Spare Part Procedure

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Tabulation of Revised Pages

Page	Revision								Page	Revision								Page	Revision							
	D00	D01	D02							D00	D01	D02														
1	X								37	X																
2	X								38	X																
3	X								39	X																
4	X								40	X																
5	X								41	X																
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7	X								43	X																
8	X								44	X																
9	X								45	X																
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30	X																									
31	X																									
32	X																									
33	X																									
34	X																									
35	X																									
36	X																									

Table of Contents

1. Purpose

This Spare Part Procedure governs and specifies the terms of performance of the supply of Spare Parts for the CONCEPTUAL, BASIC and DETAIL DESIGN ENGINEERING OF STYRENE PARK OFFSITE.

EQUIPMENT Class:

(V) for VITAL EQUIPMENT, a breakdown of which would mean an immediate and serious interruption of vital operations in field or plant and with which no risk in the ordering and stocking of spare parts can be justified (E) for ESSENTIAL EQUIPMENT, engaged in primary operations, but with which a calculated risk can be taken in ordering and stocking of spare parts. For AUXILIARY, general purpose and stand-by equipment, for secondary operations, the temporary lack of spare parts would not have a serious effect. Under this heading also comes the equipment of which there is a large number of units in used, thus ensuring a sufficient degree of protection in case of failure of one or more units.

2. Scope and Objectives

This procedure covers the procurement of spare parts for the CONCEPTUAL, BASIC and DETAIL DESIGN ENGINEERING OF STYRENE PARK OFFSITE in IRAN:
The objectives of this procedure are to:

- Give instructions for M-equipment and Major equipment spare parts monitoring
- Give instructions for other equipment and materials spare parts monitoring
- Define actions related to the 3 categories of spare parts:
  - Erection, pre-commissioning, commissioning and start-up spare parts
  - Capital spare parts
  - 2 years' spare parts

3. Principles

The types of spare parts are:

<u>Capital Spare Parts</u>

The capital spare parts to be supplied to OWNER by VENDOR are listed in the Attachment 2 of this procedure.

These spares will be included in the same Purchase Order and shall be shipped together with the main equipment/material, separately packed and adequately marked for easy recognition and warehousing.

Erection, Pre-commissioning and Commissioning and Start up Spare Parts

They include parts of the equipment and materials (such as gaskets, O-rings, etc.) which are to be or may be replaced during each phase of field activities.

PURCHASER will be asked on the Material Requisition the recommended requirements of pre-commissioning, commissioning and start-up operations spare parts.

Vendor recommendation received with the offer will also be taken into account and checked by PURCHASER as per his experience and knowledge.

These spares are included in the same Purchase Order, separately packed and adequately marked for easy recognition and warehousing and shall be shipped together with the main equipment/material.

Those spares to be supplied to OWNER by VENDOR are listed in the Attachment 1 of this procedure.

Two Years Operation Spare Parts

The two years Spare Parts include all those parts that are normally required to maintain the Plant in a satisfactory working condition over a period of two years of continuous operation after start-up.

The recommendation of these spares shall be recommended by VENDORS for OWNER's selection and approval on the basis of the following agreed upon criteria:

- Type and quantities of spare parts as per Vendor recommendation,
- Guidelines shown in paragraph 6 of this procedure.
- Cost Control

With regards to the equipment for which no guidelines are given for minimum spare parts quantities in paragraph 6.0 of this procedure, the matter will be agreed later between OWNER/CONTRACTOR/VENDOR with due consideration given to the VENDOR's recommended spare parts for such equipment.

PURCHASER will obtain from VENDORS the quotation of the two years operation spare parts together with the quotation of the main equipment (the remain spare parts will be proposed as soon as possible in due course accordingly). To this purpose the applicable general guidelines for the selection of spare parts under following paragraph 6.0 will be attached to the Material Requisitions.

PROCEDURE

PURCHASER's inquiry for the main materials shall ask bidders to submit a quotation for the 3 (three) types of spare parts, when applicable.
For each classification of equipment classifications can be distinguished:

- Vital equipment
- Essential Equipment
- Auxiliary and general purpose equipment

Spare parts are divided into three classifications:

- C for parts wearing out or deterioration during normal operation
- Q for parts not normal stocked, but ordered on request only.
- I for Insurance items.

For each classification of equipment, a spare part philosophy can be distinguished as follows:

SPARE PARTS	EQUIPMENT CLASSIFICATION		
	Vital (V)	Essential (E)	General (A)
Insurance	X		
Replacement	X	X	
Consumables	X	X	X

When interpreted correctly this should help to avoid over-ordering of spare parts and replacement parts in particular.

Purchase Orders of the Main Equipment and/or materials will normally include:

- The Capital Spares, if any,
- Erection, Pre-commissioning, Commissioning and Start up Spares, if any
- Priced lists of Spare parts for two years valid for 24 months, as optional item. The spare parts list may be preliminary and not complete in minor parts, since vendor has not yet developed the engineering, without detailed identification of single pieces (for instance wording "set of bearings" will be used). Prices however will be binding.

Alternatively, to the above, the 2 years quoted spares will be ordered at time of PO for base material, but with separate PO-S, as per OWNER decision.

3.1 Spare Parts for M-Equipment and Major Equipment

As said before, such quotation will be requested with the main materials and shall contain:

- Priced quotation for capital spares (if required)
- Price quotation for erection pre-commissioning, commissioning & start-up spares
- Bidder's priced recommendation of spares parts for two years, possibly using the SPIR form (see Attach.5)
- Short description of each part,
- Proposed quantity per spare parts item,
- Unit prices and total prices per spares parts item,
- Delivery time.

The price quotation will be submitted to PURCHASER.
PURCHASER may decide at time of PO for main material if to instruct PURCHASER to purchase also the selected spare parts with a dedicated PO-S.

Alternatively, the quotation will be kept as reference, waiting the final priced list.

The Spare Part list at first step will be preliminary and not complete in minor parts, in the second step, the VENDOR shall provide detailed identification of each "SET" etc of each Spare Part.

It is noted that for items that are not peculiar to the specific supply (bearing, mechanical seals, etc) and that can be same for other supplies, PURCHASER will recommend not to purchase them, waiting for the interchangeability study.

PURCHASER shall then expedite the receipt of final spare parts quotations.

Upon receipt, PURCHASER shall verify the quotation, especially with respect to the following items:

- Completely and properly filled out,
- Check price against Vendor's provisional spare parts quotation as per above requirements.
- Completeness of required supporting documents, such as drawings, specifications.

Upon verification, PURCHASER shall submit the final spare parts quotation with all pertaining documents to OWNER.

Following the VENDOR recommendation and PURCHASER decisions, based on these final spare parts lists, PURCHASER shall in agreement with OWNER, purchase the selected parts revising the first PO-S, if previously done, or PURCHASER shall issue the PO-S.

In order to reduce the stock of spare parts, PURCHASER shall, as far as possible, minimize the number of Vendors when the type of equipment is similar and provide a list of interchangeable parts, when feasible (e.g.; bearings, mechanical seals).

The final completed SPIR forms shall be supported by the following documents:

a) Complete manufacturer's parts list.

b) Relevant drawings, catalogue pamphlets and bulletins of the main or primary equipment.

c) Relevant parts list, drawings, sketches and pamphlets of sub-suppliers of auxiliary equipment.

All spare parts shall be furnished with adequate packing. All packing shall bear lasting and visible identification with a description of the equipment to which it belongs, and the number of parts and of the diagram to which it relates.

Such requirements for packing, marking and Shipping are included in Packing, Marking and Shipping Procedure BU40-D-000-PE-PRC-0001 D03.

VENDORS shall supply 1 (one) complete set of the special tools required for the installation of spare parts, supplying information for the future replacement of such tools.

The spare parts supplied shall normally be identical to the parts already in the equipment.

3.2 Spare Parts for Other Equipment and Materials

- Quotation for erection, pre-commissioning, commissioning & start-up spares will be requested with the main materials.

- Bidder's priced recommendation of spares parts for two years, using the SPIR form (see Attach.5), will be received during the development of the supply. Timing will be set during the negotiations for the PO definition. A budget price will be requested to the Vendor during such negotiations.

The bid will include

  - Identification of each part (identification shall include, part and position no, type and size, number, mat., dimension, class, dwg of parts if any, like bearing, oil seal, O-ring, mechanical seal, gasket and etc…)

- Proposed quantity per spare parts item,
- Unit prices and total prices per spares parts item,
- Delivery time.

Upon receipt, PURCHASER shall verify the quotation, especially with respect to the following items:

- Completely and properly filled out,
- Completeness of required supporting documents, such as drawings, specifications.
- Check price against budgetary price

The priced quotation will be submitted to OWNER, with VENDOR recommendation.

Based on PURCHASER decisions, PURCHASER shall award the PO-S.
In order to reduce the stock of spare parts, PURCHASER shall, as far as possible, minimize the number of Vendors when the type of equipment is similar and provide a list of interchangeable parts, when feasible (e.g; bearings, mechanical seals).
The final completed spare parts Interchangeability Record (SPIR) forms shall be supported by the following documents:

a) Complete manufacturer's parts list.

b) Relevant drawings, catalogue pamphlets and bulletins of the main or primary equipment.

c) Relevant parts list, drawings, sketches and pamphlets of sub-suppliers of auxiliary equipment.

All spare parts shall be furnished with adequate packing. All packing shall bear lasting and visible identification with a description of the equipment to which it belongs, and the number of parts and of the diagram to which it relates.

Such requirements for packing & marking are included in Packing and Marking Procedure BU40-B-000-PE-PRC-0001.

The spare parts supplied shall normally be identical to the parts already in the equipment.

VENDORS shall be responsible in supplying the Spare Parts even after stopping manufacturing up to TEN (10) years.

4. References

As guideline for selection of two years' operation spare parts, has been prepared on the basis of Attachment 4.

5. Reporting

Contractor shall set up, maintain and submit to owner a record showing the current status of the spare parts still to be received, already received and awaiting Approval. The said record shall be submitted for spare parts ordered, and still to be ordered. Contractor shall issue a report, listing the preceding information, to Owner on monthly basis.

6. 2 Years Spare Parts Cost Control

Refer to part 6

7. Attachments

7.1 Attachment #1: Guideline for Selection of Erection, Pre-Commissioning, Commissioning and Start-Up Spares.

7.2 Attachment #2: Capital Spare-Parts for HDPE Plant

7.3 Attachment #3: Instructions to Complete Spare Parts Interchangeability Record Forms (SPIR)

7.4 Attachment 4: Guidelines for Selection of Two Years Operation Spare Parts

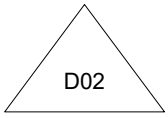
7.5 Attachment 5: Spare Parts Interchangeability Record Form (SPIR)

7.6 Attachment 6: Example of Cost Breakdown (For Two Years Operation Spare Parts)

Attachment # 1

Guideline For Selection Of Erection, Pre-Commissioning, Commissioning And Start-Up Spares

(As Following)



SPARE PARTS FOR ERECTION, PRECOMMISSIONING, COMMISSIONING AND START-UP

1) Spare Parts for Erection, Pre-commissioning, Commissioning and Start-up as per attached list shall be included in the scope of supply.

PURCHASER shall check the Equipment' spare parts list with Equipment Vendors.

2) In addition to the following tables regarding the subject of spare parts, PURCHASER shall check, as per his experience and knowledge and shall prepare similar format and quantity wise for other equipment and materials, which are not mentioned here below.

SPARE PARTS FOR ERECTION, PRECOMMISSIONING, COMMISSIONING AND START-UP

	PARTS NAME	Q.TY
1.	**FURNACES**	
	Gaskets for coil	50%
	Burner Tiles	10%
	Burner Tips	5%
	Fire eyes	10%
	Gas valves seat	20%
	Solenoid valves	20%
2.	**EXCHANGERS, REACTORS & DRUMS/TANKS**	
	Gaskets for Girth Flange, M/H & H/H & Blinded Nozzles	100%
	Stud Bolts and Nuts for the above	5% (min. 2 sets)
	Field-Installed Trays:	
	Bolts and Nuts	15% (min. 2 sets)
	Washers (metal and asb.)	20% (min. 2 sets)
	Tray Clamps	10% (min. 2 sets)
	Asb. Rope and Tape	25% (min. 2 sets)
	Field-Installed Internals, Piping and Other Bolted Internals:	
	Stud Bolts (Alloy and C.S.)	10% (min. 2 sets)
	Washers and Nuts	10% (min. 2 sets)
	Packing:	
	Inert Balls	15%
	Raschig Rings /Slotted Rings	15%
	Fan for Air Cooler:	
	Gaskets Sets and O-Rings	100%
3.	**STEEL STRUCTURE**	
	Bridge Crane:	
	Bolts & Washers	15%
	Gaskets	10%
	Contactors	5%
	Tension Springs	10%
	Fuse Elements	10%
	Gaskets	25%

	PARTS NAME	Q.TY
	Oil Seals	25%
	Relays	5%
	Collectors	1 set each size
	Contact shoes	1 set each size
	Limit Switches	1 set each size
4.	**ROTATING EQUIPMENT**	
	Pump/Agitator:	
	Gland Packing	200% per mat's/size
	Mechanical Seals	100% per model/type
	Carbon Teflon Rings	500% per model/type
	Gasket Sets and O-rings	100%
	Sealing System O-Rings	200%
	Compressor:	
	Gasket sets and O-ring	100%
	Fan:	
	Gasket Sets and O-ring	100%
	Gland Packing	100%
	Diesel Engine:	
	Gaskets and Packing	100%
	Filter Element for Oil/Fuel	1 set each size/material
	Electrical Equipment:	See Item 9
	Instrumentation:	
	Control Panel	See Item 10
	Board Instruments	See Item 10
	Field Transmitters	See Item 10
	Field Instruments	See Item 10
	Others	0%
5.	**H.V.A.C.**	
	Bolts/Nuts/….	5%
	Rotating Equipment	See Item 5
	Heat Exchangers	0%
	Filter Element	1 set each size/material
	Electrical	See Item 9

	PARTS NAME	Q.TY
	Instrumentation:	
	Control Panel	See Item 10
	Board Instruments	See Item 10
	Field Transmitters	see Item 10
	Field Instruments	See Item 10
	Others	5%
	Piping /Duct	Quantity to be recommended by Vendor
6.	**SPECIAL EQUIPMENT**	
	Heat Exchanger	See Item 2
	Rotating Equipment	See Item 5
	Filter Element	1 set each size/mat'l
	Piping	0%
	Electrical	See Item 9
	Instrumentation:	
	Control Panel	see Item 10
	Board Instruments	See Item 10
	Field Transmitters	see Item 10
	Field Instruments	See Item 10
	Others	0%
7.	**PIPING**	
	It will be considered as Contingency Allowances of Piping Material. Please refer to Job Specification for Contingency Allowances of Piping Material with Doc. No. BU40-000-PM-SPC-XXXX (To Be Issued Later).	
8.	**ELECTRICAL EQUIPMENT**	
	Switchgear, Motor Control Centers MV/LV	
	Fuse Elements	5%
	Bulb for Signal Lamps	5%
	Signal Lamp	5%
	Plastic door lock	5%
	Plastic door handle	5%

	PARTS NAME	Q.TY
	Feeder moving mechanism	2%
	Control terminal blocks	5%
	Circuit breaker	Vendor recom.
	Contactors	Vendor recom.
	Micro switches	5%
	Metering and transducers	5%
	Trip coil of C.B.	5%
	Close coil of C.B.	5%
	Under voltage coil of C.B.	2%
	Spring charger motor of C.B.	2%
	Electronic cards of C.B. or contactors (if any)	2%
	Protection relays	2%
	Interposing relay panel	Vendor recom.
	Capacitors bank	Vendor recom.
	PDCS	Vendor recom
	Local Control Panels & Control Stations	
	Fuse Elements	50%
	Bulb for Signal Lamps	50%
	Signal Lamp	50%
	Selector Switch	5%
	Push Button:	5%
	Electrical Motors:	
	Grease Nipples where applicable	10%
	Sleeve bearing complete set	(One for each type)
	Temperature sensor for bearings	5%
	Bearing oil level sight glass	5%
	Plastic cooling fan	5%
	Power terminal block	2%
	Special items (Encoder, Cooling fan)	Vendor recom.
	Lighting Fixtures	1%
	Flag Relay	2%
	Time Relay	2%
	Terminal Block	5%

	PARTS NAME	Q.TY
	Auxiliary Relays and Aux Contact Block	1%
	Moving Contacts For PURCHASER ≥ 55kW	15%
	Fixed Contacts For PURCHASER ≥ 55kW	10%
	Coils for Contactors	10%
	Breathing Device and Silicagel	one of each type & size
	Thermometer	10%
	Local Control Station	5%
	Ammeter For Control Station and Switchgear	5%
	Push button	5%
	Selector switch	5%
	UPS:	
	Fuse	20%
	MCB (miniature circuit breaker)	10%
	SCR	20%
	DIODE	10%
	Transistor	20%
	Control cards	one per each type
	Signalling lamps	10%
	Batteries	5%
	Cooling fan on door	5%
	Cooling fan for semiconductors	5%
	Special items (voltage relay)	2%
	Electrolyte for batteries	Vendor recommendations
	Batteries chargers:	
	Fuse	10%
	MCB (miniature circuit breaker)	10%
	SCR	10%
	DIODE	10%
	Transistor	10%
	Control cards	one per each type
	Signalling lamps	10%
	Batteries	5%

	PARTS NAME	Q.TY
	FIRE ALARM system	*
	Telephon system	*
	Paging system	*
	RADIO system	*
	Emergency diesel generator PDCS Cathodic protection system Variable speed drive (VSD) Motorized valve (MOV)	* * * * *
		*These are the spare parts that Vendors shall recommend based on their experience.
	Transformer: Oil Cooling fan Winding thermo meter Oil thermo meter Oil level indicator Air bag Gaskets Tank buchholz relay Conservator buchholz relay Tap changer part Multi-function protection device for sealed type transformers	 2% 2% 2% 2% 2% 2% 2% 2% 2% 1set for each type 2%
	Sockets (400V, 230V, 110V, 24V)	5%
	Plugs (400V. 230V, 110V, 24V)	20%
	All special tool's, equipment and spare parts required for commissioning and start-up shall be provided.	
9.	**INSTRUMENTATION**	
	For Control Panel:	
	Bulbs for Signal Lamps	50%
	Fuse Elements	50%
	Board Instruments:	
	Fuse Elements	50%

	PARTS NAME	Q.TY
	Chart Paper for Recorders	3 Boxes each type
	Ink for or Recorders	7 Sets each type
	Pens for Recorders	50%
	Field Transmitters:	
	Gasket	30%
	Field Instruments:	
	Air Pressure Regulators	10%
	Temperature Indicators	20% each type (min one)
	Pressure Gauges	20% each type (min one)
	Solenoid Valves	15% each type (min. one Set)
	Valve positioners	15% each type (min. one Set)
	Cable – Single Pair	20%
	Cable – Multi Pair	15%
	Cable Glands	20%
	Junction Boxes – Large	1 min.
	Pipe and Tube	10%
	Fittings, all Type	15% each size
	Valves	20% min. one valve
	Manifold Valves	10% each type
	Cable Tray	20%
	Control systems (DCS, ESD and PLC):	
	Bulbs for Signal Lamps	50%
	Fuse Elements	50%
	Printer Paper, Chart Paper	4 Boxes Each Type
	Printer Ribbon	10 sets each type
	Blank Floppy Disks/Magnetic Tape Cartridge	10 pieces
	Gas Chromatograph:	
	Filter Elements	20%
	Calibration Gas Cylinders	1 Cylinder (100 litres) each type
	Standard Gas Cylinders	1 Cylinder (100 litres) each type
	Other Gas Cylinders	1 Cylinder (100 litres) each type
	Other Analysers:	

	PARTS NAME	Q.TY
	Filter Elements	20%
	Calibration Gas Cylinders	1 Cylinder (100 litres) each type
	Standard Gas Cylinders	1 Cylinder (100 litres) each type
	Other Gas Cylinders	1 Cylinder (100 litres) each type
10.	**PAINT & INSULATION**	
	It will be considered as Contingency Allowances of Piping Material. Please refer to Job Specification for Contingency Allowances of Piping Material with Doc. No. BU40-000-PM-SPC-XXXX (To Be Issued Later).	
11.	**UTILITY EQUIPMENT**	
	Heat Exchanger, Vessel, Tank and Tower	See Item 2
	Rotating Equipment	See Item 5
	Filter Elements	1 set each size/mat'l
	Piping	0%
	Electrical	See Item 9
	Instrumentation:	
	Control Panel	See Item 10
	Board Instruments	See Item 10
	Field Instruments	See Item 10
	Others	0%

Attachment #2

Capital Spare-parts Requirement

(As Following)

D02

LIST OF CAPITAL SPARE PARTS FOR HDPE PLANT

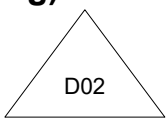
- RA-111:
  - One set Variable Gear box for Agitator RA-111.
- RA-121/22/23:
  - Three sets Gear box for Agitator.
  - One Set Motor.
- P-121 A/B:
  - One set Rotor for Suspension circuit centrifugal pump.
- P-122 A/B:
  - One set Rotor for Suspension circuit centrifugal pump.
- P-123 A/B:
  - One set Rotor for Suspension circuit centrifugal pump.
- P-125:
  - One set Rotor for Suspension circuit centrifugal pump.
- P-126:
  - One set Rotor for Suspension circuit centrifugal pump.
- CE-211 A-C:
  - One Set Motor & Rotor for Decanter Centrifuge.
  - One Set Planetary Gear.
- SC-211 A-C:
  - 3 Sets Screw
  - 1 Set Motor & Gear Box
- PK-321:
  - 1 Set Motor & Crank Shaft.
- EX-512/532:
  - 2 Sets Knife Holder for Pelletizer.
  - 2 Sets of Knifes.
  - 2 Sets Die Plate for Pelletizer.

NOTE: Rotor for pumps means completely pump without Motor & Casing.

Attachment #3

Instructions to complete Spare Parts Interchangeability Record Forms (SPIR)

(As Following)



Guidelines for the completion of The spare parts interchangeability record (SPIR)

It is recommended that the lines and columns be completed by the equipment manufacture in the following sequence:

Column 1:	Enter the same equipment registration number or tag number for each piece of equipment as stated in the Material Requisition and/or Purchase Orders.
Column 2:	Manufacturer's model, type or other identification or other positive identification reference of the equipment/instruments ordered.
Column 3:	Manufacturer's serial number or other control reference of the equipment instruments as supplied.
Column 4:	Total number of pieces of identical equipment/instruments as quoted in columns 1, 2, 3 and 6
Column 6:	Purchasing COMPANY's Material Requisition/Order reference number.
Column 8:	Describe all parts in the English language. List all parts that should be carried in stock for manual operation and also list slow-wearing parts. If an item is interchangeable between two or more units, it should be listed once.
Column 9:	For each part entered in column 8, enter the drawing number or reference number. Note: These drawings should be attached to the SPIR by the manufacturer.
Columns 10 A/B:	Enter the reference number/letters or other information that identifies each part. Interchangeability with identical parts within manufacturer's range should be indicated. Owing to the wide variety of systems in use for identification of parts, it is impossible to lay down firm rules for completing these columns. Manufacturers should give whatever identification system they use to positively identify parts and to show interchangeability with existing equipment. Manufacturer's final cross-sectional drawings, workshop drawings, and real part numbers may not always be available in the early stage of manufacture. This may cause delays in timely preparation of manufacturer's recommendation for initial spare parts in column 13 and in the subsequent ordering of the same. To avoid such delays, it is recommended that reference be made to manufacturer's documentation that is readily available, such as

	pamphlets, brochures, exploded views, and typical drawings of similar equipment.
Column 11:	Enter material specification in term of full international standards and accepted conventions, not manufacturer's or sub-manufacturer's references.
Column 5:	For each unit or group of identical units, enter in the appropriate space the number of parts fitted in each unit of equipment or instrumentation.
Column 7:	Enter the total number of identical parts in all equipment specified. In the case of identical units, multiply quantity in column 5 by the number of units given in column 4.
Column 12:	Third party supplier
Column 18:	Quantity to be ordered
Column 13:	Enter manufacturer's recommended ordered quantities of initial spare parts (pre-commissioning, commissioning and start-up).
Column 14:	Enter PURCHASER's recommended ordered quantities of initial spare parts (pre-commissioning, commissioning and start-up).
Column 15:	Enter manufacturer's recommended ordered quantities for operation spare parts (two years operating).
Column 16	Enter PURCHASER's recommended ordered quantities for operation spare parts (two years operating).
Column 19	Enter the price per piece of each part.

OWNER'S PROJECT TEAM SHOULD COMPLETE THE FOLLOWING PART OF THE SPIR FORM

Column 21:	For the classification of spare parts, i.e.:
C – for:	Parts wearing out or deteriorating during normal operations, thus shown a fairly regular consumption. (Consumable parts)
Q – for:	Parts not normal stocked, but ordered on request only.
I – for:	Insurance items.
O – for:	Temporary code number.
Column 22:	In case this form is used as a requisition or identing document relevant column, signature, reference indicator and date should be entered to authorize purchase.
Column 23:	Enter ROS date if using this form as requisition

IMPORTANT NOTE: The necessary provisions shall be made to fix the prices of spare parts for all EQUIPMENT AND MATERIALS for future purchasing of the spare parts by OWNER more than that which shall be purchased by PURCHASER for two years operations of the PLANT.

Attachment 4

Guidelines for Selection of Two Years Operation Spare Parts (As Following)

D02

TWO YEARS OPERATIONS SPARE PARTS

Guidelines for Selection of 2 Years Operation Spare Parts.

Spare Parts for equipment are shown in the following tables:

Table 1 – Spare parts for centrifugal pumps
Table 2 – Spare parts for compressors
Table 3 – Spare parts for reciprocating compressors
Table 4 – Spare parts for gear units
Table 5 – Spare parts for jet ejectors
Table 6 – Spare parts for electrical equipment
Table 7 – Spare parts for instruments
Table 8 – Spare parts for pressure vessels and heat exchangers
Table 9 – Spare parts for furnaces/fans
Table 10 – Spare parts for piping

Note: For all equipment not specifically mentioned in tables here above, the Vendor recommendation will be taken as basis for selection for Owner's Approval.

TABLE 1

SPARE PARTS

FOR CENTRIFUGAL PUMPS

Number of Pumps Using Part:	1	2	3	4	5	6	more
Throat Bushing	1	1	1	1	2	2	30% of No. of Pumps
Shaft Sleeve, Bearing Set, Impellers and case Wearing Rings	1	1	2	2	3	3	50% of No. of Pumps
Gasket Sets, Packing Mechanical Seal Non-metallic faces, O-rings, Gaskets, Springs	1	2	3	4	5	6	100% of No. of Pumps
Mechanical Seal, Metallic faces	1	1	1	1	2	2	100% of No. of Pumps
Mechanical Seal Assembly	2	2	2	3	2	4	25% of No. of Pumps
Sealing System: O-rings & Gasket	2	2	2	3	3	4	50% of No. of Pumps
O-rings & Springs of Mechanical Seal Assembly							50% of No. of Pumps
Carbon rings of Mechanical Seal Assembly	2	2	3	4	5	6	100% of No. of Pumps

NOTES:

a) The parts listed above are the principal parts only. Other parts, such as impeller special bolts etc. shall be considered for recommendation in quantities consistent with the above table.

b) Quantities listed above are based on one part per pump. If the pump has more than one, the number of parts shall be modified accordingly.

TABLE 2

SPARE PARTS

COMPRESSORS – AXIAL/ROTARY/CENTRIFUGAL

	Rotary	
No. of Machines	1	2
Spare Items	Quantities	
Seals	100%	
Thrust Bearing Pads (sets)	1	2
Oil Filter Elements	1	2
Instruments Parts (sets)	6 sets	12 sets
Accumulator		
Bladder		
Labyrinths	100%	100%
Gaskets + O-rings (sets)	2	4
Stators Blades	-	-
Casing	-	-
Timing Gears (sets)	1	1
Flushing Nozzles (sets)	-	-
Oil Cooler	-	-

NOTES:

c) Quantities for washable oil filter elements can be reduced to 5.

d) The Parts listed are the principal parts only.

Other Parts shall be considered for recommendation in quantities consistent with the above table.

TABLE 3

SPARE PARTS

FOR RECIPROCATING COMPRESSORS

No. of Machine	1	2	3
Spare Item	Quantities		
Cylinder Liners	1 set	1 set	1 set
Valves Parts (plates, springs, etc.)	3 sets	6 sets	9 sets
Piston Rods	1 set	1 set	1 set
Packing	100%	100%	200%
Connecting Rods (each type)	1	1	1
Cross Head Shoes	100%	100%	100%
Piston Rings	2 sets	4 sets	6 sets
Cylinders	-	-	-
Unloaded Device Parts	1 set each type	2 sets each type	3 sets each type
Cross Head Pins	100%	100%	100%
Relief Valve Parts	100%	100%	100%
Spec. Bolts and Nuts	1 each type	1 each type	1 each type
Flushing Nozzles	-	-	-
Crankshafts	-	-	-
Oil Filter Refills	2	4	6
O-Rings/Gaskets	2 sets	4 sets	6 sets
Unloaded Assembles	1	1	1

NOTE: The parts listed are the principal parts only.
Other parts shall be considered for recommendation in quantities consistent with the above table.

TABLE 4

SPARE PARTS FOR

SPECIAL PURPOSE GEAR UNITS

No. of Machines	1		2
Spare Item	Quantities		
Labyrinths	100%		
Gaskets	2 sets		4 sets
Thrust Bearing Pads	1 set		2 sets

NOTE: The parts listed above are the principal parts only. Other parts shall be considered for recommendation in quantities consistent with the above table.

TABLE 5

SPARE PARTS FOR

JET JECTORS

Items	Quantities
Nozzles (As far as applicable)	1 each size
Diffusers (As far as applicable)	1 each size

TABLE 5A

MINIMUM SPARE PARTS FOR

AGITATOR (MIXER)

Stems	Quantities
Shaft sleeve bearing set, Gasket set, Packing seal spring seal, Non-metallic faces, Gaskets and Spring	100% per Nos. of each type/size of agitator
Mechanical seal, metallic faces	100% of Nos.
Mechanical seal, non-metallic parts like C.R, wedge etc. if any,	100% of Nos.

TABLE 6

SPARE PARTS FOR

ELECTRICAL EQUIPMENT

1)	Switchgears:	Quantities *
	MV Fuses	15%
	Protection and Flag Relay	2%
	Time Relay	2%
	Lamps	30%
	Space Heaters	10%
	L.V. Fuses	30%
	Terminal Blocks	2%
	Auxiliary Relays	1%
	Metering Device	10%
	Moving Contacts For PURCHASER ≥ 55 kW	20%
	Fixed Contacts For PURCHASER ≥ 55 kW	10%
	Circuit Breakers	20%
	Contactors	20%
	Metering	10%
	CT	10%
	PT	15%
2)	Power Motor Control Center:	15%
	L.V. Fuses	8%
	Time Delayed Relays	10%
	Lamps	10%
	Space Heaters	15%
	Terminal Blocks	7%
	Auxiliary relays	To be determined later in conjunction with the equipment vendor
	Contactors and Contact Block	“

	Thermal overload Relays	“
	Motor Circuit Breakers complete Unit for each Type & Size	10%
	Moving Contact For PURCHASER ≥ 55 kW	20%
	Fixed Contacts For PURCHASER ≥ 55 kW	20%
	Metering Device	15%
	CT each Type	20%
	PT	20%
	Main Circuit Breaker	One per each type
3)	Transformers:	
	Buchholz Relays	One per each type & Size
	Thermometer	10%
	Bushing (MV, LV)	50%
	Air Bag (For each Type)	1 Set
	Measuring and Control Devices	20%
	CT of Neutral Resistor	10%
4)	Power Material:	
	a) Local Control Stations	5%
	b) Sockets 400V AC	10%
	c) Plugs 400V AC	15%
5)	Lighting Materials	
	a) Switches	10%
	b) Fuses	30%
	c) Sockets (230V, 110V, 24V)	10%
	d) Plugs (230V, 110V, 24V)	20%
	e) Lighting Fixtures	10%
	f) Ballast Lamps	5%
	g) Lamps	20%
	h) Portable 110V AC, 50HZ with transformer (Ex Type) Socket Plug	10%
	i) Hand Lamp 24V, AC, 50HZ (Ex Type)	30 Nos.
	g) Lamps	20%

	h) Portable 110V AC, 50HZ with transformer (Ex Type) Socket Plug	10%
6)	MOTORS	
	Number of motors 1 2 3 4 5	more
	Local Control Station 1 1 1 2 2	40%
	No of machines 1 2 3 4 5	more
	Set of bearing 1 1 1 2 2	40%
	Fan, Terminal, Blocks, Space, Heater (MV) per Type	5%
7)	UPS:	
	Fuse	30%
	MCB (miniature circuit breaker)	15%
	SCR (one complete module)	30%
	Signalling Lamp and Protective Device	15%
	Diode	10%
	Transistor (one complete module)	30%
	Control Cards	One per each type
	Batteries	10%
	Isolator switch (make before break) (by pass)	One per each type
8)	Battery Charger:	
	Fuse	30%
	MCB	15%
	SCR (one complete module)	30%
	Diode	10%
	Signalling Lamps	15%
	Control Cards	One per each type
	Batteries	10%
9)	Telephone System:	
10)	Paging System:	
11)	Radio System:	
12)	Fire Alarm System:	

13)	Neutral Grounding System:	
14)	Bus Duct:	

These are the spare parts required for two years operation. Vendor shall recommend the spares based on their experience.

*The quantities indicated are only preliminary estimation, so the firm quantities will be specified later in conjunction with recommendations of equipment vendors.

TABLE 7

SPARE PARTS FOR

INSTRUMENTS

Items	Quantities
Flow Instruments	
Level Instruments	
Temperature Instruments	To be determined in conjunction with the equipment Vendor (based on Vendor's experience on similar type of plant)
Pressure Instruments	
Analysers	
Control Valves:	
Valve Bodies	None unless service is corrosive or erosive.
	For corrosive or erosive service, shall be determined in conjunction with the equipment Vendor.
Valve Plugs	1 of each size/min. 15% or 1
Seat Rings	2 of each size/min. 25% or 2
Actuator	10% (min. one per type/size)
Valve Stems	1 of each diameter-
	These vary in length depending on valve size. Purchase the longest of each dia. These can be cut to the correct size.
Steam packing	3 boxes of each size used/min. 30%
Grease	3 boxes of each type used/min. 20%
Diaphragms	2 each of size used min. 20%
Pressure Gauges	15% each type (min two)
Solenoid and Trip Valves	15% each type (min two)
Valve Positioners	15% each type
Dial Thermometers	10% (for all)
Blank Orifice Plates	
Pressure Switches	
Plug-in Assemblies for Pneum. Instr.	
Seal, Condensate and Vent Pots	
Solenoid and Trip Valves	
Thermowells	
Signal Lights	
I/P Converters	
DCS/DCS/ESD/PLC (for each system) the Following Items:	
I/O Cards	5%, min. one for each type

Items	Quantities
Main Cards	1 set
Power Supply (AC, if any)	1 set
Power Supply (DC, if any)	1 set
On-Line Gas Chromatographs:	
Main Mother Cards	
Column	One per type
Barrier Cards	5% for each type (min. 1 for each type)

TABLE 8

SPARE PARTS FOR

PRESSURE VESSELS & HEAT EXCHANGERS

	Item	Quantities
1)	Heat Exchangers-Shell and Tube:	
	(U type included)	
	- Tubes	
		10% from longest tube of each size and material.
	- Bolts	Special, Alloy, and C.S. material: 10% per Size and Type
	- Gaskets	200%
2)	Pressure Vessels	
	- Gaskets	200%
	- Bolts	10% (Special, Alloy or size 2” diam or greater), minimum one number.
3)	Air Cooled Exchangers	
	- Plugs	Steel 5%; Non-ferrous 2% (min. one number)
	- Plugs gaskets	5% (min one number)
	- Cover plate gaskets	100%
	- Tube support boxes	10% (min one number)
	Spare Items	**Quantities (a)**
4)	Number of Air-fin Coolers Using Part.	1 2 3 4 5 6 7 or more
	i. V-belts. Sheaves (Driven & Driver)	0 0 0 0 0 0 1
	- Set of Belts	1 2 3 4 5 6 100%
	ii. Fan Shaft Bearing (Upper & Lower)	1 1 1 2 2 3 50% of No. of Air Fins
	iii. Speed Reducers (Gear Box) – Shaft & pinion	1 1 1 2 2 2 30% of No. of Air Fins
	- Bearing Set	1 1 1 2 2 3 50% of No. of Air Fins
	O-Rings, Seals, Lock- Washers, Locknuts	
	iv. Couplings – Complete Coupling, Flanges, Gaskets, Seals	1 1 1 1 1 1 1
	i. Fan Assemblies	1 2 3 4 5 6 100% of No. of Air Fans
	Automatic Pitch Control	

		Hub Assembly arts Guide Bushing, Pitch Blocks, O-Rings, Clam Gaskets	
	ii.	Bolt Assemblies, Fork Pins	1 2 3 4 5 6 100% of No. of Air Fans
	iii.	Flexible Hose, Rotary Union	1 1 1 1 1 1 2
	iv.	Automatic or Manual Adjustments:	
		Blade Retention Clamps, Pitch, Change Forks, Puch Rod, Stub (with pilot tubes)	1 1 1 2 2 2 30% of No. of Air Fans
		Bearing Retainer Rings	
	v.	Spring Housing Gasket, Diaphragm, Blade Retainer Ring, Thrust cover Gasket	1 1 1 1 2 2 20% of No. of Air Fans
	vi.	Hub Assembly with Blades	0 0 0 0 0 0 1 (b)
	vii.	Bolt Assemblies, Fork Pins	1 2 3 4 5 6 100% of No. of Air Fans
	*	NOTES	
	(a)	Quantities shown are for each size and type of part	
	(b)	Twenty units or moreThe parts listed are the principal parts only.	
	(c)	The parts listed are the principal parts only. Other parts shall be considered for recommendation in quantities consistent with the above table.	
5)	Plate type Exchanger:		
	Plate gasket		100%
	Flow Plate		10%
	Nozzle Gasket		200%
	Glue (1 Kg Pot)		1

TABLE 9

SPARE PARTS

FOR FURNACES / FANS

ITEM	QUANTITIES

(To be proposed by Vendor / PURCHASER and to be concluded by Owner prior to Placement of Purchase Order)

TABLE 10

SPARE PARTS

FOR PIPING

Item	Quantities
▪ Valves up to 1 1/2" complete units	5% for each size, type and material
▪ Valves from 2" to 6"	2% (minimum 2 pieces) for each size type and material
▪ Valves from 6" to 12"	1 piece for each size, type and material
complete units	
▪ Valves above 12"	1 only if installed valves quantity is greater than 20
For special case and critical valves less than 20"	*Shall be cleared and quoted by PURCHASER*
▪ Valves up to 10"	
Gland packing and bonnet gasket	10% (Gland Packing for class 1500 and more, minimum 20%)
▪ Valves from 2" to 10"	
Set of changeable inner parts	2 for each type, size and material
▪ Valves above 10"	
Set interchangeable inner parts:	1 for each type, size and material
- Bonnet gasket and stem packing	
▪ Steam Trap (Thermostatic)	2% for each size and type
▪ Steam Trap (another type)	1 piece for each size and type

Attachment 5

Spare Parts Interchangeability Record Form (SPIR)

(See Attachment)

D02

Guidelines for completion of the SPIR form attached here on.

Attachment 6

Example of Cost Breakdown (For Two Years Operation Spare Parts)

(As Following)

D02

EXAMPLE OF COST BREAKDOWN (for two years operation spare parts

Equipment/Material	Budget	Forecast	Actual PO-S value
Centrifugal compressor package			
Centrifugal pumps			
Piping			
CR instruments and cabinets			
Field instruments			
Motors			
Field electrical material			
SS boards			
PURCHASER PROCUREMENT SERVICES			
TOTAL			