


PROCESS & PIPING DESIGN SECTION
MECON LIMITED
DELHI - 110 092



TECHNICAL SPECIFICATION
FOR
LONG RADIUS BENDS


SPECIFICATION NO. : MEC/TS/05/62/015, Rev-1


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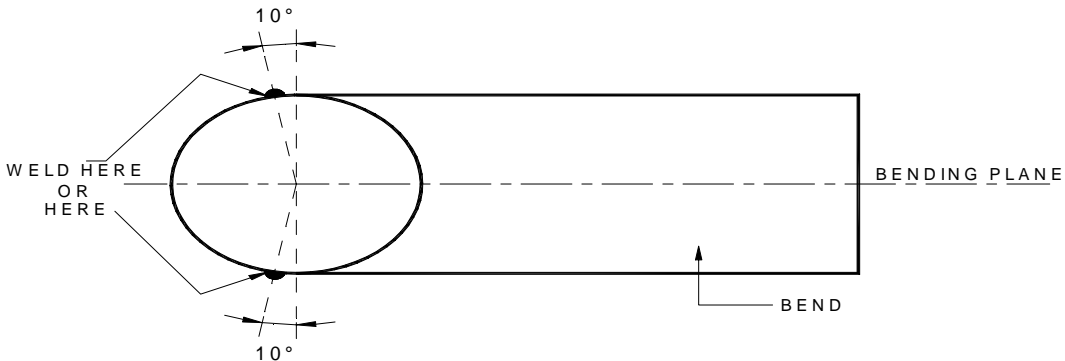
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Revision No.	Date	Revised by	Checked by	Approved by
PREPARED BY :		CHECKED BY :	APPROVED BY :	


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1.0	<u>SCOPE</u>			
	<p>This specification covers long radius steel pipe bends to be manufactured in accordance with the requirements of MSS-SP (Manufacturers Standardisation Society – Standard Practice) – 75, latest edition, to be used in pipeline system handling Natural Gas. The selection of options permitted by MSS-SP-75 shall be as described below. All applicable requirements contained in the MSS-SP-75 shall be fully valid unless cancelled, replaced or amended by more requirements as stated in this specification. In case of conflict between the requirements of this specification and MSS-SP-75, the requirements of this specification shall govern.</p>			
2.0	<u>REFERENCE DOCUMENTS</u>			
	<p>Reference has also been made in this specification to the latest edition of the following codes, standards and specifications.</p>			
	a)	ANSI B31.8	:	Gas Transmission and Distribution Piping System.
	b)	ASME – Sec. VIII Div. 1	:	Boiler and Pressure Vessel Code
	c)	ASME – Sec IX	:	Boiler & Pressure Vessel Code Welding and Brazing Qualifications
	d)	API Spec. 5L	:	Line Pipe
	e)	ASTM Part-I	:	Steel – Piping, Tubing, Fittings
	<p>In case of conflict between the above reference documents and this specification, the requirements of the specification shall prevail.</p>			
3.0	<u>MATERIALS</u>			
3.1	<p>Bends shall be fabricated from bare steel line pipe (to be issued as free issue item by Purchaser). The details of free issue line pipe material is given separately in LR Bend Data Sheet & Purchase Requisition.</p>			


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3.2	All mechanical properties of the bends after finishing shall be same as pipe specification as referred in section 3.1. The following tests shall be conducted on finished bends and test procedures shall be as per pipe specification as referred in para 3.1.			
3.2.1	One transverse tensile test will be conducted to establish the yield strength, ultimate tensile strength and elongation of :			
	a) Base material at inside radius of the bend. b) Base material at outside radius of the bend.			
3.2.2	One all weld tensile test will be conducted (wherever applicable) to establish yield strength, ultimate tensile strength and elongation of weld material on bend.			
3.2.3	Three transverse Charpy-V-notch impact tests shall be conducted on full sized specimen of the same heat in accordance with ASTM A370 at 0°C for each of the following :			
	a) Base material at outside radius of the bend. b) Weld material of bend			
3.2.4	<u>Guided Bend Tests</u>			
	One face and one root guided bend weld test shall be performed on samples cut from one bend per heat of steel. The dimensions `A' in guided bend test shall not exceed 4.0 times the nominal wall thickness and dimension `B' shall be equal to $A + 2t + 3.2\text{mm}$.			
4.0	<u>MANUFACTURE</u>			
4.1	Bends shall be manufactured by hot bending of pipe applying induction heating only.			
	The adopted procedure shall be completed by suitable heat treatment to achieve the required mechanical and chemical properties of the finished bends and is accepted only after written approval of the Purchaser. The procedure shall ensure uniform bending without any defects other than those allowed in this specification and pipe specification as referred in para 3.1.			

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4.2	<p>When bending, the weld wherever applicable shall be located at approx. 10° from the neutral zone, measured at outside of the bend as indicated in figure below.</p> 			
4.3	Bevels at the ends shall be as specified in MSS-SP-75 unless otherwise specified differently in the material/ purchase requisition.			
4.4	Bends shall not have any circumferential joint.			
4.5	No repair by welding is allowed on any part of the bends.			
4.6	The cooling of the bend immediately after bending shall be an interval cooling, alternatively with water and air at a minimum pressure of 2 atmospheres.			
4.7	The procedure shall be such which shall not require any additional heat – treatment after bending. If such a heat treatment is required, it is permitted only after the written approval of purchaser and shall be carried out at Manufacturer's expense.			
4.8	<p>Bulges, dents and flat areas shall not appear within 100mm from end of the bend.</p> <p>For the remaining part of the bend these deviations from the original contour of the pipe are permitted but the same shall be repaired, provided these deviations shall not exceed 6.5% of nominal wall thickness in height/ depth and the same shall not extend (in any direction) over a distance of more than 25% of nominal diameter.</p>			
4.9	The excess weld material wherever applicable at the inside of the bend shall be removed over a distance of 100mm at both ends.			
4.10	<p>Tolerances</p> <p>The dimensions of bends shall be controlled to make sure that they are manufactured according to the tolerances indicated below over and above the requirements of MSS-SP-75</p>			

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4.10.1	Minimum Inside Diameter	:	-2.5% of inside nominal diameter except 200mm from ends	
	Bend Angle	:	±1°	
	Bend Radius	:	± 1% of bending nominal Diameter	
4.10.2	The manufacturer shall check the wall thickness of the pipe before and after bending along the outside radius either at distances approximately equal to pipe diameter or 300mm whichever is less. The measured wall thickness shall be atleast equal to :			
	t _{min}	=	0.95 (t _{nom.} Δ t)	
	t _{nom}	=	nominal wall thickness as specified in the material/ purchase requisition.	
	Δ t	=	0.35mm for a wall thickness smaller than 10mm.	
	Δ t	=	0.50mm for a wall thickness 10mm or more.	
4.10.3	Ovality may be defined as :			
	$\frac{OD \text{ max.} - OD \text{ min.}}{OD \text{ nom.}}$			
	The above value shall be < 1% within 100mm from each end and < 6% for remaining part of the bend. The measurement shall be made over the circumference of the bend either at distance approximately equal to pipe diameter or 300mm whichever is less.			
4.10.4	Wrinkles			
	Measurements of the outside diameter shall be taken in the plane of the bend at locations where wrinkles are present (OD max.) and at locations where wrinkles are not present (OD min.). The acceptance limit shall be as defined below.			
	$\frac{OD \text{ max.} - OD \text{ min.}}{OD \text{ nom.}} < 1\%$			

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<p>5.0 <u>INSPECTION AND TESTS</u></p> <p>5.1 The manufacturer shall perform all inspection and tests as per the requirements of this specification and MSS-SP-75 prior to shipment at his works. Such inspection and tests shall be, but not limited to, the following :</p> <ol style="list-style-type: none"> a) Verify that the unfinished product arriving at manufacturer's shop is in full compliance with the pipe specification as referred in para 3.1. b) Visual Inspection. c) Dimensional and tolerances check as per MSS-SP-75 and requirements of section 4.0 of this specification. d) Check heat treatment, if carried out, as required and maintain its records. e) Temperature against time recorder charts for each induction heating. f) Material properties shall be checked to meet the requirements of section 3.0 of this specification. g) The non-destructive inspection on the finished bend shall be carried out as given below : <ul style="list-style-type: none"> • All longitudinal seam welds shall be fully radiographed and acceptance limits shall be as per pipe specification as referred in para 3.1. • The full circumference of both ends of each bend after bevelling shall be ultrasonically tested for laminations over a length of 25mm and acceptance limits shall be as per pipe specification as referred in para 3.1. <p>5.2 Purchaser's Representative reserves the right to perform stagewise inspection and witness tests on all bends as indicated in para 5.1 at Manufacturer's works, prior to shipment.</p> <p>Manufacturer shall give reasonable notice of time and shall provide without charge reasonable access and facilities required for inspection, to the Purchaser's Representative. Inspection and test performed or witnessed by Purchaser's Representative shall in no way relieve the Manufacturer's obligation to perform the required inspection and tests. Under no circumstances any action of the Purchaser's Representative shall relieve the Manufacturer of his responsibility for the material, design, quality and operation of the equipment.</p>				

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<p>5.3 Test Certificates</p> <p>The Manufacturer shall produce the Certificates (in original) for all, but not limited to, the following :</p> <ol style="list-style-type: none"> a) Certificates of chemical analysis and mechanical tests carried out on pipe and bends separately. b) Certificates of required non-destructive test inspection. c) Certificates of heat treatments, if any. d) Certificates of all other tests as required in this specification. <p>In case any of the above said certificates are not available during the final inspection, the supply shall be considered incomplete.</p> <p>6.0 <u>MARKING, PACKING AND SHIPMENT</u></p> <p>6.1 All bends shall be marked as per MSS-SP-75.</p> <p>6.2 All loose and foreign material i.e. rust, grease, etc. shall be removed from inside and outside of the bends.</p> <p>6.3 All bends except bevelled ends shall be coated internally and externally with a thin film of zinc chromate red oxide paint for protection against corrosion during transit and storage. The coating shall be easily removable in the field. Manufacturer shall furnish the details for the same.</p> <p>6.4 Both ends of all bends shall be suitably protected to avoid any damage during transit by means of metallic bevel protectors.</p> <p>6.5 Package shall be marked legibly with suitable marking to indicate the following:</p> <ol style="list-style-type: none"> a) Order Number b) Package Number c) Manufacturer's Name d) Size (Inches) and wall thickness (mm) 				

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7.0	<u>WARRANTY</u>			
	<p>Purchaser will be reimbursed by Manufacturer for any bend furnished on this order that fails under field hydrostatic test if such failure is caused by a defect in the bend which is outside the acceptance limits of this specification. The reimbursement cost shall include bend cost, labour cost and equipment rental for searching, excavation, cutting out and installation of replaced bend in position. The field hydrostatic test pressure will not exceed that value which will cause a calculated hoop stress equivalent to 100% of specified minimum yield strength of the attached pipe.</p>			
8.0	<u>DOCUMENTATION</u>			
8.1	All documents shall be in English language.			
8.2	At the time of bidding, bidder shall submit the following documents :			
	<ul style="list-style-type: none"> a) Reference list of previous supplies of bends of similar specifications. b) Clause-wise list of deviation from this specification, if any. c) Brief description of manufacturing and quality control facilities of the Manufacturer's works. 			
8.3	<p>Within one week of placement of order the Manufacturer shall submit four copies, of the manufacturing process and quality assurance plan for pipe and bends.</p> <p>Once the approval has been given by Purchaser any change in material and method of manufacture and quality control shall be notified to Purchaser whose approval in writing of all such changes shall be obtained before the bends are manufactured.</p>			
8.4	Within four weeks from the approval date Manufacturer shall submit one reproducible and six copies of the documents as stated in para 8.3 of this specification.			
8.5	Prior to shipment, the Manufacturer shall submit one reproducible and six copies of test certificates as listed in para 5.3 of this specification.			

Rev. : 0


Edition : 1

**SPECIFICATION
FOR
SEAMLESS FITTINGS & FLANGES
[SIZE UPTO DN 400 mm (16") NB]**

SPECIFICATION NO.: MEC/TS/05/21/025




**(OIL & GAS SBU)
MECON LIMITED
DELHI 110 092**

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PREPARED BY: (Shalini Singh)	CHECKED BY: (Sunil Kumar)	APPROVED BY: (A.K. Johri)	ISSUE DATE : Dec. 2008
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1.0 SCOPE


This specification covers the minimum requirements for the design, manufacture and supply of following carbon steel flanges and fittings of size upto DN 400 mm (16") to be installed in onshore pipeline systems handling non-sour hydrocarbons in liquid or gaseous phase including Liquefied Petroleum Gas (LPG) :

- Flanges such as welding neck flanges, blind flanges, spectacle blinds, spacers and blinds etc.
- Seamless fittings such as tees, elbows, reducers, caps, outlets etc.

2.0 REFERENCE DOCUMENTS

2.1 Reference has been made in this specification to the latest edition (edition enforce at the time of issue of enquiry) of the following Codes, Standards and Specifications :

- | | | |
|---------------|---|---|
| ASME B31.4 | - | Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids |
| ASME B31.8 | - | Gas Transmission and Distribution Piping Systems |
| ASME B16.5 | - | Pipe Flanges and Flanged Fittings |
| ASME B16.9 | - | Factory Made Wrought Steel Butt Welding Fittings |
| ASME B 16.11 | - | Forged Steel Fittings, Socket Welding and Threaded |
| ASME B 16.48 | - | Steel Line Blanks |
| ASME Sec VIII | - | Boiler and Pressure Vessel Code - Rules for Construction of Pressure Vessels |
| ASME Sec IX | - | Boiler and Pressure Vessel Code - Welding and Brazing Qualifications |
| ASTM A 370 | - | Standard Test Methods and Definitions for Mechanical Testing of Steel Products. |
| MSS-SP-25 | - | Standard Marking System for Valves, Fittings, Flanges and Unions |

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MSS-SP-97 - Forged Carbon Steel Branch Outlet Fittings - Socket Welding, Threaded and Butt welding Ends.

2.2 In case of conflict between the requirements of this specification and the requirements of above referred Codes and Standards, the requirements of this specification shall govern.

3.0 MANUFACTURER'S QUALIFICATION

Manufacturer who intends bidding for fittings must possess the records of a successful proof test, in accordance with the provisions of ASME B16.9 / MSS-SP-75 as applicable.

4.0 MATERIAL

4.1 The Carbon Steel used in the manufacture of flanges and fittings shall be fully killed. Material for flanges and fittings shall comply with the material standard indicated in the Purchase Requisition. In addition, the material shall also meet the requirements specified hereinafter.

4.2 Each heat of steel used for the manufacture of flanges and fittings shall have Carbon Equivalent (CE) not greater than 0.45 calculated from check analysis in accordance with the following formula:


$$CE = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Cu}{15}$$

Carbon contents on check analysis shall not exceed 0.22%.

4.3 For flanges and fittings specified to be used for Gas service or LPG service, Charpy V-notch test shall be conducted on each heat of steel. Unless specified otherwise, the Charpy V-notch test shall be conducted at 0°C in accordance with the impact test provisions of ASTM A 370 for flanges and fittings.

The average absorbed impact energy values of three full-sized specimens shall be 27 joules. The minimum impact energy value of any one specimen of the three specimens analysed as above, shall not be less than 22 Joules.

When Low Temperature Carbon Steel (LTCS) materials are specified for flanges and fittings in Purchase Requisition, the Charpy V-notch test requirements of applicable material standard shall be complied with.

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4.4 For flanges and fittings specified to be used for Gas service or LPG service, Hardness test shall be carried out in accordance with ASTM A 370. Hardness testing shall cover at least 10% per item, per size, per heat, per manufacturing method. A full thickness cross section shall be taken for this purpose and the maximum hardness shall not exceed 248 HV₁₀.

4.5 In case of RTJ (Ring Type Joint) flanges, the groove hardness shall be minimum 140 BHN. Ring Joint flanges shall have octagonal section of Ring Joint.

5.0 DESIGN AND MANUFACTURE

5.1 Flanges such as weld neck flanges and blind flanges shall conform to the requirements of ASME B16.5.

5.2 Spectacle blind and spacer & blind shall conform to the requirements of ASME B 16.48.

5.3 Fittings such as tees, elbows, reducers, etc. shall be seamless type and shall conform to ASME B16.9 for sizes DN 50 mm (2") to DN 400 mm (16") (both sizes included) and ASME B 16.11 for sizes below ON 50 mm (2").

5.4 Fittings such as weldolets, sockolets, nippolets, etc. shall be manufactured in accordance with MSS-SP-97.


5.5 Type, face and face finish of flanges shall be as specified in Purchase Requisition.

5.6 Flanges and fittings manufactured from bar stock are not acceptable.

5.7 All butt weld ends shall be bevelled as per ASME B 16.5 / ASME B 16.9 / MSS-SP-97 as applicable.

5.8 Repair by welding on flanges and fittings is not permitted.

5.9 Stub-in or pipe to pipe connection shall not be used in the manufacture of tees. Tees shall be manufactured by forging or extrusion methods. The longitudinal weld seam shall be kept at 90° from the extrusion. Fittings shall not have any circumferential joint .

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6.0 INSPECTION AND TESTS

6.1 The Manufacturer shall perform all inspections and tests as per the requirement of this specification and the relevant codes, prior to shipment at his works. Such inspections and tests shall be, not but limited to the following :

- a) All flanges and fittings shall be visually inspected. The internal and external surfaces of the flanges and fittings shall be free from any strikes, gauges and other detrimental defects.
- b) Dimensional checks shall be carried out on finished products as per ASME B16.5 for flanges, ASME B16.48 for spacers and blinds and ASME B16.9 / MSS-SP-97 as applicable for fittings and as per this specification.
- c) Chemical composition and mechanical properties shall be checked as per relevant material standards and this specification, for each heat of steel used.
- d) All finished wrought weld ends subject to welding in field, shall be 100% tested for lamination type defects by ultrasonic test. Any lamination larger then 6.35 mm shall not be acceptable.


6.2 Purchaser's Inspector reserves the right to perform stage wise inspection and witness tests, as indicated in clause 6.1 of this specification at Manufacturer's Works prior to shipment. Manufacturer shall give reasonable notice' of time and shall provide, without charge, reasonable access and facilities required for inspection, to the Purchaser's Inspector.

Inspection and tests performed / witnessed by Purchaser's Inspector shall in no way relieve the Manufacturer's obligation to perform the required inspection and tests.

7.0 TEST CERTIFICATES

Manufacturer shall furnish the following certificates:

- a) Test certificates relevant to the chemical analysis and mechanical properties of the materials used for manufacture of flanges and fittings as per relevant standards and this specification.
- b) Test Reports on non destructive testing.
- c) Certificates for each fitting stating that it is capable of withstanding without leakage a test pressure, which results in a hoop stress equivalent to 100 % of

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the specified minimum yield strength for the pipe with which the fitting is to be attached without impairment of serviceability.

8.0 PAINTING, MARKING AND SHIPMENT

- 8.1 After all inspection and tests required have been carried out; all external surfaces shall be thoroughly cleaned to remove grease, dust and rust and shall be applied with standard mill coating for protection against corrosion during transit and storage. The coating shall be easily removable in the field.
- 8.2 Ends of all fittings and weld neck flanges shall be suitably protected to avoid any damage during transit. Metallic or high impact plastic bevel protectors shall be provided for fittings and flanges. Flange face shall be suitably protected to avoid any damage during transit.
- 8.3 All flanges and fittings shall be marked as per applicable dimension / manufacturing standard.

9.0 DOCUMENTATION

Documentation to be submitted by Manufacturer to Company is summarized below. Number of Copies (Hard copies / soft copies etc.) shall be as indicated in CONTRACT document / Material Requisition.

- 9.1 At the time of bidding, Manufacturer shall submit the following documents:
- Reference list of previous supplies of similar fittings of similar specification.
 - Clausewise list of deviations from this specification, if any.
 - Brief description of the manufacturing and quality control facilities at Manufacturer's works.
 - Manufacturer's qualification requirement as per clause 3.0 of this specification.
 - Quality Assurance Plan (QAP) enclosed with this tender duly signed, stamped and accepted.
- 9.2 Prior to shipment, the Manufacturer shall submit test certificates as listed in clause 7.0 of this specification.
- 9.3 All documents shall be in English Language only.