



**OIL & GAS DEVELOPMENT COMPANY LIMITED**  
**PROCUREMENT DEPARTMENT (LOCAL), ISLAMABAD**  
**SCHEDULE OF REQUIREMENT**

Due Date:

Material : Procurement of Piping Material

Tender Enquiry No: 18785/22

EVALUATION WILL BE CARRIED OUT ON FULL PKG.

Bid Bond Value : RS.99,000/-

Attachment(if any) : YES

Sr No	Description	Quantity	Make/Brand offered	Unit	Unit Price (PKR) Inclusive Of All Taxes Except GST	Unit Price (PKR) Inclusive of GST	Total Price (PKR) Inclusive of GST	Delivery Period Offered	deviation from Tender Spec. If Any
✓ 1	FLANGE,BLIND,3/4",RTJ,900#,A-105(S) ✓	3		Number					
✓ 2	FLANGE,,SW,1" ,,900#,,SCH 80,,A-105N,,, ✓	8		Number					
✓ 3	FLANGE,CS,WN,2",RTJ,900#,SCH 80,,A-105,,, ✓	4		Number					
✓ 4	ELBOW,,,LR 45 DEG,3",SCH 40,,A-234,WPB(S),BW,,B16.9	2		Number					
✓ 5	FLANGE,CS,BLIND,1/2",RTJ,900#,A-105,WITH 1/2" TAPPING BORE	3		Number					
✓ 6	FLANGE,CS,BLIND,3/4",RTJ,900#,A-105,WITH 1/2" TAPPING BORE	5		Number					
✓ 7	FLANGE,ORIFICE,WN,4",300#,RF,A-105	2		Number					
✓ 8	FLANGE,WN,2",SCH-40,300#,RF,A-694 GR.F52,ASME B16.5	2		Number					
✓ 9	FLANGE,WN,3",SCH-40,150#,RF,A-694 GR.F52,ASME B16.5	2		Number					
✓ 10	REDUCER,CONCENTRIC,4"X3",SCH-80XSCH-40,BW,A-234 ✓ GR.WPB.	2		Number					
✓ 11	TEE,CS,REDUCING,2"X3/4",SW,9000#,A-105,AS PER ASME B16.11 ✓	8		Number					
✓ 12	VALVE, BALL, 1/2", RATING: CLASS 1500, NPT, FEMALE THREADED ENDS, BOLTED BODY, REPLACEABLE SEATS, REGULAR PORT, TRUNNION MOUNTED, LEVER, OPERATOR, MATERIAL: BODY, STEM, BALL DUPLEX SS 22% CR, B	9		Number					
✓ 13	ELBOW,,,90 DEG,1",9000#,,A-105N,,SW ✓	10		Number					
✓ 14	TEE,CS,EQUAL,2",,,SCH 80,,A-234,GR. WPB,SW,,B16.9 ✓	8		Number					
✓ 15	TEE,CS,EQUAL,4",SCH 40,A-234,GR. WPB,BW ✓	18		Number					



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✓ 16	ELBOW,LR 90 DEG,4",SCH 40,A-234,WPB,BW,B16.9 ✓	24		Number					
✓ 17	ELBOW,LR 90 DEG,2",SCH 80,A-234,WPB ✓	20		Number					
✓ 18	STUDBOLT CAD. PLATED, 1-1/8" X 170MM + 2NUTS,900#, A193 GR,B7 A194 GR,2H IP#,IASY BOLTS & NUTS, STUD BOLTS & NUTS	250		Number					
✓ 19	ELBOW,CS,,LR 45 DEG,4",,SCH 80,,A-860,WPHY52,BE,BW,NACE COMPLIANCE, ✓	2		Number					
✓ 20	FLANGE,CS,WN,4",RTJ,900#,SCH 120,,A-105,,NACE COMPLIANCE,B16.5	55		Number					
✓ 21	FLANGE,CS,BLIND,4",RTJ,900#,,,A-105,,NACE COMPLIANCE,B16.5	5		Number					
✓ 22	FLANGE,,WN,4",RTJ,900#,SCH 40,,A-694,,NACE COMPLIANCE,	8		Number					
✓ 23	FLANGE,CS,BLIND,6",RTJ,900#,,,A-694,NACE COMPLIANCE,B16.5,	3		Number					
✓ 24	REDUCER,CONCENTRIC,CS,4" X 3",,SCH 120 X 80,,A-234,WPB,BE,BW,NACE COMPLIANCE,B16.9 ✓	2		Number					
✓ 25	SOCKOLET,CS,1" X 6",9000#,,,A-694,F52,SW,NACE COMPLIANCE,B16.11	4		Number					
✓ 26	FLANGE,CS,WN,1-1/2",RTJ,900#,SCH 160,,A-105,,NACE COMPLIANCE,B16.5	2		Number					
✓ 27	GASKET SPIRAL WOUND,3",300#,3MM,WINDING:SS304,FILLER:GRAPHITE,OUTER RING: SS304,INNER RING:SS304,B16.20	2		Number					
✓ 28	FLANGE,,BLIND,1",RTJ,900#,FO,R-16	8		Number					
✓ 29	TEE,CS,REDUCING,4" X 2",,SCH 40 X 80,,A-234,GR. WPB,BW,,B16.9 ✓	4		Number					
✓ 30	FLANGE,CS,SW,1",RF,150#,SCH 40,,A-105	3		Number					
✓ 31	REDUCER,ECCENTRIC,CS,4" X 3",,SCH 40,A-234,GR. WPB,BW,B16.9	2		Number					

Sch 80 X Sch-40



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✓ 32	VALVE, BALL, 1", RATING: CLASS 1500, NPT, FEMALE THREADED ENDS, BOLTED BODY, REPLACEABLE SEATS, REGULAR PORT, TRUNNION MOUNTED, LEVER, OPERATOR, MATERIAL: BODY, STEM, BALL DUPLEX SS 22% CR, B	3		Number					
✓ 33	SOCKOLET, SW, 3/4" X 8", 9000#, ..., A-105N, ...,	5		Number					
✓ 34	SOCKOLET, SW, 1" X 4", 9000#, ..., A-105N, ...,	8		Number					
✓ 35	FLANGE, CS, BLIND, 4", RF, 300#, ..., A-105, ..., B16.5	4		Number					
✓ 36	VALVE, GLOBE, 2", B16.34, CLASS 900#, RTJ, BOLTED BONNET, FULL BORE, VALVE BODY CS, MAT: WCB, A216, TRIM MAT. BALL, STEM, SEAT RING ASTM A182 F316, HAND WHEEL OPERATED, SEAT INSERT: PTFE	12		Number					
✓ 37	GASKET SPIRAL WOUND, 3", 150#, 3MM, WINDING: SS304, FILLER: GRAPHITE, OUTER RING: SS304, INNER RING: SS304, B16.20	4		Number					
✓ 38	GASKET SPIRAL WOUND, 4", 300#, 3MM, WINDING: SS304, FILLER: GRAPHITE, OUTER RING: SS304, INNER RING: SS304, B16.20	42		Number					
✓ 39	ELBOW, CS, LR 45 DEG, 4", SCH 120, A-234, WPB, BE, BW, ✓	10		Number					
✓ 40	SOCKOLET, CS, 1" X 8", 9000#, ..., A-105, SW, B16.11	2		Number					
✓ 41	BOLT, STUD 2 NUT, 3/4" X 125 MM, A193/A194, B7M/2HM, CADMIUM PLATED, ✓	40		Number					

**Special Note:** The prospective bidders also download the master set of Tender Document

- The prospective bidders may keep in touch with OGDCL web site for downloading the clarifications/amendments (if any) issued by OGDCL.
- BID VALIDITY: 180 DAYS FROM TECHNICAL BID OPENING, DELIVERY PERIOD: 120 DAYS AFTER ISSUANCE OF LPO. PAYMENT: AFTER DELIVERY & INSPECTIONS.



**OIL & GAS DEVELOPMENT COMPANY LIMITED**  
**PROCUREMENT DEPARTMENT (LOCAL), ISLAMABAD**  
**SCHEDULE OF REQUIREMENT**

**Mandatory Checklist**

Please confirm the compliance of the following mandatory information along with the bid(s) (failing which bids(s) will not be accepted)

Documents	To be Attached with the Technical/Financial Bids	Compliance	
		Yes <input type="checkbox"/>	No <input type="checkbox"/>
Original Bid Bond	Technical Bid	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Copy of NTN Certificate	Technical Bid	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Copy of GST Certificate	Technical Bid	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Confirmation that the Firm is appearing on FBR's Active Taxpayer List	Technical Bid	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Duly signed and stamped Annexure-A (Un-priced)	Technical Bid	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Duly filled, signed and stamped Annexure-B	Technical Bid	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Duly filled, signed and stamped Annexure-D	Technical Bid	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Duly filled, signed and stamped Annexure-L on Company's Letterhead	Technical Bid	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Duly signed and stamped Annexure-M on Company's Letterhead	Technical Bid	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Duly signed and stamped Annexure-N on Non-Judicial Stamp Paper duly attested by Notary Public	Technical Bid	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Duly filled, signed and stamped Annexure-A (Priced)	Financial Bid	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Duly filled, signed and stamped Annexure-C	Financial Bid	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Duly filled, signed and stamped Annexure-E	Financial Bid	Yes <input type="checkbox"/>	No <input type="checkbox"/>



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For the Vendors/Contractors who opt to submit Bank Draft/Call Deposit/Pay order against Bid Bond/Performance Bond, our Accounts Department has finalized an arrangement for online payment to such Vendors/Contractors, which will be processed through (IBFT & LFT) for which following information is required:

i.	IBAN No. (International Bank Account Number 24 Digits)	
ii.	Vendor Name as per Title of their Bank Account	
iii.	Contact No. of Company's CEO/ Owner (Mobile & Landline)	
iv.	Bank Name.	
v.	Bank Branch Name and Code	

Name, Sign and Stamp of the authorized official of the Bidder(s) \_\_\_\_\_

## Terms & Conditions

Bidder must meet all of the following terms & conditions in order to qualify for the financial evaluation. Manufacturers and stockists both are eligible to submit their bids for the tender enquiry.

1. Bidder must comply SOR, Specifications and data sheets completely.
2. Bidder must have supplied Pipe fittings to Oil & Gas E&P (Exploration & Production) Companies in Pakistan with at least one Purchase Order of minimum Rs. 5 Million. The Oil & Gas E & P Company should be a member of Pakistan Petroleum Exploration & Production Companies Association (PPEPCA). Copy of at least one Purchase Order to be provided by the bidder along with Copy of Performance certificate.
3. Bidder to submit copies of Following quality certificates of the manufacturer. The certificates must be active
  - i. ISO 9001
  - ii. ISO 14001
  - iii. OHSAS 18001
4. Bidder must submit a certificate on letter head, confirming that the material supplied is " Brand New".
5. Bidder must confirm the delivery schedule of 04 months/120 days on FOR KBS (Korangi Base Store), Karachi basis from issuance of LPO.
6. Bidder must confirm provision of MTCs (mill test certificate) of all material and MTCs and hydro test certificates of valves, at the time of delivery of material
7. Bidder must confirm that all the supplied material is NACE MR0175 Compliance. NACE certificate to be provided with the material.
8. Bidder must confirm that in addition to the marking requirements of the relevant product standard, the following information shall be marked on each component:
  - i. Specification and grade of material
  - ii. Nominal diameter, Schedule/ wall thickness

**Note:** The detailed inspection of delivered material will be carried out at KBS after delivery.

**DATA SHEET (ANNEXURE-A)**

<b>Globe Valve</b>		
1	Style	OS&Y, BOLTED BONNET & GLAND & RENEWABLE SEATS
2	Operator	HANDWHEEL
3	Testing	ASME B 16.34
4	Design	ASME B 16.34
5	Trim Material	316 S.STEEL
6	Body Material	A-216 GR. WCB
7	Facing	RTJ, Flanged End as per ASME B16.5

## SPECIFICATION

### FOR METALLIC PIPE, FITTINGS, FLANGES, BOLTING & GASKETS

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REV	DATE	DESCRIPTION	PREP'D	CHECK'D	APP'D
0	29 <sup>th</sup> Dec 2017	Approved for Construction	SS	A.Ali	MSc



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## 1 SCOPE

This Specification states the minimum technical, manufacturing and inspection requirements for the pipe, fittings, flanges, bolting and gasket materials for use on OGDCL wellhead piping for sour service.

All piping component design and materials shall meet the requirements of the referenced specifications and the latest editions of following Codes, Standards and Statutory Regulations (where applicable).

All exceptions or deviations between the requirements of this document and the referenced Codes and Standards shall be brought to the attention of CEIS for written resolution and approval.

## 2 REFERENCES

The following documents and specifications shall be read in conjunction with this specification:

- SP-QP-11-L-001 Specification for Piping Materials.

## 3. CODES AND STANDARDS

Latest edition of the Codes and Standards referenced below shall be used.

### 3.1 American Society of Mechanical Engineers

- ASME V Boiler and Pressure Vessel Code  
Section V – Non Destructive Examination
- ASME VIII Boiler and Pressure Vessel Code  
Section VIII Div.1 & Div. 2 Rules for Construction of Pressure Vessels
- ASME IX Boiler and Pressure Vessel Code  
Section IX - Welding Qualifications
- ASME B31.3 Process Piping
- ASME B1.20.1 Pipe Threads General Purpose (Inch.)
- ASME B16.1 Cast Iron Pipe Flanges and Flanged Fittings
- ASME B16.5 Pipe Flanges and Flanged Fittings
- ASME B16.9 Wrought Steel Buttwelding Fittings
- ASME B16.10 Face-to-Face and End-to-End Dimensions of Valves
- ASME B16.11 Forged Fittings, Socket-Welding and Threaded
- ASME B16.11 Forged Fittings, Socket-Welding and Threaded
- ASME B16.20 Metallic Gaskets for Pipe Flanges – Ring-Joint, Spiral-Wound,

and Jacketed

- ASME B16.21 Non-Metallic Flat Gaskets for Pipe Flanges
- ASME B16.25 Buttwelding Ends
- ASME B16.34 Valves – Flanged, Threaded and Welding End
- ASME B16.47 Large Diameter Steel Flanges
- ASME B16.48 Steel Line Blanks
- ASME B36.10M Welded and Seamless Wrought Steel Pipe
- ASME B36.19M Stainless Steel Pipe
- ASME B46.1 Surface Texture, Surface Roughness, Waviness & Lay

### 3.2 American Petroleum Institute

- API 5L Specification for Line Pipe

### 3.3 American Society for Testing and Materials

- ASTM A53 Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- ASTM A105 Specification Carbon Steel Forgings for Piping Applications
- ASTM A106 Specification for Seamless Carbon Steel Pipe For High-Temperature Service
- ASTM A123 Specification for Zinc (Hot Dipped Galvanised) Coating on Iron and Steel Products.
- ASTM A193 Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature Service
- ASTM A194 Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High Temperature Service, or Both
- ASTM A234 Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
- ASTM A312 Specification for Seamless and Welded Austenitic Stainless Steel Pipes.
- ASTM A320 Specification for Alloy / Steel Bolting Materials for Low Temperature Service
- ASTM A333 Specification for Seamless and Welded Steel Pipe for Low-Temperature Service
- ASTM A335 Specification for Seamless Ferritic Alloy Steel Pipe for High

## Temperature Service

- ASTM A350 Specification for Carbon and Low-Alloy Steel Forgings, Requiring Notch Toughness Testing for Piping Components
- ASTM A358 Specification for Electric Fusion Welded Austenitic Chromium-Nickel Alloy Steel Pipe for High Temperature Service
- ASTM A387 Standard Specification for Pressure Vessel Plates, Alloy Steel, Chromium-Molybdenum
- ASTM A403 Specification for Wrought Austenitic Stainless Steel Piping Fittings.
- ASTM A420 Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Low Temperature Service.
- ASTM A530 Specifications for General Requirements for Specialized Carbon and Alloy Steel
- ASTM A516 Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service
- ASTM A671 Specification for Electric-Fusion-Welded Steel Pipe for Atmospheric and Lower Temperatures.
- ASTM A672 Specification for Electric-Fusion-Welded Steel Pipe for High Pressure Service at Moderate Temperatures.
- ASTM A694 Specification for Carbon and Alloy Steel Pipe Flanges, Fittings, Valves and Parts for High Pressure Transmission Service.
- ASTM A707 Specification for Forged and Alloy Steel Flanges for Low-Temperature Service
- ASTM A815 Specification for Wrought Ferritic / Austenitic and Martensitic Stainless Steel Piping Fittings.
- ASTM A860 Specification For Wrought High Strength Low Alloy Steel Butt Welding Fittings.
- ASTM A890 Specification for Castings, Iron-Chromium-Nickel-Molybdenum Corrosion-Resistant, Duplex (Austenitic/Ferritic) for General Application
- ASTM A928 Specification for Ferritic/Austenitic (Duplex) Stainless Steel Pipe Electric Fusion Welded with Addition of Filler Metal.
- ASTM A960 Specification for Common Requirements for Wrought Piping Fittings.
- ASTM A999 Specification for General Requirements for Alloy and Stainless Steel Pipe.
- ASTM B564 Standard Specification for Nickel Alloy Forgings

- ASTM G48 Standard Test Methods for Pitting and Crevice Corrosion Resistance of Stainless Steels and Related Alloys by use of Ferric Chloride Solution.

### 3.5 British Standards Institution

- BS 3799 Steel Pipe Fittings, Screwed and Socket Welding

### 3.6 Manufacturer's Standardisation Society of the Valves & Fittings Industry

- MSS SP25 Standard Marking System for Valves, Fittings, Flanges and Unions.
- MSS SP44 Steel Pipe Line Flanges
- MSS SP97 Integrally Reinforced Forged Branch Outlet Fittings, Socket Weld, Threaded and Butt Welding Ends.

### 3.7 Australian Standards

- AS 2129 Flanges for Pipes, Valves and Fittings
- AS 4037 Pressure Equipment – Examination and Testing
- AS 4041 Pressure Piping
- AS 4343 Pressure Equipment – Hazard Levels

### 3.8 National Association of Corrosion Engineers

- NACE MR-01-75 Sulfide Stress Cracking Resistant Metallic Materials for Oilfield Equipment.

## 4. GENERAL REQUIREMENTS

- 4.1 Component, type, material and grade together with the NPS and schedule/wall thickness shall be as specified in the data sheets or SOR.

## 5. MATERIAL REQUIREMENTS

### 5.1 Carbon Steel and Impact Tested Carbon Steel

The chemical composition of carbon steel and impact tested carbon steel pipe, fittings and flanges shall be limited as follows:

- Carbon content 0.22% max
- Carbon equivalent 0.43% max by ladle analysis where :

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

Pipe to ASTM A106, Grade B.

- Sulphur content shall be 0.010% maximum.
- Phosphorous content shall be 0.10% maximum.
- All materials shall be normalised and tempered. The minimum tempering temperature shall be 720 °C.

Flanges - ASTM A 105

- Sulphur content shall be 0.010% maximum.
- Phosphorous content shall be 0.010% maximum.
- Carbon equivalent shall be 0.47% maximum for forgings with maximum section thickness of 2 in. or less and 0.48% for forgings with a maximum section thickness of greater than 2 in.

For non-NACE applications sulphur and phosphorous content shall be in accordance with the product standard.

Materials specified in accordance with NACE MR0175 shall also meet the following requirements :

- Seamless pipe, fittings and forged flanges:  
Sulphur 0.010% max. Phosphorous 0.030% max.
- Pipe, fittings and flanges manufactured from plate:  
Sulphur 0.005% max, Phosphorous 0.025% max.
- All materials supplied to NACE MR0175 requirements shall be fully killed, fine grained and vacuum degassed.
- All materials shall be supplied in a normalised condition and shall be marked as such in accordance with the product specification and the applicable supplementary requirement.
- All impact tested carbon steel supplied to ASTM A350 LF2 shall be Class 1.

### 5.2 Carbon Steel High Yield Material

All High Yield materials shall be supplied in the Quench and Tempered Condition.

The chemical composition of all pipe, fittings and flanges made from high yield Carbon Steel complying to NACE MR1075 shall be limited as follows:

- Pipe to API 5L Gr. X52  
Carbon Content 0.22% max.  
Sulphur Content 0.005% max.  
Carbon equivalent 0.43% max (CEV by ladle analysis as defined in 5.1)  
Pipe shall be Seamless execution or EFW with 100% X-Ray.
- Pipe to API 5L Gr. X65  
Carbon Content 0.15% max.  
Sulphur Content 0.005% max.  
Carbon equivalent 0.43% max (CEV by ladle analysis as defined in 5.1)  
Pipe shall be Seamless execution or EFW with 100% X-Ray.
- Fittings to ASTM A860 WPHY65  
Carbon Content 0.18% max.  
Sulphur Content 0.005% max.  
Carbon equivalent 0.42% max (CEV by ladle analysis as defined in 5.1).  
Pipe shall be Seamless execution or EFW with 100% X-Ray.
- Forgings to ASTM A694 Gr. F65  
Carbon Content 0.18% max.  
Sulphur Content 0.005% max.  
Carbon equivalent 0.43% max (CEV by ladle analysis as defined in 5.1).

### 5.3 Austenitic Stainless Steel

Austenitic stainless steel shall be supplied in a solution annealed condition. Solution annealing shall be carried out after all welding.

All type 304 stainless steel shall be supplied **dual certified**, that is having the mechanical properties of 304 stainless steel and the chemical composition of 304L stainless steel.

All type 316 stainless steel shall be supplied **dual certified**, that is having the mechanical properties of 316 stainless steel and the chemical composition of 316L stainless steel.

### 5.4 Duplex and Super Duplex Stainless Steels

All materials shall meet the mechanical requirements and chemical composition of the following UNS designation as defined by its product specification:

Duplex stainless steel	-	UNS S31803
Super Duplex stainless steel	-	UNS S32750

Alloy composition shall provide a minimum Pitting Resistance Equivalent (PRE) as defined by the equation:

$$\text{PRE} = \% \text{Cr} + 3.3\% \text{ Mo} + 16\% \text{ N} \quad (\text{Calculated by \% weight})$$

PRE for Duplex stainless steel to UNS S31803 shall be 35

PRE for Super Duplex stainless steel to UNS S32750 shall be 43

All components shall be supplied in a solution annealed condition. Solution annealing shall be carried out after all welding operations have been completed. Maximum hardness shall not exceed the following:

Duplex stainless steel UNS S31803	- 28 HRC
Super Duplex stainless steel UNS 32750	- 32 HRC

Micrographic examination is required for both Duplex and Super Duplex stainless steel and shall cover the near surface and mid-thickness region. For welded pipe and fittings this shall also include the weld zone. The ferrite content shall be determined according to ASTM E562 or approved equivalent and shall be within 35 - 55 % for base material and 25 - 60 % for weld metal. The microstructure, as examined at 400X magnification on a suitably etched specimen, shall be free from intermetallic phases and precipitates.

Corrosion Testing is required for both Duplex and Super Duplex stainless steel and shall be carried out for each heat of material to establish sigma phase intergranular attack in accordance with ASTM G48 Method A. The samples shall be exposed to 10% FeCl<sub>3</sub> solution at 25°C for 72 hours. Test specimens shall be in the 'as delivered / manufactured' condition, no surface preparation is permitted, except for cut edges. The test specimens shall include the full section thickness. Visual examination shall be performed on all of the specimens with at least 20x magnification. No pitting is acceptable. Weight loss shall not exceed 4.0 g/m<sup>2</sup>.

Vendors shall submit for review with bid, details of all Manufacturers and include any further standard production testing which demonstrates resistance to Pitting and Crevice Corrosion for evaluation.

Weld procedure qualification for all welded pipe and fittings shall include impact testing of weld deposits and heat affected zones at minus 46 Deg C. The absorbed energy values shall be 45 Joules minimum average and 35 Joules minimum individual.

## 5.5 Low Alloy Steel

Pipe to ASTM A335, Grade P11.

- Sulphur content shall be 0.010% maximum.
- Phosphorous content shall be 0.010% maximum.
- All materials shall be normalised and tempered. The minimum tempering temperature shall be 720 °C.

Fittings to ASTM A 234 Grade WPB

- Sulphur content shall be 0.010% maximum.
- The phosphorous content shall be 0.010% maximum.
- For welded fittings, these chemistry limits shall also apply to the weld.

Seamless fittings and fittings forged or extruded from welded pipe shall be normalised and tempered.

For fittings manufactured from plate, the plate shall be stress relieved or normalised and tempered and shall have tensile properties in accordance with ASTM A 387 Class 2.

Flanges - ASTM A 182 Grade F11-Class 2

- Sulphur content shall be 0.010% maximum.
- Phosphorous content shall be 0.010% maximum.
- Carbon content shall be 0.14% maximum.



Flanges shall be normalized and tempered.

#### 5.6 NACE MR0175

All materials specified to NACE MR0175 shall be manufactured, tested and inspected in accordance with NACE requirements.

#### 5.7 Impact Testing

Impact Testing shall be carried out in accordance with ASTM A370. Minimum impact values, lateral expansion and minimum test temperature will be the most onerous as defined by this specification, the material description or the product specification.

### 6. MANUFACTURING REQUIREMENTS

#### 6.1 Pipe

##### Dimensions

Pipe shall be dimensionally in accordance with ASME B36.10M or ASME B36.19M as applicable.

##### Length

Pipe shall be supplied in double random lengths (11m to 13m) or single random lengths (5m to 7m).

Pipe lengths, which include joiners, are not acceptable.

##### Ends

For pipe specified as bevelled both ends, bevelling shall be in accordance with ASME B16.25 Fig 2a or 3a as applicable.

All screwed pipe shall be supplied with ends threaded in accordance with ASME B1.20.1. Couplings shall be 3000lb rating and screwed on 'hand tight' as described in API 5L Para 7.2.

##### Process

The steel shall be killed steel, with the primary melting process being open-hearth, basic-oxygen, or electric-furnace, possibly combined with separate degassing or refining. If secondary melting, using electroslag remelting or vacuum-arc remelting is subsequently employed, the heat shall be defined as all of the ingots remelted from a single primary heat.

Steel cast in ingots or strand cast is permissible. When steels of different grades are sequentially strand cast, identification of the resultant transition material is required. The producer shall remove the transition material by any established procedure that positively separates the grades.

For pipe NPS 1 1/2 [DN 40] and under, it shall be permissible to furnish hot finished or cold drawn.

Unless otherwise specified, pipe NPS 2 [DN 50] and over shall be furnished hot finished. When agreed upon between the manufacturer and the purchaser, it is permissible to furnish cold-drawn pipe.

Galvanised pipe and couplings shall be supplied galvanised in accordance with ASTM A123. Threads shall be 'dressed' after galvanising to ensure correct thread engagement, the thread dressing shall not damage the coating effectiveness. The internal bore of galvanised pipe shall be free from blockage due to galvanising.

### Heat Treatment

Hot-finished pipe need not be heat treated. Cold-drawn pipe shall be heat treated after the final cold draw pass at a temperature of 1200 °F (650 °C) or higher.

Carbon steel pipe shall be heat treated in accordance with product specification requirements after completion of all forming and welding operations.

### Hydrostatic Test

All finished pipe shall be subjected to hydrostatic test without leakage through the pipe wall.

### Bending Requirements

For pipe NPS 2 [DN 50] and under, a sufficient length of pipe shall stand being bent cold through 90° around a cylindrical mandrel, the diameter of which is twelve times the outside diameter (as shown in ASME B 36.10M) of the pipe, without developing cracks. When ordered for close coiling, the pipe shall stand being bent cold through 180° around a cylindrical mandrel, the diameter of which is eight times the outside diameter (as shown in ASME B 36.10M) of the pipe, without failure.

Subject to the approval of the purchaser, for pipe whose diameter exceeds 10 in. [250 mm], it shall be permissible for the bend test to be substituted for the flattening test. The bend test specimens shall be bent at room temperature through 180° with the inside diameter of the bend being 1 in. [25 mm], without cracking on the outside portion of the bent portion.

For pipe whose diameter exceeds 25 in. [635 mm] and whose diameter to wall thickness ratio ( $D/t = \text{Specified Outside Diameter}/\text{Nominal Wall Thickness}$ ) is 7.0 or less, the bend test described in second para (above) of this section shall be conducted instead of the flattening test.

### Flattening Tests

For pipe over NPS 2 [DN 50], a section of pipe not less than 2 1/2 in. [63.5 mm] in length shall be flattened cold between parallel plates until the opposite walls of the pipe meet. Flattening tests shall be in accordance with Specification A 530/A 530M, except that in the formula used to calculate the "H" value, the following "e" constants shall be used:

0.08 for Grade A

0.07 for Grades B and C

When low D-to-t ratio tubulars are tested, because the strain imposed due to geometry is unreasonably high on the inside surface at the six and twelve o'clock locations, cracks at these locations shall not be cause for rejection if the D-to-t ratio is less than 10.

## Nipples

Nipples shall be cut from pipe of the same dimensions and quality described in this specification.

## Workmanship, Finish and Appearance

The pipe manufacturer shall explore a sufficient number of visual surface imperfections to provide reasonable assurance that they have been properly evaluated with respect to depth. Exploration of all surface imperfections is not required but consideration should be given to the necessity of exploring all surface imperfections to assure compliance with the following:

Surface imperfections that penetrate more than 12 1/2 % of the nominal wall thickness or encroach on the minimum wall thickness shall be considered defects. Pipe with such defects shall be given one of the following dispositions:

- The defect shall be removed by grinding, provided that the remaining wall thickness at any point shall not be more than 12.5 % under the specified wall thickness.
- The section of pipe containing the defect may be cut off within the limits of requirements on length.
- Rejected.

To provide a workmanlike finish the pipe manufacturer shall remove by grinding the following noninjurious imperfections:

- Mechanical marks, abrasions (Note 5) and pits, any of which imperfections are deeper than 1/16 in. [1.6 mm].
- Visual imperfections commonly referred to as scabs, seams, laps, tears, or slivers found by exploration to be deeper than 5 % of the nominal wall thickness.

At the purchaser's discretion, pipe shall be subjected to rejection if surface imperfections are not scattered, but appear over a large area in excess of what is considered a workmanlike finish. Disposition of such pipe shall be a matter of agreement between the manufacturer and the purchaser.

When imperfections or defects are removed by grinding, a smooth curved surface shall be maintained, and the wall thickness shall not be decreased below that permitted by this specification. The outside diameter at the point of grinding is permitted to be reduced by the amount so removed.

Wall thickness measurements shall be made with a mechanical caliper or with a properly calibrated non-destructive testing device of appropriate accuracy. In case of dispute, the measurement determined by use of the mechanical caliper shall govern.

The finished pipe shall be reasonably straight.

## 6.2 Butt Weld and Threaded Fittings

Fittings shall be dimensionally in accordance with ASME B16.9, ASME B16.11, MSS SP-97 and BS 3799 as applicable.

Butt weld fittings shall have ends bevelled in accordance with ASME B16.25 Fig 2a or 3a.

Threaded fittings shall be supplied with ends threaded NPT in accordance with ASME B1.20.1.

Galvanised fittings shall be supplied galvanised in accordance with ASTM A153. Threads shall be 'dressed' after galvanising to ensure correct thread engagement, the thread dressing shall not damage the coating effectiveness. Galvanised fittings shall be supplied with the internal bore free from blockage due to galvanising.

Carbon steel and impact tested carbon steel butt weld fittings up to and including DN 400 shall be seamless. Fittings DN 450 and above may be seamless or EFW with 100% radiography of weld seam and have a joint factor of 1.0.

Stainless steel and Duplex Stainless steel butt weld fittings up to and including DN 150 shall be seamless. Fittings DN 200 and above may be seamless or EFW with 100% radiography of weld seam and have a joint factor of 1.0.

Fittings machined from solid forged blocks or solid bar are not acceptable.

Repair by welding of wrought fittings is not permitted.

All fittings shall be qualified by burst test certification, in accordance with ASME B16.9, which shall be available for Purchaser review if requested.

The design of Integrally Reinforced Forged Outlet Fittings shall be documented to demonstrate compliance with of ASME B31.3 para 304.3.2, Appendix D Table D300 and fulfil the following requirements.

- Integrally Reinforced Outlet Fittings shall be 'Bonney Forge' design, dimensions in accordance with MSS SP97, unless stated otherwise in the Material Requisition.
- Integrally Reinforced Outlet Fittings whose header wall thickness is Sch10/10s or less, shall be considered 'Lightweight Design' based upon the ASME B16.5 Class 300 pressure rating for the specified material. Typical drawings shall be submitted with bid
- The design shall be supported by area Reinforcement Calculations. The design shall not be dependent on weld material to provide the necessary area replacement required.
- Burst Test certification shall be available for all Reinforced Outlet Fittings and shall be in accordance with MSS SP97, Annex B.
- The internal bore of the Integrally Reinforced Outlet Fitting shall be tapered with a maximum slope of 30 degrees to match branch pipe.
- All Integrally Reinforced Outlet Fittings shall be forged as close as practicable to final shape with the exception of finish machining. Fittings machined from forged bar or forged rings are NOT acceptable.

Plugs shall be solid steel round or hexagonal bar stock.

Swage Nipples shall comply with BS 3799.

### 6.3 Flanges, Spectacle Blinds, Spades and Spacers

Flanges DN 600 and smaller shall be in accordance with ASME B16.5. All flanges DN 650 and larger shall comply with ASME B16.47 series A.

All threaded flanges shall be supplied threaded NPT in accordance with ASME B1.20.1.

Galvanised flanges shall be supplied galvanised in accordance with ASTM A123. Threads shall be 'dressed' after galvanising to ensure correct thread engagement, the thread dressing shall not damage the coating effectiveness. Gasket contact area shall be free of galvanising and a suitable rust preventative applied.

Flange facing shall be as follows:

Class 150 to 600 – Raised face smooth spiral finish Ra 3.2 to 6.3µm.

Class 900 to 2500 – Ring type joint side wall finish Ra 0.4 to 1.6µm.

The minimum hardness of flange ring grooves shall be as follows:

- |                                       |   |        |
|---------------------------------------|---|--------|
| • Carbon Steel                        | - | 110 HB |
| • Low Temperature Carbon Steel        | - | 110 HB |
| • Austenitic Stainless Steel AISI 316 | - | 180 HB |
| • Duplex Stainless Steel              | - | 200 HB |
| • Super Duplex Stainless Steel        | - | 200 HB |

Orifice flanges DN 600 and smaller shall be in accordance with ASME B16.36 and shall be supplied in pairs, complete with jackscrews to ASTM A193 Gr B7. Vendor shall supply with bid, dimensional details of assembly including tapping connections.

### 6.4 Bolting

Threading of all bolting shall be in accordance with ASME B 1.1, UNC series for diameters up to and including 1" and 8UN series for diameters 1-1/8" and larger. Stud bolts shall have Class 2A dimensions and nuts shall have Class 2B.

All stud bolts shall be threaded full length and supplied with two heavy series hexagon nuts. The length of Stud bolts 1-1/4" diameter and larger has been calculated to allow for the use of bolt tensioning equipment, the extra length is included in the lengths stated on the material requisition. Stud bolts 1-1/4" diameter and larger shall be supplied with thread protectors.

Hexagon head machine bolts shall be used with threaded lug Butterfly valves.

Washers, when specified in the material description (GRE piping systems) shall be 4mm thick steel to ASTM F436. Studbolts shall be supplied complete with 2 washers; machine bolts shall be supplied complete with 1 washer.

All jack screws and hexagon headed bolts shall have threads extended to the underside of the head.

All ASTM A320 L7 and L43 bolting shall be impact tested at minus 101°C. All nuts to ASTM A194 Grade 4 and 7 shall be impact tested in accordance with the 'Supplementary Requirements' S3 of ASTM A194 at minus 101°C.

All bolting materials shall be supplied 'black' unless stated otherwise, the following options are provided for coating of bolting materials:

- For items are specified as galvanised, they shall be Hot Spun Galvanised in accordance with ASTM A153 and fully passivated. Nuts shall be re-tapped after galvanising and be fully assembled with studbolts prior to despatch.
- For items specified as PTFE coated, they shall be Xylan 1070 (Whitford Corporation) or Purchaser approved equivalent. Details of PTFE coating shall be submitted for review with bid. PTFE coatings shall be 'Colour Coded' as follows:

MATERIAL	COLOUR
ASTM A193 Gr B7 / A194 Gr 2H	Green
ASTM A193 Gr B7M / A194 Gr 2HM	Orange
ASTM A193 Gr B16 / A194 Gr 8	Black
ASTM A320 Gr L7 / A194 Gr 4	Blue

The standard stamping required by the material specification shall be legible after the bolting components have been coated with the PTFE.

## 6.5 Gaskets

Flat ring gaskets shall be compressed non-asbestos fibre in accordance with ASME B16.21.

- Gasket thickness shall be 1.5mm unless specified otherwise.
- Asbestos in any form shall not be used in the manufacture and construction of gaskets.
- Gaskets shall be suitable for hydrocarbon gas/oil, hot oil, amine, potable water and wet sour service as defined in NACE MR0175.

Spiral wound gaskets shall be in accordance with API 601/ASME B16.20. Unless stated otherwise gaskets shall be 4.5mm thick graphite filled with an inner ring and 3mm thick centring ring to ASME B16.20.

- Material of inner ring and centering ring shall be stated on the requisition.
- Material of winding shall be 304L stainless steel unless stated otherwise on the requisition.
- All spiral wound gaskets shall comply with NACE MR0175.

Ring type gaskets, unless stated otherwise on the material requisition shall be, Style R Octagonal type in accordance with ASME B16.20.

- Soft iron ring joints shall be supplied with a maximum hardness of 90 HB.
- Austenitic stainless steel ring type joints AISI 316 shall be supplied in a fully solution annealed condition and minimum hardness of 160 NB.
- Super Austenitic stainless steel ring type joints Alloy 904L and 254 SMO, shall be supplied in a fully solution annealed condition and have a maximum hardness of 180 HB.
- All ring joint gaskets (except soft iron) shall comply with NACE MR0175.

Neoprene gaskets shall have a hardness of between 55 to 65 Shore A.

## 7. MARKING

7.1 In addition to the marking requirements of the relevant product standard and MSS SP-25, the following information shall be marked on each component:

- Specification and grade of material
- Nominal diameter and wall thickness
- Purchase order and item number.

7.2 Marking shall be carried out on all individual components size DN 50 and larger and on corrosion resistant metal tags for components sizes less than DN 50, the tags being securely attached to each package.

7.3 Marking of components DN 50 and larger shall be by stencilling with indelible paint, with pipe being marked 100mm from each end. The paint shall not contain any harmful metals such as zinc, or metallic salts, which would adversely affect the metal on heating or welding, with particular attention being paid to austenitic and duplex stainless steel.

7.4 All components shall additionally be hard stamped or vibro etched with the heat number. For components manufactured from austenitic and duplex stainless steel, marking shall be by vibro-etching. Carbon steel and impact tested carbon steel shall be marked by round nosed low stress stamps.

## 8. COLOUR CODING

8.1 To enable identification of materials on site, Vendors are required to mark all items, excluding bolting, with colour coding in accordance with the colour coding schedule shown in Table 1, 2 & 3 below.

Table 1 – Colour Coding Schedule (excluding gaskets)

MATERIAL	COLOUR	AS 2700 REF.	BS 4800 EQUIV.
Carbon Steel (non-NACE)	Light Green	G37	14E51
Carbon Steel (NACE)	Brown	X54	05C39
Galvanised Carbon Steel	Self Colour	-	-

Impact Tested Carbon Steel	Silver Grey	N22	10A03
Impact Tested Carbon Steel (NACE)	Off White	Y35	10B15
High Yield Carbon Steel X65 / F65 / WPHY65 (NACE)	Pink	P33	24C33
Austenitic Stainless Steel – 304 / 304L	Sapphire	B14	20D45
Austenitic Stainless Steel – 316 / 316L	Pale Blue	B35	18E49
Duplex Stainless Steel – UNS S31803 (NACE)	Yellow	Y15	08E53
Super Duplex Stainless Steel – UNS S32750 (NACE)	Red	R13	05E53
Low Alloy Steel – 1 ½ Cr ½ Mo	Violet	P13	24C39

Table 2 – Colour Coding Schedule – Spiral Wound Gaskets

Strip Winding Matl	Filler Material	Outer Ring Material	Inner Ring Material	Outer Ring Colour	Filler Identifier 4 Stripes Colour
304L SS	Flexible Graphite	316 SS	316 SS	Yellow	Grey
316L SS	Flexible Graphite	Carbon Steel (Cad. Plated)	Carbon Steel	Silver	Grey
316L SS	Flexible Graphite	316 SS	316 SS	Green	Grey

Table 3 – Colour Coding Schedule – Ring Type Joints

Ring Material	Colour
Soft Iron	Self Colour
316 SS	Green
904L SS	Magenta
254 SMO	Violet

8.2 The paint shall not contain any harmful metals such as zinc, or metallic salts, which would adversely affect the metal on heating or welding, with particular attention being paid to austenitic stainless steel.

8.3 Colour coding location shall be as follows, noting marking shall not encroach upon surfaces prepared for welding or gasket contact surfaces:

Pipe - DN 40 and smaller – broad rings painted 1.5 metres apart.  
DN 50 and larger – a broad line painted down the entire length of the pipe.

Fittings - Socket weld and threaded ends – broad circumferential band painted at one end of the fitting.

Butt weld – broad line painted down entire longitudinal length of fitting.



- Flanges - Weld neck flanges – broad circumferential band painted on the hub remote from the butt weld end. Blinds shall have bulls eye painted on the back.  
Spectacle blinds – circumferential band painted on the edge of the spacer section  
Separate blind and spacer - circumferential band painted on the edge of each item.
- Gaskets - Spiral wound type – outer edge of the outer ring as per ASME B16.20.

## 9. PREPARATION FOR SHIPMENT

- 9.1 All pipe, fittings, flanges bolting and gaskets shall be protected against corrosion and mechanical damage. Vendors/Manufacturers procedures shall be supplied with bid for Purchaser review.
- 9.2 All flange faces shall be supplied with proprietary heavy-duty plastic flange protectors or marine plywood; retained by a minimum of four bolts. Butt weld and threaded ends on pipes, fittings and flanges shall be supplied with suitable bevel and thread protectors.

## 10. INSPECTION REQUIREMENTS

- 10.1 A typical Inspection and Test Plan shall be submitted for review with the bid. All pipe, fittings, flanges, bolting and gaskets will be subject to inspection in accordance with the Purchaser approved Manufacturer's Inspection and Test Plan.

## 11. CERTIFICATION AND TRACEABILITY

- 11.1 Material Certificates in accordance with BS EN 10204.3.1.B / DIN 50049 3.1B are required for all pressure containing components. They shall be clearly legible, in the English language and as a minimum shall include:
- Chemical Analysis by Heat
  - Mechanical Properties
  - Heat Treatment Statement and Number
  - Non Destructive Test results
  - Hydrostatic and/or Pneumatic Test results
  - Heat or Melt Number
  - Compliance with NACE MR0175-97 and any additional requirements listed in this specification.
- 11.2 All certificates shall state the Manufacturers name and location, all forging and plate certificates shall be from original steel manufacturers. Certificates shall include the Vendor's purchase order number and purchase order item number. Material certificates for dual certified stainless steel materials shall indicate compliance with the requirements of both grades of stainless steel as stated in the stock code description.
- 11.3 All other components including gaskets not covered by BS EN 10204.3.1.B / DIN 50049 3.1B shall require a Certificate of Compliance in accordance with BS EN 10204.2.2 / DIN 50049 2.2.