	JJ		
06	01/02/24	ISSUED FOR REVIEW	SK	KP	JJ		
05	04/01/24	ISSUED FOR REVIEW	SK	KP	JJ		
04	14/12/23	ISSUED FOR REVIEW	TT	SK	JJ		
REV.	DATE	DESCRIPTION	DRAWN	CHECK	APPROVED		
CLIENT: 		CONTRACTOR: 	VENDOR: 				
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PROJECT TITLE: <div>LIDCO, Pars SEE Zone, Assaluyeh Integrated Methanol and Ammonia Plant 3000 MTPD MeOH/900 MTPD NH3 PROJECT</div>							
DRAWING TITLE: <div>P&ID for High Pressure Air Compressor K020</div>							
DOCUMENT No:				SC.			
17735-03 P&ID				SIZE: A3			
PROJECT No.	VENDOR DOC.	P.O. No.	DEPARTMENT	DOC. TYPE	SERIAL No.	REV.	SHEET No.
N278	VD	6019	PR	PID	0002	04	3 OF 5



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07	13/02/24	ISSUED FOR REVIEW	SK	KP	JJ
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04	14/12/23	ISSUED FOR REVIEW	TT	SK	JJ
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CONTRACTOR:



VENDOR:



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PROJECT TITLE:

LIDCO, Pars SEE Zone, Assaluyeh
Integrated Methanol and Ammonia Plant
3000 MTPD MeOH/900 MTPD NH3 PROJECT

DRAWING TITLE:

P&ID for High Pressure Air Compressor K020

DOCUMENT No:

17735-03 P&ID

SC.

SIZE: A3

PROJECT No.	VENDOR DOC.	P.O. No.	DEPARTMENT	DOC. TYPE	SERIAL No.	REV.	SHEET No.
N278	VD	6019	PR	PID	0002	05	5 OF 5

NOTES

1) All instruments have prefix '320-'.

2) Package will be DCS controlled (by others)

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION K-3

DOCUMENTS; GENERAL ARRANGEMENT DRAWING



Vendor doc. Number

17735-19

P.O. NO.:

LIDCO-PO-NEC-278-6019

Vendor:

Airpack Nederland B.V.



General Arrangement Drawing (incl foundation load details)

Document No. 17735-04

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Airpack B.V. - Air Compressor –

Integrated Methanol and Ammonia Plant

17735-COM General Arrangement Drawing (incl foundation load details) (K020)

Code 1
M.Dalakeh

05	28-08-2024	Issued for Approval	F.T.	S.K.	J.J.
04	31-07-2024	Issued for Approval	F.T.	S.K.	J.J.
03	21-06-2024	Issued for Approval	F.T.	S.K.	J.J.
02	17-04-2024	Issued for Approval	F.T.	S.K.	J.J.
01	02-01-2024	Issued for Approval	F.T.	S.K.	J.J.
REV.	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED

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General Arrangement Drawing (incl foundation load details)

Document No. 17735-04

Project No.	Vendor Doc.	P.O. No.	Department	Document Type	Serial No	Revision
N278	VD	6019	PR	GAD	0003	05

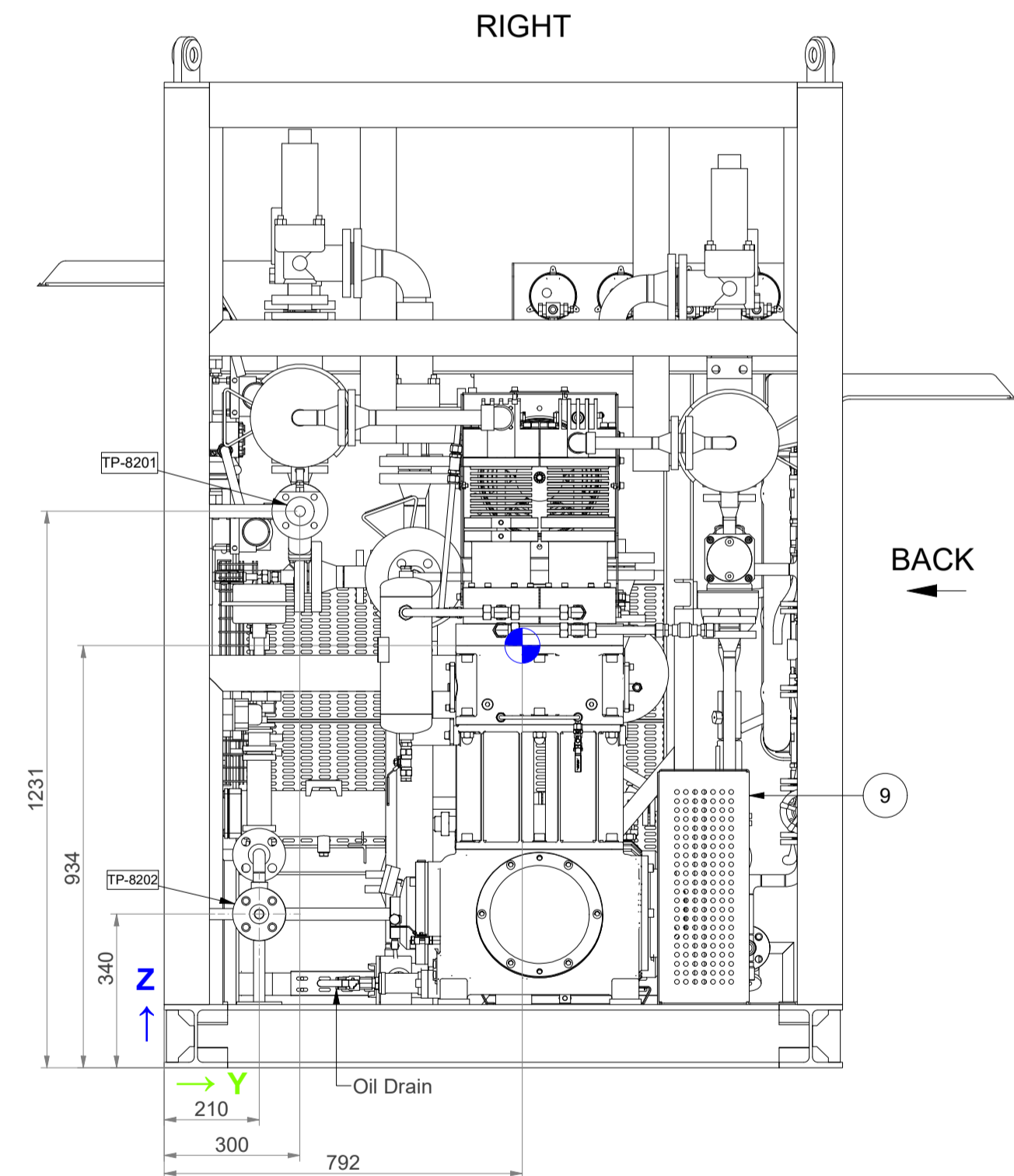
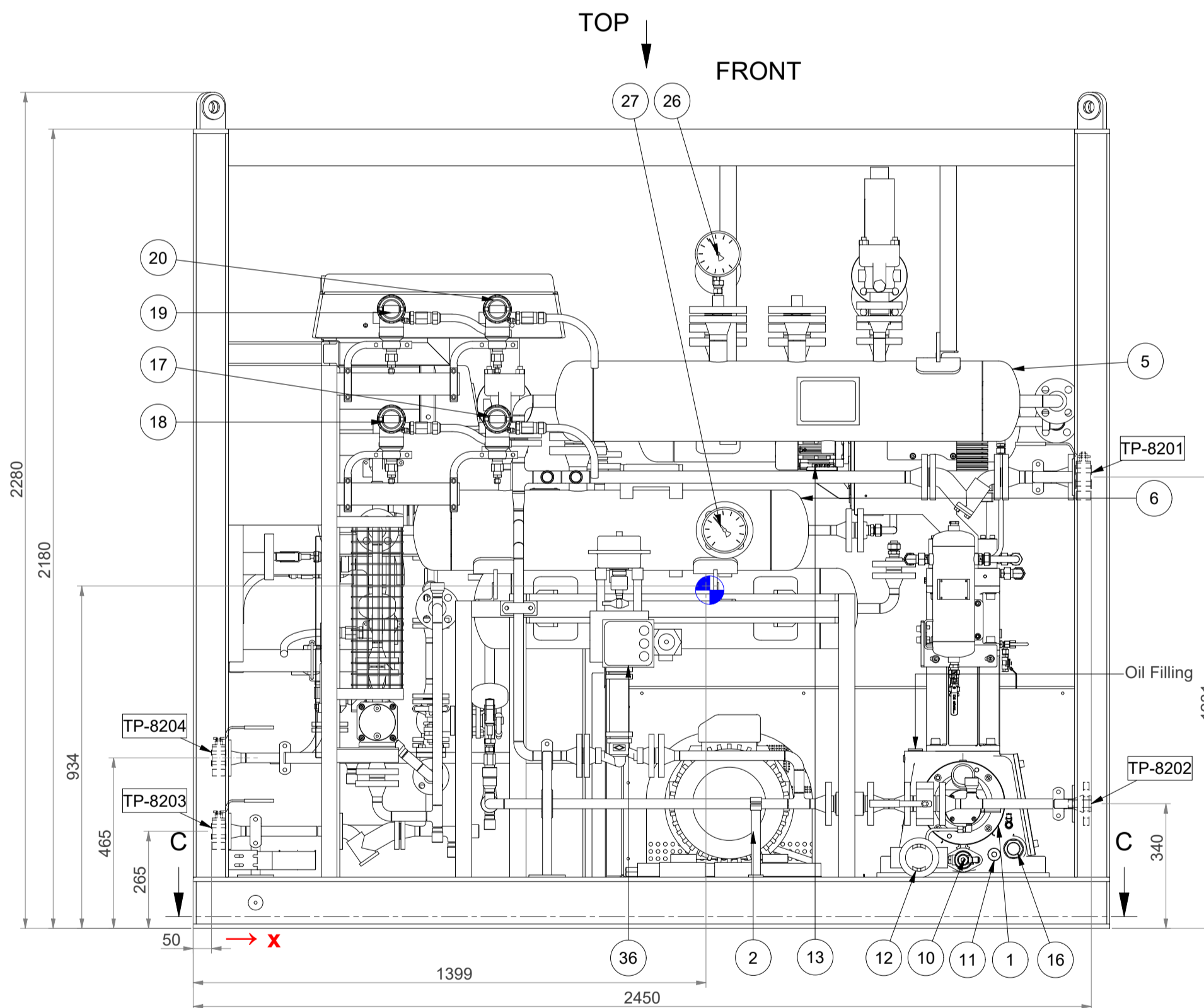
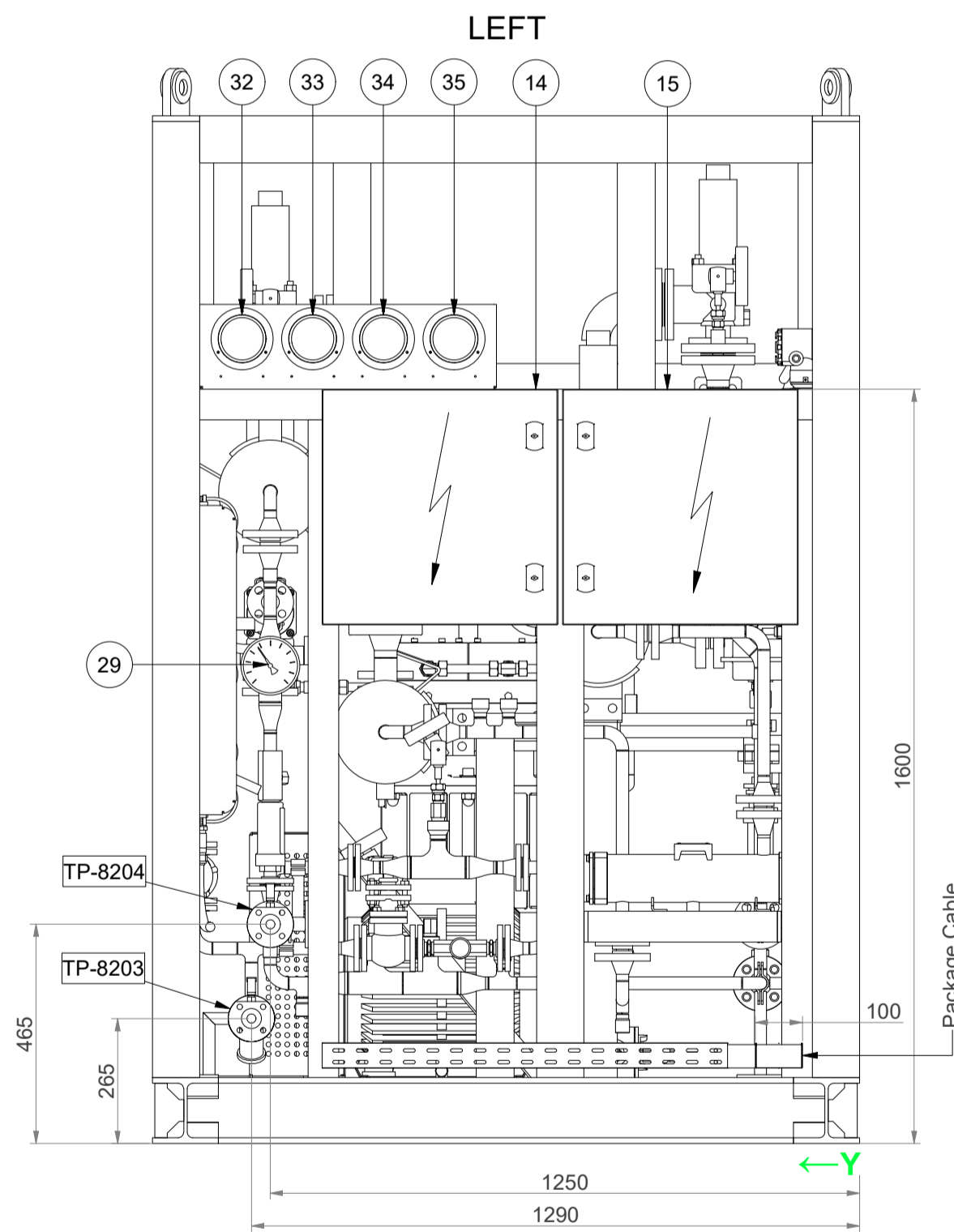
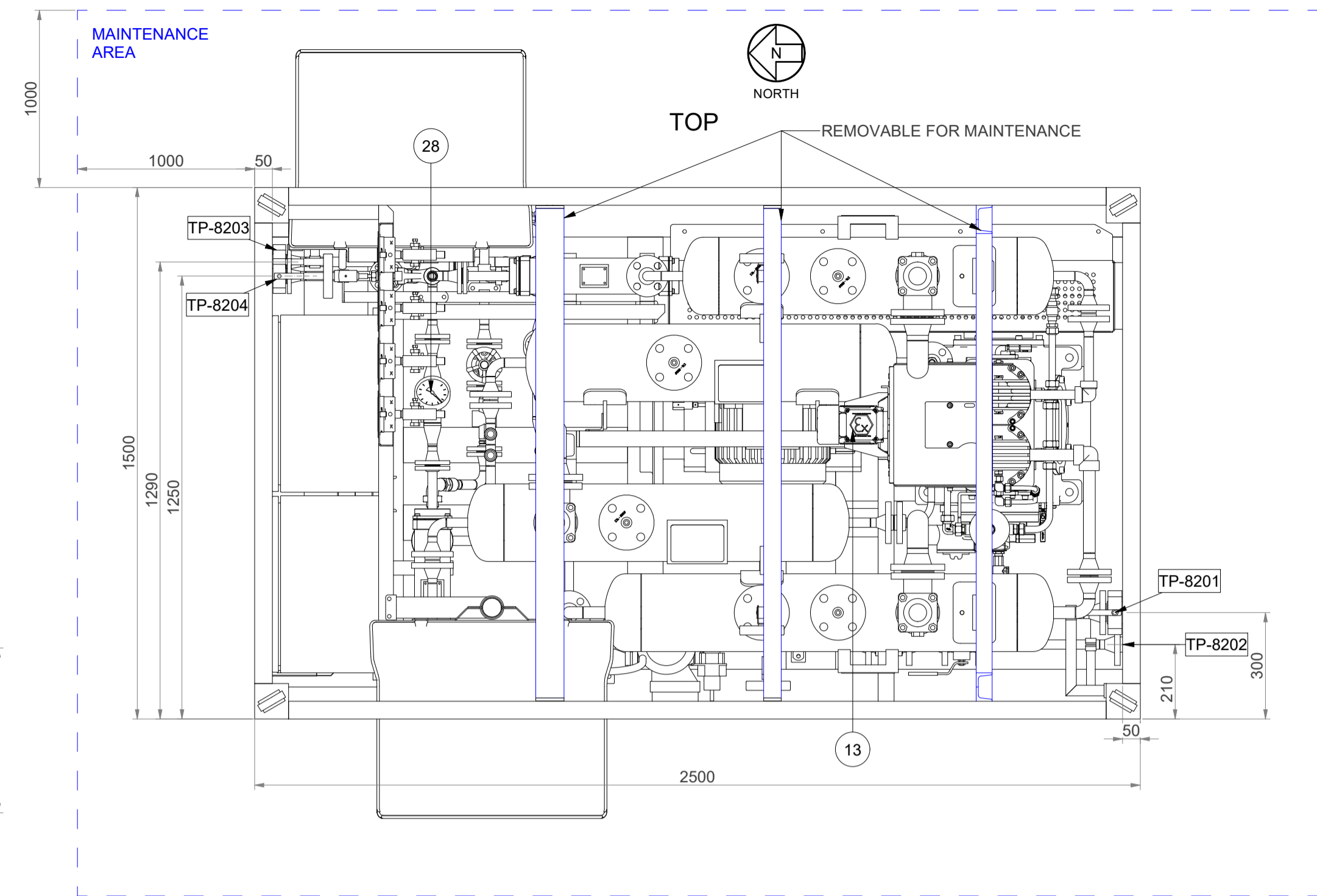
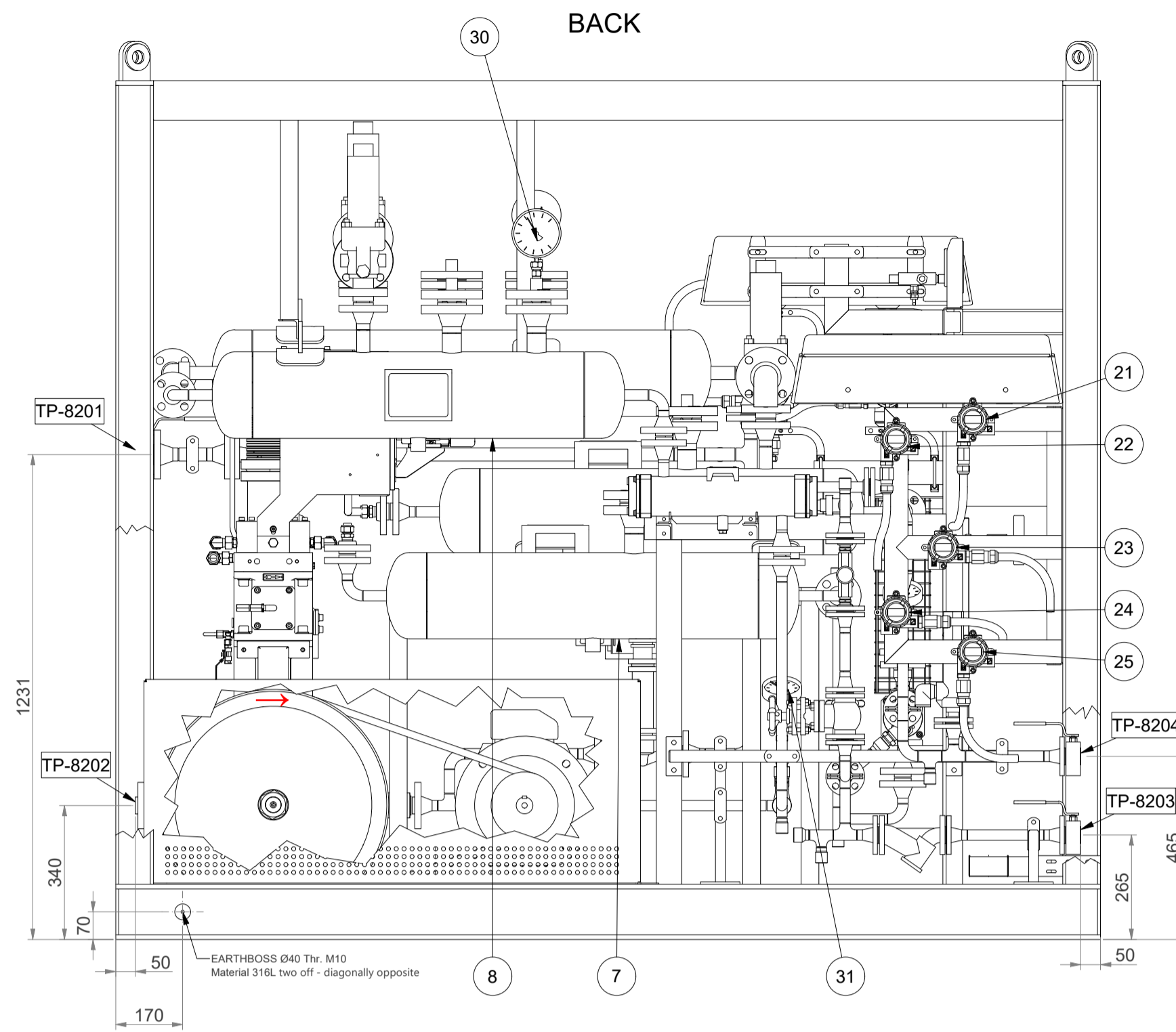
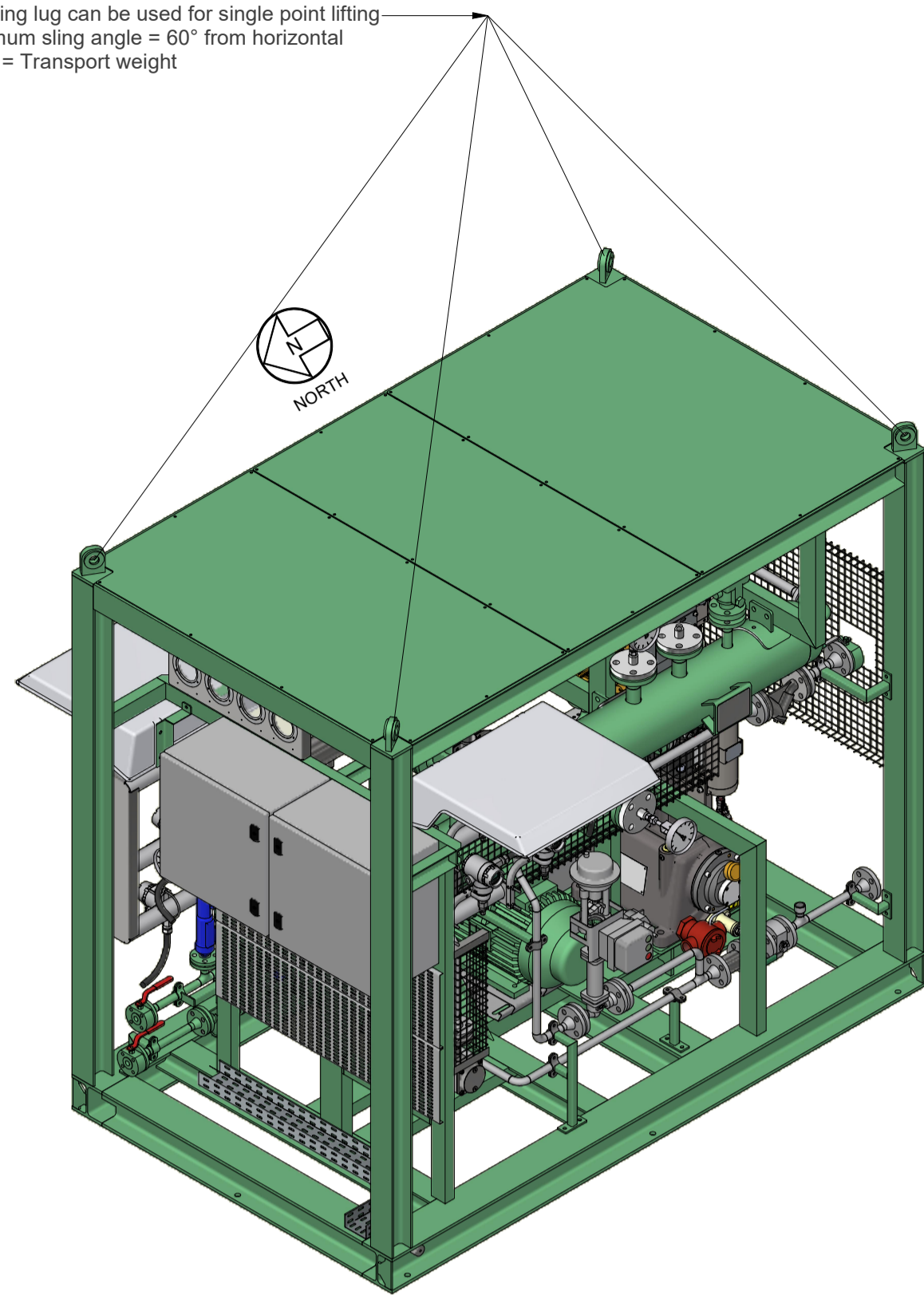
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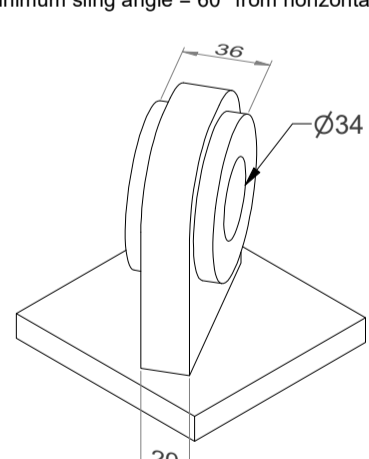
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4x lifting lug can be used for single point lifting
Minimum sling angle = 60° from horizontal
SWL = Transport weight

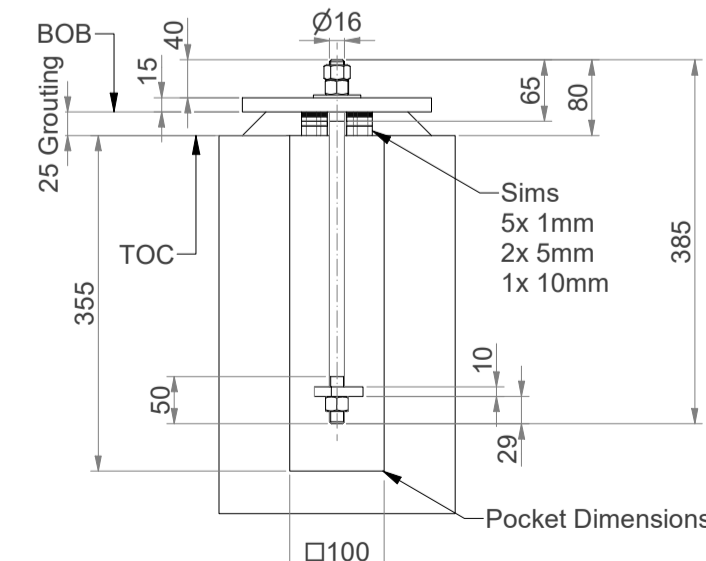
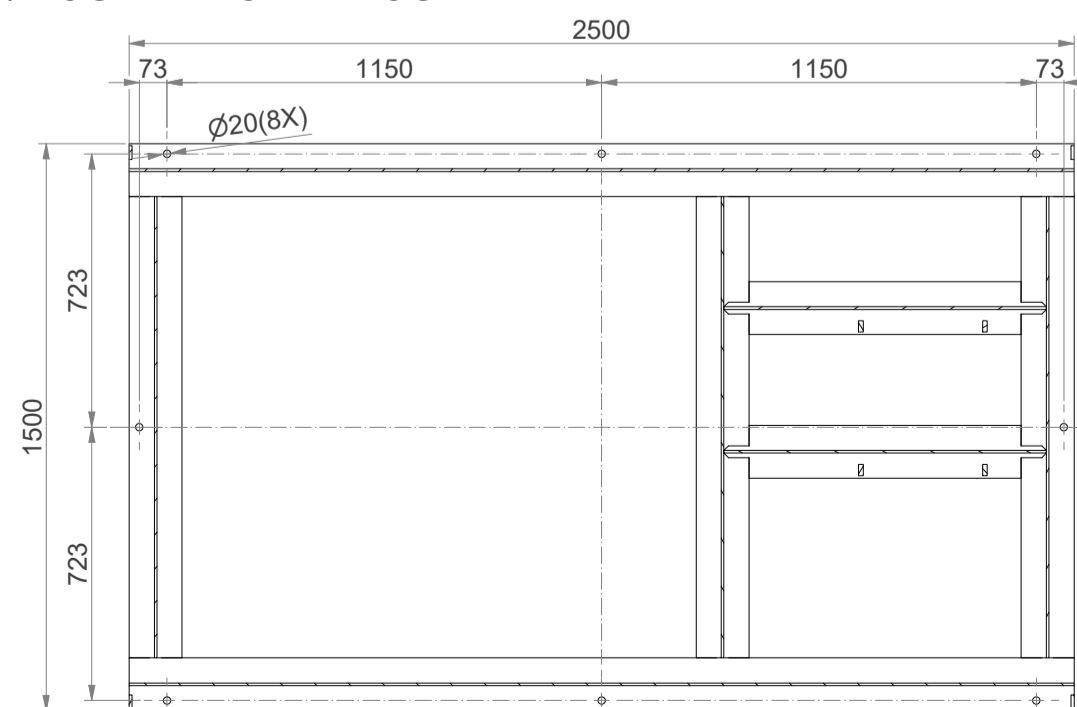


LIFTING LUG DETAIL

4x lifting lug can be used for single point lifting
Minimum sling angle = 60° from horizontal

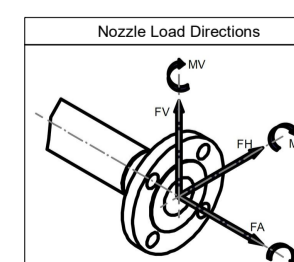


C-C / FOUNDATION LAYOUT



Notes on foundation details:

- 8x T.EN/ISO 8.8 19 MnB4.16.80.305 Anchor bolts acc.: N278-000-ST-JSC-1700-003-REV-03
- Skid will be supported on 25mm thk non-shrink cementitious grout
- No dynamic forces is envisaged on foundation or dynamic forces are negligible
- No filling of concrete inside the skid is required



Tie in Points Max. External Allowable Nozzle Loads from outside Package											
TP	Size	Nozzle Data	FH (+/-)	FV (+/-)	FA (+/-)	MH (+/-)	MA (+/-)	MV (+/-)	Pos. X	Pos. Y	Pos. Z
TP-8201	1" 300# RF B16.5	Air Inlet	1	1	1	0.3	1	0.3	2450	300	1231
TP-8202	3/4" 300# RF B16.5	Air Outlet	1	1	1	0.3	1	0.3	2450	210	340
TP-8203	3/4" 150# RF B16.5	Cooling water inlet	1	1	1	0.3	1	0.3	50	1250	265
TP-8204	3/4" 150# RF B16.5	Cooling water outlet	1	1	1	0.3	1	0.3	50	1250	465
			(kN)	(kN)	(kN)	(kNm)	(kNm)	(kNm)	(mm)	(mm)	(mm)

REFERENCE DOCUMENTS		DOCUMENT NUMBER	
PKID	Outline Dimensional Drawings for LCP Panel and Junction Box	N-278-VD-6019-PR-PID-0003-01	
Equipment Data Sheet		N-278-VD-6019-ME-DS-0011-01	
Inter / After Cooler Data Sheet		N-278-VD-6019-ME-DS-0011-01	
Package Nameplate Drawing		N-278-VD-6019-CA-NAMES-0017-01	
Main Items		Tag Nr.	Remarks
1. Compressor	K-020-001	Model REV.130	
2. Main Motor	KM-020-001	11 kW/1485rpm	
3. Inter Cooler	KE-020-001		
4. After Cooler	KE-020-002		
5. Pulsation Damper 1st	KV-020-001		Discharge side
6. Pulsation Damper 1st	KV-020-002		Discharge side
7. Pulsation Damper 2nd	KV-020-003		Discharge side
8. Pulsation Damper 2nd	KV-020-004		Discharge side
9. V-Belt Guard			
10. Lubr Oil Pump			
11. Sump			
12. Oil space heater	KH-020-001	80 W	
13. Fan Motor	KM-020-002	140 W	
14. Local Purification Station	300JA-420		
15. Junction Box	300JDN-420		
16. Oil level indicator			
17. Pressure Transmitter	PT-8201		
18. Pressure Transmitter	PT-8202		
19. Pressure Transmitter	PT-8203		
20. Pressure Transmitter	PT-8204		
21. Temperature Transmitter	TT-8201		
22. Temperature Transmitter	TT-8202		
23. Temperature Transmitter	TT-8203		
24. Temperature Transmitter	TT-8204		
25. Temperature Gauge	TG-8201		
26. Temperature Gauge	TG-8202		
27. Temperature Gauge	TG-8203		
28. Temperature Gauge	TG-8204		
29. Temperature Gauge	TG-8205		
30. Temperature Gauge	TG-8206		
31. Temperature Gauge	TG-8207		
32. Pressure Gauge	PG-8201		
33. Pressure Gauge	PG-8202		
34. Pressure Gauge	PG-8203		
35. Pressure Gauge	PG-8204		
36. Pressure Control Valve	PCV-8201		
CALCULATED WEIGHT DATA (kg)		MODIFICATIONS	
Skid dry weight	2750	REV.	DATE
Skid operational weight	2750	11-4-2024	
Maintenance weight max.	320 (main e-motor)		
Compressor	420		
Pulsation Dampers	168		
Inter After Cooler	15		
Subject		Projection	This drawing is owned by Airpack and shall not be printed or copied in any other way than with Airpack's PERMISSION
High Pressure Air Compressor			
Client	Lavan Industry Development Company (LIDCO)	Tolerances acc.to:	
Client Ref.	K-020 Integrated Methanol and Ammonia Plant	ISO-2768-1 (V)	
Client Doc. No.	N-278-VD-6019-PR-GAD-0003-01	PKID REV. No.: 04	
		Checked by	
		SK	
		Plant Location	
		Scale	
		Airpack Ref.	
		Drawing No.	



REV.	DATE	DRAWN	ACC.
4	28-08-2024	FVT	SK
3	31-7-2024	FVT	SK
2	20-6-24	FVT	SK
1	11-4-2024	FVT	SK
0	28-12-2023	FVT	SK

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION K-4

DOCUMENTS; 3D MODEL



Vendor doc. Number

17735-19

P.O. NO.:

LIDCO-PO-NEC-278-6019

Vendor:

Airpack Nederland B.V.

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION K-5

DOCUMENTS; WIRING DIAGRAM



Vendor doc. Number

17735-19

Vendor:

Airpack Nederland B.V.

P.O. NO.:

LIDCO-PO-NEC-278-6019

**Wiring Diagram (including Terminal Diagram) for
LCP Panel and Junction Box**

Document No. 17735-05

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**Airpack B.V. - Air Compressor –
Integrated Methanol and Ammonia Plant
17735-COM Wiring Diagram (including Terminal Diagram) for
LCP Panel and Junction Box (K020)**

Code 1
M.Dalakeh

08	23-05-2024	Issued for Approval	R.T.	S.K.	J.J.
07	08-05-2024	Issued for Approval	R.T.	S.K.	J.J.
06	02-05-2024	Issued for Approval	R.T.	S.K.	J.J.
05	20-03-2024	Issued for Approval	R.T.	S.K.	J.J.
04	14-02-2024	Issued for Approval	R.T.	S.K.	J.J.
03	21-12-2023	Issued for Approval	R.T.	S.K.	J.J.
02	07-12-2023	Issued for Approval	R.T.	S.K.	J.J.
01	03-11-2023	Issued for Approval	R.T.	S.K.	J.J.
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LIDCO, Pars SEE Zone, Assaluyeh,
Integrated Methanol and Ammonia
Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT



Wiring Diagram (including Terminal Diagram) for
LCP Panel and Junction Box

Document No. 17735-05

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22											72						4					
23											73						5					
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25											75						7					



Airpack B.V.

4301 RN Zierikzee
The Netherlands

PHONE: (31) (0) 111 - 415455
FAX: (31) (0) 111 - 413338
E-MAIL : AIRPACK@AIRPACK.NL
WEBPAGE : WWW.AIRPACK.NL

Client	:	LAVAN INDUSTRY DEVELOPMENT COMPANY (LIDCO)
Equipment location	:	IRAN, ONSHORE
Client reference	:	INTEGRATED METHANOL AND AMMONIA PLANT
Client dwg. no.	:	N-278-VD-6019-IN-DIA-0005
Airpack reference	:	17735-05 Wiring Diagram
Airpack dwg. no.	:	17735-05
Generation date	:	2023-11-02
E & I manager	:	RBE
Last modifications	:	2024-05-22
Last modifications by	:	RTR
		Revision no. : 08

COMMENTS ON ELECTRICAL DRAWINGS

LPS AND JB MOUNTED ON SKID
MATERIAL: SHEET STEEL
INGRESS. PROTECTION: IP-65
AREA CLASSIFICATION: SAFE

GLANDS: SS316 GLANDS WITH SHROUDS, IP-66
CABLE TRAYS: HOT-DIP GALVANIZED

AMBIENT TEMPERATURE: 0 / 49 °C

ALL "IE" CONNECTIONS WILL BE CONNECTED ON A "IE"-BAR

REFERENCE DOCUMENTS:
17735-03 - N-278-VD-6019-PR-PID-0002 - P&ID
17735-06 - N-278-VD-6019-IN-LIS-0006 - I/O List
17735-07 - N-278-VD-6019-IN-DWG-0007 - Outline Dimensional Drawings for LCP Panel and Junction Box
17735-21 - N-278-VD-6019-GN-PRO-0022 - Control Philosophy

SIGNAL PAIRS	
CURRENT LOOPS	POSITIVE: BLACK NEGATIVE: WHITE
VOLT [FREE] CONTACTS	POSITIVE: BLACK NEGATIVE: BLACK

SYMBOL LEGEND


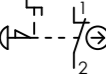






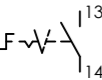
SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	CABLE SHIELD		
	EMERGENCY STOP		
	INDICATION LAMP		
	INSTRUMENT EARTH CONNECTION POINT		
	N/C PUSHBUTTON		
	N/O PUSHBUTTON		
	TERMINAL CONNECTION POINT		
	TRANSMITTER CONNECTION POINT		
	TWO-POSITION SELECTOR SWITCH		

Table of contents

Page	Page description	Supplementary page field	Date	Edited by
/1	Title page / cover sheet	1	2023-11-02	rtriegaardt
/2	Project description	2	2024-03-19	rtriegaardt
/3	Symbol Legend	3	2023-12-18	rtriegaardt
/4	Table of contents : /1 - =320-K-020+300JDAN-820/9	4	2024-05-22	rtriegaardt
=320-K-020+300LP-820/1	TERMINAL STRIP DEFINITION	5	2023-12-18	rtriegaardt
=320-K-020+300LP-820/2	PUSHBUTTONS	6	2024-05-22	rtriegaardt
=320-K-020+300LP-820/3	LAMPS	7	2024-03-19	rtriegaardt
=320-K-020+300LP-820/4	ESD PUSHBUTTON	8	2024-05-22	rtriegaardt
=320-K-020+300LP-820/5	Terminal diagram =320-K-020+300LP-820-300TDD820	9	2024-03-19	rtriegaardt
=320-K-020+300LP-820/6	Terminal diagram =320-K-020+300LP-820-300TED820	10	2024-02-13	rtriegaardt
=320-K-020+300JDAN-820/1	TERMINAL STRIP DEFINITION	11	2023-12-18	rtriegaardt
=320-K-020+300JDAN-820/2	ANALOG TRANSMITTERS	12	2024-03-19	rtriegaardt
=320-K-020+300JDAN-820/3	ANALOG TRANSMITTERS	13	2024-03-19	rtriegaardt
=320-K-020+300JDAN-820/4	ANALOG TRANSMITTERS	14	2024-04-29	rtriegaardt
=320-K-020+300JDAN-820/5	ANALOG TRANSMITTERS	15	2024-03-19	rtriegaardt
=320-K-020+300JDAN-820/6	PRESSURE CONTROL VALVE	16	2024-03-19	rtriegaardt
=320-K-020+300JDAN-820/7	Terminal diagram =320-K-020+300JDAN-820-300TDA820	17	2024-02-13	rtriegaardt
=320-K-020+300JDAN-820/8	Terminal diagram =320-K-020+300JDAN-820-300TDA820	18	2024-05-02	rtriegaardt
=320-K-020+300JDAN-820/9	Terminal diagram =320-K-020+300JDAN-820-300TDA821	19	2024-02-13	rtriegaardt

300LP-820
LOCAL PUSHBUTTON STATION

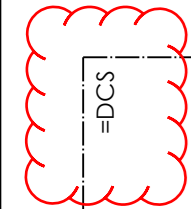
TERMINAL STRIP DEFINITION

300TDD820 = CONNECTION PUSHBUTTONS AND LAMPS

300TED820 = CONNECTION ESD PUSHBUTTON



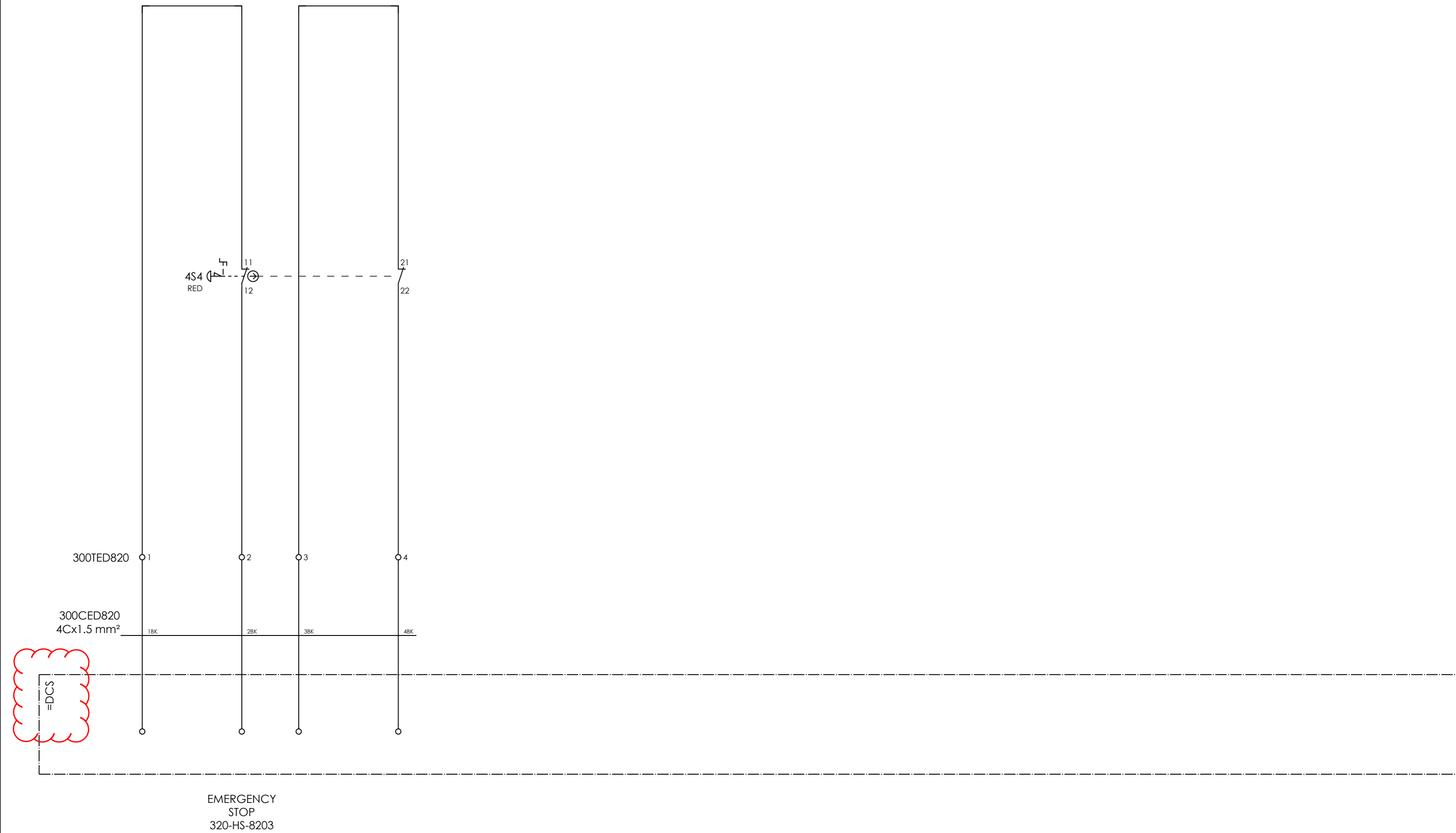
CLIENT DWG NO.	N-278-VD-6019-IN-DIA-0005	SUBJECT TERMINAL STRIP DEFINITION		DRAWN BY	RTR	= 320-K-020
EQUIPMENT NO.	320-K-020			CHECKED BY	RBE	+ 300LP-820
EQUIPMENT LOCATION	IRAN, ONSHORE	ADAPTED TO P&ID REVISION	08	LAST MODIFICATION DATE	2023-12-18	CURRENT PAGE
THIS DRAWING IS OWNED BY AIRPACK, AND SHALL NOT BE PRINTED OR COPIED IN ANY OTHER WAY THAN WITH AIRPACKS PERMISSION!		CLIENT	LAVAN INDUSTRY DEVELOPMENT COMPANY (LIDCO)	AIRPACK DWG NO.	17735-05	
		CLIENT REF.	INTEGRATED METHANOL AND AMMONIA PLANT	REVISION	08	
		AIRPACK REF.	17735-05 Wiring Diagram	TOTAL PAGE AMOUNT	5	






	14
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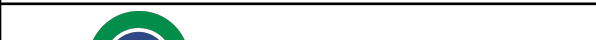
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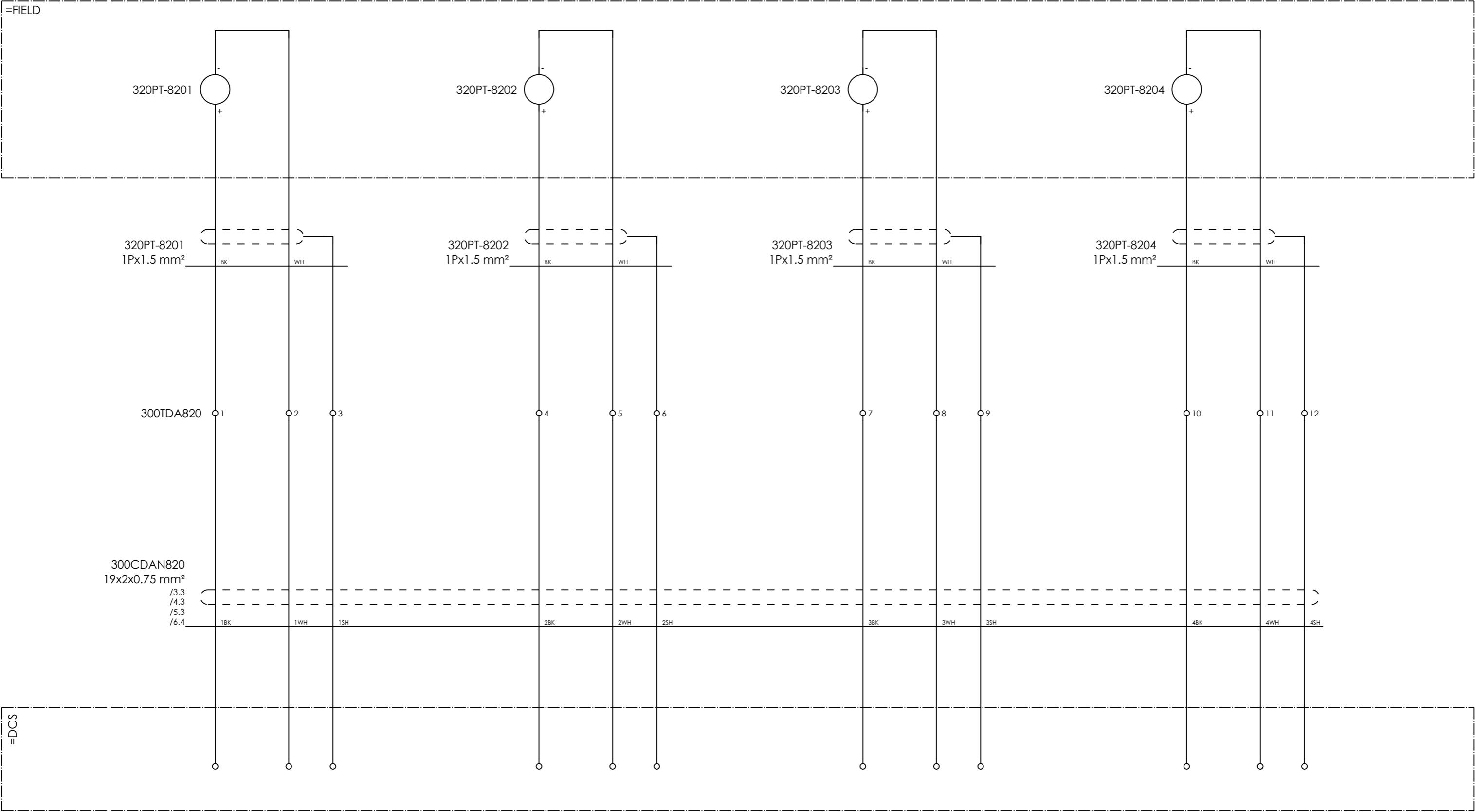


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	EQUIPMENT NO.	320-K-020			CHECKED BY	RBE	+ 300LP-820
	EQUIPMENT LOCATION	IRAN, ONSHORE	ADAPTED TO P&ID REVISION	08	LAST MODIFICATION DATE	2023-12-18	CURRENT PAGE
	THIS DRAWING IS OWNED BY AIRPACK, AND SHALL NOT BE PRINTED OR COPIED IN ANY OTHER WAY THAN WITH AIRPACKS PERMISSION!	CLIENT	LAVAN INDUSTRY DEVELOPMENT COMPANY (LIDCO)		AIRPACK DWG NO.	17735-05	
		CLIENT REF.	INTEGRATED METHANOL AND AMMONIA PLANT		REVISION	08	
		AIRPACK REF.	17735-05 Wiring Diagram		TOTAL PAGE AMOUNT	9	

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	EQUIPMENT NO.	320-K-020			CHECKED BY	RBE	+ 300LP-820
	EQUIPMENT LOCATION	IRAN, ONSHORE	ADAPTED TO P&ID REVISION	08	LAST MODIFICATION DATE	2023-12-18	CURRENT PAGE
	THIS DRAWING IS OWNED BY AIRPACK, AND SHALL NOT BE PRINTED OR COPIED IN ANY OTHER WAY THAN WITH AIRPACKS PERMISSION!	CLIENT	LAVAN INDUSTRY DEVELOPMENT COMPANY (LIDCO)		AIRPACK DWG NO.	17735-05	
		CLIENT REF.	INTEGRATED METHANOL AND AMMONIA PLANT		REVISION	08	
		AIRPACK REF.	17735-05 Wiring Diagram		TOTAL PAGE AMOUNT	10	



PRESSURE
TRANSMITTER
320PT-8201

PRESSURE
TRANSMITTER
320PT-8202

PRESSURE
TRANSMITTER
320PT-8203

PRESSURE
TRANSMITTER
320PT-8204



CLIENT DWG NO.	N-278-VD-6019-IN-DIA-0005
EQUIPMENT NO.	320-K-020
EQUIPMENT LOCATION	IRAN, ONSHORE

THIS DRAWING IS OWNED BY AIRPACK, AND SHALL NOT BE PRINTED OR COPIED IN ANY OTHER WAY THAN WITH AIRPACKS PERMISSION!

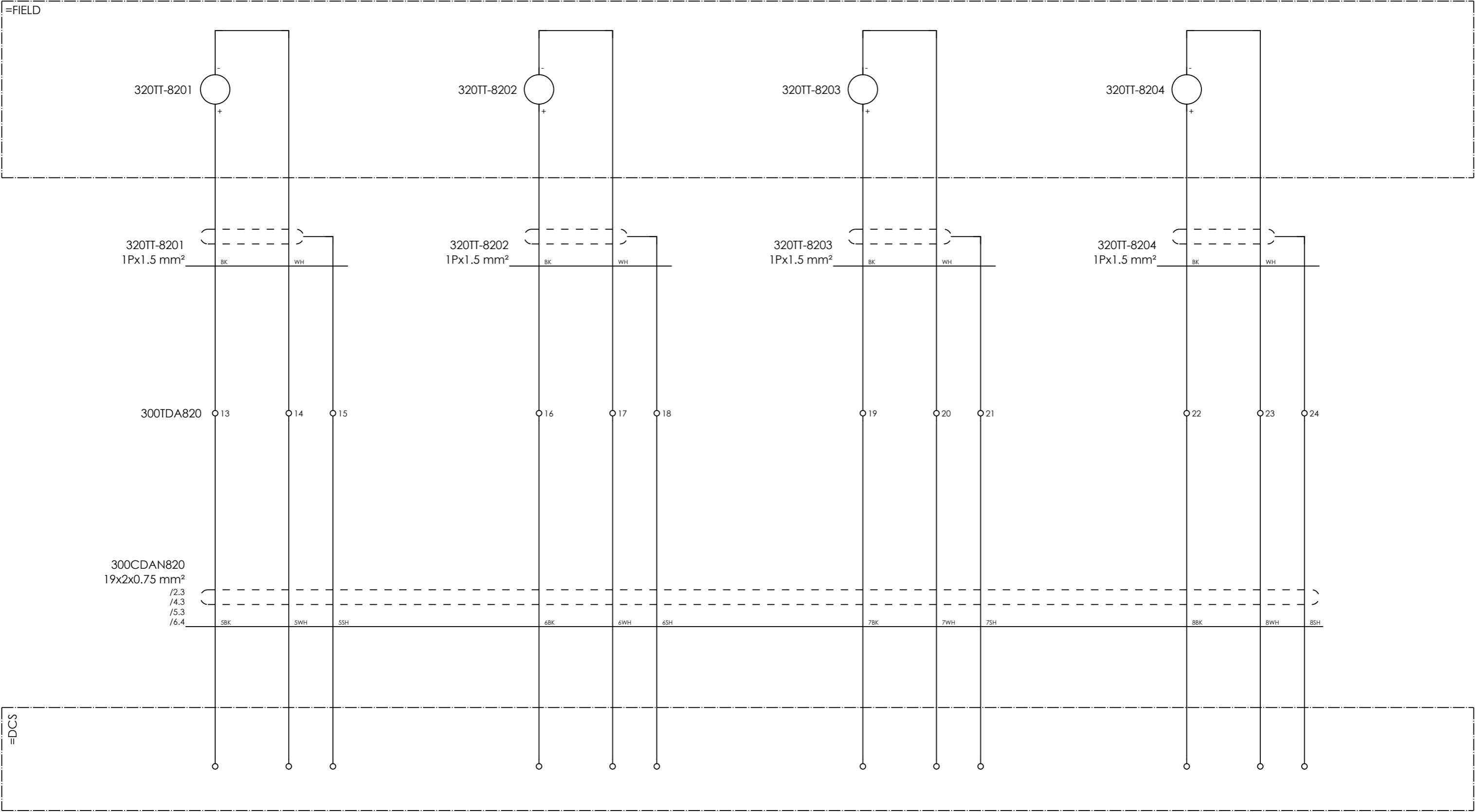
SUBJECT ANALOG TRANSMITTERS	
ADAPTED TO P&ID REVISION	08

CLIENT	LAVAN INDUSTRY DEVELOPMENT COMPANY (LIDCO)
CLIENT REF.	INTEGRATED METHANOL AND AMMONIA PLANT
AIRPACK REF.	17735-05 Wiring Diagram

DRAWN BY	RTR
CHECKED BY	RBE
LAST MODIFICATION DATE	2023-12-18

AIRPACK DWG NO.	17735-05
REVISION	08
TOTAL PAGE AMOUNT	12

= 320-K-020
+ 300JDAN-820
CURRENT PAGE



320TT-8203

-

+

320TT-8203

1Px1.5 mm²

BK

WH

19

20

21

7BK

7WH

7SH

320TT-8204

-

+

320TT-8204

1Px1.5 mm²

BK

WH

22

23

24

8BK

8WH

8SH

320TT-8201

300TDA820

300CDAN820

320TT-8202

320TT-8203

320TT-8204

=DCS

TEMPERATURE
TRANSMITTER
320TT-8201

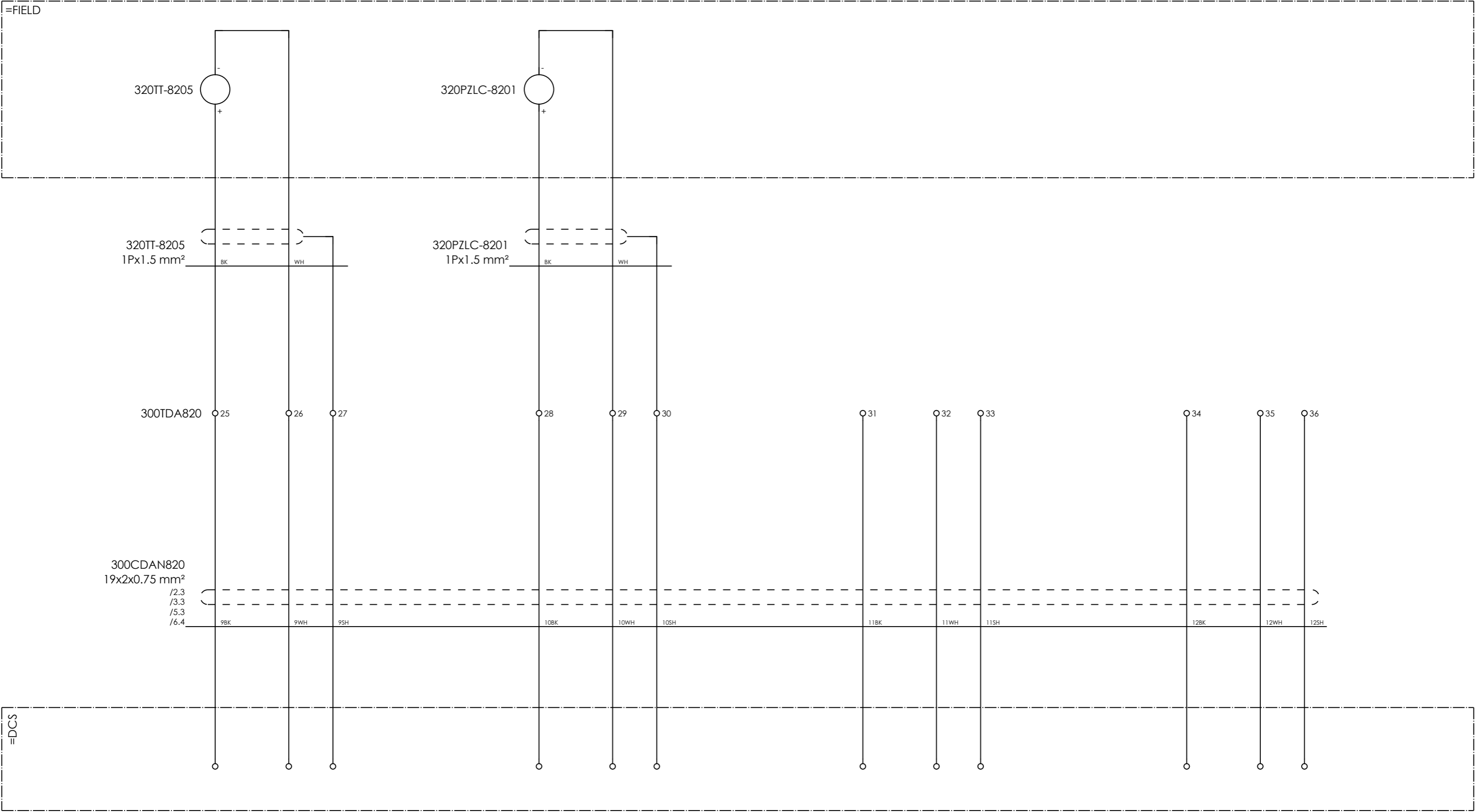
TEMPERATURE
TRANSMITTER
320TT-8202

TEMPERATURE
TRANSMITTER
320TT-8203

TEMPERATURE
TRANSMITTER
320TT-8204



CLIENT DWG NO.	N-278-VD-6019-IN-DIA-0005	SUBJECT ANALOG TRANSMITTERS		DRAWN BY	RTR	= 320-K-020
EQUIPMENT NO.	320-K-020			CHECKED BY	RBE	+ 300JDAN-820
EQUIPMENT LOCATION	IRAN, ONSHORE	ADAPTED TO P&ID REVISION	08	LAST MODIFICATION DATE	2023-12-18	CURRENT PAGE
THIS DRAWING IS OWNED BY AIRPACK, AND SHALL NOT BE PRINTED OR COPIED IN ANY OTHER WAY THAN WITH AIRPACKS PERMISSION!		CLIENT	LAVAN INDUSTRY DEVELOPMENT COMPANY (LIDCO)	AIRPACK DWG NO.	17735-05	
		CLIENT REF.	INTEGRATED METHANOL AND AMMONIA PLANT	REVISION	08	
		AIRPACK REF.	17735-05 Wiring Diagram	TOTAL PAGE AMOUNT	13	



TEMPERATURE
TRANSMITTER
320TT-8205

PRESSURE
CONTROL VALVE
320PCV-8201
POSITION FEEDBACK

SPARE

SPARE



6

[illegible]

CLIENT DWG NO.	N-278-VD-6019-IN-DIA-0005
EQUIPMENT NO.	320-K-020
EQUIPMENT LOCATION	IRAN, ONSHORE

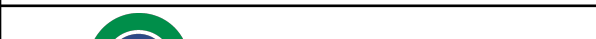
THIS DRAWING IS OWNED BY AIRPACK, AND SHALL NOT BE PRINTED OR COPIED IN ANY OTHER WAY THAN WITH AIRPACKS PERMISSION!

SUBJECT	
Terminal diagram =320-K-020+300JDAN-820-300TDA820	
ADAPTED TO P&ID REVISION	08
CLIENT	LAVAN INDUSTRY DEVELOPMENT COMPANY (LIDCO)
CLIENT REF.	INTEGRATED METHANOL AND AMMONIA PLANT
AIRPACK REF.	17735-05 Wiring Diagram

DRAWN BY	RTR	= 320-K-020	7
CHECKED BY	RBE	+ 300JDAN-820	
LAST MODIFICATION DATE	2023-12-18	CURRENT PAGE	
AIRPACK DWG NO.	17735-05		
REVISION	08		
TOTAL PAGE AMOUNT	17		

[illegible]

[illegible]

	CLIENT DWG NO.	N-278-VD-6019-IN-DIA-0005	SUBJECT Terminal diagram =320-K-020+300JDAN-820-300TDA821		DRAWN BY	RTR	= 320-K-020
	EQUIPMENT NO.	320-K-020			CHECKED BY	RBE	+ 300JDAN-820
	EQUIPMENT LOCATION	IRAN, ONSHORE	ADAPTED TO P&ID REVISION	08	LAST MODIFICATION DATE	2023-12-18	CURRENT PAGE
	THIS DRAWING IS OWNED BY AIRPACK, AND SHALL NOT BE PRINTED OR COPIED IN ANY OTHER WAY THAN WITH AIRPACKS PERMISSION!	CLIENT	LAVAN INDUSTRY DEVELOPMENT COMPANY (LIDCO)		AIRPACK DWG NO.	17735-05	
		CLIENT REF.	INTEGRATED METHANOL AND AMMONIA PLANT		REVISION	08	
		AIRPACK REF.	17735-05 Wiring Diagram		TOTAL PAGE AMOUNT	19	

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION K-6

DOCUMENTS; I/O LIST



Vendor doc. Number




17735-19

P.O. NO.:

LIDCO-PO-NEC-278-6019

Vendor:

Airpack Nederland B.V.

	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT							
	I/O List							
	Document No. 17735-06							Page
	Project No. N278	Vendor Doc. VD	P.O. No. 6019	Department IN	Document Type LIS	Serial No 0006	Revision 07	Page 1 of 3

Airpack B.V. - Air Compressor –




Integrated Methanol and Ammonia Plant

17735-COM I/O List (K020)

Code 1
M.Dalakeh

07	30-05-2024	Issued for Approval	S.K.	S.K.	J.J.
06	21-05-2024	Issued for Approval	S.K.	S.K.	J.J.
05	14-04-2024	Issued for Approval	A.Z.	S.K.	J.J.
04	05-04-2024	Issued for Approval	A.Z.	S.K.	J.J.
03	22-02-2024	Issued for Approval	A.Z.	S.K.	J.J.
02	02-02-2024	Issued for Approval	T.T.	S.K.	J.J.
01	10-11-2023	Issued for Approval	T.T.	S.K.	J.J.
REV.	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED

This document has been produced by Contractor for LIDCO. It is confidential and cannot be disclosed to or used by any third party for any purpose without prior written consent.

	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT						
	I/O List						
	Document No. 17735-06		Page				
	Project No. N278	Vendor Doc. VD	P.O. No. 6019	Department IN	Document Type LIS	Serial No. 0006	Revision 07

LIST OF REVISED PAGES

Rev. Page	01	02	03	04	05	06	07	08	09	10	Rev. Page	01	02	03	04	05	Rev. Page	01	02	03	04	05
1	X	X	X	X	X	X	X				51						76					
2	X	X	X	X	X	X	X				52						77					
3	X	X	X	X	X	X	X				53						78					
4											54						79					
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18											68						ATTACHMENT					
19											69						1					
20											70						2					
21											71						3					
22											72						4					
23											73						5					
24											74						6					
25											75						7					

TAG NUMBER	LINE NUMBER	SERVICE DESCRIPTION	INSTRUMENT TYPE	LOCATION	P&ID NUMBER	SYSTEM TYPE	I/O	SIGNAL	CALIBRATED	ENGINEERING	STATE 0	STATE 1	SET POINT L	SET POINT H	FROM	TO	PROTOCOL	I/S/NIS	NO/NC	DCS/ESD	REDUNDANCY	
210PT-8201	17-IA-320-01-042-N	Pressure transmitter package inlet	TRANSMITTER	FIELD	N-278-VD-6019-PR-PID-0002	COMPRESSOR	AI	4-20 mA	0 - 1.44 bar(g)	-	-	-	40	7.5	12	JDAN-820	DCS	HART	NIS	-	DCS	
210PT-8201	17-IA-320-01-042-N	Temperature transmitter package inlet	TRANSMITTER	FIELD	N-278-VD-6019-PR-PID-0002	COMPRESSOR	AI	4-20 mA	0 - 100°C	-	-	-	-	-	50	JDAN-820	DCS	HART	NIS	-	DCS	
210TT-8202	3/4"-IA-320-09-F42-H	Temperature transmitter 1st stage discharge	TRANSMITTER	FIELD	N-278-VD-6019-PR-PID-0002	COMPRESSOR	AI	4-20 mA	0 - 250°C	-	-	-	145	165	-	JDAN-820	DCS	HART	NIS	-	DCS	
210PT-8202	3/4"-IA-320-05-F42-H	Pressure transmitter 2nd stage suction	TRANSMITTER	FIELD	N-278-VD-6019-PR-PID-0002	COMPRESSOR	AI	4-20 mA	0 - 60 bar(g)	-	-	-	19	15.5	-	JDAN-820	DCS	HART	NIS	-	DCS	
210TT-8203	3/4"-IA-320-05-F42-H	Temperature transmitter 2nd stage suction	TRANSMITTER	FIELD	N-278-VD-6019-PR-PID-0002	COMPRESSOR	AI	4-20 mA	0 - 250°C	-	-	-	-	-	65	70	JDAN-820	DCS	HART	NIS	-	DCS
210TT-8204	3/4"-IA-320-06-F42-H	Temperature transmitter 2nd stage discharge	TRANSMITTER	FIELD	N-278-VD-6019-PR-PID-0002	COMPRESSOR	AI	4-20 mA	0 - 160°C	-	-	-	105	125	-	JDAN-820	DCS	HART	NIS	-	DCS	
210TT-8205	6"-IA-320-08-042-N	Temperature transmitter package outlet	TRANSMITTER	FIELD	N-278-VD-6019-PR-PID-0002	COMPRESSOR	AI	4-20 mA	0 - 160°C	-	-	-	-	-	-	JDAN-820	DCS	HART	NIS	-	DCS	
210PT-8203	3/4"-IA-320-09-042-N	Pressure transmitter package outlet	TRANSMITTER	FIELD	N-278-VD-6019-PR-PID-0002	COMPRESSOR	AI	4-20 mA	0 - 60 bar(g)	-	-	-	25	-	34	JDAN-820	DCS	HART	NIS	-	DCS	
210PT-8204	Oil system	Pressure transmitter oil system	TRANSMITTER	FIELD	N-278-VD-6019-PR-PID-0002	COMPRESSOR	AI	4-20 mA	0 - 1.5 bar(g)	-	-	-	-	-	-	JDAN-820	DCS	HART	NIS	-	DCS	
210CV-8201	3/4"-IA-320-11-042-N	Pressure Control Valve Bypass	CONTROL VALVE	FIELD	N-278-VD-6019-PR-PID-0002	COMPRESSOR	AO	4-20 mA	N/A	-	-	-	-	-	-	DCS	JDAN-820	-	NIS	-	REDUNDANT	
210XL-8201	-	Running Light	SIGNAL	FIELD	N-278-VD-6019-PR-PID-0002	DCS	DO	24 VDC	N/A	Stopped	Running	-	-	-	-	DCS	300LP-820	-	-	-	DCS	
210XL-8202	-	Operational Light	SIGNAL	FIELD	N-278-VD-6019-PR-PID-0002	DCS	DO	24 VDC	N/A	Operational	Operational	-	-	-	-	DCS	300LP-820	-	-	-	DCS	
210XL-8203	-	Fault Light	SIGNAL	FIELD	N-278-VD-6019-PR-PID-0002	DCS	DO	24 VDC	N/A	Healthy	Fault	-	-	-	-	DCS	300LP-820	-	-	-	DCS	
210XL-8204	-	Emergency Trip Light	SIGNAL	FIELD	N-278-VD-6019-PR-PID-0002	DCS	DO	24 VDC	N/A	Healthy	Emergency Trip	-	-	-	-	DCS	300LP-820	-	-	-	DCS	
210HS-8201	-	Start Pushbutton	SIGNAL	FIELD	N-278-VD-6019-PR-PID-0002	DCS	DI	VOLT FREE	N/A	N/A	Start	-	-	-	-	300LP-820	DCS	-	-	NO	DCS	
210HS-8202	-	Stop Pushbutton	SIGNAL	FIELD	N-278-VD-6019-PR-PID-0002	DCS	DI	VOLT FREE	N/A	N/A	Stop	-	-	-	-	300LP-820	DCS	-	-	NC	DCS	
210HS-8203	-	Emergency Stop Pushbutton	SIGNAL	FIELD	N-278-VD-6019-PR-PID-0002	DCS	DI	VOLT FREE	N/A	N/A	ESD	Healthy	-	-	-	300LP-820	DCS	-	-	NC	DCS	
210HS-8204	-	Local / Remote Switch	SIGNAL	FIELD	N-278-VD-6019-PR-PID-0002	DCS	DI	VOLT FREE	N/A	N/A	Local	Remote	-	-	-	300LP-820	DCS	-	-	NO	DCS	
210PZC-8201	3/4"-IA-320-11-042-N	Pressure Control Valve Bypass Positioner	POSITIONER	FIELD	N-278-VD-6019-PR-PID-0002	COMPRESSOR	AI	4-20 mA	0-100%	-	-	-	-	-	-	JDAN-820	DCS	HART	NIS	-	DCS	

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION K-7




DOCUMENTS; OUTLINE DIMENSIONAL DRAWINGS FOR LCP PANEL AND JUNCTION BOX



Vendor doc. Number
17735-19

P.O. NO.:
LIDCO-PO-NEC-278-6019

Vendor:
Airpack Nederland B.V.

	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT																															
	<table border="1" style="width: 100%;"> <tr> <td colspan="7" style="text-align: center;"> Outline Dimensional Drawings for LCP Panel and Junction Box </td> <td rowspan="3" style="text-align: center; vertical-align: middle;"> Page Page 1 of 6 </td> </tr> <tr> <td colspan="7"> Document No. 17735-07 </td> </tr> <tr> <td>Project No.</td> <td>Vendor Doc.</td> <td>P.O. No.</td> <td>Department</td> <td>Document Type</td> <td>Serial No</td> <td>Revision</td> </tr> <tr> <td>N278</td> <td>VD</td> <td>6019</td> <td>IN</td> <td>DWG</td> <td>0007</td> <td>06</td> <td></td> </tr> </table>		Outline Dimensional Drawings for LCP Panel and Junction Box							Page Page 1 of 6	Document No. 17735-07							Project No.	Vendor Doc.	P.O. No.	Department	Document Type	Serial No	Revision	N278	VD	6019	IN	DWG	0007	06	
Outline Dimensional Drawings for LCP Panel and Junction Box							Page Page 1 of 6																									
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N278	VD	6019	IN	DWG	0007	06																										

Airpack B.V. - Air Compressor –

Integrated Methanol and Ammonia Plant

17735-COM Outline Dimensional Drawings for LCP Panel and Junction Box (K020)

Code 1
M.Dalakeh

06	02-05-2024	Issued for Approval	R.T.	S.K.	J.J.
05	18-04-2024	Issued for Approval	R.T.	S.K.	J.J.
04	20-03-2024	Issued for Approval	R.T.	S.K.	J.J.
03	14-02-2024	Issued for Approval	R.T.	S.K.	J.J.
02	21-12-2023	Issued for Approval	R.T.	S.K.	J.J.
01	07-12-2023	Issued for Approval	R.T.	S.K.	J.J.
REV.	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED

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LIDCO, Pars SEE Zone, Assaluyeh,
Integrated Methanol and Ammonia
Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT



Outline Dimensional Drawings for LCP Panel and Junction Box

Document No. 17735-07

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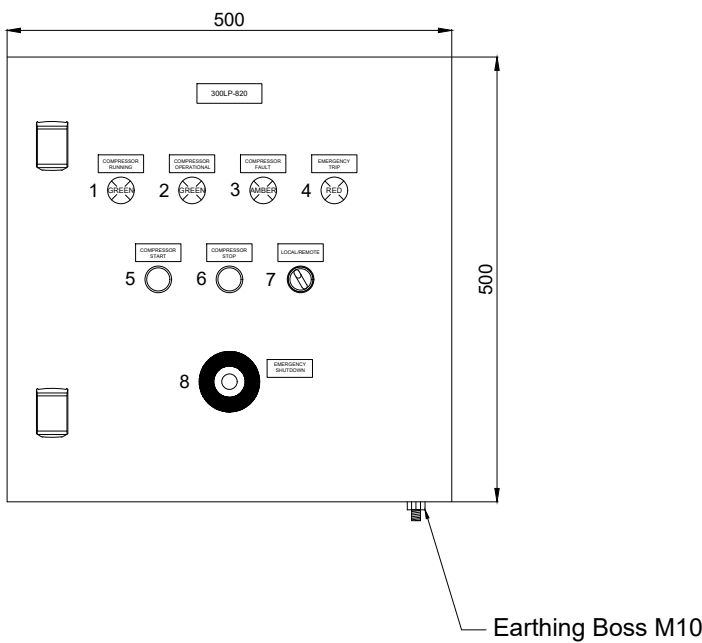
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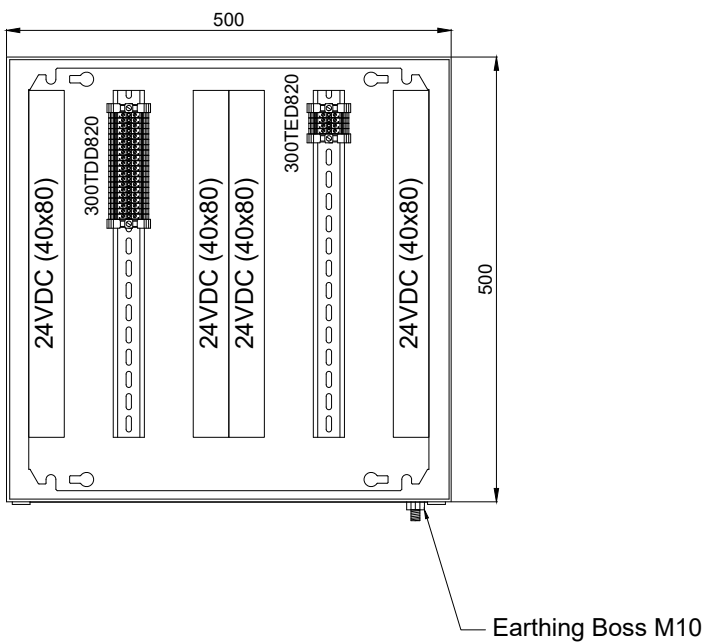
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24											74						6					
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300LP-820 Local Pushbutton Station

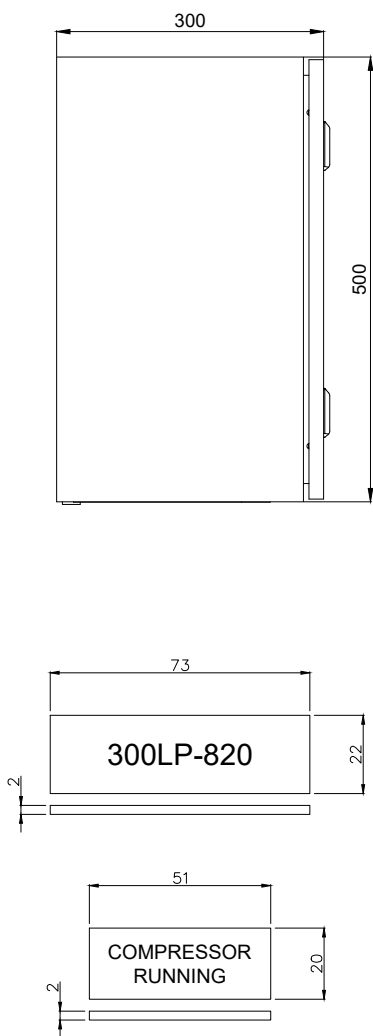
Front Side (Outside View)



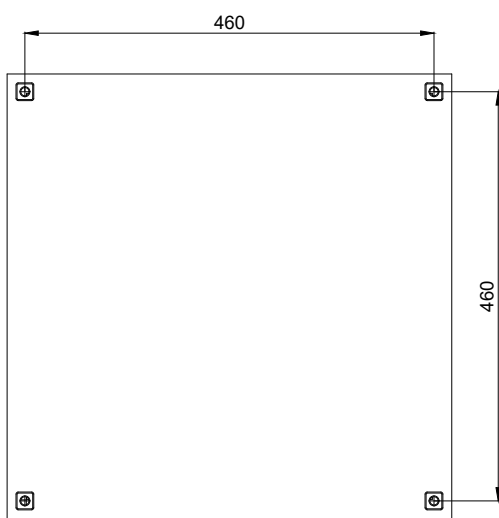
Front Side (Inside View)



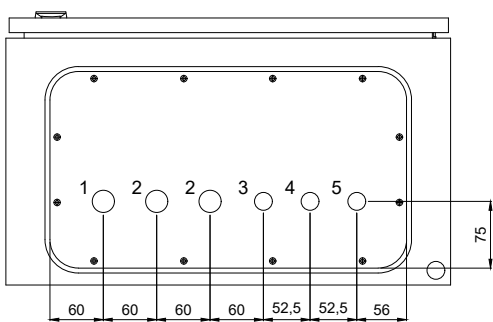
Left Side View



Back View



Bottom View






Gland Entry Details




1. M25 - 1x (Incoming Cable from Customer, Pushbuttons)
2. M25 - 1x (Incoming Cable from Customer, Lamps)
3. M25 - 1x (Spare, fitted with Ex blank)
4. M20 - 1x (Incoming Cable from Customer, ESD Pushbutton)
5. M20 - 1x (Spare, fitted with Ex blank)
6. M20 - 1x (Breather)

NOTES

- 1) Panel Dimensions: 500x500x300mm
- 2) Panel Material: Painted Sheet Steel (RAL 7035)
- 3) Panel Thickness: 1.5mm
- 4) Area Classification: Safe
- 5) Ingress Protection: IP65
- 6) Cable Raceways will have 20% spare space.
- 7) Panel Weight: ~25kg
- 8) Manufacturer: Rittal
- 9) Model Number: 1350000
- 10) DIN Rail Type: NS35
- 11) Emergency Shutdown Pushbutton shall have protective cover to avoid inadvertent shutdown.
- 12) Cable glands will CMP Cable Glands, SS316 with shrouds, IP66 rated.

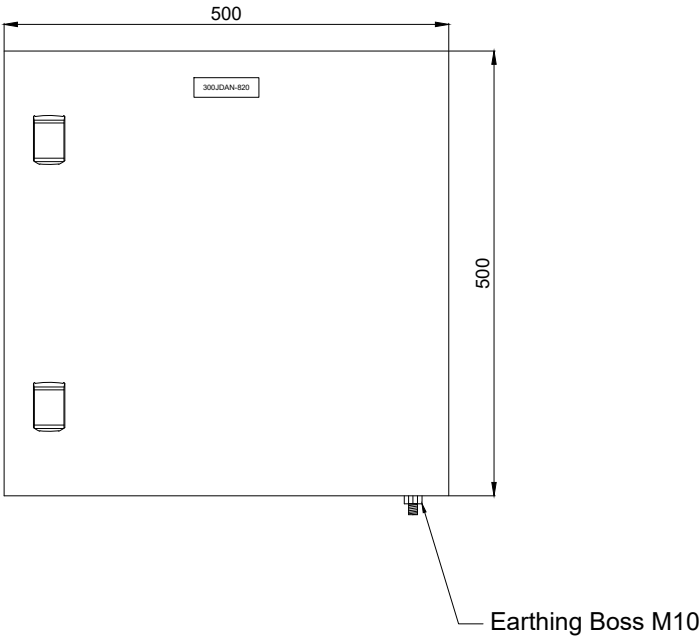
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DRAWING TITLE: <div>Outline Dimensional Drawings for LCP Panel and Junction Box</div>							
DOCUMENT No: 17735-07 Panel Layout Diagram				SC.			
				SIZE: A3			
PROJECT No.	VENDOR DOC.	P.O. No.	DEPARTMENT	DOC. TYPE	SERIAL No.	REV.	SHEET No.
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Nr.	Description	Tag Number	Qty	Make	Order Number
Terminal Strip Definition					
300TDA820	Connection Analog Transmitters to Client	300TDA820	48	Phoenix Contact	UT 4
300TDA821	Connection Pressure Control Valve to Client	300TDA821	10	Phoenix Contact	UT 4
NOTES					
1) Tags correspond to tags on wiring diagram, N-278-VD-6019-IN-DIA-0005					

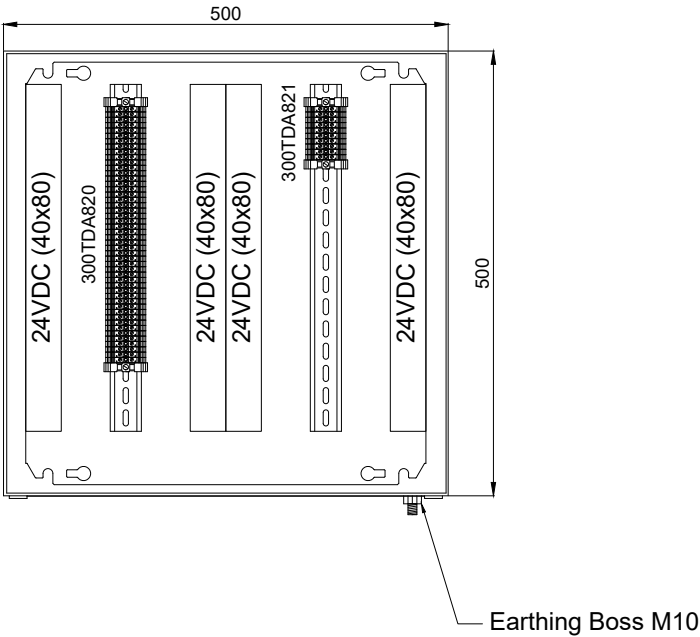
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PROJECT No.	VENDOR DOC.	P.O. No.	DEPARTMENT	DOC. TYPE	SERIAL No.	REV.	SHEET No.
N278	VD	6019	IN	DWG	0007	06	3 OF 4

300JDAN-820 Junction Box

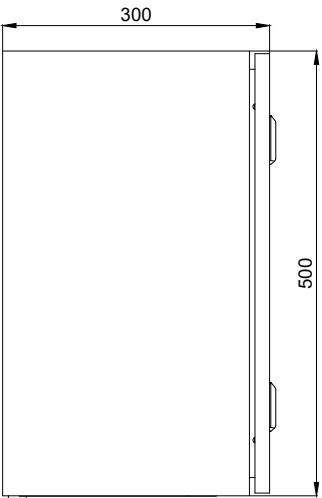
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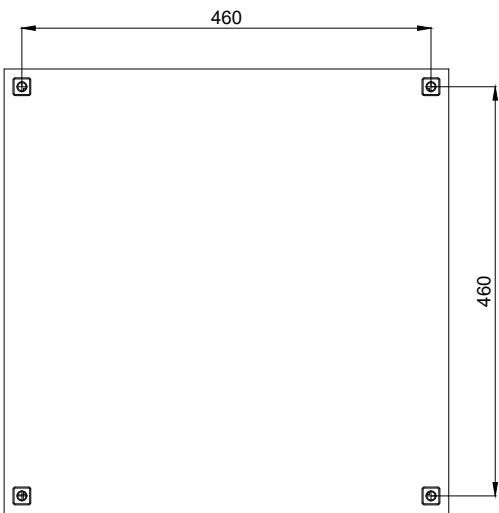
Front Side (Inside View)



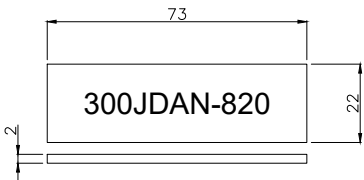
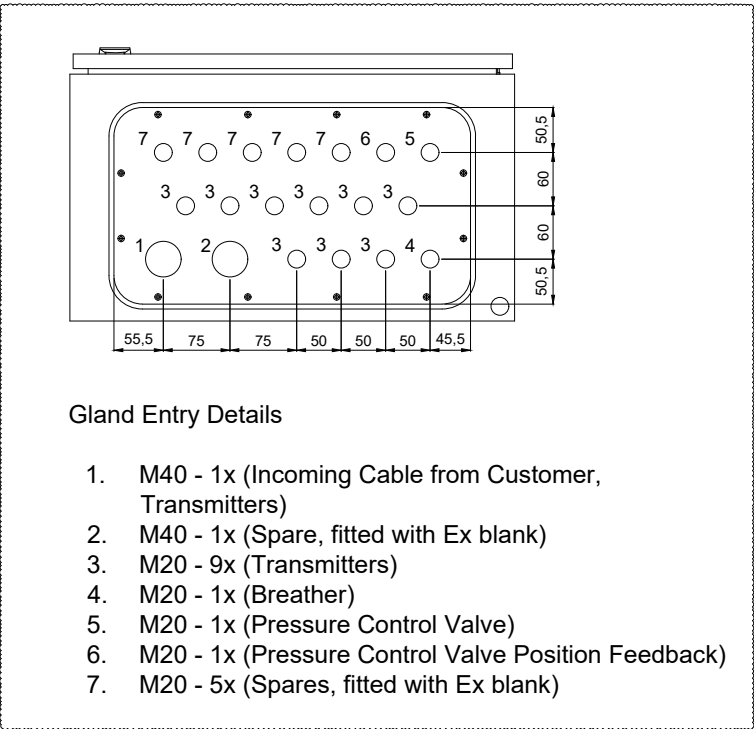
Left Side View






Back View



Bottom View



- NOTES
- 1) Panel Dimensions: 500x500x300mm
 - 2) Panel Material: Painted Sheet Steel (RAL 7035)
 - 3) Panel Thickness: 1.5mm
 - 4) Area Classification: Safe
 - 5) Ingress Protection: IP65
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05	02/04/24	ISSUED FOR REVIEW	RT	SK	KP		
04	20/03/24	ISSUED FOR REVIEW	RT	SK	KP		
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PROJECT No.	VENDOR DOC.	P.O. No.	DEPARTMENT	DOC. TYPE	SERIAL No.	REV.	SHEET No.
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Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION K-8

DOCUMENTS; INSPECTION & TEST PLAN (ITP)



Vendor doc. Number




17735-19

Vendor:



Airpack Nederland B.V.

P.O. NO.:




LIDCO-PO-NEC-278-6019

	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT						
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	Document No. 17735-08						Page
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	N278	VD	6019	GN	ITP	0008	04

Inspection and Test Plan for Air Compressor Package (K-020)

						
REV.	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED	<div> <div>INSPECTION</div> <div> 1- APPROVED <input checked="" type="checkbox"/> 2- APPROVED AS NOTED <input type="checkbox"/> 3- NOT APPROVED <input type="checkbox"/> </div> <div> BY:  DATE: 14/04/2024 </div> </div>
04	09-04-2024	Issued for Approval	SK	LvG		
03	03-04-2024	Issued for Approval	SK	LvG		
02	13-11-2023	Issued for Approval	SK	LvG		
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22						47						72						4					
23						48						73						5					
24						49						74						6					
25						50						75						7					


INSPECTION



1- APPROVED




2- APPROVED WITH NOTES

3- NOT APPROVED




BY: M. REZAEI DATE: 1403/04/25

SIGN: 




		NARGAN COMPANY
INSPECTION		
1- APPROVED	<input checked="" type="checkbox"/>	
2- APPROVED AS NOTED	<input type="checkbox"/>	
3- NOT APPROVED	<input type="checkbox"/>	
BY: M. REZAEI DATE: 14/04/2024		
SIGN: 		

	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT						
	INSPECTION AND TEST PLAN (ITP)						
	Document No.						
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	N278	VD	6019	GN	ITP	0008	03
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PROJECT : Integrated Methanol and Ammonia Plant				VENDOR: Airpack Netherlands B.V.		EQUIPMENT/PKG: K-020		
COMPANY: Lavan Industry Development Company of Iran			MR. NO.: N278-000-ME-MR-1020-001-02		SUBVENDOR: According to N-278-VD-6019-GN-EQL-0038		COMMODITY / ITEM NAME: Instrument air	
PURCHASER: Nargan Company			P.O.NO.: LIDCO-PO-NEC-278-6019		ISSUE DATE: 10-8-2023		QTY: 01 Page: 01	
ACTIVITY NO.	INSPECTION STAGE / ACTIVITY	APPLICABLE DOCUMENTS (Note-1)	VERIFYING DOCUMENT	PARTICIPATION BY:				REMARKS
				VENDOR	Nargan	LIDCO	TPA	
Before manufacturing								
1	Pre- Inspection	GAD approval P&ID approval Painting procedure approval Welding documents approval Inspection and test plan approval Datasheets approval	PIM MOM As per PO / MR / Project Specifications	HP	HP	HP	R	

	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT	
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ACTIVITY NO.	INSPECTION STAGE / ACTIVITY	APPLICABLE DOCUMENTS (Note-1)	VERIFYING DOCUMENT	PARTICIPATION BY:				REMARKS
				VENDOR	Nargan	LIDCO	TPA	
COMPRESSOR								
2.1	Component check Complete compressor	Approved mechanical datasheet	Drawing of compressor	HP	R	R	R	
2.2	Materials inspection Visual and certificate check for cylinders and cylinder heads of the compressor	EN 10204 Approved mechanical datasheet	3.1 material certificate	HP	R	R	R	Review of material certificates during FAT
2.3	Hydrostatic test Compressor cylinders	Approved hydrotest procedure	Hydrostatic test certificate	HP	R	R	W	
SKID base and lifting frame								
3.1	Materials inspection Visual check Certificate check	EN 10204 ASME Sec II, 2019	EN 10204 / 2.1 material certificate Lifting lugs: 3.1 material certificate	HP	R	R	R	Review of material certificates during FAT
3.2	Welding Visual Inspection / dimension check Base frame / lifting lugs skid	AWS D1.1	PQR / WPS	W	R	R	R	
3.3	NDT Lifting lugs 100% MT	NDT procedure	MT certificate	W	R	R	R	
3.4	Painting Random Paint thickness check Color check	Approved painting procedure	Painting report	W	R	R	R	
Piping								
4.1	Materials inspection Visual check Certificate check	EN 10204 ASME Sec II, 2019	EN 10204 / 3.1 material certificate	HP	R	R	R	Review of material certificates during FAT
4.2	Welding Visual check Certificate check	ASME section IX	Approved PQR / WPS	W	R	R	R	
4.3	NDT Welds check 10% spot RT	NDT procedure	RT certificate	W	R	R	R	
4.4	Hydrostatic test Piping	Hydrostatic test procedure	Hydrostatic test certificate	W	R	R	R	
4.4	Painting Random Paint thickness check Color check	Approved painting procedure	Painting report	W	R	R	R	

	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT	
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ACTIVITY NO.	INSPECTION STAGE / ACTIVITY	APPLICABLE DOCUMENTS (Note-1)	VERIFYING DOCUMENT	PARTICIPATION BY:				REMARKS
				VENDOR	Nargan	LIDCO	TPA	
Inter- / Aftercooler								
5.1	Component check Visual check for coolers	Approved mechanical datasheet	Drawing of coolers	W	R	R	R	
5.2	Materials inspection Visual and certificate check of Coolers	EN 10204 ASME sec II, 2019 Approved mechanical datasheet	3.1 material certificate	HP	R	R	R	Review of material certificates during FAT
5.3	Hydrostatic test Cooler shells Cooler tubes	Approved hydrotest procedure, according ASME Sec VIII div.1	Hydrostatic test certificate	HP	R	R	R	Done with service gaskets and fasteners
5.4	NDT 10% spot RT for all pressure parts	NDT procedure	RT certificate	HP	R	R	R	
5.5	Repair Execution of major repairs	Approved mechanical datasheet	Drawing of coolers	HP	HP	HP	R	If major repairs are needed
Pulsation Dampeners								
6.1	Component check Visual check for pulsation dampeners 1 st and 2 nd stage	Approved mechanical datasheet	Drawing of pulsation dampeners	W	R	R	R	
6.2	Materials inspection Visual and certificate check for pulsation dampeners 1 st and 2 nd stage pressure parts	EN 10204 ASME Sec II, 2019	3.1 material certificate	HP	R	R	R	Review of material certificates during FAT
6.3	Hydrostatic test Certificate check for pulsation dampers 1 st and 2 nd stage pressure parts	Approved hydrotest procedure, according to ASME Sec VIII div.1	Hydrostatic test certificate	HP	R	R	R	Done with service gaskets and fasteners
6.4	NDT 10% spot RT for all pressure parts	NDT procedure	RT certificate	HP	R	R	R	
6.5	Repair Execution of major repairs	Approved datasheet	Drawing of pulsation dampeners	HP	HP	HP	R	If major repairs are needed
LV motor								
7.1	Routine test Certification check for low voltage motor	Motor datasheet	Routine test certificate Ref. std. : IS: 12615/IEC60034-1	HP	R	R	R	



NARGAN

COMPANY

INSPECTION


1- APPROVED




2- APPROVED AS NOTED

3- NOT APPROVED

BY: M. REZAEI

DATE: 14/04/2024

SIGN: 

	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT	
	INSPECTION AND TEST PLAN (ITP)	
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ACTIVITY NO.	INSPECTION STAGE / ACTIVITY	APPLICABLE DOCUMENTS (Note-1)	VERIFYING DOCUMENT	PARTICIPATION BY:				REMARKS
				VENDOR	Nargan	LIDCO	TPA	
Pressure / temperature gauges								
8.1	Materials inspection Visual and certificate check for pressure / temperature gauges	Approved instrument datasheet EN 10204	3.1 material certificate	HP	R	R	R	Review of material certificates during FAT
8.2	Calibration certificate inspection Certificate check for pressure / temperature gauges	Approved instrument datasheet EN 10204	Calibration certificate	HP	R	R	R	
Pressure / temperature transmitters								
9.1	Materials inspection Visual and certificate check for pressure / temperature transmitters	Approved instrument datasheet EN 10204	3.1 material certificate	HP	R	R	R	Review of material certificates during FAT
9.2	Calibration certificate inspection Certificate check for pressure / temperature transmitters	Approved instrument datasheet EN 10204	Calibration certificate	HP	R	R	R	
9.3	Ingress Protection Declaration check for pressure / temperature transmitters	Approved instrument datasheet EN / IEC 60529	IP 65 declaration	HP	R	R	R	
Hand valves and strainers								
10.1	Materials inspection Visual and certificate check for hand valves and strainers	Approved instrument datasheet EN 10204	3.1 material certificate	HP	R	R	R	Review of material certificates during FAT
10.2	Hydrostatic test Certificate check for hand valves / strainers / body / seat	ASME B31.3 Approved instrument datasheet	Hydrostatic Test Certificate	HP	R	R	R	
10.3	Painting Random paint thickness test Color check	Approved painting procedure	Painting report	W	R	R	R	
Check valves								
11.1	Materials inspection Visual and certificate check for check valves	Approved instrument datasheet EN 10204	3.1 material certificate	HP	R	R	R	Review of material certificates during FAT
11.2	Hydrostatic test Certificate check for check valves	ASME B31.3	Hydrostatic Test Certificate	HP	R	R	R	
11.3	Painting Random paint thickness test Color check	Approved painting procedure	Painting report	W	R	R	R	



NARGAN

COMPANY

INSPECTION

1- APPROVED




2- APPROVED AS NOTED

3- NOT APPROVED

BY: M. REZAEI

DATE: 14/04/2024




SIGN: 

	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT						
	INSPECTION AND TEST PLAN (ITP)						
	Document No.						
	Project No.	Vendor Doc.	P.O. No.	Department	Document Type	Serial No	Revision
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ACTIVITY NO.	INSPECTION STAGE / ACTIVITY	APPLICABLE DOCUMENTS (Note-1)	VERIFYING DOCUMENT	PARTICIPATION BY:				REMARKS
				VENDOR	Nargan	LIDCO	TPA	
Pressure control valves								
12.1	Materials inspection Visual and certificate check for pressure control valves	Approved instrument datasheet EN 10204	3.1 material certificate	HP	R	R	R	Review of material certificates during FAT
12.2	Hydrostatic test Certificate check for pressure control valves body / seal	ASME B31.3 ANSI B16.37	Hydrostatic Test Certificate	HP	R	R	R	
12.3	Seat Leakage test Certificate check for pressure control valves	ANSI-B16.104 / FCI-70-2	Leakage test certificate	HP	R	R	R	
12.4	Painting Random paint thickness test Color check	Approved painting procedure	Painting report	W	R	R	R	
Pressure safety valves								
13.1	Materials inspection Visual and certificate check for pressure safety valves	Approved instrument datasheet EN 10204 ASME Sec II, 2019	3.1 material certificate	HP	R	R	R	Review of material certificates during FAT
13.2	Hydrostatic test Certificate check for pressure safety valves	ASME B31.3 Spec, N278-000-CI-JSS-1545-004.02	Hydrostatic test certificate	HP	R	R	R	
13.3	Tightness test Certificate check for pressure safety valves	API 527 Spec, N278-000-CI-JSS-1545-004.02	Tightness test declaration	HP	R	R	R	Part of 3.1 material certificate
13.4	Set Pressure Test Checking of setting pressure for pressure safety valves	Spec, N278-000-CI-JSS-1545-004.02	Set pressure test report	HP	R	R	R	
13.5	Seat tightness test Certificate check for pressure safety valves	API 527 Spec, N278-000-CI-JSS-1545-004.02	Seat tightness test report	HP	R	R	R	Part of 3.1 material certificate
13.6	Painting Random paint thickness test Color check	Approved painting procedure	Painting report	W	R	R	R	

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INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 14/04/2024	
SIGN: 	

	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT	
	INSPECTION AND TEST PLAN (ITP)	
Document No.		Page
Project No.	Vendor Doc.	P.O. No.
Department	Document Type	Serial No
Revision		
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GN	ITP	0008
03		
		8 of 10

ACTIVITY NO.	INSPECTION STAGE / ACTIVITY	APPLICABLE DOCUMENTS (Note-1)	VERIFYING DOCUMENT	PARTICIPATION BY:				REMARKS	
				VENDOR	Nargan	LIDCO	TPA		
Junction box									
	14.1	Dimensions Visual check for junction boxes	Approved panel layout drawing	Panel layout drawing as built	HP	R	R	R	
	14.2	Ingress protection Decleration check for junction boxes	EN / IEC 60529	IP 65 Decleration	HP	R	R	R	
	14.3	Painting Random paint thickness test Color check	Approved painting procedure	Painting report	HP	R	R	R	
Documentation									
	15.1	Content check Review of certification dosier	Index manufacturing data book Inspection test plan	Certification dossier / manufacturing data book	HP	R	R	R	Checked during final Inspection by assigned inspector
	15.2	Test instrument Calibration check	N/A	Calibration certificate	HP	R	R	R	
Factory Acceptance Test (FAT)									
	16.1	Equipment inspection Visual check P&ID, Dimensions, Painting, Junction boxes, Instruments and tagging of the complete package	Approved FAT procedure Approved General arrangement drawing Approved P&ID	Signed FAT Procedure; attachment 2: Equipment check list	W	R	H	HP	
	16.2	Functional test Functional check	Approved FAT procedure Approved control philosophy Approved wiring diagram	Signed FAT Procedure; attachment 3: functional check list	W	R	H	HP	
	16.3	Performance test Performance check	Approved FAT procedure Approved control philosophy Approved P&ID	Signed FAT Procedure; attachment 4: performance test result	W	R	H	HP	
	16.4	Noise level test Noise check	Approved FAT procedure Approved equipment data sheet	Signed FAT Procedure; attachment 5: noise level sheet list	W	R	H	HP	
Punch list									
	17.1	Punch list check Punch items check	As per PO / MR / Drawings / Datasheets	Signed Punch List	W	R	R	HP	

	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT	
	INSPECTION AND TEST PLAN (ITP)	
Document No.		Page
Project No.	Vendor Doc.	P.O. No.
N278	VD	6019
Department	Document Type	Serial No
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03		
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	ACTIVITY NO.	INSPECTION STAGE / ACTIVITY	APPLICABLE DOCUMENTS (Note-1)	VERIFYING DOCUMENT	PARTICIPATION BY:				REMARKS
					VENDOR	Nargan	LIDCO	TPA	
Packing & marking									
	18.1	Packing and marking Quantity inspection	Approved packing and preservation procedure Commisioning and Start-up Spare Part List	Signed packing list	HP	R	R	HP	
	18.2	Packing inspection Preservation check	Approved packing and preservation procedure	Signed packing list	HP	R	R	HP	
	18.3	Marking inspection Equipment Package nameplate	Approved packing and preservation procedure	Signed packing list	HP	R	R	HP	
Release of package									
	19.1	Inspection release note	Signed ITP	Signed inspection release note	HP	R	R	HP	
Documents									
	20.1	Manufacturing Data Book	-	MRB	HP	R	R	R	
	20.2	Non conformity / repairs	-	NCR document	HP	HP	HP	HP	If any
	20.3	Deviation / concession request	-	Deviations list	HP	HP	HP	HP	If any

	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT						
	INSPECTION AND TEST PLAN (ITP)						
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ABBREVIATIONS

HP: Hold Point – Vendor/ manufacturer is to notify INSPECTOR 10 days prior to performing the designated feature. Activities may not proceed (Hold) until the continuation of work is permitted by PURCHASER /COMPANY or waived in writing by PURCHASER/OWNER (Inspection waiver).

W: Full Witness Inspection/ Test. Witness-Application for inspection are required. PURCHASER/COMPANY inspector will be arranged to be present at least part of ongoing process. Vendor will proceed to the next step if he is not present; provided controls and tests records are made available to Inspector for review.

SW: Spot Witness Inspection/ Test on Spot / Random Basis. Witness by spot checks refer to an inspection performed at random, between the scheduled inspection points. The frequency and the depth of the inspection will be at least 10% of the items for bulk items, and at least one (1) item per type and category. But controls and tests records are made available to Inspector for review.

R: Verify by review of Manufacturer's Inspection/ Test Reports & Certificates

A: Approval of Manufacturer's Drawings and Documents

C: COMPANY (Lavan Industry Development Company of Iran)

LIDCO: Lavan Industry Development Company of Iran

TPA: Third Party Agency



P: PURCHASER

MFR: Manufacture



Note-1 All Standards and Codes' Edition shall be mentioned.

Note-2 Before Manufacturing includes: (1) Procedure Review and Approval, (2) Certificate Records Review and (3) Raw Material Inspection.

	
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 14/ April/ 2024	
SIGN: 	

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION K-9




DOCUMENTS; UTILITY CONSUMPTION



Vendor doc. Number
17735-19

P.O. NO.:
LIDCO-PO-NEC-278-6019

Vendor:
Airpack Nederland B.V.

<div>شرکت توسعه صنایع لوان Lavan Industry Development Company</div> <div></div>	<div>LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT</div>	<div></div>					
<div></div>	Utility Consumption						
	Document No. 17735-03						Page
	Project No.	Vendor Doc.	P.O. No.	Department	Document Type	Serial No	Revision
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Utility Consumption (K-020)

code-1
M. Vakili

03	25-03-2024	Issued for Approval	S.K.	J.J.	S.K.
02	29-01-2024	Issued for Approval	T.T.	J.J.	S.K.
01	14-09-2023	Issued for Approval	S.K.	J.J.	S.K.
REV.	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED

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Utility Consumption

Document No. 17735-03

Project No.	Vendor Doc.	P.O. No.	Department	Document Type	Serial No	Revision
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2	X	X	X			27						52						77					
3	X	X	X			28						53						78					
4						29						54						79					
5						30						55						80					
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21						46						71						3					
22						47						72						4					
23						48						73						5					
24						49						74						6					
25						50						75						7					



LIDCO, Pars SEE Zone, Assaluyeh,
Integrated Methanol and Ammonia
Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT

Utility Consumption

Document No. 17735-03

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EQUIPMENT No. (ITEM)	DESCRIPTION	COOLING WATER m ³ /h	DEMINERAL WATER m ³ /h	INSTRUMENT AIR Nm ³ /h	PLANT AIR Nm ³ /h	NITROGEN Nm ³ /h	FUEL GAS Nm ³ /h	STEAM			CONDENSATE		ELECTRIC POWER		
								HHP/HP/LP	START-UP PEAK VALUE	OPERATION	CLEAN	CONTAMINATED	VOLTAGE LEVEL V	RATED kW	ABSORBED kW
320-PCV-8201	Pressure Control Valve	-	-	1 Duty Int.	-	-	-	-	-	-	-	-	-	-	-
KE-020-001	Cooling water for intercooler	0,5	-	-	-	-	-	-	-	-	-	-	-	-	-
KE-020-001	Cooling water for aftercooler	0,5	-	-	-	-	-	-	-	-	-	-	-	-	-
KM-020-002	Cooling fan motor	-	-	-	-	-	-	-	-	-	-	-	400	0,14	N/A
KH-020-001	Oil heater	-	-	-	-	-	-	-	-	-	-	-	230	0,08	N/A
KM-020-001	Main motor	-	-	-	-	-	-	-	-	-	-	-	400	11	5

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION K-10




DOCUMENTS; MAIN MOTOR DATA SHEET



Vendor doc. Number
17735-19

P.O. NO.:
LIDCO-PO-NEC-278-6019

Vendor:
Airpack Nederland B.V.

	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT							
	Main Motor Data Sheets							
	Document No. 17735-10							Page
	Project No.	Vendor Doc.	P.O. No.	Department	Document Type	Serial No	Revision	
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Airpack B.V. - Air Compressor –




Integrated Methanol and Ammonia Plant

17735-COM Main Motor Data Sheets (K020)

Code 1
M.Dalakeh

06	03-07-2024	Issued for Approval	S.K.	S.K.	J.J.
05	01-07-2024	Issued for Approval	S.K.	S.K.	J.J.
04	21-06-2024	Issued for Approval	S.K.	S.K.	J.J.
03	10-06-2024	Issued for Approval	S.K.	S.K.	J.J.
02	03-06-2024	Issued for Approval	S.K.	S.K.	J.J.
01	08-04-2024	Issued for Approval	S.K.	S.K.	J.J.
REV.	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED

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	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT							
	Main Motor Data Sheets							
	Document No. 17735-10							Page
	Project No.	Vendor Doc.	P.O. No.	Department	Document Type	Serial No.	Revision	Page 2 of 4
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2	X	X	X	X	X	X					52						77					
3	X	X	X	X	X	X					53						78					
4	X	X	X	X	X	X					54						79					
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24											74						6					
25											75						7					



MAIN MOTOR DATA SHEET

PROJECT :	Integrated Methanol and Ammonia Plant	PROJECT N°:	UNIT	DOCUMENT N°	SHEET	REV
CLIENT:	LIDCO	17735	KM-020	N-278-VD-6019-PM-DS-0010	3 of 4	06

1	Item:	Main motor	Quantity:	1
2	General specificatio	N278-000-EL-JSS-1691-001	Standards, codes:	(IEC60034) IEC 60034-8
3	Supplier:	Airpack	Manufacturer:	Siemens
4		Unit		
5	ENVIRONMENTAL CONDITIONS			
6	Installation (indoor/outdoor) / Ambient Type		Indoor	
7	Ambient Design Temperature (Min./Max.)	°C	0-49	
8	Altitude (if > 1000m)	m	<1000 m.a.s.l.	
9	Relative Humidity	%	85%	
10	Area Classification		Safe area	
11	Other conditions		Onshore	
12				
13	DRIVEN MACHINE DATA			
14	Machine Type		Air booster compressor	
15	Max absorbed power	kW	Approx. 5	
16	Motor rated power	kW	11	
17	Coupling type		V-belt	
18	Starting current		7.4 xln	
19				
20	GENERAL MOTOR CHARACTERISTICS			
21	Rated power	kW	15	
22	Poles	N°	4	
23	Voltage	V	400+/-5%	
24	Frequency	Hz	50+/-2%	
25	phase	ph	3	
26	Motor type		Squirrel cage induction motor	
27	Fan execution		Standard	
28	Motor material		Cast Iron	
29	special execution		-	
30	Direction of Rotation (looking at motor coupling)		Clockwise	
31	Mounting		IM B35	
32	Protection degree enclosure	IP	55	
33	Protection degree terminal box	IP	55	
34	Atex protection Motor		-	
35	Atex protection terminal box		-	
36	Area Classification according ATEX		Safe area	
37	Axial Bearing Type (NDE)		Roller	
38	Bearing Code (NDE)		6309-C3	
39	Axial Bearing Type (DE)		Roller	
40	Bearing code (DE)		6309-C3	
41	Lubrication type		Esso unirex N3	
42	Lubrication interval	hr	4000	
43	Cooling method		TEFC	
44	Winding material		Copper	
45	Starting method		DOL	
46	Winding Connection		STAR	
47	Number of terminals brought out	N°	3	
48	Min. Insulation Class		F	
49	Max Temperature Rise		B	
50	Painting standard		C5M	
51	Painting Colour		RAL-7030	
52	Motor Nett Weight	Kg	217	
53	Dimension (L x W x H)	mm	725,5x350x545	
54	Frame Size	L	160	
55	Noise Level at 1 m (at full load)	dB(A)	69	
56	Full Load Speed	rpm	1467	
57	Power factor	100/75/50% load	0.82/0.82/0.72	
58	Max. voltage drop at starting	%	15	
59	Rated current	A	28	
60	Full load Torque	Nm	3.4	
61	Efficiency	100/75/50% load	92.1/92.3/91.5	
62	Power Factor 2/4		0.85	
63	Total no. of start per hour : hot		2	
64	Total no. of start per hour : Cold		3	
65	Duty type		S1	
66	Service Factor		1.0	

TO BE COMPLETED BY PURCHASER & BY DRIVEN MACHINE SUPPLIER

[illegible]

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION K-11

DOCUMENTS; EQUIPMENT DATA SHEET



Vendor doc. Number




17735-19

P.O. NO.:

LIDCO-PO-NEC-278-6019



Vendor:

Airpack Nederland B.V.



	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT						
	Equipment Data Sheet						
Document No. 17735-11A							
Project No.	Vendor Doc.	P.O. No.	Department	Document Type	Serial No.	Revision	Page
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2	X	X	X	X	X	X	X	X			52						77					
3	X	X	X	X	X	X	X				53						78					
4	X	X	X	X	X	X	X				54						79					
5	X	X	X	X	X	X	X				55						80					
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VENDOR 		EQUIPMENT DATA SHEET		P.O. No. LIDCO-PO-NEC-278-6019	
				Document No. N-278-VD-6019-ME-DS-0011-01	
				Sheet No. 3 of 5	
				Rev.No 08	
CONTRACTOR / END USER 		Integrated Methanol and Ammonia Plant		Item Tag No. K-020	
				Service Compressed Instrument Air	

1	VENDOR (COMPRESSOR) :		Airpack Netherlands B.V.		REFERENCE :	17735-COM	
2	TYPE / MODEL :		High Pressure Air Compressor		SERIAL NO. :	3000 MTPD MeOH/900 MTPD NH3 PROJECT	
3	SERVICE :		Compressed Air		OPERATION :	Duty	
4	QUANTITY :		1				
5	OPERATING CONDITIONS				PACKAGE SCOPE OF SUPPLY		
6	GAS HANDLED :		Instrument air		COMPRESSOR TYPE :	non lubricated, single acting, vertical piston	
7					DRIVER TYPE :	V-belt	
8					COUPLING / GUARD :	N/A	
9	INLET CONDITIONS				CONFIGURATION:	1x100%	
10	PRESSURE OP	bar(g)	9,5		INTERCOOLING	Water cooled shell/tube KE-020-001	
11	PRESSURE DP	bar(g)	12,5		AFTERCOOLER	Water cooled shell/tube KE-020-002	
12	TEMPERATURE OT	°C	46		LUBE-OIL HEATER	Included, KH-020-001	
13	TEMPERATURE DT	°C	75		LUBE-OIL PUMP	Shaft driven	
14	FLOW RATE	Nm³/h	35		AIR COOLER	Motor driven fan KM-020-001	
15					CONTROL PANEL	Not included	
16					PANEL ON PACKAGE:	JB and pushbutton station on package	
17	DISCHARGE CONDITIONS				INTERCONNECTING PIPEWORK & VALVES :	No piping and valves provided for outside package.	
18	PRESSURE OP	bar(g)	30		ACOUSTIC ENCLOSURE	Not included	
19	PRESSURE DP	bar(g)	39		RECEIVER VESSELS	Not included	
20	TEMPERATURE OT	°C	60 max.				
21	TEMPERATURE DT	°C	75				
22	FLOW RATE	Nm³/h	35*				
23	*NNT during full capacity				UTILITY SUPPLIES		
24	COMP. PERFORMANCE				ELECTRICAL SUPPLY :		
25	SPEED	rpm	410		V	400	Hz
26	POWER AT COUPLING	kW	11		V	230	Hz
27	TYPE		non lubricated, single acting, vertical piston				
28					COOLING MEDIUM :	Water	
29	DRIVER PERFORMANCE				TEMPERATURE INTER COOLER	°C	36
30	OPERATING SPEED	rpm	1467		TEMPERATURE AFTER COOLER	°C	46
31	RATING	kW	15		PRESSURE CWS	bar(g)	4,50
32	MANUFACTURER		SIEMENS		PRESSURE CWR	bar(g)	2,50
33					WEIGHTS AND DIMENSIONS		
34	SKID DRY WEIGHT		kg	2700			
35	SKID OPERATIONAL WEIGHT		kg	2750			
36	SIZE		mm	L X W X H	2500X1500X2110		
37	SITE CONDITIONS						
38	ELEVATION	m	0				
39	AMB. TEMPERATURE	°C	0 / 49				
40	AMB. PRESSURE	bar(a)	1,01				
41	AMBIENT AIR HUMIDITY	%	65 / 100				
42	LOCATION :		Iran, onshore				
43	AREA CLASSIFICATION		Safe area				
44	NOISE LIMITATION	dBA	< 85 dB(A)				
45							
46	NOTES :						
47	Measured, during running, at more than one point around the package at 1m distance from skid edge. Measuring points are shown in the document FAT						
48	procedure (N-278-VD-6019-GN-PRC-0015-01)						
49							
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VENDOR 		EQUIPMENT DATA SHEET		P.O. No. LIDCO-PO-NEC-278-6019 Document No. N-278-VD-6019-ME-DS-0011-01 Sheet No. 4 OF 5 Rev.No. 08	
CONTRACTOR / END USER 		Integrated Methanol and Ammonia Plant		Item Tag No. K-020 Service Compressed Instrument Air	

1	CONSTRUCTION					
2	SPEEDS			INSTRUMENTATION		
3	MAXIMUM ALLOWABLE	RPM	410	REFER TO:		
4	ROTATION VIEWED FROM DRIVEN END		CW			
5				P&ID (N-278-VD-6019-PR-PID-0002-01)		
6				INSTRUMENT DATASHEET (N-278-VD-6019-IN-DS-0013-01)		
7				CONTROL VALVE DATASHEETS (N-278-VD-6019-IN-DS-0041)		
8	CASING			PSV DATASHEET (N-278-VD-6019-IN-DS-0039)		
9	MODEL		TRZ 400			
10	WORKING PRESSURE 1ST/2ND STAGE	bar(g)	23.3/30	SKID CONNECTIONS		
11	MAWP	bar(g)	30.5/39	NOZZLE	SIZE	RATING
12	MAXIMUM OPERATING TEMP 1ST/2ND	°C	157/116	PACKAGE INLET	1"	#300 RF TP-8201
13	NO. OF CYLINDERS		2	PACKAGE OUTLET	3/4"	#600 RF TP-8202
14	SUCTION PRESSURE 1ST/2ND	bar(g)	9.5/22.1	WATER INLET	3/4"	#150 RF TP-8203
15	DISCHARGE PRESSURE 1ST/2ND	bar(g)	23.3/30	WATER OUTLET	3/4"	#150 RF TP-8204
16	CYLINDER BORE 1ST/2ND STAGE	M	0.055/0.035			
17	CYLINDER STROKE 1ST/2ND STAGE	M	0.13/0.13			
18	COOLING MEDIUM BLOCK/CYLINDERS		AIR-COOLED			
19	MATERIAL PISTON/VALVES		STAINLESS STEEL			
20	HYDROTEST PRESSURE CYLINDERS	bar(g)	58,5			
21	CYLINDERS COOLING		AIR COOLED			
22	BEARING TYPE		ANTI FRICTION			
23	BEARING BALL / ROLLER		ROLLER			
24	VALVE, INLET / DISCHARGE		CONCENTRIC VALVES	CONTROLS		
25	TYPES OF VALVES		PLATE	CAPACITY CONTROL METHOD :	Compressor PCV	
26	V-BELT DIMENSION		SPC 2500	STOP/START ON PRESSURE SIGNALS	Yes from 300LP-820	
27	PULLEY DIAMETER MOTOR		SPC 160			
28	PULLEY DIAMETER COMPRESSOR		SPC 576			
29	RATIO		1485/410 = ratio 3,62			
30						
31						
32	MATERIALS OF CONSTRUCTION			LUBRICATION		
33	CYLINDER(S)	ASTM A 249 (TP 316L) / EN 1.4404	LUBE SYSTEM :		Oil sump	
34	CYLINDER LINER(S)	ASTM A 249 (TP 316L) / EN 1.4404	LUBE OIL PUMP DRIVE :		Shaft driven	
35	PISTON(S)	ASTM A 420 / EN 1.4021	SYSTEM OIL CAPACITY	Liter	18	
36	PISTON RINGS	PTFE compound	LUBE OIL HEATER		230V, 80 W	
37	WEAR BANDS	PTFE compound	HEATING CARTRIDGE	mm	L=180	
38	PISTON RODS(S): / MATERIAL YIELD:	AISI 422 / EN 1.2316 / 1010 N/mm²	CONNECTION OIL HEATER	G	1/2	
39	PISTON ROD HARDNESS (BASE MATL.)	125 – 160 HB Rc				
40	PISTON ROD COATING / HARDNESS	Plasma nitrided / 1000HV 1 Rc				
41	ROD PRESSURE RINGS	PTFE compound				
42	ROD PRESSURE PACKING CASE	ASTM A 249 (TP 316L) / EN 1.4404				
43	WIPER PACKING RINGS	PTFE compound				
44	MAIN JOURNAL BEARING, CRANKSHAFT	ASTM 80/60/03				
45	CONNECTING ROD BEARING, CRANKPIN	Si52 / PbSb15Sn10				
46	CONN. ROD BUSHING, X-HD END	GC-Sn8z12				
47	CROSSHEAD (X-HD) PIN BUSHING	GC-Sn8z12				
48	CROSSHEAD PIN	AISI 430F / EN 1.4104				
49	CROSSHEAD	ASTM 60/40/18				
50						
51	NOTES :					
52						
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VENDOR 		EQUIPMENT DATA SHEET				P.O. No. LIDCO-PO-NEC-278-6019	
CONTRACTOR / END USER 						Document No. N-278-VD-6019-ME-DS-0011-01	
						Sheet No. 5 OF 5	
						Rev.No 08	
Integrated Methanol and Ammonia Plant		Item Tag No. K-020					
		Service Compressed Instrument Air					

1 PULSTATION DAMPER INLET											
2 EQUIPMENT NO.		KV-020-001		LOCATION :		INLET		LIQUID / AIR COOLED		AIR	
3 NO. REQD		1		MFR / SUPPLIED BY:		Locati Impianti		WEIGHT:		69 kg	
4 CAPACITY		Nm3/hr 35		MATERIAL :		SA106 Gr.B					
5 MAWP		bar(g) 12.5		MAIN IN/OUTLET		1" 300#					
6 HYDROSTATIC PRESSURE		bar(g) 16.25		VOLUME:		39 dm3					
7 CONNECTIONS		TG 1 1/2" 300#		TT 1 1/2" 300#		PSV 1" 300#		DRAIN		1/2" NPT	
8 COMPRESSED AIR		O D Bar(g) 9.5 12.5		TEMP O D °C 46 75							
9 PULSTATION DAMPER 1ST STAGE DISCHARGE											
10 EQUIPMENT NO.		KV-020-002		LOCATION :		1ST STAGE DISCHARGE		LIQUID / AIR COOLED		AIR	
11 NO. REQD		1		MFR / SUPPLIED BY:		Locati Impianti		WEIGHT:		62 kg	
12 CAPACITY		Nm3/hr 35		MATERIAL :		SA106 Gr.B					
13 MAWP		bar(g) 30.5		MAIN IN/OUTLET		3/4" 600#					
14 HYDROSTATIC PRESSURE		bar(g) 39.65		VOLUME:		33 dm3					
15 CONNECTIONS		TG 1 1/2" 600#		TT 1 1/2" 600#		PSV 1" 600#		DRAIN		1/2" NPT	
16 COMPRESSED AIR		O D Bar(g) 23.3 30.5		TEMP O D °C 157 175							
17 PULSTATION DAMPER 2nd STAGE SUCTION											
18 EQUIPMENT NO.		KV-020-003		LOCATION :		2nd STAGE SUCTION		LIQUID / AIR COOLED		AIR	
19 NO. REQD		1		MFR / SUPPLIED BY:		Locati Impianti		WEIGHT:		64 kg	
20 CAPACITY		Nm3/hr 35		MATERIAL :		SA106 Gr.B					
21 MAWP		bar(g) 39		MAIN IN/OUTLET		3/4" 600#					
22 HYDROSTATIC PRESSURE		bar(g) 50.7		VOLUME:		31 dm3					
23 CONNECTIONS		TG N/A		TT 1 1/2" 600#		PSV N/A		DRAIN		1/2" NPT	
24 COMPRESSED AIR		O D Bar(g) 22.1 39.0		TEMP O D °C 60 157							
25 PULSTATION DAMPER 2nd STAGE DISCHARGE											
26 EQUIPMENT NO.		KV-020-004		LOCATION :		2nd STAGE DISCHARGE		LIQUID / AIR COOLED		AIR	
27 NO. REQD		1		MFR / SUPPLIED BY:		Locati Impianti		WEIGHT:		72 kg	
28 CAPACITY		Nm3/hr 35		MATERIAL :		SA106 Gr.B					
29 MAWP		bar(g) 39		MAIN IN/OUTLET		3/4" 600#					
30 HYDROSTATIC PRESSURE		bar(g) 50.7		VOLUME:		31 dm3					
31 CONNECTIONS		TG 1 1/2" 600#		TT 1 1/2" 600#		PSV 1" 600#		DRAIN		1/2" NPT	
32 COMPRESSED AIR		O D Bar(g) 30.0 39.0		TEMP O D °C 116 135							
33 NOTES :											
34 Paint system is specified in document: N-278-VD-6019-GN-PRC-0019-01											
35											
36											
37											
38											
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Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION K-12




DOCUMENTS; INTER/AFTER COOLER DATA SHEET



Vendor doc. Number
17735-19

P.O. NO.:
LIDCO-PO-NEC-278-6019

Vendor:
Airpack Nederland B.V.

	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT							
	Inter / After Cooler Data Sheet							
	Document No. 17735-11B							Page
	Project No. N278	Vendor Doc. VD	P.O. No. 6019	Department ME	Document Type DS	Serial No 0012	Revision 04	Page 1 of 3

Airpack B.V. - Air Compressor –




Integrated Methanol and Ammonia Plant

17735-COM Inter / After Cooler Data Sheet (K020)

Code 1
M.Dalakeh




04	01-07-2024	Issued for Approval	S.K.	S.K.	J.J.
03	20-06-2024	Issued for Approval	S.K.	S.K.	J.J.
02	12-06-2024	Issued for Approval	S.K.	S.K.	J.J.
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REV.	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED

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	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT							
	Inter / After Cooler Data Sheet							
	Document No. 17735-11B							Page
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2	X	X	X	X		27						52						77					
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4						29						54						79					
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25						50						75						7					

VENDOR		Inter- after cooler data sheet		P.O. No.		LIDCO-PO-NEC-278-6019	
				Document No.		17735-11B	
				Sheet No.		3	
				Rev.No		Rev.04	
CONTRACTOR / END USER		LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT		Service		Instrument air booster compressor	
 							
1 INTER COOLER							
2 SHELL SIDE (HUMID AIR)			TUBE SIDE (WATER)			GENERAL	
3 SHELL OPERATING PRESS.	bar(g)	23,3	TUBE OPERATING PRESS.	bar(g)	4,5	MANUFACTURER	IWS Monje
4 LINE DESIGN PRESS.	bar(g)	30,5	LINE DESIGN PRESS.	bar(g)	7	INLET SIZE	3/4" 600# WNRF
5 SHELL DESIGN PRESS.	bar(g)	-1 TO 39	TUBE DESIGN PRESS.	bar(g)	-1 TO 10	OUTLET SIZE	3/4" 600# WNRF
6 SHELL OPERATING TEMP.	°C	157	TUBE OPERATING TEMP.	°C	46	WATER INLET	G 3/4"
7 LINE DESIGN TEMP.	°C	175	LINE DESIGN TEMP.	°C	75	WATER OUTLER	G 3/4"
8 SHELL DESIGN TEMP.	°C	-10 TO 175	TUBE DESIGN TEMP.	°C	-10 TO 100	CORROSION ALL.	0 mm
9 SHELL DIFF PRESSURE	mbar	1.249	TUBE DIFF PRESSURE	mbar	1,08	DIM. LxWxH	482,4x300x115
10 DISCHARGE TEMP.	°C	60	DISCHARGE TEMP.	°C	46	WEIGHT	15 kg
11 AIR FLOW	Nm3/hr	35	WATER FLOW	m3/hr	0,3	OPERATING WEIGHT	15,8 kg
12 SHELL MATERIAL		TP316 - SA-312	TUBE MATERIAL		TP316L - SA-312	DESIGN CODE	TEMA C, ASME VIII Div. 1
13 TEST PRESSURE	bar(g)	64,35	TEST PRESSURE	bar(g)	15		
14 VOLUME	L	1,7	VOLUME	L	0,8		
15 AFTER COOLER							
16 SHELL SIDE (HUMID AIR)			TUBE SIDE (WATER)			GENERAL	
17 SHELL OPERATING PRESS.	bar(g)	30	TUBE OPERATING PRESS.	bar(g)	4,5	MANUFACTURER	IWS Monje
18 LINE DESIGN PRESS.	bar(g)	39	LINE DESIGN PRESS.	bar(g)	7	INLET SIZE	3/4" 600# WNRF
19 SHELL DESIGN PRESS.	bar(g)	-1 TO 39	TUBE DESIGN PRESS.	bar(g)	-1 TO 10	OUTLET SIZE	3/4" 600# WNRF
20 SHELL OPERATING TEMP.	°C	116	TUBE OPERATING TEMP.	°C	46	WATER INLET	G 3/4"
21 LINE DESIGN TEMP.	°C	135	LINE DESIGN TEMP.	°C	75	WATER OUTLER	G 3/4"
22 SHELL DESIGN TEMP.	°C	-10 TO 175	TUBE DESIGN TEMP.	°C	-10 TO 100	CORROSION ALL.	0 mm
23 DIFF PRESSURE	mbar	0,9397	TUBE DIFF PRESSURE	mbar	0,3826	DIM. WxHxL	482,4x300x115
24 DISCHARGE TEMP.	°C	60	DISCHARGE TEMP.		46	WEIGHT	15 kg
25 AIR FLOW	Nm3/hr	35	WATER FLOW	m3/hr	0,14	OPERATING WEIGHT	15,8 kg
26 SHELL MATERIAL		TP316 - SA-312	TUBE MATERIAL		TP316L - SA-312	DESIGN CODE	TEMA C, ASME VIII Div. 1
27 TEST PRESSURE	bar(g)	64,35	TEST PRESSURE	bar(g)	15		
28 VOLUME	L	1,7	VOLUME	L	0,8		
29 NOTES :							
30							
31							
32							

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION K-13

DOCUMENTS; INSTRUMENT DATA SHEET



Vendor doc. Number




17735-19

P.O. NO.:

LIDCO-PO-NEC-278-6019

Vendor:

Airpack Nederland B.V.

	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT						
	Instrument Data Sheets						
	Document No. 17735-12						Page
	Project No. N278	Vendor Doc. VD	P.O. No. 6019	Department IN	Document Type DS	Serial No 0013	Revision 04

Airpack B.V. - Air Compressor –




Integrated Methanol and Ammonia Plant

17735-COM Instrument Data Sheets (K020)

code-1
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01	09-11-2023	Issued for Approval	T.T.	S.K.	J.J.
REV.	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED

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	<p align="center">LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT</p>																			
	<p align="center">Instrument Data Sheets</p>																			
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2	X	X	X	X		27		X	X	X		52						77					
3	X	X	X	X		28		X	X	X		53						78					
4	X	X	X	X		29		X	X	X		54						79					
5	X	X	X	X		30		X	X	X		55						80					
6	X	X	X	X		31		X	X	X		56						81					
7	X	X	X	X		32						57						82					
8	X	X	X	X		33						58						83					
9	X	X	X	X		34						59						84					
10	X	X	X	X		35						60						85					
11	X	X	X	X		36						61						86					
12	X	X	X	X		37						62						87					
13	X	X	X	X		38						63						88					
14	X	X	X	X		39						64						89					
15	X	X	X	X		40						65						90					
16	X	X	X	X		41						66						91					
17	X	X	X	X		42						67						92					
18	X	X	X	X		43						68						ATTACHMENT					
19	X	X	X	X		44						69						1					
20	X	X	X	X		45						70						2					
21	X	X	X	X		46						71						3					
22	X	X	X	X		47						72						4					
23	X	X	X	X		48						73						5					
24	X	X	X	X		49						74						6					
25	X	X	X	X		50						75						7					

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2	Pressure Gauge	320PG-8202	5
3	Pressure Gauge	320PG-8203	6
4	Pressure Gauge	320PG-8204	7
5	Pressure Transmitter	320PT-8201	8
6	Pressure Transmitter	320PT-8202	9
7	Pressure Transmitter	320PT-8203	10
8	Pressure Transmitter	320PT-8204	11
9	Temperature Transmitter	320TT-8201	12
10	Thermowell + Element	320TW-8201	13
11	Temperature Transmitter	320TT-8202	14
12	Thermowell + Element	320TW-8202	15
13	Temperature Transmitter	320TT-8203	16
14	Thermowell + Element	320TW-8203	17
15	Temperature Transmitter	320TT-8204	18
16	Thermowell + Element	320TW-8204	19
17	Temperature Transmitter	320TT-8205	20
18	Thermowell + Element	320TW-8205	21
19	Temperature Gauge	320TG-8206	22
20	Thermowell	320TW-8206	23
21	Temperature Gauge	320TG-8207	24
22	Thermowell	320TW-8207	25
23	Temperature Gauge	320TG-8208	26
24	Thermowell	320TW-8208	27
25	Temperature Gauge	320TG-8209	28
26	Thermowell	320TW-8209	29
27	Temperature Gauge	320TG-8210, 320TG-8211	30
28	Thermowell	320TW-8210, 320TW-8211	31
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Notes:

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04	LK	17-4-2024	For Approval		
03	LK	11-3-2024	For Approval		
02	LK	15-12-2023	For Approval		
01	TT	9-11-2023	For Approval		
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				Based on P&ID	Rev.08

GENERAL	1	Tag Number		320PG-8201	
	2	Service		Air pressure	
	3	P&ID No.		N278-VD-6019-PR-PID-0002	
	4	Location		Package inlet	
	5	Ingress Protection		IP65	
	6	Line number		1"-IA-320-01-D42-N	
	7	Area classification		Safe area	
	8				
PROCESS CONDITIONS	9	Fluid	State	Air	Vapor
	10	Pressure	Norm. Max.	9,5 bar(g)	
	11	Temperature	Norm. Max.	46 °C	
	12	Design	Press. Temp.	12,5 bar(g)	75 °C
	13	Ambient Temp.	Min. Max.	0 °C	49 °C
	14				
	15				
	16				
GAUGE	19	Type		Bourdon tube	
	20	Range	Unit	0...16	bar(g)
	21	Mounting		Panel mounted, with front flange	
	22	Dial Size	Dial Color	100 mm	White surface, black numbers
	23	Case Material		SS316L	
	24	Ring Construction	Ring Material	Bayonet	SS316L
	25	Blow-Out Protection		Yes @ Back, including baffle wall	
	26	Lens Material		Shatterproof laminated safety glass	
	27	Pressure Element Material		SS316L	
	28	Socket Material		SS316L	
	29	Connection Size		1/2" NPT-M	
	30	Connection Location		Back-bottom	
	31	Movement Material		SS316L	
	32	Nominal Accuracy		±1,0 % of span	
	33	Gauge Filling		Glycerin	
	34	Over Range Protection		1,3 x full scale value	
	35				
	OPTIONS	38	Snubber	Material	N/A
39		Gauge Savers	Material	N/A	N/A
40		Manifold (Block & Bleed)		Yes (2-way manifolds)	
41		Block valve (Hand ball valve)		Yes (3/4")	
42		Tag plate		SS316, Plate with steel wire	
43					
44					
CERTIFICATES	45	Calibration certificate		Yes	
	46	3.1 Material certificate		Yes	
	47				
	48				
	49				
	50				
PURCHASE	51	Manufacturer		According to approved vendor list	
	52	Model		VTA	
	53				
	54				
	55				
	56				
	57				

NOTES :



The manifold material should be 316 Stainless Steel 2-valve complete of oval flanges with mounting bolts, gasket, etc

				INSTRUMENT DATASHEET Pressure Gauge 			
04	LK	17-4-2024	For Approval				
03	LK	11-3-2024	For Approval				
02	LK	15-12-2023	For Approval				
01	IT	9-11-2023	For Approval				
Rev	By	Date	Description				

GENERAL	1	Tag Number		320PG-8202	
	2	Service		Air pressure	
	3	P&ID No.		N278-VD-6019-PR-PID-0002	
	4	Location		Suction 2nd stage	
	5	Ingress Protection		IP65	
	6	Line number		3/4"-IA-320-05-D42-H	
	7	Area classification		Safe area	
	8				
PROCESS CONDITIONS	9	Fluid	State	Air	Vapor
	10	Pressure	Norm. Max.	22,1 bar(g)	
	11	Temperature	Norm. Max.	60 °C	
	12	Design	Press. Temp.	39 bar(g)	157 °C
	13	Ambient Temp.	Min. Max.	0 °C	49 °C
	14				
	15				
	16				
GAUGE	19	Type		Bourdon tube	
	20	Range	Unit	0...40	bar(g)
	21	Mounting		Panel mounted, with front flange	
	22	Dial Size	Dial Color	100 mm	White surface, black numbers
	23	Case Material		SS316L	
	24	Ring Construction	Ring Material	Bayonet	SS316L
	25	Blow-Out Protection		Yes @ Back, including baffle wall	
	26	Lens Material		Shatterproof laminated safety glass	
	27	Pressure Element Material		SS316L	
	28	Socket Material		SS316L	
	29	Connection Size		1/2" NPT-M	
	30	Connection Location		Back-bottom	
	31	Movement Material		SS316L	
	32	Nominal Accuracy		±1,0 % of span	
	33	Gauge Filling		Silicone	
	34	Over Range Protection		1,3 x full scale value	
	35				
	OPTIONS	38	Snubber	Material	N/A
39		Gauge Savers	Material	N/A	N/A
40		Manifold (Block & Bleed)		Yes (2-way manifolds)	
41		Block valve (Hand ball valve)		Yes (3/4")	
42		Tag plate		SS316, Plate with steel wire	
43					
CERTIFICATES	45	Calibration certificate		Yes	
	46	3.1 Material certificate		Yes	
	47				
	48				
	49				
	50				
PURCHASE	51	Manufacturer		According to approved vendor list	
	52	Model		VTA	
	53				
	54				
	55				
	56				
	57				

NOTES :



The manifold material should be 316 Stainless Steel 2-valve complete of oval flanges with mounting bolts, gasket, etc

				INSTRUMENT DATASHEET Pressure Gauge 		 Sheet 5 of 31 Based on P&ID Rev.08	
04	LK	17-4-2024	For Approval				
03	LK	11-3-2024	For Approval				
02	LK	15-12-2023	For Approval				
01	IT	9-11-2023	For Approval				
Rev	By	Date	Description				

GENERAL	1	Tag Number		320PG-8203	
	2	Service		Gas pressure	
	3	P&ID No.		N278-VD-6019-PR-PID-0002	
	4	Location		Outlet package	
	5	Ingress Protection		IP65	
	6	Line number		3/4"-IA-320-09-D42-N	
	7	Area classification		Safe area	
	8				
PROCESS CONDITIONS	9	Fluid	State	Air	Vapor
	10	Pressure	Norm. Max.	30 bar(g)	
	11	Temperature	Norm. Max.	60 °C	
	12	Design	Press. Temp.	39 bar(g)	75 °C
	13	Ambient Temp.	Min. Max.	0 °C	49 °C
	14				
	15				
	16				
GAUGE	17				
	18				
	19	Type		Bourdon tube	
	20	Range	Unit	0...60	bar(g)
	21	Mounting		Panel mounted, with front flange	
	22	Dial Size	Dial Color	100 mm	White surface, black numbers
	23	Case Material		SS316L	
	24	Ring Construction	Ring Material	Bayonet	SS316L
	25	Blow-Out Protection		Yes @ Back, including baffle wall	
	26	Lens Material		Shatterproof laminated safety glass	
	27	Pressure Element Material		SS316L	
	28	Socket Material		SS316L	
	29	Connection Size		1/2" NPT-M	
	30	Connection Location		Back-bottom	
	31	Movement Material		SS316L	
	32	Nominal Accuracy		±1,0 % of span	
	33	Gauge Filling		Silicone	
	34	Over Range Protection		1,3 x full scale value	
	35				
	OPTIONS	36			
37					
38		Snubber	Material	N/A	N/A
39		Gauge Savers	Material	N/A	N/A
40		Manifold (Block & Bleed)		Yes (2-way manifolds)	
41		Block valve (Hand ball valve)		Yes (3/4")	
42		Tag plate		SS316, Plate with steel wire	
43					
CERTIFICATES	44				
	45	Calibration certificate		Yes	
	46	3.1 Material certificate		Yes	
	47				
	48				
	49				
	50				
PURCHASE	51	Manufacturer		According to approved vendor list	
	52	Model		VTA	
	53				
	54				
	55				
	56				
	57				

NOTES :



The manifold material should be 316 Stainless Steel 2-valve complete of oval flanges with mounting bolts, gasket, etc

				INSTRUMENT DATASHEET Pressure Gauge 	
04	LK	17-4-2024	For Approval		
03	LK	11-3-2024	For Approval		
02	LK	15-12-2023	For Approval		
01	IT	9-11-2023	For Approval		
Rev	By	Date	Description	Sheet 6 of 31 Based on P&ID Rev.08	

GENERAL	1	Tag Number		320PG-8204	
	2	Service		Liquid pressure	
	3	P&ID No.		N278-VD-6019-PR-PID-0002	
	4	Location		Cooling water inlet	
	5	Ingress Protection		IP65	
	6	Line number		3/4"-CWS-320-20-B24C-N	
	7	Area classification		Safe area	
	8				
PROCESS CONDITIONS	9	Fluid	State	Water	Liquid
	10	Pressure	Norm. Max.	4,5 bar(g)	
	11	Temperature	Norm. Max.	36 °C	
	12	Design	Press. Temp.	7 bar(g)	75 °C
	13	Ambient Temp.	Min. Max.	0 °C	49 °C
	14				
	15				
	16				
GAUGE	17				
	18				
	19	Type		Bourdon tube	
	20	Range	Unit	0...10	bar(g)
	21	Mounting		Panel mounted, with front flange	
	22	Dial Size	Dial Color	100 mm	White surface, black numbers
	23	Case Material		SS316L	
	24	Ring Construction	Ring Material	Bayonet	SS316L
	25	Blow-Out Protection		Yes @ Back, including baffle wall	
	26	Lens Material		Shatterproof laminated safety glass	
	27	Pressure Element Material		SS316L	
	28	Socket Material		SS316L	
	29	Connection Size		1/2" NPT-M	
	30	Connection Location		Back-bottom	
	31	Movement Material		SS316L	
	32	Nominal Accuracy		±1,0 % of span	
	33	Gauge Filling		Glycerine	
	34	Over Range Protection		1,3 x full scale value	
	35				
	OPTIONS	36			
37					
38		Snubber	Material	N/A	N/A
39		Gauge Savers	Material	N/A	N/A
40		Manifold (Block & Bleed)		Yes (2-way manifolds)	
41		Block valve (Hand ball valve)		Yes (3/4")	
42		Tag plate		SS316, Plate with steel wire	
43					
CERTIFICATES	44				
	45	Calibration certificate		Yes	
	46	3.1 Material certificate		Yes	
	47				
	48				
	49				
	50				
PURCHASE	51	Manufacturer		According to approved vendor list	
	52	Model		VTA	
	53				
	54				
	55				
	56				
	57				

NOTES :



The manifold material should be 316 Stainless Steel 2-valve complete of oval flanges with mounting bolts, gasket, etc

				INSTRUMENT DATASHEET Pressure Gauge 			
04	LK	17-4-2024	For Approval				
03	LK	11-3-2024	For Approval				
02	LK	15-12-2023	For Approval				
01	IT	9-11-2023	For Approval				
Rev	By	Date	Description				

GENERAL	1	Tag Number			320PT-8201	
	2	Service			Air pressure	
	3	P&ID No.			N278-VD-6019-PR-PID-0002	
	4	Location			Package inlet	
	5	Ingress Protection			IP65	
	6	Line number			1"-IA-320-01-D42-N	
	7	Area classification			Safe area	
	8					
PROCESS CONDITIONS	9	Fluid	State	Air		Vapor
	10	Pressure	Norm.	Max.	9,5 bar(g)	
	11	Temperature	Norm.	Max.	46 °C	
	12	Design	Press.	Temp.	12,5 bar(g)	75 °C
	13	Ambient Temp.	Min.	Max.	0 °C	49 °C
	14	Setpoint	LL	L	7,5 bar(g)	
	H		HH	12 bar(g)		
	16					
17						
18						
TRANSMITTER	19	Function			Field mounted	
	20	Element Type			Diaphragm	
	21	Element Material			SS316L	
	22	Housing Material			SS316L	
	23	Power Supply			24 VDC, 2-wire, loop powered	
	24	Process Conn.	Electric Conn.		½" NPTM	ISO M20 x 1,5
	25	Accuracy			± 0.1% of span	
	26	Calibrated Range		Unit	0...16	bar(g)
	27	Adjustable Range		Unit	VTA	bar(g)
	28	Allow. Press.	Allow. Temp.			
	29	Communication Protocol			Smart , HART	
	30	Output Signal			4 - 20 mA	
	31	Sensor Fill Fluid			Glycerine	
	32					
	33					
	34					
35						
36						
OPTIONS	37	Integral Meter	Scale		Yes, LCD	bar(g)
	38	Lightning And Surge Protection			N/A	
	39	Mounting facilities			Bracket	
	40	Manifold (Block & Bleed)			Yes (2-way manifolds)	
	41	Housing ground connection			Yes, external (tightened with screws)	
	42	Cable Gland			Yes	
	43	Block valve (Hand ball valve)			Yes (3/4")	
	44	Tag plate			SS316, Plate with steel wire	
CERTIFICATES	45	Calibration certificate			Yes	
	46	3.1 Material certificate			Yes	
	47					
	48					
	49					
	50					
PURCHASE	51	Manufacturer			According to approved vendor list	
	52	Model			VTA	
	53					
	54					
	55					
	56					
	57					

NOTES :



The manifold material should be 316 Stainless Steel 2-valve complete of oval flanges with mounting bolts, gasket, etc

					INSTRUMENT DATASHEET		<div>شرکت توسعه صنایع لایوان</div> <div>Lavan Industry Development Company</div> <div></div>
					Pressure Transmitter		
							
04	LK	17-4-2024	For Approval				
03	LK	11-3-2024	For Approval				
02	LK	15-12-2023	For Approval				
01	TT	9-11-2023	For Approval				
Rev	Bv	Date	Description		Sheet 8 of 31		
					Based on P&ID Rev.08		

GENERAL	1	Tag Number		320PT-8202	
	2	Service		Air pressure	
	3	P&ID No.		N278-VD-6019-PR-PID-0002	
	4	Location		2nd stage suction	
	5	Ingress Protection		IP65	
	6	Line number		3/4"-IA-320-05-D42-H	
	7	Area classification		Safe area	
	8				
PROCESS CONDITIONS	9	Fluid	State	Air	Vapor
	10	Pressure	Norm. Max.	22,1 bar(g)	
	11	Temperature	Norm. Max.	60 °C	
	12	Design	Press. Temp.	39 bar(g)	157 °C
	13	Ambient Temp.	Min. Max.	0 °C	49 °C
	14	Setpoint	LL L	15,5 bar(g)	19 bar(g)
	15		H HH		
	16				
	17				
	18				
TRANSMITTER	19	Function		Field mounted	
	20	Element Type		Diaphragm	
	21	Element Material		SS316L	
	22	Housing Material		SS316L	
	23	Power Supply		24 VDC, 2-wire, loop powered	
	24	Process Conn.	Electric Conn.	½" NPTM	ISO M20 x 1,5
	25	Accuracy		± 0.1% of span	
	26	Calibrated Range	Unit	0...60	bar(g)
	27	Adjustable Range	Unit	VTA	bar(g)
	28	Allow. Press.	Allow. Temp.		
	29	Communication Protocol		Smart , HART	
	30	Output Signal		4 - 20 mA	
	31	Sensor Fill Fluid		Silicone oil	
	32				
	33				
	34				
	35				
	36				
OPTIONS	37	Integral Meter	Scale	Yes, LCD	bar(g)
	38	Lightning And Surge Protection		N/A	
	39	Mounting facilities		Bracket	
	40	Manifold (Block & Bleed)		Yes (2-way manifolds)	
	41	Housing ground connection		Yes, external (tightened with screws)	
	42	Cable Gland		Yes	
	43	Block valve (Hand ball valve)		Yes (3/4")	
	44	Tag plate		SS316, Plate with steel wire	
CERTIFICATES	45	Calibration certificate		Yes	
	46	3.1 Material certificate		Yes	
	47				
	48				
	49				
	50				
PURCHASE	51	Manufacturer		According to approved vendor list	
	52	Model		VTA	
	53				
	54				
	55				
	56				
	57				

NOTES :



The manifold material should be 316 Stainless Steel 2-valve complete of oval flanges with mounting bolts, gasket, etc

					INSTRUMENT DATASHEET	<div>شرکت نوسعه صنعت لاوات Lavan Industry Development Company</div> <div></div>
					Pressure Transmitter	
						
04	LK	17-4-2024	For Approval			
03	LK	11-3-2024	For Approval			
02	LK	15-12-2023	For Approval			
01	TT	9-11-2023	For Approval			Sheet 9 of 31
Rev	Bv	Date	Description			Based on P&ID Rev.08

GENERAL	1	Tag Number			320PT-8203	
	2	Service			Air pressure	
	3	P&ID No.			N278-VD-6019-PR-PID-0002	
	4	Location			Package outlet	
	5	Ingress Protection			IP65	
	6	Line number			3/4"-IA-320-10-D42-N	
	7	Area classification			Safe area	
	8					
PROCESS CONDITIONS	9	Fluid	State		Air	Vapor
	10	Pressure	Norm.	Max.	30 bar(g)	
	11	Temperature	Norm.	Max.		60 °C
	12	Design	Press.	Temp.	39 bar(g)	116 °C
	13	Ambient Temp.	Min.	Max.	0 °C	49 °C
	14	Setpoint	LL	L		25 bar(g)
	H		HH		34 bar(g)	
	15					
16						
17						
18						
TRANSMITTER	19	Function			Field mounted	
	20	Element Type			Diaphragm	
	21	Element Material			SS316L	
	22	Housing Material			SS316L	
	23	Power Supply			24 VDC, 2-wire, loop powered	
	24	Process Conn.	Electric Conn.		½" NPTM	ISO M20 x 1,5
	25	Accuracy			± 0.1% of span	
	26	Calibrated Range		Unit	0...60	bar(g)
	27	Adjustable Range		Unit	VTA	bar(g)
	28	Allow. Press.	Allow. Temp.			
	29	Communication Protocol			Smart , HART	
	30	Output Signal			4 - 20 mA	
	31	Sensor Fill Fluid			Silicone oil	
	32					
	33					
34						
35						
36						
OPTIONS	37	Integral Meter	Scale		Yes, LCD	bar(g)
	38	Lightning And Surge Protection			N/A	
	39	Mounting facilities			Bracket	
	40	Manifold (Block & Bleed)			Yes (2-way manifolds)	
	41	Housing ground connection			Yes, external (tightened with screws)	
	42	Cable Gland			Yes	
	43	Block valve (Hand ball valve)			Yes (3/4")	
	44	Tag plate			SS316, Plate with steel wire	
CERTIFICATES	45	Calibration certificate			Yes	
	46	3.1 Material certificate			Yes	
	47					
	48					
	49					
	50					
PURCHASE	51	Manufacturer			According to approved vendor list	
	52	Model			VTA	
	53					
	54					
	55					
	56					
	57					

NOTES :


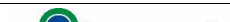
The manifold material should be 316 Stainless Steel 2-valve complete of oval flanges with mounting bolts, gasket, etc

					INSTRUMENT DATASHEET		<div>شرکت توسعه صنعت لوات Lavan Industry Development Company</div> <div></div>
					Pressure Transmitter		
							
04	LK	17-4-2024	For Approval				
03	LK	11-3-2024	For Approval				
02	LK	15-12-2023	For Approval				
01	TT	9-11-2023	For Approval				
Rev	Bv	Date	Description		Sheet 10 of 31		
					Based on P&ID Rev.08		

GENERAL	1	Tag Number		320PT-8204	
	2	Service		Liquid Pressure	
	3	P&ID No.		N278-VD-6019-PR-PID-0002	
	4	Location		Oil system	
	5	Ingress Protection		IP65	
	6	Line number		Oil pump	
	7	Area classification		Safe area	
	8				
PROCESS CONDITIONS	9	Fluid	State	Oil	Liquid
	10	Pressure	Norm. Max.	1,7 bar(g)	2 bar(g)
	11	Temperature	Norm. Max.		70 °C
	12	Design	Press. Temp.	2,5 bar(g)	85 °C
	13	Ambient Temp.	Min. Max.	0 °C	49 °C
	14	Setpoint	LL	L	
	15		H	HH	
	16				
TRANSMITTER	19	Function		Field mounted	
	20	Element Type		Diaphragm	
	21	Element Material		SS316L	
	22	Housing Material		SS316L	
	23	Power Supply		24 VDC, 2-wire, loop powered	
	24	Process Conn.	Electric Conn.	½" NPTM	ISO M20 x 1,5
	25	Accuracy		± 0.1% of span	
	26	Calibrated Range	Unit	-1...5	bar(g)
	27	Adjustable Range	Unit	VTA	bar(g)
	28	Allow. Press.	Allow. Temp.		
	29	Communication Protocol		Smart , HART	
	30	Output Signal		4 - 20 mA	
	31	Sensor Fill Fluid		Glycerin	
	32				
	33				
OPTIONS	37	Integral Meter	Scale	Yes, LCD	bar(g)
	38	Lightning And Surge Protection		N/A	
	39	Mounting facilities		Bracket	
	40	Manifold (Block & Bleed)		Yes (2-way manifolds lockable)	
	41	Housing ground connection		Yes, external (tightened with screws)	
	42	Cable Gland		Yes	
	43	Block valve (Hand ball valve)		Yes (3/4")	
	44	Tag plate		SS316, Plate with steel wire	
CERTIFICATES	45	Calibration certificate		Yes	
	46	3.1 Material certificate		Yes	
	47				
	48				
	49				
	50				
PURCHASE	51	Manufacturer		According to approved vendor list	
	52	Model		VTA	
	53				
	54				
	55				
	56				
	57				



NOTES :

The manifold material should be 316 Stainless Steel 2-valve complete of oval flanges with mounting bolts, gasket, etc

					INSTRUMENT DATASHEET	<div>شرکت توسعه صنایع لایان</div> <div>Lavan Industry Development Company</div> <div></div>	
					Pressure Transmitter		
							
04	LK	17-4-2024	For Approval				
03	LK	11-3-2024	For Approval				
02	LK	15-12-2023	For Approval				
01	TT	9-11-2023	For Approval				
Rev	Bv	Date	Description			Sheet 11 of 31	
						Based on P&ID Rev.08	



GENERAL	1	Tag Number		320TT-8201	
	2	Service		Air temperature	
	3	P&ID No.		N278-VD-6019-PR-PID-0002	
	4	Location		1st stage suction	
	5	Ingress Protection		IP65	
	6	Line number		Dampener KV-020-001	
	7	Area classification		Safe area	
	8				
PROCESS CONDITIONS	9	Fluid	State	Air	Vapor
	10	Pressure	Norm. Max.	9,5 bar(g)	
	11	Temperature	Norm. Max.	46 °C	
	12	Design	Press. Temp.	12,5 bar(g)	75 °C
	13	Ambient Temp.	Min. Max.	0 °C	49 °C
	14	Setpoint	LL	L	40 °C
	15		H	HH	
	16			50 °C	
TRANSMITTER	17	Function		Field mounted with remote element	
	18	Transmitter Type		Temperature	
	19	RTD Types Supported		N/A	
	20	Thermocouples Types Supported		Yes, TC type 'K'	
	21	MV Type Supported		N/A	
	22	Cold Junction Compensation		Internal compensation	
	23	Housing Material		SS 316	
	24	Power supply		24 VDC, 2 wire, loop powered	
	25	Electric Conn.		ISO M20 x 1,5	
	26	Accuracy		± 0.1% of span	
	27	Calibrated Range	Unit	0...100	°C
	28	Burn-out Protection/Loss of Input		Overrange	
	29	Communication Protocol		Smart , HART	
	30	Output Signal		4-20 mA	
	31	Adjustable Range		Yes	
	32				
	33				
	34				
	35				
	36				
	37				
	38				
	39				
	40				
	41				
OPTIONS	42	Integral Meter	Scale	Yes, LCD	°C
	43	Lightning And Surge Protection		N/A	
	44	Mounting facilities		Bracket	
	45	Housing ground connection		Yes, external (tightened with screws)	
	46	Cable Gland		Yes	
	47	Tag plate		SS316, Plate with steel wire	
CERTIFICATES	48	Calibration certificate		Yes	
	49				
	50				
	51				
	52				
PURCHASE	53	Manufacturer		According to approved vendor list	
	54	Model		VTA	
	55				
	56				
	57				

Notes:

					INSTRUMENT DATASHEET Temperature Transmitter	<div>شرکت توسعه صنایع لایوان</div> <div>Lavan Industry Development Company</div> <div></div>
04	LK	17-4-2024	For Approval			
03	LK	11-3-2024	For Approval		<div></div>	Sheet 12 of 31
02	LK	15-12-2023	For Approval			
01	TT	9-11-2023	For Approval			
Rev	By	Date	Description			Based on P&ID Rev.08



GENERAL	1	Thermowell Tag Number			320TW-8201	
	2	Service			Air temperature	
	3	P&ID No.			N278-VD-6019-PR-PID-0002	
	4	Location			Air inlet	
	5	Line number			Dampener KV-020-001	
	6	Area classification			Safe area	
	7					
	8					
PROCESS CONDITIONS	9	Fluid	State		Air	Vapor
	10	Pressure	Norm.	Max.	9,5 bar(g)	
	11	Temperature	Norm.	Max.	46 °C	
	12	Design	Press.	Temp.	12,5 bar(g)	75 °C
	13	Ambient Temp.	Min.	Max.	0 °C	49 °C
	14					
	15					
	16					
THERMOWELL	19	Material			SS 316	
	20	Construction			Solid bar stock	
	21	Process Connection			1 1/2" flange, RF 300#	
	22	Instrument Connection			3/4" NPT	
	23	Stem Diameter			TBD	
	24	Bore Diameter			6,6 mm	
	25	U-length			200 mm	
	26					
	27					
	28					
ELEMENT	30	Element Tag Number			320TE-8201	
	31	Construction			Sensor with lead wire, transition and relief spring	
	32	Type Of Element			Type 'K'	
	33	Accuracy Class			Class 1	
	34	Outside Diameter Sensor			6 mm	
	35	Connection			3/4" NPT	
	36	Element Length			To fit in Thermowell	
	37	Type Of Cable			Armoured	
	38	Cable Length			5 m	
	39	Sheat Material			SS 316	
	40					
	41					
	42					
	43					
OPTIONS	46					
	47					
	48					
CERTIFICATES	49	3.1 Material certificate			Yes	
	50	Calibration certificate			Yes	
	51					
	52					
CALCULATIONS	53	Wake frequency calculation			Yes	
	54					
	55					
	56					
	57					

NOTES :

					INSTRUMENT DATASHEET		<div>شرکت توسعه صنایع لایوان</div> <div>Lavan Industry Development Company</div> 
04	LK	17-4-2024	For Approval	Thermowell + Element			
03	LK	11-3-2024	For Approval				
02	LK	15-12-2023	For Approval				
01	TT	9-11-2023	For Approval				
Rev	Bv	Date	Description				Sheet 13 of 31 Based on P&ID Rev.08



GENERAL	1	Tag Number		320TT-8202	
	2	Service		Air temperature	
	3	P&ID No.		N278-VD-6019-PR-PID-0002	
	4	Location		1st stage discharge	
	5	Ingress Protection		IP65	
	6	Line number		Dampener KV-020-002	
	7	Area classification		Safe area	
	8				
PROCESS CONDITIONS	9	Fluid	State	Air	Vapor
	10	Pressure	Norm. Max.	23,3 bar(g)	
	11	Temperature	Norm. Max.	157 °C	
	12	Design	Press. Temp.	30,5 bar(g)	175 °C
	13	Ambient Temp.	Min. Max.	0 °C	49 °C
	14	Setpoint	LL	L	145 °C
	15		H	HH	
	16			165 °C	
TRANSMITTER	17	Function		Field mounted with remote element	
	18	Transmitter Type		Temperature	
	19	RTD Types Supported		N/A	
	20	Thermocouples Types Supported		Yes, TC type 'K'	
	21	MV Type Supported		N/A	
	22	Cold Junction Compensation		Internal compensation	
	23	Housing Material		SS 316	
	24	Power supply		24 VDC, 2 wire, loop powered	
	25	Electric Conn.		ISO M20 x 1,5	
	26	Accuracy		± 0.1% of span	
	27	Calibrated Range	Unit	0...250	°C
	28	Burn-out Protection/Loss of Input		Overrange	
	29	Communication Protocol		Smart , HART	
	30	Output Signal		4-20 mA	
	31	Adjustable Range		Yes	
	32				
	33				
	34				
	35				
	36				
	37				
	38				
	39				
	40				
	41				
OPTIONS	42	Integral Meter	Scale	Yes, LCD	°C
	43	Lightning And Surge Protection		N/A	
	44	Mounting facilities		Bracket	
	45	Housing ground connection		Yes, external (tightened with screws)	
	46	Cable Gland		Yes	
	47	Tag plate		SS316, Plate with steel wire	
CERTIFICATES	48	Calibration certificate		Yes	
	49				
	50				
	51				
	52				
PURCHASE	53	Manufacturer		According to approved vendor list	
	54	Model		VTA	
	55				
	56				
	57				

Notes:

					INSTRUMENT DATASHEET Temperature Transmitter	<div>شرکت توسعه صنایع لایان Lavan Industry Development Company</div> <div></div>
04	LK	17-4-2024	For Approval			
03	LK	11-3-2024	For Approval		<div></div>	Sheet 14 of 31
02	LK	15-12-2023	For Approval			
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Rev	Bv	Date	Description		Based on P&ID	Rev.08



GENERAL	1	Thermowell Tag Number			320TW-8202	
	2	Service			Air temperature	
	3	P&ID No.			N278-VD-6019-PR-PID-0002	
	4	Location			1st stage discharge	
	5	Line number			Dampener KV-020-002	
	6	Area classification			Safe area	
	7					
	8					
PROCESS CONDITIONS	9	Fluid	State		Air	Vapor
	10	Pressure	Norm.	Max.	23,3 bar(g)	
	11	Temperature	Norm.	Max.	157 °C	
	12	Design	Press.	Temp.	30,5 bar(g)	175 °C
	13	Ambient Temp.	Min.	Max.	0 °C	49 °C
	14					
	15					
	16					
THERMOWELL	19	Material			SS 316	
	20	Construction			Solid bar stock	
	21	Process Connection			1 1/2 flange, RF 600#	
	22	Instrument Connection			3/4" NPT	
	23	Stem Diameter			VTA	
	24	Bore Diameter			6,6 mm	
	25	U-length			240 mm	
	26					
ELEMENT	30	Element Tag Number			320TE-8202	
	31	Construction			Sensor with lead wire, transition and relief spring	
	32	Type Of Element			Type 'K'	
	33	Accuracy Class			Class 1	
	34	Outside Diameter Sensor			6 mm	
	35	Connection			3/4" NPT	
	36	Element Length			To fit in Thermowell	
	37	Type Of Cable			Armoured	
OPTIONS	38	Cable Length			5 m	
	39	Sheat Material			SS 316	
	40					
	41					
	42					
	43					
	44					
	45					
CERTIFICATES	46					
	47					
	48					
	49	3.1 Material certificate			Yes	
CALCULATIONS	50	Calibration certificate			Yes	
	51					
	52					
	53	Wake frequency calculation			Yes	
	54					
	55					
	56					
	57					

NOTES :

					INSTRUMENT DATASHEET Thermowell + Element	<div>شرکت نویسنه کسب لواحات Lavan Industry Development Company</div> <div></div>
04	LK	17-4-2024	For Approval			
03	LK	11-3-2024	For Approval		<div></div>	Sheet 15 of 31
02	LK	15-12-2023	For Approval			
01	TT	9-11-2023	For Approval			
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GENERAL	1	Tag Number		320TT-8203	
	2	Service		Air temperature	
	3	P&ID No.		N278-VD-6019-PR-PID-0002	
	4	Location		2nd stage suction	
	5	Ingress Protection		IP65	
	6	Line number		Dampener KV-020-003	
	7	Area classification		Safe area	
	8				
PROCESS CONDITIONS	9	Fluid	State	Air	Vapor
	10	Pressure	Norm. Max.	22,1 bar(g)	
	11	Temperature	Norm. Max.	60 °C	
	12	Design	Press. Temp.	39,0 bar(g)	157 °C
	13	Ambient Temp.	Min. Max.	0 °C	49 °C
	14	Setpoint	LL	L	
	15		H	HH	
	16			65 °C	70 °C
TRANSMITTER	17	Function		Field mounted with remote element	
	18	Transmitter Type		Temperature	
	19	RTD Types Supported		N/A	
	20	Thermocouples Types Supported		Yes, TC type 'K'	
	21	MV Type Supported		N/A	
	22	Cold Junction Compensation		Internal compensation	
	23	Housing Material		SS 316	
	24	Power supply		24 VDC, 2 wire, loop powered	
	25	Electric Conn.		ISO M20 x 1,5	
	26	Accuracy		± 0.1% of span	
	27	Calibrated Range	Unit	0...250	°C
	28	Burn-out Protection/Loss of Input		Overrange	
	29	Communication Protocol		Smart , HART	
	30	Output Signal		4-20 mA	
	31	Adjustable Range		Yes	
	32				
	33				
	34				
	35				
	36				
	37				
	38				
	39				
	40				
	41				
OPTIONS	42	Integral Meter	Scale	Yes, LCD	°C
	43	Lightning And Surge Protection		N/A	
	44	Mounting facilities		Bracket	
	45	Housing ground connection		Yes, external (tightened with screws)	
	46	Cable Gland		Yes	
	47	Tag plate		SS316, Plate with steel wire	
CERTIFICATES	48	Calibration certificate		Yes	
	49				
	50				
	51				
	52				
PURCHASE	53	Manufacturer		According to approved vendor list	
	54	Model		VTA	
	55				
	56				
	57				

Notes:

					INSTRUMENT DATASHEET Temperature Transmitter	<div>شرکت توسعه صنایع لایوان</div> <div>Lavan Industry Development Company</div> <div></div>
04	LK	17-4-2024	For Approval			
03	LK	11-3-2024	For Approval		<div></div>	Sheet 16 of 31
02	LK	15-12-2023	For Approval			
01	TT	9-11-2023	For Approval			
Rev	Bv	Date	Description			Based on P&ID Rev.08

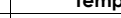

GENERAL	1	Thermowell Tag Number			320TW-8203	
	2	Service			Air temperature	
	3	P&ID No.			N278-VD-6019-PR-PID-0002	
	4	Location			2nd stage suction	
	5	Line number			Dampener KV-020-003	
	6	Area classification			Safe area	
	7					
	8					
PROCESS CONDITIONS	9	Fluid	State		Air	Vapor
	10	Pressure	Norm.	Max.	22,1 bar(g)	
	11	Temperature	Norm.	Max.	60 °C	
	12	Design	Press.	Temp.	39,0 bar(g)	157 °C
	13	Ambient Temp.	Min.	Max.	0 °C	49 °C
	14					
	15					
	16					
THERMOWELL	19	Material			SS 316	
	20	Construction			Solid bar stock	
	21	Process Connection			1 1/2 flange, RF 300#	
	22	Instrument Connection			3/4" NPT	
	23	Stem Diameter			VTA	
	24	Bore Diameter			6,6 mm	
	25	U-length			240 mm	
	26					
ELEMENT	30	Element Tag Number			320TE-8203	
	31	Construction			Sensor with lead wire, transition and relief spring	
	32	Type Of Element			Type 'K'	
	33	Accuracy Class			Class 1	
	34	Outside Diameter Sensor			6 mm	
	35	Connection			3/4" NPT	
	36	Element Length			To fit in Thermowell	
	37	Type Of Cable			Armoured	
OPTIONS	38	Cable Length			5m	
	39	Sheat Material			SS 316	
	40					
	41					
	42					
	43					
	44					
	45					
CERTIFICATES	46					
	47					
	48					
	49	3.1 Material certificate			Yes	
CALCULATIONS	50	Calibration certificate			Yes	
	51					
	52					
	53	Wake frequency calculation			Yes	
	54					
	55					
	56					
	57					

NOTES :

					INSTRUMENT DATASHEET	<div>شرکت توسعه صنایع لایان</div> <div>Lavan Industry Development Company</div> <div></div>
					Thermowell + Element	
						
04	LK	17-4-2024	For Approval			
03	LK	11-3-2024	For Approval			
02	LK	15-12-2023	For Approval			
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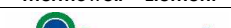
GENERAL	1	Tag Number		320TT-8204	
	2	Service		Air temperature	
	3	P&ID No.		N278-VD-6019-PR-PID-0002	
	4	Location		Second stage discharge	
	5	Ingress Protection		IP65	
	6	Line number		Dampener KV-020-004	
	7	Area classification		Safe area	
	8				
PROCESS CONDITIONS	9	Fluid	State	Air	Vapor
	10	Pressure	Norm. Max.	30 bar(g)	
	11	Temperature	Norm. Max.	116 °C	
	12	Design	Press. Temp.	39 bar(g)	135 °C
	13	Ambient Temp.	Min. Max.	0 °C	49 °C
	14	Setpoint	LL	L	105 °C
	15		H	HH	
	16				
TRANSMITTER	17	Function		Field mounted with remote element	
	18	Transmitter Type		Temperature	
	19	RTD Types Supported		N/A	
	20	Thermocouples Types Supported		Yes, TC type 'K'	
	21	MV Type Supported		N/A	
	22	Cold Junction Compensation		Internal compensation	
	23	Housing Material		SS 316	
	24	Power supply		24 VDC, 2 wire, loop powered	
	25	Electric Conn.		ISO M20 x 1.5	
	26	Accuracy		± 0.1% of span	
	27	Calibrated Range	Unit	0...160	°C
	28	Burn-out Protection/Loss of Input		Overrange	
	29	Communication Protocol		Smart , HART	
	30	Output Signal		4-20 mA	
	31	Adjustable Range		Yes	
	32				
	33				
	34				
	35				
	36				
	37				
	38				
	39				
	40				
	41				
OPTIONS	42	Integral Meter	Scale	Yes, LCD	°C
	43	Lightning And Surge Protection		N/A	
	44	Mounting facilities		Bracket	
	45	Housing ground connection		Yes, external (tightened with screws)	
	46	Cable Gland		Yes	
	47	Tag plate		SS316, Plate with steel wire	
CERTIFICATES	48	Calibration certificate		Yes	
	49				
	50				
	51				
	52				
PURCHASE	53	Manufacturer		According to approved vendor list	
	54	Model		VTA	
	55				
	56				
	57				

Notes:

					<div>INSTRUMENT DATASHEET</div> <div>Temperature Transmitter</div> <div></div>	<div>شرکت توسعه صنایع لایوان Lavan Industry Development Company</div> <div></div>
04	LK	17-4-2024	For Approval			
03	LK	11-3-2024	For Approval			
02	LK	15-12-2023	For Approval			
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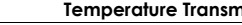
GENERAL	1	Thermowell Tag Number			320TW-8204	
	2	Service			Air temperature	
	3	P&ID No.			N278-VD-6019-PR-PID-0002	
	4	Location			Second stage discharge	
	5	Line number			Dampener KV-020-004	
	6	Area classification			Safe area	
	7					
	8					
PROCESS CONDITIONS	9	Fluid	State		Air	Vapor
	10	Pressure	Norm.	Max.	30 bar(g)	
	11	Temperature	Norm.	Max.	116 °C	
	12	Design	Press.	Temp.	39 bar(g)	135 °C
	13	Ambient Temp.	Min.	Max.	0 °C	49 °C
	14					
	15					
	16					
THERMOWELL	17					
	18					
	19	Material			SS 316	
	20	Construction			Solid bar stock	
	21	Process Connection			1 1/2 flange, RF 600#	
	22	Instrument Connection			3/4" NPT	
	23	Stem Diameter			VTA	
	24	Bore Diameter			6,6 mm	
ELEMENT	25	U-length			240 mm	
	26					
	27					
	28					
	29					
	30	Element Tag Number			320TE-8204	
	31	Construction			Sensor with lead wire, transition and relief spring	
	32	Type Of Element			Type 'K'	
OPTIONS	33	Accuracy Class			Class 1	
	34	Outside Diameter Sensor			6 mm	
	35	Connection			3/4" NPT	
	36	Element Length			To fit in Thermowell	
	37	Type Of Cable			Armoured	
	38	Cable Length			5m	
	39	Sheat Material			SS 316	
	40					
CERTIFICATES	41					
	42					
	43					
CALCULATIONS	44					
	45					
	46					
NOTES :	47					
	48					
	49					
NOTES :	50	3.1 Material certificate			Yes	
	51	Calibration certificate			Yes	
	52					
NOTES :	53	Wake frequency calculation			Yes	
	54					
	55					
NOTES :	56					
	57					
	58					

NOTES :

					INSTRUMENT DATASHEET	<div>شرکت توسعه کسب و کار لوان Lavan Industry Development Company</div> <div></div>	
					Thermowell + Element		
							
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03	LK	11-3-2024	For Approval				
02	LK	15-12-2023	For Approval				
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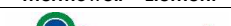
GENERAL	1	Tag Number			320TT-8205	
	2	Service			Air temperature	
	3	P&ID No.			N278-VD-6019-PR-PID-0002	
	4	Location			Package outlet	
	5	Ingress Protection			IP65	
	6	Line number			1 1/2"-IA-320-08-D42-N	
	7	Area classification			Safe area	
	8					
PROCESS CONDITIONS	9	Fluid	State		Air	Vapor
	10	Pressure	Norm.	Max.	30 bar(g)	
	11	Temperature	Norm.	Max.	60°C	
	12	Design	Press.	Temp.	39 bar(g)	116 °C
	13	Ambient Temp.	Min.	Max.	0 °C	49 °C
	14	Setpoint	LL	L		
	15		H	HH	65	70
16						
TRANSMITTER	17	Function			Field mounted with remote element	
	18	Transmitter Type			Temperature	
	19	RTD Types Supported			N/A	
	20	Thermocouples Types Supported			Yes, TC type 'K'	
	21	MV Type Supported			N/A	
	22	Cold Junction Compensation			Internal compensation	
	23	Housing Material			SS 316	
	24	Power supply			24 VDC, 2 wire, loop powered	
	25	Electric Conn.			ISO M20 x 1,5	
	26	Accuracy			± 0.1% of span	
	27	Calibrated Range		Unit	0...160	°C
	28	Burn-out Protection/Loss of Input			Overrange	
	29	Communication Protocol			Smart , HART	
	30	Output Signal			4-20 mA	
	31	Adjustable Range			Yes	
	32					
	33					
	34					
	35					
	36					
	37					
	38					
	39					
40						
41						
OPTIONS	42	Integral Meter	Scale	Yes, LCD	°C	
	43	Lightning And Surge Protection			N/A	
	44	Mounting facilities			Bracket	
	45	Housing ground connection			Yes, external (tightened with screws)	
	46	Cable Gland			Yes	
	47	Tag plate			SS316, Plate with steel wire	
CERTIFICATES	48	Calibration certificate			Yes	
	49					
	50					
	51					
	52					
PURCHASE	53	Manufacturer			According to approved vendor list	
	54	Model			VTA	
	55					
	56					
	57					

Notes:

					INSTRUMENT DATASHEET	<div>شرکت نوسان توسعه لوازم Lavan Industry Development Company</div> <div></div>	
					Temperature Transmitter		
04	LK	17-4-2024	For Approval		<div></div>		
03	LK	11-3-2024	For Approval				
02	LK	15-12-2023	For Approval				
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GENERAL	1	Thermowell Tag Number			320TW-8205	
	2	Service			Air temperature	
	3	P&ID No.			N278-VD-6019-PR-PID-0002	
	4	Location			Package outlet	
	5	Line number			1 1/2"-IA-320-08-D42-N	
	6	Area classification			Safe area	
	7					
	8					
PROCESS CONDITIONS	9	Fluid	State		Air	Vapour
	10	Pressure	Norm.	Max.	30 bar(g)	
	11	Temperature	Norm.	Max.	60 °C	
	12	Design	Press.	Temp.	39 bar(g)	116 °C
	13	Ambient Temp.	Min.	Max.	0 °C	49 °C
	14					
	15					
	16					
THERMOWELL	19	Material			SS 316	
	20	Construction			Solid bar stock	
	21	Process Connection			1" NPT	
	22	Instrument Connection			3/4" NPT	
	23	Stem Diameter			VTA	
	24	Bore Diameter			VTA	
	25	U-length			90 mm	
	26					
	27					
	28					
	29					
ELEMENT	30	Element Tag Number			320TE-8205	
	31	Construction			Sensor with lead wire, transition and relief spring	
	32	Type Of Element			Type 'K'	
	33	Accuracy Class			Class 1	
	34	Outside Diameter Sensor			6 mm	
	35	Connection			3/4" NPT	
	36	Element Length			To fit in Thermowell	
	37	Type Of Cable			Armoured	
	38	Cable Length			5m	
	39	Sheat Material			SS 316	
	40					
	41					
	42					
	43					
	44					
	45					
OPTIONS	46					
	47					
	48					
CERTIFICATES	49	3.1 Material certificate			Yes	
	50	Calibration certificate			Yes	
	51					
	52					
CALCULATIONS	53	Wake frequency calculation			Yes	
	54					
	55					
	56					
	57					

NOTES :

					INSTRUMENT DATASHEET		<div>شرکت توسعه صنایع لیاوت Lavan Industry Development Company</div> <div></div>
					Thermowell + Element		
							
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03	LK	11-3-2024	For Approval				
02	LK	15-12-2023	For Approval				
01	TT	9-11-2023	For Approval				
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GENERAL	1	Tag Number			320TG-8206	
	2	Service			Air temperature	
	3	P&ID No.			N278-VD-6019-PR-PID-0002	
	4	Location			1st stage suction	
	5	Ingress Protection			IP65	
	6	Line number			Dampener KV-020-001	
	7	Area classification			Safe area	
	8					
PROCESS CONDITIONS	9	Fluid	State		Air	Vapor
	10	Pressure	Norm.	Max.	9,5 bar(g)	
	11	Temperature	Norm.	Max.	46 °C	
	12	Design	Press.	Temp.	12,5 bar(g)	75 °C
	13	Ambient Temp.	Min.	Max.	0 °C	49 °C
	14					
	15					
	16					
GAUGE	17					
	18					
	19	Type			Bi-metallic	
	20	Range	Unit		0...100	°C
	21	Dial Size	Dial Color		100 mm	White surface, black numbers
	22	Case Material			SS316L	
	23	Stem Material			SS316L	
	24	Mounting			Locally mounted	
	25	Lens Material			Shatterproof laminated safety glass	
	26	Stem length	Stem Diameter		To fit in thermowell	6 mm
	27	External calibrator			No	
	28	Nominal Accuracy			±1.0% of full scale	
	29	Connection			3/4" NPT, to fit in thermowell	
	30	Liquid Filling			Glycerin	
	31	Tag plate			SS316, Plate with steel wire	
	32					
	33	FILLED SYSTEM	Compensation		-	
	34		Capillary Length		N/A	
	35		Capillary Material		N/A	
	36		Armor Material		N/A	
	37					
	38					
	39					
	40					
	41					
	42					
	43					
	44					
CERTIFICATES	45	Calibration certificate			Yes	
	46	3.1 Material certificate			Yes	
	47					
	48					
	49					
	50					
PURCHASE	51	Manufacturer			According to approved vendor list	
	52	Model			VTA	
	53					
	54					
	55					
	56					
	57					

NOTES :

				<div>INSTRUMENT DATASHEET</div> <div>Temperature Gauge</div> <div></div>	<div><div>شركة توسيع الخدمات لافان Lavan Industry Development Company</div><div></div></div>
04	LK	17-4-2024	For Approval		
03	LK	11-3-2024	For Approval		
02	LK	15-12-2023	For Approval		
01	TT	9-11-2023	For Approval		
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GENERAL	1	Thermowell Tag Number			320TW-8206	
	2	Service			Air temperature	
	3	P&ID No.			N278-VD-6019-PR-PID-0002	
	4	Location			1st stage suction	
	5	Line number			Dampener KV-020-001	
	6	Area classification			Safe area	
	7					
	8					
PROCESS CONDITIONS	9	Fluid	State		Air	Vapor
	10	Pressure	Norm.	Max.	9,5 bar(g)	
	11	Temperature	Norm.	Max.	46 °C	
	12	Design	Press.	Temp.	12,5 bar(g)	75 °C
	13	Ambient Temp.	Min.	Max.	0 °C	49 °C
	14					
	15					
	16					
THERMOWELL	17					
	18					
	19	Material			SS 316	
	20	Construction			Solid bar stock	
	21	Process Connection			1 1/2" flange, RF 300#	
	22	Instrument Connection			3/4" NPT	
	23	Stem Diameter			VTA	
	24	Bore Diameter			VTA, to house 6mm element	
	25	U-length			200 mm	
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					
	36					
	37					
	38					
	39					
	40					
	41					
	42					
	43					
	44					
	45					
OPTIONS	46					
	47					
	48					
CERTIFICATES	49	3.1 Material certificate			Yes	
	50					
	51					
	52					
CALCULATIONS	53	Wake frequency calculation			Yes	
	54					
	55					
	56					
	57					

NOTES :

					INSTRUMENT DATASHEET	<div>شرکت توسعه صنایع لایوان</div> <div>Lavan Industry Development Company</div> <div></div>
					Thermowell	
04	LK	17-4-2024	For Approval		<div></div>	
03	LK	11-3-2024	For Approval			
02	LK	15-12-2023	For Approval			
01	TT	9-11-2023	For Approval			
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GENERAL	1	Tag Number			320TG-8207	
	2	Service			Air temperature	
	3	P&ID No.			N278-VD-6019-PR-PID-0002	
	4	Location			1st stage discharge	
	5	Ingress Protection			IP65	
	6	Line number			Dampener KV-020-002	
	7	Area classification			Safe area	
	8					
PROCESS CONDITIONS	9	Fluid	State		Air	Vapor
	10	Pressure	Norm.	Max.	23,3 bar(g)	
	11	Temperature	Norm.	Max.	157 °C	
	12	Design	Press.	Temp.	30,5 bar(g)	175 °C
	13	Ambient Temp.	Min.	Max.	0 °C	49 °C
	14					
	15					
	16					
GAUGE	17					
	18					
	19	Type			Bi-metallic	
	20	Range	Unit		0...300	°C
	21	Dial Size	Dial Color		100 mm	White surface, black numbers
	22	Case Material			SS316L	
	23	Stem Material			SS316L	
	24	Mounting			Locally mounted	
	25	Lens Material			Shatterproof laminated safety glass	
	26	Stem length	Stem Diameter		To fit in thermowell	6 mm
	27	External Calibrator			No	
	28	Nominal Accuracy			±1.0% of full scale	
	29	Connection			3/4" NPT, to fit in thermowell	
	30	Liquid Filling			Glycerin	
	31	Tag plate			SS316, Plate with steel wire	
	32					
	33	FILLED SYSTEM	Compensation		-	
	34		Capillary Length		N/A	
	35		Capillary Material		N/A	
	36		Armor Material		N/A	
	37					
	38					
	39					
	40					
	41					
	42					
	43					
	44					
CERTIFICATES	45	Calibration certificate			Yes	
	46	3.1 Material certificate			Yes	
	47					
	48					
	49					
	50					
PURCHASE	51	Manufacturer			According to approved vendor list	
	52	Model			VTA	
	53					
	54					
	55					
	56					
	57					

NOTES :

				<div>INSTRUMENT DATASHEET</div> <div>Temperature Gauge</div> <div></div>	<div><div>شرکت نوسعه صنعت لایان Lavan Industry Development Company</div><div></div></div>
04	LK	17-4-2024	For Approval		
03	LK	11-3-2024	For Approval		
02	LK	15-12-2023	For Approval		
01	TT	9-11-2023	For Approval		
Rev	By	Date	Description		<div>Sheet24 of 31</div> <div>Based on P&IDRev.08</div>



GENERAL	1	Thermowell Tag Number			320TW-8207	
	2	Service			Air temperature	
	3	P&ID No.			N278-VD-6019-PR-PID-0002	
	4	Location			1st stage discharge	
	5	Line number			Dampener KV-020-002	
	6	Area classification			Safe area	
	7					
	8					
PROCESS CONDITIONS	9	Fluid	State		Air	Vapor
	10	Pressure	Norm.	Max.	23,3 bar(g)	
	11	Temperature	Norm.	Max.	157 °C	
	12	Design	Press.	Temp.	30,5 bar(g)	175 °C
	13	Ambient Temp.	Min.	Max.	0 °C	49 °C
	14					
	15					
	16					
THERMOWELL	17					
	18					
	19	Material			SS 316	
	20	Construction			Solid bar stock	
	21	Process Connection			1 1/2" flange, RF 600#	
	22	Instrument Connection			3/4" NPT	
	23	Stem Diameter			VTA	
	24	Bore Diameter			VTA, to house 6mm element	
	25	U-length			240 mm	
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					
	36					
	37					
	38					
	39					
	40					
	41					
	42					
	43					
	44					
	45					
OPTIONS	46					
	47					
	48					
CERTIFICATES	49	3.1 Material certificate			Yes	
	50					
	51					
	52					
CALCULATIONS	53	Wake frequency calculation			Yes	
	54					
	55					
	56					
	57					

NOTES :

					INSTRUMENT DATASHEET	<div>شرکت توسعه صنایع لایان</div> <div>Lavan Industry Development Company</div> <div></div>
					Thermowell	
						
04	LK	17-4-2024	For Approval			
03	LK	11-3-2024	For Approval			
02	LK	15-12-2023	For Approval			
01	TT	9-11-2023	For Approval			
Rev	By	Date	Description			Sheet 25 of 31 Based on P&ID Rev.08



GENERAL	1	Tag Number		320TG-8208	
	2	Service		Air temperature	
	3	P&ID No.		N278-VD-6019-PR-PID-0002	
	4	Location		2nd stage discharge	
	5	Ingress Protection		IP65	
	6	Line number		Dampener KV-020-004	
	7	Area classification		Safe area	
	8				
PROCESS CONDITIONS	9	Fluid	State	Air	Vapor
	10	Pressure	Norm. Max.	30 bar(g)	
	11	Temperature	Norm. Max.	116 °C	
	12	Design	Press. Temp.	39 bar(g)	135 °C
	13	Ambient Temp.	Min. Max.	0 °C	49 °C
	14				
	15				
	16				
GAUGE	17				
	18				
	19	Type		Bi-metallic	
	20	Range	Unit	0...200	°C
	21	Dial Size	Dial Color	100 mm	White surface, black numbers
	22	Case Material		SS316L	
	23	Stem Material		SS316L	
	24	Mounting		Locally mounted	
	25	Lens Material		Shatterproof laminated safety glass	
	26	Stem length	Stem Diameter	To fit in thermowell	6 mm
	27	External Calibrator		No	
	28	Nominal Accuracy		±1.0% of full scale	
	29	Connection		3/4" NPT, to fit in thermowell	
	30	Liquid Filling		Glycerin	
	31	Tag plate		SS316, Plate with steel wire	
	32				
	33	FILLED SYSTEM	Compensation	-	
	34		Capillary Length	N/A	
	35		Capillary Material	N/A	
	36		Armor Material	N/A	
	37				
	38				
	39				
	40				
	41				
	42				
	43				
	44				
CERTIFICATES	45	Calibration certificate		Yes	
	46	3.1 Material certificate		Yes	
	47				
	48				
	49				
	50				
PURCHASE	51	Manufacturer		According to approved vendor list	
	52	Model		VTA	
	53				
	54				
	55				
	56				
	57				

NOTES :

				INSTRUMENT DATASHEET Temperature Gauge 	 Sheet 26 of 31 Based on P&ID Rev.08
04	LK	17-4-2024	For Approval		
03	LK	11-3-2024	For Approval		
02	LK	15-12-2023	For Approval		
01	IT	9-11-2023	For Approval		
Rev	By	Date	Description		



GENERAL	1	Thermowell Tag Number			320TW-8208	
	2	Service			Air temperature	
	3	P&ID No.			N278-VD-6019-PR-PID-0002	
	4	Location			2nd stage discharge	
	5	Line number			Dampener KV-020-004	
	6	Area classification			Safe area	
	7					
	8					
PROCESS CONDITIONS	9	Fluid	State	Air	Vapor	
	10	Pressure	Norm. Max.	30 bar(g)		
	11	Temperature	Norm. Max.	116 °C		
	12	Design	Press. Temp.	39 bar(g)	135 °C	
	13	Ambient Temp.	Min. Max.	0 °C	49 °C	
	14					
	15					
	16					
THERMOWELL	19	Material			SS 316	
	20	Construction			Solid bar stock	
	21	Process Connection			1 1/2" flange, RF 600#	
	22	Instrument Connection			3/4" NPT	
	23	Stem Diameter			VTA	
	24	Bore Diameter			VTA, to house 6mm element	
	25	U-length			240 mm	
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					
	36					
	37					
	38					
	39					
	40					
	41					
	42					
	43					
	44					
	45					
	OPTIONS	46				
47						
48						
CERTIFICATES	49	3.1 Material certificate			Yes	
	50					
	51					
	52					
CALCULATIONS	53	Wake frequency calculation			Yes	
	54					
	55					
	56					
	57					

NOTES :

					INSTRUMENT DATASHEET	<div>شرکت توسعه صنایع لایان</div> <div>Lavan Industry Development Company</div> <div></div>	
					Thermowell		
04	LK	17-4-2024	For Approval	<div></div>			
03	LK	11-3-2024	For Approval				
02	LK	15-12-2023	For Approval				
01	TT	9-11-2023	For Approval				
Rev	Bv	Date	Description			Sheet 27 of 31	
						Based on P&ID Rev.08	


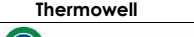
GENERAL	1	Tag Number			320TG-8209	
	2	Service			Air temperature	
	3	P&ID No.			N278-VD-6019-PR-PID-0002	
	4	Location			Package outlet	
	5	Ingress Protection			IP65	
	6	Line number			1 1/2"-IA-320-08-D42-N	
	7	Area classification			Safe area	
	8					
PROCESS CONDITIONS	9	Fluid	State		Air	Vapor
	10	Pressure	Norm.	Max.	30 bar(g)	
	11	Temperature	Norm.	Max.	60 °C	
	12	Design	Press.	Temp.	39 bar(g)	116 °C
	13	Ambient Temp.	Min.	Max.	0 °C	49 °C
	14					
	15					
	16					
GAUGE	17					
	18					
	19	Type			Gas filled	
	20	Range	Unit		0...200	°C
	21	Dial Size	Dial Color		100 mm	White surface, black numbers
	22	Case Material			SS316L	
	23	Stem Material			SS316L	
	24	Mounting			Panel mounted, with front flange	
	25	Lens Material			Shatterproof laminated safety glass	
	26	Stem length	Stem Diameter		To fit in thermowell	6 mm
	27	External Calibrator			No	
	28	Nominal Accuracy			±1.0% of full scale	
	29	Connection Size			3/4" NPT, to fit in thermowell	
	30	Gauge Filling			Glycerin	
	31	Tag plate			SS316, Plate with steel wire	
	32					
	33	FILLED SYSTEM	Compensation		-	
	34		Capillary Length		5 m	
	35		Capillary Material		SS316	
	36		Armor Material		SS316	
	37					
	38					
	39					
	40					
	41					
	42					
	43					
	44					
CERTIFICATES	45	Calibration certificate			Yes	
	46	3.1 Material certificate			Yes	
	47					
	48					
	49					
	50					
PURCHASE	51	Manufacturer			According to approved vendor list	
	52	Model			VTA	
	53					
	54					
	55					
	56					
	57					

NOTES :

				<div>INSTRUMENT DATASHEET</div> <div>Temperature Gauge</div> <div></div>	<div><div>شرکت نوسعه کنسولت لایوان Lavan Industry Development Company</div><div></div></div>
04	LK	17-4-2024	For Approval		
03	LK	11-3-2024	For Approval		
02	LK	15-12-2023	For Approval		
01	TT	9-11-2023	For Approval		
Rev	By	Date	Description		<div>Sheet28 of 31</div> <div>Based on P&IDRev.08</div>



GENERAL	1	Thermowell Tag Number			320TW-8209	
	2	Service			Air temperature	
	3	P&ID No.			N278-VD-6019-PR-PID-0002	
	4	Location			Package outlet	
	5	Line number			1 1/2"-IA-320-08-D42-N	
	6	Area classification			Safe area	
	7					
	8					
PROCESS CONDITIONS	9	Fluid	State		Air	Vapor
	10	Pressure	Norm.	Max.	30 bar(g)	
	11	Temperature	Norm.	Max.	60 °C	
	12	Design	Press.	Temp.	39 bar(g)	116 °C
	13	Ambient Temp.	Min.	Max.	0 °C	49 °C
	14					
	15					
	16					
THERMOWELL	17					
	18					
	19	Material			SS 316	
	20	Construction			Solid bar stock	
	21	Process Connection			1" NPT	
	22	Instrument Connection			3/4" NPT	
	23	Stem Diameter			VTA	
	24	Bore Diameter			VTA, to house 6mm element	
	25	U-length			90 mm	
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					
	36					
	37					
	38					
	39					
	40					
	41					
	42					
	43					
	44					
	45					
OPTIONS	46					
	47					
	48					
CERTIFICATES	49	3.1 Material certificate			Yes	
	50					
	51					
	52					
CALCULATIONS	53	Wake frequency calculation			Yes	
	54					
	55					
	56					
	57					

NOTES :

					INSTRUMENT DATASHEET	<div>شرکت نوسعه کنست لواوات Lavan Industry Development Company</div> <div></div>	
					Thermowell		
							
04	LK	17-4-2024	For Approval				
03	LK	11-3-2024	For Approval				
02	LK	15-12-2023	For Approval				
01	TT	9-11-2023	For Approval				
Rev	Bv	Date	Description			Sheet 29 of 31 Based on P&ID Rev.08	

GENERAL	1	Tag Number			320TG-8210, 320TG-8211	
	2	Service			Water temperature	
	3	P&ID No.			N278-VD-6019-PR-PID-0002	
	4	Location			Cooling water outlet	
	5	Ingress Protection			IP65	
	6	Line number			1 1/2"-CWR-320-24-B24C-N	1 1/2"-CWR-320-22-B24C-N
	7	Area classification			Safe area	
	8					
PROCESS CONDITIONS	9	Fluid	State		Water	Liquid
	10	Pressure	Norm.	Max.	4,4 bar(g)	
	11	Temperature	Norm.	Max.	36 °C	46 °C
	12	Design	Press.	Temp.	7 bar(g)	75 °C
	13	Ambient Temp.	Min.	Max.	0 °C	49 °C
	14					
	15					
	16					
GAUGE	17					
	18					
	19	Type			Gas filled	
	20	Range	Unit		0...100	°C
	21	Dial Size	Dial Color		100 mm	White surface, black numbers
	22	Case Material			SS316L	
	23	Stem Material			SS316L	
	24	Mounting			Panel mounted, with front flange	
	25	Lens Material			Shatterproof laminated safety glass	
	26	Stem length	Stem Diameter		To fit in thermowell	6 mm
	27	External Calibrator			No	
	28	Nominal Accuracy			±1.0% of full scale	
	29	Connection Size			3/4" NPT, to fit in thermowell	
	30	Gauge Filling			Glycerin	
	31	Tag plate			SS316, Plate with steel wire	
	32					
	33	FILLED SYSTEM	Compensation		-	
	34		Capillary Length		5 m	
	35		Capillary Material		SS316	
	36		Armor Material		SS316	
	37					
	38					
	39					
	40					
	41					
	42					
	43					
	44					
CERTIFICATES	45	Calibration certificate			Yes	
	46	3.1 Material certificate			Yes	
	47					
	48					
	49					
	50					
PURCHASE	51	Manufacturer			According to approved vendor list	
	52	Model			VTA	
	53					
	54					
	55					
	56					
	57					

NOTES :

				<div>INSTRUMENT DATASHEET</div> <div>Temperature Gauge</div> <div></div>	<div>شرکت توسعه صنعت لوات</div> <div></div> <div>Sheet 30 of 31</div>	<div>Based on P&ID</div> <div>Rev.08</div>
04	LK	17-4-2024	For Approval			
03	LK	11-3-2024	For Approval			
02	LK	15-12-2023	For Approval			
01	TT	9-11-2023	For Approval			
Rev	By	Date	Description			

GENERAL	1	Thermowell Tag Number		320TW-8210, 320TW-8211	
	2	Service		Water temperature	
	3	P&ID No.		N278-VD-6019-PR-PID-0002	
	4	Location		Cooling water outlet	
	5	Line number		1 1/2"-CWR-320-24-B24C-N	1 1/2"-CWR-320-22-B24C-N
	6	Area classification		Safe area	
	7				
	8				
PROCESS CONDITIONS	9	Fluid	State	Water	Liquid
	10	Pressure	Norm. Max.	4,4 bar(g)	
	11	Temperature	Norm. Max.	36 °C	46 °C
	12	Design	Press. Temp.	7 bar(g)	75 °C
	13	Ambient Temp.	Min. Max.	0 °C	49 °C
	14				
	15				
	16				
THERMOWELL	19	Material		SS 316	
	20	Construction		Solid bar stock	
	21	Process Connection		1" NPT	
	22	Instrument Connection		3/4" NPT	
	23	Stem Diameter		VTA	
	24	Bore Diameter		VTA, to house 6mm element	
	25	U-length		90 mm	
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				
	36				
	37				
	38				
	39				
	40				
	41				
	42				
	43				
	44				
	45				
	OPTIONS	46			
47					
48					
CERTIFICATES	49	3.1 Material certificate		Yes	
	50				
	51				
	52				
CALCULATIONS	53	Wake frequency calculation		Yes	
	54				
	55				
	56				
	57				

NOTES :

				INSTRUMENT DATASHEET		<div style="display: flex; align-items: center;"> <div style="margin-right: 10px;"> شركة نوسعه صنعت لوازم Lavan Industry Development Company </div> </div>
				Thermowell		
04	LK	17-4-2024	For Approval			
03	LK	11-3-2024	For Approval			
02	LK	15-12-2023	For Approval			
01	TT	9-11-2023	For Approval			
Rev	By	Date	Description			Sheet 31 of 31 Based on P&ID Rev.08

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION K-14

DOCUMENTS; COMMISSIONING AND START-UP SPARES



Vendor doc. Number




17735-19

Vendor:

Airpack Nederland B.V.

P.O. NO.:

LIDCO-PO-NEC-278-6019




	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT							
	Commissioning and Start-up Spares							
	Document No. 17735-13							Page
	Project No.	Vendor Doc.	P.O. No.	Department	Document Type	Serial No	Revision	
	N278	VD	6019	GN	OTH	0014	05	Page 1 of 3

Commissioning and Start-up Spares (K-020)

Code 1
M.Dalakeh

05	25-08-2025	Issued for Information	S.K.	M.C.	J.J.
04	20-08-2025	Issued for Information	S.K.	M.C.	J.J.
03	26-06-2025	Issued for Information	S.K.	M.C.	J.J.
02	05-02-2025	Issued for Information	M.C.	S.K.	J.J.
01	15-09-2023	Issued for Information	M.C.	S.K.	J.J.
REV.	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED

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	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT							
	Commissioning and Start-up Spares							
	Document No. 17735-13							Page
	Project No.	Vendor Doc.	P.O. No.	Department	Document Type	Serial No	Revision	Page 2 of 3
	N278	VD	6019	GN	OTH	0014	05	

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1	X	X	X	X	X	26						51						76					
2	X	X	X	X	X	27						52						77					
3	X	X	X	X	X	28						53						78					
4						29						54						79					
5						30						55						80					
6						31						56						81					
7						32						57						82					
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16						41						66						91					
17						42						67						92					
18						43						68						ATTACHMENT					
19						44						69						1					
20						45						70						2					
21						46						71						3					
22						47						72						4					
23						48						73						5					
24						49						74						6					
25						50						75						7					



فهرست قطعات یدکی و اقلام مشابه

21	EQUIPMENT CLASS رده تجهیزات												SPARE PARTS LIST AND INTERCHANGEABILITY RECORD FOR SPARE PARTS FOR 2 YEAR OPERATION												فهرست قطعات یدکی و اقلام مشابه												SPARE PARTS Commissioning and Start-up Spares																																																																																																																																														
1 EQUIPMENT REQ No. or TAG. No. شماره ثبت دستگاهها با شماره برچسب K-020												2 MANUFACTURERS MODEL مدل کارخانه سازنده RBV-130												3 MANUFACTURER'S SERIAL No. شماره سريال سازنده T-2023-00799												4 NO OF UNIT شماره دستگاهه												توضیحات:																																																																																																																																			
																																																SUBJECT : Commissioning and Start-up Spares																																																																																																																																			
																																																VENDOR : Airpack Nederland BV																																																																																																																																			
5 MANUFACTURER'S SERIAL No. شماره سريال سازنده T-2023-00799												6a 7 8 9 10 11 12 13 14 15 16												ADDRESS : Groene Weegje 19-25												DATE 26-Jun																																																																																																																																															
																								MESC NO. شماره طبقه بندی کالا												Classification of parts رده بندی قطعات					Unit Price in قیمت واحد به تقریب USD		Total Price in قیمت کل به تقریب USD		Remarks (see note 3 above) ملاحظات (رجوع شود به بند 3 توضیحات)			Item No. شماره ردیف																																																																																																																																			
5 NUMBER OF PARTS PER UNIT/ EQUIPMENT تعداد قطعات در هر دستگاهه												Set 1 Oil (5,25L required) Gasket set (39pcs)												N-278-VD-6019-PR-GAD-0003-01 NA NA												FKM Liquid Spiral wound												1 6L 1												C C C												LIDCO- PO-NEC- 278-6019- DXF-001 LIDCO- PO-NEC- 278-6019- DXF-002 LIDCO- PO-NEC- 278-6019- DXF-003																																																																																																											
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Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION K-15




DOCUMENTS; FAT PROCEDURE



Vendor doc. Number
17735-19

P.O. NO.:
LIDCO-PO-NEC-278-6019

Vendor:
Airpack Nederland B.V.

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FAT Procedure (incl. full unit mechanical run test procedure) (K-020)

Code 1
M.Dalakeh

07	20-08-2025	Issued for Approval	SK	SK	JJ
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REV.	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED




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1. Purpose

Checking the performance and functioning of the package against the approved documents and specifications.

Separate test reports for each test will be generated; however, this FAT procedure covers only the procedure to be performed on all skids.

2. Reference documents

2.1. Vendor documents




Please find below the reference vendor documents that will be used during this FAT.

N-278-VD-6019-PR-PID-0002-01	17735-03	P&ID
N-278-VD-6019-PR-GAD-0003-01	17735-04	General Arrangement Drawing
N-278-VD-6019-IN-DIA-0005-01	17735-05	Wiring Diagram (LCP and JB)
N-278-VD-6019-IN-DWG-0007-01	17735-07	Panel lay-out (LCP and JB)
N-278-VD-6019-GN-ITP-0008-01	17735-08	Inspection & Test Plan (ITP)
N-278-VD-6019-GN-PRO-0022-01	17735-21	Control Philosophy
N-278-VD-6019-GN-SF-0029-01	17735-27	Cause and Effect chart

2.2. Manufacturing data book

The manufacturing data book will also be available for review during the FAT. The MDB will be checked according to the approved MDB index and ITP.

The client or client TPI will sign the relevant pages as well as all relevant point of the ITP.

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3. Scope

One (1) Instrument air booster compressor (K-020), Vertical piston compressor with motor driver (320-KM-020), outlet capacity 35 Nm³/hr, 30 bar(g) and inlet, 9,5 bar(g). 1 duty (1x100%). The compressor is water cooled at 4,5 bar(g) inlet pressure.

The test will include:

- Main motor (KM-020)
- Intercooler and aftercooler
- 4x pulsation damper
- Oil system
- Water system
- Local panel




The compressor is equipped with:

- One (1) LPS (Local Push Button Station)
- One (1) JB (Junction Box)

4. HSE

Standard safety precautions have to be taken since we are working with pressurised air.

- Proper PPE has to be worn when working / testing the package
- All visitors for the FAT will be instructed before the FAT, about Airpack safety precautions, by Airpack Safety movie.
- All visitors will be asked to sign a disclaimer to be able to enter the hazardous area during the test.
- The test area is cordoned off to make sure non-authorized personnel does not enter this area.

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5. FAT Kick off meeting

Before starting the FAT there will be a short kick off meeting, where Airpack will explain the safety rules and regulations as well as what activities and planning will be performed during the FAT.

Kick-Off Meeting (KOM) Agenda.

- i. Introduction/Sign in (along with the name, role/designation)
- ii. HSE Induction
- iii. FAT organization, roles and responsibilities of the personnel involved.
- iv. Briefing on duration and sequence of tests planned, timing etc.

Also proper PPE will be distributed as required.

6. Roles and responsibilities




The project manager is responsible for the complete FAT. The project manager will arrange the persons who are required for each part of the FAT.

A qualified AIRPACK Technician who is familiar with the operational parameters of the Package will perform all FAT tasks.

6.1. Problem resolution

If there are any problems during the FAT, they will be rectified immediately if possible, if not possible they will be recorded in the FAT punch list and resolved before shipment / commissioning of the package.

Please find attachment 1: Punch list format.

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7. Test Instruments




The following test instruments will be used during the FAT, all instruments will have a valid calibration certificate which will be supplied as part of the FAT test results for checking and signing.

- Paint thickness meter
- Sound level meter
- Ambient pressure / temperature meter
- Multi meter (voltage check)

8. Utilities

The utilities that are available during FAT are:

- Power: 400V, 50Hz, 3ph and 230V, 50Hz, 1ph
- Cooling water supply: 4,5 bar(g), ~36 °C

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9. Test procedure

Test may not be done in below order; it is subject to availability of personnel and equipment.

9.1. Mechanical checks

The Following will be tested / checked and recorded as part of the FAT. All checks are mentioned in attachment 2: Equipment checklist

Quality

- 1 Verify all equipment are installed in accordance with approved P&ID and GAD.
- 2 Visual inspection of the complete package for quality.
- 3 Verify piping, tubing location, orientation in accordance with approved GA Drawing.

P&ID review

- 1 Verify all components are installed as per the GA Drawing.
- 2 Check that all components are tagged according to the P&ID.
- 3 Check that the location is of the components is as per the GAD.

Dimensions

- 1 Dimensional check of the complete package for compliance to approved GA Drawing.
- 2 Verification and dimensional check of Tie-in Point, lifting points.
- 3 Verification and dimensional check of foundation holes.

Painting




- 1 Check the overall paint for damages and overall quality.
- 2 Randomly check the thickness as per the approved paint procedure.
- 3 Check the paint color as per the paint procedure.

LPS and JB

- 1 Check for any loose connection in the control panel.
- 2 Verify all control panel BOM, GA, wiring, I/O etc., matches approved drawings.
- 3 Check the installation and type of cable glands.
- 4 Check the installation of the cable trays.
- 5 Check the cable type.

Instruments

- 1 Check for any loose connection of cables or wires in the instruments.
- 2 Check the installation of the instruments as per approved drawings.
- 3 Check if all instruments are tagged.
- 4 Check the quantity of the instruments.

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<div></div>	FAT Procedure (incl. full unit mechanical run test procedure)							
	Document No. 17735-14						Page	
	Project No.	Vendor Doc.	P.O. No.	Department	Document	Serial No	Revision	
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9.2. Performance test (four hours)

Test set-up for the package is as follows:

- The power from the package will come from an internal power supply
- 400V / 50Hz / 3ph and 230V / 50Hz / 1ph
- Power is ON

The following measurements will be taken during the performance test.

- Sound level at 1 metre distance from skid (max. 85 dB(A))
- The performance test will be done with ambient air. The related calculation for the outlet pressure can be found in attachment 6.
- Refer to Attachment 3 for an example of the performance test results sheet, which will be filled in during FAT.
- The piping will be sprayed and checked for leakage.

All in house instruments required / used during the test will have recent calibration certificated, which will be attached to the FAT test report.

The FAT recordings can be found in attachment 3: Performance test results

9.3. Noise level measurement

Noise test will be done during the performance test. Measuring points will be defined by a distance of 1 metre from the package and measured round the package. Final measuring point will be the same as start measure point. This is for checking correct functioning of the noise level meter.

Noise level shall not exceed 85 dB(A) for complete package at 1 metre distance (with package test blow off muffler closed).

The measurement will be recorded in attachment 4: Noise test results.

9.4 Vibration measurement

Vibration measurement will be done with job vibration transmitter unless they cannot be used. In that case a handheld analyser will be used.

The vibration is measured on the points as stated in attachment 5: Vibration test results, the values are recorded there as well.

The vibration level should not exceed an average of 10 mm/s at the compressor and the motor.



Punch List Air Compressor Package

Project: 17735-GEN

Revision

06

Dry Test

Inhouse Test

FAT

F. Inspection

Shipment

Commissioning

Item	Description	Point raised by	Action by	Completion before	Closed [date] [name]
001					
002					
003					
004					
005					
006					
007					
008					
009					
010					
011					
012					
013					
014					
015					
016					
017					
018					
019					
020					
021					
022					
023					
024					
025					
026					

FAT TEST PROCEDURE

Equipment	K-020
Customer	Lavan Industry Development Company (LIDCO)
Serial number	T-2023-00799
Project name	Integrated Methanol and Ammonia Plant
Airpack reference number	17735-COM
Date	4-8-2024
Revision	06
Document number	17735-14 Attachment 2
Handled by	SK
Number of pages	01 of 01

INSPECTION	DOCUMENT	COMPLETED	REMARKS
Quality			
1. Installation of main equipment	GAD / PID		
2. Visual inspection of overall quality	GAD / PID		
3. piping, tubing location / orientation	GAD / PID		
P&ID review			
1. Component check	P&ID		
2. Tagging of all components	P&ID		
3. Component location	P&ID		
Dimensions			
1. Overall skid dimensions	GAD		
2. Tie-in point dimensions	GAD		
3. Foundation bolt holes	GAD		
Painting			
1. Overall Paint quality	Paint procedure		
2. Paint DFT measurement	Paint procedure		
3. Paint color	Paint procedure		
Control Panel			
1. Loose connections	Wiring diagram / Panel lay-out		
2. BOM	Wiring diagram / Panel lay-out		
3. Cable glands	Wiring diagram / Panel lay-out		
4. Cable trays	Wiring diagram / Panel lay-out		
5. Cable type	Wiring diagram / Panel lay-out		
Instruments			
1. Loose connections	Wiring diagram		
2. Installation	P&ID		
3. Tagging	P&ID		
4. quantity	P&ID		

Airpack Test Engineer	Client Inspector

Notes:

FAT TEST PROCEDURE

Equipment	K-020
Customer	Lavan Industry Development Company (LIDCO)
Serial number	T-2023-00799
Project name	Integrated Methanol and Ammonia Plant
Airpack reference number	17735-COM
Date	4-8-2024
Revision	06
Document number	17735-14 Attachment 3
Handled by	SK
Number of pages	01 of 01

Performance Test Results											
											OPERATING VALUES
	00:00	00:30	01:00	01:30	02:00	02:30	03:00	03:30	04:00	UNIT	
320-PT-8201	START									bar(g)	9,5
320-TT-8201										°C	46
320-TT-8202										°C	157
320-PT-8202										bar(g)	23,3
320-TT-8203										°C	60
320-TT-8204										°C	116
320-TT-8205										°C	60
320-PG-8203										bar(g)	30
320-PT-8203										bar(g)	30
320-PG-8204										bar(g)	4,5
320-TG-8205										°C	max 46
320-PT-8204										bar(g)	1,5
Running test starting time:											
Humidity:											R.H.%
Ambient temperature:											°C
Ambient pressure:											hPa

Airpack Test Engineer	Client Inspector
Notes:	

Integrated Methanol and Ammonia Plant

Document n° : 17735-14 attachment 4

Revision : 06

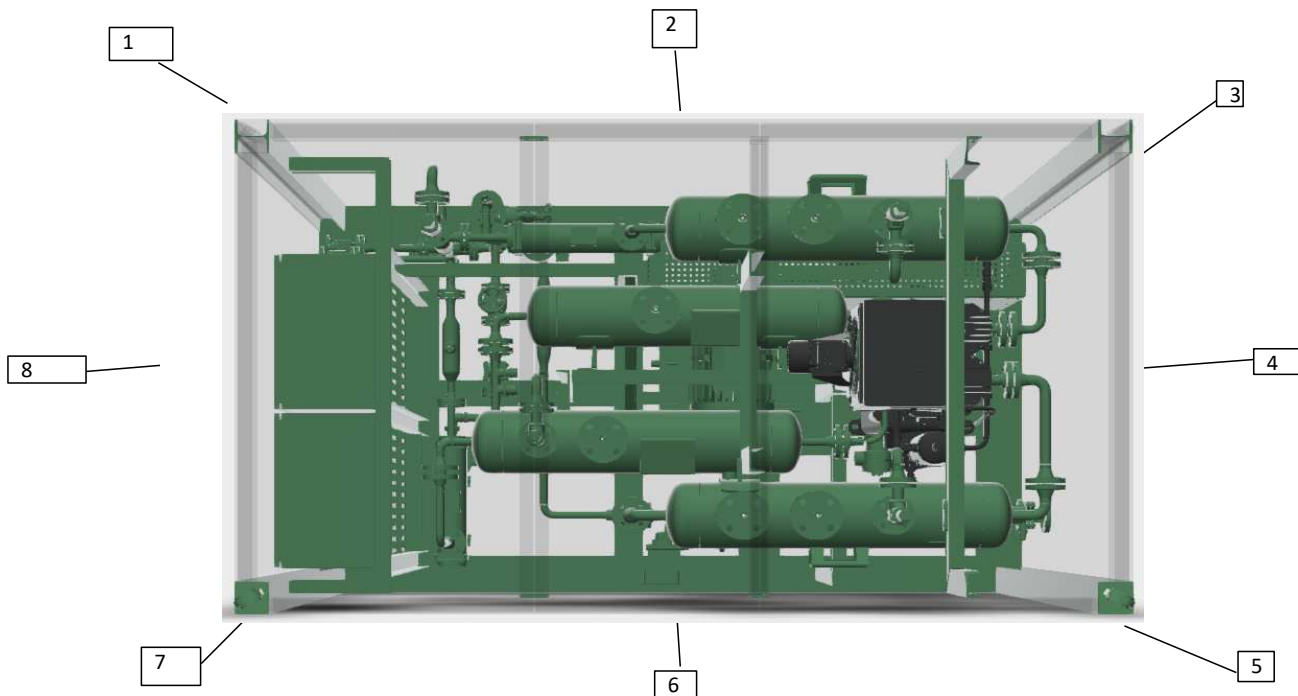
NOISE LEVEL

Unit : K-020
Service : Air booster compressor
Supplier : Airpack
Serial No. : T-2023-00799

Client: Lavan Industry Development Company (LIDCO)
Contractor: Nargan Company
Project: Integrated Methanol and Ammonia Plant

Supplier to Complete

Expected Noise Level Data



Noise test has been performed during performance test:

Procedure:

Measure point will be defined by a distance of 1 metre from the package and 1,5 metre above the ground level to measured round the package. Final measure points will be the same as start measure points. This is for checking correct functioning of the noise level meter. Noise shall not exceed 85 dB(A) for complete package. Noise meter calibration certificate is available during test

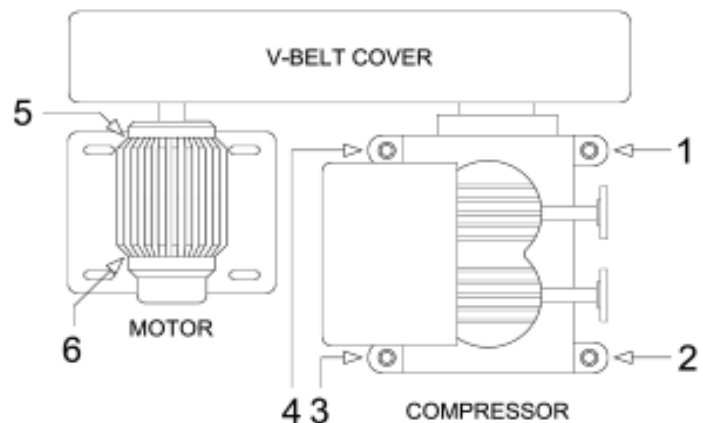
Points	Unit	Noise Estimated	Noise measured	Average of anti logs	Noise level (Logarithmic Avg)	Noise level (Arithmetic Avg)	Test Result:
P1	dB(A)	83		1	0	0	
P2	dB(A)	84					
P3	dB(A)	85					
P4	dB(A)	85					
P5	dB(A)	85					
P6	dB(A)	84					
P7	dB(A)	83					
P8	dB(A)	83					
Surrounding Noise measured (dB(A)) : 85							
Noise level (After correction (If required) as per 5.3 of ISO 2151):							
Correction Factor							
Level increase due to	Value to be subtracted from measured						
Test Condition : Noise level test as per ISO 2151							

Tested By :

Date:

NOTE:

Project	:	17735-14					
Equipment	:	K-020					
Date	:	4-8-2024					
Test Engineer(s)	:						
Vibration Test Report							
Measurement points no.as sketch	Measurement quantity: r.m.s. overall values (2 Hz. A 1000 Hz)						
	Speed	Power	H	V	L	Notes	
			horizont	vertical	axial		
			al	mm/s.	mm/s.		
	rev/min.	kW .	(M)	(M)	(M)		
Measure point tag no:							
Point 1, compressor frame							
Point 2, Compressor frame							
Point 3, Compressor frame							
Point 4, Compressor frame							
Average:							
Point 5, Motor drive end							
Point 6, Motor non drive end							
Average:							

TOP VIEW SCEMATIC


FAT TEST PROCEDURE CALCULATION

Equipment	K-020
Customer	Lavan Industry Development Company (LIDCO)
Serial number	T-2023-00799
Project name	Integrated Methanol and Ammonia Plant
Airpack reference number	17735-COM
Date	8-4-2024
Revision	06
Document number	17735-14 Attachment 6
Handled by	SK
Number of pages	01 of 01

Operation with ambient air at the inlet			
Suction conditions	1	bar absoluut	
Discharge pressure	6	bar absoluut	
Working speed	410	rpm	
Vollume flow. Approx.	3,2	Nm³/h	
Power requirement approx	1	kW	
Gas temperature 1st stage approx	112	°C	
Suction temperature 2nd stage approx	40	°C	
Gas temperature 2nd stage approx	123	°C	
max opperating time	24	hr	

Notes:
The machine operates at a 10 times smaller inlet pressure and at a pressure ration of approx. 6 instead of approx. 3.

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION K-16

DOCUMENTS; NDE PROCEDURE



Vendor doc. Number

17735-19

P.O. NO.:

LIDCO-PO-NEC-278-6019

Vendor:

Airpack Nederland B.V.

NDE Procedure

Document No. 17735-15

Page

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**Airpack B.V. - Air Compressor –
Integrated Methanol and Ammonia Plant
17735-COM NDE procedure (K020)**

REV.	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED
02	20-03-2024	Issued for Approval	F.T.	S.K.	
01	14-12-2023	Issued for Approval	S.K.	S.K.	J.J.

INSPECTION

1- APPROVED ☒

2- APPROVED AS NOTED ☐

3- NOT APPROVED ☐

BY: J.J. SIGN: *[Signature]*

NDE Procedure

Document No. 17735-15

Project No.	Vendor Doc.	P.O. No.	Department	Document Type	Serial No	Revision	Page
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1	X	X				26	X	X				51	X	X				76					
2	X	X				27	X	X				52	X	X				77					
3	X	X				28	X	X				53	X	X				78					
4	X	X				29	X	X				54	X	X				79					
5	X	X				30	X	X				55	X	X				80					
6	X	X				31	X	X				56	X	X				81					
7	X	X				32	X	X				57	X	X				82					
8	X	X				33	X	X				58	X	X				83					
9	X	X				34	X	X				59	X	X				84					
10	X	X				35	X	X				60	X	X				85					
11	X	X				36	X	X				61	X	X				86					
12	X	X				37	X	X				62	X	X				87					
13	X	X				38	X	X				63	X	X				88					
14	X	X				39	X	X				64	X	X				89					
15	X	X				40	X	X				65	X	X				90					
16	X	X				41	X	X				66	X					91					
17	X	X				42	X	X				67	X					92					
18	X	X				43	X	X				68	X					ATTACHMENT					
19	X	X				44	X	X				69	X					1					
20	X	X				45	X	X				70	X					2					
21	X	X				46	X	X				71	X					3					
22	X	X				47	X	X				72						4					
23	X	X				48	X	X				73						5					
24	X	X				49	X	X				74						6					
25	X	X				50	X	X				75						7					

INSPECTOR

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BY: DATE:

SIGN:

NARC
COMP

INSPECTION		<input checked="" type="checkbox"/> 1- APPROVED <input type="checkbox"/> 2- APPROVED AS NOTED <input type="checkbox"/> 3- NDT APPROVED BY: / REVIEW DATE: / SIGN: M. T. H.

INDEX

PROCEDURE



PAGE

MT – LIFTING LUGS



3

RT – PIPING

14

	NARGAN COMPANY
INSPECTION	
1- APPROVED	<input checked="checked" type="checkbox"/>
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BY: M. REZAEI DATE: 02-April-2024	
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MT - LIFTING LUGS

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BY: M. REZAEI DATE: 02 April 2024	
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Doc Ref : MT 19108
Revision : 1
Date : 08-03-2022
Title : Magnetic testing procedure
Client : Airpack Nederland B.V.

MAGNETIC TESTING PROCEDURE

Client : Airpack Nederland B.V.

Purpose of the examination : Magnetic particle inspection of welds.


Method : According to AWS D1.1 / D1.1M: 2015 (ASTM E709)

Issued by : Applus RTD BUA NL

Development – Revisions					
Revision no.	Prepared by	Date	Approved by	Date	Amendment details
1	Vincent Spieringhs	08-03-2022			Indicated in margin
0	Kevin Cocquyt	20-12-2019	Vincent Spieringhs	20-12-2019	

Date	08-03-2022	Date		Date	

Address
Delftweg 144, 3046 NC Rotterdam
P.O. Box 10065, 3004 AB Rotterdam
The Netherlands
www.ApplusRTD.com

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BY: M. REZAEI DATE: 08 April 2024	
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BY: M. REZAEI DATE: 08 April 2024	
SIGN: <i>M. Rezaei</i>	

1 Scope

This procedure describes the method and acceptance criteria to be used for magnetic testing on structural steel skids with AC yoke magnetisation. To be performed in conformity with the requirements of;

- AWS D1.1/D1.1M:2015 (ASTM E709)

2 Referenced documents

2.1 Applus+ RTD documents

NL-10	Written practice for the Training, Qualification, Certification and Authorization of NDT Personnel
CP 31201	Verification procedure for electric magnetic yokes
CP 31203	Verification procedure for magnetic particle suspensions
CP 31210	Verification procedure of light intensity meters

2.2 Codes and standards

ISO 9712	Qualification and certification of NDT personnel
SNT TC 1A: 2016	Personnel qualification and certification in NDT
AWS D1.1/D1.1M:2015 (ASTM E709)	Magnetic particle Examination
AWS D1.1/D1.1M:2015	Acceptance standard for magnetic particle examination

2.3 Abbreviations

AC	Alternating Current
HSE	Health Safety and Environment
kg	kilogram
MT	Magnetic Testing
NDE	Non Destructive Examination
CJP	Complete Joint Penetration
°C	Temperature in degree Celsius
mm	Millimetre
<	Less than
≥	Greater than or equal to
CJP	Complete joint penetration
NA	Not applicable

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3 General requirements

3.1 Personnel qualifications

NDE - personnel shall be qualified and certified in accordance with the valid version of Applus+ RTD written practice, which is in conformity with the recommended practice SNT-TC-1A and ISO 9712, level MT 2 as minimum.

Shall have passed an eyesight examination within the past 12 months, according the ISO 9712 section 7.4 or equivalent.

3.2 Safety precautions

All applicable HSE laws and regulations and the HSE rules of our customers shall be observed at all times. Furthermore Applus+ RTD develops its own HSE rules.

In case of conflict between rules and regulations, the strictest will prevail.
Special consideration shall be given to:

- inflammable and/or volatile materials;
- contrast paint and aerosols as used in magnetic testing;
- Extra attention at magnetic testing on hot objects > 50°C.

Use of safety gloves and eye protection is recommended.

Note:

The vapors from the consumables may be hazardous. Proper ventilation shall be provided in the case of testing being performed in a confined space. At no time during examination, shall there be exposure to any naked flames or sparks due to the flammable nature of the materials.

The use of aerosol containers and dry powders in confined spaces is dangerous and therefore it is only permitted in accordance with the Applus+ RTD safety pocketbook "working in confined spaces".

3.3 Surface preparation

Prior to the magnetic examination the surface or weld surface plus at least 25 mm on both sides of the weld, shall be dry and free of dirt, grease, coating, preserving, scale, welding flux, weld spatter, oil and other matter, that could obscure surface openings or otherwise interfere with the examination.

Typical cleaning agents which may be used are detergents, organic solvents, de-scaling solutions, and paint removers. Degreasing and ultrasonic cleaning methods may also be used.

Surface preparation by grinding or machining may be necessary where surface irregularities could mask indications or produce false indications.

3.4 Surface temperature

The surface temperature of the part to be examined (only for the "wet method") shall be within the temperature range limitations set by the manufacturer of the particles.

3.4.1 High temperature

If the (surface) temperature is > 50°C suitable consumables shall be used.

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3.5 Identification and datum position

The welds shall be identified in accordance with the client's requirements.

The marking of flaw indications on the tested component shall be considered necessary as the resultant indications found at the time of inspection cannot be considered permanent. The position of flaws shall be marked on the tested component by a method that will not affect the use of the component or prejudice any subsequent testing.

3.6 Viewing conditions

At all times during the examination with the non-fluorescent method, the light intensity at the surface to be examined shall be 1000 lux. as a minimum.

4 Equipment and consumables

4.1 Yokes

An AC magnet Yoke shall be used.

The lifting power shall be checked prior to examination, and shall be 4.5 kg as minimum at the maximum pole spacing that will be used.

The verification of the yoke shall be done once a year or whenever the yoke has been damaged or repaired, in accordance with procedure Applus+ RTD CP 31201.

A field indicator (e.g. Berthold field indicator) may be used, if necessary, to determine the field direction.

4.2 Light meters


Light meters shall be calibrated at least once a year (12 month period +/- 2 weeks) or whenever the meter has been repaired. If meters have not been in use for one year or more, calibration shall be done before being used.

The light meters have to be verified, according to Applus+ RTD verification procedure CP 31210.

4.3 Examination consumables

The examination consumables to be used must provide sufficient contrast with the surface to be examined. The examination medium shall be supplied by Applus+ RTD.

The preferred examination consumables are given on page 6; other products may be used after approval by Applus+ RTD level 3 specialist.

	
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4.3.1 Black particles (wet method)

The magnetic particles, black and fluorescent, to be used in the examination shall meet the following requirements:

- Are oil or water suspended;
- The colour of the particles shall be such as to provide an adequate contrast with the surface being examined;
- The examination consumables shall be agitated (shaken) properly, as per manufacturers' recommendation, to ensure that the dispersion of particles is equal throughout the entire use of the containers contents.
- The test medium shall be applied by either flowing or spraying over the surface. The force of the application shall be such that weakly formed indications are not disturbed or removed.

Wet particles: MR Chemie:

Type	Product	Temp. range	Suspension
• MR 76 SAS	Magnetic testink (black)	+5° to +50°C	Oil based
• MR 221 GF	Magnetic testink (black)	+5° to +50°C	Water based

These wet particles have been tested by the manufacturer for conformity. Where necessary the examination medium will be tested in accordance with verification procedure Applus+ RTD CP 31203.

4.3.2 Contrast paint

If the contrast between the surface and the examination medium is too low, a very thin contrast paint layer shall be applied to the surface.

The preferred contrast paint is given below; other contrast paint may be used after approval by Applus+ RTD level 3 specialist.

Type	Product	Temp. range	Suspension
• MR 72	White contrast paint	+5° to +50°C	
• MR 721	White contrast paint	+5° to +50°C	Water based

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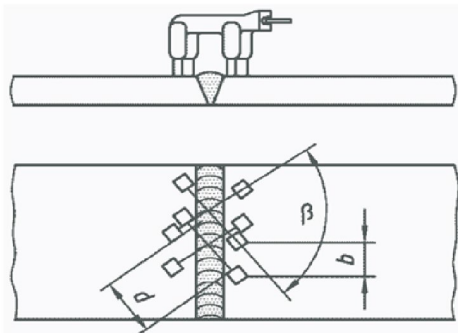
5 Examination

5.1 Examination method

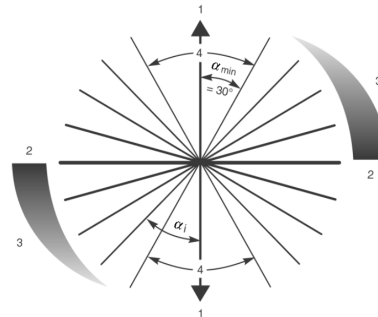
The magnetic particles used in an examination (wet or dry) shall be applied by the continuous method: The magnetizing current shall remain on while the examination medium is being applied and while excess of the examination medium will flow away, or the dry powder will be softly blown away. Following this, time shall be allowed for indications to form before removal of the magnetic field.

5.2 Direction of magnetization

To ensure detection of imperfections in all orientations, the area shall be magnetized in two directions approximately perpendicular to each other.



$d \geq 75$, $b \leq 2d$ and $\beta = 90^\circ$



α = is the angle between the magnetic field and the direction of the imperfection α_{min} = is the minimum angle for imperfection detection. α_1 = is an example of imperfection orientation.
1 = magnetic field direction, 2 = optimum sensitivity,
3 = reducing sensitivity and 4 = insufficient sensitivity

5.3 Extent of examination

The examination has to be executed in such a manner that there is sufficient overlap to ensure that 100% examination has been executed.

5.4 Demagnetization

The examined areas shall not be demagnetized after examination.

After testing with AC current, residual magnetization will normally be low and generally there is no need for demagnetization of the tested object.

5.5 Post examination cleaning

The examined areas shall not be cleaned after examination.

NARGAN COMPANY	
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BY: M. REZAEI DATE: 08 April 2024	
SIGN:	

6 Evaluation of indications

The evaluation of indications shall be done during the magnetization.

An indication of an imperfection may be larger than the real imperfection. However the size of the indication will be the basis for the evaluation.

A linear indication is an indication (piping porosity), of which the length is larger than 3 times the width.

A rounded (non-linear) indication (porosity) is an indication of circular- and/or elliptical shape with a length equal to or less than 3 times its width.

Note:

Not all of the indications are relevant, because excessive surface roughness, etc. may cause similar indications. Any questionable indications shall be re-examined, possibly after surface improvement, to determine whether or not it is relevant.

7 Acceptance standard

7.1 Choice of acceptance criteria



The client shall provide the load condition and load direction before examination.

Required info:

Statically loaded or cyclically loaded.

Tensile stress during any load condition: Yes or No.

When the load condition is unknown the used acceptance shall be cyclically loaded with tensile stress.

	
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SIGN: 	

7.2 Acceptance criteria



Acceptance according AWS D1.1: 2015 Claus 6. Table 6.1 and Clause 9, Table 9.6.

Discontinuity Category and Inspection Criteria	Table 6.1		Table 9.6
	Statically Loaded Nontubular Connections	Cyclically Loaded Nontubular Connections	Tubular Connections (All Loads)
1) Crack Prohibition <i>Any crack shall be unacceptable, regardless of size or location.</i>	X	X	X
(2) Weld/Base Metal Fusion <i>Complete fusion shall exist between adjacent layers of weld metal and between weld metal and base metal.</i>	X	X	X
(7) Undercut <i>A) For material less than 1 in [25 mm] thick, undercut shall not exceed 1/32 in [1 mm], with the following exception: undercut shall not exceed 1/16 in [2 mm] for any accumulated length up to 2 in [50 mm] in any 12 in [300 mm]. For material equal to or greater than 1 in [25 mm] thick, undercut shall not exceed 1/16 in [2 mm] for any length of weld.</i> <i>(B) In primary members, undercut shall be no more than 0.01 in [0.25 mm] deep when the weld is transverse to tensile stress under any design loading condition. Undercut shall be no more than 1/32 in [1 mm] deep for all other cases.</i>	X NA	NA X	NA X
(8) Porosity <i>(A) CJP groove welds in butt joints transverse to the direction of computed tensile stress shall have no visible piping porosity. For all other groove welds and for fillet welds, the sum of the visible piping porosity 1/32 in [1 mm] or greater in diameter shall not exceed 3/8 in [10 mm] in any linear inch of weld and shall not exceed 3/4 in [20 mm] in any 12 in [300 mm] length of weld.</i> <i>(B) The frequency of piping porosity in fillet welds shall not exceed one in each 4 in [100 mm] of weld length and the maximum diameter shall not exceed 3/32 in [2.5 mm]. Exception: for fillet welds connecting stiffeners to web, the sum of the diameters of piping porosity shall not exceed 3/8 in [10 mm] in any linear inch of weld and shall not exceed 3/4 in [20 mm] in any 12 in [300 mm] length of weld.</i> <i>(C) CJP groove welds in butt joints transverse to the direction of computed tensile stress shall have no piping porosity. For all other groove welds, the frequency of piping porosity shall not exceed one in 4 in [100 mm] of length and the maximum diameter shall not exceed 3/32 in [2.5 mm].</i>	X NA NA	NA X X	NA X X
<div>  INSPECTION 1- APPROVED <input checked="" type="checkbox"/> 2- APPROVED AS NOTED <input type="checkbox"/> 3- NOT APPROVED <input type="checkbox"/> BY: M. REZAEI DATE: 08 April 2024 SIGN:  </div>			
Discontinuities 3, 4, 5 and 6 shall only be subject to visual inspection.			
Discontinuities 2, 7 and 8 shall only be evaluated on length in case of an MPI indication and shall not be evaluated on other dimensions.			
X shall be evaluated			
NA shall not be evaluated			



8 Report

For each magnetic examination carried out a report shall be written. Each report shall contain the following information as minimum:

- Procedure number and revision;
- Examination standard, acceptance standard;
- Client;
- Date of examination;
- Equipment used and type of current;
- Magnetic particles used incl. batch numbers (wet or dry);
- Object data and examined parts;
 - base material;
 - extent of examination
 - in case of welds type of weld, welding process and filler material;
 - heat treatment (if applicable);
 - thickness;
 - temperature of the object;
- Viewing conditions(light intensity);
- Drawing or record of all indications exceeding the acceptance standard;
 - All relevant indications shall be reported with as minimum the type, location and extent (length, diameter or aligned);
- Name operator(s) qualification and signature operator(s) who performed examination.

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RT - PIPING

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RADIOGRAPHIC EXAMINATION PROCEDURE

This procedure describes the method for radiographic examination on piping welds.

Client : Airpack Netherlands B.V.
Project : MMPS Gas Compression project (MGCP)
RAMZ Project ID : SOM000MM0612-AA


The examination will be performed in accordance with the requirements of:

ASME BPVC Section V, article 2, edition 2021

This procedure shall only be used in conjunction with the following standard Applus+ technical procedures:

RT 21002 revision 29



Development – Revisions					
Revision No.	Prepared By	Date	Approved By	Date	Amendment Details
00	VMJ.Spieringhs	15-03-2022			
<div>VMJ Spieringhs RT3 ISO 9712/N43899 2022.03.15 11:15:52 +01'00'</div>					
Date:	15-03-2022	Date:		Date:	
Address Delftweg 144, 3046 NC Rotterdam P.O. Box 10065, 3004 AB Rotterdam The Netherlands www.ApplusRTD.com					
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Doc Ref : 2022 0021
Revision : 00
Date : 15-03-2022
Title : Radiographic Examination Procedure B.V.
Client : Airpack Netherlands

Revision History



Revision Number	Date	Section	Brief Description of change	Author of Change
0	15-03-2022		Issued as new document	VMJ.Spieringhs

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Doc Ref : 2022 0021
Revision : 00
Date : 15-03-2022
Title : Radiographic Examination Procedure B.V.
Client : Airpack Netherlands

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1 Scope

This procedure describes the amendments to the following standard Applus+ technical procedure:

- RT 21002 revision 29



Amendments to the following paragraphs of standard procedure RT 21002

5.2 Films

The films to be used shall be in accordance to the ISO 11699-1, class C5 (e.g. Agfa D7) or better.
For wall thicknesses $\leq 15\text{mm}$ class C3 (e.g. Agfa D4) films are recommended.

The films must be free of defects that disturb the evaluation of the results of the radiographic examination.
The following disturbances are also unacceptable:

- Repairs carried out on films due to improper treatment or development.
- Scratches and contamination.
- Static discharge.
- Indications of defect screens or carrier errors.

	
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RADIOGRAPHIC EXAMINATION PROCEDURE

Radiographic Examination of welds and materials including castings in metallic materials up to 75 mm.

To be performed in conformity with the requirements of:

ASME BPVC Section V, article 2, edition 2021

Development – Revisions					
Revision No.	Prepared By	Date	Approved By	Date	Amendment Details
29	T. Cornelissen	16-12-2021	T. Speelmeijer	16-12-2021	
28		17-12-2019		17-12-2019	
0		01-08-1991			



Digitally signed
by Theo
Cornelissen
Date: 2021.12.17
08:45:57 +01'00'

Theo Speelmeijer
MT3 PT3 RT3 UT3
Theo Speelmeijer

Date: 16-12-2021
Address
Delftweg 144, 3046 NC Rotterdam
P.O. Box 10065, 3004 AB Rotterdam
The Netherlands
www.ApplusRTD.com

Date: 16-12-2021



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Revision History

Revision Number	Date	Section	Brief Description of change	Author of Change
0	01-08-1991		Issued as new document	
10	18-10-2001	5.1		A. Kuiper
11	17-03-2003		Addenda 2002 updated	H. Luykx
12	09-07-2003		Se75 added	H. Luykx
13	03-02-2004	2.1	Addenda A03 updated	P. Briggeman
14	03-02-2005		Updated to edition 2004	
15	30-08-2006		Updated to edition 2004 including addenda 2005	P. Briggeman
16	11-01-2007		Updated to edition 2004 including addenda 2006	P. Briggeman
17	20-09-2007		Updated to ASME BPV edition 2007	P. Briggeman
18				
19	20-10-2009		Revised to addenda 2009	P. Briggeman
20	14-12-2010		Revised to edition 2010	R. Penders
21	15-12-2011		Revised to edition 2011	R. Penders
22	01-06-2012	2.1		R.A. Coenen
23	10-09-2013	2.1, 2.3.1, 2.5, 3.2, 3.3, 3.4, 3.5, 4.5, 5.1, 7		P. Briggeman
24	05-05-2014	2.1, 2.7, 3.6, 4.5.2,		P. Briggeman
25	25-10-2015		Updated to edition 2015	P. Briggeman
26	25-02-2016	8		P. Briggeman
27	12-12-2017	3.5, 5.5,	Updated to edition 2015	P. Briggeman
28	17-12-2019		Complete revised and updated to ASME BPVC code V, 2019.	M. Vondenhoff
29	16-12-2021	1, 2, 4, 5.1, 5.3, 6.1, 6.2, 6.6, 6.8, 6.11	Updated to the ASME BPVC section V 2021 edition and amended castings	T. Speelmeijer

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1 Scope

This procedure describes the method of examination of welds (up to 75 mm) and materials including castings in metallic materials according to the requirements as described in the:

- ASME BPVC Section V, article 2 edition 2021.

2 References and abbreviations



For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

2.1 Applus+ documents

- NL-10 Written practice for the Training, Qualification, Certification and Authorization of NDT Personnel.
- CP 31003 Verification procedure for film densitometers.
- CP 31014 Verification procedure for illuminators used for industrial radiographs.

2.2 Codes and standards

- ASME BPVC Section V ASME Boiler and Pressure Vessel Code, an International Code, Non-destructive Examination.
- ASTM E-747 Standard Guide for Design, Manufacturing and Material Grouping Classification of Wire IQI used for Radiology.
- ASTM E-999 Standard Guide for Controlling the Quality of Industrial Radiographic Film Processing.
- ASTM E-1025 Standard Practice for Design, Manufacture, and Material Grouping of Hole-Type IQI used for Radiology.
- ASTM E-1165 Standard Test Method for Measurement of Focal Spots of Industrial X-Ray Tubes by Pinhole Imaging.
- ISO 11699-1 Non-destructive testing - Industrial radiographic film - Part 1: Classification of film systems for industrial radiography
- ISO 19232-1 Non-destructive testing — Image quality of radiographs — Part 1: Determination of the image quality value using wire-type image quality indicators.
- ISO 19232-2 Non-destructive testing — Image quality of radiographs — Part 2: Determination of the image quality value using step/hole-type image quality indicators
- ISO 9712: 2012 Qualification and certification of NDT personnel.
- SNT-TC-1A : 2016 Personnel qualification and certification in non-destructive testing.
- CI 5A/5B Ionizing radiation course.

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2.3 Abbreviations

b	Object to film distance.
D	Distance from source of radiation to weld or object being radiographed.
D _e	Nominal external diameter of the pipe
d	Distance from source side of weld or object being radiographed to the film.
DWE	Double Wall Exposure.
DWV	Double Wall Viewing.
F	Source size: the maximum projected dimension of the radiating source (or effective focal spot) in the plane perpendicular to the distance D from the weld or object being radiographed.
f _{min}	Minimum source to object distance.
HSE	Health Safety and Environment.
IQI	Image quality indicator.
kV	kilo Voltage.
mA	milli Amperage.
NDT	Non Destructive Testing.
RT	Radiographic Testing.
S	Radiation source.
SWE	Single Wall Exposure.
SWV	Single Wall Viewing.
t	Nominal Wall thickness.
U _g	Geometric unsharpness.
w	Penetrated Thickness.

3 Safety

All applicable laws and regulations on both Applus+ HSE rules and Clients HSE rules shall be observed at all times.

In case of conflict between the different rules and regulations, the strictest will prevail.

3.1 Radiation Safety

Exposure of any part of the human body to X-ray or γ-ray can be highly injurious to health. Wherever X-ray or γ-ray equipment is in use, adequate precautions shall be taken to protect the radiographer and any other person in the vicinity.

Established safety precautions shall be strictly observed and everyone working with ionising radiation shall be certified with a radiation safety course.

For radiation monitoring only calibrated dose rate meters shall be used.

Maximum radiation at the border marked with radiation signs of the radiation working shall be in accordance with local regulations.

At least one of the crew operators shall have followed and passed a radiation safety course like CI 5A/5B, TMS or equivalent.



4 Personnel qualifications

NDE personnel shall be qualified and certified in accordance with the valid version of Applus+ Written Practice, which is in conformity with ISO 9712 and SNT-TC-1A.

The radiographic examination should be performed by personnel qualified with level RT 2 as minimum.

RT level 1 personnel and trainees shall only perform the examination under supervision of RT level 2 personnel as minimum.

All NDE personnel shall have passed a current eyesight examination within the past 12 months, according to the ISO 9712 section 7.4 or equivalent.

	
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5 Equipment and materials

5.1 Equipment

For X-ray:

Tube energy range up to 300 kV.

For examination of aluminium welds an X-ray tube with Beryllium window shall be used.

For γ-ray:

Iridium 192 (Ir192).

Selenium 75 (Se75).

Cobalt 60 (Co60).

5.2 Films

The films to be used shall be in accordance to the ISO 11699-1, class C5 (e.g. Agfa D7) or better.

The films must be free of defects that disturb the evaluation of the results of the radiographic examination.

The following disturbances are also unacceptable:

- Repairs carried out on films due to improper treatment or development.
- Scratches and contamination.
- Static discharge.
- Indications of defect screens or carrier errors.

5.2.1 Developing of films

Developing of films should be done automatically or manual in accordance to SE-999 and chemicals of the manufacturers developing machine conditions.

Tenability of the radiographs shall be at least 10 years. This can be verified with a Thiosulphate test.

5.2.2 Storage of films


All unexposed films shall be stored in a clean, dry place where the conditions will not detrimentally affect the emulsion. If any question arises about the condition of the unexposed film, sheets from the front and back of each package or a length of film equal to the circumference of each original roll shall be processed in the normal manner without exposure to light or radiation.

If the processed film shows fog, the entire box or roll from which the test film was removed shall be discarded, unless additional tests prove that the density of the remaining film is less than 0.3.

5.2.3 Screens

Ready pack films without lead screen shall be used when applied energy is below 100 kV.

Ready pack films with lead screens 0.027 mm thickness on front and back side of the film shall be used when applied energy is over 100 kV.

	
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5.3 Image Quality Indicator (IQI)

IQIs shall be either the wire type or hole type.

Wire-type IQIs shall be manufactured and identified in accordance with the requirements as per ASME BPVC V SE-747, except that the largest wire number or the identity number may be omitted.

Hole-type IQIs shall be manufactured and identified in accordance with the requirements as per ASME BPVC V SE-1025.

ASME BPVC V standard IQIs shall consist of those in Table T-233.2 for wire type and those in Table T-233.1 for hole type (refer to Attachment D: IQI-wire / hole number).

Alternate IQIs (e.g. ISO 19232-1 for wire type and ISO 19232-2 for hole type) are acceptable if the sensitivity is at least the thinnest required visible wire/hole as described in the ASME BPVC V article 2, as shown in Table 1: ASME and ISO material groups of this procedure.

In addition, any group IQI may be used for any material with a higher group number provided the applicable quality level is maintained.

ASME BPVC V material group		IQI material	Examined material	Equivalent IQI ISO 19232 -1 and -2
Light materials	01	Titanium	Titanium and alloys of which Titanium is the predominant alloying constituent	EN - TI
	02	Aluminium	Aluminium and alloys of which Aluminium is the predominant alloying constituent	EN - AL
Heavy materials	1	Carbon steel or Type 300 series Stainless steel	Carbon steel, low-alloy steels, stainless steels, and manganese-nickel-aluminium bronze (Superston).	EN - FE
	2	Aluminium Bronze (Alloy No. 623 of Specification B150M) or equivalent, or Nickel-Aluminium Bronze (Alloy No. 630 of Specification B150M) or equivalent	Aluminium Bronzes and all Nickel-Aluminium Bronzes	EN - Fe
	3	Nickel-chromium-iron alloy (UNS No. N06600) (Inconel)	Nickel-chromium-iron alloy and 18 % nickel-maraging steel	EN - Fe
	4	70 to 30 nickel-Copper alloy (Monel) (Class A or B of Specification B164) or equivalent, or 70 to 30 Copper-Nickel alloy (Alloy G of Specification B161) or equivalent	Nickel, copper, all nickel-copper series, or copper-nickel series of alloys, and all brasses (copper-zinc alloys). Group 4 IQI's may include the leaded brasses since leaded brass increases in attenuation with increase in lead content.	EN - CU
	5	Tin bronze (Alloy D of Specification B139/B139M).	Tin bronzes including gun-metal and valve bronze, or leaded-tin bronze of higher lead content than valve bronze. Group 5 IQI's may include bronze of higher lead content since leaded bronze increases in attenuation with increase in lead content. This would be equivalent to using a lower group IQI.	EN - CU

In addition, any group IQI may be used for any material with a higher group number provided the applicable quality level is maintained

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Table 1: ASME and ISO material groups

5.4 Densitometer

A densitometer with valid verification according Applus+ verification procedure CP-31003 shall be used.

6 Examination

6.1 Choice of examination energy / radioactive source

The radiation energy employed for any radiographic technique shall achieve the density and IQI image requirements.

6.1.1 Examination with X-ray

A guidance for the choice of maximum allowable energy:

- Steel, 100 kV + 8 kV/mm (w).
- Aluminium, 50 kV + 2 kV/mm (w).

6.1.2 Examination with γ -ray sources.

The recommended minimum penetrated thickness for which radioactive isotopes will be used as follows:

- For Ir192 applicable for $20 \text{ mm} \leq w$.
- For Se75 applicable for $10 \text{ mm} \leq w \leq 40 \text{ mm}$.
- Co60 for castings.

When it is not practical to perform radiography within the limitations outlined above, the procedure shall be proven satisfactory by actual demonstration of IQI image requirements on the required thickness of the material radiographed.

6.2 Surface preparations

6.2.1 Welds

The weld ripples or weld surface irregularities on both the inside (where accessible) and outside shall be removed by any suitable process to such a degree that the image of surface irregularities cannot mask or be confused with the image of any discontinuity on the resulting radiograph.



6.2.2 Materials including castings

Surfaces shall satisfy the requirements of the applicable materials specification or referencing Code Section, with additional conditioning, if necessary, by any suitable process to such a degree that the images of surface irregularities cannot mask or be confused with the image of any discontinuity on the resulting radiograph.

6.3 Backscatter radiation check

A lead symbol "B", with minimum dimensions of 11 mm in height and 1.5 mm in thickness, shall be attached to the back of each pre packed film during each exposure to determine if backscatter radiation is exposing the film.

The lead symbol "B" shall be placed in a location so that it would appear within an area on the radiograph that meets the density requirement.

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6.4 System of identification

A system of identification shall be used to produce permanent identification on the radiograph traceable to:

- The contract.
- Component.
- Weld or weld seam or Part/object numbers.
- Date.

On clients request the following items can amended to the radiograph:

- The manufacturer's or stamp holder's symbol or name.
- NDT contractor's name or symbol.

This identification system does require that the information which is not appearing as radiographic image shall be recorded in another permanent way. In all cases, this information shall not obscure the area of interest.

6.4.1 Repair identification

Radiographs of repairs shall be identified by the letter R and may include -1, -2 etc. for the number of repairs or as otherwise agreed.

6.5 Monitoring density limitations of radiographs

A calibrated densitometer shall be used for measuring film density (see paragraph 5.4).

6.6 Radiographic technique

A single-wall exposure technique shall be used for radiography whenever practical.

When it is not practical to use a single-wall technique, a double-wall technique may be used. For exposure arrangements see Attachment A: Exposure arrangements.

6.6.1 Single-wall technique.

In the single-wall technique, the radiation passes through only one wall of the material (weld), which is viewed for acceptance on the radiograph.

6.6.2 Double-wall technique.

When it is not practical to use a single-wall technique, one of the following double-wall techniques shall be used.

(a) Single-wall viewing. For materials and for welds in components, a technique may be used in which the radiation passes through two walls and only the weld (material) on the film-side wall is viewed for acceptance on the radiograph, refer to Attachment B: guideline for number of exposures.

(b) Double-wall viewing. For materials and for welds in components ≤ 89 mm in nominal outside diameter, a technique may be used in which the radiation passes through two walls and the weld (material) in both walls is viewed for acceptance on the same radiograph.

(1) For welds, the radiation beam may be offset from the plane of the weld at an angle sufficient to separate the images of the source-side and film-side portions of the weld so that there is no overlap of the areas to be interpreted. When complete coverage is required, a minimum of two exposures taken 90° to each other shall be made for each joint.

(2) As an alternative, the weld may be radiographed with the radiation beam positioned so that the images of both walls are superimposed. When complete coverage is required, a minimum of three exposures taken at either 60° or 120° to each other shall be made for each joint.

(3) Additional exposures shall be made if the required radiographic coverage cannot be obtained using the minimum number of exposures indicated in (1) or (2) above.

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6.7 Direction of radiation

The direction of the central beam of radiation should be centred on the area of interest whenever practical.

6.8 Geometric un-sharpness

Geometric unsharpness of the radiograph shall be determined with the following formula:

$$U_g = Fd/D$$

D and d shall be determined at the approximate center of the area of interest.

The geometric un-sharpness of the radiograph shall not exceed:

- 0.51 mm for wall thickness under 50 mm.
- 0.76 mm for wall thickness from 50 through 75 mm.
- 1.02 mm for wall thickness from 75 through 100 mm.

6.9 Location markers

Location markers or measure tape markers (max. interval 50mm) shall be placed on the part, and shall appear as radiographic images on the film. Their locations or "0" point shall be permanently marked on the surface of the part being radiographed or on a map, in a manner that the area of interest on the radiograph is accurately traceable to its location and provide evidence on the radiograph that the required coverage of the region being examined has been obtained.

Location markers shall be placed as follows according to Attachment C: location markers.

6.9.1 Single-wall viewing

(a) *Source side markers* Location markers shall be placed on the source side when radiographing the following:

1. Flat components or longitudinal joints in cylindrical or conical components.
2. Curved or spherical components whose concave side is toward the source and when the source to material distance is less than the inside radius of the component.
3. Curved or spherical components whose convex side is toward the source.

(b) *Film side markers* Location markers shall be placed on the film side when radiographing either curved or spherical components whose concave side is toward the source and when the source to material distance is equal to or greater than the inside radius.

6.9.2 Double-wall viewing method

For double-wall viewing at least one location marker shall be placed on the source side surface adjacent to the weld (or on the material in the area of interest) for each radiograph.

6.9.3 Mapping the placement of location markers

When inaccessibility or other limitations prevent the placement of markers as stipulated before dimensioned map of the actual marker placement shall accompany the radiographs and shall show that full coverage has been obtained.

 NARGAN COMPANY	
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
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BY: M. REZAEI DATE: 02/09/2024	
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6.10 IQI selection

IQI(s) shall be selected from either the same alloy material group or grade, or from a group with less radiation absorption than the material being radiographed. The designated hole or essential wire shall be as specified in the table below.

A smaller hole or a thinner wire than listed for each range may be used, provided equivalent penetrameter sensitivity and all other requirements for radiography are met.

The thickness on which the IQI is based is the nominal single-wall material thickness plus the weld reinforcement thickness estimated to be present on both sides of the weld (I.D. and O.D.). The values used for the estimated weld reinforcement thicknesses shall be representative of the weld conditions and shall not exceed the maximums permitted by the referencing Code Section. Physical measurement of the actual weld reinforcements is not required. Backing rings or strips shall not be considered as part of the thickness in IQI selection.

Required sensitivity for hole-type IQI is the 2T-hole and for wire-type IQI is the essential wire number see table IQI selection.

Single Wall Material Thickness Range plus estimated weld reinforcement [mm]	Source Side			Film Side		
	Essential ISO wire	Essential ASTM wire	Plate No. 2T hole	Essential ISO wire	Essential ASTM wire	Plate No. 2T hole
Up to 6.4 incl.	13	5	12	14	4	10
Over 6.4 through 9.5	12	6	15	13	5	12
Over 9.5 through 12.7	11	7	17	12	6	15
Over 12.7 through 19.0	10	8	20	11	7	17
Over 19.0 through 25.4	9	9	25	10	8	20
Over 25.4 through 38.1	8	10	30	9	9	25
Over 38.1 through 50.8	7	11	35	8	10	30
Over 50.8 through 63.5	6	12	40	7	11	35
Over 63.5 through 101.6	5	13	50	6	12	40

Table 2: IQI selection

Note; if on request where the IQI(s) are placed on the film side, the technique shall be qualified by demonstrating the required sensitivity with a source side IQI on a test piece.

6.11 IQI(s) placement

The IQI(s) shall be placed on the source side of the part being examined, except for the condition described in 6.12.2.

When, due to part or weld configuration or size, it is not practical to place the IQI(s) on the part or weld, the IQI(s) may be placed on a separate block. Separate blocks shall be made of the same or radiographically similar materials (as defined in table 1) and may be used to facilitate IQI positioning. There is no restriction on the separate block thickness, provided the IQI/area-of-interest density tolerance requirements are met.

The IQI(s) identification and the letter "F" if used shall not in the area of interest, except when geometric configuration makes it impractical.

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6.11.1 IQI(s) location

The hole type IQI(s) will be placed adjacent to or on the weld (see Figure 1). The wire type IQI(s) will be placed on the weld so that the length of the wires is across the length of the weld (see Figure 2) and not parallel to the weld (see Figure 3).



Figure 1: Hole type IQI



Figure 2: Wire type IQI



Figure 3: Not correct IQI placement

6.11.2 Film side IQI(s)

Where inaccessibility prevents hand placing the IQI(s) on the source side, it shall be placed on the film side in contact with the part being examined. A lead letter "F" shall be placed adjacent to or on the IQI(s).

6.12 Number of IQIs

For objects where one or more films are used for an exposure, at least one IQI image shall appear on each radiograph except for cylindrical welds where the source is placed on the axis of the object and one or more film holders are used for a single exposure of a complete circumference three IQIs shall be spaced approximately 120° apart. Where sections of longitudinal welds adjoining the circumferential weld are radiographed simultaneously, an additional IQI shall be placed on each longitudinal weld at the end of each section most remote from the junction with the circumferential weld being radiographed.

6.13 Shims under hole type IQIs

A shim of material radiographically similar to the weld metal shall be placed between the part and the hole type IQI, if needed, so that the radiographic density throughout the area of interest is no more than minus 15% (lighter than) the radiographic density through the IQI. The shim dimensions shall exceed the IQI dimensions such that the outline of at least three sides of the IQI image shall be visible on the radiograph.

6.14 Number of exposures for circumferential welds

An adequate number of exposures shall be made to demonstrate that the required coverage has been obtained.

Number of exposures (as shown in Attachment D) can be used as a guide line, for x-rays and gamma-rays.

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7 Evaluation of the radiograph

7.1 Quality of radiographs

All radiographs shall be free from mechanical, chemical, or other blemishes to the extent that they cannot mask or be confused with the image of any discontinuity in the area of interest of the object being radiographed.

Such blemishes include, but are not limited to:

- Fogging.
- Processing defects such as streaks, watermarks, or chemical stains.
- Scratches, finger marks, crimps, dirtiness, static marks, smudges, or tears.
- False indications due to defective screens.

7.2 Radiographic density

7.2.1 Density limitations

The transmitted film density through the radiographic image of the body of the designated IQI and the area of interest shall be 1.8 minimum for single film viewing for radiographs made with an X-ray source and 2.0 minimum for radiographs made with a gamma ray source.

The maximum density shall be 4.0 for single film viewing, the maximum density of the film assessed shall never exceed the light intensity incident of the viewer.

A tolerance of 0.05 in density is allowed for variations between densitometer readings.

7.2.2 Density variation

If the density of the radiograph anywhere through the area of interest varies more than minus 15% or plus 30% from the density through the body of the hole type IQI or adjacent to the designated wire of the wire IQI, within the minimum/maximum allowable density ranges specified above, then an additional IQI shall be used for each exceptional area or areas and the radiograph retaken. When calculating the allowable variation in density, the calculation may be rounded to the nearest 0.1 within the range specified above.


When shims are used the plus 30% density restriction may be exceeded and the minimum mentioned above does not apply, provided the required IQI sensitivity is met.

7.3 IQI sensitivity

Radiography shall be performed with a technique of sufficient sensitivity to display the designated hole type IQI image and the essential hole or essential wire of the wire type IQI. The radiographs shall also display the IQI identifying numbers and letters. For wire-type IQIs, the essential wire shall be visible within the area of interest representing the thickness used for determining the essential wire, inclusive of the allowable density variations.

7.4 Excessive backscatter

If a light image of the "B", specified in 6.3, appears on a darker background of the radiograph, protection from backscatter is insufficient and the radiograph shall be considered unacceptable. A dark image of the "B" on a lighter background will be acceptable if the image cannot be confused with a defect.

	
INSPECTION	
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7.5 Acceptance criteria radiograph

Density X-ray 1.8 – 4.0 according paragraph to 7.2.

Density Y-ray 2.0 – 4.0 according paragraph to 7.2.

Required IQI visible in area of interest according paragraph to 6.11.

No excessive backscatter or light B according paragraph to 6.4.

Film identification, weld number, date, manufacture logo and object according paragraph to 6.5.

Text and measurement markers not in area of interest.

Number of films considering effective film length.

8 Report



For a proper interpretation of the radiographs, the report accompanying each group of radiographs shall contain, as a minimum, the following information:

- Procedure and revision number used.
- Identification to the contract, component and weld.
- Identification of exposure arrangement.
- Map of location marker placement, when applicable.
- Number of exposures.
- Isotope or applied X-ray kV.
- Effective focal spot sizes (F).
- Material type and thickness range, weld thickness and reinforcement.
- Source-to-object distance (D).
- Distance from source side of object to film (d).
- Film brand and designation.
- Number of films per cassette.
- Single- or double-wall exposure/viewing.
- Date of examination.
- Name and level personnel.

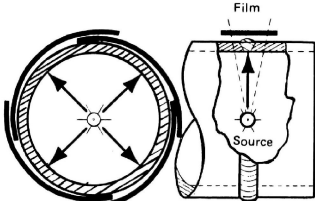
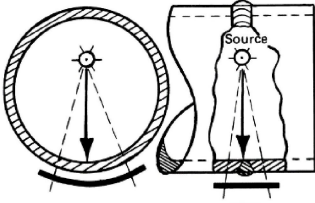
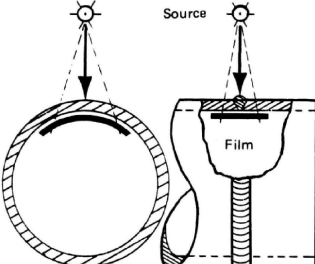
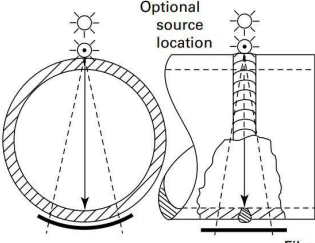
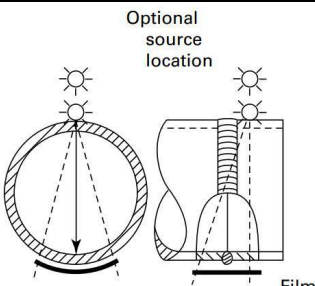
8.1 Radiograph review form.

The Manufacturer shall be responsible for the preparation of a radiograph review form. As a minimum, the following information shall be provided:

- A listing of each radiograph location.
- Evaluation and disposition of the weld(s) examined.
- Identification of the manufacturer's representative who performed the final acceptance of the radiographs (if applicable).
- Date of manufacturer's evaluation (if applicable).

	
INSPECTION	
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Attachment A Exposure arrangements

Pipe O.D.	Exposure technique	Radiograph Viewing	Source-Weld-Film Arrangement		IQI		Location marker placement
			End view	Side view	selection	placement	
Any	Single wall 6.6.1	Single wall	 <p>Exposure arrangement - A</p>		6.10	6.11 Source or film side	Attachment C
Any	Single wall 6.6.1	Single wall	 <p>Exposure arrangement - B</p>		6.10	6.11 Source or film side	Attachment C
Any	Single wall 6.6.1	Single wall	 <p>Exposure arrangement - C</p>		6.10	6.11 Source side	Attachment C
Any	Double wall 6.6.2	Single wall	 <p>Exposure arrangement - D</p>		6.10	6.11 Source or film side	Attachment C
Any	Double wall 6.6.2	Single wall	 <p>Exposure arrangement - E</p>		6.10	6.11 Source or film side	Attachment C

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SIGN: <i>M. Rezaei</i>	

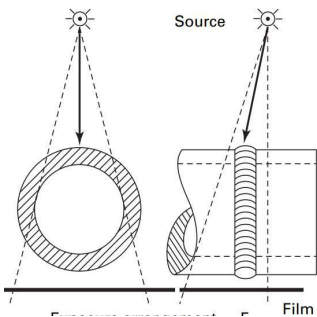
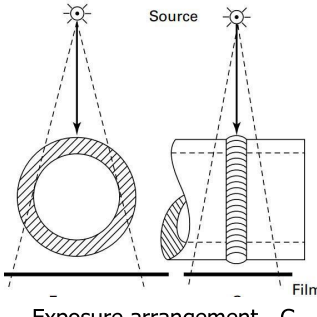


≤ 89 mm	Double wall 6.6.2	Double wall	 <p>Exposure arrangement - F</p>	6.10	6.11 Source side	Attachment C
≤ 89 mm	Double wall 6.6.2	Double wall	 <p>Exposure arrangement - G</p>	6.10	6.11 Source side	Attachment C

Table 3: Radiographic techniques

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1- APPROVED	<input checked="" type="checkbox"/>
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Attachment B Number of exposures table (guideline)

The tables 4 and 5 are a guidelines for the number of exposures, the final number of exposures shall be chosen based on the effective film length and overlap.

If for diameters up to 3" the DWDI technique will be used, the number of exposures will be demonstrated so that the weld coverage is within the requirements as described in this procedure.

X-ray		Schedule															
Diameter		5s	10s	10	20	30	STD 40s	40	60	XS 80s	80	100	120	140	160	XXS	inch
inch	mm																
1/2	21,3	2/3	2/3	---	---	---	2/3	2/3	---	2/3	2/3	---	---	---	2/3	2/3	1/2
3/4	26,7	2/3	2/3	---	---	---	2/3	2/3	---	2/3	2/3	---	---	---	2/3	3	3/4
1	33,4	2/3	2/3	---	---	---	2/3	2/3	---	2/3	2/3	---	---	---	2/3	3	1
1 1/4	42,2	2/3	2/3	---	---	---	2/3	2/3	---	2/3	2/3	---	---	---	2/3	3	1 1/4
1 1/2	48,3	2/3	2/3	---	---	---	2/3	2/3	---	2/3	2/3	---	---	---	2/3	3	1 1/2
2	60,3	2/3	2/3	---	---	---	2/3	2/3	---	2/3	2/3	---	---	---	3	3	2
2 1/2	73,0	2/3	2/3	---	---	---	2/3	2/3	---	2/3	2/3	---	---	---	3	3	2 1/2
3	88,9	2/3	2/3	---	---	---	2/3	2/3	---	2/3	2/3	---	---	---	3	3	3
3 1/2	101,6	5	5	---	---	---	5	5	---	5	5	---	---	---	---	---	3 1/2
4	114,3	5	5	---	---	---	5	5	---	5	5	---	5	---	5	6	4
5	141,3	5	5	---	---	---	5	5	---	5	5	---	5	---	5	5	5
6	168,3	5	5	---	---	---	5	5	---	5	5	---	5	---	5	5	6
8	219,1	4	4	---	4	4	5	5	5	5	5	5	5	5	5	5	8
10	273,1	4	4	---	4	4	4	4	4	4	4	5	5	5	5	5	10
12	323,9	4	4	---	4	4	4	4	4	4	4	4	4	5	5	4	12
14	355,6	4	4	4	4	4	4	4	4	4	4	4	4	4	5	---	14
16	406,4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	---	16
18	457,2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	---	18
20	508,0	4	4	4	4	4	4	4	4	4	4	4	4	4	4	---	20
22	558,8	---	---	4	4	4	4	---	4	4	4	4	4	4	4	---	22
24	609,6	4	4	4	4	4	4	4	4	4	4	4	4	4	4	---	24
26	660,4	---	---	4	4	---	4	---	---	4	---	---	---	---	---	---	26
28	711,2	---	---	4	4	4	4	---	---	4	---	---	---	---	---	---	28
30	762,0	---	---	4	4	4	4	---	---	4	---	---	---	---	---	---	30
32	812,8	---	---	4	4	4	4	4	---	4	---	---	---	---	---	---	32
34	863,8	---	---	4	4	4	4	4	---	4	---	---	---	---	---	---	34
36	914,4	---	---	4	4	4	4	4	---	4	---	---	---	---	---	---	36
42	1067,0	Wall thickness 8,74 up to including 25,4 mm					4				4						42
48	1219,0	Wall thickness 8,74 up to including 25,4 mm					4				4						48

Table 4: X-Ray exposure guideline.

Code 2/3 means: 2 exposures, the elliptical technique "F" at 90° to each other or
3 exposures, superimposed technique "G" at 60° or 120° to each other.

INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 02/09/2024	
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Doc Ref : RT 21002
Revision : 29
Date : 16-12-2021
Title : Radiographic examination
Type : Standard procedure



Se75 / Ir192		Schedule															
Diameter		5s	10s	10	20	30	STD 40s	40	60	XS 80s	80	100	120	140	160	XXS	inch
inch	mm																
1/2	21,3	2/3	2/3	---	---	---	2/3	2/3	---	2/3	2/3	---	---	---	2/3	2/3	1/2
3/4	26,7	2/3	2/3	---	---	---	2/3	2/3	---	2/3	2/3	---	---	---	2/3	3	3/4
1	33,4	2/3	2/3	---	---	---	2/3	2/3	---	2/3	2/3	---	---	---	2/3	3	1
1 1/4	42,2	2/3	2/3	---	---	---	2/3	2/3	---	2/3	2/3	---	---	---	2/3	3	1 1/4
1 1/2	48,3	2/3	2/3	---	---	---	2/3	2/3	---	2/3	2/3	---	---	---	2/3	3	1 1/2
2	60,3	2/3	2/3	---	---	---	2/3	2/3	---	2/3	2/3	---	---	---	3	3	2
2 1/2	73,0	2/3	2/3	---	---	---	2/3	2/3	---	2/3	2/3	---	---	---	3	3	2 1/2
3	88,9	2/3	2/3	---	---	---	2/3	2/3	---	2/3	2/3	---	---	---	3	3	3
3 1/2	101,6	3	3	---	---	---	3	3	---	4	4	---	---	---	---	---	3 1/2
4	114,3	3	3	---	---	---	3	3	---	4	4	---	4	---	4	4	4
5	141,3	3	3	---	---	---	3	3	---	3	3	---	4	---	4	4	5
6	168,3	3	3	---	---	---	3	3	---	3	3	---	4	---	4	4	6
8	219,1	3	3	---	3	3	3	3	3	3	3	3	4	4	4	4	8
10	273,1	3	3	---	3	3	3	3	3	3	3	3	4	4	4	4	10
12	323,9	3	3	---	3	3	3	3	3	3	3	3	4	4	4	4	12
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16	406,4	3	3	3	3	3	3	3	3	3	3	3	4	4	4	---	16
18	457,2	3	3	3	3	3	3	3	3	3	3	3	4	4	4	---	18
20	508,0	3	3	3	3	3	3	3	3	3	3	3	4	4	4	---	20
22	558,8	3	3	3	3	3	3	---	3	3	3	3	4	4	4	---	22
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26	660,4	---	---	3	3	---	3	---	---	3	---	---	---	---	---	---	26
28	711,2	---	---	3	3	3	3	---	---	3	---	---	---	---	---	---	28
30	762,0	3	3	3	3	3	3	---	---	3	---	---	---	---	---	---	30
32	812,8	---	---	3	3	3	3	3	---	3	---	---	---	---	---	---	32
34	863,8	---	---	3	3	3	3	3	---	3	---	---	---	---	---	---	34
36	914,4	---	---	3	3	3	3	3	---	3	---	---	---	---	---	---	36
42	1067,0	Wallthickness 8,74 up to including 25,4 mm						3		3							42
48	1219,0	Wallthickness 8,74 up to including 25,4 mm						3		3							48

Table 5: Y-Ray exposure guideline

Code 2/3 means: 2 exposures, the elliptical technique "F" at 90° to each other or
3 exposures, superimposed technique "G" at 60° or 120° to each other.

INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
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Attachment C Location markers

ASME BPVC V Figure T-275, location marker sketches.

<p>Figure 4: Flat component or longitudinal seam</p>	<p>Figure 5: Curved components with radiation source to film distance less than radius of component</p>	<p>Figure 6: Curved components with convex surface towards radiation source</p>
<p>Figure 7: Curved components with radiation source to film distance greater than radius of curvature</p>	<p>Figure 8: Source side marker alternate flat component or longitudinal seam</p> <p>$X = (t/D)(M_f/2)$ X = additional required coverage beyond film side location marker. t = component thickness M_f = film side location marker interval D = source to component distance</p>	<p>Figure 9: Curved components with radiation source at center curvature</p>
<p>LEGEND: Radiation source — ★ Location marker — • Component center — +</p>		

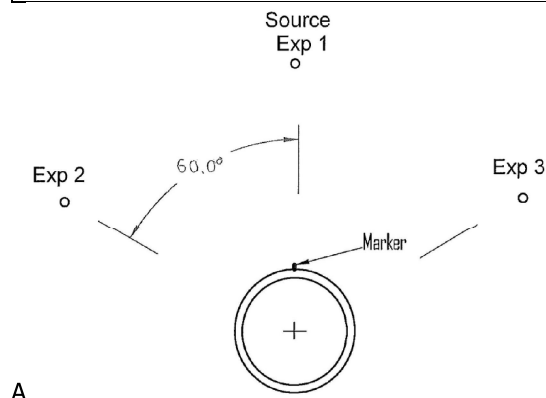


Figure 10: Location marker(s) on a small bore pipe

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INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 02/04/2024	
SIGN: <i>M. Rezaei</i>	

Attachment D **IQI wire / hole number, thickness and type**

IQI according ASME BPVC V SE-747					IQI according EN-ISO 19232-1				
Ø wire		IQI set			Ø wire	IQI set			
[In.]	[mm]	A	B	C	[mm]	13-19	10-16	6-12	1-6
					0.050	19			
					0.063	18			
0.0032	0.08	1			0.080	17			
0.004	0.1	2			0.100	16	16		
0.005	0.13	3			0.125	15	15		
0.0063	0.16	4			0.16	14	14		
0.008	0.2	5			0.20	13	13		
0.010	0.25	6	6		0.25		12	12	
0.013	0.33		7		0.32		11	11	
0.016	0.4		8		0.40		10	10	
0.020	0.51		9		0.50			9	
0.025	0.64		10		0.63			8	
0.032	0.81		11	11	0.80			7	7
0.040	1.02			12	1.00			6	6
0.050	1.27			13	1.25				5
0.063	1.6			14	1.60				4
0.080	2.03			15	2.00				3
0.100	2.5			16	2.50				2
					3.20				1

Table 6: ASME BPVC V IQI set versus ISO 19232-1 IQI set.

IQI Designation	IQI thickness		1T hole diameter		2T hole diameter		4T hole diameter	
	[In.]	[mm]	[In.]	[mm]	[In.]	[mm]	[In.]	[mm]
5	0.005	0.13	0.010	0.25	0.020	0.51	0.040	1.02
7	0.0075	0.19	0.010	0.25	0.020	0.51	0.040	1.02
10	0.010	0.25	0.010	0.25	0.020	0.51	0.040	1.02
12	0.0125	0.32	0.0125	0.32	0.025	0.64	0.050	1.27
15	0.015	0.38	0.015	0.38	0.030	0.76	0.060	1.52
17	0.0175	0.44	0.0175	0.44	0.035	0.89	0.070	1.78
20	0.020	0.51	0.020	0.51	0.040	1.02	0.080	2.03
25	0.025	0.64	0.025	0.64	0.050	1.27	0.100	2.54
30	0.030	0.76	0.030	0.76	0.060	1.52	0.120	3.05
35	0.035	0.89	0.035	0.89	0.070	1.78	0.140	3.56
40	0.040	1.02	0.040	1.02	0.080	2.03	0.160	4.06
45	0.045	1.14	0.045	1.14	0.090	2.29	0.180	4.57
50	0.050	1.27	0.050	1.27	0.100	2.54	0.200	5.08

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Table 7: Hole-type IQI designation, thickness and hole diameters

RADIOGRAPHIC ASSESSMENT PROCEDURE

Assessment of radiographic examination of welded joints in accordance with the requirements of one of the following standards:

ASME BPVC Section I, edition 2021, paragraph PW 51

ASME BPVC Section VIII Division 1, edition 2021, paragraph UW 51

ASME BPVC Section VIII Division 1, edition 2021, paragraph UW 52

ASME BPVC Section VIII Division 2, edition 2021, paragraph 7.5.3.2

ASME BPVC Section IX, edition 2021, paragraph QW 191.1.2

ASME code for Power Piping, B31.1: 2020, table 136.4.5

ASME code for Process Piping, B31.3: 2020, table 341.3.2

Development – Revisions					
Revision No.	Prepared By	Date	Approved By	Date	Amendment Details
28	T. Cornelissen	16-12-2021	T. Speelmeijer	16-12-2021	
27		02-04-2021			
0		01-08-1991			



Digitally signed
by Theo
Cornelissen
Date: 2021.12.17
08:56:43 +01'00'

Theo Speelmeijer
MT3 PT3 RT3 UT3

Theo Speelmeijer

Date: 16-12-2021
Address
Delftweg 144, 3046 NC Rotterdam
P.O. Box 10065, 3004 AB Rotterdam
The Netherlands
www.ApplusRTD.com

Date: 16-12-2021



Date:

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Revision History

Revision Number	Date	Section	Brief Description of change	Author of Change
0	01-08-1991		Issued as new document	
18	14-12-2010	1, 2.1	updated to the ASME BPVC VIII 2010	R. Coenen
19	14-12-2011	1, 2.1	updated to the ASME BPVC VIII 2010 addenda 2011	R. Coenen
20	01-06-2012	2.1		R. Coenen
21	10-01-2014	2.1, 2.2, 2.3		R. Coenen
22	21-10-2015		updated to the ASME BPVC VIII 2015 edition	P. Briggeman
23	13-12-2017		updated to the ASME BPVC VIII 2017 edition	P. Briggeman
24	07-01-2020		Complete revised and updated to the ASME BPVC VIII 2019 edition	T. Cornelissen
25	01-12-2020		Amended several ASME acceptance standards	T. Cornelissen
26	05-03-2021	10 update ASME B31.1 Table removed from 5.1.2, 6.1.1, 8.3	Updated ASME B31.1 to 2020 version and typo's corrected, indicated in margins	T. Cornelissen
27	02-04-2021	5.1.1, 6.1.6, 10.2	References corrected	T. Cornelissen
28	16-12-2021	1, 10.2	Updated to the latest ASME editions	T. Cornelissen

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8	ASME BPVC Section VIII Division 2, paragraph 7.5.3.2	16
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9	ASME BPVC Section IX, paragraph QW 191.1.2	20
9.1	<i>Acceptance Criteria</i>	20
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10.1	<i>Acceptance criteria linear indications</i>	21
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11	ASME B31.3, table 341.3.2	22
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11.2	<i>Table 341.3.2 Acceptance criteria for welds</i>	23

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1 Scope

This procedure defines the radiographic assessment of radiographs which has been performed in accordance with the requirements of the ASME BPVC Section V, article 2.

Assessment of radiographic examination of welded joints will be in accordance with the requirements of one of the following standards and shall be specified by the client:

- ASME BPVC Section I, edition 2021, paragraph PW 51.
- ASME BPVC Section VIII Division 1, edition 2021, paragraph UW 51.
- ASME BPVC Section VIII Division 1, edition 2021, paragraph UW 52 (spot examination).
- ASME BPVC Section VIII Division 2, edition 2021, paragraph 7.5.3.2.
- ASME BPVC Section IX, edition 2021, paragraph QW 191.1.2.
- ASME code for Power Piping, B31.1: 2020, table 136.4.5.
- ASME code for Process Piping, B31.3: 2020, table 341.3.2.

2 References and abbreviations

For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

2.1 *Applus+ documents*



- NL-10 Written practice for the Training, Qualification, Certification and Authorization of NDT Personnel.
- CP 31003 Procedure for calibration of film densitometers.
- CP 31014 Verification procedure for illuminators used for industrial radiographs.

2.2 *Codes and standards*

- ASME BPVC I ASME Boiler and Pressure Vessel Code, an International Code, Rules for construction of power boilers.
- ASME BPVC V ASME Boiler and Pressure Vessel Code, an International Code, Non-destructive Examination.
- ASME BPVC VIII.1 ASME Boiler and Pressure Vessel Code, Division 1.
- ASME BPVC VIII.2 ASME Boiler and Pressure Vessel Code, Division 2.
- ASME BPVC IX ASME Boiler and Pressure Vessel Code, an International Code, Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators.
- ASME B31.1 Power piping, ASME code for pressure piping, B31.
- ASME B31.3 Process piping, ASME code for pressure piping, B31.
- ISO 9712: 2012 Qualification and certification of NDT personnel.
- SNT-TC-1A: 2016 Personnel qualification and certification in NDT.

2.3 *Abbreviations*

ASME BPVC	ASME Boiler Pressure Vessel code
IQI	Image Quality Indicator
NDT	Non Destructive Testing
RT	Radiographic Testing
<i>t</i>	Nominal thickness of the parent material only where manufacturing tolerances do not have to be taken into account.

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2.4 Definitions

Rounded indications

Indications with a maximum length of three times the width or less on the radiograph are defined as rounded indications. These indications may be circular, elliptical, conical or irregular in shape and may have tails. When evaluating the size of an indication, the tail shall be included. The indication may be from any imperfection in the weld, such as porosity, slag or tungsten.

Aligned indications

A sequence of four or more rounded indications shall be considered to be aligned when they touch a line parallel to the length of the weld drawn through the centre of the two outer rounded indications.

Elongated indications

Indications, not being a crack, lack of fusion or incomplete penetration, with a length greater than 3 times the width on the radiograph are defined as elongated indications.

Thickness (t)

t is the thickness of the weld, excluding any allowable reinforcement. For a butt weld joining two members having different thicknesses at the weld, t is the thinner of these two thicknesses. If a full penetration weld includes a fillet weld, the thickness of the fillet weld throat shall be included in t .

3 Personnel qualifications

NDT-personnel shall be qualified and certified in accordance with the valid version of Applus+ Written Practice NL-10, which is in conformity with the SNT-TC-1A and ISO 9712.

The assessment of the radiographs shall be performed only by certified personnel RT level 2 including Film Interpretation level 2 as minimum.


Shall have passed an eyesight examination within the past 12 months, according the ISO 9712 section 7.4 or equivalent.

4 General requirements

4.1 Facilities for viewing of radiographs

The proper assessment of image quality and accurate reporting on the diagnostic information of the radiographs shall be achieved by:

- The densitometer shall be verified according Applus+ procedure CP 31003 and shall have a valid certificate.
- The maximum density of the film assessed shall never exceed the light intensity incident of the film viewer.
- The film viewer and lamps shall be verified according Applus+ procedure CP 31014 and shall have a valid certificate.
- No light sources with a strength > 50 lux shall be visible when assessing the radiograph, to avoid dazzling.
- Means for magnifying details in the displayed radiographic image should be available. The magnifying glass shall be max 7x.
- The ambient light intensity measured on the film viewer (with the film viewer off) shall be ≤ 20 lux.

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4.2 Radiographic quality

If the minimum requirement as described in the ASME BPVC V art.2 summerized in section 4.2.1 and 4.2.2 of this procedure are not met, the radiograph shall be rejected due to quality issues. If agreed between contracted parties the radiograph can maybe accepted.

4.2.1 Radiographic density limitations

The transmitted film density through the radiographic image of the body of the appropriate IQI and the area of interest shall be 1.8 minimum for single film viewing for radiographs made with an X-ray source and 2.0 minimum for radiographs made with a gamma-ray source.

The maximum density shall be 4.0 for either single or composite viewing, the maximum density of the film assessed shall never exceed the light intensity incident of the viewer.

A tolerance of ± 0.05 in density is allowed for variations between densitometer readings.

4.2.1 Weld reinforcement

If there is a question regarding the surface condition of the weld and the weld reinforcement when interpreting a radiographic film, the film shall be compared to the actual weld surface for determination of acceptability.

The values used for the estimated weld reinforcement thicknesses shall be representative of the weld conditions and shall not exceed the maximums permitted by the referencing Code Section. Physical measurement of the actual weld reinforcements is not required.

4.2.2 IQI sensitivity

The minimum sensitivity requirements of the radiographs shall be as mentioned in Table 1 below.

The thickness on which the IQI is based is the nominal single-wall material thickness plus the weld reinforcement thickness estimated to be present on both sides of the weld (I.D. and O.D.).

Backing rings or strips shall not be considered as part of the thickness in IQI selection.


Single Wall Material Thickness Range plus estimated weld reinforcement [mm]	Source Side			Film Side		
	Essential ISO wire	Essential ASTM wire	Plate No. 2T hole	Essential ISO wire	Essential ASTM wire	Plate No. 2T hole
Up to 6.4 incl.	13	5	12	14	4	10
Over 6.4 through 9.5	12	6	15	13	5	12
Over 9.5 through 12.7	11	7	17	12	6	15
Over 12.7 through 19.0	10	8	20	11	7	17
Over 19.0 through 25.4	9	9	25	10	8	20
Over 25.4 through 38.1	8	10	30	9	9	25
Over 38.1 through 50.8	7	11	35	8	10	30
Over 50.8 through 63.5	6	12	40	7	11	35
Over 63.5 through 101.6	5	13	50	6	12	40

Table 1: IQI sensitivity requirements

4.3 Report

The report shall be finalized with the results of the assessment, the following information shall be add to the report made for the examination as minimum by the radiograph interpreter:

- Procedure and revision number used.
- Relevant indications.
- Results of the assessment.
- Date of interpretation.
- Name and level personnel

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5 ASME BPVC Section I, paragraph PW 51

5.1 Evaluation

5.1.1 Relevant indications

Only those rounded indications which exceed the following dimensions shall be considered relevant.

1/10t	for $t < 3.0$ mm.
0.4 mm	for $3 \text{ mm} \leq t \leq 6$ mm.
0.8 mm	for $6 \text{ mm} < t \leq 50$ mm.
1.6 mm	for $t > 50$ mm.

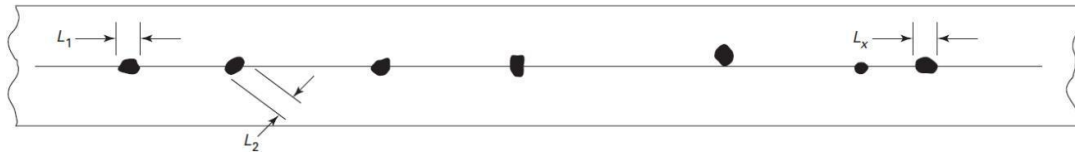
5.1.2 Maximum size of rounded indications

The maximum permissible size of any indication shall be 1/4t, or 4 mm, whichever is smaller; except that an isolated indication separated from an adjacent indication by 25 mm or more may be 1/3t, or 6 mm, whichever is less. For t greater than 50 mm, the maximum permissible size of an isolated indication shall be increased to 10 mm.

5.1.3 Aligned rounded indications

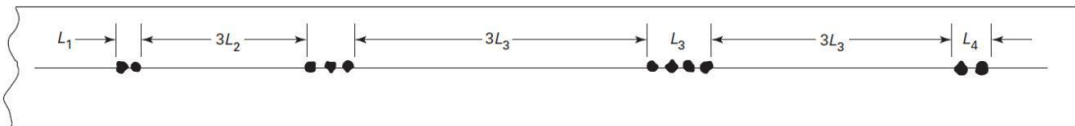
Aligned rounded indications are acceptable when the summation of the diameters of the indications is less than t in a length of 12t, refer to: rounded indication charts A-250-3.4-1.

The length of groups of aligned rounded indications and the spacing between the groups shall meet the requirements of: rounded indication charts A-250-3.4-2.



General note: Sum of L_2 to L_x shall be less than t in a length of $12t$.

Figure A-250 3.4-1. Aligned rounded indications



Maximum Group Length

L	=	6 mm for t less than 19 mm
L	=	1/3t for t 19 mm to 57 mm
L	=	19 mm for t greater than 57 mm

Minimum Group Spacing

3L where L is the length of the longest adjacent group being evaluated

GENERAL NOTE: Sum of the group lengths shall be less than t in a length of 12t

Figure A-250 3.4-2. Groups of aligned rounded indications

5.1.4 Spacing

The distance between adjacent rounded indications is not a factor in determining acceptance or rejection, except as required for isolated indications or groups of aligned indications.

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5.1.5 Weld thickness t less than 3.0 mm

For t less than 3.0 mm the maximum number of rounded indications shall not exceed 12 in any 150 mm weld length. A proportionally fewer number of indications shall be permitted in welds less than 150 mm in length.

5.1.6 Clustered indications

The illustrations for clustered indications show up to four times as many indications in a local area, as that shown in the illustrations for random indications. The length of an acceptable cluster shall not exceed the lesser of 25 mm or $2t$. Where more than one cluster present, the sum of the lengths of the clusters shall not exceed 25 mm in any 150 mm weld length.

5.2 Rounded indication charts

The rounded indications are characterized as imperfections shall not exceed that shown in the charts A-250.3.6-1 through A-250.3.6-5. These charts represent the maximum acceptable concentration limits for rounded indications in any 150 mm weld length.

Maximum size of individual rounded indications in the Figures A-250.3.6-1 up to A-250.3.6-5 shall be as per section 5.1.2.

The distributions shown are not necessarily the patterns that may appear on the radiograph, but are typical of the concentration and size of indications permitted.

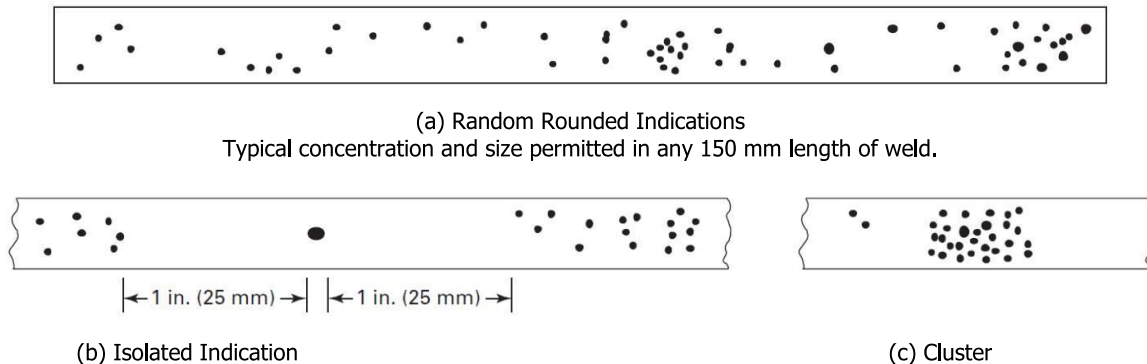


Figure A-250 3.6-1. Charts for t 3 mm to 6 mm, inclusive

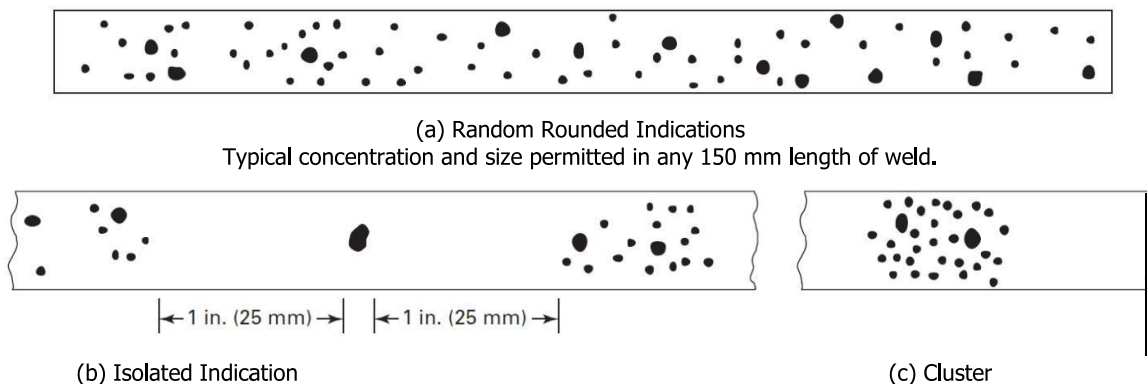
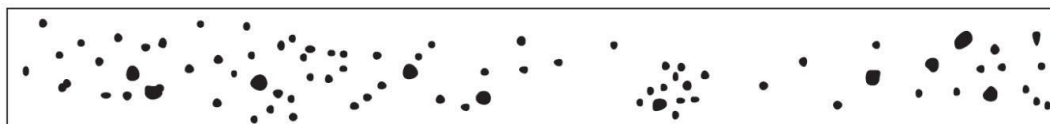
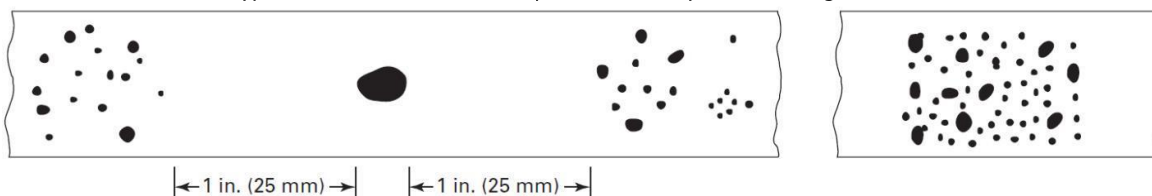


Figure A-250 3.6-2. Charts for t 6 mm to 10 mm, inclusive

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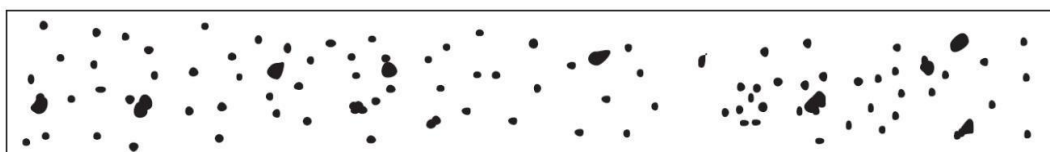
(a) Random Rounded Indications
Typical concentration and size permitted in any 150 mm length of weld.



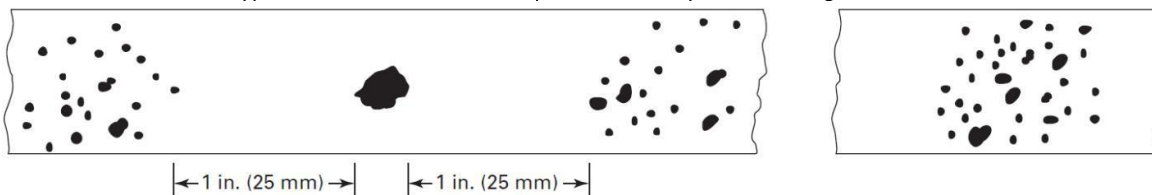
(b) Isolated Indication

(c) Cluster

Figure A-250.3.6-3. Charts for t over 10 mm to 19 mm, inclusive



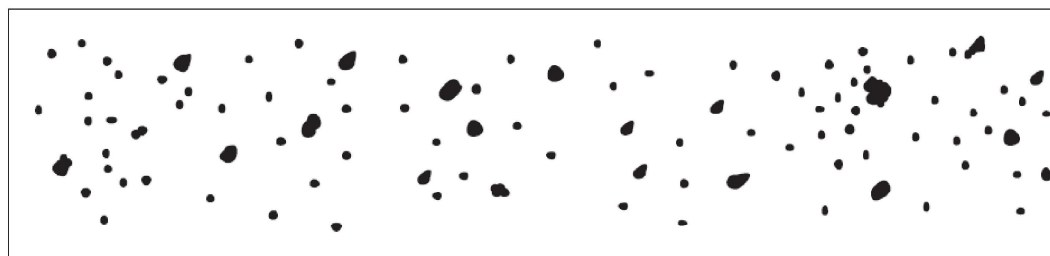
(a) Random Rounded Indications
Typical concentration and size permitted in any 150 mm length of weld.



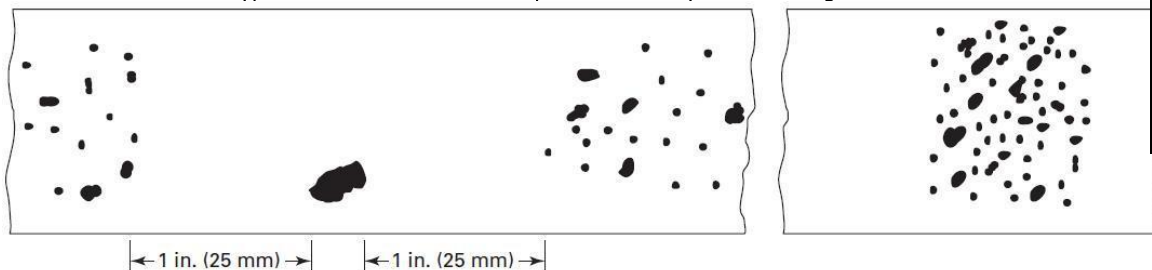
(b) Isolated Indication

(c) Cluster

Figure 250.3.6-4. Charts for t over 19 mm to 50 mm, inclusive



(a) Random Rounded Indications
Typical concentration and size permitted in any 150 mm length of weld.



(b) Isolated Indication

(c) Cluster

Figure A-250.3.6-5. Charts for t over 50 mm to 100 mm, inclusive



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5.3 Acceptance criteria

Density within the image of the indication may vary and is not a criterion for acceptance or rejection.

Indications shown on radiographs of welds and characterized as imperfections are unacceptable under the following conditions.

- Any indication characterized as a crack or zone of incomplete fusion or penetration.
- Any other elongated indication on the radiograph which has length greater than:
 - 6 mm for $t \leq 19$ mm.
 - $1/3t$ for $19 \text{ mm} < t \leq 57$ mm.
 - 19 mm for $t > 57$ mm.
- Any group of aligned indications that have an aggregate length greater than t in a length of $12t$ except when the distance between the successive imperfections exceeds $6L$ where L is the length of the longest imperfection in the group.
- Rounded indications in excess of that specified by the acceptance standards given in paragraph 5.1.2 up to 5.2.

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6 ASME BPVC Section VIII Division 1, paragraph UW 51

6.1 Evaluation

6.1.1 Maximum size of rounded relevant indications

Only those rounded indications which exceed the following dimensions shall be considered relevant:

1/10t	for $t < 3.0$ mm.
0.4 mm	for $3 \text{ mm} \leq t \leq 6$ mm.
0.8 mm	for $6 \text{ mm} < t \leq 50$ mm.
1.6 mm	for $t > 50$ mm.

The maximum permissible size of any indication shall be $1/4t$, or 4 mm, whichever is smaller; except that an isolated indication separated from an adjacent indication by 25 mm or more may be $1/3t$, or 6 mm, whichever is less. For t greater than 50 mm, the maximum permissible size of an isolated indication shall be increased to 10 mm.

6.1.2 Aligned rounded indications

Aligned rounded indications are acceptable when the summation of the diameters of the indications is less than t in any length of $12t$, refer to section 6.1.6 Rounded indication charts.

The length of groups of aligned rounded indications and the spacing between the groups shall meet the requirements of section 6.1.6.

6.1.3 Spacing

The distance between adjacent rounded indications is not a factor in determining acceptance or rejection, except as required for isolated indications or groups of aligned indications.

6.1.4 Weld thickness t less than 3.0 mm

For t less than 3.0 mm the maximum number of rounded indications shall not exceed 12 in any 150 mm weld length. A proportionally fewer number of indications shall be permitted in welds less than 150 mm in length.

6.1.5 Clustered indications

The illustrations for clustered indications show up to four times as many indications in a local area, as that shown in the illustrations for random indications. The length of an acceptable cluster shall not exceed the lesser of 25 mm or $2t$. Where more than one cluster is present, the sum of the lengths of the clusters shall not exceed 25 mm in any 150 mm weld length.

6.1.6 Rounded indication charts

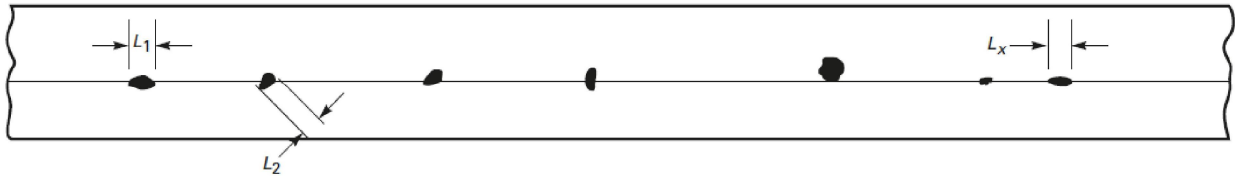
The rounded indications characterized as imperfections shall not exceed that shown in the charts. Figures 4-1 through 4-7 illustrate various types of assorted, randomly dispersed and clustered rounded indications for different weld thicknesses greater than 3.0 mm.

These charts represent the maximum acceptable concentration limits for rounded indications. The charts for each thickness range represent full-scale 150 mm radiographs.

Maximum size of individual rounded indications in the Figures 4-1 up to 4-7 shall be as per section 6.1.1.

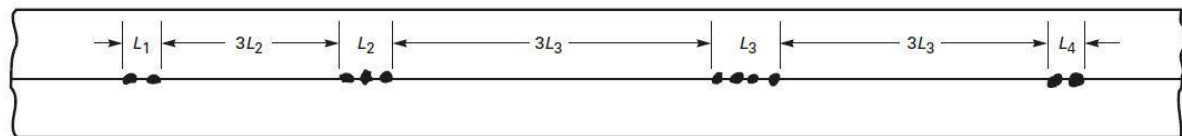
The distributions shown are not necessarily the patterns that may appear on the radiograph, but are typical of the concentration and size of indications permitted.

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General note: Sum of L_1 to L_x shall be less than t in a length of $12t$.

Figure 4-1. Aligned rounded indications



Maximum Group Length

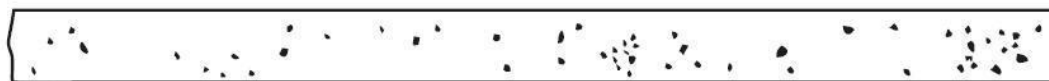
L = 6 mm for t less than 19 mm.
 L = $1/3t$ for t 19 mm to 57 mm.
 L = 19 mm for t greater than 57 mm.

Minimum Group Spacing

$3L$ where L is the length of the longest adjacent group being evaluated.

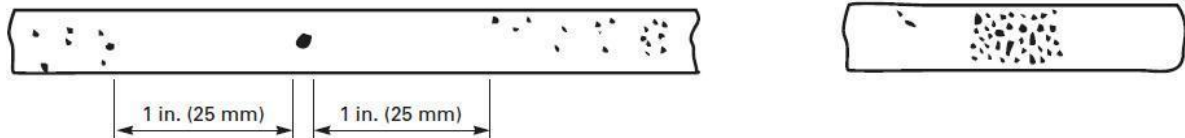
General note: Sum of the group lengths shall be less than t in a length of $12t$.

Figure 4-2. Groups of aligned rounded indications



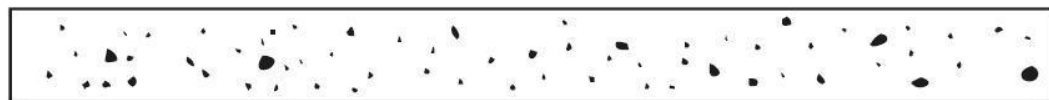
(a) Random rounded indications

Typical concentration and size permitted in any 150 mm length of weld.



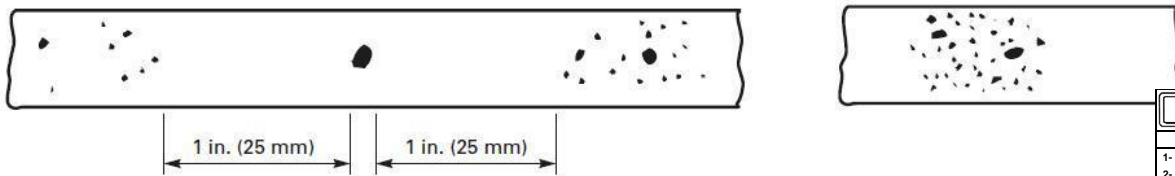
(b) Isolated indications

Figure 4-3. Charts for t equal to 3 mm to 6 mm, inclusive



(a) Random Rounded Indications

Typical concentration and size permitted in any 150 mm length of weld.

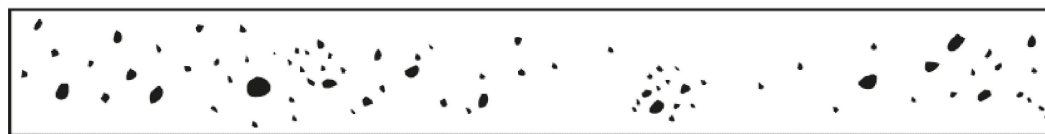


(b) Isolated Indication

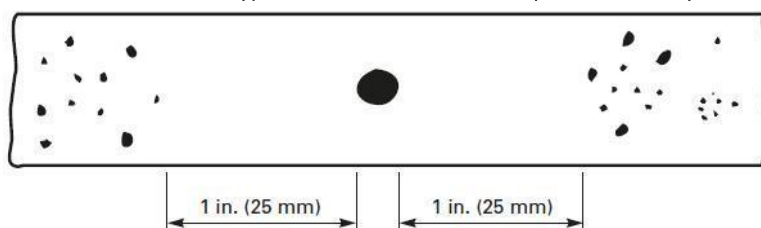
(c) Cluster

Figure 4-4. Charts for t over 6 mm to 10 mm, inclusive

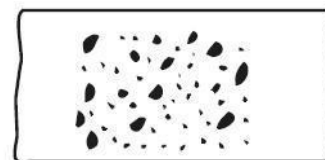
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(a) Random Rounded Indications
Typical concentration and size permitted in any 150 mm length of weld.

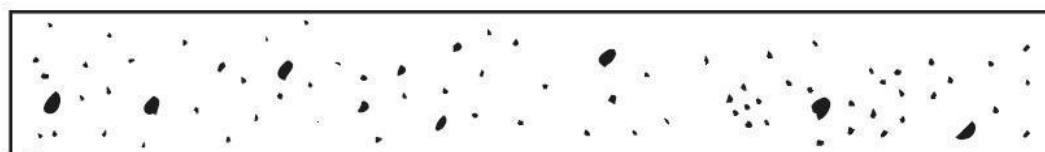


(b) Isolated Indication

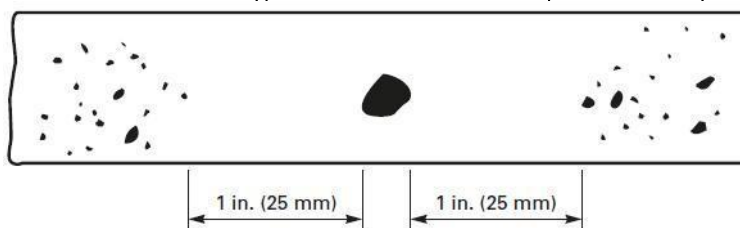


(c) Cluster

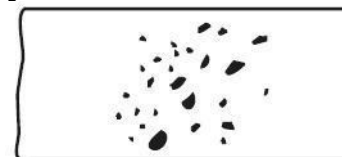
Figure 4-5. Charts for t over 10 mm to 19 mm, inclusive



(a) Random Rounded Indications
Typical concentration and size permitted in any 150 mm length of weld.





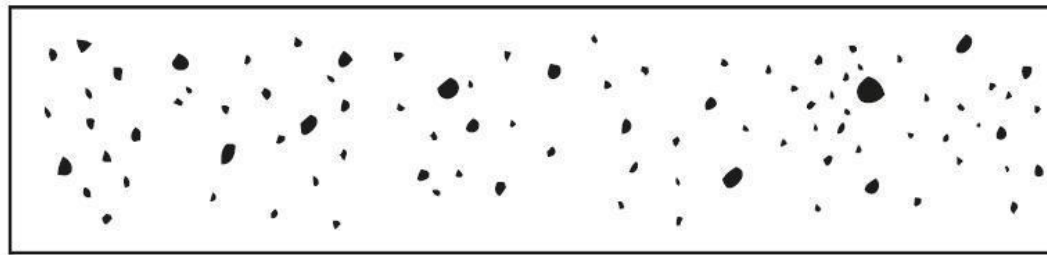
(b) Isolated Indication



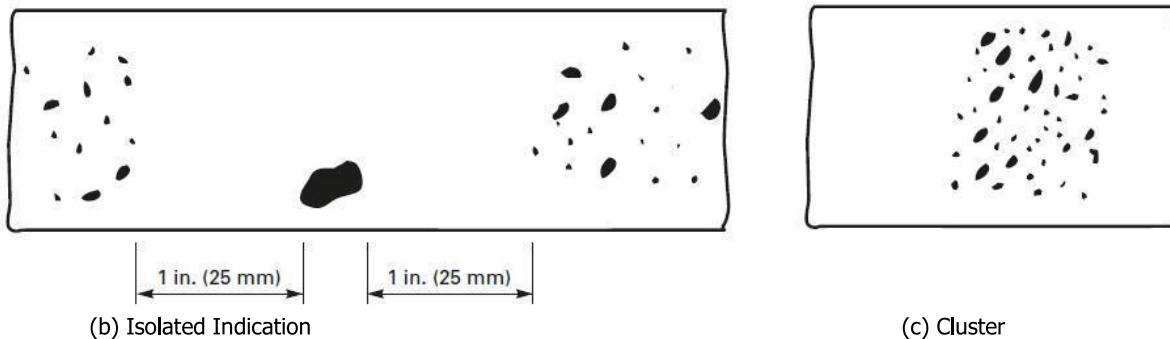
(c) Cluster

Figure 4-6. Charts for t over 19 mm to 50 mm, inclusive

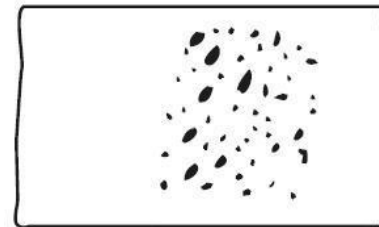
 NARGAN COMPANY	
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(a) Random Rounded Indications
Typical concentration and size permitted in any 150 mm length of weld.



(b) Isolated Indication



(c) Cluster

Figure 4-7. Charts for t over 50 mm to 100 mm, inclusive

6.2 Acceptance criteria

Indications shown on radiographs of welds and characterized as imperfections are unacceptable under the following conditions.

- Any indication characterized as a crack or zone of incomplete fusion or penetration.
- Any other elongated indication on the radiograph which has length greater than:
 - 6 mm for $t < 19$ mm.
 - $1/3t$ for $19 \text{ mm} \leq t \leq 57$ mm.
 - 19 mm for $t > 57$ mm.
- Any group of aligned indications that have an aggregate length greater than t in a length of $12t$ except when the distance between the successive imperfections exceeds $6L$ where L is the length of the longest imperfection in the group.
- Rounded indications in excess of that specified by the acceptance standards given in paragraph 6.1.



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7 ASME BPVC Section VIII Division 1, paragraph UW 52

7.1 Acceptance criteria

The acceptability of welds examined by spot radiography shall be judged by the following standard.

- Welds in which indications characterised as cracks or zones of incomplete fusion or penetration shall be unacceptable.
- Welds having indications characterized as slag inclusions or cavities are unacceptable when the indication length exceeds $2/3t$. For all thicknesses, indications less than 6 mm are acceptable, and indications greater than 19 mm are unacceptable.
- Multiple aligned indications meeting these acceptance criteria are acceptable when the sum of their longest dimensions indications does not exceed t within a length of $6t$ (or proportionally for radiographs shorter than $6t$), and when the longest length L for each indication is separated by a distance not less than $3L$ from adjacent indications.
- Rounded indications are not a factor in the acceptability of welds not required to be fully radiographed.

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8 ASME BPVC Section VIII Division 2, paragraph 7.5.3.2

8.1 Evaluation

8.1.1 Maximum size of rounded relevant indications

Only those rounded indications which exceed the following dimensions shall be considered relevant:

1/10t	for $t < 3.0$ mm.
0.4 mm	for $3 \text{ mm} \leq t \leq 6$ mm.
0.8 mm	for $6 \text{ mm} < t \leq 50$ mm.
1.5 mm	for $t > 50$ mm.

8.2 Acceptance criteria

8.2.1 Aligned rounded indications

Aligned rounded indications are acceptable when the summation of the diameters of the indications is less than t in any length of $12t$.

8.2.2 Spacing

The distance between adjacent rounded indications is not a factor in determining acceptance or rejection, except as required for isolated indications or groups of aligned indications.

8.2.3 Weld thickness t less than 3.0 mm

For t less than 3.0 mm the maximum number of rounded indications shall not exceed 12 in every 150 mm weld length. A proportionally fewer number of indications shall be permitted in welds less than 150 mm in length.

8.2.4 Clustered indications

The illustrations for clustered indications show up to four times as many indications in a local area, as that shown in the illustrations for random indications. The length of an acceptable cluster shall not exceed the lesser of 25 mm or $2t$. Where more than one cluster present, the sum of the lengths of the clusters shall not exceed 25 mm in any 150 mm weld length.



8.3 Rounded indication charts

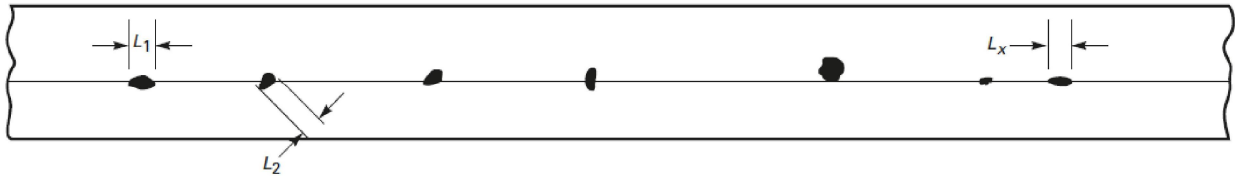
The rounded indications characterized as imperfections shall not exceed that shown in the charts. The Figures 7-3 up to 7-9 illustrate various types of assorted, randomly dispersed and clustered rounded indications for different weld thicknesses greater than 3.0 mm.

These charts represent the maximum acceptable concentration limits for rounded indications. The charts for each thickness range represent full-scale 150 mm radiographs.

Maximum size of individual rounded indications in the Figures 7-3 up to 7-9 shall be as per section 8.1.1.

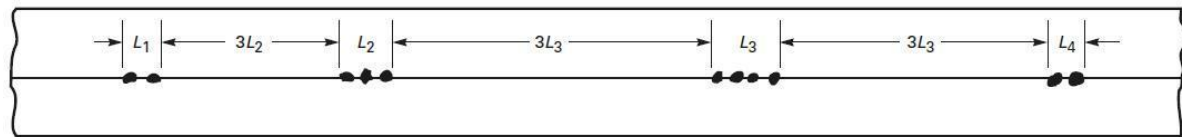
The distributions shown are not necessarily the patterns that may appear on the radiograph, but are typical of the concentration and size of indications permitted.

	
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General note: Sum of L_1 to L_x shall be less than t in a length of $12t$.

Figure 7-3. Aligned rounded indications



Maximum Group Length

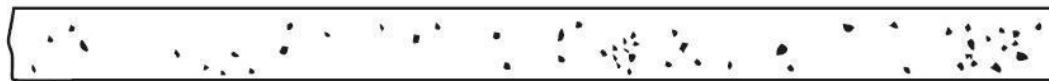
L = 6 mm for t less than 19 mm.
 L = $1/3t$ for t 19 mm to 57 mm.
 L = 19 mm for t greater than 57 mm.

Minimum Group Spacing

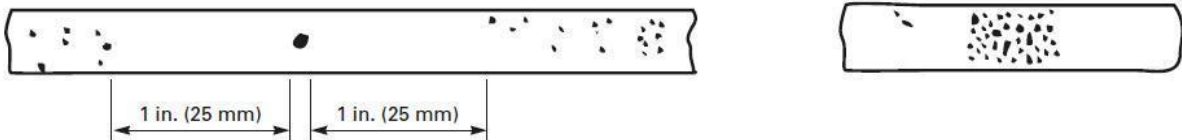
$3L$ where L is the length of the longest adjacent group being evaluated.

General note: Sum of the group lengths shall be less than t in a length of $12t$.

Figure 7-4. Groups of aligned rounded indications

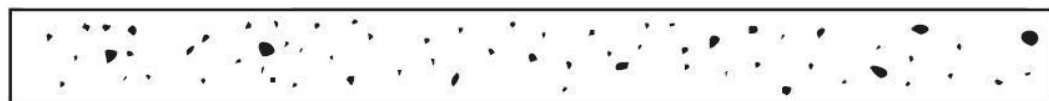


(c) Random rounded indications
Typical concentration and size permitted in any 150 mm length of weld.

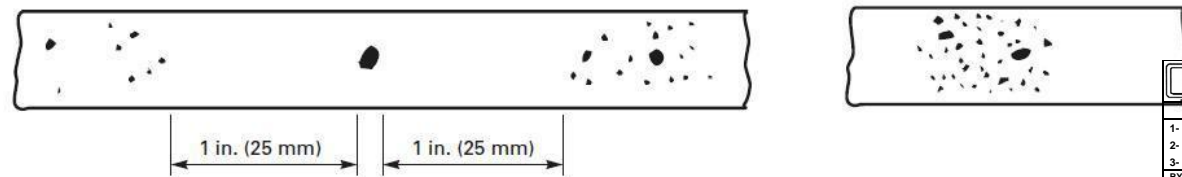


(d) Isolated indications

Figure 7-5. Charts for t equal to 3 mm to 6 mm, inclusive



(a) Random Rounded Indications
Typical concentration and size permitted in any 150 mm length of weld.



(b) Isolated Indication

(c) Cluster

Figure 7-6. Charts for t over 6 mm to 10 mm, inclusive

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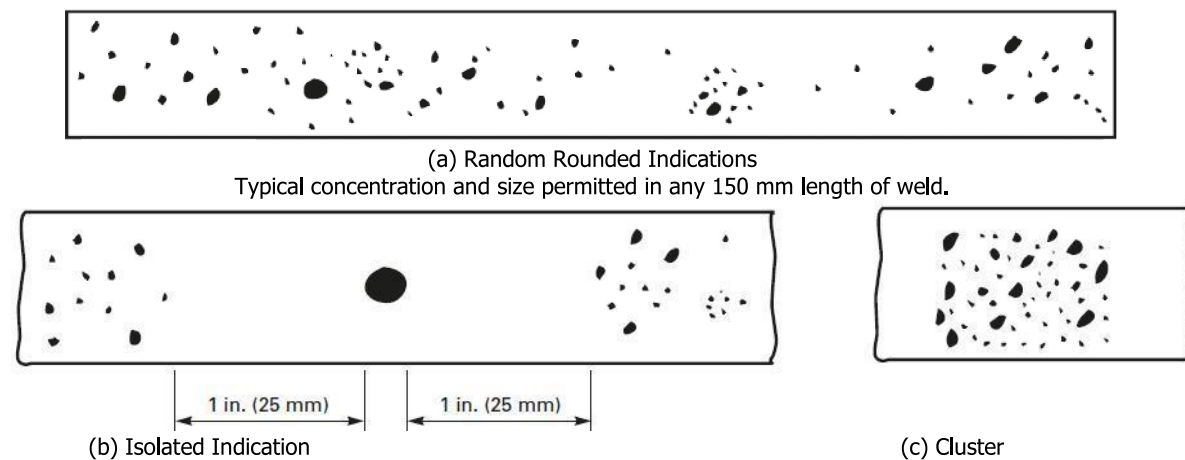


Figure 7-7. Charts for t over 10 mm to 19 mm, inclusive

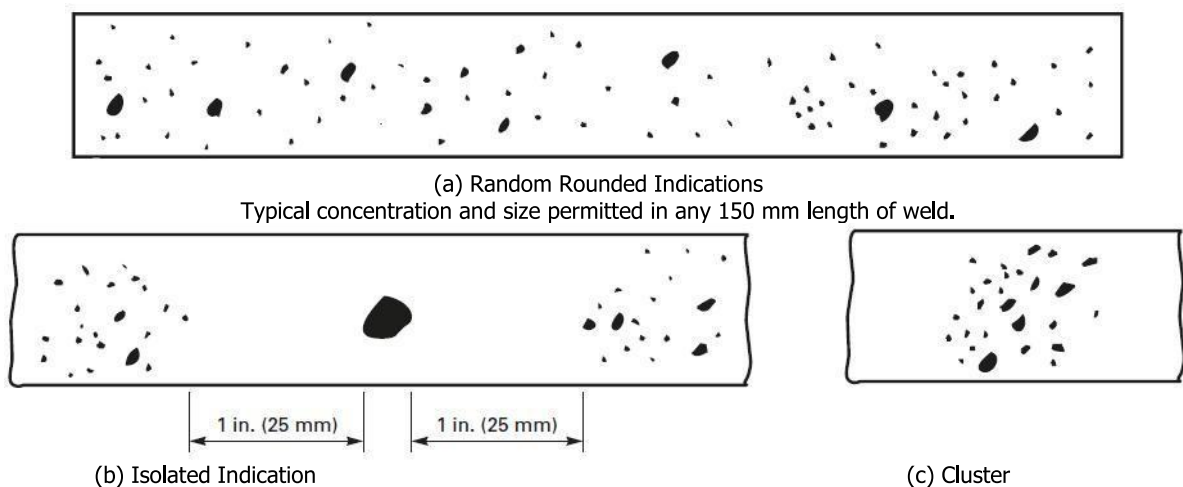


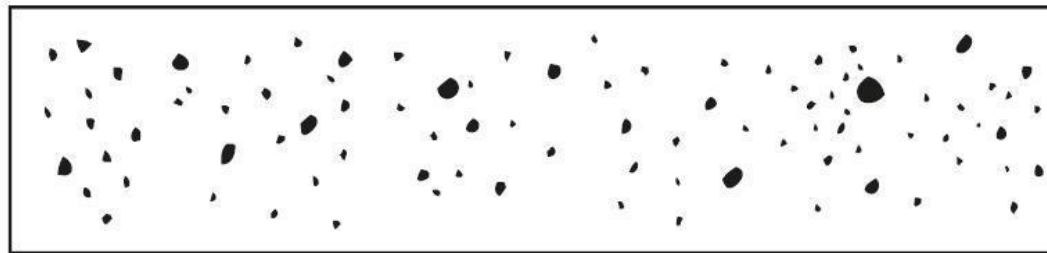
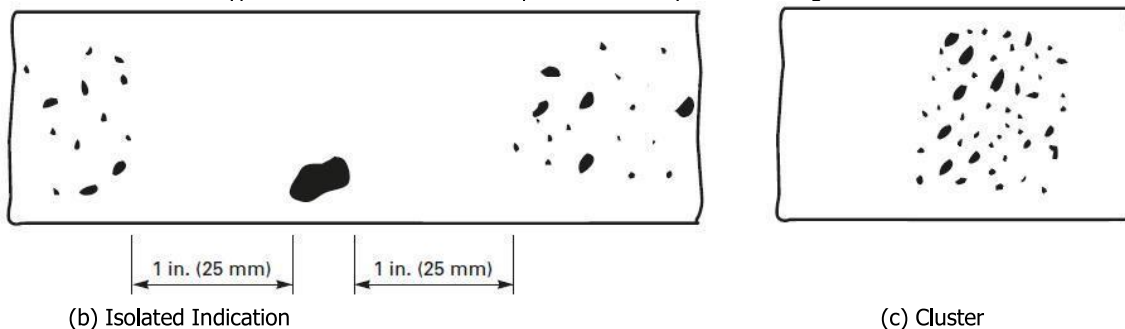


Figure 7-8. Charts for t over 19 mm to 50 mm, inclusive

 NARGAN COMPANY	
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(a) Random Rounded Indications
Typical concentration and size permitted in any 150 mm length of weld.



(b) Isolated Indication

(c) Cluster

Figure 7-9. Charts for t over 50 mm to 100 mm, inclusive

Indications shown on radiographs of welds and characterized as imperfections are unacceptable under the following conditions.

- Any indication characterized as a crack or zone of incomplete fusion or penetration.
- Any other elongated indication on the radiograph which has length greater than:
 - 6 mm for $t \leq 19$ mm.
 - $1/3t$ for $19 \text{ mm} \leq t \leq 57$ mm.
 - 19 mm for $t > 57$ mm.
- Any group of aligned indications that have an aggregate length greater than t in a length of $12t$ except when the distance between the successive imperfections exceeds $6L$ where L is the length of the longest imperfection in the group.
- Internal root conditions are acceptable when the density or image brightness change as indicated in the radiograph is not abrupt. Linear indication on the radiograph at either edge of such conditions shall be evaluated with bullet above.
- Rounded indications in excess of that specified by the acceptance standards given below.

The maximum permissible size of any indication shall be $1/4t$, or 4 mm, whichever is smaller; except that an isolated indication separated from an adjacent indication by 25 mm or more may be $1/3t$, or 6 mm, whichever is less. For t greater than 50 mm, the maximum permissible size of an isolated indication shall be increased to 10 mm.

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9 ASME BPVC Section IX, paragraph QW 191.1.2

9.1 Acceptance Criteria

Welder and welding operator performance test by radiography of welds in test assemblies shall be judged unacceptable when the radiograph exhibits any imperfections in excess of the limits specified below.

9.1.1 Linear indications

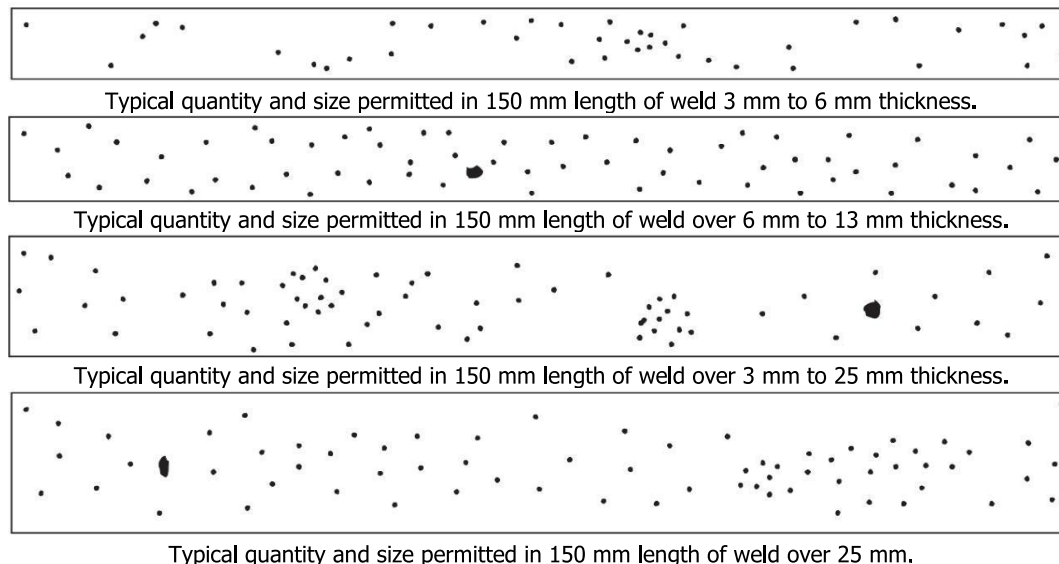
- Any type of crack or zone of incomplete fusion or penetration.
- Any elongated slag inclusion which has a length greater than:
 - 3 mm for $t \leq 10$ mm.
 - $1/3t$ for $10 \text{ mm} < t \leq 57$ mm.
 - 19 mm for $t > 57$ mm.
- Any group or slag inclusion in line that have an aggregate length greater than t in a length of $12t$, except when the distance between the successive imperfections exceeds $6L$ where L is the length of the longest imperfection in the group.

9.1.2 Rounded indications

- The maximum permissible dimension for rounded indications shall be 20% of t or 3 mm, whichever is smaller.
- For welds in material less than 3 mm in thickness, the maximum number of acceptable rounded indications shall not exceed 12 in a 150 mm length of weld. A proportionally fewer number of rounded indications shall be permitted in welds less than 150 mm in length.
- For welds in material 3 mm or greater in thickness, the charts in section 9.2 represent the maximum acceptable type of rounded indications illustrated in typically clustered, assorted and randomly dispersed configurations. Rounded indications less than 0.8 mm in maximum diameter shall not be considered in the radiographic acceptance tests of welders and welding operators in these ranges of material thicknesses.

9.2 Rounded indication chart

These charts represent the maximum acceptable concentration limits for rounded indications. The charts for each thickness range represent full-scale 150 mm radiographs.



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Figure QW-191.1.2.2(b)(4) Rounded indication charts

10 ASME B31.1, paragraph 136.4.5

10.1 Acceptance criteria linear indications

Indications shown on radiographs of welds and characterized as imperfections are unacceptable under the following conditions:

Any type of crack or zone of incomplete fusion or penetration.

Any other elongated indication that has a length greater than:

- 6.0 mm for $t \leq 19.0$ mm.
- $1/3t$ for $19.0 \text{ mm} < t \leq 57.0$ mm.
- 19.0 mm for $t > 57.0$ mm.



If a weld joins two members having different thickness at the weld, t is the thinner of these two thicknesses.

Any group of indications in line that have an aggregate length greater than t in a length of $12t$, except where the distance between the successive indications exceeds $6L$ where L is the longest indication in the group.

Root concavity when there is an abrupt change in density, as indicated on the radiograph.

10.2 Acceptance criteria for rounded indications

Porosity in excess of that shown as acceptable in non-mandatory appendix A, A-250 of ASME BPVC section I, refer to section 5.1.1 up to 5.3 of this procedure.

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11 ASME B31.3, table 341.3.2

Indications shown on radiographs of welds and characterized as imperfections are unacceptable under the following conditions as stated into, table 341.3.2 (as shown in section 11.2) for the service conditions discussed.



If no service condition is given the "Severe Cyclic Condition" shall be used.

11.1 Acceptance criteria for rounded indications

The acceptance criteria for rounded indications shall be as per Table 341.3.2, symbol D and E,(refer to section 11.2) and to the ASME BPVC, section VIII, Division 1, Appendix 4 as described in section 6.1.1 through 6.2 of this procedure.

11.1.1 Image density

Density within the image of the indication may vary and is not a criterion for acceptance or rejection.

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11.2 Table 341.3.2 Acceptance criteria for welds

Table 341.3.2 Acceptance Criteria for Welds — Visual and Radiographic Examination



Criteria (A to M) for Types of Welds and for Service Conditions [Note (1)]									
Normal and Category M Fluid Service			Severe Cyclic Conditions			Category D Fluid Service			
Girth, Miter Groove, and Branch Connection Welds [Note (2)]	Longitudinal Groove Weld [Note (3)]	Fillet Weld [Note (4)]	Girth, Miter Groove, and Branch Connection Welds [Note (2)]	Longitudinal Groove Weld [Note (3)]	Fillet Weld [Note (4)]	Girth and Miter Groove Welds [Note (4)]	Longitudinal Groove Weld [Note (3)]	Fillet Weld [Note (4)]	Branch Connection Weld [Note (2)]
A	A	A	A	A	A	A	A	A	A
A	A	A	A	A	A	C	A	N/A	A
B	A	N/A	A	A	N/A	C	A	N/A	B
E	E	N/A	D	D	N/A	N/A	N/A	N/A	N/A
G	G	N/A	F	F	N/A	N/A	N/A	N/A	N/A
H	A	H	A	A	A	I	A	H	H
A	A	A	A	A	A	A	A	A	A
N/A	N/A	N/A	J	J	J	N/A	N/A	N/A	N/A
K	K	N/A	K	K	N/A	K	K	N/A	K
L	L	L	L	L	L	M	M	M	M
Weld Imperfection									
Crack									
Lack of fusion									
Incomplete penetration									
Rounded Indications									
Linear indications									
Undercutting									
Surface porosity or exposed slag inclusion [Note (5)]									
Surface finish									
Concave surface, concave root, or burn-through									
Weld reinforcement or internal protrusion									
Visual									
Radiography									

GENERAL NOTES:

- Weld imperfections are evaluated by one or more of the types of examination methods given, as specified in paras. 341.4.1, 341.4.2, 341.4.3, and M341.4, or by the engineering design.
- "N/A" indicates the Code does not establish acceptance criteria or does not require evaluation of this kind of imperfection for this type of weld.
- Check (✓) indicates examination method generally used for evaluating this kind of weld imperfection.
- Ellipsis (...) indicates examination method not generally used for evaluating this kind of weld imperfection.

NOTES:

- Criteria given are for required examination. More-stringent criteria may be specified in the engineering design. See also paras. 341.5 and 341.5.3.
- Branch connection weld includes pressure containing welds in branches and fabricated laps.
- Longitudinal groove weld includes straight and spiral (helical) seam. Criteria are not intended to apply to welds made in accordance with a standard listed in Table A-1, Table A-1M, or Table 326.1. Alternative Leak Test requires examination of these welds; see para. 345.9.
- Fillet weld includes socket and seal welds, and attachment welds for slip-on flanges, branch reinforcement, and supports.
- These imperfections are evaluated only for welds ≤5 mm ($\frac{1}{4}$ in.) in nominal thickness.


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Criterion Value Notes for Table 341.3.2

Symbol	Criterion	Measure	Acceptable Value Limits [Note (1)]
A	Extent of imperfection		Zero (no evident imperfection)
B	Cumulative length of incomplete penetration		≤38 mm (1.5 in.) in any 150 mm (6 in.) weld length or 25% of total weld length, whichever is less
C	Cumulative length of lack of fusion and incomplete penetration		≤38 mm (1.5 in.) in any 150 mm (6 in.) weld length or 25% of total weld length, whichever is less
D	Size and distribution of rounded indications		See ASME BPVC, Section VIII, Division 1, Appendix 4 [Note (2)]
E	Size and distribution of rounded indications		For $\bar{T}_{10} \leq 6$ mm ($\frac{1}{4}$ in.), limit is same as D [Note (2)] For $\bar{T}_{10} > 6$ mm ($\frac{1}{4}$ in.), limit is $1.5 \times D$ [Note (2)]
F	Linear indications		≤ $\bar{T}_{10}/3$
	Individual length		≤2.5 mm ($\frac{3}{32}$ in.) and ≤ $\bar{T}_{10}/3$
	Individual width		≤ \bar{T}_{10} in any 12 \bar{T}_{10} weld length [Note (2)]
G	Cumulative length		≤ $2\bar{T}_{10}$
	Linear indications		≤3 mm ($\frac{1}{8}$ in.) and ≤ $\bar{T}_{10}/2$
	Individual length		≤4 \bar{T}_{10} in any 150 mm (6 in.) weld length [Note (2)]
	Individual width		≤1 mm ($\frac{1}{32}$ in.) and ≤ $\bar{T}_{10}/4$
H	Cumulative length		≤38 mm (1.5 in.) in any 150 mm (6 in.) weld length or 25% of total weld length, whichever is less
	Depth of undercut		≤1.5 mm ($\frac{1}{16}$ in.) and ≤ $\bar{T}_{10}/4$ or 1 mm ($\frac{1}{32}$ in.)
I	Cumulative length of internal and external undercut		≤38 mm (1.5 in.) in any 150 mm (6 in.) weld length or 25% of total weld length, whichever is less
	Depth of undercut		≤1.5 mm ($\frac{1}{16}$ in.) and ≤ $\bar{T}_{10}/4$ or 1 mm ($\frac{1}{32}$ in.)
J	Cumulative length of internal and external undercut		≤38 mm (1.5 in.) in any 150 mm (6 in.) weld length or 25% of total weld length, whichever is less
K	Surface roughness		≤12.5 μ m (500 μ in.) R_a in accordance with ASME B46.1
	Depth of surface concavity, root concavity, or burn-through		Total joint thickness, including weld reinforcement, ≥ \bar{T}_{10} [Notes (3) and (4)]
L	Height of reinforcement or internal protrusion [Note (5)] in any plane through the weld shall be within limits of the applicable height value in the tabulation at right, except as provided in Note (6). Weld metal shall merge smoothly into the component surfaces.		For \bar{T}_{10} mm (in.) ≤6 ($\frac{1}{4}$) >6 ($\frac{1}{4}$), ≤13 ($\frac{1}{2}$) >13 ($\frac{1}{2}$) ≤25 (1) >25 (1) Limit is twice the value applicable for L above
M	Height of reinforcement or internal protrusion [Note (5)] as described in L. Note (6) does not apply.		Height, mm (in.) ≤1.5 ($\frac{1}{16}$) ≤3 ($\frac{1}{8}$) ≤4 ($\frac{3}{32}$) ≤5 ($\frac{1}{4}$)

NOTES:



(1) Where two limiting values are separated by "and," the lesser of the values determines acceptance. Where two sets of values are separated by "or," the larger value is acceptable. \bar{T}_{10} is the nominal wall thickness of the thinner of two components joined by a butt weld.

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Criterion Value Notes for Table 341.3.2 (Cont'd)

NOTES: (Cont'd)

- (2) Porosity and inclusions such as slag or tungsten are defined as rounded indications where the maximum length is three times the width or less. These indications may be circular, elliptical, or irregular in shape; may have tails; and may vary in density. Indications where the length is greater than three times the width are defined as linear indications and may also be slag, porosity, or tungsten.
- (3) For circumferential groove welded joints in pipe, tube, and headers made entirely without the addition of filler metal, external concavity shall not exceed the lesser of 1 mm ($\frac{1}{32}$ in.) or 10% of the joint nominal thickness. The contour of the concavity shall blend smoothly with the base metal. The total joint thickness, including any reinforcement, shall not be less than the minimum wall thickness, t_m .
- (4) For radiography, acceptability may be determined by comparing the density of the image through the affected area to the density through the adjacent base metal (\bar{T}_m). If digital radiography is used, brightness comparison may be utilized. A density or brightness darker than the adjacent base metal is cause for rejection.
- (5) For groove welds, height is the lesser of the measurements made from the surfaces of the adjacent components; both reinforcement and internal protrusion are permitted in a weld. For fillet welds, height is measured from the theoretical throat, [Figure 328.5.2A](#); internal protrusion does not apply.
- (6) For welds in aluminum alloy only, internal protrusion shall not exceed the following values:
 - (a) 1.5 mm ($\frac{1}{16}$ in.) for thickness ≤ 2 mm ($\frac{3}{64}$ in.)
 - (b) 2.5 mm ($\frac{3}{32}$ in.) for thickness > 2 mm and ≤ 6 mm ($\frac{1}{4}$ in.)
For external reinforcement and for greater thicknesses, see the tabulation for symbol L.

 NARGAN COMPANY	
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3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 02 April 2024	
SIGN: 	

CERTIFICAAT

nummer / number

N 43899

Stichting Hobéon SKO Certificatie

te Den Haag

verklaart dat
certifies that

V.M.J. Spieringhs

(Hobéon SKO nr: 108113)

geboren **05 maart 1982**
date of birth

te **Bergen op Zoom**
at

voldoet aan de certificatie-eisen conform de Hobéon SKO-regelingen voor het systeem SKNDO versie 7
meets the certification criteria of the the Hobéon SKO regulations for the SKNDO system version 7

Radiografisch onderzoek (niveau 3) volgens ISO 9712:2012

Radiographic testing (level 3) in accordance with ISO 9712:2012

voor de sector Beproeving vóór en tijdens gebruik, incl. fabricage
for the sector Pre- and in-service testing which includes manufacturing


De examenprocedure en -eisen zijn overeenkomstig ISO 9712
The examination procedure en requirements are in accordance with ISO 9712

Dit certificaat is tevens een bewijs van goedkeuring voor het uitvoeren van niet-destructief onderzoek in de genoemde methode en niveau op permanente verbindingen voor drukapparatuur van de categorieën III en IV in overeenstemming met de Europese Richtlijn voor Drukapparatuur 2014/68/EU bijlage I artikel 3.1.3 (PED).



This Certificate is evidence of approval to carry out non-destructive tests in the method and level mentioned on permanent joints for pressure equipment in categories III and IV in accordance with European Pressure Equipment Directive 2014/68/EU Annex 1, section 3.1.3 (PED).

Dit certificaat is geldig vanaf **01 december 2017**
This certificate is valid from

tot **01 december 2022**
until


drs. B. Verstegen
namens het bestuur
on behalf of the board


Handtekening certificaathouder
Signature certificate holder

 NARGAN COMPANY	
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 02 April 2018	
SIGN.: 	

Kopieën zijn alleen geldig, indien voorzien van originele handtekeningen van door het bestuur geautoriseerde personen. Dit certificaat is eigendom van Hobéon SKO.
Copies are valid only, if provided with original signatures of persons authorized by the board. This certificate is the property of Hobéon SKO.

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION K-17

DOCUMENTS; PACKAGE NAMEPLATE DRAWING



Vendor doc. Number




17735-19

Vendor:

Airpack Nederland B.V.

P.O. NO.:

LIDCO-PO-NEC-278-6019

	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT						
	Package Nameplate Drawing						
	Document No. 17735-16						Page
	Project No.	Vendor Doc.	P.O. No.	Department	Document Type	Serial No	
	N278	VD	6019	GN	DWG	0017	04

code-1

M. Vakili

Package Nameplate Drawing (K-020)

04	29-01-2024	Issued for Approval	T.T.	S.K.	J.J.
03	24-01-2024	Issued for Approval	T.T.	S.K.	J.J.
02	16-01-2024	Issued for Approval	T.T.	S.K.	J.J.
01	15-09-2023	Issued for Approval	T.T.	S.K.	J.J.
REV.	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED

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Package Nameplate Drawing

Document No. 17735-16

Project No.	Vendor Doc.	P.O. No.	Department	Document Type	Serial No	Revision
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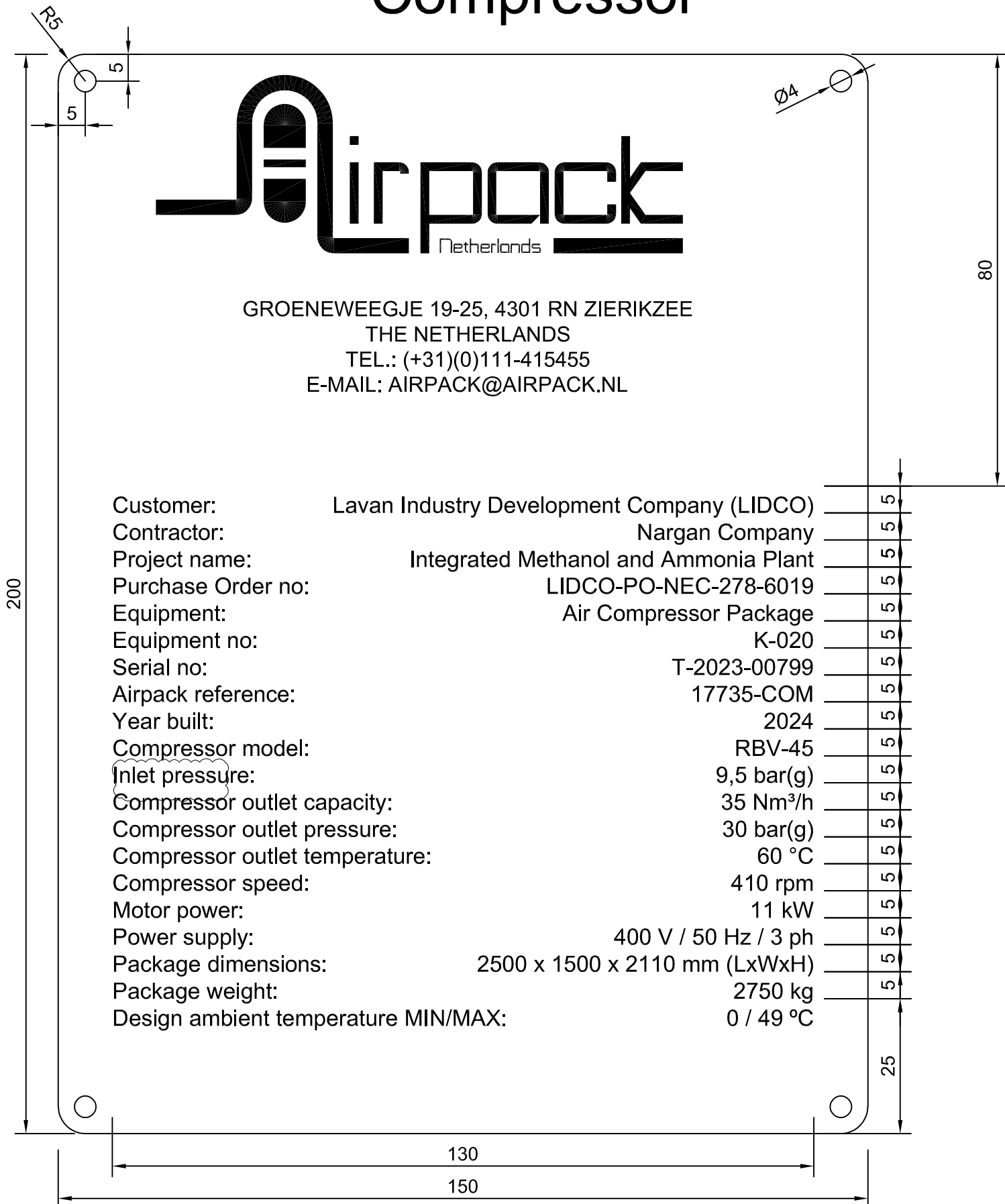
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Compressor



GROENEWEEGJE 19-25, 4301 RN ZIERIKZEE
THE NETHERLANDS
TEL.: (+31)(0)111-415455
E-MAIL: AIRPACK@AIRPACK.NL

Customer:	Lavan Industry Development Company (LIDCO)
Contractor:	Nargan Company
Project name:	Integrated Methanol and Ammonia Plant
Purchase Order no:	LIDCO-PO-NEC-278-6019
Equipment:	Air Compressor Package
Equipment no:	K-020
Serial no:	T-2023-00799
Airpack reference:	17735-COM
Year built:	2024
Compressor model:	RBV-45
Inlet pressure:	9,5 bar(g)
Compressor outlet capacity:	35 Nm ³ /h
Compressor outlet pressure:	30 bar(g)
Compressor outlet temperature:	60 °C
Compressor speed:	410 rpm
Motor power:	11 kW
Power supply:	400 V / 50 Hz / 3 ph
Package dimensions:	2500 x 1500 x 2110 mm (LxWxH)
Package weight:	2750 kg
Design ambient temperature MIN/MAX:	0 / 49 °C



Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION K-18

DOCUMENTS; HYDROTEST PROCEDURE



Vendor doc. Number




17735-19

Vendor:

Airpack Nederland B.V.

P.O. NO.:

LIDCO-PO-NEC-278-6019


 شرکت توسعه صنایع لوان Lavan Industry Development Company	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT																									
 NARGAN	<div style="text-align: center; border-bottom: 1px solid black; padding-bottom: 5px;">Hydrotest procedure</div> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="7" style="padding: 2px;">Document No. 17735-17</td> <td style="padding: 2px;">Page</td> </tr> <tr> <td style="padding: 2px;">Project No.</td> <td style="padding: 2px;">Vendor Doc.</td> <td style="padding: 2px;">P.O. No.</td> <td style="padding: 2px;">Department</td> <td style="padding: 2px;">Document Type</td> <td style="padding: 2px;">Serial No</td> <td style="padding: 2px;">Revision</td> <td style="padding: 2px;"></td> </tr> <tr> <td style="padding: 2px;">N278</td> <td style="padding: 2px;">VD</td> <td style="padding: 2px;">6019</td> <td style="padding: 2px;">GN</td> <td style="padding: 2px;">PRC</td> <td style="padding: 2px;">0018</td> <td style="padding: 2px;">05</td> <td style="padding: 2px;">Page 1 of 6</td> </tr> </table>	Document No. 17735-17							Page	Project No.	Vendor Doc.	P.O. No.	Department	Document Type	Serial No	Revision		N278	VD	6019	GN	PRC	0018	05	Page 1 of 6	
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Airpack B.V. - Air Compressor –

Integrated Methanol and Ammonia Plant

17735-COM Hydrotest procedure (K020)

05	18-04-2024	Issued for Approval	S.K.	K.P.	J.I.
04	18-12-2023	Issued for Approval	S.K.	K.P.	J.I.
03	11-12-2023	Issued for Approval	S.K.	K.P.	J.I.
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01	14-09-2023	Issued for Approval	S.K.	J.J.	S.K.
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INSPECTION




 J.I. APPROVED ☒

 J.I. APPROVED AS NOTED ☐

 J.I. NOT APPROVED ☐

 BY: M.T.G. DATE: 20 April 2024

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	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT							
	Hydrotest procedure							
	Document No. 17735-17							Page
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
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BY: M. REZKEI DATE

SIGN: 

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BY: M. REZEI DATE: 20 April 2024	
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 شرکت توسعه صنایع لوات Lavan Industry Development Company	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT						
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Hydrostatic test

This procedure is applicable to all items subject to a hydrostatic test. Refer to project Inspection & Test Plan for the items subject to a hydrostatic test.

Following procedures will be maintained before and during testing:

- Before test, tested equipment will be inspected properly by the Airpack quality manager.
- Two calibrated pressure gauges will be installed on the highest and lowest position clearly readable.
- Test pressure will be between 50% and 75% of range of used pressure gauges (where possible)
- Used gauges are direct reading type and pressure should be stable during testing.
- Duration of test will be 1 hour as required per authorities code (ASME B31.3 for piping and ASME VIII latest edition for vessels)
- Prior to carrying out the hydrostatic test, weld of reinforcing pad will be leak tested (max 1 bar(g)) by air via tell tail hole and inspected with soap and water (if applicable).
- All oil, grease, dirt and foreign material will be removed.
- Start and end pressure will be recorded by hand during hydro test.



Below Items are tested separately, no complete hydrostatic test of package is done.




Cooling water piping (carbon steel)

This test is executed by sup-supplier or Airpack. For hydrostatic tests a suitable positive displacement pump is available to supply a maximum pressure. Water will be of non-chloride type (max. 50 ppm - Cl₂), temperature approximately 20°C. Tests are non-witnessed by client as per ITP.

Hydrostatic test pressure: 1.3x design pressure for the following items (as per P&ID drawing 17735-03)

- Piping cooling water inlet / inter- aftercooler : 9,1 bar(g)
- Piping inter- aftercooler / cooling water outlet : 9,1 bar(g)

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BY: M. REZAEI DATE: 20 April 2024	
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 شرکت توسعه صنایع لوان Lavan Industry Development Company	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT						
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Main Process Air Piping (SS316)

This test is executed by sup-supplier or Airpack. For hydrostatic tests a suitable positive displacement pump is available to supply a maximum pressure. Water will be of non-chloride type (max. 50 ppm - Cl₂), temperature approximately 20°C. Tests are non-witnessed by client as per ITP.

Hydrostatic test pressure: 1.3x design pressure for the following items (as per P&ID drawing 17735-03)

- Piping Package inlet / 1st stage suction : 16,25 bar(g)
- Piping 1st stage discharge / 2nd stage suction : 39,65 bar(g)
- Piping 2nd stage discharge / package outlet : 50,7 bar(g)

Inter- Aftercooler (SS316)

This test is executed by sup-supplier or Airpack. For hydrostatic tests a suitable positive displacement pump is available to supply a maximum pressure. Water will be of non-chloride type (max. 50 ppm - Cl₂), temperature approximately 20°C. Tests are non-witnessed by client as per ITP.

Hydrostatic test pressure: 1.3x design pressure for the following items (as per P&ID drawing 17735-03)



- Intercooler KE-020-001 shell (SS316) : 39,65 bar(g)
- Intercooler KE-020-001 Tubes (SS316) : 9,1 bar(g)
- Aftercooler KE-020-002 shell (SS316) : 50,7 bar(g)
- Aftercooler KE-020-002 Tubes (SS316) : 9,1 bar(g)




Pulsation Dampeners (carbon steel)

This test is executed by sup-supplier or Airpack. For hydrostatic tests a suitable positive displacement pump is available to supply a maximum pressure. Water will be of non-chloride type (max. 50 ppm - Cl₂), temperature approximately 20°C. Tests are non-witnessed by client as per ITP.

Hydrostatic test pressure: 1.3x design pressure for the following items (as per P&ID drawing 17735-03)

- Pulsation dampener KV-020-001 : 16,25 bar(g)
- Pulsation dampener KV-020-002 : 39,65 bar(g)
- Pulsation dampener KV-020-003 : 50,7 bar(g)
- Pulsation dampener KV-020-004 : 50,7 bar(g)

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BY: M. REZAEI DATE: 20 April 2024	
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	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT														
	HYDROTEST PROCEDURE														
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Compressor pressure parts



This test is executed by sup-supplier or Airpack. For hydrostatic tests a suitable positive displacement pump is available to supply a maximum pressure. Water will be of non-chloride type (max. 50 ppm - Cl₂), temperature approximately 20°C. Tests are non-witnessed by client as per ITP.




Hydrostatic test pressure will be **1.5x** design pressure. (**45,75 bar(g) / 58,5 bar(g)**) and as per approved datasheet.

After test,

- Equipment must be free from any unexpected condition
- Equipment will be dried and cleaned appropriately. Stainless steel will be cleaned by pressurized air.
- Witnessed test report shall be issued by QA department.

Hydrostatic test will be done after completion of all welding and before any painting activities

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BY: M. REZAEI DATE: 20 April 2024	
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	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT														
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AIRPACK NEDERLAND B.V.
GROENEWEEGJE 25
4301 RN ZIERIKZEE
THE NETHERLANDS

HYDROSTATIC TEST CERTIFICATE

Customer :
Purchase Order number :
Equipment :
Airpack reference :
Serial number :
Date :

We certify that the here under mentioned test data is true and correct.
The test procedure is in accordance with ASME B31.3 & Hydrostatic Test Procedure doc
number : 17735-17

Subject name :
Subject number :
Drawing no. :
Test no. : 01 of 0X

HYDROSTATIC TEST:

Fluid: :
Test date :
Constant during : 1 hour.
Test pressure :

RECORDED PRESSURES

Start pressure :
End pressure :



Test pressure gauge number :

Remarks (If any) :

In presence of :

Airpack Approval:

Customer Approval:

	NARGAN COMPANY
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 20 April 2024	
SIGN.: 	

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION K-19




DOCUMENTS; SURFACE PREPARATION AND PAINTING PROCEDURE



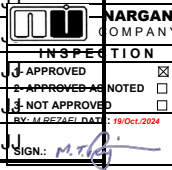
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P.O. NO.:
LIDCO-PO-NEC-278-6019

Vendor:
Airpack Nederland B.V.

	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT							
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Surface Preparation and Painting Procedure

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04	09-04-2024	Issued for Approval	SK	KP	
03	08-04-2024	Issued for Approval	SK	KP	
02	11-12-2023	Issued for Approval	SK	KP	
01	14-09-2023	Issued for Approval	SK	KP	
REV.	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED

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	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT						
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	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT																													
	<table border="1" style="width: 100%;"> <tr> <th colspan="7" style="text-align: center;">Surface Preparation and Painting Procedure</th> </tr> <tr> <td colspan="7">Document No. 17735-18</td> </tr> <tr> <td>Project No.</td> <td>Vendor Doc.</td> <td>P.O. No.</td> <td>Department</td> <td>Document Type</td> <td>Serial No</td> <td>Revision</td> </tr> <tr> <td>N278</td> <td>VD</td> <td>6019</td> <td>GN</td> <td>PRC</td> <td>0019</td> <td>05</td> </tr> </table>		Surface Preparation and Painting Procedure							Document No. 17735-18							Project No.	Vendor Doc.	P.O. No.	Department	Document Type	Serial No	Revision	N278	VD	6019	GN	PRC	0019	05
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1. References

Reference is made to the following documents.

- Offer 17735-COM
- Specification N278-000-PI-JSD-2300-005 Specification for Painting¹

2. General

Our paint system is based on brush/roller application. Painting will be done by Airpack painting specialists. As offered, Airpack equipment will be painted according to the paint schedule below.

- Galvanized steel grating does not require painting.
- Zinc plated and stainless steel bolts do not require painting.
- Stainless steel equipment like tubing, connectors etc. does not require painting.
- Instrumentation paint will be according manufacture standard.

3. Surface preparation


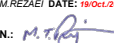
- All structures and equipment are designed and built-in accordance with ISO standards for high durability of the paint systems.
- All oil or grease shall be removed by washing the item to be painted with appropriate solvents or any other suitable means before beginning blast cleaning operations. This includes bolt holes in piping assemblies.
- Weld spatter and remains of temporary welds, deposits or surface defects shall be eliminated appropriately.
- Airpack shall protect all equipment that is not to be painted or liable to be affected by the presence of abrasives or paint. Special attention will be paid to avoid splashes of zinc paint on equipment made of austenitic steels.
- Surface preparation shall be inspected by Airpack Quality Control prior to application of paint.
- Airpack will not perform any mechanical changes to flanges and flange bolt holes and use the delivered flanges.

4. Blast cleaning of carbon steel




All surfaces to be coated, will be blast-cleaned according to:

- The grade of cleanliness, SA 2.5
- The surface profile, to be evaluated using ISO 8503-2
- As painting is Airpack standard, no blast clean record is available.

After blast-cleaning, all dust must be removed using a vacuum cleaner before applying the paint. All blast-cleaned surfaces shall be coated before the deterioration of the "grade of cleanliness". In any case, any surface that has been blast-cleaned shall be coated on the same day.

	
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¹ Airpack paint procedure is followed with color codes from mentioned specification.

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5. Paint Application

Coating system will be from paint manufacturer Jotun and interbond.

The products shall be delivered in their original sealed packaging and stored in such conditions as to avoid their degradation. The packaging shall be clearly marked with the product description, the batch number, the fabrication date and the expiration date. Paint shall always be applied to surfaces that are dry, clean and degreased, for both coating on substrate and previous coat.

Painting work shall not proceed if:

- Temperature of the substrate is less than 3°C above the dew point;
- The relative humidity is more than 85% RH (90% RH for inorganic zinc silicates);
- The weather is rainy or foggy, except under shelter, and subject to verification of the atmospheric conditions;
- The minimum or maximum temperature of the ambient atmosphere and the substrate are outside the limits given in the product data sheets.

Application shall be by brush/roller. Stripe coats shall be applied by brush to all angles, corners, and all the welds with the same product than this to be applied on the surface to be painted. Different colours shall be used for all successive coats of the paint system. The finishing coat of the required colour shall be opaque to cover the shade of the undercoat. The thickness of each coat, including frequency shall be checked by Airpack. The values will be recorded and made available.

6. Painting report

A paint report as attached (see attachment 1) will be provided with a final coating check during FAT. Dry film thickness will be checked using a calibrated Quanix Automation 1311669. Calibration certificate will be made available during FAT.



7. Paint systems




For a detailed overview of each item please refer to below paint schedule.

8. Repair procedure

In case a deviation or non-conformity has been found, this will be repaired as per below procedure. Where the coating has been scratched off, flaked, or in any other way damaged as to hamper its protective function, the coating will be grinded off 5 cm around the defect and paint will be re-applied to conform with the painting system defined in this painting procedure.



In case more than 5% of the equipment surface is not conform specifications, the entire part shall be blasted and re-coated. Where blasting is not feasible, paint will be grinded off until the bare metal is reached after which it is re-coated.




	
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PAINT SCHEDULE					
	MATERIAL	DESCRIPTION	SYSTEM	TDFT [μm]	FINAL COLOR
C1	Carbon Steel	STRUCTURAL STEEL	1	320	RAL-9006
C2	Stainless Steel	PIPING COLD	1	320	RAL-9006
C3	Stainless Steel	PIPING HOT	3	150	Metallic Gray
C4	Carbon Steel	PIPING WATER	1	320	RAL-9006
C5	Stainless Steel	Y-STRAINER	1	320	RAL-9006
C6	Stainless Steel	CHECK VALVE	1	320	RAL-9006
C7	Stainless Steel	VALVES IN MAIN PROCESS LINE	1	320	RAL-9006
C8	Carbon Steel	VALVES IN WATER PROCESS LINE	1	320	RAL-9006
C9	Carbon Steel	PRESSURE CONTROL VALVE	1	320	RAL-9006
C10	Carbon Steel	PRESSURE SAFETY VALVE COLD	1	320	RAL-9006
C11	Carbon Steel	PRESSURE SAFETY VALVE HOT	3	150	Metallic Gray
C12	Carbon Steel	PULSATION DAMPENER COLD	1	320	RAL-9006
C13	Carbon Steel	PULSATION DAMPENER HOT	3	150	Metallic Gray
C14	Carbon Steel	COMPRESOR HOT PARTS	3	150	Metallic Gray
C15	Carbon Steel	COMPRESSOR COLD PARTS	1	320	RAL-6010
C16	Carbon Steel	INTER/AFTER COOLER SHELL	1	320	RAL-9006
C17	Aluminium	MAIN E-MOTOR	Mfr. std.	Mfr. std.	RAL-7030
C18	Aluminium	AUXILLIARY MOTOR	Mfr. std.	Mfr. std.	RAL-7030
C19	Carbon Steel	LOCAL PUSHBUTTON STATION	Mfr. std.	Mfr. std.	RAL-7035
C20	Carbon Steel	LOCAL JUNCTIONBOX	Mfr. std.	Mfr. std.	RAL-7035
C21	Stainless Steel	GENERAL	Not painted	-	-

* Possibilities for painting of materials with ATEX certification is limited

	
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Paint system 1 (acc. ISO 12944-2 C5M-H table S7.04, & Jotun)



- Structural steel & piping
- Surface preparation Sa 2½ for Carbon steel.
- Temperatures up to 120°C




Layer	Type of paint	Make	DFT
1	epoxy mastic	Jotamastic Smart Pack	90 µm
2	epoxy mastic	Jotamastic Smart Pack	90 µm
3	epoxy mastic	Jotamastic Smart Pack	90 µm
4	Polyurethane	Hardtop XP	50 µm
		Total DFT	320 µm

Paint system 3

- High temperature / Carbon steel cycling use
- Surface preparation Sa 2½ for Carbon steel.
- Temperatures -196 up to 650°C
- Available colours: Metallic Gray (matte)

Layer	Type of paint	Make	DFT
1	Multipolymeric Matrix coating	International Interbond 1202UPC	75 µm
2	Multipolymeric Matrix coating	International Interbond 1202UPC	75 µm
		Total DFT	150 µm

	
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PAINT REPORT

Customer : Lavan Industry Development Company (LIDCO)
Purchase order number : LIDCO-PO-NEC-278-6019
Equipment : High Pressure Air Compressor
Equipment item no. : K-020
Airpack ref. no. : 17735-COM
Serial no. : T-2023-00799
Test location : Zierikzee
Test date :

Item : SKID
Paint system : 1

MEASUREMENTS According to Attachment #1

EXAMPLE

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Attachment #1

Paint measurements of skid

Projectnumber17735-COM

Start date

Material Temp. °C

Specification layer Thicknessminimum of320 μ

Paint system

1st layer

2nd layer

3rd layer

4th layer

5th layer

Finish date

Batch Number

Measurements in μ

		Layer		measure point 1	measure point 2	measure point 3	measure point 4	measure point 5	measure point 6	measure point 7	measure point 8	measure point 9	measure point 10	measure point 11	measure point 12	measure point 13	measure point 14	measure point 15	Min Max
Date																			
Temperature	°C	1	Min																
Humidity	%		Max																
Date		2	Min																
Temperature	°C																		
Humidity	%	Max																	
Date		3	Min																
Temperature	°C																		
Humidity	%	Max																	
Date		4	Min																
Temperature	°C																		
Humidity	%	Max																	
Date		5	Min																
Temperature	°C																		
Humidity	%	Max																	

Measurements in μ during FAT

		Layer		measure point 1	measure point 2	measure point 3	measure point 4	measure point 5	measure point 6	measure point 7	measure point 8	measure point 9	measure point 10	measure point 11	measure point 12	measure point 13	measure point 14	measure point 15	Min Max
Date																			
Temperature	°C	all	Min																
Humidity	%		Max																

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COMPANY

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BY: MAREK DĄB

DATE: 2024-07-15

Universal Pipe Coating

PRODUCT DESCRIPTION

A high temperature universal pipe coating (UPC) that complies with the performance criteria of ISO12944-9 standard for corrosion protection in offshore environments.

Interbond 1202UPC is a two component, ambient cure, inorganic copolymer.

Conforms to the inert multi-polymeric matrix coating definition as per NACE SP0198 standard.

INTENDED USES

Suitable for protecting above-ground piping and accessories operating at temperatures between -196°C (-321°F) to +650°C (1202°F).

Interbond 1202UPC reduces paint complexity and overall painting costs of new construction projects by simplifying coating specifications for process piping and accessories.

Designed as a two coat or single coat application to carbon or stainless steel for long term corrosion protection.

Suitable for use on surfaces either uninsulated or under thermal insulation and for the protection of cryogenic piping and equipment. Not suitable for buried service.

PRACTICAL INFORMATION FOR INTERBOND 1202UPC

Colour	Metallic Grey
Gloss Level	Matt
Volume Solids	56%
Typical Thickness	100-200 microns (4-8 mils) dry equivalent to 179-357 microns (7.2-14.3 mils) wet
Theoretical Coverage	5.60 m ² /litre at 100 microns d.f.t and stated volume solids 225 sq.ft/US gallon at 4 mils d.f.t and stated volume solids
Practical Coverage	Allow appropriate loss factors
Method of Application	Airless Spray, Air Spray, Brush, Conventional Spray, Roller
Drying Time	



Overcoating interval with self

Temperature	Touch Dry	Hard Dry	Minimum	Maximum
10°C (50°F)	90 minutes	6 hours	6 hours	14 days
15°C (59°F)	60 minutes	6 hours	6 hours	14 days
25°C (77°F)	30 minutes	3 hours	6 hours	14 days
40°C (104°F)	15 minutes	3 hours	6 hours	14 days

Where maximum overcoating intervals are exceeded, clean the surface of Interbond 1202UPC thoroughly with clean fresh water then lightly abrade.

REGULATORY DATA

Flash Point (Typical)	Part A 37°C (99°F); Part B 76°C (169°F); Mixed 39°C (102°F)		
Product Weight	1.25 kg/l (10.4 lb/gal)		
VOC	3.42 lb/gal (410 g/l)	EPA Method 24	
	311 g/kg	EU Solvent Emissions Directive (Council Directive 2010/75/EU)	
	405 g/l	Chinese National Standard GB23985	
See Product Characteristics section for further details			

	
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Protective Coatings

Universal Pipe Coating

SURFACE PREPARATION

All surfaces to be coated should be clean, dry and free from contamination. Prior to paint application all surfaces should be assessed and treated in accordance with ISO 8504:2000. Oil or grease should be removed in accordance with SSPC-SP1 solvent cleaning.

Abrasive Blast Cleaning

Abrasive blast clean to Sa2½ (ISO 8501-1:2007) or SSPC-SP10. If oxidation has occurred between blasting and application of Interbond 1202UPC, the surface should be reblasted to the specified visual standard. Surface defects revealed by the blast cleaning process should be ground, filled, or treated in the appropriate manner.

Power Tool Cleaning (Small Areas Only)

For small areas of touch up and repair, Power Tool cleaning to SSPC SP11 is suitable. Optimum performance will be achieved with a minimum surface profile of 50 microns (2 mils).

Austenitic Stainless Steel

Ensure surface is clean, dry and free from metal corrosion products prior to application. Abrasive blast with nonmetallic and chloride free abrasive (e.g. aluminium oxide or garnet) to obtain anchor profile of 37.5 to 50 microns (1.5 to 2 mils).

Optimum performance will be achieved for steel operating under high and cyclic temperature conditions when the preferred 50 microns (2 mils) profile is obtained.

Primed Surfaces

Interbond 1202UPC is suitable for application to unweathered steelwork freshly coated with zinc silicate shop primers.

If the zinc shop primer shows extensive or widely scattered breakdown, or excessive zinc corrosion products, overall sweep blasting will be necessary. Other types of shop primer are not suitable for overcoating and will require complete removal by abrasive blast cleaning.

Weld seams and damaged areas should be blast cleaned to Sa2½ (ISO 8501-1:2007) or SSPC-SP6.

APPLICATION

Mixing	Material is supplied in two containers as a unit. Always mix a complete unit in the proportions supplied. Once the unit has been mixed it must be used within the working pot life specified. (1) Agitate Base (Part A) with a power agitator. (2) Combine entire contents of Curing Agent (Part B) with Base (Part A) and mix thoroughly with power agitator. Refer to Interbond 1202UPC Application Guidelines for more details.			
Mix Ratio	28 part(s) : 1 part(s) by volume			
Working Pot Life	10°C (50°F) 8 hours	15°C (59°F) 8 hours	25°C (77°F) 8 hours	40°C (104°F) 4 hours
Airless Spray	Recommended	Tip Range 0.58-0.69 mm (23-27 thou) Total output fluid pressure at spray tip not less than 141 kg/cm² (2005 p.s.i.) To ensure easy application, all filters should be removed from the pump and gun.		
Air Spray (Pressure Pot)	Recommended when topcoating	Gun Air Cap Fluid Tip	DeVilbiss MBC or JGA 704 or 765 E	
Air Spray (Conventional)	Recommended when topcoating	Use suitable proprietary equipment		
Brush	Suitable - touch up only	Typically 60 microns (2.4 mils) can be achieved		
Roller	Suitable - touch up only	Typically 60 microns (2.4 mils) can be achieved		
Thinner	International GTA007	Thinning is not normally required. Consult the local representative for advice during application in extreme conditions. Do not thin more than allowed by local environmental legislation.		
Cleaner	International GTA007	Choice of cleaner maybe subject to local legislation. Please consult your local representative for specific advice.		
Work Stoppages	Do not allow material to remain in hoses, gun or spray equipment. Thoroughly flush all equipment with International GTA007. Once units of material have been mixed they should not be resealed and it is advised that after prolonged stoppages work recommences with freshly mixed units.			
Clean Up	Clean all equipment immediately after use with International GTA007. It is good working practice to periodically flush out spray equipment during the course of the working day. Frequency of cleaning will depend upon amount sprayed, temperature and elapsed time, including any delays.			

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Universal Pipe Coating

PRODUCT CHARACTERISTICS

The detailed Interbond 1202UPC Application Guidelines should be consulted prior to use.

Interbond 1202UPC conforms to the Inert Multipolymeric Matrix coating definition as per NACE Standard Practice SP0198 Table 2 typical recommendations for use on carbon steel equipment under thermal insulation.

When applying Interbond 1202UPC in confined spaces ensure adequate ventilation.

Surface temperature must always be a minimum of 3°C (5°F) above dew point.

Interbond 1202UPC reacts with atmospheric moisture, and as such when in the can should remain covered at all times. If the tin is left open and not agitated for 30-60 minutes, a skin may form. This should be removed prior to re-mixing and continued application.

In common with many products containing leafing aluminium pigmentation Interbond 1202UPC may be prone to developing a "polished" appearance in areas of minor mechanical impact etc. However, this phenomenon is merely aesthetic and is not detrimental to the anti-corrosive performance of the product.

As with all coated surfaces, it is recommended that appropriate care be taken during storage and transport to avoid mechanical damage from dragging and scraping.

Due to the flexible nature of the coating and total recommended dry film thickness being at a minimum of 200 microns (8 mils), pull-off adhesion testing (as per ISO 4624) is not considered relevant. Adhesion should be evaluated using cross cut methods as specified in ASTM D3359. Acceptable rating achieved in practice is ≥3A.

When using in high heat service over inorganic zinc primer, the products should be applied in strict accordance with film thickness specifications, since application of excessive thicknesses may cause blistering or adhesion loss. Determine that the inorganic zinc primer is thoroughly cured prior to application of the high heat coating by following the curing instructions given on the relevant product data sheet.

When using a zinc silicate primer, the recommended thickness of zinc silicate is 50 microns (2 mils) dry film thickness to ensure maximum surface strength for any subsequent temperature cycling and to avoid flaking of topcoats. The maximum subsequent single coat thickness of Interbond 1202UPC should be 150 microns (6 mils), with a maximum total system dry film thickness of 300 microns (12 mils). It is preferable to overcoat zinc silicate before weathering but in cases where this is not possible then the zinc silicate surface should be clean and free of zinc corrosion products.

Note: VOC values are typical and are provided for guidance purpose only. These may be subject to variation depending on factors such as differences in colour and normal manufacturing tolerances.

Low molecular weight reactive additives, which will form part of the film during normal ambient cure conditions, will also affect VOC values determined using EPA Method 24.

SYSTEMS COMPATIBILITY

Interbond 1202UPC is normally applied direct to metal. This specialist coating is only compatible with a very limited number of products.

Suitable primers are:



Interzinc 22 Series

Overcoating of Interbond 1202UPC for colour identification purposes may be possible.

Suitable topcoats are:

Interthane 990
Intertherm 875

For other suitable topcoats, consult International Protective Coatings.

	
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Universal Pipe Coating

ADDITIONAL INFORMATION

Further information regarding industry standards, terms and abbreviations used in this data sheet can be found in the following documents available at www.international-pc.com:

- Definitions & Abbreviations
- Surface Preparation
- Paint Application
- Theoretical & Practical Coverage
- Interbond 1202UPC Application Guidelines

Individual copies of these information sections are available upon request.

SAFETY PRECAUTIONS

This product is intended for use only by professional applicators in industrial situations in accordance with the advice given on this sheet, the Safety Data Sheet and the container(s), and should not be used without reference to the Safety Data Sheet (SDS).

All work involving the application and use of this product should be performed in compliance with all relevant national, Health, Safety & Environmental standards and regulations.

In the event welding or flame cutting is performed on metal coated with this product, dust and fumes will be emitted which will require the use of appropriate personal protective equipment and adequate local exhaust ventilation.

If in doubt regarding the suitability of use of this product, consult AkzoNobel for further advice.

PACK SIZE	Unit Size	Part A		Part B	
		Vol	Pack	Vol	Pack
	15 litre	14.48 litre	20 litre	0.52 litre	0.75 litre
	5 US gal	3.82 US gal	5 US gal	0.18 US gal	0.25 US gal
	1 US gal	0.77 US gal	1 US gal	0.03 US gal	1 US pint

For availability of other pack sizes, contact AkzoNobel.

SHIPPING WEIGHT (TYPICAL)	Unit Size	Part A	Part B
	15 litre	19.6 kg	0.61 kg
	5 US gal	43.9 lb	1.7 lb
	1 US gal	8.7 lb	0.4 lb

STORAGE	Shelf Life	12 months minimum at 25°C (77°F). Subject to re-inspection thereafter. Store in dry, shaded conditions away from sources of heat and ignition.
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Important Note


The information in this data sheet is not intended to be exhaustive; any person using the product for any purpose other than that specifically recommended in this data sheet without first obtaining written confirmation from us as to the suitability of the product for the intended purpose does so at their own risk. All advice given or statements made about the product (whether in this data sheet or otherwise) is correct to the best of our knowledge but we have no control over the quality or the condition of the substrate or the many factors affecting the use and application of the product. Therefore, unless we specifically agree in writing to do so, we do not accept any liability at all for the performance of the product or for (subject to the maximum extent permitted by law) any loss or damage arising out of the use of the product. We hereby disclaim any warranties or representations, express or implied, by operation of law or otherwise, including, without limitation, any implied warranty of merchantability or fitness for a particular purpose. All products supplied and technical advice given are subject to our Conditions of Sale. You should request a copy of this document and review it carefully. The information contained in this data sheet is liable to modification from time to time in the light of experience and our policy of continuous development. It is the user's responsibility to check with their local representative that this data sheet is current prior to using the product.

This Technical Data Sheet is available on our website at www.international-marine.com or www.international-pc.com, and should be the same as this document. Should there be any discrepancies between this document and the version of the Technical Data Sheet that appears on the website, then the version on the website will take precedence.

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Technical Data

Hardtop XP



Product description

A two-pack high solid, aliphatic polyurethane topcoat with excellent gloss and colour retention. Hardtop XP bases are intermediates and need to be processed before use.

Recommended use

As a glossy topcoat over most epoxy systems where a durable, weather-resistant finish is required in a wide range of aggressive atmospheres.

Film thickness and spreading rate

	Minimum	Maximum	Typical
Film thickness, dry (µm)	40	100	60
Film thickness, wet (µm)	65	160	95
Theoretical spreading rate (m ² /l)	15,8	6,3	10,5

Physical properties

Colour	According to colour card and Multicolor tinting system (MCI)
Solids (vol %)*	63 ± 2
Flash point	30°C ± 2 (Setaflash)
VOC	2,8 lbs/gal (336 gms/ltr) USA-EPA Method 24 320 gms/ltr UK-PG6/23(97). Appendix 3
Gloss	Glossy
Gloss retention	Excellent
Water resistance	Very good
Abrasion resistance	Very good
Solvent resistance	Good
Chemical resistance	Good
Flexibility	Very good

*Measured according to ISO 3233:1998 (E)

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BY: M. REZAEI DATE: 19/Oct/2024	
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Hong Kong rules:

Category of paints - Other vessel coatings; VOC 336 gms/ltr HK EPD method (Ready to use); Exempt compound - N/A; Specific gravity: 1.22 (A+B); Both VOC and Specific gravity values provided are typical values, subject to changes when different colour involved.

Surface preparation

All surfaces should be clean, dry and free from contamination. The surface should be assessed and treated in accordance with ISO 8504.

Coated surfaces

Clean, dry and undamaged compatible primer. Please contact your local Jotun office for more information.

Other surfaces

The coating may be used on other substrates. Please contact your local Jotun office for more information.

Condition during application


The temperature of the substrate should be minimum 5°C and at least 3°C above the dew point of the air, temperature and relative humidity measured in the vicinity of the substrate. Good ventilation is required in confined areas to ensure correct drying.

Application methods

Spray	Use airless spray or conventional spray
Brush	Recommended for stripe coating and small areas, care must be taken to achieve the specified dry film thickness.
Roller	May be used. However when using roller application care must be taken to apply sufficient material in order to achieve the specified dry film thickness.

Application data

Mixing ratio (volume)	10:1
Mixing	10 parts Hardtop XP Comp. A (Base) to be mixed thoroughly with 1 part Hardtop XP, Comp. B (Curing agent) by powered mechanical equipment. Mix complete units only, do not part mixing of this product.
Pot life (23°C)	1,5 hours
Thinner/Cleaner	Jotun Thinner No. 10/26
Guiding data airless spray	
Pressure at nozzle	15 MPa (150 kp/cm ² , 2100 psi)
Nozzle tip	0.28-0.38 mm (0.011-0.017")
Spray angle	40-80°
Filter	Check to ensure that filters are clean.
Note	Jotun Thinner No. 26 is supplied and used in USA due to legislation.

	
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BY: M. REZAEI DATE: 19/Oct/2024	
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Drying time

Drying times are generally related to air circulation, temperature, film thickness and number of coats, and will be affected correspondingly. The figures given in the table are typical with:

- * Good ventilation (Outdoor exposure or free circulation of air)
- * Typical film thickness
- * One coat on top of inert substrate

Substrate temperature	5°C	10°C	23°C	40°C
Surface dry	16 h	6 h	3,5 h	2 h
Through dry	24 h	14 h	7 h	4 h
Cured	21 d	14 d	7 d	3 d
Dry to recoat, minimum ¹	24 h	14 h	7 h	4 h

1. The surface should be dry and free from any contamination or chalking prior to application of the subsequent coat.
2. Early exposure to condensation (high humidity, low temperature) may cause colour and/or gloss variations.

The given data must be considered as guidelines only. The actual drying time/times before recoating may be shorter or longer, depending on film thickness, ventilation, humidity, underlying paint system, requirement for early handling and mechanical strength etc. A complete system can be described on a system sheet, where all parameters and special conditions could be included.

Typical paint system

Jotacote Universal	1 x 150 µm	(Dry Film Thickness)
Hardtop XP	1 x 60 µm	(Dry Film Thickness)
Jotamastic 87	1 x 150 µm	(Dry Film Thickness)
Hardtop XP	1 x 60 µm	(Dry Film Thickness)

Note: To obtain full coverage an extra coat may be necessary, especially for signal colours in red, orange and yellow.
Other systems may be specified, depending on area of use

Storage


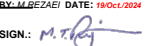
The product must be stored in accordance with national regulations. Storage conditions are to keep the containers in a dry, cool, well ventilated space and away from source of heat and ignition. Containers must be kept tightly closed.

Handling

Handle with care. Stir well before use.

Packing size

20 litre unit: 18,2 litres Comp. A in a 20 litre container and 1,8 litres Hardtop XP Comp. B (curing agent) in a 3 litre container or
5 litre unit: 4,55 litres Comp. A in a 5 litre container and 0.45 litre Hardtop XP Comp. B (curing agent) in a 1 litre container

	
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Health and safety

Please observe the precautionary notices displayed on the container. Use under well ventilated conditions. Do not breathe or inhale mist. Avoid skin contact. Spillage on the skin should immediately be removed with suitable cleanser, soap and water. Eyes should be well flushed with water and medical attention sought immediately.

For detailed information on the health and safety hazards and precautions for use of this product, we refer to the Material Safety Data Sheet.



DISCLAIMER

The information in this data sheet is given to the best of our knowledge based on laboratory testing and practical experience. However, as the product can be used under conditions beyond our control, we can only guarantee the quality of the product itself. We also reserve the right to change the given data without notice. Minor product variations may be implemented in order to comply with local requirements.

If there is any inconsistency in the text the English (UK) version will prevail.

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ISSUED 20 MAY 2011 BY JOTUN
THIS DATA SHEET SUPERSEDES THOSE PREVIOUSLY ISSUED

 NARGAN COMPANY	
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BY: M. REZAEI DATE: 19 Oct 2024	
SIGN.: 	

Technical Data

Jotamastic Smart Pack



Product description

Jotamastic Smart Pack is a two-pack surface tolerant high solids epoxy mastic coating which is provided in 1:1 mixing ratio for easy mixing and reduced wastage. Jotamastic Smart Pack is designed to be applied by brush or roller.

Recommended use

Anticorrosive touch-up coating for steel structures where small repairs are required and spray application is not practical. Jotamastic Smart Pack is suitable for areas with lower quality surface preparation and extended durability is expected. It is recommended to use brush for the first coat.

Film thickness and spreading rate

	Minimum	Maximum	Typical
Film thickness, dry (µm)	50	120	80
Film thickness, wet (µm)	68	163	110
Theoretical spreading rate (m ² /l)	14,7	6,1	9,2

Comments

Film thickness above is typical for what is achieved by one coat of brush or roller application.

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Physical properties

Colour	Aluminium, Black, Buff, Green, Grey, Red
Solids (vol %)*	72 ± 2 Aluminium 75 ± 2 Black, Buff, Grey, Green, Red
Flash point	33°C ± 2 (Setaflash)
VOC	Aluminium 2,51 lbs/gal (300 gms/ltr) USA-EPA Method 24 240 gms/ltr UK-PG6/23(97). Appendix 3 Colours 2,34 lbs/gal (280 gms/ltr) USA-EPA Method 24 230 gms/ltr UK-PG6/23(97). Appendix 3
Gloss	Semigloss
Gloss retention	Fair
Water resistance	Very good
Abrasion resistance	Very good
Solvent resistance	Good
Chemical resistance	Good
Flexibility	Good

*Measured according to ISO 3233:1998 (E)

Hong Kong rules:

Category of paints - Other vessel coatings; VOC 300(AL)/280(color) gms/ltr HK EPD method (Ready to use);
Exempt compound - N/A; Specific gravity: 1.37 (A+B); Both VOC and Specific gravity values provided are
typical values, subject to changes when different colour involved.

Surface preparation

All surfaces should be clean and free from contamination. The surface should be assessed and treated in accordance with ISO 8504.

Bare steel

Cleanliness: Power tool cleaning to min. St 2, mill scale free (ISO 8501-1:2007). Improved surface treatment (blast cleaning to Sa 2½) will improve the performance. In case of waterjetting the flash rust degree shall not exceed M (moderate) in SSPC and NACE standards for waterjetted surfaces.

Shopprimed steel

Clean, dry and undamaged approved shopprimer.

Coated surfaces

Clean, dry and undamaged compatible primer. Contact your local Jotun office for more information. For maintenance UHPWJ to WJ2 (NACE No.5/SSPC-SP 12) or Power tool cleaning to min. St 2 for rusted areas

Other surfaces

The coating may be used on other substrates. Please contact your local Jotun office for more information.

Condition during application

The temperature of the substrate should be minimum 0°C and minimum 3°C above the dew point of the air. The temperature and the relative humidity should be measured in the vicinity of the substrate. Good ventilation is usually required in confined areas to ensure proper drying. With forced ventilation, avoid heated air at first as this may cause surface drying and solvent entrapment. The coating should not be exposed to oil, chemicals or mechanical stress until fully cured.

Hydrojetting of steel surface makes a wet surface. The surrounding air must have a relative humidity not exceeding 85 %. Before painting the surface shall not be glossy with moisture, but can have a patchy appearance.

	
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Application methods

Spray	Airless spray can be used.
Brush	Use a round brush. Care must be taken to achieve the spreading rate.
Roller	Use of a foam roller will provide the best finish results.

Application data

Mixing ratio (volume)	1:1
Mixing	1 parts by volume Comp. A (Base) to be mixed thoroughly with 1 part by volume Jotamastic Smart Pack, Comp. B (Curing agent). Mix well and allow to stand (10 min. including mixing).
Pot life (23°C)	1½ hours
Thinner/Cleaner	Jotun Thinner No. 17
Note	<ul style="list-style-type: none">* The temperature of the mixture of base and curing agent is recommended to be at least 15°C, otherwise extra solvent may be required to obtain correct viscosity.* Too much solvent results in lower sag resistance and slower cure.* If extra solvent is necessary, this should be added after mixing of the two components.

Drying time



Drying times are generally related to air circulation, temperature, film thickness and number of coats, and will be affected correspondingly. The figures given in the table are typical with:

- * Good ventilation (Outdoor exposure or free circulation of air)
- * Typical film thickness
- * One coat on top of inert substrate

Substrate temperature	0°C	5°C	10°C	23°C	40°C
Surface dry	24 h	12 h	7 h	4 h	2 h
Through dry	45 h	20 h	14 h	7 h	3 h
Cured	21 d	14 d	10 d	7 d	3 d
Dry to recoat, minimum	45 h	20 h	14 h	7 h	3 h
Dry to recoat, maximum ¹					

1. Provided the surface is free from chalking and other contamination prior to application, there is normally no overcoating time limit. Best intercoat adhesion occurs, however, when the subsequent coat is applied before preceding coat has cured. If the coating has been exposed to direct sunlight for some time, special attention must be paid to surface cleaning and mattening/removal of the surface layer in order to obtain good adhesion.

The given data must be considered as guidelines only. The actual drying time/times before recoating may be shorter longer, depending on film thickness, ventilation, humidity, underlying paint system, requirement for early handling and mechanical strength etc. A complete system can be described on a system sheet, where all parameters and special conditions could be included.

	
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Typical paint system

Jotamastic Smart Pack 3 coats with roller

or
Jotamastic Smart Pack 2-3 coats with brush

Followed by surrounding topcoat.

Other systems may be specified, depending on area of use

Storage

The product must be stored in accordance with national regulations. Storage conditions are to keep the containers in a dry, cool, well ventilated space and away from source of heat and ignition. Containers must be kept tightly closed.

Handling

Handle with care. Stir well before use.

Packing size

10 litre unit: 5 litres Comp. A (base) in a 5 litre container and 5 litres Jotamastic Smart Pack, Comp. B (curing agent) in a 5 litre container

Health and safety

Please observe the precautionary notices displayed on the container. Use under well ventilated conditions. Do not breathe or inhale mist. Avoid skin contact. Spillage on the skin should immediately be removed with suitable cleanser, soap and water. Eyes should be well flushed with water and medical attention sought immediately.

For detailed information on the health and safety hazards and precautions for use of this product, we refer to the Material Safety Data Sheet.

DISCLAIMER

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BY: M. REZAEI DATE: 19/Oct/2024	
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Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION K-20

DOCUMENTS; INDEX OF VENDOR DATA BOOK



Vendor doc. Number




17735-19

P.O. NO.:

LIDCO-PO-NEC-278-6019


Vendor:

Airpack Nederland B.V.




	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT							
	Index of Vendor Data Book							
	Document No. 17735-19							Page
	Project No. N278	Vendor Doc. VD	P.O. No. 6019	Department GN	Document Type LIS	Serial No 0020	Revision 03	Page 1 of 5

**Airpack B.V. - Air Compressor –
Integrated Methanol and Ammonia Plant
17735-COM Index of Vendor Data Book (K020)**

REV.	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED
03	06-02-2024	Issued for Approval	M.C.	J.J.	SK
02	19-12-2023	Issued for Approval	M.C.	J.J.	SK
01	13-11-2023	Issued for Approval	M.C.	J.J.	SK

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BY: <i>[Signature]</i> DATE: 06Feb/2024	

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	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT							
	Index of Vendor Data Book							
	Document No. 17735-19							Page
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3	X	X	X			28						53						78					
4	X	X	X			29						54						79					
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
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BY: M. REZEI DATE: 20 Feb. 2024	
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Integrated Methanol and Ammonia Plant

Book 1; Purchase order data

A. UNPRICED PO

B. MATERIAL REQUISITION (N278-000-ME-MR-1020-001) Rev.02

C. FINAL TECHNICAL CLARIFICATIONS WITH PURCHASER

D. ENGINEERING QUERIES

E. CONCESSION REQUEST



Vendor doc. Number

17735-19

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Integrated Methanol and Ammonia Plant

Book 3, Inspection and quality control documents

A. SKID

1. Material Summary and Certificates
2. NDT certificates
3. Paint report
4. Welding

B. PIPING

1. Material Summary and Certificates
2. NDT Certificates
3. Hydrostatic test certificates
4. Paint report
5. Welding

C. COMPRESSOR

1. Material Certificates
2. Hydrostatic test certificates

D. LV MOTOR

1. Routine test certificate

E. COOLERS

1. Material Summary and Certificates
2. Hydrostatic test certificates
3. NDT Certificates

F. PULSATION DAMPERS

1. Material Summary and Certificates
2. Hydrostatic test certificates
3. NDT Certificates



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Integrated Methanol and Ammonia Plant

Book 3, Inspection and quality control documents

F. INSTRUMENTATION AND VALVES (calibration / Material / etc.)

1. Pressure Gauge
2. Pressure transmitter
3. Temperature Transmitter
4. Thermowell + Element
5. Temperature gauge
6. Pressure Safety Valve
7. Hand Ball Valve
8. Pressure Control Valve
9. Check Valve
10. Y-Strainer
11. Junction box

J. GENERAL

1. Weight data sheet
2. Certificate of compliance
3. Noise test certificate
4. Included spare parts
5. Functional / performance test results
6. Signed quality test & inspection plan
7. Release note
8. Signed packing list



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Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION K-21

DOCUMENTS; INDEX OF INSTRUCTION AND OPERATING MANUAL



Vendor doc. Number
17735-19

P.O. NO.:
LIDCO-PO-NEC-278-6019

Vendor:
Airpack Nederland B.V.



Index of Instruction and Operating Manual

Document No. 17735-20

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**Airpack B.V. - Air Compressor –
Integrated Methanol and Ammonia Plant**

17735-COM Index of Instruction and Operating Manual (K020)

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04	14-02-2024	Issued for Approval	M.C.	J.J.	S.K.
03	06-02-2024	Issued for Approval	M.C.	J.J.	S.K.
02	13-12-2023	Issued for Approval	M.C.	J.J.	S.K.
01	13-11-2023	Issued for Approval	M.C.	J.J.	S.K.
REV.	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED

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Index of Instruction and Operating Manual

Document No. 17735-20

Project No.	Vendor Doc.	P.O. No.	Department	Document Type	Serial No	Revision
N278	VD	6019	GN	LIS	0021	04

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Integrated Methanol and Ammonia Plant

Operating and maintenance data

- A General Data
- B Safety Precautions
- C Main Components (Start-up, Shutdown, Commissioning, Pre-commissioning)
 - 1 Compressor
 - 2 Motor
 - 3 Inlet Filter
 - 4 Moisture Separator
 - 5 Inter / after cooler
- D Electrical and Instrumentation Equipment
 - 1 Pressure Gauge
 - 2 Pressure transmitter
 - 3 Temperature Transmitter
 - 4 Thermowell + Element
 - 5 Temperature gauge
 - 6 Pressure Safety Valve
 - 7 Hand Ball Valve
 - 8 Pressure Control Valve
 - 9 Check Valve
 - 10 Y-Strainer
 - 11 Local Push Button Station
- E Troubleshooting
- F Preventive maintenance chart
- G Overall spare parts list
- H Logbook
- I Plant manager liability list
- J Lubricant chart

Integrated Methanol and Ammonia Plant

K Documents

- 1 Vendor Print Index and Schedule
- 2 Piping & Instrument Diagram
- 3 General Arrangement Drawing (incl foundation load details)
- 4 3D model (STP)
- 5 Wiring Diagram (including Terminal Diagram) for LCP Panel and Junction Box
- 6 I/O List
- 7 Outline Dimensional Drawings for LCP Panel and Junction Box
- 8 Inspection & Test Plan (ITP)
- 9 Utility Consumption
- 10 Main Motor Data Sheets
- 11 Equipment Data Sheet
- 12 Inter / After Cooler Data Sheet
- 13 Instrument Data Sheets
- 14 Commissioning and Start-up Spares
- 15 FAT Procedure (incl full unit mechanical run test procedure)
- 16 NDE Procedure
- 17 Package Nameplate Drawing
- 18 Hydrotest procedure
- 19 Surface Preparation and Painting Procedure
- 20 Index of Vendor Data Book
- 21 Index of Instruction and Operating Manual
- 22 Control philosophy and Interlock Description□
- 23 Preservation, Packing & Shipping Procedure
- 24 Detail Drawings for Coolers
- 25 Detail Drawings for Pulsation Dampers
- 26 Pulsation Study Approach 1 Calculations
- 27 Welding Book PQR / WPS
- 28 WPQ
- 29 Cause & Effect Chart
- 30 Tie-in Nozzle Loads

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Integrated Methanol and Ammonia Plant

K Documents

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- 32 Control and shut down Logic Block Diagram
- 33 (Pre-) Commissioning Procedure
- 34 Instrument Index
- 35 Quality Manual
- 36 Instrument Hook-up Drawing
- 37 Earthing Diagrams
- 38 Spare Parts for 2 years Operation (SPIR)
- 39 Sub-Supplier List
- 40 PSV Data Sheets
- 41 PSV sizing calculations
- 42 Control Valve Data Sheets
- 43 Noise Data Sheet
- 44 Lubrication List
- 45 Instrument Cable schedule
- 46 Line List
- 47 Weight data sheet

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Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION K-22



DOCUMENTS; CONTROL PHILOSOPHY AND INTERLOCK DESCRIPTION



Vendor doc. Number
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P.O. NO.:
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<div><div><div>شرکت توسعه صنایع لافان</div><div>Lavan Industry Development Company</div></div><div></div></div>	<div>LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT</div>						<div></div>	
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**Airpack B.V. - Air Compressor –
Integrated Methanol and Ammonia Plant
17735-COM Control philosophy and Interlock Description (K020)**

Code 1
M.Dalakeh



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1.0 GENERAL

One(1) high pressure air compressor, oil free vertical two stage piston with motor driver (1 x 35 Nm³/h at 30 bar(g)). Included is a Local Pushbutton Station and a Junction Box. The control is handled by the DCS system. The package can be operated remote and (start / stop) locally.

2.0 INSTRUMENT AIR COMPRESSOR

2.1 Local Pushbutton Station

Please refer to Electrical scheme (N-278-VD-6019-IN-DIA-0005-01, Wiring Diagram (including Terminal Diagram) for LCP Panel and Junction Box) and panel layout (N-278-VD-6019-IN-DWG-0007-01, Outline Dimensional Drawings for LCP Panel and Junction Box) for information concerning different lamps and operation buttons.

The Local Control Panel is located on the compressor package (Safe Area) and connected to the DCS with multipair cable.

2.1.1 Hardware switches and lamps LPS

The following buttons and lamps are provided on the compressor control panel.

Compressor Running Lamp (GREEN) (320ML-8201)

ON when compressor is running either loading - unloading or cooling down.

Compressor Operational Lamp (GREEN) (320YL-8202)

ON when compressor is ready to start and is OFF at failure.

Fault lamp (AMBER) (320XA-8203)

Will blink at unacknowledged alarm(s), steady at acknowledged alarm(s).

Emergency trip lamp (RED) (320UY-8204)

Will blink at unacknowledged trip(s), steady when at acknowledged trip(s).

Compressor start button (320HS-8201)

To start the package, via PLC controlled sequence.

Compressor stop button (320HS-8202)



To stop the compressor, via PLC controlled sequence.

ESD button (320HS-8203)

To shut down the package without following the controlled stop sequence.

Local / Remote select switch (320HS-8204)

To switch between start from LPS (local) or DCS (remote). Selection can be changed without the compressor stopping.

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2.1.2 SIGNALS TO/FROM DCS

Signals	Function
Start (320HS-8201)	Start Compressor
Stop (320HS-8202)	Stop Compressor
Running / stopped (320ML-8201)	Status indication of button 320HS-8201 & 320HS-8202
Local / remote (320HS-8204)	Local or remote control
Fault (320XA-8203)	Raised fault
Emergency trip (320UY-8204)	Raised trip
Operational (320YL-8202)	Status indication of button 320HS-8203 & 320HS-8204

3.0 COMPRESSOR CONTROLS

The start and stop logic for the compressor will be described in this block, including all timers and the starting and stopping of the motor.

In case of emergency the compressor can always be shut down by pressing the local ESD BUTTON (101HS-03)

3.1 START-UP



The compressor can be started locally on LPS or remote from DCS, depending on the position of the local / remote switch (320HS-8204). To initiate operating either the start button (LPS) has to be pressed or remote start from DCS has to be sent and the following starting conditions have to be met (ready to start):

1. No trips and no ESD, 'compressor operational' lamp (320YL-8202) is on.
2. Minimum run timer is not active (see chapter 3.3 TIMERS).
3. Start-up delay timer is not active (see chapter 3.3 TIMERS).
4. Motor is available, which is not running (320MBR-8204) and not fault (320-MBF-8203) Signal from MCC.

After the above start conditions are met, the following functions will be enabled:

- The compressor operational lamp (320YL-8202) will go on, which means the compressor motor and fan motor are ready to start.
- The start-up delay timer is activated (see chapter 3.3 TIMERS). The PCV will close 20 seconds after start. The operational lamp and running lamp will turn on.
- The compressor keeps running while the pressure control valve (320PCV-8201) is closed, until the discharge pressure (320PT-8203) reaches the set-point for operation. If the compressor reach the setpoint of 30 bar(g), the PCV will slowly open and control the outlet pressure.
- When the compressor start the minimum run timer will start (see chapter 3.3 TIMERS).
- The compressor keeps running until stop command is given.

Note: The opening or closed status of the PCV can be seen on the HMI from the positioner signal.

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3.2 SHUTDOWN

The compressor can have two shut down situations:

1. Planned shutdown.
2. Unplanned shutdown

3.2.1 PLANNED SHUTDOWN

To initiate planned shutdown the 'compressor stop' button (320HS-8202) on LPS needs to be pushed to receive stop signal (320MBW-8202) or 'compressor stop' signal from DCS via hardwire signal (320MBW-8205) need to be received.

The below stop conditions have to be met:

- Minimum run timer is not active (see chapter 3.3 TIMERS).
- Cool down timer is not active (see chapter 3.3 TIMERS).
- When all conditions have been met the compressor will shut down.

During the planned shut down the following functions will be enabled;



- The automatic valves will go to their fail position. This means that PCV-8201 will open.
- COOL DOWN TIMER (see chapter 3.3 TIMERS) starts.
- Main motor (KM-020-001) and fan motor (KM-020-002) is stopped.

3.2.2 UNPLANNED SHUTDOWN

In case of a trip or emergency stop button pressure, the compressor motor will shut down immediately, common trip lamp (320XA-8204) will go on, MINIMUM RUN TIMER and COOL DOWN TIMER are cancelled.

Please be aware that the alarm reset button (HMI) needs to be pressed to restart the compressor after any trip or ESD. This button to reset the alarms should be programmed in the DCS HMI where all the alarms and trips are listed.

After a planned or unplanned shutdown, a RESTART DELAY TIMER (see chapter 3.3 TIMERS). will be active. This is to prevent the motor from starting directly after a stop. The compressor needs to get to a complete standstill before starting it again.

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3.3 TIMERS

MINIMUM RUN TIMER:

- Minimum running time after initial start
- To protect the motor by preventing more than 3 starts per hour
- Duration: 20 minutes

RESTART DELAY TIMER:



- To let the compressor come to a complete stop
- Prevents the compressor from restarting until a certain time after stopping
- Duration: 1 minute for normal shutdown.

COOL DOWN TIMER:

- Keeps the compressor running unloaded for a certain time after stop
- To equalize pressure to inlet pressure and cool down of the compressor
- Duration: 3 minutes

START-UP DELAY TIMER:

- To prevent high start current until full speed of the motor, and low oil pressure trip during start-up.
- Duration: 20 seconds

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3.4 MOTOR CONTROL

There are two (2) motors for the compressor which require starting, the main motor and cooling fan motor. These motors are protected in MCC by client.

Both the main and fan motor have the following sequence for starting / stopping:

- The PLC in DCS is sending a START signal to Motor Starter Panel (MCC) to start the fan motor except main motor.
- The MCC is returning a RUNNING signal to start main motor.
- The main motor starter of MCC is returning healthy signal to the PLC in the DCS within two seconds. If not, the PLC in DCS will generate a trip.
- In case there is a fault in MCC, the MCC will send a TRIPPED signal to compressor PLC in DCS to trip the compressor.
- The PLC in DCS is sending a STOP signal to MCC to stop the motor.
- IN case of a trip for the running compressor the PLC in DCS will send a TRIP signal to trip each motor.



When the compressor is started , the fan motor is started, and in sequence the main motor is started. When the compressor is stopped or tripped both the fan and main motor are stopped, or tripped. If fan or main motor is tripped the complete compressor package is tripped.

3.5 COMMON ALARM AND COMMON TRIP

3.5.1 COMMON ALARM

All alarm and sensor failure will be collected here and put into one common alarm block, if this common alarm is active the COMMON alarm LAMP will blink, this means that a new alarm is present, and the cause should be investigated. The package will continue to run with the alarm; however, the cause of the alarm should be investigated by the operator.

If the COMMON alarm LAMP blinks it needs to be acknowledged by the ACKNOWLEDGE BUTTON in DCS and necessary maintenance must be done according to the maintenance MANUAL. If ACKNOWLEDGE BUTTON in DCS is pressed the COMMON ALARM LAMP will be on steady. If maintenance has been carried out the RESET BUTTON (HMI) can be pressed, COMMON ALARM LAMP should turn off, unless an alarm is still present, the COMMON ALARM LAMP will start blinking again.

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3.5.2 COMMON TRIP

All trip and sensor failure will be collected here and put into one common trip block, if this common trip is active the COMMON TRIP LAMP will blink, this means that a new trip is present, and the cause should be investigated. The package will stop immediately as described in 3.2.2 UNPLANNED SHUTDOWN on page 6.

If the COMMON TRIP LAMP blinks it needs to be acknowledged by the ACKNOWLEDGE BUTTON in DCS and necessary maintenance must be done according to the maintenance MANUAL. If ACKNOWLEDGE BUTTON in DCS is pressed the COMMON TRIP LAMP will be on steady. If maintenance has been carried out the RESET BUTTON in DCS can be pressed, COMMON TRIP LAMP should turn off, unless a trip is still present, the COMMON TRIP LAMP will start blinking again. In case of a trip the package will stop immediately, all timers (MINIMUM RUN and COOLDOWN) will be cancelled.

Calbe fractures or / and out of range trips shall be monitored by DCS.

3.5.3 EMERGENCY STOP FUNCTIONS



An emergency stop can be activated by pressing the local ESD BUTTON (320HS-8203) on compressor LPS or by activation of ESD TRIP SIGNAL (320HS-8206) in DCS.

An Emergency stop signal activates an ESD relay inside the panel, the ESD relay sends a trip signal to the PLC, causing the compressor to trip. Separately the ESD relay also disconnects power to all the solenoid valves as well as activating the motor shutdown signals, forcing the motor to stop.

3.5.4 ESD SIGNALS

Please find below all ESD signals:

Service	Source	Value 0	Value 1
ESD pushbutton (320HS-8203)	LPS	Trip	Healthy
ESD trip signal (320SW-8206)	DCS	Trip	Healthy

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3.6 COMPRESSOR OIL SYSTEM

The compressor oil system consists of a crank driven rotary oil pump. As soon as compressor starts oil will be supplied. Normal oil pressure will be around 0,5 bar(g).

When compressor is started the oil pressure trip will be bypassed for 20 seconds (see chapter 3.3 TIMERS).

Oil level can be checked by reading the sight glass (SG) on the oil sump integrated into compressor.

If the compressor is not running, oil heater (320H-8201) will be controlled by a thermostat to prevent mechanical damage to compressor.

3.7 COMPRESSOR AIR COOLING SYSTEM

The compressor is supplied with two water-cooled coolers:

- Inter cooler (320KE-020-001)
- After cooler (320KE-020-002)

3.8 COMPRESSOR RECYCLE VALVE

Capacity control of the compressor is done through 320PCV-8201. The PCV will open and close on exact customer compressed air demand of 30 bar(g)

Set point 30 bar(g) is derived from the outlet pressure transmitter (320PT-8203).

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION K-23

DOCUMENTS; PRESERVATION, PACKING AND SHIPPING PROCEDURE




Vendor doc. Number
17735-19

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Vendor:
Airpack Nederland B.V.

17735-COM Preservation, Packing & Shipping Procedure (K020)

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SIGN: M. T. B.

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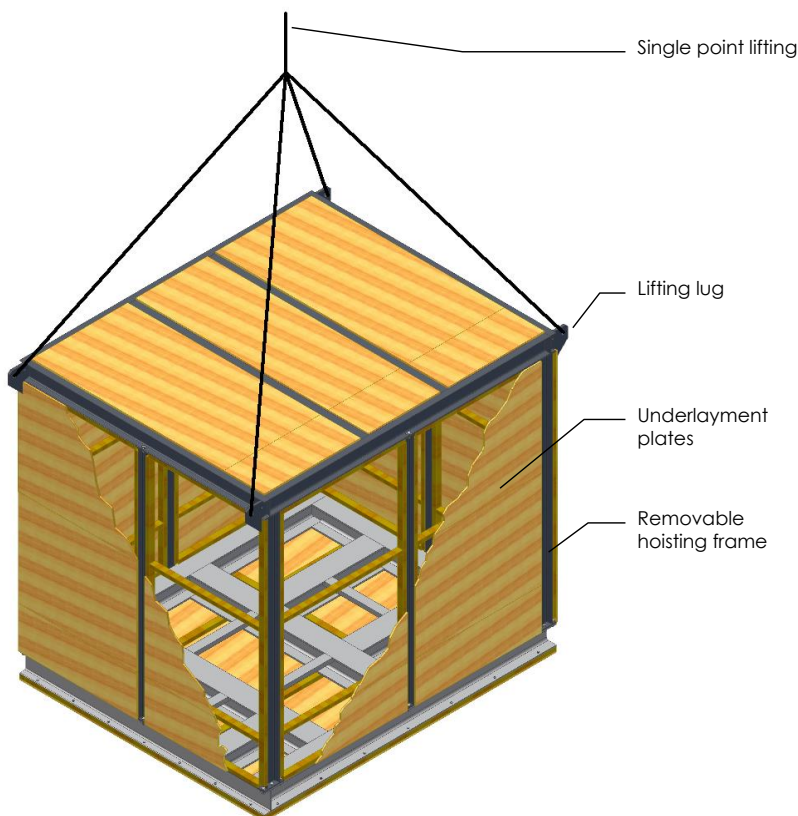
1 Preservation

The package is preserved at Airpack in the following way:




- Desiccant bags are placed inside electrical cabinets to prevent ingress of moisture in the electrical components.
- Shell Ensis Fluid DW is applied to the following surfaces:
 - customer flange faces
 - unpainted machined surfaces

2 Packing (typical)

The packing consists of removable steel packing / lifting frame with lifting lugs, each covered with underlayment sheets, which are attached to wooden support beams of 2 x 3 inch. Refer to the transport drawing (Weight Data Sheet- **N-278-VD-6019-PR-GAD-0049-01**) for all detailed information.



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Including:




- Shipping marks will be mentioned on two opposite sides of the package.
- Positions of lifting lugs will be mentioned on package.
- Center of gravity will be mentioned on opposite sites package.
- Shipping documents will be placed inside and on the outside of the package in plastic cover.

3 Shipping

To prevent damage to the package during transportation, the following instructions shall be followed:

- The package shall be hoisted and transported with use of lifting frame supplied with package. This lifting frame is removable. See GAD for further details.
- Lifting lugs are provided on each corner of this lifting frame, hence the use of spreader bars is not required.
- Lifting frame shall only be used for the hoisting of corresponding package.
- It is not allowed to make any modifications to lifting frame, whatsoever.
- Before lifting, check if all bolts attaching the lifting frame to main frame are securely fastened, if a removable lifting frame is applicable.
- Before hoisting, check if all underlayment plates are securely fastened. If in doubt, take appropriate measures to fasten or remove any loose plates. Under no circumstances shall the package be hoisted with defects to packing. Packing material may fall off and cause personnel injury.
- Use suitable lifting devices and transportation in line with weight and dimensions of package. Weight and dimensions are indicated on packing on two sides. If this data is not legible or not present, check packing list or contact Airpack.
- Never stand under a hoisted load!
- When transporting the package by road, pay attention to driving speed. When driving through a curve, slow down speed. Accelerate and decelerate as gradually as possible. When driving on an uneven road, slow down speed.
- The Spare parts must be separate packed and clearly marked "COMMISSIONING SPARE PARTS", "CAPITAL SPARE PARTS", "CONSUMABLE SPARE PARTS", "SPECIAL TOOLS" and included in main equipment packages attached to baseboards. If it deems necessary to ship them separately due to size and dimensions, they shall be properly protected for storage and packing.
- Spare parts for two years operation (if required), which shall be individually tagged and covered with a suitable preservative be packed in separate cases inside the main equipment. The cases are to bear the markings as specified and in addition the words "SPARE PARTS FOR TWO YEARS OPERATION".

 NARGAN COMPANY	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
SIGN: <i>M. T. H.</i>	

	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT						
	Preservation, Packing & Shipping Procedure						
Document No. 17735-22			Page				
Project No.	Vendor Doc.	P.O. No.	Department	Document Type	Serial No	Revision	Page
N278	VD	6019	GN	PRC	0023	04	Page 6 of 8




4 Handling & Storage

The applied preservations should protect the equipment for outside storage for up to 6 months in an uncovered and unheated condition. However, where possible, it is recommended to store the packages under a shelter. To make this storage period possible without problems, it is necessary to check the condition of the preservatives as well as the equipment itself on a regular basis. Depending on the conditions and outcome of each inspection, interval may change. It is recommended however to inspect the equipment and preservatives at least once every month.

When keeping the package in storage for longer periods, check the following:

- Package shall be stored preferably on a dry and clean location (see above explanation).
- Check if packing is still complete. If underlayment plates are missing, repair it.
- Check if applied preservation is still in good order. Furthermore, check if all rust preventatives are still sufficiently in place. If required, repair uncovered spots. If corrosion has formed, remove this first.
- Check presence of condensate in the moisture separator, safety valves, piping, control panel, instruments and any other location that may contain water. Drain condensate if present.
- To protect the control panel against humidity, bags with desiccant are placed inside panels. In case of long storage periods, replace desiccant bags ones every two months.
- In case of temperatures below 0°C, freezing of condensate can lead to damage. Prevent this by draining any condensate if applicable. In case of doubt, remove drain trap, safety valves and other instruments and keep it in a warehouse at non-freezing temperature. Do not remove tag number plates from removed valves and instruments!
- Check package for damaged coating. It is necessary to repair any damage to coating immediately, otherwise rust forming may lead to problems during start-up.
- It is advisable to turn all rotating equipment on a regular basis (e.g. once per month). To do so, turn all main and auxiliary motors (fan) and compressors manually.
- Be aware that PLC batteries will only last for 2-3 months in good conditions.
- In case of diesel engine be aware start-accus only will last for 2-3 months in good conditions.



 NARGAN COMPANY	
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 06 Feb, 2024	
SIGN: 	

	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT						
	Preservation, Packing & Shipping Procedure						
Document No. 17735-22			Page				
Project No.	Vendor Doc.	P.O. No.	Department	Document Type	Serial No	Revision	Page
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5 Unpacking

To prevent damage to package during unpacking, following instructions shall be followed:

- Package shall not be elevated when unpacking. Make sure package is standing on the ground when opening the packing.
- Do not remove bottom underlayment plates, before inspecting the inside of package!
- First remove all or at least sufficient side panels (underlayment plates) for access to inside of packing.
- Remove all loose parts that are placed on bottom underlayment plates, if applicable. Some parts may have been disassembled to minimise transport dimensions and placed inside packing as loose items. Therefore, it is required to remove all loose parts, before bottom plates are removed. Otherwise, parts may fall out.
- When bottom underlayment plates are free from obstructions, loosen all bolts which are screwed to bottom underlayment plates.
- Elevate package slightly and remove bottom plates.
- Package can now be installed on its foundation. See instruction manual for further details.
- When package is on its foundation and correctly positioned, the removable lifting frame can be removed. It is advised however to remove all side panels before removing lifting frame. Limited sight of inside of packing may lead to damage, as obstructions may not be noticed.
- Before removing lifting frame, make sure package is on its foundation and not elevated!
- To remove lifting frame, remove all bolts that connect lifting frame to main skid.
- Hoist the lifting frame vertically and take care not to hit any parts of the package.
- Underlayment plates and lifting frame shall be disposed of in a properly manner. Local regulations must be followed.
- It is advised to leave all preservatives in places until equipment will be commissioned. Check if all preservatives are still in good order, and give it the necessary attention, if required.
- After instalment of the package, please remove fixation of vibration dampers (if applicable).

 NARGAN COMPANY	
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 06 Feb, 2024	
SIGN: 	

Preservation, Packing & Shipping Procedure

Document No. 17735-22

Page

Project No.	Vendor Doc.	P.O. No.	Department	Document Type	Serial No	Revision	
N278	VD	6019	GN	PRC	0023	04	Page 8 of 8

Shipping Mark

IRAN
LAVAN Industry Development Co.
LIDCO, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH 900
/ MTPD NH3 PROJECT
NARGAN

Vendor's Name :LIDCO
P/O No. :LIDCO-PO-NEC-278-6019
Item No : 17735-COM
Description of Good :High Pressure Air Compressor
Packing List No : 17735-MM-1001
Package Number : 01 of 01
Gross Weight : kgs TBD
Net Weight : kgs TBD
Dimensions : (L) x (W) x (H) cm :TBD
Country of Origin :The Netherlands
Storage Code : B

NARGAN COMPANY	
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 06Feb, 2024	
SIGN: 	

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION K-24

DOCUMENTS; DETAIL DRAWINGS FOR COOLERS



Vendor doc. Number

17735-19

Vendor:

Airpack Nederland B.V.

P.O. NO.:

LIDCO-PO-NEC-278-6019



Detail Drawings for Coolers

Document No. 17735-23A

Project No.	Vendor Doc.	P.O. No.	Department	Document Type	Serial No	Revision	Page
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**Airpack B.V. - Air Compressor –
Integrated Methanol and Ammonia Plant
17735-COM Detail Drawings for Coolers (K020)**

Code 1
M.Dalakeh

05	21-05-2024	Issued for Information	S.K.	J.J.	S.K.
04	08-05-2024	Issued for Information	S.K.	J.J.	S.K.
03	25-04-2024	Issued for Information	S.K.	J.J.	S.K.
02	12-02-2024	Issued for Information	S.K.	J.J.	S.K.
01	13-12-2023	Issued for Information	S.K.	J.J.	S.K.
REV.	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED

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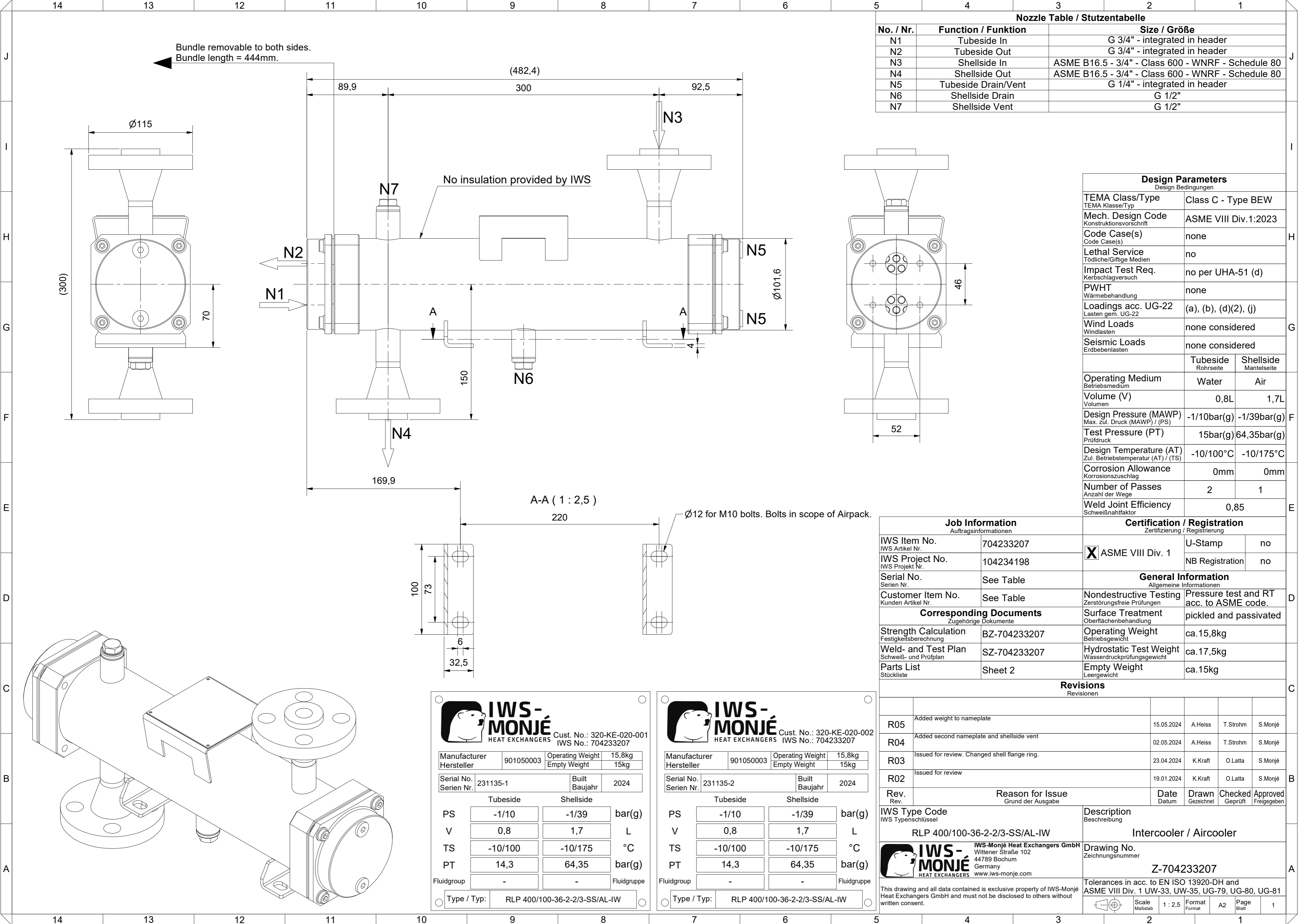
Detail Drawings for Coolers

Document No. 17735-23A


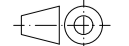
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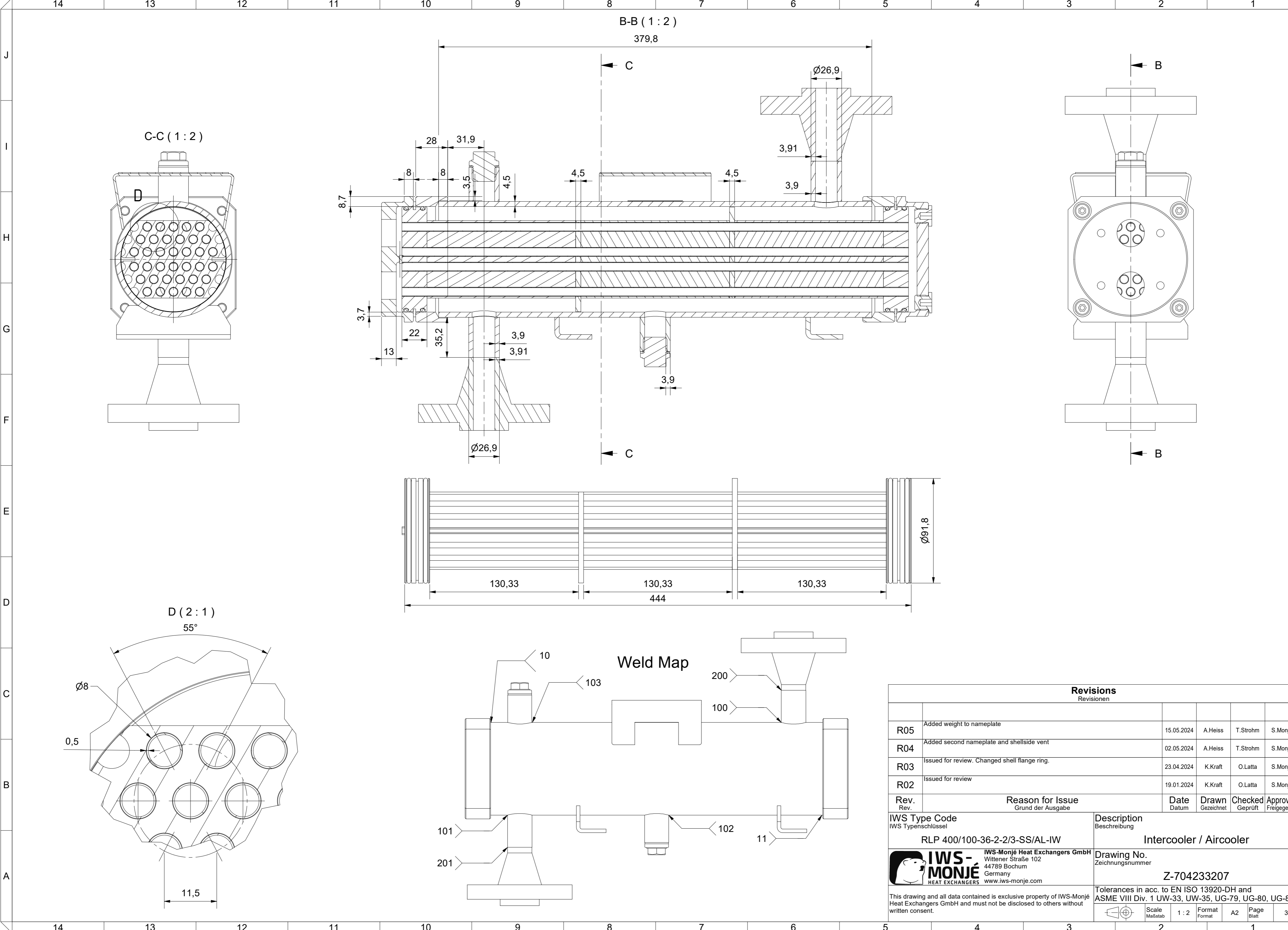
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J	1	Shell Assembly	Mantel Baugruppe	-	-	-	-	-	-	1.1	1	Shell	Mantel	TP316	SA-312	3.1	-	Ø101,6mm x 4,5mm x 379,8mm	-	1.1	1	Shell	Mantel	TP316	SA-312	3.1	-	Ø101,6mm x 4,5mm x 379,8mm	-																																																												
	2	Bundle Assembly	Bündel Baugruppe	-	-	-	-	-	-	1.2	2	Flangering	Flanschring	F316	SA-182	3.1	-	K10-2881-02	-	1.2	2	Flangering	Flanschring	F316	SA-182	3.1	-	K10-2881-02	-																																																												
	3	Inlet/Outlet Bonnet	Einlass-/Auslasskammer	304	SA-240	3.1	-	KL10-F-14	-	1.3	2	Welding Neck Flange	Vorschweißflansch	F316	SA-182	3.1	ASME B16.5	3/4" Class 600 RF	-	1.3	2	Welding Neck Flange	Vorschweißflansch	F316	SA-182	3.1	ASME B16.5	3/4" Class 600 RF	-																																																												
	4	Return Bonnet	Umlenkammer	304	SA-240	3.1	-	KL10-F-15	-	1.4	2	Nozzle Pipe	Stutzenrohr	TP316	SA-312	3.1	-	Ø26,9mm x 3,9mm	-	1.4	2	Nozzle Pipe	Stutzenrohr	TP316	SA-312	3.1	-	Ø26,9mm x 3,9mm	-																																																												
	5	Nameplate - IWS	Typenschild - IWS	304	-	-	-	t=1mm	-	1.5	2	Socket	Muffe	TP316	SA-312	3.1	-	G 1/2"	-	1.5	2	Socket	Muffe	TP316	SA-312	3.1	-	G 1/2"	-																																																												
	6	Fixing Plate	Fixierblech	304	SA-240	-	-	-	-	1.6	2	Plug	Stopfen	316	SA-182	3.1	-	G 1/2"	-	1.6	2	Plug	Stopfen	316	SA-182	3.1	-	G 1/2"	-																																																												
	7	Bolt	Schraube	B8	SA-193	3.1	DIN 6912	M8 x 30	-	1.7	2	Sealing Ring	Dichtring	Aluminium	-	-	-	-	-	1.7	2	Sealing Ring	Dichtring	Aluminium	-	-	-	-	-																																																												
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Revisions					
Revisionen					
R05	Added weight to nameplate	15.05.2024	A.Heiss	T.Strohm	S.Monje
R04	Added second nameplate and shellside vent	02.05.2024	A.Heiss	T.Strohm	S.Monje
R03	Issued for review. Changed shell flange ring.	23.04.2024	K.Kraft	O.Latta	S.Monje
R02	Issued for review	19.01.2024	K.Kraft	O.Latta	S.Monje
Rev.	Reason for Issue	Date	Drawn	Checked	Approved
Rev.	Grund der Ausgabe	Datum	Gezeichnet	Geprüft	Freigegeben
IWS Type Code IWS Typenschlüssel		Description Beschreibung			
RLP 400/100-36-2-2/3-SS/AL-IW		Intercooler / Aircooler			
 IWS-MONJE HEAT EXCHANGERS		Drawing No. Zeichnungsnummer			
IWS-Monje Heat Exchangers GmbH Wittener Straße 102 44789 Bochum Germany www.iws-monje.com		Z-704233207			
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Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION K-25

DOCUMENTS; DETAIL DRAWINGS FOR PULSATION DAMPERS



Vendor doc. Number




17735-19

P.O. NO.:

LIDCO-PO-NEC-278-6019

Vendor:

Airpack Nederland B.V.

<div><div>شرکت توسعه صنایع لوان</div><div>Lavan Industry Development Company</div></div> <div></div>	<div>LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT</div>						<div></div>	
<div></div>	Detail Drawings for Pulsation Dampers							
	Document No. 17735-23B							Page
	Project No.	Vendor Doc.	P.O. No.	Department	Document Type	Serial No	Revision	
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Airpack B.V. - Air Compressor –
Integrated Methanol and Ammonia Plant
17735-COM Detail Drawings for Pulsation Dampers (K020)

Code 1
M.Dalakeh

07	24-12-2024	Issued for Approval	S.K.	J.J.	S.K.
06	18-12-2024	Issued for Approval	S.K.	J.J.	S.K.
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04	15-10-2024	Issued for Approval	S.K.	J.J.	S.K.
03	16-09-2024	Issued for Approval	S.K.	J.J.	S.K.
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01	21-02-2024	Issued for Approval	S.K.	J.J.	S.K.
REV.	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED

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LIDCO, Pars SEE Zone, Assaluyeh,
Integrated Methanol and Ammonia
Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT

Detail Drawings for Pulsation Dampers

Document No. 17735-23B

Project No.	Vendor Doc.	P.O. No.	Department	Document Type	Serial No	Revision
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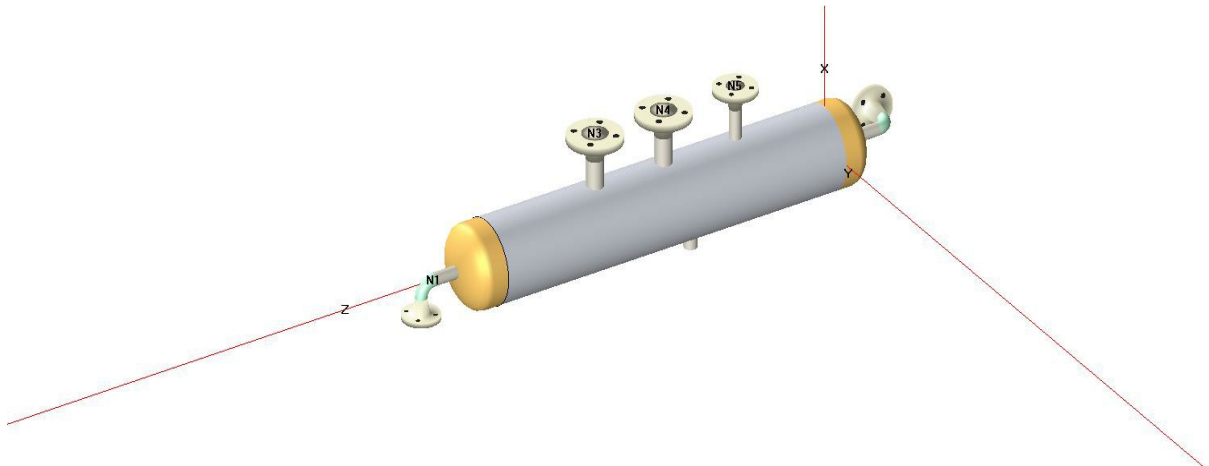
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24				X	X						74						6					
301				X	X	X	X				75						7					

Locati Impianti Srl

Via Vittorio Veneto, 37 - Verdellino - Bergamo - Italy



COMPRESS Pressure Vessel Design Calculations

Item: LI 5059

Customer: Airpack

Drawing No.: C230048DWG001

Document No.: C230048CLC005 Rev.02

Date: 04/08/2024

Service: 1st Stage Inlet Pulsation Damper

Tag Number: 320-KV-020-001

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Nozzle Schedule

Specifications									
Nozzle mark	Identifier	Size	Materials		Impact Tested	Normalized	Fine Grain	Flange	Blind
N1	Air Inlet	NPS 1 Sch 160 DN 25	Nozzle	SA-106 B Smls Pipe	No	No	No	N/A	No
	B16.9 Elbow #1 (N1)	NPS 1 Sch 160 DN 25	B16.9 Elbow	SA-234 WPB	No	No	No	NPS 1 Class 150 WN A105	No
N2	Air Outlet	NPS 1 Sch 160 DN 25	Nozzle	SA-106 B Smls Pipe	No	No	No	N/A	No
	B16.9 Elbow #2 (N2)	NPS 1 Sch 160 DN 25	B16.9 Elbow	SA-234 WPB	No	No	No	NPS 1 Class 300 WN A105	No
N3	Temperature Gauge Connection	NPS 1,5 Sch 160 DN 40	Nozzle	SA-106 B Smls Pipe	No	No	No	NPS 1 1/2 Class 300 WN A105	No
N4	Temperature Transmitter Connection	NPS 1,5 Sch 160 DN 40	Nozzle	SA-106 B Smls Pipe	No	No	No	NPS 1 1/2 Class 300 WN A105	No
N5	PSV Connection	NPS 1 Sch 160 DN 25	Nozzle	SA-106 B Smls Pipe	No	No	No	NPS 1 Class 300 WN A105	No
N6	Drain	NPS 0,5 Class 6000 DN 15 - Threaded Full Coupling	Nozzle	SA-105	No	No	No	N/A	No

Nozzle Summary

Dimensions												
Nozzle mark	OD (mm)	t _n (mm)	Req t _n (mm)	A ₁ ?	A ₂ ?	Shell			Reinforcement Pad		Corr (mm)	A _a /A _r (%)
						Nom t (mm)	Design t (mm)	User t (mm)	Width (mm)	t _{pad} (mm)		
N1	33,4	6,35	6,35	Yes	Yes	8,18	N/A		N/A	N/A	3	Exempt
N2	33,4	6,35	6,35	Yes	Yes	8,18	N/A		N/A	N/A	3	Exempt
N3	48,26	7,14	7,11	Yes	Yes	8,18	N/A		N/A	N/A	3	Exempt
N4	48,26	7,14	7,11	Yes	Yes	8,18	N/A		N/A	N/A	3	Exempt
N5	33,4	6,35	6,35	Yes	Yes	8,18	N/A		N/A	N/A	3	Exempt
N6	38,1	8,38	4,5	Yes	Yes	8,18	N/A		N/A	N/A	3	Exempt

*Head minimum thickness after forming

Definitions	
t _n	Nozzle thickness
Req t _n	Nozzle thickness required per UG-45/UG-16 Increased for pipe to account for 12.5% pipe thickness tolerance
Nom t	Vessel wall thickness
Design t	Required vessel wall thickness due to pressure + corrosion allowance per UG-37
User t	Local vessel wall thickness (near opening)
A _a	Area available per UG-37, governing condition
A _r	Area required per UG-37, governing condition
Corr	Corrosion allowance on nozzle wall

Pressure Summary

Component Summary							
Identifier	P Design (bar)	T Design (°C)	MAWP (bar)	MAP (bar)	MDMT (°C)	MDMT Exemption	Impact Tested
B16.9 Pipe Cap - Left Side	12,5	75	40,92	69,64	-105	Note 1	No
Straight Flange on B16.9 Pipe Cap - Left Side	12,5	75	48,35	77,21	-105	Note 2	No
Cylinder #1	12,5	75	38,66	67,3	-48	Note 3	No
Straight Flange on B16.9 Pipe Cap - Right Side	12,5	75	48,35	77,21	-105	Note 2	No
B16.9 Pipe Cap - Right Side	12,5	75	40,92	69,64	-105	Note 4	No
Air Inlet (N1)	12,5	75	29,2	88,24	-105	Note 5	No
B16.9 Elbow #1 (N1)	12,5	75	18,45	19,6	-29	Note 6, 7	No
Air Outlet (N2)	12,5	75	29,2	88,24	-105	Note 5	No
B16.9 Elbow #2 (N2)	12,5	75	48,35	51,1	-48	Note 8, 9	No
Temperature Gauge Connection (N3)	12,5	75	45,49	51,1	-48	Note 10	No
Temperature Transmitter Connection (N4)	12,5	75	45,49	51,1	-48	Note 10	No
PSV Connection (N5)	12,5	75	27,8	51,1	-48	Note 10	No
Drain (N6)	12,5	75	45,49	79,18	-48	Note 11	No

Chamber Summary	
Design MDMT	0 °C
Rated MDMT	0 °C @ 18,45 bar
MAWP hot & corroded	18,45 bar @ 75 °C
MAP cold & new	19,6 bar @ 21,11 °C
(1) The rated MDMT is limited to the design MDMT based on the setting in the Calculations tab of the Set Mode dialog.	
(2) This pressure chamber is not designed for external pressure.	

Notes for MDMT Rating		
Note #	Exemption	Details
1.	Straight Flange governs MDMT	
2.	Material is impact test exempt to -105°C per UCS-66(b)(3) (coincident ratio = 0,3282)	
3.	Material impact test exemption temperature from Fig UCS-66M Curve B = -29°C Fig UCS-66.1M MDMT reduction = 48,8°C, (coincident ratio = 0,4089) Rated MDMT of -77,8°C is limited to -48°C by UCS-66(b)(2)	UCS-66 governing thickness = 7,16 mm
4.	Straight Flange governs MDMT	
5.	Nozzle is impact test exempt per UCS-66(d) (NPS 4 or smaller pipe).	
6.	Material is impact test exempt to -105°C per UCS-66(b)(3) (coincident ratio = 0,1525)	
7.	Flange rating governs: Flange rated MDMT per UG-20(f) = -29°C	Bolts rated MDMT per Fig UCS-66 note (c) = -48°C
8.	Material is impact test exempt to -105°C per UCS-66(b)(3) (coincident ratio = 0,1015)	
9.	Flange rating governs: Flange rated MDMT per UCS-66(b)(1)(b) = -48°C (Coincident ratio = 0,3611)	Bolts rated MDMT per Fig UCS-66 note (c) = -48°C
10.	Flange rating governs: Flange rated MDMT per UCS-66(b)(1)(b) = -48°C (Coincident ratio = 0,3611) Bolts rated MDMT per Fig UCS-66 note (c) = -48°C	
11.	Nozzle impact test exemption temperature from Fig UCS-66M Curve B = -29°C Fig UCS-66.1M MDMT reduction = 48,6°C, (coincident ratio = 0,4094) Rated MDMT of -77,6°C is limited to -48°C by UCS-66(b)(2)	UCS-66 governing thickness = 7,16 mm.

Settings Summary

COMPRESS 2024 Build 8400	
ASME Section VIII Division 1, 2021 Edition Metric	
Units	MKS
Datum Line Location	0,00 mm from right seam
Vessel Design Mode	Design Mode
Minimum thickness	1,5 mm per UG-16(b)
Design for cold shut down only	No
Design for lethal service (full radiography required)	No
Design nozzles for	Design P only
Corrosion weight loss	100% of theoretical loss
UG-23 Stress Increase	1,20
Skirt/legs stress increase	1,0
Minimum nozzle projection	60 mm
Juncture calculations for $\alpha > 30$ only	Yes
Preheat P-No 1 Materials $> 1,25"$ and $\leq 1,50"$ thick	No
UG-37(a) shell tr calculation considers longitudinal stress	No
Cylindrical shells made from pipe are entered as minimum thickness	No
Nozzles made from pipe are entered as minimum thickness	No
ASME B16.9 fittings are entered as minimum thickness	No
Butt welds	Tapered per Figure UCS-66.3(a)
Disallow Appendix 1-5, 1-8 calculations under 15 psi	No
Hydro/Pneumatic Test	
Shop Hydrotest Pressure	1,3 times vessel MAWP [UG-99(b)]
Test liquid specific gravity	1,00
Maximum stress during test	90% of yield
Required Marking - UG-116	
UG-116(e) Radiography	RT3
UG-116(f) Postweld heat treatment	None
Code Cases\Interpretations	
Use Appendix 46	No
Use UG-44(b)	No
Use Code Case 3035	No
Apply interpretation VIII-1-83-66	Yes
Apply interpretation VIII-1-86-175	Yes
Apply interpretation VIII-1-01-37	Yes
Apply interpretation VIII-1-01-150	Yes
Apply interpretation VIII-1-07-50	Yes
Apply interpretation VIII-1-16-85	Yes
No UCS-66.1 MDMT reduction	No
No UCS-68(c) MDMT reduction	No
Disallow UG-20(f) exemptions	No
UG-22 Loadings	
UG-22(a) Internal or External Design Pressure	Yes
UG-22(b) Weight of the vessel and normal contents under operating or test conditions	No
UG-22(c) Superimposed static reactions from weight of attached equipment (external loads)	No
UG-22(d)(2) Vessel supports such as lugs, rings, skirts, saddles and legs	No
UG-22(f) Wind reactions	No
UG-22(f) Seismic reactions	No
UG-22(j) Test pressure and coincident static head acting during the test:	No

Note: UG-22(b),(c) and (f) loads only considered when supports are present.

Note 2: UG-22(d)(1),(e),(f)-snow,(g),(h),(i) are not considered. If these loads are present, additional calculations must be performed.

License Information	
Company Name	Locati Impianti s.r.l.
License	Commercial
License Key ID	32235
Support Expires	September 20, 2024
Account Number	891888909529634

Radiography Summary

UG-116 Radiography							
Component	Longitudinal Seam		Left Circumferential Seam		Right Circumferential Seam		Mark
	Category (Fig UW-3)	Radiography / Joint Type	Category (Fig UW-3)	Radiography / Joint Type	Category (Fig UW-3)	Radiography / Joint Type	
B16.9 Pipe Cap - Left Side	N/A	Seamless No RT	N/A	N/A	B	Spot UW-11(b) / Type 1	RT3
Cylinder #1	N/A	Seamless No RT	B	Spot UW-11(b) / Type 1	B	Spot UW-11(b) / Type 1	RT3
B16.9 Pipe Cap - Right Side	N/A	Seamless No RT	B	Spot UW-11(b) / Type 1	N/A	N/A	RT3
Nozzle	Longitudinal Seam		Nozzle to Vessel Circumferential Seam		Nozzle free end Circumferential Seam		
Air Inlet (N1)	N/A	Seamless No RT	D	N/A / Type 7	B	UW-11(b) exempt / Type 1	N/A
B16.9 Elbow #1 (N1)	N/A	Seamless No RT	B	UW-11(b) exempt / Type 1	C	UW-11(b) exempt / Type 1	N/A
Temperature Gauge Connection (N3)	N/A	Seamless No RT	D	N/A / Type 7	C	UW-11(b) exempt / Type 1	N/A
Temperature Transmitter Connection (N4)	N/A	Seamless No RT	D	N/A / Type 7	C	UW-11(b) exempt / Type 1	N/A
PSV Connection (N5)	N/A	Seamless No RT	D	N/A / Type 7	C	UW-11(b) exempt / Type 1	N/A
Drain (N6)	N/A	Seamless No RT	D	N/A / Type 7	N/A	N/A	N/A
Air Outlet (N2)	N/A	Seamless No RT	D	N/A / Type 7	B	UW-11(b) exempt / Type 1	N/A
B16.9 Elbow #2 (N2)	N/A	Seamless No RT	B	UW-11(b) exempt / Type 1	C	UW-11(b) exempt / Type 1	N/A
Nozzle Flange	Longitudinal Seam		Flange Face		Nozzle to Flange Circumferential Seam		
ASME B16.5/16.47 flange attached to right end of B16.9 Elbow #1 (N1)	N/A	Seamless No RT	N/A	N/A / Gasketed	C	UW-11(b) exempt / Type 1	N/A
ASME B16.5/16.47 flange attached to Temperature Gauge Connection (N3)	N/A	Seamless No RT	N/A	N/A / Gasketed	C	UW-11(b) exempt / Type 1	N/A
ASME B16.5/16.47 flange attached to Temperature Transmitter Connection (N4)	N/A	Seamless No RT	N/A	N/A / Gasketed	C	UW-11(b) exempt / Type 1	N/A
ASME B16.5/16.47 flange attached to PSV Connection (N5)	N/A	Seamless No RT	N/A	N/A / Gasketed	C	UW-11(b) exempt / Type 1	N/A
ASME B16.5/16.47 flange attached to right end of B16.9 Elbow #2 (N2)	N/A	Seamless No RT	N/A	N/A / Gasketed	C	UW-11(b) exempt / Type 1	N/A
UG-116(e) Required Marking: RT3							

Thickness Summary

Component Data								
Component Identifier	Material	Diameter (mm)	Length (mm)	Nominal t (mm)	Design t (mm)	Total Corrosion (mm)	Joint E	Load
B16.9 Pipe Cap - Left Side	SA-234 WPB	219,07 OD	57,83	8,18	4,3	3	0,85	Internal
Straight Flange on B16.9 Pipe Cap - Left Side	SA-234 WPB	219,07 OD	44,16	8,18	4,36	3	0,85	Internal
Cylinder #1	SA-106 B Smls Pipe	219,07 OD	1.060	8,18	4,36	3	0,85	Internal
Straight Flange on B16.9 Pipe Cap - Right Side	SA-234 WPB	219,07 OD	44,16	8,18	4,36	3	0,85	Internal
B16.9 Pipe Cap - Right Side	SA-234 WPB	219,07 OD	57,83	8,18	4,3	3	0,85	Internal

Definitions	
Nominal t	Vessel wall nominal thickness
Design t	Required vessel thickness due to governing loading + corrosion
Joint E	Longitudinal seam joint efficiency
Load	
Internal	Circumferential stress due to internal pressure governs
External	External pressure governs
Wind	Combined longitudinal stress of pressure + weight + wind governs
Seismic	Combined longitudinal stress of pressure + weight + seismic governs

Weight Summary

Weight (kg) Contributed by Vessel Elements											
Component	Metal New*	Metal Corroded	Insulation	Insulation Supports	Lining	Piping + Liquid	Operating Liquid		Test Liquid		Surface Area m ²
							New	Corroded	New	Corroded	
B16.9 Pipe Cap - Left Side	5,2	3,4	0	0	0	0	0	0	2,6	2,8	0,09
Cylinder #1	44,6	28,7	0	0	0	0	0	0	34,4	36,5	0,72
B16.9 Pipe Cap - Right Side	5,2	3,4	0	0	0	0	0	0	2,6	2,8	0,09
TOTAL:	55	35,4	0	0	0	0	0	0	39,5	42,1	0,9

*Shells with attached nozzles have weight reduced by material cut out for opening.

Weight (kg) Contributed by Attachments										
Component	Body Flanges		Nozzles & Flanges		Packed Beds	Trays	Tray Supports	Rings & Clips	Vertical Loads	Surface Area m ²
	New	Corroded	New	Corroded						
B16.9 Pipe Cap - Left Side	0	0	1,9	1,7	0	0	0	0	0	0,03
Cylinder #1	0	0	10	9,3	0	0	0	0	0	0,15
B16.9 Pipe Cap - Right Side	0	0	2,4	2,1	0	0	0	0	0	0,04
TOTAL:	0	0	14,3	13,1	0	0	0	0	0	0,22

Vessel Totals		
	New	Corroded
Operating Weight (kg)	69	49
Empty Weight (kg)	69	49
Test Weight (kg)	109	91
Surface Area (m ²)	1,12	-
Capacity** (liters)	39	42

**The vessel capacity does not include volume of nozzle, piping or other attachments.

Vessel Lift Condition	
Vessel Lift Weight, New (kg)	69
Center of Gravity from Datum (mm)	527,16

Hydrostatic Test

Horizontal shop hydrostatic test based on MAWP per UG-99(b)

$$\begin{aligned}
 \text{Gauge pressure at } 21,11^{\circ}\text{C} &= 1,3 \cdot MAWP \cdot LSR \\
 &= 1,3 \cdot 18,45 \cdot 1 \\
 &= 23,99 \text{ bar}
 \end{aligned}$$

Horizontal shop hydrostatic test				
Identifier	Local test pressure (bar)	Test liquid static head (bar)	UG-99(b) stress ratio	UG-99(b) pressure factor
B16.9 Pipe Cap - Left Side (1)	24,02	0,03	1	1,30
Straight Flange on B16.9 Pipe Cap - Left Side	24,02	0,03	1	1,30
Cylinder #1	24,02	0,03	1	1,30
Straight Flange on B16.9 Pipe Cap - Right Side	24,02	0,03	1	1,30
B16.9 Pipe Cap - Right Side	24,02	0,03	1	1,30
Air Inlet (N1)	24,01	0,03	1	1,30
Air Outlet (N2)	24,01	0,03	1	1,30
B16.9 Elbow #1 (N1)	24,01	0,03	1	1,30
B16.9 Elbow #2 (N2)	24,01	0,03	1	1,30
Drain (N6)	24,02	0,04	1	1,30
PSV Connection (N5)	24	0,01	1	1,30
Temperature Gauge Connection (N3)	24	0,01	1	1,30
Temperature Transmitter Connection (N4)	24	0,01	1	1,30
(1) B16.9 Pipe Cap - Left Side limits the UG-99(b) stress ratio. (2) The zero degree angular position is assumed to be up, and the test liquid height is assumed to the top-most flange.				

The field test condition has not been investigated.

The test temperature of 21,11 °C is warmer than the minimum recommended temperature of -31 °C so the brittle fracture provision of UG-99(h) has been met.

B16.9 Pipe Cap - Left Side

ASME Section VIII Division 1, 2021 Edition Metric				
Component		ASME B16.9 Pipe Cap (modified)		
Material		SA-234 WPB (II-D Metric p. 16, ln. 18)		
Attached To		Cylinder #1		
Impact Tested	Normalized	Fine Grain Practice	PWHT	Maximize MDMT/ No MAWP
No	No	No	No	No
		Design Pressure (bar)	Design Temperature (°C)	Design MDMT (°C)
Internal		12,5	75	0
Static Liquid Head				
Condition		P _s (bar)	H _s (mm)	SG
Test horizontal		0,03	351,36	1
Dimensions				
NPS and Schedule		NPS 8 Sch 40 (Std) DN 200		
Outer Diameter		219,07 mm		
Overall Length E		102 mm		
Nominal Thickness		8,18 mm		
Minimum Thickness ¹		7,16 mm		
Corrosion	Inner	3 mm		
	Outer	0 mm		
Length L _{sf}		44,17 mm		
Nominal Thickness t _{sf}		8,18 mm		
Weight and Capacity				
		Weight (kg) ²		Capacity (liters) ²
New		5,17		2,52
Corroded		3,36		2,74
Radiography				
Category A joints		Seamless No RT		
Head to shell seam		Spot UW-11(b) Type 1		

¹ minimum thickness = nominal thickness times pipe tolerance factor of 0,875.

² includes straight flange

Results Summary	
Governing condition	UG-16
Minimum thickness per UG-16	1,5 mm + 3 mm = 4,5 mm
Design thickness due to internal pressure (t)	4.3 mm
Governing straight flange design thickness	4,36 mm
Maximum allowable working pressure (MAWP)	40.92 bar
Maximum allowable pressure (MAP)	69.64 bar
Straight Flange governs MDMT	-105°C

Factor K		
$K = \left(\frac{1}{6}\right) \cdot \left[2 + \left(\frac{D}{2 \cdot h}\right)^2\right]$		
Corroded	$K = \left(\frac{1}{6}\right) \cdot \left[2 + \left(\frac{208,71}{2 \cdot 53,68}\right)^2\right]$	0,9633
New	$K = \left(\frac{1}{6}\right) \cdot \left[2 + \left(\frac{202,71}{2 \cdot 50,68}\right)^2\right]$	1

Design thickness for internal pressure, (Corroded at 75 °C) Appendix 1-4(c)

$$t = \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} + \text{Corrosion} = \frac{12,5 \cdot 219,07 \cdot 0,963264}{2 \cdot 1.180 \cdot 0,85 + 2 \cdot 12,5 \cdot (0,963264 - 0,1)} + 3 = \underline{4.3} \text{ mm}$$

Maximum allowable working pressure, (Corroded at 75 °C) Appendix 1-4(c)

$$P = \frac{2 \cdot S \cdot E \cdot t}{K \cdot D_o - 2 \cdot t \cdot (K - 0,1)} - P_s = \frac{2 \cdot 1.180 \cdot 0,85 \cdot (0,875 \cdot 8,18 - 3)}{0,963264 \cdot 219,07 - 2 \cdot (0,875 \cdot 8,18 - 3) \cdot (0,963264 - 0,1)} - 0 = \underline{40.92} \text{ bar}$$

Maximum allowable pressure, (New at 21,11 °C) Appendix 1-4(c)

$$P = \frac{2 \cdot S \cdot E \cdot t}{K \cdot D_o - 2 \cdot t \cdot (K - 0,1)} - P_s = \frac{2 \cdot 1.180 \cdot 0,85 \cdot 0,875 \cdot 8,18}{1 \cdot 219,07 - 2 \cdot 0,875 \cdot 8,18 \cdot (1 - 0,1)} - 0 = \underline{69.64} \text{ bar}$$

ASME Section VIII Division 1 UG-81(a) Out-of-Roundness
Inside surface shall not deviate outside the shape by more than 1,25 % of D
Inside surface shall not deviate inside the shape by more than 0,625 % of D

Straight Flange on B16.9 Pipe Cap - Left Side

ASME Section VIII Division 1, 2021 Edition Metric				
Component		Cylinder		
Material		SA-234 WPB (II-D Metric p. 16, ln. 18)		
Impact Tested	Normalized	Fine Grain Practice	PWHT	Maximize MDMT/ No MAWP
No	No	No	No	No
		Design Pressure (bar)	Design Temperature (°C)	Design MDMT (°C)
Internal		12,5	75	0
Static Liquid Head				
Condition		P _s (bar)	H _s (mm)	SG
Test horizontal		0,03	351,36	1
Dimensions				
Outer Diameter		219,07 mm		
Length		44,17 mm		
Nominal Thickness		8,18 mm		
Corrosion	Inner	3 mm		
	Outer	0 mm		
Weight and Capacity				
		Weight (kg)		Capacity (liters)
New		1,87		1,43
Corroded		1,2		1,51
Radiography				
Longitudinal seam		Seamless No RT		
Right Circumferential seam		Spot UW-11(b) Type 1		

Results Summary	
Governing condition	UG-16
Minimum thickness per UG-16	1,5 mm + 3 mm = 4,5 mm
Design thickness due to internal pressure (t)	4,36 mm
Maximum allowable working pressure (MAWP)	48,35 bar
Maximum allowable pressure (MAP)	77,21 bar
Rated MDMT	-105 °C

UCS-66 Material Toughness Requirements	
$t_r = \frac{18,45 \cdot 109,54}{1.180 \cdot 0,85 + 0,4 \cdot 18,45} =$	2 mm
$\text{Stress ratio} = \frac{t_r \cdot E^*}{t_n - c} = \frac{2 \cdot 0,85}{8,18 - 3} =$	0,3282
Stress ratio $\leq 0,35$, MDMT per UCS-66(b)(3) =	-105°C
Material is exempt from impact testing at the Design MDMT of 0°C.	

Design thickness, (at 75 °C) Appendix 1-1

$$t = \frac{P \cdot R_o}{S \cdot E + 0,40 \cdot P} + \text{Corrosion} = \frac{12,5 \cdot 109,54}{1.180 \cdot 0,85 + 0,40 \cdot 12,5} + 3 = \text{4,36 mm}$$

Maximum allowable working pressure, (at 75 °C) Appendix 1-1

$$P = \frac{S \cdot E \cdot t}{R_o - 0,40 \cdot t} - P_s = \frac{1.180 \cdot 0,85 \cdot 5,18}{109,54 - 0,40 \cdot 5,18} - 0 = \underline{48,35} \text{ bar}$$

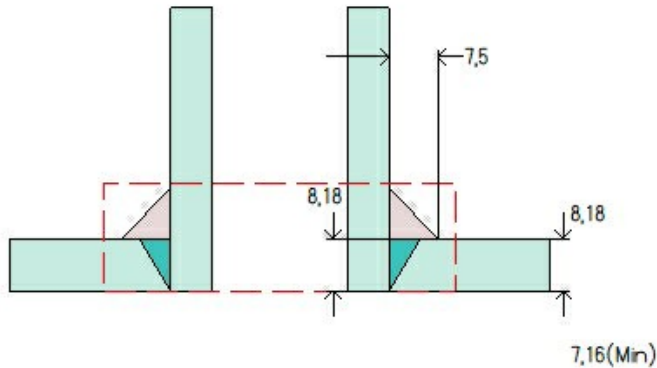
Maximum allowable pressure, (at 21,11 °C) Appendix 1-1

$$P = \frac{S \cdot E \cdot t}{R_o - 0,40 \cdot t} = \frac{1.180 \cdot 0,85 \cdot 8,18}{109,54 - 0,40 \cdot 8,18} = \underline{77,21} \text{ bar}$$

ASME Section VIII Division 1 UG-80(a) Out-of-Roundness
$(D_{\max} - D_{\min})$ shall not exceed 1% of D
When the cross section passes through an opening or within 1 I.D. of the opening, $(D_{\max} - D_{\min})$ shall not exceed 1% of $D + 2\%$ of the inside diameter of the opening

Air Inlet (N1)

ASME Section VIII Division 1, 2021 Edition Metric



Note: round inside edges per UG-76(c)

Location and Orientation

Located on	B16.9 Pipe Cap - Left Side
Orientation	0°
End of nozzle to datum line	1.226 mm
Calculated as hillside	No
Distance to head center, R	0 mm
Passes through a Category A joint	No

Nozzle

Description	NPS 1 Sch 160 DN 25
Access opening	No
Material specification	SA-106 B Smls Pipe (II-D Metric p. 16, In. 16)
Inside diameter, new	20,7 mm
Pipe nominal wall thickness	6,35 mm
Pipe minimum wall thickness ¹	5,56 mm
Corrosion allowance	3 mm
Projection available outside vessel, L _{pr}	64,68 mm
Local vessel minimum thickness	7,16 mm
Liquid static head included	0 bar

Welds

Inner fillet, Leg ₄₁	7,5 mm
Nozzle to vessel groove weld	8,18 mm

Radiography

Longitudinal seam	Seamless No RT
Circumferential seam	Full UW-11(a) Type 1

¹Pipe minimum thickness = nominal thickness times pipe tolerance factor of 0,875.

UCS-66 Material Toughness Requirements Nozzle

Impact test exempt per UCS-66(d) (NPS 4 or smaller pipe) =	-105°C
Material is exempt from impact testing at the Design MDMT of 0°C.	

Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 12,5 bar @ 75 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							4,5	5,56

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (mm)	Actual weld throat size (mm)	Status
Nozzle to shell fillet (Leg ₄₁)	2,35	5,25	weld size is adequate

Calculations for internal pressure 12,5 bar @ 75 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [26,7, 13,35 + (6,35 - 3) + (7,16 - 3)] \\
 &= 26,7 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (7,16 - 3), 2,5 \cdot (6,35 - 3) + 0] \\
 &= 8,38 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{12,5 \cdot 13,35}{1.180 \cdot 1 - 0,6 \cdot 12,5} \\
 &= 0,14 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)(c)

$$\begin{aligned}
 t_r &= \frac{P \cdot K_1 \cdot D_o}{2 \cdot S \cdot E + 0,8 \cdot P} \\
 &= \frac{12,5 \cdot 0,8749 \cdot 219,07}{2 \cdot 1.180 \cdot 1 + 0,8 \cdot 12,5} \\
 &= 1,01 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$t_r = \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} = \frac{12,5 \cdot 219,07 \cdot 0,963264}{2 \cdot 1.180 \cdot 0,85 + 2 \cdot 12,5 \cdot (0,963264 - 0,1)} = 1,3 \text{ mm}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(c) Weld Check

Fillet weld: $t_{\min} = \min [19\text{ mm}, t_n, t] = 3,35 \text{ mm}$

$$t_{c(\min)} = \min [6 \text{ mm}, 0,7 \cdot t_{\min}] = 2,35 \text{ mm}$$

$$t_{c(\text{actual})} = 0,7 \cdot \text{Leg} = 0,7 \cdot 7,5 = 5,25 \text{ mm}$$

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-45 Nozzle Neck Thickness Check

Interpretation VIII-1-83-66 has been applied.

$$\begin{aligned} t_{a\text{UG-27}} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\ &= \frac{12,5 \cdot 13,35}{1.180 \cdot 1 - 0,6 \cdot 12,5} + 3 \\ &= 3,14 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_a &= \max [t_{a\text{UG-27}}, t_{a\text{UG-22}}] \\ &= \max [3,14, 0] \\ &= 3,14 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{b1} &= \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} + \text{Corrosion} \\ &= \frac{12,5 \cdot 219,07 \cdot 0,963264}{2 \cdot 1.180 \cdot 1 + 2 \cdot 12,5 \cdot (0,963264 - 0,1)} + 3 \\ &= 4,11 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{b1} &= \max [t_{b1}, t_{b\text{UG16}}] \\ &= \max [4,11, 4,5] \\ &= 4,5 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_b &= \min [t_{b3}, t_{b1}] \\ &= \min [5,96, 4,5] \\ &= 4,5 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{\text{UG-45}} &= \max [t_a, t_b] \\ &= \max [3,14, 4,5] \\ &= 4,5 \text{ mm} \end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 6,35 = 5,56 \text{ mm}$

The nozzle neck thickness is adequate.

Reinforcement Calculations for MAWP

The thickness requirements of UG-45 govern the MAWP of this nozzle.

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 29,2 bar @ 75 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							5,56	5,56

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (mm)	Actual weld throat size (mm)	Status
Nozzle to shell fillet (Leg ₄₁)	2,35	5,25	weld size is adequate

Calculations for internal pressure 29,2 bar @ 75 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [26,7, 13,35 + (6,35 - 3) + (7,16 - 3)] \\
 &= 26,7 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (7,16 - 3), 2,5 \cdot (6,35 - 3) + 0] \\
 &= 8,38 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{29,2014 \cdot 13,35}{1,180 \cdot 1 - 0,6 \cdot 29,2014} \\
 &= 0,34 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)(c)

$$\begin{aligned}
 t_r &= \frac{P \cdot K_1 \cdot D_o}{2 \cdot S \cdot E + 0,8 \cdot P} \\
 &= \frac{29,2014 \cdot 0,8749 \cdot 219,07}{2 \cdot 1,180 \cdot 1 + 0,8 \cdot 29,2014} \\
 &= 2,35 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$t_r = \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} = \frac{29,2 \cdot 219,07 \cdot 0,963264}{2 \cdot 1,180 \cdot 0,85 + 2 \cdot 29,2 \cdot (0,963264 - 0,1)} = 3 \text{ mm}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(c) Weld Check

Fillet weld: $t_{\min} = \min [19\text{ mm}, t_n, t] = 3,35 \text{ mm}$

$t_{c(\min)} = \min [6 \text{ mm}, 0,7 \cdot t_{\min}] = 2,35 \text{ mm}$

$t_{c(actual)} = 0,7 \cdot \text{Leg} = 0,7 \cdot 7,5 = 5,25 \text{ mm}$

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-45 Nozzle Neck Thickness Check

Interpretation VIII-1-83-66 has been applied.

$$\begin{aligned} t_{aUG-27} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\ &= \frac{29,2014 \cdot 13,35}{1,180 \cdot 1 - 0,6 \cdot 29,2014} + 3 \\ &= 3,34 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_a &= \max [t_{aUG-27}, t_{aUG-22}] \\ &= \max [3,34, 0] \\ &= 3,34 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{b1} &= \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} + \text{Corrosion} \\ &= \frac{29,2 \cdot 219,07 \cdot 0,963264}{2 \cdot 1,180 \cdot 1 + 2 \cdot 29,2 \cdot (0,963264 - 0,1)} + 3 \\ &= 5,56 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{b1} &= \max [t_{b1}, t_{bUG16}] \\ &= \max [5,56, 4,5] \\ &= 5,56 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_b &= \min [t_{b3}, t_{b1}] \\ &= \min [5,96, 5,56] \\ &= 5,56 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{UG-45} &= \max [t_a, t_b] \\ &= \max [3,34, 5,56] \\ &= 5,56 \text{ mm} \end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 6,35 = 5,56 \text{ mm}$

The nozzle neck thickness is adequate.

Reinforcement Calculations for MAP

The vessel wall thickness governs the MAP of this nozzle.

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 88,24 bar @ 21,11 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							2,96	5,56

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

Calculations for internal pressure 88,24 bar @ 21,11 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [20,7, 10,35 + (6,35 - 0) + (7,16 - 0)] \\
 &= 23,86 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (7,16 - 0), 2,5 \cdot (6,35 - 0) + 0] \\
 &= 15,88 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{88,237 \cdot 10,35}{1.180 \cdot 1 - 0,6 \cdot 88,237} \\
 &= 0,81 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)(c)

$$\begin{aligned}
 t_r &= \frac{P \cdot K_1 \cdot D_o}{2 \cdot S \cdot E + 0,8 \cdot P} \\
 &= \frac{88,237 \cdot 0,9 \cdot 219,07}{2 \cdot 1.180 \cdot 1 + 0,8 \cdot 88,237} \\
 &= 7,16 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$t_r = \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} = \frac{88,24 \cdot 219,07 \cdot 1}{2 \cdot 1.180 \cdot 0,85 + 2 \cdot 88,24 \cdot (1 - 0,1)} = 8,93 \text{ mm}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UG-45 Nozzle Neck Thickness Check

Interpretation VIII-1-83-66 has been applied.

$$\begin{aligned}
 t_{aUG-27} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\
 &= \frac{88,237 \cdot 10,35}{1.180 \cdot 1 - 0,6 \cdot 88,237} + 0 \\
 &= 0,81 \text{ mm}
 \end{aligned}$$

$$\begin{aligned}
 t_a &= \max [t_{aUG-27}, t_{aUG-22}] \\
 &= \max [0,81, 0] \\
 &= 0,81 \text{ mm}
 \end{aligned}$$

$$\begin{aligned}
 t_{b1} &= \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} + \text{Corrosion} \\
 &= \frac{88,24 \cdot 219,07 \cdot 1}{2 \cdot 1.180 \cdot 1 + 2 \cdot 88,24 \cdot (1 - 0,1)} + 0 \\
 &= 7,67 \text{ mm}
 \end{aligned}$$

$$\begin{aligned}
 t_{b1} &= \max [t_{b1}, t_{bUG16}] \\
 &= \max [7,67, 1,5] \\
 &= 7,67 \text{ mm}
 \end{aligned}$$

$$\begin{aligned}
 t_b &= \min [t_{b3}, t_{b1}] \\
 &= \min [2,96, 7,67] \\
 &= 2,96 \text{ mm}
 \end{aligned}$$

$$\begin{aligned}
 t_{UG-45} &= \max [t_a, t_b] \\
 &= \max [0,81, 2,96] \\
 &= \underline{2.96} \text{ mm}
 \end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 6,35 = 5,56 \text{ mm}$

The nozzle neck thickness is adequate.

B16.9 Elbow #1 (N1)

ASME Section VIII Division 1, 2021 Edition Metric				
Component		ASME B16.9 Elbow		
Type		Long Radius 90-deg		
Material		SA-234 WPB (II-D Metric p. 16, ln. 18)		
Pipe NPS and Schedule		NPS 1 Sch 160 DN 25		
Attached To		Air Inlet (N1)		
Impact Tested	Normalized	Fine Grain Practice	PWHT	Maximize MDMT/ No MAWP
No	No	No	No	No
		Design Pressure (bar)	Design Temperature (°C)	Design MDMT (°C)
Internal		12,5	75	0
Static Liquid Head				
Condition		P _s (bar)	H _s (mm)	SG
Test horizontal		0,03	288,1	1
Dimensions				
Outer Diameter		33,4 mm		
Nominal Thickness		6,35 mm		
Minimum Thickness ¹		5,56 mm		
Center-to-End, A		38 mm		
Corrosion	Inner	3 mm		
	Outer	0 mm		
Weight and Capacity				
		Weight (kg)		Capacity (liters)
New		0,25		0,02
Corroded		0,15		0,03
Radiography				
Longitudinal seam		Seamless No RT		
Left Circumferential seam		Full UW-11(a) Type 1		
Right Circumferential seam		Full UW-11(a) Type 1		

¹ minimum thickness = nominal thickness times pipe tolerance factor of 0,875.

ASME B16.5-2017 Flange	
Description	NPS 1 Class 150 WN A105
Bolt Material	SA-193 B7 Bolt <= 64 (II-D Metric p. 410, ln. 32)
Blind included	No
Rated MDMT	-29°C
Liquid static head	0 bar
MAWP rating	18,45 bar @ 75°C
MAP rating	19,6 bar @ 21,11°C
Hydrotest rating	30 bar @ 21,11°C
PWHT performed	No
Produced to Fine Grain Practice and Supplied in Heat Treated Condition	No
Impact Tested	No
Circumferential joint radiography	Full UW-11(a) Type 1
Gasket	
Type	ASME B16.21 Nonmetallic Flat Gasket
Description	Flexitallic Compressed Fiber SF 2401 Synthetic/NBR
Factor, m	3,2
Seating Stress, y	203,89 kgf/cm ²
Thickness, T	3 mm
Inner Diameter	33 mm
Outer Diameter	67 mm
Notes	
Flange rated MDMT per UG-20(f) = -29°C Bolts rated MDMT per Fig UCS-66 note (c) = -48°C	

Results Summary	
Governing condition	UG-16
Minimum thickness per UG-16	1,5 mm + 3 mm = 4,5 mm
Design thickness due to internal pressure (t)	3.18 mm
Maximum allowable working pressure (MAWP)	192.42 bar
Maximum allowable pressure (MAP)	477.33 bar
Rated MDMT	-105 °C

UCS-66 Material Toughness Requirements	
$t_r = \frac{27,8 \cdot 16,7}{1.180 \cdot 1 + 0,4 \cdot 27,8} =$	0,39 mm
Stress ratio = $\frac{t_r \cdot E^*}{t_n - c} = \frac{0,39 \cdot 1}{5,56 - 3} =$	0,1525
Stress ratio ≤ 0,35, MDMT per UCS-66(b)(3) =	-105°C
Material is exempt from impact testing at the Design MDMT of 0°C.	

Design thickness, (at 75 °C) Appendix 1-1

$$t = \frac{P \cdot R_o}{S \cdot E + 0,40 \cdot P} + \text{Corrosion} = \frac{12,5 \cdot 16,7}{1.180 \cdot 1,00 + 0,40 \cdot 12,5} + 3 = \text{3.18 mm}$$

Maximum allowable working pressure, (at 75 °C) Appendix 1-1

$$P = \frac{S \cdot E \cdot t}{R_o - 0,40 \cdot t} - P_s = \frac{1.180 \cdot 1,00 \cdot (6,35 \cdot 0,875 - 3)}{16,7 - 0,40 \cdot (6,35 \cdot 0,875 - 3)} - 0 = \text{192.42 bar}$$

Maximum allowable pressure, (at 21,11 °C) Appendix 1-2

$$P = S \cdot E \cdot \ln\left(\frac{R_o}{R_o - t}\right) = 1.180 \cdot 1,00 \cdot \ln\left(\frac{16,7}{16,7 - (6,35 \cdot 0,875)}\right) = \underline{477,33} \text{ bar}$$

Cylinder #1

ASME Section VIII Division 1, 2021 Edition Metric				
Component		Cylinder		
Material		SA-106 B Smls Pipe (II-D Metric p. 16, ln. 16)		
Pipe NPS and Schedule		NPS 8 Sch 40 (Std) DN 200		
Impact Tested	Normalized	Fine Grain Practice	PWHT	Maximize MDMT No MAWP
No	No	No	No	No
		Design Pressure (bar)	Design Temperature (°C)	Design MDMT (°C)
Internal		12,5	75	0
Static Liquid Head				
Condition		P _s (bar)	H _s (mm)	SG
Test horizontal		0,03	351,36	1
Dimensions				
Outer Diameter		219,07 mm		
Length		1.060 mm		
Pipe Nominal Thickness		8,18 mm		
Pipe Minimum Thickness ¹		7,16 mm		
Corrosion	Inner	3 mm		
	Outer	0 mm		
Weight and Capacity				
		Weight (kg)		Capacity (liters)
New		44,63		34,21
Corroded		28,67		36,26
Radiography				
Longitudinal seam		Seamless No RT		
Left Circumferential seam		Spot UW-11(b) Type 1		
Right Circumferential seam		Spot UW-11(b) Type 1		

¹Pipe minimum thickness = nominal thickness times pipe tolerance factor of 0,875.

Results Summary	
Governing condition	UG-16
Minimum thickness per UG-16	1,5 mm + 3 mm = 4,5 mm
Design thickness due to internal pressure (t)	4,36 mm
Maximum allowable working pressure (MAWP)	38,66 bar
Maximum allowable pressure (MAP)	67,3 bar
Rated MDMT	-48 °C

UCS-66 Material Toughness Requirements	
Governing thickness, t _g =	7,16 mm
Exemption temperature from Fig UCS-66M Curve B =	-29°C
$t_r = \frac{18,45 \cdot 109,54}{1.180 \cdot 0,85 + 0,4 \cdot 18,45} =$	2 mm
$\text{Stress ratio} = \frac{t_r \cdot E^*}{t_n - c} = \frac{2 \cdot 0,85}{7,16 - 3} =$	0,4089
Reduction in MDMT, T _R from Fig UCS-66.1M =	48,8°C
$MDMT = \max [MDMT - T_R, -48] = \max [-29 - 48,8, -48] =$	-48°C
Material is exempt from impact testing at the Design MDMT of 0°C.	

Design thickness, (at 75 °C) Appendix 1-1

$$t = \frac{P \cdot R_o}{S \cdot E + 0,40 \cdot P} + \text{Corrosion} = \frac{12,5 \cdot 109,54}{1.180 \cdot 0,85 + 0,40 \cdot 12,5} + 3 = 4,36 \text{ mm}$$

Maximum allowable working pressure, (at 75 °C) Appendix 1-1

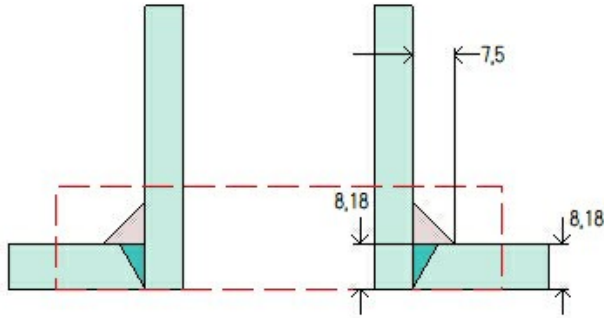
$$P = \frac{S \cdot E \cdot t}{R_o - 0,40 \cdot t} - P_s = \frac{1.180 \cdot 0,85 \cdot (8,18 \cdot 0,875 - 3)}{109,54 - 0,40 \cdot (8,18 \cdot 0,875 - 3)} - 0 = 38,66 \text{ bar}$$

Maximum allowable pressure, (at 21,11 °C) Appendix 1-1

$$P = \frac{S \cdot E \cdot t}{R_o - 0,40 \cdot t} = \frac{1.180 \cdot 0,85 \cdot (8,18 \cdot 0,875)}{109,54 - 0,40 \cdot (8,18 \cdot 0,875)} = 67,3 \text{ bar}$$

Temperature Gauge Connection (N3)

ASME Section VIII Division 1, 2021 Edition Metric



Note: round inside edges per UG-76(c)

Location and Orientation

Located on	Cylinder #1
Orientation	0°
Nozzle center line offset to datum line	720 mm
End of nozzle to shell center	250 mm
Passes through a Category A joint	No

Nozzle

Description	NPS 1,5 Sch 160 DN 40
Access opening	No
Material specification	SA-106 B Smls Pipe (II-D Metric p. 16, In. 16)
Inside diameter, new	33,99 mm
Pipe nominal wall thickness	7,14 mm
Pipe minimum wall thickness ¹	6,25 mm
Corrosion allowance	3 mm
Projection available outside vessel, Lpr	72,14 mm
Projection available outside vessel to flange face, Lf	140,47 mm
Local vessel minimum thickness	7,16 mm
Liquid static head included	0 bar

Welds

Inner fillet, Leg ₄₁	7,5 mm
Nozzle to vessel groove weld	8,18 mm

Radiography

Longitudinal seam	Seamless No RT
Circumferential seam	Full UW-11(a) Type 1

¹Pipe minimum thickness = nominal thickness times pipe tolerance factor of 0,875.

ASME B16.5-2017 Flange	
Description	NPS 1,5 Class 300 WN A105
Bolt Material	SA-193 B7 Bolt <= 64 (II-D Metric p. 410, ln. 32)
Blind included	No
Rated MDMT	-48°C
Liquid static head	0 bar
MAWP rating	48,35 bar @ 75°C
MAP rating	51,1 bar @ 21,11°C
Hydrotest rating	77 bar @ 21,11°C
PWHT performed	No
Produced to Fine Grain Practice and Supplied in Heat Treated Condition	No
Impact Tested	No
Circumferential joint radiography	Full UW-11(a) Type 1
Gasket	
Type	ASME B16.20 Spiral-Wound
Description	Garlock FLEXSEAL RW 316L SS / Flexible Graphite
Factor, m	3
Seating Stress, y	703,07 kgf/cm ²
Thickness, T	3 mm
Inner Diameter	54,1 mm
Outer Diameter	69,9 mm
Notes	
Flange rated MDMT per UCS-66(b)(1)(b) = -48°C (Coincident ratio = 0,3611) Bolts rated MDMT per Fig UCS-66 note (c) = -48°C	

UCS-66 Material Toughness Requirements Nozzle	
$t_r = \frac{18,45 \cdot 19,99}{1.180 \cdot 1 - 0,6 \cdot 18,45} =$	0,32 mm
Stress ratio = $\frac{t_r \cdot E^*}{t_n - c} = \frac{0,32 \cdot 1}{6,25 - 3} =$	0,0972
Stress ratio ≤ 0,35, MDMT per UCS-66(b)(3) =	-105°C
Material is exempt from impact testing at the Design MDMT of 0°C.	

Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 12,5 bar @ 75 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							4,5	6,25

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (mm)	Actual weld throat size (mm)	Status
Nozzle to shell fillet (Leg ₄₁)	2,9	5,25	weld size is adequate

Calculations for internal pressure 12,5 bar @ 75 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [39,99, 19,99 + (7,14 - 3) + (7,16 - 3)] \\
 &= 39,99 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (7,16 - 3), 2,5 \cdot (7,14 - 3) + 0] \\
 &= 10,34 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{12,5 \cdot 19,99}{1.180 \cdot 1 - 0,6 \cdot 12,5} \\
 &= 0,21 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{12,5 \cdot 109,54}{1.180 \cdot 1 + 0,4 \cdot 12,5} \\
 &= 1,16 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$\begin{aligned}
t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
&= \frac{12,5 \cdot 109,54}{1.180 \cdot 0,85 + 0,4 \cdot 12,5} \\
&= 1,36 \text{ mm}
\end{aligned}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(c) Weld Check

Fillet weld: $t_{\min} = \min [19mm, t_n, t] = 4,14 \text{ mm}$

$$t_{c(\min)} = \min [6 \text{ mm}, 0,7 \cdot t_{\min}] = 2,9 \text{ mm}$$

$$t_{c(actual)} = 0,7 \cdot \text{Leg} = 0,7 \cdot 7,5 = 5,25 \text{ mm}$$

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-45 Nozzle Neck Thickness Check

$$\begin{aligned}
t_{aUG-27} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\
&= \frac{12,5 \cdot 19,99}{1.180 \cdot 1 - 0,6 \cdot 12,5} + 3 \\
&= 3,21 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_a &= \max [t_{aUG-27}, t_{aUG-22}] \\
&= \max [3,21, 0] \\
&= 3,21 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{b1} &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} + \text{Corrosion} \\
&= \frac{12,5 \cdot 109,54}{1.180 \cdot 1 + 0,4 \cdot 12,5} + 3 \\
&= 4,16 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{b1} &= \max [t_{b1}, t_{bUG16}] \\
&= \max [4,16, 4,5] \\
&= 4,5 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_b &= \min [t_{b3}, t_{b1}] \\
&= \min [6,22, 4,5] \\
&= 4,5 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{UG-45} &= \max [t_a, t_b] \\
&= \max [3,21, 4,5] \\
&= 4,5 \text{ mm}
\end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 7,14 = 6,25$ mm

The nozzle neck thickness is adequate.

Reinforcement Calculations for MAWP

The vessel wall thickness governs the MAWP of this nozzle.

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 45,49 bar @ 75 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							6,22	6,25

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (mm)	Actual weld throat size (mm)	Status
Nozzle to shell fillet (Leg ₄₁)	2,9	5,25	weld size is adequate

Calculations for internal pressure 45,49 bar @ 75 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [39,99, 19,99 + (7,14 - 3) + (7,16 - 3)] \\
 &= 39,99 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (7,16 - 3), 2,5 \cdot (7,14 - 3) + 0] \\
 &= 10,34 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{45,4851 \cdot 19,99}{1,180 \cdot 1 - 0,6 \cdot 45,4851} \\
 &= 0,79 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{45,4851 \cdot 109,54}{1,180 \cdot 1 + 0,4 \cdot 45,4851} \\
 &= 4,16 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$\begin{aligned}
t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
&= \frac{45,4851 \cdot 109,54}{1,180 \cdot 0,85 + 0,4 \cdot 45,4851} \\
&= 4,88 \text{ mm}
\end{aligned}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(c) Weld Check

Fillet weld: $t_{\min} = \min [19mm, t_n, t] = 4,14 \text{ mm}$

$t_{c(\min)} = \min [6 \text{ mm}, 0,7 \cdot t_{\min}] = 2,9 \text{ mm}$

$t_{c(actual)} = 0,7 \cdot \text{Leg} = 0,7 \cdot 7,5 = 5,25 \text{ mm}$

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-45 Nozzle Neck Thickness Check

$$\begin{aligned}
t_{aUG-27} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\
&= \frac{45,4851 \cdot 19,99}{1,180 \cdot 1 - 0,6 \cdot 45,4851} + 3 \\
&= 3,79 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_a &= \max [t_{aUG-27}, t_{aUG-22}] \\
&= \max [3,79, 0] \\
&= 3,79 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{b1} &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} + \text{Corrosion} \\
&= \frac{45,4851 \cdot 109,54}{1,180 \cdot 1 + 0,4 \cdot 45,4851} + 3 \\
&= 7,16 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{b1} &= \max [t_{b1}, t_{bUG16}] \\
&= \max [7,16, 4,5] \\
&= 7,16 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_b &= \min [t_{b3}, t_{b1}] \\
&= \min [6,22, 7,16] \\
&= 6,22 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{UG-45} &= \max [t_a, t_b] \\
&= \max [3,79, 6,22] \\
&= 6,22 \text{ mm}
\end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 7,14 = 6,25$ mm

The nozzle neck thickness is adequate.

Reinforcement Calculations for MAP

The attached ASME B16.5 flange limits the nozzle MAP.

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 51,1 bar @ 21,11 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							3,22	6,25

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

Calculations for internal pressure 51,1 bar @ 21,11 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [33,99, 16,99 + (7,14 - 0) + (7,16 - 0)] \\
 &= 33,99 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (7,16 - 0), 2,5 \cdot (7,14 - 0) + 0] \\
 &= 17,84 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{51,1 \cdot 16,99}{1.180 \cdot 1 - 0,6 \cdot 51,1} \\
 &= 0,75 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{51,1 \cdot 109,54}{1.180 \cdot 1 + 0,4 \cdot 51,1} \\
 &= 4,66 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{51,1 \cdot 109,54}{1.180 \cdot 0,85 + 0,4 \cdot 51,1} \\
 &= 5,47 \text{ mm}
 \end{aligned}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UG-45 Nozzle Neck Thickness Check

$$\begin{aligned}t_{aUG-27} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\&= \frac{51,1 \cdot 16,99}{1.180 \cdot 1 - 0,6 \cdot 51,1} + 0 \\&= 0,75 \text{ mm}\end{aligned}$$

$$\begin{aligned}t_a &= \max [t_{aUG-27}, t_{aUG-22}] \\&= \max [0,75, 0] \\&= 0,75 \text{ mm}\end{aligned}$$

$$\begin{aligned}t_{b1} &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} + \text{Corrosion} \\&= \frac{51,1 \cdot 109,54}{1.180 \cdot 1 + 0,4 \cdot 51,1} + 0 \\&= 4,66 \text{ mm}\end{aligned}$$

$$\begin{aligned}t_{b1} &= \max [t_{b1}, t_{bUG16}] \\&= \max [4,66, 1,5] \\&= 4,66 \text{ mm}\end{aligned}$$

$$\begin{aligned}t_b &= \min [t_{b3}, t_{b1}] \\&= \min [3,22, 4,66] \\&= 3,22 \text{ mm}\end{aligned}$$

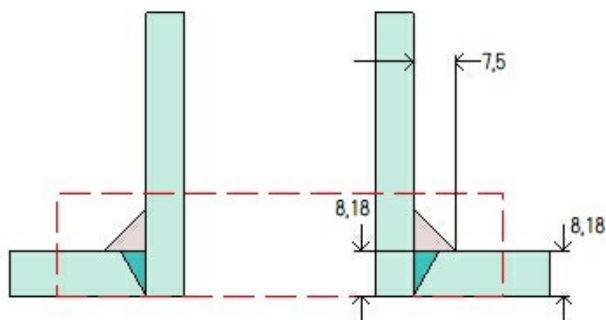
$$\begin{aligned}t_{UG-45} &= \max [t_a, t_b] \\&= \max [0,75, 3,22] \\&= \underline{3,22} \text{ mm}\end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 7,14 = 6,25 \text{ mm}$

The nozzle neck thickness is adequate.

Temperature Transmitter Connection (N4)

ASME Section VIII Division 1, 2021 Edition Metric



Note: round inside edges per UG-76(c)

Location and Orientation

Located on	Cylinder #1
Orientation	0°
Nozzle center line offset to datum line	505 mm
End of nozzle to shell center	250 mm
Passes through a Category A joint	No

Nozzle

Description	NPS 1,5 Sch 160 DN 40
Access opening	No
Material specification	SA-106 B Smls Pipe (II-D Metric p. 16, In. 16)
Inside diameter, new	33,99 mm
Pipe nominal wall thickness	7,14 mm
Pipe minimum wall thickness ¹	6,25 mm
Corrosion allowance	3 mm
Projection available outside vessel, Lpr	72,14 mm
Projection available outside vessel to flange face, Lf	140,47 mm
Local vessel minimum thickness	7,16 mm
Liquid static head included	0 bar

Welds

Inner fillet, Leg ₄₁	7,5 mm
Nozzle to vessel groove weld	8,18 mm

Radiography

Longitudinal seam	Seamless No RT
Circumferential seam	Full UW-11(a) Type 1

¹Pipe minimum thickness = nominal thickness times pipe tolerance factor of 0,875.

ASME B16.5-2017 Flange	
Description	NPS 1,5 Class 300 WN A105
Bolt Material	SA-193 B7 Bolt <= 64 (II-D Metric p. 410, ln. 32)
Blind included	No
Rated MDMT	-48°C
Liquid static head	0 bar
MAWP rating	48,35 bar @ 75°C
MAP rating	51,1 bar @ 21,11°C
Hydrotest rating	77 bar @ 21,11°C
PWHT performed	No
Produced to Fine Grain Practice and Supplied in Heat Treated Condition	No
Impact Tested	No
Circumferential joint radiography	Full UW-11(a) Type 1
Gasket	
Type	ASME B16.20 Spiral-Wound
Description	Garlock FLEXSEAL RW 316L SS / Flexible Graphite
Factor, m	3
Seating Stress, y	703,07 kgf/cm ²
Thickness, T	3 mm
Inner Diameter	54,1 mm
Outer Diameter	69,9 mm
Notes	
Flange rated MDMT per UCS-66(b)(1)(b) = -48°C (Coincident ratio = 0,3611) Bolts rated MDMT per Fig UCS-66 note (c) = -48°C	

UCS-66 Material Toughness Requirements Nozzle	
$t_r = \frac{18,45 \cdot 19,99}{1.180 \cdot 1 - 0,6 \cdot 18,45} =$	0,32 mm
Stress ratio = $\frac{t_r \cdot E^*}{t_n - c} = \frac{0,32 \cdot 1}{6,25 - 3} =$	0,0972
Stress ratio ≤ 0,35, MDMT per UCS-66(b)(3) =	-105°C
Material is exempt from impact testing at the Design MDMT of 0°C.	

Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 12,5 bar @ 75 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							4,5	6,25

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (mm)	Actual weld throat size (mm)	Status
Nozzle to shell fillet (Leg ₄₁)	2,9	5,25	weld size is adequate

Calculations for internal pressure 12,5 bar @ 75 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [39,99, 19,99 + (7,14 - 3) + (7,16 - 3)] \\
 &= 39,99 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (7,16 - 3), 2,5 \cdot (7,14 - 3) + 0] \\
 &= 10,34 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{12,5 \cdot 19,99}{1.180 \cdot 1 - 0,6 \cdot 12,5} \\
 &= 0,21 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{12,5 \cdot 109,54}{1.180 \cdot 1 + 0,4 \cdot 12,5} \\
 &= 1,16 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$\begin{aligned}
t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
&= \frac{12,5 \cdot 109,54}{1.180 \cdot 0,85 + 0,4 \cdot 12,5} \\
&= 1,36 \text{ mm}
\end{aligned}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(c) Weld Check

Fillet weld: $t_{\min} = \min [19mm, t_n, t] = 4,14 \text{ mm}$

$$t_{c(\min)} = \min [6 \text{ mm}, 0,7 \cdot t_{\min}] = 2,9 \text{ mm}$$

$$t_{c(actual)} = 0,7 \cdot \text{Leg} = 0,7 \cdot 7,5 = 5,25 \text{ mm}$$

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-45 Nozzle Neck Thickness Check

$$\begin{aligned}
t_{aUG-27} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\
&= \frac{12,5 \cdot 19,99}{1.180 \cdot 1 - 0,6 \cdot 12,5} + 3 \\
&= 3,21 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_a &= \max [t_{aUG-27}, t_{aUG-22}] \\
&= \max [3,21, 0] \\
&= 3,21 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{b1} &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} + \text{Corrosion} \\
&= \frac{12,5 \cdot 109,54}{1.180 \cdot 1 + 0,4 \cdot 12,5} + 3 \\
&= 4,16 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{b1} &= \max [t_{b1}, t_{bUG16}] \\
&= \max [4,16, 4,5] \\
&= 4,5 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_b &= \min [t_{b3}, t_{b1}] \\
&= \min [6,22, 4,5] \\
&= 4,5 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{UG-45} &= \max [t_a, t_b] \\
&= \max [3,21, 4,5] \\
&= 4,5 \text{ mm}
\end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 7,14 = 6,25$ mm

The nozzle neck thickness is adequate.

Reinforcement Calculations for MAWP

The vessel wall thickness governs the MAWP of this nozzle.

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 45,49 bar @ 75 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							6,22	6,25

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (mm)	Actual weld throat size (mm)	Status
Nozzle to shell fillet (Leg ₄₁)	2,9	5,25	weld size is adequate

Calculations for internal pressure 45,49 bar @ 75 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [39,99, 19,99 + (7,14 - 3) + (7,16 - 3)] \\
 &= 39,99 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (7,16 - 3), 2,5 \cdot (7,14 - 3) + 0] \\
 &= 10,34 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{45,4851 \cdot 19,99}{1,180 \cdot 1 - 0,6 \cdot 45,4851} \\
 &= 0,79 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{45,4851 \cdot 109,54}{1,180 \cdot 1 + 0,4 \cdot 45,4851} \\
 &= 4,16 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$\begin{aligned}
t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
&= \frac{45,4851 \cdot 109,54}{1.180 \cdot 0,85 + 0,4 \cdot 45,4851} \\
&= 4,88 \text{ mm}
\end{aligned}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(c) Weld Check

Fillet weld: $t_{\min} = \min [19mm, t_n, t] = 4,14 \text{ mm}$

$t_{c(\min)} = \min [6 \text{ mm}, 0,7 \cdot t_{\min}] = 2,9 \text{ mm}$

$t_{c(actual)} = 0,7 \cdot \text{Leg} = 0,7 \cdot 7,5 = 5,25 \text{ mm}$

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-45 Nozzle Neck Thickness Check

$$\begin{aligned}
t_{aUG-27} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\
&= \frac{45,4851 \cdot 19,99}{1.180 \cdot 1 - 0,6 \cdot 45,4851} + 3 \\
&= 3,79 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_a &= \max [t_{aUG-27}, t_{aUG-22}] \\
&= \max [3,79, 0] \\
&= 3,79 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{b1} &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} + \text{Corrosion} \\
&= \frac{45,4851 \cdot 109,54}{1.180 \cdot 1 + 0,4 \cdot 45,4851} + 3 \\
&= 7,16 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{b1} &= \max [t_{b1}, t_{bUG16}] \\
&= \max [7,16, 4,5] \\
&= 7,16 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_b &= \min [t_{b3}, t_{b1}] \\
&= \min [6,22, 7,16] \\
&= 6,22 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{UG-45} &= \max [t_a, t_b] \\
&= \max [3,79, 6,22] \\
&= 6,22 \text{ mm}
\end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 7,14 = 6,25$ mm

The nozzle neck thickness is adequate.

Reinforcement Calculations for MAP

The attached ASME B16.5 flange limits the nozzle MAP.

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 51,1 bar @ 21,11 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							3,22	6,25

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

Calculations for internal pressure 51,1 bar @ 21,11 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [33,99, 16,99 + (7,14 - 0) + (7,16 - 0)] \\
 &= 33,99 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (7,16 - 0), 2,5 \cdot (7,14 - 0) + 0] \\
 &= 17,84 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{51,1 \cdot 16,99}{1.180 \cdot 1 - 0,6 \cdot 51,1} \\
 &= 0,75 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{51,1 \cdot 109,54}{1.180 \cdot 1 + 0,4 \cdot 51,1} \\
 &= 4,66 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{51,1 \cdot 109,54}{1.180 \cdot 0,85 + 0,4 \cdot 51,1} \\
 &= 5,47 \text{ mm}
 \end{aligned}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UG-45 Nozzle Neck Thickness Check

$$\begin{aligned}t_{aUG-27} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\&= \frac{51,1 \cdot 16,99}{1.180 \cdot 1 - 0,6 \cdot 51,1} + 0 \\&= 0,75 \text{ mm}\end{aligned}$$

$$\begin{aligned}t_a &= \max [t_{aUG-27}, t_{aUG-22}] \\&= \max [0,75, 0] \\&= 0,75 \text{ mm}\end{aligned}$$

$$\begin{aligned}t_{b1} &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} + \text{Corrosion} \\&= \frac{51,1 \cdot 109,54}{1.180 \cdot 1 + 0,4 \cdot 51,1} + 0 \\&= 4,66 \text{ mm}\end{aligned}$$

$$\begin{aligned}t_{b1} &= \max [t_{b1}, t_{bUG16}] \\&= \max [4,66, 1,5] \\&= 4,66 \text{ mm}\end{aligned}$$

$$\begin{aligned}t_b &= \min [t_{b3}, t_{b1}] \\&= \min [3,22, 4,66] \\&= 3,22 \text{ mm}\end{aligned}$$

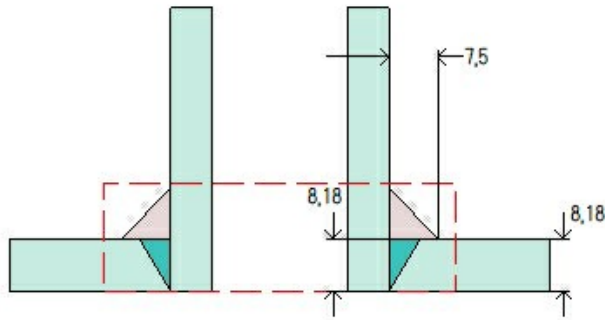
$$\begin{aligned}t_{UG-45} &= \max [t_a, t_b] \\&= \max [0,75, 3,22] \\&= \underline{3,22} \text{ mm}\end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 7,14 = 6,25 \text{ mm}$

The nozzle neck thickness is adequate.

PSV Connection (N5)

ASME Section VIII Division 1, 2021 Edition Metric



Note: round inside edges per UG-76(c)

Location and Orientation

Located on	Cylinder #1
Orientation	0°
Nozzle center line offset to datum line	280 mm
End of nozzle to shell center	250 mm
Passes through a Category A joint	No

Nozzle

Description	NPS 1 Sch 160 DN 25
Access opening	No
Material specification	SA-106 B Smls Pipe (II-D Metric p. 16, In. 16)
Inside diameter, new	20,7 mm
Pipe nominal wall thickness	6,35 mm
Pipe minimum wall thickness ¹	5,56 mm
Corrosion allowance	3 mm
Projection available outside vessel, L _{pr}	78,49 mm
Projection available outside vessel to flange face, L _f	140,47 mm
Local vessel minimum thickness	7,16 mm
Liquid static head included	0 bar

Welds

Inner fillet, Leg ₄₁	7,5 mm
Nozzle to vessel groove weld	8,18 mm

Radiography

Longitudinal seam	Seamless No RT
Circumferential seam	Full UW-11(a) Type 1

¹Pipe minimum thickness = nominal thickness times pipe tolerance factor of 0,875.

ASME B16.5-2017 Flange	
Description	NPS 1 Class 300 WN A105
Bolt Material	SA-193 B7 Bolt <= 64 (II-D Metric p. 410, ln. 32)
Blind included	No
Rated MDMT	-48°C
Liquid static head	0 bar
MAWP rating	48,35 bar @ 75°C
MAP rating	51,1 bar @ 21,11°C
Hydrotest rating	77 bar @ 21,11°C
PWHT performed	No
Produced to Fine Grain Practice and Supplied in Heat Treated Condition	No
Impact Tested	No
Circumferential joint radiography	Full UW-11(a) Type 1
Gasket	
Type	ASME B16.20 Spiral-Wound
Description	Garlock FLEXSEAL RW 316L SS / Flexible Graphite
Factor, m	3
Seating Stress, y	703,07 kg/cm ²
Thickness, T	3 mm
Inner Diameter	31,8 mm
Outer Diameter	47,8 mm
Notes	
Flange rated MDMT per UCS-66(b)(1)(b) = -48°C (Coincident ratio = 0,3611) Bolts rated MDMT per Fig UCS-66 note (c) = -48°C	

UCS-66 Material Toughness Requirements Nozzle	
Impact test exempt per UCS-66(d) (NPS 4 or smaller pipe) =	-105°C
Material is exempt from impact testing at the Design MDMT of 0°C.	

Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 12,5 bar @ 75 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							4,5	5,56

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (mm)	Actual weld throat size (mm)	Status
Nozzle to shell fillet (Leg ₄₁)	2,35	5,25	weld size is adequate

Calculations for internal pressure 12,5 bar @ 75 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [26,7, 13,35 + (6,35 - 3) + (7,16 - 3)] \\
 &= 26,7 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (7,16 - 3), 2,5 \cdot (6,35 - 3) + 0] \\
 &= 8,38 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{12,5 \cdot 13,35}{1.180 \cdot 1 - 0,6 \cdot 12,5} \\
 &= 0,14 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{12,5 \cdot 109,54}{1.180 \cdot 1 + 0,4 \cdot 12,5} \\
 &= 1,16 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$\begin{aligned}
t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
&= \frac{12,5 \cdot 109,54}{1.180 \cdot 0,85 + 0,4 \cdot 12,5} \\
&= 1,36 \text{ mm}
\end{aligned}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(c) Weld Check

Fillet weld: $t_{\min} = \min [19mm, t_n, t] = 3,35 \text{ mm}$

$$t_{c(\min)} = \min [6 \text{ mm}, 0,7 \cdot t_{\min}] = 2,35 \text{ mm}$$

$$t_{c(actual)} = 0,7 \cdot \text{Leg} = 0,7 \cdot 7,5 = 5,25 \text{ mm}$$

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-45 Nozzle Neck Thickness Check

$$\begin{aligned}
t_{aUG-27} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\
&= \frac{12,5 \cdot 13,35}{1.180 \cdot 1 - 0,6 \cdot 12,5} + 3 \\
&= 3,14 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_a &= \max [t_{aUG-27}, t_{aUG-22}] \\
&= \max [3,14, 0] \\
&= 3,14 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{b1} &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} + \text{Corrosion} \\
&= \frac{12,5 \cdot 109,54}{1.180 \cdot 1 + 0,4 \cdot 12,5} + 3 \\
&= 4,16 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{b1} &= \max [t_{b1}, t_{bUG16}] \\
&= \max [4,16, 4,5] \\
&= 4,5 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_b &= \min [t_{b3}, t_{b1}] \\
&= \min [5,96, 4,5] \\
&= 4,5 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{UG-45} &= \max [t_a, t_b] \\
&= \max [3,14, 4,5] \\
&= 4,5 \text{ mm}
\end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 6,35 = 5,56 \text{ mm}$

The nozzle neck thickness is adequate.

Reinforcement Calculations for MAWP

The thickness requirements of UG-45 govern the MAWP of this nozzle.

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 27,8 bar @ 75 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							5,56	5,56

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (mm)	Actual weld throat size (mm)	Status
Nozzle to shell fillet (Leg ₄₁)	2,35	5,25	weld size is adequate

Calculations for internal pressure 27,8 bar @ 75 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [26,7, 13,35 + (6,35 - 3) + (7,16 - 3)] \\
 &= 26,7 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (7,16 - 3), 2,5 \cdot (6,35 - 3) + 0] \\
 &= 8,38 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{27,7998 \cdot 13,35}{1.180 \cdot 1 - 0,6 \cdot 27,7998} \\
 &= 0,32 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{27,7998 \cdot 109,54}{1.180 \cdot 1 + 0,4 \cdot 27,7998} \\
 &= 2,56 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$\begin{aligned}
t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
&= \frac{27,7998 \cdot 109,54}{1.180 \cdot 0,85 + 0,4 \cdot 27,7998} \\
&= 3 \text{ mm}
\end{aligned}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(c) Weld Check

Fillet weld: $t_{\min} = \min [19 \text{ mm}, t_n, t] = 3,35 \text{ mm}$

$t_{c(\min)} = \min [6 \text{ mm}, 0,7 \cdot t_{\min}] = 2,35 \text{ mm}$

$t_{c(\text{actual})} = 0,7 \cdot \text{Leg} = 0,7 \cdot 7,5 = 5,25 \text{ mm}$

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-45 Nozzle Neck Thickness Check

$$\begin{aligned}
t_{a\text{UG-27}} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\
&= \frac{27,7998 \cdot 13,35}{1.180 \cdot 1 - 0,6 \cdot 27,7998} + 3 \\
&= 3,32 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_a &= \max [t_{a\text{UG-27}}, t_{a\text{UG-22}}] \\
&= \max [3,32, 0] \\
&= 3,32 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{b1} &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} + \text{Corrosion} \\
&= \frac{27,7998 \cdot 109,54}{1.180 \cdot 1 + 0,4 \cdot 27,7998} + 3 \\
&= 5,56 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{b1} &= \max [t_{b1}, t_{b\text{UG16}}] \\
&= \max [5,56, 4,5] \\
&= 5,56 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_b &= \min [t_{b3}, t_{b1}] \\
&= \min [5,96, 5,56] \\
&= 5,56 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{\text{UG-45}} &= \max [t_a, t_b] \\
&= \max [3,32, 5,56] \\
&= 5,56 \text{ mm}
\end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 6,35 = 5,56 \text{ mm}$

The nozzle neck thickness is adequate.

Reinforcement Calculations for MAP

The attached ASME B16.5 flange limits the nozzle MAP.

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 51,1 bar @ 21,11 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							2,96	5,56

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

Calculations for internal pressure 51,1 bar @ 21,11 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [20,7, 10,35 + (6,35 - 0) + (7,16 - 0)] \\
 &= 23,86 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (7,16 - 0), 2,5 \cdot (6,35 - 0) + 0] \\
 &= 15,88 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{51,1 \cdot 10,35}{1.180 \cdot 1 - 0,6 \cdot 51,1} \\
 &= 0,46 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{51,1 \cdot 109,54}{1.180 \cdot 1 + 0,4 \cdot 51,1} \\
 &= 4,66 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{51,1 \cdot 109,54}{1.180 \cdot 0,85 + 0,4 \cdot 51,1} \\
 &= 5,47 \text{ mm}
 \end{aligned}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UG-45 Nozzle Neck Thickness Check

$$\begin{aligned}t_{aUG-27} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\&= \frac{51,1 \cdot 10,35}{1.180 \cdot 1 - 0,6 \cdot 51,1} + 0 \\&= 0,46 \text{ mm}\end{aligned}$$

$$\begin{aligned}t_a &= \max [t_{aUG-27}, t_{aUG-22}] \\&= \max [0,46, 0] \\&= 0,46 \text{ mm}\end{aligned}$$

$$\begin{aligned}t_{b1} &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} + \text{Corrosion} \\&= \frac{51,1 \cdot 109,54}{1.180 \cdot 1 + 0,4 \cdot 51,1} + 0 \\&= 4,66 \text{ mm}\end{aligned}$$

$$\begin{aligned}t_{b1} &= \max [t_{b1}, t_{bUG16}] \\&= \max [4,66, 1,5] \\&= 4,66 \text{ mm}\end{aligned}$$

$$\begin{aligned}t_b &= \min [t_{b3}, t_{b1}] \\&= \min [2,96, 4,66] \\&= 2,96 \text{ mm}\end{aligned}$$

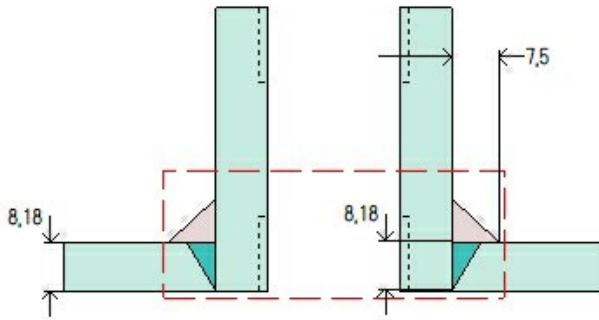
$$\begin{aligned}t_{UG-45} &= \max [t_a, t_b] \\&= \max [0,46, 2,96] \\&= \underline{2,96} \text{ mm}\end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 6,35 = 5,56 \text{ mm}$

The nozzle neck thickness is adequate.

Drain (N6)

ASME Section VIII Division 1, 2021 Edition Metric



Note: round inside edges per UG-76(c)

Location and Orientation	
Located on	Cylinder #1
Orientation	180°
Nozzle center line offset to datum line	420 mm
End of nozzle to shell center	147,3 mm
Passes through a Category A joint	No
Nozzle	
Description	NPS 0,5 Class 6000 DN 15 - Threaded Full Coupling
Access opening	No
Material specification	SA-105 (II-D Metric p. 20, ln. 31)
Inside diameter, new	21,34 mm
Nominal wall thickness	8,38 mm
Corrosion allowance	3 mm
Projection available outside vessel, L _{pr}	37,77 mm
Local vessel minimum thickness	7,16 mm
Liquid static head included	0 bar
Welds	
Inner fillet, Leg ₄₁	7,5 mm
Nozzle to vessel groove weld	8,18 mm
Radiography	
Longitudinal seam	Seamless No RT

UCS-66 Material Toughness Requirements Nozzle At Intersection	
Governing thickness, $t_g =$	7,16 mm
Exemption temperature from Fig UCS-66M Curve B =	-29°C
$t_r = \frac{18,45 \cdot 109,54}{1,180 \cdot 1 + 0,4 \cdot 18,45} =$	1,7 mm
Stress ratio $= \frac{t_r \cdot E^*}{t_n - c} = \frac{1,7 \cdot 1}{7,16 - 3} =$	0,4094
Reduction in MDMT, T_R from Fig UCS-66.1M =	48,6°C
$MDMT = \max [MDMT - T_R, -48] = \max [-29 - 48,6, -48] =$	-48°C
Material is exempt from impact testing at the Design MDMT of 0°C.	

UCS-66 Material Toughness Requirements Nozzle	
$t_r = \frac{18,45 \cdot 13,67}{1.380 \cdot 1 - 0,6 \cdot 18,45} =$	0,18 mm
Stress ratio $= \frac{t_r \cdot E^*}{t_n - c} = \frac{0,18 \cdot 1}{8,38 - 3} =$	0,0342
Stress ratio $\leq 0,35$, MDMT per UCS-66(b)(3) =	-105°C
Material is exempt from impact testing at the Design MDMT of 0°C.	

Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (cm ²)							UG-44 Summary (mm)	
For P = 12,5 bar @ 75 °C							The nozzle passes UG-44	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							4,5	8,38

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (mm)	Actual weld throat size (mm)	Status
Nozzle to shell fillet (Leg ₄₁)	2,5	5,25	weld size is adequate

Calculations for internal pressure 12,5 bar @ 75 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [27,34, 13,67 + (8,38 - 3) + (7,16 - 3)] \\
 &= 27,34 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (7,16 - 3), 2,5 \cdot (8,38 - 3) + 0] \\
 &= 10,4 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{12,5 \cdot 13,67}{1.380 \cdot 1 - 0,6 \cdot 12,5} \\
 &= 0,12 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{12,5 \cdot 109,54}{1.180 \cdot 1 + 0,4 \cdot 12,5} \\
 &= 1,16 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{12,5 \cdot 109,54}{1.180 \cdot 0,85 + 0,4 \cdot 12,5} \\
 &= 1,36 \text{ mm}
 \end{aligned}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(f)(2)(b) Weld Check

Fillet weld: $t_{\min} = \min [19mm, t_n, t] = 4,16 \text{ mm}$

$t_{c(\min)} = \min [2,5 \text{ mm}, 0,7 \cdot t_{\min}] = 2,5 \text{ mm}$

$t_{c(actual)} = 0,7 \cdot \text{Leg} = 0,7 \cdot 7,5 = 5,25 \text{ mm}$

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-44 Thickness Check - ASME B16.11 Coupling

$$\begin{aligned}
 t_{aApp \text{ 1-1}} &= \frac{P \cdot R_o}{S_n \cdot E + 0,4 \cdot P} + \text{Corrosion} \\
 &= \frac{12,5 \cdot 19,05}{1.380 \cdot 1 + 0,4 \cdot 12,5} + 3 \\
 &= 3,17 \text{ mm}
 \end{aligned}$$

$$\begin{aligned}
 t_{aUG-44} &= \max [t_{aApp \text{ 1-1}}, t_{bUG16}] \\
 &= \max [3,17, 4,5] \\
 &= 4,5 \text{ mm}
 \end{aligned}$$

Available nozzle wall thickness new, $t_n = 8,38 \text{ mm}$

The nozzle neck thickness is adequate.

Reinforcement Calculations for MAWP

The vessel wall thickness governs the MAWP of this nozzle.

UG-37 Area Calculation Summary (cm ²)							UG-44 Summary (mm)	
For P = 45,49 bar @ 75 °C							The nozzle passes UG-44	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							4,5	8,38

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (mm)	Actual weld throat size (mm)	Status
Nozzle to shell fillet (Leg ₄₁)	2,5	5,25	weld size is adequate

Calculations for internal pressure 45,49 bar @ 75 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [27,34, 13,67 + (8,38 - 3) + (7,16 - 3)] \\
 &= 27,34 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (7,16 - 3), 2,5 \cdot (8,38 - 3) + 0] \\
 &= 10,4 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{45,4851 \cdot 13,67}{1.380 \cdot 1 - 0,6 \cdot 45,4851} \\
 &= 0,46 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{45,4851 \cdot 109,54}{1.180 \cdot 1 + 0,4 \cdot 45,4851} \\
 &= 4,16 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{45,4851 \cdot 109,54}{1.180 \cdot 0,85 + 0,4 \cdot 45,4851} \\
 &= 4,88 \text{ mm}
 \end{aligned}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(f)(2)(b) Weld Check

Fillet weld: $t_{\min} = \min [19mm, t_n, t] = 4,16 \text{ mm}$

$$t_{c(\min)} = \min [2,5 \text{ mm}, 0,7 \cdot t_{\min}] = 2,5 \text{ mm}$$

$$t_{c(actual)} = 0,7 \cdot \text{Leg} = 0,7 \cdot 7,5 = 5,25 \text{ mm}$$

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-44 Thickness Check - ASME B16.11 Coupling

$$\begin{aligned}
 t_{aApp \text{ 1-1}} &= \frac{P \cdot R_o}{S_n \cdot E + 0,4 \cdot P} + \text{Corrosion} \\
 &= \frac{45,4851 \cdot 19,05}{1.380 \cdot 1 + 0,4 \cdot 45,4851} + 3 \\
 &= 3,62 \text{ mm}
 \end{aligned}$$

$$\begin{aligned}
 t_{aUG-44} &= \max [t_{aApp \text{ 1-1}}, t_{bUG16}] \\
 &= \max [3,62, 4,5] \\
 &= 4,5 \text{ mm}
 \end{aligned}$$

Available nozzle wall thickness new, $t_n = 8,38 \text{ mm}$

The nozzle neck thickness is adequate.

Reinforcement Calculations for MAP

The vessel wall thickness governs the MAP of this nozzle.

UG-37 Area Calculation Summary (cm ²)							UG-44 Summary (mm)	
For P = 79,18 bar @ 21,11 °C							The nozzle passes UG-44	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							1,5	8,38

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

Calculations for internal pressure 79,18 bar @ 21,11 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [21,34, 10,67 + (8,38 - 0) + (7,16 - 0)] \\
 &= 26,21 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (7,16 - 0), 2,5 \cdot (8,38 - 0) + 0] \\
 &= 17,89 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{79,1797 \cdot 10,67}{1,380 \cdot 1 - 0,6 \cdot 79,1797} \\
 &= 0,64 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{79,1797 \cdot 109,54}{1,180 \cdot 1 + 0,4 \cdot 79,1797} \\
 &= 7,16 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{79,1797 \cdot 109,54}{1,180 \cdot 0,85 + 0,4 \cdot 79,1797} \\
 &= 8,38 \text{ mm}
 \end{aligned}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UG-44 Thickness Check - ASME B16.11 Coupling

$$\begin{aligned}t_{aApp\ 1-1} &= \frac{P \cdot R_o}{S_n \cdot E + 0,4 \cdot P} + \text{Corrosion} \\&= \frac{79,1797 \cdot 19,05}{1.380 \cdot 1 + 0,4 \cdot 79,1797} + 0 \\&= 1,07 \text{ mm}\end{aligned}$$

$$\begin{aligned}t_{aUG-44} &= \max [t_{aApp\ 1-1}, t_{UG16}] \\&= \max [1,07, 1,5] \\&= \underline{1,5} \text{ mm}\end{aligned}$$

Available nozzle wall thickness new, $t_n = 8,38 \text{ mm}$

The nozzle neck thickness is adequate.

Straight Flange on B16.9 Pipe Cap - Right Side

ASME Section VIII Division 1, 2021 Edition Metric				
Component		Cylinder		
Material		SA-234 WPB (II-D Metric p. 16, ln. 18)		
Impact Tested	Normalized	Fine Grain Practice	PWHT	Maximize MDMT/ No MAWP
No	No	No	No	No
		Design Pressure (bar)	Design Temperature (°C)	Design MDMT (°C)
Internal		12,5	75	0
Static Liquid Head				
Condition		P _s (bar)	H _s (mm)	SG
Test horizontal		0,03	351,36	1
Dimensions				
Outer Diameter		219,07 mm		
Length		44,17 mm		
Nominal Thickness		8,18 mm		
Corrosion	Inner	3 mm		
	Outer	0 mm		
Weight and Capacity				
		Weight (kg)		Capacity (liters)
New		1,87		1,43
Corroded		1,2		1,51
Radiography				
Longitudinal seam		Seamless No RT		
Left Circumferential seam		Spot UW-11(b) Type 1		

Results Summary	
Governing condition	UG-16
Minimum thickness per UG-16	1,5 mm + 3 mm = 4,5 mm
Design thickness due to internal pressure (t)	4,36 mm
Maximum allowable working pressure (MAWP)	48,35 bar
Maximum allowable pressure (MAP)	77,21 bar
Rated MDMT	-105 °C

UCS-66 Material Toughness Requirements	
$t_r = \frac{18,45 \cdot 109,54}{1.180 \cdot 0,85 + 0,4 \cdot 18,45} =$	2 mm
$\text{Stress ratio} = \frac{t_r \cdot E^*}{t_n - c} = \frac{2 \cdot 0,85}{8,18 - 3} =$	0,3282
Stress ratio $\leq 0,35$, MDMT per UCS-66(b)(3) =	-105°C
Material is exempt from impact testing at the Design MDMT of 0°C.	

Design thickness, (at 75 °C) Appendix 1-1

$$t = \frac{P \cdot R_o}{S \cdot E + 0,40 \cdot P} + \text{Corrosion} = \frac{12,5 \cdot 109,54}{1.180 \cdot 0,85 + 0,40 \cdot 12,5} + 3 = \text{4,36 mm}$$

Maximum allowable working pressure, (at 75 °C) Appendix 1-1

$$P = \frac{S \cdot E \cdot t}{R_o - 0,40 \cdot t} - P_s = \frac{1.180 \cdot 0,85 \cdot 5,18}{109,54 - 0,40 \cdot 5,18} - 0 = \underline{48,35} \text{ bar}$$

Maximum allowable pressure, (at 21,11 °C) Appendix 1-1

$$P = \frac{S \cdot E \cdot t}{R_o - 0,40 \cdot t} = \frac{1.180 \cdot 0,85 \cdot 8,18}{109,54 - 0,40 \cdot 8,18} = \underline{77,21} \text{ bar}$$

ASME Section VIII Division 1 UG-80(a) Out-of-Roundness
$(D_{\max} - D_{\min})$ shall not exceed 1% of D
When the cross section passes through an opening or within 1 I.D. of the opening, $(D_{\max} - D_{\min})$ shall not exceed 1% of $D + 2\%$ of the inside diameter of the opening

B16.9 Pipe Cap - Right Side

ASME Section VIII Division 1, 2021 Edition Metric				
Component		ASME B16.9 Pipe Cap (modified)		
Material		SA-234 WPB (II-D Metric p. 16, ln. 18)		
Attached To		Cylinder #1		
Impact Tested	Normalized	Fine Grain Practice	PWHT	Maximize MDMT/ No MAWP
No	No	No	No	No
		Design Pressure (bar)	Design Temperature (°C)	Design MDMT (°C)
Internal		12,5	75	0
Static Liquid Head				
Condition		P _s (bar)	H _s (mm)	SG
Test horizontal		0,03	351,36	1
Dimensions				
NPS and Schedule		NPS 8 Sch 40 (Std) DN 200		
Outer Diameter		219,07 mm		
Overall Length E		102 mm		
Nominal Thickness		8,18 mm		
Minimum Thickness ¹		7,16 mm		
Corrosion	Inner	3 mm		
	Outer	0 mm		
Length L _{sf}		44,17 mm		
Nominal Thickness t _{sf}		8,18 mm		
Weight and Capacity				
		Weight (kg) ²		Capacity (liters) ²
New		5,17		2,52
Corroded		3,36		2,74
Radiography				
Category A joints		Seamless No RT		
Head to shell seam		Spot UW-11(b) Type 1		

¹ minimum thickness = nominal thickness times pipe tolerance factor of 0,875.

² includes straight flange

Results Summary	
Governing condition	UG-16
Minimum thickness per UG-16	1,5 mm + 3 mm = 4,5 mm
Design thickness due to internal pressure (t)	4.3 mm
Governing straight flange design thickness	4,36 mm
Maximum allowable working pressure (MAWP)	40.92 bar
Maximum allowable pressure (MAP)	69.64 bar
Straight Flange governs MDMT	-105°C

Factor K		
$K = \left(\frac{1}{6}\right) \cdot \left[2 + \left(\frac{D}{2 \cdot h}\right)^2\right]$		
Corroded	$K = \left(\frac{1}{6}\right) \cdot \left[2 + \left(\frac{208,71}{2 \cdot 53,68}\right)^2\right]$	0,9633
New	$K = \left(\frac{1}{6}\right) \cdot \left[2 + \left(\frac{202,71}{2 \cdot 50,68}\right)^2\right]$	1

Design thickness for internal pressure, (Corroded at 75 °C) Appendix 1-4(c)

$$t = \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} + \text{Corrosion} = \frac{12,5 \cdot 219,07 \cdot 0,963264}{2 \cdot 1.180 \cdot 0,85 + 2 \cdot 12,5 \cdot (0,963264 - 0,1)} + 3 = 4.3 \text{ mm}$$

Maximum allowable working pressure, (Corroded at 75 °C) Appendix 1-4(c)

$$P = \frac{2 \cdot S \cdot E \cdot t}{K \cdot D_o - 2 \cdot t \cdot (K - 0,1)} - P_s = \frac{2 \cdot 1.180 \cdot 0,85 \cdot (0,875 \cdot 8,18 - 3)}{0,963264 \cdot 219,07 - 2 \cdot (0,875 \cdot 8,18 - 3) \cdot (0,963264 - 0,1)} - 0 = 40.92 \text{ bar}$$

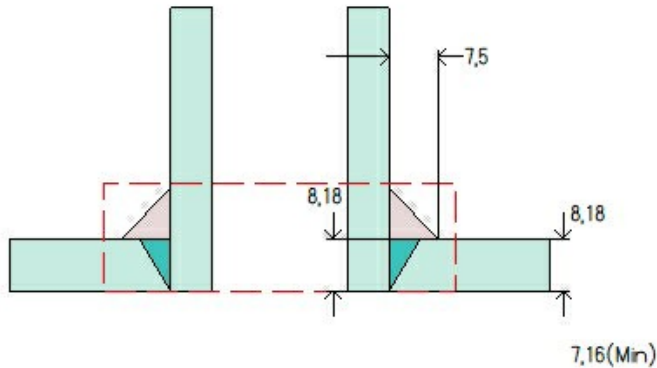
Maximum allowable pressure, (New at 21,11 °C) Appendix 1-4(c)

$$P = \frac{2 \cdot S \cdot E \cdot t}{K \cdot D_o - 2 \cdot t \cdot (K - 0,1)} - P_s = \frac{2 \cdot 1.180 \cdot 0,85 \cdot 0,875 \cdot 8,18}{1 \cdot 219,07 - 2 \cdot 0,875 \cdot 8,18 \cdot (1 - 0,1)} - 0 = 69.64 \text{ bar}$$

ASME Section VIII Division 1 UG-81(a) Out-of-Roundness
Inside surface shall not deviate outside the shape by more than 1,25 % of D
Inside surface shall not deviate inside the shape by more than 0,625 % of D

Air Outlet (N2)

ASME Section VIII Division 1, 2021 Edition Metric



Note: round inside edges per UG-76(c)

Location and Orientation

Located on	B16.9 Pipe Cap - Right Side
Orientation	0°
End of nozzle to datum line	-166 mm
Calculated as hillside	No
Distance to head center, R	0 mm
Passes through a Category A joint	No

Nozzle

Description	NPS 1 Sch 160 DN 25
Access opening	No
Material specification	SA-106 B Smls Pipe (II-D Metric p. 16, In. 16)
Inside diameter, new	20,7 mm
Pipe nominal wall thickness	6,35 mm
Pipe minimum wall thickness ¹	5,56 mm
Corrosion allowance	3 mm
Projection available outside vessel, L _{pr}	64,68 mm
Local vessel minimum thickness	7,16 mm
Liquid static head included	0 bar

Welds

Inner fillet, Leg ₄₁	7,5 mm
Nozzle to vessel groove weld	8,18 mm

Radiography

Longitudinal seam	Seamless No RT
Circumferential seam	Full UW-11(a) Type 1

¹Pipe minimum thickness = nominal thickness times pipe tolerance factor of 0,875.

UCS-66 Material Toughness Requirements Nozzle

Impact test exempt per UCS-66(d) (NPS 4 or smaller pipe) =	-105°C
Material is exempt from impact testing at the Design MDMT of 0°C.	

Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 12,5 bar @ 75 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							4,5	5,56

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (mm)	Actual weld throat size (mm)	Status
Nozzle to shell fillet (Leg ₄₁)	2,35	5,25	weld size is adequate

Calculations for internal pressure 12,5 bar @ 75 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [26,7, 13,35 + (6,35 - 3) + (7,16 - 3)] \\
 &= 26,7 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (7,16 - 3), 2,5 \cdot (6,35 - 3) + 0] \\
 &= 8,38 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{12,5 \cdot 13,35}{1.180 \cdot 1 - 0,6 \cdot 12,5} \\
 &= 0,14 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)(c)

$$\begin{aligned}
 t_r &= \frac{P \cdot K_1 \cdot D_o}{2 \cdot S \cdot E + 0,8 \cdot P} \\
 &= \frac{12,5 \cdot 0,8749 \cdot 219,07}{2 \cdot 1.180 \cdot 1 + 0,8 \cdot 12,5} \\
 &= 1,01 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$t_r = \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} = \frac{12,5 \cdot 219,07 \cdot 0,963264}{2 \cdot 1.180 \cdot 0,85 + 2 \cdot 12,5 \cdot (0,963264 - 0,1)} = 1,3 \text{ mm}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(c) Weld Check

Fillet weld: $t_{\min} = \min [19\text{ mm}, t_n, t] = 3,35 \text{ mm}$

$$t_{c(\min)} = \min [6 \text{ mm}, 0,7 \cdot t_{\min}] = 2,35 \text{ mm}$$

$$t_{c(\text{actual})} = 0,7 \cdot \text{Leg} = 0,7 \cdot 7,5 = 5,25 \text{ mm}$$

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-45 Nozzle Neck Thickness Check

Interpretation VIII-1-83-66 has been applied.

$$\begin{aligned} t_{a\text{UG-27}} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\ &= \frac{12,5 \cdot 13,35}{1.180 \cdot 1 - 0,6 \cdot 12,5} + 3 \\ &= 3,14 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_a &= \max [t_{a\text{UG-27}}, t_{a\text{UG-22}}] \\ &= \max [3,14, 0] \\ &= 3,14 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{b1} &= \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} + \text{Corrosion} \\ &= \frac{12,5 \cdot 219,07 \cdot 0,963264}{2 \cdot 1.180 \cdot 1 + 2 \cdot 12,5 \cdot (0,963264 - 0,1)} + 3 \\ &= 4,11 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{b1} &= \max [t_{b1}, t_{b\text{UG16}}] \\ &= \max [4,11, 4,5] \\ &= 4,5 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_b &= \min [t_{b3}, t_{b1}] \\ &= \min [5,96, 4,5] \\ &= 4,5 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{\text{UG-45}} &= \max [t_a, t_b] \\ &= \max [3,14, 4,5] \\ &= 4,5 \text{ mm} \end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 6,35 = 5,56 \text{ mm}$

The nozzle neck thickness is adequate.

Reinforcement Calculations for MAWP

The thickness requirements of UG-45 govern the MAWP of this nozzle.

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 29,2 bar @ 75 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							5,56	5,56

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (mm)	Actual weld throat size (mm)	Status
Nozzle to shell fillet (Leg ₄₁)	2,35	5,25	weld size is adequate

Calculations for internal pressure 29,2 bar @ 75 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [26,7, 13,35 + (6,35 - 3) + (7,16 - 3)] \\
 &= 26,7 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (7,16 - 3), 2,5 \cdot (6,35 - 3) + 0] \\
 &= 8,38 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{29,2014 \cdot 13,35}{1,180 \cdot 1 - 0,6 \cdot 29,2014} \\
 &= 0,34 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)(c)

$$\begin{aligned}
 t_r &= \frac{P \cdot K_1 \cdot D_o}{2 \cdot S \cdot E + 0,8 \cdot P} \\
 &= \frac{29,2014 \cdot 0,8749 \cdot 219,07}{2 \cdot 1,180 \cdot 1 + 0,8 \cdot 29,2014} \\
 &= 2,35 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$t_r = \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} = \frac{29,2 \cdot 219,07 \cdot 0,963264}{2 \cdot 1,180 \cdot 0,85 + 2 \cdot 29,2 \cdot (0,963264 - 0,1)} = 3 \text{ mm}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(c) Weld Check

Fillet weld: $t_{\min} = \min [19\text{ mm}, t_n, t] = 3,35 \text{ mm}$

$t_{c(\min)} = \min [6 \text{ mm}, 0,7 \cdot t_{\min}] = 2,35 \text{ mm}$

$t_{c(actual)} = 0,7 \cdot \text{Leg} = 0,7 \cdot 7,5 = 5,25 \text{ mm}$

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-45 Nozzle Neck Thickness Check

Interpretation VIII-1-83-66 has been applied.

$$\begin{aligned} t_{aUG-27} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\ &= \frac{29,2014 \cdot 13,35}{1,180 \cdot 1 - 0,6 \cdot 29,2014} + 3 \\ &= 3,34 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_a &= \max [t_{aUG-27}, t_{aUG-22}] \\ &= \max [3,34, 0] \\ &= 3,34 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{b1} &= \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} + \text{Corrosion} \\ &= \frac{29,2 \cdot 219,07 \cdot 0,963264}{2 \cdot 1,180 \cdot 1 + 2 \cdot 29,2 \cdot (0,963264 - 0,1)} + 3 \\ &= 5,56 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{b1} &= \max [t_{b1}, t_{bUG16}] \\ &= \max [5,56, 4,5] \\ &= 5,56 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_b &= \min [t_{b3}, t_{b1}] \\ &= \min [5,96, 5,56] \\ &= 5,56 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{UG-45} &= \max [t_a, t_b] \\ &= \max [3,34, 5,56] \\ &= 5,56 \text{ mm} \end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 6,35 = 5,56 \text{ mm}$

The nozzle neck thickness is adequate.

Reinforcement Calculations for MAP

The vessel wall thickness governs the MAP of this nozzle.

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 88,24 bar @ 21,11 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							2,96	5,56

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

Calculations for internal pressure 88,24 bar @ 21,11 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [20,7, 10,35 + (6,35 - 0) + (7,16 - 0)] \\
 &= 23,86 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (7,16 - 0), 2,5 \cdot (6,35 - 0) + 0] \\
 &= 15,88 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{88,237 \cdot 10,35}{1.180 \cdot 1 - 0,6 \cdot 88,237} \\
 &= 0,81 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)(c)

$$\begin{aligned}
 t_r &= \frac{P \cdot K_1 \cdot D_o}{2 \cdot S \cdot E + 0,8 \cdot P} \\
 &= \frac{88,237 \cdot 0,9 \cdot 219,07}{2 \cdot 1.180 \cdot 1 + 0,8 \cdot 88,237} \\
 &= 7,16 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$t_r = \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} = \frac{88,24 \cdot 219,07 \cdot 1}{2 \cdot 1.180 \cdot 0,85 + 2 \cdot 88,24 \cdot (1 - 0,1)} = 8,93 \text{ mm}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UG-45 Nozzle Neck Thickness Check

Interpretation VIII-1-83-66 has been applied.

$$\begin{aligned}
 t_{aUG-27} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\
 &= \frac{88,237 \cdot 10,35}{1.180 \cdot 1 - 0,6 \cdot 88,237} + 0 \\
 &= 0,81 \text{ mm}
 \end{aligned}$$

$$\begin{aligned}
 t_a &= \max [t_{aUG-27}, t_{aUG-22}] \\
 &= \max [0,81, 0] \\
 &= 0,81 \text{ mm}
 \end{aligned}$$

$$\begin{aligned}
 t_{b1} &= \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} + \text{Corrosion} \\
 &= \frac{88,24 \cdot 219,07 \cdot 1}{2 \cdot 1.180 \cdot 1 + 2 \cdot 88,24 \cdot (1 - 0,1)} + 0 \\
 &= 7,67 \text{ mm}
 \end{aligned}$$

$$\begin{aligned}
 t_{b1} &= \max [t_{b1}, t_{bUG16}] \\
 &= \max [7,67, 1,5] \\
 &= 7,67 \text{ mm}
 \end{aligned}$$

$$\begin{aligned}
 t_b &= \min [t_{b3}, t_{b1}] \\
 &= \min [2,96, 7,67] \\
 &= 2,96 \text{ mm}
 \end{aligned}$$

$$\begin{aligned}
 t_{UG-45} &= \max [t_a, t_b] \\
 &= \max [0,81, 2,96] \\
 &= \underline{2.96} \text{ mm}
 \end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 6,35 = 5,56 \text{ mm}$

The nozzle neck thickness is adequate.

B16.9 Elbow #2 (N2)

ASME Section VIII Division 1, 2021 Edition Metric				
Component		ASME B16.9 Elbow		
Type		Long Radius 90-deg		
Material		SA-234 WPB (II-D Metric p. 16, ln. 18)		
Pipe NPS and Schedule		NPS 1 Sch 160 DN 25		
Attached To		Air Outlet (N2)		
Impact Tested	Normalized	Fine Grain Practice	PWHT	Maximize MDMT/ No MAWP
No	No	No	No	No
		Design Pressure (bar)	Design Temperature (°C)	Design MDMT (°C)
Internal		12,5	75	0
Static Liquid Head				
Condition		P _s (bar)	H _s (mm)	SG
Test horizontal		0,03	260,35	1
Dimensions				
Outer Diameter		33,4 mm		
Nominal Thickness		6,35 mm		
Minimum Thickness ¹		5,56 mm		
Center-to-End, A		38 mm		
Corrosion	Inner	3 mm		
	Outer	0 mm		
Weight and Capacity				
		Weight (kg)		Capacity (liters)
New		0,25		0,02
Corroded		0,15		0,03
Radiography				
Longitudinal seam		Seamless No RT		
Left Circumferential seam		Full UW-11(a) Type 1		
Right Circumferential seam		Full UW-11(a) Type 1		

¹ minimum thickness = nominal thickness times pipe tolerance factor of 0,875.

ASME B16.5-2017 Flange	
Description	NPS 1 Class 300 WN A105
Bolt Material	SA-193 B7 Bolt <= 64 (II-D Metric p. 410, ln. 32)
Blind included	No
Rated MDMT	-48°C
Liquid static head	0 bar
MAWP rating	48,35 bar @ 75°C
MAP rating	51,1 bar @ 21,11°C
Hydrotest rating	77 bar @ 21,11°C
PWHT performed	No
Produced to Fine Grain Practice and Supplied in Heat Treated Condition	No
Impact Tested	No
Circumferential joint radiography	Full UW-11(a) Type 1
Gasket	
Type	ASME B16.21 Nonmetallic Flat Gasket
Description	Flexitallic Compressed Fiber SF 2401 Synthetic/NBR
Factor, m	3,2
Seating Stress, y	203,89 kgf/cm ²
Thickness, T	3 mm
Inner Diameter	33 mm
Outer Diameter	73 mm
Notes	
Flange rated MDMT per UCS-66(b)(1)(b) = -48°C (Coincident ratio = 0,3611) Bolts rated MDMT per Fig UCS-66 note (c) = -48°C	

Results Summary	
Governing condition	UG-16
Minimum thickness per UG-16	1,5 mm + 3 mm = 4,5 mm
Design thickness due to internal pressure (t)	3.18 mm
Maximum allowable working pressure (MAWP)	192.42 bar
Maximum allowable pressure (MAP)	477.33 bar
Rated MDMT	-105 °C

UCS-66 Material Toughness Requirements	
$t_r = \frac{18,45 \cdot 16,7}{1.180 \cdot 1 + 0,4 \cdot 18,45} =$	0,26 mm
Stress ratio = $\frac{t_r \cdot E^*}{t_n - c} = \frac{0,26 \cdot 1}{5,56 - 3} =$	0,1015
Stress ratio ≤ 0,35, MDMT per UCS-66(b)(3) =	-105°C
Material is exempt from impact testing at the Design MDMT of 0°C.	

Design thickness, (at 75 °C) Appendix 1-1

$$t = \frac{P \cdot R_o}{S \cdot E + 0,40 \cdot P} + \text{Corrosion} = \frac{12,5 \cdot 16,7}{1.180 \cdot 1,00 + 0,40 \cdot 12,5} + 3 = \text{3.18 mm}$$

Maximum allowable working pressure, (at 75 °C) Appendix 1-1

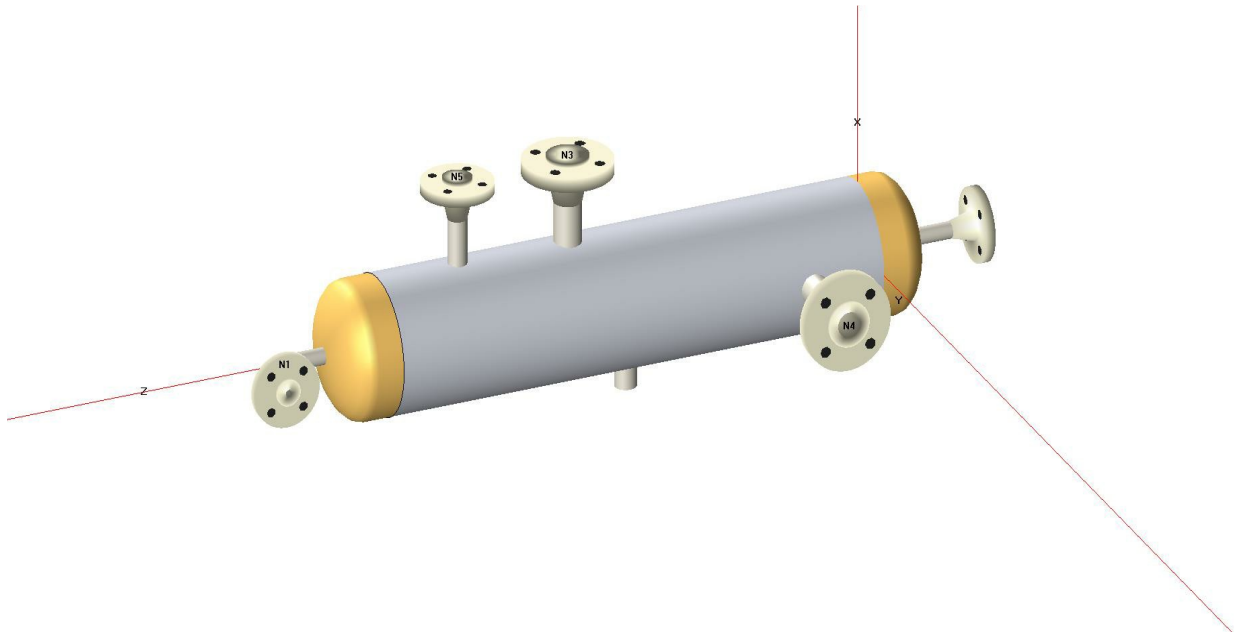
$$P = \frac{S \cdot E \cdot t}{R_o - 0,40 \cdot t} - P_s = \frac{1.180 \cdot 1,00 \cdot (6,35 \cdot 0,875 - 3)}{16,7 - 0,40 \cdot (6,35 \cdot 0,875 - 3)} - 0 = \text{192.42 bar}$$

Maximum allowable pressure, (at 21,11 °C) Appendix 1-2

$$P = S \cdot E \cdot \ln\left(\frac{R_o}{R_o - t}\right) = 1.180 \cdot 1,00 \cdot \ln\left(\frac{16,7}{16,7 - (6,35 \cdot 0,875)}\right) = \underline{477,33} \text{ bar}$$

Locati Impianti Srl

Via Vittorio Veneto, 37 - Verdellino - Bergamo - Italy



COMPRESS Pressure Vessel Design Calculations

Item: LI 5060

Customer: Airpack

Drawing No.: C230048DWG002

Document No.: C230048CLC006 Rev.02

Date: 03/08/2024

Service: 1st Stage Outlet Pulsation Damper

Tag Number: 320-KV-020-002

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Nozzle Schedule

Specifications									
Nozzle mark	Identifier	Size	Materials		Impact Tested	Normalized	Fine Grain	Flange	Blind
N1	Air Inlet	NPS 0,75 XXS DN 20	Nozzle	SA-106 B Smls Pipe	No	No	No	N/A	No
	B16.9 Elbow #1 (N1)	NPS 0,75 XXS DN 20	B16.9 Elbow	SA-234 WPB	No	No	No	NPS 3/4 Class 600 WN A105	No
N2	Air Outlet	NPS 0,75 XXS DN 20	Nozzle	SA-106 B Smls Pipe	No	No	No	NPS 3/4 Class 600 WN A105	No
N3	Temperature Gauge Connection	NPS 1,5 Sch 160 DN 40	Nozzle	SA-106 B Smls Pipe	No	No	No	NPS 1 1/2 Class 600 WN A105	No
N4	Temperature Transmitter Connection	NPS 1,5 Sch 160 DN 40	Nozzle	SA-106 B Smls Pipe	No	No	No	NPS 1 1/2 Class 600 WN A105	No
N5	PSV Connection	NPS 1 XXS DN 25	Nozzle	SA-106 B Smls Pipe	No	No	No	NPS 1 Class 600 WN A105	No
N6	Drain	NPS 0,5 Class 6000 DN 15 - Threaded Full Coupling	Nozzle	SA-105	No	No	No	N/A	No

Nozzle Summary

Dimensions												
Nozzle mark	OD (mm)	t _n (mm)	Req t _n (mm)	A ₁ ?	A ₂ ?	Shell			Reinforcement Pad		Corr (mm)	A _a /A _r (%)
						Nom t (mm)	Design t (mm)	User t (mm)	Width (mm)	t _{pad} (mm)		
N1	26,67	7,82	6,3	Yes	Yes	8,18	N/A		N/A	N/A	3	Exempt
N2	26,67	7,82	6,3	Yes	Yes	8,18	N/A		N/A	N/A	3	Exempt
N3	48,26	7,14	7,11	Yes	Yes	8,18	N/A		N/A	N/A	3	Exempt
N4	48,26	7,14	7,11	Yes	Yes	8,18	N/A		N/A	N/A	3	Exempt
N5	33,4	9,09	6,81	Yes	Yes	8,18	N/A		N/A	N/A	3	Exempt
N6	38,1	8,38	4,5	Yes	Yes	8,18	N/A		N/A	N/A	3	Exempt
*Head minimum thickness after forming												

Definitions	
t _n	Nozzle thickness
Req t _n	Nozzle thickness required per UG-45/UG-16 Increased for pipe to account for 12.5% pipe thickness tolerance
Nom t	Vessel wall thickness
Design t	Required vessel wall thickness due to pressure + corrosion allowance per UG-37
User t	Local vessel wall thickness (near opening)
A _a	Area available per UG-37, governing condition
A _r	Area required per UG-37, governing condition
Corr	Corrosion allowance on nozzle wall

Pressure Summary

Component Summary							
Identifier	P Design (bar)	T Design (°C)	MAWP (bar)	MAP (bar)	MDMT (°C)	MDMT Exemption	Impact Tested
B16.9 Pipe Cap - Left Side	30,5	175	40,92	69,64	-46,8	Note 1	No
Straight Flange on B16.9 Pipe Cap - Left Side	30,5	175	48,35	77,21	-46,8	Note 2	No
Cylinder #1	30,5	175	38,66	67,3	-37,4	Note 3	No
Straight Flange on B16.9 Pipe Cap - Right Side	30,5	175	48,35	77,21	-46,8	Note 2	No
B16.9 Pipe Cap - Right Side	30,5	175	40,92	69,64	-46,8	Note 4	No
Air Inlet (N1)	30,5	175	52,1	88,24	-105	Note 5	No
B16.9 Elbow #1 (N1)	30,5	175	88,9	102,1	-48	Note 6, 7	No
Air Outlet (N2)	30,5	175	52,1	88,24	-48	Note 8	No
Temperature Gauge Connection (N3)	30,5	175	45,48	79,18	-48	Note 8	No
Temperature Transmitter Connection (N4)	30,5	175	45,48	79,18	-48	Note 8	No
PSV Connection (N5)	30,5	175	45,48	79,18	-37,3	Note 9	No
Drain (N6)	30,5	175	45,48	79,18	-37,3	Note 9	No

Chamber Summary	
Design MDMT	0 °C
Rated MDMT	0 °C @ 38,66 bar
MAWP hot & corroded	38,66 bar @ 175 °C
MAP cold & new	67,3 bar @ 21,11 °C
(1) The rated MDMT is limited to the design MDMT based on the setting in the Calculations tab of the Set Mode dialog. (2) This pressure chamber is not designed for external pressure.	

Notes for MDMT Rating		
Note #	Exemption	Details
1.	Straight Flange governs MDMT	
2.	Material impact test exemption temperature from Fig UCS-66M Curve B = -29°C Fig UCS-66.1M MDMT reduction = 17,8°C, (coincident ratio = 0,6822)	UCS-66 governing thickness = 7,16 mm
3.	Material impact test exemption temperature from Fig UCS-66M Curve B = -29°C Fig UCS-66.1M MDMT reduction = 8,4°C, (coincident ratio = 0,85)	UCS-66 governing thickness = 7,16 mm
4.	Straight Flange governs MDMT	
5.	Nozzle is impact test exempt to -105°C per UCS-66(b)(3) (coincident ratio = 0,074).	
6.	Material is impact test exempt to -105°C per UCS-66(b)(3) (coincident ratio = 0,1118)	
7.	Flange rating governs: Flange rated MDMT per UCS-66(b)(1)(b) = -48°C (Coincident ratio = 0,3786)	Bolts rated MDMT per Fig UCS-66 note (c) = -48°C
8.	Flange rating governs: Flange rated MDMT per UCS-66(b)(1)(b) = -48°C (Coincident ratio = 0,3786) Bolts rated MDMT per Fig UCS-66 note (c) = -48°C	
9.	Nozzle impact test exemption temperature from Fig UCS-66M Curve B = -29°C Fig UCS-66.1M MDMT reduction = 8,3°C, (coincident ratio = 0,8519)	UCS-66 governing thickness = 7,16 mm.

Settings Summary

COMPRESS 2024 Build 8400	
ASME Section VIII Division 1, 2021 Edition Metric	
Units	MKS
Datum Line Location	0,00 mm from right seam
Vessel Design Mode	Design Mode
Minimum thickness	1,5 mm per UG-16(b)
Design for cold shut down only	No
Design for lethal service (full radiography required)	No
Design nozzles for	Design P only
Corrosion weight loss	100% of theoretical loss
UG-23 Stress Increase	1,20
Skirt/legs stress increase	1,0
Minimum nozzle projection	60 mm
Juncture calculations for $\alpha > 30$ only	Yes
Preheat P-No 1 Materials $> 1,25"$ and $\leq 1,50"$ thick	No
UG-37(a) shell tr calculation considers longitudinal stress	No
Cylindrical shells made from pipe are entered as minimum thickness	No
Nozzles made from pipe are entered as minimum thickness	No
ASME B16.9 fittings are entered as minimum thickness	No
Butt welds	Tapered per Figure UCS-66.3(a)
Disallow Appendix 1-5, 1-8 calculations under 15 psi	No
Hydro/Pneumatic Test	
Shop Hydrotest Pressure	1,3 times vessel MAWP [UG-99(b)]
Test liquid specific gravity	1,00
Maximum stress during test	90% of yield
Required Marking - UG-116	
UG-116(e) Radiography	RT3
UG-116(f) Postweld heat treatment	None
Code Cases\Interpretations	
Use Appendix 46	No
Use UG-44(b)	No
Use Code Case 3035	No
Apply interpretation VIII-1-83-66	Yes
Apply interpretation VIII-1-86-175	Yes
Apply interpretation VIII-1-01-37	Yes
Apply interpretation VIII-1-01-150	Yes
Apply interpretation VIII-1-07-50	Yes
Apply interpretation VIII-1-16-85	Yes
No UCS-66.1 MDMT reduction	No
No UCS-68(c) MDMT reduction	No
Disallow UG-20(f) exemptions	No
UG-22 Loadings	
UG-22(a) Internal or External Design Pressure	Yes
UG-22(b) Weight of the vessel and normal contents under operating or test conditions	No
UG-22(c) Superimposed static reactions from weight of attached equipment (external loads)	No
UG-22(d)(2) Vessel supports such as lugs, rings, skirts, saddles and legs	No
UG-22(f) Wind reactions	No
UG-22(f) Seismic reactions	No
UG-22(j) Test pressure and coincident static head acting during the test:	No

Note: UG-22(b),(c) and (f) loads only considered when supports are present.

Note 2: UG-22(d)(1),(e),(f)-snow,(g),(h),(i) are not considered. If these loads are present, additional calculations must be performed.

License Information	
Company Name	Locati Impianti s.r.l.
License	Commercial
License Key ID	32235
Support Expires	September 20, 2024
Account Number	891888909529634

Radiography Summary

UG-116 Radiography							
Component	Longitudinal Seam		Left Circumferential Seam		Right Circumferential Seam		Mark
	Category (Fig UW-3)	Radiography / Joint Type	Category (Fig UW-3)	Radiography / Joint Type	Category (Fig UW-3)	Radiography / Joint Type	
B16.9 Pipe Cap - Left Side	N/A	Seamless No RT	N/A	N/A	B	Spot UW-11(b) / Type 1	RT3
Cylinder #1	N/A	Seamless No RT	B	Spot UW-11(b) / Type 1	B	Spot UW-11(b) / Type 1	RT3
B16.9 Pipe Cap - Right Side	N/A	Seamless No RT	B	Spot UW-11(b) / Type 1	N/A	N/A	RT3
Nozzle	Longitudinal Seam		Nozzle to Vessel Circumferential Seam		Nozzle free end Circumferential Seam		
Air Inlet (N1)	N/A	Seamless No RT	D	N/A / Type 7	B	UW-11(b) exempt / Type 1	N/A
B16.9 Elbow #1 (N1)	N/A	Seamless No RT	B	UW-11(b) exempt / Type 1	C	UW-11(b) exempt / Type 1	N/A
Temperature Gauge Connection (N3)	N/A	Seamless No RT	D	N/A / Type 7	C	UW-11(b) exempt / Type 1	N/A
Temperature Transmitter Connection (N4)	N/A	Seamless No RT	D	N/A / Type 7	C	UW-11(b) exempt / Type 1	N/A
PSV Connection (N5)	N/A	Seamless No RT	D	N/A / Type 7	C	UW-11(b) exempt / Type 1	N/A
Drain (N6)	N/A	Seamless No RT	D	N/A / Type 7	N/A	N/A	N/A
Air Outlet (N2)	N/A	Seamless No RT	D	N/A / Type 7	C	UW-11(b) exempt / Type 1	N/A
Nozzle Flange	Longitudinal Seam		Flange Face		Nozzle to Flange Circumferential Seam		
ASME B16.5/16.47 flange attached to right end of B16.9 Elbow #1 (N1)	N/A	Seamless No RT	N/A	N/A / Gasketed	C	UW-11(b) exempt / Type 1	N/A
ASME B16.5/16.47 flange attached to Temperature Gauge Connection (N3)	N/A	Seamless No RT	N/A	N/A / Gasketed	C	UW-11(b) exempt / Type 1	N/A
ASME B16.5/16.47 flange attached to Temperature Transmitter Connection (N4)	N/A	Seamless No RT	N/A	N/A / Gasketed	C	UW-11(b) exempt / Type 1	N/A
ASME B16.5/16.47 flange attached to PSV Connection (N5)	N/A	Seamless No RT	N/A	N/A / Gasketed	C	UW-11(b) exempt / Type 1	N/A
ASME B16.5/16.47 flange attached to Air Outlet (N2)	N/A	Seamless No RT	N/A	N/A / Gasketed	C	UW-11(b) exempt / Type 1	N/A
UG-116(e) Required Marking: RT3							

Thickness Summary

Component Data								
Component Identifier	Material	Diameter (mm)	Length (mm)	Nominal t (mm)	Design t (mm)	Total Corrosion (mm)	Joint E	Load
B16.9 Pipe Cap - Left Side	SA-234 WPB	219,07 OD	57,83	8,18	6,13	3	0,85	Internal
Straight Flange on B16.9 Pipe Cap - Left Side	SA-234 WPB	219,07 OD	44,16	8,18	6,29	3	0,85	Internal
Cylinder #1	SA-106 B Smls Pipe	219,07 OD	870	8,18	6,29	3	0,85	Internal
Straight Flange on B16.9 Pipe Cap - Right Side	SA-234 WPB	219,07 OD	44,16	8,18	6,29	3	0,85	Internal
B16.9 Pipe Cap - Right Side	SA-234 WPB	219,07 OD	57,83	8,18	6,13	3	0,85	Internal

Definitions	
Nominal t	Vessel wall nominal thickness
Design t	Required vessel thickness due to governing loading + corrosion
Joint E	Longitudinal seam joint efficiency
Load	
Internal	Circumferential stress due to internal pressure governs
External	External pressure governs
Wind	Combined longitudinal stress of pressure + weight + wind governs
Seismic	Combined longitudinal stress of pressure + weight + seismic governs

Weight Summary

Weight (kg) Contributed by Vessel Elements											
Component	Metal New*	Metal Corroded	Insulation	Insulation Supports	Lining	Piping + Liquid	Operating Liquid		Test Liquid		Surface Area m ²
							New	Corroded	New	Corroded	
B16.9 Pipe Cap - Left Side	5,2	3,4	0	0	0	0	0	0	2,5	2,8	0,09
Cylinder #1	36,6	23,5	0	0	0	0	0	0	28,2	29,9	0,59
B16.9 Pipe Cap - Right Side	5,2	3,4	0	0	0	0	0	0	2,5	2,7	0,09
TOTAL:	46,9	30,2	0	0	0	0	0	0	33,2	35,5	0,77

*Shells with attached nozzles have weight reduced by material cut out for opening.

Weight (kg) Contributed by Attachments										
Component	Body Flanges		Nozzles & Flanges		Packed Beds	Trays	Tray Supports	Rings & Clips	Vertical Loads	Surface Area m ²
	New	Corroded	New	Corroded						
B16.9 Pipe Cap - Left Side	0	0	2,3	2,2	0	0	0	0	0	0,03
Cylinder #1	0	0	10,9	10,3	0	0	0	0	0	0,16
B16.9 Pipe Cap - Right Side	0	0	2,1	2	0	0	0	0	0	0,03
TOTAL:	0	0	15,3	14,4	0	0	0	0	0	0,23

Vessel Totals		
	New	Corroded
Operating Weight (kg)	62	45
Empty Weight (kg)	62	45
Test Weight (kg)	95	80
Surface Area (m ²)	1	-
Capacity** (liters)	33	35

**The vessel capacity does not include volume of nozzle, piping or other attachments.

Vessel Lift Condition	
Vessel Lift Weight, New (kg)	62
Center of Gravity from Datum (mm)	435,06

Hydrostatic Test

Horizontal shop hydrostatic test based on MAWP per UG-99(b)

$$\begin{aligned}
 \text{Gauge pressure at } 21,11^{\circ}\text{C} &= 1,3 \cdot MAWP \cdot LSR \\
 &= 1,3 \cdot 38,66 \cdot 1 \\
 &= 50,26 \text{ bar}
 \end{aligned}$$

Horizontal shop hydrostatic test				
Identifier	Local test pressure (bar)	Test liquid static head (bar)	UG-99(b) stress ratio	UG-99(b) pressure factor
B16.9 Pipe Cap - Left Side (1)	50,29	0,03	1	1,30
Straight Flange on B16.9 Pipe Cap - Left Side	50,29	0,03	1	1,30
Cylinder #1	50,29	0,03	1	1,30
Straight Flange on B16.9 Pipe Cap - Right Side	50,29	0,03	1	1,30
B16.9 Pipe Cap - Right Side	50,29	0,03	1	1,30
Air Inlet (N1)	50,28	0,03	1	1,30
Air Outlet (N2)	50,28	0,03	1	1,30
B16.9 Elbow #1 (N1)	50,28	0,03	1	1,30
Drain (N6)	50,3	0,04	1	1,30
PSV Connection (N5)	50,27	0,01	1	1,30
Temperature Gauge Connection (N3)	50,27	0,01	1	1,30
Temperature Transmitter Connection (N4)	50,28	0,03	1	1,30
(1) B16.9 Pipe Cap - Left Side limits the UG-99(b) stress ratio. (2) The zero degree angular position is assumed to be up, and the test liquid height is assumed to the top-most flange.				

The field test condition has not been investigated.

The test temperature of 21,11 °C is warmer than the minimum recommended temperature of -20,3 °C so the brittle fracture provision of UG-99(h) has been met.

B16.9 Pipe Cap - Left Side

ASME Section VIII Division 1, 2021 Edition Metric				
Component		ASME B16.9 Pipe Cap (modified)		
Material		SA-234 WPB (II-D Metric p. 16, ln. 18)		
Attached To		Cylinder #1		
Impact Tested	Normalized	Fine Grain Practice	PWHT	Maximize MDMT/ No MAWP
No	No	No	No	No
		Design Pressure (bar)	Design Temperature (°C)	Design MDMT (°C)
Internal		30,5	175	0
Static Liquid Head				
Condition		P _s (bar)	H _s (mm)	SG
Test horizontal		0,03	351,36	1
Dimensions				
NPS and Schedule		NPS 8 Sch 40 (Std) DN 200		
Outer Diameter		219,07 mm		
Overall Length E		102 mm		
Nominal Thickness		8,18 mm		
Minimum Thickness ¹		7,16 mm		
Corrosion	Inner	3 mm		
	Outer	0 mm		
Length L _{sf}		44,17 mm		
Nominal Thickness t _{sf}		8,18 mm		
Weight and Capacity				
		Weight (kg) ²		Capacity (liters) ²
New		5,19		2,52
Corroded		3,38		2,74
Radiography				
Category A joints		Seamless No RT		
Head to shell seam		Spot UW-11(b) Type 1		

¹ minimum thickness = nominal thickness times pipe tolerance factor of 0,875.

² includes straight flange

Results Summary	
Governing condition	internal pressure
Minimum thickness per UG-16	1,5 mm + 3 mm = 4,5 mm
Design thickness due to internal pressure (t)	6,13 mm
Governing straight flange design thickness	6,29 mm
Maximum allowable working pressure (MAWP)	40,92 bar
Maximum allowable pressure (MAP)	69,64 bar
Straight Flange governs MDMT	-46,8°C

Factor K		
$K = \left(\frac{1}{6}\right) \cdot \left[2 + \left(\frac{D}{2 \cdot h}\right)^2\right]$		
Corroded	$K = \left(\frac{1}{6}\right) \cdot \left[2 + \left(\frac{208,71}{2 \cdot 53,68}\right)^2\right]$	0,9633
New	$K = \left(\frac{1}{6}\right) \cdot \left[2 + \left(\frac{202,71}{2 \cdot 50,68}\right)^2\right]$	1

Design thickness for internal pressure, (Corroded at 175 °C) Appendix 1-4(c)

$$t = \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} + \text{Corrosion} = \frac{30,5 \cdot 219,07 \cdot 0,963264}{2 \cdot 1.180 \cdot 0,85 + 2 \cdot 30,5 \cdot (0,963264 - 0,1)} + 3 = \underline{6.13} \text{ mm}$$

Maximum allowable working pressure, (Corroded at 175 °C) Appendix 1-4(c)

$$P = \frac{2 \cdot S \cdot E \cdot t}{K \cdot D_o - 2 \cdot t \cdot (K - 0,1)} - P_s = \frac{2 \cdot 1.180 \cdot 0,85 \cdot (0,875 \cdot 8,18 - 3)}{0,963264 \cdot 219,07 - 2 \cdot (0,875 \cdot 8,18 - 3) \cdot (0,963264 - 0,1)} - 0 = \underline{40.92} \text{ bar}$$

Maximum allowable pressure, (New at 21,11 °C) Appendix 1-4(c)

$$P = \frac{2 \cdot S \cdot E \cdot t}{K \cdot D_o - 2 \cdot t \cdot (K - 0,1)} - P_s = \frac{2 \cdot 1.180 \cdot 0,85 \cdot 0,875 \cdot 8,18}{1 \cdot 219,07 - 2 \cdot 0,875 \cdot 8,18 \cdot (1 - 0,1)} - 0 = \underline{69.64} \text{ bar}$$

ASME Section VIII Division 1 UG-81(a) Out-of-Roundness
Inside surface shall not deviate outside the shape by more than 1,25 % of D
Inside surface shall not deviate inside the shape by more than 0,625 % of D

Straight Flange on B16.9 Pipe Cap - Left Side

ASME Section VIII Division 1, 2021 Edition Metric				
Component		Cylinder		
Material		SA-234 WPB (II-D Metric p. 16, ln. 18)		
Impact Tested	Normalized	Fine Grain Practice	PWHT	Maximize MDMT/ No MAWP
No	No	No	No	No
		Design Pressure (bar)	Design Temperature (°C)	Design MDMT (°C)
Internal		30,5	175	0
Static Liquid Head				
Condition		P _s (bar)	H _s (mm)	SG
Test horizontal		0,03	351,36	1
Dimensions				
Outer Diameter		219,07 mm		
Length		44,17 mm		
Nominal Thickness		8,18 mm		
Corrosion	Inner	3 mm		
	Outer	0 mm		
Weight and Capacity				
		Weight (kg)		Capacity (liters)
New		1,87		1,43
Corroded		1,2		1,51
Radiography				
Longitudinal seam		Seamless No RT		
Right Circumferential seam		Spot UW-11(b) Type 1		

Results Summary	
Governing condition	Internal pressure
Minimum thickness per UG-16	1,5 mm + 3 mm = 4,5 mm
Design thickness due to internal pressure (t)	6,29 mm
Maximum allowable working pressure (MAWP)	48,35 bar
Maximum allowable pressure (MAP)	77,21 bar
Rated MDMT	-46,8 °C

UCS-66 Material Toughness Requirements	
Governing thickness, t _g =	7,16 mm
Exemption temperature from Fig UCS-66M Curve B =	-29°C
$t_r = \frac{38,66 \cdot 109,54}{1.180 \cdot 0,85 + 0,4 \cdot 38,66} =$	4,16 mm
$\text{Stress ratio} = \frac{t_r \cdot E^*}{t_n - c} = \frac{4,16 \cdot 0,85}{8,18 - 3} =$	0,6822
Reduction in MDMT, T _R from Fig UCS-66.1M =	17,8°C
$MDMT = \max [MDMT - T_R, -48] = \max [-29 - 17,8, -48] =$	-46,8°C
Material is exempt from impact testing at the Design MDMT of 0°C.	

Design thickness, (at 175 °C) Appendix 1-1

$$t = \frac{P \cdot R_o}{S \cdot E + 0,40 \cdot P} + \text{Corrosion} = \frac{30,5 \cdot 109,54}{1.180 \cdot 0,85 + 0,40 \cdot 30,5} + 3 = \underline{6,29} \text{ mm}$$

Maximum allowable working pressure, (at 175 °C) Appendix 1-1

$$P = \frac{S \cdot E \cdot t}{R_o - 0,40 \cdot t} - P_s = \frac{1.180 \cdot 0,85 \cdot 5,18}{109,54 - 0,40 \cdot 5,18} - 0 = \underline{48,35} \text{ bar}$$

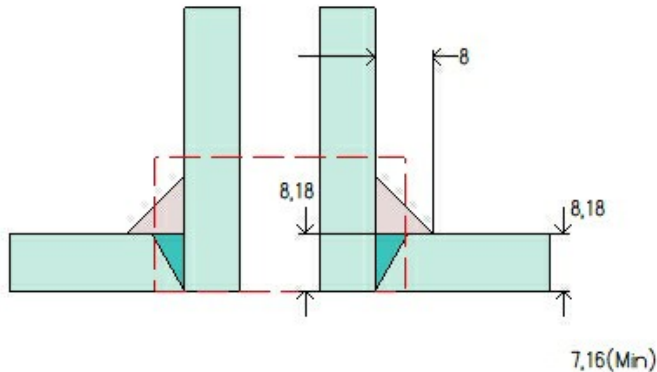
Maximum allowable pressure, (at 21,11 °C) Appendix 1-1

$$P = \frac{S \cdot E \cdot t}{R_o - 0,40 \cdot t} = \frac{1.180 \cdot 0,85 \cdot 8,18}{109,54 - 0,40 \cdot 8,18} = \underline{77,21} \text{ bar}$$

ASME Section VIII Division 1 UG-80(a) Out-of-Roundness
$(D_{\max} - D_{\min})$ shall not exceed 1% of D
When the cross section passes through an opening or within 1 I.D. of the opening, $(D_{\max} - D_{\min})$ shall not exceed 1% of D + 2% of the inside diameter of the opening

Air Inlet (N1)

ASME Section VIII Division 1, 2021 Edition Metric



Note: round inside edges per UG-76(c)

Location and Orientation

Located on	B16.9 Pipe Cap - Left Side
Orientation	0°
End of nozzle to datum line	1.036 mm
Calculated as hillside	No
Distance to head center, R	0 mm
Passes through a Category A joint	No

Nozzle

Description	NPS 0,75 XXS DN 20
Access opening	No
Material specification	SA-106 B Smls Pipe (II-D Metric p. 16, In. 16)
Inside diameter, new	11,02 mm
Pipe nominal wall thickness	7,82 mm
Pipe minimum wall thickness ¹	6,85 mm
Corrosion allowance	3 mm
Projection available outside vessel, L _{pr}	64,43 mm
Local vessel minimum thickness	7,16 mm
Liquid static head included	0 bar

Welds

Inner fillet, Leg ₄₁	8 mm
Nozzle to vessel groove weld	8,18 mm

Radiography

Longitudinal seam	Seamless No RT
Circumferential seam	Full UW-11(a) Type 1

¹Pipe minimum thickness = nominal thickness times pipe tolerance factor of 0,875.

UCS-66 Material Toughness Requirements Nozzle

$t_r = \frac{38,66 - 8,51}{1,180 \cdot 1 - 0,6 \cdot 38,66} =$	0,28 mm
$\text{Stress ratio} = \frac{t_r \cdot E^*}{t_n - c} = \frac{0,28 \cdot 1}{6,85 - 3} =$	0,074
Stress ratio $\leq 0,35$, MDMT per UCS-66(b)(3) =	-105°C
Material is exempt from impact testing at the Design MDMT of 0°C.	

Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 30,5 bar @ 175 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							5,51	6,85

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (mm)	Actual weld throat size (mm)	Status
Nozzle to shell fillet (Leg ₄₁)	3,38	5,6	weld size is adequate

Calculations for internal pressure 30,5 bar @ 175 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [17,02, 8,51 + (7,82 - 3) + (7,16 - 3)] \\
 &= 17,49 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (7,16 - 3), 2,5 \cdot (7,82 - 3) + 0] \\
 &= 10,39 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{30,5001 \cdot 8,51}{1,180 \cdot 1 - 0,6 \cdot 30,5001} \\
 &= 0,22 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)(c)

$$\begin{aligned}
 t_r &= \frac{P \cdot K_1 \cdot D_o}{2 \cdot S \cdot E + 0,8 \cdot P} \\
 &= \frac{30,5001 \cdot 0,8749 \cdot 219,07}{2 \cdot 1,180 \cdot 1 + 0,8 \cdot 30,5001} \\
 &= 2,45 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$t_r = \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} = \frac{30,5 \cdot 219,07 \cdot 0,963264}{2 \cdot 1,180 \cdot 0,85 + 2 \cdot 30,5 \cdot (0,963264 - 0,1)} = 3,13 \text{ mm}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(c) Weld Check

Fillet weld: $t_{\min} = \min [19\text{ mm}, t_n, t] = 4,82 \text{ mm}$

$$t_{c(\min)} = \min [6 \text{ mm}, 0,7 \cdot t_{\min}] = \underline{3,38} \text{ mm}$$

$$t_{c(\text{actual})} = 0,7 \cdot \text{Leg} = 0,7 \cdot 8 = 5,6 \text{ mm}$$

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-45 Nozzle Neck Thickness Check

Interpretation VIII-1-83-66 has been applied.

$$\begin{aligned} t_{a\text{UG-27}} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\ &= \frac{30,5001 \cdot 8,51}{1.180 \cdot 1 - 0,6 \cdot 30,5001} + 3 \\ &= 3,22 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_a &= \max [t_{a\text{UG-27}}, t_{a\text{UG-22}}] \\ &= \max [3,22, 0] \\ &= 3,22 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{b1} &= \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} + \text{Corrosion} \\ &= \frac{30,5 \cdot 219,07 \cdot 0,963264}{2 \cdot 1.180 \cdot 1 + 2 \cdot 30,5 \cdot (0,963264 - 0,1)} + 3 \\ &= 5,67 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{b1} &= \max [t_{b1}, t_{b\text{UG16}}] \\ &= \max [5,67, 4,5] \\ &= 5,67 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_b &= \min [t_{b3}, t_{b1}] \\ &= \min [5,51, 5,67] \\ &= 5,51 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{\text{UG-45}} &= \max [t_a, t_b] \\ &= \max [3,22, 5,51] \\ &= \underline{5,51} \text{ mm} \end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 7,82 = 6,85 \text{ mm}$

The nozzle neck thickness is adequate.

Reinforcement Calculations for MAWP

The vessel wall thickness governs the MAWP of this nozzle.

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 52,1 bar @ 175 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							5,51	6,85

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (mm)	Actual weld throat size (mm)	Status
Nozzle to shell fillet (Leg ₄₁)	3,38	5,6	weld size is adequate

Calculations for internal pressure 52,1 bar @ 175 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [17,02, 8,51 + (7,82 - 3) + (7,16 - 3)] \\
 &= 17,49 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (7,16 - 3), 2,5 \cdot (7,82 - 3) + 0] \\
 &= 10,39 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{52,1004 \cdot 8,51}{1,180 \cdot 1 - 0,6 \cdot 52,1004} \\
 &= 0,39 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)(c)

$$\begin{aligned}
 t_r &= \frac{P \cdot K_1 \cdot D_o}{2 \cdot S \cdot E + 0,8 \cdot P} \\
 &= \frac{52,1004 \cdot 0,8749 \cdot 219,07}{2 \cdot 1,180 \cdot 1 + 0,8 \cdot 52,1004} \\
 &= 4,16 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$t_r = \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} = \frac{52,1 \cdot 219,07 \cdot 0,963264}{2 \cdot 1,180 \cdot 0,85 + 2 \cdot 52,1 \cdot (0,963264 - 0,1)} = 5,25 \text{ mm}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(c) Weld Check

Fillet weld: $t_{\min} = \min [19\text{ mm}, t_n, t] = 4,82 \text{ mm}$

$t_{c(\min)} = \min [6 \text{ mm}, 0,7 \cdot t_{\min}] = 3,38 \text{ mm}$

$t_{c(actual)} = 0,7 \cdot \text{Leg} = 0,7 \cdot 8 = 5,6 \text{ mm}$

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-45 Nozzle Neck Thickness Check

Interpretation VIII-1-83-66 has been applied.

$$\begin{aligned} t_{aUG-27} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\ &= \frac{52,1004 \cdot 8,51}{1,180 \cdot 1 - 0,6 \cdot 52,1004} + 3 \\ &= 3,39 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_a &= \max [t_{aUG-27}, t_{aUG-22}] \\ &= \max [3,39, 0] \\ &= 3,39 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{b1} &= \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} + \text{Corrosion} \\ &= \frac{52,1 \cdot 219,07 \cdot 0,963264}{2 \cdot 1,180 \cdot 1 + 2 \cdot 52,1 \cdot (0,963264 - 0,1)} + 3 \\ &= 7,49 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{b1} &= \max [t_{b1}, t_{bUG16}] \\ &= \max [7,49, 4,5] \\ &= 7,49 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_b &= \min [t_{b3}, t_{b1}] \\ &= \min [5,51, 7,49] \\ &= 5,51 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{UG-45} &= \max [t_a, t_b] \\ &= \max [3,39, 5,51] \\ &= 5,51 \text{ mm} \end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 7,82 = 6,85 \text{ mm}$

The nozzle neck thickness is adequate.

Reinforcement Calculations for MAP

The vessel wall thickness governs the MAP of this nozzle.

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 88,24 bar @ 21,11 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							2,51	6,85

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

Calculations for internal pressure 88,24 bar @ 21,11 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [11,02, 5,51 + (7,82 - 0) + (7,16 - 0)] \\
 &= 20,49 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (7,16 - 0), 2,5 \cdot (7,82 - 0) + 0] \\
 &= 17,89 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{88,2375 \cdot 5,51}{1,180 \cdot 1 - 0,6 \cdot 88,2375} \\
 &= 0,43 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)(c)

$$\begin{aligned}
 t_r &= \frac{P \cdot K_1 \cdot D_o}{2 \cdot S \cdot E + 0,8 \cdot P} \\
 &= \frac{88,2375 \cdot 0,9 \cdot 219,07}{2 \cdot 1,180 \cdot 1 + 0,8 \cdot 88,2375} \\
 &= 7,16 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$t_r = \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} = \frac{88,24 \cdot 219,07 \cdot 1}{2 \cdot 1,180 \cdot 0,85 + 2 \cdot 88,24 \cdot (1 - 0,1)} = 8,93 \text{ mm}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UG-45 Nozzle Neck Thickness Check

Interpretation VIII-1-83-66 has been applied.

$$\begin{aligned}
 t_{aUG-27} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\
 &= \frac{88,2375 \cdot 5,51}{1.180 \cdot 1 - 0,6 \cdot 88,2375} + 0 \\
 &= 0,43 \text{ mm} \\
 t_a &= \max [t_{aUG-27}, t_{aUG-22}] \\
 &= \max [0,43, 0] \\
 &= 0,43 \text{ mm} \\
 t_{b1} &= \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} + \text{Corrosion} \\
 &= \frac{88,24 \cdot 219,07 \cdot 1}{2 \cdot 1.180 \cdot 1 + 2 \cdot 88,24 \cdot (1 - 0,1)} + 0 \\
 &= 7,67 \text{ mm} \\
 t_{b1} &= \max [t_{b1}, t_{bUG16}] \\
 &= \max [7,67, 1,5] \\
 &= 7,67 \text{ mm} \\
 t_b &= \min [t_{b3}, t_{b1}] \\
 &= \min [2,51, 7,67] \\
 &= 2,51 \text{ mm} \\
 t_{UG-45} &= \max [t_a, t_b] \\
 &= \max [0,43, 2,51] \\
 &= \underline{2,51} \text{ mm}
 \end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 7,82 = 6,85 \text{ mm}$

The nozzle neck thickness is adequate.

B16.9 Elbow #1 (N1)

ASME Section VIII Division 1, 2021 Edition Metric				
Component		ASME B16.9 Elbow		
Type		Long Radius 90-deg		
Material		SA-234 WPB (II-D Metric p. 16, ln. 18)		
Pipe NPS and Schedule		NPS 0,75 XXS DN 20		
Attached To		Air Inlet (N1)		
Impact Tested	Normalized	Fine Grain Practice	PWHT	Maximize MDMT/ No MAWP
No	No	No	No	No
		Design Pressure (bar)	Design Temperature (°C)	Design MDMT (°C)
Internal		30,5	175	0
Static Liquid Head				
Condition		P _s (bar)	H _s (mm)	SG
Test horizontal		0,03	255,51	1
Dimensions				
Outer Diameter		26,67 mm		
Nominal Thickness		7,82 mm		
Minimum Thickness ¹		6,85 mm		
Center-to-End, A		38 mm		
Corrosion	Inner	3 mm		
	Outer	0 mm		
Weight and Capacity				
		Weight (kg)		Capacity (liters)
New		0,22		0,01
Corroded		0,16		0,01
Radiography				
Longitudinal seam		Seamless No RT		
Left Circumferential seam		Full UW-11(a) Type 1		
Right Circumferential seam		Full UW-11(a) Type 1		

¹ minimum thickness = nominal thickness times pipe tolerance factor of 0,875.

ASME B16.5-2017 Flange	
Description	NPS 0,75 Class 600 WN A105
Bolt Material	SA-193 B7 Bolt ≤ 64 (II-D Metric p. 410, In. 32)
Blind included	No
Rated MDMT	-48°C
Liquid static head	0 bar
MAWP rating	88,9 bar @ 175°C
MAP rating	102,1 bar @ 21,11°C
Hydrotest rating	154 bar @ 21,11°C
PWHT performed	No
Produced to Fine Grain Practice and Supplied in Heat Treated Condition	No
Impact Tested	No
Circumferential joint radiography	Full UW-11(a) Type 1
Bore diameter, B (specified by purchaser)	11,02 mm
Gasket	
Type	ASME B16.20 Spiral-Wound
Description	Garlock FLEXSEAL RW 316L SS / Flexible Graphite
Factor, m	3
Seating Stress, y	703,07 kgf/cm ²
Thickness, T	3 mm
Inner Diameter	25,4 mm
Outer Diameter	39,6 mm
Notes	
Flange rated MDMT per UCS-66(b)(1)(b) = -48°C (Coincident ratio = 0,3786) Bolts rated MDMT per Fig UCS-66 note (c) = -48°C	

Results Summary	
Governing condition	UG-16
Minimum thickness per UG-16	1,5 mm + 3 mm = 4,5 mm
Design thickness due to internal pressure (t)	3,34 mm
Maximum allowable working pressure (MAWP)	401,45 bar
Maximum allowable pressure (MAP)	849,81 bar
Rated MDMT	-105 °C

UCS-66 Material Toughness Requirements	
$t_r = 13,34 \cdot \left(1 - \exp \left(- \frac{38,66}{1.180 \cdot 1} \right) \right) =$	0,43 mm
$\text{Stress ratio} = \frac{t_r \cdot E^*}{t_n - c} = \frac{0,43 \cdot 1}{6,85 - 3} =$	0,1118
Stress ratio ≤ 0,35, MDMT per UCS-66(b)(3) =	-105°C
Material is exempt from impact testing at the Design MDMT of 0°C.	

Design thickness, (at 175 °C) Appendix 1-2

$$t = R_o \cdot \left(1 - \exp \left[- \frac{P}{S \cdot E} \right] \right) + \text{Corrosion} = 13,34 \cdot \left(1 - \exp \left[- \frac{30,5}{1.180 \cdot 1,00} \right] \right) + 3 = \text{3,34 mm}$$

Maximum allowable working pressure, (at 175 °C) Appendix 1-2

$$P = S \cdot E \cdot \ln\left(\frac{R_o}{R_o - t}\right) - P_s = 1.180 \cdot 1,00 \cdot \ln\left(\frac{13,34}{13,34 - (7,82 \cdot 0,875 - 3)}\right) - 0 = \underline{401,45} \text{ bar}$$

Maximum allowable pressure, (at 21,11 °C) Appendix 1-2

$$P = S \cdot E \cdot \ln\left(\frac{R_o}{R_o - t}\right) = 1.180 \cdot 1,00 \cdot \ln\left(\frac{13,34}{13,34 - (7,82 \cdot 0,875)}\right) = \underline{849,81} \text{ bar}$$

Cylinder #1

ASME Section VIII Division 1, 2021 Edition Metric				
Component		Cylinder		
Material		SA-106 B Smls Pipe (II-D Metric p. 16, In. 16)		
Pipe NPS and Schedule		NPS 8 Sch 40 (Std) DN 200		
Impact Tested	Normalized	Fine Grain Practice	PWHT	Maximize MDMT/ No MAWP
No	No	No	No	No
		Design Pressure (bar)	Design Temperature (°C)	Design MDMT (°C)
Internal		30,5	175	0
Static Liquid Head				
Condition		P _s (bar)	H _s (mm)	SG
Test horizontal		0,03	351,36	1
Dimensions				
Outer Diameter		219,07 mm		
Length		870 mm		
Pipe Nominal Thickness		8,18 mm		
Pipe Minimum Thickness ¹		7,16 mm		
Corrosion	Inner	3 mm		
	Outer	0 mm		
Weight and Capacity				
		Weight (kg)		Capacity (liters)
New		36,57		28,08
Corroded		23,49		29,76
Radiography				
Longitudinal seam		Seamless No RT		
Left Circumferential seam		Spot UW-11(b) Type 1		
Right Circumferential seam		Spot UW-11(b) Type 1		

¹Pipe minimum thickness = nominal thickness times pipe tolerance factor of 0,875.

Results Summary	
Governing condition	Internal pressure
Minimum thickness per UG-16	1,5 mm + 3 mm = 4,5 mm
Design thickness due to internal pressure (t)	6,29 mm
Maximum allowable working pressure (MAWP)	38,66 bar
Maximum allowable pressure (MAP)	67,3 bar
Rated MDMT	-37,4 °C

UCS-66 Material Toughness Requirements	
Governing thickness, t _g =	7,16 mm
Exemption temperature from Fig UCS-66M Curve B =	-29°C
$t_r = \frac{38,66 \cdot 109,54}{1.180 \cdot 0,85 + 0,4 \cdot 38,66} =$	4,16 mm
$\text{Stress ratio} = \frac{t_r \cdot E^*}{t_n - c} = \frac{4,16 \cdot 0,85}{7,16 - 3} =$	0,85
Reduction in MDMT, T _R from Fig UCS-66.1M =	8,4°C
$MDMT = \max [MDMT - T_R, -48] = \max [-29 - 8,4, -48] =$	-37,4°C
Material is exempt from impact testing at the Design MDMT of 0°C.	

Design thickness, (at 175 °C) Appendix 1-1

$$t = \frac{P \cdot R_o}{S \cdot E + 0,40 \cdot P} + \text{Corrosion} = \frac{30,5 \cdot 109,54}{1.180 \cdot 0,85 + 0,40 \cdot 30,5} + 3 = \underline{6,29} \text{ mm}$$

Maximum allowable working pressure, (at 175 °C) Appendix 1-1

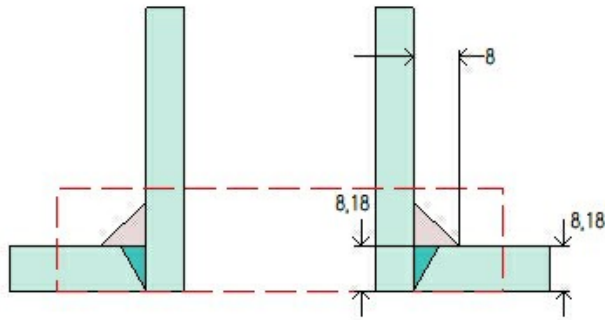
$$P = \frac{S \cdot E \cdot t}{R_o - 0,40 \cdot t} - P_s = \frac{1.180 \cdot 0,85 \cdot (8,18 \cdot 0,875 - 3)}{109,54 - 0,40 \cdot (8,18 \cdot 0,875 - 3)} - 0 = \underline{38,66} \text{ bar}$$

Maximum allowable pressure, (at 21,11 °C) Appendix 1-1

$$P = \frac{S \cdot E \cdot t}{R_o - 0,40 \cdot t} = \frac{1.180 \cdot 0,85 \cdot (8,18 \cdot 0,875)}{109,54 - 0,40 \cdot (8,18 \cdot 0,875)} = \underline{67,3} \text{ bar}$$

Temperature Gauge Connection (N3)

ASME Section VIII Division 1, 2021 Edition Metric



Note: round inside edges per UG-76(c)

Location and Orientation

Located on	Cylinder #1
Orientation	0°
Nozzle center line offset to datum line	525 mm
End of nozzle to shell center	250 mm
Passes through a Category A joint	No

Nozzle

Description	NPS 1,5 Sch 160 DN 40
Access opening	No
Material specification	SA-106 B Smls Pipe (II-D Metric p. 16, In. 16)
Inside diameter, new	33,99 mm
Pipe nominal wall thickness	7,14 mm
Pipe minimum wall thickness ¹	6,25 mm
Corrosion allowance	3 mm
Projection available outside vessel, L _{pr}	64,27 mm
Projection available outside vessel to flange face, L _f	140,47 mm
Local vessel minimum thickness	7,16 mm
Liquid static head included	0 bar

Welds

Inner fillet, Leg ₄₁	8 mm
Nozzle to vessel groove weld	8,18 mm

Radiography

Longitudinal seam	Seamless No RT
Circumferential seam	Full UW-11(a) Type 1

¹Pipe minimum thickness = nominal thickness times pipe tolerance factor of 0,875.

ASME B16.5-2017 Flange	
Description	NPS 1,5 Class 600 WN A105
Bolt Material	SA-193 B7 Bolt <= 64 (II-D Metric p. 410, In. 32)
Blind included	No
Rated MDMT	-48°C
Liquid static head	0 bar
MAWP rating	88,9 bar @ 175°C
MAP rating	102,1 bar @ 21,11°C
Hydrotest rating	154 bar @ 21,11°C
PWHT performed	No
Produced to Fine Grain Practice and Supplied in Heat Treated Condition	No
Impact Tested	No
Circumferential joint radiography	Full UW-11(a) Type 1
Bore diameter, B (specified by purchaser)	40,89 mm
Gasket	
Type	ASME B16.20 Spiral-Wound
Description	Garlock FLEXSEAL RW 316L SS / Flexible Graphite
Factor, m	3
Seating Stress, y	703,07 kg/cm ²
Thickness, T	3 mm
Inner Diameter	54,1 mm
Outer Diameter	69,9 mm
Notes	
Flange rated MDMT per UCS-66(b)(1)(b) = -48°C (Coincident ratio = 0,3786) Bolts rated MDMT per Fig UCS-66 note (c) = -48°C	

UCS-66 Material Toughness Requirements Nozzle	
$t_r = \frac{38,66 \cdot 19,99}{1,180 \cdot 1 - 0,6 \cdot 38,66} =$	0,67 mm
$\text{Stress ratio} = \frac{t_r \cdot E^*}{t_n - c} = \frac{0,67 \cdot 1}{6,25 - 3} =$	0,2059
Stress ratio ≤ 0,35, MDMT per UCS-66(b)(3) =	-105°C
Material is exempt from impact testing at the Design MDMT of 0°C.	

Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 30,5 bar @ 175 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							5,8	6,25

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (mm)	Actual weld throat size (mm)	Status
Nozzle to shell fillet (Leg ₄₁)	2,9	5,6	weld size is adequate

Calculations for internal pressure 30,5 bar @ 175 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [39,99, 19,99 + (7,14 - 3) + (7,16 - 3)] \\
 &= 39,99 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (7,16 - 3), 2,5 \cdot (7,14 - 3) + 0] \\
 &= 10,34 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{30,5001 \cdot 19,99}{1,180 \cdot 1 - 0,6 \cdot 30,5001} \\
 &= 0,53 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{30,5001 \cdot 109,54}{1,180 \cdot 1 + 0,4 \cdot 30,5001} \\
 &= 2,8 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$\begin{aligned}
t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
&= \frac{30,5001 \cdot 109,54}{1.180 \cdot 0,85 + 0,4 \cdot 30,5001} \\
&= 3,29 \text{ mm}
\end{aligned}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(c) Weld Check

Fillet weld: $t_{\min} = \min [19mm, t_n, t] = 4,14 \text{ mm}$

$$t_{c(\min)} = \min [6 \text{ mm}, 0,7 \cdot t_{\min}] = 2,9 \text{ mm}$$

$$t_{c(actual)} = 0,7 \cdot \text{Leg} = 0,7 \cdot 8 = 5,6 \text{ mm}$$

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-45 Nozzle Neck Thickness Check

$$\begin{aligned}
t_{aUG-27} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\
&= \frac{30,5001 \cdot 19,99}{1.180 \cdot 1 - 0,6 \cdot 30,5001} + 3 \\
&= 3,53 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_a &= \max [t_{aUG-27}, t_{aUG-22}] \\
&= \max [3,53, 0] \\
&= 3,53 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{b1} &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} + \text{Corrosion} \\
&= \frac{30,5001 \cdot 109,54}{1.180 \cdot 1 + 0,4 \cdot 30,5001} + 3 \\
&= 5,8 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{b1} &= \max [t_{b1}, t_{bUG16}] \\
&= \max [5,8, 4,5] \\
&= 5,8 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_b &= \min [t_{b3}, t_{b1}] \\
&= \min [6,22, 5,8] \\
&= 5,8 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{UG-45} &= \max [t_a, t_b] \\
&= \max [3,53, 5,8] \\
&= 5,8 \text{ mm}
\end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 7,14 = 6,25$ mm

The nozzle neck thickness is adequate.

Reinforcement Calculations for MAWP

The vessel wall thickness governs the MAWP of this nozzle.

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 45,48 bar @ 175 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							6,22	6,25

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (mm)	Actual weld throat size (mm)	Status
Nozzle to shell fillet (Leg ₄₁)	2,9	5,6	weld size is adequate

Calculations for internal pressure 45,48 bar @ 175 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [39,99, 19,99 + (7,14 - 3) + (7,16 - 3)] \\
 &= 39,99 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (7,16 - 3), 2,5 \cdot (7,14 - 3) + 0] \\
 &= 10,34 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{45,4848 \cdot 19,99}{1,180 \cdot 1 - 0,6 \cdot 45,4848} \\
 &= 0,79 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{45,4848 \cdot 109,54}{1,180 \cdot 1 + 0,4 \cdot 45,4848} \\
 &= 4,16 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$\begin{aligned}
t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
&= \frac{45,4848 \cdot 109,54}{1,180 \cdot 0,85 + 0,4 \cdot 45,4848} \\
&= 4,88 \text{ mm}
\end{aligned}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(c) Weld Check

Fillet weld: $t_{\min} = \min [19mm, t_n, t] = 4,14 \text{ mm}$

$t_{c(\min)} = \min [6 \text{ mm}, 0,7 \cdot t_{\min}] = 2,9 \text{ mm}$

$t_{c(actual)} = 0,7 \cdot \text{Leg} = 0,7 \cdot 8 = 5,6 \text{ mm}$

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-45 Nozzle Neck Thickness Check

$$\begin{aligned}
t_{aUG-27} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\
&= \frac{45,4848 \cdot 19,99}{1,180 \cdot 1 - 0,6 \cdot 45,4848} + 3 \\
&= 3,79 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_a &= \max [t_{aUG-27}, t_{aUG-22}] \\
&= \max [3,79, 0] \\
&= 3,79 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{b1} &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} + \text{Corrosion} \\
&= \frac{45,4848 \cdot 109,54}{1,180 \cdot 1 + 0,4 \cdot 45,4848} + 3 \\
&= 7,16 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{b1} &= \max [t_{b1}, t_{bUG16}] \\
&= \max [7,16, 4,5] \\
&= 7,16 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_b &= \min [t_{b3}, t_{b1}] \\
&= \min [6,22, 7,16] \\
&= 6,22 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{UG-45} &= \max [t_a, t_b] \\
&= \max [3,79, 6,22] \\
&= 6,22 \text{ mm}
\end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 7,14 = 6,25$ mm

The nozzle neck thickness is adequate.

Reinforcement Calculations for MAP

The vessel wall thickness governs the MAP of this nozzle.

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 79,18 bar @ 21,11 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							3,22	6,25

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

Calculations for internal pressure 79,18 bar @ 21,11 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [33,99, 16,99 + (7,14 - 0) + (7,16 - 0)] \\
 &= 33,99 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (7,16 - 0), 2,5 \cdot (7,14 - 0) + 0] \\
 &= 17,84 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{79,1796 \cdot 16,99}{1,180 \cdot 1 - 0,6 \cdot 79,1796} \\
 &= 1,19 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{79,1796 \cdot 109,54}{1,180 \cdot 1 + 0,4 \cdot 79,1796} \\
 &= 7,16 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{79,1796 \cdot 109,54}{1,180 \cdot 0,85 + 0,4 \cdot 79,1796} \\
 &= 8,38 \text{ mm}
 \end{aligned}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UG-45 Nozzle Neck Thickness Check

$$\begin{aligned}t_{aUG-27} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\&= \frac{79,1796 \cdot 16,99}{1,180 \cdot 1 - 0,6 \cdot 79,1796} + 0 \\&= 1,19 \text{ mm}\end{aligned}$$

$$\begin{aligned}t_a &= \max [t_{aUG-27}, t_{aUG-22}] \\&= \max [1,19, 0] \\&= 1,19 \text{ mm}\end{aligned}$$

$$\begin{aligned}t_{b1} &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} + \text{Corrosion} \\&= \frac{79,1796 \cdot 109,54}{1,180 \cdot 1 + 0,4 \cdot 79,1796} + 0 \\&= 7,16 \text{ mm}\end{aligned}$$

$$\begin{aligned}t_{b1} &= \max [t_{b1}, t_{bUG16}] \\&= \max [7,16, 1,5] \\&= 7,16 \text{ mm}\end{aligned}$$

$$\begin{aligned}t_b &= \min [t_{b3}, t_{b1}] \\&= \min [3,22, 7,16] \\&= 3,22 \text{ mm}\end{aligned}$$

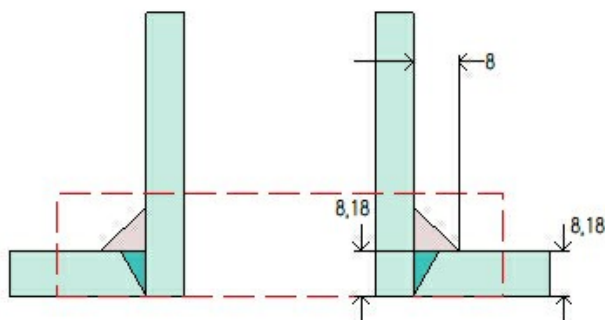
$$\begin{aligned}t_{UG-45} &= \max [t_a, t_b] \\&= \max [1,19, 3,22] \\&= \underline{3,22} \text{ mm}\end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 7,14 = 6,25 \text{ mm}$

The nozzle neck thickness is adequate.

Temperature Transmitter Connection (N4)

ASME Section VIII Division 1, 2021 Edition Metric



Note: round inside edges per UG-76(c)

Location and Orientation

Located on	Cylinder #1
Orientation	90°
Nozzle center line offset to datum line	125 mm
End of nozzle to shell center	250 mm
Passes through a Category A joint	No

Nozzle

Description	NPS 1,5 Sch 160 DN 40
Access opening	No
Material specification	SA-106 B Smls Pipe (II-D Metric p. 16, In. 16)
Inside diameter, new	33,99 mm
Pipe nominal wall thickness	7,14 mm
Pipe minimum wall thickness ¹	6,25 mm
Corrosion allowance	3 mm
Projection available outside vessel, Lpr	64,27 mm
Projection available outside vessel to flange face, Lf	140,47 mm
Local vessel minimum thickness	7,16 mm
Liquid static head included	0 bar

Welds

Inner fillet, Leg ₄₁	8 mm
Nozzle to vessel groove weld	8,18 mm

Radiography

Longitudinal seam	Seamless No RT
Circumferential seam	Full UW-11(a) Type 1

¹Pipe minimum thickness = nominal thickness times pipe tolerance factor of 0,875.

ASME B16.5-2017 Flange	
Description	NPS 1,5 Class 600 WN A105
Bolt Material	SA-193 B7 Bolt ≤ 64 (II-D Metric p. 410, In. 32)
Blind included	No
Rated MDMT	-48°C
Liquid static head	0 bar
MAWP rating	88,9 bar @ 175°C
MAP rating	102,1 bar @ 21,11°C
Hydrotest rating	154 bar @ 21,11°C
PWHT performed	No
Produced to Fine Grain Practice and Supplied in Heat Treated Condition	No
Impact Tested	No
Circumferential joint radiography	Full UW-11(a) Type 1
Bore diameter, B (specified by purchaser)	40,89 mm
Gasket	
Type	ASME B16.20 Spiral-Wound
Description	Garlock FLEXSEAL RW 316L SS / Flexible Graphite
Factor, m	3
Seating Stress, y	703,07 kgf/cm ²
Thickness, T	3 mm
Inner Diameter	54,1 mm
Outer Diameter	69,9 mm
Notes	
Flange rated MDMT per UCS-66(b)(1)(b) = -48°C (Coincident ratio = 0,3786) Bolts rated MDMT per Fig UCS-66 note (c) = -48°C	

UCS-66 Material Toughness Requirements Nozzle	
$t_r = \frac{38,66 \cdot 19,99}{1,180 \cdot 1 - 0,6 \cdot 38,66} =$	0,67 mm
$\text{Stress ratio} = \frac{t_r \cdot E^*}{t_n - c} = \frac{0,67 \cdot 1}{6,25 - 3} =$	0,2059
Stress ratio ≤ 0,35, MDMT per UCS-66(b)(3) =	-105°C
Material is exempt from impact testing at the Design MDMT of 0°C.	

Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 30,5 bar @ 175 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							5,8	6,25

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (mm)	Actual weld throat size (mm)	Status
Nozzle to shell fillet (Leg ₄₁)	2,9	5,6	weld size is adequate

Calculations for internal pressure 30,5 bar @ 175 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [39,99, 19,99 + (7,14 - 3) + (7,16 - 3)] \\
 &= 39,99 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (7,16 - 3), 2,5 \cdot (7,14 - 3) + 0] \\
 &= 10,34 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{30,5001 \cdot 19,99}{1,180 \cdot 1 - 0,6 \cdot 30,5001} \\
 &= 0,53 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{30,5001 \cdot 109,54}{1,180 \cdot 1 + 0,4 \cdot 30,5001} \\
 &= 2,8 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$\begin{aligned}
t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
&= \frac{30,5001 \cdot 109,54}{1.180 \cdot 0,85 + 0,4 \cdot 30,5001} \\
&= 3,29 \text{ mm}
\end{aligned}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(c) Weld Check

Fillet weld: $t_{\min} = \min [19mm, t_n, t] = 4,14 \text{ mm}$

$$t_{c(\min)} = \min [6 \text{ mm}, 0,7 \cdot t_{\min}] = 2,9 \text{ mm}$$

$$t_{c(actual)} = 0,7 \cdot \text{Leg} = 0,7 \cdot 8 = 5,6 \text{ mm}$$

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-45 Nozzle Neck Thickness Check

$$\begin{aligned}
t_{aUG-27} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\
&= \frac{30,5001 \cdot 19,99}{1.180 \cdot 1 - 0,6 \cdot 30,5001} + 3 \\
&= 3,53 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_a &= \max [t_{aUG-27}, t_{aUG-22}] \\
&= \max [3,53, 0] \\
&= 3,53 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{b1} &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} + \text{Corrosion} \\
&= \frac{30,5001 \cdot 109,54}{1.180 \cdot 1 + 0,4 \cdot 30,5001} + 3 \\
&= 5,8 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{b1} &= \max [t_{b1}, t_{bUG16}] \\
&= \max [5,8, 4,5] \\
&= 5,8 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_b &= \min [t_{b3}, t_{b1}] \\
&= \min [6,22, 5,8] \\
&= 5,8 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{UG-45} &= \max [t_a, t_b] \\
&= \max [3,53, 5,8] \\
&= 5,8 \text{ mm}
\end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 7,14 = 6,25 \text{ mm}$

The nozzle neck thickness is adequate.

Reinforcement Calculations for MAWP

The vessel wall thickness governs the MAWP of this nozzle.

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 45,48 bar @ 175 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							6,22	6,25

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (mm)	Actual weld throat size (mm)	Status
Nozzle to shell fillet (Leg ₄₁)	2,9	5,6	weld size is adequate

Calculations for internal pressure 45,48 bar @ 175 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [39,99, 19,99 + (7,14 - 3) + (7,16 - 3)] \\
 &= 39,99 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (7,16 - 3), 2,5 \cdot (7,14 - 3) + 0] \\
 &= 10,34 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{45,4848 \cdot 19,99}{1,180 \cdot 1 - 0,6 \cdot 45,4848} \\
 &= 0,79 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{45,4848 \cdot 109,54}{1,180 \cdot 1 + 0,4 \cdot 45,4848} \\
 &= 4,16 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$\begin{aligned}
t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
&= \frac{45,4848 \cdot 109,54}{1,180 \cdot 0,85 + 0,4 \cdot 45,4848} \\
&= 4,88 \text{ mm}
\end{aligned}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(c) Weld Check

Fillet weld: $t_{\min} = \min [19mm, t_n, t] = 4,14 \text{ mm}$

$t_{c(\min)} = \min [6 \text{ mm}, 0,7 \cdot t_{\min}] = 2,9 \text{ mm}$

$t_{c(actual)} = 0,7 \cdot \text{Leg} = 0,7 \cdot 8 = 5,6 \text{ mm}$

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-45 Nozzle Neck Thickness Check

$$\begin{aligned}
t_{aUG-27} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\
&= \frac{45,4848 \cdot 19,99}{1,180 \cdot 1 - 0,6 \cdot 45,4848} + 3 \\
&= 3,79 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_a &= \max [t_{aUG-27}, t_{aUG-22}] \\
&= \max [3,79, 0] \\
&= 3,79 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{b1} &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} + \text{Corrosion} \\
&= \frac{45,4848 \cdot 109,54}{1,180 \cdot 1 + 0,4 \cdot 45,4848} + 3 \\
&= 7,16 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{b1} &= \max [t_{b1}, t_{bUG16}] \\
&= \max [7,16, 4,5] \\
&= 7,16 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_b &= \min [t_{b3}, t_{b1}] \\
&= \min [6,22, 7,16] \\
&= 6,22 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{UG-45} &= \max [t_a, t_b] \\
&= \max [3,79, 6,22] \\
&= 6,22 \text{ mm}
\end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 7,14 = 6,25$ mm

The nozzle neck thickness is adequate.

Reinforcement Calculations for MAP

The vessel wall thickness governs the MAP of this nozzle.

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 79,18 bar @ 21,11 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							3,22	6,25

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

Calculations for internal pressure 79,18 bar @ 21,11 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [33,99, 16,99 + (7,14 - 0) + (7,16 - 0)] \\
 &= 33,99 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (7,16 - 0), 2,5 \cdot (7,14 - 0) + 0] \\
 &= 17,84 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{79,1796 \cdot 16,99}{1,180 \cdot 1 - 0,6 \cdot 79,1796} \\
 &= 1,19 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{79,1796 \cdot 109,54}{1,180 \cdot 1 + 0,4 \cdot 79,1796} \\
 &= 7,16 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{79,1796 \cdot 109,54}{1,180 \cdot 0,85 + 0,4 \cdot 79,1796} \\
 &= 8,38 \text{ mm}
 \end{aligned}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UG-45 Nozzle Neck Thickness Check

$$\begin{aligned}t_{aUG-27} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\&= \frac{79,1796 \cdot 16,99}{1,180 \cdot 1 - 0,6 \cdot 79,1796} + 0 \\&= 1,19 \text{ mm}\end{aligned}$$

$$\begin{aligned}t_a &= \max [t_{aUG-27}, t_{aUG-22}] \\&= \max [1,19, 0] \\&= 1,19 \text{ mm}\end{aligned}$$

$$\begin{aligned}t_{b1} &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} + \text{Corrosion} \\&= \frac{79,1796 \cdot 109,54}{1,180 \cdot 1 + 0,4 \cdot 79,1796} + 0 \\&= 7,16 \text{ mm}\end{aligned}$$

$$\begin{aligned}t_{b1} &= \max [t_{b1}, t_{bUG16}] \\&= \max [7,16, 1,5] \\&= 7,16 \text{ mm}\end{aligned}$$

$$\begin{aligned}t_b &= \min [t_{b3}, t_{b1}] \\&= \min [3,22, 7,16] \\&= 3,22 \text{ mm}\end{aligned}$$

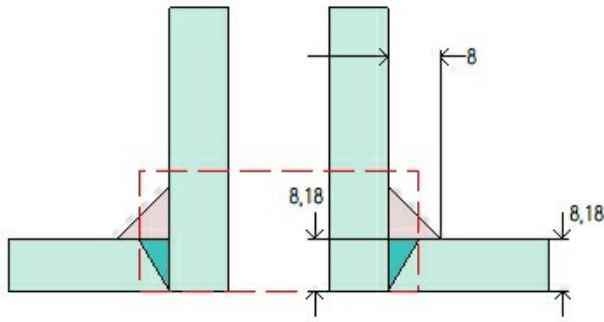
$$\begin{aligned}t_{UG-45} &= \max [t_a, t_b] \\&= \max [1,19, 3,22] \\&= \underline{3,22} \text{ mm}\end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 7,14 = 6,25 \text{ mm}$

The nozzle neck thickness is adequate.

PSV Connection (N5)

ASME Section VIII Division 1, 2021 Edition Metric



Note: round inside edges per UG-76(c)

Location and Orientation

Located on	Cylinder #1
Orientation	0°
Nozzle center line offset to datum line	725 mm
End of nozzle to shell center	250 mm
Passes through a Category A joint	No

Nozzle

Description	NPS 1 XXS DN 25
Access opening	No
Material specification	SA-106 B Smls Pipe (II-D Metric p. 16, In. 16)
Inside diameter, new	15,21 mm
Pipe nominal wall thickness	9,09 mm
Pipe minimum wall thickness ¹	7,96 mm
Corrosion allowance	3 mm
Projection available outside vessel, L _{pr}	72,14 mm
Projection available outside vessel to flange face, L _f	140,47 mm
Local vessel minimum thickness	7,16 mm
Liquid static head included	0 bar

Welds

Inner fillet, Leg ₄₁	8 mm
Nozzle to vessel groove weld	8,18 mm

Radiography

Longitudinal seam	Seamless No RT
Circumferential seam	Full UW-11(a) Type 1

¹Pipe minimum thickness = nominal thickness times pipe tolerance factor of 0,875.

ASME B16.5-2017 Flange	
Description	NPS 1 Class 600 WN A105
Bolt Material	SA-193 B7 Bolt <= 64 (II-D Metric p. 410, In. 32)
Blind included	No
Rated MDMT	-48°C
Liquid static head	0 bar
MAWP rating	88,9 bar @ 175°C
MAP rating	102,1 bar @ 21,11°C
Hydrotest rating	154 bar @ 21,11°C
PWHT performed	No
Produced to Fine Grain Practice and Supplied in Heat Treated Condition	No
Impact Tested	No
Circumferential joint radiography	Full UW-11(a) Type 1
Bore diameter, B (specified by purchaser)	26,67 mm
Gasket	
Type	ASME B16.20 Spiral-Wound
Description	Garlock FLEXSEAL RW 316L SS / Flexible Graphite
Factor, m	3
Seating Stress, y	703,07 kg/cm ²
Thickness, T	3 mm
Inner Diameter	31,8 mm
Outer Diameter	47,8 mm
Notes	
Flange rated MDMT per UCS-66(b)(1)(b) = -48°C (Coincident ratio = 0,3786) Bolts rated MDMT per Fig UCS-66 note (c) = -48°C	

UCS-66 Material Toughness Requirements Nozzle At Intersection	
Governing thickness, $t_g =$	7,16 mm
Exemption temperature from Fig UCS-66M Curve B =	-29°C
$t_r = \frac{38,66 \cdot 109,54}{1.180 \cdot 1 + 0,4 \cdot 38,66} =$	3,54 mm
Stress ratio $= \frac{t_r \cdot E^*}{t_n - c} = \frac{3,54 \cdot 1}{7,16 - 3} =$	0,8519
Reduction in MDMT, T_R from Fig UCS-66.1M =	8,3°C
$MDMT = \max [MDMT - T_R, -48] = \max [-29 - 8,3, -48] =$	-37,3°C
Material is exempt from impact testing at the Design MDMT of 0°C.	

UCS-66 Material Toughness Requirements Nozzle	
Impact test exempt per UCS-66(d) (NPS 4 or smaller pipe) =	-105°C
Material is exempt from impact testing at the Design MDMT of 0°C.	

Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 30,5 bar @ 175 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							5,8	7,96

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (mm)	Actual weld throat size (mm)	Status
Nozzle to shell fillet (Leg ₄₁)	2,91	5,6	weld size is adequate

Calculations for internal pressure 30,5 bar @ 175 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [21,21, 10,61 + (9,09 - 3) + (7,16 - 3)] \\
 &= 21,21 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (7,16 - 3), 2,5 \cdot (9,09 - 3) + 0] \\
 &= 10,4 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{30,5001 \cdot 10,61}{1,180 \cdot 1 - 0,6 \cdot 30,5001} \\
 &= 0,28 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{30,5001 \cdot 109,54}{1,180 \cdot 1 + 0,4 \cdot 30,5001} \\
 &= 2,8 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$\begin{aligned}
t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
&= \frac{30,5001 \cdot 109,54}{1.180 \cdot 0,85 + 0,4 \cdot 30,5001} \\
&= 3,29 \text{ mm}
\end{aligned}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(c) Weld Check

Fillet weld: $t_{\min} = \min [19mm, t_n, t] = 4,16 \text{ mm}$

$t_{c(\min)} = \min [6 \text{ mm}, 0,7 \cdot t_{\min}] = 2,91 \text{ mm}$

$t_{c(actual)} = 0,7 \cdot \text{Leg} = 0,7 \cdot 8 = 5,6 \text{ mm}$

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-45 Nozzle Neck Thickness Check

$$\begin{aligned}
t_{aUG-27} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\
&= \frac{30,5001 \cdot 10,61}{1.180 \cdot 1 - 0,6 \cdot 30,5001} + 3 \\
&= 3,28 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_a &= \max [t_{aUG-27}, t_{aUG-22}] \\
&= \max [3,28, 0] \\
&= 3,28 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{b1} &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} + \text{Corrosion} \\
&= \frac{30,5001 \cdot 109,54}{1.180 \cdot 1 + 0,4 \cdot 30,5001} + 3 \\
&= 5,8 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{b1} &= \max [t_{b1}, t_{bUG16}] \\
&= \max [5,8, 4,5] \\
&= 5,8 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_b &= \min [t_{b3}, t_{b1}] \\
&= \min [5,96, 5,8] \\
&= 5,8 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{UG-45} &= \max [t_a, t_b] \\
&= \max [3,28, 5,8] \\
&= 5,8 \text{ mm}
\end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 9,09 = 7,96 \text{ mm}$

The nozzle neck thickness is adequate.

Reinforcement Calculations for MAWP

The vessel wall thickness governs the MAWP of this nozzle.

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 45,48 bar @ 175 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							5,96	7,96

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (mm)	Actual weld throat size (mm)	Status
Nozzle to shell fillet (Leg ₄₁)	2,91	5,6	weld size is adequate

Calculations for internal pressure 45,48 bar @ 175 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [21,21, 10,61 + (9,09 - 3) + (7,16 - 3)] \\
 &= 21,21 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (7,16 - 3), 2,5 \cdot (9,09 - 3) + 0] \\
 &= 10,4 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{45,4848 \cdot 10,61}{1.180 \cdot 1 - 0,6 \cdot 45,4848} \\
 &= 0,42 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{45,4848 \cdot 109,54}{1.180 \cdot 1 + 0,4 \cdot 45,4848} \\
 &= 4,16 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$\begin{aligned}
t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
&= \frac{45,4848 \cdot 109,54}{1.180 \cdot 0,85 + 0,4 \cdot 45,4848} \\
&= 4,88 \text{ mm}
\end{aligned}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(c) Weld Check

Fillet weld: $t_{\min} = \min [19mm, t_n, t] = 4,16 \text{ mm}$

$$t_{c(\min)} = \min [6 \text{ mm}, 0,7 \cdot t_{\min}] = 2,91 \text{ mm}$$

$$t_{c(actual)} = 0,7 \cdot \text{Leg} = 0,7 \cdot 8 = 5,6 \text{ mm}$$

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-45 Nozzle Neck Thickness Check

$$\begin{aligned}
t_{aUG-27} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\
&= \frac{45,4848 \cdot 10,61}{1.180 \cdot 1 - 0,6 \cdot 45,4848} + 3 \\
&= 3,42 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_a &= \max [t_{aUG-27}, t_{aUG-22}] \\
&= \max [3,42, 0] \\
&= 3,42 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{b1} &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} + \text{Corrosion} \\
&= \frac{45,4848 \cdot 109,54}{1.180 \cdot 1 + 0,4 \cdot 45,4848} + 3 \\
&= 7,16 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{b1} &= \max [t_{b1}, t_{bUG16}] \\
&= \max [7,16, 4,5] \\
&= 7,16 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_b &= \min [t_{b3}, t_{b1}] \\
&= \min [5,96, 7,16] \\
&= 5,96 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{UG-45} &= \max [t_a, t_b] \\
&= \max [3,42, 5,96] \\
&= 5,96 \text{ mm}
\end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 9,09 = 7,96 \text{ mm}$

The nozzle neck thickness is adequate.

Reinforcement Calculations for MAP

The vessel wall thickness governs the MAP of this nozzle.

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 79,18 bar @ 21,11 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							2,96	7,96

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

Calculations for internal pressure 79,18 bar @ 21,11 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [15,21, 7,61 + (9,09 - 0) + (7,16 - 0)] \\
 &= 23,86 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (7,16 - 0), 2,5 \cdot (9,09 - 0) + 0] \\
 &= 17,89 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{79,1796 \cdot 7,61}{1,180 \cdot 1 - 0,6 \cdot 79,1796} \\
 &= 0,53 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{79,1796 \cdot 109,54}{1,180 \cdot 1 + 0,4 \cdot 79,1796} \\
 &= 7,16 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{79,1796 \cdot 109,54}{1,180 \cdot 0,85 + 0,4 \cdot 79,1796} \\
 &= 8,38 \text{ mm}
 \end{aligned}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UG-45 Nozzle Neck Thickness Check

$$\begin{aligned}t_{aUG-27} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\&= \frac{79,1796 \cdot 7,61}{1.180 \cdot 1 - 0,6 \cdot 79,1796} + 0 \\&= 0,53 \text{ mm}\end{aligned}$$

$$\begin{aligned}t_a &= \max [t_{aUG-27}, t_{aUG-22}] \\&= \max [0,53, 0] \\&= 0,53 \text{ mm}\end{aligned}$$

$$\begin{aligned}t_{b1} &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} + \text{Corrosion} \\&= \frac{79,1796 \cdot 109,54}{1.180 \cdot 1 + 0,4 \cdot 79,1796} + 0 \\&= 7,16 \text{ mm}\end{aligned}$$

$$\begin{aligned}t_{b1} &= \max [t_{b1}, t_{bUG16}] \\&= \max [7,16, 1,5] \\&= 7,16 \text{ mm}\end{aligned}$$

$$\begin{aligned}t_b &= \min [t_{b3}, t_{b1}] \\&= \min [2,96, 7,16] \\&= 2,96 \text{ mm}\end{aligned}$$

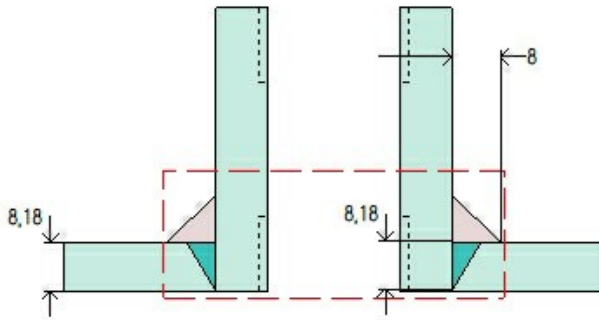
$$\begin{aligned}t_{UG-45} &= \max [t_a, t_b] \\&= \max [0,53, 2,96] \\&= \underline{2,96} \text{ mm}\end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 9,09 = 7,96 \text{ mm}$

The nozzle neck thickness is adequate.

Drain (N6)

ASME Section VIII Division 1, 2021 Edition Metric



Note: round inside edges per UG-76(c)

Location and Orientation

Located on	Cylinder #1
Orientation	180°
Nozzle center line offset to datum line	420 mm
End of nozzle to shell center	147,3 mm
Passes through a Category A joint	No
Nozzle	
Description	NPS 0,5 Class 6000 DN 15 - Threaded Full Coupling
Access opening	No
Material specification	SA-105 (II-D Metric p. 20, In. 31)
Inside diameter, new	21,34 mm
Nominal wall thickness	8,38 mm
Corrosion allowance	3 mm
Projection available outside vessel, L _{pr}	37,77 mm
Local vessel minimum thickness	7,16 mm
Liquid static head included	0 bar
Welds	
Inner fillet, Leg ₄₁	8 mm
Nozzle to vessel groove weld	8,18 mm
Radiography	
Longitudinal seam	Seamless No RT

UCS-66 Material Toughness Requirements Nozzle At Intersection

Governing thickness, t_g =	7,16 mm
Exemption temperature from Fig UCS-66M Curve B =	-29°C
$t_r = \frac{38,66 \cdot 109,54}{1.180 \cdot 1 + 0,4 \cdot 38,66} =$	3,54 mm
$\text{Stress ratio} = \frac{t_r \cdot E^*}{t_n - c} = \frac{3,54 \cdot 1}{7,16 - 3} =$	0,8519
Reduction in MDMT, T_R from Fig UCS-66.1M =	8,3°C
$MDMT = \max [MDMT - T_R, -48] = \max [-29 - 8,3, -48] =$	-37,3°C
Material is exempt from impact testing at the Design MDMT of 0°C.	

UCS-66 Material Toughness Requirements Nozzle	
$t_r = \frac{38,66 \cdot 13,67}{1.380 \cdot 1 - 0,6 \cdot 38,66} =$	0,39 mm
Stress ratio $= \frac{t_r \cdot E^*}{t_n - c} = \frac{0,39 \cdot 1}{8,38 - 3} =$	0,0724
Stress ratio $\leq 0,35$, MDMT per UCS-66(b)(3) =	-105°C
Material is exempt from impact testing at the Design MDMT of 0°C.	

Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (cm ²)							UG-44 Summary (mm)	
For P = 30,5 bar @ 175 °C							The nozzle passes UG-44	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							4,5	8,38

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (mm)	Actual weld throat size (mm)	Status
Nozzle to shell fillet (Leg ₄₁)	2,5	5,6	weld size is adequate

Calculations for internal pressure 30,5 bar @ 175 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [27,34, 13,67 + (8,38 - 3) + (7,16 - 3)] \\
 &= 27,34 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (7,16 - 3), 2,5 \cdot (8,38 - 3) + 0] \\
 &= 10,4 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{30,5001 \cdot 13,67}{1,380 \cdot 1 - 0,6 \cdot 30,5001} \\
 &= 0,31 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{30,5001 \cdot 109,54}{1,180 \cdot 1 + 0,4 \cdot 30,5001} \\
 &= 2,8 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{30,5001 \cdot 109,54}{1,180 \cdot 0,85 + 0,4 \cdot 30,5001} \\
 &= 3,29 \text{ mm}
 \end{aligned}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(f)(2)(b) Weld Check

Fillet weld: $t_{\min} = \min [19mm, t_n, t] = 4,16 \text{ mm}$

$t_{c(\min)} = \min [2,5 \text{ mm}, 0,7 \cdot t_{\min}] = 2,5 \text{ mm}$

$t_{c(actual)} = 0,7 \cdot \text{Leg} = 0,7 \cdot 8 = 5,6 \text{ mm}$

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-44 Thickness Check - ASME B16.11 Coupling

$$\begin{aligned}
 t_{aApp \text{ 1-1}} &= \frac{P \cdot R_o}{S_n \cdot E + 0,4 \cdot P} + \text{Corrosion} \\
 &= \frac{30,5001 \cdot 19,05}{1,380 \cdot 1 + 0,4 \cdot 30,5001} + 3 \\
 &= 3,42 \text{ mm}
 \end{aligned}$$

$$\begin{aligned}
 t_{aUG-44} &= \max [t_{aApp \text{ 1-1}}, t_{bUG16}] \\
 &= \max [3,42, 4,5] \\
 &= 4,5 \text{ mm}
 \end{aligned}$$

Available nozzle wall thickness new, $t_n = 8,38 \text{ mm}$

The nozzle neck thickness is adequate.

Reinforcement Calculations for MAWP

The vessel wall thickness governs the MAWP of this nozzle.

UG-37 Area Calculation Summary (cm ²)							UG-44 Summary (mm)	
For P = 45,48 bar @ 175 °C							The nozzle passes UG-44	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							4,5	8,38

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (mm)	Actual weld throat size (mm)	Status
Nozzle to shell fillet (Leg ₄₁)	2,5	5,6	weld size is adequate

Calculations for internal pressure 45,48 bar @ 175 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [27,34, 13,67 + (8,38 - 3) + (7,16 - 3)] \\
 &= 27,34 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (7,16 - 3), 2,5 \cdot (8,38 - 3) + 0] \\
 &= 10,4 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{45,4848 \cdot 13,67}{1.380 \cdot 1 - 0,6 \cdot 45,4848} \\
 &= 0,46 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{45,4848 \cdot 109,54}{1.180 \cdot 1 + 0,4 \cdot 45,4848} \\
 &= 4,16 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{45,4848 \cdot 109,54}{1.180 \cdot 0,85 + 0,4 \cdot 45,4848} \\
 &= 4,88 \text{ mm}
 \end{aligned}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(f)(2)(b) Weld Check

Fillet weld: $t_{\min} = \min [19mm, t_n, t] = 4,16 \text{ mm}$

$$t_{c(\min)} = \min [2,5 \text{ mm}, 0,7 \cdot t_{\min}] = 2,5 \text{ mm}$$

$$t_{c(actual)} = 0,7 \cdot \text{Leg} = 0,7 \cdot 8 = 5,6 \text{ mm}$$

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-44 Thickness Check - ASME B16.11 Coupling

$$\begin{aligned}
 t_{aApp \text{ 1-1}} &= \frac{P \cdot R_o}{S_n \cdot E + 0,4 \cdot P} + \text{Corrosion} \\
 &= \frac{45,4848 \cdot 19,05}{1.380 \cdot 1 + 0,4 \cdot 45,4848} + 3 \\
 &= 3,62 \text{ mm}
 \end{aligned}$$

$$\begin{aligned}
 t_{aUG-44} &= \max [t_{aApp \text{ 1-1}}, t_{bUG16}] \\
 &= \max [3,62, 4,5] \\
 &= 4,5 \text{ mm}
 \end{aligned}$$

Available nozzle wall thickness new, $t_n = 8,38 \text{ mm}$

The nozzle neck thickness is adequate.

Reinforcement Calculations for MAP

The vessel wall thickness governs the MAP of this nozzle.

UG-37 Area Calculation Summary (cm ²)							UG-44 Summary (mm)	
For P = 79,18 bar @ 21,11 °C							The nozzle passes UG-44	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							1,5	8,38

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

Calculations for internal pressure 79,18 bar @ 21,11 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [21,34, 10,67 + (8,38 - 0) + (7,16 - 0)] \\
 &= 26,21 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (7,16 - 0), 2,5 \cdot (8,38 - 0) + 0] \\
 &= 17,89 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{79,1796 \cdot 10,67}{1,380 \cdot 1 - 0,6 \cdot 79,1796} \\
 &= 0,64 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{79,1796 \cdot 109,54}{1,180 \cdot 1 + 0,4 \cdot 79,1796} \\
 &= 7,16 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{79,1796 \cdot 109,54}{1,180 \cdot 0,85 + 0,4 \cdot 79,1796} \\
 &= 8,38 \text{ mm}
 \end{aligned}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UG-44 Thickness Check - ASME B16.11 Coupling

$$\begin{aligned}t_{aApp\ 1-1} &= \frac{P \cdot R_o}{S_n \cdot E + 0,4 \cdot P} + \text{Corrosion} \\&= \frac{79,1796 \cdot 19,05}{1,380 \cdot 1 + 0,4 \cdot 79,1796} + 0 \\&= 1,07 \text{ mm}\end{aligned}$$

$$\begin{aligned}t_{aUG-44} &= \max [t_{aApp\ 1-1}, t_{bUG16}] \\&= \max [1,07, 1,5] \\&= \underline{1,5} \text{ mm}\end{aligned}$$

Available nozzle wall thickness new, $t_n = 8,38 \text{ mm}$

The nozzle neck thickness is adequate.

Straight Flange on B16.9 Pipe Cap - Right Side

ASME Section VIII Division 1, 2021 Edition Metric				
Component		Cylinder		
Material		SA-234 WPB (II-D Metric p. 16, ln. 18)		
Impact Tested	Normalized	Fine Grain Practice	PWHT	Maximize MDMT/ No MAWP
No	No	No	No	No
		Design Pressure (bar)	Design Temperature (°C)	Design MDMT (°C)
Internal		30,5	175	0
Static Liquid Head				
Condition		P _s (bar)	H _s (mm)	SG
Test horizontal		0,03	351,36	1
Dimensions				
Outer Diameter		219,07 mm		
Length		44,17 mm		
Nominal Thickness		8,18 mm		
Corrosion	Inner	3 mm		
	Outer	0 mm		
Weight and Capacity				
		Weight (kg)		Capacity (liters)
New		1,87		1,43
Corroded		1,2		1,51
Radiography				
Longitudinal seam		Seamless No RT		
Left Circumferential seam		Spot UW-11(b) Type 1		

Results Summary	
Governing condition	Internal pressure
Minimum thickness per UG-16	1,5 mm + 3 mm = 4,5 mm
Design thickness due to internal pressure (t)	6,29 mm
Maximum allowable working pressure (MAWP)	48,35 bar
Maximum allowable pressure (MAP)	77,21 bar
Rated MDMT	-46,8 °C

UCS-66 Material Toughness Requirements	
Governing thickness, t _g =	7,16 mm
Exemption temperature from Fig UCS-66M Curve B =	-29°C
$t_r = \frac{38,66 \cdot 109,54}{1.180 \cdot 0,85 + 0,4 \cdot 38,66} =$	4,16 mm
$\text{Stress ratio} = \frac{t_r \cdot E^*}{t_n - c} = \frac{4,16 \cdot 0,85}{8,18 - 3} =$	0,6822
Reduction in MDMT, T _R from Fig UCS-66.1M =	17,8°C
$MDMT = \max [MDMT - T_R, -48] = \max [-29 - 17,8, -48] =$	-46,8°C
Material is exempt from impact testing at the Design MDMT of 0°C.	

Design thickness, (at 175 °C) Appendix 1-1

$$t = \frac{P \cdot R_o}{S \cdot E + 0,40 \cdot P} + \text{Corrosion} = \frac{30,5 \cdot 109,54}{1.180 \cdot 0,85 + 0,40 \cdot 30,5} + 3 = \underline{6,29} \text{ mm}$$

Maximum allowable working pressure, (at 175 °C) Appendix 1-1

$$P = \frac{S \cdot E \cdot t}{R_o - 0,40 \cdot t} - P_s = \frac{1.180 \cdot 0,85 \cdot 5,18}{109,54 - 0,40 \cdot 5,18} - 0 = \underline{48,35} \text{ bar}$$

Maximum allowable pressure, (at 21,11 °C) Appendix 1-1

$$P = \frac{S \cdot E \cdot t}{R_o - 0,40 \cdot t} = \frac{1.180 \cdot 0,85 \cdot 8,18}{109,54 - 0,40 \cdot 8,18} = \underline{77,21} \text{ bar}$$

ASME Section VIII Division 1 UG-80(a) Out-of-Roundness
$(D_{\max} - D_{\min})$ shall not exceed 1% of D
When the cross section passes through an opening or within 1 I.D. of the opening, $(D_{\max} - D_{\min})$ shall not exceed 1% of $D + 2\%$ of the inside diameter of the opening

B16.9 Pipe Cap - Right Side

ASME Section VIII Division 1, 2021 Edition Metric				
Component		ASME B16.9 Pipe Cap (modified)		
Material		SA-234 WPB (II-D Metric p. 16, ln. 18)		
Attached To		Cylinder #1		
Impact Tested	Normalized	Fine Grain Practice	PWHT	Maximize MDMT/ No MAWP
No	No	No	No	No
		Design Pressure (bar)	Design Temperature (°C)	Design MDMT (°C)
Internal		30,5	175	0
Static Liquid Head				
Condition		P _s (bar)	H _s (mm)	SG
Test horizontal		0,03	351,36	1
Dimensions				
NPS and Schedule		NPS 8 Sch 40 (Std) DN 200		
Outer Diameter		219,07 mm		
Overall Length E		102 mm		
Nominal Thickness		8,18 mm		
Minimum Thickness ¹		7,16 mm		
Corrosion	Inner	3 mm		
	Outer	0 mm		
Length L _{sf}		44,17 mm		
Nominal Thickness t _{sf}		8,18 mm		
Weight and Capacity				
		Weight (kg) ²		Capacity (liters) ²
New		5,19		2,52
Corroded		3,38		2,74
Radiography				
Category A joints		Seamless No RT		
Head to shell seam		Spot UW-11(b) Type 1		

¹ minimum thickness = nominal thickness times pipe tolerance factor of 0,875.

² includes straight flange

Results Summary	
Governing condition	internal pressure
Minimum thickness per UG-16	1,5 mm + 3 mm = 4,5 mm
Design thickness due to internal pressure (t)	6,13 mm
Governing straight flange design thickness	6,29 mm
Maximum allowable working pressure (MAWP)	40,92 bar
Maximum allowable pressure (MAP)	69,64 bar
Straight Flange governs MDMT	-46,8°C

Factor K		
$K = \left(\frac{1}{6}\right) \cdot \left[2 + \left(\frac{D}{2 \cdot h}\right)^2\right]$		
Corroded	$K = \left(\frac{1}{6}\right) \cdot \left[2 + \left(\frac{208,71}{2 \cdot 53,68}\right)^2\right]$	0,9633
New	$K = \left(\frac{1}{6}\right) \cdot \left[2 + \left(\frac{202,71}{2 \cdot 50,68}\right)^2\right]$	1

Design thickness for internal pressure, (Corroded at 175 °C) Appendix 1-4(c)

$$t = \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} + \text{Corrosion} = \frac{30,5 \cdot 219,07 \cdot 0,963264}{2 \cdot 1.180 \cdot 0,85 + 2 \cdot 30,5 \cdot (0,963264 - 0,1)} + 3 = \underline{6.13} \text{ mm}$$

Maximum allowable working pressure, (Corroded at 175 °C) Appendix 1-4(c)

$$P = \frac{2 \cdot S \cdot E \cdot t}{K \cdot D_o - 2 \cdot t \cdot (K - 0,1)} - P_s = \frac{2 \cdot 1.180 \cdot 0,85 \cdot (0,875 \cdot 8,18 - 3)}{0,963264 \cdot 219,07 - 2 \cdot (0,875 \cdot 8,18 - 3) \cdot (0,963264 - 0,1)} - 0 = \underline{40.92} \text{ bar}$$

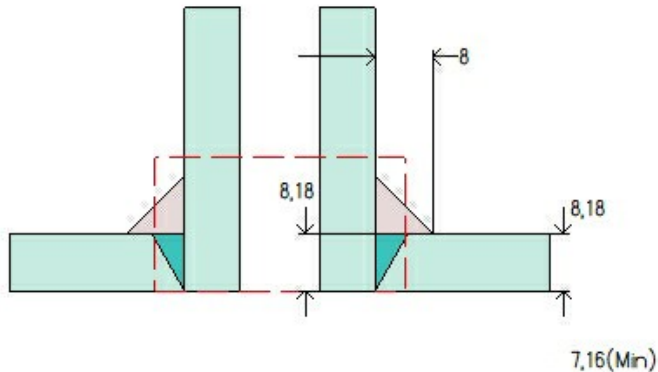
Maximum allowable pressure, (New at 21,11 °C) Appendix 1-4(c)

$$P = \frac{2 \cdot S \cdot E \cdot t}{K \cdot D_o - 2 \cdot t \cdot (K - 0,1)} - P_s = \frac{2 \cdot 1.180 \cdot 0,85 \cdot 0,875 \cdot 8,18}{1 \cdot 219,07 - 2 \cdot 0,875 \cdot 8,18 \cdot (1 - 0,1)} - 0 = \underline{69.64} \text{ bar}$$

ASME Section VIII Division 1 UG-81(a) Out-of-Roundness
Inside surface shall not deviate outside the shape by more than 1,25 % of D
Inside surface shall not deviate inside the shape by more than 0,625 % of D

Air Outlet (N2)

ASME Section VIII Division 1, 2021 Edition Metric



Note: round inside edges per UG-76(c)

Location and Orientation

Located on	B16.9 Pipe Cap - Right Side
Orientation	0°
End of nozzle to datum line	-230 mm
Calculated as hillside	No
Distance to head center, R	0 mm
Passes through a Category A joint	No

Nozzle

Description	NPS 0,75 XXS DN 20
Access opening	No
Material specification	SA-106 B Smls Pipe (II-D Metric p. 16, In. 16)
Inside diameter, new	11,02 mm
Pipe nominal wall thickness	7,82 mm
Pipe minimum wall thickness ¹	6,85 mm
Corrosion allowance	3 mm
Projection available outside vessel, L _{pr}	64,93 mm
Projection available outside vessel to flange face, L _f	128,43 mm
Local vessel minimum thickness	7,16 mm
Liquid static head included	0 bar

Welds

Inner fillet, Leg ₄₁	8 mm
Nozzle to vessel groove weld	8,18 mm

Radiography

Longitudinal seam	Seamless No RT
Circumferential seam	Full UW-11(a) Type 1

¹Pipe minimum thickness = nominal thickness times pipe tolerance factor of 0,875.

ASME B16.5-2017 Flange	
Description	NPS 0,75 Class 600 WN A105
Bolt Material	SA-193 B7 Bolt ≤ 64 (II-D Metric p. 410, In. 32)
Blind included	No
Rated MDMT	-48°C
Liquid static head	0 bar
MAWP rating	88,9 bar @ 175°C
MAP rating	102,1 bar @ 21,11°C
Hydrotest rating	154 bar @ 21,11°C
PWHT performed	No
Produced to Fine Grain Practice and Supplied in Heat Treated Condition	No
Impact Tested	No
Circumferential joint radiography	Full UW-11(a) Type 1
Bore diameter, B (specified by purchaser)	11,02 mm
Gasket	
Type	ASME B16.20 Spiral-Wound
Description	Garlock FLEXSEAL RW 316L SS / Flexible Graphite
Factor, m	3
Seating Stress, y	703,07 kg/cm ²
Thickness, T	3 mm
Inner Diameter	25,4 mm
Outer Diameter	39,6 mm
Notes	
Flange rated MDMT per UCS-66(b)(1)(b) = -48°C (Coincident ratio = 0,3786) Bolts rated MDMT per Fig UCS-66 note (c) = -48°C	

UCS-66 Material Toughness Requirements Nozzle	
$t_r = \frac{38,66-8,51}{1.180 \cdot 1 - 0,6 \cdot 38,66} =$	0,28 mm
$\text{Stress ratio} = \frac{t_r \cdot E^*}{t_n - c} = \frac{0,28 \cdot 1}{6,85-3} =$	0,074
Stress ratio ≤ 0,35, MDMT per UCS-66(b)(3) =	-105°C
Material is exempt from impact testing at the Design MDMT of 0°C.	

Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 30,5 bar @ 175 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							5,51	6,85

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (mm)	Actual weld throat size (mm)	Status
Nozzle to shell fillet (Leg ₄₁)	3,38	5,6	weld size is adequate

Calculations for internal pressure 30,5 bar @ 175 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [17,02, 8,51 + (7,82 - 3) + (7,16 - 3)] \\
 &= 17,49 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (7,16 - 3), 2,5 \cdot (7,82 - 3) + 0] \\
 &= 10,39 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{30,5001 \cdot 8,51}{1,180 \cdot 1 - 0,6 \cdot 30,5001} \\
 &= 0,22 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)(c)

$$\begin{aligned}
 t_r &= \frac{P \cdot K_1 \cdot D_o}{2 \cdot S \cdot E + 0,8 \cdot P} \\
 &= \frac{30,5001 \cdot 0,8749 \cdot 219,07}{2 \cdot 1,180 \cdot 1 + 0,8 \cdot 30,5001} \\
 &= 2,45 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$t_r = \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} = \frac{30,5 \cdot 219,07 \cdot 0,963264}{2 \cdot 1,180 \cdot 0,85 + 2 \cdot 30,5 \cdot (0,963264 - 0,1)} = 3,13 \text{ mm}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(c) Weld Check

Fillet weld: $t_{\min} = \min [19\text{ mm}, t_n, t] = 4,82 \text{ mm}$

$$t_{c(\min)} = \min [6 \text{ mm}, 0,7 \cdot t_{\min}] = \underline{3,38} \text{ mm}$$

$$t_{c(\text{actual})} = 0,7 \cdot \text{Leg} = 0,7 \cdot 8 = 5,6 \text{ mm}$$

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-45 Nozzle Neck Thickness Check

Interpretation VIII-1-83-66 has been applied.

$$\begin{aligned} t_{a\text{UG-27}} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\ &= \frac{30,5001 \cdot 8,51}{1.180 \cdot 1 - 0,6 \cdot 30,5001} + 3 \\ &= 3,22 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_a &= \max [t_{a\text{UG-27}}, t_{a\text{UG-22}}] \\ &= \max [3,22, 0] \\ &= 3,22 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{b1} &= \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} + \text{Corrosion} \\ &= \frac{30,5 \cdot 219,07 \cdot 0,963264}{2 \cdot 1.180 \cdot 1 + 2 \cdot 30,5 \cdot (0,963264 - 0,1)} + 3 \\ &= 5,67 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{b1} &= \max [t_{b1}, t_{b\text{UG16}}] \\ &= \max [5,67, 4,5] \\ &= 5,67 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_b &= \min [t_{b3}, t_{b1}] \\ &= \min [5,51, 5,67] \\ &= 5,51 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{\text{UG-45}} &= \max [t_a, t_b] \\ &= \max [3,22, 5,51] \\ &= \underline{5,51} \text{ mm} \end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 7,82 = 6,85 \text{ mm}$

The nozzle neck thickness is adequate.

Reinforcement Calculations for MAWP

The vessel wall thickness governs the MAWP of this nozzle.

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 52,1 bar @ 175 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							5,51	6,85

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (mm)	Actual weld throat size (mm)	Status
Nozzle to shell fillet (Leg ₄₁)	3,38	5,6	weld size is adequate

Calculations for internal pressure 52,1 bar @ 175 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [17,02, 8,51 + (7,82 - 3) + (7,16 - 3)] \\
 &= 17,49 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (7,16 - 3), 2,5 \cdot (7,82 - 3) + 0] \\
 &= 10,39 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{52,1004 \cdot 8,51}{1,180 \cdot 1 - 0,6 \cdot 52,1004} \\
 &= 0,39 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)(c)

$$\begin{aligned}
 t_r &= \frac{P \cdot K_1 \cdot D_o}{2 \cdot S \cdot E + 0,8 \cdot P} \\
 &= \frac{52,1004 \cdot 0,8749 \cdot 219,07}{2 \cdot 1,180 \cdot 1 + 0,8 \cdot 52,1004} \\
 &= 4,16 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$t_r = \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} = \frac{52,1 \cdot 219,07 \cdot 0,963264}{2 \cdot 1,180 \cdot 0,85 + 2 \cdot 52,1 \cdot (0,963264 - 0,1)} = 5,25 \text{ mm}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(c) Weld Check

Fillet weld: $t_{\min} = \min [19\text{ mm}, t_n, t] = 4,82 \text{ mm}$

$t_{c(\min)} = \min [6 \text{ mm}, 0,7 \cdot t_{\min}] = 3,38 \text{ mm}$

$t_{c(actual)} = 0,7 \cdot \text{Leg} = 0,7 \cdot 8 = 5,6 \text{ mm}$

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-45 Nozzle Neck Thickness Check

Interpretation VIII-1-83-66 has been applied.

$$\begin{aligned} t_{aUG-27} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\ &= \frac{52,1004 \cdot 8,51}{1,180 \cdot 1 - 0,6 \cdot 52,1004} + 3 \\ &= 3,39 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_a &= \max [t_{aUG-27}, t_{aUG-22}] \\ &= \max [3,39, 0] \\ &= 3,39 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{b1} &= \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} + \text{Corrosion} \\ &= \frac{52,1 \cdot 219,07 \cdot 0,963264}{2 \cdot 1,180 \cdot 1 + 2 \cdot 52,1 \cdot (0,963264 - 0,1)} + 3 \\ &= 7,49 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{b1} &= \max [t_{b1}, t_{bUG16}] \\ &= \max [7,49, 4,5] \\ &= 7,49 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_b &= \min [t_{b3}, t_{b1}] \\ &= \min [5,51, 7,49] \\ &= 5,51 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{UG-45} &= \max [t_a, t_b] \\ &= \max [3,39, 5,51] \\ &= 5,51 \text{ mm} \end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 7,82 = 6,85 \text{ mm}$

The nozzle neck thickness is adequate.

Reinforcement Calculations for MAP

The vessel wall thickness governs the MAP of this nozzle.

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 88,24 bar @ 21,11 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							2,51	6,85

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

Calculations for internal pressure 88,24 bar @ 21,11 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [11,02, 5,51 + (7,82 - 0) + (7,16 - 0)] \\
 &= 20,49 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (7,16 - 0), 2,5 \cdot (7,82 - 0) + 0] \\
 &= 17,89 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{88,2375 \cdot 5,51}{1,180 \cdot 1 - 0,6 \cdot 88,2375} \\
 &= 0,43 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)(c)

$$\begin{aligned}
 t_r &= \frac{P \cdot K_1 \cdot D_o}{2 \cdot S \cdot E + 0,8 \cdot P} \\
 &= \frac{88,2375 \cdot 0,9 \cdot 219,07}{2 \cdot 1,180 \cdot 1 + 0,8 \cdot 88,2375} \\
 &= 7,16 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$t_r = \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} = \frac{88,24 \cdot 219,07 \cdot 1}{2 \cdot 1,180 \cdot 0,85 + 2 \cdot 88,24 \cdot (1 - 0,1)} = 8,93 \text{ mm}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UG-45 Nozzle Neck Thickness Check

Interpretation VIII-1-83-66 has been applied.

$$\begin{aligned}
 t_{aUG-27} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\
 &= \frac{88,2375 \cdot 5,51}{1.180 \cdot 1 - 0,6 \cdot 88,2375} + 0 \\
 &= 0,43 \text{ mm}
 \end{aligned}$$

$$\begin{aligned}
 t_a &= \max [t_{aUG-27}, t_{aUG-22}] \\
 &= \max [0,43, 0] \\
 &= 0,43 \text{ mm}
 \end{aligned}$$

$$\begin{aligned}
 t_{b1} &= \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} + \text{Corrosion} \\
 &= \frac{88,24 \cdot 219,07 \cdot 1}{2 \cdot 1.180 \cdot 1 + 2 \cdot 88,24 \cdot (1 - 0,1)} + 0 \\
 &= 7,67 \text{ mm}
 \end{aligned}$$

$$\begin{aligned}
 t_{b1} &= \max [t_{b1}, t_{bUG16}] \\
 &= \max [7,67, 1,5] \\
 &= 7,67 \text{ mm}
 \end{aligned}$$

$$\begin{aligned}
 t_b &= \min [t_{b3}, t_{b1}] \\
 &= \min [2,51, 7,67] \\
 &= 2,51 \text{ mm}
 \end{aligned}$$

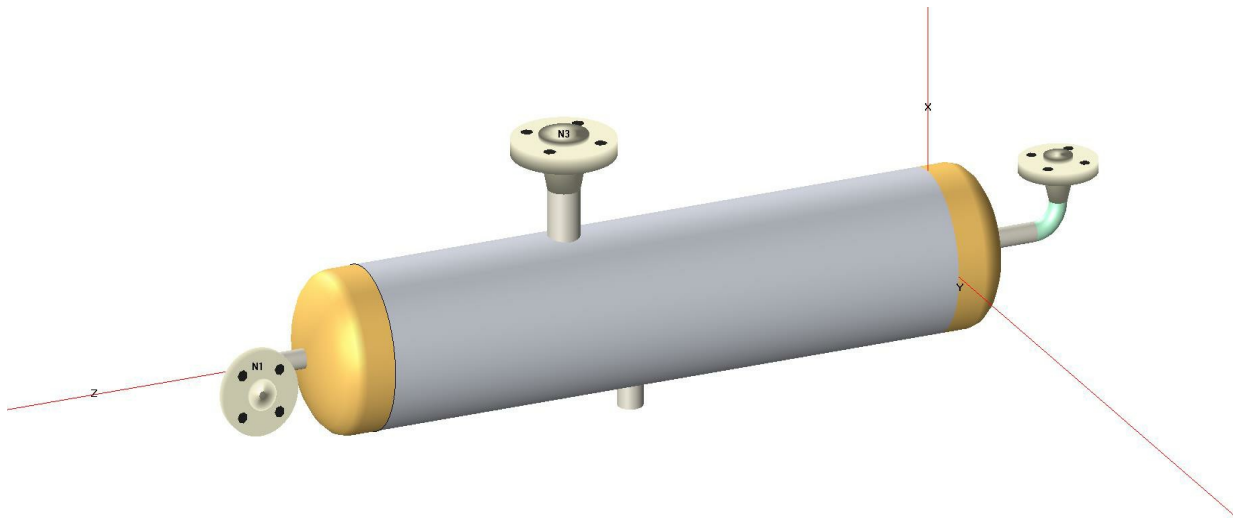
$$\begin{aligned}
 t_{UG-45} &= \max [t_a, t_b] \\
 &= \max [0,43, 2,51] \\
 &= 2,51 \text{ mm}
 \end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 7,82 = 6,85 \text{ mm}$

The nozzle neck thickness is adequate.

Locati Impianti Srl

Via Vittorio Veneto, 37 - Verdellino - Bergamo - Italy



COMPRESS Pressure Vessel Design Calculations

Item: LI 5061

Customer: Airpack

Drawing No.: C230048DWG003

Document No.: C230048CLC007 Rev.04

Date: 04/10/2024

Service: 2nd Stage Inlet Pulsation Damper

Tag Number: 320-KV-020-003

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Nozzle Schedule

Specifications									
Nozzle mark	Identifier	Size	Materials		Impact Tested	Normalized	Fine Grain	Flange	Blind
N1	Air Inlet	NPS 0,75 XXS DN 20	Nozzle	SA-106 B Smls Pipe	No	No	No	N/A	No
	B16.9 Elbow #1 (N1)	NPS 0,75 XXS DN 20	B16.9 Elbow	SA-234 WPB	No	No	No	NPS 3/4 Class 600 WN A105	No
N2	Air Outlet	NPS 0,75 XXS DN 20	Nozzle	SA-106 B Smls Pipe	No	No	No	N/A	No
	B16.9 Elbow #2 (N2)	NPS 0,75 XXS DN 20	B16.9 Elbow	SA-234 WPB	No	No	No	NPS 3/4 Class 600 WN A105	No
N3	Temperature Transmitter Connection	NPS 1,5 Sch 160 DN 40	Nozzle	SA-106 B Smls Pipe	No	No	No	NPS 1 1/2 Class 600 WN A105	No
N4	Drain	NPS 0,5 Class 6000 DN 15 - Threaded Full Coupling	Nozzle	SA-105	No	No	No	N/A	No

Nozzle Summary

Dimensions												
Nozzle mark	OD (mm)	t_n (mm)	Req t_n (mm)	$A_1?$	$A_2?$	Shell			Reinforcement Pad		Corr (mm)	A_a/A_r (%)
						Nom t (mm)	Design t (mm)	User t (mm)	Width (mm)	t_{pad} (mm)		
N1	26,67	7,82	6,3	Yes	Yes	12,7	N/A		N/A	N/A	3	Exempt
N2	26,67	7,82	6,3	Yes	Yes	12,7	N/A		N/A	N/A	3	Exempt
N3	48,26	7,14	7,11	Yes	Yes	12,7	N/A		N/A	N/A	3	Exempt
N4	38,1	8,38	4,5	Yes	Yes	12,7	N/A		N/A	N/A	3	Exempt
*Head minimum thickness after forming												

Definitions	
t_n	Nozzle thickness
Req t_n	Nozzle thickness required per UG-45/UG-16 Increased for pipe to account for 12.5% pipe thickness tolerance
Nom t	Vessel wall thickness
Design t	Required vessel wall thickness due to pressure + corrosion allowance per UG-37
User t	Local vessel wall thickness (near opening)
A_a	Area available per UG-37, governing condition
A_r	Area required per UG-37, governing condition
Corr	Corrosion allowance on nozzle wall

Pressure Summary

Component Summary							
Identifier	P Design (bar)	T Design (°C)	MAWP (bar)	MAP (bar)	MDMT (°C)	MDMT Exemption	Impact Tested
B16.9 Pipe Cap - Left Side	39	157	82,74	111,98	-48	Note 1	No
Straight Flange on B16.9 Pipe Cap - Left Side	39	157	92,09	121,95	-48	Note 2	No
Cylinder #1	39	157	76,56	106,06	-48	Note 3	No
Straight Flange on B16.9 Pipe Cap - Right Side	39	157	92,09	121,95	-48	Note 2	No
B16.9 Pipe Cap - Right Side	39	157	82,74	111,98	-48	Note 4	No
Air Inlet (N1)	39	157	103,54	139,29	-105	Note 5	No
B16.9 Elbow #1 (N1)	39	157	89,84	102,1	-48	Note 6, 7	No
Air Outlet (N2)	39	157	103,54	139,29	-105	Note 5	No
B16.9 Elbow #2 (N2)	39	157	89,84	102,1	-48	Note 6, 7	No
Temperature Transmitter Connection (N3)	39	157	89,84	102,1	-48	Note 8	No
Drain (N4)	39	157	90,07	124,78	-105	Note 9	No

Chamber Summary	
Design MDMT	0 °C
Rated MDMT	0 °C @ 40,92 bar
MAWP hot & corroded	40,92 bar @ 157 °C
MAP cold & new	102,1 bar @ 21,11 °C
(1) The MAWP is limited due to the MAWP limit set in the Calculations tab of the Set Mode dialog. (2) The rated MDMT is limited to the design MDMT based on the setting in the Calculations tab of the Set Mode dialog. (3) This pressure chamber is not designed for external pressure.	

Notes for MDMT Rating		
Note #	Exemption	Details
1.	Straight Flange governs MDMT	
2.	Material impact test exemption temperature from Fig UCS-66M Curve B = -24,98°C Fig UCS-66.1M MDMT reduction = 57,6°C, (coincident ratio = 0,3853) Rated MDMT of -82,58°C is limited to -48°C by UCS-66(b)(2)	UCS-66 governing thickness = 11,11 mm
3.	Material impact test exemption temperature from Fig UCS-66M Curve B = -24,98°C Fig UCS-66.1M MDMT reduction = 36,9°C, (coincident ratio = 0,4607) Rated MDMT of -61,88°C is limited to -48°C by UCS-66(b)(2)	UCS-66 governing thickness = 11,11 mm
4.	Straight Flange governs MDMT	
5.	Nozzle is impact test exempt to -105°C per UCS-66(b)(3) (coincident ratio = 0,0784).	
6.	Material is impact test exempt to -105°C per UCS-66(b)(3) (coincident ratio = 0,1182)	
7.	Flange rating governs: Flange rated MDMT per UCS-66(b)(1)(b) = -48°C (Coincident ratio = 0,4008)	Bolts rated MDMT per Fig UCS-66 note (c) = -48°C
8.	Flange rating governs: Flange rated MDMT per UCS-66(b)(1)(b) = -48°C (Coincident ratio = 0,4008) Bolts rated MDMT per Fig UCS-66 note (c) = -48°C	
9.	Nozzle is impact test exempt to -105°C per UCS-66(b)(3) (coincident ratio = 0,0767).	

Settings Summary

COMPRESS 2024 Build 8400	
ASME Section VIII Division 1, 2021 Edition Metric	
Units	MKS
Datum Line Location	0,00 mm from right seam
Vessel Design Mode	Design Mode
Minimum thickness	1,5 mm per UG-16(b)
Design for cold shut down only	No
Design for lethal service (full radiography required)	No
User has limited MAWP to	40,92 bar
Design nozzles for	Design P only
Corrosion weight loss	100% of theoretical loss
UG-23 Stress Increase	1,20
Skirt/legs stress increase	1,0
Minimum nozzle projection	60 mm
Juncture calculations for $\alpha > 30$ only	Yes
Preheat P-No 1 Materials $> 1,25"$ and $\leq 1,50"$ thick	No
UG-37(a) shell tr calculation considers longitudinal stress	No
Cylindrical shells made from pipe are entered as minimum thickness	No
Nozzles made from pipe are entered as minimum thickness	No
ASME B16.9 fittings are entered as minimum thickness	No
Butt welds	Tapered per Figure UCS-66.3(a)
Disallow Appendix 1-5, 1-8 calculations under 15 psi	No
Hydro/Pneumatic Test	
Shop Hydrotest Pressure	1,3 times vessel MAWP [UG-99(b)]
Test liquid specific gravity	1,00
Maximum stress during test	90% of yield
Required Marking - UG-116	
UG-116(e) Radiography	RT3
UG-116(f) Postweld heat treatment	None
Code Cases/Interpretations	
Use Appendix 46	No
Use UG-44(b)	No
Use Code Case 3035	No
Apply interpretation VIII-1-83-66	Yes
Apply interpretation VIII-1-86-175	Yes
Apply interpretation VIII-1-01-37	Yes
Apply interpretation VIII-1-01-150	Yes
Apply interpretation VIII-1-07-50	Yes
Apply interpretation VIII-1-16-85	Yes
No UCS-66.1 MDMT reduction	No
No UCS-68(c) MDMT reduction	No
Disallow UG-20(f) exemptions	No
UG-22 Loadings	
UG-22(a) Internal or External Design Pressure	Yes
UG-22(b) Weight of the vessel and normal contents under operating or test conditions	No
UG-22(c) Superimposed static reactions from weight of attached equipment (external loads)	No
UG-22(d)(2) Vessel supports such as lugs, rings, skirts, saddles and legs	No
UG-22(f) Wind reactions	No
UG-22(f) Seismic reactions	No

UG-22(j) Test pressure and coincident static head acting during the test:	No
Note: UG-22(b),(c) and (f) loads only considered when supports are present.	
Note 2: UG-22(d)(1),(e),(f)-snow,(g),(h),(i) are not considered. If these loads are present, additional calculations must be performed.	

License Information	
Company Name	Locati Impianti s.r.l.
License	Commercial
License Key ID	32235
Support Expires	September 20, 2025
Account Number	891888909529634

Radiography Summary

UG-116 Radiography							
Component	Longitudinal Seam		Left Circumferential Seam		Right Circumferential Seam		Mark
	Category (Fig UW-3)	Radiography / Joint Type	Category (Fig UW-3)	Radiography / Joint Type	Category (Fig UW-3)	Radiography / Joint Type	
B16.9 Pipe Cap - Left Side	N/A	Seamless No RT	N/A	N/A	B	Spot UW-11(b) / Type 1	RT3
Cylinder #1	N/A	Seamless No RT	B	Spot UW-11(b) / Type 1	B	Spot UW-11(b) / Type 1	RT3
B16.9 Pipe Cap - Right Side	N/A	Seamless No RT	B	Spot UW-11(b) / Type 1	N/A	N/A	RT3
Nozzle	Longitudinal Seam		Nozzle to Vessel Circumferential Seam		Nozzle free end Circumferential Seam		
Air Inlet (N1)	N/A	Seamless No RT	D	N/A / Type 7	B	UW-11(b) exempt / Type 1	N/A
B16.9 Elbow #1 (N1)	N/A	Seamless No RT	B	UW-11(b) exempt / Type 1	C	UW-11(b) exempt / Type 1	N/A
Temperature Transmitter Connection (N3)	N/A	Seamless No RT	D	N/A / Type 7	C	UW-11(b) exempt / Type 1	N/A
Drain (N4)	N/A	Seamless No RT	D	N/A / Type 7	N/A	N/A	N/A
Air Outlet (N2)	N/A	Seamless No RT	D	N/A / Type 7	B	UW-11(b) exempt / Type 1	N/A
B16.9 Elbow #2 (N2)	N/A	Seamless No RT	B	UW-11(b) exempt / Type 1	C	UW-11(b) exempt / Type 1	N/A
Nozzle Flange	Longitudinal Seam		Flange Face		Nozzle to Flange Circumferential Seam		
ASME B16.5/16.47 flange attached to right end of B16.9 Elbow #1 (N1)	N/A	Seamless No RT	N/A	N/A / Gasketed	C	UW-11(b) exempt / Type 1	N/A
ASME B16.5/16.47 flange attached to Temperature Transmitter Connection (N3)	N/A	Seamless No RT	N/A	N/A / Gasketed	C	UW-11(b) exempt / Type 1	N/A
ASME B16.5/16.47 flange attached to right end of B16.9 Elbow #2 (N2)	N/A	Seamless No RT	N/A	N/A / Gasketed	C	UW-11(b) exempt / Type 1	N/A
UG-116(e) Required Marking: RT3							

Thickness Summary

Component Data								
Component Identifier	Material	Diameter (mm)	Length (mm)	Nominal t (mm)	Design t (mm)	Total Corrosion (mm)	Joint E	Load
B16.9 Pipe Cap - Left Side	SA-234 WPB	219,07 OD	59,53	12,7	6,96	3	0,85	Internal
Straight Flange on B16.9 Pipe Cap - Left Side	SA-234 WPB	219,07 OD	42,47	12,7	7,2	3	0,85	Internal
Cylinder #1	SA-106 B Smls Pipe	219,07 OD	890	12,7	7,2	3	0,85	Internal
Straight Flange on B16.9 Pipe Cap - Right Side	SA-234 WPB	219,07 OD	42,47	12,7	7,2	3	0,85	Internal
B16.9 Pipe Cap - Right Side	SA-234 WPB	219,07 OD	59,53	12,7	6,96	3	0,85	Internal

Definitions	
Nominal t	Vessel wall nominal thickness
Design t	Required vessel thickness due to governing loading + corrosion
Joint E	Longitudinal seam joint efficiency
Load	
Internal	Circumferential stress due to internal pressure governs
External	External pressure governs
Wind	Combined longitudinal stress of pressure + weight + wind governs
Seismic	Combined longitudinal stress of pressure + weight + seismic governs

Weight Summary

Weight (kg) Contributed by Vessel Elements											
Component	Metal New*	Metal Corroded	Insulation	Insulation Supports	Lining	Piping + Liquid	Operating Liquid		Test Liquid		Surface Area m ²
							New	Corroded	New	Corroded	
B16.9 Pipe Cap - Left Side	7,7	6,1	0	0	0	0	0	0	2,2	2,4	0,09
Cylinder #1	57,1	44,3	0	0	0	0	0	0	26,3	27,9	0,61
B16.9 Pipe Cap - Right Side	7,7	6,1	0	0	0	0	0	0	2,2	2,4	0,09
TOTAL:	72,6	56,4	0	0	0	0	0	0	30,7	32,8	0,78

*Shells with attached nozzles have weight reduced by material cut out for opening.

Weight (kg) Contributed by Attachments										
Component	Body Flanges		Nozzles & Flanges		Packed Beds	Trays	Tray Supports	Rings & Clips	Vertical Loads	Surface Area m ²
	New	Corroded	New	Corroded						
B16.9 Pipe Cap - Left Side	0	0	2,3	2,2	0	0	0	0	0	0,03
Cylinder #1	0	0	4,5	4,2	0	0	0	0	0	0,06
B16.9 Pipe Cap - Right Side	0	0	2,3	2,2	0	0	0	0	0	0,03
TOTAL:	0	0	9,1	8,5	0	0	0	0	0	0,13

Vessel Totals		
	New	Corroded
Operating Weight (kg)	82	65
Empty Weight (kg)	82	65
Test Weight (kg)	112	98
Surface Area (m ²)	0,91	-
Capacity** (liters)	31	33

**The vessel capacity does not include volume of nozzle, piping or other attachments.

Vessel Lift Condition	
Vessel Lift Weight, New (kg)	82
Center of Gravity from Datum (mm)	452,08

Hydrostatic Test

Horizontal shop hydrostatic test based on MAWP per UG-99(b)

$$\begin{aligned}
 \text{Gauge pressure at } 21,11^{\circ}\text{C} &= 1,3 \cdot MAWP \cdot LSR \\
 &= 1,3 \cdot 40,92 \cdot 1 \\
 &= 53,2 \text{ bar}
 \end{aligned}$$

Horizontal shop hydrostatic test				
Identifier	Local test pressure (bar)	Test liquid static head (bar)	UG-99(b) stress ratio	UG-99(b) pressure factor
B16.9 Pipe Cap - Left Side (1)	53,23	0,03	1	1,30
Straight Flange on B16.9 Pipe Cap - Left Side	53,23	0,03	1	1,30
Cylinder #1	53,23	0,03	1	1,30
Straight Flange on B16.9 Pipe Cap - Right Side	53,23	0,03	1	1,30
B16.9 Pipe Cap - Right Side	53,23	0,03	1	1,30
Air Inlet (N1)	53,22	0,03	1	1,30
Air Outlet (N2)	53,22	0,03	1	1,30
B16.9 Elbow #1 (N1)	53,22	0,03	1	1,30
B16.9 Elbow #2 (N2)	53,22	0,03	1	1,30
Drain (N4)	53,23	0,04	1	1,30
Temperature Transmitter Connection (N3)	53,21	0,01	1	1,30
(1) B16.9 Pipe Cap - Left Side limits the UG-99(b) stress ratio. (2) The zero degree angular position is assumed to be up, and the test liquid height is assumed to the top-most flange.				

The field test condition has not been investigated.

The test temperature of 21,11 °C is warmer than the minimum recommended temperature of -31 °C so the brittle fracture provision of UG-99(h) has been met.

B16.9 Pipe Cap - Left Side

ASME Section VIII Division 1, 2021 Edition Metric				
Component		ASME B16.9 Pipe Cap (modified)		
Material		SA-234 WPB (II-D Metric p. 16, ln. 18)		
Attached To		Cylinder #1		
Impact Tested	Normalized	Fine Grain Practice	PWHT	Maximize MDMT/ No MAWP
No	No	No	No	No
		Design Pressure (bar)	Design Temperature (°C)	Design MDMT (°C)
Internal		39	157	0
Static Liquid Head				
Condition		P _s (bar)	H _s (mm)	SG
Test horizontal		0,03	346,84	1
Dimensions				
NPS and Schedule		NPS 8 Sch 80 (XS) DN 200		
Outer Diameter		219,07 mm		
Overall Length E		102 mm		
Nominal Thickness		12,7 mm		
Minimum Thickness ¹		11,11 mm		
Corrosion	Inner	3 mm		
	Outer	0 mm		
Length L _{sf}		42,47 mm		
Nominal Thickness t _{sf}		12,7 mm		
Weight and Capacity				
		Weight (kg) ²		Capacity (liters) ²
New		7,72		2,2
Corroded		6,06		2,4
Radiography				
Category A joints		Seamless No RT		
Head to shell seam		Spot UW-11(b) Type 1		

¹ minimum thickness = nominal thickness times pipe tolerance factor of 0,875.

² includes straight flange

Results Summary	
Governing condition	internal pressure
Minimum thickness per UG-16	1,5 mm + 3 mm = 4,5 mm
Design thickness due to internal pressure (t)	<u>6,96</u> mm
Governing straight flange design thickness	7,2 mm
Maximum allowable working pressure (MAWP)	<u>82,74</u> bar
Maximum allowable pressure (MAP)	<u>111,98</u> bar
<u>Straight Flange</u> governs MDMT	-48°C

Factor K		
$K = \left(\frac{1}{6}\right) \cdot \left[2 + \left(\frac{D}{2 \cdot h}\right)^2\right]$		
Corroded	$K = \left(\frac{1}{6}\right) \cdot \left[2 + \left(\frac{199,67}{2 \cdot 51,42}\right)^2\right]$	0,9617
New	$K = \left(\frac{1}{6}\right) \cdot \left[2 + \left(\frac{193,67}{2 \cdot 48,42}\right)^2\right]$	1

Design thickness for internal pressure, (Corroded at 157 °C) Appendix 1-4(c)

$$t = \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} + \text{Corrosion} = \frac{39 \cdot 219,07 \cdot 0,961673}{2 \cdot 1.180 \cdot 0,85 + 2 \cdot 39 \cdot (0,961673 - 0,1)} + 3 = \underline{6.96} \text{ mm}$$

Maximum allowable working pressure, (Corroded at 157 °C) Appendix 1-4(c)

$$P = \frac{2 \cdot S \cdot E \cdot t}{K \cdot D_o - 2 \cdot t \cdot (K - 0,1)} - P_s = \frac{2 \cdot 1.180 \cdot 0,85 \cdot (0,875 \cdot 12,7 - 3)}{0,961673 \cdot 219,07 - 2 \cdot (0,875 \cdot 12,7 - 3) \cdot (0,961673 - 0,1)} - 0 = \underline{82.74} \text{ bar}$$

Maximum allowable pressure, (New at 21,11 °C) Appendix 1-4(c)

$$P = \frac{2 \cdot S \cdot E \cdot t}{K \cdot D_o - 2 \cdot t \cdot (K - 0,1)} - P_s = \frac{2 \cdot 1.180 \cdot 0,85 \cdot 0,875 \cdot 12,7}{1 \cdot 219,07 - 2 \cdot 0,875 \cdot 12,7 \cdot (1 - 0,1)} - 0 = \underline{111.98} \text{ bar}$$

ASME Section VIII Division 1 UG-81(a) Out-of-Roundness
Inside surface shall not deviate outside the shape by more than 1,25 % of D
Inside surface shall not deviate inside the shape by more than 0,625 % of D

Straight Flange on B16.9 Pipe Cap - Left Side

ASME Section VIII Division 1, 2021 Edition Metric				
Component		Cylinder		
Material		SA-234 WPB (II-D Metric p. 16, ln. 18)		
Impact Tested	Normalized	Fine Grain Practice	PWHT	Maximize MDMT/ No MAWP
No	No	No	No	No
		Design Pressure (bar)	Design Temperature (°C)	Design MDMT (°C)
Internal		39	157	0
Static Liquid Head				
Condition		P _s (bar)	H _s (mm)	SG
Test horizontal		0,03	346,84	1
Dimensions				
Outer Diameter		219,07 mm		
Length		42,47 mm		
Nominal Thickness		12,7 mm		
Corrosion	Inner	3 mm		
	Outer	0 mm		
Weight and Capacity				
		Weight (kg)		Capacity (liters)
New		2,74		1,25
Corroded		2,12		1,33
Radiography				
Longitudinal seam		Seamless No RT		
Right Circumferential seam		Spot UW-11(b) Type 1		

Results Summary	
Governing condition	Internal pressure
Minimum thickness per UG-16	1,5 mm + 3 mm = 4,5 mm
Design thickness due to internal pressure (t)	7,2 mm
Maximum allowable working pressure (MAWP)	92,09 bar
Maximum allowable pressure (MAP)	121,95 bar
Rated MDMT	-48 °C

UCS-66 Material Toughness Requirements	
Governing thickness, t _g =	11,11 mm
Exemption temperature from Fig UCS-66M Curve B =	-24,98°C
$t_r = \frac{40,92 \cdot 109,54}{1.180 \cdot 0,85 + 0,4 \cdot 40,92} =$	4,4 mm
$\text{Stress ratio} = \frac{t_r \cdot E^*}{t_n - c} = \frac{4,4 \cdot 0,85}{12,7 - 3} =$	0,3853
Reduction in MDMT, T _R from Fig UCS-66.1M =	57,6°C
$MDMT = \max [MDMT - T_R, -48] = \max [-24,98 - 57,6, -48] =$	-48°C
Material is exempt from impact testing at the Design MDMT of 0°C.	

Design thickness, (at 157 °C) Appendix 1-1

$$t = \frac{P \cdot R_o}{S \cdot E + 0,40 \cdot P} + \text{Corrosion} = \frac{39 \cdot 109,54}{1.180 \cdot 0,85 + 0,40 \cdot 39} + 3 = \underline{7,2} \text{ mm}$$

Maximum allowable working pressure, (at 157 °C) Appendix 1-1

$$P = \frac{S \cdot E \cdot t}{R_o - 0,40 \cdot t} - P_s = \frac{1.180 \cdot 0,85 \cdot 9,7}{109,54 - 0,40 \cdot 9,7} - 0 = \underline{92,09} \text{ bar}$$

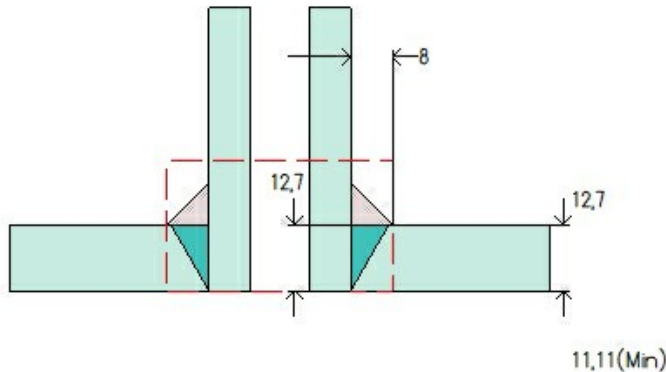
Maximum allowable pressure, (at 21,11 °C) Appendix 1-1

$$P = \frac{S \cdot E \cdot t}{R_o - 0,40 \cdot t} = \frac{1.180 \cdot 0,85 \cdot 12,7}{109,54 - 0,40 \cdot 12,7} = \underline{121,95} \text{ bar}$$

ASME Section VIII Division 1 UG-80(a) Out-of-Roundness
$(D_{\max} - D_{\min})$ shall not exceed 1% of D
When the cross section passes through an opening or within 1 I.D. of the opening, $(D_{\max} - D_{\min})$ shall not exceed 1% of $D + 2\%$ of the inside diameter of the opening

Air Inlet (N1)

ASME Section VIII Division 1, 2021 Edition Metric



Note: round inside edges per UG-76(c)

Location and Orientation

Located on	B16.9 Pipe Cap - Left Side
Orientation	0°
End of nozzle to datum line	1.056 mm
Calculated as hillside	No
Distance to head center, R	0 mm
Passes through a Category A joint	No

Nozzle

Description	NPS 0,75 XXS DN 20
Access opening	No
Material specification	SA-106 B Smls Pipe (II-D Metric p. 16, In. 16)
Inside diameter, new	11,02 mm
Pipe nominal wall thickness	7,82 mm
Pipe minimum wall thickness ¹	6,85 mm
Corrosion allowance	3 mm
Projection available outside vessel, L _{pr}	64,44 mm
Local vessel minimum thickness	11,11 mm
Liquid static head included	0 bar

Welds

Inner fillet, Leg ₄₁	8 mm
Nozzle to vessel groove weld	12,7 mm

Radiography

Longitudinal seam	Seamless No RT
Circumferential seam	Full UW-11(a) Type 1

¹Pipe minimum thickness = nominal thickness times pipe tolerance factor of 0,875.

UCS-66 Material Toughness Requirements Nozzle

$t_r = \frac{40,92 \cdot 8,51}{1,180 \cdot 1 - 0,6 \cdot 40,92} =$	0,3 mm
$\text{Stress ratio} = \frac{t_r \cdot E^*}{t_n - c} = \frac{0,3 \cdot 1}{6,85 - 3} =$	0,0784
Stress ratio $\leq 0,35$, MDMT per UCS-66(b)(3) =	-105°C
Material is exempt from impact testing at the Design MDMT of 0°C.	

Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 39 bar @ 157 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							5,51	6,85

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (mm)	Actual weld throat size (mm)	Status
Nozzle to shell fillet (Leg ₄₁)	3,38	5,6	weld size is adequate

Calculations for internal pressure 39 bar @ 157 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [17,02, 8,51 + (7,82 - 3) + (11,11 - 3)] \\
 &= 21,45 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (11,11 - 3), 2,5 \cdot (7,82 - 3) + 0] \\
 &= 12,06 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{39,0001 \cdot 8,51}{1,180 \cdot 1 - 0,6 \cdot 39,0001} \\
 &= 0,29 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)(c)

$$\begin{aligned}
 t_r &= \frac{P \cdot K_1 \cdot D_o}{2 \cdot S \cdot E + 0,8 \cdot P} \\
 &= \frac{39,0001 \cdot 0,8737 \cdot 219,07}{2 \cdot 1,180 \cdot 1 + 0,8 \cdot 39,0001} \\
 &= 3,12 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$t_r = \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} = \frac{39 \cdot 219,07 \cdot 0,961673}{2 \cdot 1,180 \cdot 0,85 + 2 \cdot 39 \cdot (0,961673 - 0,1)} = 3,96 \text{ mm}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(c) Weld Check

Fillet weld: $t_{\min} = \min [19\text{ mm}, t_n, t] = 4,82 \text{ mm}$

$$t_{c(\min)} = \min [6 \text{ mm}, 0,7 \cdot t_{\min}] = \underline{3,38} \text{ mm}$$

$$t_{c(\text{actual})} = 0,7 \cdot \text{Leg} = 0,7 \cdot 8 = 5,6 \text{ mm}$$

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-45 Nozzle Neck Thickness Check

Interpretation VIII-1-83-66 has been applied.

$$\begin{aligned} t_{a\text{UG-27}} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\ &= \frac{39,0001 \cdot 8,51}{1,180 \cdot 1 - 0,6 \cdot 39,0001} + 3 \\ &= 3,29 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_a &= \max [t_{a\text{UG-27}}, t_{a\text{UG-22}}] \\ &= \max [3,29, 0] \\ &= 3,29 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{b1} &= \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} + \text{Corrosion} \\ &= \frac{39 \cdot 219,07 \cdot 0,961673}{2 \cdot 1,180 \cdot 1 + 2 \cdot 39 \cdot (0,961673 - 0,1)} + 3 \\ &= 6,38 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{b1} &= \max [t_{b1}, t_{b\text{UG16}}] \\ &= \max [6,39, 4,5] \\ &= 6,39 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_b &= \min [t_{b3}, t_{b1}] \\ &= \min [5,51, 6,39] \\ &= 5,51 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{\text{UG-45}} &= \max [t_a, t_b] \\ &= \max [3,29, 5,51] \\ &= \underline{5,51} \text{ mm} \end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 7,82 = 6,85 \text{ mm}$

The nozzle neck thickness is adequate.

Reinforcement Calculations for MAWP

The vessel wall thickness governs the MAWP of this nozzle.

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 103,54 bar @ 157 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							5,51	6,85

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (mm)	Actual weld throat size (mm)	Status
Nozzle to shell fillet (Leg ₄₁)	3,38	5,6	weld size is adequate

Calculations for internal pressure 103,54 bar @ 157 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [17,02, 8,51 + (7,82 - 3) + (11,11 - 3)] \\
 &= 21,45 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (11,11 - 3), 2,5 \cdot (7,82 - 3) + 0] \\
 &= 12,06 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{103,5405 \cdot 8,51}{1.180 \cdot 1 - 0,6 \cdot 103,5405} \\
 &= 0,79 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)(c)

$$\begin{aligned}
 t_r &= \frac{P \cdot K_1 \cdot D_o}{2 \cdot S \cdot E + 0,8 \cdot P} \\
 &= \frac{103,5405 \cdot 0,8737 \cdot 219,07}{2 \cdot 1.180 \cdot 1 + 0,8 \cdot 103,5405} \\
 &= 8,11 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$t_r = \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} = \frac{103,54 \cdot 219,07 \cdot 0,961673}{2 \cdot 1.180 \cdot 0,85 + 2 \cdot 103,54 \cdot (0,961673 - 0,1)} = 9,99 \text{ mm}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(c) Weld Check

Fillet weld: $t_{\min} = \min [19\text{ mm}, t_n, t] = 4,82 \text{ mm}$

$t_{c(\min)} = \min [6 \text{ mm}, 0,7 \cdot t_{\min}] = 3,38 \text{ mm}$

$t_{c(actual)} = 0,7 \cdot \text{Leg} = 0,7 \cdot 8 = 5,6 \text{ mm}$

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-45 Nozzle Neck Thickness Check

Interpretation VIII-1-83-66 has been applied.

$$\begin{aligned} t_{aUG-27} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\ &= \frac{103,5405 \cdot 8,51}{1,180 \cdot 1 - 0,6 \cdot 103,5405} + 3 \\ &= 3,79 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_a &= \max [t_{aUG-27}, t_{aUG-22}] \\ &= \max [3,79, 0] \\ &= 3,79 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{b1} &= \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} + \text{Corrosion} \\ &= \frac{103,54 \cdot 219,07 \cdot 0,961673}{2 \cdot 1,180 \cdot 1 + 2 \cdot 103,54 \cdot (0,961673 - 0,1)} + 3 \\ &= 11,59 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{b1} &= \max [t_{b1}, t_{bUG16}] \\ &= \max [11,59, 4,5] \\ &= 11,59 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_b &= \min [t_{b3}, t_{b1}] \\ &= \min [5,51, 11,59] \\ &= 5,51 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{UG-45} &= \max [t_a, t_b] \\ &= \max [3,79, 5,51] \\ &= 5,51 \text{ mm} \end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 7,82 = 6,85 \text{ mm}$

The nozzle neck thickness is adequate.

Reinforcement Calculations for MAP

The vessel wall thickness governs the MAP of this nozzle.

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 139,29 bar @ 21,11 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							2,51	6,85

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

Calculations for internal pressure 139,29 bar @ 21,11 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [11,02, 5,51 + (7,82 - 0) + (11,11 - 0)] \\
 &= 24,45 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (11,11 - 0), 2,5 \cdot (7,82 - 0) + 0] \\
 &= 19,56 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{139,2932 \cdot 5,51}{1.180 \cdot 1 - 0,6 \cdot 139,2932} \\
 &= 0,7 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)(c)

$$\begin{aligned}
 t_r &= \frac{P \cdot K_1 \cdot D_o}{2 \cdot S \cdot E + 0,8 \cdot P} \\
 &= \frac{139,2932 \cdot 0,9 \cdot 219,07}{2 \cdot 1.180 \cdot 1 + 0,8 \cdot 139,2932} \\
 &= 11,11 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$t_r = \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} = \frac{139,29 \cdot 219,07 \cdot 1}{2 \cdot 1.180 \cdot 0,85 + 2 \cdot 139,29 \cdot (1 - 0,1)} = 13,52 \text{ mm}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UG-45 Nozzle Neck Thickness Check

Interpretation VIII-1-83-66 has been applied.

$$\begin{aligned}
 t_{aUG-27} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\
 &= \frac{139,2932 \cdot 5,51}{1.180 \cdot 1 - 0,6 \cdot 139,2932} + 0 \\
 &= 0,7 \text{ mm} \\
 t_a &= \max [t_{aUG-27}, t_{aUG-22}] \\
 &= \max [0,7, 0] \\
 &= 0,7 \text{ mm} \\
 t_{b1} &= \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} + \text{Corrosion} \\
 &= \frac{139,29 \cdot 219,07 \cdot 1}{2 \cdot 1.180 \cdot 1 + 2 \cdot 139,29 \cdot (1 - 0,1)} + 0 \\
 &= 11,69 \text{ mm} \\
 t_{bl} &= \max [t_{bl}, t_{bUG16}] \\
 &= \max [11,69, 1,5] \\
 &= 11,69 \text{ mm} \\
 t_b &= \min [t_{b3}, t_{bl}] \\
 &= \min [2,51, 11,69] \\
 &= 2,51 \text{ mm} \\
 t_{UG-45} &= \max [t_a, t_b] \\
 &= \max [0,7, 2,51] \\
 &= \underline{2,51} \text{ mm}
 \end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 7,82 = 6,85 \text{ mm}$

The nozzle neck thickness is adequate.

B16.9 Elbow #1 (N1)

ASME Section VIII Division 1, 2021 Edition Metric				
Component		ASME B16.9 Elbow		
Type		Long Radius 90-deg		
Material		SA-234 WPB (II-D Metric p. 16, ln. 18)		
Pipe NPS and Schedule		NPS 0,75 XXS DN 20		
Attached To		Air Inlet (N1)		
Impact Tested	Normalized	Fine Grain Practice	PWHT	Maximize MDMT/ No MAWP
No	No	No	No	No
		Design Pressure (bar)	Design Temperature (°C)	Design MDMT (°C)
Internal		39	157	0
Static Liquid Head				
Condition		P _s (bar)	H _s (mm)	SG
Test horizontal		0,03	255,51	1
Dimensions				
Outer Diameter		26,67 mm		
Nominal Thickness		7,82 mm		
Minimum Thickness ¹		6,85 mm		
Center-to-End, A		38 mm		
Corrosion	Inner	3 mm		
	Outer	0 mm		
Weight and Capacity				
		Weight (kg)		Capacity (liters)
New		0,22		0,01
Corroded		0,16		0,01
Radiography				
Longitudinal seam		Seamless No RT		
Left Circumferential seam		Full UW-11(a) Type 1		
Right Circumferential seam		Full UW-11(a) Type 1		

¹ minimum thickness = nominal thickness times pipe tolerance factor of 0,875.

ASME B16.5-2017 Flange	
Description	NPS 0,75 Class 600 WN A105
Bolt Material	SA-193 B7 Bolt ≤ 64 (II-D Metric p. 410, In. 32)
Blind included	No
Rated MDMT	-48°C
Liquid static head	0 bar
MAWP rating	89,84 bar @ 157°C
MAP rating	102,1 bar @ 21,11°C
Hydrotest rating	154 bar @ 21,11°C
PWHT performed	No
Produced to Fine Grain Practice and Supplied in Heat Treated Condition	No
Impact Tested	No
Circumferential joint radiography	Full UW-11(a) Type 1
Bore diameter, B (specified by purchaser)	11,02 mm
Gasket	
Type	ASME B16.21 Nonmetallic Flat Gasket
Description	Flexitallic Compressed Fiber SF 2401 Synthetic/NBR
Factor, m	3,2
Seating Stress, y	203,89 kgf/cm ²
Thickness, T	3 mm
Inner Diameter	27 mm
Outer Diameter	67 mm
Notes	
Flange rated MDMT per UCS-66(b)(1)(b) = -48°C (Coincident ratio = 0,4008) Bolts rated MDMT per Fig UCS-66 note (c) = -48°C	

Results Summary	
Governing condition	UG-16
Minimum thickness per UG-16	1,5 mm + 3 mm = 4,5 mm
Design thickness due to internal pressure (t)	3,43 mm
Maximum allowable working pressure (MAWP)	401,45 bar
Maximum allowable pressure (MAP)	849,81 bar
Rated MDMT	-105 °C

UCS-66 Material Toughness Requirements	
$t_r = 13,34 \cdot \left(1 - \exp \left(- \frac{40,92}{1.180 \cdot 1} \right) \right) =$	0,45 mm
$\text{Stress ratio} = \frac{t_r \cdot E^*}{t_n - c} = \frac{0,45 \cdot 1}{6,85 - 3} =$	0,1182
Stress ratio ≤ 0,35, MDMT per UCS-66(b)(3) =	-105°C
Material is exempt from impact testing at the Design MDMT of 0°C.	

Design thickness, (at 157 °C) Appendix 1-2

$$t = R_o \cdot \left(1 - \exp \left[- \frac{P}{S \cdot E} \right] \right) + \text{Corrosion} = 13,34 \cdot \left(1 - \exp \left[- \frac{39}{1.180 \cdot 1,00} \right] \right) + 3 = \text{3,43 mm}$$

Maximum allowable working pressure, (at 157 °C) Appendix 1-2

$$P = S \cdot E \cdot \ln\left(\frac{R_o}{R_o - t}\right) - P_s = 1.180 \cdot 1,00 \cdot \ln\left(\frac{13,34}{13,34 - (7,82 \cdot 0,875 - 3)}\right) - 0 = \underline{401,45} \text{ bar}$$

Maximum allowable pressure, (at 21,11 °C) Appendix 1-2

$$P = S \cdot E \cdot \ln\left(\frac{R_o}{R_o - t}\right) = 1.180 \cdot 1,00 \cdot \ln\left(\frac{13,34}{13,34 - (7,82 \cdot 0,875)}\right) = \underline{849,81} \text{ bar}$$

Cylinder #1

ASME Section VIII Division 1, 2021 Edition Metric				
Component		Cylinder		
Material		SA-106 B Smls Pipe (II-D Metric p. 16, In. 16)		
Pipe NPS and Schedule		NPS 8 Sch 80 (XS) DN 200		
Impact Tested	Normalized	Fine Grain Practice	PWHT	Maximize MDMT/ No MAWP
No	No	No	No	No
		Design Pressure (bar)	Design Temperature (°C)	Design MDMT (°C)
Internal		39	157	0
Static Liquid Head				
Condition		P _s (bar)	H _s (mm)	SG
Test horizontal		0,03	346,84	1
Dimensions				
Outer Diameter		219,07 mm		
Length		890 mm		
Pipe Nominal Thickness		12,7 mm		
Pipe Minimum Thickness ¹		11,11 mm		
Corrosion	Inner	3 mm		
	Outer	0 mm		
Weight and Capacity				
		Weight (kg)		Capacity (liters)
New		57,11		26,22
Corroded		44,25		27,87
Radiography				
Longitudinal seam		Seamless No RT		
Left Circumferential seam		Spot UW-11(b) Type 1		
Right Circumferential seam		Spot UW-11(b) Type 1		

¹Pipe minimum thickness = nominal thickness times pipe tolerance factor of 0,875.

Results Summary	
Governing condition	Internal pressure
Minimum thickness per UG-16	1,5 mm + 3 mm = 4,5 mm
Design thickness due to internal pressure (t)	7,2 mm
Maximum allowable working pressure (MAWP)	76,56 bar
Maximum allowable pressure (MAP)	106,06 bar
Rated MDMT	-48 °C

UCS-66 Material Toughness Requirements	
Governing thickness, t _g =	11,11 mm
Exemption temperature from Fig UCS-66M Curve B =	-24,98°C
$t_r = \frac{40,92 \cdot 109,54}{1.180 \cdot 0,85 + 0,4 \cdot 40,92} =$	4,4 mm
$\text{Stress ratio} = \frac{t_r \cdot E^*}{t_n - c} = \frac{4,4 \cdot 0,85}{11,11 - 3} =$	0,4607
Reduction in MDMT, T _R from Fig UCS-66.1M =	36,9°C
$MDMT = \max [MDMT - T_R, -48] = \max [-24,98 - 36,9, -48] =$	-48°C
Material is exempt from impact testing at the Design MDMT of 0°C.	

Design thickness, (at 157 °C) Appendix 1-1

$$t = \frac{P \cdot R_o}{S \cdot E + 0,40 \cdot P} + \text{Corrosion} = \frac{39 \cdot 109,54}{1.180 \cdot 0,85 + 0,40 \cdot 39} + 3 = \underline{7.2} \text{ mm}$$

Maximum allowable working pressure, (at 157 °C) Appendix 1-1

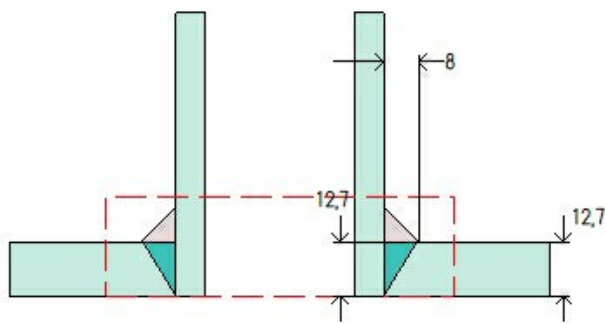
$$P = \frac{S \cdot E \cdot t}{R_o - 0,40 \cdot t} - P_s = \frac{1.180 \cdot 0,85 \cdot (12,7 \cdot 0,875 - 3)}{109,54 - 0,40 \cdot (12,7 \cdot 0,875 - 3)} - 0 = \underline{76.56} \text{ bar}$$

Maximum allowable pressure, (at 21,11 °C) Appendix 1-1

$$P = \frac{S \cdot E \cdot t}{R_o - 0,40 \cdot t} = \frac{1.180 \cdot 0,85 \cdot (12,7 \cdot 0,875)}{109,54 - 0,40 \cdot (12,7 \cdot 0,875)} = \underline{106.06} \text{ bar}$$

Temperature Transmitter Connection (N3)

ASME Section VIII Division 1, 2021 Edition Metric



Note: round inside edges per UG-76(c)

Location and Orientation

Located on	Cylinder #1
Orientation	0°
Nozzle center line offset to datum line	575 mm
End of nozzle to shell center	250 mm
Passes through a Category A joint	No

Nozzle

Description	NPS 1,5 Sch 160 DN 40
Access opening	No
Material specification	SA-106 B Smls Pipe (II-D Metric p. 16, In. 16)
Inside diameter, new	33,99 mm
Pipe nominal wall thickness	7,14 mm
Pipe minimum wall thickness ¹	6,25 mm
Corrosion allowance	3 mm
Projection available outside vessel, L _{pr}	64,27 mm
Projection available outside vessel to flange face, L _f	140,47 mm
Local vessel minimum thickness	11,11 mm
Liquid static head included	0 bar

Welds

Inner fillet, Leg ₄₁	8 mm
Nozzle to vessel groove weld	12,7 mm

Radiography

Longitudinal seam	Seamless No RT
Circumferential seam	Full UW-11(a) Type 1

¹Pipe minimum thickness = nominal thickness times pipe tolerance factor of 0,875.

ASME B16.5-2017 Flange	
Description	NPS 1,5 Class 600 WN A105
Bolt Material	SA-193 B7 Bolt <= 64 (II-D Metric p. 410, In. 32)
Blind included	No
Rated MDMT	-48°C
Liquid static head	0 bar
MAWP rating	89,84 bar @ 157°C
MAP rating	102,1 bar @ 21,11°C
Hydrotest rating	154 bar @ 21,11°C
PWHT performed	No
Produced to Fine Grain Practice and Supplied in Heat Treated Condition	No
Impact Tested	No
Circumferential joint radiography	Full UW-11(a) Type 1
Bore diameter, B (specified by purchaser)	40,89 mm
Gasket	
Type	ASME B16.20 Spiral-Wound
Description	Garlock FLEXSEAL RW 316L SS / Flexible Graphite
Factor, m	3
Seating Stress, y	703,07 kgf/cm ²
Thickness, T	3 mm
Inner Diameter	54,1 mm
Outer Diameter	69,9 mm
Notes	
Flange rated MDMT per UCS-66(b)(1)(b) = -48°C (Coincident ratio = 0,4008) Bolts rated MDMT per Fig UCS-66 note (c) = -48°C	

UCS-66 Material Toughness Requirements Nozzle	
$t_r = \frac{40,92 \cdot 19,99}{1.180 \cdot 1 - 0,6 \cdot 40,92} =$	0,71 mm
$\text{Stress ratio} = \frac{t_r \cdot E^*}{t_n - c} = \frac{0,71 \cdot 1}{6,25 - 3} =$	0,2182
Stress ratio ≤ 0,35, MDMT per UCS-66(b)(3) =	-105°C
Material is exempt from impact testing at the Design MDMT of 0°C.	

Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 39 bar @ 157 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							6,22	6,25

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (mm)	Actual weld throat size (mm)	Status
Nozzle to shell fillet (Leg ₄₁)	2,9	5,6	weld size is adequate

Calculations for internal pressure 39 bar @ 157 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [39,99, 19,99 + (7,14 - 3) + (11,11 - 3)] \\
 &= 39,99 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (11,11 - 3), 2,5 \cdot (7,14 - 3) + 0] \\
 &= 10,34 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{39,0001 \cdot 19,99}{1,180 \cdot 1 - 0,6 \cdot 39,0001} \\
 &= 0,67 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{39,0001 \cdot 109,54}{1,180 \cdot 1 + 0,4 \cdot 39,0001} \\
 &= 3,57 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$\begin{aligned}
t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
&= \frac{39,0001 \cdot 109,54}{1.180 \cdot 0,85 + 0,4 \cdot 39,0001} \\
&= 4,19 \text{ mm}
\end{aligned}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(c) Weld Check

Fillet weld: $t_{\min} = \min [19mm, t_n, t] = 4,14 \text{ mm}$

$$t_{c(\min)} = \min [6 \text{ mm}, 0,7 \cdot t_{\min}] = 2,9 \text{ mm}$$

$$t_{c(actual)} = 0,7 \cdot \text{Leg} = 0,7 \cdot 8 = 5,6 \text{ mm}$$

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-45 Nozzle Neck Thickness Check

$$\begin{aligned}
t_{aUG-27} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\
&= \frac{39,0001 \cdot 19,99}{1.180 \cdot 1 - 0,6 \cdot 39,0001} + 3 \\
&= 3,67 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_a &= \max [t_{aUG-27}, t_{aUG-22}] \\
&= \max [3,67, 0] \\
&= 3,67 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{b1} &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} + \text{Corrosion} \\
&= \frac{39,0001 \cdot 109,54}{1.180 \cdot 1 + 0,4 \cdot 39,0001} + 3 \\
&= 6,57 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{b1} &= \max [t_{b1}, t_{bUG16}] \\
&= \max [6,57, 4,5] \\
&= 6,57 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_b &= \min [t_{b3}, t_{b1}] \\
&= \min [6,22, 6,57] \\
&= 6,22 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{UG-45} &= \max [t_a, t_b] \\
&= \max [3,67, 6,22] \\
&= 6,22 \text{ mm}
\end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 7,14 = 6,25$ mm

The nozzle neck thickness is adequate.

Reinforcement Calculations for MAWP

The attached ASME B16.5 flange limits the nozzle MAWP.

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 89,84 bar @ 157 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							6,22	6,25

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (mm)	Actual weld throat size (mm)	Status
Nozzle to shell fillet (Leg ₄₁)	2,9	5,6	weld size is adequate

Calculations for internal pressure 89,84 bar @ 157 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [39,99, 19,99 + (7,14 - 3) + (11,11 - 3)] \\
 &= 39,99 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (11,11 - 3), 2,5 \cdot (7,14 - 3) + 0] \\
 &= 10,34 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{89,836 \cdot 19,99}{1.180 \cdot 1 - 0,6 \cdot 89,836} \\
 &= 1,6 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{89,836 \cdot 109,54}{1.180 \cdot 1 + 0,4 \cdot 89,836} \\
 &= 8,09 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$\begin{aligned}
t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
&= \frac{89,836 \cdot 109,54}{1.180 \cdot 0,85 + 0,4 \cdot 89,836} \\
&= 9,47 \text{ mm}
\end{aligned}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(c) Weld Check

Fillet weld: $t_{\min} = \min [19mm, t_n, t] = 4,14 \text{ mm}$

$$t_{c(\min)} = \min [6 \text{ mm}, 0,7 \cdot t_{\min}] = 2,9 \text{ mm}$$

$$t_{c(actual)} = 0,7 \cdot \text{Leg} = 0,7 \cdot 8 = 5,6 \text{ mm}$$

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-45 Nozzle Neck Thickness Check

$$\begin{aligned}
t_{aUG-27} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\
&= \frac{89,836 \cdot 19,99}{1.180 \cdot 1 - 0,6 \cdot 89,836} + 3 \\
&= 4,6 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_a &= \max [t_{aUG-27}, t_{aUG-22}] \\
&= \max [4,6, 0] \\
&= 4,6 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{b1} &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} + \text{Corrosion} \\
&= \frac{89,836 \cdot 109,54}{1.180 \cdot 1 + 0,4 \cdot 89,836} + 3 \\
&= 11,09 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{b1} &= \max [t_{b1}, t_{bUG16}] \\
&= \max [11,09, 4,5] \\
&= 11,09 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_b &= \min [t_{b3}, t_{b1}] \\
&= \min [6,22, 11,09] \\
&= 6,22 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{UG-45} &= \max [t_a, t_b] \\
&= \max [4,6, 6,22] \\
&= 6,22 \text{ mm}
\end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 7,14 = 6,25$ mm

The nozzle neck thickness is adequate.

Reinforcement Calculations for MAP

The attached ASME B16.5 flange limits the nozzle MAP.

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 102,1 bar @ 21,11 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							3,22	6,25

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

Calculations for internal pressure 102,1 bar @ 21,11 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [33,99, 16,99 + (7,14 - 0) + (11,11 - 0)] \\
 &= 35,24 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (11,11 - 0), 2,5 \cdot (7,14 - 0) + 0] \\
 &= 17,84 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{102,1 \cdot 16,99}{1.180 \cdot 1 - 0,6 \cdot 102,1} \\
 &= 1,55 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{102,1 \cdot 109,54}{1.180 \cdot 1 + 0,4 \cdot 102,1} \\
 &= 9,16 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{102,1 \cdot 109,54}{1.180 \cdot 0,85 + 0,4 \cdot 102,1} \\
 &= 10,71 \text{ mm}
 \end{aligned}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UG-45 Nozzle Neck Thickness Check

$$\begin{aligned}t_{aUG-27} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\&= \frac{102,1 \cdot 16,99}{1.180 \cdot 1 - 0,6 \cdot 102,1} + 0 \\&= 1,55 \text{ mm}\end{aligned}$$

$$\begin{aligned}t_a &= \max [t_{aUG-27}, t_{aUG-22}] \\&= \max [1,55, 0] \\&= 1,55 \text{ mm}\end{aligned}$$

$$\begin{aligned}t_{b1} &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} + \text{Corrosion} \\&= \frac{102,1 \cdot 109,54}{1.180 \cdot 1 + 0,4 \cdot 102,1} + 0 \\&= 9,16 \text{ mm}\end{aligned}$$

$$\begin{aligned}t_{b1} &= \max [t_{b1}, t_{bUG16}] \\&= \max [9,16, 1,5] \\&= 9,16 \text{ mm}\end{aligned}$$

$$\begin{aligned}t_b &= \min [t_{b3}, t_{b1}] \\&= \min [3,22, 9,16] \\&= 3,22 \text{ mm}\end{aligned}$$

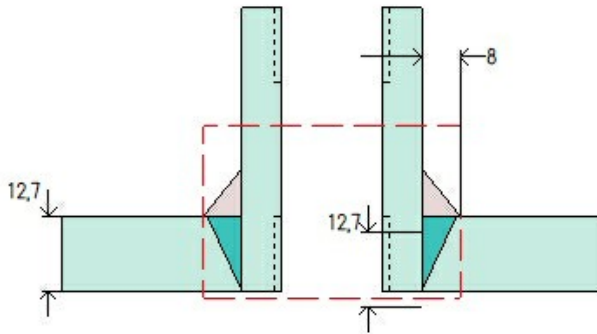
$$\begin{aligned}t_{UG-45} &= \max [t_a, t_b] \\&= \max [1,55, 3,22] \\&= \underline{3,22} \text{ mm}\end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 7,14 = 6,25 \text{ mm}$

The nozzle neck thickness is adequate.

Drain (N4)

ASME Section VIII Division 1, 2021 Edition Metric



Note: round inside edges per UG-76(c)

Location and Orientation

Located on	Cylinder #1
Orientation	180°
Nozzle center line offset to datum line	470 mm
End of nozzle to shell center	142,69 mm
Passes through a Category A joint	No

Nozzle

Description	NPS 0,5 Class 6000 DN 15 - Threaded Full Coupling
Access opening	No
Material specification	SA-105 (II-D Metric p. 20, In. 31)
Inside diameter, new	21,34 mm
Nominal wall thickness	8,38 mm
Corrosion allowance	3 mm
Projection available outside vessel, L _{pr}	33,16 mm
Local vessel minimum thickness	11,11 mm
Liquid static head included	0 bar

Welds

Inner fillet, Leg ₄₁	8 mm
Nozzle to vessel groove weld	12,7 mm

Radiography

Longitudinal seam	Seamless No RT
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UCS-66 Material Toughness Requirements Nozzle

$t_r = \frac{40,92 \cdot 13,67}{1.380 \cdot 1 - 0,6 \cdot 40,92} =$	0,41 mm
Stress ratio $= \frac{t_r \cdot E^*}{t_n - c} = \frac{0,41 \cdot 1}{8,38 - 3} =$	0,0767
Stress ratio $\leq 0,35$, MDMT per UCS-66(b)(3) =	-105°C
Material is exempt from impact testing at the Design MDMT of 0°C.	

Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (cm ²)							UG-44 Summary (mm)	
For P = 39 bar @ 157 °C							The nozzle passes UG-44	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							4,5	8,38

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (mm)	Actual weld throat size (mm)	Status
Nozzle to shell fillet (Leg ₄₁)	2,5	5,6	weld size is adequate

Calculations for internal pressure 39 bar @ 157 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [27,34, 13,67 + (8,38 - 3) + (11,11 - 3)] \\
 &= 27,34 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (11,11 - 3), 2,5 \cdot (8,38 - 3) + 0] \\
 &= 13,46 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{39,0001 \cdot 13,67}{1,380 \cdot 1 - 0,6 \cdot 39,0001} \\
 &= 0,39 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{39,0001 \cdot 109,54}{1,180 \cdot 1 + 0,4 \cdot 39,0001} \\
 &= 3,57 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$\begin{aligned}
t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
&= \frac{39,0001 \cdot 109,54}{1.180 \cdot 0,85 + 0,4 \cdot 39,0001} \\
&= 4,19 \text{ mm}
\end{aligned}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(f)(2)(b) Weld Check

Fillet weld: $t_{\min} = \min [19mm, t_n, t] = 5,38 \text{ mm}$

$$t_{c(\min)} = \min [2,5 \text{ mm}, 0,7 \cdot t_{\min}] = 2,5 \text{ mm}$$

$$t_{c(actual)} = 0,7 \cdot \text{Leg} = 0,7 \cdot 8 = 5,6 \text{ mm}$$

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-44 Thickness Check - ASME B16.11 Coupling

$$\begin{aligned}
t_{aApp \text{ 1-1}} &= \frac{P \cdot R_o}{S_n \cdot E + 0,4 \cdot P} + \text{Corrosion} \\
&= \frac{39,0001 \cdot 19,05}{1.380 \cdot 1 + 0,4 \cdot 39,0001} + 3 \\
&= 3,53 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{aUG-44} &= \max [t_{aApp \text{ 1-1}}, t_{bUG16}] \\
&= \max [3,53, 4,5] \\
&= 4,5 \text{ mm}
\end{aligned}$$

Available nozzle wall thickness new, $t_n = 8,38 \text{ mm}$

The nozzle neck thickness is adequate.

Reinforcement Calculations for MAWP

The vessel wall thickness governs the MAWP of this nozzle.

UG-37 Area Calculation Summary (cm ²)							UG-44 Summary (mm)	
For P = 90,07 bar @ 157 °C							The nozzle passes UG-44	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							4,5	8,38

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (mm)	Actual weld throat size (mm)	Status
Nozzle to shell fillet (Leg ₄₁)	2,5	5,6	weld size is adequate

Calculations for internal pressure 90,07 bar @ 157 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [27,34, 13,67 + (8,38 - 3) + (11,11 - 3)] \\
 &= 27,34 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (11,11 - 3), 2,5 \cdot (8,38 - 3) + 0] \\
 &= 13,46 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{90,0666 \cdot 13,67}{1,380 \cdot 1 - 0,6 \cdot 90,0666} \\
 &= 0,93 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{90,0666 \cdot 109,54}{1,180 \cdot 1 + 0,4 \cdot 90,0666} \\
 &= 8,11 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{90,0666 \cdot 109,54}{1.180 \cdot 0,85 + 0,4 \cdot 90,0666} \\
 &= 9,49 \text{ mm}
 \end{aligned}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(f)(2)(b) Weld Check

Fillet weld: $t_{\min} = \min [19mm, t_n, t] = 5,38 \text{ mm}$

$t_{c(\min)} = \min [2,5 \text{ mm}, 0,7 \cdot t_{\min}] = 2,5 \text{ mm}$

$t_{c(actual)} = 0,7 \cdot \text{Leg} = 0,7 \cdot 8 = 5,6 \text{ mm}$

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-44 Thickness Check - ASME B16.11 Coupling

$$\begin{aligned}
 t_{aApp \text{ 1-1}} &= \frac{P \cdot R_o}{S_n \cdot E + 0,4 \cdot P} + \text{Corrosion} \\
 &= \frac{90,0666 \cdot 19,05}{1.380 \cdot 1 + 0,4 \cdot 90,0666} + 3 \\
 &= 4,21 \text{ mm}
 \end{aligned}$$

$$\begin{aligned}
 t_{aUG-44} &= \max [t_{aApp \text{ 1-1}}, t_{bUG16}] \\
 &= \max [4,21, 4,5] \\
 &= 4,5 \text{ mm}
 \end{aligned}$$

Available nozzle wall thickness new, $t_n = 8,38 \text{ mm}$

The nozzle neck thickness is adequate.

Reinforcement Calculations for MAP

The vessel wall thickness governs the MAP of this nozzle.

UG-37 Area Calculation Summary (cm ²)							UG-44 Summary (mm)	
For P = 124,78 bar @ 21,11 °C							The nozzle passes UG-44	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							1,66	8,38

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

Calculations for internal pressure 124,78 bar @ 21,11 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [21,34, 10,67 + (8,38 - 0) + (11,11 - 0)] \\
 &= 30,16 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (11,11 - 0), 2,5 \cdot (8,38 - 0) + 0] \\
 &= 20,96 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{124,7779 \cdot 10,67}{1,380 \cdot 1 - 0,6 \cdot 124,7779} \\
 &= 1,02 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{124,7779 \cdot 109,54}{1,180 \cdot 1 + 0,4 \cdot 124,7779} \\
 &= 11,11 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{124,7779 \cdot 109,54}{1,180 \cdot 0,85 + 0,4 \cdot 124,7779} \\
 &= 12,98 \text{ mm}
 \end{aligned}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UG-44 Thickness Check - ASME B16.11 Coupling

$$\begin{aligned}t_{aApp\ 1-1} &= \frac{P \cdot R_o}{S_n \cdot E + 0,4 \cdot P} + \text{Corrosion} \\&= \frac{124,7779 \cdot 19,05}{1,380 \cdot 1 + 0,4 \cdot 124,7779} + 0 \\&= 1,66 \text{ mm} \\t_{aUG-44} &= \max [t_{aApp\ 1-1}, t_{bUG16}] \\&= \max [1,66, 1,5] \\&= \underline{1,66} \text{ mm}\end{aligned}$$

Available nozzle wall thickness new, $t_n = 8,38 \text{ mm}$

The nozzle neck thickness is adequate.

Straight Flange on B16.9 Pipe Cap - Right Side

ASME Section VIII Division 1, 2021 Edition Metric				
Component		Cylinder		
Material		SA-234 WPB (II-D Metric p. 16, ln. 18)		
Impact Tested	Normalized	Fine Grain Practice	PWHT	Maximize MDMT/ No MAWP
No	No	No	No	No
		Design Pressure (bar)	Design Temperature (°C)	Design MDMT (°C)
Internal		39	157	0
Static Liquid Head				
Condition		P _s (bar)	H _s (mm)	SG
Test horizontal		0,03	346,84	1
Dimensions				
Outer Diameter		219,07 mm		
Length		42,47 mm		
Nominal Thickness		12,7 mm		
Corrosion	Inner	3 mm		
	Outer	0 mm		
Weight and Capacity				
		Weight (kg)		Capacity (liters)
New		2,74		1,25
Corroded		2,12		1,33
Radiography				
Longitudinal seam		Seamless No RT		
Left Circumferential seam		Spot UW-11(b) Type 1		

Results Summary	
Governing condition	Internal pressure
Minimum thickness per UG-16	1,5 mm + 3 mm = 4,5 mm
Design thickness due to internal pressure (t)	7,2 mm
Maximum allowable working pressure (MAWP)	92,09 bar
Maximum allowable pressure (MAP)	121,95 bar
Rated MDMT	-48 °C

UCS-66 Material Toughness Requirements	
Governing thickness, t _g =	11,11 mm
Exemption temperature from Fig UCS-66M Curve B =	-24,98°C
$t_r = \frac{40,92 \cdot 109,54}{1.180 \cdot 0,85 + 0,4 \cdot 40,92} =$	4,4 mm
$\text{Stress ratio} = \frac{t_r \cdot E^*}{t_n - c} = \frac{4,4 \cdot 0,85}{12,7 - 3} =$	0,3853
Reduction in MDMT, T _R from Fig UCS-66.1M =	57,6°C
$MDMT = \max [MDMT - T_R, -48] = \max [-24,98 - 57,6, -48] =$	-48°C
Material is exempt from impact testing at the Design MDMT of 0°C.	

Design thickness, (at 157 °C) Appendix 1-1

$$t = \frac{P \cdot R_o}{S \cdot E + 0,40 \cdot P} + \text{Corrosion} = \frac{39 \cdot 109,54}{1.180 \cdot 0,85 + 0,40 \cdot 39} + 3 = \underline{7,2} \text{ mm}$$

Maximum allowable working pressure, (at 157 °C) Appendix 1-1

$$P = \frac{S \cdot E \cdot t}{R_o - 0,40 \cdot t} - P_s = \frac{1.180 \cdot 0,85 \cdot 9,7}{109,54 - 0,40 \cdot 9,7} - 0 = \underline{92,09} \text{ bar}$$

Maximum allowable pressure, (at 21,11 °C) Appendix 1-1

$$P = \frac{S \cdot E \cdot t}{R_o - 0,40 \cdot t} = \frac{1.180 \cdot 0,85 \cdot 12,7}{109,54 - 0,40 \cdot 12,7} = \underline{121,95} \text{ bar}$$

ASME Section VIII Division 1 UG-80(a) Out-of-Roundness
$(D_{\max} - D_{\min})$ shall not exceed 1% of D
When the cross section passes through an opening or within 1 I.D. of the opening, $(D_{\max} - D_{\min})$ shall not exceed 1% of $D + 2\%$ of the inside diameter of the opening

B16.9 Pipe Cap - Right Side

ASME Section VIII Division 1, 2021 Edition Metric				
Component		ASME B16.9 Pipe Cap (modified)		
Material		SA-234 WPB (II-D Metric p. 16, ln. 18)		
Attached To		Cylinder #1		
Impact Tested	Normalized	Fine Grain Practice	PWHT	Maximize MDMT/ No MAWP
No	No	No	No	No
		Design Pressure (bar)	Design Temperature (°C)	Design MDMT (°C)
Internal		39	157	0
Static Liquid Head				
Condition		P _s (bar)	H _s (mm)	SG
Test horizontal		0,03	346,84	1
Dimensions				
NPS and Schedule		NPS 8 Sch 80 (XS) DN 200		
Outer Diameter		219,07 mm		
Overall Length E		102 mm		
Nominal Thickness		12,7 mm		
Minimum Thickness ¹		11,11 mm		
Corrosion	Inner	3 mm		
	Outer	0 mm		
Length L _{sf}		42,47 mm		
Nominal Thickness t _{sf}		12,7 mm		
Weight and Capacity				
		Weight (kg) ²		Capacity (liters) ²
New		7,72		2,2
Corroded		6,06		2,4
Radiography				
Category A joints		Seamless No RT		
Head to shell seam		Spot UW-11(b) Type 1		

¹ minimum thickness = nominal thickness times pipe tolerance factor of 0,875.

² includes straight flange

Results Summary	
Governing condition	internal pressure
Minimum thickness per UG-16	1,5 mm + 3 mm = 4,5 mm
Design thickness due to internal pressure (t)	<u>6,96</u> mm
Governing straight flange design thickness	7,2 mm
Maximum allowable working pressure (MAWP)	<u>82,74</u> bar
Maximum allowable pressure (MAP)	<u>111,98</u> bar
<u>Straight Flange</u> governs MDMT	-48°C

Factor K		
$K = \left(\frac{1}{6}\right) \cdot \left[2 + \left(\frac{D}{2 \cdot h}\right)^2\right]$		
Corroded	$K = \left(\frac{1}{6}\right) \cdot \left[2 + \left(\frac{199,67}{2 \cdot 51,42}\right)^2\right]$	0,9617
New	$K = \left(\frac{1}{6}\right) \cdot \left[2 + \left(\frac{193,67}{2 \cdot 48,42}\right)^2\right]$	1

Design thickness for internal pressure, (Corroded at 157 °C) Appendix 1-4(c)

$$t = \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} + \text{Corrosion} = \frac{39 \cdot 219,07 \cdot 0,961673}{2 \cdot 1.180 \cdot 0,85 + 2 \cdot 39 \cdot (0,961673 - 0,1)} + 3 = \underline{6.96} \text{ mm}$$

Maximum allowable working pressure, (Corroded at 157 °C) Appendix 1-4(c)

$$P = \frac{2 \cdot S \cdot E \cdot t}{K \cdot D_o - 2 \cdot t \cdot (K - 0,1)} - P_s = \frac{2 \cdot 1.180 \cdot 0,85 \cdot (0,875 \cdot 12,7 - 3)}{0,961673 \cdot 219,07 - 2 \cdot (0,875 \cdot 12,7 - 3) \cdot (0,961673 - 0,1)} - 0 = \underline{82.74} \text{ bar}$$

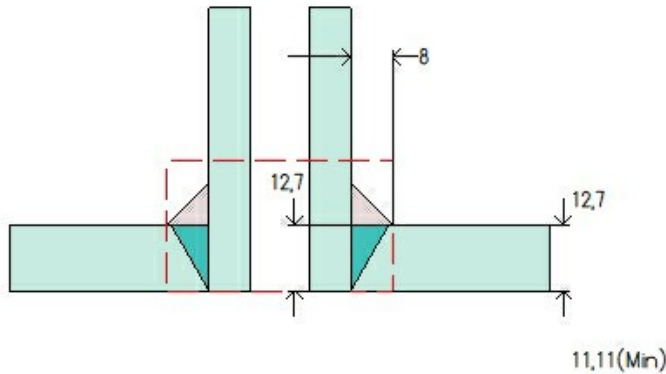
Maximum allowable pressure, (New at 21,11 °C) Appendix 1-4(c)

$$P = \frac{2 \cdot S \cdot E \cdot t}{K \cdot D_o - 2 \cdot t \cdot (K - 0,1)} - P_s = \frac{2 \cdot 1.180 \cdot 0,85 \cdot 0,875 \cdot 12,7}{1 \cdot 219,07 - 2 \cdot 0,875 \cdot 12,7 \cdot (1 - 0,1)} - 0 = \underline{111.98} \text{ bar}$$

ASME Section VIII Division 1 UG-81(a) Out-of-Roundness
Inside surface shall not deviate outside the shape by more than 1,25 % of D
Inside surface shall not deviate inside the shape by more than 0,625 % of D

Air Outlet (N2)

ASME Section VIII Division 1, 2021 Edition Metric



Note: round inside edges per UG-76(c)

Location and Orientation

Located on	B16.9 Pipe Cap - Right Side
Orientation	0°
End of nozzle to datum line	-166 mm
Calculated as hillside	No
Distance to head center, R	0 mm
Passes through a Category A joint	No

Nozzle

Description	NPS 0,75 XXS DN 20
Access opening	No
Material specification	SA-106 B Smls Pipe (II-D Metric p. 16, In. 16)
Inside diameter, new	11,02 mm
Pipe nominal wall thickness	7,82 mm
Pipe minimum wall thickness ¹	6,85 mm
Corrosion allowance	3 mm
Projection available outside vessel, L _{pr}	64,44 mm
Local vessel minimum thickness	11,11 mm
Liquid static head included	0 bar

Welds

Inner fillet, Leg ₄₁	8 mm
Nozzle to vessel groove weld	12,7 mm

Radiography

Longitudinal seam	Seamless No RT
Circumferential seam	Full UW-11(a) Type 1

¹Pipe minimum thickness = nominal thickness times pipe tolerance factor of 0,875.

UCS-66 Material Toughness Requirements Nozzle

$t_r = \frac{40,92 \cdot 8,51}{1,180 \cdot 1 - 0,6 \cdot 40,92} =$	0,3 mm
Stress ratio $= \frac{t_r \cdot E^*}{t_n - c} = \frac{0,3 \cdot 1}{6,85 - 3} =$	0,0784
Stress ratio $\leq 0,35$, MDMT per UCS-66(b)(3) =	-105°C
Material is exempt from impact testing at the Design MDMT of 0°C.	

Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 39 bar @ 157 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							5,51	6,85

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (mm)	Actual weld throat size (mm)	Status
Nozzle to shell fillet (Leg ₄₁)	3,38	5,6	weld size is adequate

Calculations for internal pressure 39 bar @ 157 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [17,02, 8,51 + (7,82 - 3) + (11,11 - 3)] \\
 &= 21,45 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (11,11 - 3), 2,5 \cdot (7,82 - 3) + 0] \\
 &= 12,06 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{39,0001 \cdot 8,51}{1,180 \cdot 1 - 0,6 \cdot 39,0001} \\
 &= 0,29 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)(c)

$$\begin{aligned}
 t_r &= \frac{P \cdot K_1 \cdot D_o}{2 \cdot S \cdot E + 0,8 \cdot P} \\
 &= \frac{39,0001 \cdot 0,8737 \cdot 219,07}{2 \cdot 1,180 \cdot 1 + 0,8 \cdot 39,0001} \\
 &= 3,12 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$t_r = \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} = \frac{39 \cdot 219,07 \cdot 0,961673}{2 \cdot 1,180 \cdot 0,85 + 2 \cdot 39 \cdot (0,961673 - 0,1)} = 3,96 \text{ mm}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(c) Weld Check

Fillet weld: $t_{\min} = \min [19\text{ mm}, t_n, t] = 4,82 \text{ mm}$

$$t_{c(\min)} = \min [6 \text{ mm}, 0,7 \cdot t_{\min}] = \underline{3,38} \text{ mm}$$

$$t_{c(\text{actual})} = 0,7 \cdot \text{Leg} = 0,7 \cdot 8 = 5,6 \text{ mm}$$

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-45 Nozzle Neck Thickness Check

Interpretation VIII-1-83-66 has been applied.

$$\begin{aligned} t_{a\text{UG-27}} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\ &= \frac{39,0001 \cdot 8,51}{1,180 \cdot 1 - 0,6 \cdot 39,0001} + 3 \\ &= 3,29 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_a &= \max [t_{a\text{UG-27}}, t_{a\text{UG-22}}] \\ &= \max [3,29, 0] \\ &= 3,29 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{b1} &= \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} + \text{Corrosion} \\ &= \frac{39 \cdot 219,07 \cdot 0,961673}{2 \cdot 1,180 \cdot 1 + 2 \cdot 39 \cdot (0,961673 - 0,1)} + 3 \\ &= 6,38 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{b1} &= \max [t_{b1}, t_{b\text{UG16}}] \\ &= \max [6,39, 4,5] \\ &= 6,39 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_b &= \min [t_{b3}, t_{b1}] \\ &= \min [5,51, 6,39] \\ &= 5,51 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{\text{UG-45}} &= \max [t_a, t_b] \\ &= \max [3,29, 5,51] \\ &= \underline{5,51} \text{ mm} \end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 7,82 = 6,85 \text{ mm}$

The nozzle neck thickness is adequate.

Reinforcement Calculations for MAWP

The vessel wall thickness governs the MAWP of this nozzle.

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 103,54 bar @ 157 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							5,51	6,85

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (mm)	Actual weld throat size (mm)	Status
Nozzle to shell fillet (Leg ₄₁)	3,38	5,6	weld size is adequate

Calculations for internal pressure 103,54 bar @ 157 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [17,02, 8,51 + (7,82 - 3) + (11,11 - 3)] \\
 &= 21,45 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (11,11 - 3), 2,5 \cdot (7,82 - 3) + 0] \\
 &= 12,06 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{103,5405 \cdot 8,51}{1.180 \cdot 1 - 0,6 \cdot 103,5405} \\
 &= 0,79 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)(c)

$$\begin{aligned}
 t_r &= \frac{P \cdot K_1 \cdot D_o}{2 \cdot S \cdot E + 0,8 \cdot P} \\
 &= \frac{103,5405 \cdot 0,8737 \cdot 219,07}{2 \cdot 1.180 \cdot 1 + 0,8 \cdot 103,5405} \\
 &= 8,11 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$t_r = \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} = \frac{103,54 \cdot 219,07 \cdot 0,961673}{2 \cdot 1.180 \cdot 0,85 + 2 \cdot 103,54 \cdot (0,961673 - 0,1)} = 9,99 \text{ mm}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(c) Weld Check

Fillet weld: $t_{\min} = \min [19\text{ mm}, t_n, t] = 4,82 \text{ mm}$

$t_{c(\min)} = \min [6 \text{ mm}, 0,7 \cdot t_{\min}] = 3,38 \text{ mm}$

$t_{c(actual)} = 0,7 \cdot \text{Leg} = 0,7 \cdot 8 = 5,6 \text{ mm}$

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-45 Nozzle Neck Thickness Check

Interpretation VIII-1-83-66 has been applied.

$$\begin{aligned} t_{aUG-27} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\ &= \frac{103,5405 \cdot 8,51}{1,180 \cdot 1 - 0,6 \cdot 103,5405} + 3 \\ &= 3,79 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_a &= \max [t_{aUG-27}, t_{aUG-22}] \\ &= \max [3,79, 0] \\ &= 3,79 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{b1} &= \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} + \text{Corrosion} \\ &= \frac{103,54 \cdot 219,07 \cdot 0,961673}{2 \cdot 1,180 \cdot 1 + 2 \cdot 103,54 \cdot (0,961673 - 0,1)} + 3 \\ &= 11,59 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{b1} &= \max [t_{b1}, t_{bUG16}] \\ &= \max [11,59, 4,5] \\ &= 11,59 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_b &= \min [t_{b3}, t_{b1}] \\ &= \min [5,51, 11,59] \\ &= 5,51 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{UG-45} &= \max [t_a, t_b] \\ &= \max [3,79, 5,51] \\ &= 5,51 \text{ mm} \end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 7,82 = 6,85 \text{ mm}$

The nozzle neck thickness is adequate.

Reinforcement Calculations for MAP

The vessel wall thickness governs the MAP of this nozzle.

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 139,29 bar @ 21,11 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							2,51	6,85

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

Calculations for internal pressure 139,29 bar @ 21,11 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [11,02, 5,51 + (7,82 - 0) + (11,11 - 0)] \\
 &= 24,45 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (11,11 - 0), 2,5 \cdot (7,82 - 0) + 0] \\
 &= 19,56 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{139,2932 \cdot 5,51}{1.180 \cdot 1 - 0,6 \cdot 139,2932} \\
 &= 0,7 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)(c)

$$\begin{aligned}
 t_r &= \frac{P \cdot K_1 \cdot D_o}{2 \cdot S \cdot E + 0,8 \cdot P} \\
 &= \frac{139,2932 \cdot 0,9 \cdot 219,07}{2 \cdot 1.180 \cdot 1 + 0,8 \cdot 139,2932} \\
 &= 11,11 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$t_r = \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} = \frac{139,29 \cdot 219,07 \cdot 1}{2 \cdot 1.180 \cdot 0,85 + 2 \cdot 139,29 \cdot (1 - 0,1)} = 13,52 \text{ mm}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UG-45 Nozzle Neck Thickness Check

Interpretation VIII-1-83-66 has been applied.

$$\begin{aligned}
 t_{aUG-27} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\
 &= \frac{139,2932 \cdot 5,51}{1.180 \cdot 1 - 0,6 \cdot 139,2932} + 0 \\
 &= 0,7 \text{ mm} \\
 t_a &= \max [t_{aUG-27}, t_{aUG-22}] \\
 &= \max [0,7, 0] \\
 &= 0,7 \text{ mm} \\
 t_{b1} &= \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} + \text{Corrosion} \\
 &= \frac{139,29 \cdot 219,07 \cdot 1}{2 \cdot 1.180 \cdot 1 + 2 \cdot 139,29 \cdot (1 - 0,1)} + 0 \\
 &= 11,69 \text{ mm} \\
 t_{b1} &= \max [t_{b1}, t_{bUG16}] \\
 &= \max [11,69, 1,5] \\
 &= 11,69 \text{ mm} \\
 t_b &= \min [t_{b3}, t_{b1}] \\
 &= \min [2,51, 11,69] \\
 &= 2,51 \text{ mm} \\
 t_{UG-45} &= \max [t_a, t_b] \\
 &= \max [0,7, 2,51] \\
 &= \underline{2,51} \text{ mm}
 \end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 7,82 = 6,85 \text{ mm}$

The nozzle neck thickness is adequate.

B16.9 Elbow #2 (N2)

ASME Section VIII Division 1, 2021 Edition Metric				
Component		ASME B16.9 Elbow		
Type		Long Radius 90-deg		
Material		SA-234 WPB (II-D Metric p. 16, ln. 18)		
Pipe NPS and Schedule		NPS 0,75 XXS DN 20		
Attached To		Air Outlet (N2)		
Impact Tested	Normalized	Fine Grain Practice	PWHT	Maximize MDMT/ No MAWP
No	No	No	No	No
		Design Pressure (bar)	Design Temperature (°C)	Design MDMT (°C)
Internal		39	157	0
Static Liquid Head				
Condition		P _s (bar)	H _s (mm)	SG
Test horizontal		0,03	255,51	1
Dimensions				
Outer Diameter		26,67 mm		
Nominal Thickness		7,82 mm		
Minimum Thickness ¹		6,85 mm		
Center-to-End, A		38 mm		
Corrosion	Inner	3 mm		
	Outer	0 mm		
Weight and Capacity				
		Weight (kg)		Capacity (liters)
New		0,22		0,01
Corroded		0,16		0,01
Radiography				
Longitudinal seam		Seamless No RT		
Left Circumferential seam		Full UW-11(a) Type 1		
Right Circumferential seam		Full UW-11(a) Type 1		

¹ minimum thickness = nominal thickness times pipe tolerance factor of 0,875.

ASME B16.5-2017 Flange	
Description	NPS 0,75 Class 600 WN A105
Bolt Material	SA-193 B7 Bolt <= 64 (II-D Metric p. 410, In. 32)
Blind included	No
Rated MDMT	-48°C
Liquid static head	0 bar
MAWP rating	89,84 bar @ 157°C
MAP rating	102,1 bar @ 21,11°C
Hydrotest rating	154 bar @ 21,11°C
PWHT performed	No
Produced to Fine Grain Practice and Supplied in Heat Treated Condition	No
Impact Tested	No
Circumferential joint radiography	Full UW-11(a) Type 1
Bore diameter, B (specified by purchaser)	11,02 mm
Gasket	
Type	ASME B16.21 Nonmetallic Flat Gasket
Description	Flexitallic Compressed Fiber SF 2401 Synthetic/NBR
Factor, m	3,2
Seating Stress, y	203,89 kgf/cm ²
Thickness, T	3 mm
Inner Diameter	27 mm
Outer Diameter	67 mm
Notes	
Flange rated MDMT per UCS-66(b)(1)(b) = -48°C (Coincident ratio = 0,4008) Bolts rated MDMT per Fig UCS-66 note (c) = -48°C	

Results Summary	
Governing condition	UG-16
Minimum thickness per UG-16	1,5 mm + 3 mm = 4,5 mm
Design thickness due to internal pressure (t)	3,43 mm
Maximum allowable working pressure (MAWP)	401,45 bar
Maximum allowable pressure (MAP)	849,81 bar
Rated MDMT	-105 °C

UCS-66 Material Toughness Requirements	
$t_r = 13,34 \cdot \left(1 - \exp \left(- \frac{40,92}{1.180 \cdot 1} \right) \right) =$	0,45 mm
$\text{Stress ratio} = \frac{t_r \cdot E^*}{t_n - c} = \frac{0,45 \cdot 1}{6,85 - 3} =$	0,1182
Stress ratio $\leq 0,35$, MDMT per UCS-66(b)(3) =	-105°C
Material is exempt from impact testing at the Design MDMT of 0°C.	

Design thickness, (at 157 °C) Appendix 1-2

$$t = R_o \cdot \left(1 - \exp \left[- \frac{P}{S \cdot E} \right] \right) + \text{Corrosion} = 13,34 \cdot \left(1 - \exp \left[- \frac{39}{1.180 \cdot 1,00} \right] \right) + 3 = \text{3,43 mm}$$

Maximum allowable working pressure, (at 157 °C) Appendix 1-2

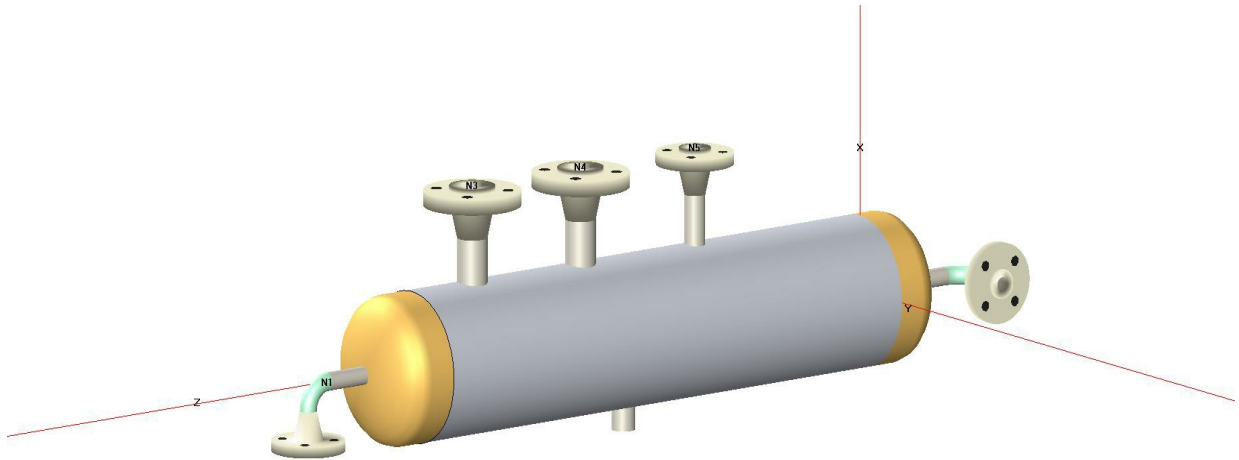
$$P = S \cdot E \cdot \ln\left(\frac{R_o}{R_o - t}\right) - P_s = 1.180 \cdot 1,00 \cdot \ln\left(\frac{13,34}{13,34 - (7,82 \cdot 0,875 - 3)}\right) - 0 = \underline{401,45} \text{ bar}$$

Maximum allowable pressure, (at 21,11 °C) Appendix 1-2

$$P = S \cdot E \cdot \ln\left(\frac{R_o}{R_o - t}\right) = 1.180 \cdot 1,00 \cdot \ln\left(\frac{13,34}{13,34 - (7,82 \cdot 0,875)}\right) = \underline{849,81} \text{ bar}$$

Locati Impianti Srl

Via Vittorio Veneto, 37 - Verdellino - Bergamo - Italy



COMPRESS Pressure Vessel Design Calculations

Item: LI 5062

Customer: Airpack

Drawing No.: C230048DWG004

Document No.: C230048CLC008 Rev.05

Date: 04/10/2024

Service: 2nd Stage Outlet Pulsation Damper

Tag Number: 320-KV-020-004

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Nozzle Schedule

Specifications									
Nozzle mark	Identifier	Size	Materials		Impact Tested	Normalized	Fine Grain	Flange	Blind
N1	Air Inlet	NPS 0,75 XXS DN 20	Nozzle	SA-106 B Smls Pipe	No	No	No	N/A	No
	B16.9 Elbow #1 (N1)	NPS 0,75 XXS DN 20	B16.9 Elbow	SA-234 WPB	No	No	No	NPS 3/4 Class 600 WN A105	No
N2	Air Outlet	NPS 0,75 XXS DN 20	Nozzle	SA-106 B Smls Pipe	No	No	No	N/A	No
	B16.9 Elbow #2 (N2)	NPS 0,75 XXS DN 20	B16.9 Elbow	SA-234 WPB	No	No	No	NPS 3/4 Class 600 WN A105	No
N3	Temperature Gauge Connection	NPS 1,5 Sch 160 DN 40	Nozzle	SA-106 B Smls Pipe	No	No	No	NPS 1 1/2 Class 600 WN A105	No
N4	Temperature Transmitter Connection	NPS 1,5 Sch 160 DN 40	Nozzle	SA-106 B Smls Pipe	No	No	No	NPS 1 1/2 Class 600 WN A105	No
N5	PSV Connection	NPS 1 XXS DN 25	Nozzle	SA-106 B Smls Pipe	No	No	No	NPS 1 Class 600 WN A105	No
N6	Drain	NPS 0,5 Class 6000 DN 15 - Threaded Full Coupling	Nozzle	SA-105	No	No	No	N/A	No

Nozzle Summary

Dimensions												
Nozzle mark	OD (mm)	t _n (mm)	Req t _n (mm)	A ₁ ?	A ₂ ?	Shell			Reinforcement Pad		Corr (mm)	A _a /A _r (%)
						Nom t (mm)	Design t (mm)	User t (mm)	Width (mm)	t _{pad} (mm)		
N1	26,67	7,82	6,3	Yes	Yes	12,7	N/A		N/A	N/A	3	Exempt
N2	26,67	7,82	6,3	Yes	Yes	12,7	N/A		N/A	N/A	3	Exempt
N3	48,26	7,14	7,11	Yes	Yes	12,7	N/A		N/A	N/A	3	Exempt
N4	48,26	7,14	7,11	Yes	Yes	12,7	N/A		N/A	N/A	3	Exempt
N5	33,4	9,09	6,81	Yes	Yes	12,7	N/A		N/A	N/A	3	Exempt
N6	38,1	8,38	4,5	Yes	Yes	12,7	N/A		N/A	N/A	3	Exempt

*Head minimum thickness after forming

Definitions	
t _n	Nozzle thickness
Req t _n	Nozzle thickness required per UG-45/UG-16 Increased for pipe to account for 12.5% pipe thickness tolerance
Nom t	Vessel wall thickness
Design t	Required vessel wall thickness due to pressure + corrosion allowance per UG-37
User t	Local vessel wall thickness (near opening)
A _a	Area available per UG-37, governing condition
A _r	Area required per UG-37, governing condition
Corr	Corrosion allowance on nozzle wall

Pressure Summary

Component Summary							
Identifier	P Design (bar)	T Design (°C)	MAWP (bar)	MAP (bar)	MDMT (°C)	MDMT Exemption	Impact Tested
B16.9 Pipe Cap - Left Side	39	135	82,74	111,98	-48	Note 1	No
Straight Flange on B16.9 Pipe Cap - Left Side	39	135	92,09	121,95	-48	Note 2	No
Cylinder #1	39	135	76,56	106,06	-45,68	Note 3	No
Straight Flange on B16.9 Pipe Cap - Right Side	39	135	92,09	121,95	-48	Note 2	No
B16.9 Pipe Cap - Right Side	39	135	82,74	111,98	-48	Note 4	No
Air Inlet (N1)	39	135	103,54	139,29	-105	Note 5	No
B16.9 Elbow #1 (N1)	39	135	91,1	102,1	-44,78	Note 6, 7	No
Air Outlet (N2)	39	135	103,54	139,29	-105	Note 5	No
B16.9 Elbow #2 (N2)	39	135	91,1	102,1	-44,78	Note 6, 7	No
Temperature Gauge Connection (N3)	39	135	90,07	102,1	-44,78	Note 8	No
Temperature Transmitter Connection (N4)	39	135	90,07	102,1	-44,78	Note 8	No
PSV Connection (N5)	39	135	90,07	102,1	-44,78	Note 8	No
Drain (N6)	39	135	90,07	124,78	-105	Note 9	No

Chamber Summary	
Design MDMT	0 °C
Rated MDMT	0 °C @ 56,38 bar
MAWP hot & corroded	56,38 bar @ 135 °C
MAP cold & new	102,1 bar @ 21,11 °C
(1) The MAWP is limited due to the MAWP limit set in the Calculations tab of the Set Mode dialog. (2) The rated MDMT is limited to the design MDMT based on the setting in the Calculations tab of the Set Mode dialog. (3) This pressure chamber is not designed for external pressure.	

Notes for MDMT Rating		
Note #	Exemption	Details
1.	Straight Flange governs MDMT	
2.	Material impact test exemption temperature from Fig UCS-66M Curve B = -24,98°C Fig UCS-66.1M MDMT reduction = 28,9°C, (coincident ratio = 0,5277) Rated MDMT of -53,88°C is limited to -48°C by UCS-66(b)(2)	UCS-66 governing thickness = 11,11 mm
3.	Material impact test exemption temperature from Fig UCS-66M Curve B = -24,98°C Fig UCS-66.1M MDMT reduction = 20,7°C, (coincident ratio = 0,6309)	UCS-66 governing thickness = 11,11 mm
4.	Straight Flange governs MDMT	
5.	Nozzle is impact test exempt to -105°C per UCS-66(b)(3) (coincident ratio = 0,1089).	
6.	Material is impact test exempt to -105°C per UCS-66(b)(3) (coincident ratio = 0,1618)	
7.	Flange rating governs: Flange rated MDMT per UCS-66(b)(1)(b) = -44,78°C (Coincident ratio = 0,5522)	Bolts rated MDMT per Fig UCS-66 note (c) = -48°C
8.	Flange rating governs: Flange rated MDMT per UCS-66(b)(1)(b) = -44,78°C (Coincident ratio = 0,5522) Bolts rated MDMT per Fig UCS-66 note (c) = -48°C	
9.	Nozzle is impact test exempt to -105°C per UCS-66(b)(3) (coincident ratio = 0,1064).	

Settings Summary

COMPRESS 2024 Build 8400	
ASME Section VIII Division 1, 2021 Edition Metric	
Units	MKS
Datum Line Location	0,00 mm from right seam
Vessel Design Mode	Design Mode
Minimum thickness	1,5 mm per UG-16(b)
Design for cold shut down only	No
Design for lethal service (full radiography required)	No
User has limited MAWP to	56,38 bar
Design nozzles for	Design P only
Corrosion weight loss	100% of theoretical loss
UG-23 Stress Increase	1,20
Skirt/legs stress increase	1,0
Minimum nozzle projection	60 mm
Juncture calculations for $\alpha > 30$ only	Yes
Preheat P-No 1 Materials $> 1,25"$ and $\leq 1,50"$ thick	No
UG-37(a) shell tr calculation considers longitudinal stress	No
Cylindrical shells made from pipe are entered as minimum thickness	No
Nozzles made from pipe are entered as minimum thickness	No
ASME B16.9 fittings are entered as minimum thickness	No
Butt welds	Tapered per Figure UCS-66.3(a)
Disallow Appendix 1-5, 1-8 calculations under 15 psi	No
Hydro/Pneumatic Test	
Shop Hydrotest Pressure	1,3 times vessel MAWP [UG-99(b)]
Test liquid specific gravity	1,00
Maximum stress during test	90% of yield
Required Marking - UG-116	
UG-116(e) Radiography	RT3
UG-116(f) Postweld heat treatment	None
Code Cases/Interpretations	
Use Appendix 46	No
Use UG-44(b)	No
Use Code Case 3035	No
Apply interpretation VIII-1-83-66	Yes
Apply interpretation VIII-1-86-175	Yes
Apply interpretation VIII-1-01-37	Yes
Apply interpretation VIII-1-01-150	Yes
Apply interpretation VIII-1-07-50	Yes
Apply interpretation VIII-1-16-85	Yes
No UCS-66.1 MDMT reduction	No
No UCS-68(c) MDMT reduction	No
Disallow UG-20(f) exemptions	No
UG-22 Loadings	
UG-22(a) Internal or External Design Pressure	Yes
UG-22(b) Weight of the vessel and normal contents under operating or test conditions	No
UG-22(c) Superimposed static reactions from weight of attached equipment (external loads)	No
UG-22(d)(2) Vessel supports such as lugs, rings, skirts, saddles and legs	No
UG-22(f) Wind reactions	No
UG-22(f) Seismic reactions	No

UG-22(j) Test pressure and coincident static head acting during the test:	No
Note: UG-22(b),(c) and (f) loads only considered when supports are present.	
Note 2: UG-22(d)(1),(e),(f)-snow,(g),(h),(i) are not considered. If these loads are present, additional calculations must be performed.	

License Information	
Company Name	Locati Impianti s.r.l.
License	Commercial
License Key ID	32235
Support Expires	September 20, 2025
Account Number	891888909529634

Radiography Summary

UG-116 Radiography							
Component	Longitudinal Seam		Left Circumferential Seam		Right Circumferential Seam		Mark
	Category (Fig UW-3)	Radiography / Joint Type	Category (Fig UW-3)	Radiography / Joint Type	Category (Fig UW-3)	Radiography / Joint Type	
B16.9 Pipe Cap - Left Side	N/A	Seamless No RT	N/A	N/A	B	Spot UW-11(b) / Type 1	RT3
Cylinder #1	N/A	Seamless No RT	B	Spot UW-11(b) / Type 1	B	Spot UW-11(b) / Type 1	RT3
B16.9 Pipe Cap - Right Side	N/A	Seamless No RT	B	Spot UW-11(b) / Type 1	N/A	N/A	RT3
Nozzle	Longitudinal Seam		Nozzle to Vessel Circumferential Seam		Nozzle free end Circumferential Seam		
Air Inlet (N1)	N/A	Seamless No RT	D	N/A / Type 7	B	UW-11(b) exempt / Type 1	N/A
B16.9 Elbow #1 (N1)	N/A	Seamless No RT	B	UW-11(b) exempt / Type 1	C	UW-11(b) exempt / Type 1	N/A
Temperature Gauge Connection (N3)	N/A	Seamless No RT	D	N/A / Type 7	C	UW-11(b) exempt / Type 1	N/A
Temperature Transmitter Connection (N4)	N/A	Seamless No RT	D	N/A / Type 7	C	UW-11(b) exempt / Type 1	N/A
PSV Connection (N5)	N/A	Seamless No RT	D	N/A / Type 7	C	UW-11(b) exempt / Type 1	N/A
Drain (N6)	N/A	Seamless No RT	D	N/A / Type 7	N/A	N/A	N/A
Air Outlet (N2)	N/A	Seamless No RT	D	N/A / Type 7	B	UW-11(b) exempt / Type 1	N/A
B16.9 Elbow #2 (N2)	N/A	Seamless No RT	B	UW-11(b) exempt / Type 1	C	UW-11(b) exempt / Type 1	N/A
Nozzle Flange	Longitudinal Seam		Flange Face		Nozzle to Flange Circumferential Seam		
ASME B16.5/16.47 flange attached to right end of B16.9 Elbow #1 (N1)	N/A	Seamless No RT	N/A	N/A / Gasketed	C	UW-11(b) exempt / Type 1	N/A
ASME B16.5/16.47 flange attached to Temperature Gauge Connection (N3)	N/A	Seamless No RT	N/A	N/A / Gasketed	C	UW-11(b) exempt / Type 1	N/A
ASME B16.5/16.47 flange attached to Temperature Transmitter Connection (N4)	N/A	Seamless No RT	N/A	N/A / Gasketed	C	UW-11(b) exempt / Type 1	N/A
ASME B16.5/16.47 flange attached to PSV Connection (N5)	N/A	Seamless No RT	N/A	N/A / Gasketed	C	UW-11(b) exempt / Type 1	N/A
ASME B16.5/16.47 flange attached to right end of B16.9 Elbow #2 (N2)	N/A	Seamless No RT	N/A	N/A / Gasketed	C	UW-11(b) exempt / Type 1	N/A
UG-116(e) Required Marking: RT3							

Thickness Summary

Component Data								
Component Identifier	Material	Diameter (mm)	Length (mm)	Nominal t (mm)	Design t (mm)	Total Corrosion (mm)	Joint E	Load
B16.9 Pipe Cap - Left Side	SA-234 WPB	219,07 OD	59,53	12,7	6,96	3	0,85	Internal
Straight Flange on B16.9 Pipe Cap - Left Side	SA-234 WPB	219,07 OD	42,47	12,7	7,2	3	0,85	Internal
Cylinder #1	SA-106 B Smls Pipe	219,07 OD	890	12,7	7,2	3	0,85	Internal
Straight Flange on B16.9 Pipe Cap - Right Side	SA-234 WPB	219,07 OD	42,47	12,7	7,2	3	0,85	Internal
B16.9 Pipe Cap - Right Side	SA-234 WPB	219,07 OD	59,53	12,7	6,96	3	0,85	Internal

Definitions	
Nominal t	Vessel wall nominal thickness
Design t	Required vessel thickness due to governing loading + corrosion
Joint E	Longitudinal seam joint efficiency
Load	
Internal	Circumferential stress due to internal pressure governs
External	External pressure governs
Wind	Combined longitudinal stress of pressure + weight + wind governs
Seismic	Combined longitudinal stress of pressure + weight + seismic governs

Weight Summary

Weight (kg) Contributed by Vessel Elements											
Component	Metal New*	Metal Corroded	Insulation	Insulation Supports	Lining	Piping + Liquid	Operating Liquid		Test Liquid		Surface Area m ²
							New	Corroded	New	Corroded	
B16.9 Pipe Cap - Left Side	7,7	6,1	0	0	0	0	0	0	2,2	2,4	0,09
Cylinder #1	56,8	44	0	0	0	0	0	0	26,3	28,1	0,61
B16.9 Pipe Cap - Right Side	7,7	6,1	0	0	0	0	0	0	2,2	2,4	0,09
TOTAL:	72,3	56,2	0	0	0	0	0	0	30,8	32,9	0,78

*Shells with attached nozzles have weight reduced by material cut out for opening.

Weight (kg) Contributed by Attachments										
Component	Body Flanges		Nozzles & Flanges		Packed Beds	Trays	Tray Supports	Rings & Clips	Vertical Loads	Surface Area m ²
	New	Corroded	New	Corroded						
B16.9 Pipe Cap - Left Side	0	0	2,3	2,2	0	0	0	0	0	0,03
Cylinder #1	0	0	11	10,3	0	0	0	0	0	0,16
B16.9 Pipe Cap - Right Side	0	0	2,3	2,2	0	0	0	0	0	0,03
TOTAL:	0	0	15,6	14,6	0	0	0	0	0	0,23

Vessel Totals		
	New	Corroded
Operating Weight (kg)	88	71
Empty Weight (kg)	88	71
Test Weight (kg)	119	104
Surface Area (m ²)	1,01	-
Capacity** (liters)	31	33

**The vessel capacity does not include volume of nozzle, piping or other attachments.

Vessel Lift Condition	
Vessel Lift Weight, New (kg)	88
Center of Gravity from Datum (mm)	463,56

Hydrostatic Test

Horizontal shop hydrostatic test based on MAWP per UG-99(b)

$$\begin{aligned}
 \text{Gauge pressure at } 21,11^{\circ}\text{C} &= 1,3 \cdot MAWP \cdot LSR \\
 &= 1,3 \cdot 56,38 \cdot 1 \\
 &= 73,29 \text{ bar}
 \end{aligned}$$

Horizontal shop hydrostatic test				
Identifier	Local test pressure (bar)	Test liquid static head (bar)	UG-99(b) stress ratio	UG-99(b) pressure factor
B16.9 Pipe Cap - Left Side (1)	73,33	0,03	1	1,30
Straight Flange on B16.9 Pipe Cap - Left Side	73,33	0,03	1	1,30
Cylinder #1	73,33	0,03	1	1,30
Straight Flange on B16.9 Pipe Cap - Right Side	73,33	0,03	1	1,30
B16.9 Pipe Cap - Right Side	73,33	0,03	1	1,30
Air Inlet (N1)	73,32	0,03	1	1,30
Air Outlet (N2)	73,32	0,03	1	1,30
B16.9 Elbow #1 (N1)	73,32	0,03	1	1,30
B16.9 Elbow #2 (N2)	73,32	0,03	1	1,30
Drain (N6)	73,33	0,04	1	1,30
PSV Connection (N5)	73,31	0,01	1	1,30
Temperature Gauge Connection (N3)	73,31	0,01	1	1,30
Temperature Transmitter Connection (N4)	73,31	0,01	1	1,30
(1) B16.9 Pipe Cap - Left Side limits the UG-99(b) stress ratio. (2) The zero degree angular position is assumed to be up, and the test liquid height is assumed to the top-most flange.				

The field test condition has not been investigated.

The test temperature of 21,11 °C is warmer than the minimum recommended temperature of -27,78 °C so the brittle fracture provision of UG-99(h) has been met.

B16.9 Pipe Cap - Left Side

ASME Section VIII Division 1, 2021 Edition Metric				
Component		ASME B16.9 Pipe Cap (modified)		
Material		SA-234 WPB (II-D Metric p. 16, ln. 18)		
Attached To		Cylinder #1		
Impact Tested	Normalized	Fine Grain Practice	PWHT	Maximize MDMT/ No MAWP
No	No	No	No	No
		Design Pressure (bar)	Design Temperature (°C)	Design MDMT (°C)
Internal		39	135	0
Static Liquid Head				
Condition		P _s (bar)	H _s (mm)	SG
Test horizontal		0,03	346,84	1
Dimensions				
NPS and Schedule		NPS 8 Sch 80 (XS) DN 200		
Outer Diameter		219,07 mm		
Overall Length E		102 mm		
Nominal Thickness		12,7 mm		
Minimum Thickness ¹		11,11 mm		
Corrosion	Inner	3 mm		
	Outer	0 mm		
Length L _{sf}		42,47 mm		
Nominal Thickness t _{sf}		12,7 mm		
Weight and Capacity				
		Weight (kg) ²		Capacity (liters) ²
New		7,72		2,2
Corroded		6,06		2,4
Radiography				
Category A joints		Seamless No RT		
Head to shell seam		Spot UW-11(b) Type 1		

¹ minimum thickness = nominal thickness times pipe tolerance factor of 0,875.

² includes straight flange

Results Summary	
Governing condition	internal pressure
Minimum thickness per UG-16	1,5 mm + 3 mm = 4,5 mm
Design thickness due to internal pressure (t)	<u>6,96</u> mm
Governing straight flange design thickness	7,2 mm
Maximum allowable working pressure (MAWP)	<u>82,74</u> bar
Maximum allowable pressure (MAP)	<u>111,98</u> bar
<u>Straight Flange</u> governs MDMT	-48°C

Factor K		
$K = \left(\frac{1}{6}\right) \cdot \left[2 + \left(\frac{D}{2 \cdot h}\right)^2\right]$		
Corroded	$K = \left(\frac{1}{6}\right) \cdot \left[2 + \left(\frac{199,67}{2 \cdot 51,42}\right)^2\right]$	0,9617
New	$K = \left(\frac{1}{6}\right) \cdot \left[2 + \left(\frac{193,67}{2 \cdot 48,42}\right)^2\right]$	1

Design thickness for internal pressure, (Corroded at 135 °C) Appendix 1-4(c)

$$t = \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} + \text{Corrosion} = \frac{39 \cdot 219,07 \cdot 0,961673}{2 \cdot 1.180 \cdot 0,85 + 2 \cdot 39 \cdot (0,961673 - 0,1)} + 3 = \underline{6.96} \text{ mm}$$

Maximum allowable working pressure, (Corroded at 135 °C) Appendix 1-4(c)

$$P = \frac{2 \cdot S \cdot E \cdot t}{K \cdot D_o - 2 \cdot t \cdot (K - 0,1)} - P_s = \frac{2 \cdot 1.180 \cdot 0,85 \cdot (0,875 \cdot 12,7 - 3)}{0,961673 \cdot 219,07 - 2 \cdot (0,875 \cdot 12,7 - 3) \cdot (0,961673 - 0,1)} - 0 = \underline{82.74} \text{ bar}$$

Maximum allowable pressure, (New at 21,11 °C) Appendix 1-4(c)

$$P = \frac{2 \cdot S \cdot E \cdot t}{K \cdot D_o - 2 \cdot t \cdot (K - 0,1)} - P_s = \frac{2 \cdot 1.180 \cdot 0,85 \cdot 0,875 \cdot 12,7}{1 \cdot 219,07 - 2 \cdot 0,875 \cdot 12,7 \cdot (1 - 0,1)} - 0 = \underline{111.98} \text{ bar}$$

ASME Section VIII Division 1 UG-81(a) Out-of-Roundness
Inside surface shall not deviate outside the shape by more than 1,25 % of D
Inside surface shall not deviate inside the shape by more than 0,625 % of D

Straight Flange on B16.9 Pipe Cap - Left Side

ASME Section VIII Division 1, 2021 Edition Metric				
Component		Cylinder		
Material		SA-234 WPB (II-D Metric p. 16, ln. 18)		
Impact Tested	Normalized	Fine Grain Practice	PWHT	Maximize MDMT/ No MAWP
No	No	No	No	No
		Design Pressure (bar)	Design Temperature (°C)	Design MDMT (°C)
Internal		39	135	0
Static Liquid Head				
Condition		P _s (bar)	H _s (mm)	SG
Test horizontal		0,03	346,84	1
Dimensions				
Outer Diameter		219,07 mm		
Length		42,47 mm		
Nominal Thickness		12,7 mm		
Corrosion	Inner	3 mm		
	Outer	0 mm		
Weight and Capacity				
		Weight (kg)		Capacity (liters)
New		2,74		1,25
Corroded		2,12		1,33
Radiography				
Longitudinal seam		Seamless No RT		
Right Circumferential seam		Spot UW-11(b) Type 1		

Results Summary	
Governing condition	Internal pressure
Minimum thickness per UG-16	1,5 mm + 3 mm = 4,5 mm
Design thickness due to internal pressure (t)	7,2 mm
Maximum allowable working pressure (MAWP)	92,09 bar
Maximum allowable pressure (MAP)	121,95 bar
Rated MDMT	-48 °C

UCS-66 Material Toughness Requirements	
Governing thickness, t _g =	11,11 mm
Exemption temperature from Fig UCS-66M Curve B =	-24,98°C
$t_r = \frac{56,38 \cdot 109,54}{1.180 \cdot 0,85 + 0,4 \cdot 56,38} =$	6,02 mm
$\text{Stress ratio} = \frac{t_r \cdot E^*}{t_n - c} = \frac{6,02 \cdot 0,85}{12,7 - 3} =$	0,5277
Reduction in MDMT, T _R from Fig UCS-66.1M =	28,9°C
$MDMT = \max [MDMT - T_R, -48] = \max [-24,98 - 28,9, -48] =$	-48°C
Material is exempt from impact testing at the Design MDMT of 0°C.	

Design thickness, (at 135 °C) Appendix 1-1

$$t = \frac{P \cdot R_o}{S \cdot E + 0,40 \cdot P} + \text{Corrosion} = \frac{39 \cdot 109,54}{1.180 \cdot 0,85 + 0,40 \cdot 39} + 3 = \underline{7,2} \text{ mm}$$

Maximum allowable working pressure, (at 135 °C) Appendix 1-1

$$P = \frac{S \cdot E \cdot t}{R_o - 0,40 \cdot t} - P_s = \frac{1.180 \cdot 0,85 \cdot 9,7}{109,54 - 0,40 \cdot 9,7} - 0 = \underline{92,09} \text{ bar}$$

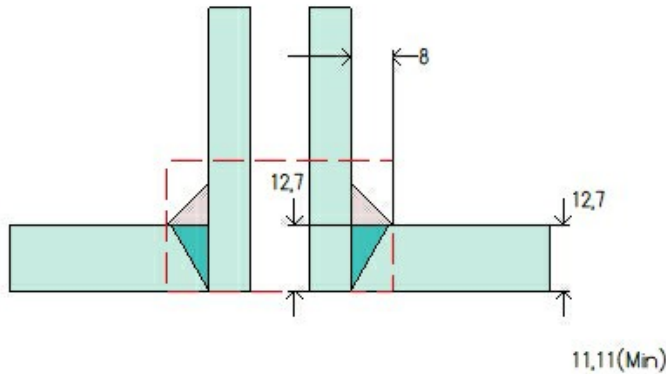
Maximum allowable pressure, (at 21,11 °C) Appendix 1-1

$$P = \frac{S \cdot E \cdot t}{R_o - 0,40 \cdot t} = \frac{1.180 \cdot 0,85 \cdot 12,7}{109,54 - 0,40 \cdot 12,7} = \underline{121,95} \text{ bar}$$

ASME Section VIII Division 1 UG-80(a) Out-of-Roundness
$(D_{\max} - D_{\min})$ shall not exceed 1% of D
When the cross section passes through an opening or within 1 I.D. of the opening, $(D_{\max} - D_{\min})$ shall not exceed 1% of $D + 2\%$ of the inside diameter of the opening

Air Inlet (N1)

ASME Section VIII Division 1, 2021 Edition Metric



Note: round inside edges per UG-76(c)

Location and Orientation

Located on	B16.9 Pipe Cap - Left Side
Orientation	0°
End of nozzle to datum line	1.056 mm
Calculated as hillside	No
Distance to head center, R	0 mm
Passes through a Category A joint	No

Nozzle

Description	NPS 0,75 XXS DN 20
Access opening	No
Material specification	SA-106 B Smls Pipe (II-D Metric p. 16, In. 16)
Inside diameter, new	11,02 mm
Pipe nominal wall thickness	7,82 mm
Pipe minimum wall thickness ¹	6,85 mm
Corrosion allowance	3 mm
Projection available outside vessel, L _{pr}	64,44 mm
Local vessel minimum thickness	11,11 mm
Liquid static head included	0 bar

Welds

Inner fillet, Leg ₄₁	8 mm
Nozzle to vessel groove weld	12,7 mm

Radiography

Longitudinal seam	Seamless No RT
Circumferential seam	Full UW-11(a) Type 1

¹Pipe minimum thickness = nominal thickness times pipe tolerance factor of 0,875.

UCS-66 Material Toughness Requirements Nozzle

$t_r = \frac{56,38-8,51}{1.180 \cdot 1 - 0,6 \cdot 56,38} =$	0,42 mm
Stress ratio $= \frac{t_r \cdot E^*}{t_n - c} = \frac{0,42 \cdot 1}{6,85-3} =$	0,1089
Stress ratio $\leq 0,35$, MDMT per UCS-66(b)(3) =	-105°C
Material is exempt from impact testing at the Design MDMT of 0°C.	

Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 39 bar @ 135 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							5,51	6,85

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (mm)	Actual weld throat size (mm)	Status
Nozzle to shell fillet (Leg ₄₁)	3,38	5,6	weld size is adequate

Calculations for internal pressure 39 bar @ 135 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [17,02, 8,51 + (7,82 - 3) + (11,11 - 3)] \\
 &= 21,45 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (11,11 - 3), 2,5 \cdot (7,82 - 3) + 0] \\
 &= 12,06 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{39,0001 \cdot 8,51}{1,180 \cdot 1 - 0,6 \cdot 39,0001} \\
 &= 0,29 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)(c)

$$\begin{aligned}
 t_r &= \frac{P \cdot K_1 \cdot D_o}{2 \cdot S \cdot E + 0,8 \cdot P} \\
 &= \frac{39,0001 \cdot 0,8737 \cdot 219,07}{2 \cdot 1,180 \cdot 1 + 0,8 \cdot 39,0001} \\
 &= 3,12 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$t_r = \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} = \frac{39 \cdot 219,07 \cdot 0,961673}{2 \cdot 1,180 \cdot 0,85 + 2 \cdot 39 \cdot (0,961673 - 0,1)} = 3,96 \text{ mm}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(c) Weld Check

Fillet weld: $t_{\min} = \min [19mm, t_n, t] = 4,82 \text{ mm}$

$$t_{c(\min)} = \min [6 \text{ mm}, 0,7 \cdot t_{\min}] = \underline{3,38} \text{ mm}$$

$$t_{c(actual)} = 0,7 \cdot \text{Leg} = 0,7 \cdot 8 = 5,6 \text{ mm}$$

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-45 Nozzle Neck Thickness Check

Interpretation VIII-1-83-66 has been applied.

$$\begin{aligned} t_{aUG-27} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\ &= \frac{39,0001 \cdot 8,51}{1.180 \cdot 1 - 0,6 \cdot 39,0001} + 3 \\ &= 3,29 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_a &= \max [t_{aUG-27}, t_{aUG-22}] \\ &= \max [3,29, 0] \\ &= 3,29 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{b1} &= \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} + \text{Corrosion} \\ &= \frac{39 \cdot 219,07 \cdot 0,961673}{2 \cdot 1.180 \cdot 1 + 2 \cdot 39 \cdot (0,961673 - 0,1)} + 3 \\ &= 6,38 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{b1} &= \max [t_{b1}, t_{bUG16}] \\ &= \max [6,39, 4,5] \\ &= 6,39 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_b &= \min [t_{b3}, t_{b1}] \\ &= \min [5,51, 6,39] \\ &= 5,51 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{UG-45} &= \max [t_a, t_b] \\ &= \max [3,29, 5,51] \\ &= \underline{5,51} \text{ mm} \end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 7,82 = 6,85 \text{ mm}$

The nozzle neck thickness is adequate.

Reinforcement Calculations for MAWP

The vessel wall thickness governs the MAWP of this nozzle.

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 103,54 bar @ 135 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							5,51	6,85

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (mm)	Actual weld throat size (mm)	Status
Nozzle to shell fillet (Leg ₄₁)	3,38	5,6	weld size is adequate

Calculations for internal pressure 103,54 bar @ 135 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [17,02, 8,51 + (7,82 - 3) + (11,11 - 3)] \\
 &= 21,45 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (11,11 - 3), 2,5 \cdot (7,82 - 3) + 0] \\
 &= 12,06 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{103,5405 \cdot 8,51}{1.180 \cdot 1 - 0,6 \cdot 103,5405} \\
 &= 0,79 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)(c)

$$\begin{aligned}
 t_r &= \frac{P \cdot K_1 \cdot D_o}{2 \cdot S \cdot E + 0,8 \cdot P} \\
 &= \frac{103,5405 \cdot 0,8737 \cdot 219,07}{2 \cdot 1.180 \cdot 1 + 0,8 \cdot 103,5405} \\
 &= 8,11 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$t_r = \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} = \frac{103,54 \cdot 219,07 \cdot 0,961673}{2 \cdot 1.180 \cdot 0,85 + 2 \cdot 103,54 \cdot (0,961673 - 0,1)} = 9,99 \text{ mm}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(c) Weld Check

Fillet weld: $t_{\min} = \min [19\text{ mm}, t_n, t] = 4,82 \text{ mm}$

$t_{c(\min)} = \min [6 \text{ mm}, 0,7 \cdot t_{\min}] = 3,38 \text{ mm}$

$t_{c(actual)} = 0,7 \cdot \text{Leg} = 0,7 \cdot 8 = 5,6 \text{ mm}$

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-45 Nozzle Neck Thickness Check

Interpretation VIII-1-83-66 has been applied.

$$\begin{aligned} t_{aUG-27} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\ &= \frac{103,5405 \cdot 8,51}{1,180 \cdot 1 - 0,6 \cdot 103,5405} + 3 \\ &= 3,79 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_a &= \max [t_{aUG-27}, t_{aUG-22}] \\ &= \max [3,79, 0] \\ &= 3,79 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{b1} &= \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} + \text{Corrosion} \\ &= \frac{103,54 \cdot 219,07 \cdot 0,961673}{2 \cdot 1,180 \cdot 1 + 2 \cdot 103,54 \cdot (0,961673 - 0,1)} + 3 \\ &= 11,59 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{b1} &= \max [t_{b1}, t_{bUG16}] \\ &= \max [11,59, 4,5] \\ &= 11,59 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_b &= \min [t_{b3}, t_{b1}] \\ &= \min [5,51, 11,59] \\ &= 5,51 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{UG-45} &= \max [t_a, t_b] \\ &= \max [3,79, 5,51] \\ &= 5,51 \text{ mm} \end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 7,82 = 6,85 \text{ mm}$

The nozzle neck thickness is adequate.

Reinforcement Calculations for MAP

The vessel wall thickness governs the MAP of this nozzle.

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 139,29 bar @ 21,11 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							2,51	6,85

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

Calculations for internal pressure 139,29 bar @ 21,11 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [11,02, 5,51 + (7,82 - 0) + (11,11 - 0)] \\
 &= 24,45 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (11,11 - 0), 2,5 \cdot (7,82 - 0) + 0] \\
 &= 19,56 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{139,2932 \cdot 5,51}{1.180 \cdot 1 - 0,6 \cdot 139,2932} \\
 &= 0,7 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)(c)

$$\begin{aligned}
 t_r &= \frac{P \cdot K_1 \cdot D_o}{2 \cdot S \cdot E + 0,8 \cdot P} \\
 &= \frac{139,2932 \cdot 0,9 \cdot 219,07}{2 \cdot 1.180 \cdot 1 + 0,8 \cdot 139,2932} \\
 &= 11,11 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$t_r = \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} = \frac{139,29 \cdot 219,07 \cdot 1}{2 \cdot 1.180 \cdot 0,85 + 2 \cdot 139,29 \cdot (1 - 0,1)} = 13,52 \text{ mm}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UG-45 Nozzle Neck Thickness Check

Interpretation VIII-1-83-66 has been applied.

$$\begin{aligned}
 t_{aUG-27} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\
 &= \frac{139,2932 \cdot 5,51}{1.180 \cdot 1 - 0,6 \cdot 139,2932} + 0 \\
 &= 0,7 \text{ mm} \\
 t_a &= \max [t_{aUG-27}, t_{aUG-22}] \\
 &= \max [0,7, 0] \\
 &= 0,7 \text{ mm} \\
 t_{b1} &= \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} + \text{Corrosion} \\
 &= \frac{139,29 \cdot 219,07 \cdot 1}{2 \cdot 1.180 \cdot 1 + 2 \cdot 139,29 \cdot (1 - 0,1)} + 0 \\
 &= 11,69 \text{ mm} \\
 t_{bl} &= \max [t_{bl}, t_{bUG16}] \\
 &= \max [11,69, 1,5] \\
 &= 11,69 \text{ mm} \\
 t_b &= \min [t_{b3}, t_{bl}] \\
 &= \min [2,51, 11,69] \\
 &= 2,51 \text{ mm} \\
 t_{UG-45} &= \max [t_a, t_b] \\
 &= \max [0,7, 2,51] \\
 &= \underline{2,51} \text{ mm}
 \end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 7,82 = 6,85 \text{ mm}$

The nozzle neck thickness is adequate.

B16.9 Elbow #1 (N1)

ASME Section VIII Division 1, 2021 Edition Metric				
Component		ASME B16.9 Elbow		
Type		Long Radius 90-deg		
Material		SA-234 WPB (II-D Metric p. 16, ln. 18)		
Pipe NPS and Schedule		NPS 0,75 XXS DN 20		
Attached To		Air Inlet (N1)		
Impact Tested	Normalized	Fine Grain Practice	PWHT	Maximize MDMT/ No MAWP
No	No	No	No	No
		Design Pressure (bar)	Design Temperature (°C)	Design MDMT (°C)
Internal		39	135	0
Static Liquid Head				
Condition		P _s (bar)	H _s (mm)	SG
Test horizontal		0,03	288,1	1
Dimensions				
Outer Diameter		26,67 mm		
Nominal Thickness		7,82 mm		
Minimum Thickness ¹		6,85 mm		
Center-to-End, A		38 mm		
Corrosion	Inner	3 mm		
	Outer	0 mm		
Weight and Capacity				
		Weight (kg)		Capacity (liters)
New		0,22		0,01
Corroded		0,16		0,01
Radiography				
Longitudinal seam		Seamless No RT		
Left Circumferential seam		Full UW-11(a) Type 1		
Right Circumferential seam		Full UW-11(a) Type 1		

¹ minimum thickness = nominal thickness times pipe tolerance factor of 0,875.

ASME B16.5-2017 Flange	
Description	NPS 0,75 Class 600 WN A105
Bolt Material	SA-193 B7 Bolt ≤ 64 (II-D Metric p. 410, In. 32)
Blind included	No
Rated MDMT	-44,78°C
Liquid static head	0 bar
MAWP rating	91,1 bar @ 135°C
MAP rating	102,1 bar @ 21,11°C
Hydrotest rating	154 bar @ 21,11°C
PWHT performed	No
Produced to Fine Grain Practice and Supplied in Heat Treated Condition	No
Impact Tested	No
Circumferential joint radiography	Full UW-11(a) Type 1
Bore diameter, B (specified by purchaser)	11,02 mm
Gasket	
Type	ASME B16.20 Spiral-Wound
Description	Garlock FLEXSEAL RW 316L SS / Flexible Graphite
Factor, m	3
Seating Stress, y	703,07 kgf/cm ²
Thickness, T	3 mm
Inner Diameter	25,4 mm
Outer Diameter	39,6 mm
Notes	
Flange rated MDMT per UCS-66(b)(1)(b) = -44,78°C (Coincident ratio = 0,5522) Bolts rated MDMT per Fig UCS-66 note (c) = -48°C	

Results Summary	
Governing condition	UG-16
Minimum thickness per UG-16	1,5 mm + 3 mm = 4,5 mm
Design thickness due to internal pressure (t)	3,43 mm
Maximum allowable working pressure (MAWP)	401,45 bar
Maximum allowable pressure (MAP)	849,81 bar
Rated MDMT	-105 °C

UCS-66 Material Toughness Requirements	
$t_r = 13,34 \cdot \left(1 - \exp \left(- \frac{56,38}{1.180 \cdot 1} \right) \right) =$	0,62 mm
$\text{Stress ratio} = \frac{t_r \cdot E^*}{t_n - c} = \frac{0,62 \cdot 1}{6,85 - 3} =$	0,1618
Stress ratio ≤ 0,35, MDMT per UCS-66(b)(3) =	-105°C
Material is exempt from impact testing at the Design MDMT of 0°C.	

Design thickness, (at 135 °C) Appendix 1-2

$$t = R_o \cdot \left(1 - \exp \left[- \frac{P}{S \cdot E} \right] \right) + \text{Corrosion} = 13,34 \cdot \left(1 - \exp \left[- \frac{39}{1.180 \cdot 1,00} \right] \right) + 3 = \text{3,43 mm}$$

Maximum allowable working pressure, (at 135 °C) Appendix 1-2

$$P = S \cdot E \cdot \ln\left(\frac{R_o}{R_o - t}\right) - P_s = 1.180 \cdot 1,00 \cdot \ln\left(\frac{13,34}{13,34 - (7,82 \cdot 0,875 - 3)}\right) - 0 = \underline{401,45} \text{ bar}$$

Maximum allowable pressure, (at 21,11 °C) Appendix 1-2

$$P = S \cdot E \cdot \ln\left(\frac{R_o}{R_o - t}\right) = 1.180 \cdot 1,00 \cdot \ln\left(\frac{13,34}{13,34 - (7,82 \cdot 0,875)}\right) = \underline{849,81} \text{ bar}$$

Cylinder #1

ASME Section VIII Division 1, 2021 Edition Metric				
Component		Cylinder		
Material		SA-106 B Smls Pipe (II-D Metric p. 16, In. 16)		
Pipe NPS and Schedule		NPS 8 Sch 80 (XS) DN 200		
Impact Tested	Normalized	Fine Grain Practice	PWHT	Maximize MDMT/ No MAWP
No	No	No	No	No
		Design Pressure (bar)	Design Temperature (°C)	Design MDMT (°C)
Internal		39	135	0
Static Liquid Head				
Condition		P _s (bar)	H _s (mm)	SG
Test horizontal		0,03	346,84	1
Dimensions				
Outer Diameter		219,07 mm		
Length		890 mm		
Pipe Nominal Thickness		12,7 mm		
Pipe Minimum Thickness ¹		11,11 mm		
Corrosion	Inner	3 mm		
	Outer	0 mm		
Weight and Capacity				
		Weight (kg)		Capacity (liters)
New		56,84		26,22
Corroded		44,05		27,87
Radiography				
Longitudinal seam		Seamless No RT		
Left Circumferential seam		Spot UW-11(b) Type 1		
Right Circumferential seam		Spot UW-11(b) Type 1		

¹Pipe minimum thickness = nominal thickness times pipe tolerance factor of 0,875.

Results Summary	
Governing condition	Internal pressure
Minimum thickness per UG-16	1,5 mm + 3 mm = 4,5 mm
Design thickness due to internal pressure (t)	7,2 mm
Maximum allowable working pressure (MAWP)	76,56 bar
Maximum allowable pressure (MAP)	106,06 bar
Rated MDMT	-45,68 °C

UCS-66 Material Toughness Requirements	
Governing thickness, t _g =	11,11 mm
Exemption temperature from Fig UCS-66M Curve B =	-24,98°C
$t_r = \frac{56,38 \cdot 109,54}{1.180 \cdot 0,85 + 0,4 \cdot 56,38} =$	6,02 mm
$\text{Stress ratio} = \frac{t_r \cdot E^*}{t_n - c} = \frac{6,02 \cdot 0,85}{11,11 - 3} =$	0,6309
Reduction in MDMT, T _R from Fig UCS-66.1M =	20,7°C
$MDMT = \max [MDMT - T_R, -48] = \max [-24,98 - 20,7, -48] =$	-45,68°C
Material is exempt from impact testing at the Design MDMT of 0°C.	

Design thickness, (at 135 °C) Appendix 1-1

$$t = \frac{P \cdot R_o}{S \cdot E + 0,40 \cdot P} + \text{Corrosion} = \frac{39 \cdot 109,54}{1.180 \cdot 0,85 + 0,40 \cdot 39} + 3 = \underline{7.2} \text{ mm}$$

Maximum allowable working pressure, (at 135 °C) Appendix 1-1

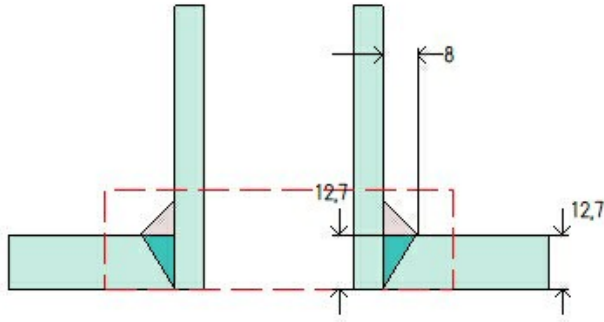
$$P = \frac{S \cdot E \cdot t}{R_o - 0,40 \cdot t} - P_s = \frac{1.180 \cdot 0,85 \cdot (12,7 \cdot 0,875 - 3)}{109,54 - 0,40 \cdot (12,7 \cdot 0,875 - 3)} - 0 = \underline{76.56} \text{ bar}$$

Maximum allowable pressure, (at 21,11 °C) Appendix 1-1

$$P = \frac{S \cdot E \cdot t}{R_o - 0,40 \cdot t} = \frac{1.180 \cdot 0,85 \cdot (12,7 \cdot 0,875)}{109,54 - 0,40 \cdot (12,7 \cdot 0,875)} = \underline{106.06} \text{ bar}$$

Temperature Gauge Connection (N3)

ASME Section VIII Division 1, 2021 Edition Metric



Note: round inside edges per UG-76(c)

Location and Orientation

Located on	Cylinder #1
Orientation	0°
Nozzle center line offset to datum line	770 mm
End of nozzle to shell center	250 mm
Passes through a Category A joint	No

Nozzle

Description	NPS 1,5 Sch 160 DN 40
Access opening	No
Material specification	SA-106 B Smls Pipe (II-D Metric p. 16, In. 16)
Inside diameter, new	33,99 mm
Pipe nominal wall thickness	7,14 mm
Pipe minimum wall thickness ¹	6,25 mm
Corrosion allowance	3 mm
Projection available outside vessel, L _{pr}	64,27 mm
Projection available outside vessel to flange face, L _f	140,47 mm
Local vessel minimum thickness	11,11 mm
Liquid static head included	0 bar

Welds

Inner fillet, Leg ₄₁	8 mm
Nozzle to vessel groove weld	12,7 mm

Radiography

Longitudinal seam	Seamless No RT
Circumferential seam	Full UW-11(a) Type 1

¹Pipe minimum thickness = nominal thickness times pipe tolerance factor of 0,875.

ASME B16.5-2017 Flange	
Description	NPS 1,5 Class 600 WN A105
Bolt Material	SA-193 B7 Bolt ≤ 64 (II-D Metric p. 410, In. 32)
Blind included	No
Rated MDMT	-44,78°C
Liquid static head	0 bar
MAWP rating	91,1 bar @ 135°C
MAP rating	102,1 bar @ 21,11°C
Hydrotest rating	154 bar @ 21,11°C
PWHT performed	No
Produced to Fine Grain Practice and Supplied in Heat Treated Condition	No
Impact Tested	No
Circumferential joint radiography	Full UW-11(a) Type 1
Bore diameter, B (specified by purchaser)	40,89 mm
Gasket	
Type	ASME B16.20 Spiral-Wound
Description	Garlock FLEXSEAL RW 316L SS / Flexible Graphite
Factor, m	3
Seating Stress, y	703,07 kgf/cm ²
Thickness, T	3 mm
Inner Diameter	54,1 mm
Outer Diameter	69,9 mm
Notes	
Flange rated MDMT per UCS-66(b)(1)(b) = -44,78°C (Coincident ratio = 0,5522) Bolts rated MDMT per Fig UCS-66 note (c) = -48°C	

UCS-66 Material Toughness Requirements Nozzle	
$t_r = \frac{56,38 \cdot 19,99}{1.180 \cdot 1 - 0,6 \cdot 56,38} =$	0,98 mm
$\text{Stress ratio} = \frac{t_r \cdot E^*}{t_n - c} = \frac{0,98 \cdot 1}{6,25 - 3} =$	0,303
Stress ratio ≤ 0,35, MDMT per UCS-66(b)(3) =	-105°C
Material is exempt from impact testing at the Design MDMT of 0°C.	

Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 39 bar @ 135 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							6,22	6,25

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (mm)	Actual weld throat size (mm)	Status
Nozzle to shell fillet (Leg ₄₁)	2,9	5,6	weld size is adequate

Calculations for internal pressure 39 bar @ 135 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [39,99, 19,99 + (7,14 - 3) + (11,11 - 3)] \\
 &= 39,99 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (11,11 - 3), 2,5 \cdot (7,14 - 3) + 0] \\
 &= 10,34 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{39,0001 \cdot 19,99}{1,180 \cdot 1 - 0,6 \cdot 39,0001} \\
 &= 0,67 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{39,0001 \cdot 109,54}{1,180 \cdot 1 + 0,4 \cdot 39,0001} \\
 &= 3,57 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$\begin{aligned}
t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
&= \frac{39,0001 \cdot 109,54}{1.180 \cdot 0,85 + 0,4 \cdot 39,0001} \\
&= 4,19 \text{ mm}
\end{aligned}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(c) Weld Check

Fillet weld: $t_{\min} = \min [19mm, t_n, t] = 4,14 \text{ mm}$

$$t_{c(\min)} = \min [6 \text{ mm}, 0,7 \cdot t_{\min}] = 2,9 \text{ mm}$$

$$t_{c(actual)} = 0,7 \cdot \text{Leg} = 0,7 \cdot 8 = 5,6 \text{ mm}$$

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-45 Nozzle Neck Thickness Check

$$\begin{aligned}
t_{aUG-27} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\
&= \frac{39,0001 \cdot 19,99}{1.180 \cdot 1 - 0,6 \cdot 39,0001} + 3 \\
&= 3,67 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_a &= \max [t_{aUG-27}, t_{aUG-22}] \\
&= \max [3,67, 0] \\
&= 3,67 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{b1} &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} + \text{Corrosion} \\
&= \frac{39,0001 \cdot 109,54}{1.180 \cdot 1 + 0,4 \cdot 39,0001} + 3 \\
&= 6,57 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{b1} &= \max [t_{b1}, t_{bUG16}] \\
&= \max [6,57, 4,5] \\
&= 6,57 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_b &= \min [t_{b3}, t_{b1}] \\
&= \min [6,22, 6,57] \\
&= 6,22 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{UG-45} &= \max [t_a, t_b] \\
&= \max [3,67, 6,22] \\
&= 6,22 \text{ mm}
\end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 7,14 = 6,25$ mm

The nozzle neck thickness is adequate.

Reinforcement Calculations for MAWP

The vessel wall thickness governs the MAWP of this nozzle.

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 90,07 bar @ 135 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							6,22	6,25

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (mm)	Actual weld throat size (mm)	Status
Nozzle to shell fillet (Leg ₄₁)	2,9	5,6	weld size is adequate

Calculations for internal pressure 90,07 bar @ 135 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [39,99, 19,99 + (7,14 - 3) + (11,11 - 3)] \\
 &= 39,99 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (11,11 - 3), 2,5 \cdot (7,14 - 3) + 0] \\
 &= 10,34 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{90,0666 \cdot 19,99}{1,180 \cdot 1 - 0,6 \cdot 90,0666} \\
 &= 1,6 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{90,0666 \cdot 109,54}{1,180 \cdot 1 + 0,4 \cdot 90,0666} \\
 &= 8,11 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$\begin{aligned}
t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
&= \frac{90,0666 \cdot 109,54}{1.180 \cdot 0,85 + 0,4 \cdot 90,0666} \\
&= 9,49 \text{ mm}
\end{aligned}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(c) Weld Check

Fillet weld: $t_{\min} = \min [19mm, t_n, t] = 4,14 \text{ mm}$

$t_{c(\min)} = \min [6 \text{ mm}, 0,7 \cdot t_{\min}] = 2,9 \text{ mm}$

$t_{c(actual)} = 0,7 \cdot \text{Leg} = 0,7 \cdot 8 = 5,6 \text{ mm}$

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-45 Nozzle Neck Thickness Check

$$\begin{aligned}
t_{aUG-27} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\
&= \frac{90,0666 \cdot 19,99}{1.180 \cdot 1 - 0,6 \cdot 90,0666} + 3 \\
&= 4,6 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_a &= \max [t_{aUG-27}, t_{aUG-22}] \\
&= \max [4,6, 0] \\
&= 4,6 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{b1} &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} + \text{Corrosion} \\
&= \frac{90,0666 \cdot 109,54}{1.180 \cdot 1 + 0,4 \cdot 90,0666} + 3 \\
&= 11,11 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{b1} &= \max [t_{b1}, t_{bUG16}] \\
&= \max [11,11, 4,5] \\
&= 11,11 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_b &= \min [t_{b3}, t_{b1}] \\
&= \min [6,22, 11,11] \\
&= 6,22 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{UG-45} &= \max [t_a, t_b] \\
&= \max [4,6, 6,22] \\
&= 6,22 \text{ mm}
\end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 7,14 = 6,25$ mm

The nozzle neck thickness is adequate.

Reinforcement Calculations for MAP

The attached ASME B16.5 flange limits the nozzle MAP.

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 102,1 bar @ 21,11 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							3,22	6,25

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

Calculations for internal pressure 102,1 bar @ 21,11 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [33,99, 16,99 + (7,14 - 0) + (11,11 - 0)] \\
 &= 35,24 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (11,11 - 0), 2,5 \cdot (7,14 - 0) + 0] \\
 &= 17,84 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{102,1 \cdot 16,99}{1.180 \cdot 1 - 0,6 \cdot 102,1} \\
 &= 1,55 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{102,1 \cdot 109,54}{1.180 \cdot 1 + 0,4 \cdot 102,1} \\
 &= 9,16 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{102,1 \cdot 109,54}{1.180 \cdot 0,85 + 0,4 \cdot 102,1} \\
 &= 10,71 \text{ mm}
 \end{aligned}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UG-45 Nozzle Neck Thickness Check

$$\begin{aligned}t_{aUG-27} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\&= \frac{102,1 \cdot 16,99}{1.180 \cdot 1 - 0,6 \cdot 102,1} + 0 \\&= 1,55 \text{ mm}\end{aligned}$$

$$\begin{aligned}t_a &= \max [t_{aUG-27}, t_{aUG-22}] \\&= \max [1,55, 0] \\&= 1,55 \text{ mm}\end{aligned}$$

$$\begin{aligned}t_{b1} &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} + \text{Corrosion} \\&= \frac{102,1 \cdot 109,54}{1.180 \cdot 1 + 0,4 \cdot 102,1} + 0 \\&= 9,16 \text{ mm}\end{aligned}$$

$$\begin{aligned}t_{b1} &= \max [t_{b1}, t_{bUG16}] \\&= \max [9,16, 1,5] \\&= 9,16 \text{ mm}\end{aligned}$$

$$\begin{aligned}t_b &= \min [t_{b3}, t_{b1}] \\&= \min [3,22, 9,16] \\&= 3,22 \text{ mm}\end{aligned}$$

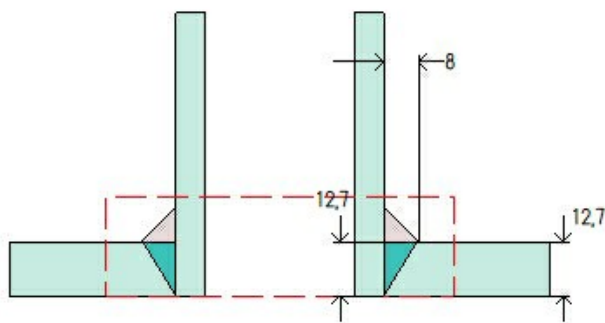
$$\begin{aligned}t_{UG-45} &= \max [t_a, t_b] \\&= \max [1,55, 3,22] \\&= \underline{3,22} \text{ mm}\end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 7,14 = 6,25 \text{ mm}$

The nozzle neck thickness is adequate.

Temperature Transmitter Connection (N4)

ASME Section VIII Division 1, 2021 Edition Metric



Note: round inside edges per UG-76(c)

Location and Orientation

Located on	Cylinder #1
Orientation	0°
Nozzle center line offset to datum line	555 mm
End of nozzle to shell center	250 mm
Passes through a Category A joint	No

Nozzle

Description	NPS 1,5 Sch 160 DN 40
Access opening	No
Material specification	SA-106 B Smls Pipe (II-D Metric p. 16, In. 16)
Inside diameter, new	33,99 mm
Pipe nominal wall thickness	7,14 mm
Pipe minimum wall thickness ¹	6,25 mm
Corrosion allowance	3 mm
Projection available outside vessel, L _{pr}	64,27 mm
Projection available outside vessel to flange face, L _f	140,47 mm
Local vessel minimum thickness	11,11 mm
Liquid static head included	0 bar

Welds

Inner fillet, Leg ₄₁	8 mm
Nozzle to vessel groove weld	12,7 mm

Radiography

Longitudinal seam	Seamless No RT
Circumferential seam	Full UW-11(a) Type 1

¹Pipe minimum thickness = nominal thickness times pipe tolerance factor of 0,875.

ASME B16.5-2017 Flange	
Description	NPS 1,5 Class 600 WN A105
Bolt Material	SA-193 B7 Bolt ≤ 64 (II-D Metric p. 410, In. 32)
Blind included	No
Rated MDMT	-44,78°C
Liquid static head	0 bar
MAWP rating	91,1 bar @ 135°C
MAP rating	102,1 bar @ 21,11°C
Hydrotest rating	154 bar @ 21,11°C
PWHT performed	No
Produced to Fine Grain Practice and Supplied in Heat Treated Condition	No
Impact Tested	No
Circumferential joint radiography	Full UW-11(a) Type 1
Bore diameter, B (specified by purchaser)	40,89 mm
Gasket	
Type	ASME B16.20 Spiral-Wound
Description	Garlock FLEXSEAL RW 316L SS / Flexible Graphite
Factor, m	3
Seating Stress, y	703,07 kgf/cm ²
Thickness, T	3 mm
Inner Diameter	54,1 mm
Outer Diameter	69,9 mm
Notes	
Flange rated MDMT per UCS-66(b)(1)(b) = -44,78°C (Coincident ratio = 0,5522) Bolts rated MDMT per Fig UCS-66 note (c) = -48°C	

UCS-66 Material Toughness Requirements Nozzle	
$t_r = \frac{56,38 \cdot 19,99}{1.180 \cdot 1 - 0,6 \cdot 56,38} =$	0,98 mm
$\text{Stress ratio} = \frac{t_r \cdot E^*}{t_n - c} = \frac{0,98 \cdot 1}{6,25 - 3} =$	0,303
Stress ratio ≤ 0,35, MDMT per UCS-66(b)(3) =	-105°C
Material is exempt from impact testing at the Design MDMT of 0°C.	

Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 39 bar @ 135 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							6,22	6,25

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (mm)	Actual weld throat size (mm)	Status
Nozzle to shell fillet (Leg ₄₁)	2,9	5,6	weld size is adequate

Calculations for internal pressure 39 bar @ 135 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [39,99, 19,99 + (7,14 - 3) + (11,11 - 3)] \\
 &= 39,99 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (11,11 - 3), 2,5 \cdot (7,14 - 3) + 0] \\
 &= 10,34 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{39,0001 \cdot 19,99}{1,180 \cdot 1 - 0,6 \cdot 39,0001} \\
 &= 0,67 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{39,0001 \cdot 109,54}{1,180 \cdot 1 + 0,4 \cdot 39,0001} \\
 &= 3,57 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$\begin{aligned}
t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
&= \frac{39,0001 \cdot 109,54}{1.180 \cdot 0,85 + 0,4 \cdot 39,0001} \\
&= 4,19 \text{ mm}
\end{aligned}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(c) Weld Check

Fillet weld: $t_{\min} = \min [19mm, t_n, t] = 4,14 \text{ mm}$

$$t_{c(\min)} = \min [6 \text{ mm}, 0,7 \cdot t_{\min}] = 2,9 \text{ mm}$$

$$t_{c(actual)} = 0,7 \cdot \text{Leg} = 0,7 \cdot 8 = 5,6 \text{ mm}$$

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-45 Nozzle Neck Thickness Check

$$\begin{aligned}
t_{aUG-27} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\
&= \frac{39,0001 \cdot 19,99}{1.180 \cdot 1 - 0,6 \cdot 39,0001} + 3 \\
&= 3,67 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_a &= \max [t_{aUG-27}, t_{aUG-22}] \\
&= \max [3,67, 0] \\
&= 3,67 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{b1} &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} + \text{Corrosion} \\
&= \frac{39,0001 \cdot 109,54}{1.180 \cdot 1 + 0,4 \cdot 39,0001} + 3 \\
&= 6,57 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{b1} &= \max [t_{b1}, t_{bUG16}] \\
&= \max [6,57, 4,5] \\
&= 6,57 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_b &= \min [t_{b3}, t_{b1}] \\
&= \min [6,22, 6,57] \\
&= 6,22 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{UG-45} &= \max [t_a, t_b] \\
&= \max [3,67, 6,22] \\
&= 6,22 \text{ mm}
\end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 7,14 = 6,25$ mm

The nozzle neck thickness is adequate.

Reinforcement Calculations for MAWP

The vessel wall thickness governs the MAWP of this nozzle.

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 90,07 bar @ 135 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							6,22	6,25

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (mm)	Actual weld throat size (mm)	Status
Nozzle to shell fillet (Leg ₄₁)	2,9	5,6	weld size is adequate

Calculations for internal pressure 90,07 bar @ 135 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [39,99, 19,99 + (7,14 - 3) + (11,11 - 3)] \\
 &= 39,99 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (11,11 - 3), 2,5 \cdot (7,14 - 3) + 0] \\
 &= 10,34 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{90,0666 \cdot 19,99}{1,180 \cdot 1 - 0,6 \cdot 90,0666} \\
 &= 1,6 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{90,0666 \cdot 109,54}{1,180 \cdot 1 + 0,4 \cdot 90,0666} \\
 &= 8,11 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$\begin{aligned}
t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
&= \frac{90,0666 \cdot 109,54}{1.180 \cdot 0,85 + 0,4 \cdot 90,0666} \\
&= 9,49 \text{ mm}
\end{aligned}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(c) Weld Check

Fillet weld: $t_{\min} = \min [19mm, t_n, t] = 4,14 \text{ mm}$

$t_{c(\min)} = \min [6 \text{ mm}, 0,7 \cdot t_{\min}] = 2,9 \text{ mm}$

$t_{c(actual)} = 0,7 \cdot \text{Leg} = 0,7 \cdot 8 = 5,6 \text{ mm}$

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-45 Nozzle Neck Thickness Check

$$\begin{aligned}
t_{aUG-27} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\
&= \frac{90,0666 \cdot 19,99}{1.180 \cdot 1 - 0,6 \cdot 90,0666} + 3 \\
&= 4,6 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_a &= \max [t_{aUG-27}, t_{aUG-22}] \\
&= \max [4,6, 0] \\
&= 4,6 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{b1} &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} + \text{Corrosion} \\
&= \frac{90,0666 \cdot 109,54}{1.180 \cdot 1 + 0,4 \cdot 90,0666} + 3 \\
&= 11,11 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{b1} &= \max [t_{b1}, t_{bUG16}] \\
&= \max [11,11, 4,5] \\
&= 11,11 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_b &= \min [t_{b3}, t_{b1}] \\
&= \min [6,22, 11,11] \\
&= 6,22 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{UG-45} &= \max [t_a, t_b] \\
&= \max [4,6, 6,22] \\
&= 6,22 \text{ mm}
\end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 7,14 = 6,25$ mm

The nozzle neck thickness is adequate.

Reinforcement Calculations for MAP

The attached ASME B16.5 flange limits the nozzle MAP.

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 102,1 bar @ 21,11 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							3,22	6,25

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

Calculations for internal pressure 102,1 bar @ 21,11 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [33,99, 16,99 + (7,14 - 0) + (11,11 - 0)] \\
 &= 35,24 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (11,11 - 0), 2,5 \cdot (7,14 - 0) + 0] \\
 &= 17,84 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{102,1 \cdot 16,99}{1.180 \cdot 1 - 0,6 \cdot 102,1} \\
 &= 1,55 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{102,1 \cdot 109,54}{1.180 \cdot 1 + 0,4 \cdot 102,1} \\
 &= 9,16 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{102,1 \cdot 109,54}{1.180 \cdot 0,85 + 0,4 \cdot 102,1} \\
 &= 10,71 \text{ mm}
 \end{aligned}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UG-45 Nozzle Neck Thickness Check

$$\begin{aligned}t_{aUG-27} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\&= \frac{102,1 \cdot 16,99}{1.180 \cdot 1 - 0,6 \cdot 102,1} + 0 \\&= 1,55 \text{ mm}\end{aligned}$$

$$\begin{aligned}t_a &= \max [t_{aUG-27}, t_{aUG-22}] \\&= \max [1,55, 0] \\&= 1,55 \text{ mm}\end{aligned}$$

$$\begin{aligned}t_{b1} &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} + \text{Corrosion} \\&= \frac{102,1 \cdot 109,54}{1.180 \cdot 1 + 0,4 \cdot 102,1} + 0 \\&= 9,16 \text{ mm}\end{aligned}$$

$$\begin{aligned}t_{b1} &= \max [t_{b1}, t_{bUG16}] \\&= \max [9,16, 1,5] \\&= 9,16 \text{ mm}\end{aligned}$$

$$\begin{aligned}t_b &= \min [t_{b3}, t_{b1}] \\&= \min [3,22, 9,16] \\&= 3,22 \text{ mm}\end{aligned}$$

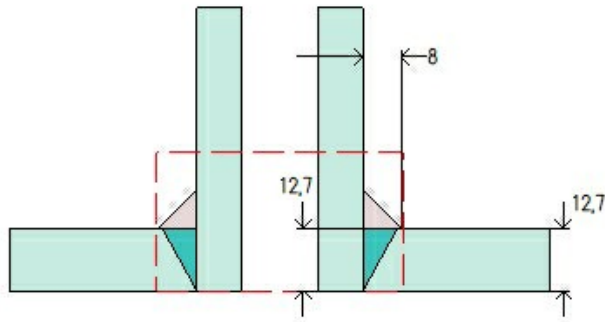
$$\begin{aligned}t_{UG-45} &= \max [t_a, t_b] \\&= \max [1,55, 3,22] \\&= \underline{3,22} \text{ mm}\end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 7,14 = 6,25 \text{ mm}$

The nozzle neck thickness is adequate.

PSV Connection (N5)

ASME Section VIII Division 1, 2021 Edition Metric



Note: round inside edges per UG-76(c)

Location and Orientation

Located on	Cylinder #1
Orientation	0°
Nozzle center line offset to datum line	328 mm
End of nozzle to shell center	250 mm
Passes through a Category A joint	No

Nozzle

Description	NPS 1 XXS DN 25
Access opening	No
Material specification	SA-106 B Smls Pipe (II-D Metric p. 16, In. 16)
Inside diameter, new	15,21 mm
Pipe nominal wall thickness	9,09 mm
Pipe minimum wall thickness ¹	7,96 mm
Corrosion allowance	3 mm
Projection available outside vessel, L _{pr}	72,14 mm
Projection available outside vessel to flange face, L _f	140,47 mm
Local vessel minimum thickness	11,11 mm
Liquid static head included	0 bar

Welds

Inner fillet, Leg ₄₁	8 mm
Nozzle to vessel groove weld	12,7 mm

Radiography

Longitudinal seam	Seamless No RT
Circumferential seam	Full UW-11(a) Type 1

¹Pipe minimum thickness = nominal thickness times pipe tolerance factor of 0,875.

ASME B16.5-2017 Flange	
Description	NPS 1 Class 600 WN A105
Bolt Material	SA-193 B7 Bolt ≤ 64 (II-D Metric p. 410, In. 32)
Blind included	No
Rated MDMT	-44,78°C
Liquid static head	0 bar
MAWP rating	91,1 bar @ 135°C
MAP rating	102,1 bar @ 21,11°C
Hydrotest rating	154 bar @ 21,11°C
PWHT performed	No
Produced to Fine Grain Practice and Supplied in Heat Treated Condition	No
Impact Tested	No
Circumferential joint radiography	Full UW-11(a) Type 1
Bore diameter, B (specified by purchaser)	26,67 mm
Gasket	
Type	ASME B16.20 Spiral-Wound
Description	Garlock FLEXSEAL RW 316L SS / Flexible Graphite
Factor, m	3
Seating Stress, y	703,07 kg/cm ²
Thickness, T	3 mm
Inner Diameter	31,8 mm
Outer Diameter	47,8 mm
Notes	
Flange rated MDMT per UCS-66(b)(1)(b) = -44,78°C (Coincident ratio = 0,5522) Bolts rated MDMT per Fig UCS-66 note (c) = -48°C	

UCS-66 Material Toughness Requirements Nozzle	
$t_r = \frac{56,38 \cdot 10,61}{1.180 \cdot 1 - 0,6 \cdot 56,38} =$	0,52 mm
$\text{Stress ratio} = \frac{t_r \cdot E^*}{t_n - c} = \frac{0,52 \cdot 1}{7,96 - 3} =$	0,1053
Stress ratio ≤ 0,35, MDMT per UCS-66(b)(3) =	-105°C
Material is exempt from impact testing at the Design MDMT of 0°C.	

Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 39 bar @ 135 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							5,96	7,96

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (mm)	Actual weld throat size (mm)	Status
Nozzle to shell fillet (Leg ₄₁)	4,27	5,6	weld size is adequate

Calculations for internal pressure 39 bar @ 135 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [21,21, 10,61 + (9,09 - 3) + (11,11 - 3)] \\
 &= 24,81 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (11,11 - 3), 2,5 \cdot (9,09 - 3) + 0] \\
 &= 15,23 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{39,0001 \cdot 10,61}{1,180 \cdot 1 - 0,6 \cdot 39,0001} \\
 &= 0,36 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{39,0001 \cdot 109,54}{1,180 \cdot 1 + 0,4 \cdot 39,0001} \\
 &= 3,57 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$\begin{aligned}
t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
&= \frac{39,0001 \cdot 109,54}{1.180 \cdot 0,85 + 0,4 \cdot 39,0001} \\
&= 4,19 \text{ mm}
\end{aligned}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(c) Weld Check

Fillet weld: $t_{\min} = \min [19mm, t_n, t] = 6,09 \text{ mm}$

$$t_{c(\min)} = \min [6 \text{ mm}, 0,7 \cdot t_{\min}] = 4,27 \text{ mm}$$

$$t_{c(actual)} = 0,7 \cdot \text{Leg} = 0,7 \cdot 8 = 5,6 \text{ mm}$$

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-45 Nozzle Neck Thickness Check

$$\begin{aligned}
t_{aUG-27} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\
&= \frac{39,0001 \cdot 10,61}{1.180 \cdot 1 - 0,6 \cdot 39,0001} + 3 \\
&= 3,36 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_a &= \max [t_{aUG-27}, t_{aUG-22}] \\
&= \max [3,36, 0] \\
&= 3,36 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{b1} &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} + \text{Corrosion} \\
&= \frac{39,0001 \cdot 109,54}{1.180 \cdot 1 + 0,4 \cdot 39,0001} + 3 \\
&= 6,57 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{b1} &= \max [t_{b1}, t_{bUG16}] \\
&= \max [6,57, 4,5] \\
&= 6,57 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_b &= \min [t_{b3}, t_{b1}] \\
&= \min [5,96, 6,57] \\
&= 5,96 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{UG-45} &= \max [t_a, t_b] \\
&= \max [3,36, 5,96] \\
&= 5,96 \text{ mm}
\end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 9,09 = 7,96 \text{ mm}$

The nozzle neck thickness is adequate.

Reinforcement Calculations for MAWP

The vessel wall thickness governs the MAWP of this nozzle.

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 90,07 bar @ 135 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							5,96	7,96

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (mm)	Actual weld throat size (mm)	Status
Nozzle to shell fillet (Leg ₄₁)	4,27	5,6	weld size is adequate

Calculations for internal pressure 90,07 bar @ 135 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [21,21, 10,61 + (9,09 - 3) + (11,11 - 3)] \\
 &= 24,81 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (11,11 - 3), 2,5 \cdot (9,09 - 3) + 0] \\
 &= 15,23 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{90,0666 \cdot 10,61}{1.180 \cdot 1 - 0,6 \cdot 90,0666} \\
 &= 0,85 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{90,0666 \cdot 109,54}{1.180 \cdot 1 + 0,4 \cdot 90,0666} \\
 &= 8,11 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$\begin{aligned}
t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
&= \frac{90,0666 \cdot 109,54}{1.180 \cdot 0,85 + 0,4 \cdot 90,0666} \\
&= 9,49 \text{ mm}
\end{aligned}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(c) Weld Check

Fillet weld: $t_{\min} = \min [19mm, t_n, t] = 6,09 \text{ mm}$

$$t_{c(\min)} = \min [6 \text{ mm}, 0,7 \cdot t_{\min}] = 4,27 \text{ mm}$$

$$t_{c(actual)} = 0,7 \cdot \text{Leg} = 0,7 \cdot 8 = 5,6 \text{ mm}$$

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-45 Nozzle Neck Thickness Check

$$\begin{aligned}
t_{aUG-27} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\
&= \frac{90,0666 \cdot 10,61}{1.180 \cdot 1 - 0,6 \cdot 90,0666} + 3 \\
&= 3,85 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_a &= \max [t_{aUG-27}, t_{aUG-22}] \\
&= \max [3,85, 0] \\
&= 3,85 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{b1} &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} + \text{Corrosion} \\
&= \frac{90,0666 \cdot 109,54}{1.180 \cdot 1 + 0,4 \cdot 90,0666} + 3 \\
&= 11,11 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{b1} &= \max [t_{b1}, t_{bUG16}] \\
&= \max [11,11, 4,5] \\
&= 11,11 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_b &= \min [t_{b3}, t_{b1}] \\
&= \min [5,96, 11,11] \\
&= 5,96 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{UG-45} &= \max [t_a, t_b] \\
&= \max [3,85, 5,96] \\
&= 5,96 \text{ mm}
\end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 9,09 = 7,96 \text{ mm}$

The nozzle neck thickness is adequate.

Reinforcement Calculations for MAP

The attached ASME B16.5 flange limits the nozzle MAP.

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 102,1 bar @ 21,11 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							2,96	7,96

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

Calculations for internal pressure 102,1 bar @ 21,11 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [15,21, 7,61 + (9,09 - 0) + (11,11 - 0)] \\
 &= 27,81 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (11,11 - 0), 2,5 \cdot (9,09 - 0) + 0] \\
 &= 22,73 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{102,1 \cdot 7,61}{1.180 \cdot 1 - 0,6 \cdot 102,1} \\
 &= 0,69 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{102,1 \cdot 109,54}{1.180 \cdot 1 + 0,4 \cdot 102,1} \\
 &= 9,16 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{102,1 \cdot 109,54}{1.180 \cdot 0,85 + 0,4 \cdot 102,1} \\
 &= 10,71 \text{ mm}
 \end{aligned}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UG-45 Nozzle Neck Thickness Check

$$\begin{aligned}t_{aUG-27} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\&= \frac{102,1 \cdot 7,61}{1.180 \cdot 1 - 0,6 \cdot 102,1} + 0 \\&= 0,69 \text{ mm}\end{aligned}$$

$$\begin{aligned}t_a &= \max [t_{aUG-27}, t_{aUG-22}] \\&= \max [0,69, 0] \\&= 0,69 \text{ mm}\end{aligned}$$

$$\begin{aligned}t_{b1} &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} + \text{Corrosion} \\&= \frac{102,1 \cdot 109,54}{1.180 \cdot 1 + 0,4 \cdot 102,1} + 0 \\&= 9,16 \text{ mm}\end{aligned}$$

$$\begin{aligned}t_{b1} &= \max [t_{b1}, t_{bUG16}] \\&= \max [9,16, 1,5] \\&= 9,16 \text{ mm}\end{aligned}$$

$$\begin{aligned}t_b &= \min [t_{b3}, t_{b1}] \\&= \min [2,96, 9,16] \\&= 2,96 \text{ mm}\end{aligned}$$

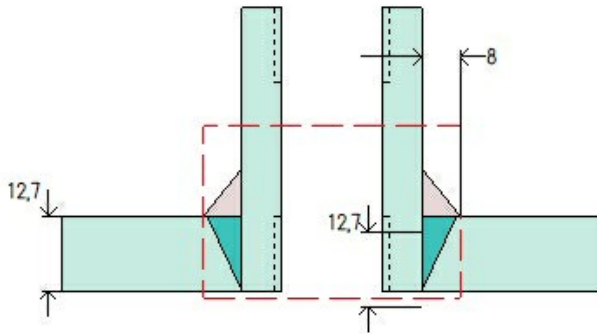
$$\begin{aligned}t_{UG-45} &= \max [t_a, t_b] \\&= \max [0,69, 2,96] \\&= \underline{2,96} \text{ mm}\end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 9,09 = 7,96 \text{ mm}$

The nozzle neck thickness is adequate.

Drain (N6)

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Note: round inside edges per UG-76(c)

Location and Orientation

Located on	Cylinder #1
Orientation	180°
Nozzle center line offset to datum line	470 mm
End of nozzle to shell center	142,69 mm
Passes through a Category A joint	No

Nozzle

Description	NPS 0,5 Class 6000 DN 15 - Threaded Full Coupling
Access opening	No
Material specification	SA-105 (II-D Metric p. 20, In. 31)
Inside diameter, new	21,34 mm
Nominal wall thickness	8,38 mm
Corrosion allowance	3 mm
Projection available outside vessel, L _{pr}	33,16 mm
Local vessel minimum thickness	11,11 mm
Liquid static head included	0 bar

Welds

Inner fillet, Leg ₄₁	8 mm
Nozzle to vessel groove weld	12,7 mm

Radiography

Longitudinal seam	Seamless No RT
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UCS-66 Material Toughness Requirements Nozzle

$t_r = \frac{56,38 \cdot 13,67}{1.380 \cdot 1 - 0,6 \cdot 56,38} =$	0,57 mm
Stress ratio $= \frac{t_r \cdot E^*}{t_n - c} = \frac{0,57 \cdot 1}{8,38 - 3} =$	0,1064
Stress ratio $\leq 0,35$, MDMT per UCS-66(b)(3) =	-105°C
Material is exempt from impact testing at the Design MDMT of 0°C.	

Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (cm ²)							UG-44 Summary (mm)	
For P = 39 bar @ 135 °C							The nozzle passes UG-44	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							4,5	8,38

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (mm)	Actual weld throat size (mm)	Status
Nozzle to shell fillet (Leg ₄₁)	2,5	5,6	weld size is adequate

Calculations for internal pressure 39 bar @ 135 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [27,34, 13,67 + (8,38 - 3) + (11,11 - 3)] \\
 &= 27,34 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (11,11 - 3), 2,5 \cdot (8,38 - 3) + 0] \\
 &= 13,46 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{39,0001 \cdot 13,67}{1,380 \cdot 1 - 0,6 \cdot 39,0001} \\
 &= 0,39 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{39,0001 \cdot 109,54}{1,180 \cdot 1 + 0,4 \cdot 39,0001} \\
 &= 3,57 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$\begin{aligned}
t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
&= \frac{39,0001 \cdot 109,54}{1.180 \cdot 0,85 + 0,4 \cdot 39,0001} \\
&= 4,19 \text{ mm}
\end{aligned}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(f)(2)(b) Weld Check

Fillet weld: $t_{\min} = \min [19mm, t_n, t] = 5,38 \text{ mm}$

$$t_{c(\min)} = \min [2,5 \text{ mm}, 0,7 \cdot t_{\min}] = 2,5 \text{ mm}$$

$$t_{c(actual)} = 0,7 \cdot \text{Leg} = 0,7 \cdot 8 = 5,6 \text{ mm}$$

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-44 Thickness Check - ASME B16.11 Coupling

$$\begin{aligned}
t_{aApp \text{ 1-1}} &= \frac{P \cdot R_o}{S_n \cdot E + 0,4 \cdot P} + \text{Corrosion} \\
&= \frac{39,0001 \cdot 19,05}{1.380 \cdot 1 + 0,4 \cdot 39,0001} + 3 \\
&= 3,53 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{aUG-44} &= \max [t_{aApp \text{ 1-1}}, t_{bUG16}] \\
&= \max [3,53, 4,5] \\
&= 4,5 \text{ mm}
\end{aligned}$$

Available nozzle wall thickness new, $t_n = 8,38 \text{ mm}$

The nozzle neck thickness is adequate.

Reinforcement Calculations for MAWP

The vessel wall thickness governs the MAWP of this nozzle.

UG-37 Area Calculation Summary (cm ²)							UG-44 Summary (mm)	
For P = 90,07 bar @ 135 °C							The nozzle passes UG-44	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							4,5	8,38

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (mm)	Actual weld throat size (mm)	Status
Nozzle to shell fillet (Leg ₄₁)	2,5	5,6	weld size is adequate

Calculations for internal pressure 90,07 bar @ 135 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [27,34, 13,67 + (8,38 - 3) + (11,11 - 3)] \\
 &= 27,34 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (11,11 - 3), 2,5 \cdot (8,38 - 3) + 0] \\
 &= 13,46 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{90,0666 \cdot 13,67}{1,380 \cdot 1 - 0,6 \cdot 90,0666} \\
 &= 0,93 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{90,0666 \cdot 109,54}{1,180 \cdot 1 + 0,4 \cdot 90,0666} \\
 &= 8,11 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$\begin{aligned}
t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
&= \frac{90,0666 \cdot 109,54}{1.180 \cdot 0,85 + 0,4 \cdot 90,0666} \\
&= 9,49 \text{ mm}
\end{aligned}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(f)(2)(b) Weld Check

Fillet weld: $t_{\min} = \min [19mm, t_n, t] = 5,38 \text{ mm}$

$$t_{c(\min)} = \min [2,5 \text{ mm}, 0,7 \cdot t_{\min}] = 2,5 \text{ mm}$$

$$t_{c(actual)} = 0,7 \cdot \text{Leg} = 0,7 \cdot 8 = 5,6 \text{ mm}$$

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-44 Thickness Check - ASME B16.11 Coupling

$$\begin{aligned}
t_{aApp \text{ 1-1}} &= \frac{P \cdot R_o}{S_n \cdot E + 0,4 \cdot P} + \text{Corrosion} \\
&= \frac{90,0666 \cdot 19,05}{1.380 \cdot 1 + 0,4 \cdot 90,0666} + 3 \\
&= 4,21 \text{ mm}
\end{aligned}$$

$$\begin{aligned}
t_{aUG-44} &= \max [t_{aApp \text{ 1-1}}, t_{bUG16}] \\
&= \max [4,21, 4,5] \\
&= 4,5 \text{ mm}
\end{aligned}$$

Available nozzle wall thickness new, $t_n = 8,38 \text{ mm}$

The nozzle neck thickness is adequate.

Reinforcement Calculations for MAP

The vessel wall thickness governs the MAP of this nozzle.

UG-37 Area Calculation Summary (cm ²)							UG-44 Summary (mm)	
For P = 124,78 bar @ 21,11 °C							The nozzle passes UG-44	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							1,66	8,38

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

Calculations for internal pressure 124,78 bar @ 21,11 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [21,34, 10,67 + (8,38 - 0) + (11,11 - 0)] \\
 &= 30,16 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (11,11 - 0), 2,5 \cdot (8,38 - 0) + 0] \\
 &= 20,96 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{124,7779 \cdot 10,67}{1,380 \cdot 1 - 0,6 \cdot 124,7779} \\
 &= 1,02 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{124,7779 \cdot 109,54}{1,180 \cdot 1 + 0,4 \cdot 124,7779} \\
 &= 11,11 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$\begin{aligned}
 t_r &= \frac{P \cdot R_o}{S \cdot E + 0,4 \cdot P} \\
 &= \frac{124,7779 \cdot 109,54}{1,180 \cdot 0,85 + 0,4 \cdot 124,7779} \\
 &= 12,98 \text{ mm}
 \end{aligned}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UG-44 Thickness Check - ASME B16.11 Coupling

$$\begin{aligned}t_{aApp\ 1-1} &= \frac{P \cdot R_o}{S_n \cdot E + 0,4 \cdot P} + \text{Corrosion} \\&= \frac{124,7779 \cdot 19,05}{1,380 \cdot 1 + 0,4 \cdot 124,7779} + 0 \\&= 1,66 \text{ mm} \\t_{aUG-44} &= \max [t_{aApp\ 1-1}, t_{bUG16}] \\&= \max [1,66, 1,5] \\&= \underline{1,66} \text{ mm}\end{aligned}$$

Available nozzle wall thickness new, $t_n = 8,38 \text{ mm}$

The nozzle neck thickness is adequate.

Straight Flange on B16.9 Pipe Cap - Right Side

ASME Section VIII Division 1, 2021 Edition Metric				
Component		Cylinder		
Material		SA-234 WPB (II-D Metric p. 16, In. 18)		
Impact Tested	Normalized	Fine Grain Practice	PWHT	Maximize MDMT No MAWP
No	No	No	No	No
		Design Pressure (bar)	Design Temperature (°C)	Design MDMT (°C)
Internal		39	135	0
Static Liquid Head				
Condition		P _s (bar)	H _s (mm)	SG
Test horizontal		0,03	346,84	1
Dimensions				
Outer Diameter		219,07 mm		
Length		42,47 mm		
Nominal Thickness		12,7 mm		
Corrosion	Inner	3 mm		
	Outer	0 mm		
Weight and Capacity				
		Weight (kg)		Capacity (liters)
New		2,74		1,25
Corroded		2,12		1,33
Radiography				
Longitudinal seam		Seamless No RT		
Left Circumferential seam		Spot UW-11(b) Type 1		

Results Summary	
Governing condition	Internal pressure
Minimum thickness per UG-16	1,5 mm + 3 mm = 4,5 mm
Design thickness due to internal pressure (t)	7,2 mm
Maximum allowable working pressure (MAWP)	92,09 bar
Maximum allowable pressure (MAP)	121,95 bar
Rated MDMT	-48 °C

UCS-66 Material Toughness Requirements	
Governing thickness, t _g =	11,11 mm
Exemption temperature from Fig UCS-66M Curve B =	-24,98°C
$t_r = \frac{56,38 \cdot 109,54}{1.180 \cdot 0,85 + 0,4 \cdot 56,38} =$	6,02 mm
$\text{Stress ratio} = \frac{t_r \cdot E^*}{t_n - c} = \frac{6,02 \cdot 0,85}{12,7 - 3} =$	0,5277
Reduction in MDMT, T _R from Fig UCS-66.1M =	28,9°C
$MDMT = \max [MDMT - T_R, -48] = \max [-24,98 - 28,9, -48] =$	-48°C
Material is exempt from impact testing at the Design MDMT of 0°C.	

Design thickness, (at 135 °C) Appendix 1-1

$$t = \frac{P \cdot R_o}{S \cdot E + 0,40 \cdot P} + \text{Corrosion} = \frac{39 \cdot 109,54}{1.180 \cdot 0,85 + 0,40 \cdot 39} + 3 = \underline{7,2} \text{ mm}$$

Maximum allowable working pressure, (at 135 °C) Appendix 1-1

$$P = \frac{S \cdot E \cdot t}{R_o - 0,40 \cdot t} - P_s = \frac{1.180 \cdot 0,85 \cdot 9,7}{109,54 - 0,40 \cdot 9,7} - 0 = \underline{92,09} \text{ bar}$$

Maximum allowable pressure, (at 21,11 °C) Appendix 1-1

$$P = \frac{S \cdot E \cdot t}{R_o - 0,40 \cdot t} = \frac{1.180 \cdot 0,85 \cdot 12,7}{109,54 - 0,40 \cdot 12,7} = \underline{121,95} \text{ bar}$$

ASME Section VIII Division 1 UG-80(a) Out-of-Roundness
$(D_{\max} - D_{\min})$ shall not exceed 1% of D
When the cross section passes through an opening or within 1 I.D. of the opening, $(D_{\max} - D_{\min})$ shall not exceed 1% of $D + 2\%$ of the inside diameter of the opening

B16.9 Pipe Cap - Right Side

ASME Section VIII Division 1, 2021 Edition Metric				
Component		ASME B16.9 Pipe Cap (modified)		
Material		SA-234 WPB (II-D Metric p. 16, ln. 18)		
Attached To		Cylinder #1		
Impact Tested	Normalized	Fine Grain Practice	PWHT	Maximize MDMT/ No MAWP
No	No	No	No	No
		Design Pressure (bar)	Design Temperature (°C)	Design MDMT (°C)
Internal		39	135	0
Static Liquid Head				
Condition		P _s (bar)	H _s (mm)	SG
Test horizontal		0,03	346,84	1
Dimensions				
NPS and Schedule		NPS 8 Sch 80 (XS) DN 200		
Outer Diameter		219,07 mm		
Overall Length E		102 mm		
Nominal Thickness		12,7 mm		
Minimum Thickness ¹		11,11 mm		
Corrosion	Inner	3 mm		
	Outer	0 mm		
Length L _{sf}		42,47 mm		
Nominal Thickness t _{sf}		12,7 mm		
Weight and Capacity				
		Weight (kg) ²		Capacity (liters) ²
New		7,72		2,2
Corroded		6,06		2,4
Radiography				
Category A joints		Seamless No RT		
Head to shell seam		Spot UW-11(b) Type 1		

¹ minimum thickness = nominal thickness times pipe tolerance factor of 0,875.

² includes straight flange

Results Summary	
Governing condition	internal pressure
Minimum thickness per UG-16	1,5 mm + 3 mm = 4,5 mm
Design thickness due to internal pressure (t)	<u>6,96</u> mm
Governing straight flange design thickness	7,2 mm
Maximum allowable working pressure (MAWP)	<u>82,74</u> bar
Maximum allowable pressure (MAP)	<u>111,98</u> bar
<u>Straight Flange</u> governs MDMT	-48°C

Factor K		
$K = \left(\frac{1}{6}\right) \cdot \left[2 + \left(\frac{D}{2 \cdot h}\right)^2\right]$		
Corroded	$K = \left(\frac{1}{6}\right) \cdot \left[2 + \left(\frac{199,67}{2 \cdot 51,42}\right)^2\right]$	0,9617
New	$K = \left(\frac{1}{6}\right) \cdot \left[2 + \left(\frac{193,67}{2 \cdot 48,42}\right)^2\right]$	1

Design thickness for internal pressure, (Corroded at 135 °C) Appendix 1-4(c)

$$t = \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} + \text{Corrosion} = \frac{39 \cdot 219,07 \cdot 0,961673}{2 \cdot 1.180 \cdot 0,85 + 2 \cdot 39 \cdot (0,961673 - 0,1)} + 3 = \underline{6.96} \text{ mm}$$

Maximum allowable working pressure, (Corroded at 135 °C) Appendix 1-4(c)

$$P = \frac{2 \cdot S \cdot E \cdot t}{K \cdot D_o - 2 \cdot t \cdot (K - 0,1)} - P_s = \frac{2 \cdot 1.180 \cdot 0,85 \cdot (0,875 \cdot 12,7 - 3)}{0,961673 \cdot 219,07 - 2 \cdot (0,875 \cdot 12,7 - 3) \cdot (0,961673 - 0,1)} - 0 = \underline{82.74} \text{ bar}$$

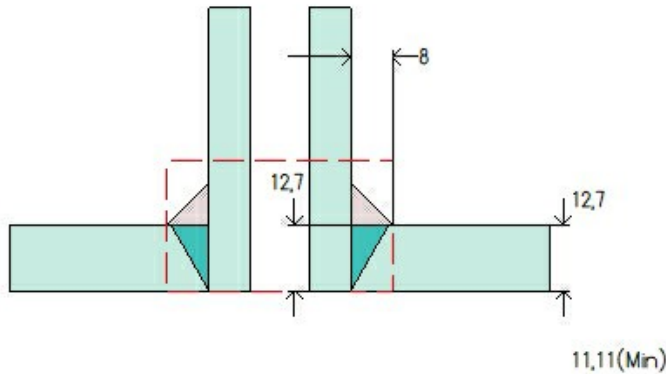
Maximum allowable pressure, (New at 21,11 °C) Appendix 1-4(c)

$$P = \frac{2 \cdot S \cdot E \cdot t}{K \cdot D_o - 2 \cdot t \cdot (K - 0,1)} - P_s = \frac{2 \cdot 1.180 \cdot 0,85 \cdot 0,875 \cdot 12,7}{1 \cdot 219,07 - 2 \cdot 0,875 \cdot 12,7 \cdot (1 - 0,1)} - 0 = \underline{111.98} \text{ bar}$$

ASME Section VIII Division 1 UG-81(a) Out-of-Roundness
Inside surface shall not deviate outside the shape by more than 1,25 % of D
Inside surface shall not deviate inside the shape by more than 0,625 % of D

Air Outlet (N2)

ASME Section VIII Division 1, 2021 Edition Metric



Note: round inside edges per UG-76(c)

Location and Orientation

Located on	B16.9 Pipe Cap - Right Side
Orientation	0°
End of nozzle to datum line	-166 mm
Calculated as hillside	No
Distance to head center, R	0 mm
Passes through a Category A joint	No

Nozzle

Description	NPS 0,75 XXS DN 20
Access opening	No
Material specification	SA-106 B Smls Pipe (II-D Metric p. 16, ln. 16)
Inside diameter, new	11,02 mm
Pipe nominal wall thickness	7,82 mm
Pipe minimum wall thickness ¹	6,85 mm
Corrosion allowance	3 mm
Projection available outside vessel, L _{pr}	64,44 mm
Local vessel minimum thickness	11,11 mm
Liquid static head included	0 bar

Welds

Inner fillet, Leg ₄₁	8 mm
Nozzle to vessel groove weld	12,7 mm

Radiography

Longitudinal seam	Seamless No RT
Circumferential seam	Full UW-11(a) Type 1

¹Pipe minimum thickness = nominal thickness times pipe tolerance factor of 0,875.

UCS-66 Material Toughness Requirements Nozzle

$t_r = \frac{56,38-8,51}{1.180 \cdot 1 - 0,6 \cdot 56,38} =$	0,42 mm
Stress ratio $= \frac{t_r \cdot E^*}{t_n - c} = \frac{0,42 \cdot 1}{6,85-3} =$	0,1089
Stress ratio $\leq 0,35$, MDMT per UCS-66(b)(3) =	-105°C
Material is exempt from impact testing at the Design MDMT of 0°C.	

Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 39 bar @ 135 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							5,51	6,85

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (mm)	Actual weld throat size (mm)	Status
Nozzle to shell fillet (Leg ₄₁)	3,38	5,6	weld size is adequate

Calculations for internal pressure 39 bar @ 135 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [17,02, 8,51 + (7,82 - 3) + (11,11 - 3)] \\
 &= 21,45 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (11,11 - 3), 2,5 \cdot (7,82 - 3) + 0] \\
 &= 12,06 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{39,0001 \cdot 8,51}{1,180 \cdot 1 - 0,6 \cdot 39,0001} \\
 &= 0,29 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)(c)

$$\begin{aligned}
 t_r &= \frac{P \cdot K_1 \cdot D_o}{2 \cdot S \cdot E + 0,8 \cdot P} \\
 &= \frac{39,0001 \cdot 0,8737 \cdot 219,07}{2 \cdot 1,180 \cdot 1 + 0,8 \cdot 39,0001} \\
 &= 3,12 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$t_r = \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} = \frac{39 \cdot 219,07 \cdot 0,961673}{2 \cdot 1,180 \cdot 0,85 + 2 \cdot 39 \cdot (0,961673 - 0,1)} = 3,96 \text{ mm}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(c) Weld Check

Fillet weld: $t_{\min} = \min [19\text{ mm}, t_n, t] = 4,82 \text{ mm}$

$$t_{c(\min)} = \min [6 \text{ mm}, 0,7 \cdot t_{\min}] = \underline{3,38} \text{ mm}$$

$$t_{c(\text{actual})} = 0,7 \cdot \text{Leg} = 0,7 \cdot 8 = 5,6 \text{ mm}$$

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-45 Nozzle Neck Thickness Check

Interpretation VIII-1-83-66 has been applied.

$$\begin{aligned} t_{a\text{UG-27}} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\ &= \frac{39,0001 \cdot 8,51}{1,180 \cdot 1 - 0,6 \cdot 39,0001} + 3 \\ &= 3,29 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_a &= \max [t_{a\text{UG-27}}, t_{a\text{UG-22}}] \\ &= \max [3,29, 0] \\ &= 3,29 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{b1} &= \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} + \text{Corrosion} \\ &= \frac{39 \cdot 219,07 \cdot 0,961673}{2 \cdot 1,180 \cdot 1 + 2 \cdot 39 \cdot (0,961673 - 0,1)} + 3 \\ &= 6,38 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{b1} &= \max [t_{b1}, t_{b\text{UG16}}] \\ &= \max [6,39, 4,5] \\ &= 6,39 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_b &= \min [t_{b3}, t_{b1}] \\ &= \min [5,51, 6,39] \\ &= 5,51 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{\text{UG-45}} &= \max [t_a, t_b] \\ &= \max [3,29, 5,51] \\ &= \underline{5,51} \text{ mm} \end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 7,82 = 6,85 \text{ mm}$

The nozzle neck thickness is adequate.

Reinforcement Calculations for MAWP

The vessel wall thickness governs the MAWP of this nozzle.

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 103,54 bar @ 135 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							5,51	6,85

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (mm)	Actual weld throat size (mm)	Status
Nozzle to shell fillet (Leg ₄₁)	3,38	5,6	weld size is adequate

Calculations for internal pressure 103,54 bar @ 135 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [17,02, 8,51 + (7,82 - 3) + (11,11 - 3)] \\
 &= 21,45 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (11,11 - 3), 2,5 \cdot (7,82 - 3) + 0] \\
 &= 12,06 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{103,5405 \cdot 8,51}{1.180 \cdot 1 - 0,6 \cdot 103,5405} \\
 &= 0,79 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)(c)

$$\begin{aligned}
 t_r &= \frac{P \cdot K_1 \cdot D_o}{2 \cdot S \cdot E + 0,8 \cdot P} \\
 &= \frac{103,5405 \cdot 0,8737 \cdot 219,07}{2 \cdot 1.180 \cdot 1 + 0,8 \cdot 103,5405} \\
 &= 8,11 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$t_r = \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} = \frac{103,54 \cdot 219,07 \cdot 0,961673}{2 \cdot 1.180 \cdot 0,85 + 2 \cdot 103,54 \cdot (0,961673 - 0,1)} = 9,99 \text{ mm}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(c) Weld Check

Fillet weld: $t_{\min} = \min [19\text{ mm}, t_n, t] = 4,82 \text{ mm}$

$t_{c(\min)} = \min [6 \text{ mm}, 0,7 \cdot t_{\min}] = 3,38 \text{ mm}$

$t_{c(actual)} = 0,7 \cdot \text{Leg} = 0,7 \cdot 8 = 5,6 \text{ mm}$

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-45 Nozzle Neck Thickness Check

Interpretation VIII-1-83-66 has been applied.

$$\begin{aligned} t_{aUG-27} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\ &= \frac{103,5405 \cdot 8,51}{1,180 \cdot 1 - 0,6 \cdot 103,5405} + 3 \\ &= 3,79 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_a &= \max [t_{aUG-27}, t_{aUG-22}] \\ &= \max [3,79, 0] \\ &= 3,79 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{b1} &= \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} + \text{Corrosion} \\ &= \frac{103,54 \cdot 219,07 \cdot 0,961673}{2 \cdot 1,180 \cdot 1 + 2 \cdot 103,54 \cdot (0,961673 - 0,1)} + 3 \\ &= 11,59 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{b1} &= \max [t_{b1}, t_{bUG16}] \\ &= \max [11,59, 4,5] \\ &= 11,59 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_b &= \min [t_{b3}, t_{b1}] \\ &= \min [5,51, 11,59] \\ &= 5,51 \text{ mm} \end{aligned}$$

$$\begin{aligned} t_{UG-45} &= \max [t_a, t_b] \\ &= \max [3,79, 5,51] \\ &= 5,51 \text{ mm} \end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 7,82 = 6,85 \text{ mm}$

The nozzle neck thickness is adequate.

Reinforcement Calculations for MAP

The vessel wall thickness governs the MAP of this nozzle.

UG-37 Area Calculation Summary (cm ²)							UG-45 Summary (mm)	
For P = 139,29 bar @ 21,11 °C							The nozzle passes UG-45	
A required	A available	A ₁	A ₂	A ₃	A ₅	A welds	t _{req}	t _{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							2,51	6,85

UG-41 Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

Calculations for internal pressure 139,29 bar @ 21,11 °C

Parallel Limit of reinforcement per UG-40

$$\begin{aligned}
 L_R &= \max [d, R_n + (t_n - C_n) + (t - C)] \\
 &= \max [11,02, 5,51 + (7,82 - 0) + (11,11 - 0)] \\
 &= 24,45 \text{ mm}
 \end{aligned}$$

Outer Normal Limit of reinforcement per UG-40

$$\begin{aligned}
 L_H &= \min [2,5 \cdot (t - C), 2,5 \cdot (t_n - C_n) + t_e] \\
 &= \min [2,5 \cdot (11,11 - 0), 2,5 \cdot (7,82 - 0) + 0] \\
 &= 19,56 \text{ mm}
 \end{aligned}$$

Nozzle required thickness per UG-27(c)(1)

$$\begin{aligned}
 t_{rn} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} \\
 &= \frac{139,2932 \cdot 5,51}{1.180 \cdot 1 - 0,6 \cdot 139,2932} \\
 &= 0,7 \text{ mm}
 \end{aligned}$$

Required thickness t_r from UG-37(a)(c)

$$\begin{aligned}
 t_r &= \frac{P \cdot K_1 \cdot D_o}{2 \cdot S \cdot E + 0,8 \cdot P} \\
 &= \frac{139,2932 \cdot 0,9 \cdot 219,07}{2 \cdot 1.180 \cdot 1 + 0,8 \cdot 139,2932} \\
 &= 11,11 \text{ mm}
 \end{aligned}$$

Required thickness t_r per Interpretation VIII-1-07-50

$$t_r = \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} = \frac{139,29 \cdot 219,07 \cdot 1}{2 \cdot 1.180 \cdot 0,85 + 2 \cdot 139,29 \cdot (1 - 0,1)} = 13,52 \text{ mm}$$

This opening does not require reinforcement per UG-36(c)(3)(a)

UG-45 Nozzle Neck Thickness Check

Interpretation VIII-1-83-66 has been applied.

$$\begin{aligned}
 t_{aUG-27} &= \frac{P \cdot R_n}{S_n \cdot E - 0,6 \cdot P} + \text{Corrosion} \\
 &= \frac{139,2932 \cdot 5,51}{1.180 \cdot 1 - 0,6 \cdot 139,2932} + 0 \\
 &= 0,7 \text{ mm} \\
 t_a &= \max [t_{aUG-27}, t_{aUG-22}] \\
 &= \max [0,7, 0] \\
 &= 0,7 \text{ mm} \\
 t_{b1} &= \frac{P \cdot D_o \cdot K}{2 \cdot S \cdot E + 2 \cdot P \cdot (K - 0,1)} + \text{Corrosion} \\
 &= \frac{139,29 \cdot 219,07 \cdot 1}{2 \cdot 1.180 \cdot 1 + 2 \cdot 139,29 \cdot (1 - 0,1)} + 0 \\
 &= 11,69 \text{ mm} \\
 t_{bl} &= \max [t_{bl}, t_{bUG16}] \\
 &= \max [11,69, 1,5] \\
 &= 11,69 \text{ mm} \\
 t_b &= \min [t_{b3}, t_{bl}] \\
 &= \min [2,51, 11,69] \\
 &= 2,51 \text{ mm} \\
 t_{UG-45} &= \max [t_a, t_b] \\
 &= \max [0,7, 2,51] \\
 &= 2,51 \text{ mm}
 \end{aligned}$$

Available nozzle wall thickness new, $t_n = 0,875 \cdot 7,82 = 6,85 \text{ mm}$

The nozzle neck thickness is adequate.

B16.9 Elbow #2 (N2)

ASME Section VIII Division 1, 2021 Edition Metric				
Component		ASME B16.9 Elbow		
Type		Long Radius 90-deg		
Material		SA-234 WPB (II-D Metric p. 16, ln. 18)		
Pipe NPS and Schedule		NPS 0,75 XXS DN 20		
Attached To		Air Outlet (N2)		
Impact Tested	Normalized	Fine Grain Practice	PWHT	Maximize MDMT/ No MAWP
No	No	No	No	No
		Design Pressure (bar)	Design Temperature (°C)	Design MDMT (°C)
Internal		39	135	0
Static Liquid Head				
Condition		P _s (bar)	H _s (mm)	SG
Test horizontal		0,03	255,51	1
Dimensions				
Outer Diameter		26,67 mm		
Nominal Thickness		7,82 mm		
Minimum Thickness ¹		6,85 mm		
Center-to-End, A		38 mm		
Corrosion	Inner	3 mm		
	Outer	0 mm		
Weight and Capacity				
		Weight (kg)		Capacity (liters)
New		0,22		0,01
Corroded		0,16		0,01
Radiography				
Longitudinal seam		Seamless No RT		
Left Circumferential seam		Full UW-11(a) Type 1		
Right Circumferential seam		Full UW-11(a) Type 1		

¹ minimum thickness = nominal thickness times pipe tolerance factor of 0,875.

ASME B16.5-2017 Flange	
Description	NPS 0,75 Class 600 WN A105
Bolt Material	SA-193 B7 Bolt ≤ 64 (II-D Metric p. 410, In. 32)
Blind included	No
Rated MDMT	-44,78°C
Liquid static head	0 bar
MAWP rating	91,1 bar @ 135°C
MAP rating	102,1 bar @ 21,11°C
Hydrotest rating	154 bar @ 21,11°C
PWHT performed	No
Produced to Fine Grain Practice and Supplied in Heat Treated Condition	No
Impact Tested	No
Circumferential joint radiography	Full UW-11(a) Type 1
Bore diameter, B (specified by purchaser)	20,83 mm
Gasket	
Type	ASME B16.20 Spiral-Wound
Description	Garlock FLEXSEAL RW 316L SS / Flexible Graphite
Factor, m	3
Seating Stress, y	703,07 kgf/cm ²
Thickness, T	3 mm
Inner Diameter	25,4 mm
Outer Diameter	39,6 mm
Notes	
Flange rated MDMT per UCS-66(b)(1)(b) = -44,78°C (Coincident ratio = 0,5522) Bolts rated MDMT per Fig UCS-66 note (c) = -48°C	

Results Summary	
Governing condition	UG-16
Minimum thickness per UG-16	1,5 mm + 3 mm = 4,5 mm
Design thickness due to internal pressure (t)	3,43 mm
Maximum allowable working pressure (MAWP)	401,45 bar
Maximum allowable pressure (MAP)	849,81 bar
Rated MDMT	-105 °C

UCS-66 Material Toughness Requirements	
$t_r = 13,34 \cdot \left(1 - \exp \left(- \frac{56,38}{1.180 \cdot 1} \right) \right) =$	0,62 mm
$\text{Stress ratio} = \frac{t_r \cdot E^*}{t_n - c} = \frac{0,62 \cdot 1}{6,85 - 3} =$	0,1618
Stress ratio ≤ 0,35, MDMT per UCS-66(b)(3) =	-105°C
Material is exempt from impact testing at the Design MDMT of 0°C.	

Design thickness, (at 135 °C) Appendix 1-2

$$t = R_o \cdot \left(1 - \exp \left[- \frac{P}{S \cdot E} \right] \right) + \text{Corrosion} = 13,34 \cdot \left(1 - \exp \left[- \frac{39}{1.180 \cdot 1,00} \right] \right) + 3 = \text{3,43 mm}$$

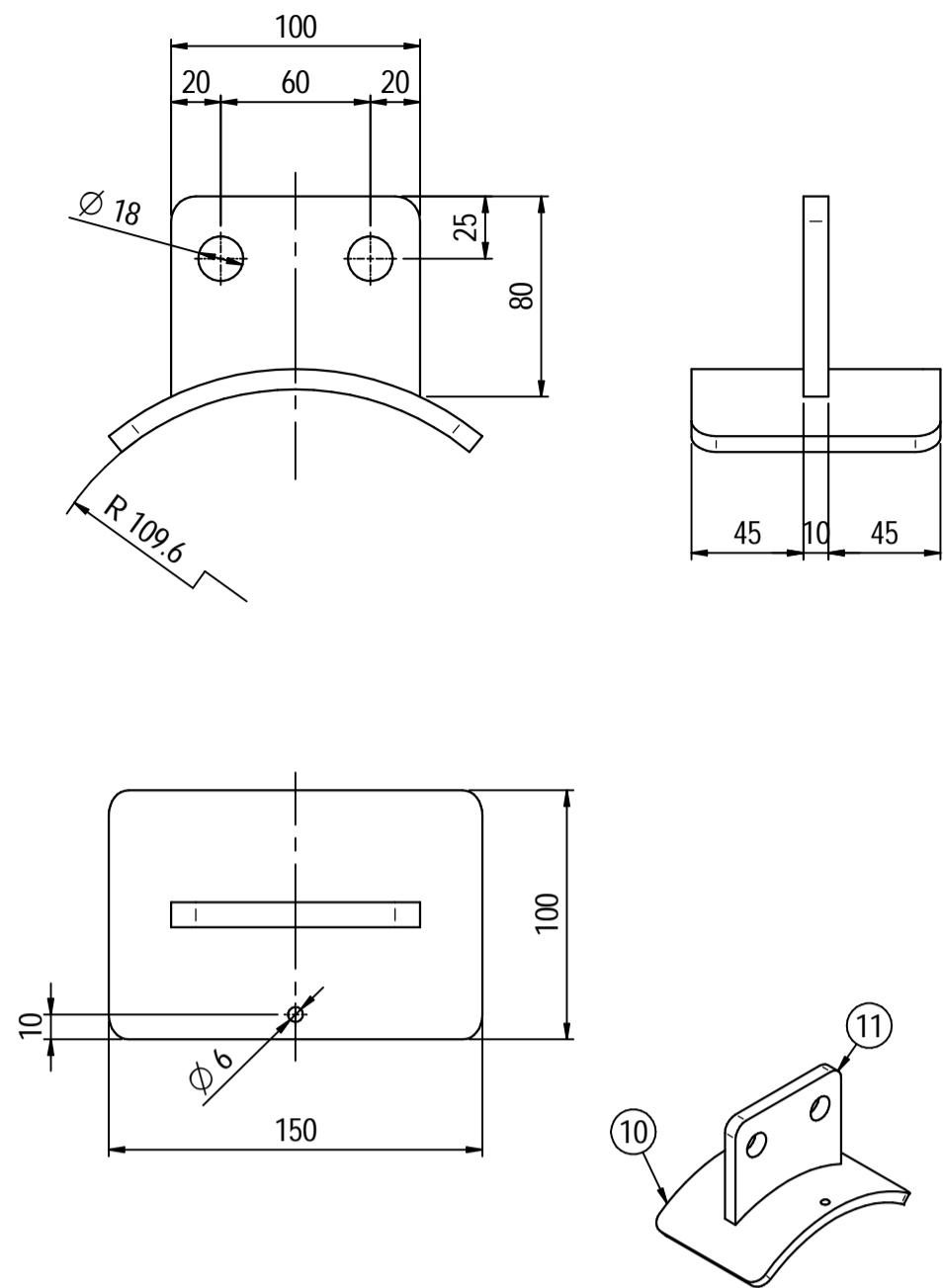
Maximum allowable working pressure, (at 135 °C) Appendix 1-2

$$P = S \cdot E \cdot \ln\left(\frac{R_o}{R_o - t}\right) - P_s = 1.180 \cdot 1,00 \cdot \ln\left(\frac{13,34}{13,34 - (7,82 \cdot 0,875 - 3)}\right) - 0 = \underline{401,45} \text{ bar}$$

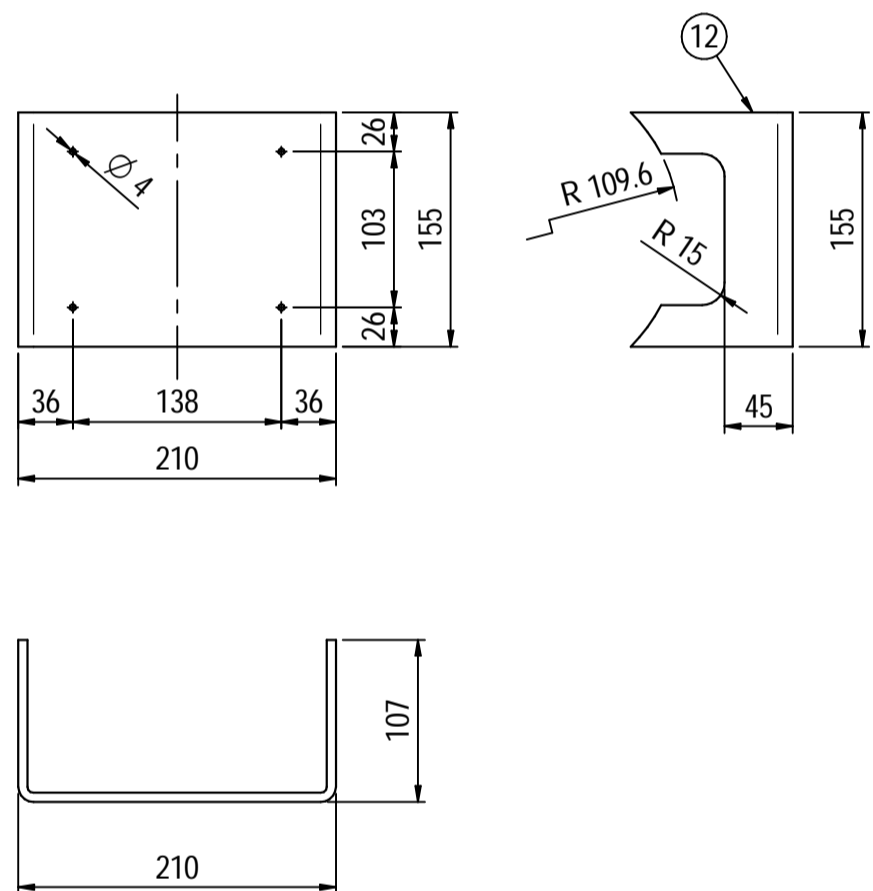
Maximum allowable pressure, (at 21,11 °C) Appendix 1-2

$$P = S \cdot E \cdot \ln\left(\frac{R_o}{R_o - t}\right) = 1.180 \cdot 1,00 \cdot \ln\left(\frac{13,34}{13,34 - (7,82 \cdot 0,875)}\right) = \underline{849,81} \text{ bar}$$

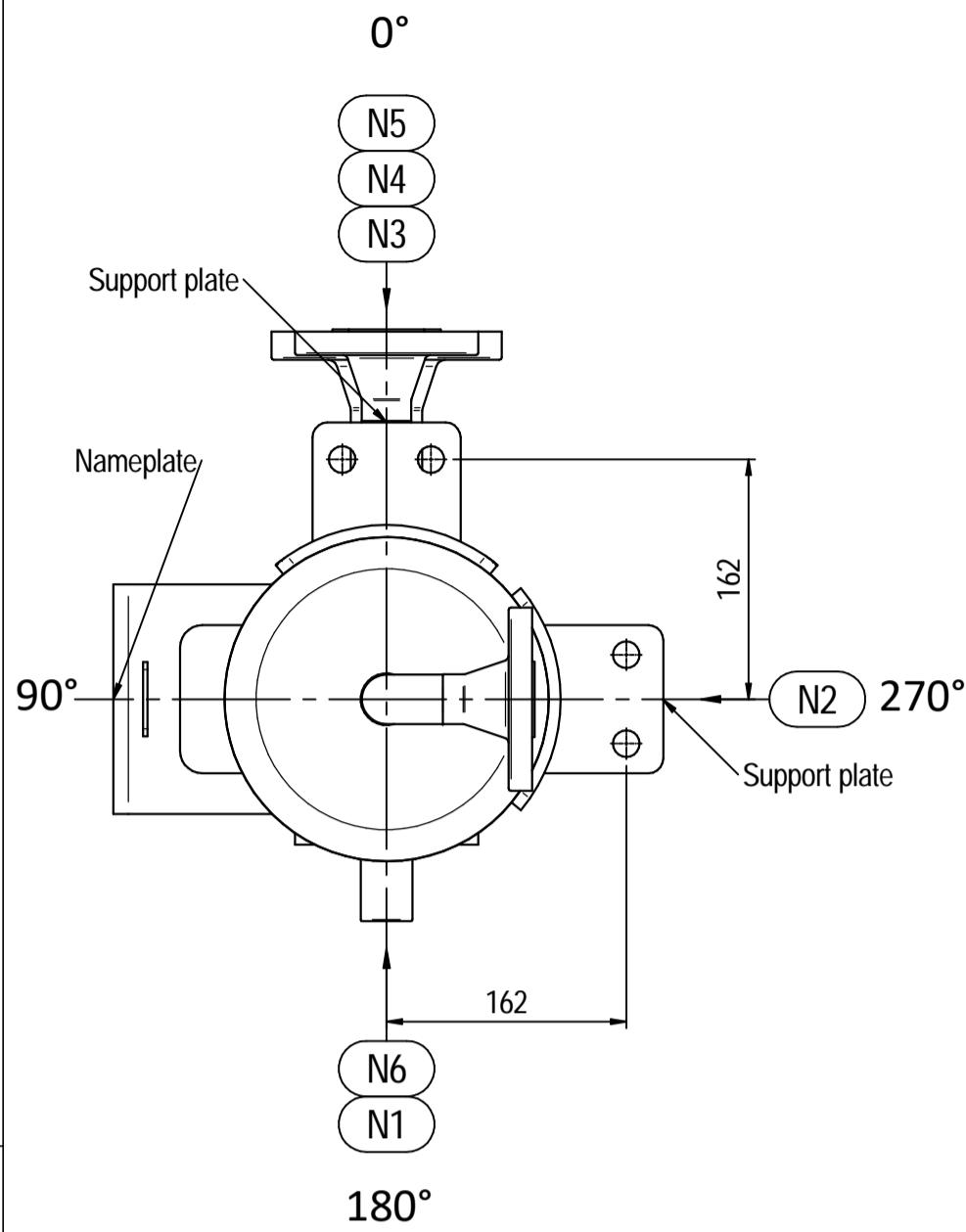
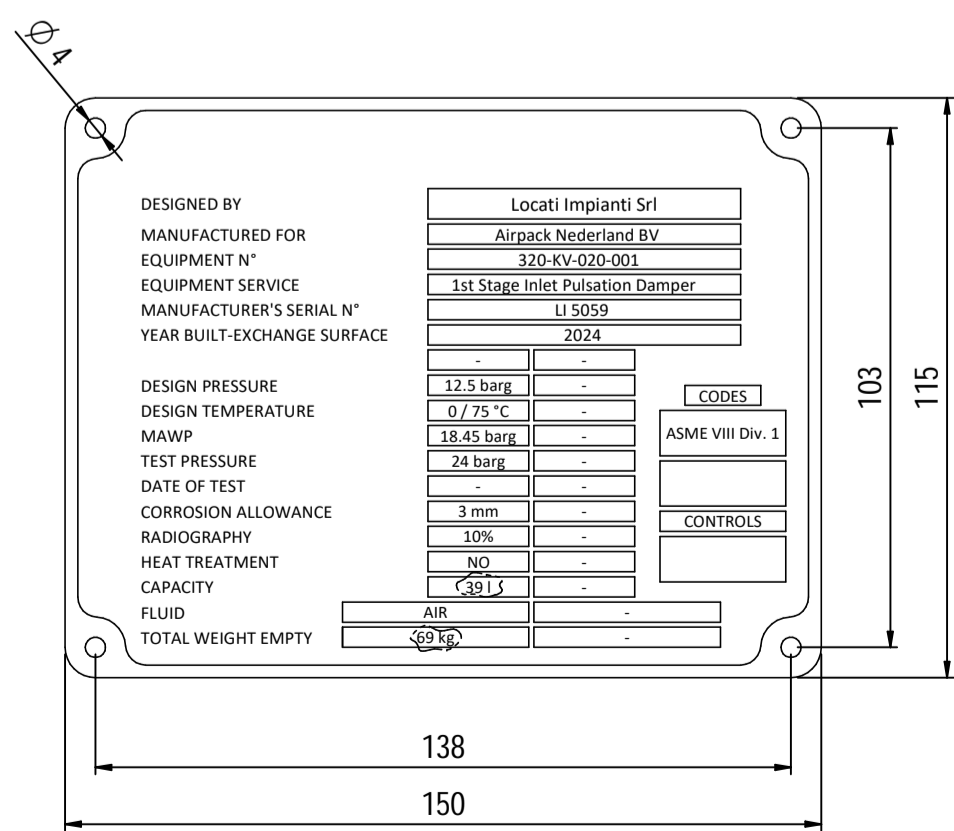
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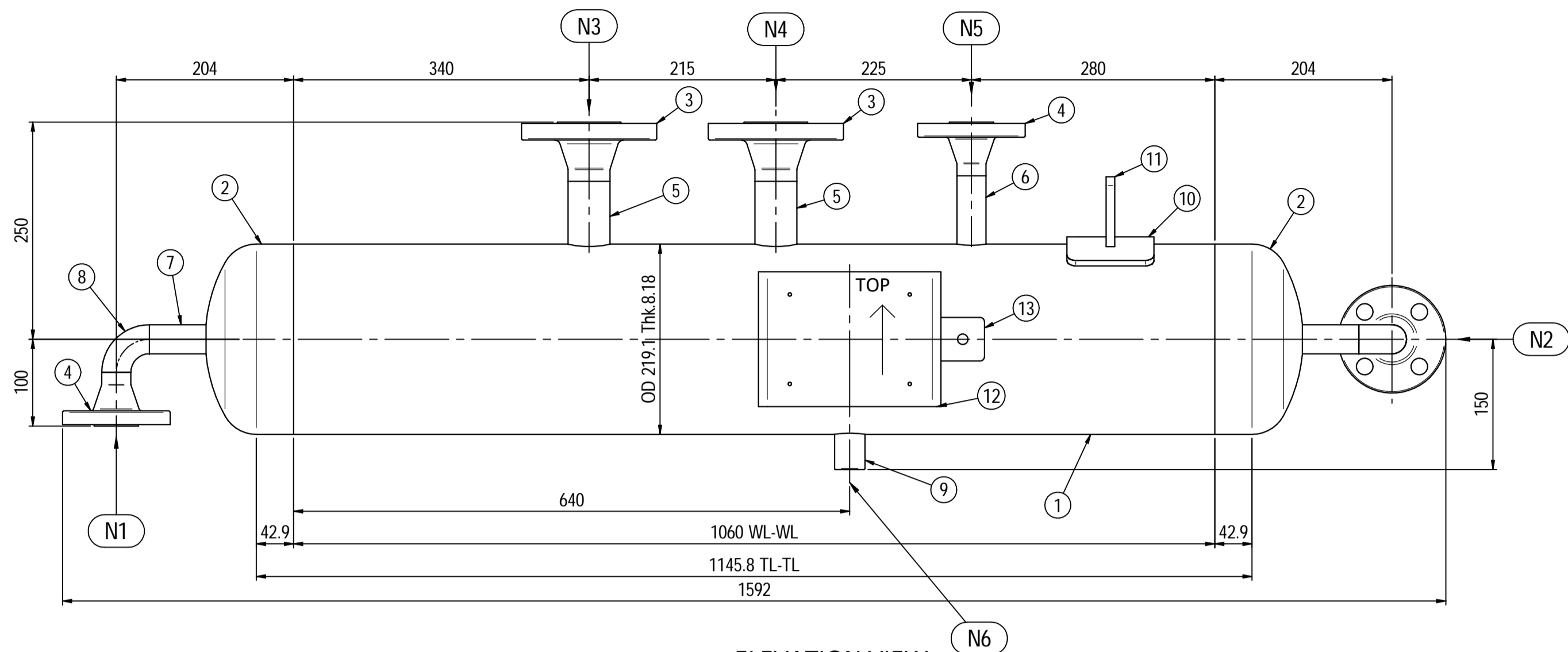
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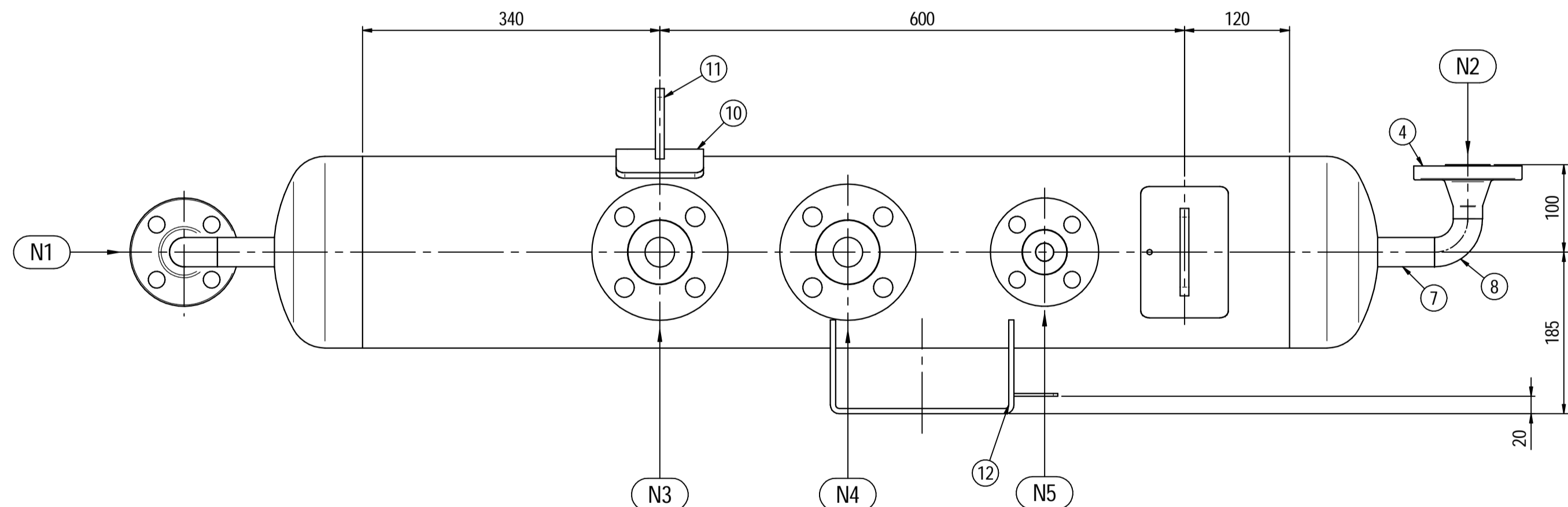
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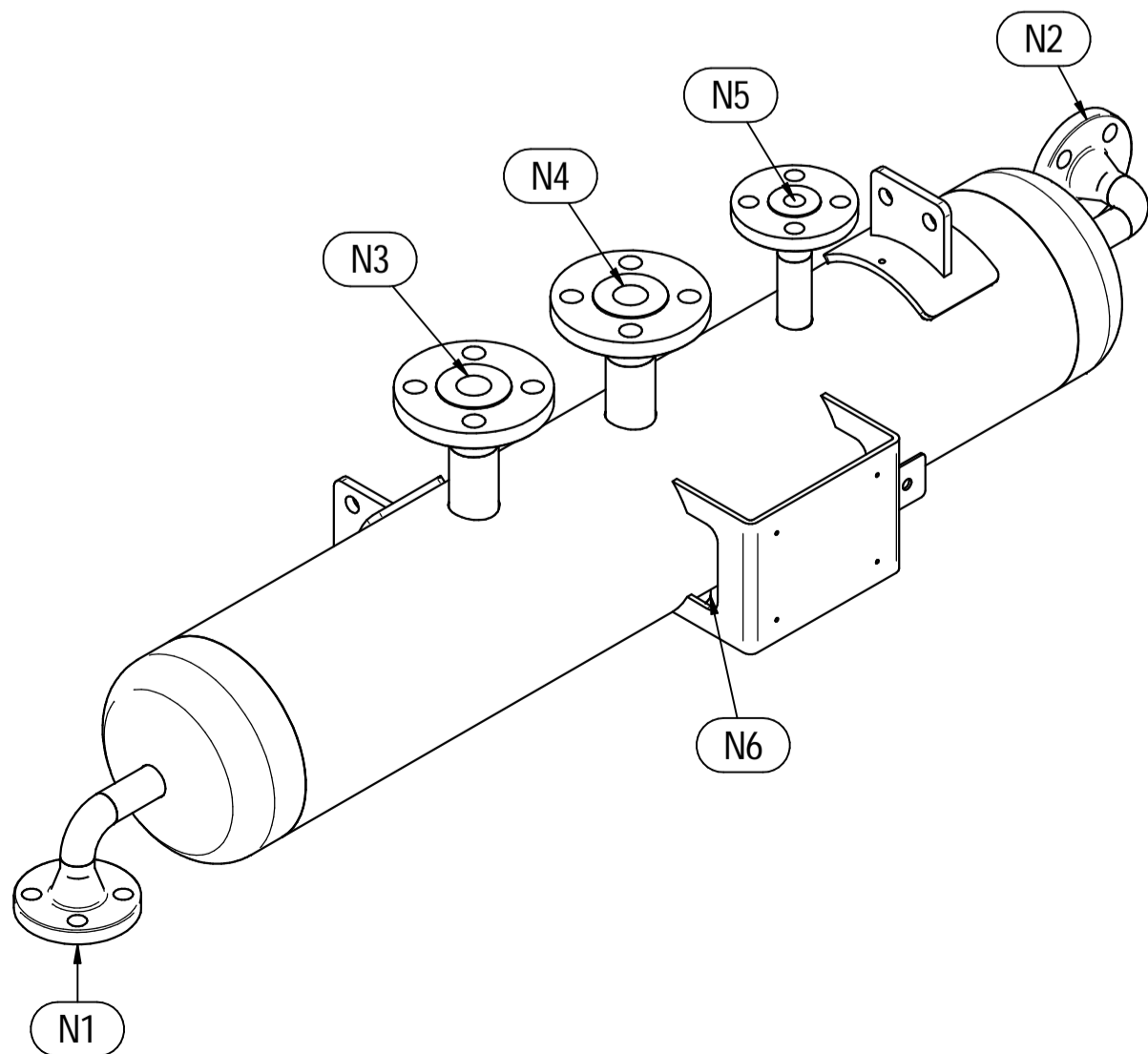
ORIENTATION VIEW



ELEVATION VIEW



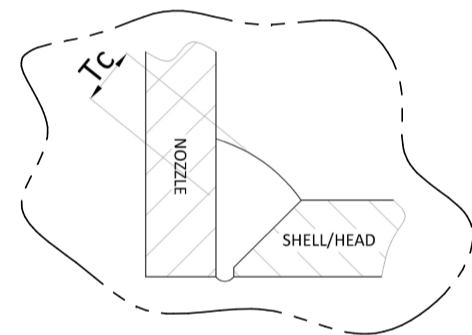
PLAN VIEW



ISOMETRIC VIEW

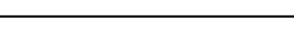
Note:

- 1) Governing measurement S.I. unless otherwise specified
- 2) Flange bolt holes have to be straddled from main vessel center line in plan & vertical & horizontal centreline in elevation
- 3) Material: certification 3.1 EN 10204
- 4) All internal edge shall be rounded off
- 5) Nozzle flanges in accordance with ASME B16.5: 2020
- 6) Flange fittings in accordance with ASME B16.9: 2018
- 7) All fillet welds not detailed on "WELDING MAP" or drawing shall have the weld throated equal to 0.7 times the minimum thickness to be welded
- 8) All welds are continuous except where indicated
- 9) Detailed
- 10) The nameplate is in SS316 and is laser engraved
- 11) Non corrosive service, no inspection opening per UG-46(a)
- 12) On support hexagonal bolts DIN 933, class 8.8 shall be used (Airpact scope)



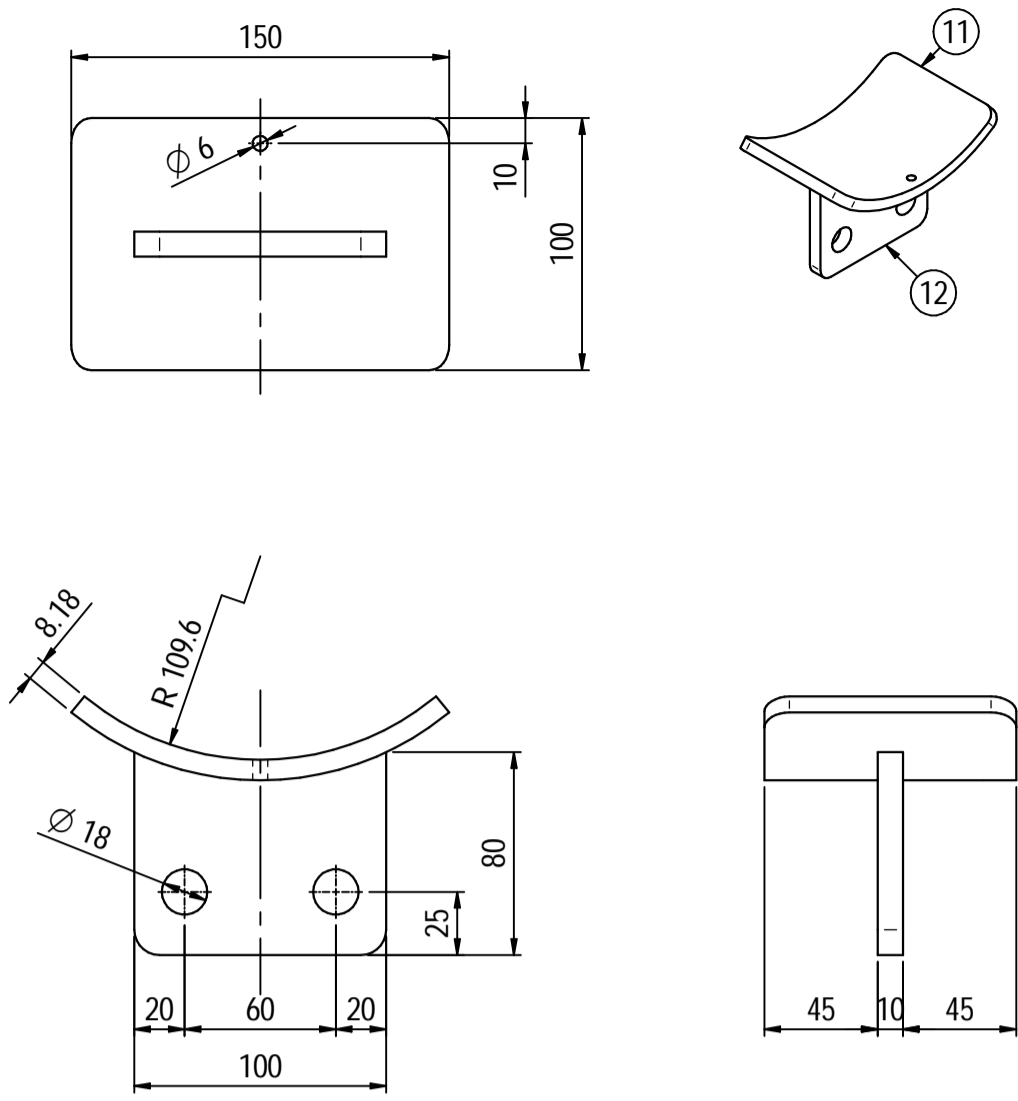
DATI DI PROGETTO / Design data				
FLUIDO <i>Fluid</i>	Air	COLLAUDO <i>Test</i>		Irra Inspection Iberia SA
STATO FISICO DEL FLUIDO <i>Physical state of fluid</i>	Gas	PED		N/A
CODICE DI CALCOLO <i>Construction code</i>	ASME VIII Div.1 Ed.2021			
PRESSIONE DI ESERCIZIO <i>Operating pressure</i>	9.5 barg	SERVIZIO LETALE <i>Lethal service</i>		NO
PRESSIONE DI PROGETTO <i>Design pressure</i>	12.5 barg	X-RAY <i>RT examination</i>		Spot (10%)
PRESSIONE ESTERNA <i>External pressure</i>	NO	LIQUIDI PENETRANTI <i>Dye penetrant extension</i>		NO
PRESSIONE DI PROVA IDRAULICA <i>Hydraulic test pressure</i>	24 barg	ULTRASUONI <i>Ultrasonic extension</i>		NO
TEMPERATURA DI ESERCIZIO <i>Operating temperature</i>	5 + 46 °C	CONTROLLIO MAGNETICO SCOPICO <i>Magnetic particle examination</i>		NO
TEMPERATURA DI PROGETTO <i>Design temperature</i>	75 °C	TALLONE DI SALDATURA <i>Weld teels coupon</i>		NO
SOVRAMETALLO DI CORROSIONE <i>Corrosion allowance</i>	3 mm	PROCEDIMENTO DI SALDATURA <i>Welding procedure</i>		See doc.C230048WBK009
CAPACITA' <i>Capacity</i>	39 l	TIPO DI FONDO <i>Head type</i>		CAP
EFFICIENZA GIUNTI <i>Joint efficiency</i>	0.85	FORMA TURA FONDO <i>Head formed</i>		HOT
MAWP @ Design Temperature	18.45 barg @ +75°C	PESO A VUOTO <i>Empty weight</i>		69 kg
MAWP(EXT)	NO	PESO IN ESERCIZIO <i>Operating weight</i>		69 kg
MDMT @ MAWP	0 °C @ 18.45 barg	PESO PIENO D'ACQUA <i>Full water weight</i>		109 kg
TRATTAMENTO TERMICO <i>P.W.H.T.</i>		DATI DEL VENTO <i>Wind datas</i>		-
IMPACT TEST <i>Exemption</i>	NO	DATI SISMICI <i>Seismological datas</i>		-

Oggetto/Object 1st STAGE INLET PULSATION DAMPER

	Scale/Scale	1 : 5	Formato/Size	A1
	Comm. N°/Job No.	C230048	Foglio/Sheet	1 - 1
	Cliente/Customer	Lirpasc Nederland B.V.		
	Ord. No.	17735-VV-900 (SK)		
	Dis. N°/Dwg No.	C230048BDWG001		Rev. 03
Locati Impianti S.r.l. - Via Vittorio Veneto, 37 24040 Vardellino (BG) Italy - Ph. +39 035 883.176 Fax +39 035 885.015 - e-mail: info@locati-impianti.com http://www.locati-impianti.com				

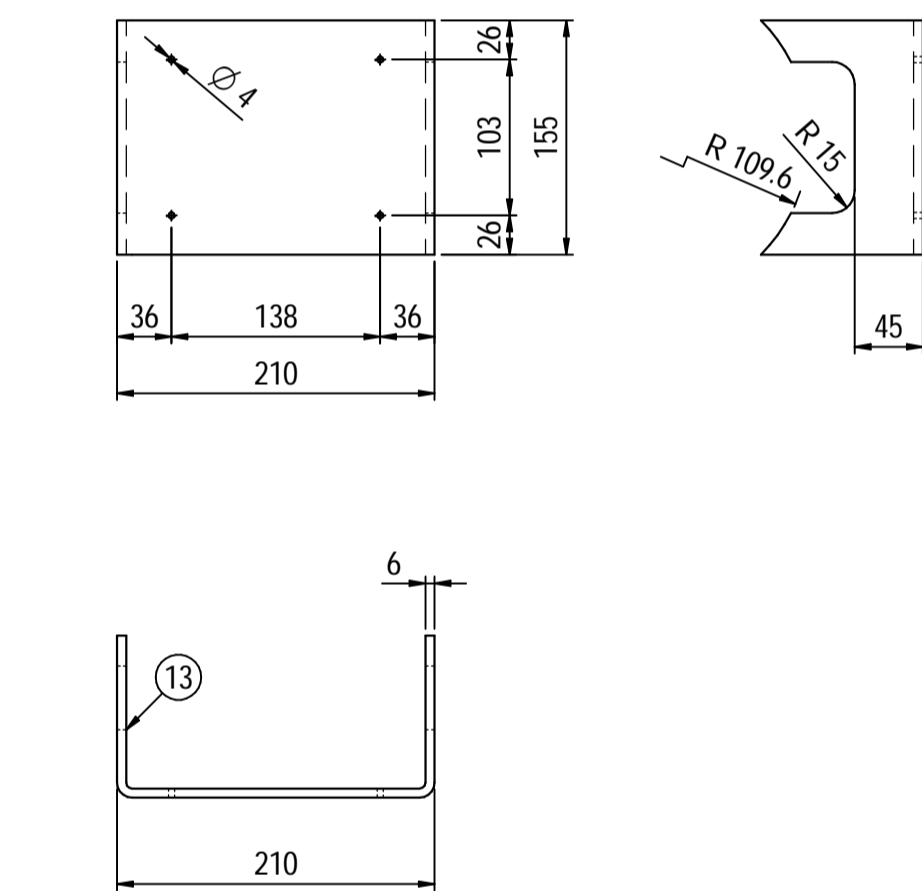
Supports detail

Scale 1 : 3



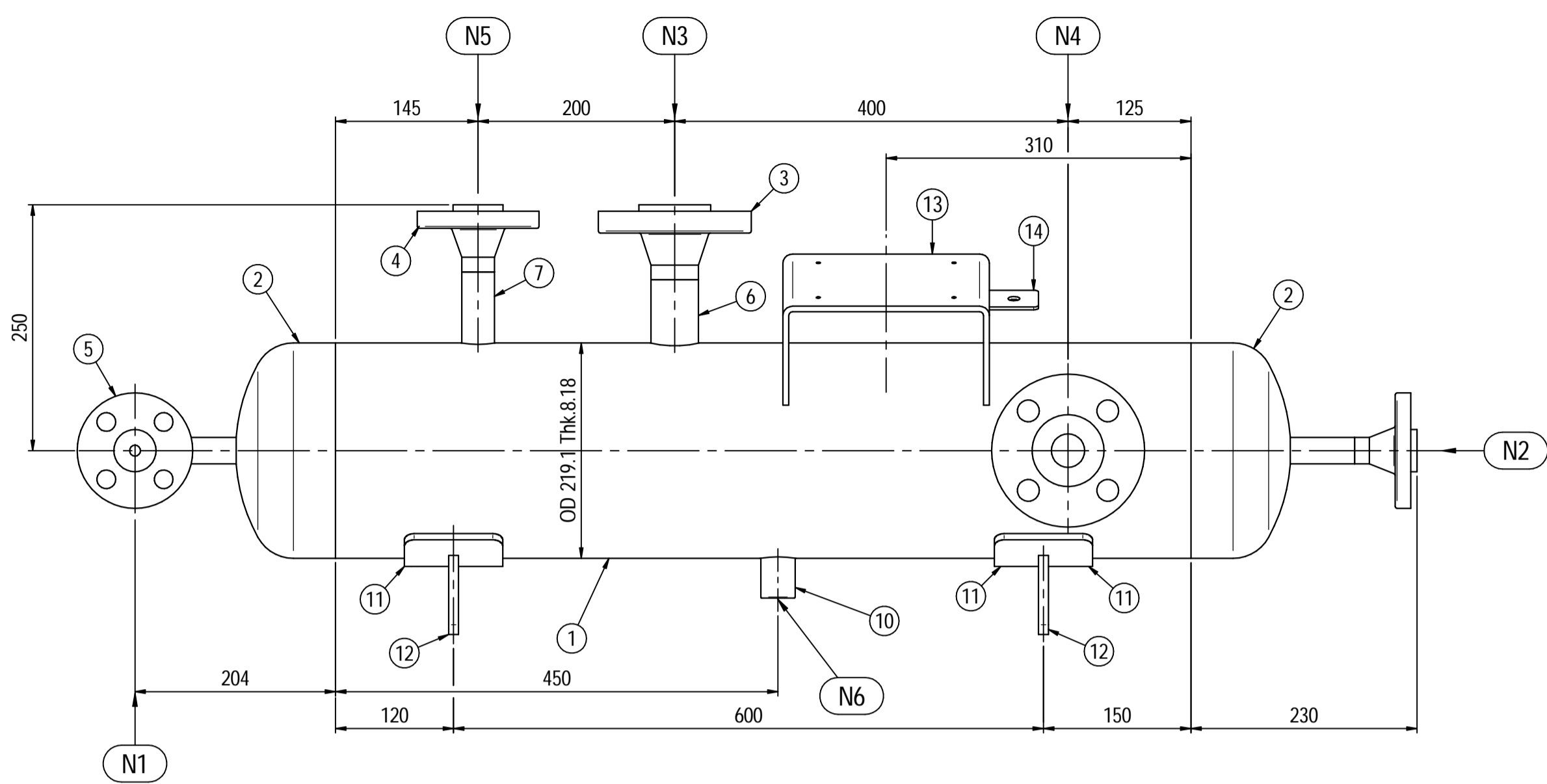
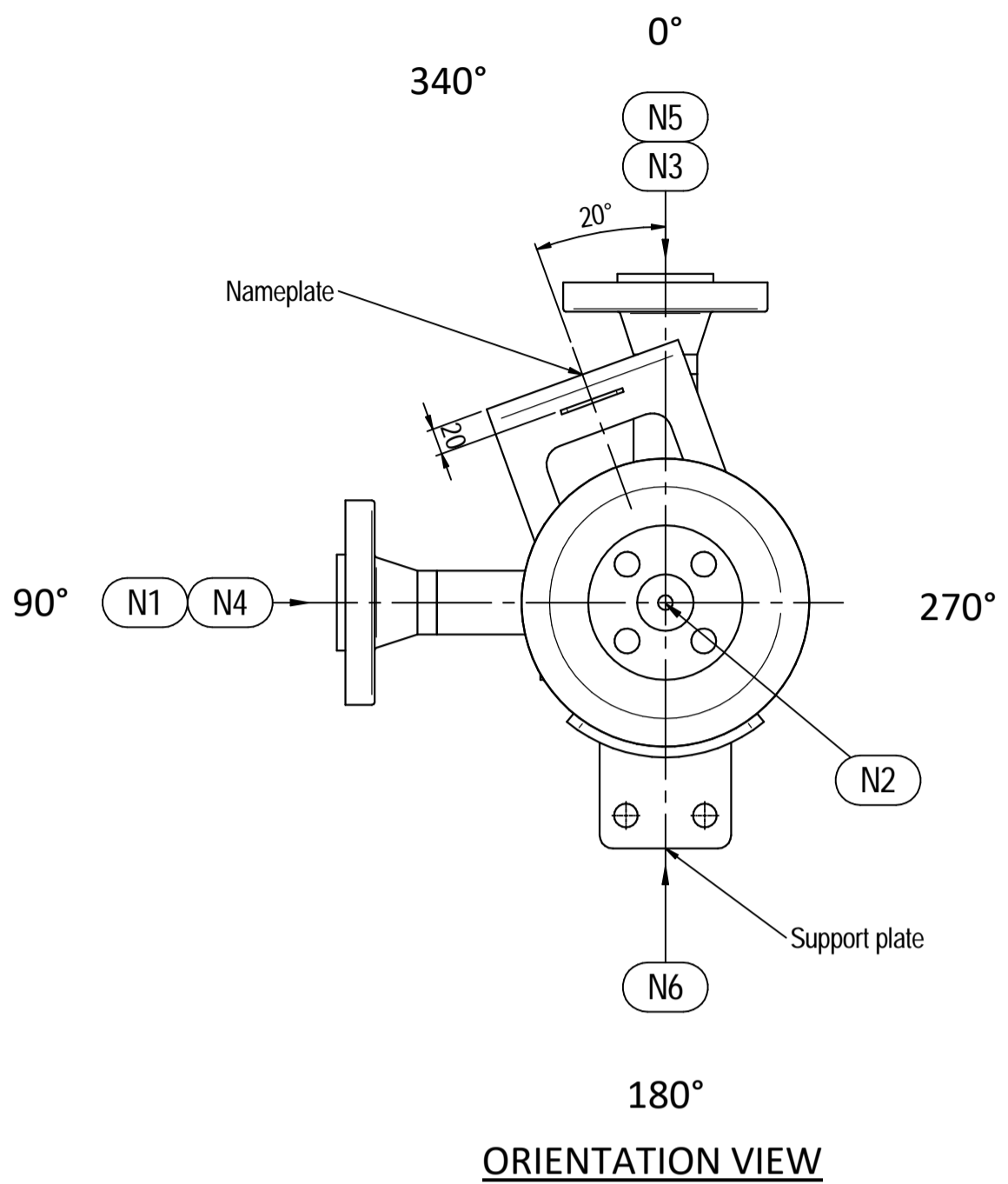
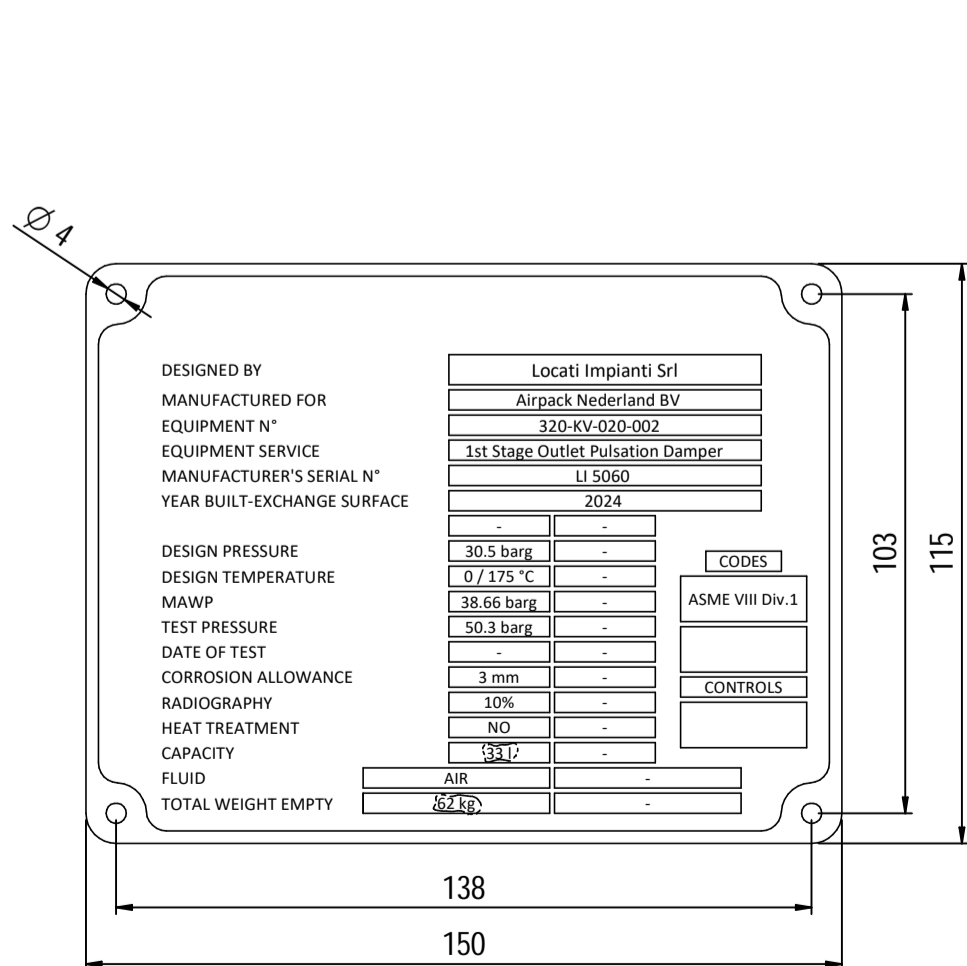
Nameplate detail

Scale 1:5

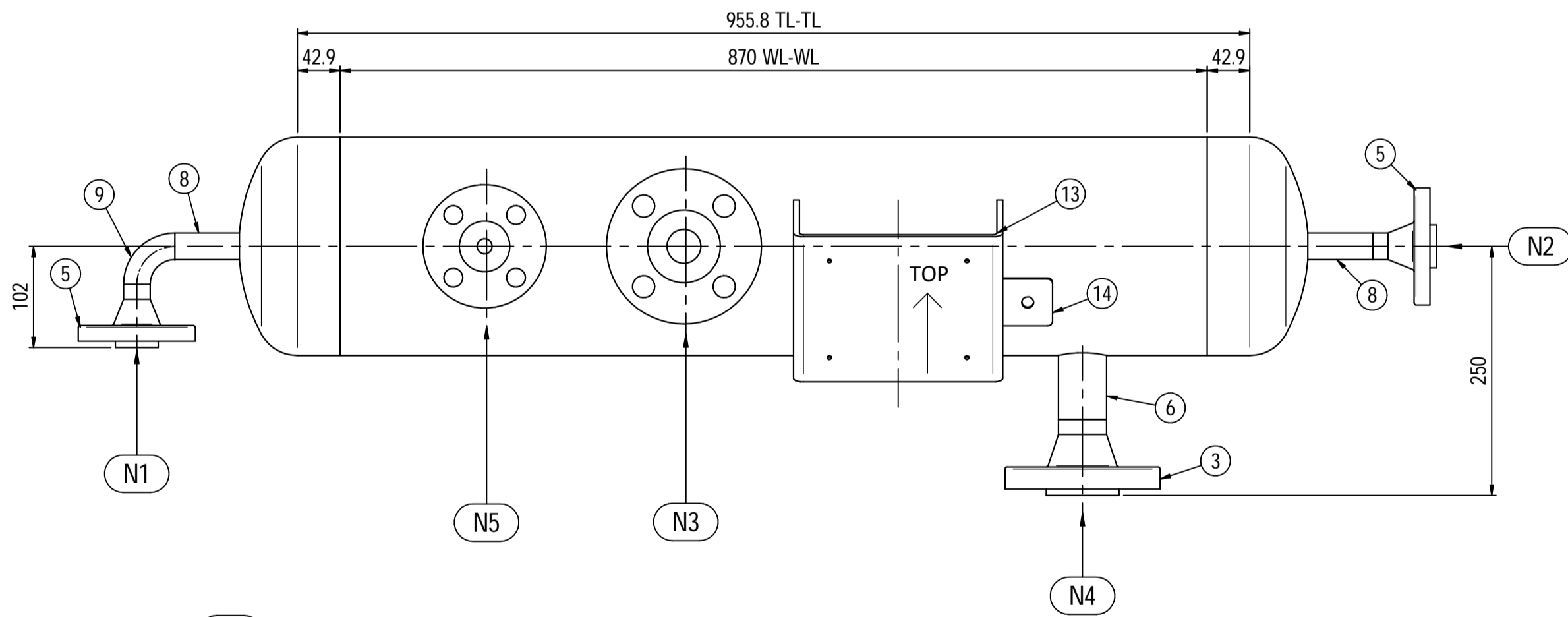


Nameplate detail

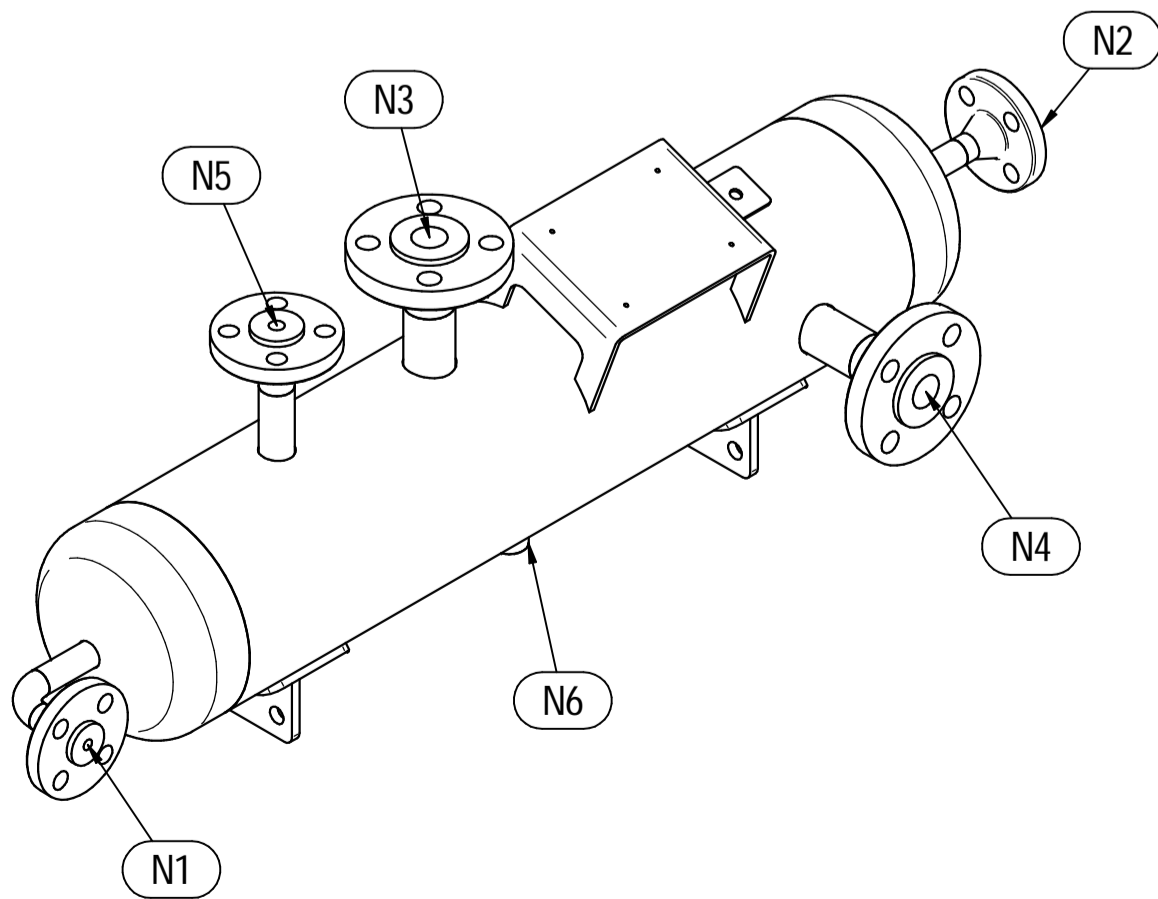
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ELEVATION VIEW



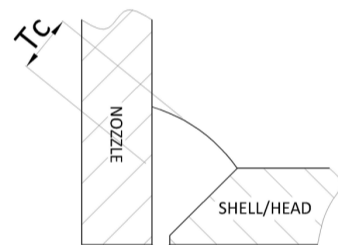
PLAN VIEW



ISOMETRIC VIEW

Pos.	QTY	Description	Material	Cert.
1	1	Shell by Seamless Pipe 8" Sch.40 L=870	SA106 Gr.B	3.1
2	2	Cap 8" Sch.40	SA234 WPB	3.1
3	2	Flange 1½" WN #600 RF Sch.160	SA105	3.1
4	1	Flange 1" WN #600 RF Sch.XXS	SA105	3.1
5	2	Flange ¾" WN #600 RF Sch.XXS	SA105	3.1
6	2	Seamless Pipe 1½" Sch.160 L=75	SA106 Gr.B	3.1
7	1	Seamless Pipe 1" Sch.XXS L=80	SA106 Gr.B	3.1
8	2	Seamless Pipe ¾" Sch.XXS L=73	SA106 Gr.B	3.1
9	1	Seamless elbow ¾" 90° LR Sch.XXS	SA234 WPB	3.1
10	1	Coupling ¾" NPT #6000	A105	3.1
11	2	Pad by pipe 100 x 150 Thk.8.18	SA106 Gr.B	
12	2	Support plate 100 x 80 Thk.10	SA516 70	
13	1	Nameplate support by plate 403 x 155 Thk.6	SA516 70	
14	1	Earthing plate 50 x 40 Thk.3	SA240 TP316L	

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 - 3) Material: certification 3.1 EN 10204
 - 4) All internal edge shall be rounded off
 - 5) Nozzle flanges in accordance with ASME B16.5: 2020
 - 6) Flange fittings in accordance with ASME B16.9: 2018
 - 7) All fillet welds not detailed on "WELDING MAP" or drawing shall have the weld throated equal to 0.7 times the minimum thickness to be welded
 - 8) All welds are continuous except where indicate
 - 9) Delated
 - 10) The nameplate ise in SS316 and is laser engraved
 - 11) Non corrosive service, no inspection opening per UG-46(a)
 - 12) On support hexagonal bolts DIN 933, class 8.8 shall be use (Airpack scope)




N6	1	DRAIN	¾"	38.1	8.38	#6000	NPT-F	-	-	-	8÷10
N5	1	PSV CONNECTION	1"	33.4	9.09	#600	WN RF	-	-	-	8÷10
N4	1	TEMPERATURE GAUGE	1½"	48.3	7.14	#600	WN RF	-	-	-	8÷10
N3	1	TEMPERATURE TRANSMITTER	1½"	48.3	7.14	#600	WN RF	-	-	-	8÷10
N2	1	AIR OUTLET	¾"	26.7	7.82	#600	WN RF	-	-	-	8÷10
N1	1	AIR INLET	¾"	26.7	7.82	#600	WN RF	-	-	-	8÷10

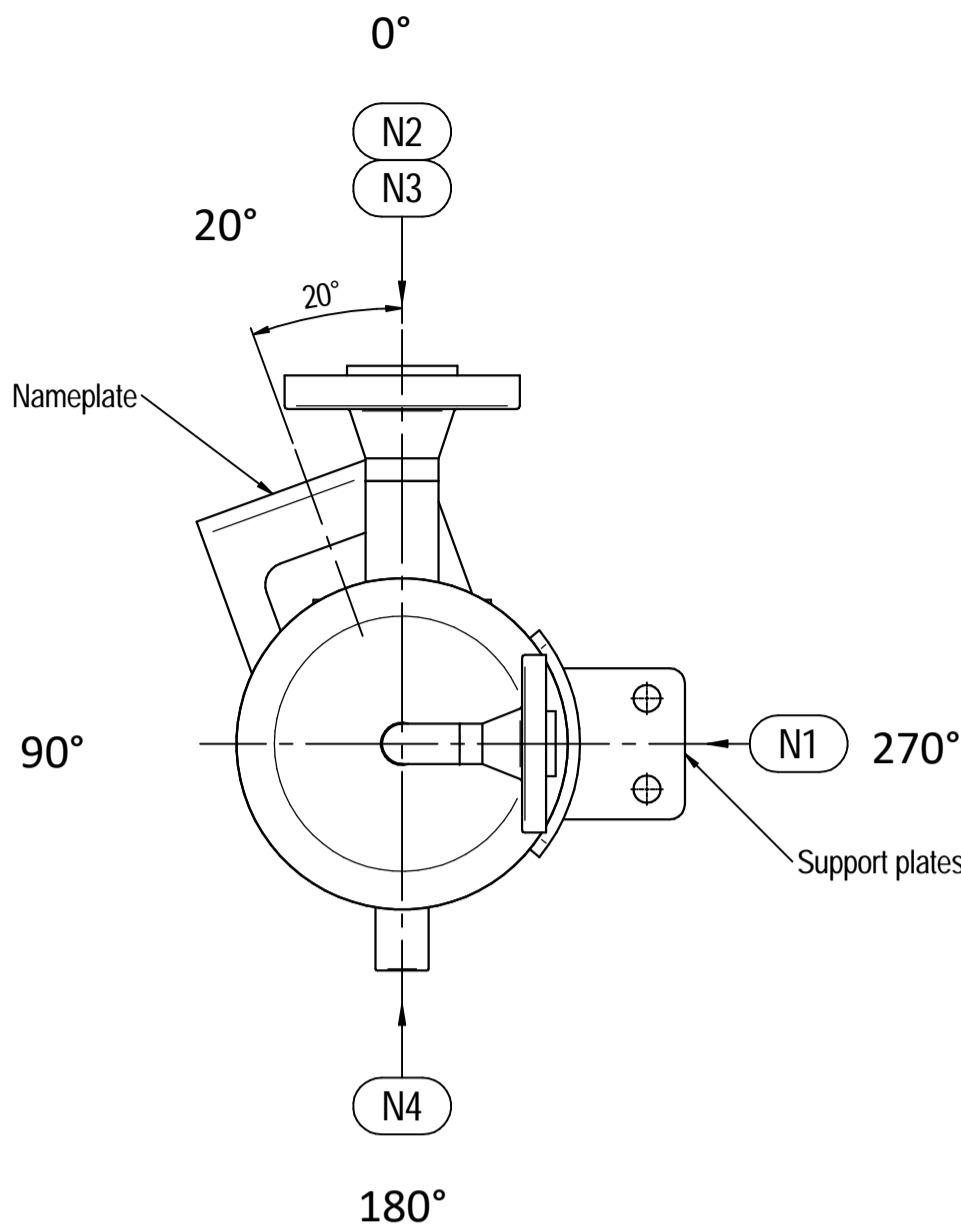
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ITEM	Qtà	SERVIZIO	NPS/DN	O.D.	THK	RATING	TYPE	FACE	O.D.	THK.	
				TUBO			FLANGIA	FLANGIA		RINFORZO	

DATI DI PROGETTO / Design data			
FLUIDO	Air	COLLAUDO	0094 Iqa Inspeccion Iberia SA
Fluid	Gas	Test	N/A
STATO FISICO DEL FLUIDO	Gas	PED	N/A
Physical state of fluid			
CODICE DI CALCOLO	ASME VIII Div.1 Ed.2021		
Construction code			
PRESSIONE DI ESERCIZIO	23.3 barg	SERVIZIO LETALE	NO
Operating pressure		Lethal service	
PRESSIONE DI PROGETTO	30.5 barg	X-RAY	Spot (10%)
Design pressure		RT examination	
PRESSIONE ESTERNA	NO	LIQUIDI PENETRANTI	NO
External pressure		Dye penetrant extension	
PRESSIONE DI PROVA IDRAULICA	50.26 barg	ULTRASUONI	NO
Hydraulic test pressure		Ultrasonic extension	
TEMPERATURA DI ESERCIZIO	157 °C	CONTROLLO MAGNETOSCOPICO	NO
Operating temperature		Magnetic particle examination	
TEMPERATURA DI PROGETTO	175 °C	TALLONE DI SALDATURA	NO
Design temperature		Weld teils coupon	
SOVRAME TALLO DI CORROSIONE	3 mm	PROCEDIMENTO DI SALDATURA	See doc:C230048WBK009
Corrosion allowance		Welding procedure	
CAPACITA'	331	TIPO DI FONDO	CAP
Capacity		Head type	
EFFICIENZA GIUNTI	0.85	FORMATURA FONDO	HOT
Joint efficiency		Head forma	
MAWP @ Design Temperature	38.66 barg @ +175° C	PESO A VUOTO	62 kg
		Empty weight	
MAWP(EXT)	NO	PESO IN ESERCIZIO	62 kg
		Operating weight	
MDMT @ MAWP	0 °C @ 38.66 barg	PESO PIENO D'ACQUA	95 kg
		Full water weight	
TRATTAMENTO TERMICO	NO	DATI DEL VENTO	-
P.W.H.T.		Wind datas	
IMPACT TEST	NO	DATI SISMICI	-
Exemption		Seismological datas	

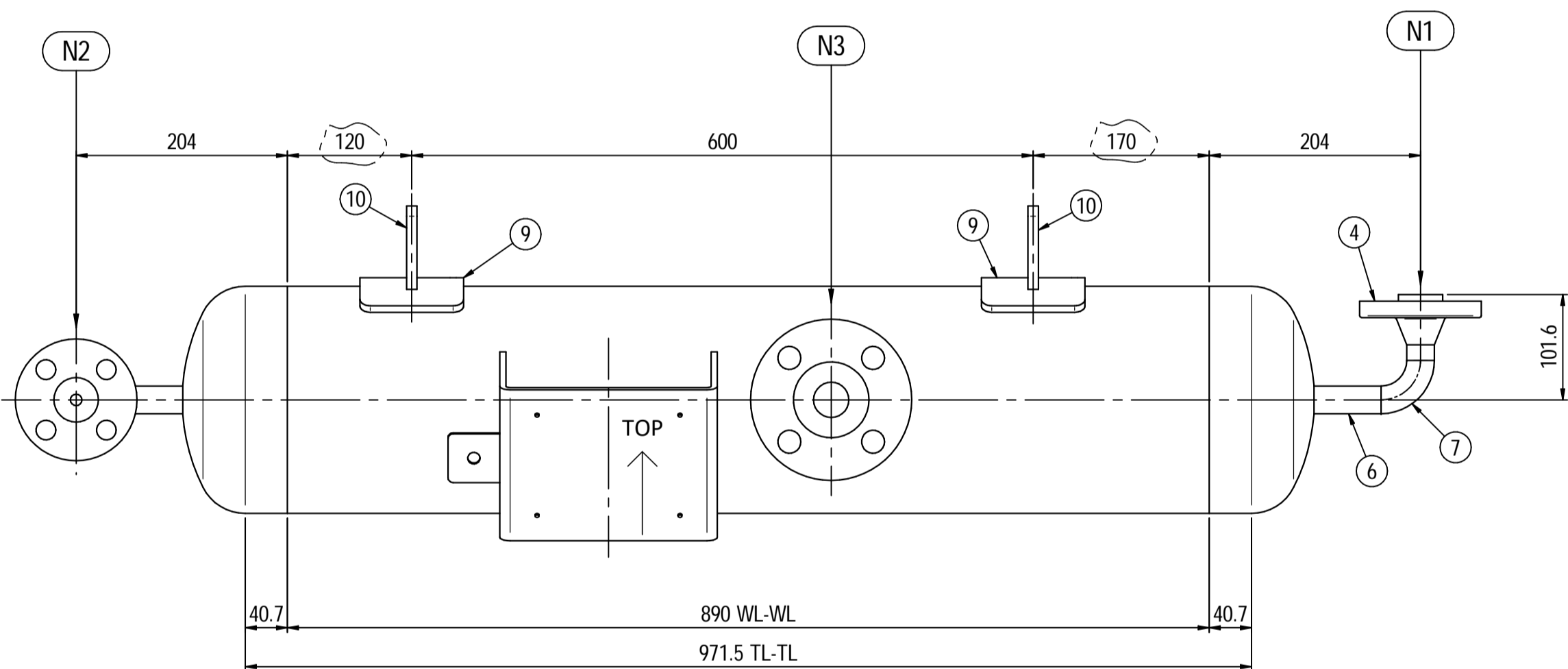
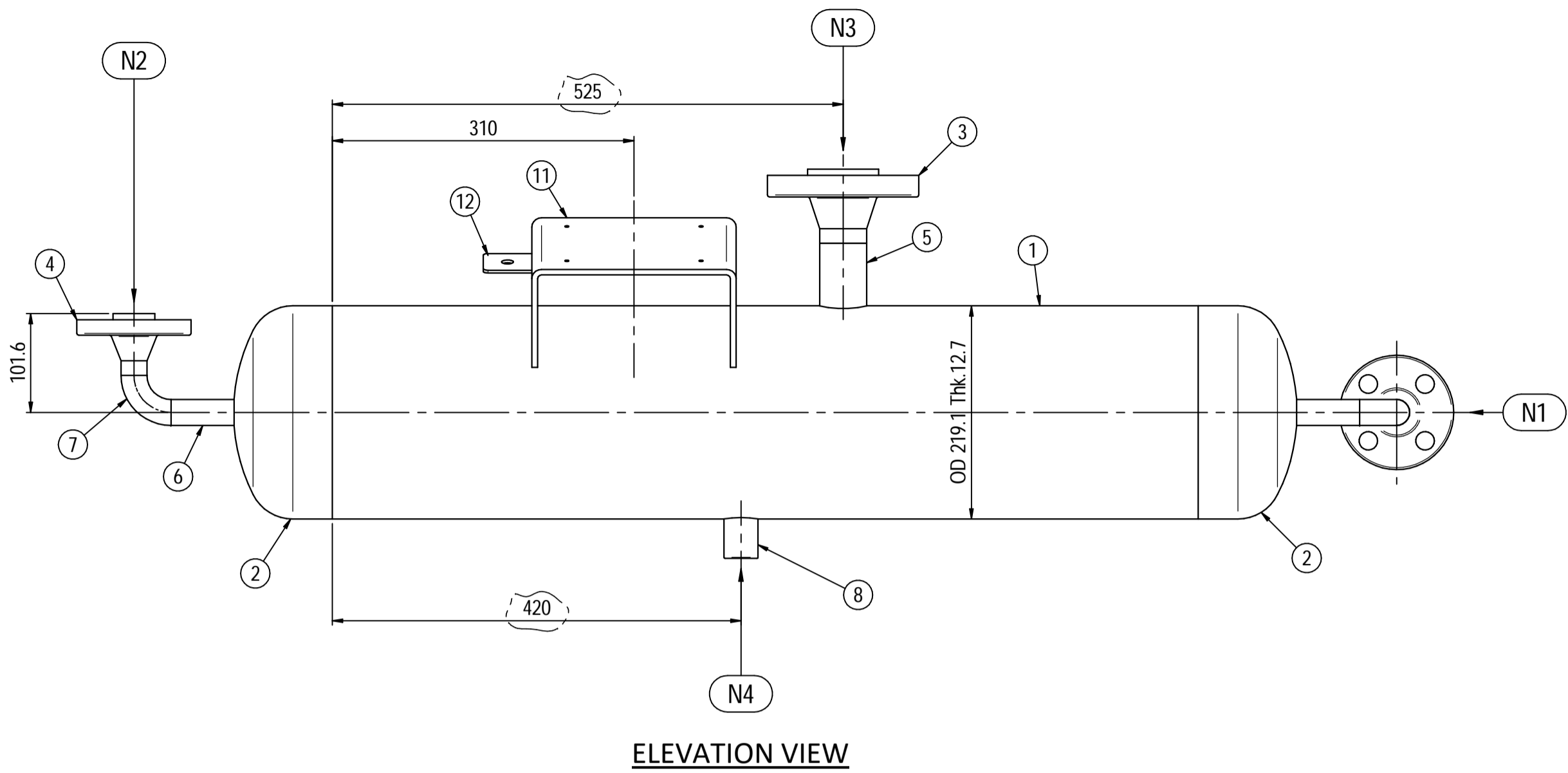
04	Issue for approval	MG	MV	MV	18/12/2024
03	Issue for approval	LG	MV	MV	11/09/2024
02	Upaded volume	LG	MV	MV	03/08/2024
01	Revised as per Custome comments	LG	MV	MV	11/05/2024
00	FIRST ISSUE	LG	MV	MV	03/02/2024
Rev.	Descrizione / Description	Disegnato/Draw	Controllato/Checked	Approvato/Approved	Data/Date

Oggetto/Object		1st STAGE OUTLET PULSATION DAMPER			
		Scala/Scale	1 : 5	Formato/Size	A1
		Comm. N°/Job No.	C2300048	Foglio/Sheet	1 - 1
		Cliente/Customer	Airpack Nederland B.V.		
		Ord. No.	17735-VV-900 (SK)		
		Dis. N°/Dwg No.	C230048DWG002		
				Rev.	04
Locati Impianti Srl - Via Vittorio Veneto, 37 24040 Verdelino (BG) Italy - P.I. +39 (0)35.883.176 Fax +39 (0)35.885.015 - e-mail: info@locati-impianti.com http: www. locati-impianti.com					

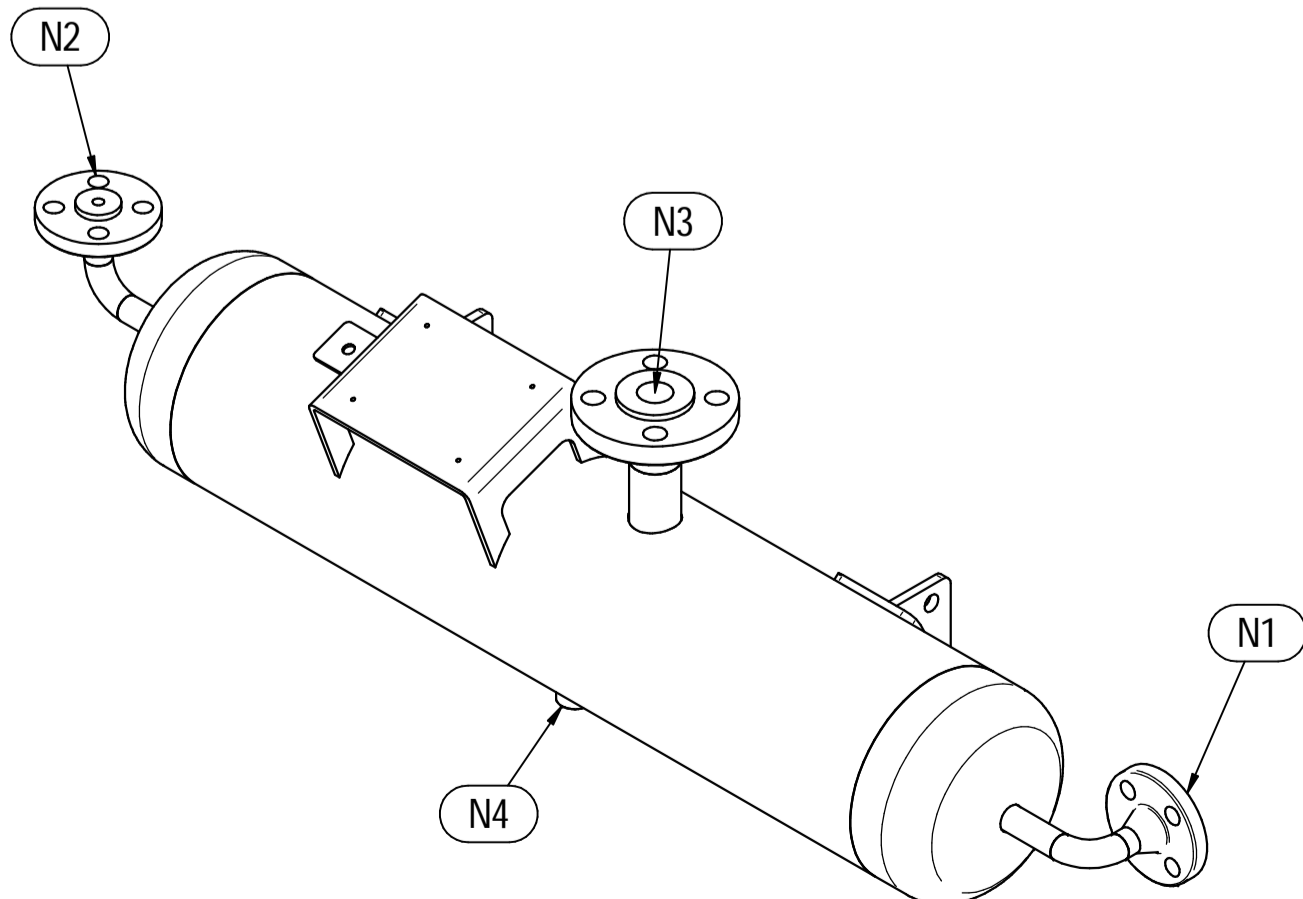
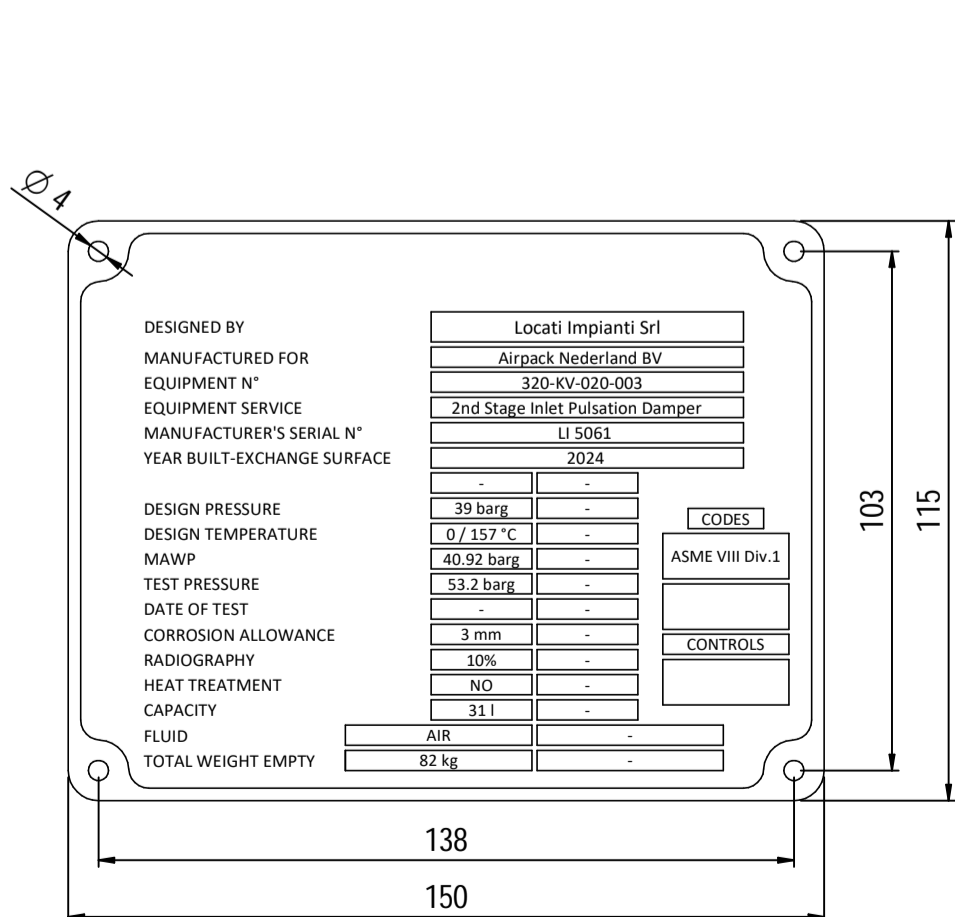
Scale 1 : 3



Scale 1:5



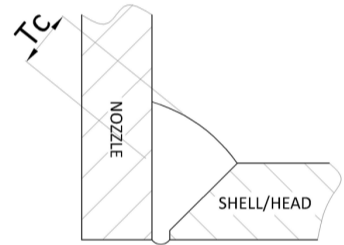
scale 1:1.5



ISOMETRIC VIEW


Note:

- 1) Governing measurement S.I. unless otherwise specified
- 2) Flange bolt holes have to be straddled from main vessel center line in plan & vertical & horizontal centreline in elevation
- 3) Material: certification 3.1 EN 10204
- 4) All internal edge shall be rounded off
- 5) Nozzle flanges in accordance with ASME B16.5: 2020
- 6) Flange fittings in accordance with ASME B16.9: 2018
- 7) All fillet welds not detailed on "WELDING MAP" or drawing shall have the weld throated equal to 0.7 times the minimum thickness to be welded
- 8) All welds are continuous except where indicate
- 9) Delated
- 10) The nameplate ise in SS316 and is laser engraved
- 11) Non corrosive service, no inspection opening per UG-46(a)
- 12) On support hexagonal bolts DIN 933, class 8.8 shall be use (Airpack scope)

[illegible]

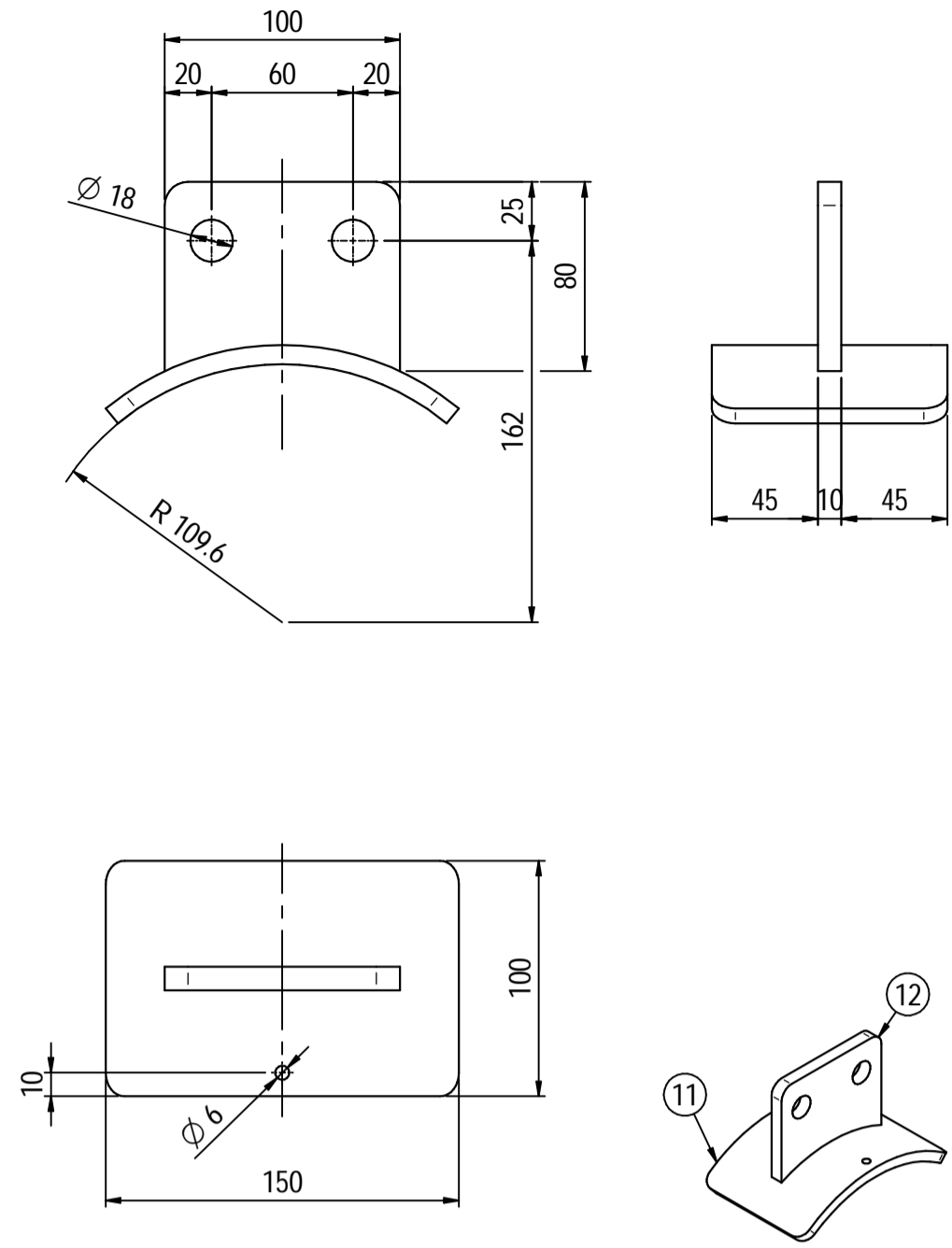
DATI DI PROGETTO / Design data				
FLUIDO <i>Fluid</i>	Air	COLLAUDO <i>Test</i>		0094 kga Inspection Iberia SA
STATO FISICO DEL FLUIDO <i>Physical state of fluid</i>	Gas	PED		N/A
CODICE DI CALCOLO <i>Construction code</i>	ASME VIII Div. 1 Ed.2021			
PRESSIONE DI ESERCIZIO <i>Operating pressure</i>	22.1 barg	SERVIZIO LETALE <i>Lethal service</i>		NO
PRESSIONE DI PROGETTO <i>Design pressure</i>	39 barg	X-RAY <i>RT examination</i>		Spot (10%)
PRESSIONE ESTERNA <i>External pressure</i>	NO	LIQUIDI PENETRANTI <i>Dye penetrant extension</i>		NO
PRESSIONE DI PROVA IDRAULICA <i>Hydraulic test pressure</i>	53.2 barg	ULTRASUONI <i>Ultrasonic extension</i>		NO
TEMPERATURA DI ESERCIZIO <i>Operating temperature</i>	60 °C	CONTROLLO MAGNE TOSCOPIO <i>Magnetic particle examination</i>		NO
TEMPERATURA DI PROGETTO <i>Design temperature</i>	157 °C	ALLONE DI SALDATURA <i>Weld Iels coupon</i>		NO
SOVRACCARICO DI CORROSIONE <i>Corrosion allowance</i>	3 mm	PROCEDIMENTO DI SALDATURA <i>Welding procedure</i>		See doc: C230048WBK009
CAPACITA' <i>Capacity</i>	31 l	TIPO DI FONDO <i>Head type</i>		CAP
EFFICIENZA GIUNTI <i>Joint efficiency</i>	0.85	FORMATURA FONDO <i>Head formed</i>		HOT
MAWP @ Design Temperature	40.92 barg @ +157°C	PESO A VUOTO <i>Empty weight</i>		82 kg
MAWP(EXT)	NO	PESO IN ESERCIZIO <i>Operating weight</i>		82 kg
MDMT @ MAWP	0 °C @ 40.92 barg	PESO PIENO D'ACQUA <i>Full water weight</i>		112 kg
TRATTAMENTO TERMICO <i>P.W.H.T.</i>	NO	DATI DEL VENTO <i>Wind datas</i>		-
IMPACT TEST <i>Exemtion</i>	NO	DATI SISMICI <i>Seismological datas</i>		-

04	Issue for approval	LG	MV	MV	04/10/2024
03	Issue for approval	LG	MV	MV	01/10/2024
02	Issue for approval	LG	MV	MV	11/09/2024
01	Revised as per Customer comments	LG	MV	MV	11/05/2024
00	FIRST ISSUE	LG	MV	MV	03/02/2024
Rev.	Descrizione / Description	Disegnato/Draw	Controllato/Checked	Approvato/Approved	Data/Date

Oggetto/Objekt		2nd STAGE INLET PULSATION DAMPER		
	Scala/Scale	1 : 5	Formato/Size	A1
	Comm. N./Job No.	C230048	Foglio/Sheet	1 - 1
	Cliente/Customer	Airpact Nederland B.V.		
	Ord. No.	17735-Vv-900 (SK)		
	Dis. N./Dwg No.	C230048DWG003	Rev.	04
Locapct Locapct Ed. Via Mestreektlaan 27 3584MS (Utrecht) (NL) Tel. +31 - 36 - 4036 883 3 Fax +31-0318 885 400 E-mail: info@locapct.com locapct.locapct.com				

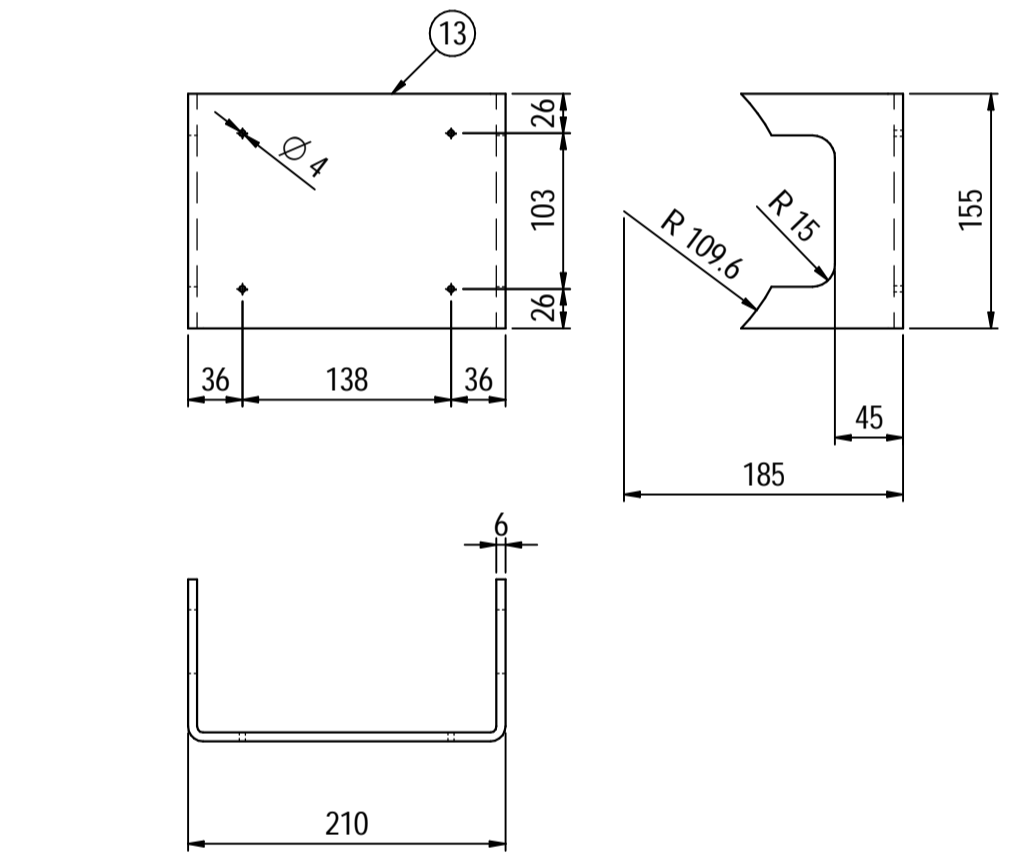
Supports detail

Scale 1 : 3



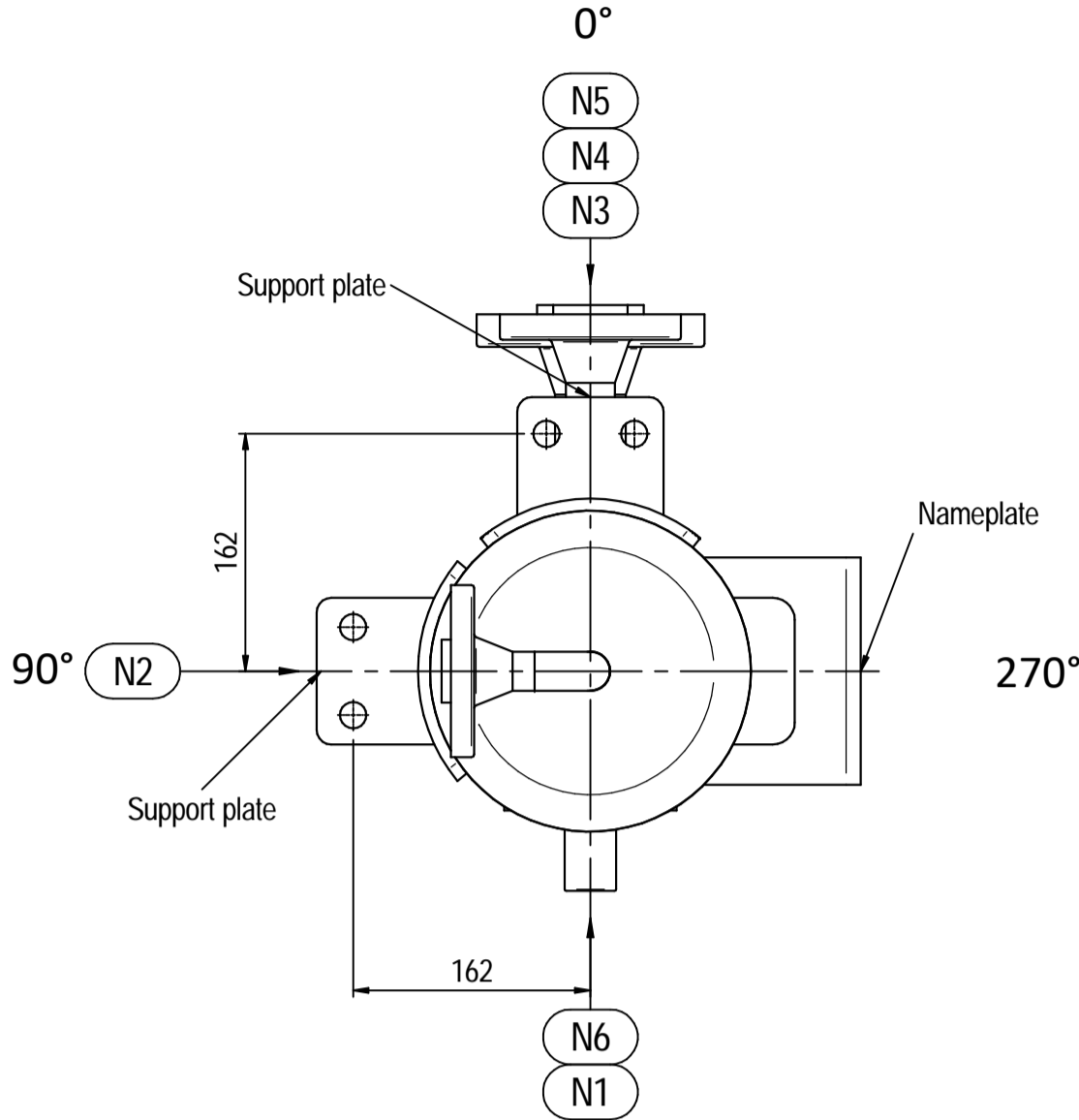
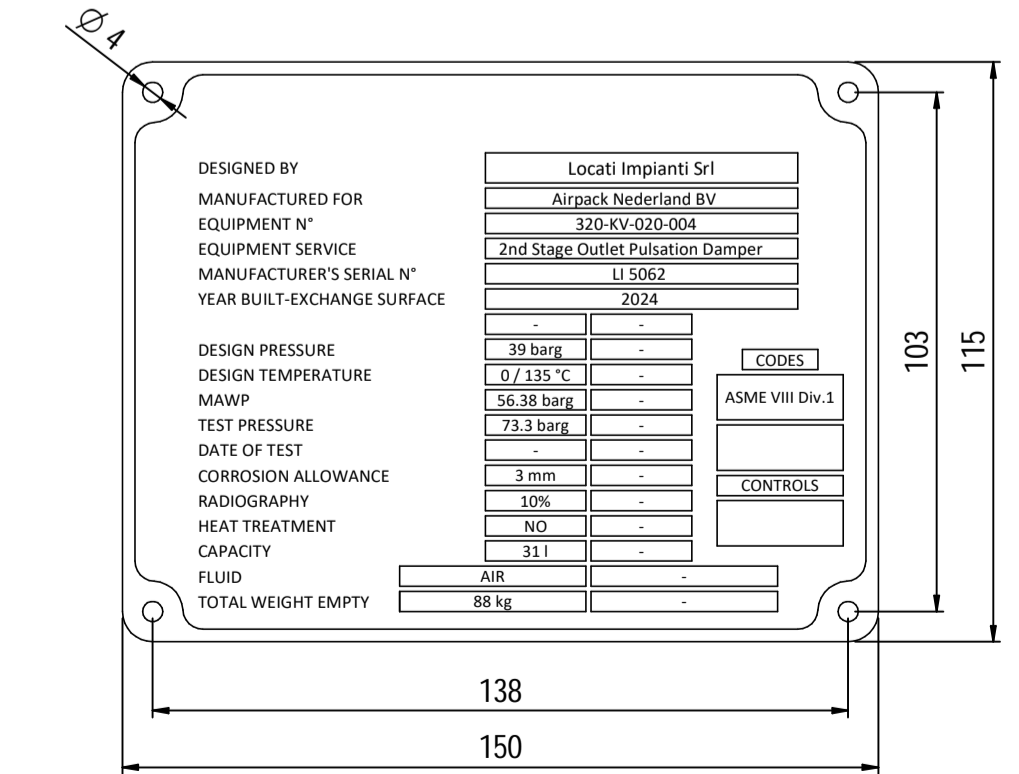
Nameplate detail

Scale 1:5

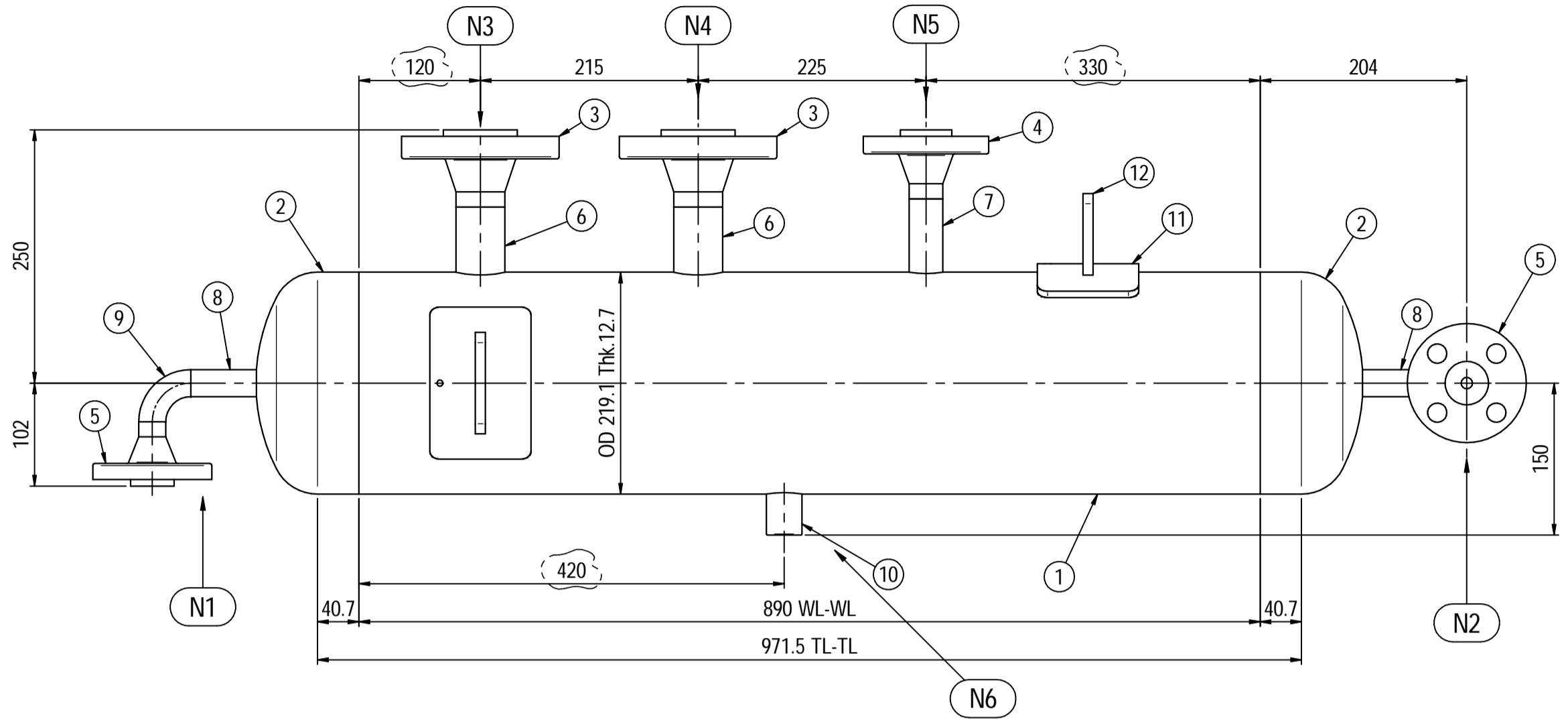


Nameplate detail

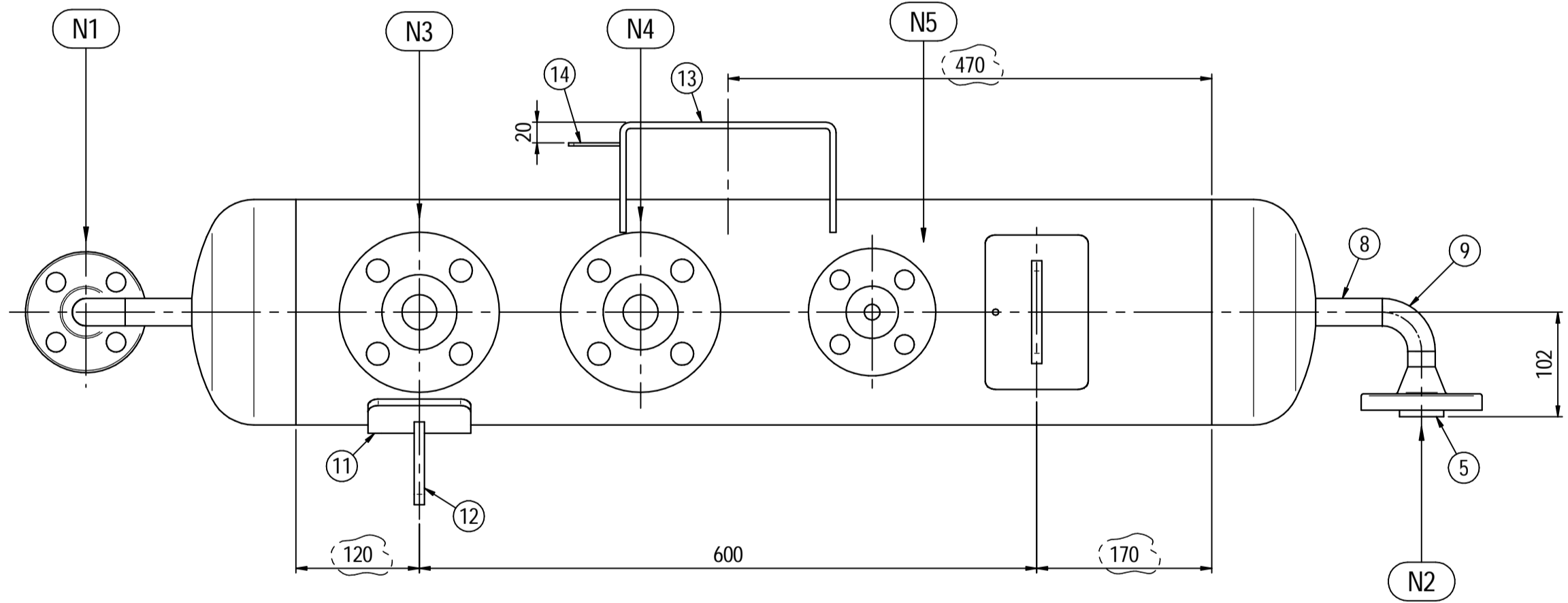
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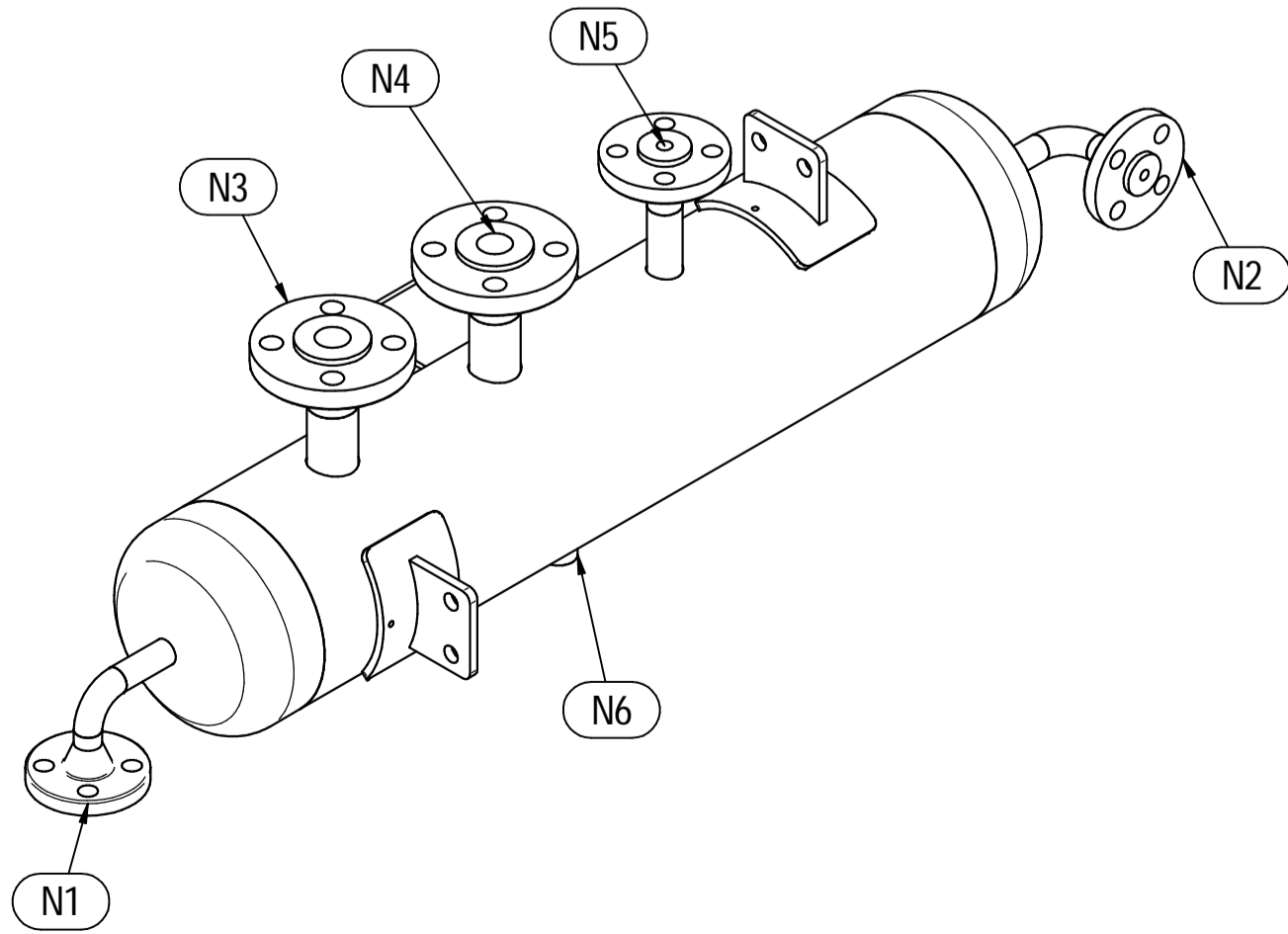
180°
ORIENTATION VIEW



ELEVATION VIEW



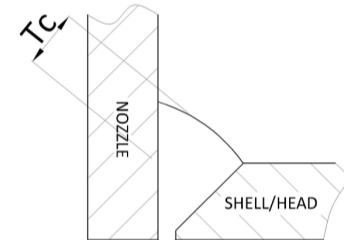
PLAN VIEW



ISOMETRIC VIEW

Pos.	QTY	Description	Material	Cert.
1	1	Shell by Seamless Pipe 8" Sch.80 L=890	SA106 Gr.B	3.1
2	2	Cap 8" Sch80	A234 WPB	3.1
3	2	Flange 1½" WN #600 RF Sch.160	SA105	3.1
4	1	Flange 1" WN #600 RF Sch.XXS	SA105	3.1
5	2	Flange ¾" WN #600 RF Sch.XXS	SA105	3.1
6	2	Seamless Pipe 1½" Sch.160 L=80	SA106 Gr.B	3.1
7	1	Seamless Pipe 1" Sch.XXS L=80	SA106 Gr.B	3.1
8	2	Seamless Pipe ¾" Sch.XXS L=77	SA106 Gr.B	3.1
9	2	Seamless elbow ¾" 90° LR Sch.XXS	SA234 WPB	3.1
10	1	Coupling ¾" NPT #6000	A105	3.1
11	2	Pad by pipe 100 x 150 Thk.8.18	SA106 Gr.B	3.1
12	2	Support plate 100 x 80 Thk.10	SA516 70	
13	1	Nameplate support by plate 403 x 155 Thk.6	SA516 70	
14	1	Earthing plate 50 x 40 Thk.3	SA240 TP316L	

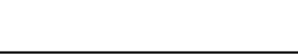
- Note:
- Governing measurement S.I. unless otherwise specified
 - Flange bolt holes have to be straddled from main vessel center line in plan & vertical & horizontal centreline in elevation
 - Material: certification 3.1 EN 10204
 - All internal edge shall be rounded off
 - Nozzle flanges in accordance with ASME B16.5: 2020
 - Flange fittings in accordance with ASME B16.9: 2018
 - All fillet welds not detailed on "WELDING MAP" or drawing shall have the weld throat equal to 0.7 times the minimum thickness to be welded
 - All welds are continuous except where indicate
 - Delated
 - The nameplate ise in SS316 and is laser engraved
 - Non corrosive service, no inspection opening per UG-46(a)
 - On support hexagonal bolts DIN 933, class 8.8 shall be use (Airpack scope)



N6	1	DRAIN	½"	38.1	8.38	#6000	NPT-F	-	-	-	8÷10
N5	1	PSV CONNECTION	1"	33.4	9.09	#600	WN RF	-	-	-	8÷10
N4	1	TEMPERATURE TRANSMITTER	1½"	48.3	7.14	#600	WN RF	-	-	-	8÷10
N3	1	TEMPERATURE GAUGE	1½"	48.3	7.14	#600	WN RF	-	-	-	8÷10
N2	1	AIR OUTLET	¾"	26.7	7.82	#600	WN RF	-	-	-	8÷10
N1	1	AIR INLET	¾"	26.7	7.82	#600	WN RF	-	-	-	8÷10
ITEM	QTY	SERVICE	SIZE	O.D.	THK	RATING	TYPE	FACE	O.D.	THK.	Tc
ITEM	Qtà	SERVIZIO	NPS/DN	O.D.	THK	RATING	TYPE	FACE	O.D.	THK.	
				TUBO			FLANGIA	FLANGIA	RINFORZO		

DATI DI PROGETTO / Design data			
FLUIDO	Air	COLLAUDO	0094 Iqa Inspeccion Iberia SA
Fluid	Gas	Test	N/A
STATO FISICO DEL FLUIDO	Gas	PED	N/A
Physical state of fluid	Gas	PED	N/A
CODICE DI CALCOLO	ASME VIII Div.1 Ed.2021		
Construction code	ASME VIII Div.1 Ed.2021		
PRESSIONE DI ESERCIZIO	30 barg	SERVIZIO LETALE	NO
Operating pressure	30 barg	Lethal service	NO
PRESSIONE DI PROGETTO	39 barg	X-RAY	Spot (10%)
Design pressure	39 barg	RT examination	Spot (10%)
PRESSIONE ESTERNA	NO	LIQUIDI PENETRANTI	NO
External pressure	NO	Dye penetrant extension	NO
PRESSIONE DI PROVA IDRAULICA	73.3 barg	ULTRASUONI	NO
Hydraulic test pressure	73.3 barg	Ultrasonic extension	NO
TEMPERATURA DI ESERCIZIO	116°C	CONTROLLO MAGNETOSCOPICO	NO
Operating temperature	116°C	Magnetic particle examination	NO
TEMPERATURA DI PROGETTO	135 °C	TALLONE DI SALDATURA	NO
Design temperature	135 °C	Weld teils coupon	NO
SOVRAME TALLO DI CORROSIONE	3 mm	PROCEDIMENTO DI SALDATURA	See doc:C230048WBK009
Corrosion allowance	3 mm	Welding procedure	See doc:C230048WBK009
CAPACITA'	31 l	TIPO DI FONDO	CAP
Capacity	31 l	Head type	CAP
EFFICIENZA GIUNTI	0.85	FORMATURA FONDO	HOT
Joint efficiency	0.85	Head form	HOT
MAWP @ Design Temperature	56.38 barg @ +135°C	PESO A VUOTO	88 kg
Empty weight	56.38 barg @ +135°C	PESO IN ESERCIZIO	88 kg
MAWP(EXT)	NO	PESO PIENO D'ACQUA	119 kg
Operating weight	NO	Full water weight	119 kg
MDMT @ MAWP	0 °C @ 56.38 barg	DATI DEL VENTO	-
Wind data	0 °C @ 56.38 barg	Wind data	-
TRATTAMENTO TERMICO	NO	DATI SISMICI	-
Seismological data	NO	Seismological data	-
P.W.H.T.	NO		
IMPACT TEST	NO		
Exemtion	NO		

05	Issue for approval	LG	MV	MV	04/10/2024
04	Issue for approval	LG	MV	MV	01/10/2024
03	Issue for approval	LG	MV	MV	11/09/2024
02	Change position of N2 nozzle	LG	MV	MV	11/07/2024
01	Revised as per Customer comments	LG	MV	MV	11/05/2024
00	FIRST ISSUE	LG	MV	MV	03/02/2024
Rev.	Descrizione / Description	Disegnato/Draw	Controllato/Checked	Approvato/Approved	Data/Date
Oggetto/Object	2nd STAGE OUTLET PULSATION DAMPER				

Oggetto/Object 2nd STAGE OUTLET PULSATION DAMPER				
	Scale/Scale	1 : 5	Formato/Size	A1
	Comm. N°/Job No.	C2300048	Foglio/Sheet	1 - 1
	Cliente/Customer	Airpack Nederland B.V.		
	Ord. No.	17735-VV-900 (SK)		
	Dis. N°/Dwg No.	C230048DWG004		
Locati Impianti Srl - Via Vittoria Veneto, 37 24040 Verdelino (BG) Italy - P.I. +39 (0)35.883.176 Fax +39 (0)35.885.015 - e-mail: info@locati-impianti.com http: www.locati-impianti.com				Rev. 05

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION K-26

DOCUMENTS; PULSATION STUDY APPROACH 1 CALCULATIONS



Vendor doc. Number
17735-19

P.O. NO.:
LIDCO-PO-NEC-278-6019

Vendor:
Airpack Nederland B.V.



Pulsation Study Approach 1 Calculations

Document No. 17735-24

Page

Project No.

Vendor Doc.

P.O. No.

Department

Document Type

Serial No

Revision

N278

VD

6019

ME

CAL

0026

05

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Pulsation Study Approach 1 Calculations

Code 1
M.Dalakeh

05	02-08-2024	Issued for Information	S.K.	J.J.	S.K.
04	15-07-2024	Issued for Information	K.P.	J.J.	S.K.
03	20-06-2024	Issued for Information	S.K.	J.J.	S.K.
02	13-12-2023	Issued for Information	S.K.	J.J.	S.K.
01	14-09-2023	Issued for Information	S.K.	J.J.	S.K.
REV.	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED

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LIDCO, Pars SEE Zone, Assaluyeh,
Integrated Methanol and Ammonia
Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT






Pulsation Study Approach 1 Calculations

Document No. 17735-24

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2	X	X	X	X	X						52						77					
3	X	X	X	X	X						53						78					
4	X	X	X	X	X						54						79					
5	X	X	X	X	X						55						80					
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7	X	X	X	X	X						57						82					
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9	X	X	X	X	X						59						84					
10		X	X	X	X						60						85					
11				X							61						86					
12											62						87					
13											63						88					
14											64						89					
15											65						90					
16											66						91					
17											67						92					
18											68						ATTACHMENT					
19											69						1					
20											70						2					
21											71						3					
22											72						4					
23											73						5					
24											74						6					
25											75						7					

<div><div>شرکت توسعه صنایع لوان</div><div>Lavan Industry Development Company</div></div> <div></div>	<div>LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT</div>	<div></div>					
<div></div>	Pulsation Study Approach 1 Calculations						
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Design approach 1 in accordance with API 618




Project: Integrated Methanol and Ammonia Plant
 Location: Iran
 Equipment: Air Compressor
 Purchase order: LIDCO-PO-NEC-278-6019
 Airpack reference: 17735-COM

Requirements

Pulsation levels have to meet the limits as per paragraph 7.9.4.2.5.2.2.1 as well as the criteria in paragraph 7.9.2 through 7.9.3.

para 7.9.4.2.5.2.5.1

The peak-to-peak cyclic stress range is far below 180 N/mm^2 , therefore this paragraph is considered as not applicable.

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<div></div>	Pulsation Study Approach 1 Calculations							
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para 7.9.3.2

$$V_s = 8,1 \cdot PD \cdot \left(\frac{k \cdot T_s}{M} \right)^{1/4}$$

$$V_d = 1,6 \cdot \left(\frac{V_s}{(R)^{1/k}} \right)$$




$$V_s \geq V_d$$

$$V_s \geq 0,03 \text{ m}^3$$

$$V_d \geq 0,03 \text{ m}^3$$

$$\frac{l}{ID} \leq 4.0$$

- V_s = minimum required suction surge volume [m³]
 V_d = minimum required discharge surge volume [m³]
 K = isentropic compression exponent at average operating gas pressure and temperature
 T_s = absolute suction temperature [K]
 M = molecular weight
 PD = total net displaced volume per revolution of all compressor cylinders to be manifolded in the surge volume
 R = stage pressure ratio at cylinder flanges (= quotient of absolute discharge and suction pressures)
 l = surge volume length
 ID = surge volume inside diameter

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<div></div>	<div>Pulsation Study Approach 1 Calculations</div>						
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	<div>Project No.</div>	<div>Vendor Doc.</div>	<div>P.O. No.</div>	<div>Department</div>	<div>Document Type</div>	<div>Serial No</div>	<div>Revision</div>
	<div>N278</div>	<div>VD</div>	<div>6019</div>	<div>ME</div>	<div>CAL</div>	<div>0026</div>	<div>05</div>
	<div>Page 5 of 10</div>						

para 7.9.4.2.5.2

$$P_{cf} = 3R \%$$

$$P_{cf} \leq 7 \%$$

P_{cf} = maximum allowable unfiltered peak-to-peak pulsation level, as a percentage of average absolute line pressure at the compressor cylinder flange [%]

para 7.9.4.2.5.3.1

$$\Delta p = \frac{1,67 \cdot (R - 1)}{R}$$

$$\Delta p \leq 0,25 \%$$

Δp = maximum pressure drop based on steady flow through a pulsation suppression device, as a percentage of the average absolute line pressure at the inlet of the device [%]

R = stage pressure ratio at cylinder flanges (= quotient of absolute discharge and suction pressures)

para 7.9.2




The gas composition, specified in the purchaser datasheet is considered as the basis of this calculation.

para 7.9.4.2.5.2.2.1

$$P_l = \frac{4,1}{(P_L)^{1/3}}$$

P_l = maximum allowable peak-to-peak pulsation level at any discrete frequency, as a percentage of average absolute pressure [%]

P_L = average absolute line pressure [bar(a)]

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<div></div>	Pulsation Study Approach 1 Calculations							
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Input

		stage 1	stage 2	
K	isentropic compression exponent	1,4	1,4	
T_s	abs. suction temperature	319,15	333,15	K
M	molecular weight	28,959	28,959	
PD	total net displaced volume per revolution	2,376 E-3 [note 1]	9,621 E-4 [note 2]	m ³
R	stage pressure ratio	2,314	1,342	
P_L	avg abs. line pressure	17,032	25,742	Bar(a)

Compressor stage data

	1 st stage	2 nd stage	Unit
Suction pressure	10,5	23,1	Bar(a)
Discharge pressure	24,3	31	Bar(a)
Pressure ratio	2,314	1,342	
Suction temperature	319,15	333,15	K

[note 1]

1st stage

stroke 130 mm
cyl bore 55 mm
rod dia 30 mm
Single acting




$$PD = \frac{1}{4} \pi (0,055)^2 \cdot 0,13 = 2,376 \cdot 10^{-3} m^3$$

[note 2]

2nd stage

stroke 130 mm
cyl bore 35 mm
rod dia 30 mm
Single acting

$$PD = \frac{1}{4} \pi (0,035)^2 \cdot 0,13 = 9,621 \cdot 10^{-4} m^3$$

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<div></div>	<div>Pulsation Study Approach 1 Calculations</div>						
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	<div>N278</div>	<div>VD</div>	<div>6019</div>	<div>ME</div>	<div>CAL</div>	<div>0026</div>	<div>05</div>

Output

para 7.9.3.2

1st stage

$$V_s = 8,1 \cdot 2,376 \cdot 10^{-3} \cdot \left(\frac{1,4 \cdot 319,15}{28,959} \right)^{1/4} = 0,0381 \text{ m}^3 = 38,1 \text{ dm}^3$$

$$V_d = 1,6 \cdot \left(\frac{0,0381}{(2,314)^{1/1,4}} \right) = 0,0322 \text{ m}^3 = 32,2 \text{ dm}^3$$

$$V_s \geq V_d \text{ True}$$

$$V_s \geq 0,03 \text{ m}^3 \text{ True, so } V_s = 0,0381 \text{ m}^3$$

$$V_d \geq 0,03 \text{ m}^3 \text{ True, so } V_d = 0,0322 \text{ m}^3$$

2nd stage

$$V_s = 8,1 \cdot 9,621 \cdot 10^{-4} \cdot \left(\frac{1,4 \cdot 333,15}{28,959} \right)^{1/4} = 0,0156 \text{ m}^3 = 15,6 \text{ dm}^3$$




$$V_d = 1,6 \cdot \left(\frac{0,0156}{(1,342)^{1/1,4}} \right) = 0,0202 \text{ m}^3 = 20,2 \text{ dm}^3$$

Some of the following 3 equations are not true, hence calculated sizes are not acceptable. Sizes are too small for API 618, minimum sizes of 0,03 m³ must be used.

$$V_s \geq V_d \text{ Not True, so } V_s = 0,03 \text{ m}^3$$

$$V_s \geq 0,03 \text{ m}^3 \text{ Not True, so } V_s = 0,03 \text{ m}^3$$

$$V_d \geq 0,03 \text{ m}^3 \text{ Not True, so } V_d = 0,03 \text{ m}^3$$

<div><div>شرکت توسعه صنایع لوانت</div><div>Lavan Industry Development Company</div></div> <div></div>	<div>LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT</div>	<div></div>					
<div></div>	<div>Pulsation Study Approach 1 Calculations</div>						
	<div>Document No. 17735-24</div>						<div>Page</div>
	<div>Project No.</div>	<div>Vendor Doc.</div>	<div>P.O. No.</div>	<div>Department</div>	<div>Document Type</div>	<div>Serial No</div>	<div>Revision</div>
	<div>N278</div>	<div>VD</div>	<div>6019</div>	<div>ME</div>	<div>CAL</div>	<div>0026</div>	<div>05</div>
	<div>Page 8 of 10</div>						

summary

Some sizes are too small for API 618, minimum sizes of 0,03 m³ (30 dm³) must be used. Therefore the final minimum suction and discharge volumes are as per below.

	1 st stage	2 nd stage	
V_s	38,1	30,0	dm ³
V_d	32,2	30,0	dm ³

para 7.9.4.2.5.2.1

1st stage

$$P_{cf} = 3 \cdot 2,314 = 6.942 \%$$

According to para 7.9.4.2.5.2.1 the cylinder flange pressure pulsation P_{cf} shall be limited at the lesser of 7% or the value from the above equation.




6.942 % is less than 7%, therefore the pulsation have to be lower than 6.942%, this is acceptable as per compressor information

2nd stage

$$P_{cf} = 3 \cdot 1,342 = 4,026 \%$$

According to para 7.9.4.2.5.2.1 the cylinder flange pressure pulsation P_{cf} shall be limited at the lesser of 7% or the value from the above equation.

4.026 % is less than 7%, therefore the pulsation have to be lower then 4.026%, this is acceptable as per compressor information

<div><div>شرکت توسعه صنایع پالایش</div><div></div><div>Lavan Industry Development Company</div></div>	<div>LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT</div>						<div></div>	
<div></div>	Pulsation Study Approach 1 Calculations							
	Document No. 17735-24						Page	
	Project No.	Vendor Doc.	P.O. No.	Department	Document Type	Serial No	Revision	
	N278	VD	6019	ME	CAL	0026	05	Page 9 of 10

para 7.9.4.2.5.3.1

1st stage




$$\Delta p = 1,67 \left(\frac{2,453 - 1}{2,453} \right) = 0,989 \%$$

0,989 % of 23,3 bar discharge pressure is 0,23 bar. Which is higher than the calculated differential pressure across the pulsation dampeners. (0.12bar)

2nd stage

$$\Delta p = 1,67 \left(\frac{1,357 - 1}{1,357} \right) = 0,439 \%$$

0,439 % of 30 bar discharge pressure is 0,13 bar, Which is higher than the calculated differential pressure across the pulsation dampeners. (0.08bar)

<div><div>شرکت توسعه صنایع پالایش</div><div></div><div>Lavan Industry Development Company</div></div>	<div>LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT</div>						<div></div>	
<div></div>	Pulsation Study Approach 1 Calculations							
	Document No. 17735-24							Page
	Project No.	Vendor Doc.	P.O. No.	Department	Document Type	Serial No	Revision	
	N278	VD	6019	ME	CAL	0026	05	
	Page 10 of 10							

para 7.9.4.2.5.2.2.1

Maximum allowable peak-to-peak pulsation level at any discrete frequency, expressed as a percentage of average mean absolute pressure.

1st stage suction

$$P_l = \frac{4,1}{(9,500)^{1/3}} = 1,936 \%$$

Maximum allowable peak to peak is 1,936 % is 0.45bar. The calculated peak to peak is significantly lower due to pulsation dampers

1st stage discharge

$$P_l = \frac{4,1}{(17,368)^{1/3}} = 1,583 \%$$

Maximum allowable peak to peak is 1,583 % is 0.37bar. The calculated peak to peak is significantly lower due to pulsation dampers

2nd stage suction

$$P_l = \frac{4,1}{(22,100)^{1/3}} = 1,461 \%$$

Maximum allowable peak to peak is 1,461 % is 0.44bar. The calculated peak to peak is significantly lower due to pulsation dampers

2nd stage discharge

$$P_l = \frac{4,1}{(26,250)^{1/3}} = 1,380 \%$$

Maximum allowable peak to peak is 1,380 % is 0.41bar. The calculated peak to peak is significantly lower due to pulsation dampers

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION K-27

DOCUMENTS; WELDING BOOK PQR WPS



Vendor doc. Number

17735-19

Vendor:

Airpack Nederland B.V.

P.O. NO.:

LIDCO-PO-NEC-278-6019

**Airpack B.V. - Air Compressor –
Integrated Methanol and Ammonia Plant
17735-COM Welding Book PQR / WPS (K020)**

REV.	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED
03	19-04-2024	Issued for Information	F.T.	S.K.	
02	21-03-2024	Issued for Information	F.T.	S.K.	
01	12-12-2023	Issued for Information	S.K.	J.J.	S.K.

INSPECTION	
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BY: J.J.	
SIGN:	

Welding Book PQR / WPS

Document No. 17735-25

Project No.	Vendor Doc.	P.O. No.	Department	Document Type	Serial No	Revision	Page
N278	VD	6019	GN	WS	0027	03	Page 2 of 65

LIST OF REVISED PAGES

Rev. Page	01	02	03	04	05	Rev. Page	01	02	03	04	05	Rev. Page	01	02	03	04	05	Rev. Page	01	02	03	04	05
1	X	X	X			26	X	X	X			51	X	X	X			76	X				
2	X	X	X			27	X	X	X			52	X	X	X			77	X				
3	X	X	X			28	X	X	X			53	X	X	X			78	X				
4	X	X	X			29	X	X	X			54	X	X	X			79	X				
5	X	X	X			30	X	X	X			55	X	X	X			80	X				
6	X	X	X			31	X	X	X			56	X	X	X			81	X				
7	X	X	X			32	X	X	X			57	X	X	X			82	X				
8	X	X	X			33	X	X	X			58	X	X	X			83	X				
9	X	X	X			34	X	X	X			59	X	X	X			84	X				
10	X	X	X			35	X	X	X			60	X	X	X			85	X				
11	X	X	X			36	X	X	X			61	X	X	X			86	X				
12	X	X	X			37	X	X	X			62	X	X	X			87	X				
13	X	X	X			38	X	X	X			63	X	X	X			88	X				
14	X	X	X			39	X	X	X			64	X	X	X			89	X				
15	X	X	X			40	X	X	X			65	X	X	X			90	X				
16	X	X	X			41	X	X	X			66	X					91	X				
17	X	X	X			42	X	X	X			67	X					98	X				
18	X	X	X			43	X	X	X			68	X					ATTACHMENT					
19	X	X	X			44	X	X	X			69	X					1					
20	X	X	X			45	X	X	X			70	X					2					
21	X	X	X			46	X	X	X			71	X					3					
22	X	X	X			47	X	X	X			72	X					4					
23	X	X	X			48	X	X	X			73	X					5					
24	X	X	X			49	X	X	X			74	X					6					
25	X	X	X			50	X	X	X			75	X					7					

INSPECTION

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BY: DATE:

SIGN:

NARC
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INSPECTION		<input checked="" type="checkbox"/> NARGAN COMPANY 1- APPROVED <input checked="" type="checkbox"/> 2- APPROVED AS NOTED <input type="checkbox"/> 3- NOT APPROVED <input type="checkbox"/> BY: / CREATES DATE: / SIGN: M. T. J.

WPS/
PQR

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INSPECTION	
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BY: M. REZAEI DATE: 21 April 2024	
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INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
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BY: M. REZAEI DATE: 21 April 2024	
SIGN: 	

WPS record number	S2600	Revision 5	Qualified to	AWS D1.1/D1.1M:2020
Date	Thursday, 29 September 2022		Company name	Airpack Netherlands BV
Supporting PQR(s)	RET0278790/TK/001 - Rev 1			
Reference docs.				

Scope	Groove, no PWHT (As-welded), impact testing
Joint	Joint details for this welding procedure specification in: Production drawings

BASE METALS

Type	Plate: API 2W (50) AWS D1.1 Grp-no II / ISO 15608 Grp-no II
Welded to	Plate: API 2W (50) AWS D1.1 Grp-no II / ISO 15608 Grp-no II
Backing:	None
Retainers	None
Notes	

THICKNESS RANGE QUALIFIED (mm)

	As-welded		With PWHT	
	Min.	Max.	Min.	Max.
Complete pen.	3,	8,	-	-
Impact tested	3,	8,	-	-
Partial pen.	3,	8,	-	-
Fillet welds	no min.	no max.	-	-

DIAMETER RANGE QUALIFIED (mm)

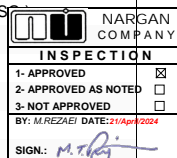
	As-welded		With PWHT	
	Min.	Max.	Min.	Max.
Nominal pipe size	600,	no max.	-	-

FILLER METALS

	SFA	Classification	F-no.	A-no.	Chemical analysis or Trade name	As-welded		With PWHT	
						Min.	Max.	Min.	Max.
GMAW	5.18	E70C-6MH4	-	-	Lincoln, Outershield MC715-H	3,	8,	-	-
GMAW						-	-	-	-
GMAW						-	-	-	-
Sup. filler						- Required -			
Suppl. filler metal vol. (mm ³)	-								

WELDING PROCEDURE

		GMAW	GMAW	GMAW
		Semi-automatic	Semi-automatic	Semi-automatic
Welding process				
Type				
Minimum preheat/interpass temperature (°C)		10	10	10
Maximum interpass temperature (°C)		124 Method contact thermometer	124 Method contact thermometer	124 Method contact thermometer
Filler metal size (mm)		1,2	1,2	1,2
Layer number		Root	Fill	Cap
Position		F,H	F,H	F,H
Weld progression		Not applicable	Not applicable	Not applicable
Current/polarity		DCEP (reverse polarity)	DCEP (reverse polarity)	DCEP (reverse polarity)
Waveform control		Not Used	Not Used	Not Used
Energy (J)		Not Used	Not Used	Not Used
Power (J/s)		Not Used	Not Used	Not Used
Amperes		80 - 100	175 - 185	175 - 185
Volts		14 - 16	19 - 21	19 - 21
Travel speed (mm/min)		110 - 120	460 - 500	440 - 470
Maximum heat input (kJ/mm)		0,57 - 0,70	0,40 - 0,49	0,44 - 0,53
Wire feed speed (m/min)		Not used	Not used	Not used
Arc transfer mode		Short-circuiting	Globular	Globular
Shielding:	Gas type	AC-20 (A5.32 SG-)	AC-20 (A5.32 SG-)	AC-20 (A5.32 SG-)
	Flow rate (l/min)	14 - 16	14 - 16	14 - 16
Trailing:	Gas type	None	None	None
	Flow rate (l/min)	-	-	-
Backing:	Gas type	None	None	None
	Flow rate (l/min)	-	-	-
String or weave		Stringer or Weave	Stringer or Weave	Stringer or Weave
Orifice/gas cup size		15	15	15
C.T.W.D (mm)		15	15	15
Multi/Single pass per side		Single pass	Multiple passes	Multiple passes
Multi/single electrode		Single electrode	Single electrode	Single electrode
Maximum pass thickness (mm)		5	5	5
Weld deposit chemistry		-	-	-
Power Source		CV	CV	CV



WPS record number	S2600	Revision 5	Qualified to	AWS D1.1/D1.1M:2020
Date	Thursday, 29 September 2022		Company name	Airpack Netherlands BV


PREHEAT TABLE

Applicable standard	
AWS D1.1 (Category B)	For thickness 3 to 19(mm): 0(°C). Preheat to 20(°C) if the base metal temperature is below 0(°C). Over 19 thru 38.1(mm): 10(°C). Over 38.1 thru 63.5(mm): 66(°C). Over 63.5(mm): 107(°C).


TECHNIQUE

Peening	Not used
Surface preparation	Grinding
Initial/interpass cleaning	Brushing and Grinding
Back gouging method	None

NOTES

 NARGAN COMPANY	
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
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BY: M. REZAEI DATE: 21 April 2024	
SIGN: 	

Signature 1

Name	Signature	Name	Signature
F. van Toledo			
Date		Date	
Thursday, 29 September 2022			

Signature 2

WPS record number	S2700	Revision 5	Qualified to	AWS D1.1/D1.1M:2020
Date	Thursday, 29 September 2022		Company name	Airpack Netherlands BV
Supporting PQR(s)	RET0278790/TK/002 - Rev 1			
Reference docs.				

Scope	General instruction welding structural for skids Groove, fillet, no PWHT (As-welded), impact testing
Joint	Joint details for this welding procedure specification in: Production drawings

BASE METALS

Type	Plate: API 2W (50) AWS D1.1 Grp-no II / ISO 15608 Grp-no II
Welded to	Plate: API 2W (50) AWS D1.1 Grp-no II / ISO 15608 Grp-no II
Backing:	None P-no. Grp-no.
Retainers	None
Notes	

THICKNESS RANGE QUALIFIED (mm)

	As-welded		With PWHT	
	Min.	Max.	Min.	Max.
Complete pen.	3,	16,	-	-
Impact tested	8,	16,	-	-
Partial pen.	3,	16,	-	-
Fillet welds	no min.	no max.	-	-

DIAMETER RANGE QUALIFIED (mm)

	As-welded		With PWHT	
	Min.	Max.	Min.	Max.
Nominal pipe size	600,	no max.	-	-

FILLER METALS

	SFA	Classification	F-no.	A-no.	Chemical analysis or Trade name	As-welded		With PWHT	
						Min.	Max.	Min.	Max.
GMAW	5.18	E70C-6MH4	-	-	Lincoln, Outershield MC715-H	3,	16,	-	-
GMAW						-	-	-	-
GMAW						-	-	-	-
Sup. filler	-	-	-	-	-	- None -			

WELDING PROCEDURE

	GMAW	GMAW	GMAW
Welding process	Semi-automatic	Semi-automatic	Semi-automatic
Type	10	10	10
Minimum preheat/interpass temperature (°C)	178 Method contact thermometer	178 Method contact thermometer	178 Method contact thermometer
Maximum interpass temperature (°C)	1,2	1,2	1,2
Filler metal size (mm)	Root	Filler	Cap
Layer number	F, H	F, H	F, H
Position	Not applicable	Not applicable	Not applicable
Weld progression	DCEP (reverse polarity)	DCEP (reverse polarity)	DCEP (reverse polarity)
Current/polarity			
Waveform control			
Energy (J)			
Power (J/s)			
Amperes	117 - 143	190 - 210	190 - 210
Volts	15 - 17	21 - 23	22 - 24
Travel speed (mm/min)	135 - 150	320 - 350	350 - 390
Maximum heat input (kJ/mm)	0,8 - 1,0	0,7 - 0,8	0,6 - 0,8
Wire feed speed (m/min)	0,	0	0
Arc transfer mode	Short-circuiting	Globular	Globular
Shielding:	AC-20 (A5.32 SG-)	AC-20 (A5.32 SG-)	AC-20 (A5.32 SG-)
Gas type			
Flow rate (l/min)	12- 22	12 - 22	12 - 2
Trailing:	None	None	None
Gas type			
Flow rate (l/min)	-	-	-
Backing:	None	None	None
Gas type			
Flow rate (l/min)	-	-	-
String or weave	Stringer and Weave	Stringer or Weave	Stringer or Weave
Orifice/gas cup size	15	15	15
C.T.W.D (mm)	15	15	15
Multi/Single pass per side	Multiple passes	Multiple passes	Multiple passes
Multi/single electrode	Single electrode	Single electrode	Single electrode
Maximum pass thickness (mm)	5	5	5
Weld deposit chemistry	-	-	-
Power source	CV	CV	CV



WPS record number	S2700	Revision 5	Qualified to	AWS D1.1/D1.1M:2020
Date	Thursday, 29 September 2022		Company name	Airpack Netherlands BV

PREHEAT TABLE

Applicable standard	
AWS D1.1 (Category B)	For thickness 3 to 19(mm): 0(°C). Preheat to 20(°C) if the base metal temperature is below 0(°C). Over 19 thru 38.1(mm): 10(°C). Over 38.1 thru 63.5(mm): 66(°C). Over 63.5(mm): 107(°C).

TECHNIQUE


Peening	Not used
Surface preparation	Grinding
Initial/interpass cleaning	Brushing and Grinding
Back gouging method	None

NOTES

 NARGAN COMPANY	
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
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BY: M. REZAEI DATE: 21 April 2024	
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Name	Signature	Name	Signature
F. van Toledo			
Date		Date	
Thursday, 29 September 2022			

WPS

CS PIPING

 NARGAN COMPANY	
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
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BY: M. REZAEI DATE: 21 April 2024	
SIGN: 	

WPS record number	P2000	Revision 5	Qualified to	ASME Section ASME IX:2021
Date	Tuesday, 25 January 2022		Company name	Airpack Netherlands BV
Supporting PQR(s)	RET0245029-001-17 - Rev 0			
Reference docs.				

Scope	Welding instruction piping Groove, no PWHT (As-welded), impact testing
Joint	Joint details for this welding procedure specification in: Production drawings,

BASE METALS (QW-403)

Type	Carbon steel (P1)	P-no. 1	Grp-no. 1
Welded to	Carbon steel (P1)	P-no. 1	Grp-no. 1
Backing:	Without backingP-no.		
Retainers			
Notes			

THICKNESS RANGE QUALIFIED (mm)

	As-welded		With PWHT	
	Min.	Max.	Min.	Max.
Complete pen.	1,50	10,32	-	-
Impact tested	2.58	10.32	-	-
Partial pen.	1.50	10.32	-	-
Fillet welds	no min.	no max.	-	-

DIAMETER RANGE QUALIFIED (mm)

	As-welded		With PWHT	
	Min.	Max.	Min.	Max.
Nominal pipe size	½"	no max.	-	-

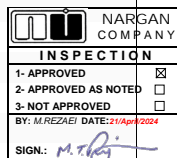
FILLER METALS (QW-404)

THICKNESS RANGE QUALIFIED (mm)

	SFA	Classification	F-no.	A-no.	Chemical analysis or Trade name	As-welded		With PWHT	
						Min.	Max.	Min.	Max.
GTAW	5.18	ER70S-3	6	1	Lincoln Ellectric LNT 25 (solid wire)	1.5	10.32	-	-
Cons. insert	-	-	-	-	-	- None -			
Flux	-	-	-	-	-	- None -			

WELDING PROCEDURE

Welding process	GTAW								
Type	Manual								
Minimum preheat temperature (°C)	20								
Maximum interpass temperature (°C)	221 Method contact thermometer								
Tungsten size (mm)	2,4								
Tungsten type	SFA 5.12 EWCE-2								
Filler metal size (mm)	2,4								
Layer number	All								
Position	All								
Weld progression	Uphill								
Current/polarity	DCEN (straight polarity)								
Amperes	90 -120								
Volts	9 -11								
Travel speed (mm/min)	30 - 70								
Maximum heat input (kJ/mm)	1,8165								
DC pulsing current	None								
Shielding: Gas type	Argon (A5.32 SG-A) Purity min. 99.998%								
Flow rate (l/min)	12 - 16								
Trailing: Gas type	None								
Flow rate (l/min)	None								
Backing: Gas type	None								
Flow rate (l/min)	None								
String or weave	Stringer or Weave								
Orifice/gas cup size	9.5								
Multi/Single pass per side	Multi passes								
Weld deposit chemistry	-								
Notes	When, before welding, the base metal temperature is below 0°C, the base metal shall be preheated to at least 20°								



WPS record number	P2000	Revision 5	Qualified to	ASME Section ASME IX:2021
Date	Tuesday, 25 January 2022		Company name	Airpack Netherlands BV



PREHEAT TABLE

Applicable standard	
ASME B31.1	Base metal p1: Min. 95 °C for thickness >25 mm and specified maximum carbon content > 0.30% Base metal p1: Min. 10 °C for thickness >25 mm and specified maximum carbon content ≤ 0.30% Base metal p1: Min. 10 °C for thickness ≤25 mm maximum carbon content no additional limits.
ASME B31.3	Base metal p1: Min. 95 °C for thickness >25 mm and specified maximum carbon content > 0.30% Base metal p1: Min. 10 °C for thickness >25 mm and specified maximum carbon content ≤ 0.30% Base metal p1: Min. 10 °C for thickness ≤25 mm maximum carbon content no additional limits.


TECHNIQUE (QW-410)

Peening	Not used
Surface preparation	Grinding
Initial/interpass cleaning	Grinding and Brushing
Back gouging method	None
Closed to out chamber	None
Use of thermal processes	None

NOTES

 NARGAN COMPANY	
INSPECTION	
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2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 21 April 2024	
SIGN: 	

Signature 1

Name	Signature	Name	Signature
F. van Toledo			
Date		Date	
Tuesday, 25 January 2022			

WPS record number	P2500	Revision 5	Qualified to	ASME Section ASME IX:2021
Date	Tuesday, 25 January 2022		Company name	Airpack Netherlands BV
Supporting PQR(s)	RET0245029-001-19 – Rev 0			
Reference docs.				

Scope	Welding instruction piping Groove, no PWHT (As-welded), impact testing
Joint	Joint details for this welding procedure specification in: Production drawings,

BASE METALS (QW-403)

Type	Carbon steel (P1)	P-no. 1	Grp-no. 2
Welded to	Carbon steel (P1)	P-no. 1	Grp-no. 2
Backing:	Without backing		.
Retainers			
Notes			

THICKNESS RANGE QUALIFIED (mm)

	As-welded		With PWHT	
	Min.	Max.	Min.	Max.
Complete pen.	1,50	10,32	-	-
Impact tested	2.58	10.32	-	-
Partial pen.	1.50	10.32	-	-
Fillet welds	no min.	no max.	-	-

DIAMETER RANGE QUALIFIED (mm)

	As-welded		With PWHT	
	Min.	Max.	Min.	Max.
Nominal pipe size	½"	no max.	-	-

FILLER METALS (QW-404)

THICKNESS RANGE QUALIFIED (mm)

	SFA	Classification	F-no.	A-no.	Chemical analysis or Trade name	As-welded		With PWHT	
						Min.	Max.	Min.	Max.
GTAW	5.18	ER70S-3	6	1	Lincoln Ellectric LNT 25 (solid wire)	1.5	10.32	-	-
Cons. insert	-	-	-	-	-	- None -			
Flux	-	-	-	-	-	- None -			

WELDING PROCEDURE

Welding process	GTAW								
Type	Manual								
Minimum preheat temperature (°C)	20								
Maximum interpass temperature (°C)	223 Method contact thermometer								
Tungsten size (mm)	2,4								
Tungsten type	SFA 5.12 EWCe-2								
Filler metal size (mm)	2,4								
Layer number	All								
Position	All								
Weld progression	Uphill								
Current/polarity	DCEN (straight polarity)								
Amperes	90 -115								
Volts	9 - 12								
Travel speed (mm/min)	30 - 70								
Maximum heat input (kJ/mm)	1,65								
DC pulsing current	None								
Shielding: Gas type	Argon (A5.32 SG-A)								
Flow rate (l/min)	14								
Trailing: Gas type	None								
Flow rate (l/min)	None								
Backing: Gas type	None								
Flow rate (l/min)	None								
String or weave	Stringer or Weave								
Orifice/gas cup size	9.5								
Multi/Single pass per side	Multi passes								
Weld deposit chemistry	-								
Notes	When, before welding, the base metal temperature is below 0°C, the base metal shall be preheated to at least 20°								



WPS record number	P2500	Revision 5	Qualified to	ASME Section ASME IX:2021
Date	Tuesday, 25 January 2022		Company name	Airpack Netherlands BV



PREHEAT TABLE

Applicable standard	
ASME B31.1	Base metal p1: Min. 95 °C for thickness >25 mm and specified maximum carbon content > 0.30% Base metal p1: Min. 10 °C for thickness >25 mm and specified maximum carbon content ≤ 0.30% Base metal p1: Min. 10 °C for thickness ≤25 mm maximum carbon content no additional limits.
ASME B31.3	Base metal p1: Min. 95 °C for thickness >25 mm and specified maximum carbon content > 0.30% Base metal p1: Min. 10 °C for thickness >25 mm and specified maximum carbon content ≤ 0.30% Base metal p1: Min. 10 °C for thickness ≤25 mm maximum carbon content no additional limits.


TECHNIQUE (QW-410)

Peening	Not used
Surface preparation	Grinding
Initial/interpass cleaning	Grinding and Brushing
Back gouging method	None
Closed to out chamber	None
Use of thermal processes	None

NOTES



 NARGAN COMPANY	
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 21 April 2024	
SIGN: 	

Signature 1

Name	Signature	Name	Signature
F. van Toledo			
Date		Date	
Tuesday, 25 January 2022			

WPS

SS PIPING

 NARGAN COMPANY	
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 21 April 2024	
SIGN: 	

WPS record number	P3000	Revision 5	Qualified to	ASME Section ASME IX:2019
Date	Monday, 28 June 2021		Company name	Airpack Netherlands BV
Supporting PQR(s)	RET0245029-001-21 – Rev 1			
Reference docs.				

Scope	Welding instruction piping Groove, no PWHT (As-welded), impact testing
Joint	Joint details for this welding procedure specification in: Production drawings,

BASE METALS (QW-403)

Type	Stainless steel (P8)	P-no. 8	Grp-no. 1
Welded to	Stainless steel (P8)	P-no. 8	Grp-no. 1
Backing:		P-no.	Grp-no.
Retainers	None		
Notes			

THICKNESS RANGE QUALIFIED (mm)

	As-welded		With PWHT	
	Min.	Max.	Min.	Max.
Complete pen.	1,50	19,06	-	-
Impact tested	-	-	-	-
Partial pen.	1.50	19.06	-	-
Fillet welds	-	-	-	-

DIAMETER RANGE QUALIFIED (mm)

	As-welded		With PWHT	
	Min.	Max.	Min.	Max.
Nominal pipe size	no min.	no max.	-	-

FILLER METALS (QW-404)

THICKNESS RANGE QUALIFIED (mm)

	SFA	Classification	F-no.	A-no.	Chemical analysis or Trade name	As-welded		With PWHT	
						Min.	Max.	Min.	Max.
GTAW	5.9	ER316LSi	6	8	Lincoln Ellectric, LNT 316LSi (solid wire)	No min.	19.06	-	-
Cons. insert	-	-	-	-	-	- None -			
Flux	-	-	-	-	-	- None -			

WELDING PROCEDURE


Welding process		GTAW	
Type		Manual	
Minimum preheat/interpass temperature (°C)		10	
Maximum interpass temperature (°C)		150 Method contact thermometer	
Tungsten size (mm)		2,4	
Tungsten type		SFA 5.12 EWCe-2	
Filler metal size (mm)		2.0	2,4
Layer number		All	All
Position		All	All
Weld progression		Uphill	Uphill
Current/polarity		DCEN (straight polarity)	DCEN (straight polarity)
Amperes		75 - 90	85- 115
Volts		9 - 11	9 - 12
Travel speed (mm/min)		40 - 60	30 - 70
Maximum heat input (kJ/mm)		0,87	1,93
DC pulsing current		None	
Shielding: Gas type		Argon (A5.32 SG-A) Purity min. 99.998%	
Flow rate (l/min)		12 - 16	
Trailing: Gas type		None	
Flow rate (l/min)		None	
Backing: Gas type		95%N2 Purity min. 99.998% – 5%H2 Purity min. 99.995%	
Flow rate (l/min)		10 - 14	
String or weave		Stringer or Weave	
Orifice/gas cup size		9.5	
Multi/Single pass per side		Multi passes	
Weld deposit chemistry		-	
Notes		Backing shall be maintained until the weld has been completed. Oxygen level shall be below 0.05%	

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INSPECTIO

1- APPROVED
2- APPROVED AS NOTED
3- NOT APPROVED

BY: M. REZAEI DATE: 21/04/2024

SIGN.: 

NARGAN COMPANY	
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 21 April 2024	
SIGN: 	

WPS record number	P3000	Revision 5	Qualified to	ASME Section ASME IX:2019
Date	Monday, 28 June 2021		Company name	Airpack Netherlands BV



PREHEAT TABLE

Applicable standard	
ASME B31.3	Min. 10 °C


TECHNIQUE (QW-410)

Peening	Not used
Surface preparation	Grinding
Initial/interpass cleaning	Grinding and Brushing
Back gouging method	None
Closed to out chamber	None
Use of thermal processes	None

NOTES

 NARGAN COMPANY	
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 21 April 2024	
SIGN: 	

Signature 1

Name	Signature	Name	Signature
F. van Toledo			
Date		Date	
Monday, 28 June 2021			

WPS record number	SP4000	Revision 3	Qualified to	ASME Section ASME IX:2019
Date	Monday, 15 August 2022		Company name	Airpack Netherlands BV
Supporting PQR(s)	RET 0278790/TK/004 Rev.1			
Reference docs.				

Scope	Fillet, no PWHT (As-welded)
Joint	Joint details for this welding procedure specification in: Production drawings, Engineering specifications

BASE METALS (QW-403)

Type	Plate	P-no. S355MC acc. EN 10149-2	Grp- None
Welded to	Austenitic stainless steel	P-no. 8	Grp- 1
Backing:	No		
Retainers			
Notes			

THICKNESS RANGE QUALIFIED (mm)

	As-welded		With PWHT	
	Min.	Max.	Min.	Max.
Complete pen.	-	-	-	-
Impact tested	-	-	-	-
Partial pen.	-	-	-	-
Fillet welds	no min.	no max.	-	-

DIAMETER RANGE QUALIFIED (mm)

	As-welded		With PWHT	
	Min.	Max.	Min.	Max.
Nominal pipe size	no min.	no max.	-	-

FILLER METALS (QW-404)

THICKNESS RANGE QUALIFIED (mm)

	SFA	Classification	F-no.	A-no.	Chemical analysis or Trade name	As-welded		With PWHT	
						Min.	Max.	Min.	Max.
GTAW	5.9	ER309LSi	6	8	Lincoln Ellectric LNT 309LSi	-	-	-	-
Cons. insert	-	-	-	-	-	- None -			
Flux	-	-	-	-	-	- None -			

WELDING PROCEDURE

Welding process	GTAW			
Type	Manual			
Minimum preheat/interpass temperature (°C)	10			
Maximum interpass temperature (°C)	10			
Tungsten size (mm)	2,4			
Tungsten type	SFA 5.12 EWLa-1			
Filler metal size (mm)	2,4			
Layer number	All			
Position	All			
Weld progression	-			
Current/polarity	DCEN			
Waveform control	Not Used			
Energy (J)	-			
Power (J/s)	-			
Amperes	125 - 145			
Volts	12 - 15			
Travel speed (mm/min)	40 - 55			
Maximum heat input (kJ/mm)	2,174			
DC pulsing current	Not used			
Shielding:	Argon (A5.32 SG-A) Purity min. 99.998%			
Gas type				
Flow rate (l/min)	10			
Trailing:	None			
Gas type				
Flow rate (l/min)	-			
Backing:	None			
Gas type				
Flow rate (l/min)	-			
String or weave	Stringer or Weave			
Orifice/gas cup size	9,5			
Multi/Single pass per side	Single pass			
Weld deposit chemistry	-			
Notes				


NARGAN COMPANY	
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 21 April 2024	
SIGN: 	

WPS record number	SP4000	Revision 3	Qualified to	ASME Section ASME IX:2019
Date	Monday, 15 August 2022		Company name	Airpack Netherlands BV

TECHNIQUE (QW-410)


Peening	Not used
Surface preparation	Grinding and Brushing
Initial/interpass cleaning	N.A.
Back gouging method	None

NOTES

 NARGAN COMPANY	
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 21 April 2024	
SIGN: 	

Signature 1

Signature 2

Name	Signature	Name	Signature
F. van Toledo			
Date		Date	
Monday, 15 August 2022			

PQR

SKID

	NARGAN COMPANY
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 21 April 2024	
SIGN: 	

[illegible]

Airpack Netherlands BV

Groenewegje 19 - 25, 4301 RN Zierikzee, The Netherlands

AWS - Procedure Qualification Record (PQR)

WeldOffice WPS



PQR record number	RET 0245029-001-25	Revision 1	WPS record number	S2300	Revision 0
Date	13-6-2012		Company name	Airpack Netherlands BV	
			Welding standard	AWS D1.1/D1.1M:2010	

BASE METALS

	Product form	Specification (type or grade)	P no.	Grp-no.	Size	Sch.	Thick. (mm)	Dia. (mm)
Welded to:	Plate	API 2W (50)	U	II	-	-	30	-
	Plate	API 2W (50)	U	II	-	-	30	-
and tested:	Without PWHT, Fillet-weld test							
Notes								

JOINTS

Joint design	Fillet weld	See addition information	See addition information
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WELDING PROCESSES

Welding process	GMAW
Type	Semi-automatic

FILLER METALS

SFA specification	5.18
AWS classification	E70C-6MH4
Filler metal F-number	6
Weld metal A-number	-
Filler metal nominal composition	N.A.
Filler metal trade name	Lincoln, Outershield MC715-H
Filler metal size (mm)	1,2
Deposited thickness (mm)	8,00
Maximum pass thickness (mm)	5
Weld deposit chemistry	-
Supplemental filler metal	-
Supplemental filler metal vol. (mm³)	-

POSITION

Position	2F
Weld progression	-

PREHEAT

Preheat temperature (°C)	10
Maximum interpass temperature (°C)	112

GAS

Shielding gas: Type	AC-20 (A5.32 SG-)
Flow rate (l/min)	15
Trailing gas: Type	None
Flow rate (l/min)	-
Backing gas: Type	None
Flow rate (l/min)	-

ELECTRICAL

Filler metal size (mm)	1,2
Amperes	237 - 245
Volts	26,4 - 26,6
Travel speed (mm/min)	315 - 391
Maximum heat input (kJ/mm)	1,2421
Current/polarity	DCEP (reverse polarity)
Wire feed speed (m/min)	0
Arc transfer mode	Spray

TECHNIQUE

String or weave	Stringer and Weave
Orifice/gas cup size	15
C.T.W.D (mm)	15
Multi/single electrode	Single electrode
Multi/Single pass per side	Single and Multiple passes
Peening	Not used
Initial/interpass cleaning	Brushing and Grinding
Back gouging method	None

NARGAN COMPANY	
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 21 April 2024	
SIGN:	

Airpack Netherlands BV

Groenewegje 19 - 25, 4301 RN Zierikzee, The Netherlands

AWS - Procedure Qualification Record (PQR) - Test results (as welded)

WeldOffice WPS



PQR record number	RET 0245029-001-25	Revision 1	WPS record number	S2300	Revision 0
Date	13-6-2012		Company name	Airpack Netherlands BV	
			Welding standard	AWS D1.1/D1.1M:2010	

TENSILE TESTS

Specimen number	Width (mm)	Thickness (mm)	Area (mm ²)	Ultimate total load (N)	Ultimate unit stress (MPa)	Type of failure and location
Comments						

GUIDED BEND TESTS

Type of test	Acceptance criteria	Result	Comments
Comments			

FILLET WELD TESTS

Type of test	Acceptance criteria	Result	Fillet leg size (mm) x (mm)
3x Macroscopic examination multiple pass	AWS D1.1	Acceptable	a=8 mm
3x Macroscopic examination single pass	AWS D1.1	Acceptable	a=6 mm
Comments			

CERTIFICATION

Welder's name	ID Number	Stamp number	Mechanical testing by	
T. Lajos	ID Card 353992JA	W-104	Laboratory test number	Schielab Breda (NLD)
			Test file number	SL 12.6055-1
			Tests conducted by	ARL1559-13
				A. Karstanje

We certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of section 4 of ANSI/AWS D1.1-2010 Structural Welding Code-Steel.

NARGAN COMPANY	
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 21 April 2024	
SIGN:	

Signature 1

Name	Signature	Name	Signature
Franky van Toledo		W. Komdeur (Lloyds)	
Date		Date	
8-6-2012		8-6-2012	



Airpack Netherlands BV

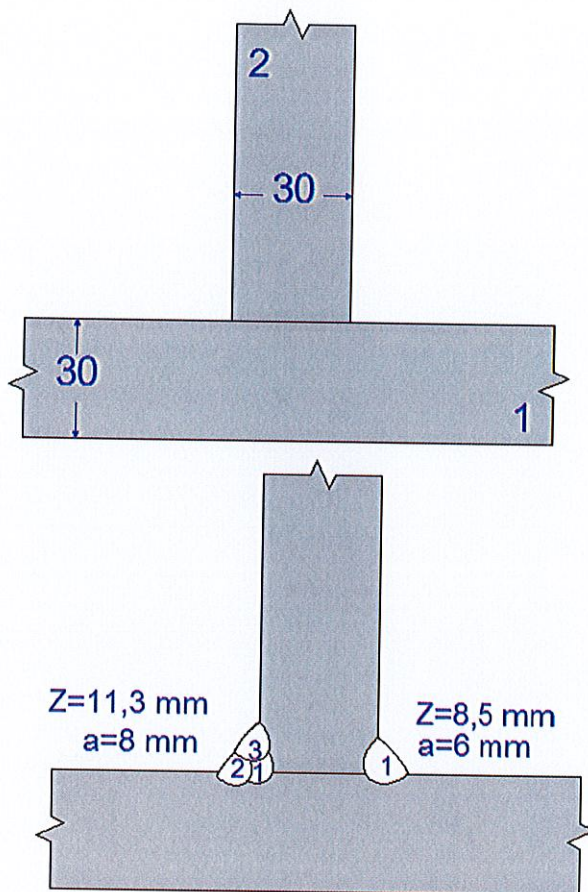
Groenewegje 19 - 25, 4301 RN Zierikzee, The Netherlands

AWS - Additional information (PQR)

WeldOffice WPS



PQR record number	RET 0245029-001-25	Revision 1	WPS record number	S2300	Revision 0
Date	13-6-2012		Company name	Airpack Netherlands BV	
			Welding standard	AWS D1.1/D1.1M:2010	



NARGAN COMPANY	
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 21 April 2024	
SIGN:	

Airpack Netherlands BV

Groeneweegje 19 - 25, 4301 RN Zierikzee, The Netherlands

AWS - Welding conditions - (PQRD Welding Data Record)

WeldOffice WPS



PQRD number	ARL1559-13	Revision 1	Date	29-5-2012
PQR number	RET 0245029-001-25	Revision 1	Welding standard	AWS D1.1/D1.1M:2010
WPS number	S2300	Revision 0	Company name	Airpack Netherlands BV
			To be tested	Without PWHT

WELDING PROCESSES

Welding process	GMAW
Type	Semi-automatic

BASE METALS

Product form	Plate
Material control number	362705
Specification (type or grade)	API 2W (50)
Nominal composition	C-Mn
Trade name	Dillinger Hutte
P number	U
G number	
AWS group number	II
Nominal pipe/tube size	-
Schedule	-
Length	(mm) 350
Width (OD)	(mm) 150
Thickness	(mm) 30

Welded to:

Product form	Plate
Material control number	362705
Specification (type or grade)	API 2W (50)
Nominal composition	C-Mn
Trade name	Dillinger Hutte
P number	U
G number	
AWS group number	II
Nominal pipe/tube size	-
Schedule	-
Length	(mm) 350
Width (OD)	(mm) 150
Thickness	(mm) 30

JOINTS

Joint design	Fillet weld	See addition information	See addition information
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CLEANING/ROOT TREATMENT

Surface preparation	Grinding
Initial/interpass cleaning	Brushing and Grinding
Back gouging method	None

NARGAN COMPANY	
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 21 April 2024	
SIGN:	

PQRD number	ARL1559-13	Revision	1	Date	29-5-2012
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PASS INFORMATION

Pass number	1 single layer	1 Multi layer	1 Multi layer	2 Multi layer
Layer number	1	1	2	2

WELDING PROCESSES

Welding process	GMAW	GMAW	GMAW	GMAW
Type	Semi-automatic	Semi-automatic	Semi-automatic	Semi-automatic

FILLER METALS

Material control number	P1FC110214	P1FC110214	P1FC110214	P1FC110214
SFA specification	5.18	5.18	5.18	5.18
AWS classification	E70C-6MH4	E70C-6MH4	E70C-6MH4	E70C-6MH4
Filler metal F-number	6	6	6	6
Weld metal A-number	-	-	-	-
Filler metal nominal composition	N.A.	N.A.	N.A.	N.A.
Filler metal trade name	Lincoln, Outershield MC715-H	Lincoln, Outershield MC715-H	Lincoln, Outershield MC715-H	Lincoln, Outershield MC715-H
Filler metal size (mm)	1,2	1,2	1,2	1,2
Length of filler metal consumed (mm)	-	-	-	-
Deposited thickness (mm)	4	4	4	4
Maximum pass thickness (mm)	5	5	5	5
Weld deposit chemistry	-	-	-	-
Supplemental filler metal	-	-	-	-
Supplemental filler metal vol. (mm³)	-	-	-	-

POSITION

Position	2F	2F	2F	2F
Weld progression	-	-	-	-

PREHEAT

Preheat temperature (°C)	10	10	10	10
Maximum interpass temperature (°C)	10	10	85	112

GAS

Shielding gas: Type	AC-20 (A5.32 SG-)	AC-20 (A5.32 SG-)	AC-20 (A5.32 SG-)	AC-20 (A5.32 SG-)
Flow rate (l/min)	15	15	15	15
Trailing gas: Type	None	None	None	None
Flow rate (l/min)	-	-	-	-
Backing gas: Type	None	None	None	None
Flow rate (l/min)	-	-	-	-

ELECTRICAL

Filler metal size (mm)	1,2	1,2	1,2	1,2
Amperes	245	247	237	240
Volts	26.4	26.4	26.6	26.4
Travel speed (mm/min)	315	315	391	382
Maximum heat input (kJ/mm)	1,232	1,2421	0,9674	0,9952
Current/polarity	DCEP (reverse polarity)	DCEP (reverse polarity)	DCEP (reverse polarity)	DCEP (reverse polarity)
Wire feed speed (m/min)	-	-	-	-
Arc transfer mode	Spray	Spray	Spray	Spray

TECHNIQUE

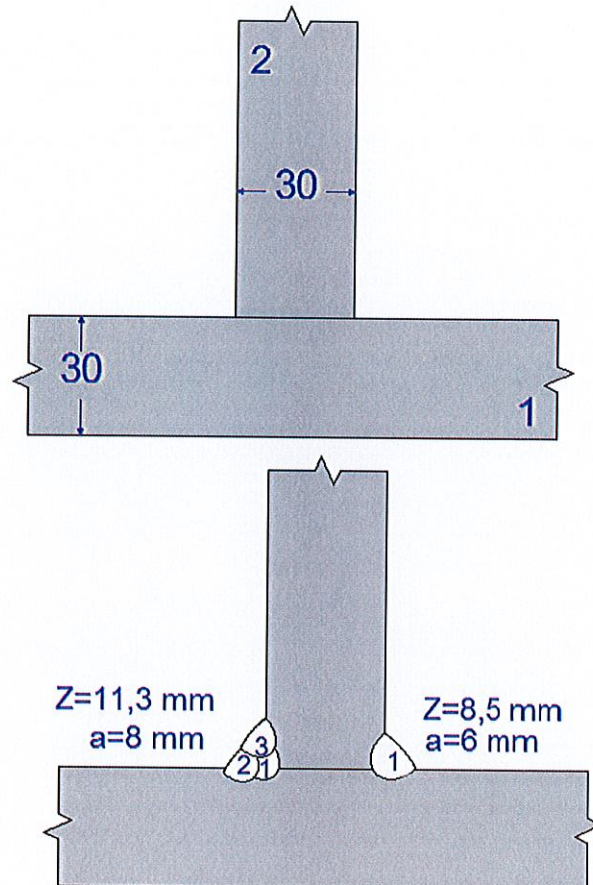
String or weave	Stringer and Weave	Stringer and Weave	Stringer and Weave	Stringer and Weave
Orifice/gas cup size	15	15	15	15
C.T.W.D (mm)	15	15	15	15
Multi/single electrode	Single electrode	Single electrode	Single electrode	Single electrode
Multi/Single pass per side	Multiple passes	Single pass	Multiple passes	Multiple passes
Peening	Not used	Not used	Not used	Not used
Initial/interpass cleaning	Brushing and Grinding	Brushing and Grinding	Brushing and Grinding	Brushing and Grinding
Back gouging method	None	None	None	None

NARGAN COMPANY	
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
SIGN: M. Roza	

PASS PERFORMED/WITNESSED BY

Welders name	T. Lajos	T. Lajos	T. Lajos	T. Lajos
Recorded/witnessed by	A.J.H. Roza (IWT/IWI)	A.J.H. Roza (IWT/IWI)	A.J.H. Roza (IWT/IWI)	A.J.H. Roza (IWT/IWI)
Date	29-5-2012	29-5-2012	29-5-2012	29-5-2012
Data entry by	A.J.H. Roza (IWT/IWI)	A.J.H. Roza (IWT/IWI)	A.J.H. Roza (IWT/IWI)	A.J.H. Roza (IWT/IWI)

PQRD number	ARL1559-13	Revision 1	Date	29-5-2012
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NARGAN COMPANY	
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 21 April 2012	
SIGN: 	



PQR record number Date	RET0278790/TK/001 1-6-2016	Revision 1	WPS record number Company name Welding standard	S2600 Airpack Netherlands BV AWS D1.1/D1.1M:2015	Revision 1
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BASE METALS

	Product form	Specification (type or grade)	P no.	Grp-no.	Size	Sch.	Thick. (mm)	Dia. (mm)
Welded to:	Plate	API 2W (50LS)	U	II	-	-	4	-
	Plate	API 2W (50LS)	U	II	-	-	4	-
and tested:	Without PWHT, With impacts, With hardness							
Notes								

JOINTS

Joint design	Single-V-groove	See addition information	See addition information
Backing:	None		
Retainers	None		
Groove angle (deg.)	60		
Root opening (mm)	2-3		
Root face (mm)	0-1		

WELDING PROCESSES

Welding process	GMAW
Type	Semi-automatic

FILLER METALS

SFA specification	5.18
AWS classification	E70C-6MH4
Filler metal F-number	6
Weld metal A-number	-
Filler metal nominal composition	N.A.
Filler metal trade name	Lincoln, Outershield MC715-H
Filler metal size (mm)	1,2
Deposited thickness (mm)	4,00
Maximum pass thickness (mm)	3
Weld deposit chemistry	-
Supplemental filler metal	-
Supplemental filler metal vol. (mm³)	-

POSITION

Position	2G
Weld progression	-

PREHEAT

Preheat temperature (°C)	10
Maximum interpass temperature (°C)	124

GAS


Shielding gas:	Type	AC-20 (A5.32 SG-)
	Flow rate (l/min)	15
Trailing gas:	Type	None
	Flow rate (l/min)	-
Backing gas:	Type	None
	Flow rate (l/min)	-

ELECTRICAL

Filler metal size (mm)	1,2
Waveform control	Not Used
Energy (J)	Not Used
Power (J/s)	Not Used
Arc time (sec)	Not Used
Weld bead length (mm)	Not Used
Amperes	87 - 183
Volts	14,5 - 20,1
Travel speed (mm/min)	117 - 485
Maximum heat input (kJ/mm)	0,45 - 0,64
Current/polarity	DCEP (reverse polarity)
Wire feed speed (m/min)	0
Arc transfer mode	Short-circuiting, Globular

TECHNIQUE

String or weave	Stringer and Weave
Orifice/gas cup size	15
C.T.W.D (mm)	15
Multi/single electrode	Single electrode
Multi/Single pass per side	Multiple passes
Peening	Not used
Initial/interpass cleaning	Brushing and Grinding
Back gouging method	None

NARGAN COMPANY	
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 21/April/2024	
SIGN: 	

PQR record number Date	RET0278790/TK/001 1-6-2016	Revision 1	WPS record number Company name Welding standard	S2600 Airpack Netherlands BV AWS D1.1/D1.1M:2015	Revision 1
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TENSILE TESTS						Reduced section
Specimen number	Width (mm)	Thickness (mm)	Area (mm ²)	Ultimate total load (N)	Ultimate unit stress (MPa)	Type of failure and location
1	20.01	3.83	76,838	-	527	Ductile-BM
2	20.02	3.82	76,476	-	502	Ductile-BM
Comments						

GUIDED BEND TESTS			
Type of test	Acceptance criteria	Result	Comments
Root bend	AWS D1.1	Acceptable	
Root bend	AWS D1.1	Acceptable	
Face bend	AWS D1.1	Acceptable	
Face bend	AWS D1.1	Acceptable	
Comments			

TOUGHNESS TESTS								
Specimen number	Notch location	Notch type	Specimen size (mm) x (mm)	Test temperature (°C)	Impact values			Drop weight break
					(J)	(% Shear)	(mm)	
1	Weld Metal	Charpy V	10 x 3	-40	29/34/36	-	-	No
2	HAZ	Charpy V	10 x 3	-40	34/48/38	-	-	No
3	HAZ + 1 mm	Charpy V	10 x 3	-40	55/47/48	-	-	No
4	HAZ + 2 mm	Charpy V	10 x 3	-40	52/52/53	-	-	No
5	HAZ + 5 mm	Charpy V	10 x 3	-40	48/48/51	-	-	No
Comments								

HARDNESS TEST						
Type (Scale)	Distance from surface	API 2W (50LS)	HAZ	Weld	HAZ	API 2W (50LS)
Vickers (HV)	Cap area 1-2 mm	170-172-170	192-208-218-218-214	203-211-211-211-208	209-207-203-208-208	169-167-167
Vickers (HV)	Cap area 1-2 mm	166-167-167	192-204-212-211-206	207-203-207-205-200	216-214-216-211-194	170-170-169
Comments						

OTHER TESTS			
Type of test	Acceptance criteria	Result	Comments
2x Macroscopic examination	AWS D1.1	Acceptable	
RT examination	AWS D1.1	Acceptable	
MT examination	AWS D1.1	Acceptable	
Comments			

CERTIFICATION				
Welder's name	ID Number	Stamp number	Mechanical testing by Laboratory test number Test file number Tests conducted by	Element Breda (NL) ARJ001-16-01-18390-1 ARL2064-1 A. Karstanje
Dorremans M.	ID Card IKP0996J6	W-013		

We certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of section 4 of ANSI/AWS D1.1 Structural Welding Code-Steel.

NARGAN COMPANY	
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 21 April 2024	
SIGN: 	

Signature 1

Name	Signature	Name	Signature
F. van Toledo		T. Konings (Lloyds)	
Date	1-6-2016	Date	1-6-2016

PQRD number	ARL2064-1	Revision 1	Date	11-01-2016
PQR number	RET0278790/TK/001	Revision 1	Welding standard	AWS D1.1/D1.1M:2015
WPS number	S2600	Revision 1	Company name	Airpack Netherlands BV
			To be tested	Without PWHT

WELDING PROCESSES

Welding process	GMAW
Type	Semi-automatic

BASE METALS


Product form	Plate	Welded to:	Product form	Plate
Material control number	816729 293819/1		Material control number	816729 293819/1
Specification (type or grade)	API 2W (50LS)		Specification (type or grade)	API 2W (50LS)
Nominal composition	C-Mn		Nominal composition	C-Mn
Trade name	Voestalpine Grobblech		Trade name	Voestalpine Grobblech
P number	U		P number	U
G number			G number	
AWS group number	II		AWS group number	II
Nominal pipe/tube size	-		Nominal pipe/tube size	-
Schedule	-		Schedule	-
Length	(mm) 500		Length	(mm) 500
Width (OD)	(mm) 200		Width (OD)	(mm) 200
Thickness	(mm) 4		Thickness	(mm) 4

JOINTS

Joint design	Single-V-groove	See addition information	See addition information
Backing:	None		
Retainers	None		
Groove angle	(deg.) 60		
Root opening	(mm) 2-3		
Root face	(mm) 0-1		

CLEANING/ROOT TREATMENT

Surface preparation	Grinding
Initial/interpass cleaning	Brushing and Grinding
Back gouging method	None

NARGAN COMPANY	
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 21 April 2024	
SIGN: 	

PQRD number	ARL2064-1	Revision 1	Date	11-01-2016
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PASS INFORMATION

Pass number	1	2	3
Layer number	1	2	2

WELDING PROCESSES

Welding process	GMAW	GMAW	GMAW
Type	Semi-automatic	Semi-automatic	Semi-automatic

FILLER METALS

Material control number	P1FC150311	P1FC150311	P1FC150311
SFA specification	5.18	5.18	5.18
AWS classification	E70C-6MH4	E70C-6MH4	E70C-6MH4
Filler metal F-number	6	6	6
Weld metal A-number	-	-	-
Filler metal nominal composition	N.A.	N.A.	N.A.
Filler metal trade name	Lincoln, Outershield MC715-H	Lincoln, Outershield MC715-H	Lincoln, Outershield MC715-H
Filler metal size (mm)	1,2	1,2	1,2
Length of filler metal consumed (mm)	-	-	-
Deposited thickness (mm)	2	2	2
Maximum pass thickness (mm)	3	3	3
Weld deposit chemistry	-	-	-
Supplemental filler metal	-	-	-
Supplemental filler metal vol. (mm³)	-	-	-

POSITION

Position	2G	2G	2G
Weld progression	-	-	-

PREHEAT

Preheat temperature (°C)	10	10	10
Maximum interpass temperature (°C)	10	69	124

GAS

Shielding gas: Type	AC-20 (A5.32 SG-)	AC-20 (A5.32 SG-)	AC-20 (A5.32 SG-)
Flow rate (l/min)	15	15	15
Trailing gas: Type	None	None	None
Flow rate (l/min)	-	-	-
Backing gas: Type	None	None	None
Flow rate (l/min)	-	-	-

ELECTRICAL

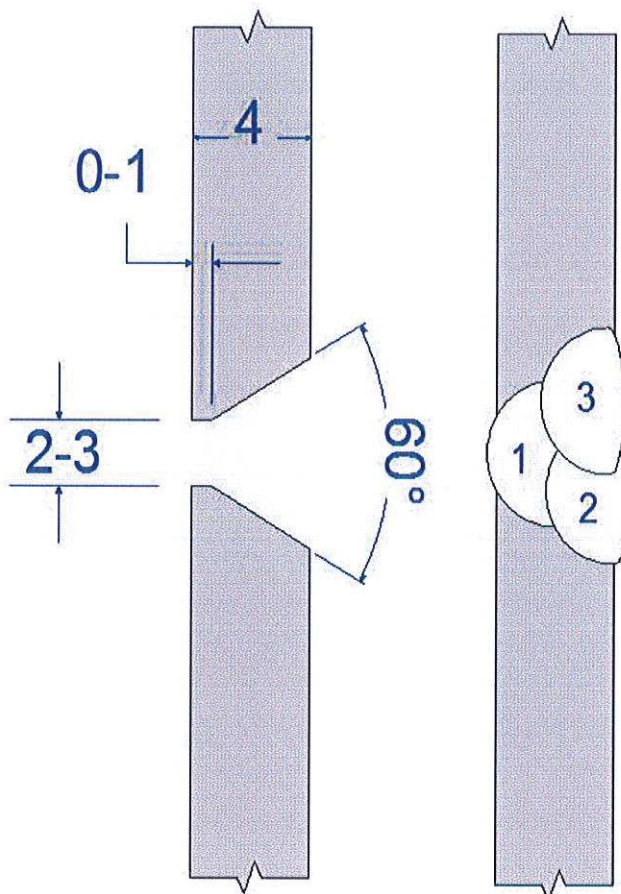
Filler metal size (mm)	1,2	1,2	1,2
Waveform control	Not Used	Not Used	Not Used
Energy (J)	-	-	-
Power (J/s)	-	-	-
Arc time (sec)	-	-	-
Weld bead length (mm)	-	-	-
Amperes	87	182	183
Volts	14.5	20.1	20.1
Travel speed (mm/min)	117	485	450
Maximum heat input (kJ/mm)	0,6469	0,4526	0,4904
Current/polarity	DCEP (reverse polarity)	DCEP (reverse polarity)	DCEP (reverse polarity)
Wire feed speed (m/min)	-	-	-
Arc transfer mode	Short-circuiting	Globular	Globular


TECHNIQUE

String or weave	Stringer and Weave	Stringer and Weave	Stringer and Weave
Orifice/gas cup size (mm)	15	15	15
C.T.W.D (mm)	15	15	15
Multi/single electrode	Single electrode	Single electrode	Single electrode
Multi/Single pass per side	Multiple passes	Multiple passes	Multiple passes
Peening	Not used	Not used	Not used
Initial/interpass cleaning	Brushing and Grinding	Brushing and Grinding	Brushing and Grinding
Back gouging method	None	None	None

NARGAN COMPANY	
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
SIGN: M. REZAEI DATE: 21 April 2024	

PQRD number	ARL2064-1	Revision 1	Date	11-01-2016
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NARGAN COMPANY	
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 21 April 2016	
SIGN: 	

PQR record number	RET0278790/TK/002	Revision 1	WPS record number	S2700	Revision 1
Date	31-5-2016		Company name	Airpack Netherlands BV	
			Welding standard	AWS D1.1/D1.1M:2015	

BASE METALS

	Product form	Specification (type or grade)	P no.	Grp-no.	Size	Sch.	Thick. (mm)	Dia. (mm)
Welded to:	Plate	API 2W (50LS)	U	II	-	-	8	-
	Plate	API 2W (50LS)	U	II	-	-	8	-
and tested:	Without PWHT, With impacts, With hardness							
Notes								

JOINTS

Joint design	Single-V-groove	See addition information	See addition information
Backing:	None		
Retainers:	None		
Groove angle (deg.)	60		
Root opening (mm)	2-3		
Root face (mm)	0-1		

WELDING PROCESSES

Welding process	GMAW
Type	Semi-automatic

FILLER METALS

SFA specification	5.18
AWS classification	E70C-6MH4
Filler metal F-number	6
Weld metal A-number	-
Filler metal nominal composition	N.A.
Filler metal trade name	Lincoln, Outershield MC715-H
Filler metal size (mm)	1,2
Deposited thickness (mm)	6,00
Maximum pass thickness (mm)	3
Weld deposit chemistry	-
Supplemental filler metal	-
Supplemental filler metal vol. (mm³)	-

POSITION

Position	2G
Weld progression	-

PREHEAT

Preheat temperature (°C)	10
Maximum interpass temperature (°C)	178

GAS


Shielding gas:	Type	AC-20 (A5.32 SG-)
	Flow rate (l/min)	15
Trailing gas:	Type	None
	Flow rate (l/min)	-
Backing gas:	Type	None
	Flow rate (l/min)	-

ELECTRICAL

Filler metal size (mm)	1,2
Waveform control	Not Used
Energy (J)	Not Used
Power (J/s)	Not Used
Arc time (sec)	Not Used
Weld bead length (mm)	Not Used
Amperes	130 - 197
Volts	15,9 - 22,2
Travel speed (mm/min)	142 - 383
Maximum heat input (kJ/mm)	0,67 - 0,87
Current/polarity	DCEP (reverse polarity)
Wire feed speed (m/min)	0
Arc transfer mode	Short-circuiting, Globular

TECHNIQUE

String or weave	Stringer and Weave
Orifice/gas cup size	15
C.T.W.D (mm)	15
Multi/single electrode	Single electrode
Multi/Single pass per side	Multiple passes
Peening	Not used
Initial/interpass cleaning	Brushing and Grinding
Back gouging method	None

MARGAN COMPANY	
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 21/April/2024	
SIGN: 	

PQR record number Date	RET0278790/TK/002 31-5-2016	Revision 1	WPS record number Company name Welding standard	S2700 Airpack Netherlands BV AWS D1.1/D1.1M:2015	Revision 1
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TENSILE TESTS						Reduced section
Specimen number	Width (mm)	Thickness (mm)	Area (mm ²)	Ultimate total load (N)	Ultimate unit stress (MPa)	Type of failure and location
1	20.03	7.23	144,817	-	529	Ductile-BM
2	20.03	7.28	145,818	-	530	Ductile-BM
Comments						

GUIDED BEND TESTS				
Type of test		Acceptance criteria	Result	Comments
Face bend		AWS D1.1	Acceptable	
Face bend		AWS D1.1	Acceptable	
Root bend		AWS D1.1	Acceptable	
Root bend		AWS D1.1	Acceptable	
Comments				


TOUGHNESS TESTS								
Specimen number	Notch location	Notch type	Specimen size (mm) x (mm)	Test temperature (°C)	(J)	Impact values (% Shear)	(mm)	Drop weight break
1	Weld Metal	Charpy V	10 x 5	-40	56/56/60	-	-	No
2	HAZ	Charpy V	10 x 5	-40	51/69/60	-	-	No
3	HAZ + 1 mm	Charpy V	10 x 5	-40	115/104/84	-	-	No
4	HAZ + 2 mm	Charpy V	10 x 5	-40	104/99/100	-	-	No
5	HAZ + 5 mm	Charpy V	10 x 5	-40	119/115/104	-	-	No
Comments								

HARDNESS TEST						
Type (Scale)	Distance from surface	API 2W (50LS)	HAZ	Weld	HAZ	API 2W (50LS)
Vickers (HV)	Cap area 1-2 mm	166-164-164	184-193-204-205-204	213-214-217-199-211	205-199-198-196-186	167-170=170
Vickers (HV)	Root area 1-2 mm	171-169-165	186-198-206-206-188	173-184-186-186-187	187-186-186-188-170	165-166-164
Vickers (HV)	Cap area 1-2 mm	165-168-167	197-206-211-211-211	220-221-207-208-219	209-211-207-209-198	168-165-166
Vickers (HV)	Root area 1-2 mm	167-170-164	187-199-196-191-207	192-196-188-194-189	178-186-180-175-174	162-163-166
Comments						

OTHER TESTS			
Type of test	Acceptance criteria	Result	Comments
2x Macroscopic examination	AWS D1.1	Acceptable	
RT examination	AWS D1.1	Acceptable	
MT examination	AWS D1.1	Acceptable	
Comments			

CERTIFICATION				
Welder's name	ID Number	Stamp number	Mechanical testing by	Element Breda (NL)
Dorremans M.	ID Card IKP0996J6	W-013	Laboratory test number	ARJ001-16-01-18390-2
			Test file number	ARL2064-2
			Tests conducted by	A. Karstjanje

We certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of section 4 of ANSI/AWS D1.1 Structural Welding Code-Steel.

NARGAN COMPANY	
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 21 April 2024	
SIGN: 	

Signature 1

Name
F. van Toledo
Date
1-6-2016

Signature

Airpack Netherlands BV

Signature 2

Name
T. Konings (Lloyds)
Date
1-6-2016

Witnessed	<input checked="" type="checkbox"/>
Reviewed	<input checked="" type="checkbox"/>
Examined	<input checked="" type="checkbox"/>
Iron Konings	<input checked="" type="checkbox"/>
Lloyd's Register Energy	

PQRD number	ARL2064-2	Revision 1	Date	11-01-2016
PQR number	RET0278790/TK/002	Revision 1	Welding standard	AWS D1.1/D1.1M:2015
WPS number	S2700	Revision 1	Company name	Airpack Netherlands BV
			To be tested	Without PWHT

WELDING PROCESSES

Welding process	GMAW
Type	Semi-automatic

BASE METALS

Product form	Plate
Material control number	816729 293819/1
Specification (type or grade)	API 2W (50LS)
Nominal composition	C-Mn
Trade name	Voestalpine Grobblech
P number	U
G number	
AWS group number	II
Nominal pipe/tube size	-
Schedule	-
Length	(mm) 500
Width (OD)	(mm) 200
Thickness	(mm) 8

Welded to:


Product form	Plate
Material control number	816729 293819/1
Specification (type or grade)	API 2W (50LS)
Nominal composition	C-Mn
Trade name	Voestalpine Grobblech
P number	U
G number	
AWS group number	II
Nominal pipe/tube size	-
Schedule	-
Length	(mm) 500
Width (OD)	(mm) 200
Thickness	(mm) 8

JOINTS

Joint design	Single-V-groove	See addition information	See addition information
Backing:	None		
Retainers	None		
Groove angle	(deg.) 60		
Root opening	(mm) 2-3		
Root face	(mm) 0-1		

CLEANING/ROOT TREATMENT

Surface preparation	Grinding
Initial/interpass cleaning	Brushing and Grinding
Back gouging method	None

 NARGAN COMPANY	
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 21 April 2024	
SIGN: 	

PQRD number	ARL2064-2	Revision 1	Date	11-01-2016
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PASS INFORMATION

Pass number	1	2	3	4
Layer number	1	2	3	3

WELDING PROCESSES

Welding process	GMAW	GMAW	GMAW	GMAW
Type	Semi-automatic	Semi-automatic	Semi-automatic	Semi-automatic

FILLER METALS

Material control number	P1FC150311	P1FC150311	P1FC150311	P1FC150311
SFA specification	5.18	5.18	5.18	5.18
AWS classification	E70C-6MH4	E70C-6MH4	E70C-6MH4	E70C-6MH4
Filler metal F-number	6	6	6	6
Weld metal A-number	-	-	-	-
Filler metal nominal composition	N.A.	N.A.	N.A.	N.A.
Filler metal trade name	Lincoln, Outershield MC715-H	Lincoln, Outershield MC715-H	Lincoln, Outershield MC715-H	Lincoln, Outershield MC715-H
Filler metal size (mm)	1,2	1,2	1,2	1,2
Length of filler metal consumed (mm)	-	-	-	-
Deposited thickness (mm)	2	2	2	2
Maximum pass thickness (mm)	3	3	3	3
Weld deposit chemistry	-	-	-	-
Supplemental filler metal	-	-	-	-
Supplemental filler metal vol. (mm ³)	-	-	-	-

POSITION

Position	2G	2G	2G	2G
Weld progression	-	-	-	-

PREHEAT

Preheat temperature (°C)	10	10	10	10
Maximum interpass temperature (°C)	10	69	129	178

GAS


Shielding gas: Type	AC-20 (A5.32 SG-)	AC-20 (A5.32 SG-)	AC-20 (A5.32 SG-)	AC-20 (A5.32 SG-)
Flow rate (l/min)	15	15	15	15
Trailing gas: Type	None	None	None	None
Flow rate (l/min)	-	-	-	-
Backing gas: Type	None	None	None	None
Flow rate (l/min)	-	-	-	-

ELECTRICAL

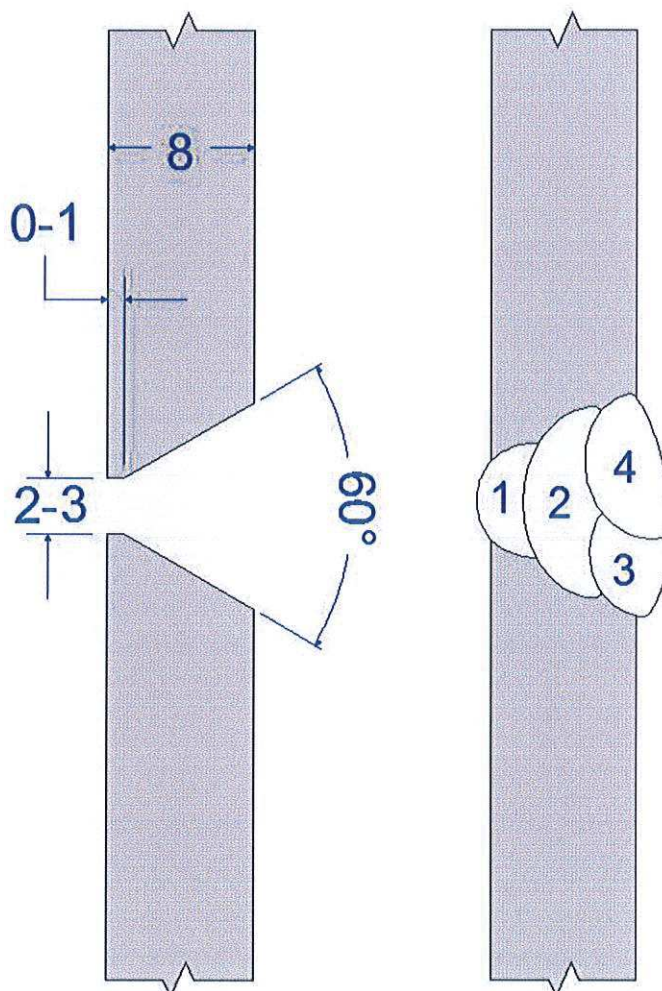
Filler metal size (mm)	1,2	1,2	1,2	1,2
Waveform control	Not Used	Not Used	Not Used	
Energy (J)	-	-	-	
Power (J/s)	-	-	-	
Arc time (sec)	-	-	-	
Weld bead length (mm)	-	-	-	
Amperes	130	196	197	194
Volts	15,9	21,7	22,2	22,2
Travel speed (mm/min)	142	340	383	355
Maximum heat input (kJ/mm)	0,8734	0,7506	0,679	0,7214
Current/polarity	DCEP (reverse polarity)	DCEP (reverse polarity)	DCEP (reverse polarity)	DCEP (reverse polarity)
Wire feed speed (m/min)	-	-	-	-
Arc transfer mode	Short-circuiting	Globular	Globular	Globular

TECHNIQUE

String or weave	Stringer and Weave	Stringer and Weave	Stringer and Weave	Stringer and Weave
Orifice/gas cup size (mm)	15	15	15	15
C.T.W.D (mm)	15	15	15	15
Multi/single electrode	Single electrode	Single electrode	Single electrode	Single electrode
Multi/Single pass per side	Multiple passes	Multiple passes	Multiple passes	Multiple passes
Peening	Not used	Not used	Not used	Not used
Initial/interpass cleaning	Brushing and Grinding	Brushing and Grinding	Brushing and Grinding	Brushing and Grinding
Back gouging method	None	None	None	None

NARGAN COMPANY	
INSPECTION	
1. APPROVED	<input checked="" type="checkbox"/>
2. APPROVED AS NOTED	<input type="checkbox"/>
3. NOT APPROVED	<input type="checkbox"/>
DATE: 24 April 2024	
SIGN: 	

PQRD number	ARL2064-2	Revision 1	Date	11-01-2016
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NARGAN COMPANY	
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 21 April 2024	
SIGN: 	

PQR

CS PIPING

 NARGAN COMPANY	
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 21 April 2024	
SIGN: 	

Airpack Netherlands BV

Groeneweegje 19 - 25, 4301 RN Zierikzee, The Netherlands

ASME - Procedure Qualification Record (PQR) - QW-483

WeldOffice WPS



PQR record number	RET 0245029-001-17	Revision 0	WPS record number	P2000	Revision 1
Date	13-6-2012		Company name	Airpack Netherlands BV	
			Welding standard	ASME Section IX:2010 including addenda 2011	

BASE METALS (QW-403)

	Product form	Specification (type or grade)	P no.	Grp-no.	Size	Sch.	Thick. (mm)	Dia. (mm)
Welded to:	Pipe/Tube	SA-333 (6)	1	1	63,50	Standard	5,16	73,03
	Pipe/Tube	SA-333 (6)	1	1	63,50	Standard	5,16	73,03
and tested:	Without PWHT, With impacts							
Notes								

JOINTS (QW-402)

Joint design	Single-V-groove	See addition information	See addition information
Backing:	None		
Retainers	None		
Groove angle (deg.)	60		
Root opening (mm)	4		
Root face (mm)	0-1		

WELDING PROCESSES

Welding process	GTAW
Type	Manual

FILLER METALS (QW-404)

SFA specification	5.18
AWS classification	ER70S-3
Filler metal F-number	6
Weld metal A-number	1
Filler metal nominal composition	N.A.
Filler metal trade name	Lincoln Electric, LNT 25
Filler metal size (mm)	2,4
Deposited thickness (mm)	5,16
Maximum pass thickness (mm)	4
Weld deposit chemistry	-

POSITION (QW-405)

Position	6G
Weld progression	Uphill

PREHEAT (QW-406)

Preheat temperature (°C)	10
Maximum interpass temperature (°C)	166

GAS (QW-408)

Shielding gas: Type	Argon (A5.32 SG-A)
Flow rate (l/min)	14
Trailing gas: Type	None
Flow rate (l/min)	-
Backing gas: Type	None
Flow rate (l/min)	-

ELECTRICAL (QW-409)

Filler metal size (mm)	2,4
Amperes	97 - 101
Volts	9,6 - 10,3
Travel speed (mm/min)	33 - 69
Maximum heat input (kJ/mm)	1,8165
Tungsten size (mm)	2,4
Tungsten type	SFA 5.12 EWCe-2
Current/polarity	DCEN (straight polarity)
DC pulsing current	None

NARGAN COMPANY	
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 21 April 2024	
SIGN:	

TECHNIQUE (QW-410)

String or weave	Stringer and Weave
Orifice/gas cup size	9,5
Multi/Single pass per side	Multiple passes
Peening	Not used
Initial/interpass cleaning	Brushing and Grinding
Back gouging method	None

Airpack Netherlands BV

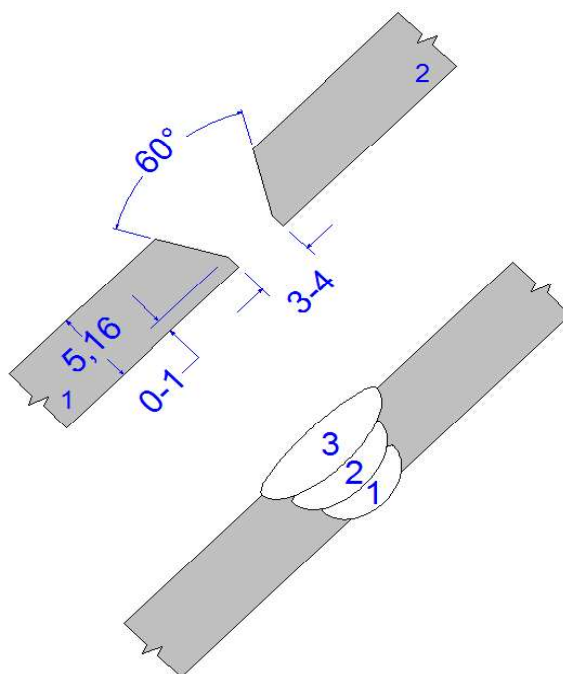
Groeneweegje 19 - 25, 4301 RN Zierikzee, The Netherlands

ASME - Additional information (PQR)

WeldOffice WPS



PQR record number	RET 0245029-001-17	Revision 0	WPS record number	P2000	Revision 1
Date	13-6-2012		Company name	Airpack Netherlands BV	
			Welding standard	ASME Section IX:2010 including addenda 2011	



Pipe diameter 2½" x STD (73,0,3x5,15 mm)

NARGAN COMPANY	
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 21 April 2024	
SIGN:	

Airpack Netherlands BV

Groeneweegje 19 - 25, 4301 RN Zierikzee, The Netherlands

ASME - Welding conditions - (PQRD Welding Data Record)

WeldOffice WPS



PQRD number	ARL1559-1	Revision 0	Date	29-5-2012
PQR number	RET 0245029-001-17	Revision 0	Welding standard	ASME Section IX:2010 including addenda 2011
WPS number	P2000	Revision 1	Company name	Airpack Netherlands BV
			To be tested	Without PWHT

WELDING PROCESSES

Welding process	GTAW
Type	Manual

BASE METALS (QW-403)

Product form	Pipe/Tube
Material control number	353566
Specification (type or grade)	SA-333 (6)
Nominal composition	C-Mn-Si
Trade name	Vallourec & Mannesmann
P number	1
G number	1
AWS group number	U
Nominal pipe/tube size	63,50
Schedule	Standard
Length (mm)	150
Width (OD) (mm)	73,03
Thickness (mm)	5,16

Welded to:

Product form	Pipe/Tube
Material control number	353566
Specification (type or grade)	SA-333 (6)
Nominal composition	C-Mn-Si
Trade name	Vallourec & Mannesmann
P number	1
G number	1
AWS group number	U
Nominal pipe/tube size	63,50
Schedule	Standard
Length (mm)	150
Width (OD) (mm)	73,03
Thickness (mm)	5,16

JOINTS (QW-402)

Joint design	Single-V-groove	See addition information	See addition information
Backing:	None		
Retainers	None		
Groove angle (deg.)	60		
Root opening (mm)	4		
Root face (mm)	0-1		

CLEANING/ROOT TREATMENT

Surface preparation	Grinding
Initial/interpass cleaning	Brushing and Grinding
Back gouging method	None

INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 21 April 2024	
SIGN:	

Airpack Netherlands BV

Groenewegje 19 - 25, 4301 RN Zierikzee, The Netherlands

ASME - Welding parameters - (PQRD Welding Data Record)

WeldOffice WPS



PQRD number	ARL1559-1	Revision 0	Date	29-5-2012
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PASS INFORMATION

Pass number	1	2	3
Layer number	1	2	3

WELDING PROCESSES

Welding process	GTAW	GTAW	GTAW
Type	Manual	Manual	Manual

FILLER METALS (QW-404)

Material control number	334136	334136	334136
SFA specification	5.18	5.18	5.18
AWS classification	ER70S-3	ER70S-3	ER70S-3
Filler metal F-number	6	6	6
Weld metal A-number	1	1	1
Filler metal nominal composition	N.A.	N.A.	N.A.
Filler metal trade name	Lincoln Electric, LNT 25	Lincoln Electric, LNT 25	Lincoln Electric, LNT 25
Filler metal size (mm)	2,4	2,4	2,4
Length of filler metal consumed (mm)	-	-	-
Deposited thickness (mm)	3	3	3
Maximum pass thickness (mm)	4	4	4
Weld deposit chemistry	-	-	-
Flux nominal composition	N.A.	N.A.	N.A.
Flux trade name	N.A.	N.A.	N.A.

POSITION (QW-405)

Position	6G	6G	6G
Weld progression	Uphill	Uphill	Uphill

PREHEAT (QW-406)

Preheat temperature (°C)	10	10	10
Maximum interpass temperature (°C)	10	112	166

GAS (QW-408)

Shielding gas: Type	Argon (A5.32 SG-A)	Argon (A5.32 SG-A)	Argon (A5.32 SG-A)
Flow rate (l/min)	14	14	14
Trailing gas: Type	None	None	None
Flow rate (l/min)	-	-	-
Backing gas: Type	None	None	None
Flow rate (l/min)	-	-	-

ELECTRICAL (QW-409)

Filler metal size (mm)	2,4	2,4	2,4
Amperes	97	101	97
Volts	10.1	9.6	10.3
Travel speed (mm/min)	64	69	33
Maximum heat input (kJ/mm)	0,9185	0,8431	1,8165
Tungsten size (mm)	2,4	2,4	2,4
Tungsten type	SFA 5.12 EWCe-2	SFA 5.12 EWCe-2	SFA 5.12 EWCe-2
Current/polarity	DCEN (straight polarity)	DCEN (straight polarity)	DCEN (straight polarity)
DC pulsing current	None	None	None

TECHNIQUE (QW-410)

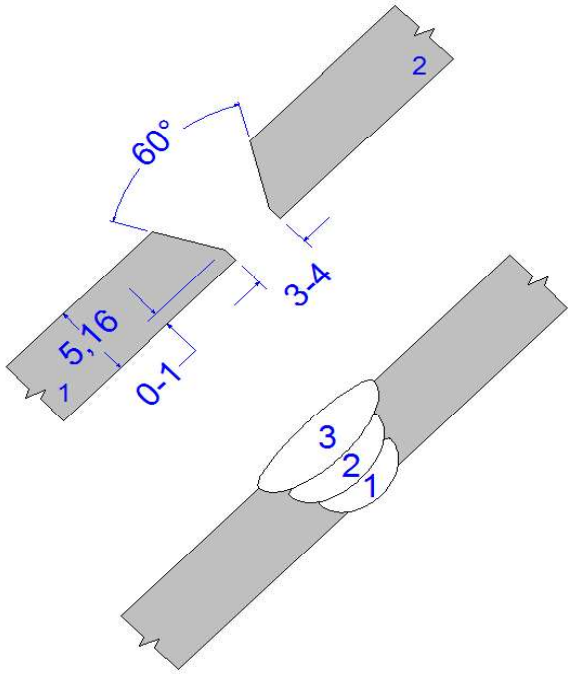
String or weave	Stringer and Weave	Stringer and Weave	Stringer and Weave
Orifice/gas cup size	9,5	9,5	9,5
Multi/Single pass per side	Multiple passes	Multiple passes	Multiple passes
Peening	Not used	Not used	Not used
Initial/interpass cleaning	Brushing and Grinding	Brushing and Grinding	Brushing and Grinding
Back gouging method	None	None	None

NARGAN COMPANY	
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 21 April 2004	
SIGN:	



PASS PERFORMED/WITNESSED BY

Welders name	A. Sumantri	A. Sumantri	A. Sumantri
Recorded/witnessed by	A.J.H. Roza (IWT/IWI)	A.J.H. Roza (IWT/IWI)	A.J.H. Roza (IWT/IWI)
Date	29-5-2012	29-5-2012	29-5-2012
Data entry by	A.J.H. Roza (IWT/IWI)	A.J.H. Roza (IWT/IWI)	A.J.H. Roza (IWT/IWI)

PQRD number	ARL1559-1	Revision 0	Date	29-5-2012
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Pipe diameter 2½" x STD (73,0,3x5,15 mm)

 NARGAN COMPANY	
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 21 April 2024	
SIGN: 	

Airpack Netherlands BV

Groeneweegje 19 - 25, 4301 RN Zierikzee, The Netherlands

ASME - Procedure Qualification Record (PQR) - QW-483

WeldOffice WPS



PQR record number	RET 0245029-001-19	Revision 0	WPS record number	P2500	Revision 0
Date	13-6-2012		Company name	Airpack Netherlands BV	
			Welding standard	ASME Section IX:2010 including addenda 2011	

BASE METALS (QW-403)

	Product form	Specification (type or grade)	P no.	Grp-no.	Size	Sch.	Thick. (mm)	Dia. (mm)
Welded to:	Flange	SA-350 (LF2)	1	2	63,50	Standard	5,16	73,03
		SA-350 (LF2)	1	2	63,50	Standard	5,16	73,03
and tested:	Without PWHT, With impacts							
Notes								

JOINTS (QW-402)

Joint design	Single-V-groove	See addition information	See addition information
Backing:	None		
Retainers	None		
Groove angle (deg.)	30		
Root opening (mm)	4		
Root face (mm)	0-1		

WELDING PROCESSES

Welding process	GTAW
Type	Manual

FILLER METALS (QW-404)

SFA specification	5.18
AWS classification	ER70S-3
Filler metal F-number	6
Weld metal A-number	1
Filler metal nominal composition	N.A.
Filler metal trade name	Lincoln Electric, LNT 25
Filler metal size (mm)	2,4
Deposited thickness (mm)	5,16
Maximum pass thickness (mm)	4
Weld deposit chemistry	-

POSITION (QW-405)

Position	6G
Weld progression	-

PREHEAT (QW-406)

Preheat temperature (°C)	10
Maximum interpass temperature (°C)	167

GAS (QW-408)

Shielding gas: Type	Argon (A5.32 SG-A)
Flow rate (l/min)	14
Trailing gas: Type	None
Flow rate (l/min)	-
Backing gas: Type	None
Flow rate (l/min)	-

ELECTRICAL (QW-409)

Filler metal size (mm)	2,4
Amperes	93 - 98
Volts	9,6 - 10,6
Travel speed (mm/min)	37 - 58
Maximum heat input (kJ/mm)	1,65
Tungsten size (mm)	2,4
Tungsten type	SFA 5.12 EWCe-2
Current/polarity	DCEN (straight polarity)
DC pulsing current	None



TECHNIQUE (QW-410)

String or weave	Stringer and Weave
Orifice/gas cup size	9,5
Multi/Single pass per side	Multiple passes
Peening	Not used
Initial/interpass cleaning	Brushing and Grinding
Back gouging method	None

Airpack Netherlands BV

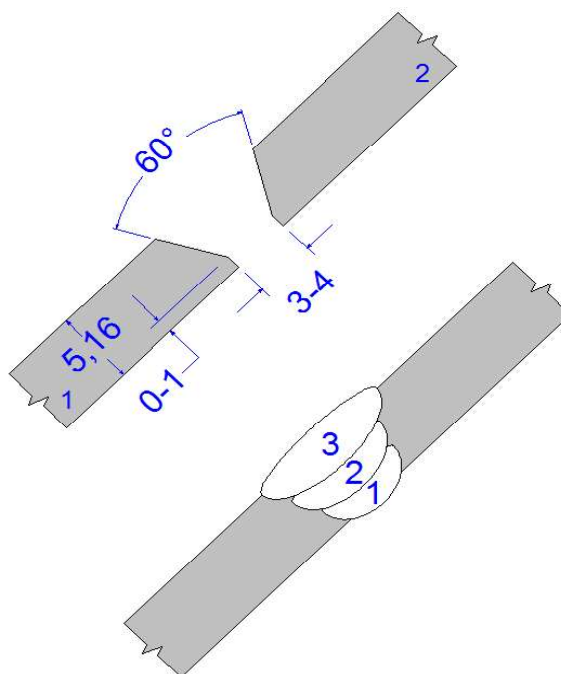
Groeneweegje 19 - 25, 4301 RN Zierikzee, The Netherlands

ASME - Additional information (PQR)

WeldOffice WPS



PQR record number	RET 0245029-001-19	Revision 0	WPS record number	P2500	Revision 0
Date	13-6-2012		Company name	Airpack Netherlands BV	
			Welding standard	ASME Section IX:2010 including addenda 2011	



Pipe diameter 2½" x STD (73,0,3x5,15 mm)

NARGAN COMPANY	
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 21 April 2024	
SIGN:	

Airpack Netherlands BV

Groeneweegje 19 - 25, 4301 RN Zierikzee, The Netherlands

ASME - Welding conditions - (PQRD Welding Data Record)

WeldOffice WPS



PQRD number	ARL1559-3	Revision 0	Date	29-5-2012
PQR number	RET 0245029-001-19	Revision 0	Welding standard	ASME Section IX:2010 including addenda 2011
WPS number	P2500	Revision 0	Company name	Airpack Netherlands BV
			To be tested	Without PWHT

WELDING PROCESSES

Welding process	GTAW
Type	Manual

BASE METALS (QW-403)

Product form	Pipe/Tube	Welded to:	Product form	Pipe/Tube
Material control number	29685		Material control number	29685
Specification (type or grade)	SA-350 (LF2)		Specification (type or grade)	SA-350 (LF2)
Nominal composition	C-Mn-Si		Nominal composition	C-Mn-Si
Trade name	Sochorvá válcovna S.A.		Trade name	Sochorvá válcovna S.A.
P number	1		P number	1
G number	2		G number	2
AWS group number	U		AWS group number	U
Nominal pipe/tube size	63,50		Nominal pipe/tube size	63,50
Schedule	Standard		Schedule	Standard
Length (mm)	150		Length (mm)	150
Width (OD) (mm)	73,03		Width (OD) (mm)	73,03
Thickness (mm)	5,16		Thickness (mm)	5,16

JOINTS (QW-402)

Joint design	Single-V-groove	See addition information	See addition information
Backing:	None		
Retainers	None		
Groove angle (deg.)	60		
Root opening (mm)	4		
Root face (mm)	0-1		

CLEANING/ROOT TREATMENT

Surface preparation	Grinding
Initial/interpass cleaning	Brushing and Grinding
Back gouging method	None

NARGAN COMPANY	
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 21 April 2024	
SIGN:	

Airpack Netherlands BV

Groenewegje 19 - 25, 4301 RN Zierikzee, The Netherlands

ASME - Welding parameters - (PQRD Welding Data Record)

WeldOffice WPS



PQRD number	ARL1559-3	Revision 0	Date	29-5-2012
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PASS INFORMATION

Pass number	1	2	3
Layer number	1	2	3

WELDING PROCESSES

Welding process	GTAW	GTAW	GTAW
Type	Manual	Manual	Manual

FILLER METALS (QW-404)

Material control number	334136	334136	334136
SFA specification	5.18	5.18	5.18
AWS classification	ER70S-3	ER70S-3	ER70S-3
Filler metal F-number	6	6	6
Weld metal A-number	1	1	1
Filler metal nominal composition	N.A.	N.A.	N.A.
Filler metal trade name	Lincoln Electric, LNT 25	Lincoln Electric, LNT 25	Lincoln Electric, LNT 25
Filler metal size (mm)	2,4	2,4	2,4
Length of filler metal consumed (mm)	-	-	-
Deposited thickness (mm)	3	3	3
Maximum pass thickness (mm)	4	4	4
Weld deposit chemistry	-	-	-
Flux nominal composition	N.A.	N.A.	N.A.
Flux trade name	N.A.	N.A.	N.A.

POSITION (QW-405)

Position	6G	6G	6G
Weld progression	-	-	-

PREHEAT (QW-406)

Preheat temperature (°C)	10	10	10
Maximum interpass temperature (°C)	10	154	167

GAS (QW-408)

Shielding gas: Type	Argon (A5.32 SG-A)	Argon (A5.32 SG-A)	Argon (A5.32 SG-A)
Flow rate (l/min)	14	14	14
Trailing gas: Type	None	None	None
Flow rate (l/min)	-	-	-
Backing gas: Type	None	None	None
Flow rate (l/min)	-	-	-

ELECTRICAL (QW-409)

Filler metal size (mm)	2,4	2,4	2,4
Amperes	93	98	96
Volts	9.6	9.9	10.6
Travel speed (mm/min)	58	54	37
Maximum heat input (kJ/mm)	0,9236	1,078	1,6502
Tungsten size (mm)	2,4	2,4	2,4
Tungsten type	SFA 5.12 EWCe-2	SFA 5.12 EWCe-2	SFA 5.12 EWCe-2
Current/polarity	DCEN (straight polarity)	DCEN (straight polarity)	DCEN (straight polarity)
DC pulsing current	None	None	None

TECHNIQUE (QW-410)

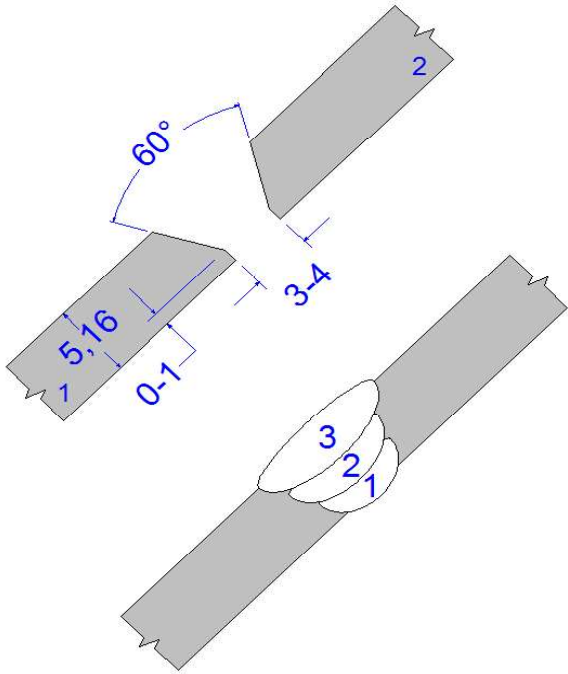
String or weave	Stringer and Weave	Stringer and Weave	Stringer and Weave
Orifice/gas cup size	9,5	9,5	9,5
Multi/Single pass per side	Multiple passes	Multiple passes	Multiple passes
Peening	Not used	Not used	Not used
Initial/interpass cleaning	Brushing and Grinding	Brushing and Grinding	Brushing and Grinding
Back gouging method	None	None	None

NARGAN COMPANY	
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 21 April 2014	
SIGN:	


PASS PERFORMED/WITNESSED BY

Welders name	A. Sumantri	A. Sumantri	A. Sumantri
Recorded/witnessed by	A.J.H. Roza (IWT/IWI)	A.J.H. Roza (IWT/IWI)	A.J.H. Roza (IWT/IWI)
Date	29-5-2012	29-5-2012	29-5-2012
Data entry by	A.J.H. Roza (IWT/IWI)	A.J.H. Roza (IWT/IWI)	A.J.H. Roza (IWT/IWI)

PQRD number	ARL1559-3	Revision 0	Date	29-5-2012
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Pipe diameter 2½" x STD (73,0,3x5,15 mm)

NARGAN COMPANY	
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 21 April 2004	
SIGN: 	



PQR

SS PIPING

 NARGAN COMPANY	
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 21 April 2024	
SIGN: 	

Airpack Netherlands BV

Groeneweegje 19 - 25, 4301 RN Zierikzee, The Netherlands

ASME - Procedure Qualification Record (PQR) - QW-483

WeldOffice WPS



PQR record number	RET 0245029-001-21	Revision 1	WPS record number	P3000	Revision 1
Date	13-6-2012		Company name	Airpack Netherlands BV	
			Welding standard	ASME Section IX:2010 including addenda 2011	

BASE METALS (QW-403)

	Product form	Specification (type or grade)	P no.	Grp-no.	Size	Sch.	Thick. (mm)	Dia. (mm)
Welded to:	Pipe/Tube	SA-312 (TP316L)	8	1	63,50	160	9,53	73,03
	Pipe/Tube	SA-312 (TP316L)	8	1	63,50	160	9,53	73,03
and tested:	Without PWHT							
Notes								

JOINTS (QW-402)

Joint design	Single-V-groove	See addition information	See addition information
Backing:	None		
Retainers	None		
Groove angle (deg.)	60		
Root opening (mm)	4		
Root face (mm)	0-1		

WELDING PROCESSES

Welding process	GTAW
Type	Manual

FILLER METALS (QW-404)

SFA specification	5.9	
AWS classification	ER316LSi	
Filler metal F-number	6	
Weld metal A-number	8	
Filler metal nominal composition	N.A.	
Filler metal trade name	Lincoln Electric, LNT 316LSi	
Filler metal size (mm)	2,0	2,4
Deposited thickness (mm)	9,53	
Maximum pass thickness (mm)	4	
Weld deposit chemistry	-	

POSITION (QW-405)

Position	6G
Weld progression	Uphill

PREHEAT (QW-406)


Preheat temperature (°C)	10
Maximum interpass temperature (°C)	132

GAS (QW-408)

Shielding gas:	Type	Argon (A5.32 SG-A)	
	Flow rate (l/min)	14	14
Trailing gas:	Type	None	
	Flow rate (l/min)	-	-
Backing gas:	Type	95%N2 - 5%H2	
	Flow rate (l/min)	12	12

ELECTRICAL (QW-409)

Filler metal size	(mm)	2,0	2,4
Amperes		84	92 - 94
Volts		10,1	9,7 - 10,4
Travel speed	(mm/min)	58	30 - 62
Maximum heat input	(kJ/mm)	0,87	1,93
Tungsten size	(mm)	2,4	
Tungsten type		SFA 5.12 EWCe-2	
Current/polarity		DCEN (straight polarity)	DCEN (straight polarity)
DC pulsing current		None	



NARGAN
COMPANY

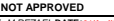
INSPECTION

1- APPROVED ☒

2- APPROVED AS NOTED ☐

3- NOT APPROVED ☐

BY: M. REZAEI DATE: 21 April 2024

SIGN: 



TECHNIQUE (QW-410)

String or weave	Stringer and Weave
Orifice/gas cup size	9,5
Multi/Single pass per side	Multiple passes
Peening	Not used
Initial/interpass cleaning	Brushing and Grinding
Back gouging method	None

Airpack Netherlands BV

Groeneweegje 19 - 25, 4301 RN Zierikzee, The Netherlands

ASME - Procedure Qualification Record (PQR) - Test results (as welded)

WeldOffice WPS



PQR record number	RET 0245029-001-21	Revision 1	WPS record number	P3000	Revision 1
Date	13-6-2012		Company name	Airpack Netherlands BV	
			Welding standard	ASME Section IX:2010 including addenda 2011	

TENSILE TESTS (QW-150)

Reduced section

Specimen number	Width (mm)	Thickness (mm)	Area (mm ²)	Ultimate total load (N)	Ultimate unit stress (MPa)	Type of failure and location
1	19.00	9.42	178,980	-	555 N/mm ²	
2	19.00	9.30	176,700	-	581 N/mm ²	

Comments	
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GUIDED BEND TESTS (QW-160)

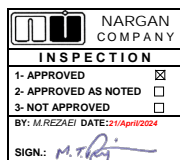
Type of test	Acceptance criteria	Result	Comments
Face bend	QW 163	Acceptable	
Face bend	QW 163	Acceptable	
Root bend	QW 163	Acceptable	
Root bend	QW 163	Acceptable	

Comments	
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CERTIFICATION

Welder's name	ID Number	Stamp number	Mechanical testing by	
A. Sumantri	ID Card IXH4P6551	A1	Laboratory test number	Schielab BV Breda (NLD)
			Test file number	SL 12.6047-1A
			Tests conducted by	ARL1559-5 A. Karstanje

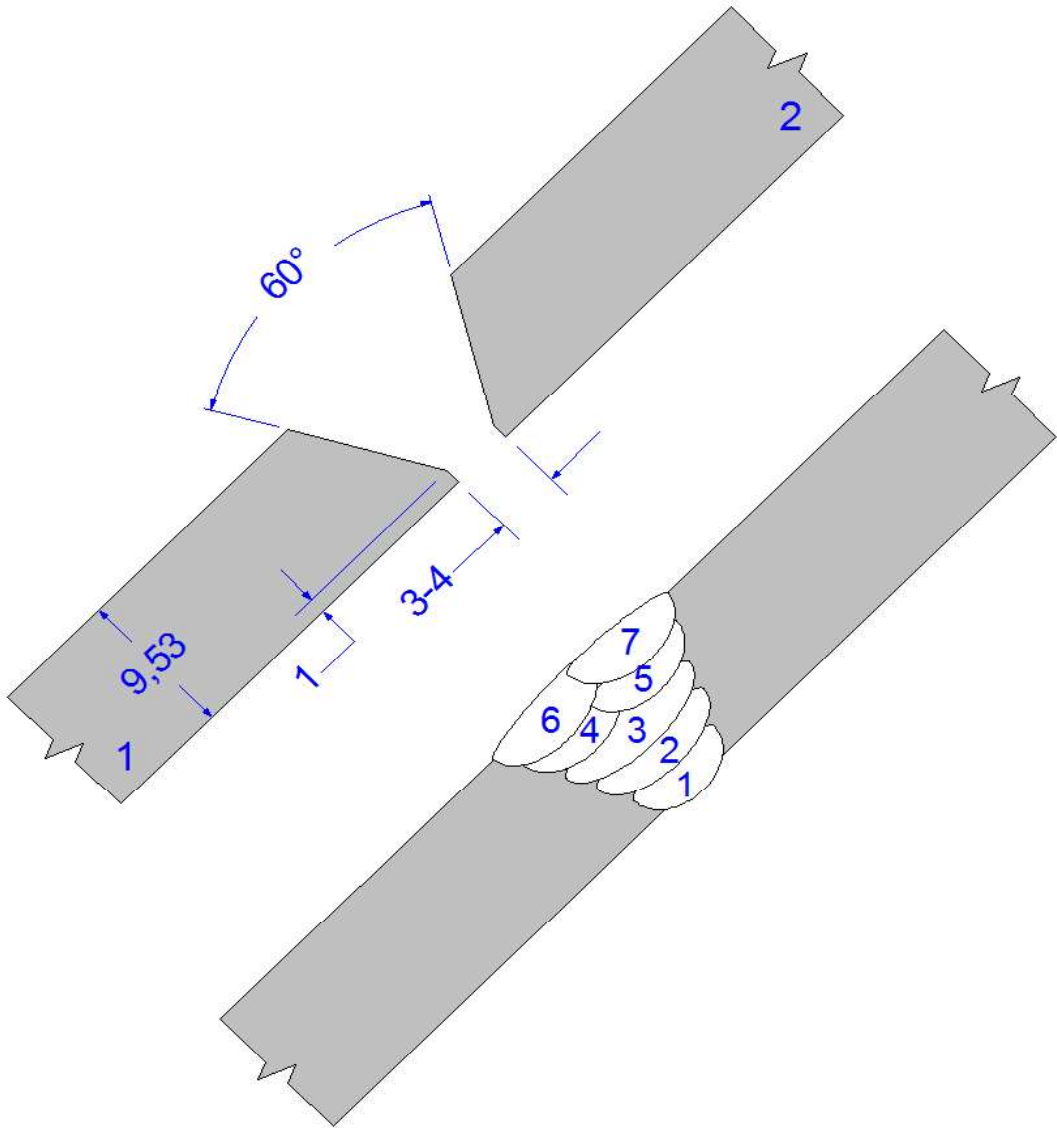
We certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code.





Signature 1

Name	Signature	Name	Signature
Franky van Toledo		W. Komdeur (Lloyds)	
Date		Date	
8-6-2012		8-6-2012	

PQR record number	RET 0245029-001-21	Revision 1	WPS record number	P3000	Revision 1
Date	13-6-2012		Company name	Airpack Netherlands BV	
			Welding standard	ASME Section IX:2010 including addenda 2011	



Pipe diameter 2½" xSCH160 (73,03x9,53 mm)

 NARGAN COMPANY	
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 21 April 2024	
SIGN: 	

Airpack Netherlands BV

Groeneweegje 19 - 25, 4301 RN Zierikzee, The Netherlands

ASME - Welding conditions - (PQRD Welding Data Record)

WeldOffice WPS



PQRD number	ARL1559-5	Revision 1	Date	29-5-2012
PQR number	RET 0245029-001-21	Revision 1	Welding standard	ASME Section IX:2010 including addenda 2011
WPS number	P3000	Revision 1	Company name	Airpack Netherlands BV
			To be tested	Without PWHT

WELDING PROCESSES

Welding process	GTAW
Type	Manual

BASE METALS (QW-403)

Product form	Pipe/Tube
Material control number	3D995
Specification (type or grade)	SA-312 (TP316L)
Nominal composition	16Cr-12Ni-2Mo
Trade name	Changshu Walsin Spec.
P number	8
G number	1
AWS group number	U
Nominal pipe/tube size	63,50
Schedule	160
Length (mm)	150
Width (OD) (mm)	73,03
Thickness (mm)	9,53

Welded to:

Product form	Pipe/Tube
Material control number	3D995
Specification (type or grade)	SA-312 (TP316L)
Nominal composition	16Cr-12Ni-2Mo
Trade name	Changshu Walsin Spec.
P number	8
G number	1
AWS group number	U
Nominal pipe/tube size	63,50
Schedule	160
Length (mm)	150
Width (OD) (mm)	73,03
Thickness (mm)	9,53

JOINTS (QW-402)

Joint design	Single-V-groove	See addition information	See addition information
Backing:	None		
Retainers	None		
Groove angle (deg.)	60		
Root opening (mm)	4		
Root face (mm)	0-1		

CLEANING/ROOT TREATMENT

Surface preparation	Grinding
Initial/interpass cleaning	Brushing and Grinding
Back gouging method	None

INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 21 April 2024	
SIGN:	

Airpack Netherlands BV

Groeneweegje 19 - 25, 4301 RN Zierikzee, The Netherlands

ASME - Welding parameters - (PQRD Welding Data Record)

WeldOffice WPS



PQRD number	ARL1559-5	Revision	1	Date	29-5-2012
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PASS INFORMATION

Pass number	1	2	3	4	5	6
Layer number	1	2	3	4	4	5

WELDING PROCESSES

Welding process	GTAW	GTAW	GTAW	GTAW	GTAW	GTAW
Type	Manual	Manual	Manual	Manual	Manual	Manual

FILLER METALS (QW-404)

Material control number	80V7074	55072526	55072526	55072526	55072526	55072526
SFA specification	5.9	5.9	5.9	5.9	5.9	5.9
AWS classification	ER316LSi	ER316LSi	ER316LSi	ER316LSi	ER316LSi	ER316LSi
Filler metal F-number	6	6	6	6	6	6
Weld metal A-number	8	8	8	8	8	8
Filler metal nominal composition	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Filler metal trade name	Lincoln LNT 316LSi	Lincoln LNT 316LSi	Lincoln LNT 316LSi	Lincoln Electric, LNT 316LSi	Lincoln LNT 316LSi	Lincoln LNT 316LSi
Filler metal size (mm)	2,0	2,4	2,4	2,4	2,4	2,4
Length of filler metal consumed (mm)	-	-	-	-	-	-
Deposited thickness (mm)	3	2	2	2	2	2
Maximum pass thickness (mm)	4	4	4	4	4	4
Weld deposit chemistry	-	-	-	-	-	-
Flux nominal composition	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Flux trade name	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

POSITION (QW-405)

Position	6G	6G	6G	6G	6G	6G
Weld progression	Uphill	Uphill	Uphill	Uphill	Uphill	Uphill

PREHEAT (QW-406)

Preheat temperature (°C)	10	10	10	10	10	10
Maximum interpass temperature (°C)	10	86	126	131	124	127

GAS (QW-408)

Shielding gas: Type	Argon (A5.32 SG-A)	Argon (A5.32 SG-A)	Argon (A5.32 SG-A)	Argon (A5.32 SG-A)	Argon (A5.32 SG-A)	Argon (A5.32 SG-A)
Flow rate (l/min)	14	14	14	14	14	14
Trailing gas: Type	None	None	None	None	None	None
Flow rate (l/min)	-	-	-	-	-	-
Backing gas: Type	95%N2 - 5%H2	95%N2 - 5%H2	95%N2 - 5%H2	95%H2 - 5%N2	95%H2 - 5%N2	95%N2 - 5%H2
Flow rate (l/min)	12	12	12	12	12	12

ELECTRICAL (QW-409)

Filler metal size (mm)	2,0	2,4	2,4	2,4	2,4	2,4
Amperes	84	92	94	94	94	94
Volts	10,1	9,7	10,1	9,7	10	10,4
Travel speed (mm/min)	58	62	31	54	45	41
Maximum heat input (kJ/mm)	0,8777	0,8636	1,8375	1,0131	1,2533	1,4306
Tungsten size (mm)	2,4	2,4	2,4	2,4	2,4	2,4
Tungsten type	SFA 5.12 EWCe-2	SFA 5.12 EWCe-2	SFA 5.12 EWCe-2	SFA 5.12 EWCe-2	SFA 5.12 EWCe-2	SFA 5.12 EWCe-2
Current/polarity	DCEN (straight polarity)	DCEN (straight polarity)	DCEN (straight polarity)	DCEN (straight polarity)	DCEN (straight polarity)	DCEN (straight polarity)
DC pulsing current	None	None	None	None	None	None

TECHNIQUE (QW-410)

String or weave	Stringer and Weave	Stringer and Weave	Stringer and Weave	Stringer and Weave	Stringer and Weave	Stringer and Weave
Orifice/gas cup size	9,5	9,5	9,5	9,5	9,5	9,5
Multi/Single pass per side	Multiple passes	Multiple passes	Multiple passes	Multiple passes	Multiple passes	Multiple passes
Peening	Not used	Not used	Not used	Not used	Not used	Not used
Initial/interpass cleaning	Brushing and Grinding	Brushing and Grinding	Brushing and Grinding	Brushing and Grinding	Brushing and Grinding	Brushing and Grinding
Back gouging method	None	None	None	None	None	None

NARGAN COMPANY	
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
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3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 21 April 2014	
SIGN:	

PASS PERFORMED/WITNESSED BY

Welders name	A. Sumantri	A. Sumantri	A. Sumantri	A. Sumantri	A. Sumantri	A. Sumantri
Recorded/witnessed by	A.J.H. Roza (IWT/IWI)	A.J.H. Roza (IWT/IWI)	A.J.H. Roza (IWT/IWI)	A.J.H. Roza (IWT/IWI)	A.J.H. Roza (IWT/IWI)	A.J.H. Roza (IWT/IWI)
Date	29-5-2012	29-5-2012	29-5-2012	29-5-2012	29-5-2012	29-5-2012
Data entry by	A.J.H. Roza (IWT/IWI)	A.J.H. Roza (IWT/IWI)	A.J.H. Roza (IWT/IWI)	A.J.H. Roza (IWT/IWI)	A.J.H. Roza (IWT/IWI)	A.J.H. Roza (IWT/IWI)

Airpack Netherlands BV

Groeneweegje 19 - 25, 4301 RN Zierikzee, The Netherlands

ASME - Welding parameters - (PQRD Welding Data Record)

WeldOffice WPS



PQRD number	ARL1559-5	Revision	1	Date	29-5-2012
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PASS INFORMATION

Pass number	7				
Layer number	5				

WELDING PROCESSES

Welding process	GTAW				
Type	Manual				

FILLER METALS (QW-404)

Material control number	55072526				
SFA specification	5.9				
AWS classification	ER316LSi				
Filler metal F-number	6				
Weld metal A-number	8				
Filler metal nominal composition	N.A.				
Filler metal trade name	Lincoln LNT 316LSi				
Filler metal size (mm)	2,4				
Length of filler metal consumed (mm)	-				
Deposited thickness (mm)	3				
Maximum pass thickness (mm)	4				
Weld deposit chemistry	-				
Flux nominal composition	N.A.				
Flux trade name	N.A.				

POSITION (QW-405)

Position	6G				
Weld progression	Uphill				

PREHEAT (QW-406)

Preheat temperature (°C)	10				
Maximum interpass temperature (°C)	132				

GAS (QW-408)

Shielding gas: Type	Argon (A5.32 SG-A)				
Flow rate (l/min)	14				
Trailing gas: Type	None				
Flow rate (l/min)	-				
Backing gas: Type	95%N2 - 5%H2				
Flow rate (l/min)	12				

ELECTRICAL (QW-409)

Filler metal size (mm)	2,4				
Amperes	94				
Volts	10.3				
Travel speed (mm/min)	30				
Maximum heat input (kJ/mm)	1,9364				
Tungsten size (mm)	2,4				
Tungsten type	SFA 5.12 EWCe-2				
Current/polarity	DCEN (straight polarity)				
DC pulsing current	None				

TECHNIQUE (QW-410)

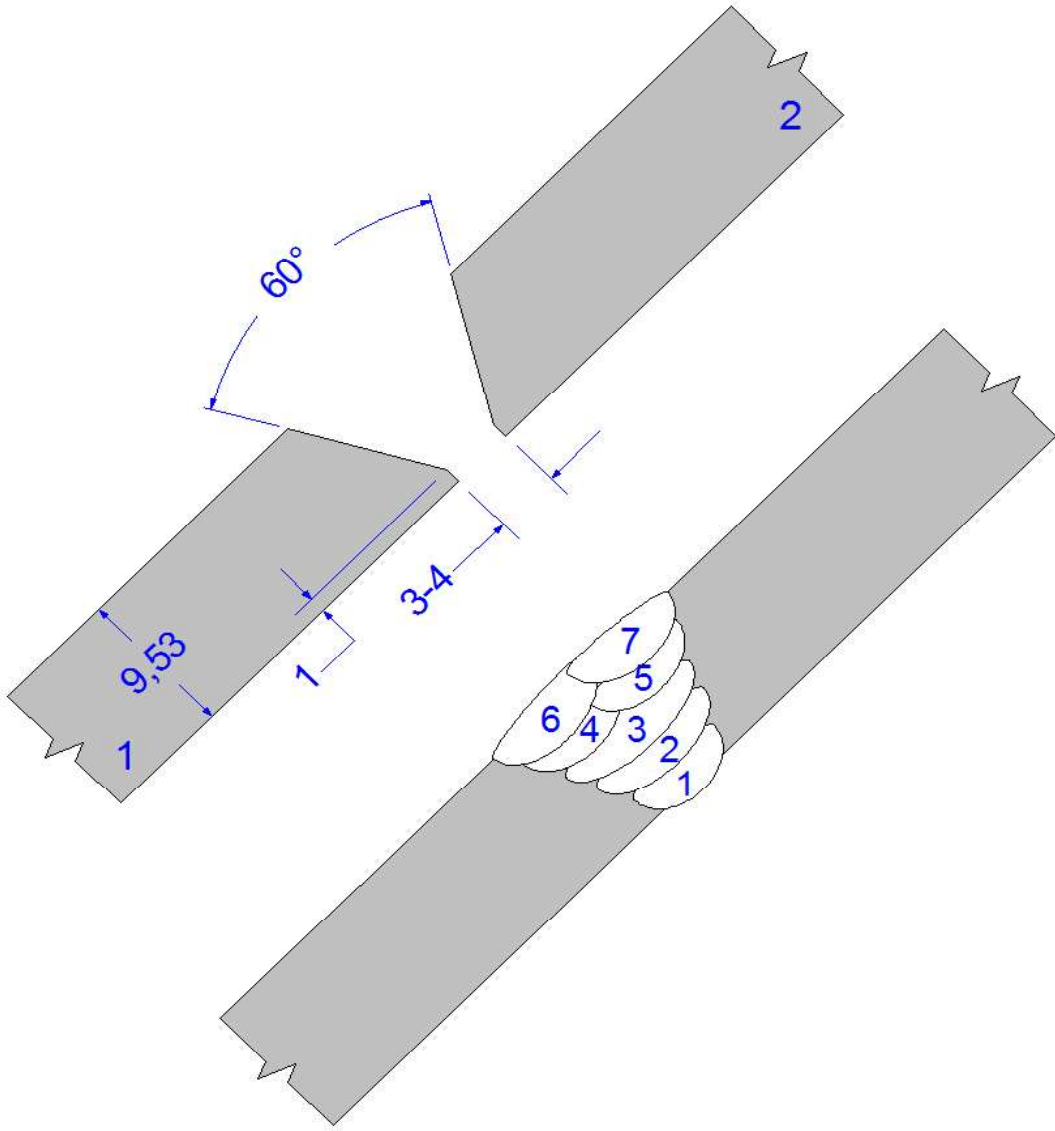
String or weave	Stringer and Weave				
Orifice/gas cup size	9,5				
Multi/Single pass per side	Multiple passes				
Peening	Not used				
Initial/interpass cleaning	Brushing and Grinding				
Back gouging method	None				

NARGAN COMPANY	
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 21 April 2004	
SIGN:	


PASS PERFORMED/WITNESSED BY

Welders name	A. Sumantri				
Recorded/witnessed by	A.J.H. Roza (IWT/IWI)				
Date	29-5-2012				
Data entry by	A.J.H. Roza (IWT/IWI)				

PQRD number	ARL1559-5	Revision 1	Date	29-5-2012
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Pipe diameter 2½" xSCH160 (73,03x9,53 mm)

NARGAN COMPANY	
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 21 April 2024	
SIGN: 	

PQR record number	RET0278790/TK/004	Revision 1	WPS record number	SP4000	Revision 1
Date	1-6-2016		Company name	Airpack Netherlands BV	
			Welding standard	ASME Section ASME IX:2015	

BASE METALS (QW-403)

	Product form	Specification (type or grade)	P no.	Grp-no.	Size	Sch.	Thick. (mm)	Dia. (mm)
Welded to:	Plate	S355MC acc. EN 10149-2	U	None	-	-	10	-
	Pipe	SA-312 (TP316L)	8	1	38,10	80	5,08	48,26
and tested:	Without PWHT, Fillet-weld test							
Notes								

JOINTS (QW-402)

Joint design	Fillet weld		
		See addition information	See addition information

WELDING PROCESSES

Welding process	GTAW
Type	Manual

FILLER METALS (QW-404)

SFA specification	5,9
AWS classification	ER309LSi
Filler metal F-number	6
Weld metal A-number	8
Filler metal nominal composition	-
Filler metal trade name	Lincoln Ellectric LNT 309LSi
Filler metal size (mm)	2,4
Deposited thickness (mm)	0,00
Maximum pass thickness (mm)	5
Weld deposit chemistry	-

POSITION (QW-405)

Position	2F
Weld progression	-

PREHEAT (QW-406)

Preheat temperature (°C)	10
Maximum interpass temperature (°C)	10

GAS (QW-408)


Shielding gas: Type	Argon (A5.32 SG-A)
Flow rate (l/min)	10
Trailing gas: Type	None
Flow rate (l/min)	-
Backing gas: Type	None
Flow rate (l/min)	-

ELECTRICAL (QW-409)

Filler metal size (mm)	2,4
Waveform control	Not Used
Energy (J)	-
Power (J/s)	-
Arc time (sec)	-
Weld bead length (mm)	-
Amperes	131
Volts	13,2
Travel speed (mm/min)	47
Maximum heat input (kJ/mm)	2,174
Tungsten size (mm)	2,4
Tungsten type	SFA 5.12 EWLa-1
Current/polarity	DCEN
DC pulsing current	Not used

TECHNIQUE (QW-410)

String or weave	Stringer and Weave
Orifice/gas cup size	9,5
Multi/Single pass per side	Single pass
Peening	Not used
Initial/interpass cleaning	N.A.
Back gouging method	None

NARGAN COMPANY	
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 21 April 2024	
SIGN: 	

PQR record number	RET0278790/TK/004	Revision 1	WPS record number	SP4000	Revision 1
Date	1-6-2016		Company name	Airpack Netherlands BV	
			Welding standard	ASME Section ASME IX:2015	

TENSILE TESTS (QW-150)

Specimen number	Width (mm)	Thickness (mm)	Area (mm²)	Ultimate total load (N)	Ultimate unit stress (MPa)	Type of failure and location
Comments						

GUIDED BEND TESTS (QW-160)

Type of test	Acceptance criteria	Result	Comments
Comments			

FILLET WELD TESTS (QW-180)

Type of test	Acceptance criteria	Result	Fillet leg size (mm) x (mm)
4x Macroscopic examination	ASME IX	Acceptable	4,2x4,2
Comments			


CERTIFICATION

Welder's name	ID Number	Stamp number	Mechanical testing by	Element Breda (NLD)
Dorremans M.	ID Card IKP0996J6	W-013	Laboratory test number	ARJ001-16-01-18390-4
			Test file number	ARL2064-4
			Tests conducted by	A. Karstanje


We certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code.

INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 21 April 2016	
SIGN: 	

Signature 1

Name	Signature
F. van Toledo	
Date	1-6-2016

Signature 2

Name	Signature
T. Konings (lloyds)	
Date	1-6-2016

☐ Witnessed
☒ Reviewed
☐ Examined
T. Konings



PQRD number	ARL2064-4	Revision 1	Date	1-6-2016
PQR number	RET0278790/TK/004	Revision 1	Welding standard	ASME Section ASME IX:2015
WPS number	SP4000	Revision 1	Company name	Airpack Netherlands BV
			To be tested	Without PWHT

WELDING PROCESSES

Welding process	GTAW
Type	Manual

BASE METALS (QW-403)



Product form	Plate	Welded to:	Product form	Pipe
Material control number	140287		Material control number	470133
Specification (type or grade)	S355MC acc. EN 10149-2		Specification (type or grade)	SA-312 (TP316L)
Nominal composition	C-Mn		Nominal composition	16Cr-12Ni-2Mo
Trade name	Severstal		Trade name	Salzgitter
P number	U		P number	8
G number	None		G number	1
AWS group number	II		AWS group number	U
Nominal pipe/tube size	-		Nominal pipe/tube size	38,10
Schedule	-		Schedule	80
Length (mm)	150		Length (mm)	150
Width (OD) (mm)	150		Width (OD) (mm)	48,26
Thickness (mm)	10		Thickness (mm)	5,08

JOINTS (QW-402)

Joint design	Fillet weld		
		See addition information	See addition information

CLEANING/ROOT TREATMENT

Surface preparation	Grinding and Brushing
Initial/interpass cleaning	N.A.
Back gouging method	None

 NARGAN COMPANY	
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 21 April 2024	
SIGN: 	

PQRD number	ARL2064-4	Revision 1	Date	1-6-2016
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PASS INFORMATION

Pass number	1
Layer number	1

WELDING PROCESSES

Welding process	GTAW
Type	Manual

FILLER METALS (QW-404)

Material control number	55E80442
SFA specification	5.9
AWS classification	ER309LSi
Filler metal F-number	6
Weld metal A-number	8
Filler metal nominal composition	-
Filler metal trade name	Lincoln Ellectric LNT 309LSi
Filler metal size (mm)	2,4
Length of filler metal consumed (mm)	-
Deposited thickness (mm)	throat thickenss 3 mm
Maximum pass thickness (mm)	5
Weld deposit chemistry	-
Flux nominal composition	-
Flux trade name	-

POSITION (QW-405)

Position	2F
Weld progression	-

PREHEAT (QW-406)

Preheat temperature (°C)	10
Maximum interpass temperature (°C)	10

GAS (QW-408)


Shielding gas: Type	Argon (A5.32 SG-A)
Flow rate (l/min)	10
Trailing gas: Type	None
Flow rate (l/min)	-
Backing gas: Type	None
Flow rate (l/min)	-

ELECTRICAL (QW-409)

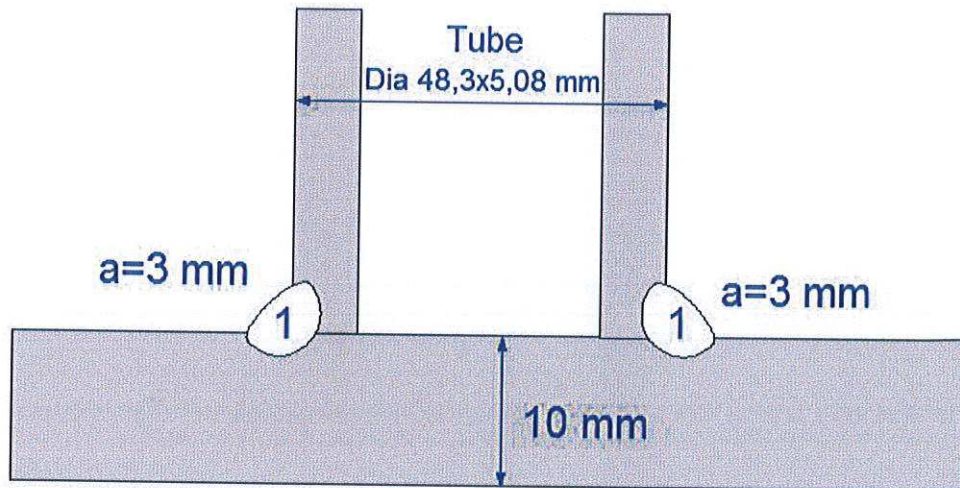
Filler metal size (mm)	2,4
Waveform control	Not Used
Energy (J)	none
Power (J/s)	none
Arc time (sec)	none
Weld bead length (mm)	none
Amperes	131
Volts	13.2
Travel speed (mm/min)	47
Maximum heat input (kJ/mm)	2,2075
Tungsten size (mm)	2,4
Tungsten type	SFA 5.12 EWLa-1
Current/polarity	DCEN
DC pulsing current	Not used


TECHNIQUE (QW-410)

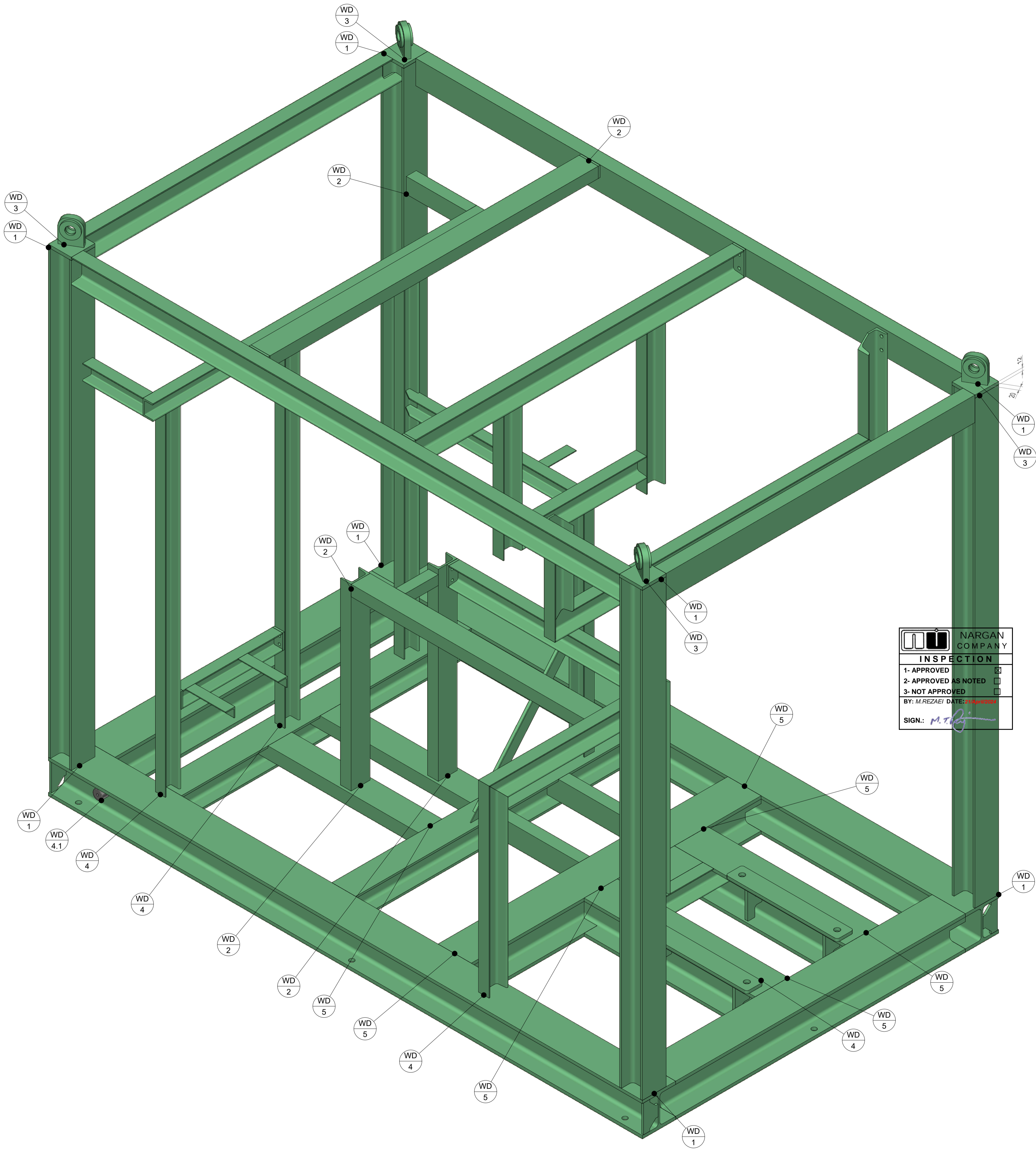
String or weave	Stringer and Weave
Orifice/gas cup size	9,5
Multi/Single pass per side	Single pass
Peening	Not used
Initial/interpass cleaning	N.A.
Back gouging method	None

NARGAN COMPANY	
INSPECTION	
1- APPROVED	<input checked="" type="checkbox"/>
2- APPROVED AS NOTED	<input type="checkbox"/>
3- NOT APPROVED	<input type="checkbox"/>
BY: M. REZAEI DATE: 21 April 2016	
SIGN: 	

PQRD number	ARL2064-4	Revision 1	Date	1-6-2016
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BY: M. REZAEI DATE: 21 April 2016	
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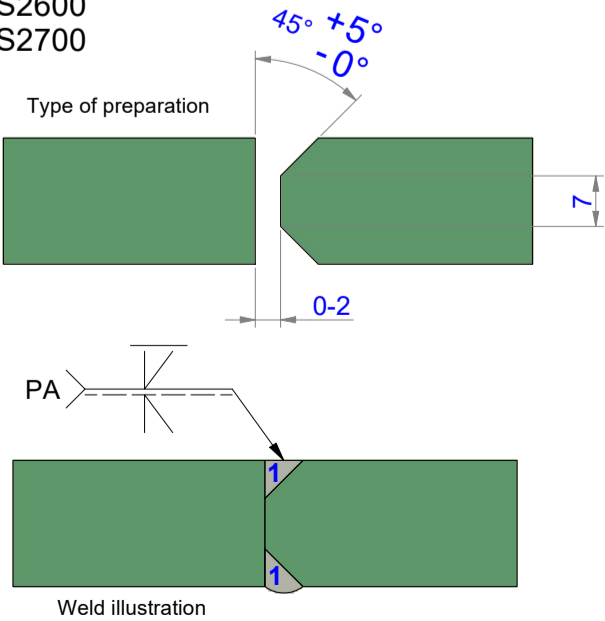


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BY: M.REZAEI DATE: 20-3-2024	
SIGN:	

NOTE:
Material of construction: S235JR
Material Thickness: Min. 6 mm and max. 20 mm

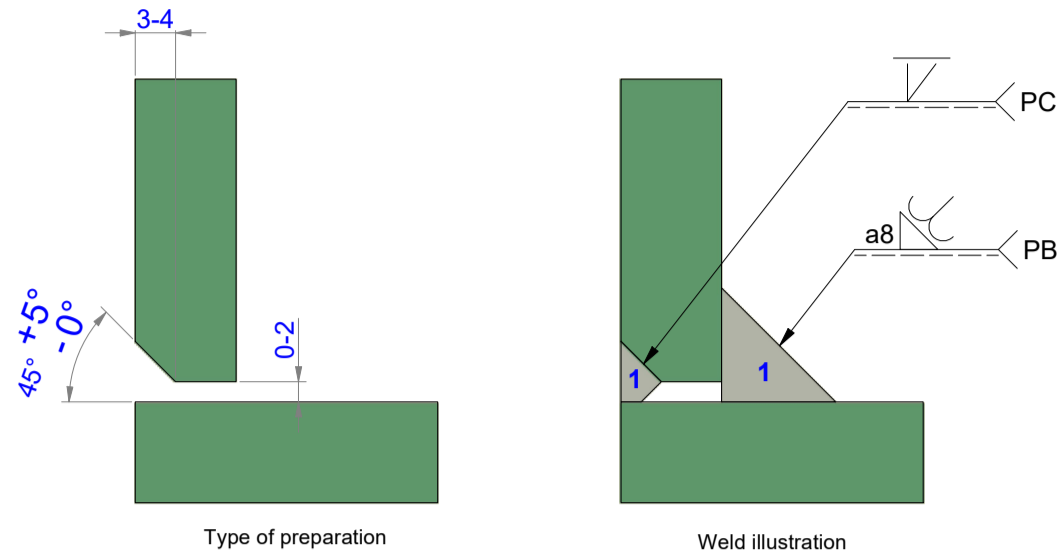
WD-5

PQR/ WPS reference:
PQR/ WPS-S2300
PQR/ WPS-S2600
PQR/ WPS-S2700



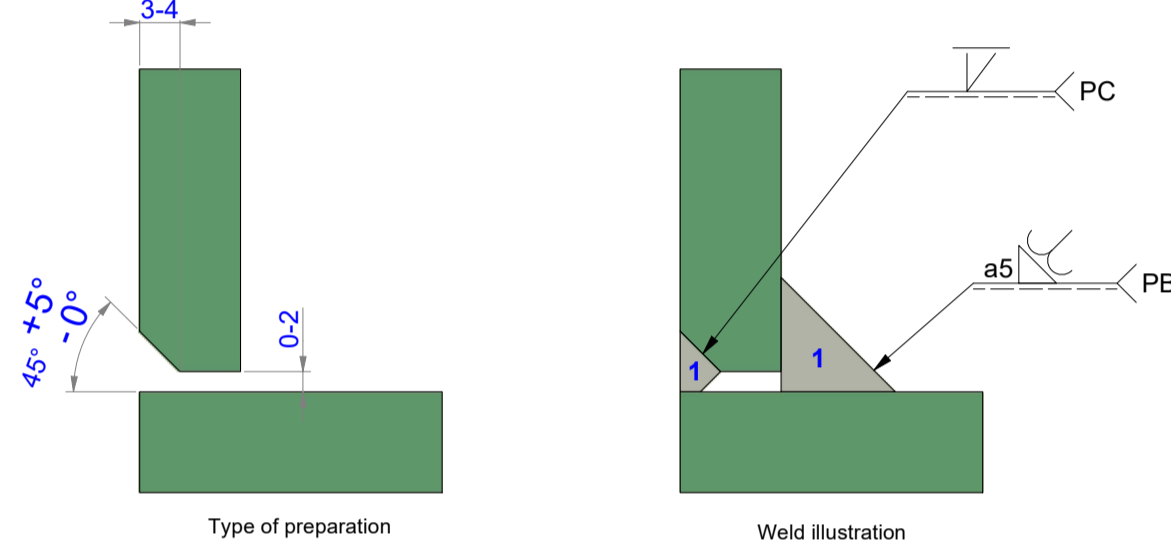
WD-1

PQR/ WPS reference:
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PQR/ WPS-S2600
PQR/ WPS-S2700



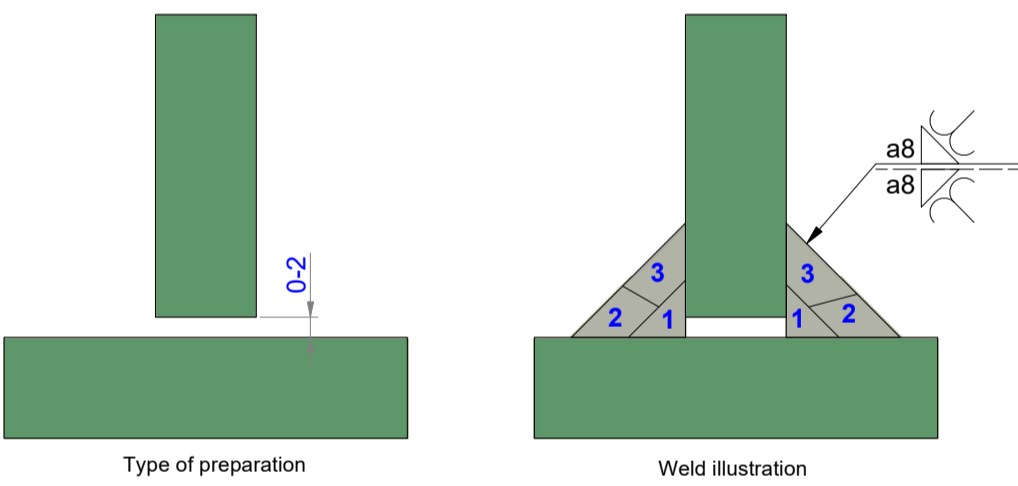
WD-2

PQR/ WPS reference:
PQR/ WPS-S2300
PQR/ WPS-S2600
PQR/ WPS-S2700



WD-3

PQR/ WPS reference:
PQR/ WPS-S2300

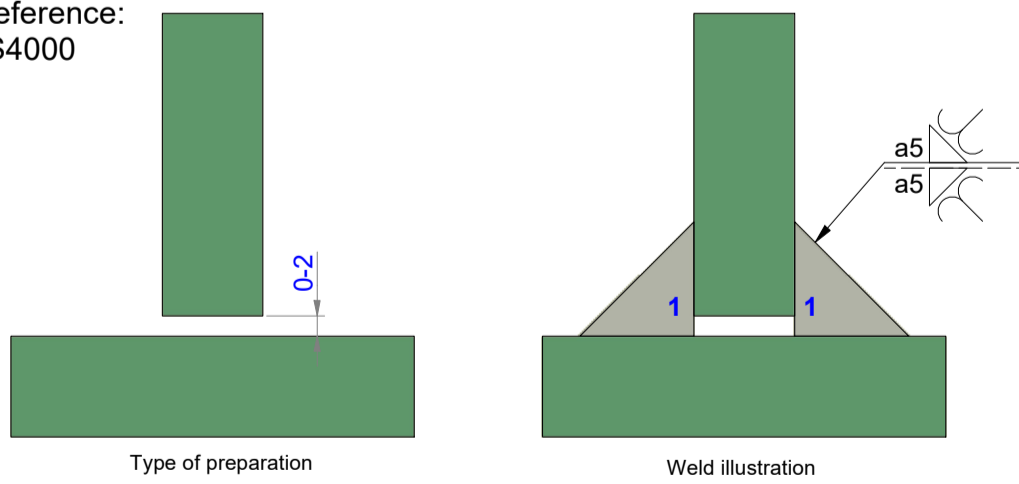




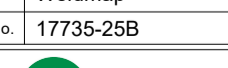
WD-4

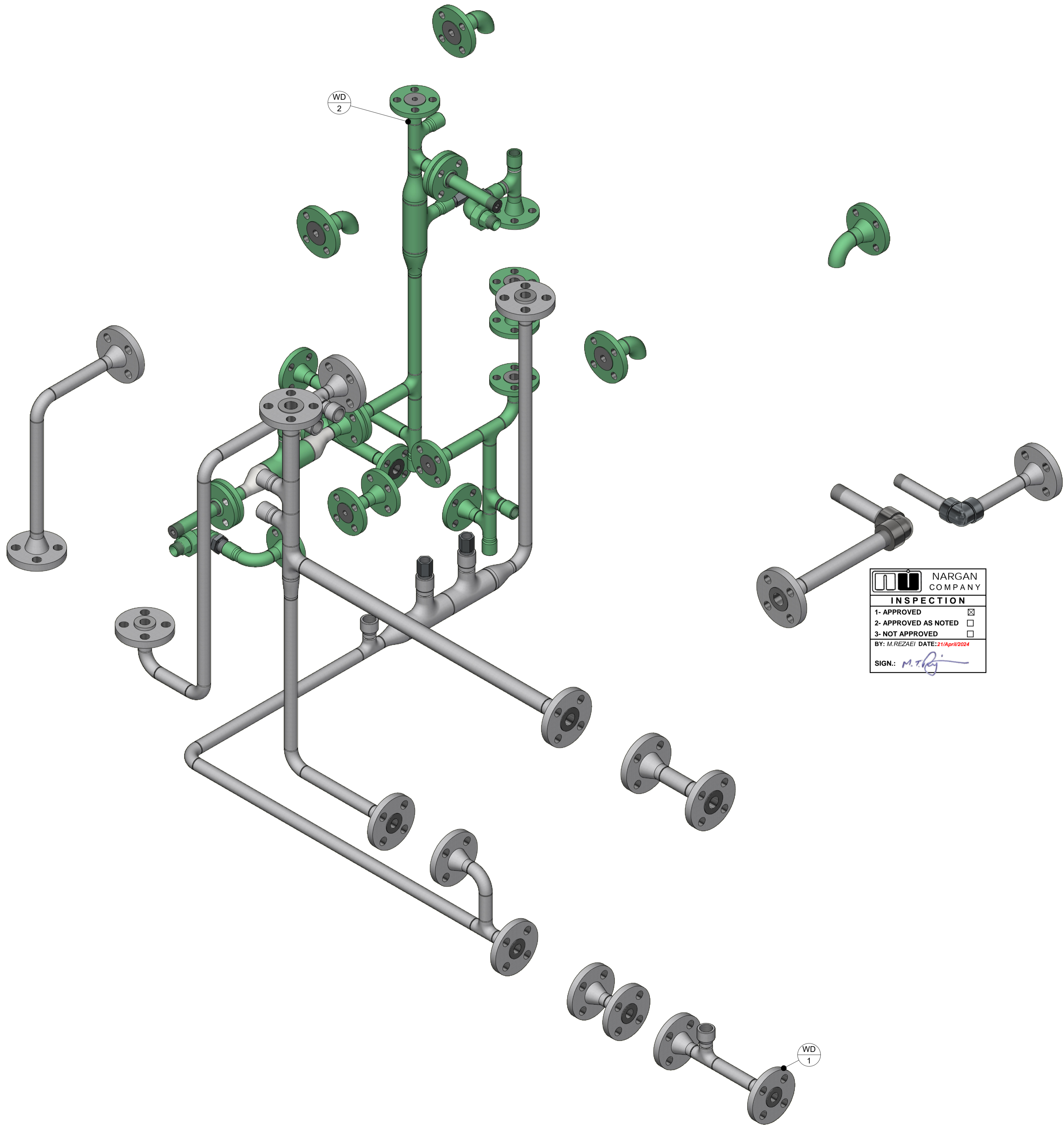
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PQR/ WPS-S2300

WD-4.1

PQR/ WPS reference:
PQR/ WPS-S4000



Subject		Projection		<div>This drawing is owned by Airpack and shall not be printed or copied in any other way than with Airpack's PERMISSION</div> 
Weld Map Skid				
				
Client	Lavan Industry Development Company (LIDCO)			MODIFICATIONS
Client Ref.	Weldmap			
Client Doc. No.	17735-25B			
		Airpack Nederland BV		
		Gronseweg 25		
		4301 RM Zurikzele		
		The Netherlands		
		Telephone (31) (0) 111 - 415445 Email: airpack@airpack.nl URL: http://www.airpack.nl		
		Date	20-3-2024	
		Drawn by	FvT	
		Checked by	SK	
		Plant Location		
		Scale		
		Airpack Ref.	17735-COM	
		Drawing No.	17735-25B Weldmap Skid	
				Sheet 1 of 1



NARGAN COMPANY

INSPECTION

1- APPROVED ☒

2- APPROVED AS NOTED ☐

3- NOT APPROVED ☐

BY: M. REZAEI DATE: 21/April/2024

SIGN: *M. Rezaei*

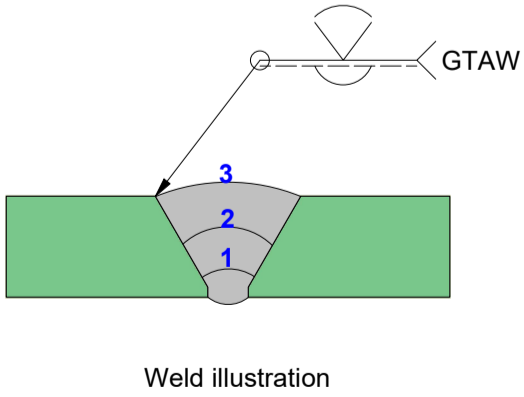
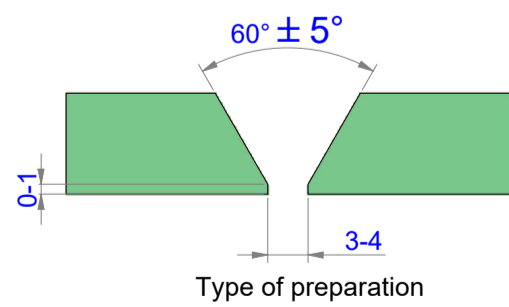
Type-1



WPS/PQR reference:
P2000 Material of construction: A/SA 106-B / A/SA 234 WPB
P2500 Material of construction: A/SA 105N

Type-2

WPS/PQR reference:
P3000 Material of construction: A/SA 316L

Material Thickness: Min. 2,9 mm and max. 3,7 mm



Subject		Projection		<div>This drawing is owned by Airpack and shall not be printed or copied in any other way than with Airpack's PERMISSION</div>	
Weld Map Piping		<div></div>			
Client	Lavan Industry Development Company (LIDCO)	MODIFICATIONS			
Client Ref.	Weldmap	Date		20-3-2024	
Client Doc. No.	17735-25A	Drawn by		FVT	
<div><div>Airpack Nederland BV Gronseweg 25 4301 RH Zevenlue The Netherlands Telephone (31) (0) 111 - 415455 Email: airpack@airpack.nl URL: http://www.airpack.nl</div></div>		Checked by			
		Plant Location			
		Scale			
		Airpack Ref.		17735-COM	
		Drawing No.		17735-25A Weldmap Piping	Sheet 1 of 1

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION K-28

DOCUMENTS; WPQ



Vendor doc. Number
17735-19

P.O. NO.:
LIDCO-PO-NEC-278-6019

Vendor:
Airpack Nederland B.V.



**Airpack B.V. - Air Compressor –
Integrated Methanol and Ammonia Plant
17735-COM WPQ (K020)**

						INSPECTION
						REVIEWED <input checked="" type="checkbox"/>
						WITNESSED <input type="checkbox"/>
						RELEASED <input type="checkbox"/>
						BY: M. REZAEI DATE: 1302-2023
						SIGN:
01	12-12-2023	Issued for Information	S.K.	J.J.	S.K.	
REV.	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED	

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LIST OF REVISED PAGES


Rev. Page	01	02	03	04	05	Rev. Page	01	02	03	04	05	Rev. Page	01	02	03	04	05	Rev. Page	01	02	03	04	05
1	X					26	X					51	X					76					
2	X					27	X					52	X					77					
3	X					28	X					53	X					78					
4	X					29	X					54	X					79					
5	X					30	X					55	X					80					
6	X					31	X					56	X					81					
7	X					32	X					57	X					82					
8	X					33	X					58	X					83					
9	X					34	X					59	X					84					
10	X					35	X					60	X					85					
11	X					36	X					61	X					86					
12	X					37	X					62	X					87					
13	X					38	X					63						88					
14	X					39	X					64						89					
15	X					40	X					65						90					
16	X					41	X					66						91					
17	X					42	X					67						98					
18	X					43	X					68						ATTACHMENT					
19	X					44	X					69						1					
20	X					45	X					70						2					
21	X					46	X					71						3					
22	X					47	X					72						4					
23	X					48	X					73						5					
24	X					49	X					74						6					
25	X					50	X					75						7					

WARGA
COMPA

INSPECTION


REVIEWED
WITNESSED
RELEASED

BY: M. T. H. DATE: 2023-09-05

SIGN: 

NARGAN COMPANY	
INSPECTION	
REVIEWED	<input checked="" type="checkbox"/>
WITNESSED	<input type="checkbox"/>
RELEASED	<input type="checkbox"/>
SIGN: <i>M. H. H.</i>	

WPQ

		NARGAN COMPANY
INSPECTION		
REVIEWED	<input checked="" type="checkbox"/>	
WITNESSED	<input type="checkbox"/>	
RELEASED	<input type="checkbox"/>	
BY: M. REZAEI DATE: 13 Dec. 2023		
SIGN: 		

WPQ

SKID

 NARGAN COMPANY	
INSPECTION	
REVIEWED	<input checked="" type="checkbox"/>
WITNESSED	<input type="checkbox"/>
RELEASED	<input type="checkbox"/>
BY: M. REZAEI DATE: 13 Dec. 2023	
SIGN: 	

Welder's name	Berrevoots A.	Test date	28-11-2022
ID Number	Verified by DNV	WPQ record number	A1153205-2-61
Date of birth	27-3-1968	Standard test number	N.A.
Stamp number	BA	WPS record number	S2400
Company name	Airpack Netherlands BV	Qualification code	AWS D1.1: 2020
Division	N.A.		

BASE METALS

	Product form	Specification (type or grade)	P no.	Grp.no.	Size	Sch.	Thick. (mm)	Dia. (mm)
Welded to:	Plate	API 2H (50)	U	II	-	-	20	-
	Plate	API 2H (50)	U	II	-	-	20	-
Joint type	Fillet							

VARIABLES

	Actual values	RANGE QUALIFIED
Type of weld joint	Plate - Fillet	Fillet welds
Base metal	Group II to Group II	Carbon and Low-Alloy Steel

BASE METAL THICKNESS

	Groove	Fillet	Groove	Fillet
Plate thickness (mm)	-	20	-	3 min.
Pipe/tube thickness (mm)	-	-	-	3 min.
Pipe size (mm)	-	-	-	600 min.

PROCESS VARIABLES

	Actual values	RANGE QUALIFIED
Welding process	GMAW	GMAW
Type	Semi-automatic	Semi-automatic, Machine, Automatic
Backing	With	With
Filler metal specification	5.18	A5.xx
Filler metal classification	E70C-6MH4	All
Weld position (Actual position tested)	3F	F.H,V
Fillet - Plate & Pipe >= 610mm		F.H,V
Fillet - Pipe 73mm to 610mm		F.H,V
Fillet - Pipe < 73mm		Up
Progression	Up	Spray, pulse, globular
GMAW transfer mode	Spray	A5.xx approved
Shielding gas/flux	AC-20	

TESTS

Type of test	Acceptance criteria	Result	Comments
Visual examination per clause 4.9.1	clause 4.9.1.2.	Acceptable	ARL 2717
1x Break test acc. clause 4.31.4	clause 4.31.4.1	Acceptable	-
1x macroscopic examination acc. clause 4.31.2.3	clause 4.31.2.3	Acceptable	-
Notes	asdDDD		


CERTIFICATION

Tests conducted by	Maik van den Branden	Laboratory test number	Report ARJ001-22-12-53197-6
Mechanical tests by	Element Breda (NLD)	Test file number	ARL2717

We certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of section 4 of the ANSI/AWS D1.1 Structural Welding Code-Steel.

NARGAN COMPANY	
INSPECTION	
REVIEWED	<input checked="" type="checkbox"/>
WITNESSED	<input type="checkbox"/>
RELEASED	<input type="checkbox"/>
BY: M. REZAEI DATE: 13 Dec 2022	
SIGN: 	

Signature 1

Name	Signature
F. van Toledo	
Date	19-12-2022

Signature 2

Name	Signature
M. van Ginneken DNV	
Date	19-12-2022

 And found to comply with: Date: 2022-12-21 Sign: M. van Ginneken	Witnessed <input checked="" type="checkbox"/>
	Reviewed <input checked="" type="checkbox"/>

WPS record number	S2400	Revision 0	Qualified to	AWS D1.1/D1.1M:2010
Date	14-6-2012		Company name	Airpack Netherlands BV
Supporting PQR(s)	RET 0245029-001-26 - Rev 1			
Reference docs.				

Scope	Filletwelds single layer a <= 6 mm and multi layer filletwelds => 8 mm Fillet, no PWHT (As-welded)
Joint	Joint details for this welding procedure specification in: Production drawings

BASE METALS

Type	Plate	P-no. U	Grp-no. II
Welded to	Plate	P-no. U	Grp-no. II
Backing:	None	P-no.	Grp-no.
Retainers	None		
Notes			

THICKNESS RANGE QUALIFIED (mm)

	As-welded		With PWHT	
	Min.	Max.	Min.	Max.
Complete pen.	-	-	-	-
Impact tested	-	-	-	-
Partial pen.	-	-	-	-
Fillet welds	no min.	no max.	-	-

DIAMETER RANGE QUALIFIED (mm)

	As-welded		With PWHT	
	Min.	Max.	Min.	Max.
Nominal pipe size	610,	no max.	-	-

FILLER METALS

	SFA	Classification	F-no.	A-no.	Chemical analysis or Trade name	As-welded		With PWHT	
						Min.	Max.	Min.	Max.
GMAW	5.18	E70C-6MH4	6	-	Lincoln, Outershield MC715-H	3,	no max.	-	-
Sup. filler	-	-	-	-	-	- None -			

WELDING PROCEDURE

Welding process	GMAW								
Type	Semi-automatic								
Minimum preheat/interpass temperature (°C)	10								
Maximum interpass temperature (°C)	188								
Filler metal size (mm)	1,2								
Layer number	All								
Position	V								
Weld progression	Uphill								
Current/polarity	DCEP (reverse polarity)								
Waveform control									
Energy (J)									
Power (J/s)									
Amperes	127 - 157								
Volts	14,7 - 17,1								
Travel speed (mm/min)	54 - 112								
Maximum heat input (kJ/mm)	1,88								
Wire feed speed (m/min)	0,								
Arc transfer mode	Short-circuiting								
Shielding: Gas type	AC-20 (A5.32 SG-)								
Flow rate (l/min)	12 - 22								
Trailing: Gas type	None								
Flow rate (l/min)	-								
Backing: Gas type	None								
Flow rate (l/min)	-								
String or weave	Stringer or Weave								
Orifice/gas cup size (mm)	15								
C.T.W.D (mm)	15								
Multi/Single pass per side	Multiple passes								
Multi/single electrode	Single electrode								
Maximum pass thickness (mm)	5								
Weld deposit chemistry	-								
Notes									

NARGAN COMPANY	
INSPECTION	
REVIEWED	<input checked="" type="checkbox"/>
WITNESSED	<input type="checkbox"/>
RELEASED	<input type="checkbox"/>
BY: M. REZAEI DATE: 13 Dec 2023	
SIGN: <i>M. Rezaei</i>	



WPS record number	S2400	Revision 0	Qualified to	AWS D1.1/D1.1M:2010
Date	14-6-2012		Company name	Airpack Netherlands BV

PREHEAT TABLE

Applicable standard	
AWS D1.1 (Category A)	For thickness 3 to 19(mm): 0(°C). Preheat to 20(°C) if the base metal temperature is below 0(°C). Over 19 thru 38.1(mm): 66(°C). Over 38.1 thru 63.5(mm): 107(°C). Over 63.5(mm): 150(°C).

TECHNIQUE

Peening	Not used
Surface preparation	Grinding
Initial/interpass cleaning	Brushing and Grinding
Back gouging method	None

NOTES

 NARGAN COMPANY	
INSPECTION	
REVIEWED	<input checked="" type="checkbox"/>
WITNESSED	<input type="checkbox"/>
RELEASED	<input type="checkbox"/>
BY: M. REZAEI DATE: 13 Dec. 2023	
SIGN: 	

Signature 1

Signature 2

Name	Signature	Name	Signature
Date		Date	

Arjan Roza Lastechniek
G. Sterkenburgstraat 38
4268 GS MEEUWEN

Date(s) tested : 13-12-2022
Date reported : 13-12-2022
Element report number : ARJ001-22-12-53197-6

Customer reference : ARL2717

TEST REPORT

WELDERS PERFORMANCE QUALIFICATION TEST RECORD

Testing in accordance with : AWS D1.1:2020
Purchaser : Arjan Roza Lastechniek BV
Purchase order no. : ARL2717

Manufacturer : Airpack Nederland BV.
WPS : S2400

Description of sample(s) : Plate with filletweld multipass
Dimension(s) : 380x150x20 mm
Group number : II -II
Material grade : API 2W grade 50 - API 2W grade 50

Welding process(es) : GMAW (metal cored)
Filler : SFA 5.18 : E70C-6MH4, F-number 6
Brand and type : Lincoln Electric Outershield MC715-H
Shielding gas : AC-20 (A5.32 SG-)
Backing gas : N.A.

Welding position : 3Fu
Preheat / Interpass temp. : 10 °C / 188 °C
Joint type : Fillet weld

Welder/Operator

Numbers(s)	Welder(s)	Specimen	Results
ARL2717-6	Berrevoets A.	53197-6 / 1,2	Acceptable
ARL2717-7	Wesdorp J.	53197-7 / 1,2	Acceptable

NARGAN COMPANY	
INSPECTION	
REVIEWED	<input checked="" type="checkbox"/>
WITNESSED	<input type="checkbox"/>
RELEASED	<input type="checkbox"/>
BY: M. REZAEI DATE: 13 Dec. 2023	
SIGN: 	

FILLET WELD BREAK TEST

Test method: AWS D1.1			Test temperature: R.T.
Specimen	Qty	Results	Remark
53197-6 / 1	1x	No weld defects observed.	Acceptable
53197-7 / 1	1x	No weld defects observed.	Acceptable

MACRO EXAMINATION

Method: ASTM E3					Magnification: 5x
Specimen	Qty	Etchant:	Observations:	Result	
53197-6 / 2	1x	Nital	No significant inclusions or other defects	Acceptable	
53197-7 / 2	1x	Nital	No significant inclusions or other defects	Acceptable	

The above mentioned items satisfy the requirements.

Element Materials Technology

All characteristics of the above object(s) have, as far as accessible and relevant, been verified by Element Materials Technology Rotterdam b.v. (Element). Other information was provided by the purchaser. This information was verified as far as possible and has been copied into this report, unchanged. Element does not bear responsibility for the correctness of this submitted information. Any kind of "witnessing" and conclusions by a third party is not covered by the RVA accreditation L063 and is no part of the Element report. We hereby certify that the reported test data is correct and that the above object(s) was (were) tested/examined in accordance with purchaser's requirements and/or the above procedure(s) and/or code(s)/specification(s). If a declaration of conformity is issued in the report with regard to compliance with a specification or standard, this declaration is only applicable to the product(s) examined. In this assessment, the decision rule is applied that assumes that the expanded measurement uncertainty is not included in the assessment. Unless otherwise stated in the test standard or accreditation rules, the rounding rule according to ISO 80000-1 Annex A Rule B is used. On occasion a test is subcontracted by Element, the accreditation number of the subcontracted party is reported. Interpretations, opinions, conclusions and advice are partly based on the examination results and partly on information supplied by the purchaser. This report has legal value only when furnished with an authorized signature. If, upon reproduction, only part of this report is copied, Element will not bear any responsibility for content, purport and conclusions of that reproduction.

 **element**
 Maik van den Branden

☐ Witnessed ☒ Reviewed
 And found to comply with:
 Date: 20.12.22
 Sign: M. van Ginneken

NARGAN COMPANY	
INSPECTION	
REVIEWED	<input checked="" type="checkbox"/>
WITNESSED	<input type="checkbox"/>
RELEASED	<input type="checkbox"/>
BY: M. REZAEI DATE: 13 Dec. 2023	
SIGN: 	

300 MM Plate



DILLINGER HÜTTE

M-System: Certification as per ISO 9001

Unterlagen siehe Rückseite/Explications voir au verso/See reverse for explanations (www.dillinger.de/certificate)

2 INSPECTION CERTIFICATE 3.2 AS PER EN 10204:2004
INSPECTION REPORT 3.2 AS PER EN 10204:1991+A1:1995 + AS PER ISO 10474:1991

5 Established inspecting body LR A06 Purchaser AM PROJECTS, HEIJNING A07 1 No 3200019765
Final receiver AM PROJECTS, ROTTERDA A07 2 No.

2/ Steel design 2W-50-MOD
3 Any suppl API-2W:06+OPTION-S1:S3;S4;S5;S8;S10;S12
requirements AGREED MODIFICATIONS

B01-B99 Description of the product									
14 B08 am B.	B08 Number of pieces	B09 Thickness mm	B10 Width mm	B11 Length	B12 Theoretical mass KG	B04 Product delivery condition	B07.2 Heat No.	B07.1 Rolled plate No./ Test No.	A09 Purchaser article number
1	1	30,00	X 2500	X 12000	7065	TM	362704	730557-02	
1	1	30,00	X 2500	X 12000	7065	TM	362705	730556-01	
1	1	30,00	X 2500	X 12000	7065	TM	362705	730556-02	
3	3				21195				
3	3				21195				

B06 Marking of the product
ITEM NO.: 04
TEEL DESIGNATION S355G10+M API 2W 50 Z LS MOD
AT NO. / TRADEMARK / ROLLED PLATE NO.-TEST NO. / INSPECTOR'S STAMP

C10-C29 Tensile test									
14 B07.2 am B.	B07.1 Rol.plate/ Test No.	B05 Reference (heat) treatment	C01 C02/ C03 Temp. GR.C	C10 C11 MPA RP02	C12 C13 RM	A % LO=5D 29	A % LO=8IN 27	C14-C15 REH/RM 0,87 0,83	Z %
362704	730557		K4 Q0 RT	449	468				
			K2 Q0 RT	444	451				
			F2 Q0 RT	454	473				
			K2 SO RT				27		70,7
			K2 SO RT				28		77,2
			K2 SO RT						76,2
			K2 SO RT						74,4
			F2 SO RT						70,0
			F2 SO RT						68,0

201020203 We hereby certify that the materials mentioned in this certificate are in accordance with the terms of the contract.

REVIEWED BY: [Signature] DATE: 13 Dec 2009
WITNESSED BY: [Signature]
RELEASED BY: [Signature]

INSPECTION SECTION
NARGAN COMPANY

above mentioned materials have been delivered in accordance

CONTROL NUMBER
DNK 118134
Inspector

POISSONNET
Test House Manager

GTS Industries - Groupe Dillinger Hütte
Port 3032
3032 rue du Comte Jean - CS 56317
F-59379 Dunkerque Cedex 1 - FRANCE
Service Qualité-Essais
Date 05.09.11

CD 1

M-System: Certification as per ISO 9001

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2 INSPECTION CERTIFICATE 3.2 AS PER EN 10204:2004

INSPECTION REPORT 3.2 AS PER EN 10204:1991+A1:1995 + AS PER ISO 10474:1991



DILLINGER HÜTTE

5 Established Inspecting body LR	A06 Purchaser Final receiver	AM PROJECTS, HEIJNING AM PROJECTS, ROTTERDA	A071 No. 3200019765 A072 No	A10 Advice of dispatch No./ Date of dispatch 2378342-02.09.11	A08/ Manufacturer's order/ A03 Certificate No 366375-002	Sheet 2/...
2/ Steel design 2W-50-MOD					B01 Product HOT ROLLED PLATES	
3 Any suppl requirements		API-2W:06+OPTION-S1;S3;S4;S5;S8;S10;S12 AGREED MODIFICATIONS				

C10-C29 Tensile test

14 B07.2 Heat No.	B07.1 Rol.plate/ Test No.	B05 Reference (heat) treatment	C01 K4 Q0	C02/ C03 Q0 RT	C10 C11 MPA RP02	C12 RM	C13 A % L0=5D 29	A % L0=8IN 0,86	C14-C15 REH/RM 0,86 0,83	Z %
362705	730556		K4 Q0	RT	450	537				69,8
			K2 Q0	RT	449	537				60,5
			F2 Q0	RT	452	540				75,5
			K2 S0	RT		521				65,4
			K2 S0	RT		520				74,5
			K2 S0	RT		520				70,5
			F2 S0	RT		530				
			F2 S0	RT		524				
			F2 S0	RT		536				

C30-C39 Further information about hardness test

EM NO.: 04

RDNESS TEST INFORMATIVE

EM NO.: 04	C33	C01	C02/C01	RESULTS	AVERAGE
7.2 B07.1	HV10	K9	Q0	164/170/167/165	167
2707 728022	HV10	K9	QU	181/186/184/179	183
2707 728022	HV10	K9	Q0	187/182/185/188	186
2446 730483	HV10	K9	QU	198/196/197/199	198
2446 730483	HV10	K9	Q0	181/175/170/177	176
2702 730097	HV10	K9	QU	174/176/180/183	178
2702 730097	HV10	K9	Q0	196/189/189/182	189
2446 730196	HV10	K9	Q0	186/191/184/180	185

above mentioned materials have been delivered in accordance

INSPECTION	
RECEIVED	RECEIVED
RECEIVED	RECEIVED
RECEIVED	RECEIVED

with the terms and conditions of the contract

TFK
Manufacturer's mark

GTS Industries - Groupe Dillinger Hütte
Port 3032
3032 rue du Comte Jean - CS 56317
F-59379 Dunkerque Cedex 1 - FRANCE
Service Qualité-Essais
Date 05.09.11

POISSONNET
Test House Manager



DILLINGER HÜTTE

M-System: Certification as per ISO 9001

2 INSPECTION CERTIFICATE 3.2 AS PER EN 10204:2004

INSPECTION REPORT 3.2 AS PER EN 10204:1991+A1:1995 + AS PER ISO 10474:1991

2		INSPECTION CERTIFICATE 3.2 AS PER EN 10204:2004		A10 Advice of dispatch No / Date of dispatch		A08/ Manufacturer's order/ A03 Certificate No	Sheet
INSPECTION REPORT		3.2 AS PER EN 10204:1991+A1:1995 + AS PER ISO 10474:1991		2378342-02.09.11		366375-002	3 / ...
5 Established inspecting body		A06 Purchaser		A07.1 No. 3200019765		B01 Product	
LR		Final receiver		A07.2 No.		HOT ROLLED PLATES	
		AM PROJECTS, HEIJNING		AM PROJECTS, ROTTERDA			
2/ Steel design.		2W-50-MOD					
3 Any suppl		API-2W: 06+OPTION-S1;S3;S4;S5;S8;S10;S12					
requirements		AGREED MODIFICATIONS					

C30-C39 Further information about hardness test

2712	730551	HV10	K9	QO	165/166/168/168	167
2712	730551	HV10	K9	QU	166/171/172/169	170
2446	730195	HV10	K9	QO	175/176/178/177	177
2446	730195	HV10	K9	QU	177/177/176/178	177

ITEM NO.: 04

17.2	B07.1	C33	C01	C02/C01	RESULTS	AVERAGE
12705	730556	HV10	K9	QO	166/166/172/169	168
12705	730556	HV10	K9	QU	174/175/176/174	175
12702	730096	HV10	K9	QO	166/169/171/171	169
12702	730096	HV10	K9	QU	172/174/173/171	173
12446	730555	HV10	K9	QO	176/175/170/172	173
12446	730555	HV10	K9	QU	178/177/178/175	177
12446	730105	HV10	K9	QO	166/167/171/188	173
12446	730105	HV10	K9	QU	171/176/176/174	174
12446	730107	HV10	K9	QO	177/174/171/173	174
12446	730107	HV10	K9	QU	178/177/177/179	178
12446	730197	HV10	K9	QO	181/184/189/182	184
12446	730197	HV10	K9	QU	194/188/187/188	189

ITEM NO.: 04

ITEM NO.	17.2	B07.1	C33	C01	C02/C01	RESULTS	AVERAGE
2446	730198	HV10	K9	QO	194/191/191/190	192	
2446	730198	HV10	K9	QU	188/192/192/191	191	
2712	731016	HV10	K9	QO	166/165/167/166	166	
2712	731016	HV10	K9	QU	167/172/171/170	170	

2011/202/203 We hereby certify that the materials have been delivered in accordance with the terms of the contract.

REVIEWED BY: [Signature]	DATE: 13 Dec 2011
WITH NESS (RECEIVED)	
RELEASED BY: [Signature]	DATE: 13 Dec 2011

TFK
Manufacturer's



CONTROL NUMBER
JAN 11/0154
- 2011/202/203

POISSONNET
Test House Manager

GTS Industries - Groupe Dillinger Hütte
Port 3032
3032 rue du Comte Jean - CS 56317
F-59379 Dunkerque Cedex 1 - FRANCE
Service Qualité-Essais
Date 05.09.11
CD 1



DILLINGER HÜTTE

V-System: Certification as per ISO 9001

Unterlagen siehe Rückseite/Explications voir au verso/See reverse for explanations (www.dillinger.de/certificate)

INSPECTION CERTIFICATE 3.2 AS PER EN 10204:2004

INSPECTION REPORT 3.2 AS PER EN 10204:1991+A1:1995 + AS PER ISO 10474:1991

A10	Advice of dispatch No./ Date of dispatch	A08/ Manufacturer's order/ A03 Certificate No.	Sheet
	2378342-02.09.11	366375-002	4/....

5 Established inspecting body A06 Purchaser AM PROJECTS, HEIJNING A07.1 No. 3200019765

LR Final receiver AM PROJECTS, ROTTERDA A07.2 No.

2/ Steel design. 2W-50-MOD

3 Any suppl API-2W:06+OPTION-S1;S3;S4;S5;S8;S10;S12

requirements AGREED MODIFICATIONS

B01 Product
HOT ROLLED PLATES

C40-C49 Impact test

14	B07.2 Heat No.	B05 Rol.plate/ Test No.	Reference (heat) treatment	C01	C02/ C01	C03 Temp. GR.C	C41 Width of test piece	C40 Type of test piece	C44 Testing method	C46 Energy Joule	C45 Individual values AV=J	C43 Mean value
3.	362704	730557		K4	QX	-40		CHP-V		600	233	222
				K4	QM	-40		CHP-V		600	206	179
				K4	QV	-40		CHP-V		600	234	223
				K2	QX	-40		CHP-V	5, 0%-250C/60MN	600	120	114
				K4	QX	-40		CHP-V		600	211	220
				K4	QM	-40		CHP-V		600	136	137
				K4	QV	-40		CHP-V		600	222	231
				K2	QX	-40		CHP-V	5, 0%-250C/60MN	600	217	211

C66-C68 Supplementary tests on test samples

TEM NO.: 04

POP WEIGHT TEST (PELLINI)

17.2 B07.1 RESULT

2704 730557 T -35,0 C : NO BREAK

2705 730556 T -35,0 C : NO BREAK

TEM NO.: 04

REP ETCH TESTING AS PER DH-STANDARD <=2B : SATISFACTORY

C70-C99 Chemical composition % - Heat analysis

07.2	C70	C	SI	MN	P	S	N	CU	MO	NI	CR	V	NB	AS	SN
eat															
2704	Y	0,081	0,384	1,54	0,013	0,0008	0,0047	0,040	0,013	0,064	0,038	0,001	0,020	0,002	0,001
2705	Y	0,081	0,381	1,54	0,014	0,0007	0,0038	0,039	0,022	0,058	0,036	0,001	0,019	0,003	0,001

REVIEWED BY: [Signature]
WITHNESS AND
RELEASED BY: [Signature]
DATE: 13 Dec 2023

2011/2020/203 We hereby certify that the above mentioned materials have been delivered in accordance with the terms of the contract.

TFK

Manufacturer's

GTS Industries - Groupe Dillinger Hütte

Port 3032

3032 rue du Comte Jean - CS 56317

F-59379 Dunkerque Cedex 1 - FRANCE

Service Qualité-Essais

Date 05.09.11

[Signature]

POISSONNET

Test House Manager

Lloyds Register

NARGAN COMPANY

SECTION

Signature

Date

Signature

Date

Signature

Date

Signature

Date

Signature

Date



DILLINGER HÜTTE

M-System: Certification as per ISO 9001

Wiederholungen siehe Rückseite/Explications voir au verso/See reverse for explanations (www.dillinger.de/certificate)

INSPECTION CERTIFICATE 3.2 AS PER EN 10204:2004

INSPECTION REPORT 3.2 AS PER EN 10204:1991+A1:1995 + AS PER ISO 10474:1991

A10 Advice of dispatch No / Date of dispatch		A08/ Manufacturer's order/ Certificate No	Sheet
2378342-02.09.11		366375-002	5/....
Established inspecting body	A06 Purchaser	A07.1 No.	3200019765
LR	Final receiver	A07.2 No.	
	AM PROJECTS, HEIJNING		
	AM PROJECTS, ROTTERDA		HOT ROLLED PLATES
2/ Steel design	2W-50-MOD		
3 Any suppl. requirements	API-2W:06+OPTION-S1;S3;S4;S5;S8;S10;S12		
	AGREED MODIFICATIONS		

C70-C99 Chemical composition % - Heat analysis

	C70	Ti	PB	B	SB	CA	BI	AL-T
2704 Y	0,002	0,001	0,0002	0,0001	0,0022	0,0001	0,033	
2705 Y	0,002	0,001	0,0001	0,0002	0,0019	0,0001	0,032	

C94 Heat analysis Carbon equivalent / Alloying restrictions

2704	FO-02=	0,35	FO-31=	0,18	FO-51=	0,02	FO-52=	0,02	FO-A1=	7,02
2705	FO-02=	0,36	FO-31=	0,18	FO-51=	0,02	FO-52=	0,02	FO-A1=	8,42

C95 Ladle treatment

EM NO.: 04
AT OF THE INDICATED ITEM: VACUUM DEGASSED

C70-C99 Chemical composition % - Product analysis

	C01	C	Si	MN	P	S	N	CU	MO	NI	CR	V	NB	Ti	B
2704 730557 K40	0,084	0,384	1,52	0,013	0,0009	0,0050	0,041	0,015	0,062	0,036	0,034	0,000	0,021	0,003	0,0002
2705 730556 K40	0,085	0,378	1,51	0,013	0,0007	0,0037	0,038	0,024	0,054	0,034	0,034	0,000	0,019	0,002	0,0002

2704 730557 K40	AL-T	0,033
2705 730556 K40	AL-T	0,032

C94 Product analysis Carbon equivalent / Alloying restrictions

2704 730557 K40	FO-31=	0,18	FO-51=	0,02	FO-52=	0,02	FO-A1=	6,60
2705 730556 K40	FO-31=	0,18	FO-51=	0,02	FO-52=	0,02	FO-A1=	8,65

Z01Z02Z03 We hereby certify that the above mentioned materials have been delivered in accordance with the terms of order

REVIEWED	<input checked="" type="checkbox"/>
WITNESSED	<input checked="" type="checkbox"/>
RELEASED	<input checked="" type="checkbox"/>
SIGN.	<input checked="" type="checkbox"/>
DATE: 13 Dec 2003	

TFK

Manufacturer's

POISSONNET
Test House Manager

GTS Industries - Groupe Dillinger Hütte
Port 3032
3032 rue du Comte Jean - CS 56317
F-59379 Dunkerque Cedex 1 - FRANCE
Service Qualité-Essais
Date 05.09.11

CD 1



DILLINGER HÜTTE

V-System: Certification as per ISO 9001

Unterlagen siehe Rückseite/Explications voir au verso/See reverse for explanations (www.dillinger.de/certificate)

INSPECTION CERTIFICATE 3.2 AS PER EN 10204:2004

INSPECTION REPORT 3.2 AS PER EN 10204:1991+A1:1995 + AS PER ISO 10474:1991

A10 Advice of dispatch No./ Date of dispatch		A08/ Manufacturer's order/ A03 Certificate No.	Sheet
2378342-02.09.11		366375-002	6
5 Established Inspecting body LR	A06 Purchaser Final receiver	AM PROJECTS, HEIJNING AM PROJECTS, ROTTERDA	B01 Product HOT ROLLED PLATES
2/ Steel design. 2W-50-MOD			
3 Any suppl. requirements	API-2W: 06+OPTION-S1; S3; S4; S5; S8; S10; S12 AGREED MODIFICATIONS		

C94 Carbon equivalent formula / Alloying restrictions

- 02 = $C + (Mn/6) + (Cr+Mo+V) / 5 + (Ni+Cu) / 15$
- 31 = $C + Si / 30 + (Mn+Cr+Cu) / 20 + Mo / 15 + V / 10 + Ni / 60 + 5B$
- 51 = V + NB
- 52 = V + NB + TI
- A1 = AT/N

D01 Marking and identification, surface appearance, shape and dimensional properties

TEM NO.: 04
RESULT OF MARKING, SURFACE, SHAPE AND DIMENSIONS: NO REMARKS
RFACE AS PER EN-10163-A3
THICKNESS AS PER EN-10029:91-A
LENGTH AND WIDTH AS PER EN-10029:91
FINISH AS PER EN-10029:91-T4L

D02 Non-destructive tests - Ultrasonic testing

TEM NO.: 04
SPECIFICATION : EN 10160 KLASSE S1/E2 AND API 2W APPENDIX A SUPPLEMENTARY REQUIREMENTS S1
WELDING PLAN BODY : LONGITUDINALLY SCAN LINES SPACING 75 MM
EDGES : 100 MM
PERSONNEL QUALIFICATION : LEVEL 2 IN ACC. TO EN 473 AND SNT-TC-1A
THE TEST RESULTS MEET THE REQUIREMENTS OF THE ORDER.

REVISION	DATE	BY
1	13 Dec 2003	...
WITH SIGNATURE		
REL. BY		
SIGNATURE		

201/202/203 We hereby certify that the materials mentioned above have been delivered in accordance with the terms of the order.

TFK

Manufacturer's

GTS Industries - Groupe Dillinger Hütte

Port 3032

3032 rue du Comte Jean - CS 56317

F-59379 Dunkerque Cedex 1 - FRANCE

Service Qualité-Essais

Date 05.09.11

POISSONNET

Test House Manager

Inspector

CONTROL NUMBER

DNK 100134

CD 1

Welder's name	Wesdorp J.	Test date	28-11-2022
ID Number	Verified by DNV	WPQ record number	A1153205-2-62
Date of birth	12-9-1996	Standard test number	N.A.
Stamp number	JW	WPS record number	S2400
Company name	Airpack Netherlands BV	Qualification code	AWS D1.1:2020
Division	N.A.		

BASE METALS

	Product form	Specification (type or grade)	P no.	Grp.no.	Size	Sch.	Thick. (mm)	Dia. (mm)
Welded to:	Plate	API 2H (50)	U	II	-	-	20	-
	Plate	API 2H (50)	U	II	-	-	20	-
Joint type	Fillet							

VARIABLES

	Actual values	RANGE QUALIFIED
Type of weld joint	Plate - Fillet	Fillet welds
Base metal	Group II to Group II	Carbon and Low-Alloy Steel
BASE METAL THICKNESS	Groove	Fillet
Plate thickness (mm)	-	20
Pipe/tube thickness (mm)	-	-
Pipe size (mm)	-	-

PROCESS VARIABLES

	Actual values	RANGE QUALIFIED
Welding process	GMAW	GMAW
Type	Semi-automatic	Semi-Automatic, Machine, Automatic
Backing	With	With
Filler metal specification	5.18	A5.xx
Filler metal classification	E70C-6MH4	All
Weld position (Actual position tested)	3F	F.H,V
Fillet - Plate & Pipe >= 610mm		F.H,V
Fillet - Pipe 73mm to 610mm		F.H,V
Fillet - Pipe < 73mm		Up
Progression	Up	Spray, pulse, globular
GMAW transfer mode	Spray	A5.xx approved
Shielding gas/flux	AC-20	

TESTS

Type of test	Acceptance criteria	Result	Comments
Visual examination per clause 4.9.1	clause 4.9.1.2.	Acceptable	ARL 2717
1x Break test acc. clause 4.31.4	4.31.4.1	Acceptable	-
1x macroscopic examination acc. clause 4.31.2.3	clause 4.31.2.3	Acceptable	-
Notes			


CERTIFICATION

Tests conducted by	Maik van den Branden	Laboratory test number	Report ARJ001-22-12-53197-6
Mechanical tests by	Element Breda (NLD)	Test file number	ARL2717

We certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of section 4 of the ANSI/AWS D1.1 Structural Welding Code-Steel.

NARGAN COMPANY	
INSPECTION	
REVIEWED	<input checked="" type="checkbox"/>
WITNESSED	<input type="checkbox"/>
RELEASED	<input type="checkbox"/>
BY: M. REZAEI DATE: 13 Dec. 2022	
SIGN: 	

Signature 1

Name	Signature
F. van Toledo	
Date	19-12-2022

Signature 2

Name	Signature
M. van Ginneken DNV	
Date	19-12-2022

<input type="checkbox"/> Witnessed <input checked="" type="checkbox"/> Reviewed And found to comply with: Date: 2022-12-21 Sign: M. van Ginneken
--

WPS record number	S2400	Revision 0	Qualified to	AWS D1.1/D1.1M:2010
Date	14-6-2012		Company name	Airpack Netherlands BV
Supporting PQR(s)	RET 0245029-001-26 - Rev 1			
Reference docs.				

Scope	Filletwelds single layer a <= 6 mm and multi layer filletwelds => 8 mm Fillet, no PWHT (As-welded)
Joint	Joint details for this welding procedure specification in: Production drawings

BASE METALS

Type	Plate	P-no. U	Grp-no. II
Welded to	Plate	P-no. U	Grp-no. II
Backing:	None	P-no.	Grp-no.
Retainers	None		
Notes			

THICKNESS RANGE QUALIFIED (mm)

	As-welded		With PWHT	
	Min.	Max.	Min.	Max.
Complete pen.	-	-	-	-
Impact tested	-	-	-	-
Partial pen.	-	-	-	-
Fillet welds	no min.	no max.	-	-

DIAMETER RANGE QUALIFIED (mm)

	As-welded		With PWHT	
	Min.	Max.	Min.	Max.
Nominal pipe size	610,	no max.	-	-

FILLER METALS

	SFA	Classification	F-no.	A-no.	Chemical analysis or Trade name	As-welded		With PWHT	
						Min.	Max.	Min.	Max.
GMAW	5.18	E70C-6MH4	6	-	Lincoln, Outershield MC715-H	3,	no max.	-	-
Sup. filler	-	-	-	-	-	- None -			

WELDING PROCEDURE

Welding process	GMAW			
Type	Semi-automatic			
Minimum preheat/interpass temperature (°C)	10			
Maximum interpass temperature (°C)	188			
Filler metal size (mm)	1,2			
Layer number	All			
Position	V			
Weld progression	Uphill			
Current/polarity	DCEP (reverse polarity)			
Waveform control				
Energy (J)				
Power (J/s)				
Amperes	127 - 157			
Volts	14,7- 17,1			
Travel speed (mm/min)	54 - 112			
Maximum heat input (kJ/mm)	1,88			
Wire feed speed (m/min)	0,			
Arc transfer mode	Short-circuiting			
Shielding: Gas type	AC-20 (A5.32 SG-)			
Flow rate (l/min)	12 - 22			
Trailing: Gas type	None			
Flow rate (l/min)	-			
Backing: Gas type	None			
Flow rate (l/min)	-			
String or weave	Stringer or Weave			
Orifice/gas cup size	15			
C.T.W.D (mm)	15			
Multi/Single pass per side	Multiple passes			
Multi/single electrode	Single electrode			
Maximum pass thickness (mm)	5			
Weld deposit chemistry	-			
Notes				

NARGAN COMPANY	
INSPECTION	
REVIEWED	<input checked="" type="checkbox"/>
WITNESSED	<input type="checkbox"/>
RELEASED	<input type="checkbox"/>
BY: M. REZAEI DATE: 13 Dec. 2022	
SIGN: <i>M. Rezaei</i>	

WPS record number	S2400	Revision 0	Qualified to	AWS D1.1/D1.1M:2010
Date	14-6-2012		Company name	Airpack Netherlands BV

PREHEAT TABLE

Applicable standard	
AWS D1.1 (Category A)	For thickness 3 to 19(mm): 0(°C). Preheat to 20(°C) if the base metal temperature is below 0(°C). Over 19 thru 38.1(mm): 66(°C). Over 38.1 thru 63.5(mm): 107(°C). Over 63.5(mm): 150(°C).

TECHNIQUE

Peening	Not used
Surface preparation	Grinding
Initial/interpass cleaning	Brushing and Grinding
Back gouging method	None

NOTES

 NARGAN COMPANY	
INSPECTION	
REVIEWED	<input checked="" type="checkbox"/>
WITNESSED	<input type="checkbox"/>
RELEASED	<input type="checkbox"/>
BY: M. REZAEI DATE: 13 Dec. 2023	
SIGN: 	

Signature 1

Signature 2

Name	Signature	Name	Signature
Date		Date	

Arjan Roza Lastechniek
G. Sterkenburgstraat 38
4268 GS MEEUWEN

Date(s) tested : 13-12-2022
Date reported : 13-12-2022
Element report number : ARJ001-22-12-53197-6

Customer reference : ARL2717

TEST REPORT

WELDERS PERFORMANCE QUALIFICATION TEST RECORD

Testing in accordance with : AWS D1.1:2020
Purchaser : Arjan Roza Lastechniek BV
Purchase order no. : ARL2717

Manufacturer : Airpack Nederland BV.
WPS : S2400

Description of sample(s) : Plate with filletweld multipass
Dimension(s) : 380x150x20 mm
Group number : II -II
Material grade : API 2W grade 50 - API 2W grade 50

Welding process(es) : GMAW (metal cored)
Filler : SFA 5.18 : E70C-6MH4, F-number 6
Brand and type : Lincoln Electric Outershield MC715-H
Shielding gas : AC-20 (A5.32 SG-)
Backing gas : N.A.

Welding position : 3Fu
Preheat / Interpass temp. : 10 °C / 188 °C
Joint type : Fillet weld

Welder/Operator

Numbers(s)	Welder(s)	Specimen	Results
ARL2717-6	Berrevoets A.	53197-6 / 1,2	Acceptable
ARL2717-7	Wesdorp J.	53197-7 / 1,2	Acceptable

NARGAN COMPANY	
INSPECTION	
REVIEWED	<input checked="" type="checkbox"/>
WITNESSED	<input type="checkbox"/>
RELEASED	<input type="checkbox"/>
BY: M. van Ginneken DATE: 13 Dec. 2022	
SIGN: 	



ARJ001-22-12-53197-6
page 1 of 2

FILLET WELD BREAK TEST

Test method: AWS D1.1			Test temperature: R.T.
Specimen	Qty	Results	Remark
53197-6 / 1	1x	No weld defects observed.	Acceptable
53197-7 / 1	1x	No weld defects observed.	Acceptable

MACRO EXAMINATION

MACRO EXAMINATION				
Method: ASTM E3				Magnification: 5x
Specimen	Qty	Etchant:	Observations:	Result
53197-6 / 2	1x	Nital	No significant inclusions or other defects	Acceptable
53197-7 / 2	1x	Nital	No significant inclusions or other defects	Acceptable

The above mentioned items satisfy the requirements.



Maik van den Branden

Element Materials Technology

All characteristics of the above object(s) have, as far as accessible and relevant, been verified by Element Materials Technology Rotterdam b.v. (Element). Other information was provided by the purchaser. This information was verified as far as possible and has been copied into this report, unchanged. Element does not bear responsibility for the correctness of this submitted information. Any kind of "witnessing" and conclusions by a third party is not covered by the RVA accreditation L063 and is no part of the Element report. We hereby certify that the reported test data is correct and that the above object(s) was (were) tested/examined in accordance with purchaser's requirements and/or the above procedure(s) and/or code(s)/specification(s). If a declaration of conformity is issued in the report with regard to compliance with a specification or standard, this declaration is only applicable to the product(s) examined. In this assessment, the decision rule is applied that assumes that the expanded measurement uncertainty is not included in the assessment. Unless otherwise stated in the test standard or accreditation rules, the rounding rule according to ISO 80000-1 Annex A Rule B is used. On occasion a test is subcontracted by Element, the accreditation number of the subcontracted party is reported. Interpretations, opinions, conclusions and advice are partly based on the examination results and partly on information supplied by the purchaser. This report has legal value only when furnished with an authorized signature. If, upon reproduction, only part of this report is copied, Element will not bear any responsibility for content, purport and conclusions of that reproduction.

NARGAN COMPANY	
INSPECTION	
REVIEWED	<input checked="" type="checkbox"/>
WITNESSED	<input type="checkbox"/>
RELEASED	<input type="checkbox"/>
BY: M. REZAEI DATE: 13 Dec. 2023	
SIGN: 	

M-System: Certification as per ISO 9001



Unternehmen siehe Rückseite/Explications voir au verso/See reverse for explanations (www.dillinger.de/certificate)

2 INSPECTION CERTIFICATE 3.2 AS PER EN 10204:2004
INSPECTION REPORT 3.2 AS PER EN 10204:1991+A1:1995 + AS PER ISO 10474:1991

A10 Advice of dispatch No./
Date of dispatch
2378342-02.09.11

A08/ Manufacturer's order/
A03 Certificate No.
366375-002

Sheet
1/...

5 Established Inspecting body
LR
A06 Purchaser
AM PROJECTS, HEIJNING
A07 1 No 3200019765
Final receiver
AM PROJECTS, ROTTERDA
A07 2 No.

2/ Steel design 2W-50-MOD
3 Any suppl API-2W: 06+OPTION-S1; S3; S4; S5; S8; S10; S12
requirements AGREED MODIFICATIONS

B01-B99 Description of the product

14 B08 m D.	B09 Thickness	B10 Width	B11 Length	B12 Theoretical mass KG	B04 Product delivery condition	B07.2 Heat No.	B07.1 Rolled plate No./ Test No.	A09 Purchaser article number
1	30,00	x 2500	x 12000	7065	TM	362704	730557-02	
1	30,00	x 2500	x 12000	7065	TM	362705	730556-01	
1	30,00	x 2500	x 12000	7065	TM	362705	730556-02	
3				21195				
3				21195				

B06 Marking of the product

ITEM NO.: 04
STEEL DESIGNATION S355G10+M API 2W 50 Z LS MOD
MARK NO. / TRADEMARK / ROLLED PLATE NO.-TEST NO. / INSPECTOR'S STAMP

C10-C29 Tensile test

14 B07.2 m D.	B07.1 Rol. plate/ Test No.	B05 Reference (heat) treatment	C01 Temp. GRC	C02/ C03 C01	C10 MPA RP02	C11 REH	C12 RM	C13 A % LO=SD	C14-C15 A % LO=8IN REH/RM RP02/RM	Z %
362704	730557			K4 QO	RT	449	537	29	0,87	0,83
				K2 QO	RT	444	535	27		
				F2 QO	RT	454	537	28		
				K2 SO	RT		516			70,7
				K2 SO	RT		518			77,2
				K2 SO	RT		511			76,2
				F2 SO	RT		525			74,4
				F2 SO	RT		528			70,0
				F2 SO	RT		528			68,0

REVIEWED BY: [Signature]
WITH APPROVAL: [Signature]
RELEASED BY: [Signature]
DATE: 13 Dec 2002

201Z02Z03 We hereby certify that the above mentioned materials have been delivered in accordance with the terms of order.

TFK
Manufacturer's

GTS Industries - Groupe Dillinger Hütte
Port 3032
3032 rue du Comte Jean - CS 56317
F-59379 Dunkerque Cedex 1 - FRANCE
Service Qualité-Essais
Date 05.09.11

POISSONNET
Test House Manager

CONTROL NUMBER
DNK 000134
Inspector

Lloyd's Register



DILLINGER HÜTTE

M-System: Certification as per ISO 9001

unterlagen siehe Rückseite/Explications voir au verso/See reverse for explanations (www.dillinger.de/certificate)

2 INSPECTION CERTIFICATE 3.2 AS PER EN 10204:2004

INSPECTION REPORT 3.2 AS PER EN 10204:1991+A1:1995 + AS PER ISO 10474:1991

A10	Advice of dispatch No./ Date of dispatch	A08/ Manufacturer's order/ A03 Certificate No	Sheet
	2378342-02.09.11	366375-002	2/...

5	Established inspecting body LR	A06 Purchaser AM PROJECTS, HEIJNING	A071 No. 3200019765
	Final receiver	AM PROJECTS, ROTTERDA	A072 No.

2/ Steel design 2W-50-MOD

3 Any suppl API-2W: 06+OPTION-S1; S3; S4; S5; S8; S10; S12

requirements AGREED MODIFICATIONS

B01 Product
HOT ROLLED PLATES

C10-C29 Tensile test

14 B07.2 Heat No.	B07.1 Rol. plate/ Test No.	B05 Reference (heat) treatment	C01 C02/ C03 C01 Temp. GR.C	C10 C11 MPA RP02	REH	C12 RM	C13	A % LO=5D 29	A % LO=8IN 27 24	C14-C15 REH/RM 0,86 0,83	Z %
362705	730556		K4 QO RT 462	450	462	537					69,8
			K2 QO RT 470	449	470	537					60,5
			F2 QO RT 469	452	469	540					75,5
			K2 SO RT			521					65,4
			K2 SO RT			520					74,5
			K2 SO RT			520					70,5
			F2 SO RT			530					
			F2 SO RT			524					
			F2 SO RT			536					

C30-C39 Further information about hardness test

TEM NO.: 04

HARDNESS TEST INFORMATIVE

TEM NO.: 04

17.2 B07.1 HV10	C33 HV10	C01 K9	C02/C01 QO	RESULTS	AVERAGE
2707 728022	2707 728022	K9 QO	QO	164/170/167/165	167
2707 728022	2707 728022	K9 QO	QO	181/186/184/179	183
2446 730483	2707 728022	K9 QO	QO	187/182/185/188	186
2446 730483	2707 728022	K9 QO	QO	198/196/197/199	198
2702 730097	2707 728022	K9 QO	QO	181/175/170/177	176
2702 730097	2707 728022	K9 QO	QO	174/176/180/183	178
2446 730196	2707 728022	K9 QO	QO	196/189/189/182	189
2446 730196	2707 728022	K9 QO	QO	186/191/184/180	185

TFK Manufacturer's mark	201702203 We hereby certify that the materials mentioned materials have been delivered in accordance with the terms of order.	 POISSONNET Test House Manager	GTS Industries - Groupe Dillinger Hütte Port 3032 3032 rue du Comte Jean - CS 56317 F-59379 Dunkerque Cedex 1 - FRANCE Service Qualité-Essais Date 05.09.11	A01 CD 1
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M-System: Certification as per ISO 9001

anforderungen siehe Rückseite/Explications voir au verso/See reverse for explanations (www.dillinger.de/certificate)

2 INSPECTION CERTIFICATE 3.2 AS PER EN 10204:2004
INSPECTION REPORT 3.2 AS PER EN 10204:1991+A1:1995 + AS PER ISO 10474:1991

A08/ Manufacturer's order/ A03 Certificate No				366375-002		3 / ...	
A10 Advice of dispatch No / Date of dispatch				2378342-02.09.11			
A06 Purchaser				A07.1 No. 3200019765			
Final receiver				A07.2 No.			
A06 Purchaser				AM PROJECTS, HEIJNING			
Final receiver				AM PROJECTS, ROTTERDA			
5 Established inspecting body				2W-50-MOD			
LR				API-2W: 06+OPTION-S1;S3;S4;S5;S8;S10;S12			
2/ Steel design.				AGREED MODIFICATIONS			
3 Any suppl				requirements			
B01 Product				HOT ROLLED PLATES			

C30-C39 Further information about hardness test

ITEM NO.:	04						AVERAGE
17.2 B07.1	C33	C01	C02/C01	RESULTS			
12705 730556	HV10	K9	QO	166/166/172/169			168
12705 730556	HV10	K9	QU	174/175/176/174			175
12702 730096	HV10	K9	QO	166/169/171/171			169
12702 730096	HV10	K9	QU	172/174/173/171			173
12446 730555	HV10	K9	QO	176/175/170/172			173
12446 730555	HV10	K9	QU	178/177/178/175			177
12446 730105	HV10	K9	QO	166/167/171/188			173
12446 730105	HV10	K9	QU	171/176/176/174			174
12446 730107	HV10	K9	QO	177/174/171/173			174
12446 730107	HV10	K9	QU	178/177/177/179			178
12446 730197	HV10	K9	QO	181/184/189/182			184
12446 730197	HV10	K9	QU	194/188/187/188			189

ITEM NO.:	04						AVERAGE
17.2 B07.1	C33	C01	C02/C01	RESULTS			
12446 730198	HV10	K9	QO	194/191/191/190			192
12446 730198	HV10	K9	QU	188/192/192/191			191
12712 731016	HV10	K9	QO	166/165/167/166			166
12712 731016	HV10	K9	QU	167/172/171/170			170

above mentioned materials have been delivered in accordance

GTS Industries - Groupe Dillinger Hütte
Port 3032
3032 rue du Comte Jean - CS 56317
F-59379 Dunkerque Cedex 1 - FRANCE
Service Qualité-Essais
Date 05.09.11

POISSONNET
Test House Manager

TFK

Manufacturer's

CONTROL NUMBER
DUNKERQUE
Lloyd's Register
NARGAN COMPANY
SECTION 8



DILLINGER HÜTTE

M-System: Certification as per ISO 9001

Unterlagen siehe Rückseite/Explications voir au verso/See reverse for explanations (www.dillinger.de/certificate)

INSPECTION CERTIFICATE 3.2 AS PER EN 10204:2004

INSPECTION REPORT 3.2 AS PER EN 10204:1991+A1:1995 + AS PER ISO 10474:1991

Anmerkungen siehe Rückseite (Explications voir au verso/See reverse for explanations (www.dillingers.de/certificate))					A10	Advice of dispatch No / Date of dispatch	A08/ Manufacturer's order/ A03 Certificate No	Sheet
INSPECTION CERTIFICATE 3.2 AS PER EN 10204:2004								
INSPECTION REPORT 3.2 AS PER EN 10204:1991+A1:1995 + AS PER ISO 10474:1991						2378342-02.09.11	366375-002	5 /
							B01 Product	
							HOT ROLLED PLATES	

C70-C99 Chemical composition % - Heat analysis

	C70	TI	PB	B	SB	CA	BI	AL-T
2704	Y	0,002	0,001	0,0002	0,0001	0,0022	0,0001	0,033
2705	Y	0,002	0,001	0,0001	0,0002	0,0019	0,0001	0,032

C94 Heat analysis Carbon equivalent / Alloying restrictions

2704	FO-02=	0,35	FO-31=	0,18	FO-51=	0,02	FO-52=	0,02	FO-A1=	7,02
2705	FO-02=	0,36	FO-31=	0,18	FO-51=	0,02	FO-52=	0,02	FO-A1=	8,42

C95 Ladle treatment

ITEM NO.: 04
AT OF THE INDICATED ITEM: VACUUM DEGASSED

C70-C99 Chemical composition % - Product analysis

	C01	C	SI	MN	P	S	N	CU	MO	NI	CR	V	NB	TI	B
2704	Test No.	K40	0,084	0,384	1,52	0,013	0,0009	0,0050	0,041	0,015	0,062	0,036	0,021	0,003	0,0002
2705	Test No.	K40	0,085	0,378	1,51	0,013	0,0007	0,0037	0,038	0,024	0,054	0,034	0,019	0,002	0,0002

2704	Test No.	K40	0,033
2705	Test No.	K40	0,032

C94 Product analysis Carbon equivalent / Alloying restrictions

2704	FO-31=	0,18	FO-51=	0,02	FO-52=	0,02	FO-A1=	6,60
2705	FO-31=	0,18	FO-51=	0,02	FO-52=	0,02	FO-A1=	8,65

TFK

Manufacturer's

REVISION

WITNESSED BY

RELEASED BY

DATE: 13 Dec 2003

CONTROL NUMBER

DNAL118154

INSPECTION

INSPECTION

201Z02Z03 We hereby certify that the above mentioned materials have been delivered in accordance with the terms of order

GTS Industries - Groupe Dillinger Hütte
Port 3032
3032 rue du Comte Jean - CS 56317
F-59379 Dunkerque Cedex 1 - FRANCE
Service Qualité-Essais
Date 05.09.11

POISSONNET
Test House Manager



DILLINGER HÜTTE

M-System: Certification as per ISO 9001

Änderungen siehe Rückseite/Explications voir au verso/See reverse for explanations (www.dillinger.de/certificate)

INSPECTION CERTIFICATE 3.2 AS PER EN 10204:2004
INSPECTION REPORT 3.2 AS PER EN 10204:1991+A1:1995 + AS PER ISO 10474:1991

A10 Advice of dispatch No./ Date of dispatch		A08/ Manufacturer's order/ A03 Certificate No.	Sheet
2378342-02.09.11		366375-002	6
A07.1 No. 3200019765		B01 Product	
A07.2 No.		HOT ROLLED PLATES	
A08 Purchaser		AM PROJECTS, HEIJNING	
Final receiver		AM PROJECTS, ROTTERDA	
2/ Steel design.		2W-50-MOD	
3 Any suppl.		API-2W: 06+OPTION-S1; S3; S4; S5; S8; S10; S12	
requirements		AGREED MODIFICATIONS	

C94 Carbon equivalent formula / Alloying restrictions

- 02 = $C + (Mn/6) + (Cr+Mo+V)/5 + (Ni+Cu)/15$
- 31 = $C+Si/30 + (Mn+Cr+Cu)/20 + Mo/15 + V/10 + Ni/60 + 5B$
- 51 = $V + Nb$
- 52 = $V + Nb + Ti$
- A1 = AT/N

D01 Marking and identification, surface appearance, shape and dimensional properties

TEM NO.: 04

SURFACE, SHAPE AND DIMENSIONS: NO REMARKS

- THICKNESS AS PER EN-10163-A3
- WIDTH AS PER EN-10029:91-A
- LENGTH AS PER EN-10029:91
- FINISH AS PER EN-10029:91-T4L

D02 Non-destructive tests - Ultrasonic testing

TEM NO.: 04

CLASSIFICATION : EN 10160 KLASSE S1/E2 AND API 2W APPENDIX A SUPPLEMENTARY REQUIREMENTS S1

WELDING PLAN BODY : LONGITUDINALLY SCAN LINES SPACING 75 MM
EDGES : 100 MM

PERSONNEL QUALIFICATION : LEVEL 2 IN ACC. TO EN 473 AND SNT-TC-1A

THE TEST RESULTS MEET THE REQUIREMENTS OF THE ORDER.

REVIEWED	BY: MARGAN	DATE: 13 Dec 2003
WITNESSED		
RELEASED		
SIGNATURE: [Signature]		

above mentioned materials have been delivered in accordance

TFK

Manufacturer's

[Signature]

POISSONNET
Test House Manager

GTS Industries - Groupe Dillinger Hütte
Port 3032
3032 rue du Comte Jean - CS 56317
F-59379 Dunkerque Cedex 1 - FRANCE
Service Qualité-Essais
Date 05.09.11

Welder's name	Berrevoets A.		Test date	28-11-2022	
ID Number	Verified by DNV		WPQ record number	A1153205-2-63	
Date of birth	27-3-1968		Standard test number	N.A.	Rev. -
Stamp number	BA		WPS record number	S2600	Rev. 1
Company name	Airpack Netherlands BV		Qualification code	AWS D1.1:2020	
Division	N.A.				

BASE METALS

	Product form	Specification (type or grade)	P no.	Grp.no.	Size	Sch.	Thick. (mm)	Dia. (mm)
Welded to:	Plate	API 2H (50)	U	II	-	-	20	-
	Plate	API 2H (50)	U	II	-	-	20	-
Joint type	Groove							

VARIABLES

Type of weld joint	Plate - Groove	Groove, Fillet, Plug and Slot welds (T-, Y-, K-Groove PJP only)
Base metal	Group II to Group II	Carbon and Low-Alloy Steel

BASE METAL THICKNESS

	Groove	Fillet	Groove	Fillet
Plate thickness (mm)	20	-	3 - 40,0	3 min.
Pipe/tube thickness (mm)	-	-	3 - 40,0	no limit
Pipe size (mm)	-	-	600 min.	no limit

PROCESS VARIABLES

	Actual values	RANGE QUALIFIED
Welding process	GMAW	GMAW
Type	Semi-automatic	Semi-Automatic, Machine, Automatic
Backing	With	With
Filler metal specification	5.18	A5.xx
Filler metal classification	E70C-6MH4	All
Weld position (Actual position tested)	2G	
Groove - Plate & Pipe >= 610mm		F,H
Groove - Pipe 73mm to 610mm		-
Groove - Pipe 73mm		-
Fillet - Plate & Pipe >= 610mm		F,H
Fillet - Pipe 73mm to 610mm		F,H
Fillet - Pipe < 73mm		F,H
Progression	-	-
GMAW transfer mode	Short-circuiting	Short-circuiting
Shielding gas/flux	AC-20	A5.xx approved

TESTS

Type of test	Acceptance criteria	Result	Comments
2 transverse side bends acc. clause 4.9.3.1	clause 4.9.3.3	Acceptable	-
Visual examination per clause 4.9.1	clause 4.9.1.1	Acceptable	Report ARL2717

Notes

CERTIFICATION

Tests conducted by	Maik van den Branden	Laboratory test number	Report ARJ001-22-53197-3
Mechanical tests by	Element Breda (NLD)	Test file number	ARL2717

We certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of section 4 of the ANSI/AWS D1.1 Structural Welding Code-Steel.

NARGAN COMPANY	
INSPECTION	
REVIEWED	<input checked="" type="checkbox"/>
WITNESSED	<input type="checkbox"/>
RELEASED	<input type="checkbox"/>
BY: M. REZAEI DATE: 13 Dec. 2023	
SIGN: 	

Signature 1

Name	Signature	Name	Signature
F. van Toledo		M. van Ginneken DNV	
Date		Date	
19-12-2022		19-12-2022	

Signature	<input checked="" type="checkbox"/> Witnessed <input checked="" type="checkbox"/> Reviewed
And found to comply with:	
Date: 2022-12-21	
Sign: M. van Ginneken	

WPS record number	S2600	Revision 1	Qualified to	AWS D1.1/D1.1M:2015
Date	1-6-2016		Company name	Airpack Netherlands BV
Supporting PQR(s)	RET0278790/TK/001 - Rev 1			
Reference docs.				

Scope	Groove, fillet, no PWHT (As-welded), impact testing
Joint	Joint details for this welding procedure specification in: Production drawings

BASE METALS

Type	Plate	P-no. U	Grp-no. II
Welded to	Plate	P-no. U	Grp-no. II
Backing:	None	P-no.	Grp-no.
Retainers	None		
Notes			

THICKNESS RANGE QUALIFIED (mm)

	As-welded		With PWHT	
	Min.	Max.	Min.	Max.
Complete pen.	3,	8,	-	-
Impact tested	3,	8,	-	-
Partial pen.	3,	8,	-	-
Fillet welds	no min.	no max.	-	-

DIAMETER RANGE QUALIFIED (mm)

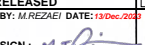
	As-welded		With PWHT	
	Min.	Max.	Min.	Max.
Nominal pipe size	610,	no max.	-	-

FILLER METALS

	SFA	Classification	F-no.	A-no.	Chemical analysis or Trade name	As-welded		With PWHT	
						Min.	Max.	Min.	Max.
GMAW	5.18	E70C-6MH4	6	-	Lincoln, Outershield MC715-H	3,	8,	-	-
GMAW						-	-	-	-
GMAW						-	-	-	-
Sup. filler						- Required -			
Suppl. filler metal vol.	(mm³)	-							

WELDING PROCEDURE

		GMAW	GMAW	GMAW
		Semi-automatic	Semi-automatic	Semi-automatic
Welding process				
Type		10	10	10
Minimum preheat/interpass temperature (°C)		174	174	174
Maximum interpass temperature (°C)		1,2	1,2	1,2
Filler metal size (mm)		Root	Fill	Cap
Layer number		F,H	F,H	F,H
Position		Not applicable	Not applicable	Not applicable
Weld progression		DCEP (reverse polarity)	DCEP (reverse polarity)	DCEP (reverse polarity)
Current/polarity		Not Used	Not Used	Not Used
Waveform control		Not Used	Not Used	Not Used
Energy (J)		Not Used	Not Used	Not Used
Power (J/s)		Not Used	Not Used	Not Used
Amperes		80 - 100	175 - 185	175 - 185
Volts		14 - 17	19 - 21	10 - 21
Travel speed (mm/min)		110 - 120	460 - 500	440 - 470
Maximum heat input (kJ/mm)		0,57 - 0,70	0,40 - 0,49	0,44 - 0,53
Wire feed speed (m/min)		Not used	Not used	Not used
Arc transfer mode		Short-circuiting	Short-circuiting	Short-circuiting
Shielding:	Gas type	AC-20 (A5.32 SG-)	AC-20 (A5.32 SG-)	AC-20 (A5.32 SG-)
	Flow rate (l/min)	14 - 16	14 - 16	14 - 16
Trailing:	Gas type	None	None	None
	Flow rate (l/min)	-	-	-
Backing:	Gas type	None	None	None
	Flow rate (l/min)	-	-	-
String or weave		Stringer or Weave	Stringer or Weave	Stringer or Weave
Orifice/gas cup size		15	15	15
C.T.W.D (mm)		15	15	15
Multi/Single pass per side		Single pass	Multiple passes	Multiple passes
Multi/single electrode		Single electrode	Single electrode	Single electrode
Maximum pass thickness (mm)		5	5	5
Weld deposit chemistry		-	-	-
Notes		-	-	-

NARGAN COMPANY	
INSPECTION	
REVIEWED	<input checked="" type="checkbox"/>
WITNESSED	<input type="checkbox"/>
RELEASED	<input type="checkbox"/>
BY: M. REZAEI DATE: 13 Dec 2025	
SIGN: 	

WPS record number	S2600	Revision 1	Qualified to	AWS D1.1/D1.1M:2015
Date	1-6-2016		Company name	Airpack Netherlands BV

PREHEAT TABLE

Applicable standard	
AWS D1.1 (Category B)	For thickness 3 to 19(mm): 0(°C). Preheat to 20(°C) if the base metal temperature is below 0(°C). Over 19 thru 38.1(mm): 10(°C). Over 38.1 thru 63.5(mm): 66(°C). Over 63.5(mm): 107(°C).

TECHNIQUE


Peening	Not used
Surface preparation	Grinding
Initial/interpass cleaning	Brushing and Grinding
Back gouging method	None

NOTES

 NARGAN COMPANY	
INSPECTION	
REVIEWED	<input checked="" type="checkbox"/>
WITNESSED	<input type="checkbox"/>
RELEASED	<input type="checkbox"/>
BY: M. REZAEI DATE: 13 Dec. 2023	
SIGN: 	

Signature 1

Signature 2

Name	Signature	Name	Signature
F. van Toledo			
Date		Date	
1-6-2016			



Element Materials Technology
Voerref 18
4824 GN Breda
NL

P +31 (0)76 5424 300
F +31 (0)76 5424 848
Info.breda@element.com
element.com

Bank ABN AMRO, Amsterdam
BIC ABNANL2A
IBAN NL74ABNA0529117738
BTW NL8056.95.333.B01
KvK 24170257

Arjan Roza Lastetechniek
G. Sterkenburgstraat 38
4268 GS MEEUWEN

Date(s) tested : 13-12-2022
Date reported : 13-12-2022
Element report number : ARJ001-22-12-53197-3

Customer reference : ARL2717

TEST REPORT

WELDERS PERFORMANCE QUALIFICATION TEST RECORD

Testing in accordance with : AWS D1.1:2020
Purchaser : Arjan Roza Lastetechniek BV
Purchase order no. : ARL2717

Manufacturer : Airpack Nederland BV.
WPS : S2600

Description of sample(s) : Plate with Single-V-groove
Dimension(s) : 600x400x20 mm
Group number : II -II
Material grade : API 2W grade 50 - API 2W grade 50

Welding process(es) : GMAW (metal cored)
Filler : SFA 5.18 : E70C-6MH4, F-number 6
Brand and type : Lincoln Electric Outershield MC715-H
Shielding gas : AC-20 (A5.32 SG-)
Backing gas : N.A.

Welding position : 2G
Preheat / Interpass temp. : 10 °C / 196 °C

Welder/Operator

Numbers(s)	Welder(s)	Specimen	Results
ARL2717-3	Berrevoets A.	53197-3 / 1,2,3,4	Acceptable

NARGAN COMPANY	
INSPECTION	
REVIEWED	<input checked="" type="checkbox"/>
WITNESSED	<input checked="" type="checkbox"/>
RELEASED with:	<input checked="" type="checkbox"/>
BY: M. REZAEI	DATE: 13 Dec 2022
Date: 13-12-2022	
Sign: M. van Ginneken	



ARJ001-22-12-53197-3
page 1 of 2

GUIDED BEND TEST

Test method: ASME IX (QW-162)					Test temperature: R.T.		
Specimen	Type	Size [mm]	Former [mm]	Roller distance [mm]	Bend Angle [°]	Results	Remark
53197-3 / 1	Side bend	20x10	40	65	180	Acceptable	
53197-3 / 2	Side bend	20x10	40	65	180	Acceptable	

The above mentioned items satisfy the requirements.

Element Materials Technology

All characteristics of the above object(s) have, as far as accessible and relevant, been verified by Element Materials Technology Rotterdam b.v. (Element). Other information was provided by the purchaser. This information was verified as far as possible and has been copied into this report, unchanged. Element does not bear responsibility for the correctness of this submitted information. Any kind of "witnessing" and conclusions by a third party is not covered by the RVA accreditation L063 and is no part of the Element report. We hereby certify that the reported test data is correct and that the above object(s) was (were) tested/examined in accordance with purchaser's requirements and/or the above procedure(s) and/or code(s)/specification(s). If a declaration of conformity is issued in the report with regard to compliance with a specification or standard, this declaration is only applicable to the product(s) examined. In this assessment, the decision rule is applied that assumes that the expanded measurement uncertainty is not included in the assessment. Unless otherwise stated in the test standard or accreditation rules, the rounding rule according to ISO 80000-1 Annex A Rule B is used. On occasion a test is subcontracted by Element, the accreditation number of the subcontracted party is reported. Interpretations, opinions, conclusions and advice are partly based on the examination results and partly on information supplied by the purchaser. This report has legal value only when furnished with an authorized signature. If, upon reproduction, only part of this report is copied, Element will not bear any responsibility for content, purport and conclusions of that reproduction.

NARGAN COMPANY	
INSPECTION	
REVIEWED	<input checked="" type="checkbox"/>
WITNESSED	<input type="checkbox"/>
RELEASED	<input type="checkbox"/>
BY: M. REZAEI DATE: 13 Dec. 2023	
SIGN: 	

M-System: Certification as per ISO 9001



anforderungen siehe Rückseite/Explications voir au verso/See reverse for explanations (www.dillinger.de/certificate)

2 INSPECTION CERTIFICATE 3.2 AS PER EN 10204:2004
INSPECTION REPORT 3.2 AS PER EN 10204:1991+A1:1995 + AS PER ISO 10474:1991

A10 Advice of dispatch No./ Date of dispatch		A08/ Manufacturer's order/ A03 Certificate No.		Sheet
2378342-02.09.11		366375-002		1/...
A06 Purchaser		A071 No		B01 Product HOT ROLLED PLATES
AM PROJECTS, HEIJNING		3200019765		
LR Final receiver		A072 No		
AM PROJECTS, ROTTERDA				

2/ Steel design 2W-50-MOD
3 Any suppl API-2W:06+OPTION-S1;S3;S4;S5;S8;S10;S12
requirements AGREED MODIFICATIONS

B01-B99 Description of the product

14 B08 am Number of pieces	B09 Thickness	B10 Width	B11 Length	B12 Theoretical mass KG	B04 Product delivery condition	B07.2 Heat No.	B07.1 Rolled plate No./ Test No.	A09 Purchaser article number
1	30,00	x 2500	x 12000	7065	TM	362704	730557-02	
1	30,00	x 2500	x 12000	7065	TM	362705	730556-01	
1	30,00	x 2500	x 12000	7065	TM	362705	730556-02	
3				21195				
3				21195				

B06 Marking of the product

ITEM NO.: 04
TEEL DESIGNATION S355G10+M API 2W 50 Z LS MOD
AT NO. / TRADEMARK / ROLLED PLATE NO.-TEST NO. / INSPECTOR'S STAMP

C10-C29 Tensile test

14 B07.2 am Heat No.	B07.1 Rol. plate/ Test No.	B05 Reference (heat) treatment	C01 C02/ C03 C01 Temp. GR.C	C10 MPA RP02	C11 REH	C12 RM	C13 L0=5D 29	A % L0=8IN 27	C14-C15 REH/RM 0,87 0,83	RP02/RM 0,83	Z %
362704	730557		K4 QO RT	449	468	537	29	27			70,7
			K2 QO RT	444	451	535		28			77,2
			F2 QO RT	454	473	537					76,2
			K2 SO RT			516					74,4
			K2 SO RT			518					70,0
			K2 SO RT			511					68,0
			F2 SO RT			525					
			F2 SO RT			528					
			F2 SO RT			528					

REVIEWED	BY: / DATE: 13 Dec 2011
WITNESSED	
RELEASED	
SIGNATURE	

above mentioned materials have been delivered in accordance

GTS Industries - Groupe Dillinger Hütte
Port 3032
3032 rue du Comte Jean - CS 56317
F-59379 Dunkerque Cedex 1 - FRANCE
Service Qualité-Essais
Date 05.09.11

POISSONNET
Test House Manager

TFK
Manufacturer's

M-System: Certification as per ISO 9001



DILLINGER HÜTTE

anforderungen siehe Rückseite/Explications voir au verso/See reverse for explanations (www.dillinger.de/certificate)

2 INSPECTION CERTIFICATE 3.2 AS PER EN 10204:2004
INSPECTION REPORT 3.2 AS PER EN 10204:1991+A1:1995 + AS PER ISO 10474:1991A10 Advice of dispatch No./
Date of dispatch
2378342-02.09.11A08/ Manufacturer's order/
A03 Certificate No
366375-002Sheet
2/...5 Established Inspecting body
LR
A06 Purchaser
AM PROJECTS, HEIJNING A071 No. 3200019765
Final receiver
AM PROJECTS, ROTTERDA A072 No2/ Steel design 2W-50-MOD
3 Any suppl API-2W:06+OPTION-S1;S3;S4;S5;S8;S10;S12
requirements AGREED MODIFICATIONSB01 Product
HOT ROLLED PLATES

C10-C29 Tensile test

14 B07.2 Heat No.	B07.1 Rol. plate/ Test No.	B05 Reference (heat) treatment	C01 C02/ C03 C01 Temp. GR.C	C10 C11 MPA RP02	REH	C12 RM	C13	A % LO=5D	A % LO=8IN	C14-C15 REH/RM RP02/RM	Z %
362705	730556		K4 QO RT	450	462	537		29		0,86 0,83	
			K2 QO RT	449	470	537			27		69,8
			F2 QO RT	452	469	540			24		60,5
			K2 SO RT			521					75,5
			K2 SO RT			520					65,4
			K2 SO RT			520					74,5
			F2 SO RT			530					70,5
			F2 SO RT			524					
			F2 SO RT			536					

C30-C39 Further information about hardness test

TEM NO.: 04

HARDNESS TEST INFORMATIVE

TEM NO.: 04	C33	C01	C02/C01	RESULTS	AVERAGE
17.2 B07.1	HV10	K9	QO	164/170/167/165	167
2707 728022	HV10	K9	QU	181/186/184/179	183
2707 728022	HV10	K9	QO	187/182/185/188	186
2446 730483	HV10	K9	QU	198/196/197/199	198
2446 730483	HV10	K9	QO	181/175/170/177	176
2702 730097	HV10	K9	QU	174/176/180/183	178
2702 730097	HV10	K9	QO	196/189/189/182	189
2446 730196	HV10	K9	QO	186/191/184/180	185

TFK	We hereby certify that the above mentioned materials have been delivered in accordance with the terms and conditions of the contract.		GTS Industries - Groupe Dillinger Hütte Port 3032 3032 rue du Comte Jean - CS 56317 F-59379 Dunkerque Cedex 1 - FRANCE Service Qualité-Essais		A01
Manufacturer's mark	INSPECTION RECEIVED DATE: 13 Dec 2011		POISSONNET Test House Manager		CD 1
Date		05.09.11			



GTS Industries - Groupe Dillinger Hütte
Port 3032
3032 rue du Comte Jean - CS 56317
F-59379 Dunkerque Cedex 1 - FRANCE
Service Qualité-Essais

Date 05.09.11 CD 1



DILLINGER HÜTTE

M-System: Certification as per ISO 9001

Unterlagen siehe Rückseite/Explications voir au verso/See reverse for explanations (www.dillinger.de/certificate)

INSPECTION CERTIFICATE 3.2 AS PER EN 10204:2004

INSPECTION REPORT 3.2 AS PER EN 10204:1991+AL:1995 + AS PER ISO 10474:1991

A10 Advice of dispatch No / Date of dispatch		A08/ Manufacturer's order/ A03 Certificate No	Sheet
2378342-02.09.11		366375-002	5/...
Established inspecting body LR	A06 Purchaser Final receiver	A07.1 No A07.2 No	B01 Product
	AM PROJECTS, HEIJNING AM PROJECTS, ROTTERDA	3200019765	HOT ROLLED PLATES
2/ Steel design 2W-50-MOD			
3 Any suppl requirements API-2W:06+OPTION-S1;S3;S4;S5;S8;S10;S12 AGREED MODIFICATIONS			

C70-C99 Chemical composition % - Heat analysis

	C70	TI	PB	B	SB	CA	BI	AL-T
2704	Y	0,002	0,001	0,0002	0,0001	0,0022	0,0001	0,033
2705	Y	0,002	0,001	0,0001	0,0002	0,0019	0,0001	0,032

C94 Heat analysis Carbon equivalent / Alloying restrictions

2704	FO-02=	0,35	FO-31=	0,18	FO-51=	0,02	FO-52=	0,02	FO-A1=	7,02
2705	FO-02=	0,36	FO-31=	0,18	FO-51=	0,02	FO-52=	0,02	FO-A1=	8,42

C95 Ladle treatment

ITEM NO.: 04
AT OF THE INDICATED ITEM: VACUUM DEGASSED

C70-C99 Chemical composition % - Product analysis

	C01	C	SI	MN	P	S	N	CU	MO	NI	CR	V	NB	TI	B
2704	Test No.	K40	0,084	0,384	1,52	0,013	0,0009	0,0050	0,041	0,015	0,062	0,036	0,021	0,003	0,0002
2705	Test No.	K40	0,085	0,378	1,51	0,013	0,0007	0,0037	0,038	0,024	0,054	0,034	0,019	0,002	0,0002

C94 Product analysis Carbon equivalent / Alloying restrictions

2704	FO-31=	0,18	FO-51=	0,02	FO-52=	0,02	FO-A1=	6,60
2705	FO-31=	0,18	FO-51=	0,02	FO-52=	0,02	FO-A1=	8,65

above mentioned materials have been delivered in accordance with the terms of order

GTS Industries - Groupe Dillinger Hütte
Port 3032
3032 rue du Comte Jean - CS 56317
F-59379 Dunkerque Cedex 1 - FRANCE
Service Qualité-Essais
Date 05.09.11

POISSONNET
Test House Manager

CONTROL NUMBER
DNK1100154
Insaebne

Lloyds Register

NARGAN COMPANY
ACTION

REVIEWED
WITNESSED
RELEASED
DATE: 13 Dec 2003



TFK
Manufacturer's



CD 1

WPQ

CS PIPING

 NARGAN COMPANY	
INSPECTION	
REVIEWED	<input checked="" type="checkbox"/>
WITNESSED	<input type="checkbox"/>
RELEASED	<input type="checkbox"/>
BY: M. REZAEI DATE: 13 Dec. 2023	
SIGN: 	

Welder's name	J. Wesdorp	Test date	1/14/2020
ID Number	5171457148	WPQ record number	A0790090-1
Date of birth	9-12-1996	Standard test number	N.A.
Stamp number	JW	WPS record number	P2250
Company name	Airpack Netherlands BV	Qualification code	ASME Section IX: 2019
Division			

BASE METALS (QW-403)

	Product form	Specification (type or grade)	P no.	Grp-no.	Size	Sch.	Thick. (mm)	Dia. (mm)
Welded to:	Pipe	SA-106 (B)	1	1	50,80	XS	5,54	60,33
	Pipe	SA-106 (B)	1	1	50,80	XS	5,54	60,33
Joint type	Groove							

VARIABLES

	Actual values	RANGE QUALIFIED
Type of weld joint	Pipe - Groove	Groove and Fillet welds
Base metal	P1 to P1	P-no. 1 thru 15F, 34, 41 thru 49

BASE METAL THICKNESS

	Groove	Fillet	Overlay	Groove	Fillet	Overlay
Plate thickness (mm)	-	-	-	no limit	no limit	-
Pipe/tube thickness (mm)	5,54	-	-	no limit	no limit	-
Pipe diameter (mm)	60,33	-	-	25,4 min	no limit	-

PROCESS VARIABLES

	Actual values	RANGE QUALIFIED
Welding process	GTAW	GTAW
Type	Manual	Manual
Backing	No backing used	With, without
Filler metal specification	5,18	5,xx
Filler metal classification	ER70S-3	Any
Filler metal F-number	6	6
Filler metal variety (QW-404.23)	Bare (solid)	Solid, metal cored
Consumable insert	None	Without
Number of layers deposited	3	
Weld deposit thickness (mm)	5,54	11,08 max
Weld position (Actual position tested)	6G	
		All
Groove - Plate & Pipe > 610mm		All
Groove - Pipe 73mm to 610mm		All
Groove - Pipe 73mm		All
Fillet - Plate & Pipe > 610mm		All
Fillet - Pipe 73mm to 610mm		All
Fillet - Pipe < 73mm		All
Progression	Up	Up
Backing gas	Without	With, without
GTAW welding current/polarity	DCEN (straight polarity)	DCEN (straight polarity)

TESTS

Type of test	Acceptance criteria	Result	Comments
2 traverse face bends per QW-161.2, QW-463.2(d) and QW-462.3(a)	QW-163	Acceptable	see - ASME IX QW-452.1(a) Note 1
2 traverse root bends per QW-161.3, QW-463.2(d) and QW-462.3(a)	QW-163	Acceptable	see - ASME IX QW-452.1(a) Note 1
Visual examination per QW-302.4	QW-194	Acceptable	

Notes: This WPQ is based on PQR RET 0245029-001-18

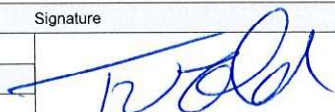
CERTIFICATION

Tests conducted by	Element Breda (NLD)	Laboratory test number	ARJ001-20-01-39594-2
Mechanical tests by	N.A.	Test file number	ARI 2503-3

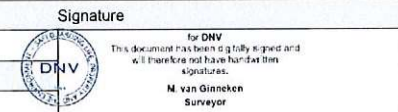
We certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code.



Signature 1

Name	Signature
F. van Toledo	
Date	9/4/2023

Signature 2

Name	Signature
M. van Ginneken DNV	
Date	9/4/2023

Welder's name	R. Ali	Test date	1/14/2020
ID Number	4882630217	WPQ record number	A0790090-2
Date of birth	8/9/1957	Standard test number	N.A.
Stamp number	RA	WPS record number	P2250
Company name	Airpack Netherlands BV	Qualification code	ASME Section IX: 2019
Division	N.A.		

BASE METALS (QW-403)

	Product form	Specification (type or grade)	P no.	Grp-no.	Size	Sch.	Thick. (mm)	Dia. (mm)
Welded to:	Pipe	SA-106 (B)	1	1	50,80	XS	5,54	60,33
	Pipe	SA-106 (B)	1	1	50,80	XS	5,54	60,33
Joint type	Groove							

VARIABLES

	Actual values	RANGE QUALIFIED
Type of weld joint	Pipe - Groove	Groove and Fillet welds
Base metal	P1 to P1	P-no. 1 thru 15F, 34, 41 thru 49

BASE METAL THICKNESS

	Groove	Fillet	Overlay	Groove	Fillet	Overlay
Plate thickness (mm)	-	-	-	no limit	no limit	-
Pipe/tube thickness (mm)	5,54	-	-	no limit	no limit	-
Pipe diameter (mm)	60,33	-	-	25,4 min	no limit	-

PROCESS VARIABLES

	Actual values	RANGE QUALIFIED
Welding process	GTAW	GTAW
Type	Manual	Manual
Backing	No backing used	With, without
Filler metal specification	5,18	5.xx
Filler metal classification	ER70S-3	Any
Filler metal F-number	6	6
Filler metal variety (QW-404.23)	Bare (solid)	Solid, metal cored
Consumable insert	None	Without
Number of layers deposited	3	
Weld deposit thickness (mm)	5,54	11,08 max
Weld position (Actual position tested)	6G	
Groove - Plate & Pipe > 610mm		All
Groove - Pipe 73mm to 610mm		All
Groove - Pipe 73mm		All
Fillet - Plate & Pipe > 610mm		All
Fillet - Pipe 73mm to 610mm		All
Fillet - Pipe < 73mm		All
Progression	Up	Up
Backing gas	Without	With, without
GTAW welding current/polarity	DCEN (straight polarity)	DCEN (straight polarity)

TESTS

Type of test	Acceptance criteria	Result	Comments
2 traverse face bends per QW-161.2, QW-463.2(d) and QW-462.3(a)	QW-163	Acceptable	see - ASME IX QW-452.1(a) Note 1
2 traverse root bends per QW-161.3, QW-463.2(d) and QW-462.3(a)	QW-163	Acceptable	see - ASME IX QW-452.1(a) Note 1
Visual examination per QW-302.4	QW-194	Acceptable	

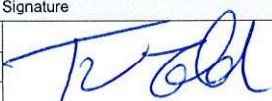

Notes: This WPQ is based on PQR RET 0245029-001-18

CERTIFICATION

Tests conducted by	Element Breda (NLD)	Laboratory test number	ARJ001-20-01-39594-2
Mechanical tests by	N.A.	Test file number	ARL2503-3

We certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code.


Signature 1

Name	Signature	Name	Signature
F. van Toledo		M. van Ginneken DNV	
Date		Date	
9/4/2023		9/4/2023	



Airpack Netherlands BV
Groeneweegje 19 - 25, 4301 RN Zierikzee, The Netherlands
ASME Section IX - Welder Performance Qualification (WPQ)
WeldOffice WPQ

Welder's name	A. Sumantri		Test date	25-5-2012
ID Number	ID Card IXH4P6551		WPQ record number	RET 0245029-002-23 Rev 1
Date of birth	23-02-1962		Standard test number	N.A.
Stamp number	W-102		WPS record number	P2000
Company name	Airpack Netherlands BV		Qualification code	ASME Section IX: 2010 including
Division	N.A.			

BASE METALS (QW-403)

	Product form	Specification (type or grade)	P no.	Grp-no.	Size	Sch.	Thick. (mm)	Dia. (mm)
Welded to:	Pipe	SA-333 (6)	1	1	12,70	160	4,78	21,34
	Pipe	SA-333 (6)	1	1	12,70	160	4,78	21,34
Joint type	Groove							

VARIABLES

	Actual values	RANGE QUALIFIED
Type of weld joint	Pipe - Groove	Groove and Fillet welds
Base metal	P1 to P1	P-no. 1 thru 15F, 34, 41 thru 49

BASE METAL THICKNESS

	Groove	Fillet	Overlay	Groove	Fillet	Overlay
Plate thickness (mm)	-	-	-	no limit	no limit	-
Pipe/tube thickness (mm)	4,78	-	-	no limit	no limit	-
Pipe diameter (mm)	21,34	-	-	21,34 min	no limit	-

PROCESS VARIABLES

	Actual values	RANGE QUALIFIED
Welding process	GTAW	GTAW
Type	Manual	Manual
Backing	No backing used	With, without
Filler metal specification	5.18	5 xx
Filler metal classification	ER70S-3	Any
Filler metal F-number	6	6
Filler metal variety (QW-404.23)	Bare (solid)	Solid, metal cored
Consumable insert	None	Without
Number of layers deposited	5	
Weld deposit thickness (mm)	4,78	9,56 max
Weld position (Actual position tested)	6G	
Groove - Plate & Pipe > 610mm		All
Groove - Pipe 73mm to 610mm		All
Groove - Pipe 73mm		All
Fillet - Plate & Pipe > 610mm		All
Fillet - Pipe 73mm to 610mm		All
Fillet - Pipe < 73mm		All
Progression	Up	Up
Backing gas	Without	With, without
GTAW welding current/polarity	DCEN (straight polarity)	DCEN (straight polarity)

TESTS

Type of test	Acceptance criteria	Result	Comments
Radiographic examination	ASME IX	Acceptable	Report number 1213-1012-24-020

Notes

CERTIFICATION

Tests conducted by	Schielab BV Breda (NLD)	Laboratory test number	SL 12 6538-1
Mechanical tests by	N.A.	Test file number	ARL 1559-7

We certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code.

INSPECTION	
REVIEWED	<input checked="" type="checkbox"/>
WITNESSED	<input type="checkbox"/>
RELEASED	<input type="checkbox"/>
BY: M. REZAEI DATE: 13 Dec 2012	
SIGN:	

Signature

Name	Signature
F. van Toledo	
Date	
21-6-2012	

Signature Welder

Name	Signature
W. Komdeur (Lloyds)	
Date	
21-6-2012	

WELDING PROCEDURE QUALIFICATION RECORD AND WELDERS PERFORMANCE QUALIFICATION TEST RECORD

Testing in accordance with : ASME IX:2010
Purchaser : Arjan Roza Lastechniek BV
Purchase order no. : ARL1559-1

Manufacturer : Airpack Nederland BV.
WPS : P2000

Description of sample(s) : Pipe with Single-V-groove
Dimension(s) : 2,5" Sch 40S (Ø 73,03 x 5,15 mm)
Material grade : P1 Gr.1 – P1 Gr. 1
Material : ASTM SA-333 Gr.6 - ASTM SA-333 Gr.6

Welding process(es) : GTAW
Filler : F-no.6 A-no. 1
Brand and type : Lincoln Electric LNT 25, ER70S-3
Shielding gas : Argon (A5.32 SG-A)
Backing gas : Not used

Welding position : 6G progression up
Preheat / Interpass temp. : 10 °C / 166 °C
Joint type : Single-V-groove

Welder : A. Sumantri
Date / place of birth : 23-02-1962 / Oost- en West-Souburg
Stamp. No. / ID : W-102 / ID Card IXH4P6551
Testpiece marked with : ARL1559-1

NON DESTRUCTIVE EXAMINATION

* Visual examination : performed by examiner

CROSS WELD TENSILE TESTS

Dimensions(s) [mm]	Rm [N/mm ²]	Fracture location
19.01 x 4.53	538	Base material
19.02 x 4.73	527	Base material
Requirements;	≥ 415	

TECHNOLOGICAL TESTS

Type	Former / Bending angle	Results
Face bend	4t / 180°	2 x acceptable
root bend	4t / 180°	2 x acceptable

NARGAN COMPANY	
INSPECTION	
REVIEWED	<input checked="" type="checkbox"/>
WITNESSED	<input type="checkbox"/>
RELEASED	<input type="checkbox"/>
BY: M. REZAEI DATE: 13 Dec. 2023	
SIGN: <i>M. Rezaei</i>	

IMPACT TESTS - Type: Charpy KV

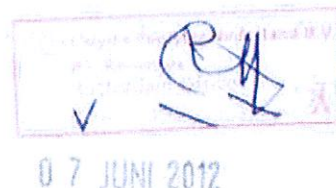
Notch location	Size [mm]	Test temp. [°C]	Results [J]	Average value [J]
Midweld	10 x 4	-55	52-19-55	42
Fusion line	10 x 4	-55	74-61-58	64
Requirements for size 10x10mm;			≥ 19	≥ 27
Requirements for size 10x4mm;			≥ 7.5	≥ 11

Conclusion: The results satisfy the requirements.

All characteristics of the above object(s) have, as far as accessible and relevant, been verified by Schielab b.v. Other information was provided by the purchaser. This information was verified as far as possible and has been copied into this report, unchanged. We hereby certify that the reported test data is correct and that the above object(s) was (were) tested/examined in accordance with purchasers requirements and/or the above procedure(s) and/or code(s)/specification(s). On occasion a destructive test is subcontracted by Schielab b.v. (marked 'U' on the report). Opinions, interpretations and advice expressed in this report are outside the scope of any possible RvA accreditation, but are presented in a true and fair manner based on the best knowledge of the Schielab personnel involved. If, upon reproduction, only part of this report is copied, Schielab will not bear any responsibility for content, purport and conclusions of that reproduction. This report has legal value only when printed on Schielab paper and furnished with an authorised signature. Digital versions of this report have no legal value. Unless explicitly agreed upon otherwise in writing, our "General conditions for activities performed by Schielab b.v.", deposited at the Chamber of Commerce in Rotterdam, under number 24170257, apply.

Breda, 07-06-2012

Witnessed and approved by; Mr.
Representing: Lloyd's Register Nederland B.V.
[RET 0245029]

NARGAN COMPANY	
INSPECTION	
REVIEWED	<input checked="" type="checkbox"/>
WITNESSED	<input type="checkbox"/>
RELEASED	<input type="checkbox"/>
BY: M. REZAEI DATE: 13 Dec 2023	
SIGN: 	

Welder's name	A. Sumantri		Test date	25-5-2012	Rev. - Rev. 0
ID Number	ID Card IX-H4P6551		WPQ record number	RET 0245029-002-15	
Date of birth	23-02-1962		Standard test number	N.A.	
Stamp number	W-102		WPS record number	P2250	
Company name	Airpack Netherlands BV		Qualification code	ASME Section IX:2010 including	
Division	N.A.				

BASE METALS (QW-403)

	Product form	Specification (type or grade)	P no.	Grp-no.	Size	Sch.	Thick. (mm)	Dia. (mm)
Welded to:	Pipe	SA-333 (6)	1	1	63,50	160	9,53	73,03
	Pipe	SA-333 (6)	1	1	63,50	160	9,53	73,03
Joint type	Groove							

VARIABLES

	Actual values	RANGE QUALIFIED
Type of weld joint	Pipe - Groove	Groove and Fillet welds
Base metal	P1 to P1	P-no. 1 thru 15F, 34, 41 thru 49

BASE METAL THICKNESS

	Groove	Fillet	Overlay	Groove	Fillet	Overlay
Plate thickness (mm)	-	-	-	no limit	no limit	-
Pipe/tube thickness (mm)	9,53	-	-	no limit	no limit	-
Pipe diameter (mm)	73,03	-	-	73 min	no limit	-

PROCESS VARIABLES

	Actual values	RANGE QUALIFIED
Welding process	GTAW	GTAW
Type	Manual	Manual
Backing	No backing used	With, without
Filler metal specification	5.18	5.xx
Filler metal classification	ER70S-3	Any
Filler metal F-number	6	6
Filler metal variety (QW-404.23)	Bare (solid)	Solid, metal cored
Consumable insert	None	Without
Number of layers deposited	5	
Weld deposit thickness (mm)	9,53	19,06 max
Weld position (Actual position tested)	6G	
Groove - Plate & Pipe > 610mm		All
Groove - Pipe 73mm to 610mm		All
Groove - Pipe 73mm		All
Fillet - Plate & Pipe > 610mm		All
Fillet - Pipe 73mm to 610mm		All
Fillet - Pipe < 73mm		All
Progression	Up	Up
Backing gas	Without	With, without
GTAW welding current/polarity	DCEN (straight polarity)	DCEN (straight polarity)

TESTS


Type of test	Acceptance criteria	Result	Comments
Face bend test per QW-463.2(a)	QW-163	Acceptable	see -
Face bend test per QW-463.2(a)	QW-163	Acceptable	see -
Root bend test per QW-463.2(a)	QW-163	Acceptable	see -
Root bend test per QW-463.2(a)	QW-163	Acceptable	see -

Notes	This WPQ is based on PQR RET 0245029-001-17
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CERTIFICATION

Tests conducted by	Schiellab BV Breda (NLD)	Laboratory test number	SL 12.6044-1A
Mechanical tests by	N.A.	Test file number	ARL1559-2

We certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code.

	
INSPECTION	
REVIEWED	<input checked="" type="checkbox"/>
WITNESSED	<input type="checkbox"/>
RELEASED	<input type="checkbox"/>
BY: M. REZAEI DATE: 13 Dec. 2023	
SIGN: 	

Signature

Name	Signature	Name	Signature
Franky van Toledo		A. Sumantri	
Date		Date	
8-6-2012		8-6-2012	

WELDING PROCEDURE QUALIFICATION RECORD AND WELDERS PERFORMANCE QUALIFICATION TEST RECORD

Testing in accordance with : ASME IX:2010
Purchaser : Arjan Roza Lastechniek BV
Purchase order no. : ARL1559-2

Manufacturer : Airpack Nederland BV.
WPS : P2250

Description of sample(s) : Pipe with Single-V-groove
Dimension(s) : 2,5" Sch 160 (Ø 73,03 x 9,52 mm)
Material grade : P1 Gr.1 – P1 Gr. 1
Material : ASTM SA-333 Gr. 6 - ASTM SA-333 Gr. 6

Welding process(es) : GTAW
Filler : F-no.6 A-no. 1
Brand and type : Lincoln Electric LNT 25, ER70S-3
Shielding gas : Argon (A5.32 SG-A)
Backing gas : Not used

Welding position : 6G progression up
Preheat / Interpass temp. : 10 °C / 156 °C
Joint type : Single-V-groove

Welder : A. Sumantri
Date / place of birth : 23-02-1962 / Oost- en West-Souburg
Stamp. No. / ID : W-102 / ID Card IXH4P6551
Testpiece marked with : ARL1559-2

NON DESTRUCTIVE EXAMINATION

* Visual examination : performed by examiner

CROSS WELD TENSILE TESTS

Dimensions(s) [mm]	Rm [N/mm ²]	Fracture location
19.04 x 8.80	490	Base material
19.02 x 8.94	488	Base material
Requirements;	≥ 415	

TECHNOLOGICAL TESTS

Type	Former / Bending angle	Results
Face bend	4t / 180°	2 x acceptable
root bend	4t / 180°	2 x acceptable

NARGAN COMPANY	
INSPECTION	
REVIEWED	<input checked="" type="checkbox"/>
WITNESSED	<input type="checkbox"/>
RELEASED	<input type="checkbox"/>
BY: M. REZAEI DATE: 13 Dec. 2023	
SIGN: <i>M. Rezaei</i>	

IMPACT TESTS - Type: Charpy KV

Notch location	Size [mm]	Test temp. [°C]	Results [J]	Average value [J]
Midweld	10 x 7.5	-49	141-170-212	174
Fusion line	10 x 7.5	-49	214-212-218	215
Requirements for size 10x10mm;			≥ 19	≥ 27
Requirements for size 10x7.5mm;			≥ 14	≥ 20

Conclusion: The results satisfy the requirements.

All characteristics of the above object(s) have, as far as accessible and relevant, been verified by Schielab b.v. Other information was provided by the purchaser. This information was verified as far as possible and has been copied into this report, unchanged. We hereby certify that the reported test data is correct and that the above object(s) was (were) tested/examined in accordance with purchasers requirements and/or the above procedure(s) and/or code(s)/specification(s). On occasion a destructive test is subcontracted by Schielab b.v. (marked 'U' on the report). Opinions, interpretations and advice expressed in this report are outside the scope of any possible RvA accreditation, but are presented in a true and fair manner based on the best knowledge of the Schielab personnel involved. If, upon reproduction, only part of this report is copied, Schielab will not bear any responsibility for content, purport and conclusions of that reproduction. This report has legal value only when printed on Schielab paper and furnished with an authorised signature. Digital versions of this report have no legal value. Unless explicitly agreed upon otherwise in writing our "General conditions for activities performed by Schielab b.v.", deposited at the Chamber of Commerce in Rotterdam, under number 24170257, apply.

Breda, 07-06-2012

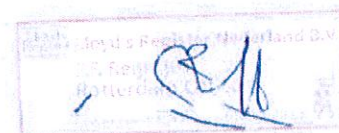
Witnessed and approved by; Mr.

Representing: Lloyd's Register Nederland B.V.

[RET 0245029]



A. Karstanje

07 JUNI 2012

NARGAN COMPANY	
INSPECTION	
REVIEWED	<input checked="" type="checkbox"/>
WITNESSED	<input type="checkbox"/>
RELEASED	<input type="checkbox"/>
BY: M. REZAEI DATE: 13 Dec. 2023	
SIGN: 	



Ingeschreven in het RvA register voor laboratoria onder nr. L 063 voor gebieden zoals nader omschreven in de erkenning. Entered in the RvA register for laboratories under number L 063 for the areas outlined in the approval.

Schielab-Breda Voorerf 18-20, 4824 GN Breda, Tel. 076 - 5424 300, Fax 076 - 5424 848
Schielab b.v. Handelsregister/Register of Commerce Rotterdam nr. 24170257



Welder's name	A. Sumantri		Test date	9/22/2020	
ID Number	ID Card IXH4P6551		WPQ record number	A0790090-58	
Date of birth	23-02-1962		Standard test number	N.A.	Rev. -
Stamp number	W-102		WPS record number	PGF-2000	Rev. 0
Company name	Airpack Netherlands BV		Qualification code	ASME Section IX: 2019	
Division	N.A.				

BASE METALS (QW-403)

	Product form	Specification (type or grade)	P no.	Grp.no.	Size	Sch.	Thick. (mm)	Dia. (mm)
Welded to:	Pipe	SA-333 (6)	1	1	101.60	40	6.02	114.30
	Pipe	SA-350 (LF2)	1	2	101.60	40	6.02	114.30
Joint type	Groove							

VARIABLES

	Actual values	RANGE QUALIFIED
Type of weld joint	Pipe - Groove	Groove and Fillet welds
Base metal	P1 to P1	P-no. 1 thru 15F, 34, 41 thru 49

BASE METAL THICKNESS

	Groove	Fillet	Overlay	Groove	Fillet	Overlay
Plate thickness (mm)	-	-	-	no limit	no limit	-
Pipe/tube thickness (mm)	6.02	-	-	no limit	no limit	-
Pipe diameter (mm)	114.30	-	-	73 min	no limit	-

PROCESS VARIABLES

	Actual values		RANGE QUALIFIED	
Welding process	GTAW	FCAW	GTAW	FCAW
Type	Manual	Semi-automatic	Manual	Semi-automatic
Backing	Without	With	With, without	With
Filler metal specification	5.18	5.20	5.xx	5.xx
Filler metal classification	ER70S-3	E71T-9M-J	Any	Any
Filler metal F-number	6	6	6	6
Filler metal variety (QW-404.23)	Bare (solid)	-	Solid, metal cored	-
Consumable insert	None	-	Without	-
Number of layers deposited	1	2	-	-
Weld deposit thickness (mm)	2.02	4.0	4.04 max	8.0 max
Weld position (Actual position tested)	1G Rotated	1G Rotated		
Groove - Plate & Pipe > 610mm			F	F
Groove - Pipe 73mm to 610mm			F	F
Groove - Pipe 73mm			F	F
Fillet - Plate & Pipe > 610mm			F	F
Fillet - Pipe 73mm to 610mm			F	F
Fillet - Pipe < 73mm			F	F
Progression	-	-	-	-
Backing gas	Without	Without	With, without	With, without
GMAW transfer mode (QW-409)	-	-	-	Spray, pulse, globular
GTAW welding current/polarity	DCSP	-	DCSP	-

TESTS

Type of test	Acceptance criteria	Result	Comments
1 transverse face bend per QW-161.2 and QW-462.3(a)	QW-163	Acceptable	see - ASME IX - QW-452.1 (a)
1 transverse root bend per QW-161.3 and QW-462.3(a)	QW-163	Acceptable	see - ASME IX - QW-452.1 (a)
Visual examination per QW-302.4	QW-194	Acceptable	see - ASME IX - QW-452.1 (a)

Notes


CERTIFICATION

Tests conducted by	Daniel Schutt	Laboratory test number	ARJ001-20-09-42663-1
Mechanical tests by	Element Breda (NLD)	Test file number	ARL2542-1A0790090-60

We certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code.



Signature 1

Name	Signature	Name	Signature
F. van Toledo (Airpack)		L. Knops (DNVGL)	
Date	9/22/2020	Date	10/6/2020

Welder's name	J. Wesdorp	Test date	9/22/2020
ID Number	5171457148	WPQ record number	A0790090-60
Date of birth	9-12-1996	Standard test number	N.A.
Stamp number	JW	WPS record number	PGF-2000
Company name	Airpack Netherlands BV	Qualification code	ASME Section IX: 2019
Division			

BASE METALS (QW-403)

	Product form	Specification (type or grade)	P no.	Grp-no.	Size	Sch.	Thick. (mm)	Dia. (mm)
Welded to:	Pipe	SA-333 (6)	1	1	101,60	40	6,02	114,30
	Pipe	SA-350 (LF2)	1	2	101,60	40	6,02	114,30
Joint type	Groove							

VARIABLES

	Actual values	RANGE QUALIFIED
Type of weld joint	Pipe - Groove	Groove and Fillet welds
Base metal	P1 to P1	P-no. 1 thru 15F, 34, 41 thru 49

BASE METAL THICKNESS

	Groove	Fillet	Overlay	Groove	Fillet	Overlay
Plate thickness (mm)	-	-	-	no limit	no limit	-
Pipe/tube thickness (mm)	6,02	-	-	no limit	no limit	-
Pipe diameter (mm)	114,30	-	-	73 min	no limit	-

PROCESS VARIABLES

	Actual values		RANGE QUALIFIED	
Welding process	GTAW	FCAW	GTAW	FCAW
Type	Manual	Semi-automatic	Manual	Semi-automatic
Backing	Without	With	With, without	With
Filler metal specification	5.18	5.20	5.xx	5.xx
Filler metal classification	ER70S-3	E71T-9M-J	Any	Any
Filler metal F-number	6	6	6	6
Filler metal variety (QW-404.23)	Bare (solid)	-	Solid, metal cored	-
Consumable insert	None	-	Without	-
Number of layers deposited	1	2		
Weld deposit thickness (mm)	2,02	4,0	4,04 max	8,0 max
Weld position (Actual position tested)	1G Rotated	1G Rotated		
Groove - Plate & Pipe > 610mm			F	F
Groove - Pipe 73mm to 610mm			F	F
Groove - Pipe 73mm			F	F
Fillet - Plate & Pipe > 610mm			F	F
Fillet - Pipe 73mm to 610mm			F	F
Fillet - Pipe < 73mm			F	F
Progression	-	-	-	-
Backing gas	Without	Without	With, without	With, without
GMAW transfer mode (QW-409)	-	Spray	-	Spray, pulse, globular
GTAW welding current/polarity	DCEN (straight polarity)	-	DCEN (straight polarity)	-

TESTS


Type of test	Acceptance criteria	Result	Comments
1 traverse face bends per QW-161.2, QW-463.2(d) and QW-462.3(a)	QW-163	Acceptable	see - ASME IX QW-452.1(a) Note 1
1 traverse root bends per QW-161.3, QW-463.2(d) and QW-462.3(a)	QW-163	Acceptable	see - ASME IX QW-452.1(a) Note 1
Visual examination per QW-302.4	QW-194	Acceptable	
Notes			

CERTIFICATION

Tests conducted by	Daniel Schutt	Laboratory test number	ARJ001-20-09-42663-2
Mechanical tests by	Element Breda (NLD)	Test file number	ARL2542-2

We certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code.


Signature 1

Name	Signature
F. van Toledo	
Date	9/4/2023

Signature 2

Name	Signature
M. van Ginneken DNV	
Date	9/4/2023

Welder's name	R. Ali	Test date	9/22/2020
ID Number	4882630217	WPQ record number	A0790090-62
Date of birth	8/9/1957	Standard test number	N.A.
Stamp number	RA	WPS record number	PGF-2000
Company name	Airpack Netherlands BV	Qualification code	ASME Section IX: 2019
Division	N.A.		

BASE METALS (QW-403)

	Product form	Specification (type or grade)	P no.	Grp-no.	Size	Sch.	Thick. (mm)	Dia. (mm)
Welded to:	Pipe	SA-333 (6)	1	1	101,60	40	6,02	114,30
	Pipe	SA-350 (LF2)	1	2	101,60	40	6,02	114,30
Joint type	Groove							

VARIABLES

	Actual values	RANGE QUALIFIED
Type of weld joint	Pipe - Groove	Groove and Fillet welds
Base metal	P1 to P1	P-no. 1 thru 15F, 34, 41 thru 49

BASE METAL THICKNESS

	Groove	Fillet	Overlay	Groove	Fillet	Overlay
Plate thickness (mm)	-	-	-	no limit	no limit	-
Pipe/tube thickness (mm)	6,02	-	-	no limit	no limit	-
Pipe diameter (mm)	114,30	-	-	73 min	no limit	-

PROCESS VARIABLES

	Actual values		RANGE QUALIFIED	
Welding process	GTAW	FCAW	GTAW	FCAW
Type	Manual	Semi-automatic	Manual	Semi-automatic
Backing	Without	With	With, without	With
Filler metal specification	5.18	5.20	5.xx	5.xx
Filler metal classification	ER70S-3	E71T-9M-J	Any	Any
Filler metal F-number	6	6	6	6
Filler metal variety (QW-404.23)	Bare (solid)	-	Solid, metal cored	-
Consumable insert	None	-	Without	-
Number of layers deposited	1	2		
Weld deposit thickness (mm)	2,02	4,0	4,04 max	8,0 max
Weld position (Actual position tested)	1G Rotated	1G Rotated		
Groove - Plate & Pipe > 610mm			F	F
Groove - Pipe 73mm to 610mm			F	F
Groove - Pipe 73mm			F	F
Fillet - Plate & Pipe > 610mm			F	F
Fillet - Pipe 73mm to 610mm			F	F
Fillet - Pipe < 73mm			F	F
Progression	-	-	-	-
Backing gas	Without	Without	With, without	With, without
GMAW transfer mode (QW-409)	-	Spray	-	Spray, pulse, globular
GTAW welding current/polarity	DCEN (straight polarity)	-	DCEN (straight polarity)	-

TESTS

Type of test	Acceptance criteria	Result	Comments
1 traverse face bends per QW-161.2, QW-463.2(d) and QW-462.3(a)	QW-163	Acceptable	see - ASME IX QW-452.1(a) Note 1
1 traverse root bends per QW-161.3, QW-463.2(d) and QW-462.3(a)	QW-163	Acceptable	see - ASME IX QW-452.1(a) Note 1
Visual examination per QW-302.4	QW-194	Acceptable	



Notes	
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CERTIFICATION



Tests conducted by	Daniel Schutt	Laboratory test number	ARJ001-20-09-42663-3
Mechanical tests by	Element Breda (NLD)	Test file number	ARL2542-3

We certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code.


Signature 1

Name	Signature	Name	Signature
F. van Toledo		M. van Ginneken DNV	
Date	9/4/2023	Date	9/4/2023

WPQ SS PIPING

 NARGAN COMPANY	
INSPECTION	
REVIEWED	<input checked="" type="checkbox"/>
WITNESSED	<input type="checkbox"/>
RELEASED	<input type="checkbox"/>
BY: M. REZAEI DATE: 13 Dec. 2023	
SIGN: 	

Welder's name	J. Wesdorp	Test date	1/14/2020
ID Number	5171457148	WPQ record number	A0790090-3
Date of birth	9-12-1996	Standard test number	N.A.
Stamp number	JW	WPS record number	P3000
Company name	Airpack Netherlands BV	Qualification code	ASME Section IX: 2019
Division			

BASE METALS (QW-403)

	Product form	Specification (type or grade)	P no.	Grp-no.	Size	Sch.	Thick. (mm)	Dia. (mm)
Welded to:	Pipe	SA-312 (TP316L)	8	1	50,80	XS	5,54	60,33
	Pipe	SA-312 (TP316L)	8	1	50,80	XS	5,54	60,33
Joint type	Groove							

VARIABLES

	Actual values	RANGE QUALIFIED
Type of weld joint	Pipe - Groove	Groove and Fillet welds
Base metal	P8 to P8	P-no. 1 thru 15F, 34, 41 thru 49

BASE METAL THICKNESS

	Groove	Fillet	Overlay	Groove	Fillet	Overlay
Plate thickness (mm)	-	-	-	no limit	no limit	-
Pipe/tube thickness (mm)	5,54	-	-	no limit	no limit	-
Pipe diameter (mm)	60,33	-	-	25,4 min	no limit	-

PROCESS VARIABLES

	Actual values	RANGE QUALIFIED
Welding process	GTAW	GTAW
Type	Manual	Manual
Backing	No backing used	With, without
Filler metal specification	5.9	5.xx
Filler metal classification	ER316LSi	Any
Filler metal F-number	6	6
Filler metal variety (QW-404.23)	Bare (solid)	Solid, metal cored
Consumable insert	None	Without
Number of layers deposited	3	
Weld deposit thickness (mm)	5,54	11,08 max
Weld position (Actual position tested)	6G	
Groove - Plate & Pipe > 610mm		All
Groove - Pipe 73mm to 610mm		All
Groove - Pipe 73mm		All
Fillet - Plate & Pipe > 610mm		All
Fillet - Pipe 73mm to 610mm		All
Fillet - Pipe < 73mm		All
Progression	Up	Up
Backing gas	With	With
GTAW welding current/polarity	DCEN (straight polarity)	DCEN (straight polarity)

TESTS

Type of test	Acceptance criteria	Result	Comments
2 traverse face bends per QW-161.2, QW-463.2(d) and QW-462.3(a)	QW-163	Acceptable	see - ASME IX QW-452.1(a) Note 1
2 traverse root bends per QW-161.3, QW-463.2(d) and QW-462.3(a)	QW-163	Acceptable	see - ASME IX QW-452.1(a) Note 1
Visual examination per QW-302.4	QW-194	Acceptable	

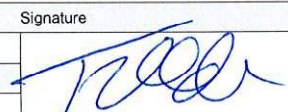

Notes: This WPQ is based on PQR RET 0245029-001-21

CERTIFICATION

Tests conducted by	Element Breda (NLD)	Laboratory test number	ARJ001-20-01-39594-1
Mechanical tests by	N.A.	Test file number	ARL2503-2

We certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code.


Signature 1

Name	Signature	Name	Signature
F. van Toledo		M. van Ginneken DNV	
Date		Date	
9/4/2023		9/4/2023	

Welder's name	R. Ali	Test date	1/14/2020
ID Number	4882630217	WPQ record number	A0790090-4
Date of birth	8/9/1957	Standard test number	N.A.
Stamp number	RA	WPS record number	P3000
Company name	Airpack Netherlands BV	Qualification code	ASME Section IX: 2019
Division	N.A.		

BASE METALS (QW-403)

	Product form	Specification (type or grade)	P no.	Grp-no.	Size	Sch.	Thick. (mm)	Dia. (mm)
Welded to:	Pipe	SA-312 (TP316L)	8	1	50,80	XS	5,54	60,33
	Pipe	SA-312 (TP316L)	8	1	50,80	XS	5,54	60,33
Joint type	Groove							

VARIABLES

Type of weld joint	Pipe - Groove	RANGE QUALIFIED
Base metal	P8 to P8	Groove and Fillet welds P-no. 1 thru 15F, 34, 41 thru 49

BASE METAL THICKNESS

	Groove	Fillet	Overlay	Groove	Fillet	Overlay
Plate thickness (mm)	-	-	-	no limit	no limit	-
Pipe/tube thickness (mm)	5,54	-	-	no limit	no limit	-
Pipe diameter (mm)	60,33	-	-	25,4 min	no limit	-

PROCESS VARIABLES

	Actual values	RANGE QUALIFIED
Welding process	GTAW	GTAW
Type	Manual	Manual
Backing	No backing used	With, without
Filler metal specification	5.9	5.xx
Filler metal classification	ER316LSi	Any
Filler metal F-number	6	6
Filler metal variety (QW-404.23)	Bare (solid)	Solid, metal cored
Consumable insert	None	Without
Number of layers deposited	3	
Weld deposit thickness (mm)	5,54	11,08 max
Weld position (Actual position tested)	6G	
Groove - Plate & Pipe > 610mm		All
Groove - Pipe 73mm to 610mm		All
Groove - Pipe 73mm		All
Fillet - Plate & Pipe > 610mm		All
Fillet - Pipe 73mm to 610mm		All
Fillet - Pipe < 73mm		All
Progression	Up	Up
Backing gas	With	With
GTAW welding current/polarity	DCEN (straight polarity)	DCEN (straight polarity)

TESTS

Type of test	Acceptance criteria	Result	Comments
2 traverse face bends per QW-161.2, QW-463.2(d) and QW-462.3(a)	QW-163	Acceptable	see - ASME IX QW-452.1(a) Note 1
2 traverse root bends per QW-161.3, QW-463.2(d) and QW-462.3(a)	QW-163	Acceptable	see - ASME IX QW-452.1(a) Note 1
Visual examination per QW-302.4	QW-194	Acceptable	

Notes: This WPQ is based on PQR RET 0245029-001-21

CERTIFICATION

Tests conducted by	Element Breda (NLD)	Laboratory test number	ARJ001-20-01-39594-1
Mechanical tests by	N.A.	Test file number	ARJ2503-2

We certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code.


Signature 1

Name	Signature	Name	Signature
F. van Toledo		M. van Ginneken DNV	
Date		Date	
9/4/2023		4/9/2023	

WELDER PERFORMANCE QUALIFICATION CERTIFICATE ASME BPVC.IX

Welder's identification: ID card Verified
Employer: Airpack
Welder's name: A. Sumantri
Place of birth and date: Oost- en West Souburg/ 23-02-1962

Specification and type/grade or UNS number of base metal(s): A106-Gr.B / AISI 316

Thickness(mm): 1: 10 2: 5,08

Welding variables (QW-350)	Actual Values				Range qualified				Photo (if required)
Welding process(es)	1:	GTAW	2:	-	1:	GTAW	2:	-	
Transfer mode	1:	-	2:	-	1:	-	2:	-	
Product type (Plate/Pipe)	Pipe - Fillet				Plate & Pipe- Fillet or Tack				
Backing (with/ without)	1:	Without	2:	-	1:	With/ without	2:	-	
Base metal P-No. to P-No.	1:	P-No.1	2:	P-No.8	P-No.1 through P-No.15F, P-No.34, or P-No.41 through P-No.49				
Filler metal specification(s) (SFA)	1:	SFA-5.9	2:	-	For information only				
Filler metal classification(s)	1:	ER 309LSi	2:	-					
Filler metal F-number(s)	1:	F-No.6			All F-No.6				
	2:	-			-				
Consumable insert (GTAW or PAW)	Without				With, Without				
Filler Metal Product Form (QW-404.23) (GTAW or PAW)	1:	Solid	2:	-	1:	Solid, Metal cored	2:	-	
Deposited thickness (mm) 3 layers minimum	1:	-	1:	-	All fillet sizes				
Deposited thickness (mm) 3 layers minimum	2:	-	2:	-	-				
Outside pipe diameter [O.D.] (mm)	48,3				≥25				
Welding position(s)	1:	2F	2:	-	(Fillet/ Tack) F, H				
Vertical progression (uphill/downhill)	1:	-	2:	-	1:	-	2:	-	
Type of fuel gas (OFW only)	-				-				
Use of backing gas (GTAW, PAW, GMAW)	Without				With, Without				
GTAW current type and polarity	DCEN				DCEN				
Type (manual, semi-automatic)	1:	Manual	2:	-	1:	-	2:	-	
Date of welding	26-04-2023				Examiner: M. van Ginneken				
Place of welding	Rotterdam								
Type of inspection/ test	Performed & accepted / Not tested								
Visual examination (QW-302.4)	Performed & accepted				-				
Radiography (QW-191)	-				Not tested				
Ultrasonic (QW-191)	-				Not tested				
Macro examination (QW-184)	Performed & accepted				-				
Fracture test (QW-181.2)	Performed & accepted				-				
Bend tests (QW-462)	-				Not tested				
Other tests	-				Not tested				

We certify that the statements in this record are correct and that the test coupons were prepared, welded, and tested in accordance with the requirements of Section IX of the ASME BOILER AND PRESSURE VESSEL CODE.

See reverse side for confirmation statement by employer and prolongation by DNV Netherlands B.V.
Additional information may also be stated in the column "Supplementary remarks".

Place: Barendrecht
Date: 16-05-2023
Qualification valid until: 26-04-2025
DNV Netherlands B.V.
Signature: 
Stamp: 

INSPECTION	
REVIEWED	<input checked="" type="checkbox"/>
WITNESSED	<input type="checkbox"/>
RELEASED	<input type="checkbox"/>
BY: M. REZAEI DATE: 13 Dec 2023	

Quality Support Holleman
Lavendelberg 26
4708 LE ROOSENDAAL

Date(s) tested : 4-5-2023
Date reported : 4-5-2023
Element report number : QUA002-23-05-55363-1

Customer reference : QSH 23-131

TEST REPORT

TEST REPORT FOR THE PURPOSE OF: WELDERS PERFORMANCE QUALIFICATION

Testing in accordance with:	- NEN-EN-ISO 9606-1 - ASME-IX
pWPS No.:	SP 4000
Test No.:	QSH 23-131
Manufacturer:	Airpack Nederland B.V.
Item Description:	Pipe on plate with fillet weld
Dimensions :	Pipe Ø 48.3 x 5.08 mm Plate thickness = 10 mm
Material type and grade:	Plate = S355MC, Heat no.: 208954 Pipe = AISI 316L, Heat no.: 53298
Identification on Sample:	Test no.
Welding Process(es):	141 / GTAW
Welding Consumable:	Lincoln Electric LNT309LSi / W 23 12 Lsi, Batch no.: 8011096
Shieldinggas:	I1 / 99,996%Ar
Welding position:	PB / 2F
Joint Type:	FW, ml
Welder:	A. Sumantri
Place and D.O.B.:	Oost- en West Souburg, 23-02-1962

NON-DESTRUCTIVE TEST

- Visual examination:	Performed on site
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Note: The above mentioned data is only for information and is no part of the examination in this test report

NARGAN COMPANY	
INSPECTION	
REVIEWED	<input checked="" type="checkbox"/>
WITNESSED	<input type="checkbox"/>
RELEASED	<input type="checkbox"/>
BY: M. REZAEI DATE: 13 Dec. 2023	
SIGN: 	

MACRO EXAMINATION

Method: ISO 17639 / ASTM E3 / ISO 5817 / ISO 6520-1			Magnification: 5x
Specimen	Etchant:	Observations:	Remark
55363 / 1	Adler	No significant inclusions or other defects	Acceptable
55363 / 2	Adler	No significant inclusions or other defects	Acceptable

FILLET WELD BREAK TEST

Test method: ISO 9017			Test temperature: R.T.
Specimen	Qty	Results	Remark
55363 / 3	1x	No weld defects observed.	Acceptable

The above mentioned items satisfy the requirements.



Jens de Koning

Element Materials Technology

All characteristics of the above object(s) have, as far as accessible and relevant, been verified by Element Materials Technology Rotterdam b.v. (Element). Other information was provided by the purchaser. This information was verified as far as possible and has been copied into this report, unchanged. Element does not bear responsibility for the correctness of this submitted information. Any kind of "witnessing" and conclusions by a third party is not covered by the RVA accreditation L063 and is no part of the Element report. We hereby certify that the reported test data is correct and that the above object(s) was (were) tested/examined in accordance with purchaser's requirements and/or the above procedure(s) and/or code(s)/specification(s). If a declaration of conformity is issued in the report with regard to compliance with a specification or standard, this declaration is only applicable to the product(s) examined. In this assessment, the decision rule is applied that assumes that the expanded measurement uncertainty is not included in the assessment. Unless otherwise stated in the test standard or accreditation rules, the rounding rule according to ISO 80000-1 Annex A Rule B is used. On occasion a test is subcontracted by Element, the accreditation number of the subcontracted party is reported. Interpretations, opinions, conclusions and advice are partly based on the examination results and partly on information supplied by the purchaser. This report has legal value only when furnished with an authorized signature. If, upon reproduction, only part of this report is copied, Element will not bear any responsibility for content, purport and conclusions of that reproduction.

NARGAN COMPANY	
INSPECTION	
REVIEWED	<input checked="" type="checkbox"/>
WITNESSED	<input type="checkbox"/>
RELEASED	<input type="checkbox"/>
BY: M. REZAEI DATE: 13 Dec. 2023	
SIGN: 	



QUA002-23-05-55363-1
page 2 of 2

Welder's name	A. Sumantri		Test date	25-5-2012	Rev. - Rev. 0
ID Number	ID Card IXH4P6551		WPQ record number	RET 0245029-002-18	
Date of birth	23-02-1962		Standard test number	N.A.	
Stamp number	W-102		WPS record number	P3000	
Company name	Airpack Netherlands BV		Qualification code	ASME Section IX:2010 including	
Division	N.A.				

BASE METALS (QW-403)

	Product form	Specification (type or grade)	P no.	Grp-no.	Size	Sch.	Thick. (mm)	Dia. (mm)
Welded to:	Pipe	SA-312 (TP316L)	8	1	63,50	160	9,53	73,03
	Pipe	SA-312 (TP316L)	8	1	63,50	160	9,53	73,03
Joint type	Groove							

VARIABLES

	Actual values	RANGE QUALIFIED
Type of weld joint	Pipe - Groove	Groove and Fillet welds
Base metal	P8 to P8	P-no. 1 thru 15F, 34, 41 thru 49

BASE METAL THICKNESS

	Groove	Fillet	Overlay	Groove	Fillet	Overlay
Plate thickness (mm)	-	-	-	no limit	no limit	-
Pipe/tube thickness (mm)	9,53	-	-	no limit	no limit	-
Pipe diameter (mm)	73,03	-	-	73 min	no limit	-

PROCESS VARIABLES

	Actual values	RANGE QUALIFIED
Welding process	GTAW	GTAW
Type	Manual	Manual
Backing	No backing used	With, without
Filler metal specification	5.9	5.xx
Filler metal classification	ER316LSi	Any
Filler metal F-number	6	6
Filler metal variety (QW-404.23)	Bare (solid)	Solid, metal cored
Consumable insert	None	Without
Number of layers deposited	5	
Weld deposit thickness (mm)	9,53	19,06 max
Weld position (Actual position tested)	6G	
Groove - Plate & Pipe > 610mm		All
Groove - Pipe 73mm to 610mm		All
Groove - Pipe 73mm		All
Fillet - Plate & Pipe > 610mm		All
Fillet - Pipe 73mm to 610mm		All
Fillet - Pipe < 73mm		All
Progression	Up	Up
Backing gas	Without	With, without
GTAW welding current/polarity	DCEN (straight polarity)	DCEN (straight polarity)

TESTS

Type of test	Acceptance criteria	Result	Comments
Face bend test per QW-463.2(a)	QW-163	Acceptable	see -
Face bend test per QW-463.2(a)	QW-163	Acceptable	see -
Root bend test per QW-463.2(a)	QW-163	Acceptable	see -
Root bend test per QW-463.2(a)	QW-163	Acceptable	see -
Notes	This WPQ is based on PQR RET 0245029-001-21		


CERTIFICATION

Tests conducted by	Schielab BV Breda (NLD)	Laboratory test number	SL 12.6047-1A
Mechanical tests by	N.A.	Test file number	ARL1559-5


We certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code.

	
INSPECTION	
REVIEWED	<input checked="" type="checkbox"/>
WITNESSED	<input type="checkbox"/>
RELEASED	<input type="checkbox"/>
BY: M. REZAEI DATE: 13 Dec 2023	
SIGN: 	

Signature

Name	Signature
Franky van Toledo	
Date	8-6-2012

Signature Welder

Name	Signature
A. Sumantri	
Date	8-6-2012

WELDING PROCEDURE QUALIFICATION RECORD AND WELDERS PERFORMANCE QUALIFICATION TEST RECORD

Testing in accordance with : ASME IX:2010
Purchaser : Arjan Roza Lastechneik BV
Purchase order no. : ARL1559-5

Manufacturer : Airpack Nederland BV.
WPS : P3000

Description of sample(s) : Pipe with Single-V-groove
Dimension(s) : 2,5" Sch 160 (Ø 73,03 x 9,52 mm)
Material grade : P8 gr. 1 - P8 gr. 1
Material : ASTM SA-312 TP316L - ASTM SA-312 TP316L

Welding process(es) : GTAW
Filler : F-no.6 A-no. 8
Brand and type : Lincoln Electric LNT 316LSi , ER316LSi
Shielding gas : Argon (A5.32 SG-A)
Backing gas : 95% N₂ + 5% H₂

Welding position : 6G progression up
Preheat / Interpass temp. : 10 °C / 132 °C
Joint type : Single-V-groove
Welder : A. Sumantri
Date / place of birth : 23-02-1962 / Oost- en West-Souburg
Stamp. No. / ID : W-102 / ID Card IXH4P6551
Testpiece marked with : ARL1559-5

NON DESTRUCTIVE EXAMINATION

* Visual examination : performed by examiner

CROSS WELD TENSILE TESTS

Dimensions(s) [mm]	Rm [N/mm ²]	Fracture location
19.00 x 9.42	555	Base material
19.00 x 9.30	581	Base material
Requirements;	≥ 515	

TECHNOLOGICAL TESTS

Type	Former / Bending angle	Results
Face bend	4t / 180°	2 x acceptable
root bend	4t / 180°	2 x acceptable

Conclusion: The results satisfy the requirements.

All characteristics of the above object(s) have, as far as accessible and relevant, been verified by Schielab b.v. Other information was provided by the purchaser. This information was verified as far as possible and has been copied into this report, unchanged. We hereby certify that the reported test data is correct and that the above object(s) was (were) tested/examined in accordance with purchasers requirements and/or the above procedure(s) and/or code(s)/specification(s). On occasion a destructive test is subcontracted to Schielab b.v. (marked 'U' on the report). Opinions, interpretations and advice expressed in this report are outside the scope of any possible RvA accreditation, but are presented in a true and fair manner based on the best knowledge of the Schielab personnel involved. If, upon reproduction, only part of this report is copied, Schielab will not bear responsibility for content, purport and conclusions of that reproduction. This report has legal value only when printed on Schielab paper and furnished with an authorised signature. Digital versions of this report have no legal value. Unless explicitly agreed upon otherwise in writing our "General conditions for activities performed by Schielab b.v.", deposited at the Chamber of Commerce in Rotterdam, under number 24170257, apply.

Breda, 07-06-2012

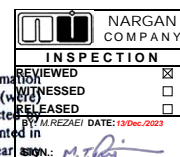
Witnessed and approved by; Mr.

Representing: Lloyd's Register Nederland B.V.

[RET 0245029]



Ingeschreven in het RvA register voor laboratoria onder nr. L 063 voor gebieden zoals nader omschreven in de erkenning.
Entered in the RvA register for laboratories under number L 063 for the areas outlined in the approval.



Welder's name	A. Sumantri		Test date	25-5-2012	Rev. - Rev. 0
ID Number	ID Card IXH4P6551		WPQ record number	RET 0245029-002-24	
Date of birth	23-02-1962		Standard test number	N.A.	
Stamp number	W-102		WPS record number	P3000	
Company name	Airpack Netherlands BV		Qualification code	ASME Section IX:2010 including	
Division	N.A.				

BASE METALS (QW-403)

	Product form	Specification (type or grade)	P no.	Grp-no.	Size	Sch.	Thick. (mm)	Dia. (mm)
Welded to:	Pipe	SA-312 (TP316)	8	1	12,70	160	4,78	21,34
	Pipe	SA-312 (TP316)	8	1	12,70	160	4,78	21,34
Joint type	Groove							

VARIABLES

Type of weld joint	Pipe - Groove	RANGE QUALIFIED
Base metal	P8 to P8	Groove and Fillet welds P-no. 1 thru 15F, 34, 41 thru 49

BASE METAL THICKNESS

	Groove	Fillet	Overlay	Groove	Fillet	Overlay
Plate thickness (mm)	-	-	-	no limit	no limit	-
Pipe/tube thickness (mm)	4,78	-	-	no limit	no limit	-
Pipe diameter (mm)	21,34	-	-	21,34 min	no limit	-

PROCESS VARIABLES

	Actual values	RANGE QUALIFIED
Welding process	GTAW	GTAW
Type	Manual	Manual
Backing	No backing used	With, without
Filler metal specification	5.9	5.xx
Filler metal classification	ER316LSi	Any
Filler metal F-number	6	6
Filler metal variety (QW-404.23)	Bare (solid)	Solid, metal cored
Consumable insert	None	Without
Number of layers deposited	5	
Weld deposit thickness (mm)	4,78	9,56 max
Weld position (Actual position tested)	6G	
Groove - Plate & Pipe > 610mm		All
Groove - Pipe 73mm to 610mm		All
Groove - Pipe 73mm		All
Fillet - Plate & Pipe > 610mm		All
Fillet - Pipe 73mm to 610mm		All
Fillet - Pipe < 73mm		All
Progression	Up	Up
Backing gas	Without	With, without
GTAW welding current/polarity	DCEN (straight polarity)	DCEN (straight polarity)

TESTS

Type of test	Acceptance criteria	Result	Comments
Radiographic examination	ASME IX	Acceptable	

Notes

CERTIFICATION

Tests conducted by	Schielab BV Breda (NLD)	Laboratory test number	SL 12.6404-1
Mechanical tests by	N.A.	Test file number	ARL1559-9

We certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code.

	
INSPECTION	
REVIEWED	<input checked="" type="checkbox"/>
WITNESSED	<input type="checkbox"/>
RELEASED	<input type="checkbox"/>
BY: M. REZAEI DATE: 13 Dec. 2023	
SIGN: 	

Signature

Name	Signature
Date	



Signature Welder

Name	Signature
Date	



WELDERS PERFORMANCE QUALIFICATION TEST RECORD

Testing in accordance with : ASME IX:2012

Purchaser : Arjan Roza Lastechneik BV

Purchase order no. : ARL1559-9

Manufacturer : Airpack Nederland BV.

WPS : P3000

Description of sample(s) : Pipe with Single-V-groove

Dimension(s) : 1/2" Sch 160 (Ø 21,3 x 4,78 mm)

Material grade : P8 gr. 1 - P8 gr. 1

Material : ASTM SA-312 TP316L - ASTM SA-312 TP316L

Welding process(es) : GTAW

Filler : F-no.6 A-no. 8

Brand and type : Lincoln Electric LNT 316LSi , ER316LSi

Shielding gas : Argon (A5.32 SG-A)

Backing gas : Argon (A5.32 SG-A)

Welding position : 6G progression up

Preheat / Interpass temp. : 10 °C / 150 °C

Joint type : Single-V-groove

Welder : A. Sumantri

Date / place of birth : 23-02-1962 / Oost- en West-Souburg

Stamp. No. / ID : A1 / ID Card IXH4P6551

Testpiece marked with : ARL1559-9

NON DESTRUCTIVE EXAMINATION

* Visual examination : performed by examiner

* Radiographic examination : acceptable, see RTD report 1213-2012-24-020, film no. 6404

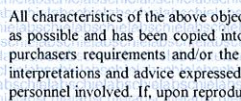
Conclusion: The results satisfy the requirements.

All characteristics of the above object(s) have, as far as accessible and relevant, been verified by Schielab b.v. Other information was provided by the purchaser. This information was verified as far as possible and has been copied into this report, unchanged. We hereby certify that the reported test data is correct and that the above object(s) was (were) tested/examined in accordance with purchaser's requirements and/or the above procedure(s) and/or code(s) specification(s). On occasion a destructive test is subcontracted by Schielab b.v. (marked 'U' on the report). Opinions, interpretations and advice expressed in this report are outside the scope of any possible RvA accreditation, but are presented in a true and fair manner based on the best knowledge of the Schielab personnel involved. If, upon reproduction, only part of this report is copied, Schielab will not bear any responsibility for content, purpose and conclusions of that reproduction. This report has legal value only when printed on Schielab paper and furnished with an authorised signature. Digital versions of this report have no legal value.

Breda, 13.06.2012

Testing witnessed by; Mr.

Representing; Lloyd's Register (RET 0245029)

 S. Wevers

 P. Schmitz

 Green Office

 Lloyd's Register

 Lloyd's Register

 Lloyd's Register

 Lloyd's Register

 Lloyd's Register


 Lloyd's Register

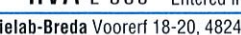
 Lloyd's Register

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Ingeschreven in het RvA register voor laboratoria onder nr. L 063 voor gebieden zoals nader omschreven in de erkenning.
Entered in the RvA register for laboratories under number L 063 for the areas outlined in the approval.

Schielab-Breda Voorerf 18-20, 4824 GN Breda, Tel. 076 - 5424 300, Fax 076 - 5424 848
Schielab b.v. Handelsregister/Register of Commerce Rotterdam nr. 24170257

Welder's name ID Number Date of birth Stamp number Company name Division	A. Sumantri ID Card IXH4P6551 23-02-1962 W-102 Airpack Netherlands BV N.A.		Test date WPQ record number Standard test number WPS record number Qualification code	9/22/2020 A0790090-59 N.A. PGF-3000 ASME Section IX	Rev. - Rev. 0
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BASE METALS (QW-403)

	Product form	Specification (type or grade)	P no.	Grp.no.	Size	Sch.	Thick. (mm)	Dia. (mm)
Welded to:	Pipe	SA-312 (TP316L)	8	1	101.60	40S	6.02	114.30
	Pipe	SA-312 (TP316L)	8	1	101.60	40S	6.02	114.30
Joint type	Groove							

VARIABLES

Actual values

RANGE QUALIFIED

Type of weld joint Base metal	Pipe - Groove P8 to P8	Groove and Fillet welds P-no. 1 thru 15F, 34, 41 thru 49
----------------------------------	---------------------------	---

BASE METAL THICKNESS

		Groove	Fillet	Overlay	Groove	Fillet	Overlay
Plate thickness (mm)	-	-	-	-	no limit	no limit	-
Pipe/tube thickness (mm)	6.02	-	-	-	no limit	no limit	-
Pipe diameter (mm)	114.30	-	-	-	73 min	no limit	-

PROCESS VARIABLES

Actual values

RANGE QUALIFIED

	GTAW	FCAW	GTAW	FCAW
Welding process	Manual	Semi-automatic	Manual	Semi-automatic
Type	Without	With	With, without	With
Backing	5.9	5.22	5.xx	5.xx
Filler metal specification	ER316LSi	E316LT0-1	Any	Any
Filler metal classification	6	6	6	6
Filler metal F-number	Bare (solid)	-	Solid, metal cored	-
Filler metal variety (QW-404.23)	None	-	Without	-
Consumable insert	1	2	-	-
Number of layers deposited	2.02	4	4.04 max	8.0 max
Weld deposit thickness (mm)	1G Rotated	1G Rotated	-	-
Weld position (Actual position tested)	-	-	-	-
Groove - Plate & Pipe > 610mm	-	-	F	F
Groove - Pipe 73mm to 610mm	-	-	F	F
Groove - Pipe 73mm	-	-	F	F
Fillet - Plate & Pipe > 610mm	-	-	F	F
Fillet - Pipe 73mm to 610mm	-	-	F	F
Fillet - Pipe < 73mm	-	-	F	F
Progression	-	-	-	-
Backing gas	Without	Without	With, without	With, without
GMAW transfer mode (QW-409)	-	Spray	-	Spray, pulse, globular
GTAW welding current/polarity	DCSP	-	DCSP	-


TESTS

Type of test	Acceptance criteria	Result	Comments
1 transverse face bend per QW-161.2 and QW-462.3(a)	QW-163	Acceptable	see - ASME IX - QW-452.1 (a)
1 transverse root bend per QW-161.3 and QW-462.3(a)	QW-163	Acceptable	see - ASME IX - QW-452.1 (a)
Visual examination per QW-302.4	QW-194	Acceptable	see - ASME IX - QW-452.1 (a)
Notes			

CERTIFICATION

Tests conducted by	Daniel Schutt	Laboratory test number	ARJ001-20-09-42663-4
Mechanical tests by	Element Breda (NLD)	Test file number	ARL2542-4

We certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code.



INSPECTION


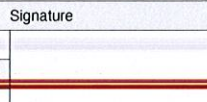
Reviewed ☒ Witnessed ☒ Released ☒

And found to comply

Date: 7/10/20
Sign: L. Knops

BY: M. REZAEI DATE: 13 Dec 2023
SIGN: M. Rezaei

Signature 1

Name	Signature	Name	Signature
F. van Toledo (Airpack)		L. Knops (DNVGL)	
Date		Date	
10/6/2020		10/6/2020	

Welder's name	J. Wesdorp	Test date	9/22/2020
ID Number	5171457148	WPQ record number	A0790090-61
Date of birth	9-12-1996	Standard test number	N.A.
Stamp number	JW	WPS record number	PGF-3000
Company name	Airpack Netherlands BV	Qualification code	ASME Section IX: 2019
Division			

BASE METALS (QW-403)

	Product form	Specification (type or grade)	P no.	Grp-no.	Size	Sch.	Thick. (mm)	Dia. (mm)
Welded to:	Pipe	SA-312 (TP316L)	8	1	101,60	40S	6,02	114,30
	Pipe	SA-312 (TP316L)	8	1	101,60	40S	6,02	114,30
Joint type	Groove							

VARIABLES

Type of weld joint	Pipe - Groove	Groove and Fillet welds
Base metal	P8 to P8	P-no. 1 thru 15F, 34, 41 thru 49

BASE METAL THICKNESS

	Groove	Fillet	Overlay	Groove	Fillet	Overlay
Plate thickness (mm)	-	-	-	no limit	no limit	-
Pipe/tube thickness (mm)	6,02	-	-	no limit	no limit	-
Pipe diameter (mm)	114,30	-	-	73 min	no limit	-

PROCESS VARIABLES

	Actual values		RANGE QUALIFIED	
Welding process	GTAW	FCAW	GTAW	FCAW
Type	Manual	Semi-automatic	Manual	Semi-automatic
Backing	Without	With	With, without	With
Filler metal specification	5.9	5.22	5.xx	5.xx
Filler metal classification	ER316LSi	E316LT0-1	Any	Any
Filler metal F-number	6	6	6	6
Filler metal variety (QW-404.23)	Bare (solid)	-	Solid, metal cored	-
Consumable insert	None	-	Without	-
Number of layers deposited	1	2		
Weld deposit thickness (mm)	2,02	4,0	4,04 max	8,0 max
Weld position (Actual position tested)	1G Rotated	1G Rotated		
Groove - Plate & Pipe > 610mm			F	F
Groove - Pipe 73mm to 610mm			F	F
Groove - Pipe 73mm			F	F
Fillet - Plate & Pipe > 610mm			F	F
Fillet - Pipe 73mm to 610mm			F	F
Fillet - Pipe < 73mm			F	F
Progression	-	-	-	-
Backing gas	With	With	With	With
GMAW transfer mode (QW-409)	-	Spray	-	Spray, pulse, globular
GTAW welding current/polarity	DCEN (straight polarity)	-	DCEN (straight polarity)	-

TESTS

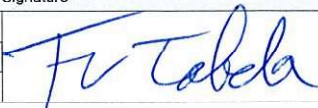
Type of test	Acceptance criteria	Result	Comments
1 traverse face bends per QW-161.2, QW-463.2(d) and QW-462.3(a)	QW-163	Acceptable	see - ASME IX QW-452.1(a) Note 1
1 traverse root bends per QW-161.3, QW-463.2(d) and QW-462.3(a)	QW-163	Acceptable	see - ASME IX QW-452.1(a) Note 1
Visual examination per QW-302.4	QW-194	Acceptable	

Notes
CERTIFICATION

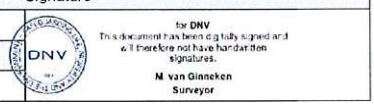
Tests conducted by	Daniel Schutt	Laboratory test number	ARJ001-20-09-42663-5
Mechanical tests by	Element Breda (NLD)	Test file number	ARL2542-5

We certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code.


Signature 1

Name	Signature
F. van Toledo	
Date	9/4/2023

Signature 2

Name	Signature
M. van Ginneken DNV	
Date	9/4/2023

Welder's name	R. Ali	Test date	9/22/2020
ID Number	4882630217	WPQ record number	A0790090-63
Date of birth	8/9/1957	Standard test number	N.A.
Stamp number	RA	WPS record number	PGF-3000
Company name	Airpack Netherlands BV	Qualification code	ASME Section IX: 2019
Division	N.A.		

BASE METALS (QW-403)

	Product form	Specification (type or grade)	P no.	Grp-no.	Size	Sch.	Thick. (mm)	Dia. (mm)
Welded to:	Pipe	SA-312 (TP316L)	8	1	101,60	40S	6,02	114,30
	Pipe	SA-312 (TP316L)	8	1	101,60	40S	6,02	114,30
Joint type	Groove							

VARIABLES

Type of weld joint	Pipe - Groove	RANGE QUALIFIED
Base metal	P8 to P8	Groove and Fillet welds P-no. 1 thru 15F, 34, 41 thru 49

BASE METAL THICKNESS

	Groove	Fillet	Overlay	Groove	Fillet	Overlay
Plate thickness (mm)	-	-	-	no limit	no limit	-
Pipe/tube thickness (mm)	6,02	-	-	no limit	no limit	-
Pipe diameter (mm)	114,30	-	-	73 min	no limit	-

PROCESS VARIABLES

	Actual values		RANGE QUALIFIED	
Welding process	GTAW	FCAW	GTAW	FCAW
Type	Manual	Semi-automatic	Manual	Semi-automatic
Backing	Without	With	With, without	With
Filler metal specification	5.9	5.22	5.xx	5.xx
Filler metal classification	ER316LSi	E316LT0-1	Any	Any
Filler metal F-number	6	6	6	6
Filler metal variety (QW-404.23)	Bare (solid)	-	Solid, metal cored	-
Consumable insert	None	-	Without	-
Number of layers deposited	1	2		
Weld deposit thickness (mm)	2,02	4,0	4,04 max	8,0 max
Weld position (Actual position tested)	1G Rotated	1G Rotated		
Groove - Plate & Pipe > 610mm			F	F
Groove - Pipe 73mm to 610mm			F	F
Groove - Pipe 73mm			F	F
Fillet - Plate & Pipe > 610mm			F	F
Fillet - Pipe 73mm to 610mm			F	F
Fillet - Pipe < 73mm			F	F
Progression	-	-	-	-
Backing gas	With	With	With	With
GMAW transfer mode (QW-409)	-	Spray	-	Spray, pulse, globular
GTAW welding current/polarity	DCEN (straight polarity)	-	DCEN (straight polarity)	-

TESTS

Type of test	Acceptance criteria	Result	Comments
1 traverse face bends per QW-161.2, QW-463.2(d) and QW-462.3(a)	QW-163	Acceptable	see - ASME IX QW-452.1(a) Note 1
1 traverse root bends per QW-161.3, QW-463.2(d) and QW-462.3(a)	QW-163	Acceptable	see - ASME IX QW-452.1(a) Note 1
Visual examination per QW-302.4	QW-194	Acceptable	

Notes



CERTIFICATION

Tests conducted by	Daniel Schutt	Laboratory test number	ARJ001-20-09-42663-6
Mechanical tests by	Element Breda (NLD)	Test file number	ARL2542-6

We certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code.



Signature 1

Name	Signature	Name	Signature
F. van Toledo		M. van Ginneken DNV	
Date		Date	
9/4/2023		9/4/2023	

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION K-29




DOCUMENTS; CAUSE & EFFECT CHART



Vendor doc. Number
17735-19

P.O. NO.:
LIDCO-PO-NEC-278-6019

Vendor:
Airpack Nederland B.V.

	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT	
	Cause & Effect Chart	
Document No. 17735-27		Page
Project No. N278	Vendor Doc. VD	P.O. No. 6019
Department GN	Document Type SF	Serial No 0029
Revision 07	Page 1 of 3	

Airpack B.V. - Air Compressor –




Integrated Methanol and Ammonia Plant

17735-COM Cause & Effect Chart (K020)

Code 1
M.Dalakeh


07	29-07-2024	Issued for Approval	S.K.	J.J.	S.K.
06	18-07-2024	Issued for Approval	S.K.	J.J.	S.K.
05	05-07-2024	Issued for Approval	S.K.	J.J.	S.K.
04	25-06-2024	Issued for Approval	S.K.	J.J.	S.K.
03	11-06-2024	Issued for Approval	S.K.	J.J.	S.K.
02	23-05-2024	Issued for Approval	S.K.	J.J.	S.K.
01	12-12-2023	Issued for Approval	S.K.	J.J.	S.K.
REV.	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED

This document has been produced by Contractor for LIDCO. It is confidential and cannot be disclosed to or used by any third party for any purpose without prior written consent.

	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT							
	Cause & Effect Chart							
	Document No. 17735-27							Page
	Project No.	Vendor Doc.	P.O. No.	Department	Document Type	Serial No.	Revision	Page 2 of 3
	N278	VD	6019	GN	SF	0029	07	

LIST OF REVISED PAGES

Rev. Page	01	02	03	04	05	06	07	08	09	10	Rev. Page	01	02	03	04	05	Rev. Page	01	02	03	04	05
1	X	X	X	X	X	X	X				51						76					
2	X	X	X	X	X	X	X				52						77					
3	X	X	X	X	X	X	X				53						78					
4											54						79					
5											55						80					
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18											68						ATTACHMENT					
19											69						1					
20											70						2					
21											71						3					
22											72						4					
23											73						5					
24											74						6					
25											75						7					

<div></div> <div>DOCUMENT TITLE: 17735-27 Cause & Effect chart Compressor</div>					EFFECT	Tag. Number	N/A	320MBS-8201	320MBW-8202	320PCV-8201	320UY-8204	320YL-8202	320XA-8203	320ML-8201
Component	on DCS	MOTOR START	MOTOR STOP	LOAD / UNLOAD VALVE <small>note 2</small>		EMERGENCY TRIP LIGHT	OPERATIONAL LIGHT <small>note 3</small>	FAULT LIGHT	RUNNING LIGHT					
	READOUT	START	STOP	BYPASS										
Instrument Tag	Signal	Type	Description	Interlock		x		SP	DE	x				
320HS-8203	EMERGENCY STOP	ESD	EMERGENCY SHUT DOWN LPS	IP-920		x		SP	DE	x				
320SW-8206	EMERGENCY STOP	ESD	EMERGENCY SHUT DOWN DCS	IP-920		x		SP	DE	x				
320HS-8201	START	BUTTON	START COMPRESSOR LPS	IP-922		x	ST		E		x	x		
320SW-8207	START	BUTTON	START COMPRESSOR DCS	IP-922		x	ST		E		x	x		
320HS-8202	STOP	BUTTON	STOP COMPRESSOR LPS	IP-923		x		SP	DE					
320SW-8208	STOP	BUTTON	STOP COMPRESSOR DCS	IP-923		x		SP	DE					
320PT-8201	TRANSMITTER	LL	COMPRESSOR INLET PRESSURE LOW LOW	IP-920		x		SP	DE	x				
320PT-8202	TRANSMITTER	LL	2ND STAGE SUCTION PRESSURE LOW LOW	IP-920		x		SP	DE	x				
320TT-8203	TRANSMITTER	HH	2ND STAGE SUCTION TEMPERATURE HIGH HIGH	IP-920		x		SP	DE	x				
320TT-8205	TRANSMITTER	HH	COMPRESSOR OULTET TEMPERATURE HIGH HIGH	IP-920		x		SP	DE	x				
320PT-8203	TRANSMITTER	HH	COMPRESSOR OULTET PRESSURE HIGH HIGH	IP-920		x		SP	DE	x				
320PT-8204	TRANSMITTER	LL	OIL PRESSURE LOW LOW	IP-920		x		SP	DE	x				
101-MBP-001	MOTOR	CONTROL	MOTOR RUNNING FEEDBACK TRIP		note 1	x		SP	DE	x				
320PT-8201	TRANSMITTER	H	COMPRESSOR INLET PRESSURE HIGH			x					x			
320TT-8201	TRANSMITTER	L	COMTRESSOR INLET TEMPERATURE LOW			x					x			
320TT-8201	TRANSMITTER	H	COMTRESSOR INLET TEMPERATURE HIGH			x					x			
320TT-8202	TRANSMITTER	L	1ST STAGE OUTLET TEMPERATURE LOW			x					x			
320TT-8202	TRANSMITTER	H	1ST STAGE OUTLET TEMPERATURE HIGH			x					x			
320PT-8202	TRANSMITTER	L	2ND STAGE SUCTION PRESSURE LOW			x					x			
320TT-8203	TRANSMITTER	H	2ND STAGE SUCTION TEMPERATURE HIGH			x					x			
320TT-8204	TRANSMITTER	L	2ND STAGE DISCHARGE TEMPERATURE LOW			x					x			
320TT-8204	TRANSMITTER	H	2ND STAGE DISCHARGE TEMPERATURE HIGH			x					x			
320TT-8205	TRANSMITTER	H	2ND STAGE DISCHARGE TEMPERATURE HIGH			x					x			
320PT-8203	TRANSMITTER	L	COMPRESSOR OUTLET PRESSURE LOW			x					x			
320PZLC	TRANSMITTER	READOUT	POSITIONER FEEDBACK 320PCV-8201			x								
320PAHH-8191	TRANSMITTER	HH	EXTERNAL SIGNAL PRESSURE VESSEL HIGH HIGH	IP-920	note 4	x		SP	DE	x				
320PALL-8191	TRANSMITTER	LL	EXTERNAL PRESSURE VESSEL LOW LOW	IP-922	note 4	x	ST		E		x	x		
320PAH-8191	TRANSMITTER	H	EXTERNAL PRESSURE VESSEL HIGH	IP-923	note 4	x		SP	DE					

Legend:
ST = Start
SP = Stop
X = Action
E = Energize
DE = De-energize
NOTES:
1. MOTOR FEEDBACK TRIP, 2 SECOND AFTER START SINGAL IS SEND AND MOTOR IS NOT SENDING FEEDBACK, THE PACKAGE IS TRIPPED
2. PCV-8201 ENERGIZE MEANS PCV IS REGULATING THE OUTLET PRESSURE AT THE SET POINT. DE-ENERGIZE IS FAIL POSITION (OPEN).
3. OPERATIONAL LIGHT IS OFF DURING ANY TRIP OR STOP BUTTON IS PRESSED.
4. TRANSMITTER IS EXTERNALLY PLACED ON THE PRESSURE VESSEL AFTER THE COMPRESSOR PACKAGE.
Refer to: 17735-03 P&ID, 17735-21 Control philosophy

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION K-30




DOCUMENTS; TIE-IN NOZZLE LOAD



Vendor doc. Number
17735-19

P.O. NO.:
LIDCO-PO-NEC-278-6019

Vendor:
Airpack Nederland B.V.

	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT							
	Tie in nozzle loads							
	Document No. 17735-28						Page	
	Project No.	Vendor Doc.	P.O. No.	Department	Document	Serial No	Revision	1 of 3
	N278	VD	6019	GN	OTH	0030	02	

Tie in nozzle loads

code-1
M. Vakili

02	14-12-2023	Issued for Information	SK	KP	JJ
01	11-12-2023	Issued for Information	SK	KP	JJ
REV.	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED

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Document No. 17735-28

Page

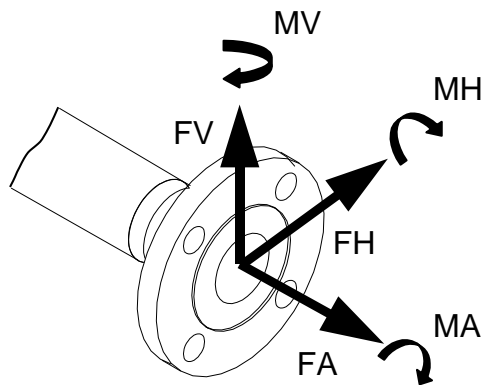
Revision
02

2 of 3

Rev. Page	0 1	0 2	0 3	0 4	0 5	rev. Page	0 1	0 2	0 3	0 4	0 5	Rev. Page	0 1	0 2	0 3	0 4	0 5	Rev. Page	0 1	0 2	0 3	0 4	0 5
1	X	X				26						51						76					
2	X	X				27						52						77					
3	X	X				28						53						78					
4						29						54						79					
5						30						55						80					
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15						40						65						90					
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17						42						67						92					
18						43						68						ATTACHMENT					
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21						46						71						3					
22						47						72						4					
23						48						73						5					
24						49						74						6					
25						50						75						7					

<div><div>شرکت توسعه صنایع لوان</div><div>Lavan Industry Development Company</div></div> <div></div>	<div>LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT</div>						<div></div>
<div></div>	<div>Tie in nozzle loads</div>						
	<div>Document No. 17735-28</div>						
	<div>Project No.</div> <div>N278</div>	<div>Vendor Doc.</div> <div>VD</div>	<div>P.O. No.</div> <div>6019</div>	<div>Department</div> <div>GN</div>	<div>Document</div> <div>OTH</div>	<div>Serial No</div> <div>0030</div>	<div>Revision</div> <div>02</div>

1. Tie-in nozzle loads



NOZZLE SIZE INS.	150LB, 300LB & 600LB FLANGE RATING					
	FORCES kN			MOMENTS kNm		
	FH	FA	FV	MH	MA	MV
1	1	1	1	0.3	1	0.3
2	2	2	2	0.9	2	0.9
3	3	3	3	1.5	3	1.5
4	4	4	4	2.5	4	2.5
6	6	6	6	3.5	6	3.5
8	8	8	8	6	8	6
10	9.8	13.0	13.0	8.5	9.8	6.5
12	11.3	15.1	15.1	11.8	13.6	9.1
14	12.8	17.1	17.1	15.5	17.9	12.0
16	14.2	18.9	18.9	19.8	22.7	15.1
18	15.4	20.5	20.5	24.6	27.7	18.5
20	16.5	22.0	22.0	28.6	33.0	22.0
24	19.1	25.4	25.4	39.7	45.8	30.5

Table 1: Allowable nozzle load data

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION K-31

DOCUMENTS; LOOP DIAGRAMS



Vendor doc. Number




17735-19

P.O. NO.:

LIDCO-PO-NEC-278-6019

Vendor:

Airpack Nederland B.V.

	<p align="center">LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT</p>							
	<p align="center">Loop diagrams</p>							
	Document No. 17735-30						Page	
	Project No.	Vendor Doc.	P.O. No.	Department	Document Type	Serial No	Revision	
	N278	VD	6019	EL	DIA	0031	08	Page 1 of 24

**Airpack B.V. - Air Compressor –
Integrated Methanol and Ammonia Plant
17735-COM Loop diagrams (K020)**

Code 1
M.Dalakeh

08	23-05-2024	Issued for Approval	R.T.	S.K.	J.J.
07	08-05-2024	Issued for Approval	R.T.	S.K.	J.J.
06	02-05-2024	Issued for Approval	R.T.	S.K.	J.J.
05	18-04-2024	Issued for Approval	R.T.	S.K.	J.J.
04	30-03-2024	Issued for Approval	R.T.	S.K.	J.J.
03	14-02-2024	Issued for Approval	R.T.	S.K.	J.J.
02	21-12-2023	Issued for Approval	R.T.	S.K.	J.J.
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LIDCO, Pars SEE Zone, Assaluyeh,
Integrated Methanol and Ammonia
Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT

Loop diagrams

Document No. 17735-30

Project No.	Vendor Doc.	P.O. No.	Department	Document Type	Serial No	Revision	Page
N278	VD	6019	EL	DIA	0031	08	Page 2 of 24

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1	X	X	X	X	X	X	X	X			51						76					
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24						X	X	X			74						6					
25											75						7					




Airpack B.V.

4301 RN Zierikzee
The Netherlands

PHONE: (31) (0) 111 - 415455
FAX: (31) (0) 111 - 413338
E-MAIL : AIRPACK@AIRPACK.NL
WEBPAGE : WWW.AIRPACK.NL

Client	:	LAVAN INDUSTRY DEVELOPMENT COMPANY (LIDCO)
Equipment location	:	IRAN, ONSHORE
Client reference	:	INTEGRATED METHANOL AND AMMONIA PLANT
Client dwg. no.	:	N-278-VD-6019-EL-DIA-0031
Airpack reference	:	17735-30 Loop Diagrams
Airpack dwg. no.	:	17735-30
Generation date	:	2023-12-07
E & I manager	:	RBE
Last modifications	:	2024-05-22
Last modifications by	:	RTR
		Revision no. : 08

	CLIENT DWG NO.	N-278-VD-6019-EL-DIA-0031	SUBJECT Title page / cover sheet		DRAWN BY	RTR	=
	EQUIPMENT NO.	320-K-020			CHECKED BY	RBE	+
	EQUIPMENT LOCATION	IRAN, ONSHORE	ADAPTED TO P&ID REVISION	08	LAST MODIFICATION DATE	2024-05-02	CURRENT PAGE
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			CLIENT REF.	INTEGRATED METHANOL AND AMMONIA PLANT	REVISION	08	
AIRPACK REF.			17735-30 Loop Diagrams	TOTAL PAGE AMOUNT	1	1	

COMMENTS ON ELECTRICAL DRAWINGS

LPS AND JB MOUNTED ON SKID
MATERIAL: SHEET STEEL
INGRESS. PROTECTION: IP-65
AREA CLASSIFICATION: SAFE

GLANDS: SS316 GLANDS WITH SHROUDS, IP-66
CABLE TRAYS: HOT-DIP GALVANIZED


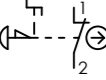







AMBIENT TEMPERATURE: 0 / 49 °C

ALL "IE" CONNECTIONS WILL BE CONNECTED ON A "IE"-BAR

REFERENCE DOCUMENTS:
17735-03 - N-278-VD-6019-PR-PID-0002 - P&ID
17735-06 - N-278-VD-6019-IN-LIS-0006 - I/O List
17735-07 - N-278-VD-6019-IN-DWG-0007 - Outline Dimensional Drawings for LCP Panel and Junction Box
17735-21 - N-278-VD-6019-GN-PRO-0022 - Control Philosophy

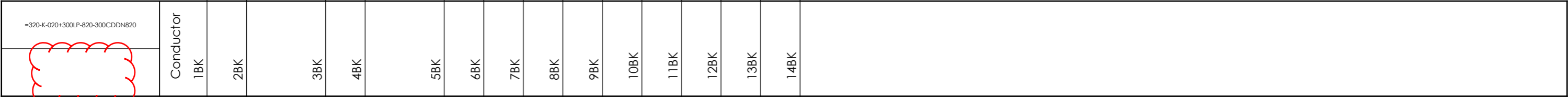
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CURRENT LOOPS	POSITIVE: BLACK NEGATIVE: WHITE
VOLT [FREE] CONTACTS	POSITIVE: BLACK NEGATIVE: BLACK

SYMBOL LEGEND

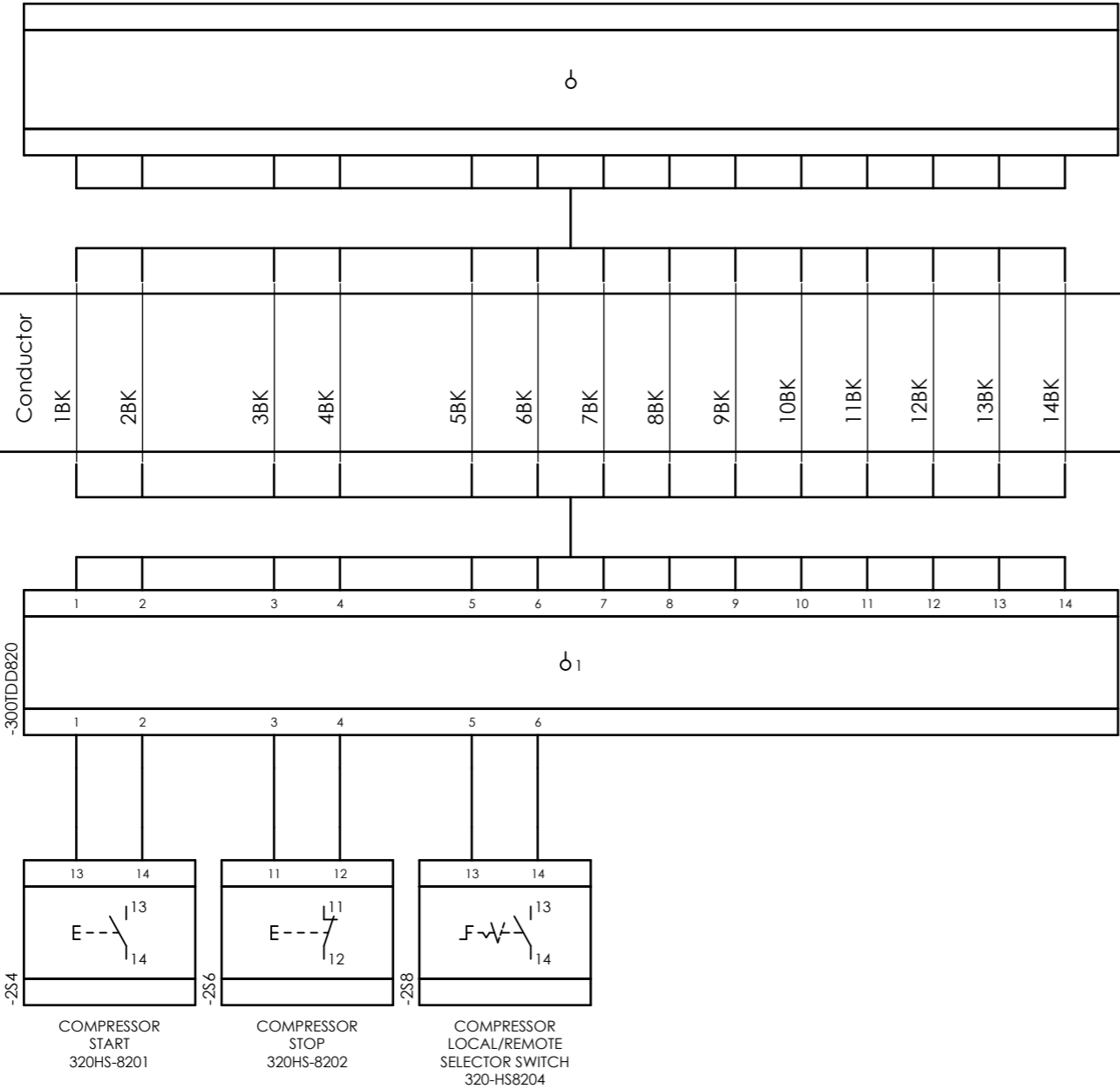
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	EMERGENCY STOP		
	INDICATION LAMP		
	INSTRUMENT EARTH CONNECTION POINT		
	N/C PUSHBUTTON		
	N/O PUSHBUTTON		
	TERMINAL CONNECTION POINT		
	TRANSMITTER CONNECTION POINT		
	TWO-POSITION SELECTOR SWITCH		

Loop Diagrams

Internal targets



External targets



CLIENT DWG NO.	N-278-VD-6019-EL-DIA-0031
EQUIPMENT NO.	320-K-020
EQUIPMENT LOCATION	IRAN, ONSHORE
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SUBJECT	
Cable-connection diagram =320-K-020+300LP-820-300CDDN820	
ADAPTED TO P&ID REVISION	08
CLIENT	LAVAN INDUSTRY DEVELOPMENT COMPANY (LIDCO)
CLIENT REF.	INTEGRATED METHANOL AND AMMONIA PLANT
AIRPACK REF.	17735-30 Loop Diagrams

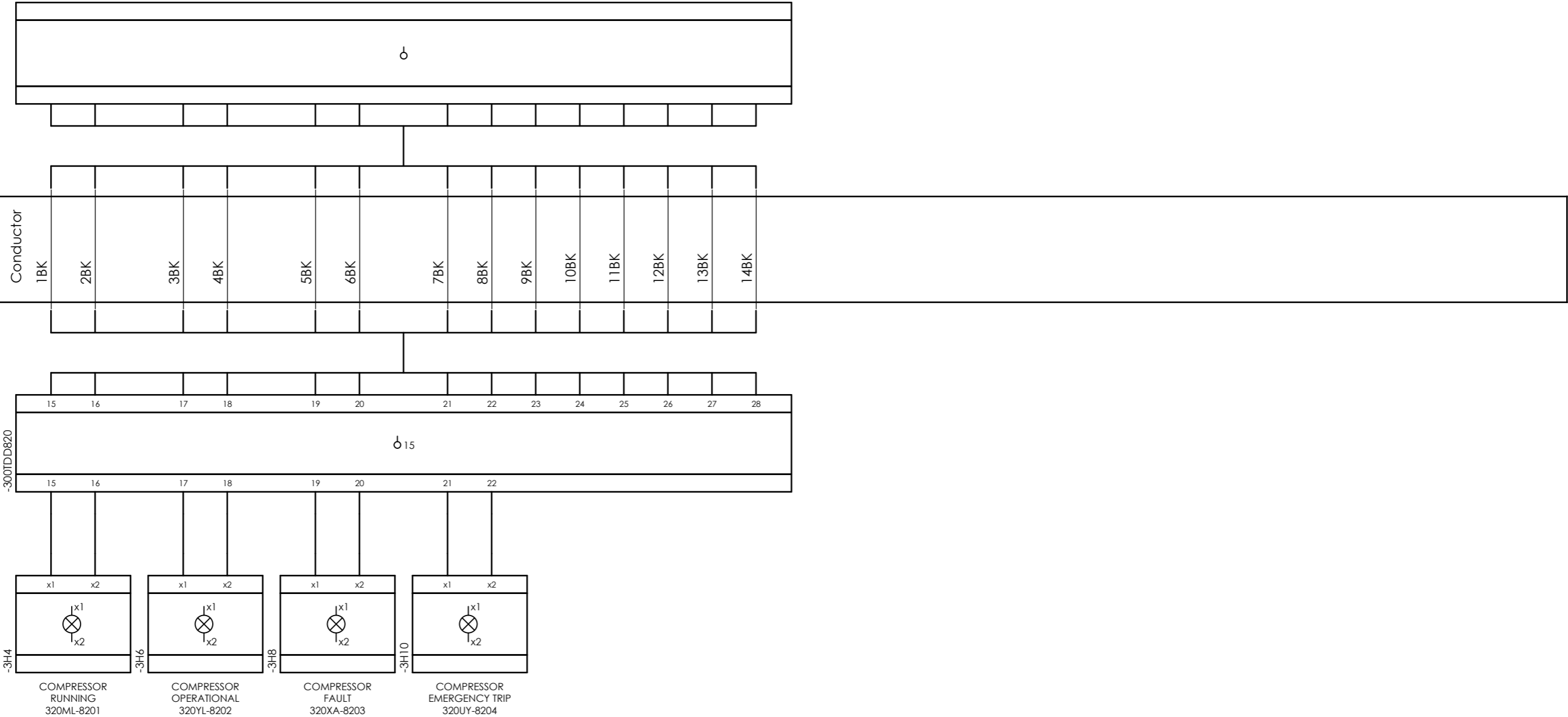
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LAST MODIFICATION DATE	2024-05-02
AIRPACK DWG NO.	17735-30
REVISION	08
TOTAL PAGE AMOUNT	5

= 320-K-020	CURRENT PAGE
+ 300LP-820	

Loop Diagrams

Internal targets

External targets



CLIENT DWG NO.	N-278-VD-6019-EL-DIA-0031	SUBJECT Cable-connection diagram =320-K-020+300LP-820-300CDDN821		DRAWN BY	RTR	= 320-K-020
EQUIPMENT NO.	320-K-020			CHECKED BY	RBE	+ 300LP-820
EQUIPMENT LOCATION	IRAN, ONSHORE	ADAPTED TO P&ID REVISION	08	LAST MODIFICATION DATE	2024-05-02	CURRENT PAGE
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		CLIENT REF.	INTEGRATED METHANOL AND AMMONIA PLANT	REVISION	08	
		AIRPACK REF.	17735-30 Loop Diagrams	TOTAL PAGE AMOUNT	6	
3						

Loop Diagrams

Internal targets



External targets

300JDAN-820 JUNCTION BOX



CLIENT DWG NO.	N-278-VD-6019-EL-DIA-0031
EQUIPMENT NO.	320-K-020
EQUIPMENT LOCATION	IRAN, ONSHORE

SUBJECT	PANEL DESCRIPTION
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ADAPTED TO P&ID REVISION	08
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CLIENT	LAVAN INDUSTRY DEVELOPMENT COMPANY (LIDCO)
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CLIENT REF.	INTEGRATED METHANOL AND AMMONIA PLANT
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LAST MODIFICATION DATE	2024-05-02
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AIRPACK DWG NO.	17735-30
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REVISION	08
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= 320-K-020

+ 300JDAN820

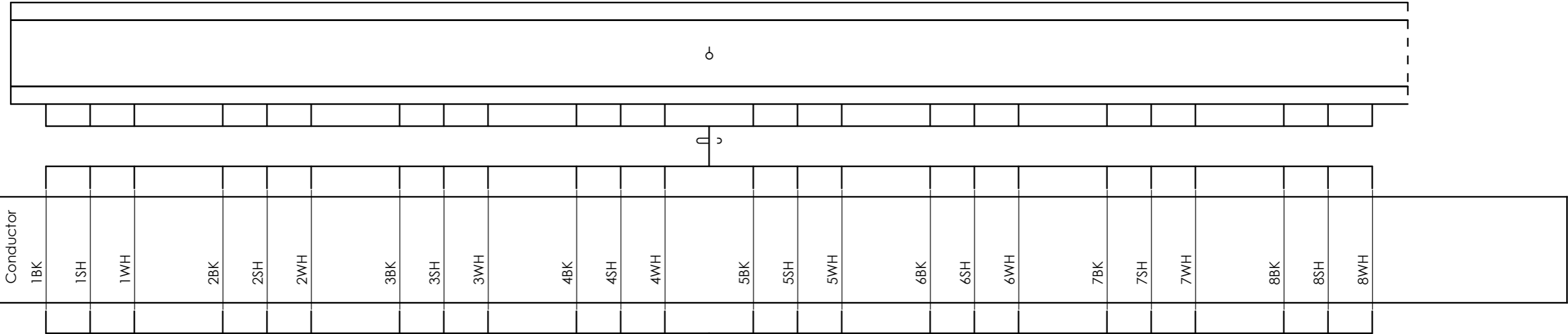
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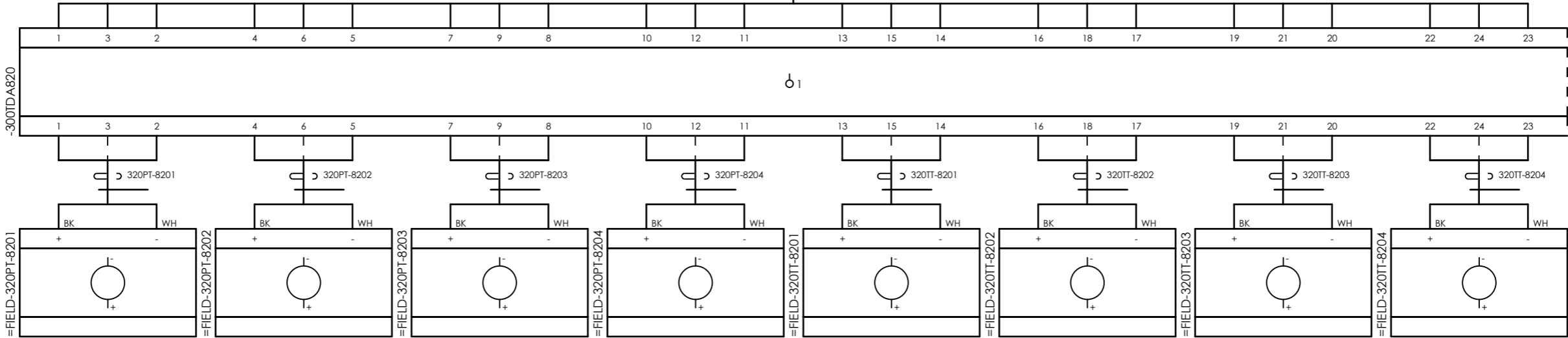
Loop Diagrams

Internal targets

=320-K-020+300JDAN-820-300CDAN820



External targets



CLIENT DWG NO.	N-278-VD-6019-EL-DIA-0031
EQUIPMENT NO.	320-K-020
EQUIPMENT LOCATION	IRAN, ONSHORE

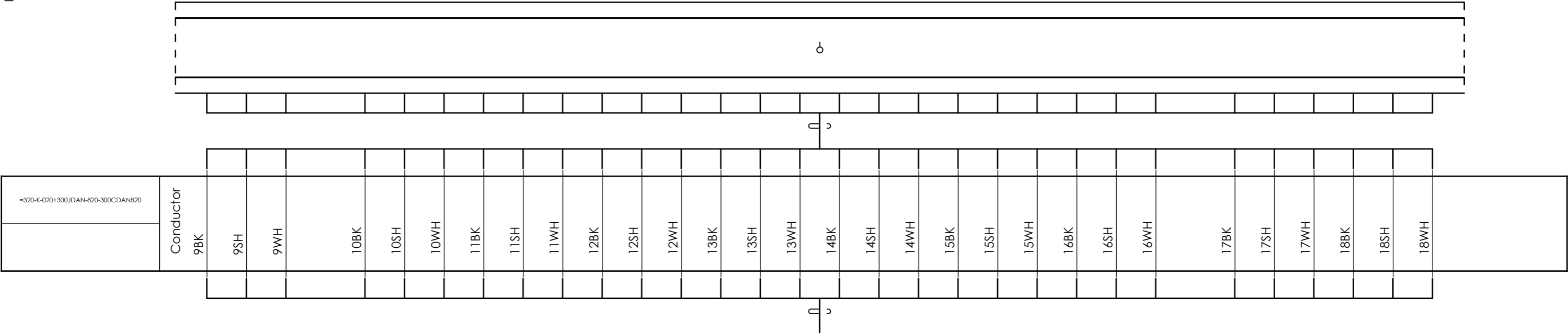
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SUBJECT	
Cable-connection diagram =320-K-020+300JDAN-820-300CDAN820	
ADAPTED TO P&ID REVISION	08
CLIENT	LAVAN INDUSTRY DEVELOPMENT COMPANY (LIDCO)
CLIENT REF.	INTEGRATED METHANOL AND AMMONIA PLANT
AIRPACK REF.	17735-30 Loop Diagrams

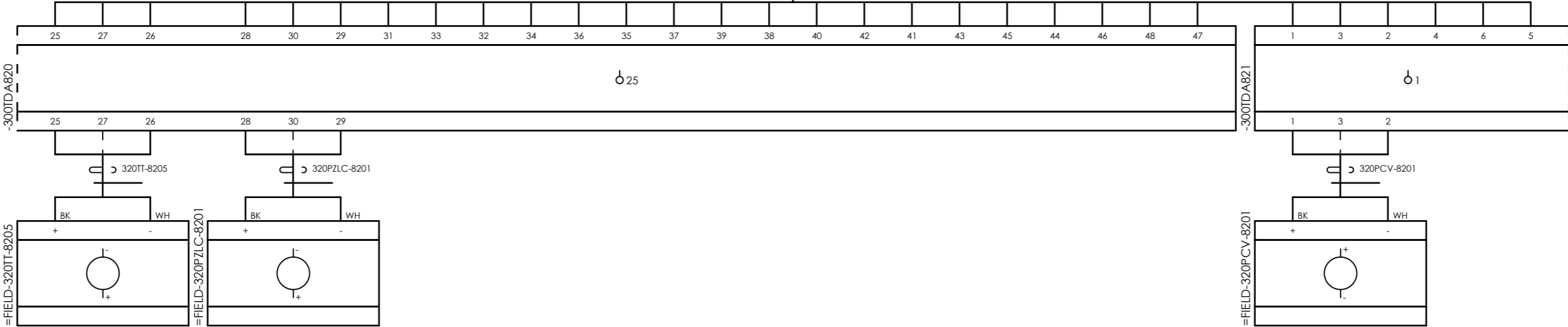
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AIRPACK DWG NO.	17735-30	
REVISION	08	
TOTAL PAGE AMOUNT	9	

Loop Diagrams

Internal targets



External targets



CLIENT DWG NO.	N-278-VD-6019-EL-DIA-0031
EQUIPMENT NO.	320-K-020
EQUIPMENT LOCATION	IRAN, ONSHORE

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SUBJECT	
Cable-connection diagram =320-K-020+300JDAN-820-300CDAN820	
ADAPTED TO P&ID REVISION	08
CLIENT	LAVAN INDUSTRY DEVELOPMENT COMPANY (LIDCO)
CLIENT REF.	INTEGRATED METHANOL AND AMMONIA PLANT
AIRPACK REF.	17735-30 Loop Diagrams

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REVISION	08
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= 320-K-020
+ 300JDAN820
CURRENT PAGE

Loop Diagrams

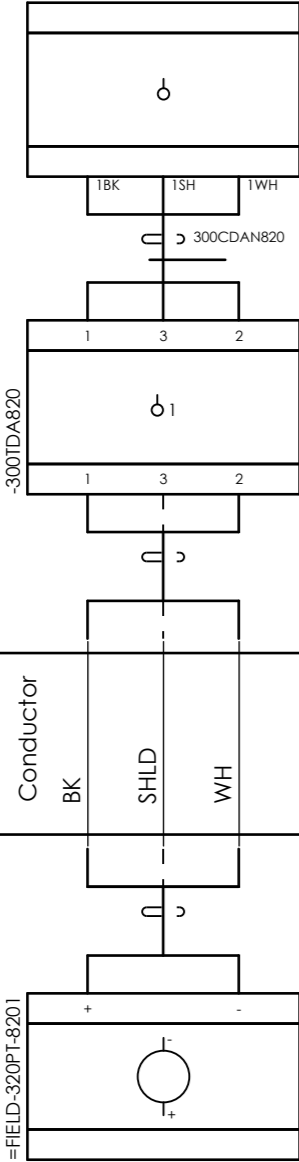
Internal targets



External targets

Loop Diagrams

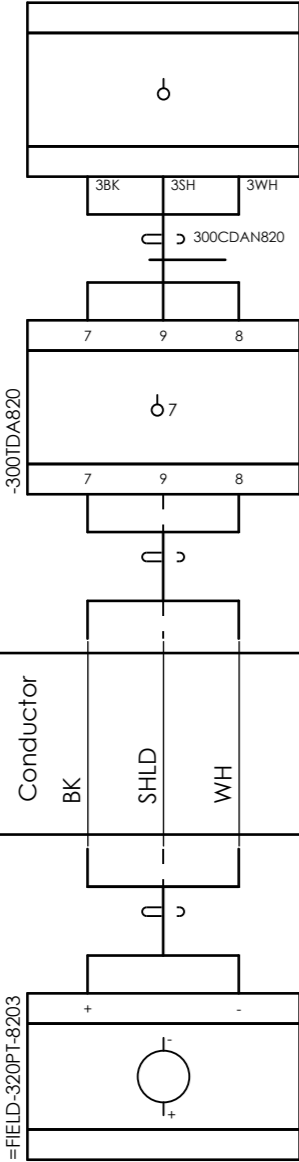
Internal targets



External targets

Loop Diagrams

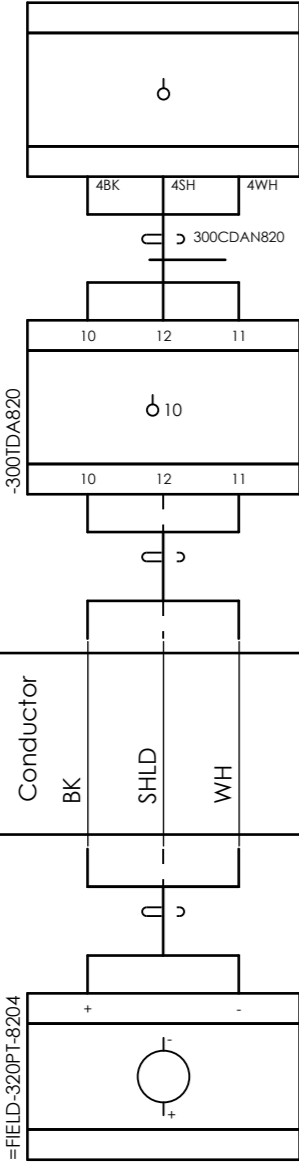
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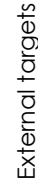
External targets

Loop Diagrams

Internal targets



External targets



Loop Diagrams

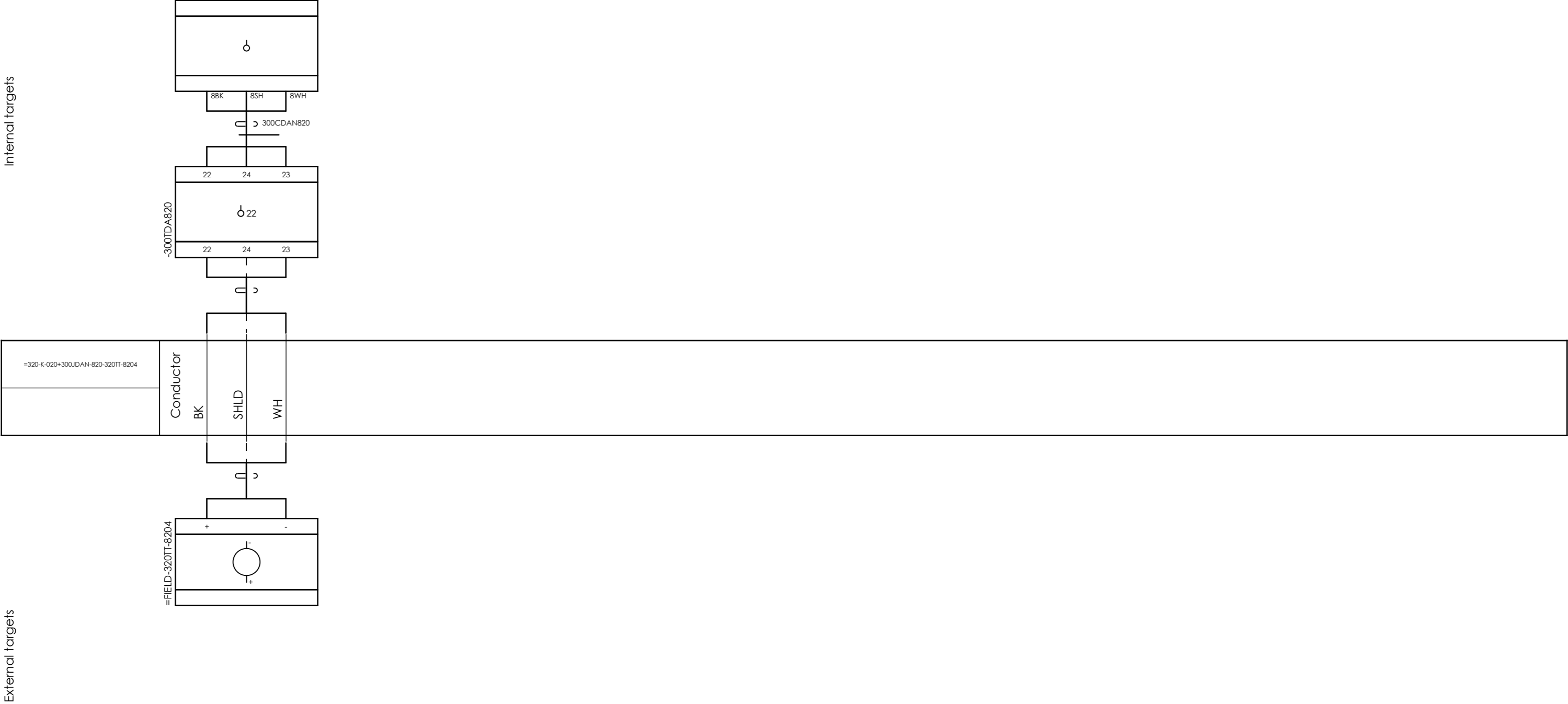


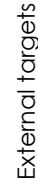
Loop Diagrams

F07_001
rtriegaardt 2024-05-02



Loop Diagrams





Loop Diagrams



Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION K-32

DOCUMENTS; CONTROL AND SHUTDOWN LOGIC BLOCK DIAGRAM



Vendor doc. Number
17735-19

P.O. NO.:
LIDCO-PO-NEC-278-6019

Vendor:
Airpack Nederland B.V.



LIDCO, Pars SEE Zone, Assaluyeh,
Integrated Methanol and Ammonia
Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT



Control and shut down Logic Block Diagram

Document No. 17735-32

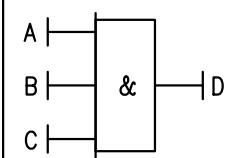
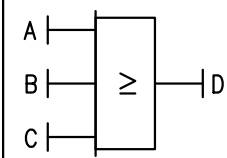
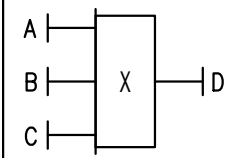
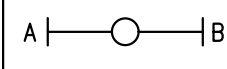
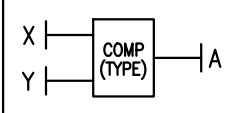
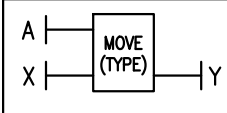
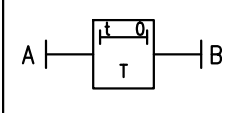
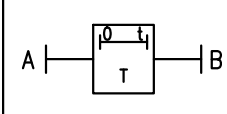
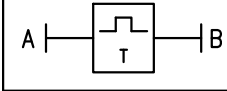
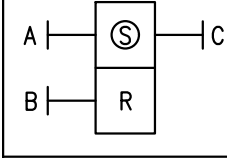
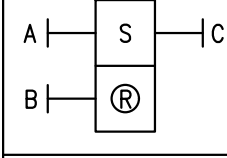
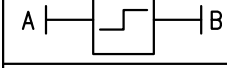
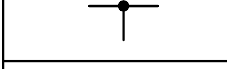
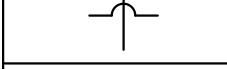
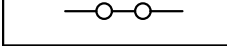
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N278	VD	6019	EL	DIA	0049	07

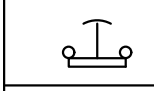
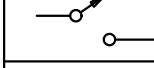
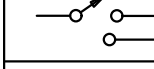
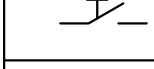
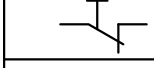
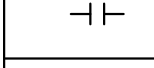
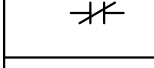






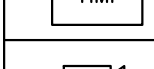
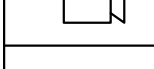
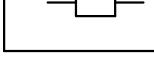
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LIST OF REVISED PAGES

Rev. Page	01	02	03	04	05	06	07	08	09	10	Rev. Page	01	02	03	04	05	Rev. Page	01	02	03	04	05
1	X	X	X	X	X	X	X				51						76					
2	X	X	X	X	X	X	X				52						77					
3	X	X	X	X	X	X	X				53						78					
4	X	X	X	X	X	X	X				54						79					
5	X	X	X	X	X	X	X				55						80					
6	X	X	X	X	X	X	X				56						81					
7	X	X	X	X	X	X	X				57						82					
8	X	X	X	X	X	X	X				58						83					
9	X	X	X	X	X	X	X				59						84					
10	X	X	X	X	X	X	X				60						85					
11	X	X	X	X	X	X	X				61						86					
12	X	X	X	X	X	X	X				62						87					
13	X	X	X	X	X	X	X				63						88					
14	X	X	X	X	X	X	X				64						89					
15	X	X	X	X	X	X	X				65						90					
16	X	X	X	X	X	X	X				66						91					
17	X	X	X	X	X	X	X				67						92					
18	X	X	X	X	X	X	X				68						ATTACHMENT					
19	X	X	X	X	X	X	X				69						1					
20	X										70						2					
21											71						3					
22											72						4					
23											73						5					
24											74						6					
25											75						7					

SYMBOL	FUNCTION	DESCRIPTION
	AND	OUTPUT D EXISTS ONLY IF AND WHILE INPUTS A,B AND C EXIST.
	OR	OUTPUT D EXISTS ONLY IF AND WHILE ONE OR MORE OF INPUTS A,B OR C EXIST.
	XOR	OUTPUT D EXISTS ONLY IF AND WHILE ONE OF INPUTS A,B OR C EXIST.
	NOT	OUTPUT B EXISTS ONLY IF AND WHILE INPUT A DOES NOT EXIST.
	COMPARE	COMPARE FUNCTION THAT COMPARES THE VALUES IN X AND Y, AND IF THE COMPARISON INDICATED BY "TYPE" IS TRUE, OUTPUT A EXISTS. VALID COMPARISONS ARE: GREATER THAN(>), LESS THAN(<), EQUAL TO(==), GREATER THAN OR EQUAL TO (>=) AND LESS THAN OR EQUAL TO (<=).
	MOVE	IF INPUT A EXISTS, THE VALUE X IS ASSIGNED TO THE VARIABLE AT THE OUTPUT Y. TYPE IS INCLUDED TO INDICATE THE TYPE OF VARIABLE. B TERMINATES IMMEDIATELY WHEN A TERMINATES.
	TIMER (DELAY INITIATION)	THE CONTINUOUS EXISTENCE OF INPUT A FOR TIME T CAUSES OUTPUT B TO EXIST WHEN THE TIME T EXPIRES. B TERMINATES IMMEDIATELY WHEN A TERMINATES.
	TIMER (DELAY TERMINATION)	THE EXISTENCE OF INPUT A CAUSES OUTPUT B TO EXIST IMMEDIATELY. B TERMINATES WHEN A HAS TERMINATED AND HAS NOT AGAIN EXISTED FOR TIME T.
	PULSE OUTPUT	THE EXISTENCE OF INPUT A CAUSES OUTPUT B TO EXIST IMMEDIATELY. B EXISTS FOR TIME T, REGARDLESS OF THE STATE OF A.
	FLIP-FLOP MEMORY (SET PRIORITY)	OUTPUT C EXISTS AS SOON AS A EXISTS. C CONTINUES TO EXIST, REGARDLESS OF THE SUBSEQUENT STATE OF A, UNTIL THE MEMORY IS RESET (I.E; TERMINATED BY B EXISTING) C REMAINS TERMINATED, REGARDLESS OF THE SUBSEQUENT STATE OF B, UNTIL A CAUSES THE MEMORY TO BE SET. IF A AND B EXIST SIMULTANEOUSLY, A OVERRIDES B.
	FLIP-FLOP MEMORY (RESET PRIORITY)	OUTPUT C EXISTS AS SOON AS A EXISTS. C CONTINUES TO EXIST, REGARDLESS OF THE SUBSEQUENT STATE OF A, UNTIL THE MEMORY IS RESET (I.E; TERMINATED BY B EXISTING) C REMAINS TERMINATED, REGARDLESS OF THE SUBSEQUENT STATE OF B, UNTIL A CAUSES THE MEMORY TO BE SET. IF A AND B EXIST SIMULTANEOUSLY, B OVERRIDES A.
	RISING TRIGGER	THE EXISTENCE OF INPUT A CAUSES OUTPUT B TO EXIST IMMEDIATELY, AND FALL AWAY ON THE NEXT INSTRUCTION CYCLE.
		LOGIC CONNECTION, BRANCH
		NO CONNECTION, JUMP
		MODBUS CONNECTION

SYMBOL	DESCRIPTION
	EMERGENCY PUSHBUTTON, RED HEAD, STAY PUT.
	TWO WAY SWITCH
	THREE WAY SWITCH
	PUSHBUTTON MOMENTARILY MAKE
	PUSHBUTTON MOMENTARILY BREAK
	CONTACT NORMALLY OPEN
	CONTACT NORMALLY CLOSED
	HARDWIRED INPUT/OUTPUT
	SOLENOID VALVE, 3-WAY
	DCS CONTROL SYSTEM
	PLC CONTROL SYSTEM
	DCS AUXILIARY CONSOLE
	LAMP
	HMI
	AUDIBLE ALARM
	RELAY COIL

GENERAL NOTES

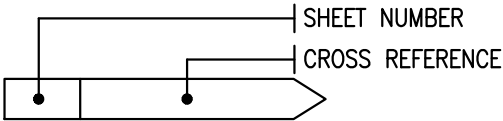
- THIS LOGIC DIAGRAM PROVIDES THE DETAILED OPERATION OF COMPRESSOR K020.
- SHUTDOWN CONDITION ;
0 = SHUTDOWN 1 = OPERATING
- ALARM/TRIP CONDITION ;
0 = ALARM 1=NORMAL
0 = TRIP 1=NORMAL

ABBREVIATIONS

DCS : DISTRIBUTED CONTROL SYSTEM
MCC : MOTOR CONTROL CENTER
LPS : LOCAL PANEL STATION
I/P : HARDWIRED INPUT
O/P : HARDWIRED OUTPUT

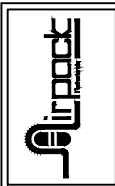
DEFINITION

- AVAILABLE: COMPRESSOR READY TO START.
- RUNNING: PACKAGE RUNNING.
- LOGIC CONTINUATION FROM/TO OTHER SHEET




REFERENCE DOCUMENTS

- Piping & Instrument Diagram
- Cause & Effect Chart
- Control philosophy and Interlock Description
- I/O List




SUBJECT LOGIC DIAGRAM HIGH PRESSURE AIR COMPRESSOR K020		DATE	08-03-2024	THIS DRAWING IS OWNED BY AIRPACK AND SHALL NOT BE PRINTED OR COPIED IN ANY OTHER WAY THAN WITH AIRPACKS PERMISSION	07	19-08-2024	AZ
		DRAWN BY	AZ		06	06-08-2024	SK
		CHECKED BY	SK		05	18-07-2024	AZ
CLIENT	Lavan Industry Development Company	PLANT LOCATION	IRAN, ONSHORE		04	04-07-2024	AZ
CLIENT REF	N-278-VD-6019-EL-DIA-0049	DRAWING NO.	17735-32		03	01-05-2024	AZ
AIRPACK REF	17735-COM	SHEET NO.	01 / 17		02	09-04-2024	AZ
					01	08-03-2024	AZ

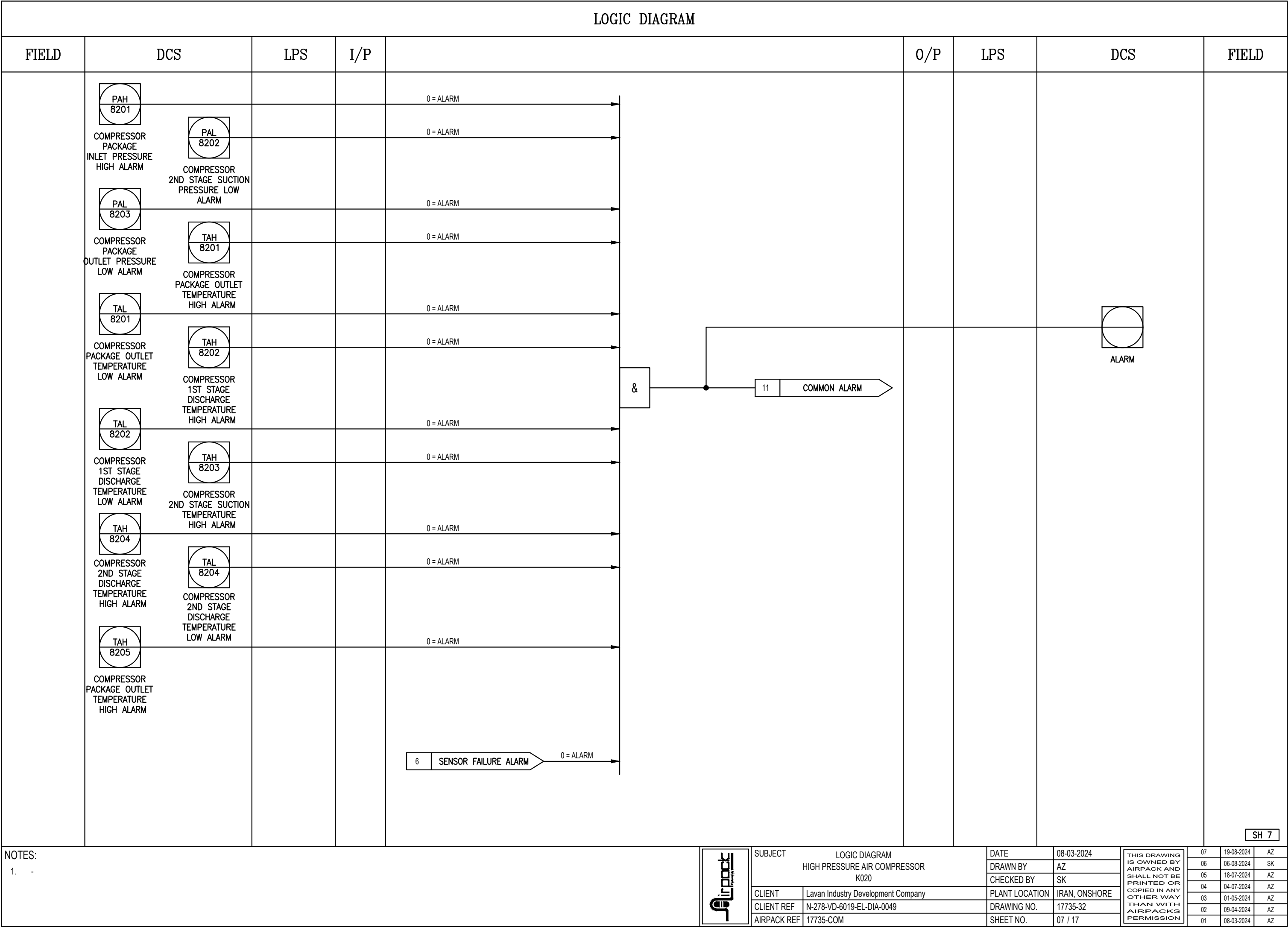
LOGIC DIAGRAM																
FIELD	DCS	MCC	LPS	I/P		O/P	LPS	MCC	DCS	FIELD						
<div>320PT-8201</div> <div>COMPRESSOR PACKAGE INLET PRESSURE</div>				<div></div>	<div>< 12 bar(g)</div>				<div>PAH 8201</div> <div>COMPRESSOR PACKAGE INLET PRESSURE HIGH ALARM</div>							
					<div>> 7,5 bar(g)</div>				<div>PALL 8201</div> <div>COMPRESSOR PACKAGE INLET PRESSURE LOW TRIP</div>							
					<div>0=SENSOR FAILURE</div>				<div>PXA 8201</div> <div>320PT-8201 SENSOR FAILURE</div>							
<div>320PT-8202</div> <div>COMPRESSOR 2ND STAGE SUCTION PRESSURE</div>				<div></div>	<div>> 19 bar(g)</div>				<div>PAL 8202</div> <div>COMPRESSOR 2ND STAGE SUCTION PRESSURE LOW ALARM</div>							
					<div>> 15,5 bar(g)</div>				<div>PALL 8202</div> <div>COMPRESSOR 2ND STAGE SUCTION PRESSURE LOW TRIP</div>							
					<div>0=SENSOR FAILURE</div>				<div>PXA 8202</div> <div>320PT-8202 SENSOR FAILURE</div>							
											SH 2					
NOTES: 1. -						SUBJECT LOGIC DIAGRAM HIGH PRESSURE AIR COMPRESSOR K020			DATE	08-03-2024	THIS DRAWING IS OWNED BY AIRPACK AND SHALL NOT BE PRINTED OR COPIED IN ANY OTHER WAY THAN WITH AIRPACKS PERMISSION			07	19-08-2024	AZ
									DRAWN BY	AZ				06	06-08-2024	SK
						CLIENT Lavan Industry Development Company			CHECKED BY	SK				05	18-07-2024	AZ
									PLANT LOCATION	IRAN, ONSHORE				04	04-07-2024	AZ
						CLIENT REF N-278-VD-6019-EL-DIA-0049			DRAWING NO.	17735-32				03	01-05-2024	AZ
									AIRPACK REF	17735-COM				02	09-04-2024	AZ
									SHEET NO.	02 / 17				01	08-03-2024	AZ

LOGIC DIAGRAM													
FIELD	DCS	MCC	LPS	I/P		O/P	LPS	MCC	DCS	FIELD			
320PT-8203 <div>COMPRESSOR PACKAGE OUTLET PRESSURE</div>				<div></div>	<div><div>> 25 bar(g)</div><div>< 34 bar(g)</div><div><div>17</div><div>320PT-8203</div><div>COMPRESSOR OUTLET PRESSURE</div></div><div>0=SENSOR FAILURE</div></div>				<div><div><div>PAL 8203</div><div>COMPRESSOR PACKAGE OUTLET PRESSURE LOW ALARM</div></div><div><div>PAHH 8203</div><div>COMPRESSOR PACKAGE OUTLET PRESSURE HIGH TRIP</div></div><div><div>PXA 8203</div><div>320PT-8203 SENSOR FAILURE</div></div><div><div>PALL 8204</div><div>COMPRESSOR OIL SYSTEM PRESSURE LOW TRIP</div></div><div><div>PXA 8204</div><div>320PT-8204 SENSOR FAILURE</div></div><div><div>TAH 8201</div><div>COMPRESSOR PACKAGE OUTLET TEMPERATURE HIGH ALARM</div></div><div><div>TAL 8201</div><div>COMPRESSOR PACKAGE OUTLET TEMPERATURE LOW ALARM</div></div><div><div>TXA 8201</div><div>320TT-8201 SENSOR FAILURE</div></div></div>				
320PT-8204 <div>COMPRESSOR OIL SYSTEM PRESSURE</div>				<div></div>	<div><div>> 1 bar(g)</div><div><div>16</div><div>START-UP DELAY</div></div><div>0=SENSOR FAILURE</div></div>								
320TT-8201 <div>COMPRESSOR PACKAGE INLTER TEMPERATURE</div>				<div></div>	<div><div>< 50 °C</div><div>> 40 °C</div><div>0=SENSOR FAILURE</div></div>								
NOTES: 1. -					<div><div></div></div>	SUBJECT LOGIC DIAGRAM HIGH PRESSURE AIR COMPRESSOR K020		DATE 08-03-2024	THIS DRAWING IS OWNED BY AIRPACK AND SHALL NOT BE PRINTED OR COPIED IN ANY OTHER WAY THAN WITH AIRPACKS PERMISSION		07 19-08-2024 AZ		
						CLIENT Lavan Industry Development Company		DRAWN BY AZ			06 06-08-2024 SK		
						CLIENT REF N-278-VD-6019-EL-DIA-0049		CHECKED BY SK			05 18-07-2024 AZ		
						AIRPACK REF 17735-COM		PLANT LOCATION IRAN, ONSHORE			04 04-07-2024 AZ		
								DRAWING NO. 17735-32			03 01-05-2024 AZ		
								SHEET NO. 03 / 17			02 09-04-2024 AZ		
											01 08-03-2024 AZ		
											SH 3		

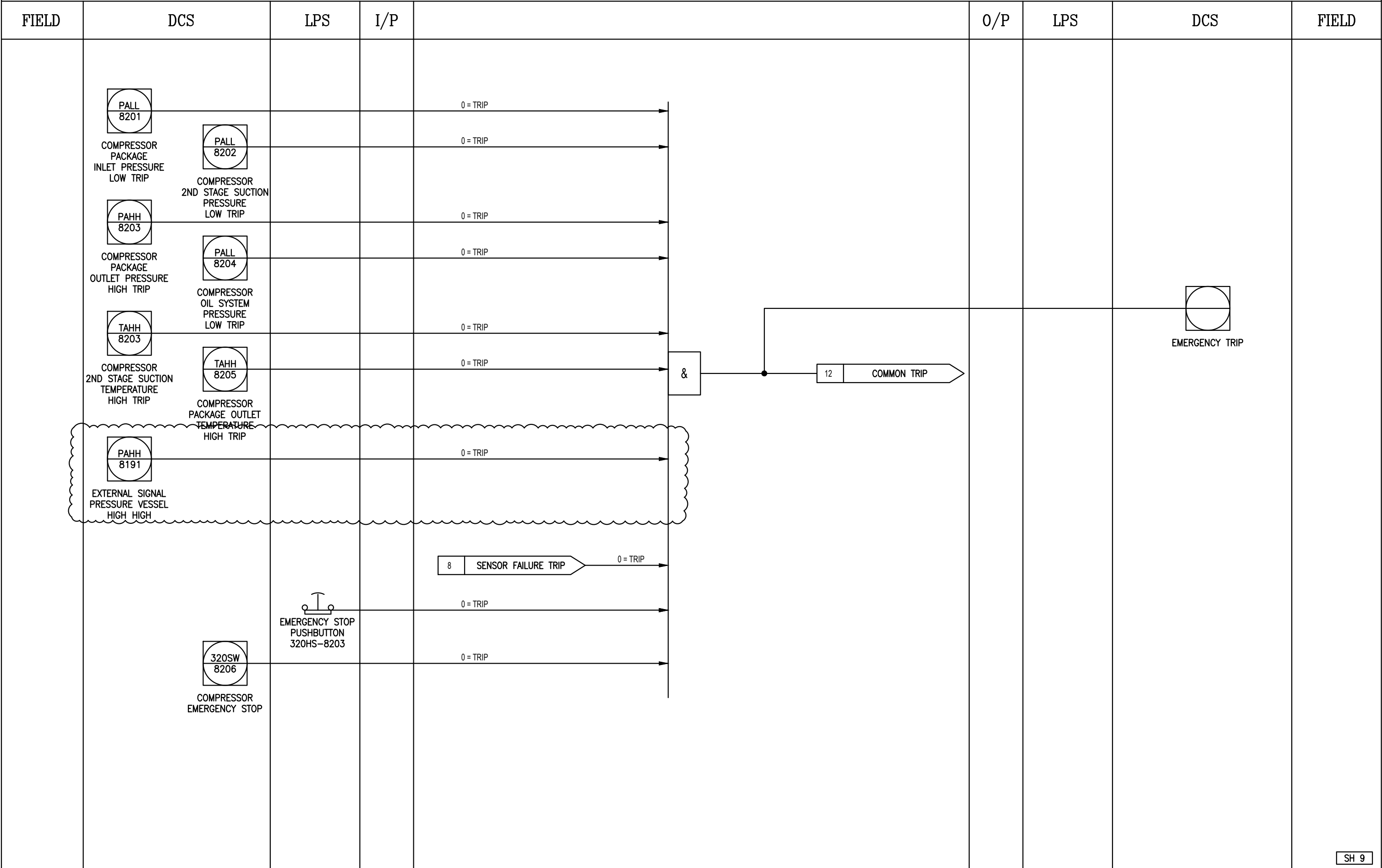
LOGIC DIAGRAM																
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320TT-8202 <div>COMPRESSOR 1ST STAGE DISCHARGE TEMPERATURE</div>				<div></div>	<div>< 165 °C</div>				<div>TAH 8202</div> <div>COMPRESSOR 1ST STAGE DISCHARGE TEMPERATURE HIGH ALARM</div>							
					<div>> 145 °C</div>				<div>TAL 8202</div> <div>COMPRESSOR 1ST STAGE DISCHARGE TEMPERATURE LOW ALARM</div>							
					<div>0=SENSOR FAILURE</div>				<div>TXA 8202</div> <div>320TT-8202 SENSOR FAILURE</div>							
320TT-8203 <div>COMPRESSOR 2ND STAGE SUCTION TEMPERATURE</div>				<div></div>	<div>< 65 °C</div>				<div>TAH 8203</div> <div>COMPRESSOR 2ND STAGE SUCTION TEMPERATURE HIGH ALARM</div>							
					<div>< 70 °C</div>				<div>TAHH 8203</div> <div>COMPRESSOR 2ND STAGE SUCTION TEMPERATURE HIGH TRIP</div>							
					<div>0=SENSOR FAILURE</div>				<div>TXA 8203</div> <div>320TT-8203 SENSOR FAILURE</div>							
										<div>SH 4</div>						
NOTES: 1. -					<div>AIRPACK</div>	SUBJECT		LOGIC DIAGRAM HIGH PRESSURE AIR COMPRESSOR K020		DATE	08-03-2024		<div>THIS DRAWING IS OWNED BY AIRPACK AND SHALL NOT BE PRINTED OR COPIED IN ANY OTHER WAY THAN WITH AIRPACKS PERMISSION</div>	07	19-08-2024	AZ
DRAWN BY		AZ		CHECKED BY		SK		06	06-08-2024	SK						
CLIENT		Lavan Industry Development Company		PLANT LOCATION		IRAN, ONSHORE		05	18-07-2024	AZ						
CLIENT REF		N-278-VD-6019-EL-DIA-0049		DRAWING NO.		17735-32		04	04-07-2024	AZ						
AIRPACK REF		17735-COM		SHEET NO.		04 / 17		03	01-05-2024	AZ						
								02	09-04-2024	AZ						
										01	08-03-2024	AZ				

LOGIC DIAGRAM													
FIELD	DCS	MCC	LPS	I/P		O/P	LPS	MCC	DCS	FIELD			
320TT-8204 <div>COMPRESSOR 2ND STAGE DISCHARGE TEMPERATURE</div>				<div></div>	<div>< 125 °C</div>				<div>TAH 8204</div> <div>COMPRESSOR 2ND STAGE DISCHARGE TEMPERATURE HIGH ALARM</div>				
					<div>> 105 °C</div>				<div>TAL 8204</div> <div>COMPRESSOR 2ND STAGE DISCHARGE TEMPERATURE LOW ALARM</div>				
					<div>0=SENSOR FAILURE</div>				<div>TXA 8204</div> <div>320TT-8204 SENSOR FAILURE</div>				
320TT-8205 <div>COMPRESSOR PACKAGE OUTLET TEMPERATURE</div>				<div></div>	<div>< 65 °C</div>				<div>TAH 8205</div> <div>COMPRESSOR PACKAGE OUTLET TEMPERATURE HIGH ALARM</div>				
					<div>< 70 °C</div>				<div>TAHH 8205</div> <div>COMPRESSOR PACKAGE OUTLET TEMPERATURE HIGH TRIP</div>				
					<div>0=SENSOR FAILURE</div>				<div>TXA 8205</div> <div>320TT-8205 SENSOR FAILURE</div>				
										<div>SH 5</div>			
NOTES: 1. -					<div></div>	SUBJECT LOGIC DIAGRAM HIGH PRESSURE AIR COMPRESSOR K020		DATE	08-03-2024		<div>THIS DRAWING IS OWNED BY AIRPACK AND SHALL NOT BE PRINTED OR COPIED IN ANY OTHER WAY THAN WITH AIRPACKS PERMISSION</div>		
								DRAWN BY	AZ				
								CHECKED BY	SK				
						CLIENT	Lavan Industry Development Company		PLANT LOCATION	IRAN, ONSHORE			
						CLIENT REF	N-278-VD-6019-EL-DIA-0049		DRAWING NO.	17735-32			
						AIRPACK REF	17735-COM		SHEET NO.	05 / 17			
						07	19-08-2024	AZ					
06	06-08-2024	SK											
05	18-07-2024	AZ											
04	04-07-2024	AZ											
03	01-05-2024	AZ											
02	09-04-2024	AZ											
01	08-03-2024	AZ											

LOGIC DIAGRAM												
FIELD	DCS		LPS	I/P				O/P	LPS	DCS		FIELD
	<div>PXA 8201</div> <div>320PT-8201 SENSOR FAILURE</div>				0 = ALARM							
	<div>PXA 8202</div> <div>320PT-8202 SENSOR FAILURE</div>				0 = ALARM							
	<div>PXA 8203</div> <div>320PT-8203 SENSOR FAILURE</div>				0 = ALARM							
	<div>TXA 8205</div> <div>320TT-8205 SENSOR FAILURE</div>				0 = ALARM							
	<div>TXA 8201</div> <div>320TT-8201 SENSOR FAILURE</div>				0 = ALARM							
	<div>TXA 8202</div> <div>320TT-8202 SENSOR FAILURE</div>				0 = ALARM							
	<div>TXA 8203</div> <div>320TT-8203 SENSOR FAILURE</div>				0 = ALARM							
	<div>TXA 8204</div> <div>320TT-8204 SENSOR FAILURE</div>				0 = ALARM							
								</				



LOGIC DIAGRAM



NOTES:

1.



SUBJECT	LOGIC DIAGRAM HIGH PRESSURE AIR COMPRESSOR K020
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CLIENT	Lavan Industry Development Company
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CLIENT REF | N-278-VD-6019-EL-DIA-0049

AIRPACK REF | 17735-COM

DATE	08-03-2024
------	------------

DRAWN BY | AZ

CHECKED BY	SK
------------	----

PLANT LOCATION	IRAN, ONSHORE
----------------	---------------

DRAWING NO.	17735-32
-------------	----------

SHEET NO.	09 / 17
-----------	---------

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AIRPACKS
PERMISSION

07	19-08-2024	AZ
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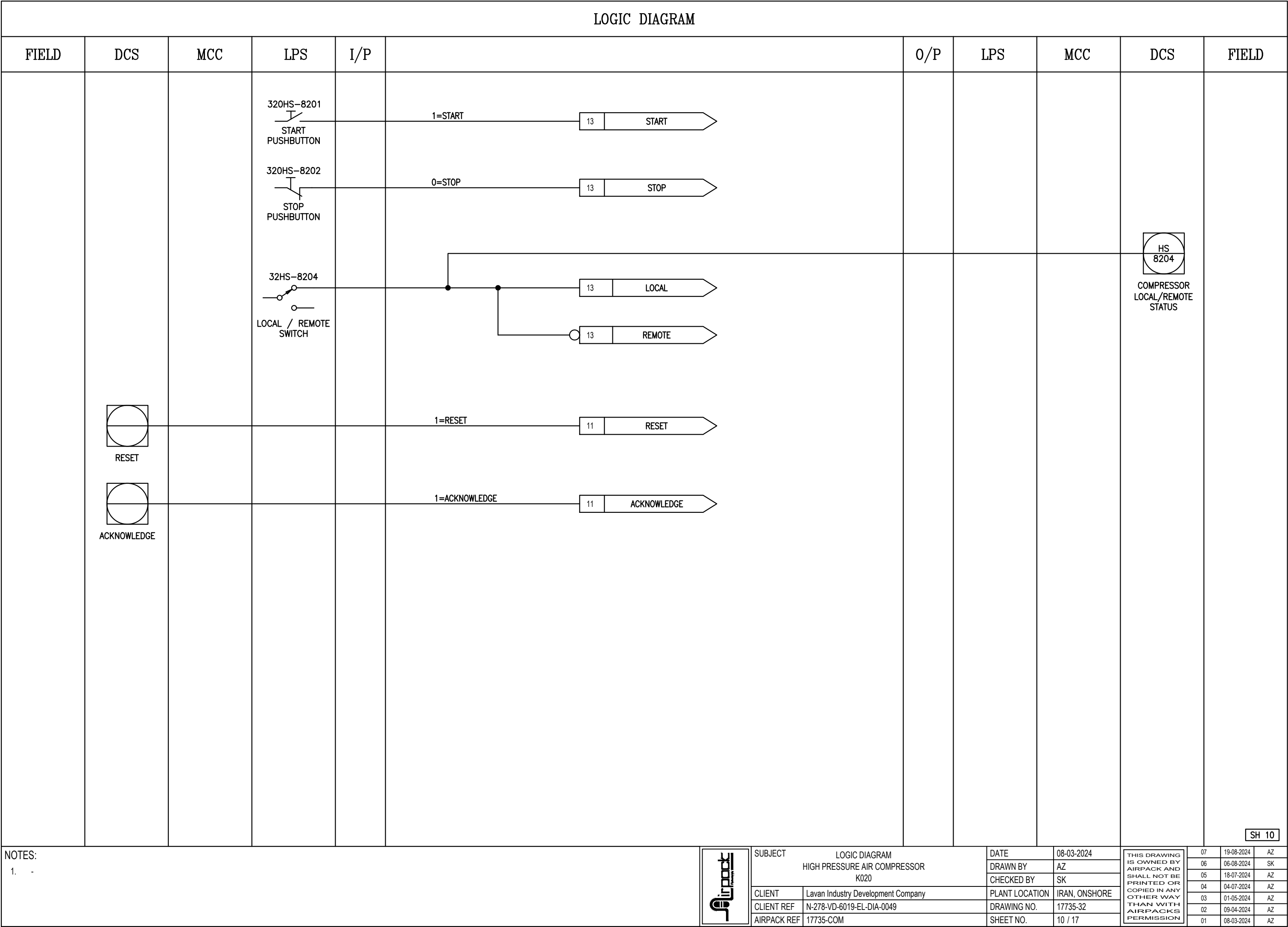
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06	18-07-2024	AZ

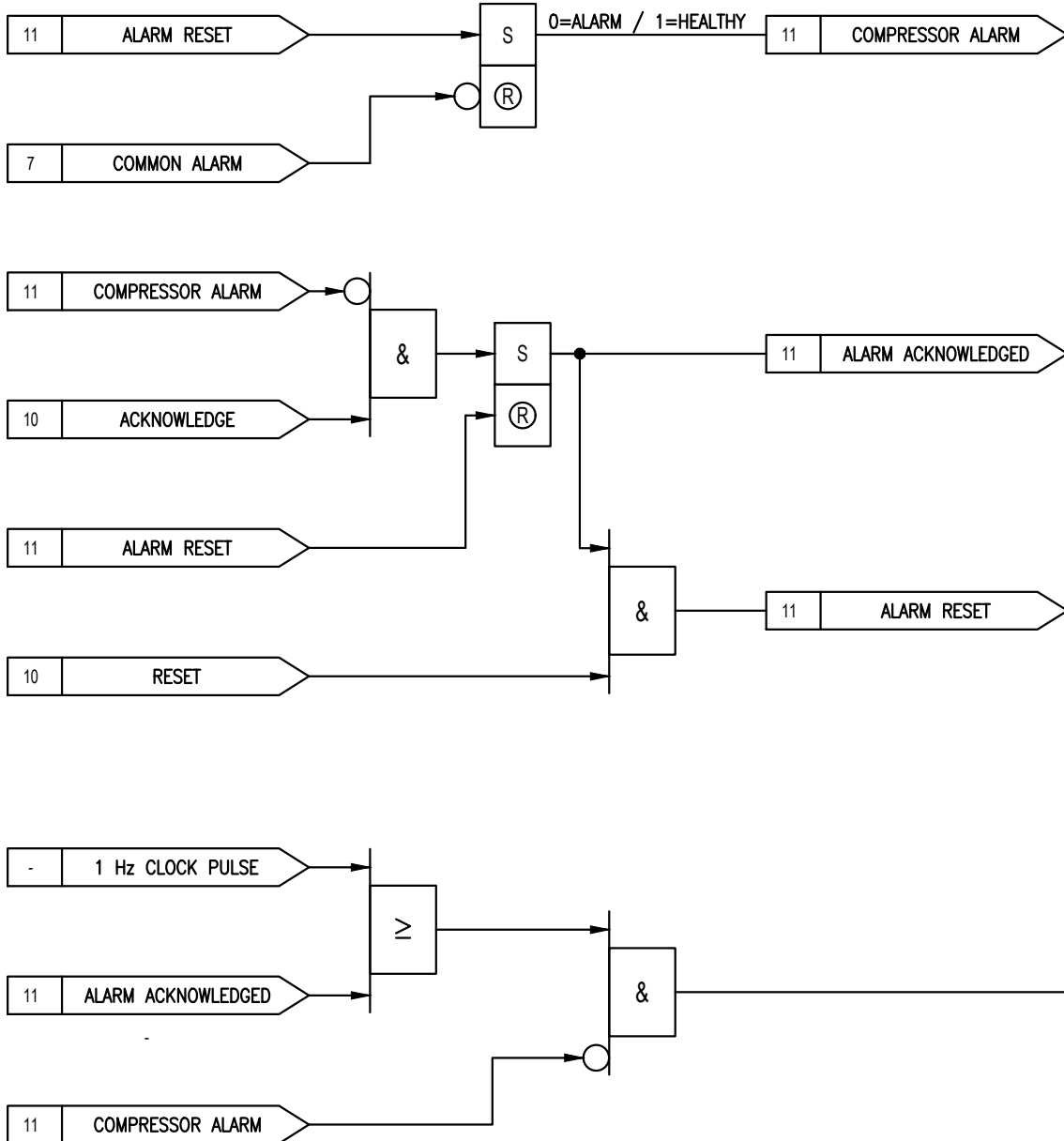
04	04-01-2024	A2
03	01-05-2024	A7

02	09-04-2024	A7
----	------------	----

01	08-03-2024	AZ
----	------------	----



LOGIC DIAGRAM



FAULT LAMP
320XA-8203

SH 11

NOTES:

1. -



SUBJECT	LOGIC DIAGRAM HIGH PRESSURE AIR COMPRESSOR K020
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CLIENT	Lavan Industry Development Company
--------	------------------------------------

CLIENT REF	N-278-VD-6019-EL-DIA-0049
------------	---------------------------

AIRPACK REF	17735-COM
-------------	-----------

DATE	08-03-2024
------	------------

DRAWN BY	AZ
----------	----

CHECKED BY	SK
------------	----

PLANT LOCATION	IRAN, ONSH
----------------	------------

DRAWING NO.	17735-32
-------------	----------

SHEET NO.	11 / 17
-----------	---------

THIS DRAWING
IS OWNED BY
AIRPACK AND
SHALL NOT BE
PRINTED OR
COPIED IN ANY
OTHER WAY
THAN WITH
AIRPACKS
PERMISSION

07	19-08-2024	AZ
----	------------	----


06	06-08-2024	SK
----	------------	----

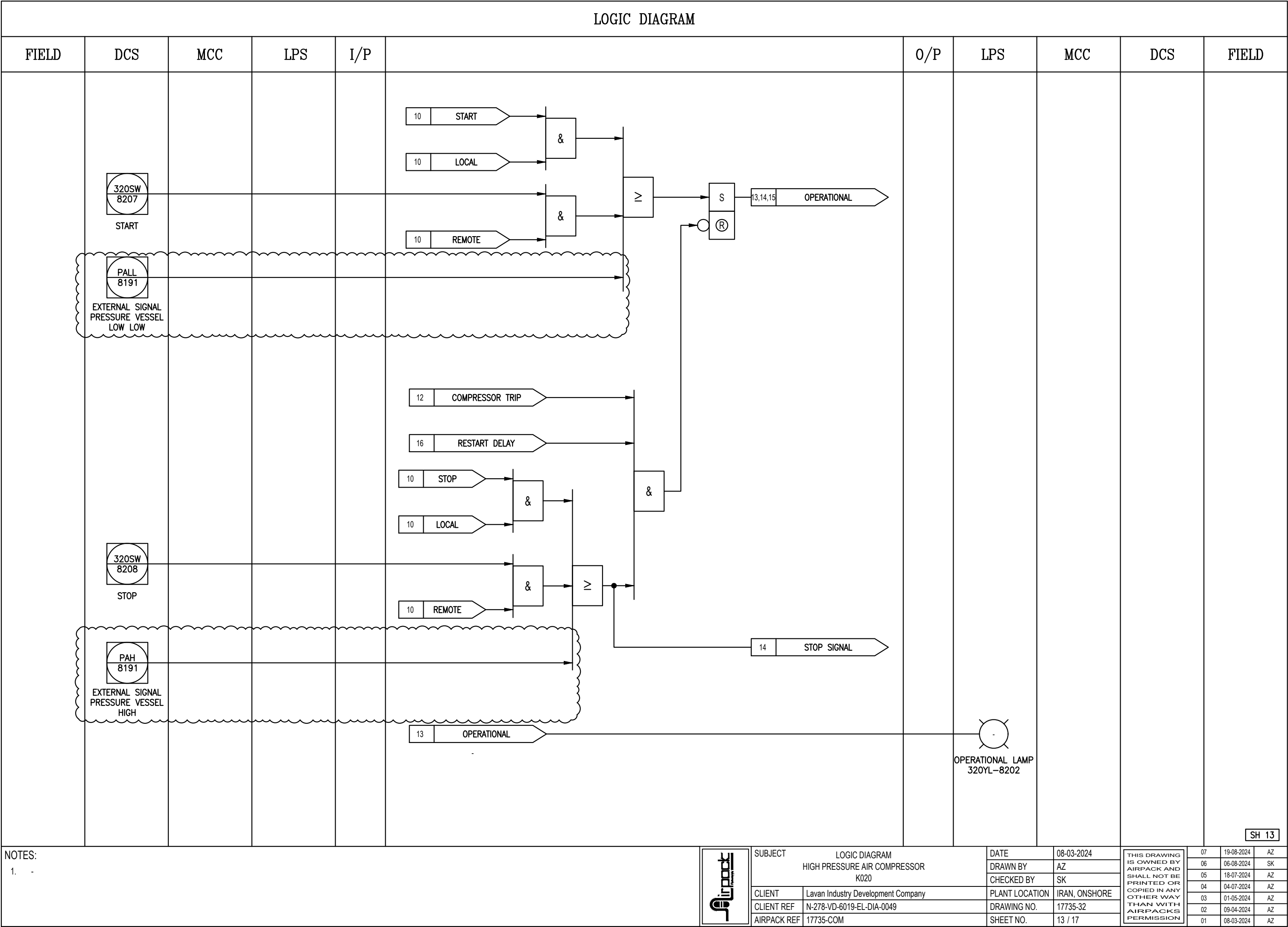
05	18-07-2024	AZ
06	18-07-2024	AZ


04	04-07-2024	AZ
03	01.05.2024	A7

03	01-05-2024	AZ
02	09-04-2024	A7

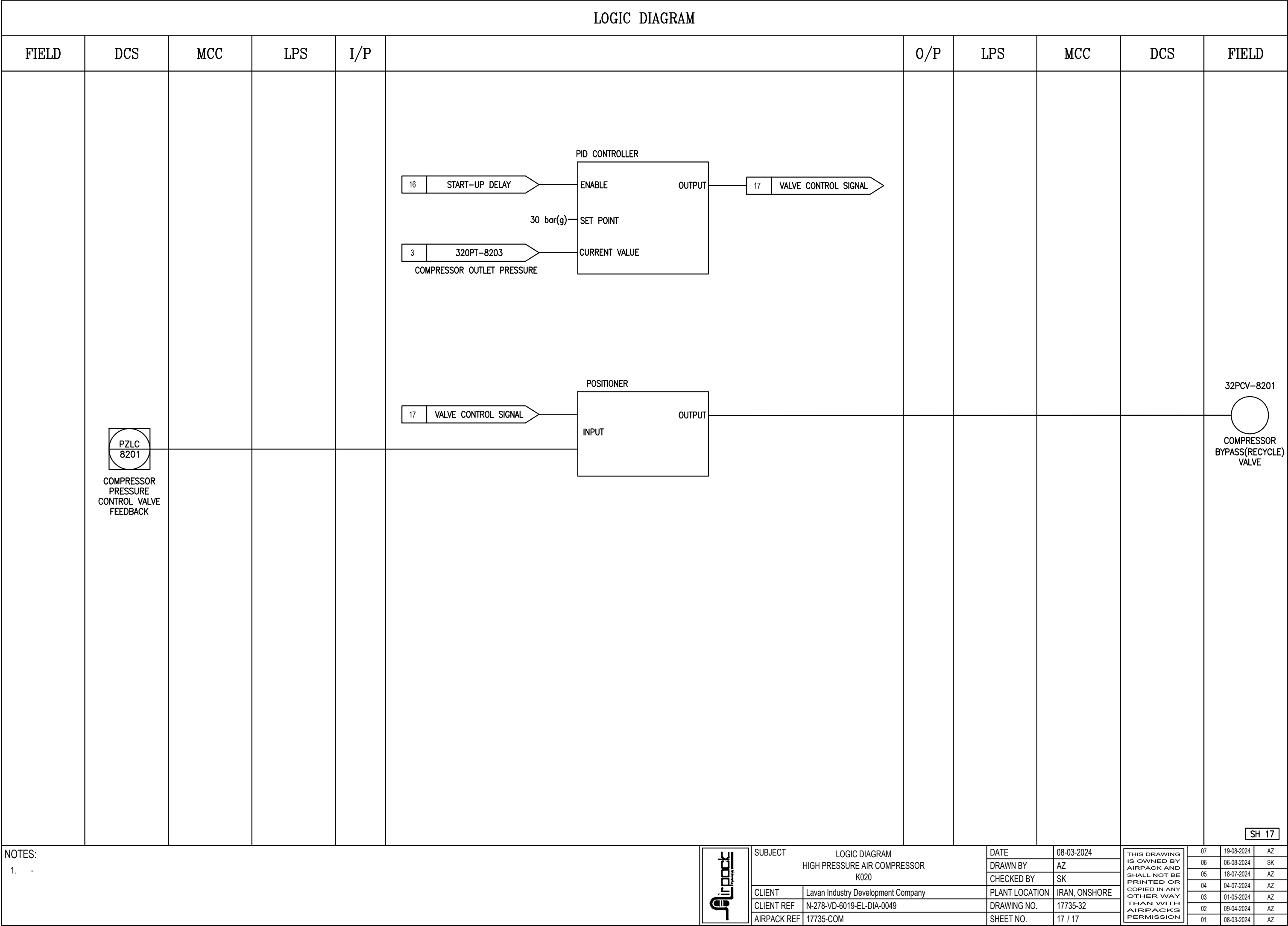
02	09-04-2024	AZ
01	08-03-2024	AZ

LOGIC DIAGRAM															
FIELD	DCS	MCC	LPS	I/P		O/P	LPS	MCC	DCS	FIELD					
					<div><div><div><div><div>12</div><div>TRIP RESET</div></div><div><div>9</div><div>COMMON TRIP</div></div></div><div><div>12</div><div>COMPRESSOR TRIP</div></div><div><div>10</div><div>ACCEPT</div></div><div><div>12</div><div>TRIP RESET</div></div><div><div>10</div><div>RESET</div></div></div><div><div><div>S</div><div>0=ALARM / 1=HEALTHY</div><div>12,13,15</div><div>COMPRESSOR TRIP</div></div><div><div>⊙</div><div>Ⓡ</div></div><div><div><div>&</div><div><div>S</div><div>Ⓡ</div></div></div><div><div>12</div><div>TRIP ACCEPTED</div></div><div><div><div>&</div><div><div>12</div><div>TRIP RESET</div></div></div></div></div><div><div><div>1</div><div>1 Hz CLOCK PULSE</div></div><div><div>12</div><div>TRIP ACCEPTED</div></div><div><div>12</div><div>COMPRESSOR TRIP</div></div></div><div><div><div>≥</div><div><div>&</div></div></div><div><div><div>EMERGENCY TRIP LAMP</div><div>320UY-8204</div></div></div></div></div></div>										
NOTES: 1. -						SUBJECT LOGIC DIAGRAM HIGH PRESSURE AIR COMPRESSOR K020		DATE 08-03-2024	THIS DRAWING IS OWNED BY AIRPACK AND SHALL NOT BE PRINTED OR COPIED IN ANY OTHER WAY THAN WITH AIRPACKS PERMISSION						
						CLIENT	Lavan Industry Development Company	DRAWN BY	AZ						
						CLIENT REF	N-278-VD-6019-EL-DIA-0049	CHECKED BY	SK						
						AIRPACK REF	17735-COM	PLANT LOCATION	IRAN, ONSHORE						
								DRAWING NO.	17735-32						
								SHEET NO.	12 / 17						
									07	19-08-2024	AZ				
									06	06-08-2024	SK				
									05	18-07-2024	AZ				
									04	04-07-2024	AZ				
									03	01-05-2024	AZ				
									02	09-04-2024	AZ				
									01	08-03-2024	AZ				



LOGIC DIAGRAM																	
FIELD	DCS	MCC	LPS	I/P		O/P	LPS	MCC	DCS	FIELD							
					<div><div><div><div>13</div><div>STOP SIGNAL</div></div><div><div>13</div><div>OPERATIONAL</div></div><div><div>14</div><div>COOLDOWN TIME</div></div></div><div><div><div><div><div></div><div>&</div><div></div></div><div><div>S</div><div>Ⓜ</div></div></div><div><div>14</div><div>STOP COMMAND</div></div></div></div><div><div>COOL DOWN TIMER</div><div><div><div><div>14</div><div>STOP COMMAND</div></div><div><div>180s</div></div></div><div><div>14,15</div><div>COOLDOWN TIME</div></div></div></div></div>												
											SH 14						
NOTES: 1. -						SUBJECT LOGIC DIAGRAM HIGH PRESSURE AIR COMPRESSOR K020			DATE	08-03-2024	THIS DRAWING IS OWNED BY AIRPACK AND SHALL NOT BE PRINTED OR COPIED IN ANY OTHER WAY THAN WITH AIRPACKS PERMISSION	07	19-08-2024	AZ			
									DRAWN BY	AZ		06	06-08-2024	SK			
						CLIENT	Lavan Industry Development Company	CHECKED BY	SK	05		18-07-2024	AZ				
								PLANT LOCATION	IRAN, ONSHORE	04		04-07-2024	AZ				
						CLIENT REF	N-278-VD-6019-EL-DIA-0049	DRAWING NO.	17735-32	03		01-05-2024	AZ				
						AIRPACK REF	17735-COM	SHEET NO.	14 / 17	02		09-04-2024	AZ				
												01	08-03-2024	AZ			

LOGIC DIAGRAM														
FIELD	DCS	MCC	LPS	I/P		O/P	LPS	MCC	DCS	FIELD				
					<div><div>15</div><div>RUNNING</div></div>			<div><div></div><div>FAN MOTOR START/STOP</div></div>						
		<div><div><div></div><div></div></div><div>FAN MOTOR RUNNING</div></div>			<div>MAIN MOTOR DELAY</div> <div><div><div></div><div>0</div></div><div>2s</div></div>			<div><div></div><div>MAIN MOTOR START/STOP</div></div>						
		<div><div><div></div><div></div></div><div>MAIN MOTOR RUNNING</div></div>			<div>RESTART DELAY TIMER</div> <div><div><div></div><div>0</div></div><div>60s</div></div> <div>15</div> <div>RESTART DELAY</div>									
					<div>START-UP DELAY TIMER</div> <div><div><div></div><div>0</div></div><div>20s</div></div> <div>3,17</div> <div>START-UP DELAY</div>									
					<div>MINIMUM RUN TIMER</div> <div><div><div></div><div>0</div></div><div>20m</div></div> <div>15</div> <div>MINIMUM RUN TIME</div>									
<div>NOTES:</div> <div>1. -</div>												<div><div></div><div>Airpack</div></div>	<div>SUBJECT</div> <div>LOGIC DIAGRAM HIGH PRESSURE AIR COMPRESSOR K020</div> <div>DATE</div> <div>08-03-2024</div> <div>DRAWN BY</div> <div>AZ</div> <div>CHECKED BY</div> <div>SK</div> <div>CLIENT</div> <div>Lavan Industry Development Company</div> <div>CLIENT REF</div> <div>N-278-VD-6019-EL-DIA-0049</div> <div>AIRPACK REF</div> <div>17735-COM</div> <div>PLANT LOCATION</div> <div>IRAN, ONSHORE</div> <div>DRAWING NO.</div> <div>17735-32</div> <div>SHEET NO.</div> <div>16 / 17</div> <div>THIS DRAWING IS OWNED BY AIRPACK AND SHALL NOT BE PRINTED OR COPIED IN ANY OTHER WAY THAN WITH AIRPACKS PERMISSION</div>	<div>07</div> <div>19-08-2024</div> <div>AZ</div> <div>06</div> <div>06-08-2024</div> <div>SK</div> <div>05</div> <div>18-07-2024</div> <div>AZ</div> <div>04</div> <div>04-07-2024</div> <div>AZ</div> <div>03</div> <div>01-05-2024</div> <div>AZ</div> <div>02</div> <div>09-04-2024</div> <div>AZ</div> <div>01</div> <div>08-03-2024</div> <div>AZ</div>



Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION K-33

DOCUMENTS; PRE-COMMISSIONING PROCEDURE



Vendor doc. Number




17735-19

Vendor:

Airpack Nederland B.V.

P.O. NO.:

LIDCO-PO-NEC-278-6019

	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT							
	(Pre-) Commissioning Procedure							
	Document No. 17735-33							Page
	Project No.	Vendor Doc.	P.O. No.	Department	Document Type	Serial No	Revision	Page 1 of 8
	N278	VD	6019	GN	PRC	0032	02	

Airpack B.V. - Air Compressor –




Integrated Methanol and Ammonia Plant

17735-COM (Pre-) Commissioning Procedure (K020)

Code 1
M.Dalakeh




02	21-05-2024	Issued for Approval	S.K.	J.J.	S.K.
01	19-04-2024	Issued for Approval	S.C.	J.J.	S.K.
REV.	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED

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	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT							
	(Pre-) Commissioning Procedure							
	Document No. 17735-33							Page
	Project No.	Vendor Doc.	P.O. No.	Department	Document Type	Serial No	Revision	Page 2 of 8
	N278	VD	6019	GN	PRC	0032	02	

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2	X	X				27						52						77					
3	X	X				28						53						78					
4	X	X				29						54						79					
5	X	X				30						55						80					
6	X	X				31						56						81					
7	X	X				32						57						82					
8	X	X				33						58						83					
9						34						59						84					
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16						41						66						91					
17						42						67						92					
18						43						68						ATTACHMENT					
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21						46						71						3					
22						47						72						4					
23						48						73						5					
24						49						74						6					
25						50						75						7					

	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT	
	(Pre-) Commissioning Procedure	
Document No. 17735-33		Page
Project No. N278	Vendor Doc. VD	P.O. No. 6019
Department GN	Document Type PRC	Serial No 0032
Revision 02	Page 4 of 8	

1. Purpose

Checking the installation and operation of the package at site against the approved engineering documents.

2. Reference documents

Please find below the reference vendor documents that will be used during the (pre) commissioning of the package.

N-278-VD-6019-PR-PID-0002-01	17735-03	P&ID
N-278-VD-6019-PR-GAD-0003-01	17735-04	General Arrangement Drawing
N-278-VD-6019-IN-DIA-0005-01	17735-05	Wiring Diagram (including Terminal Diagram) for LCP Panel and Junction Box
N-278-VD-6019-IN-DWG-0007-01	17735-07	Outline Dimensional Drawings for LCP Panel and Junction Box
N-278-VD-6019-GN-ITP-0008-01	17735-08	Inspection & Test Plan (ITP)
N-278-VD-6019-GN-UFD-0009-01	17735-09	Utility Consumption List
N-278-VD-6019-GN-PRO-0022-01	17735-21	Control philosophy and Interlock Description

3. Scope

The scope of supply is as follows:

Single package with one oil-free, air cooled, vertical piston compressor for compression of instrument air.

- The air inlet flow is 35Nm³ at a pressure of 9,5 bar(g) with a temperature of 46°C.
- The outlet air flow is 35Nm³ at a pressure of 30 bar(g) with a temperature of max 60°C.
- The water system inlet flow is 1m³/h at a pressure of 4,5 bar(g) and a temperature of 36°C.
- The water system outlet flow is 1m³/h at a pressure of 4.4 bar(g) and a max temperature of 46°C.

The package consists of the following main Items:




- 4x 100% Pulsation damper KV-020-001/2/3/4.
- 1x 100% Intercooler KE-020-001.
- 1x 100% Aftercooler KE-020-002.
- 1 x 100% Main motor KM-020.

The package is equipped with a LPS (Local pushbutton station) to operate the package locally. The package is controlled by the DCS.

The package is equipped with a JB (Junction Box) to connect the instruments to the DCS.

4. HSE

Standard safety precautions have to be taken since we are working with pressurized air.

 <p>شرکت توسعه صنایع گواره Lavan Industry Development Company</p>	<p>LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT</p>						
	<p>(Pre-) Commissioning Procedure</p>						
<p>Document No. 17735-33</p>			<p>Page</p>				
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<p>N278</p>	<p>VD</p>	<p>6019</p>	<p>GN</p>	<p>PRC</p>	<p>0032</p>	<p>02</p>	

- Proper PPE has to be worn when working on or testing the package
- The test area needs cordoned off to make sure non-authorized personnel does not enter this area.
- As minimum the safety rules of the site has to be followed.
- Additional safety instructions as per Airpack site supervision engineer has to be followed.

5. Test instruments

The following test instruments are required during the SAT:

- Sound level meter
- Ambient pressure / temperature meter
- Multi meter (voltage check)

It is client responsibility to provide the required test instrumentation with valid calibration certificate.

6. Pre-commissioning

- ☐ Check if all cables are connected to the correct boxes.
- ☐ Check if all piping is connected to the correct location and without stresses
- ☐ Loop-check all cables
- ☐ Visual inspection of the package to check for any damage

7. Commissioning

During commissioning the functionality of the package will be tested. All findings will be tracked in the commissioning checklist.

Please refer to attachment #1: (pre-) commissioning checklist, which will be filled in during SAT.

Performance test (4 hours)

During commissioning the functionality of the package will be tested. All findings will be tracked in the commissioning checklist and the performance test results. **The performance check will test if the package gets the needed flow and pressure.**

Please refer to attachment #2: Performance test results, which will be filled in during SAT.

COMMISSIONING CHECK LIST INSTRUMENT AIR BOOSTER COMPRESSOR PACKAGE

Description	Airpack	Customer
1. Check the orientation of the air compressor skid in relation to the geological North.		
2. Check instruments and EI-panel(s) for direct sunshine.		
3. Check the package(s) for damages and the scope of supply of instrumentation as per P&ID.		
4. Make sure that the package is properly installed to its foundation.		
5. Check if skid compartments, which are not filled with concrete, are provided with foundation drain holes and clear of debris.		
6. Check all customer-piping connections to and from the package.		
7. Cold loop check all customer electrical connections. Make sure that all terminals are tightened properly by pushing against the individual cables. Verify that all connections have been done in an orderly way and no cables are damaged. Compare the interconnection done to the electrical drawings.		
8. Check the earth link from the skid to a protective earth system. An earth cable is to be connected, and no damages or loose cables are found		
9. Check the safety settings according to P&ID: pressure, oxygen content, PCV settings, etc. Verify settings of PSVs by nameplate, verification of transmitters will be done full-loop test and alarms and trips test.		
10. Check the 24V DC connection from the DCS.		
11. Check if PSV 8204 is not obstructed in dropping water		
12. Check if customer drain connection is correctly mounted and not obstructed.		
13. Carry out a live functional test of all signals to and from customer. Perform a full loop test for all transmitters and sensors.		
14. Make sure that all electrical jumpers for testing have been removed. And register all forces in a force matrix. Verify that the ESD system is working correctly, Arm, disarm and reset.		
15. Check if PSV blow off points are not obstructed.		
16. Alarms and trips test. Run the compressor under close supervision and verify, first all the trips, by triggering the set point by IE hart communicator.		
17. Grounding check (instruments will be earthed externally)		
18. I/O checks		
19. Alarms (10% random alarms are individually dry tested)		
20. Trips (10% random trips are individually dry tested)		
21. Cause and effect test of the compressor package		
22. Operation check (start, stop, etc.)		
23. Test run the air compressor package and check the following (before 4 hours running test):		
24. Check if the outlet is according to P&ID.		
25. Piping, tubing and screwed connections for leakage.		
26. Hand and auto operation according to the logic diagram.		

27. Alarms and trips test. Run the air compressor package under close supervision and verify, first all trips by triggering the set point by i.e. a Hart-communicator		
28. Perform a four-hour running test according to attachment 2.		

FAT TEST PROCEDURE

Equipment Instrument air booster package
 Customer Lavan Industry Development Company (LIDCO)
 Project name Integrated Methanol and Ammonia Plant
 Airpack reference number 17735-COM
 Date DD-MM-YYYY
 Revision 02
 Document number 17735-33
 Handled by TT
 Number of pages 01

Performance Test Results 862-U-2501B																			
	00:00	00:15	00:30	00:45	01:00	01:15	01:30	01:45	02:00	02:15	02:30	02:45	03:00	03:15	03:30	03:45	04:00	UNIT	OPERATING VALUES
320-PT-8201 Pressure transmitter package inlet	START																	bar(g)	9,5
320-PG-8201 Pressure gauge package inlet																		bar(g)	9,5
320-TT-8201 Temperature transmitter package inlet																		°C	46
320-TG-8206 Temperature gauge package inlet																		°C	46
320-TT-8202 Temperature transmitter 1st stage discharge																		°C	157
320-TG-8207 Temperature gauge 1st stage discharge																		°C	157
320-PG-8202 Pressure gauge 2nd stage suction																		bar(g)	22,1
320-PT-8202 Pressure transmitter 2nd stage suction																		bar(g)	22,1
320-TT-8203 Temperature transmitter 2nd stage suction																		°C	60
320-TT-8204 Temperature transmitter 2nd stage discharge																		°C	116
320-TG-8208 Temperature gauge 2nd stage discharge																		°C	116
320-TT-8205 Temperature transmitter package outlet																		°C	Max. 60
320-TG-8209 Temperature gauge package outlet																		°C	Max. 60
320-PG-8203 Pressure gauge package outlet																		bar(g)	30
320-PT-8203 Pressure transmitter package outlet																		bar(g)	30
320-PG-8204 Pressure gauge cooling water inlet																		bar(g)	4,5
320-TG-8210 Temperature gauge cooling water outlet																		°C	Max. 46
320-TG-8211 Temperature gauge cooling water outlet																		°C	Max. 46
320-PT-8204 Pressure transmitter oil system																		bar(g)	>1
Running test starting time:																			
Humidity:																			R.H. %
Ambient temperature:																			°C
Ambient pressure:																			hPa
Airpack Test Engineer	Client Inspector																		

Notes:

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION K-34




DOCUMENTS; INSTRUMENT INDEX



Vendor doc. Number
17735-19

P.O. NO.:
LIDCO-PO-NEC-278-6019

Vendor:
Airpack Nederland B.V.

	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT						
	Instrument Index						
	Document No. 17735-35		Page				
	Project No. N278	Vendor Doc. VD	P.O. No. 6019	Department IN	Document Type LIS	Serial No 0033	Revision 04

Airpack B.V. - Air Compressor –




Integrated Methanol and Ammonia Plant

17735-COM Instrument Index (K020)

Code 1
M.Dalakeh

04	30-05-2024	Issued for Approval	S.K.	S.K.	J.J.
03	21-05-2024	Issued for Approval	S.K.	S.K.	J.J.
02	18-04-2024	Issued for Approval	S.C.	S.K.	J.J.
01	09-11-2023	Issued for Approval	T.T.	S.K.	J.J.
REV.	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED

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<div><div>شرکت نوسعه صنعت گازها Lavan Industry Development Company</div><div></div></div>	<div>LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT</div>							<div></div>
<div><div></div><div>NARGAN</div></div>	Instrument Index							
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2	X	X	X	X		27						52						77					
3	X	X	X	X		28						53						78					
4						29						54						79					
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22						47						72						4					
23						48						73						5					
24						49						74						6					
25						50						75						7					

TAG NUMBER	INSTRUMENT TYPE	LOCATION	P&ID NUMBER	LINE/EQUIPMENT NUMBER	SYSTEM TYPE	I/O TYPE	SIGNAL TYPE	CAUBURATED		ENGINEER	SET POINT L	SET POINT LL	SET POINT H	SET POINT HH	PROCESS CONNECTION	INSTRUMENT CONNECTION		B&B	TYPE B&B	TW	PROTOCOL	PANEL OR LOCAL MOUNTED	MANUFACTURER	MODEL	DCS/ESD	EX CLASS	
								RANGE	NG UNIT							CONNECTION	CONNECTION										
320PT-8201	TRANSMITTER	FIELD	N-278-VD-6019-PR-PID-0002-01	1A-320-012-042-N	COMPRESSOR	AI	ANALOG	0-16	bar(g)		7.5	12			1/2" NPT	1/2" NPT	YES	2-WAY		HART			DCS	Safe Area			
320PT-8201	GAUGE	FIELD	N-278-VD-6019-PR-PID-0002-01	1A-320-012-042-N	COMPRESSOR	-	-	0-16	bar(g)						1/2" NPT	1/2" NPT	YES	2-WAY			PANEL MOUNTED						
320PSV-8201	SAFETY VALVE	FIELD	N-278-VD-6019-PR-PID-0002-01	DAMPENER KV-020-001	COMPRESSOR	-	-								1 1/2" 300M RF	1 1/2" 300M RF	YES	2-WAY									
320TT-8201	TRANSMITTER	FIELD	N-278-VD-6019-PR-PID-0002-01	DAMPENER KV-020-001	COMPRESSOR	AI	ANALOG	0-100	°C			50			3/4" NPT	1 1/2" 300M RF			320-TW-8201	HART			DCS				
320TT-8206	GAUGE	FIELD	N-278-VD-6019-PR-PID-0002-01	DAMPENER KV-020-001	COMPRESSOR	-	-	0-100	°C						3/4" NPT	1 1/2" 300M RF			320-TW-8206								
320PSV-8202	SAFETY VALVE	FIELD	N-278-VD-6019-PR-PID-0002-01	DAMPENER KV-020-002	COMPRESSOR	-	-								1 1/2" 300M RF	1 1/2" 300M RF	YES	2-WAY									
320TT-8202	TRANSMITTER	FIELD	N-278-VD-6019-PR-PID-0002-01	DAMPENER KV-020-002	COMPRESSOR	AI	ANALOG	0-250	°C		145	165			3/4" NPT	1 1/2" 300M RF			320-TW-8202	HART			DCS				
320TG-8202	GAUGE	FIELD	N-278-VD-6019-PR-PID-0002-01	DAMPENER KV-020-002	COMPRESSOR	-	-	0-300	°C						3/4" NPT	1 1/2" 300M RF			320-TW-8207								
320TG-8202	GAUGE	FIELD	N-278-VD-6019-PR-PID-0002-01	3A5-320-08-042-N	COMPRESSOR	-	-	0-40	bar(g)						1/2" NPT	1/2" NPT	YES	2-WAY			LOCAL MOUNTED						
320TT-8202	TRANSMITTER	FIELD	N-278-VD-6019-PR-PID-0002-01	3A-320-08-042-N	COMPRESSOR	AI	ANALOG	0-60	bar(g)		19	15.5			1/2" NPT	1/2" NPT	YES	2-WAY		HART			DCS				
320TT-8203	TRANSMITTER	FIELD	N-278-VD-6019-PR-PID-0002-01	DAMPENER KV-020-003	COMPRESSOR	AI	ANALOG	0-250	°C			65	70		3/4" NPT	1 1/2" 300M RF			320-TW-8203	HART			DCS				
320PSV-8203	SAFETY VALVE	FIELD	N-278-VD-6019-PR-PID-0002-01	DAMPENER KV-020-004	COMPRESSOR	-	-								3/4" 300M RF	3/4" 300M RF											
320TT-8204	TRANSMITTER	FIELD	N-278-VD-6019-PR-PID-0002-01	DAMPENER KV-020-004	COMPRESSOR	AI	ANALOG	0-250	°C		105	125			3/4" NPT	1 1/2" 300M RF			320-TW-8204				DCS				
320TG-8208	GAUGE	FIELD	N-278-VD-6019-PR-PID-0002-01	DAMPENER KV-020-004	COMPRESSOR	-	-	0-200	°C						1 1/2" 300M RF	1 1/2" 300M RF	YES	2-WAY			LOCAL MOUNTED						
320TT-8205	TRANSMITTER	FIELD	N-278-VD-6019-PR-PID-0002-01	4A-320-08-042-N	COMPRESSOR	AI	ANALOG	0-160	°C			65	70		3/4" NPT	1 1/2" 300M RF			320-TW-8205	HART			DCS				
320TG-8209	GAUGE	FIELD	N-278-VD-6019-PR-PID-0002-01	4A-320-08-042-N	COMPRESSOR	-	-	0-200	°C						3/4" NPT	1 1/2" 300M RF			320-TW-8209				LOCAL MOUNTED				
320TG-8203	GAUGE	FIELD	N-278-VD-6019-PR-PID-0002-01	3A5-320-08-042-N	COMPRESSOR	-	-	0-40	bar(g)						1/2" NPT	1/2" NPT	YES	2-WAY			PANEL MOUNTED						
320PT-8203	TRANSMITTER	FIELD	N-278-VD-6019-PR-PID-0002-01	3/4"-3A-320-10-D42-N	COMPRESSOR	AI	ANALOG	0-60	bar(g)		25		34		1/2" NPT	1/2" NPT	YES	2-WAY		HART			DCS				
320PG-8204	GAUGE	FIELD	N-278-VD-6019-PR-PID-0002-01	3/4"-CWS-320-20-B24C-N	COMPRESSOR	-	-	0-10	bar(g)						1/2" NPT	1/2" NPT	YES	2-WAY			PANEL MOUNTED						
320TT-8210	GAUGE	FIELD	N-278-VD-6019-PR-PID-0002-01	4-CWR-320-24-B24C-N	COMPRESSOR	-	-	0-100	°C						3/4" NPT	1 1/2" 300M RF			320-TW-8210				LOCAL MOUNTED				
320TG-8211	GAUGE	FIELD	N-278-VD-6019-PR-PID-0002-01	4-CWR-320-22-B24C-N	COMPRESSOR	-	-	0-100	°C						3/4" NPT	1 1/2" 300M RF			320-TW-8211				LOCAL MOUNTED				
320PSV-8204	SAFETY VALVE	FIELD	N-278-VD-6019-PR-PID-0002-01	3/4"-CWR-320-26-B24C-N	COMPRESSOR	-	-								1 1/2" 300M RF	1 1/2" 300M RF	YES	2-WAY					DCS				
320PT-8204	TRANSMITTER	FIELD	N-278-VD-6019-PR-PID-0002-01	OIL PUMP	COMPRESSOR	AI	ANALOG	-1-5	bar(g)						1/2" NPT	1/2" NPT	YES	2-WAY					DCS				
320CV-8201	CONTROL VALVE	FIELD	N-278-VD-6019-PR-PID-0002-01	3/4"-3A-320-11-D42-N	COMPRESSOR	AO	ANALOG								1 1/2" 300M RF	1/4" NPT				HART			LOCAL MOUNTED				
320PIC-8201	CONTROL POSITIONER	FIELD	N-278-VD-6019-PR-PID-0002-01	3/4"-3A-320-11-D42-N	COMPRESSOR	AI	ANALOG													HART			LOCAL MOUNTED				
For more information see hook-up drawings: N-278-VD-6019-IN-DWG-0035-1																											
For more information see instrument datasheets: N-278-VD-6019-IN-IS-0013																											

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION K-35




DOCUMENTS; QUALITY MANUAL



Vendor doc. Number
17735-19

P.O. NO.:
LIDCO-PO-NEC-278-6019




Vendor:
Airpack Nederland B.V.

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Integrated Methanol and Ammonia Plant
17735-COM Quality manual**

01	28-11-2023	Issued for information	J.J.	S.K.	S.K.
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1. Introduction of Airpack Nederland BV

1.1. Core business

The core business of Airpack is manufacturing custom made, turn-key compressor, dryer and nitrogen generator installations for the oil & gas industry around the world. We design, engineer and build all of our packages according to the requirements of the customer within our facilities in Zierikzee from which each package is accordingly transported by sea, truck, train or plane to its final destination.

1.2. A complete package

Airpack packages, whether a compressor, dryer or nitrogen generator are all completely interconnected, cabled, programmed and tested within our workshop and are ready to operate upon arrival at site. This turn-key philosophy has been the strength of Airpack since the start of the company and significantly reduces expensive commissioning time in the field.

1.3. One package, one responsible supplier

As Airpack is an independent manufacturer with all the needed expertise within its facilities we are free to cooperate with any sub-supplier. This high level of customization creates a package that is completely according to the customers' requirements and is designed just right for the application. As we guarantee the high quality of each of our packages Airpack takes the warranty of the entire installation, giving the customer one responsible supplier for the entire package.



1.4. Build to last

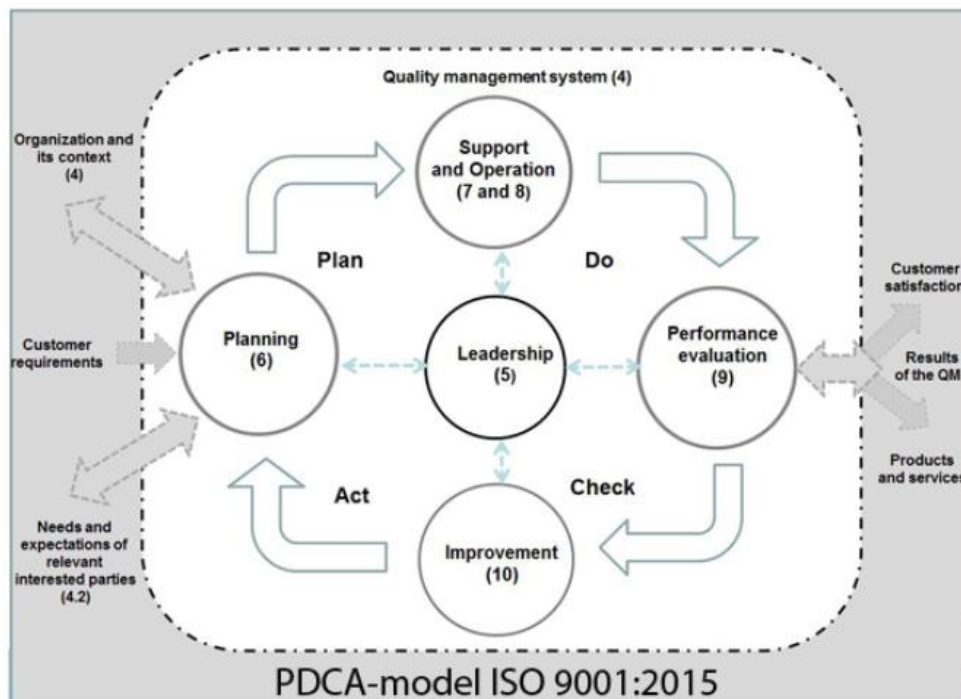
Because Airpack packages are completely designed and built according to the given specifications, our client is assured of the required performance and durability. The custom design allows us to make the installations operate flawlessly within the harsh conditions of a petrochemical facility. Whether it is a desert, arctic, elevated or earthquake sensitive environment, Airpack always has the right solution.

1.5. Quality Management System Airpack Nederland BV

The Quality Management System of Airpack Nederland BV complies with the requirements of the International Standard ISO 9001:2015.

Airpack Nederland BV has adopted risk-based thinking throughout the company by addressing applicable risks and opportunities. In combination with our processes-based approach we develop, implement and improve the effectiveness of our quality management system, to enhance customer satisfaction by meeting customers' requirements.

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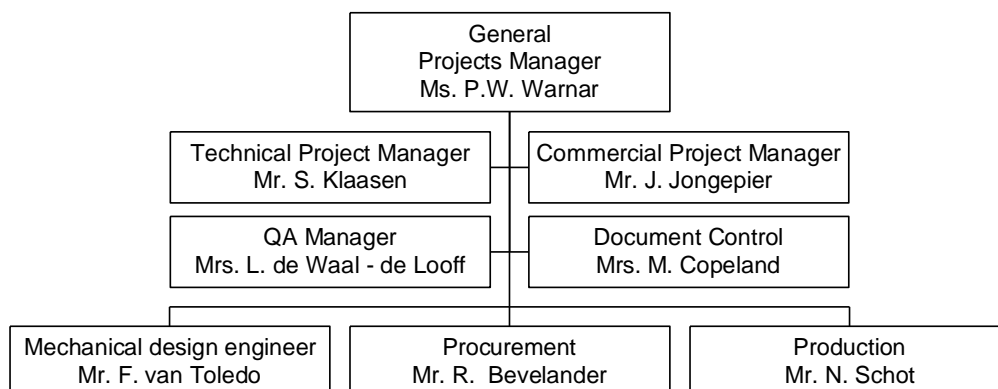
1.6. Scope of QMS




The Quality Management System of Airpack Nederland BV is applicable to:

Sales, design and manufacturing of following products and services;

- Air and gas compressor packages;
- Air and gas dryer packages;
- Gas generators;
- Static blender installations;
- Supply and delivery of spare parts;
- Commissioning, start up and service

1.7. Project Organisation



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1.8. Appointment QA manager

The general manager has appointed a quality assurance manager and management representative with the responsibility and authority:

To ensure that processes needed for the QMS are established, implemented and maintained (in accordance with the ISO 9001: 2015 standard);

- To report to general management on the performance of the QMS and on any need for improvement;
- To ensure the promotion of awareness of customer requirements throughout the organisation;
- To ensure the promotion of awareness of risk based thinking throughout the organisation;
- To work with external parties on matters relating to the quality management system.

1.9. QM Software

Airpack Nederland BV uses Qooling software to administrate and maintain procedures, registers, issues, internal audits and other documentation applicable for the QMS.

Key personnel is equipped with a login and password to sign off on tasks, procedures, issues, etc. Furthermore, every employee has access to procedures and task-descriptions in Qooling.

All printouts and pdf documents derived from Qooling are "Uncontrolled Copies". The same goes for Work Instructions and Standard Forms. Latest versions are always available in Qooling or on our network.

2. Quality policy and objectives




2.1. Quality policy statement

Airpack Nederland BV's mission is to provide our global users in the oil and gas industries with high-quality, innovative, customized and turnkey compressor, dryer and nitrogen generator packages that best suit their needs and requirements. We design, engineer and build these packages for reliable operation throughout their lifetime.

Our vision is to grow sustainably and become the preferred supplier for high-quality, customized products in the oil and gas market and beyond. We offer our users one responsible supplier providing the best support and service.

Airpack Nederland BV is committed to:

- Deliver high quality products and service to our customers according to their requirements, national and international standards, regulations and legislation.
- Quality Control by President, Vice-President, management and staff through the Quality Management System seeking continual improvement by constant review.

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- Ensure all employees are provided with the means necessary to achieve the standards required
- Encourage sub-suppliers to co-operate in delivering the best possible products and services
- Achieving customer satisfaction by the use of quality procedures which meet or exceed the requirements of ISO-9001

For Health, Safety and Environment we refer to our HSE Policy Statement

All personnel within the company are responsible for the quality of their work. The company provides training and has established systems to assist all personnel to achieve the standards required.

2.2. Quality objectives

General management is responsible for communicating the company's quality policy and quality objectives as stated above in such a way that they are understood correctly within the entire organisation. This is done through annual new-year speech, mailings about our Quality Management System, management team meetings and internal training.

Objectives for individual jobs are to carry out their work to the satisfaction of the customer and in accordance with the contract as agreed with the customer within time and price limit.

During management team meetings and management reviews internal and external issues are discussed and quality objectives are determined evaluated and if necessary adjusted. Measures which result from these meetings are registered and tracked in Qooling.

3. Personnel & Infrastructure




The human resource manager is responsible for all affairs regarding personnel. Decisions regarding personnel are taken in consultation with (vice) president.

3.1. Job descriptions

Job Descriptions per function have been described in the Qooling Program and all employees have been given one or more functions.

They describe what is expected in terms of tasks, education and competencies and state what is their authority.

They are available for all personnel at all times. In case an employee is offered a (new) contract or if changes have been made the job description is discussed with the employee, his/her responsible manager and the (vice) president. The HR Manager is responsible for keeping job descriptions up to date.

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3.2. Review

Employee performance is reviewed at different occasions:

During MT meeting departments and their employees are discussed, if necessary action is taken

During the performance review. The frequency of this review can vary from once every 3 months to once every 3 years depending on person, function, experience, etc. Every employee may at any time request a review.

Progress and agreed measures are noted and kept by the HR Manager.

3.3. Education and Training

Education and training needs are identified as follows:

- Demands stated at the job descriptions
- In case his/her manager or management think it is necessary
- The employee communicating his own need for training and education
- Because of technical developments, identified by employee or his/her manager
- Because of new rules/laws/requirements, often identified by the manager




The responsible manager and (vice) president will discuss the need for education with the employee and together they will decide whether it will be useful.

3.4. Safety and working conditions

Safety and working regulations are described in our HSE Manual (ARBO Handboek) and in Airpack House Rules. Every employee will receive and sign Airpack house rules (consisting of safety & Work regulations) at the start of his/her employment for Airpack and will be shown safety & ISO video.

Visitors sign the logbook upon arrival and at departure, they will be shown safety and ISO video. House rules are available in the logbook. Upon signing they agree with Airpack House rules.

Safety and working conditions for our employees who work abroad have to be at acceptable level as stated in our general terms for Commissioning and Service. General Management will decide in case this is questionable, however employee is allowed to refuse service and leave site at any time in case HSE is not at an acceptable level.

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3.5. Infrastructure

Airpack has determined that in order to achieve conformity to product requirements the following infrastructure is required:

- Buildings, workspace and associated utilities:
 1. Modern and safe workspace;
 2. Office and conference space.
- Process equipment (hardware as well as software):
 1. Calibrated measuring and monitoring devices;
 2. Calibration devices;
 3. Personal protection equipment;
 4. Approved and safe tools;
 5. Software for designing systems and products;
 6. Software for testing products;
 7. Software for administration and accounting.
- Supporting services:
 1. Start-up and commissioning of projects;
 2. Maintenance for the customer;
 3. Maintenance instruction for the customer.

Employees can always do a proposal to their manager or general management for additions/alterations/improvements of the above mentioned.

4. Communication

4.1. Internal communication

4.1.1. Management Review

Agenda As per ISO-9001:2015 and "Agenda MR and Planning Frequency Split into different meetings as per "Agenda MR and Planning" Participants (Vice) president, Management Team Initiator QA Manager Output Minutes of meeting, Context, Risks & Opportunities. Actions are stated in Qooling




4.1.2. Management Team Meeting

Agenda As per standard agenda Frequency Four times per year, after each quarter.

Participants (Vice) president, Management Team Initiator General Management Output Minutes of meeting, Context, Risks & Opportunities, Actions are stated in Qooling

4.1.3. Sales Meeting

Agenda As per MOM of Sales Meeting (New inquiries, Agents, Hot projects, Gazpack active projects, Exhibitions, Marketing, General, Travel Schedule) Frequency Weekly Participants (Vice) president, Sales Team Initiator General Management Output Minutes of meeting

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4.1.4. Project Sales Meeting

Agenda Minutes last meeting added with suggested items from participants (items concerning both Sales and Project department) Frequency Approximately 5 times a year Participants (Vice) president, General Sales Manager, Sales department, Project department, anyone concerned Initiator General Management Output Minutes of meeting.

4.1.5. Project Meeting

Agenda Minutes last meeting added with suggested items from participants (items concerning Project department) Frequency Approximately 5 times a year Participants (Vice) president, General sales manager, Project department, anyone concerned Initiator General Management Output Minutes of Meeting

4.1.6. Pre-definition Meeting

Agenda Scope of supply Prices calculated Risks concerning EPC, end user, country, etc.

Input from agent (if any Frequency Before LOA (Letter of Award) Participants (Vice) president, Commercial sales manager, Technical sales manager, Project Team, Engineering and E& I if necessary Initiator Commercial Sales Manager Output Final price, pricing strategy. In PBD summary tab is stated who are present, discussed risks, other matters discussed, measures and conclusion.




Agenda As per items stated in HANDOVER folder in Standard project document/Offer stage Frequency For each project Participants (Vice) president (if required), Sales manager (technical & commercial), Project manager (technical & commercial), Mechanical engineer, E& I manager, Production manager Initiator Commercial Sales Manager Output Project summary list, Specifications

4.1.7. Specification Review

Agenda Specification review sheet Frequency Approximately two weeks after Handover meeting Participants (Vice) president (if required), Sales manager (technical & commercial), Project manager (technical & commercial), Mechanical engineer, E& I manager, Production manager Initiator Commercial Project Manager Output Specification Review Sheet and final decisions incorporated in Project Summary

4.1.8. Spaghetti Meeting

Agenda GA Drawing (pipe routing) and 3D checklist (H-33) Frequency For each project, when first draft of GA is ready Participants (Vice) president (if required) Project manager, Mechanical engineer, E& I manager (if required) Initiator Mechanical engineer Output 3D checklist (H-33).

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4.1.9. Project Planning Meeting

Agenda Planning per project Frequency Weekly Participants (Vice) president, Manager Sales & Projects, Project managers, E& I Manager, Production manager Initiator General Management Output Minutes of meeting

4.1.10. Production Planning Meeting

Agenda Planning per project Frequency Weekly Participants Vice president, Project managers, Production manager Initiator General Management Output Minutes of meeting, new planning

4.1.11. Project Evaluation

Agenda Project Evaluation Sheet Frequency After shipment of project Participants (Vice) president, Project managers, Sales Manager, Management Team, Workshop manager, others if necessary Initiator Project manager Output Project Evaluation sheet à Qooling

4.1.12. Start-up Evaluation

Agenda Start-up Evaluation Sheet Frequency After Start-up of a project Participants (Vice) president, Project managers, Sales Manager, Management Team, Workshop manager, others if necessary Initiator After Sales Assistant Output Start-up Evaluation sheet à Qooling




4.1.13. Toolbox Meeting

Agenda News per project, General notes, Safety, Quality, Items Evaluations, News from General Management Frequency Once a month Participants Workshop Manager, Workshop Personnel, Project Managers, (Vice) president, Initiator Workshop Manager Output Minutes of meeting, Attendance List

4.2. Communication with Customer/end user

If requested by customer a Kick-off-Meeting (KOM) will be held either in person or by teleconference. Contract and outstanding issues are discussed with our project manager(s). Commercial Project manager is first contact for customer regarding documents/questions. Technical Project manager is his/her back-up in case of technical issues. Communication can occur by:

- • Email airpack@airpack.nl
- • Phone +31 (0) 111 415 455
- • Teleconference +31 (0) 111 415 455
- • Documentation doc@airpack.nl

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5. QUALITY PERFORMANCE

Information on following subjects is used to monitor, analyse and evaluate performance:

- Customer satisfaction
- Sub suppliers performance
- Sales performance
- Spare parts performance
- Manufacturing performance
- Delivery according to specifications
- Status of incidents
- Status of measures taken (to take up risks and opportunities, after MR)

The exact methods, frequency and time of analysis/evaluation is stated in the “KPI’s General Management” and the minutes of MT and MR Meetings

5.1. CUSTOMER SATISFACTION

To keep track of customer satisfaction we register the following:

- Customer complaints: This is a complaint of a customer after our start-up engineer has finished his job and package has been running. Complaint can come from our customer or the end-user. Complaint is filed in Qooling and discussed during first possible meeting with concerned engineers, Sales Manager, Project Manager, Start-up Manager, QA Manager and (Vice) president. Measures taken are stated in Qooling and incorporated in our standards if necessary.
- Guarantee costs
- Customer satisfaction notes and feedback. Sales department registers customer feedback in the Sales Force System.

5.2. INTERNAL AUDIT

Plan

The audit program takes into account the status and importance of the processes and areas to be audited, as well as the result of previous audits. The program is updated at least yearly, but adjusted if QA Manager or General Management finds it necessary.




Audits may be carried out by QA Manager or external company.

Do

Findings during internal audit are discussed with MT and registered in Qooling. Actions taken are also registered in Qooling.

Check

QA Manager will follow up on above-mentioned outstanding issues and verifies the implementation and effectiveness of the actions taken.

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Act

It is the QA Manager's responsibility to report the results of the audit and the implementation and effectiveness of actions taken to the management team. At any time different summaries can be derived from Qooling.

5.3. MANAGEMENT REVIEW

Management review is done according to "Management Agenda & Planning" which contains the items stated in ISO-9001:2015.

Review output:

- Decisions and actions related to risks & opportunities
- Decisions and actions related to the need for changes in the QMS
- Decisions and actions related to the need for resources
- Decisions and actions are stated in Qooling and minutes of the management revise.

6. Improvement

Airpack is constantly trying to improve her quality system, her products and services. Below mentioned is contributing to this.

6.1. OPPORTUNITIES

Opportunities for improvement are determined during:

- Management Review
 - Project Evaluation
 - Start-up evaluation
 - Internal/external audits
- Actions are registered in Qooling.




6.2. NON CONFORMING PRODUCTS

Each employee can identify and record non-conformities in the logbook (per project):

Customer complaints

This is a complaint of a customer after our start-up engineer has finished his job and package has been running. The complaint can originate from our customer or the end-user. General Management determines if any other complaints from customers have to be filed as customer complaint.

The complaint is filed in Qooling and discussed during first possible meeting with concerned engineers, Sales Manager, Project Manager, Start-up Manager, QA Manager and (Vice) president. Measures taken are stated in Qooling and incorporated in our standards if necessary.

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Complaints about sub-suppliers

This can involve:

- Late or wrong offering
- Late or wrong delivery
- Bad quality of the product
- Bad quality of service

Sub suppliers performance is registered in Sales Force, so performance can be measured. Result of this may lead to sub supplier audit.

Non conformities

These can involve:

- Product does not perform according to requirements
- Product does not conform to customer requirements
- Product does not conform to Airpack standard
- Production delay
- Cost over-runs

Ideas for improvement

Any ideas that can contribute to improving our quality, effectiveness or save costs can be brought to the attention of the General Management.

During project evaluation all items in the logbook are discussed with concerning employees. If necessary the incidents will be registered in Qooling and follow up will be done by QA Manager.

Start-up engineers will fill in the logbook as well and after they have finished their job these items will be discussed during start-up evaluation. If necessary incidents will be registered in Qooling and follow up will be done by QA Manager

6.3. CORRECTIVE ACTIONS




Corrections

As soon as a non-conformity is noted action is taken to correct the problem. This is the correction.

Corrective actions

During project evaluation the following happens:

- Cause is determined
- Measures are determined to prevent re-occurrence (if necessary) and registered in Qooling

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- Managers are responsible for implementation of the measures (Cooling task)
- QA Manager follows up to check effectiveness

7. CONTROL OF MONITORING & MEASURING DEVICES

7.1. Measuring equipment

The equipment used by Airpack is subject to the control of monitoring and measuring devices necessary to ensure valid results. The monitoring and measuring equipment stated in the file "Test Equipment" (under E&I) is tested yearly. E&I Department is responsible for keeping this list up to date.

7.2. Planning of calibration

The appointed project assistant takes care of the calibration of measuring devices according to planning.

An external expert bureau carries out calibration.

Reports of calibration are filed in the database of the external bureau. This database is accessible for a number of persons within Airpack. We get a warning when equipment is due for calibration.




7.3. Identification of calibrated equipment

A sticker with expiry date is attached to the calibrated measuring equipment. Only approved, calibrated measuring equipment is used when testing products.

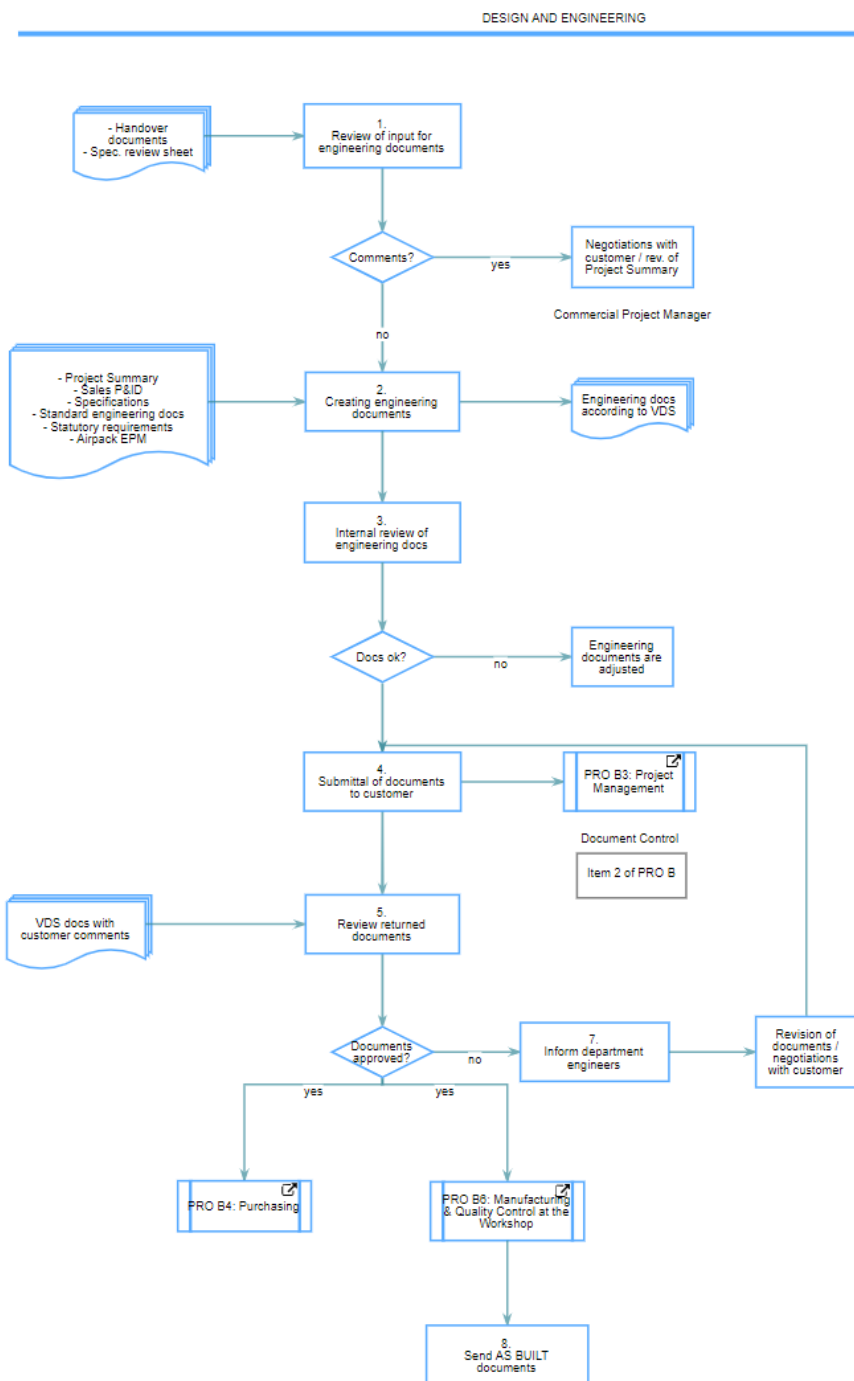
When a measuring device is needed in the shop, the instrument has to be signed off on a list that is kept by the project assistant. When the device is returned again this will be signed off.

7.4. Failures

If the measuring equipment is found to be defective during testing it will be replaced and the test results will be declared invalid. The measuring equipment replacing the defective measuring equipment will, of course, also be tested.




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8. Design and Engineering



8.1. Review of design input

9. At sales stage main equipment is selected and criteria are being discussed with customer as per PRO B1 item 1.3 to 1.5. After order Sales Department creates documents for the handover meeting as stated in the standard handover folder. This contains f.e. Project

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Summary, PO and applicable specifications At the project handover meeting each department receives applicable specifications to study. Each department will note any discrepancies / impossibilities found in these specifications in the “Specification Review Sheet” in the project folder. Project Manager and Sales Manager assess the items and if necessary contact the customer to reach a final decision. This decision will be incorporated in the Project Summary List and engineers will be informed by the Project Manager.

9.1. **Creating engineering documents**

Project Management initiates creating engineering documents according to VDS and provides departments with relevant information (input for design):

- Project Summary
- P& I Diagram
- Specifications

Further design inputs are:

- Standard engineering documents
- Statutory requirements
- Professional knowledge
- Relevant information from the Engineering and Production Manual

Based on this information necessary documents/drawings for customer approval and manufacturing/ordering will be provided by dedicated departments:

Project Department: Main equipment (compressors, motors, membranes, coolers, filters) and all other documents on the Vendor Document Schedule (VDS), project planning and Project Summary

The E& I Department: Electrical equipment, PLC, Instrumentation and Valves




Engineering Department: General Arrangement Drawings, vessels

Work Preparation: 2D drawings for fabrication, piping and construction materials

9.2. **Internal Review of engineering documents**

Key Engineering documents are reviewed before they are sent to the customer for approval:

- P& ID: General Management, E& I dept., Engineering dept.
- GA: During Spaghetti Meeting

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- Instrument Data Sheets: Engineering Department and Project Manager

9.3. Review of engineering documents by customer

The Project Manager signs off the documents electronically before submitting all necessary documents/drawings to the customer for approval. This will be done according to the Vendor Document Schedule (VDS) which has been negotiated during Sales stage.

9.4. Return of commented documents

Documents/drawings are returned by the customer with or without comments:

- Approved without comments"
- Approved with minor comments
- Approved with comments
- Not approved
- Not subject for review




This results in revisions of the documents/drawings and/or negotiations with the customer. To minimize number of revisions and create clarity about the agreements a Comment Review Sheet is used. The Project Summary is updated and changes are highlighted before internal distribution. A specific project assistant is responsible for distributing the correct revision of documents/drawing to the departments.

9.5. Release for Manufacturing and Ordering

Manufacturing and ordering will be done according to drawings/documents after documents have been at least "code B" approved by the customer. The project manager can make an exception after approval of General Management.

9.6. Managing changes

- Changes during the process of getting customer approval are handled as per item 5 and recorded in the Doc Book of the project
- The Project Manager checks if changes affect other documents and informs the departments, so documents can be adjusted
- If changes in one document have an effect on documents already approved also customer is informed
- If an engineer notices an effect of changes, they will inform the Project Manager

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9.7. As Built Documents

At delivery AS BUILT documents are provided to the customer. This includes the Data book and Instruction and Operating Manual.

10. Project Management

10.1. Project management

10.1.1. Project Planning

After Project Transfer Meeting and Specification Review the Project Manager will prepare an Overall Project Planning.

This document contains planning regarding documents, drawings, ordering of materials, manufacturing and testing and is discussed with all departments weekly during the Project Planning Meeting.

10.1.2. Planning changes

Changes in project planning can be caused by our customer:

- Late return of documents for approval
- Ongoing discussion about scope of supply with customer
- Non-payment by customer

Or changes can be caused by Airpack:

- Late submittal of documents for approval
- Late delivery of materials by sub suppliers
- Mistakes in production process




During Project Planning Meeting the impact on the delivery time is discussed to see if delivery delay can be avoided.

If this is not the case, the customer is informed about the impact on the delivery time by project manager and Overall Project Planning is adjusted and distributed to the departments.

10.1.3. Project Documents

- The Project Document Book contains all documents, which are stated on the Vendor Document Schedule. The 1st date of submittal and turn-around-time are discussed with the customer, often during Kick Off Meeting (KOM). In the second part of this procedure is described how Project Document Control is arranged.
- The Project Data book contains all certificates (index is part of VDS)
- The Instruction and Operating Manual (index is part of VDS)

The document controller is responsible for submitting/receiving documents according to the Overall Planning (and VDS) according to item 2 of this procedure.

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Furthermore, the project manager is responsible for all correspondence with the customer, which is saved on our network and for keeping the Project Summary up-to-date.

10.1.4. Purchasing parts, manufacturing parts and assembling

During Project Planning Meeting is decided when parts can/need to be ordered, this is often after key documents are approved (with minor comments). Purchasing is done according to PRO B4.

Manufacturing parts and assembling the package is done according to PRO B5. Project Manager is responsible to keep manufacturing within planning.

10.1.5. Project Cost Accounting

Throughout the project the concerned engineers compare actual prices with the prices in the final price breakdown (refer to Sales Department). When big positive or negative discrepancies occur the sales department is informed. Financial results are also discussed during project evaluation.

10.1.6. In-house testing

In-house testing is done according to PRO B5. The project manager is responsible for the execution of the items on the Punch list and re-testing if necessary.

10.1.7. Final Inspection

Final inspection with customer and/or third party including review of the manufacturing data book is accompanied by the Project Manager. Any defects are noted on the Punch List and are resolved (and re-tested) before shipment as much as possible. Unresolved items are noted on the Field Punch List and resolved at site.

10.1.8. Packing and delivery




If the final inspection is satisfactory the customer will provide a release note for shipment and seaworthy packing will be applied in accordance with PRO B6.

If agreed packing inspection will take place.

Delivery will be arranged according to PRO B6, including the Final Project Documents (according to VDS).

10.1.9. Project Evaluation

As soon as possible after Final Inspection a project evaluation meeting is held according to PRO A3 where non-conformities, ideas for improvement, complaints about sub-suppliers and the actual costs of the projects are discussed.

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Note that corrections take place immediately and non-conformities that are urgent are discussed in petit comité immediately. Hence sometimes corrective actions are already taken when project evaluation takes place, this is noted in the project evaluation form.

Financial administration is responsible for actual cost calculation.

10.2. PROJECT DOCUMENT CONTROL

10.2.1. Vendor document Schedule

Project Manager discusses content of the Vendor Document Schedule (VDS), first date of submittal and turn-around-time with customer, often during Kick Off Meeting (KOM). They provide the Document Controller with the results.

10.2.2. Document Tasks

The Document Controller makes Outlook Tasks for the Commercial Project Manager according to the VDS. After review the project manager sends the tasks to the concerned engineers.

10.2.3. Providing Project Documents

The concerned engineer prepares the documents required. After review the engineer saves the document on the network and marks the Outlook Task as "Complete". A hyperlink to the document is sent with the completed task.

The Project Manager and Document Controller receive a message that the document is ready to be submitted.

10.2.4. Submitting Project Documents

The Document Controller will submit the required documents per mail or upload them to customer FTP. The mail with document list or transmittal sheet is saved on the network and the VDS is updated.




10.2.5. Document Distribution

All latest revisions of project documents are saved on the network. For all project documents on the VDS a hard-copy is kept in the Document Book.

A hard-copy of the P&ID is provided to the different departments by the Document Controller. In case it is not the first revision, changes are highlighted.

10.2.6. Receipt of Project Documents

In case documents are not returned in time (according to VDS), the Document Controller sends a reminder to the customer and informs the Project Manager.

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Received documents are saved on the network by the Document Controller and the Project Manager is informed. A hard-copy is kept in the document book. The VDS is updated. Tasks are sent as per step 2.1.

In case a document is overdue, either Project Manager or Customer will get a reminder.

10.2.7. Incorporating comments

The Project Manager reviews the comments, discusses consequences with concerned engineers and customer. A Comment Review Sheet is used to reach agreement with customer about changes. This is also noted in the VDS.

Project Manager gives the order to incorporate changes in documents, raise the revision number and the process repeats itself from step 2.2

Document controller is responsible for updating the VDS throughout the project.

10.2.8. As Built documents

At the end of a project all documents are sent to customer one last time with the code: "As Built". This includes the Data book and Instruction and Operating Manual.

A hardcopy of the As Built documents is stored in our fire proof archive and the complete project folder is moved to the "Archive Disk".

11. Purchasing

11.1. SELECTION & EVALUATION OF SUBSUPPLIERS

11.1.1. Selection of Sub suppliers




Airpack Sub Suppliers of project materials are registered in Sub Supplier List. New sub suppliers can be added for the following reasons:

- They are on our customer's Preferred Vendor List
- Current sub suppliers cannot deliver the requested product
- Current sub suppliers are not performing well enough
- Extension of our sub supplier list

Concerned engineer will decide if a new sub supplier is added to our sub supplier list. Depending on the importance of the materials and the order amount this will be discussed with the department manager and/or (vice) president. For different types of products, different criteria for acceptance are applicable. This can even differ per project.

11.1.2. Evaluation of Sub suppliers

Sub supplier performance on following criteria is registered in Sales Force throughout the purchasing process:

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- Response time to inquiry
- Quality of the offer
- Delivery time
- Delivery according to order
- (Access to) information
- Quality of the product
- Response time to complaints

Complaints about sub suppliers that have had influence on our ability to deliver according to customer requirements are noted in the logbook of the project and discussed at project evaluation. If Airpack is not satisfied about the performance of a sub supplier, they will be informed about our complaints and if we think it is necessary they will be audited. If performance does not improve Sales Department will be informed, so they can inform customers if necessary.

For the suppliers of services other criteria are used.

Once a year, during MR, the performance of the sub suppliers is discussed and ,if necessary, actions are taken.

11.2. **PURCHASING PARTS**

11.2.1. **Determining required parts**

After project handover meeting and specification review meeting the concerned engineers determine which parts are required for the project based on PO, specifications, P&ID and Airpack offer. For some parts Project documents have to be approved first.

11.2.2. **Sending inquiries**

Inquiries are sent to different sub suppliers if this is possible. Every inquiry will bear its specific reference number with product code. Also inquiries are registered in Sales Force.




For spare parts inquiry is only sent to the supplier of the requested part and in some cases supplier has been selected by the customer.

If planning requires it and it does not concern main parts it is allowed to make inquiry at just one supplier or not make inquiry but order directly.

11.2.3. **Receipt and review of (revised) offers**

Received offers are registered on the network. The concerned engineer (purchaser) receives the offers and contacts sub supplier in case this is necessary.

Concerned engineer will decide, in some cases together with the project manager, about awarding the order. This may depend on:

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- Pricing
- Delivery time
- Quality
- Specifications

Criteria for this decision differs per item and project.

11.2.4. Submitting the order

The concerned engineer submits the order to the selected sub supplier. If they are not allowed to sign for the amount of the order the department manager or (vice) president will do so. Each order should contain the following information as a minimum:

- Description of requested parts (+ documentation)
- Specifications (acceptance criteria)
- Delivery time
- Delivery conditions
- Purchase conditions of Airpack
- Unit- and total price
- Payment conditions

For stock-items or services not all above mentioned is applicable. Also in cases as mentioned in step 2.2 it is allowed to differ from this step.

11.2.5. Verification




The ordered parts are inspected upon arrival as a minimum according to PRO B5. Depending on the item, inspection may take place at sub supplier site (sometimes also during fabrication).

For small electrical stock items and mechanical stock items our sub supplier is checking and keeping the stock up-to-date on a regular base, these items are not checked according to PRO B5.

11.3. Verification of purchased products

11.3.1. Receipt

Incoming products are placed in a special pre-inspection area, depending on the size of the material this may be in different places. All purchased products are subjected to a visual inspection against the packing list (concerning damage and quantity) by personnel assigned for warehousing. Non-conformities are registered on the packing list using the stamp "incoming goods".

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11.3.2. Temporary storing

Visually inspected correct products are marked with project number & tag number if possible and stored temporarily on a shelf with the project number that is marked: "Nog niet gecontroleerd" (= uncontrolled). Items at these shelves are not yet released for construction!

Materials such as piping and caps are stored at a specially reserved location. Materials that do not fit on the shelves are stored in the workshop, if damaged they are marked.

Damaged/incorrect materials are brought to the attention of the purchaser, who will follow up.

11.3.3. Inspection by purchaser

Visually inspected products are subject to a (technical) inspection by the purchaser or representative, using AIRPACK's purchase order. Tag numbers are placed in case they are not there yet. It is also checked and registered if all required certificates are available.

Non-conformities are also registered on the packing list using the above-mentioned imprint. If so required, the purchaser contacts the sub-supplier for corrective actions. The purchaser informs the product manager about the findings. For the verification of piping, see the notes.

Rejected items are placed at REJECTED area and labeled with reason for rejection and responsible person. The purchaser will follow up. If the item is too big to be placed here, it will be placed in the workshop with a note that this item is not ready for assembly. Furthermore the workshop manager is informed.

11.3.4. Filing

After verification of the product the packing list is filed under the project and the sub supplier's name. These files are kept at the construction bureau.

11.3.5. Ready for use




For each project special shelves are reserved for all components. After releasing the inspected goods the purchaser stores the products on the project shelf where they are ready for use (GECONTROLEERD)

Before assembly/construction the items are checked by the workshop employee against the manufacturing documents released to the workshop.

11.4. TRACEABILITY & IDENTIFICATION

11.4.1. Serial number

At receipt of a purchase order from a customer a serial number is given to each package (skid).

	<p align="center">LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT</p>							
	<p align="center">Quality Manual</p>							
	<p>Document No. 17735-37</p>							Page
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11.4.2. Tag number

Items will have a tagnumber (if applicable) according to the P&ID. This may be a loose tagplate or a bolted one. During production this may also be a sticker.

11.4.3. Heat numbers

Upon receipt of piping material (including flanges, caps, etc.) heat numbers are checked against the material certificates. Above-mentioned heat numbers are registered in the dedicated drawing. If piping is cut the heatnumber is written on each piece of piping and also registered on the dedicated drawing.

12. Manufacturing & Quality Control at the Workshop

12.1.1. Planning

During project progress meeting the production leader is informed by the project manager when a project is ready to be manufactured. The project progress meetings are held every week. General manager, production manager, project manager and concerned engineers are present.

12.1.2. Production documents




All relevant documents are handed over to the production manager by the project manager or engineer in question. The production manager is the only one who may provide drawings to the production personnel and takes care of removing old revisions.

- P&ID;
- Construction drawings;
- Paint specifications;
- summary of all relevant information about the project
- Cabling and instrumentation production manual (SF G-08).

The production manager is responsible for manufacturing according to the documents provided and for revising / adding to the standard work instructions and for making them available to the working staff.

12.1.3. Changes

If any changes occur during manufacturing, the project manager will inform the engineer in question and he will inform the production manager. In case the production manager is not available he will be informed by written notice.

	<p align="center">LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT</p>							
	<p align="center">Quality Manual</p>							
	<p>Document No. 17735-37</p>							Page
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12.2. QUALITY CONTROL AT THE WORKSHOP

12.2.1. Inspection & Test Plan

Project manager provides Inspection and Test Plan to customer as part of the VDS. This contains quality controls during project and is signed off after each check. Signed ITP is part of the data book provided with the package.

12.2.2. In-house testing

When package is ready it will be subject to in-house testing according to our standard forms. In case non-conformities are found they are noted on the punch list and will be corrected and re-testing will be done. Project manager is responsible for this process.

12.2.3. Factory Acceptance Test

After manufacturing and in-house testing have taken place the customer will be invited for FAT. This will take place according to the Inspection & Test Plan

In case non-conformities are found they will be solved at Airpack site and retesting will be done. Or, if no time is available, at customer site. In this case it will be noted on the Start-up punch list.

12.2.4. Release note

Customer provides a "release not" in case FAT has been satisfactory, so we can arrange packing and shipment.

13. Preservation and delivery

13.1. PRESERVATION

13.1.1. Inspection




Preservation is very often subject to inspection by the customer and has been described in detail in the Inspection and Test Plan. The production manager is responsible for preserving the conformity of the product during internal processing and delivery to the intended destination.

13.1.2. Packing / preservation

Preservation & Packing is done according to Standard Form I-22 which is subject for customer's approval and part of the VDS.

13.1.3. Pictures and photo archive

Before shipment pictures are taken of each vital part of the installation because of the following reasons:

<div><div>شرکت توسعه صنایع لوان</div><div>Lavan Industry Development Company</div></div> <div></div>	<div>LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT</div>						<div></div>
<div></div>	Quality Manual						
	Document No. 17735-37						Page
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- For start-up, commissioning and maintenance
- For reproduction

Project manager is responsible for detail pictures, sales department is responsible for overall pictures. They are stored on our network

13.1.4. Spare parts

Loose items are usually boxed in substantial crating to prevent damage during shipment of storage at job site for at least 6 months.

13.1.5. Delivery

After packing delivery is done according to PO

13.2. ADMINISTRATION OF PURCHASE ORDERS

13.2.1. Preparation of documents for payment

If an order is ready to be shipped the financial administration will prepare the documents for payment:

- Invoice (standard form J-01)
- Packing list (standard form J-01)
- Letter of Credit
- Release note
- Legalisation by Chamber of Commerce and/or Embassy (standard forms J-03 and J-04)

13.2.2. Preparation of documents for transport

The financial administration will prepare the documents for transport:

- Invoice (standard form J-01)
- Packing list (standard form J-01)
- CMR
- Customs Form

13.2.3. Submitting documents for bank (if required)




When the customer or Airpack requires that payment is effected by LC, down payment or bank guarantee, the necessary documents will be submitted to the bank.

13.2.4. Review documents by bank (if required)

The documents are reviewed by the bank and if required changes will be made.

13.2.5. Submittal of approved documents to customer's bank

If the documents are approved the bank will submit them to the customer's bank.

	<p align="center">LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT</p>							
	<p align="center">Quality Manual</p>							
	<p>Document No. 17735-37</p>							Page
	Project No.	Vendor Doc.	P.O. No.	Department	Document Type	Serial No	Revision	Page
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13.2.6. Payment receipt

Payment of the invoice will be effected by customer's bank to Airpack.

13.2.7. Accounting check

Accounting of the invoice after receipt of the payment will be effected by the financial administration. The date and statement number are registered.

14. Service and guarantee

14.1. Instruction manual

For each customer's engineered product, the project manager writes an instruction manual. This manual is delivered to the customer and a copy is kept in our fire-proof archives. The content and/or a complete instruction manual can be subject to customer approval.

14.2. Reference number

When a request for service is received, it will be given a reference number according to PRO B1.1 (added codes FE for start-up, GAR for guarantee and RM for repair and maintenance).

In case it is not a matter of guarantee or start-up was not part of the original order an offer will be made to the customer under the reference number using standard form E-06b Pre Service Contract. This form shall be signed by the customer and returned to Airpack before any other steps are taken.

14.3. Registration

Files are kept in the office of the service engineer under reference number and customer name. After a year the files are kept in our fire-proof archives.

14.4. Network




On the network a file is created under Start-up and reference number.

14.5. Assignment

Based on the requested personnel and availability after sales and vice-president decide which engineer will be assigned to the project.

14.6. Commissioning, start-up and maintenance

Commissioning & start-up as well as maintenance are done according to the instruction manual and commissioning checklist (standard forms).

	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT								
	Quality Manual								
	Document No. 17735-37							Page	
	Project No.		Vendor Doc.	P.O. No.	Department	Document Type	Serial No		Revision
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The customer will have to fill in and sign standard form E-06c Commissioning/Service Time Sheet every day. If the time sheet of the previous day is not signed no further assistance will be given.

14.7. **Guarantee**

If a customer contacts Airpack regarding a failure of the equipment Airpack will respond on short notice and register the customer complaint. We will produce a plan for trouble shooting and if possible, decide whether it is a matter of guarantee or not. This decision will be made during the engineering meeting. The customer will be contacted to discuss the problem and to come to a solution. From this point on the guarantee matter will be handled as a regular project.

14.8. **Service reports**

The service engineer writes a service report every day. These reports are signed by the customer and are kept in the above-mentioned file.

14.9. **Invoice**

The invoice will be checked by the service engineer and will be sent to customer by financial administration.

14.10. **Evaluation**

During assignment engineers will fill in logbook. After finished assignment items from the logbook will be evaluated during start-up evaluation. Issues will be discussed and registered.

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION K-36

DOCUMENTS; INSTRUMENT HOOK-UP DIAGRAM



Vendor doc. Number

17735-19

Vendor:

Airpack Nederland B.V.

P.O. NO.:

LIDCO-PO-NEC-278-6019



Instrument Hook-up Drawing

Document No. 17735-38

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**Airpack B.V. - Air Compressor –
Integrated Methanol and Ammonia Plant
17735-COM Instrument Hook-up Drawing (K020)**

code-1
M. Vakili

REV.	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED
03	18-03-2024	Issued for Approval	A.Z.	S.K.	J.J.
02	14-02-2024	Issued for Approval	A.Z.	S.K.	J.J.
01	07-12-2023	Issued for Approval	A.Z.	S.K.	J.J.

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Instrument Hook-up Drawing

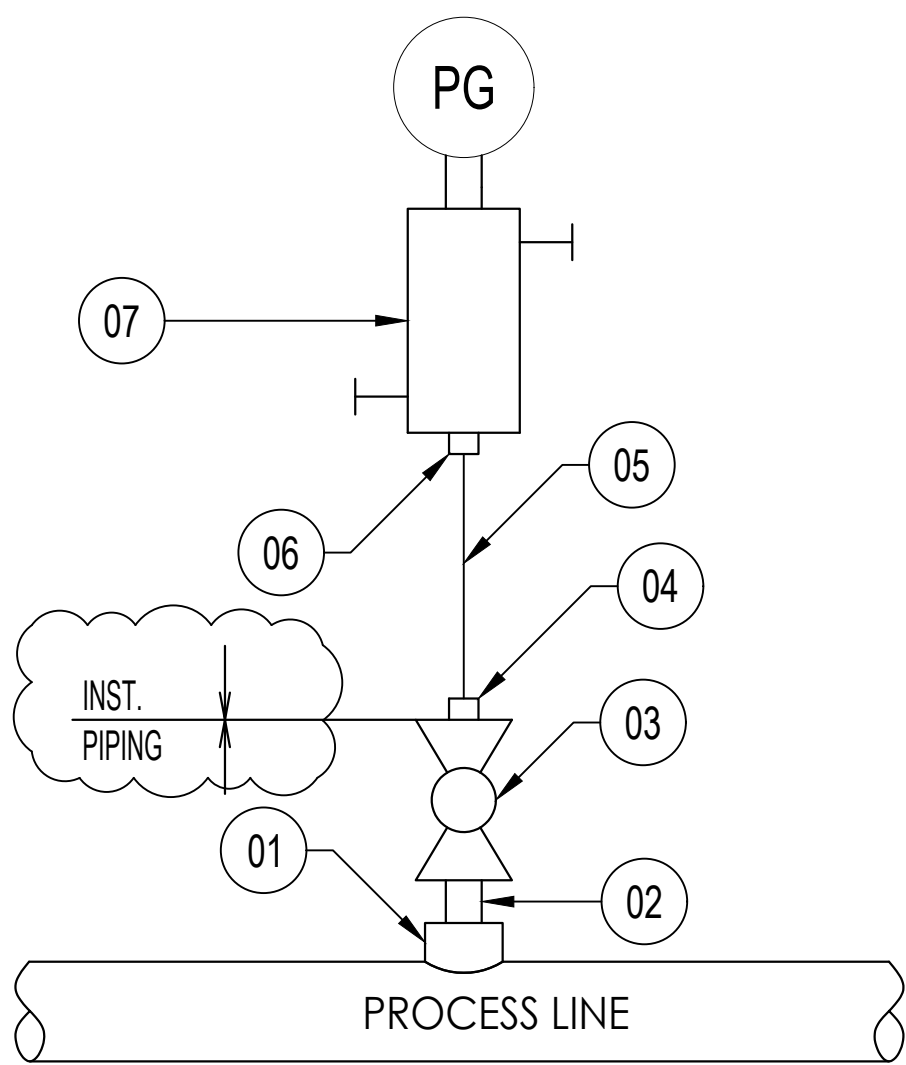
Document No. 17735-38

Project No.	Vendor Doc.	P.O. No.	Department	Document Type	Serial No	Revision	Page
N278	VD	6019	IN	DWG	0035	03	Page 2 of 10

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1	X	X	X			26						51						76					
2	X	X	X			27						52						77					
3	X	X	X			28						53						78					
4	X	X	X			29						54						79					
5	X	X	X			30						55						80					
6	X	X	X			31						56						81					
7	X	X	X			32						57						82					
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9	X	X	X			34						59						84					
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11						36						61						86					
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13						38						63						88					
14						39						64						89					
15						40						65						90					
16						41						66						91					
17						42						67						92					
18						43						68						ATTACHMENT					
19						44						69						1					
20						45						70						2					
21						46						71						3					
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23						48						73						5					
24						49						74						6					
25						50						75						7					

PRESSURE GAUGE



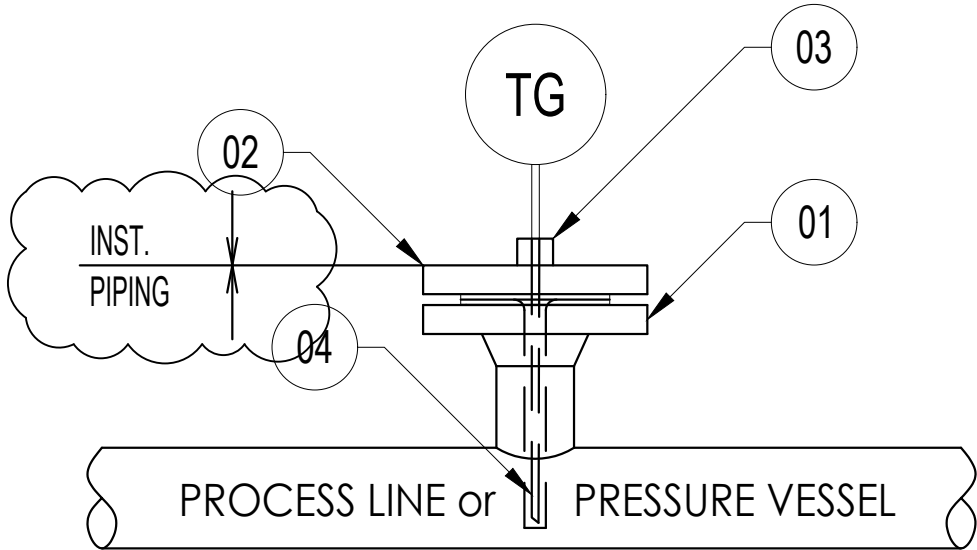
NOTE:
THESE PRESSURE GAUGES
ARE PANEL MOUNTED

ITEM	QTY	DESCRIPTION	SIZE	MATERIAL
01	01	PROCESS CONNECTION	3/4" NPT	SS316
02	01	HEX NIPPLE	3/4" NPT	SS316
03	01	BALL VALVE	3/4" NPT-F	SS316
04	01	CONNECTOR DOUBLE COMPRESSION TYPE	3/4"NPT-M-12mmOD	SS316
05	-	TUBING	12mmOD	SS316
06	01	CONNECTOR DOUBLE COMPRESSION TYPE	1/2"NPT-M-12mmOD	SS316
07	01	2-WAY BLOCK & BLEED MANIFOLD	1/2" NPT-F x 1/2" NPT-F	SS316
08				
09				

TAGNUMBERS: 320PG-8201, 320PG-8202, 320PG-8203, 320PG-8204		REFERENCE DOCUMENTS: N-278-VD-6019-PR-PID-0002 P&ID N-278-VD-6019-IN-DS-0013 INSTRUMENT DATA SHEETS	
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	SUBJECT HOOKUP PRESSURE GAUGE		DATE	07-12-2023	THIS DRAWING IS OWNED BY AIRPACK AND SHALL NOT BE PRINTED OR COPIED IN ANY OTHER WAY THAN WITH AIRPACKS PERMISSION			
			DRAWN BY	AZ				
			CHECKED BY	SK				
	CLIENT	LAVAN INDUSTRY	PLANT LOCATION	IRAN ONSHORE		03	18-03-2024	AZ
	CLIENT REF	Integrated Methanol and Ammonia Plant	DRAWING NO.	17735-38		02	13-02-2024	AZ
AIRPACK REF		17735-COM	SHEETNO.	1		01	07-12-2023	AZ

TEMPERATURE GAUGE
LOCALLY MOUNTED

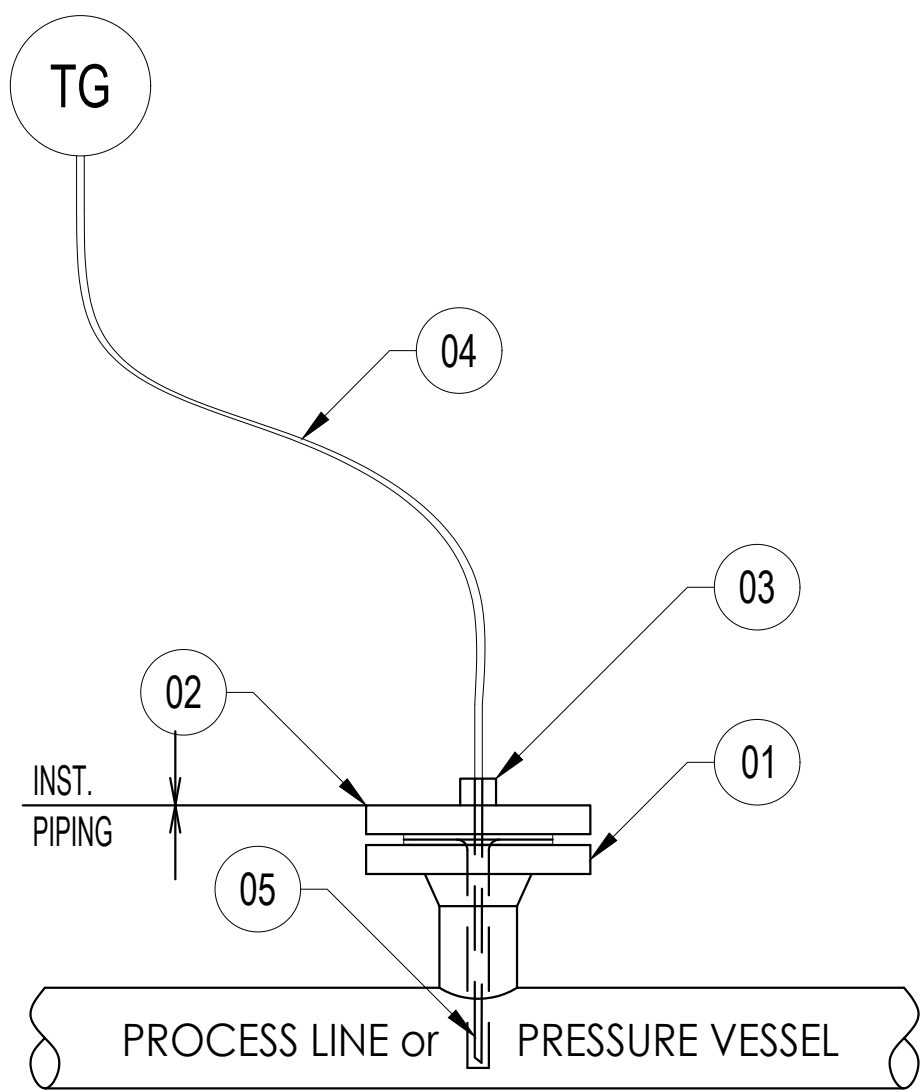


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02	01	THERMOWELL	1 1/2" ANSI 300# RF	SS316
03	01	CONNECTOR DOUBLE COMPRESSION FITTING	3/4"NPT-M - 6mm OD	SS316
04	01	TEMPERATURE ELEMENT	N.A.	SS316
05				
06				
07				
08				
09				

TAGNUMBERS: 320TG-8206		REFERENCE DOCUMENTS: N-278-VD-6019-PR-PID-0002 P&ID N-278-VD-6019-IN-DS-0013 INSTRUMENT DATA SHEETS	
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			DRAWN BY	AZ				
			CHECKED BY	SK				
	CLIENT	LAVAN INDUSTRY	PLANT LOCATION	IRAN ONSHORE		03	18-03-2024	AZ
	CLIENT REF	Integrated Methanol and Ammonia Plant	DRAWING NO.	17735-38		02	13-02-2024	AZ
AIRPACK REF	17735-COM		SHEETNO.	2		01	07-12-2023	AZ

TEMPERATURE GAUGE
REMOTE MOUNTED



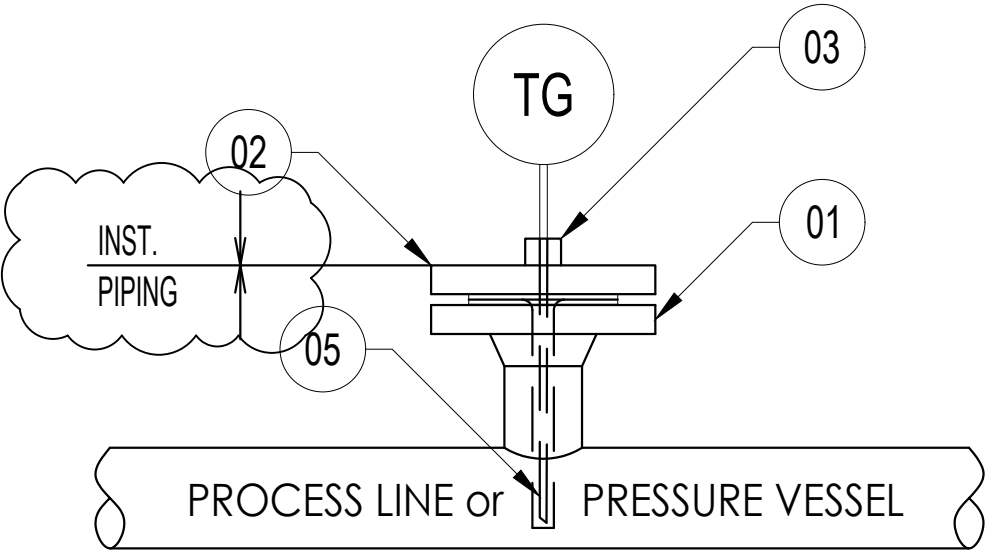
NOTE:
THESE TEMPERATURE GAUGES
ARE PANEL MOUNTED

ITEM	QTY	DESCRIPTION	SIZE	MATERIAL
01	01	PROCESS CONNECTION	1 1/2" ANSI 300# RF	SS316
02	01	THERMOWELL	1 1/2" ANSI 300# RF	SS316
03	01	CONNECTOR DOUBLE COMPRESSION FITTING	3/4"NPT-M - 6mm OD	SS316
04	01	CAPILLARY, MOULDED TO TEMPERATURE ELEMENT	L=5m	SS316
05	01	TEMPERATURE ELEMENT	N.A.	SS316
06				
07				
08				
09				

TAGNUMBERS: 320TG-8209, 320TG-8210, 320TG-8211		REFERENCE DOCUMENTS: N-278-VD-6019-PR-PID-0002 P&ID N-278-VD-6019-IN-DS-0013 INSTRUMENT DATA SHEETS	
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			DRAWN BY AZ				
			CHECKED BY SK				
			PLANT LOCATION IRAN ONSHORE				
			DRAWING NO. 17735-38		03	18-03-2024	AZ
CLIENT LAVAN INDUSTRY		PLANT LOCATION IRAN ONSHORE			02	13-02-2024	AZ
CLIENT REF Integrated Methanol and Ammonia Plant		DRAWING NO. 17735-38			01	07-12-2023	AZ
AIRPACK REF 17735-COM		SHEETNO. 3					

TEMPERATURE GAUGE
LOCALLY MOUNTED



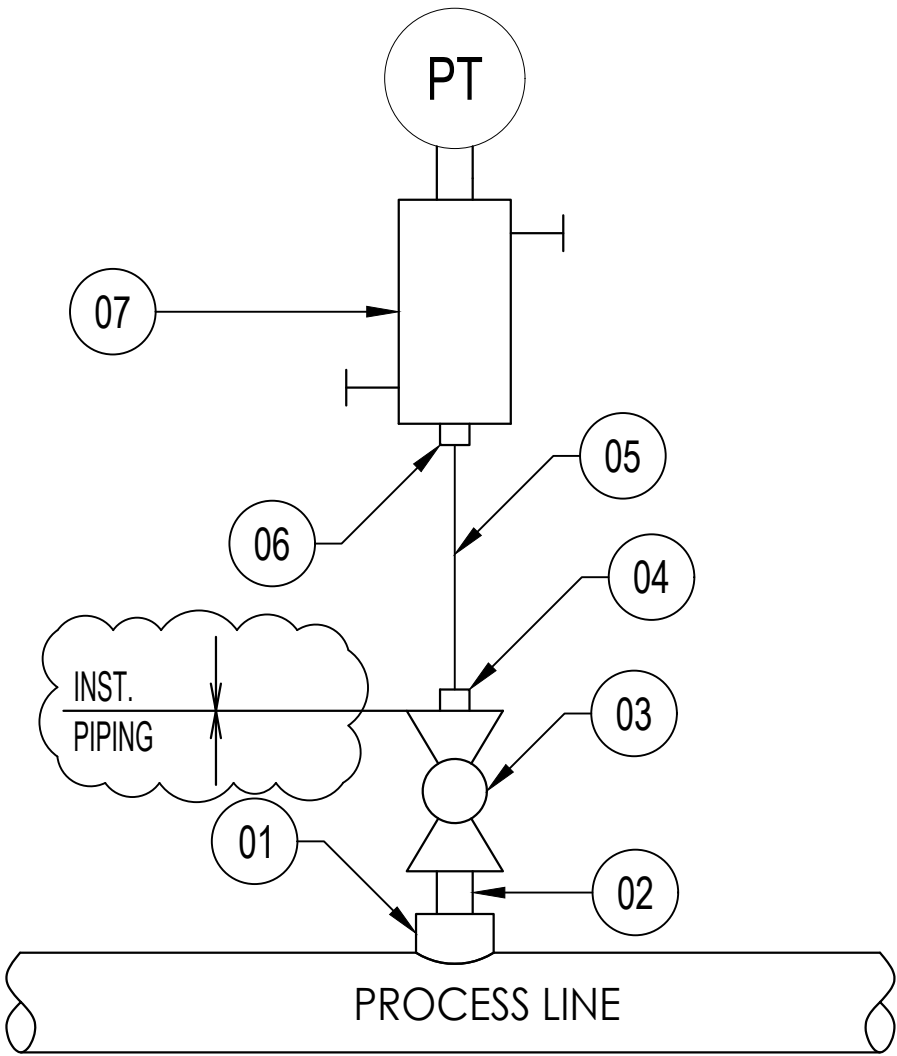
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01	01	PROCESS CONNECTION	1 1/2" ANSI 600# RF	SS316
02	01	THERMOWELL	1 1/2" ANSI 600# RF	SS316
03	01	CONNECTOR DOUBLE COMPRESSION FITTING	3/4"NPT-M - 6mm OD	SS316
04	01	TEMPERATURE ELEMENT	N.A.	SS316
05				
06				
07				
08				
09				

TAGNUMBERS:
320TG-8207, 320TG-8208

REFERENCE DOCUMENTS:
N-278-VD-6019-PR-PID-0002 P&ID
N-278-VD-6019-IN-DS-0013 INSTRUMENT DATA SHEETS

	SUBJECT HOOKUP TEMPERATURE GAUGE		DATE	07-12-2023	THIS DRAWING IS OWNED BY AIRPACK AND SHALL NOT BE PRINTED OR COPIED IN ANY OTHER WAY THAN WITH AIRPACKS PERMISSION			
			DRAWN BY	AZ				
			CHECKED BY	SK				
	CLIENT	LAVAN INDUSTRY	PLANT LOCATION	IRAN ONSHORE		03	18-03-2024	AZ
	CLIENT REF	Integrated Methanol and Ammonia Plant	DRAWING NO.	17735-38		02	13-02-2024	AZ
	AIRPACK REF	17735-COM	SHEETNO.	4		01	07-12-2023	AZ

PRESSURE TRANSMITTER



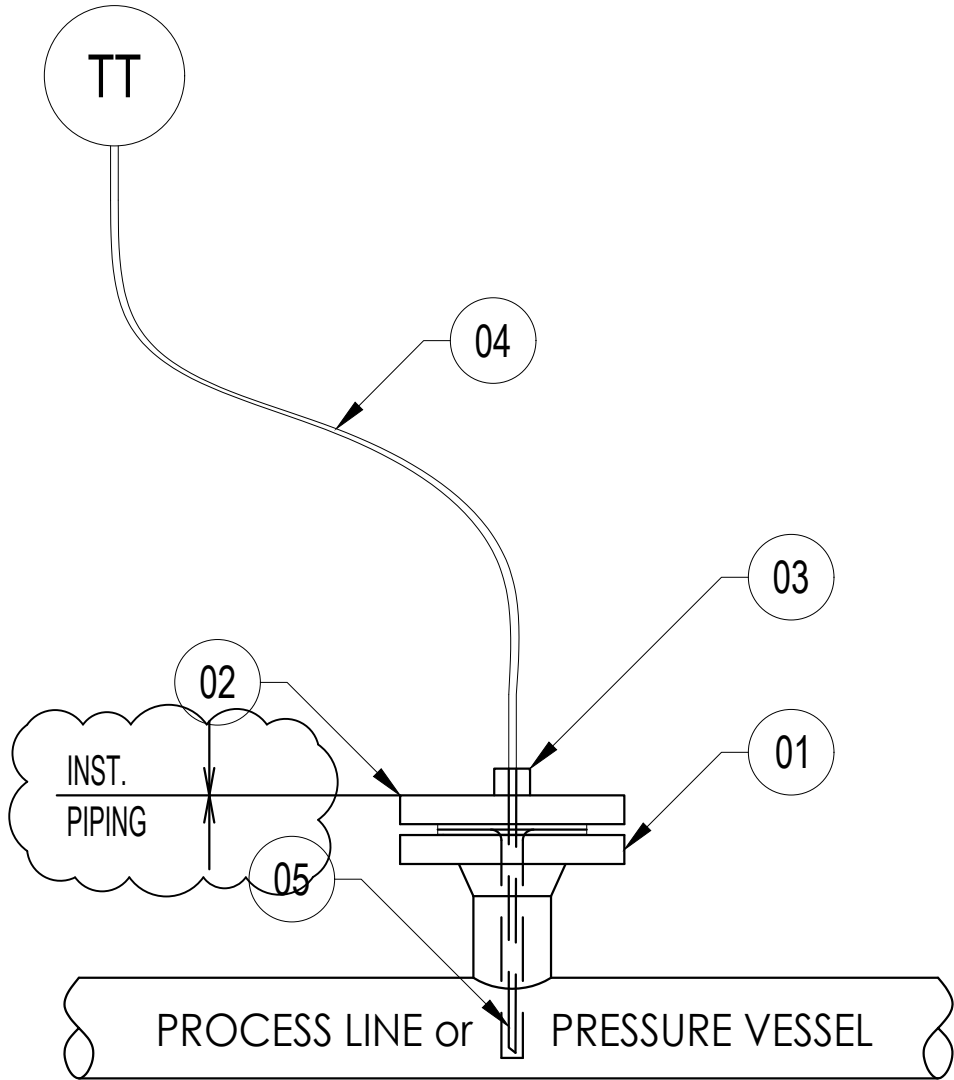
NOTE:
MOUNTING BRACKET TO BE
SUPPLIED FOR THESE
PRESSURE TRANSMITTERS.

ITEM	QTY	DESCRIPTION	SIZE	MATERIAL
01	01	PROCESS CONNECTION	3/4" NPT	SS316
02	01	HEX NIPPLE	3/4" NPT	SS316
03	01	BALL VALVE	3/4" NPT-F	SS316
04	01	CONNECTOR DOUBLE COMPRESSION TYPE	3/4"NPT-M-12mmOD	SS316
05	-	TUBING	12mmOD	SS316
06	01	CONNECTOR DOUBLE COMPRESSION TYPE	1/2"NPT-M-12mmOD	SS316
07	01	2-WAY BLOCK & BLEED MANIFOLD	1/2" NPT-F x 1/2" NPT-F	SS316
08				
09				

TAGNUMBERS: 320PT-8201, 320PT-8202, 320PT-8203, 320PT-8204		REFERENCE DOCUMENTS: N-278-VD-6019-PR-PID-0002 P&ID N-278-VD-6019-IN-DS-0013 INSTRUMENT DATA SHEETS	
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	SUBJECT HOOKUP PRESSURE TRANSMITTER		DATE	07-12-2023	THIS DRAWING IS OWNED BY AIRPACK AND SHALL NOT BE PRINTED OR COPIED IN ANY OTHER WAY THAN WITH AIRPACKS PERMISSION			
			DRAWN BY	AZ				
			CHECKED BY	SK				
	CLIENT	LAVAN INDUSTRY	PLANT LOCATION	IRAN ONSHORE		03	18-03-2024	AZ
	CLIENT REF	Integrated Methanol and Ammonia Plant	DRAWING NO.	17735-38		02	13-02-2024	AZ
AIRPACK REF		17735-COM	SHEETNO.	5		01	07-12-2023	AZ

TEMPERATURE TRANSMITTER
REMOTE MOUNTED



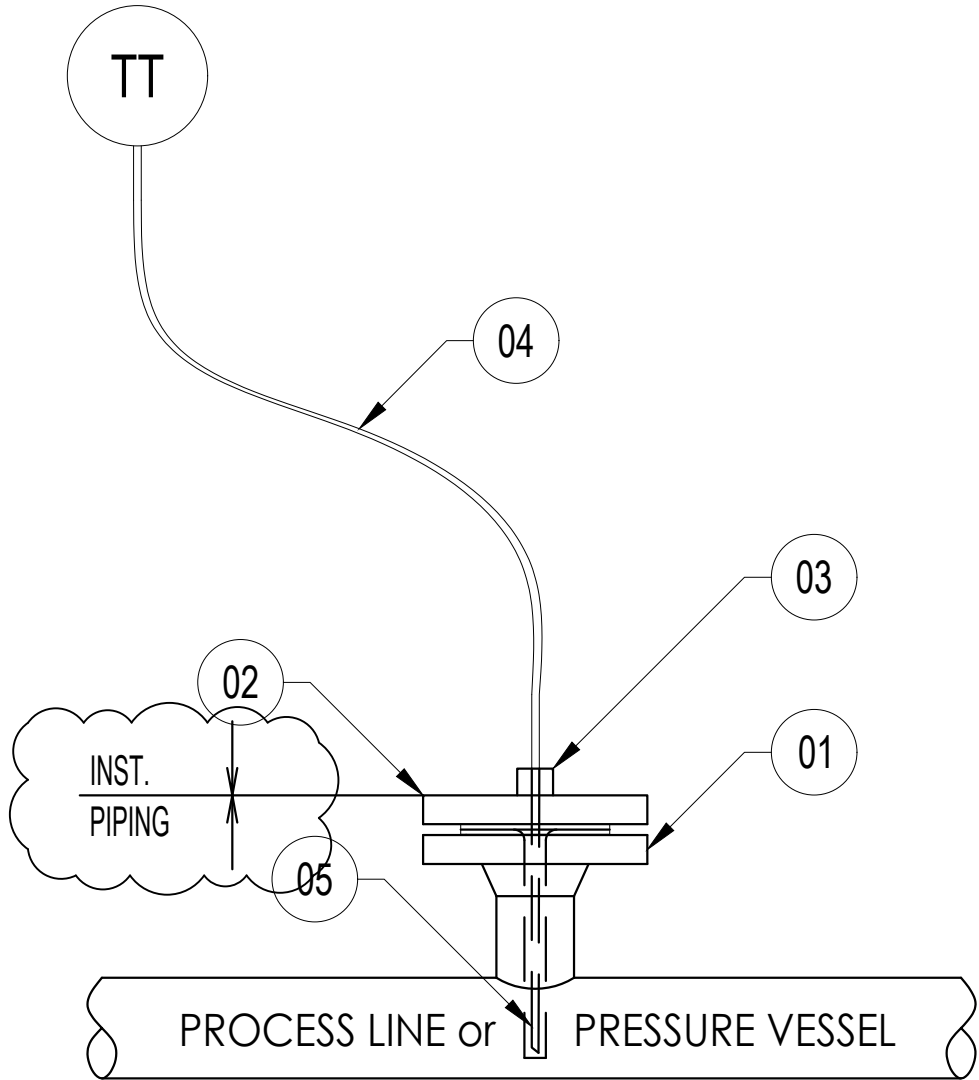
ITEM	QTY	DESCRIPTION	SIZE	MATERIAL
01	01	PROCESS CONNECTION	1 1/2" ANSI 300# RF	SS316
02	01	THERMOWELL	1 1/2" ANSI 300# RF	SS316
03	01	CONNECTOR DOUBLE COMPRESSION FITTING	3/4"NPT-M - 6mm OD	SS316
04	01	CAPILLARY, MOULDED TO TEMPERATURE ELEMENT	L=5m	SS316
05	01	TEMPERATURE ELEMENT	N.A.	SS316
06				
07				
08				
09				

TAGNUMBERS:
320TT-8201, 320TT-8205

REFERENCE DOCUMENTS:
N-278-VD-6019-PR-PID-0002 P&ID
N-278-VD-6019-IN-DS-0013 INSTRUMENT DATA SHEETS

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			DRAWN BY	AZ				
			CHECKED BY	SK				
	CLIENT	LAVAN INDUSTRY	PLANT LOCATION	IRAN ONSHORE		03	18-03-2024	AZ
	CLIENT REF	Integrated Methanol and Ammonia Plant	DRAWING NO.	17735-38		02	13-02-2024	AZ
AIRPACK REF		17735-COM	SHEETNO.	6		01	07-12-2023	AZ

TEMPERATURE TRANSMITTER
REMOTE MOUNTED



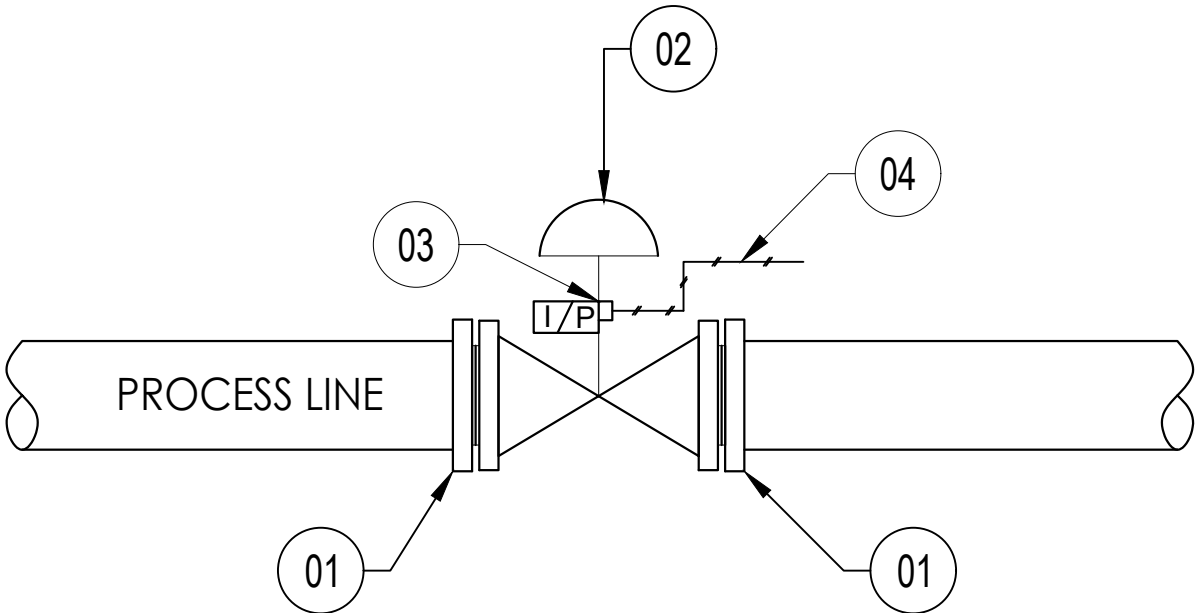
NOTE:
MOUNTING BRACKET TO BE
SUPPLIED FOR THESE
TEMPERATURE TRANSMITTERS.

ITEM	QTY	DESCRIPTION	SIZE	MATERIAL
01	01	PROCESS CONNECTION	1 1/2" ANSI 600# RF	SS316
02	01	THERMOWELL	1 1/2" ANSI 600# RF	SS316
03	01	CONNECTOR DOUBLE COMPRESSION FITTING	3/4"NPT-M - 6mm OD	SS316
04	01	CAPILLARY, MOULDED TO TEMPERATURE ELEMENT	L=5m	SS316
05	01	TEMPERATURE ELEMENT	N.A.	SS316
06				
07				
08				
09				

TAGNUMBERS: 320TT-8202, 320TT-8203, 320TT-8204			REFERENCE DOCUMENTS: N-278-VD-6019-PR-PID-0002 P&ID N-278-VD-6019-IN-DS-0013 INSTRUMENT DATA SHEETS		
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	SUBJECT HOOKUP TEMPERATURE TRANSMITTER		DATE	07-12-2023	THIS DRAWING IS OWNED BY AIRPACK AND SHALL NOT BE PRINTED OR COPIED IN ANY OTHER WAY THAN WITH AIRPACKS PERMISSION			
			DRAWN BY	AZ				
			CHECKED BY	SK				
	CLIENT	LAVAN INDUSTRY	PLANT LOCATION	IRAN ONSHORE		03	18-03-2024	AZ
	CLIENT REF	Integrated Methanol and Ammonia Plant	DRAWING NO.	17735-38		02	13-02-2024	AZ
AIRPACK REF		17735-COM	SHEETNO.	7		01	07-12-2023	AZ

PRESSURE BYPASS (RECYCLE) VALVE



ITEM	QTY	DESCRIPTION	SIZE	MATERIAL
01	02	PROCESS CONNECTION	3/4" ANSI 300# RF	SS316
02	01	PRESSURE CONTROL VALVE	3/4"ANSI 300# RF	SS316
03	01	CONNECTOR DOUBLE COMPRESSION TYPE	1/4"NPT-M- 12mmOD	SS316
04	-	TUBING	12mmOD	SS316
05				
06				
07				
08				
09				

TAGNUMBERS:
320PCV-8201

REFERENCE DOCUMENTS:
N-278-VD-6019-PR-PID-0002 P&ID
N-278-VD-6019-IN-DS-0041 CONTROL VALVE DATA SHEETS

	SUBJECT HOOKUP PRESSURE BYPASS (RECYCLE) VALVE		DATE	07-12-2023	THIS DRAWING IS OWNED BY AIRPACK AND SHALL NOT BE PRINTED OR COPIED IN ANY OTHER WAY THAN WITH AIRPACKS PERMISSION			
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	CLIENT	LAVAN INDUSTRY	PLANT LOCATION	IRAN ONSHORE		03	18-03-2024	AZ
	CLIENT REF	Integrated Methanol and Ammonia Plant	DRAWING NO.	17735-38		02	13-02-2024	AZ
	AIRPACK REF	17735-COM	SHEETNO.	8		01	07-12-2023	AZ

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION K-37

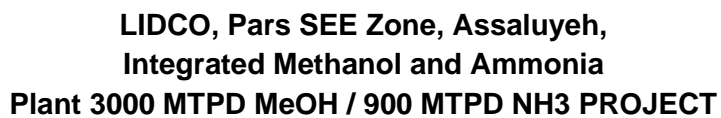
DOCUMENTS; EARTHING DIAGRAM



Vendor doc. Number
17735-19

P.O. NO.:
LIDCO-PO-NEC-278-6019

Vendor:
Airpack Nederland B.V.



Earthing Diagrams

Document No. 17735-41

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Vendor Doc.

P.O. No.

Department

Document Type

Serial No

Revision

N278

VD

6019

FI

DIA

0036

02

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**Airpack B.V. - Air Compressor –
Integrated Methanol and Ammonia Plant
17735-COM Earthing Diagrams (K020)**

code-1
M. Vakili

02	11-03-2024	Issued for Approval	L.K.	S.K.	J.J.
01	28-11-2023	Issued for Approval	A.Z.	S.K.	J.J.
REV.	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED

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Earthing Diagrams

Document No. 17735-41

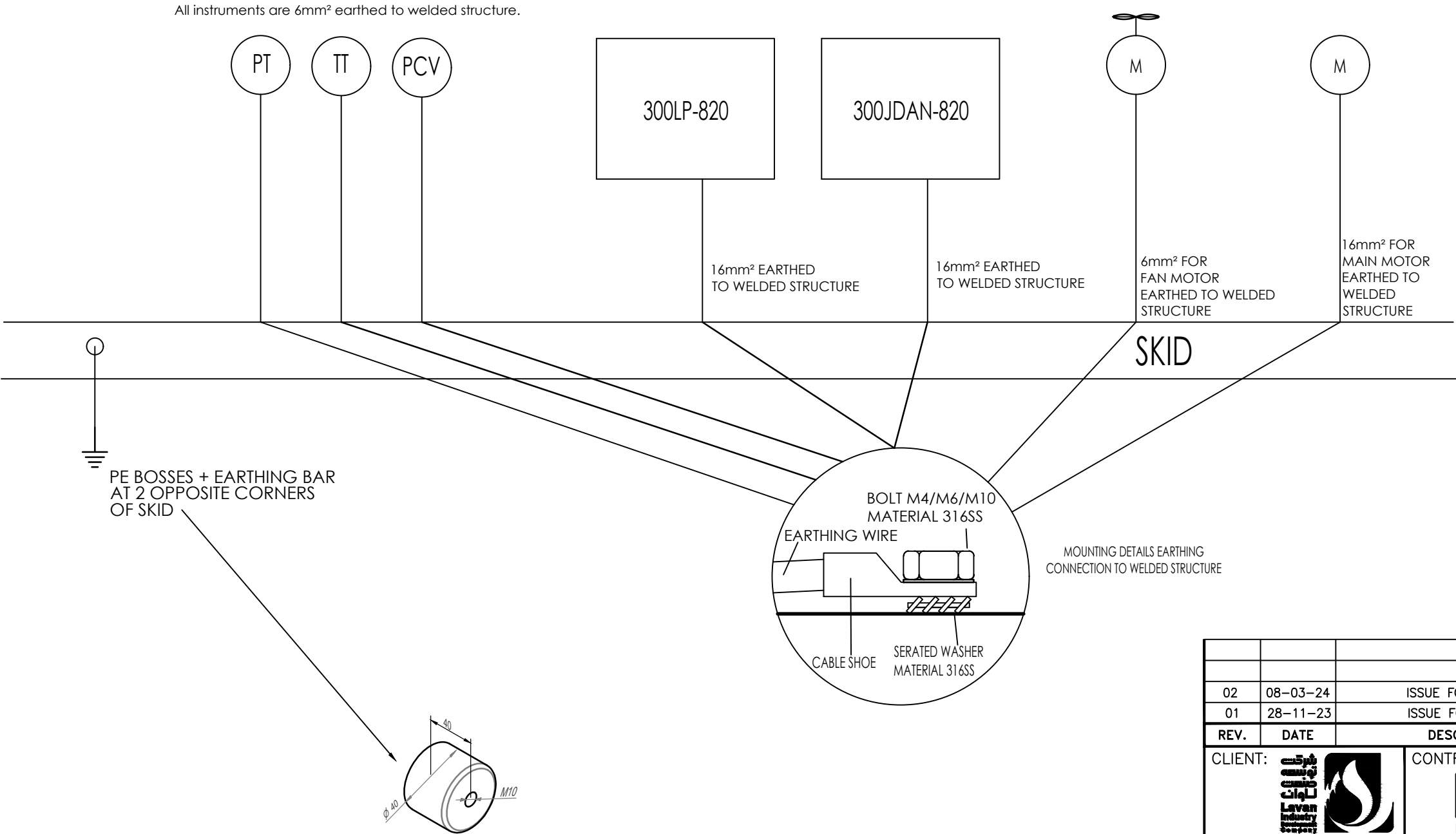
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25						50						75						7					

- NOTES:
1. BOLT SIZES FOR CONNECTIONS TO SKID WILL BE AS FOLLOWS:
- 6mm² = M6 BOLT
 - 16mm² = M8 BOLT

All instruments are 6mm² earthed to welded structure.



PT : PRESSURE TRANSMITTER
TT : TEMPERATURE TRANSMITTER
PCV : PRESSURE CONTROL VALVE
M : MOTOR

02	08-03-24	ISSUE FOR APPROVAL	LK	RB	SK		
01	28-11-23	ISSUE FOR APPROVAL	AZ	RB	SK		
REV.	DATE	DESCRIPTION	DRAWN	CHECK	APPROVED		
CLIENT:		CONTRACTOR:	VENDOR:				
							
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PROJECT TITLE: <div>LIDCO, Pars SEE Zone, Assaluyeh Integrated Methanol and Ammonia Plant 3000 MTPD MeOH/900 MTPD NH3 PROJECT</div>							
DRAWING TITLE: <div>EARTHING DIAGRAM</div>							
DOCUMENT No:				SC.			
N-278-VD-6019-EL-DIA-0036-01				SIZE: A3			
PROJECT No.	VENDOR DOC.	P.O. No.	DEPARTMENT	DOC. TYPE	SERIAL No.	REV.	SHEET No.
N278	VD	6019	EL	DIA	0036	02	3 OF 3

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION K-38

DOCUMENTS; SPARE PART FOR 2 YEARS



Vendor doc. Number




17735-19

Vendor:

Airpack Nederland B.V.

P.O. NO.:

LIDCO-PO-NEC-278-6019

	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT							
	Spare Parts for 2 years Operation (SPIR)							
	Document No. 17735-42							Page
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Airpack B.V. - Air Compressor –




Integrated Methanol and Ammonia Plant

17735-COM Spare Parts for 2 years Operation (SPIR)

Code 1
M.Dalakeh

03	17-09-2025	Issued for Information	S.K.	S.K.	J.J.
02	11-09-2025	Issued for Information	S.K.	S.K.	J.J.
01	26-08-2025	Issued for Information	M.C.	S.K.	J.J.
REV.	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED

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	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT							
	Spare Parts for 2 years Operation (SPIR)							
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3	X	X				28						53						78					
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25						50						75						7					

SPARE PARTS LIST AND INTERCHANGEABILITY RECORD

21	EQUIPMENT CLASS رده تجهیز ات												فهرست قطعات یدکی و اقلام مشابه												SPARE PARTS		SPARE PARTS FOR 2 YEAR OPERATION									
1	EQUIPMENT REQ No. or TAG. No. شماره تگ دستگاهها یا شماره ارجع	K-020											توضیحات: 1- کلیه دستگاههاییکه دارای اقلام مشابه هستند باید در فرم یکسان درج گردند. 2- در ستون 10 شماره حقیقی قطعه ای ذکر گردد که با سایر دستگاههای ماشین آلات کارخانه سازنده تشابه داشته باشد. 3- در ستون 20 شماره های حقیقی سازنده فرعی (تالنت) مانند باطقان، آب بندهای مکانیکی، اتصالات، فیوزها و غیره درج گردند. 4- در ستون 11 اسم و نوع جنس به کار رفته در کالا ذکر گردد مانند (مغرغ، چدن، فولاد درجه 304، لاستیک، بتون و غیره)										SUBJECT : Spare Parts for 2 years Operation (SPIR)													
													Approved for Purchase by تاریخ خرید توسط :										VENDOR : Airpack Nederland BV													
													Required on Site Date تاریخ مورد نیاز در سایت										ADDRESS : Groene Weegje 19-25													
2	MANUFACTURERS MODEL مدل کارخانه سازنده	RBV-130											OPERATIONAL SPARE PARTS قطعات مورد نیاز عملیات										DATE :		Classification of parts رده بندی قطعات	Unit Price in USD قیمت واحد به تقریب	Total Price in USD قیمت کل به تقریب	Remarks (see note 3 above) ملاحظات (رجوع شود به بند 3 توضیحات)	Item No. شماره ردیف							
3	MANUFACTURERS SERILA No. شماره سریال سازنده	T-2023-00799											MANUFACTURERS DATA شرح قطعات شامل کلیه قطعات پیشنهادی to include all parts recommended to be kept for normal operation and slow wearing parts بطور عادی یا به صورت کنیجی مصرف و در اقبال نگهداری شود		DRAWING/ REF.NO. شماره نقشه/ مرجع سازنده	Manufacturers Real part No. (see note 2 above) شماره قطعه حقیقی سازنده (رجوع شود به بند2 توضیحات)	Material (see note 4 a bove) رجوع شود به بند 4	Recommended by manufacturer پیشنهاد سازنده	Recommended by contractor پیشنهاد پیمانکار	2-Year spares قطعات یدکی دو سالانه	Quantity to be supplied تعداد مورد ستارش	MESC NO. شماره طبقه بندی کالا														
4	NO OF UNIT شماره دستگاه												6a	7	8	9	10	11	12	13	14	15	16	17	18	19	20	22								
5	NUMBER OF PARTS PER UNIT/ EQUIPMENT تعداد قطعات در هر دستگاه	1											lot	1 (32)	Lot of piston rings and rider rings	N-278-VD-6019-PR-GAD-0003-01	NA	N/A	1	1	X	100%		C				17735-C-0801 17735-C-0802 17735-C-0803 17735-C-0804 17735-C-0805 17735-C-0806 17735-C-0807 17735-C-0808 17735-C-0809 17735-C-0813 17735-C-0814 17735-C-0815								
		1											lot	1 (2)	Lot of valve parts	N-278-VD-6019-PR-GAD-0003-01	NA	SS	1	1	X	100%		C				17735-C-0835 17735-C-0836								
		1											set	1 (32)	Gasket set for compressor	N-278-VD-6019-PR-GAD-0003-01	NA	FKM	1	1	X	100%		C				17735-C-0810 17735-C-0811								
		1											set	1 (40)	Set of O-rings	N-278-VD-6019-PR-GAD-0003-01	NA	FKM	1	1	X	100%		C				17735-C-0816 17735-C-0817 17735-C-0818 17735-C-0819 17735-C-0820 17735-C-0821 17735-C-0822 17735-C-0823 17735-C-0824 17735-C-0825 17735-C-0826 17735-C-0827 17735-C-0828 17735-C-0829 17735-C-0830 17735-C-0831 17735-C-0832 17735-C-0833 17735-C-0834								
													lot	1 (1)	Non return valve	N-278-VD-6019-PR-GAD-0003-01	NA	SS316	1	1	X	100%		C				17735-C-0835								
6	EQUIPMENT PURCHASE ORDER NO شماره سفارش خرید دستگاه																							Rev. No.												
																									Date											
																									Sign											
		Total amount this sheet : EX- Works Delivery time : WEEKS AFTER ORDER COMMITMENT												Sheet No. 1 of																						
												Requisition No.																								

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION K-39

DOCUMENTS; SUB SUPPLIER LIST



Vendor doc. Number




17735-19

P.O. NO.:

LIDCO-PO-NEC-278-6019

Vendor:

Airpack Nederland B.V.




	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT							
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code-1
M. Vakili

Sub-Supplier List (K-020)

03	04-12-2023	Issued for Approval	J.J.	S.K.	S.K.
02	28-11-2023	Issued for Approval	J.J.	S.K.	S.K.
01	14-09-2023	Issued for Approval	S.K.	J.J.	S.K.
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24						49						74						6					
25						50						75						7					



PREFERRED SUBSUPPLIERS LIST

PROJECT :	17735-COM	
CLIENT:	NARGAN COMPANY	
Type of Material	Make	Country
COMPRESSOR	Mehrer	Germany
COOLER	Warmtetransport	The Netherlands
	IWS Monje	Switzerland
	Flovex	Italy
	Unidro Scambiatori	Italy
	Airpack Nederland B.V.	The Netherlands
ELECTRIC MOTORS	ABB	Finland
	Loher	Germany
	Siemens	Netherlands
	Marelli	Italy
	WEG	Germany
	GE	USA
GAUGES (pressure / temperature)	Wika	USA
	Ashcroft	UK
TRANSMITTERS (pressure / temperature)	ABB	UK
	Endress & Hauser	Switzerland
	Rosemount & Emerson	USA
	Siemens	Germany
	Yokogawa	Japan
CABLE	Incore Cables	The Netherlands
	Batt Cables	UK
	Voltec	The Netherlands
	TKF	The Netherlands
CABLE GLAND	CMP	UK
	Hawke	UK
VIBRATION DAMPERS	Trelleborg	The Netherlands
	Airpack Nederland B.V.	The Netherlands
	Eriks	The Netherlands
	Econosto	The Netherlands
TAPERLOCK & PULLEYS	FPT	UK
	Vector	Germany
	Imthorn	The Netherlands



PREFERRED SUBSUPPLIERS LIST

PROJECT :	17735-COM	
CLIENT:	NARGAN COMPANY	
Type of Material	Make	Country
GRATING	Thielco Staalindustrie B.V.	The Netherlands
	Staco Roosters	The Netherlands
PRESSURE VESSELS	Locati Impianti	Italy
	Tankbouw Rootselaar	The Netherlands
	TMS	The Netherlands
	Delta Engineering	Italy
	SABA Werk	Germany
	Airpack Nederland B.V.	The Netherlands
CONSTRUCTION / COMPONENTS	Dumaco BV (ITM)	The Netherlands
	Tummers Plaatbewerking	The Netherlands
	Meeuwsen BV	The Netherlands
GASKETS	Klinger	USA
	Eriks	The Netherlands
JUNCTION BOXES	Index electro	The Netherlands
	Rittal	Germany
	Bartec	Germany
	Eldon	The Netherlands
RELAIS/TERMINALS	Phoenix contact	Germany
POWER SUPPLY	Phoenix contact	Germany
VALVES	Pekos	Spain
	Kitz	Japan
	JC	Spain
	Adler Spa	Italy
	Alfa Valvole	Italy
	Airpack Nederland B.V.	The Netherlands
ACTUATORS	Air Torque	Italy
	(El-o-Matic) Emerson	USA
	Rotork	UK
CHECK VALVES	Hoerbiger	USA
	Ondastop	Italy
	Swagelok	USA
PAINT	Jotun	Norway
	International	The Netherlands
	Sigma	The Netherlands



PREFERRED SUBSUPPLIERS LIST

PROJECT :	17735-COM	
CLIENT:	NARGAN COMPANY	
Type of Material	Make	Country
SAFETY VALVES	Broady	UK
	(Crosby) Emerson	France
	Farris	UK
	Leser	Germany
	Niezgodka (no API)	Germany
SOLENOID VALVES	(ASCO) aim Fluid, Emerson	USA
	(Maxseal) MRC Global	UK
REGULATORS (pressure reducer / back pressure)	Maxseal	UK
	Mankenberg	Germany
	Niezgodka	Germany
	Norgren	UK
	(Fisher) Emerson	USA
STEEL PROFILES & PLATES	Arcelor Mittal	The Netherlands
	Kloeckner Metals (ODS)	The Netherlands
	ZSB Constructie	The Netherlands
PIPING & FITTINGS	Bergen Stainless & Stel Products BV	The Netherlands
	Van Leeuwen Stainless B.V. -RVS	The Netherlands
	Van Leeuwen Buizen - Staal	The Netherlands
	Arcus	The Netherlands
TUBING & CONNECTORS	Gyrolock	USA
	Parker	USA
	Swagelok	USA
COUPLINGS	FPT	UK
	Vector	Germany
	John Crane	USA
	Imthorn	The Netherlands
	Thomas Rexnord	USA
	TB Woods	USA
	Reich Aandrijftechniek	The Netherlands
	Intertech B.V.	Netherlands
	Bakker en co.	Netherlands
PRESSURE CONTROL VALVE	(Fisher) Emerson	USA
	Samson	Germany
Y-STRAINER	Barton-Firtop	UK
	Spirax Sarco	UK



PREFERRED SUBSUPPLIERS LIST

PROJECT :	17735-COM	
CLIENT:	NARGAN COMPANY	
Type of Material	Make	Country
PANEL / JUNCTION BOXES	Index electro	The Netherlands
	Rittal	Germany
	Bartec	Germany
	Eldon	The Netherlands

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION K-40

DOCUMENTS; PSV DATA SHEET



Vendor doc. Number




17735-19

Vendor:

Airpack Nederland B.V.

P.O. NO.:

LIDCO-PO-NEC-278-6019




	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT							
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Airpack B.V. - Air Compressor – Integrated Methanol and Ammonia Plant 17735-COM PSV Data Sheets (K020)

Code 1
M.Dalakeh

06	25-06-2024	Issued for Approval	L.K.	J.J.	S.K.
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04	17-04-2024	Issued for Approval	L.K.	J.J.	S.K.
03	26-03-2024	Issued for Approval	L.K.	J.J.	S.K.
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04	LK	17-4-2024	Issue for Approval		
03	LK	26-3-2024	Issue for Approval		
02	LK	11-3-2024	Issue for Approval		
01	SK	8-11-2023	Issue for Approval		Sheet 3 of 7 Based on P&ID Rev.08
Rev	By	Date	Description		


GENERAL	1	Tag Number		320PSV-8201	
	2	Service		Pressure Safety Valve	
	3	P&ID No.		N278-VD-6019-PR-PID-0002	
	4	Location		Package inlet	
	5	Line number		DAMPENER KV-020-001	
	6	Area classification		Safe area	
	7	Nozzle		Full nozzle	
	8	Design type		Safety	
	9	Conv., Bellows, Pilot op.		Conventional type	
	10	Bonnet Type		Closed	
	11	Bonnet connection		Bolted	
PROCESS CONDITIONS	12	Fluid	State	Air	Vapor
	13	Pressure	Inlet Max.	9,5 bar(g)	12,5 bar(g)
	14	Temperature	Norm. Max.	46 °C	-
	15	Design	Press. Temp.	12,5 bar(g)	75 °C
	16	Ambient Temp.	Min. Max.	-	-
	17	Flow		35 Nm ³ /hr	
	18	Set Pressure		12,5 bar(g)	
BASIS AND SELECTION	19	Molecular Weight	Oper. Sp. Gr.	-	-
	20	Back Pres. (bar(g))		ATM	
	21	Allowable Overpressure (%)		10%	
	22	Compressibility Factor (Z)		1	
	23	Ratio of Specific Heat (Cp/Cv)		-	
	24	Operating Viscosity (cP)		-	
	25	Barometric Pressure		1,013 bar(a)	
	26	Max. Allowable Relief Pressure		14,7 bar(a)	
	27	Design Code		API 520, 521, 526	
	28	Size Basis		Blocked discharge	
	29	Required discharge Area (sq.mm)		4,03 mm ²	
	30	Selected Area (sq.mm)		70,97 mm ²	
	31	Orifice Designation		D	
	32	Noise level at 1m (from calculation)		101.74 dB	
	33	Blow-down		5-7%	
CONNECTIONS	34	Inlet Size	Outlet Size	1"	2"
	35	Inlet Connection	Outlet Conn.	RF	RF
	36	Inlet Rating	Outlet Rating	300#	150#
	37				
MATERIAL	39	Body and Bonnet		SS316	
	40	Seat and Disc		SS316	
	41	Guide and Rings		SS316	
	42	Spring		SS316	
	43	Nozzle		SS316	
OPTIONS	44	Tag plate		SS316, Plate with steel wire	
	45	Test gag		Yes, with stamped tag number	
	46	Lever		Packed	
	47	Cap		Screwed	
CERTIFICATES	48	3.1 Material certificate		Yes	
	49	Calibration certificate		Yes	
	50	Leakage test acc to API STD 527		Yes	
	51	Functional test		No	
CALCULATIONS	52	Sizing calculation		Yes	
	53				
	54				
PURCHASE	55	Manufacturer		Broady	
	56	Model		3531D-SN-021A0	
	57				

NOTES :

06	LK	25-6-2024	Issue for Approval	<div>INSTRUMENT AND VALVE DATASHEET</div> <div>Pressure Safety Valve</div> <div></div>	<div>Sheet 4 of 7</div> <div>Based on P&ID Rev.08</div>
05	LK	8-5-2024	Issue for Approval		
04	LK	17-4-2024	Issue for Approval		
03	LK	26-3-2024	Issue for Approval		
02	LK	11-3-2024	Issue for Approval		
01	SK	8-11-2023	Issue for Approval		
Rev	Bv	Date	Description		


GENERAL	1	Tag Number			320PSV-8202	
	2	Service			Pressure Safety Valve	
	3	P&ID No.			N278-VD-6019-PR-PID-0002	
	4	Location			1st stage discharge	
	5	Line number			DAMPENER KV-020-002	
	6	Area classification			Safe area	
	7	Nozzle			Full nozzle	
	8	Design type			Safety	
	9	Conv., Bellows, Pilot op.			Conventional type	
	10	Bonnet Type			Closed	
	11	Bonnet connection			Bolted	
PROCESS CONDITIONS	12	Fluid	State		Air	Vapor
	13	Pressure	Inlet	Max.	23,3 bar(g)	30,5 bar(g)
	14	Temperature	Norm.	Max.	157 °C	-
	15	Design	Press.	Temp.	30,5 bar(g)	175 °C
	16	Ambient Temp.	Min.	Max.	-	-
BASIS AND SELECTION	17	Flow			35 Nm ³ /hr	
	18	Set Pressure			30,5 bar(g)	
	19	Molecular Weight	Oper. Sp. Gr.		-	-
	20	Back Pres. (bar(g))			ATM	
	21	Allowable Overpressure (%)			10%	
	22	Compressibility Factor (Z)			1	
	23	Ratio of Specific Heat (Cp/Cv)			-	
	24	Operating Viscosity (cP)			-	
	25	Barometric Pressure			1,013 bar(a)	
	26	Max. Allowable Relief Pressure			34,5 bar(a)	
	27	Design Code			API 520, 521, 526	
	28	Size Basis			Blocked discharge	
	29	Required discharge Area (sq.mm)			1,95 mm ²	
	30	Selected Area (sq.mm)			70,97 mm ²	
	31	Orifice Designation			D	
	32	Noise level at 1m (from calculation)			113,4 dB	
	CONNECTIONS	33	Blow-down			5-7%
34		Inlet Size	Outlet Size		1"	2"
35		Inlet Connection	Outlet Conn.		RF	RF
36		Inlet Rating	Outlet Rating		600#	150#
MATERIAL	37	Body and Bonnet			SS316	
	38	Seat and Disc			SS316	
	39	Guide and Rings			SS316	
	40	Spring			SS316	
	41	Nozzle			SS316	
	42					
	43					
OPTIONS	44	Tag plate			SS316, Plate with steel wire	
	45	Test gag			Yes, with stamped tag number	
	46	Lever			Packed	
	47	Cap			Screwed	
CERTIFICATES	48	3.1 Material certificate			Yes	
	49	Calibration certificate			Yes	
	50	Leakage test acc to API STD 527			Yes	
	51	Functional test			No	
CALCULATIONS	52	Sizing calculation			Yes	
	53					
	54					
PURCHASE	55	Manufacturer			Broady	
	56	Model			3551D-SN-021A0	
	57					

NOTES :


06	LK	25-6-2024	Issue for Approval	<div>INSTRUMENT AND VALVE DATASHEET</div> <div>Pressure Safety Valve</div> <div></div>	<div>Sheet 3 of 7</div> <div>Based on P&ID Rev.08</div>
05	LK	8-5-2024	Issue for Approval		
04	LK	17-4-2024	Issue for Approval		
03	LK	26-3-2024	Issue for Approval		
02	LK	11-3-2024	Issue for Approval		
01	SK	8-11-2023	Issue for Approval		
Rev	Bv	Date	Description		

GENERAL	1	Tag Number		320PSV-8203	
	2	Service		Pressure Safety Valve	
	3	P&ID No.		N278-VD-6019-PR-PID-0002	
	4	Location		2nd stage discharge	
	5	Line number		DAMPENER KV-020-004	
	6	Area classification		Safe area	
	7	Nozzle		Full nozzle	
	8	Design type		Safety	
	9	Conv., Bellows, Pilot op.		Conventional type	
	10	Bonnet Type		Closed	
	11	Bonnet connection		Bolted	
PROCESS CONDITIONS	12	Fluid	State	Air	Vapor
	13	Pressure	Inlet Max.	30 bar (g)	39 bar(g)
	14	Temperature	Norm. Max.	116°C	-
	15	Design	Press. Temp.	39 bar (g)	135 °C
	16	Ambient Temp.	Min. Max.	-	-
	17	Flow		35 Nm ³ /hr	
BASIS AND SELECTION	18	Set Pressure		39 bar(g)	
	19	Molecular Weight	Oper. Sp. Gr.	-	-
	20	Back Pres. (bar(g))		ATM	
	21	Allowable Overpressure (%)		10%	
	22	Compressibility Factor (Z)		1	
	23	Ratio of Specific Heat (Cp/Cv)		-	
	24	Operating Viscosity (cP)		-	
	25	Barometric Pressure		1,013 bar(a)	
	26	Max. Allowable Relief Pressure		43,9 bar(a)	
	27	Design Code		API 520, 521, 526	
	28	Size Basis		Blocked discharge	
	29	Required discharge Area (sq.mm)		1,47 mm ²	
	30	Selected Area (sq.mm)		70,97 mm ²	
	31	Orifice Designation		D	
CONNECTIONS	32	Noise level at 1m (from calculation)		113,36 dB	
	33	Blow-down		5-7%	
	34	Inlet Size	Outlet Size	1"	2"
	35	Inlet Connection	Outlet Conn.	RF	RF
MATERIAL	36	Inlet Rating	Outlet Rating	600#	150#
	37	Body and Bonnet		SS316	
	38	Seat and Disc		SS316	
	39	Guide and Rings		SS316	
	40	Spring		SS316	
	41	Nozzle		SS316	
OPTIONS	42				
	43				
	44	Tag plate		SS316, Plate with steel wire	
	45	Test gag		Yes, with stamped tag number	
CERTIFICATES	46	Lever		Packed	
	47	Cap		Screwed	
	48	3.1 Material certificate		Yes	
	49	Calibration certificate		Yes	
CALCULATIONS	50	Leakage test acc to API STD 527		Yes	
	51	Functional test		No	
	52	Sizing calculation		Yes	
	53				
PURCHASE	54				
	55	Manufacturer		Broady	
	56	Model		3551D-SN-021A0	
	57				

NOTES :

06	LK	25-6-2024	Issue for Approval	<div>INSTRUMENT AND VALVE DATASHEET</div> <div>Pressure Safety Valve</div> <div></div>	<div>Sheet 6 of 7</div> <div>Based on P&ID Rev.08</div>
05	LK	8-5-2024	Issue for Approval		
04	LK	17-4-2024	Issue for Approval		
03	LK	26-3-2024	Issue for Approval		
02	LK	11-3-2024	Issue for Approval		
01	SK	8-11-2023	Issue for Approval		
Rev	Bv	Date	Description		

GENERAL	1	Tag Number			320PSV-8204	
	2	Service			Pressure Safety Valve	
	3	P&ID No.			N278-VD-6019-PR-PID-0002	
	4	Location			Water system	
	5	Line number			3/4"-CWR-320-26-B24C-N	
	6	Area classification			Safe area	
	7	Nozzle			Full nozzle	
	8	Design type			Safety	
	9	Conv., Bellows, Pilot op.			Conventional type	
	10	Bonnet Type			Closed	
	11	Bonnet connection			Bolted	
PROCESS CONDITIONS	12	Fluid	State		Water	Liquid
	13	Pressure	Inlet	Max.	4,4 bar(g)	
	14	Temperature	Norm.	Max.		46 °C
	15	Design	Press.	Temp.	7 bar(g)	75 °C
	16	Ambient Temp.	Min.	Max.	-	-
	17	Flow			1 Nm ³ /h	
TUBE RUPTURE CASE	18	Fluid	State		Water/Air	Liquid/Gas
	19	Pressure	Temperature		max. 39 bar(g)	135 °C
BASIS AND SELECTION	20	Flow on air side			35 Nm ³ /h	
	21	Set Pressure			7 bar(g)	
	22	Molecular Weight	Oper. Sp. Gr.		-	-
	23	Back Pres. (bar(g))			ATM	
	24	Allowable Overpressure (%)			10%	
	25	Compressibility Factor (Z)			1	
	26	Ratio of Specific Heat (Cp/Cv)			-	
	27	Operating Viscosity (cP)			-	
	28	Barometric Pressure			1,013 bar(a)	
	29	Max. Allowable Relief Pressure			8,7 bar(a)	
	30	Design Code			API 520, 521	
	31	Size Basis			Tube rupture & thermal expansion	
	32	Required discharge Area (sq.mm)			7,4 mm ²	
	33	Selected Area (sq.mm)			25,81 mm ²	
	34	Orifice Designation			N/A	
	35	Noise level at 1m (from calculation)			97,85 dB	
CONNECTIONS	36	Blow-down			10-20%	
	37	Inlet Size	Outlet Size		3/4"	1"
	38	Inlet Connection	Outlet Conn.		NPT	NPT
	39	Inlet Rating	Outlet Rating		6000#	6000#
MATERIAL	40	Body and Bonnet			CS	
	41	Seat and Disc			SS316	
	42	Guide and Rings			SS316	
	43	Spring			SS316	
	44	Nozzle			SS316	
OPTIONS	45					
	46	Tag plate			SS316, Plate with steel wire	
	47	Test gag			Yes, with stamped tag number	
	48	Lever			Packed	
CERTIFICATES	49	Cap			Screwed	
	50	3.1 Material certificate			Yes	
	51	Calibration certificate			Yes	
	52	Leakage test acc to API STD 527			Yes	
CALCULATIONS	53	Functional test			No	
	54	Sizing calculation			Yes	
PURCHASE	55	Manufacturer			Broady	
	56	Model			26002-CN-021A1	
	57					

06	LK	25-6-2024	Issue for Approval	<div>INSTRUMENT AND VALVE DATASHEET</div> <div>Pressure Safety Valve</div> <div></div>	<div>Sheet 7 of 7</div> <div>Based on P&ID Rev.08</div>
05	LK	8-5-2024	Issue for Approval		
04	LK	17-4-2024	Issue for Approval		
03	LK	26-3-2024	Issue for Approval		
02	LK	11-3-2024	Issue for Approval		
01	SK	8-11-2023	Issue for Approval		
Rev	Bv	Date	Description		

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION K-41

DOCUMENTS; PSV SIZING CALCULATIONS



Vendor doc. Number
17735-19

P.O. NO.:
LIDCO-PO-NEC-278-6019

Vendor:
Airpack Nederland B.V.



PSV sizing calculations

Document No. 17735-47

Project No.	Vendor Doc.	P.O. No.	Department	Document Type	Serial No	Revision
N278	VD	6019	IN	CAL	0040	02

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**Airpack B.V. - Air Compressor –
Integrated Methanol and Ammonia Plant
17735-COM PSV sizing calculations (K020)**

Code 1
M.Dalakeh

02	25-06-2024	Issued for Approval	L.K.	J.J.	S.K.
01	08-05-2024	Issued for Approval	L.K.	J.J.	S.K.
REV.	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED

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PSV sizing calculations

Document No. 17735-47

Project No.	Vendor Doc.	P.O. No.	Department	Document Type	Serial No	Revision
N278	VD	6019	IN	CAL	0040	02

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LIST OF REVISED PAGES

Rev. Page	01	02	03	04	05	Rev. Page	01	02	03	04	05	Rev. Page	01	02	03	04	05	Rev. Page	01	02	03	04	05
1	X	X				26						51						76					
2	X	X				27						52						77					
3	X	X				28						53						78					
4	X	X				29						54						79					
5	X	X				30						55						80					
6	X	X				31						56						81					
7	X	X				32						57						82					
8	X					33						58						83					
9	X					34						59						84					
10	X					35						60						85					
11	X					36						61						86					
12	X					37						62						87					
13						38						63						88					
14						39						64						89					
15						40						65						90					
16						41						66						91					
17						42						67						92					
18						43						68						ATTACHMENT					
19						44						69						1					
20						45						70						2					
21						46						71						3					
22						47						72						4					
23						48						73						5					
24						49						74						6					
25						50						75						7					

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Sizing 320PSV-8202 R1	3
Sizing 320PSV-8203 R1	4
Sizing 320PSV-8204 R1	5

API Recommended Practice 520 Part 1, 10th Edition Oct 2020

$$A = \frac{W}{C.Kd.P1.Kb.Kc} \times \sqrt{\frac{T.Z}{M}} \quad \text{Critical Gas Equation}$$

$$A = \frac{17.9 \times W}{F2.Kd.Kc} \times \sqrt{\frac{Z.T}{M.P1(P1 - P2)}} \quad \text{Sub-critical Gas Equation}$$

$$A = \frac{11.78 \times Q}{Kd.Kb.Kc.Kv} \times \sqrt{\frac{G}{P1 - P2}} \quad \text{Liquid Equation}$$

$$A = \frac{190.5 \times W}{P1.Kd.Kb.Kc.Kn.Ksh} \quad \text{Steam Equation}$$

Customer Name:

Virago Valves

Customer Ref:

17735 VV-0301

Broady Ref:

Q-149119

Date

Data Sheet Rev

Sales Engineer

18 June 2024

WM

Tag or Item Number

320PSV-8201

Sizing Case

Blocked Discharge

Safety Valve Type & Code

Conventional

API 520

Fluid Name

Air

Fluid State (Gas or Liquid)

Gas

Set Pressure, P_s

12.500

Barg

Constant Back Pressure, P_c

0.000

Barg

Variable Back Pressure, P_v

0.000

Barg

Total Back Pressure, P_b

0.000

Barg

Over Pressure

10.00

%

Flow rate

35

Nm3/hr

Molecular Weight

28.97

kg/kmol

Ratio of specific heat, C_p/C_v

1.400

Compressibility, z

1.000

Relief Temperature

75.00

C

Design Pressure (Min/Max)

12.50

Barg

Design Temperature (Min/Max)

75.00

C

Critical Flow ?

Yes

Psig/F

181.25

167

Bara

14.763

1.013

Relieving Pressure

1476.30

kPaa

Back Pressure

101.30

kPaa

Pcf =

779.902

kPaa

Gas Constant

0.02703

Co-efficient of Discharge, K_d

0.975

1

Back Pressure Correction Factor, K_b

1.00

Bursting Disc Correction Factor, K_c

1.000

Barg

12.50

Spring Cold Set Pressure

12.50

Barg

Orifice Area Calculation per API 520

0.0063

in²

Or

4.03

mm²

Selected Orifice Area

0.110

in²

API 526 Orifice Designation

D

Maximum Discharge Capacity

664.32

Nm3/hr

SPL per API 521 5.8.10.3 in (dB)

86.5

open discharge

Reaction Force API 520 Pt 2 5.8.2.1 (Kg)

8.3

open discharge

Safety Valve Data Sheet

Inlet Size

1 in

Inlet Finish

ANSI #300

RF

Outlet Size

2 in

Outlet Finish

ANSI #150

RF

Body

Stainless Steel - ASME SA351 CF8M

Bonnet

Stainless Steel - ASME SA351 CF8M

Screwed Cap

Stainless Steel - ASME SA351 CF8M

Nozzle

316SS/316LSS (UNS S31600/UNS S31603)

Disc

316SS/316LSS (UNS S31600/UNS S31603)

Guide Flange

316SS/316LSS (UNS S31600/UNS S31603)

Spindle

316SS/316LSS (UNS S31600/UNS S31603)

Spring

Stainless Steel

Fasteners

SS-ASME SA193 Grd B8M/ SA194 Grd 8M

Accessories

Test Gag

Packed Lever

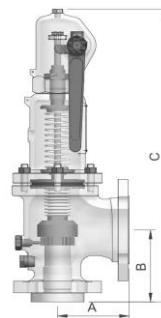
Notes

Valve Series

3500

Model Number

3531D-SN-021A0



Dimensional Information

	mm/kg
A	115
B	104
C	454
Mass	15

Please check with Broady's before using dimensions for pipe work/design

API Recommended Practice 520 Part 1, 10th Edition Oct 2020

$$A = \frac{W}{C.Kd.P1.Kb.Kc} \times \sqrt{\frac{T.Z}{M}} \quad \text{Critical Gas Equation}$$

$$A = \frac{17.9 \times W}{F2.Kd.Kc} \times \sqrt{\frac{Z.T}{M.P1(P1 - P2)}} \quad \text{Sub-critical Gas Equation}$$

$$A = \frac{11.78 \times Q}{Kd.Kb.Kc.Kv} \times \sqrt{\frac{G}{P1 - P2}} \quad \text{Liquid Equation}$$

$$A = \frac{190.5 \times W}{P1.Kd.Kb.Kc.Kn.Ksh} \quad \text{Steam Equation}$$

Customer Name:

Virago Valves

Customer Ref:

17735 VV-0301

Broady Ref:

Q-149119

Date

Data Sheet Rev

Sales Engineer

18 June 2024

WM

Tag or Item Number

320PSV-8202

Sizing Case

Blocked Discharge

Safety Valve Type & Code

Conventional

API 520

Fluid Name

Air

Fluid State (Gas or Liquid)

Gas

Set Pressure, P_s

30.500

Barg

Constant Back Pressure, P_c

0.000

Barg

Variable Back Pressure, P_v

0.000

Barg

Total Back Pressure, P_b

0.000

Barg

Over Pressure

10.00

%

Flow rate

35

Nm3/hr

Molecular Weight

28.97

kg/kmol

Ratio of specific heat, C_p/C_v

1.400

Compressibility, z

1.000

Relief Temperature

175.00

C

Design Pressure (Min/Max)

30.50

Barg

Design Temperature (Min/Max)

175.00

C

Critical Flow ?

Yes

Relieving Pressure

3456.30

kPaa

Back Pressure

101.30

kPaa

Pcf =

1825.900

kPaa

Gas Constant

0.02703

Co-efficient of Discharge, K_d

0.975

1

Back Pressure Correction Factor, K_b

1.00

Bursting Disc Correction Factor, K_c

1.000

Spring Cold Set Pressure

31.11

Barg

Orifice Area Calculation per API 520

0.0030

in²

Or

1.95

mm²

Selected Orifice Area

0.110

in²

API 526 Orifice Designation

D

Maximum Discharge Capacity

1370.83

Nm3/hr

SPL per API 521 5.8.10.3 in (dB)

87.6

open discharge

Reaction Force API 520 Pt 2 5.8.2.1 (Kgff)

19.5

open discharge

Safety Valve Data Sheet

Inlet Size

1 in

Inlet Finish

ANSI #600

RF

Outlet Size

2 in

Outlet Finish

ANSI #150

RF

Body

Stainless Steel - ASME SA351 CF8M

Bonnet

Stainless Steel - ASME SA351 CF8M

Screwed Cap

Stainless Steel - ASME SA351 CF8M

Nozzle

316SS/316LSS (UNS S31600/UNS S31603)

Disc

316SS/316LSS (UNS S31600/UNS S31603)

Guide Flange

316SS/316LSS (UNS S31600/UNS S31603)

Spindle

316SS/316LSS (UNS S31600/UNS S31603)

Spring

Stainless Steel

Fasteners

SS-ASME SA193 Grd B8M/ SA194 Grd 8M

Accessories

Test Gag

Packed Lever

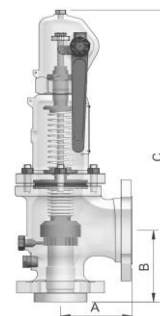
Notes

Valve Series

3500

Model Number

3551D-SN-021A0



Dimensional Information

	mm/kg
A	115
B	104
C	454
Mass	15

Please check with Broady's before using dimensions for pipe work/design

API Recommended Practice 520 Part 1, 10th Edition Oct 2020

$$A = \frac{W}{C.Kd.P1.Kb.Kc} \times \sqrt{\frac{T.Z}{M}} \quad \text{Critical Gas Equation}$$

$$A = \frac{17.9 \times W}{F2.Kd.Kc} \times \sqrt{\frac{Z.T}{M.P1(P1 - P2)}} \quad \text{Sub-critical Gas Equation}$$

$$A = \frac{11.78 \times Q}{Kd.Kb.Kc.Kv} \times \sqrt{\frac{G}{P1 - P2}} \quad \text{Liquid Equation}$$

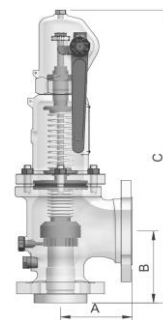
$$A = \frac{190.5 \times W}{P1.Kd.Kb.Kc.Kn.Ksh} \quad \text{Steam Equation}$$

Customer Name:	Virago Valves	
Customer Ref:	17735 VV-0301	
Broady Ref:	Q-149119	
Date	Data Sheet Rev	Sales Engineer
18 June 2024		WM
Tag or Item Number	320PSV-8203	

Sizing Case	Blocked Discharge	
Safety Valve Type & Code	Conventional	API 520
Fluid Name	Air	
Fluid State (Gas or Liquid)	Gas	
Set Pressure, P_s	39.000	Barg
Constant Back Pressure, P_c	0.000	Barg
Variable Back Pressure, P_v	0.000	Barg
Total Back Pressure, P_b	0.000	Barg
Over Pressure	10.00	%
Flow rate	35	Nm ³ /hr
Molecular Weight	28.97	kg/kmol
Ratio of specific heat, C_p/C_v	1.400	
Compressibility, z	1.000	
Relief Temperature	135.00	C
Design Pressure (Min/Max)		39.00 Barg
Design Temperature (Min/Max)		135.00 C
Critical Flow ?	Yes	
Relieving Pressure	4391.30	kPaa
Back Pressure	101.30	kPaa
Pcf =	2319.844	kPaa
Gas Constant	0.02703	
Co-efficient of Discharge, K_d	0.975	
Back Pressure Correction Factor, K_b	1.00	
Bursting Disc Correction Factor, K_c	1.000	
Spring Cold Set Pressure	39.78	Barg
Orifice Area Calculation per API 520	0.0023	in ²
Or	1.47	mm ²
Selected Orifice Area	0.110	in ²
API 526 Orifice Designation	D	
Maximum Discharge Capacity	1825.01	Nm ³ /hr
SPL per API 521 5.8.10.3 in (dB)	87.2	open discharge
Reaction Force API 520 Pt 2 5.8.2.1 (Kgf)	24.8	open discharge

Safety Valve Data Sheet

Inlet Size	1	in
Inlet Finish	ANSI #600	RF
Outlet Size	2	in
Outlet Finish	ANSI #150	RF
Body	Stainless Steel - ASME SA351 CF8M	
Bonnet	Stainless Steel - ASME SA351 CF8M	
Screwed Cap	Stainless Steel - ASME SA351 CF8M	
Nozzle	316SS/316LSS (UNS S31600/UNS S31603)	
Disc	316SS/316LSS (UNS S31600/UNS S31603)	
Guide Flange	316SS/316LSS (UNS S31600/UNS S31603)	
Spindle	316SS/316LSS (UNS S31600/UNS S31603)	
Spring	Stainless Steel	
Fasteners	SS-ASME SA193 Grd B8M/ SA194 Grd 8M	
Accessories	Test Gag	
	Packed Lever	
Notes		
Valve Series	3500	
Model Number	3551D-SN-021A0	



Dimensional Information

	mm/kg
A	115
B	104
C	454
Mass	15

Please check with Broady's before using dimensions for pipe work/design

API Recommended Practice 520 Part 1, 10th Edition Oct 2020

$$A = \frac{W}{C.Kd.P1.Kb.Kc} \times \sqrt{\frac{T.Z}{M}} \quad \text{Critical Gas Equation}$$

$$A = \frac{17.9 \times W}{F2.Kd.Kc} \times \sqrt{\frac{Z.T}{M.P1(P1 - P2)}} \quad \text{Sub-critical Gas Equation}$$

$$A = \frac{11.78 \times Q}{Kd.Kb.Kc.Kv} \times \sqrt{\frac{G}{P1 - P2}} \quad \text{Liquid Equation}$$

$$A = \frac{190.5 \times W}{P1.Kd.Kb.Kc.Kn.Ksh} \quad \text{Steam Equation}$$

Customer Name:

Virago Valves

Customer Ref:

17735 VV-0301

Broady Ref:

Q-149119

Date

Data Sheet Rev

Sales Engineer

18 June 2024

WM

Tag or Item Number

320PSV-8204

Sizing Case

Tube rupture

Safety Valve Type & Code

Conventional

API 520

Fluid Name

Air

Fluid State (Gas or Liquid)

Gas

Set Pressure, P_s

7.000

Barg

Constant Back Pressure, P_c

0.000

Barg

Variable Back Pressure, P_v

0.000

Barg

Total Back Pressure, P_b

0.000

Barg

Over Pressure

10.00

%

Flow rate

35

Nm3/hr

Molecular Weight

28.97

kg/kmol

Ratio of specific heat, C_p/C_v

1.400

Compressibility, z

1.000

Relief Temperature

135.00

C

Design Pressure (Min/Max)

7.00

Barg

Design Temperature (Min/Max)

75.00

C

Critical Flow ?

Yes

Relieving Pressure

871.30

kPaa

Back Pressure

101.30

kPaa

Pcf =

460.292

kPaa

Gas Constant

0.02703

Co-efficient of Discharge, K_d

0.975

1

Back Pressure Correction Factor, K_b

1.00

Bursting Disc Correction Factor, K_c

1.000

Spring Cold Set Pressure

7.14

Barg

Orifice Area Calculation per API 520

0.0115

Or

7.40

in²

Selected Orifice Area

0.040

in²

NA

Maximum Discharge Capacity

122.09

Nm3/hr

SPL per API 521 5.8.10.3 in (dB)

86.8

open discharge

Reaction Force API 520 Pt 2 5.8.2.1 (Kg)

1.7

open discharge

Safety Valve Data Sheet

Inlet Size

0.75

in

Inlet Finish

NPT

(M)

Outlet Size

1

in

Outlet Finish

NPT

(F)

Body

Carbon Steel - ASME SA216 WCB

Bonnet

N/A

Screwed Cap

316SS/316LSS (UNS S31600/UNS S31603)

Nozzle

316SS/316LSS (UNS S31600/UNS S31603)

Disc

316SS/316LSS (UNS S31600/UNS S31603)

Guide Flange

N/A

Spindle

316SS/316LSS (UNS S31600/UNS S31603)

Spring

Stainless Steel

Fasteners

N/A

Accessories

Test Gag

Broady Standard Paint

Packed Lever

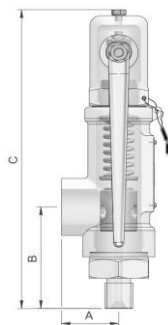
Notes

Valve Series

2600

Model Number

26002-CN-021A1



Dimensional Information

	mm/kg
A	81
B	97
C	231
Mass	6

Please check with Broady's before using dimensions for pipe work/design

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION K-42




DOCUMENTS; CONTROL VALVE DATA SHEET



Vendor doc. Number
17735-19

P.O. NO.:
LIDCO-PO-NEC-278-6019

Vendor:
Airpack Nederland B.V.




	<p align="center">LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT</p>							
	<p align="center">Valve and Strainer Data Sheets</p>							
	<p>Document No. 17735-48</p>							Page
	Project No.	Vendor Doc.	P.O. No.	Department	Document Type	Serial No	Revision	Page 1 of 18
	N278	VD	6019	PI	DS	0041	08	

**Airpack B.V. - Air Compressor –
Integrated Methanol and Ammonia Plant
17735-COM Valve and Strainer Data Sheets (K020)**

Code 1
M.Dalakeh

08	16-09-2024	Issued for Approval	L.K.	S.K.	J.J.
07	05-09-2024	Issued for Approval	L.K.	S.K.	J.J.
06	01-08-2024	Issued for Approval	A.Z.	S.K.	J.J.
05	08-07-2024	Issued for Approval	L.K.	S.K.	J.J.
04	23-05-2024	Issued for Approval	L.K.	S.K.	J.J.
03	17-04-2024	Issued for Approval	L.K.	S.K.	J.J.
02	11-03-2024	Issued for Approval	L.K.	S.K.	J.J.
01	09-11-2023	Issued for Approval	T.T.	S.K.	J.J.
REV.	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED



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	<p align="center">LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT</p>																			
	<p align="center">Valve and Strainer Data Sheets</p>																			
	<p>Document No. 17735-48</p> <table border="1"> <tr> <th>Project No.</th> <th>Vendor Doc.</th> <th>P.O. No.</th> <th>Department</th> <th>Document Type</th> <th>Serial No</th> <th>Revision</th> </tr> <tr> <td>N278</td> <td>VD</td> <td>6019</td> <td>PI</td> <td>DS</td> <td>0041</td> <td>08</td> </tr> </table>							Project No.	Vendor Doc.	P.O. No.	Department	Document Type	Serial No	Revision	N278	VD	6019	PI	DS	0041
Project No.	Vendor Doc.	P.O. No.	Department	Document Type	Serial No	Revision														
N278	VD	6019	PI	DS	0041	08														
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2	X	X	X	X	X	X	X	X			52						77					
3	X	X	X	X	X	X	X	X			53						78					
4	X	X	X	X	X	X	X	X			54						79					
5	X	X	X	X	X	X	X	X			55						80					
6	X	X	X	X	X	X	X	X			56						81					
7	X	X	X	X	X	X	X	X			57						82					
8	X	X	X	X	X	X	X	X			58						83					
9	X	X	X	X	X	X	X	X			59						84					
10	X	X	X	X	X	X	X	X			60						85					
11	X	X	X	X	X	X	X	X			61						86					
12						X	X	X			62						87					
13						X	X	X			63						88					
14						X	X	X			64						89					
15						X	X	X			65						90					
16						X	X	X			66						91					
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20											70						2					
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25											75						7					

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3	Hand Ball Valve	320V-8203	6
4	Hand Ball Valve	320V-8204	7
5	Hand Ball Valve	No tag, 4 pcs	8
6	Hand Ball Valve	No tag, 3 pcs	9
7	Hand Ball Valve	No tag, 1 pc	10
8	Hand Ball Valve	No tag, 4 pcs	11
9	Hand Ball Valve	No tag, 1 pc	12
10	Hand Ball Valve	No tag, 1 pc	13
11	Hand Gate Valve	No tag, 2pcs	14
12	Check Valve	320CV-8201	15
13	Y-Strainer	320ST-8201	16
14	Y-Strainer	320ST-8202	17
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Notes:					
08	LK	16-9-2024	For Approval	VALVE AND STRAINER DATASHEET Index	<div><div>شركت توسعه صنعت لایان Lavan Industry Development Company</div><div></div></div>
07	LK	5-9-2024	For Approval		
06	AZ	1-8-2024	For Approval		
05	LK	8-7-2024	For Approval		Sheet3 of 17
04	LK	23-5-2024	For Approval		
03	LK	17-4-2024	For Approval		
Rev	By	Date	Description	Based on P&ID	Rev.08



GENERAL	1	Tag Number		320V-8201	
	2	Service		Hand Ball valve	
	3	P&ID No.		N278-VD-6019-PR-PID-0002	
	4	Location		Compressor Air Inlet	
	5	Line number		1"-IA-320-01-D42-N	
	6	Area classification		Safe area	
PROCESS CONDITIONS	7				
	8	Fluid	State	Air	Dry Gas
	9	Pressure	Norm. Max.	9,5 bar(g)	
	10	Temperature	Norm. Max.	46 °C	
	11	Design	Press. Temp.	12,5 bar(g)	75 °C
	12	Ambient Temp.	Min. Max.	0 °C	49 °C
	13	Oper. Flow		35 Nm³/hr	
	14				
BODY	15				
	16	Body Type		Ball valve, wafer type	
	17	Body Size	Bore	1"	Full bore
	18	Guiding	No. Of Ports	-	2
	19	Conn. Type	End Conn. Rat.	RF	300#
	20	Body Material		SS316	
	21	Packing Material		PTFE	
	22	Bonnet Type		Screwed	
	23	Trim	Form	Floating ball	
	24		Seat Mat.	PTFE	
	25		Ball Mat. Shaft Mat.	SS 316	SS316
	26	Actuation	Material	Lever handle	SS316
	27	Threaded connections if applicable		Metric	
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				
	36				
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42					
43					
OPTIONS	44			Fire safe design (acc. API 607)	
	45				
	46				
CERTIFICATES	47	3.1 Material certificate		Yes	
	48	Hydrotest certificate		Yes	
	49				
	50				
	51				
PURCHASE	52	Manufacturer		Alfa valve	
	53	Model		A10N	
	54				
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	56				
	57				

NOTES :

08	LK	16-9-2024	For Approval	<div>VALVE AND STRAINER DATASHEET</div> <div>Hand Ball Valve</div> <div></div>	<div><div>شرکت توسعه صنایع لایان</div><div></div></div>
07	LK	5-9-2024	For Approval		
06	AZ	1-8-2024	For Approval		
05	LK	8-7-2024	For Approval		
04	LK	23-5-2024	For Approval		
03	LK	17-4-2024	For Approval		
Rev	By	Date	Description	Sheet	4 of 17
				Based on P&ID	Rev.08



GENERAL	1	Tag Number		320V-8202	
	2	Service		Hand Ball valve	
	3	P&ID No.		N278-VD-6019-PR-PID-0002	
	4	Location		Compressor Air Outlet	
	5	Line number		3/4"-IA-320-10-D42-N	
	6	Area classification		Safe area	
PROCESS CONDITIONS	7				
	8	Fluid	State	Air	Dry Gas
	9	Pressure	Norm. Max.	30 bar(g)	
	10	Temperature	Norm. Max.		60 °C
	11	Design	Press. Temp.	39 bar(g)	75 °C
	12	Ambient Temp.	Min. Max.	0 °C	49 °C
BODY	13	Oper. Flow		35 Nm³/hr	
	14				
	15				
	16	Body Type		Ball valve, wafer type	
	17	Body Size	Bore	3/4"	Full bore
	18	Guiding	No. Of Ports	-	2
	19	Conn. Type	End Conn. Rat.	RF	600#
	20	Body Material		SS316	
	21	Packing Material		PTFE	
	22	Bonnet Type		Screwed	
	23	Trim	Form	Floating ball	
	24		Seat Mat.	PTFE	
	25		Ball Mat. Shaft Mat.	SS316	SS316
	26	Actuation	Material	Lever handle	SS316
	27	Threaded connections if applicable		Metric	
	28				
	29				
	30				
	31				
	32				
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	41				
	42				
	43				
OPTIONS	44			Fire safe design (acc. API 607)	
	45				
	46				
CERTIFICATES	47	3.1 Material certificate		Yes	
	48	Hydrotest certificate		Yes	
	49				
	50				
	51				
PURCHASE	52	Manufacturer		Alfa Valve	
	53	Model		A10HP	
	54				
	55				
	56				
	57				

NOTES :

08	LK	16-9-2024	For Approval	<div>VALVE AND STRAINER DATASHEET</div> <div>Hand Ball Valve</div> <div></div>	<div><div>شرکت توسعه صنعتی لایان</div><div>Lavan Industry Development Company</div><div></div></div>
07	LK	5-9-2024	For Approval		
06	AZ	1-8-2024	For Approval		
05	LK	8-7-2024	For Approval		
04	LK	23-5-2024	For Approval		
03	LK	17-4-2024	For Approval		
Rev	By	Date	Description		<div>Sheet 5 of 17</div> <div>Based on P&ID Rev.08</div>



GENERAL	1	Tag Number			320V-8203	
	2	Service			Hand Ball valve	
	3	P&ID No.			N278-VD-6019-PR-PID-0002	
	4	Location			Cooling Water Inlet	
	5	Line number			3/4"-CWS-320-20-B24C-N	
	6	Area classification			Safe area	
	7					
PROCESS CONDITIONS	8	Fluid	State	Cooling Water	Liquid	
	9	Pressure	Norm. Max.	4,5 bar(g)		
	10	Temperature	Norm. Max.	36 °C		
	11	Design	Press. Temp.	7 bar(g)	75 °C	
	12	Ambient Temp.	Min. Max.	0 °C	49 °C	
	13	Oper. Flow			1 m³/hr	
	14					
BODY	15					
	16	Body Type			Ball valve, wafer type	
	17	Body Size	Bore	3/4"	Full bore	
	18	Guiding	No. Of Ports	-	2	
	19	Conn. Type	End Conn. Rat.	RF	150#	
	20	Body Material			Carbon steel ASTM A 216 Gr. WCB / A105	
	21	Packing Material			PTFE	
	22	Bonnet Type			Screwed	
	23	Trim	Form		Floating ball	
	24		Seat Mat.		PTFE	
	25		Ball Mat.	Shaft Mat.	SS 316	SS316
	26	Actuation	Material	Lever handle	CS	
	27	Threaded connections if applicable			Metric	
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					
	36					
	37					
	38					
	39					
	40					
	41					
	42					
	43					
OPTIONS	44				Fire safe design (acc. API 607)	
	45					
	46					
CERTIFICATES	47	3.1 Material certificate			Yes	
	48	Hydrotest certificate			Yes	
	49					
	50					
	51					
PURCHASE	52	Manufacturer			Alfa Valve	
	53	Model			A10NF	
	54					
	55					
	56					
	57					

NOTES :

08	LK	16-9-2024	For Approval	<div>VALVE AND STRAINER DATASHEET</div> <div>Hand Ball Valve</div> <div></div>	<div><div>شرکت توسعه صنعت لایان Lavan Industry Development Company</div><div></div></div>	<div>Sheet6 of 17</div> <div>Based on P&IDRev.08</div>
07	LK	5-9-2024	For Approval			
06	AZ	1-8-2024	For Approval			
05	LK	8-7-2024	For Approval			
04	LK	23-5-2024	For Approval			
03	LK	17-4-2024	For Approval			
Rev	By	Date	Description			



GENERAL	1	Tag Number			320V-8204	
	2	Service			Hand Ball valve	
	3	P&ID No.			N278-VD-6019-PR-PID-0002	
	4	Location			Cooling Water Outlet	
	5	Line number			3/4"-CWR-320-26-B24C-N	
	6	Area classification			Safe area	
	7					
PROCESS CONDITIONS	8	Fluid	State	Cooling Water	Liquid	
	9	Pressure	Norm. Max.	4,4 bar(g)		
	10	Temperature	Norm. Max.		46 °C	
	11	Design	Press. Temp.	7 bar(g)	75 °C	
	12	Ambient Temp.	Min. Max.	0 °C	49 °C	
	13	Oper. Flow			1 Nm³/hr	
	14					
BODY	15					
	16	Body Type			Ball valve, wafer type	
	17	Body Size	Bore	3/4"	Full bore	
	18	Guiding	No. Of Ports	-	2	
	19	Conn. Type	End Conn. Rat.	RF	150#	
	20	Body Material			Carbon steel ASTM A 216 Gr. WCB / A105	
	21	Packing Material			PTFE	
	22	Bonnet Type			Screwed	
	23	Trim	Form		Floating ball	
	24		Seat Mat.		PTFE	
	25		Ball Mat.	Shaft Mat.	SS 316	SS316
	26	Actuation	Material	Lever handle	CS	
	27	Threaded connections if applicable			Metric	
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					
	36					
	37					
	38					
	39					
	40					
	41					
	42					
	43					
OPTIONS	44				Fire safe design (acc. API 607)	
	45					
	46					
CERTIFICATES	47	3.1 Material certificate			Yes	
	48	Hydrotest certificate			Yes	
	49					
	50					
	51					
PURCHASE	52	Manufacturer			Alfa Valve	
	53	Model			A10NF	
	54					
	55					
	56					
	57					

NOTES :

08	LK	16-9-2024	For Approval	<div>VALVE AND STRAINER DATASHEET</div> <div>Hand Ball Valve</div> <div></div>	<div><div>شرکت نویسنه کسب لواحات Lavan Industry Development Company</div><div></div></div>	Sheet 7 of 17
07	LK	5-9-2024	For Approval			
06	AZ	1-8-2024	For Approval			
05	LK	8-7-2024	For Approval			
04	LK	23-5-2024	For Approval			
03	LK	17-4-2024	For Approval			
Rev	By	Date	Description	Based on P&ID Rev.08		



GENERAL	1	Tag Number		No tag, 4 pcs	
	2	Service		Hand Ball valve	
	3	P&ID No.		N278-VD-6019-PR-PID-0002	
	4	Location		Compressed air PGs/PTs	
	5	Line number		PG, PT block valves	
	6	Area classification		Safe area	
PROCESS CONDITIONS	7				
	8	Fluid	State	Air	Gas
	9	Pressure	Norm. Max.	30 bar(g)	
	10	Temperature	Norm. Max.	60 °C	
	11	Design	Press. Temp.	39 bar(g)	157 °C
	12	Ambient Temp.	Min. Max.	0 °C	49 °C
	13	Oper. Flow		-	
BODY	14				
	15				
	16	Body Type		Ball valve	
	17	Body Size	Bore	3/4"	Full bore
	18	Guiding	No. Of Ports	-	2
	19	Conn. Type	End Conn. Rat.	NPT-F	300#
	20	Body Material		SS 316	
	21	Packing Material		PTFE	
	22	Bonnet Type		Screwed	
	23	Trim	Form	Floating ball	
	24		Seat Mat.	PTFE	
	25		Ball Mat. Shaft Mat.	SS 316	SS316
	26	Actuation	Material	Lever handle	CS
	27	Threaded connections if applicable		Metric	
	28				
	29				
	30				
	31				
	32				
	33				
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	35				
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40					
41					
42					
43					
OPTIONS	44			Fire safe design (acc. API 607)	
	45				
	46				
CERTIFICATES	47	3.1 Material certificate		Yes	
	48	Hydrotest certificate		Yes	
	49				
	50				
	51				
PURCHASE	52	Manufacturer		Alfa Valve	
	53	Model		K20T	
	54				
	55				
	56				
	57				

NOTES :

08	LK	16-9-2024	For Approval	<div>VALVE AND STRAINER DATASHEET</div> <div>Hand Ball Valve</div> <div></div>	<div><div>شرکت نوسعه کامپوت لاوان Lavan Industry Development Company</div><div></div></div>	Sheet 8 of 17 Based on P&ID Rev.08
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06	AZ	1-8-2024	For Approval			
05	LK	8-7-2024	For Approval			
04	LK	23-5-2024	For Approval			
03	LK	17-4-2024	For Approval			
Rev	By	Date	Description			



GENERAL	1	Tag Number		No tag, 3 pcs	
	2	Service		Hand Ball valve	
	3	P&ID No.		N278-VD-6019-PR-PID-0002	
	4	Location		2xCompressed Air, 1x Oil system	
	5	Line number		PG, PT block valves	
	6	Area classification		Safe area	
	7				
PROCESS CONDITIONS	8	Fluid	State	Air/Oil	Gas/Liquid
	9	Pressure	Norm. Max.		2 bar(g)
	10	Temperature	Norm. Max.	46°C	75°C
	11	Design	Press. Temp.	12,5 bar(g)	85 °C
	12	Ambient Temp.	Min. Max.	0 °C	49 °C
	13	Oper. Flow		-	
	14				
BODY	16	Body Type		Ball valve	
	17	Body Size	Bore	3/4"	Full bore
	18	Guiding	No. Of Ports	-	2
	19	Conn. Type	End Conn. Rat.	NPT-F	300#
	20	Body Material		SS 316	
	21	Packing Material		PTFE	
	22	Bonnet Type		Screwed	
	23	Trim	Form	Floating ball	
	24		Seat Mat.	PTFE	
	25		Ball Mat. Shaft Mat.	SS 316	SS316
	26	Actuation	Material	Lever handle	CS
	27	Threaded connections if applicable		Metric	
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				
	36				
	37				
	38				
	39				
	40				
	41				
	42				
	43				
OPTIONS	44			Fire safe design (acc. API 607)	
	45				
	46				
CERTIFICATES	47	3.1 Material certificate		Yes	
	48	Hydrotest certificate		Yes	
	49				
	50				
	51				
PURCHASE	52	Manufacturer		Alfa Valve	
	53	Model		K20T	
	54				
	55				
	56				
	57				

NOTES :

08	LK	16-9-2024	For Approval	<div>VALVE AND STRAINER DATASHEET</div> <div>Hand Ball Valve</div> <div></div>	<div><div><div>شرکت توسعه صنایع لوان</div><div>Lavan Industry Development Company</div></div><div></div></div>	Sheet 9 of 17
07	LK	5-9-2024	For Approval			
06	AZ	1-8-2024	For Approval			
05	LK	8-7-2024	For Approval			
04	LK	23-5-2024	For Approval			
03	LK	17-4-2024	For Approval			
Rev	Bv	Date	Description	Based on P&ID Rev.08		



GENERAL	1	Tag Number		No tag, 1 pc	
	2	Service		Hand Ball valve	
	3	P&ID No.		N278-VD-6019-PR-PID-0002	
	4	Location		Cooling water system	
	5	Line number		PG-8204	
	6	Area classification		Safe area	
	7				
PROCESS CONDITIONS	8	Fluid	State	Water	Liquid
	9	Pressure	Norm. Max.	4,5 bar(g)	
	10	Temperature	Norm. Max.	36 °C	
	11	Design	Press. Temp.	7 bar(g)	75 °C
	12	Ambient Temp.	Min. Max.	0 °C	49 °C
	13	Oper. Flow		-	
	14				
BODY	15				
	16	Body Type		Ball valve	
	17	Body Size	Bore	3/4"	Full bore
	18	Guiding	No. Of Ports	-	2
	19	Conn. Type	End Conn. Rat.	NPT-F	150#
	20	Body Material		Carbon steel	
	21	Packing Material		PTFE	
	22	Bonnet Type		Screwed	
	23	Trim	Form	Floating ball	
	24		Seat Mat.	PTFE	
	25		Ball Mat. Shaft Mat.	SS 316	SS316
	26	Actuation	Material	Lever handle	CS
	27	Threaded connections if applicable		Metric	
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				
	36				
	37				
	38				
	39				
	40				
	41				
	42				
	43				
OPTIONS	44			Fire safe design (acc. API 607)	
	45				
	46				
CERTIFICATES	47	3.1 Material certificate		Yes	
	48	Hydrotest certificate		Yes	
	49				
	50				
	51				
PURCHASE	52	Manufacturer		Alfa Valve	
	53	Model		K20T	
	54				
	55				
	56				
	57				

NOTES :

08	LK	16-9-2024	For Approval	VALVE AND STRAINER DATASHEET Hand Ball Valve 		Sheet 10 of 17 Based on P&ID Rev.08
07	LK	5-9-2024	For Approval			
06	AZ	1-8-2024	For Approval			
05	LK	8-7-2024	For Approval			
04	LK	23-5-2024	For Approval			
03	LK	17-4-2024	For Approval			
Rev	Bv	Date	Description			



GENERAL	1	Tag Number		No tag, 4 pcs	
	2	Service		Hand Ball valve	
	3	P&ID No.		N278-VD-6019-PR-PID-0002	
	4	Location		Dampener drain	
	5	Line number		Dampener KV-020-001...004	
	6	Area classification		Safe area	
PROCESS CONDITIONS	7				
	8	Fluid	State	Air	Gas
	9	Pressure	Norm. Max.	23,3 bar(g)	
	10	Temperature	Norm. Max.	157°C	
	11	Design	Press. Temp.	39 bar(g)	175 °C
	12	Ambient Temp.	Min. Max.	0 °C	49 °C
	13	Oper. Flow		-	
	14				
BODY	15				
	16	Body Type		Ball valve	
	17	Body Size	Bore	1/2"	Full bore
	18	Guiding	No. Of Ports	-	2
	19	Conn. Type	End Conn. Rat.	NPT-F	#6000
	20	Body Material		SS316	
	21	Packing Material		PTFE	
	22	Bonnet Type		Screwed	
	23	Trim	Form	Floating ball	
	24		Seat Mat.	PTFE	
	25		Ball Mat. Shaft Mat.	SS 316	SS316
	26	Actuation	Material	Lever handle	CS
	27	Threaded connections if applicable		Metric	
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				
	36				
	37				
	38				
	39				
	40				
	41				
42					
43					
OPTIONS	44			Fire safe design (acc. API 607)	
	45				
	46				
CERTIFICATES	47	3.1 Material certificate		Yes	
	48	Hydrotest certificate		Yes	
	49				
	50				
	51				
PURCHASE	52	Manufacturer		Alfa Valve	
	53	Model		K20T	
	54				
	55				
	56				
	57				

NOTES :

08	LK	16-9-2024	For Approval	<div>VALVE AND STRAINER DATASHEET</div> <div>Hand Ball Valve</div> <div></div>	<div><div>شرکت نوسین کانتینر لایان Lavan Industry Development Company</div><div></div></div>	<div>Sheet 11 of 17</div> <div>Based on P&ID Rev.08</div>
07	LK	5-9-2024	For Approval			
06	AZ	1-8-2024	For Approval			
05	LK	8-7-2024	For Approval			
04	LK	23-5-2024	For Approval			
03	LK	17-4-2024	For Approval			
Rev	By	Date	Description			



GENERAL	1	Tag Number		No tag, 1 pc	
	2	Service		Hand Ball valve	
	3	P&ID No.		N278-VD-6019-PR-PID-0002	
	4	Location		Cooling water inlet	
	5	Line number		3/4"-CWS-320-20-B24C-N	
	6	Area classification		Safe area	
PROCESS CONDITIONS	7				
	8	Fluid	State	Water	Liquid
	9	Pressure	Norm. Max.	4,5 bar(g)	
	10	Temperature	Norm. Max.	36 °C	
	11	Design	Press. Temp.	7 bar(g)	75 °C
	12	Ambient Temp.	Min. Max.	0 °C	49 °C
	13	Oper. Flow		-	
	14				
BODY	15				
	16	Body Type		Ball valve	
	17	Body Size	Bore	1/2"	Full bore
	18	Guiding	No. Of Ports	-	2
	19	Conn. Type	End Conn. Rat.	NPT-F	150#
	20	Body Material		Carbon steel	
	21	Packing Material		PTFE	
	22	Bonnet Type		Screwed	
	23	Trim	Form	Floating ball	
	24		Seat Mat.	PTFE	
	25		Ball Mat. Shaft Mat.	SS 316	SS316
	26	Actuation	Material	Lever handle	CS
	27	Threaded connections if applicable		Metric	
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				
	36				
	37				
	38				
	39				
	40				
	41				
42					
43					
OPTIONS	44			Fire safe design (acc. API 607)	
	45				
	46				
CERTIFICATES	47	3.1 Material certificate		Yes	
	48	Hydrotest certificate		Yes	
	49				
	50				
	51				
PURCHASE	52	Manufacturer		Alfa Valve	
	53	Model		K20T	
	54				
	55				
	56				
	57				

NOTES :

08	LK	16-9-2024	For Approval	<div>VALVE AND STRAINER DATASHEET</div> <div>Hand Ball Valve</div> <div></div>	<div><div>شرکت نوسین کلیات لاوان Lavan Industry Development Company</div><div></div></div>	<div>Sheet 12 of 17</div> <div>Based on P&ID Rev.08</div>
07	LK	5-9-2024	For Approval			
06	AZ	1-8-2024	For Approval			
05	LK	8-7-2024	For Approval			
04	LK	23-5-2024	For Approval			
03	LK	17-4-2024	For Approval			
Rev	By	Date	Description			



GENERAL	1	Tag Number		No tag, 1 pc	
	2	Service		Hand Ball valve	
	3	P&ID No.		N278-VD-6019-PR-PID-0002	
	4	Location		Cooling water outlet	
	5	Line number		3/4"-CWS-320-20-B24C-N	
	6	Area classification		Safe area	
	7				
PROCESS CONDITIONS	8	Fluid	State	Water	Liquid
	9	Pressure	Norm. Max.	4,5 bar(g)	
	10	Temperature	Norm. Max.		46°C
	11	Design	Press. Temp.	7 bar(g)	75 °C
	12	Ambient Temp.	Min. Max.	0 °C	49 °C
	13	Oper. Flow		-	
	14				
BODY	15				
	16	Body Type		Ball valve	
	17	Body Size	Bore	1/4"	Full bore
	18	Guiding	No. Of Ports	-	2
	19	Conn. Type	End Conn. Rat.	NPT-F	150#
	20	Body Material		Carbon steel	
	21	Packing Material		PTFE	
	22	Bonnet Type		Screwed	
	23	Trim	Form	Floating ball	
	24		Seat Mat.	PTFE	
	25		Ball Mat. Shaft Mat.	SS 316	SS316
	26	Actuation	Material	Lever handle	CS
	27	Threaded connections if applicable		Metric	
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				
	36				
	37				
	38				
	39				
	40				
	41				
	42				
	43				
OPTIONS	44			Fire safe design (acc. API 607)	
	45				
	46				
CERTIFICATES	47	3.1 Material certificate		Yes	
	48	Hydrotest certificate		Yes	
	49				
	50				
	51				
PURCHASE	52	Manufacturer		Alfa Valve	
	53	Model		K20T	
	54				
	55				
	56				
	57				

NOTES :

08	LK	16-9-2024	For Approval	<div>VALVE AND STRAINER DATASHEET</div> <div>Hand Ball Valve</div> <div></div>	<div><div>شرکت توسعه صنعت لوان Lavan Industry Development Company</div><div></div></div>	<div>Sheet 13 of 17</div> <div>Based on P&ID Rev.08</div>
07	LK	5-9-2024	For Approval			
06	AZ	1-8-2024	For Approval			
05	LK	8-7-2024	For Approval			
04	LK	23-5-2024	For Approval			
03	LK	17-4-2024	For Approval			
Rev	By	Date	Description			



GENERAL	1	Tag Number			No tag, 2pcs	
	2	Service			Gate valve	
	3	P&ID No.			N278-VD-6019-PR-PID-0002	
	4	Location			Cooling water sight glasses	
	5					
	6					
	7					
PROCESS CONDITIONS	8	Fluid	State		Water	Liquid
	9	Pressure	Norm.	Max.	4,4 bar(g)	
	10	Temperature	Norm.	Max.		46 °C
	11	Design	Press.	Temp.	7 bar(g)	75 °C
	12	Ambient Temp.	Min.	Max.	0 °C	49 °C
	13	Oper. Flow			1 Nm³/h	
	14					
BODY	15	Body Type			Gate valve type	
	16	Body Size			3/4"	
	17	Guiding	No. Of Ports		-	2
	18	Conn. Type	End Conn. Rat.		RF	150#
	19	Body Material			Carbon steel	
	20	Packing Material			PTFE	
	21	Bonnet Type			Screwed	
	22	Trim	Form		Solid wedge	
	23		Seat Mat.		A479 410/ST.6	
	24		Disc Mat.	Shaft Mat.	ASTM A182	ASTM A479 410
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					
	36					
	37					
	38					
39						
40						
41						
42						
43						
OPTIONS	44				Fire safe design (acc. API 607)	
	45					
	46					
CERTIFICATES	47	3.1 Material certificate			Yes	
	48	Hydrotest certificate			Yes	
	49					
	50					
	51					
PURCHASE	52	Manufacturer			Alfa Valve	
	53	Model			BFE	
	54					
	55					
	56					
	57					

NOTES :



08	LK	16-9-2024	For Approval	<div>VALVE AND STRAINER DATASHEET</div> <div>Hand Gate Valve</div> <div></div>	<div><div>شرکت توسعه صنایع لافان</div><div></div><div>Lavan Industry Development Company</div></div>	<div>Sheet 14 of 17</div> <div>Based on P&ID Rev.08</div>
07	LK	5-9-2024	For Approval			
06	AZ	1-8-2024	For Approval			
05	LK	8-7-2024	For Approval			
04	LK	23-5-2024	For Approval			
03	LK	17-4-2024	For Approval			
Rev	By	Date	Description			

GENERAL	1	Tag Number			320CV-8201	
	2	Service			Check Valve	
	3	P&ID No.			N278-VD-6019-PR-PID-0002	
	4	Location			Compressor Air Outlet	
	5	Line number			3/4"-IA-320-09-D42-N	
	6	Area classification			Safe area	
	7					
	8					
PROCESS CONDITIONS	9	Fluid	State		Air	Dry Gas
	10	Pressure	Norm.	Max.	30 bar(g)	
	11	Temperature	Norm.	Max.		60 °C
	12	Design	Press.	Temp.	39 bar(g)	75 °C
	13	Ambient Temp.	Min.	Max.	0 °C	49 °C
	14	Oper. Flow			35 Nm³/hr	
	15					
	16					
	17					
	18					
BODY	20	Type Of Body			Wafer type	
	21	Type Of valve			Plate type	
	21	Body Size			DN 20 (Process line = 3/4" ANSI 300# RF)	
	22	Body Material			SS316	
	23	Cracking Pressure			0,2 bar	
	24	Inlet Connection	Outlet Conn.		RF	RF
	25	Inlet Rating	Outlet Rating		600#	600#
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					
	36					
	37					
	38					
39						
40						
OPTIONS	41					
	42					
	43					
	44					
	45					
CERTIFICATES	46	3.1 Material certificate			Yes	
	47					
	48					
	49					
	50					
	51					
PURCHASE	52	Manufacturer			Hoerbiger	
	53	Model			RVB 19R	
	54					
	55					
	56					

NOTES :



08	LK	16-9-2024	For Approval	<div>VALVE AND STRAINER DATASHEET</div> <div>Check Valve</div> <div></div>	<div><div>شركة نوبعة صناعات للوان Lavan Industry Development Company</div><div></div></div>
07	LK	5-9-2024	For Approval		
06	AZ	1-8-2024	For Approval		
05	LK	8-7-2024	For Approval		
04	LK	23-5-2024	For Approval		
03	LK	17-4-2024	For Approval		
Rev	By	Date	Description	Sheet 15 of 17	
				Based on P&ID Rev.08	

GENERAL	1:	Tag Number	320ST-8201		
	2:	Service	Y-strainer		
	3:	P&ID No.	N278-VD-6019-PR-PID-0002		
	4:	Location	Compressor Air Inlet		
	5:	Line number	1"IA-320-01-D42-N		
	6:	Area classification	Safe area		
	7:				
	8:				
PROCESS CONDITIONS	9:	Fluid	State	Air	Dry Gas
	10:	Pressure	Norm. Max.	9.5 bar(g)	
	11:	Temperature	Norm. Max.	46 °C	
	12:	Design	Press. Temp.	12.5 bar(g)	75 °C
	13:	Ambient Temp.	Min. Max.	0 °C	49 °C
	14:	Oper. flow		35 Nm ³ /hr	
	15:				
	16:				
BODY	17:				
	18:				
	19:				
	20:	Type Of Body		Y-strainer	
	21:	Connection		1" 300# RF	
	22:	Body Material		SS 316	
	23:	Mesh Material		SS 316	
	24:	Mesh Size		0.57 mm	
	25:				
	26:				
	27:				
	28:				
	29:				
	30:				
	31:				
	32:				
	33:				
	34:				
	35:				
	36:				
CERTIFICATES	37:				
	38:				
	39:				
	40:				
	41:				
	42:				
	43:				
	44:				
PURCHASE	45:				
	46:				
	47:	3.1 Material certificate		Yes	
	48:				
	49:				
	50:				
	51:				
	52:				
	53:	Manufacturer		Barton Fintop	
	54:	Model		A025	
	55:				
	56:				
	57:				

NOTES :					
08	LK	16-9-2024	For Approval	<div>VALVE AND STRAINER DATASHEET</div> <div>Y-Strainer</div> <div></div>	<div>شرکت توسعه صنایع لایوان</div> <div>Lavan Industry Development Company</div> <div></div>
07	LK	5-9-2024	For Approval		
06	AZ	1-8-2024	For Approval		
05	LK	8-7-2024	For Approval		
04	LK	23-5-2024	For Approval		
03	LK	17-4-2024	For Approval		
Rev	By	Date	Description		

GENERAL	1	Tag Number			320ST-8202	
	2	Service			Y-strainer	
	3	P&ID No.			N278-VD-6019-PR-PID-0002	
	4	Location			Cooling Water Inlet	
	5	Line number			3/4"-CWS-320-20-B24C-N	
	6	Area classification			Safe area	
	7					
	8					
PROCESS CONDITIONS	9	Fluid	State		Cooling Water	Liquid
	10	Pressure	Norm.	Max.	4,5 bar(g)	
	11	Temperature	Norm.	Max.	36 °C	
	12	Design	Press.	Temp.	7 bar(g)	75 °C
	13	Ambient Temp.	Min.	Max.	0 °C	49 °C
	14	Oper. Flow			1 Nm³/hr	
	15					
	16					
	17					
	18					
BODY	20	Type Of Body			Y-strainer	
	21	Connection			3/4" 150# RF	
	22	Body Material			ASTM A216 WCB	
	23	Mesh Material			SS 316	
	24	Mesh Size			0,57 mm	
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					
	36					
	37					
	38					
	39					
	40					
CERTIFICATES	47	3.1 Material certificate			Yes	
	48					
	49					
	50					
	51					
	52					
PURCHASE	53	Manufacturer			Barton Firtop	
	54	Model			A020	
	55					
	56					
	57					

NOTES :

08	LK	16-9-2024	For Approval	VALVE AND STRAINER DATASHEET Y-Strainer 	<div>شرکت نوسنه کسپه لانات Lavan Industry Development Company</div> 	Sheet 17 of 17 Based on P&ID Rev.08
07	LK	5-9-2024	For Approval			
06	AZ	1-8-2024	For Approval			
05	LK	8-7-2024	For Approval			
04	LK	23-5-2024	For Approval			
03	LK	17-4-2024	For Approval			
Rev	By	Date	Description			

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION K-43

DOCUMENTS; NOISE DATA SHEET



Vendor doc. Number

17735-19

Vendor:

Airpack Nederland B.V.

P.O. NO.:

LIDCO-PO-NEC-278-6019



LIDCO, Pars SEE Zone, Assaluyeh,
Integrated Methanol and Ammonia
Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT



Noise data sheet

Document No. 17735-49

Project No.	Vendor Doc.	P.O. No.	Department	Document Type	Serial No	Revision
N278	VD	6019	IN	DS	0042	02

Page

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1	X					26						51						76					
2	X					27						52						77					
3	X					28						53						78					
4						29						54						79					
5						30						55						80					
6						31						56						81					
7						32						57						82					
8						33						58						83					
9						34						59						84					
10						35						60						85					
11						36						61						86					
12						37						62						87					
13						38						63						88					
14						39						64						89					
15						40						65						90					
16						41						66						91					
17						42						67						92					
18						43						68						ATTACHMENT					
19						44						69						1					
20						45						70						2					
21						46						71						3					
22						47						72						4					
23						48						73						5					
24						49						74						6					
25						50						75						7					

Integrated Methanol and Ammonia Plant

Document n° : 17735-14 attachment 4

Revision : 06

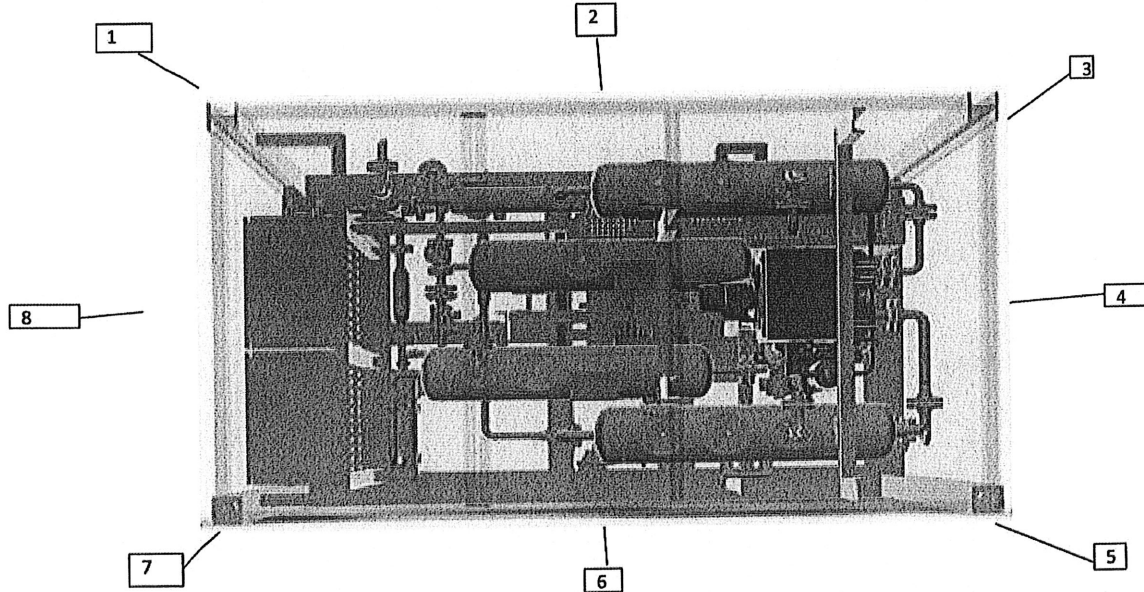
NOISE LEVEL

Unit : K-020
Service : Air booster compressor
Supplier : Airpack
Serial No. : T-2023-00799

Client: Lavan Industry Development Company (LIDCO)
Contractor: Nargan Company
Project: Integrated Methanol and Ammonia Plant

Supplier to Complete

Expected Noise Level Data




Noise test has been performed during performance test:

Procedure:

Measure point will be defined by a distance of 1 metre from the package and 1,5 metre above the ground level to measured round the package. Final measure points will be the same as start measure points. This is for checking correct functioning of the noise level meter. Noise shall not exceed 85 dB(A) for complete package. Noise meter calibration certificate is available during test

Points	Unit	Noise Estimated	Noise measured	Average of anti logs	Noise level (Logarithmic Avg)	Noise level (Arithmetic Avg)
P1	dB(A)	83	70	16402224	72.14903	71.875
P2	dB(A)	84	73			
P3	dB(A)	85	72			
P4	dB(A)	85	74			
P5	dB(A)	85	71			
P6	dB(A)	84	74			
P7	dB(A)	83	70			
P8	dB(A)	83	71			

Test Result:	
	
Tested By :	SK
Date:	28/02/2025
NOTE:	

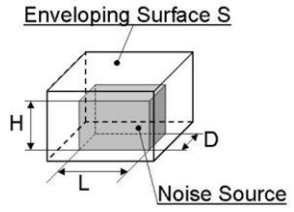
Surrounding Noise measured (dB(A)) : 85

Noise level (After correction (if required) as per 5.3 of ISO 2151):

Correction Factor	
Level increase due to	Value to be subtracted from measured

Test Condition : Noise level test as per ISO 2151

Rang

NOISE SOURCE DATA SHEET														
POS	ITEM : K-020													
1	INSTALLED POWER (KW) : 11			ROTARY SPEED (RPM) : 1485					DIMENSIONS ⁽¹⁾ 2500 x 1500 x 3000 mm					
2	SOUND POWER LEVEL TEST METHOD			STD. ISO 2151										
3	OCTAVE BAND FREQUENCY (Hz)			63	125	250	500	1k	2k	4k	8k	OVERALL		
												"A"	Lin	
4	CUSTOMER SPECIFIED NOISE LEVELS			Lw ⁽²⁾	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	85 dB	
				Lp ⁽³⁾	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	85 dB
5	VENDOR GUARANTEED NOISE LEVELS FOR STANDARD EQUIPMENT ⁽¹⁾			Lw ⁽²⁾	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	85 dB	
				Lp ⁽³⁾	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	85 dB
6	VENDOR GUARANTEED NOISE LEVELS FOR INTRINSECALLY LOW NOISE EQUIPMENT ⁽¹⁾			Lw ⁽²⁾	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
				Lp ⁽³⁾	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
7	VENDOR GUARANTEED NOISE LEVELS WITH ACOUSTIC TREATMENT ⁽¹⁾			Lw ⁽²⁾	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
				Lp ⁽³⁾	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8	THE SOUND POWER LEVELS HAVE BEEN OBTAINED BY			DIRECT MEASURING										
				MEASURING ON ANALOGOUS SOURCE										
9	LOAD CONDITIONS			NORMAL OPERATION										
10	DRIVER			INCLUDED										
11	DESCRIPTION OF INTRINSECALLY LOW NOISE EQUIPMENT													
12	DESCRIPTION OF ACOUSTIC TREATMENT													
13	WE GUARANTEE OUR EQUIPMENT, WHEN INSTALLED AND OPERATING UNDER DESIGN CONDITION, WILL NOT PRODUCE SOUND POWER LEVELS IN EXCESS OF THE ABOVE MENTIONE													
	DATE _____ VENDOR STAMP AND SIGNATURE _____													
NOTES: THE Lw VALUES IN ANY CASE MUST BE REPORTED														
<p>(1) IF SOUND POWER LEVEL (Lw) IS NOT AVAILABLE, IT SHALL BE ESTIMATED FROM THE SOUND PRESSURE LEVEL (Lp) IN FREE-FIELD MEASURED AT 1 METER FROM EQUIPMENT, BY MEANS THE FOLLOWING FORMULA (SEE FIGURE BY SIDE): $Lw = Lp + 10 \log_{10}(S)$ WHERE: $S = 4(ab + bc + ca)m^2$ WITH: $a = (L/2 + 1)m$, $b = (D/2 + 1)m$, $c = (H + 1)m$</p> <p>(2) Lw = SOUND POWER LEVEL, dB ref. 1·pW</p> <p>(3) Lp = SOUND PRESSURE LEVEL AT 1 METER, dB ref. 20 µPa</p>														
														
2														
1														
ISS.	DESCRIPTION			DRAWN UP		CHECKED		APPROVED		DATE				

RESULTS / GUARANTEE:

Measured Noise Level (Arithmetic Avg): 71.88 dB(A)

Measured Noise Level (Logarithmic Avg): 72.15 dB(A)

Result: PASS (all measured points ≤ 74 dB(A), below limit of 85 dB(A))

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION K-44

DOCUMENTS; LUBRICATION LIST



Vendor doc. Number

17735-19

Vendor:

Airpack Nederland B.V.

P.O. NO.:

LIDCO-PO-NEC-278-6019

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION K-45




DOCUMENTS; INSTRUMENT CABLE SCHEDULE



Vendor doc. Number
17735-19

P.O. NO.:
LIDCO-PO-NEC-278-6019

Vendor:
Airpack Nederland B.V.

	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT						
	Instrument Cable schedule						
Document No. 17735-52			Page				
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Airpack B.V. - Air Compressor –

Integrated Methanol and Ammonia Plant

17735-COM Instrument Cable schedule (K020)

Code 1
M.Dalakeh

07	23-05-2024	Issued for Approval	R.T.	S.K.	J.J.
06	08-05-2024	Issued for Approval	R.T.	S.K.	J.J.
05	02-05-2024	Issued for Approval	R.T.	S.K.	J.J.
04	03-04-2024	Issued for Approval	R.T.	S.K.	J.J.
03	20-03-2024	Issued for Approval	R.T.	S.K.	J.J.
02	15-02-2024	Issued for Approval	A.Z.	S.K.	J.J.
01	13-12-2023	Issued for Approval	A.Z.	S.K.	J.J.
REV.	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED

	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT							
	Instrument Cable schedule							
	Document No. 17735-52							Page
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2	X	X	X	X	X	X	X				52						77					
3	X	X	X	X	X	X	X				53						78					
4											54						79					
5											55						80					
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7											57						82					
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18											68						ATTACHMENT					
19											69						1					
20											70						2					
21											71						3					
22											72						4					
23											73						5					
24											74						6					
25											75						7					

Sl.	LOCATION	FROM BOARD / INSTRUMENT	GLAND	CABLE NAME	TO BOARD / INSTRUMENT	TERM . STRIP	TERMINAL	GLAND	LOCATION	CABLE	CABLE LENGTH	CABLE CODE	FUNCTION	SCOPE
			SIZE					SIZE		mm ²	m			
1	300LP-820													
2	CONTROL BUILDING	DCS	TBA	300CCDN820	300LP-820	300TDD820	1-14	M25	FIELD	14Cx1,5	TBA	14C1.501ARGYN	GENERATOR MULTIPAIR CABLE PUSHBUTTONS FROM CUSTOMER	CUSTOMER
3	CONTROL BUILDING	DCS	TBA	300CCDN821	300LP-820	300TDD820	15-28	M25	FIELD	14Cx1,5	TBA	14C1.501ARGYN	GENERATOR MULTIPAIR CABLE LAMPS FROM CUSTOMER	CUSTOMER
4	CONTROL BUILDING	DCS	TBA	320CED820	300LP-820	300TED820	1-4	M20	FIELD	4Cx1,5	TBA	4C1.501ASRDN	GENERATOR MULTIPAIR CABLE ESD BUTTON FROM CUSTOMER	CUSTOMER
5	300IDAN-820													
6	CONTROL BUILDING	DCS	TBA	320CCDN820	300IDAN-820	300TDA820 300TDA821	1-48 1-10	M40	FIELD	19x2x0,75	TBA	19P0.7511ARGYN	GENERATOR MULTIPAIR CABLE TRANSMITTER FROM CUSTOMER	CUSTOMER
7	FIELD	320PT-8201	M20	320PT-8201	300IDAN-820	300TDA820	1-3	M20	FIELD	1Px1,5	7	1P1.501ARGYN	PACKAGE INLET PRESSURE TRANSMITTER	AIRPACK
8	FIELD	320PT-8202	M20	320PT-8202	300IDAN-820	300TDA820	4-6	M20	FIELD	1Px1,5	7	1P1.501ARGYN	2ND STAGE SUCTION PRESSURE TRANSMITTER	AIRPACK
9	FIELD	320PT-8203	M20	320PT-8203	300IDAN-820	300TDA820	7-9	M20	FIELD	1Px1,5	7	1P1.501ARGYN	PACKAGE OUTLET PRESSURE TRANSMITTER	AIRPACK
10	FIELD	320PT-8204	M20	320PT-8204	300IDAN-820	300TDA820	10-12	M20	FIELD	1Px1,5	7	1P1.501ARGYN	OIL SYSTEM PRESSURE TRANSMITTER	AIRPACK
11	FIELD	320TT-8201	M20	320TT-8201	300IDAN-820	300TDA820	13-15	M20	FIELD	1Px1,5	7	1P1.501ARGYN	PACKAGE INLET TEMPERATURE TRANSMITTER	AIRPACK
12	FIELD	320TT-8202	M20	320TT-8202	300IDAN-820	300TDA820	16-18	M20	FIELD	1Px1,5	7	1P1.501ARGYN	1ST STAGE DISCHARGE PRESSURE TRANSMITTER	AIRPACK
13	FIELD	320TT-8203	M20	320TT-8203	300IDAN-820	300TDA820	19-21	M20	FIELD	1Px1,5	7	1P1.501ARGYN	2ND STAGE SUCTION TEMPERATURE TRANSMITTER	AIRPACK
14	FIELD	320TT-8204	M20	320TT-8204	300IDAN-820	300TDA820	22-24	M20	FIELD	1Px1,5	7	1P1.501ARGYN	2ND STAGE DISCHARGE TEMPERATURE TRANSMITTER	AIRPACK
15	FIELD	320TT-8205	M20	320TT-8205	300IDAN-820	300TDA820	25-27	M20	FIELD	1Px1,5	7	1P1.501ARGYN	PACKAGE OUTLET TEMPERATURE TRANSMITTER	AIRPACK
16	FIELD	320PZLC-8201	M20	320PZLC-8201	300IDAN-820	300TDA820	28-30	M20	FIELD	1Px1,5	7	1P1.501ARGYN	PRESSURE CONTROL VALVE POSITION FEEDBACK	AIRPACK
17	FIELD	320PCV-8201	M20	320PCV-8201	300IDAN-820	300TDA821	1-3	M20	FIELD	1Px1,5	7	1P1.501ARGYN	PRESSURE CONTROL VALVE	AIRPACK

Integrated Methanol and Ammonia Plant

VENDOR NAME	: Airpack Nederland B.V
EQUIPMENT DESCRIPTION	Instrument Air Package
EQUIPMENT TAGNUMBER	K-20

SECTION K-46

DOCUMENTS; LINE LIST



Vendor doc. Number




17735-19

P.O. NO.:

LIDCO-PO-NEC-278-6019

Vendor:

Airpack Nederland B.V.




	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT																									
	<div style="text-align: center; border-bottom: 1px solid black; padding-bottom: 5px;">Line List</div> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="7" style="padding: 2px;">Document No. 17735-61</td> <td style="padding: 2px;">Page</td> </tr> <tr> <td style="padding: 2px;">Project No.</td> <td style="padding: 2px;">Vendor Doc.</td> <td style="padding: 2px;">P.O. No.</td> <td style="padding: 2px;">Department</td> <td style="padding: 2px;">Document Type</td> <td style="padding: 2px;">Serial No</td> <td style="padding: 2px;">Revision</td> <td style="padding: 2px;"></td> </tr> <tr> <td style="padding: 2px;">N278</td> <td style="padding: 2px;">VD</td> <td style="padding: 2px;">6019</td> <td style="padding: 2px;">IN</td> <td style="padding: 2px;">LIS</td> <td style="padding: 2px;">0048</td> <td style="padding: 2px;">05</td> <td style="padding: 2px;">Page 1 of 3</td> </tr> </table>	Document No. 17735-61							Page	Project No.	Vendor Doc.	P.O. No.	Department	Document Type	Serial No	Revision		N278	VD	6019	IN	LIS	0048	05	Page 1 of 3	
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Airpack B.V. - Air Compressor – Integrated Methanol and Ammonia Plant 17735-COM Line List (K020)

Code 1
M. Dalakeh

05	26-04-2024	Issued for Approval	S.K.	S.K.	J.J.
04	08-04-2024	Issued for Approval	S.K.	S.K.	J.J.
03	23-01-2024	Issued for Approval	T.T.	S.K.	J.J.
02	08-01-2024	Issued for Approval	S.K.	S.K.	J.J.
01	19-12-2023	Issued for Approval	S.K.	S.K.	J.J.
REV.	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED

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	LIDCO, Pars SEE Zone, Assaluyeh, Integrated Methanol and Ammonia Plant 3000 MTPD MeOH / 900 MTPD NH3 PROJECT						
	Line List						
	Document No. 17735-61		Page				
	Project No. N278	Vendor Doc. VD	P.O. No. 6019	Department IN	Document Type LIS	Serial No 0048	Revision 05

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2	X	X	X	X	X	27						52						77					
3	X	X	X	X	X	28						53						78					
4	X					29						54						79					
5						30						55						80					
6						31						56						81					
7						32						57						82					
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23						48						73						5					
24						49						74						6					
25						50						75						7					

Line no.	Line description	P&ID Number	Line size	Schedule	Ends Note 7	Pipe material Note-2	Flange as per ASME B16.5	Flange Material Note-2	Operating press. Max.	Design press.	Hydrotest pressure	Operating temp.	Design temp.	Insulation	Tie in Point	Paint system	Final colour	NDT
P&ID for High Pressure Air Compressor K020																		
1"-IA-320-01-D42-N	Package inlet	N278-VD-6019-PR-PID-0002	1"	S-40S	BE	SS316L	300#	ASTM A182	9,5 bar(g)	12,5 bar(g)	16,25 bar(g)	46°C	75°C	Not Insulated	TP-8201	1	RAL-9006	10% RT welds, Leak test & Hydrotest with water
1"-IA-320-02-D42-N	1st stage suction	N278-VD-6019-PR-PID-0002	1"	S-40S	BE	SS316L	300#	ASTM A182	9,5 bar(g)	12,5 bar(g)	16,25 bar(g)	46°C	75°C	Not Insulated	N/A	1	RAL-9006	
3/4"-IA-320-03-F42-H	1st stage discharge	N278-VD-6019-PR-PID-0002	3/4"	S-40S	BE	SS316L	600#	ASTM A182	23,3 bar(g)	30,5 bar(g)	39,65 bar(g)	157°C	175°C	Personal protection	N/A	3	Metallic Gray	
3/4"-IA-320-04-F42-H	1st stage discharge	N278-VD-6019-PR-PID-0002	3/4"	S-40S	BE	SS316L	600#	ASTM A182	23,3 bar(g)	30,5 bar(g)	39,65 bar(g)	46°C	185°C	Personal protection	N/A	3	Metallic Gray	
3/4"-IA-320-05-F42-N	2nd stage suction	N278-VD-6019-PR-PID-0002	3/4"	S-40S	BE	SS316L	600#	ASTM A182	23,3 bar(g)	30,5 bar(g)	39,65 bar(g)	157°C	175°C	Not Insulated	N/A	1	RAL-9006	
3/4"-IA-320-06-F42-H	2nd stage discharge	N278-VD-6019-PR-PID-0002	3/4"	S-40S	BE	SS316L	600#	ASTM A182	22,1 bar(g)	39 bar(g)	50,7 bar(g)	60°C	175°C	Personal protection	N/A	3	Metallic Gray	
3/4"-IA-320-07-F42-H	2nd stage discharge	N278-VD-6019-PR-PID-0002	3/4"	S-40S	BE	SS316L	600#	ASTM A182	30 bar(g)	39 bar(g)	50,7 bar(g)	60°C	175°C	Personal protection	N/A	3	Metallic Gray	
1 1/2"-IA-320-08-D42-N	Package outlet	N278-VD-6019-PR-PID-0002	1 1/2"	S-40S	BE	SS316L	300#	ASTM A182	30 bar(g)	39 bar(g)	50,7 bar(g)	60°C	75°C	Not Insulated	N/A	1	RAL-9006	
3/4"-IA-320-09-D42-N	Package outlet	N278-VD-6019-PR-PID-0002	3/4"	S-40S	BE	SS316L	300#	ASTM A182	30 bar(g)	39 bar(g)	50,7 bar(g)	60°C	75°C	Not Insulated	N/A	1	RAL-9006	
3/4"-IA-320-10-D42-N	Package outlet	N278-VD-6019-PR-PID-0002	3/4"	S-40S	BE	SS316L	300#	ASTM A182	30 bar(g)	39 bar(g)	50,7 bar(g)	60°C	75°C	Not Insulated	TP-8202	1	RAL-9006	
3/4"-IA-320-11-D42-N	Bypass	N278-VD-6019-PR-PID-0002	3/4"	S-40S	BE	SS316L	300#	ASTM A182	30 bar(g)	39 bar(g)	50,7 bar(g)	60°C	75°C	Not Insulated	N/A	1	RAL-9006	
P&ID for High Pressure Air Compressor K020 water system																		
3/4"-CWS-320-20-B24C-N	Cooling water inlet	N278-VD-6019-PR-PID-0002	3/4"	S-40S	BE	CS	150#	ASTM A 10S	4,5 bar(g)	7 bar(g)	9,1 bar(g)	36°C	75°C	Not Insulated	TP-8203	1	RAL-9006	10% RT welds, Leak test & Hydrotest with water
3/4"-CWS-320-21-B24C-N	Cooling water inlet	N278-VD-6019-PR-PID-0002	3/4"	S-40S	BE	CS	150#	ASTM A 10S	4,5 bar(g)	7 bar(g)	9,1 bar(g)	36°C	75°C	Not Insulated	N/A	1	RAL-9006	
1 1/2"-CWR-320-22-B24C-N	Cooling water outlet	N278-VD-6019-PR-PID-0002	1 1/2"	S-10S	BE	CS	150#	ASTM A 10S	5 bar(g)	7 bar(g)	9,1 bar(g)	46°C	75°C	Not Insulated	N/A	1	RAL-9006	
3/4"-CWS-320-23-B24C-N	Cooling water inlet	N278-VD-6019-PR-PID-0002	3/4"	S-40S	BE	CS	150#	ASTM A 10S	4,5 bar(g)	7 bar(g)	9,1 bar(g)	36°C	75°C	Not Insulated	N/A	1	RAL-9006	
1 1/2"-CWR-320-24-B24C-N	Cooling water outlet	N278-VD-6019-PR-PID-0002	1 1/2"	S-10S	BE	CS	150#	ASTM A 10S	5 bar(g)	7 bar(g)	9,1 bar(g)	46°C	75°C	Not Insulated	N/A	1	RAL-9006	
3/4"-CWR-320-25-B24C-N	Cooling water outlet	N278-VD-6019-PR-PID-0002	3/4"	S-40S	BE	CS	150#	ASTM A 10S	5 bar(g)	7 bar(g)	9,1 bar(g)	46°C	75°C	Not Insulated	N/A	1	RAL-9006	
3/4"-CWR-320-26-B24C-N	Cooling water outlet	N278-VD-6019-PR-PID-0002	3/4"	S-40S	BE	CS	150#	ASTM A 10S	5 bar(g)	7 bar(g)	9,1 bar(g)	46°C	75°C	Not Insulated	TP-8204	1	RAL-9006	

Notes:

- 1.) pipe class will be followed for all component mentioned like, tem NPS, Rating,Schedule, Type, Specification Notes, NIPPLES, FITTINGS - threaded & Butt Welded /Caps, elbows,Tees ,Couplings ,Plug,Unions, Swaged Nipples, Boss,Blinds , spectacle blinds, GASKETS, bolts / Fasteners , valves, etc.
- 2.) All Components in water system are CS material and will externally painted (except for the valves which will be carbon steel and externally painted)
- 3.) Corrosion allowance = 0 mm. Corrosion allowance watersystem= 3,2mm
- 4.) Design code = ASME B31.3
- 5.) Stress Relieving = Not applicable
- 6.) Welding Spec : N278-000-PI-JSS-1300-009
- 7.) BE = Beveled Ends (for pipe)
- 8.) Valve body material with ASTM A10S shall be supplied in Normalized condition