

RECOMMENDED PRACTICE FOR LOCAL POST-WELD HEAT TREATMENT

ES-45

Prepared by

Pipe Fabrication Institute Engineering Committee



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1. Scope

- 1.1 This standard describes recommendations regarding procedures for local post weld heat treatment of welds on pipe fabrication.
- 1.2 The project contract and specification shall dictate when post weld heat treatment is required.
- 1.3 It is the intent of this standard to provide guidance in establishing the minimum requirements when performing local post weld heat treatment.

2. Methods

- 2.1 Local heat treatment shall be performed by electric resistance or induction method controlled with proper equipment and recording instruments. For more information regarding methods of heat treatment, consult AWS D10.10 "*Recommended Practices for Local Heating of Pipe and Tubes*" and for creep strength enhanced ferritic pipe and tube (e.g. GR 91) reference AWS D10.22. *Specification for Local Heating of Welds in Creep Strength-enhanced Ferritic Steels, in Piping and Tubing Using Electric Resistance Heating*

3. Personnel and Equipment

- 3.1 Personnel shall be trained in the operation of equipment, insulation materials, proper application of thermocouples and have knowledge of heat treatment cycle for the particular codes and materials involved.
- 3.2 Measuring and recording equipment shall be in good working order and shall be calibrated in accordance with the applicable QA manual at a minimum of 1-year intervals.
- 3.3 Proper safeguards and redundancies shall be in place to ensure a proper heat cycle is monitored. Special attention shall be given to protect against accelerated heating or cooling rates and exceeding maximum rates permitted. It is strongly recommended that spare thermocouples be placed at locations where the highest temperature will be anticipated as a precaution to thermocouple failure during the heating cycle. Thermocouples should use the capacitive discharge method of attachment. This method of attachment provides a more accurate measure of work piece temperature.

4. Fabricator Responsibilities

- 4.1 Fabricator/erector shall be responsible for providing the following instructions in accordance with the applicable code and client specifications.
 - 4.1.1 Job reference
 - 4.1.2 Fabrication Code Paragraph
 - 4.1.3 Material specification
 - 4.1.4 Thickness upon which heat treatment will be based
 - 4.1.5 Quantity & Unit of Measure
 - 4.1.6 Tag number(s) if applicable
 - 4.1.7 Hardness test requirements
- 4.2 It is recommended that the fabricator performing heat treatment services provide the following documentation at the completion of work.
 1. PWHT procedure with all the required information completed
 2. Drawing / Sketches of heater, thermocouple, and insulation layout
 3. Thermocouple and extension wire certificates of compliance
 4. Temperature recorder calibration records
 5. Hardness testing results, (if applicable)
 6. Chart record of the entire heat treatment cycle, with the following information:
 - Date, time period, and location of work performed
 - Identification of contractor/personnel performing the work
 - Identification number of weldment or spool
 - Temperature and time scales
 - Cross reference between thermocouple numbers on charts and drawings/sketches
 - Heating rate above specified temperature
 - Hold period time and temperature
 - Cooling rate above specified temperature

5. Heat Cycle

- 5.1 When required, fabricator's/contractor's heat procedure shall be submitted to owner for approval prior to commencing the work.
- 5.2 Heat band on pipe welds shall extend the greater of 3 times the width of the weld cap on both sides of

the weld center line, or as specified by the applicable code or standard.

- 5.3 Local PWHT of branches and welded attachments shall require a complete circumferential heat band around the run pipe and shall contain the welded addition.
- 5.4 Heat band on welded shoes, reinforcing pads or other attachments shall be extended the greater of 6 times the header thickness on each side of the weld, or as specified by the applicable code or standard.

6. Special Precautions

- 6.1 Special precautions may be required when components such as valves or strainers are installed on spool(s) to be heat-treated. The component manufacturer and/or the Owner shall be consulted to advise procedures involved.
- 6.2 Work shall be properly supported so as not deform during heat treatment.
- 6.3 Be sure that combustible materials are removed from the work zone.
- 6.4 Be sure that that no foreign materials such as removable purge plugs, tools or water are present inside the pipe prior to heat cycle.
- 6.5 When there is a large heat sink such as a valve or flange, or when joining parts of differing thicknesses the heating pads will have to provide more heat to the thicker member without overheating the weld. Symmetric placement of the heating source can easily result in overheating of the thinner materials adjacent to the weld being heated. In these situations, it is recommended to monitor the temperature of the thinner member an inch or so from the toe of the weld to ensure that no part of the materials subject to heat treatment exceeds the lower transformation temperature of the material. Particular care shall be exercised when the heat treatment temperature is very close to the lower transformation temperature, such as Gr.91 materials.

7. Safety

- 7.1 All employees engaged in the local heat treatment process shall be properly instructed in the applicable safety procedures as required by company policies and local fire codes.
- 7.2 Employee / employer shall provide adequate signage surrounding the heat treatment area to prevent accidental burns.
- 7.3 Employees shall be trained in the proper use of fire extinguishing equipment, and employer will assure that the fire extinguishing equipment is in proper working order.