

1.0 PURPOSE AND SCOPE

This procedure describes the minimum requirements for manufacturing and inspection of induction bends made from carbon steel, low intermediate alloy steel, and high alloy steel with a minimum bend radius of one and one half diameter.

2.0 CODES AND STANDARDS

2.1 Bends shall be manufactured and tested in accordance with Industry Codes and Standards (latest editions) as they are applicable, which shall constitute the minimum requirements to be met by the purchaser's design.

- ASME B31.1 - Power Piping
- ASME B31.3 - Process Piping
- ASME B31.4 - Liquid Transportation systems for Liquid Hydrocarbons and Other Liquids
- ASME B31.8 – Gas Transmission and Distribution Piping Systems
- ASME SECTION 1 – Rules for Construction of Power Boilers
- ASME SEC VIII – Rules for Construction of Pressure Vessels
- TPA-IBS 98 – Recommended Standards for Induction Bending of Pipe and Tube
- PFI-ES-24 – Pipe Bending Methods, Tolerances, Process and Material Requirements

3.0 MATERIALS

3.1 Materials for bending shall conform to the applicable specification and grade (i.e.: ASTM, API, etc.).

3.2 Austenitic stainless steel pipe shall be furnished in the solution annealed condition.

3.3 For types 304, 316 and 317, carbon content shall not exceed .05

3.4 When purchasing chrome material for bending, the chemistry shall have a restriction of 0.016% maximum aluminum content.

3.5 Traceability: Confirm material required, check heat number and maintain traceability. Notify Shop Quality Control if material is not marked. Maintain markings throughout each process.

3.6 Inspection: Inspect visually for surface imperfections and contaminants. Materials for bending shall be free from surface contamination, cracks, nicks, gouges, waves, buckles or any other such defects that may inhibit

	CONTROL COPY DATA		DATE
Prepared By:	GORDON AAKER		DECEMBER 07, 2016
Reviewed By:			
Approved By:			
Issued By:			
Issued To:			

successful completion of bending. Clean as required prior to bending (i.e.: Remove any oil, grease, dirt, or other foreign matter).

4.0 PROCEDURE QUALIFICATION

4.1 Qualification tests shall be performed (when required) on a Qualification bend to demonstrate that bend has suitable properties such as strength, ductility and hardness, prior to manufacturing of Production Bends. Testing shall be in accordance with TPA-IBS 98 Table 2-1.

4.2 A bending procedure qualification shall be re-qualified when a change is made beyond the limit indicated in any of the essential variables in Table 2-2 of TPA-IBS-98.

4.3 Induction Bending Inspection Report (see attached Exhibit 1) shall be generated to document the bending parameters supported by the testing above. Bending parameters shall be established and documented on the Induction Bending Inspection Report for each combination of pipe diameter, wall thickness and bend radius.

5.0 PRODUCTION BENDS

- Bending Parameters – See Section 6
- Post Bend Heat Treatment - See
- Dimensional Inspection - See
- Non-Destructive Examination - See

6.0 BENDING PARAMETERS

6.1 Bends shall be completed in a continuous heating cycle without stops and re-starts. The bending process shall produce bends that are smooth and free from cracks, buckling, wrinkles, or other forms of mechanical damage (exclusive of start/stop upset).

6.2 The pipe shall be loaded into the machine so that the thickest quadrant will lie in the extrados of the bend. If the pipe has a weld seam, the seam shall be located along the top neutral axis and may be tilted toward the intrados no more than 15 degrees from the neutral axis.

	CONTROL COPY DATA		DATE
Prepared By:	GORDON AAKER		DECEMBER 07, 2016
Reviewed By:			
Approved By:			
Issued By:			
Issued To:			

6.3 The minimum bending temperature for individual material shall be based on past experience with the particular material. Temperature range will be 1600° F – 1900°F (+/- 50°F).

6.4 Bending through girth welds is not permitted unless approved by customer.

	CONTROL COPY DATA		DATE
Prepared By:	GORDON AAKER		DECEMBER 07, 2016
Reviewed By:			
Approved By:			
Issued By:			
Issued To:			