



Toase-eh Park Sanati Gohar Ofogh  
Petrochemical Co.  
**CONCEPTUAL, BASIC and DETAIL DESIGN  
ENGINEERING OF STYRENE PARK OFFSITE**



Document Title: PWHT Procedure

Document No.: EI027-DMF-VD-QC-PRO-025

Rev. R0

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# STYRENE PARK OFFSITE

**Document Title:  
PWHT Procedure**

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**REVISION RECORD SHEET**

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## 1. PURPOSES:

This procedure describes the Post Weld Heat Treatment of Header boxes of Air-cooled heat exchangers that will be procured in “Toase-eh Park Sanati Gohar Ofogh Petrochemical Co. **CONCEPTUAL, BASIC and DETAIL DESIGN ENGINEERING OF STYRENE PARK OFFSITE**”.

## 2. SCOPE

Post Weld Heat Treatment use only for header box welds with carbon steel material.

## 3. REFERENCE

3.1. ASME SEC.VIII-2010-Div.1- UW-40 (Part 3), UCS-56

## 4. WELDING REPAIRS

4.1 Repairs to base metal surface nonconformities

4.1.1. Remove the defect by grinding or chipping.

4.1.2. Visually inspect the area prepared for welding.

4.1.3. Re-weld in accordance with an approved welding procedure.

4.1.4. Welded repairs shall be visually inspected after welding and previous NDE method shall be applied on welded zone.

4.2. Repairs to edge preparation





4.2.1. Remove the defect by grinding or chipping.

4.2.2. Visually inspect the area prepared for welding.

4.2.3. Re-weld in accordance with an approved welding procedure.

4.2.4. Grind the welded surface for preparing the area for welding.

4.2.5. Visually inspect the area prepared for welding.

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4.2.6. Re-grinded area shall be visually inspected after welding and any applicable NDE method shall be applied on welded zone.

#### 4.3. Repairs to Welds

##### 4.3.1. For repairs not required welding

4.3.1.1. Weld defects shall be removed by grinding or chipping.

4.3.1.2. Visually inspect the area to ensure that the defects has been removed and any applicable NDE method shall be applied on welded zone to ensure that the grinding or chipping process does not have any destructive effect on the adjacent area.

##### 4.3.2. For repairs required welding

4.3.2.1. Weld defects shall be removed by grinding or chipping.

4.3.2.2. Visually inspect the area to ensure that the defects has been removed and any weld defects shall be fully chipped out,

The repair welding shall be re-examined after the required heat treatment.

4.3.2.3. Re-weld in accordance with an approved welding procedure.





4.3.2.4. Welded repairs shall be visually inspected after welding and previous NDE method shall be applied on welded zone.

### 5 - PREPARATION:

All welded header boxes (complete welded) shall be in horizontal state to be placed in furnace. And all machined surfaces shall be protected against oxidation.

A way header will place in the furnace can act an important role in quality considerations. With choosing proper method and locations to place the headers.

Then headers shall be placed in furnace by a proper crane and chain. All parts shall be placed in furnace very slowly with no any damage.

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Temp. Range of the furnace when headers are to be charged in it, shall not exceed 425°C.

Three thermocouples will be placed into the furnace to measure the temperature exactly along the treatment. One will be placed in the front of the furnace, second in the middle and the other in the end of the furnace. Each thermocouple has its own graph to be evaluated.

In the top and the bottom of the furnace we have air flow by an air suction device. This device will homogenize the air flow in the furnace. So, heat transfer will be modified in the furnace.

Arrangement of the thermocouples shall be designed to cover whole furnace and whole effective heat radius to be able to register and record the results.

Before heat treatment, oil, scale, weld spatter and dirt shall be removed and items shall be inspected for its cleanliness.

Temperature time recorder and thermocouples shall be calibrated annually. Temperature chart shall be signed by inspector before and after heat treatment.

#### **6 – FURNACE DIMENSIONS:**

Furnace with 5m length, 2m width, 3m height, with appropriate insulation system.






#### **7 – HEATING AND COOLING PROCEDURE:**

After charging the furnace and closing the door, it shall be turned on. PWHT shall be proceeding according to the related schematic cycle. Operator should control the graph of time and temp. Carefully.

After considering the sufficient holding time, the furnace shall be turned off. So all parts can be cooled into the furnace.

Above 425°C the rate of heating shall not be more than (222 °C/h) divided by the maximum metal thickness of the shell or head plate in inches , but in no case more than 222 °C/h . During the heating period there shall not be a greater variation in temperature throughout the portion of the vessel being heated than 140°C within any 4.6 mm interval of length.

Above 425°C, cooling shall be done in a closed furnace or cooling chamber at a rate not greater than

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280°C/h divided by the maximum metal thickness of plate in inches . But in no case more than 280 °C/h. From 800°F (425°C) the vessel may be cooled in still air.

During holding period there shall not be a greater difference than 83 °C between the highest and lowest temperature.

Item Number	Thickness (Max.)	Heating Rate (Max.) °C/Hr.	Holding Time Min. (minutes)	Holding Temp. (°C)	Cooling Rate (Max.) °C/Hr.
Air Cooler	20	222	60	610±10	222

### SCHEDULING OF PWHT

PWHT shall be performed after following actions:





- Machining
- Cold and hot forming
- All repair and welding
- Final dimensional check
- Main NDT of header

### OPERATING OF POST WELD HEAT TREATMENT





The operating of the post weld heat treatment should be generally performed in accordance

With the sequence prescribed here after.

- 1) Review the procedure of the heat treatment work and drawing.
- 2) Check the weld and line number, cleaning condition and other requirement to be performed for PWHT.

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- 3) Determination the burner number and type, thermocouple type, number position and adhesion Condition.
- 4) confirm the calibration status (report) of temperature recorder. The temperature recorder shall be calibrated in accordance to the fabricator recommendation or laboratory guidance.
- 5) Thermocouple calibration record shall be reviewed and approved with inspector.
- 6) Connect of power cables to temperature recorder and controller, respectively.
- 7) All machined surface, such as Flange faces, Bolts holes, Threads, etc., shall be protected from oxidation during the heat treatment by coating with deoxy aluminate or other suitable material such as refractory mud mixing with water.
- 8) Seal furnace gap.
- 9) Check the temporary supports for fill-up distortion due to the PWHT operation, and check all of the dial's instruments, knobs/ controller and indicators related to the PWHT operation.
- 10) Heat up until PWHT temperature is reached at the desired value of the heat treatment procedure.
- 11) Monitor the heating rate, holding time and cooling rate during the PWHT operation.
- 12) Disassemble the thermocouple and temporary attachment.
- 13) Check the time-temperature chart, and make a heat treatment report in accordance with the time-temperature chart.
- 14) During the heating and holding periods, the furnace atmosphere shall be do controlled as the avoid excessive oxidation of the surface of the Header. The furnace shall be of such design as for prevent direct impingement of the flame on the Header.

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## 8 – POST TREATING CONSIDERATIONS:

After completing PWHT procedure, time-temperature charts shall be record from the registration unit of the furnace according to the service description.

- Hardness test shall consist of at least two hardness measurements in weld metal which shall be taken on each longitudinal and circumferential weld seam and each branch connection nozzle, except for (at least 20%). small nozzle connections of diameter 3" and less which may be random tested. Each weld forming part of prefabricated head shall be as well hardness tested.

-Maximum Hardness is 200 HB -API 661 2013

## 9 – ACCEPTANCE CRITERIA:

-NDT CHECKLIST & NDT MAP (EI027-DMF-VD-QC-PRO-023)

**- Hardness conversions shall be made in accordance with ASTM E110.**

## 10 - REPORT:

Related graphs of the furnace shall be attached to Report format. (See Annex I)



# P.W.H.T & HARDNESS INSPECTION REPORT



Report No :

Project Name / Dtt Job No :

## PWHT PROCEDURE

Reference Document Name / No: **NDT. CHECK LIST & NDT MAP**

Item No :

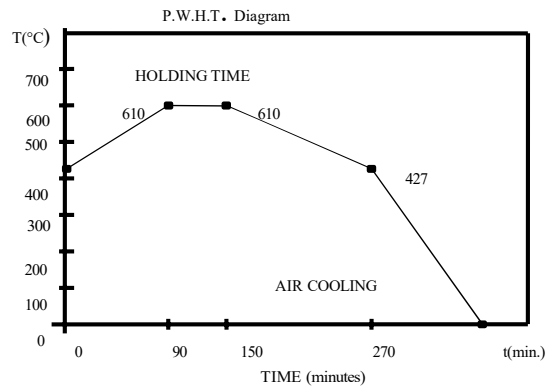
Front Header No :

### P.W.H.T :

Holding Time : 60 (min.) **Accept**

P.W.H.T Temp. : 610 ± 10° C **Accept**

P.W.H.T Graph No. :



### HARDNESS TEST :

Maximun Hardness : 200 HB

#### Type of material :

Max. = Min. = **Accept**

#### H.A.Z :

Max. = Min. = **Accept**

#### Weld Metal :

Max. = Min. = **Accept**

#### Instrument for hardness measurment & Calbration Date: TIME TH-140

#### DTT

Name :

Date :

Sign

#### Contractor

Name :

Date :

Sign

#### TPI

Name :

Date :

Sign