

# Field Bending and Alignment

## STD.8706

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### Scope

This standard provides Enterprise (Company) requirements for field bending and alignment for pipeline construction and installation. These requirements shall apply to all field bends, irrespective of pipe seam type, unless noted otherwise, whether made by Company forces or by other parties constructing to Company standards. All bends shall meet the criteria set forth in 49 CFR Part 192 or Part 195 and ASME B31.4 or B31.8, whichever is applicable.

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## 1.0 REFERENCES

### 1.1. Pipeline and Hazardous Materials Safety Administration (PHMSA)

49 CFR Part 192	Transportation of Natural and Other Gas by Pipeline
49 CFR Part 195	Transportation of Hazardous Liquids By Pipeline

### 1.2. American Society of Mechanical Engineers (ASME)

B31.4-2006	Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids
B31.8-2007	Gas Transmission and Distribution Piping Systems

### 1.3. NACE International (NACE)

MR0175	Standard Material Requirements - Sulfide Stress Cracking Resistant Metallic Materials for Oilfield Equipment
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### 1.4. Company Standards

STD.7002	Protective Coatings – Below Ground Steel Surfaces – Field Applied
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## 2.0 DEFINITIONS

**Company** – Enterprise (if used in connection with a contract or other agreement, the actual Enterprise entity will be the specific Enterprise entity referenced in the contract).

## 3.0 FIELD BENDING

### 3.1. General Requirements

The intent of this standard is to require that field bends shall be made in a manner that minimizes unwanted distortion while maintaining the structural integrity and strength of the source pipe.

- (1) A bend must not impair the serviceability of the pipe.
- (2) Where it is necessary to bend pipe, only cold bends shall be employed.
- (3) The bends shall have a smooth contour and be free from wrinkling, buckling, flattening, cracking, or any other evidence of mechanical damage.
- (4) Particular care shall be taken so that any bending induced ovality of the pipe through the area of bend does not exceed 2.5 percent of the outside pipe diameter.
- (5) All bends shall meet the criteria set forth in 49 CFR Part 192 or 195 and ASME B31.4 or B31.8, whichever is applicable.
- (6) All bends will be visually inspected in accordance with Company standards and comply with project-specific inspection form(s). The condition of the bend will be documented on project-specific inspection form(s).
  - a. Any coating damage identified through visual inspection or jeeping will be repaired in accordance with Company Standard STD.7002.

### 3.2. Slack, Longitudinal, and Spiral Welds

- (1) All over-bends, sags and side-bends shall be made to provide an adequate amount of slack or flexibility in the pipeline and shall conform to engineering design tolerances provided in this standard.
- (2) On pipe containing a longitudinal weld, the longitudinal weld must be as near as practicable to the neutral axis of the bend unless:
  - a. The pipe is 12.75 inches or less outside diameter or has an outside diameter to wall thickness ratio less than 70; or
  - b. The field bend is made utilizing an internal mandrel.
- (3) On pipe containing a spiral (helical) weld, an internal bending mandrel must be utilized when field bending. Helically welded pipe is excluded from the neutral axis weld seam positioning requirements.

### 3.3. Bending Machine

- (1) Bending machines must be capable of producing dimensionally acceptable field bends in accordance with Section 3.4.
- (2) Unless approved otherwise by a waiver to this standard, bending machines must have full encirclement bending shoes with a neoprene or urethane lining to produce a smooth, symmetrical bend.
- (3) If the pipe is internally coated, the bearing surfaces of the mandrel shall be constructed to avoid permanently marking or damaging the internal coating.
- (4) Position bending shoes and mandrels so as not to apply a point load to the seam weld and minimize stresses in the seam weld.
  - a. Helically welded pipe is an exception to this bending shoe positioning requirement.
- (5) An internal bending mandrel will be used when bending welded pipe 12.75 inches or greater in outside diameter unless approved otherwise by a waiver to this standard.
- (6) Contractor shall complete change out of shoes and perform any other equipment maintenance required.

### 3.4. Bending Limitation

- (1) Contractor shall follow the minimum bend radii limits, based on ASME B31.4, B31.8, and accepted industry practice listed below.

Minimum Bend Radii per Pipe Size	
Nominal Pipe Size	Bend Radius in Nominal Pipe Size Diameters
	All Seam Types and Seamless Pipe
NPS 12 and smaller	18D
NPS 14	21D
NPS 16	24D
NPS 18	27D
NPS 20 and larger	30D

- (2) Bend radius tolerances shall be  $\pm 1\%$  of source nominal pipe size (0.01D)

- (3) The contractor shall use a consistent method of measurement when both marking the pipe in preparation for bending and in subsequent post-bending inspections.
- (4) The bending operations shall be inspected to verify that the minimum allowable radius of the bend is not exceeded and that there is no wrinkling or excessive flattening of the pipe.

### 3.5. Tangents

Bending shall not be allowed in a circumferential weld and not closer than six feet to an open end.

### 3.6. Material Properties

- (1) Bends used in sour gas pipelines should meet the hardness requirements of NACE MR0175 in the as-bent condition. Bends exposed to or used in low-temperature service should meet toughness and tensile requirements in the as-bent condition.
- (2) The Company Project Manager may request that prototype bends are made and tested to ensure that a particular field bending procedure produces bends meeting the material property requirements.

## Attachment: Revision Log

Revision 0.0		Publish Date: 24 Jun 11
Location of Change	Type of Change	Reason for Change
N/A	N/A	
Revision 0.1		Publish Date: 20 Jun 12
Location of Change	Type of Change	Reason for Change
Section 3.0	Deletion	Deleted section on swabbing and closing open ends.
Revision 0.2		Publish Date: 12 Nov 15
Location of Change	Type of Change	Reason for Change
Title	Addition	Added "Field" before "Bending".
Section 1.0	Addition	Added Section 1.2 references to ASME standards.
Section 2.2	Revision	Replaced "practical to" with "practicable to the" and "inch" with "inches".
Revision 1.0		Publish Date: 31 Jan 17
Location of Change	Type of Change	Reason for Change
Scope	Addition	Added phrase "And ASME B31.4 or B31.8".
Section 2.1	Addition	Added phrase And ASME B31.4 or B31.8".
Section 2.2	Addition	Added phrase "and Spiral" to section name.
Section 2.2	Addition	Added phrase ", or flexibility, in the pipeline and shall conform to engineering design tolerances. Where no such tolerances were provided, the Contractor shall consult with Company to seek guidance prior to proceeding."
Section 2.2	Deletion	Deleted phrase "On pipe containing a longitudinal weld, the longitudinal..."
Section 2.4	Addition	Added phrase "the amount specified in the Scope of Work or engineering design basis. Where no limitation is provided, Contractor shall obtain prior approval of bending limitations from Company Representative prior to any bending activities taking place."
Section 2.4	Deletion	Deleted phrase "a maximum of one and one half degrees per pipe measured longitudinally along the pipe."

<b>Revision 2.0</b>		<b>Publish Date: 26 May 17</b>
<b>Location of Change</b>	<b>Type of Change</b>	<b>Reason for Change</b>
Section 1.2	Deletion	Deleted references to specific paragraphs in ASME B31.4 and B31.8
Section 1.3	Addition	Added reference to NACE MR0175
Section 2.1	Clarification	Reworded paragraph to clarify intent
Section 2.2	Clarification	Provided clarification regarding weld seam position requirement and exception for helically welded pipe
Section 2.3	Addition	Added sentences "Position bending shoes and mandrels so as not to apply a point load to the seam weld and minimize stresses in the seam weld. Helically welded pipe is an exception to this bending shoe positioning requirement."
Section 2.4	Revision/ Addition	Revised section to align with ASME B31.4 and B31.8, and added minimum bend radii table for long seam and spiral seam pipe
Section 2.6	Addition	Added section on material properties
<b>Revision 2.1</b>		<b>Publish Date: 14 Nov 18</b>
<b>Location of Change</b>	<b>Type of Change</b>	<b>Reason for Change</b>
Section 2.3	Clarification	Reword paragraph to clarify bending machine statement
<b>Revision 2.2</b>		<b>Publish Date: 03 Apr 19</b>
<b>Location of Change</b>	<b>Type of Change</b>	<b>Reason for Change</b>
Section 2.0	Addition	Added a Definition Section. All other sections below this addition where renumbered.
Sections 3.1 and 3.2	Addition	Incorporated bend requirements of 49 CFR 192.313 and 195.212
Section 3.1(6)	Addition	Added visual inspection and documentation requirement
Section 3.3	Addition	Added requirement for contractor to change out shoes and perform maintenance
Section 3.4	Deletion	Removed minimum bend radii table for spiral seam pipe
<b>Revision 3.0</b>		<b>Publish Date: 03 Nov 20</b>
<b>Location of Change</b>	<b>Type of Change</b>	<b>Reason for Change</b>
Scope	Clarification	Clarify the STD applies to all seam types.

3.1(4)	Clarification	Added “bending induced” to ovality
3.2 (1)	Removal	Removed last sentence “Where no such...” and added “provided in this standard”.
3.2(2)(b)	Addition	Added paragraph as an alternative to (a)
3.2(3)	Addition	Added a requirement to utilize an internal bending mandrel when field bending spiral pipe
3.3 (2) & (5)	Clarification	Clarify that a Waiver must be approved to deviate from the requirements of these paragraphs.
3.4 Table	Clarification	Removed the note and changed the table heading to clarify
All	Clarification	Replaced nominal diameter with outside diameter