



Exploration & Production

GENERAL SPECIFICATION

PIPELINES - RISERS

GS PLR 222

**Carbon steel flanges for pipelines
(Sweet and Mild Sour Service)**

02	11/03	Change of Group name and logo
01	10/02	Updated for Mild Sour Service
00	02/01	First issue
Rev.	Date	Notes



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1. Scope

This specification defines the COMPANY's general technical requirements for the design, materials, manufacture, testing and inspection of forged carbon steel flanges of the welding neck type to be used in onshore and offshore pipeline systems.

This Specification shall be used in conjunction with a Project Particular Specification (PPS) detailing the additional tests and requirements or the possible modifications to the present specification, based on the particular design conditions of the pipeline Project.

Within this specification the term "flanges" is used indifferently to designate anchor flanges, blind flanges and swivel rings, when applicable

This specification applies to flanges with minimum specified yield strength ranging from 241 N/mm² (35,000 psi) up to 482 N/mm² (70,000 psi).

This specification also covers ring joint gaskets, as well as stud bolts and nuts for these flanges.

Flanges specified in this specification are to be used in Sweet and Mild Sour Service as defined in [GS COR 170](#).

Flanges shall comply with the requirements of [MSS SP 44](#), except where otherwise noted in this specification. Pressure-temperature ratings are defined in Appendix 1.

Flanges shall be forgings meeting the requirements of this specification and the requirements for forged flanges in [ASTM A 694](#), unless otherwise indicated in this specification.

Requirements are specifically stated in this specification for flanges to be used in platform topsides, risers or expansion loops where the wall thickness at weld neck is in excess of 31.8 m, or where the properties of Base Steel are to be ascertained after a Post Weld heat treatment.

Flanges may be supplied welded onto a piece of pipe at least 1000 m in length, when so required in the PPS. This welded pipe piece is designated as "pup piece" in this specification.

2. Reference documents

The reference documents listed below form an integral part of this General Specification. Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the EFFECTIVE DATE of the CONTRACT.

The order of precedence of the applicable documents shall be:

- The Project Particular Specification
- The present General Specification
- The Codes and Standards in reference.

Applicable Codes and Standards, which are to be used in conjunction with this specification, are stated hereafter.

Unless otherwise specifically indicated in writing, the SUPPLIER shall work in accordance with the requirements specified herein and the applicable requirements of the latest editions of the referenced Codes and Standards at time of contract award, whenever asked in the present specification.

Where this specification states no overriding requirements, the referenced Codes and Standards shall apply in full.

Standards equivalent to those referred to herein shall not be substituted without written approval from the COMPANY.

The SUPPLIER shall equip himself with copies of all the reference specifications referred to in this specification and shall make them readily available to all fabrication, testing and inspection personnel involved on the work.

Standards

Reference	Title
MSS SP 44	Steel pipe line flanges
ASTM E 10	Test method for Brinell Hardness of Metallic Materials
ASTM E 23	Method for Notched Bar Impact Testing of Metallic Materials
ASTM E 709	Guide for Practice of Magnetic Particle Examination
ASTM A 194/A 194M	Carbon and Alloy Steel Nuts for High-Pressure and High Temperature Service
ASTM A 320/A 320M	Specification for Alloy Steel - Bolting Materials for Low Temperature Service
ASTM A 370	Test Methods and Definitions for Mechanical testing of Steel Products
ASTM A 388/A 388M	Practice for Ultrasonic Examination of Heavy Steel Forgings
ASTM A 694/A 694M	Specification for Forgings, Carbon and Alloy Steel for Pipe, Flanges, Fittings, Valves and Parts for High - Pressure Transmission Services
ISO 148	Charpy impact test (V-notch)
ISO 9002	Quality systems: Model for quality assurance in production, installation and servicing
EN 10204	Types of inspection documents
BS EN 473	Qualification and certification of non-destructive testing personnel
BS 4515	

Professional Documents

Reference	Title
COFREND	Comité Français des essais non-destructifs (French Committee of non-destructive testing). Qualification and certification of non-destructive personnel
API 5L	Specification for Line pipe



Regulations

Reference	Title
Not applicable	

Codes

Reference	Title
ASME, section V	Boiler and Pressure Vessel Code. Non-destructive Examination
ANSI B 16.5	Pipe flanges and flanged fittings
ANSI B 16.20	Ring-Joint Gaskets and Grooves for Steel Pipe Flanges

Other documents

Reference	Title
Not applicable	

Total General Specifications

Reference	Title
GS COR 170	Materials for sour service (upstream applications) – Specification for design
GS COR 350	External protection of offshore and related structures and equipment by painting
GS PLR 420	Site welding of carbon steel pipelines to API 1104 (Sweet and Mild Sour Service)

3. General

3.1 Definition

Throughout this specification, the following definitions apply:

Purchaser Means the COMPANY or the SUPPLIER (as applicable), which have placed the Purchase Order to the MANUFACTURER.

Inspector Means the COMPANY's representative(s) of member(s) from an Inspection Agency duly appointed by the COMPANY or the SUPPLIER (as applicable) to act as its representative(s) for the purpose of the contract.

Approval Means the authorisation in writing given by the COMPANY to the SUPPLIER to proceed with the performance of a specific part of the work without releasing in any way the SUPPLIER from any of its



obligations or liabilities under the contract or at law; Approve, Approved and Approval shall be construed accordingly.

PPS

Designates the Project Particular Specification.

3.2 Approval of SUPPLIER's procedures

The SUPPLIER shall submit the following documentation for review and approval one month prior to commencement of fabrication.

- Design calculations and fabrication drawing of flanges
- Design calculation of gaskets and bolts
- Manufacturing Procedure Specification, describing all proposed forging operations, heat treatment, inspection and non-destructive testing in their correct sequence. This document will also mention the characteristics of equipment used to carry out above mentioned operations
- Sketch showing rough forging piece before machining and, when applicable, the test blank with exact location and orientation of test specimens
- Heat treatment and recording procedures, including number and location of thermocouples
- Dimensional inspection procedures
- Non-destructive inspection procedures
- Quality Control Plan
- Welding Procedures Specifications (where applicable)
- Welder qualifications (when applicable)
- Handling, storage and packing procedures
- Proposed measures for temporary corrosion prevention (non-coated flanges).

Once approved these procedures shall not be altered without the written approval of the COMPANY.

The SUPPLIER shall also submit for approval any deviations to requirements specified in the other applicable technical documents referenced herein.

3.3 Quality Assurance/Quality Control

The SUPPLIER shall operate a Quality Assurance system in accordance with [ISO 9002](#), or equivalent, approved by a recognised authority. The Quality Assurance Manual shall be submitted prior to the start of work.

Four weeks prior to the commencement of the flange manufacture, the SUPPLIER shall prepare and submit a quality Control Plan which describes the inspections to be performed during the supply of flanges. The Quality Control Plan shall set forth "witness", "hold", "review" and "monitor" points.

4. Design

4.1 Design data

Details of pipe diameter, wall thickness and material grades for the matching pipelines shall be given in pipeline Data Sheets and in Appendix 1 of this specification, together with the relevant design conditions.

4.2 Flange design

1. The SUPPLIER shall provide design calculations and fabrication drawings in accordance to [MSS SP 44](#) for approval. Specifically, the flanges shall be checked for the service conditions: i.e. design pressure, design temperature and external bending moments applied to the flanges (mainly due to the pipeline expansion).
2. Design calculations shall also be provided for gaskets and bolts for the intended service conditions.
3. The required flange facing (i.e. raised face, ring type joint) shall be clarified in the PPS. Flange facings (including ring joint grooves) shall be in accordance with [MSS SP 44](#) and [ANSI B 16.5](#), as applicable.
4. All flanges shall be designed with material tensile properties at least equal to those of the matching pipes (refer to para. 5.4 of this specification).
5. The nominal internal diameter (bore) shall be that of the matching pipeline as defined in Appendix 1, with a tolerance of ± 1.6 m.
6. The minimum wall thickness at weld neck (or hub) shall not be less than that of the matching pipeline. The flange hub shall be designed so that it can be easily fitted to the matching pipeline.

5. Flange material

5.1 Specification

Flange material shall comply with [ASTM A 694](#) and the requirements stated in the following.

5.2 Manufacturing process

Steel shall be made by the Electric Furnace or Basic Oxygen Converter, and shall be fully killed and made to fine grain practice.

The material shall be hot forged to bring it as close as possible to the final shape and size of flange. All parts shall undergo a reduction ratio of at least 2:1 during the forging process.

All flanges shall be normalised or quenched and tempered after forging.

5.3 Chemical composition

Unless alternative compositions are proposed by the SUPPLIER and approved at the bid stage, the chemical analysis shall comply with the following for ladle and product.

Element	Weight % max	
	Ladle	Product
Carbon	0.16	0.18
Manganese	1.50	1.60
Silicon	0.35	0.40
Aluminium (total)	0.060	0.060
Phosphorus	0.025	0.025
Sulphur	0.025	0.025
Niobium	0.06	0.06
Vanadium	0.06	0.06
Nickel	0.80	0.80
Chromium	0.25	0.25
Molybdenum	0.30	0.30
Copper	0.30	0.30
Cr + Mo + Cu	0.50	0.50
Nitrogen	0.015	0.015

Aluminium to nitrogen ratio shall be at least 2.

No alloying additions of elements other than those listed above shall be made without prior approval of the COMPANY.

The SUPPLIER shall perform analysis for all the elements listed above and any other intentionally added elements.

The SUPPLIER shall carry out a chemical analysis on each heat of steel used and also on two products per heat. The maximum Carbon Equivalent shall be 0.42% on ladle analysis and 0.43% on product analysis, when calculated with the following formula:

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

If any part of the product analyses fails to meet the requirements stated above, the whole heat shall be rejected or each individual product shall be fully analysed and all products failing to meet the requirements shall be rejected.

For flange diameter above 16", chemical analysis shall be carried out on every products.

5.4 Mechanical properties

5.4.1 Sampling and frequency of testing

The SUPPLIER shall test specimens cut from a complete production forging from locations and with orientations shown in Appendix 2 and Appendix 3. However, when thickness of flange hub or ring exceeds 100 m, then the specimens may be located at 50 m minimum from hub of ring surface.

For flange 24" and larger, testing on separately forged test blanks may be made provided that shape and size of test blanks (to be proposed by the SUPPLIER) are quite realistic against size of the products to test and that approval has been obtained from the COMPANY at the bid stage.

The sampling requirement shall be one full set of tensile and Charpy tests per each steel heat, flange size and heat treatment batch.

Grouping of flange sizes and materials may be agreed with the COMPANY at the bid stage according to manufacturing process.

Hardness tests shall be carried out on all flanges.

5.4.2 Tensile properties

Tensile tests shall be carried out in accordance with [ASTM A 370](#). The largest practical test specimen size shall be used. The required tests results are stated in the following table.

Mechanical properties	Flange material grade (ASTM A 694)							
	F 36	F 42	F 46	F 52	F 56	F 60	F 65	F 70
Minimum Yield Strength (0.2% proof stress) (MPa)	241	290	317	358	386	413	448	482
Minimum UTS (MPa)	413	413	434	455	468	517	530	565
Minimum Elongation in 2 inches (%)	23	23	23	22	21	20	20	18
Max YS/UTS	≤ 0.85	≤ 0.85	≤ 0.85	≤ 0.85	≤ 0.85	≤ 0.88	≤ 0.90	≤ 0.90
BRINELL Hardness (HB)				136-198	139-190	155-225	158-210	165-220

5.4.3 Impact properties

Charpy V-notch tests shall be carried out in accordance with [ASTM A 370](#) and [ASTM E 23](#) at locations shown in sketches of Appendices 2 and 3. Each impact test shall consist of three specimens. Full size specimens (10 m x 10 m) shall be used.

The minimum required impact energies are stated in the table below. The impact test temperature shall be stated in the PPS and/or Data Sheet.

Grade (A 694)	Minimum Average Value (J)	Minimum Individual Value (J)
F 36	28	21
F 42	34	26
F 46	36	27
F 52	40	30
F 56	44	33
F 60	48	36
F 65	52	39
F70	56	42

5.4.4 Hardness survey

A hardness survey shall be carried out on each produced flange after final heat treatment, in accordance with [ASTM E 10](#), or equivalent. A minimum of eight equi-spaced readings shall be carried out on the outside edge close to the welding neck (i.e. on flange “hub”). A further minimum of eight readings shall also be made at random locations on the thicker part of each flange (i.e. on flange “ring”).

Hardness shall not exceed the hardness range shown in table of para. 5.4.2 above, at any point. The Inspector reserves the right to ask for hardness checks at any other location on the flange, e.g. when any doubt about consistency of results occurs.

Hardness testing shall be performed using portable equipment approved by the COMPANY.

5.4.5 Simulated PWHT

When so required in the PPS (and at least when wall thickness at flange welding end exceeds 31.8 m), tensile tests and impact tests as per para. 5.4.2 and 5.4.3 above shall be repeated after a simulated Post Weld Heat Treatment (PWHT) has been made on the flange material at a holding temperature of $620^{\circ}\text{C} \pm 10^{\circ}\text{C}$ for one hour per 25 m thickness of flange hub. The tests and test results shall meet the requirements of this specification.

PWHT tests are required on flanges when a PWHT is made by the MANUFACTURER on weld between flange and pup piece, if any. This happens as a minimum when wall thickness of matching pipe exceeds 31.8 m.

5.4.6 Failed tests

The Inspector will only permit a retest if there is reason to believe that failure was due to some fault in preparation or testing and that the result was not representative of the test sample. Otherwise, the failed test shall be carried out on every flanges in the heat or lot, or alternatively, the entire heat or lot shall be re-heat treated and the full set of tests carried out on one flange.

5.4.7 Material rings for welding tests

When it is agreed that flanges can be supplied without welded pup pieces, then the SUPPLIER shall supply three (3) test rings to the COMPANY for qualification of weld procedures to be made by others. The rings shall be of the same material and size of the hub and also shall have been forged and heat treated in the same way as the related supplied flanges.

Test rings shall have a minimum length of 300 m. Three rings are required for each size and material grade of flanges. Both ends of the rings shall be bevelled as for the related bends of the order.

Marking of test rings shall be agreed with the COMPANY.

6. Welding necks ends

The flange welding neck bevel shall be as per [MSS SP 44](#), except that root face shall be $1.6 \text{ m} \pm 0.6 \text{ m}$.

7. Gaskets and bolting materials

7.1 Gaskets

The gasket material shall be comply with [MSS SP 44](#) and shall be selected in agreement with the COMPANY.

Ring joint gaskets shall be made to [ANSI B 16.20](#) and [MSS SP 44](#) and shall be manufactured from soft iron.

7.2 Bolting

Bolting shall be in accordance with MSS SP 44. The PPS may state the required specifications and grades for bolts and nuts, where necessary. Surface treatment is not recommended. After assembly, stud bolts and nuts shall be cleaned (washed and degreased) abrasive blasted and painted as per specification [GS COR 350](#).

The bolts provided shall allow for use hydraulic tightening system.

7.3 Electrical continuity

The SUPPLIER shall ensure that the flanges shall achieve the electrical continuity of the pipeline after installation. The bolting shall be in electrical contact with the flanges.

8. Pup pieces

The welded pup pieces, if any (refer to para. 1 of this specification), shall be selected among the pipes procured for the pipeline project, according to the requirements of relevant project specifications.

9. Blind flanges

When required in the PPS blind flanges with a 1½ valve and plug, suitable for hydrotest, will be supplied with the flanges. Blind flanges will be forged.



These items are temporary items and bolts and gaskets used for the connections to the flange are also considered as temporary items (i.e. they will not be re-used for the final connection).

These temporary items have to be designed (flange rating) by the SUPPLIER for one year design life on the construction site.

Blind flanges and gaskets shall comply with [MSS SP 44](#) and [ANSI B 16-20](#).

10. Inspection and non-destructive testing

10.1 General

The Inspector shall have access to the workshops at all times when work is in progress and shall be at liberty to inspect the manufactured items at any stage and to reject any part not complying with this specification.

Each part of the work shall be inspected by the SUPPLIER during manufacture. Sufficient inspections shall be made by the SUPPLIER to ensure that the materials, manufactured items and testing comply in all respects with the requirements of this specification.

The COMPANY inspection shall not relieve the SUPPLIER from its responsibility, being understood that the SUPPLIER shall remain responsible for quality and inspections.

10.2 Non-Destructive Testing (NDT)

10.2.1 General

The SUPPLIER shall submit detailed inspection and NDT procedures for review and approval. This shall also detail the full extent of the inspection.

The SUPPLIER shall establish, before commencing production, an identification system such that each flange can be fully identified against the Mill test certificates.

The qualifications of the NDT personnel used by the SUPPLIER shall be subject to approval by the Inspector. The Inspector reserves the right to retest and reject any of the NDT personnel at any time.

10.2.2 Extent of inspection

Flanges shall be subject to the following inspection:

- 100% visual inspection of internal and external surfaces
- 100% magnetic particle inspection of internal and external surfaces
- 100% ultrasonic inspection.

Final NDT shall be carried out after heat treatment with the forging in the finish-machined condition.

10.2.3 Visual inspection

Forgings shall comply with the workmanship, finish and appearance requirements of [ASTM A 694](#).



10.2.4 Magnetic Particle Inspection (MPI)

MPI shall be carried out over the entire surface area of the forgings in accordance with SE 709, Article 25 of [ASME V](#), using wet particles and the yoke method.

No linear indication shall be permitted.

10.2.5 Ultrasonic inspection

Ultrasonic testing shall be carried out in accordance with [ASME V](#) or [ASTM A 388/A 388M](#).

10.2.5.1 Straight beam examination

Indications which are equal to or exceed that obtained from a 5 m diameter flat bottom hole located at mid-thickness in a calibration test piece of thickness equal to half the thickness of the work piece or 50 m, whichever is greater, are unacceptable.

10.2.5.2 Angle beam examination

Indications which are equal to or exceed those obtained from a 60 deg. V-notch 25 m long and having a depth no greater than 5% of the nominal wall thickness in a test piece are unacceptable.

11. Repair of defects

Minor surface defects on flanges shall be ground out leaving a smooth gradual profile provided that the wall thickness is not reduced below the nominal value given in [MSS SP 44](#) or by proper calculations for non-standard flanges. Any ground areas (except for cosmetic grinding) shall be examined by Magnetic Particle Inspection. Forgings containing larger defects shall be rejected. Repair welding of forgings is forbidden.

12. Dimensional requirements and inspection

Flanges shall be machined according to the dimensions and tolerances of [MSS SP 44](#) for sizes above NPS 10", and of [ANSI B 16.5](#) for NPS 10" and smaller, or as otherwise agreed between the COMPANY and the SUPPLIER for non-standard flanges.

In all cases, the nominal internal diameter of the flange shall be the same as the nominal internal diameter of the matching pipeline (as shown in Appendix 1), with a tolerance of ± 1.6 m (refer. to para. 5.2.4 of this specification).

This shall be checked in the presence of the Inspector using internal callipers, gauges or equivalent approved devices.

The finish of contact faces of flanges shall be checked on each flange in full compliance with [MSS SP 44](#).

Profile and dimensions of weld neck ends are defined in section 6 of this specification. This requirement also applies to welded pup pieces, if any.

The dimensional inspection shall be carried out after welding the pup piece (if any) to the flange.

13. Welding

13.1 General

Welding of pup pieces to flanges shall be in accordance with the requirements of Specification **GS PLR 420** and the additional requirements stated in the following.

13.2 Welding process

The use of welding processes other than SMAW and SAW is not permitted without prior approval of the COMPANY except that GTAW is acceptable for root runs. Only low hydrogen coated electrodes shall be used when the manual metal arc process is employed.

13.3 Welding Procedure Specification (WPS)

Before performance of a qualification test weld (see para. 13.4 hereafter) the SUPPLIER shall draw up a detailed Welding Procedure Specification (WPS) and submit it to the COMPANY approval prior to commencement of welding.

This WPS shall include:

- A description of the welding procedure and weld repair procedures
- Bevel profile and dimensions
- The MANUFACTURER and brand name of all welding consumables
- The extent and method of interpass cleaning
- For each run, the current type, polarity, arc current and voltage, direction of welding, welding speed and/or run out length (when applicable)
- Details of welding consumable baking and handling procedures.

13.4 Welding procedure qualification tests

13.4.1 Welding test performance

After approval of the proposed WPS, the SUPPLIER shall demonstrate by qualification tests that the proposed WPS and the equipment the intends to use enable him to produce welds which meet the quality and property requirements of this specification. Final approval by the Inspector will only be given on satisfactory completion of all testing to this specification.

The welding procedure qualification test shall be carried out on a butt weld between a flange from the same lot as the rest of the flanges being supplied and a pup piece of matching nominal pipe size and wall thickness.

The welding consumables used for weld procedure qualification test shall be from the same lots as those planned for use in production welding.

Tests conducted by the SUPPLIER in qualifying the welding procedures shall be witnessed by the Inspector.

13.4.2 Examination of qualification weld

The completed test weld shall be examined visually in accordance with specification **GS PLR 420**.



After visual examination and at least 24 hours after completion of welding, the test joint shall be 100% examined by X-radiography in accordance with above mentioned specification.

At the Inspector's request an ultrasonic examination shall be performed where there is any doubt over weld quality after X-radiography inspection.

Mechanical testing of the joint can only proceed after the weld is judged satisfactory.

13.4.3 Destructive testing

The number, type and position of the specimens shall be as stated in specification [GS PLR 420](#). Test procedures and results shall comply with the requirements of specification [GS PLR 420](#).

13.4.3.1 Macro-section/Hardness tests

Hardness values shall not exceed 300 HV5.

13.4.3.2 Impact tests

The specimen size shall be the largest practicable. The minimum values of impact energy absorption for weld and base material are stated in the PPS and/or pipeline Data Sheets, together with the impact test temperature.

No fabrication shall commence until the procedure qualification tests have been approved by the Inspector.

13.5 Qualification of welders

Welders shall be qualified as per [GS PLR 420](#). Welders who are pre-qualified to [BS 4515](#) or other recognised pipe welding standard may be accepted at the discretion of the Inspector.

13.6 Inspection and testing

Inspection of welds shall not commence until at least 24 hours have elapsed since weld completion.

All welds shall be 100% visually inspected for surface appearance and defects, and shall satisfy the acceptance criteria of [GS PLR 420](#).

All welds shall then be 100% examined by Magnetic Particle Inspection in accordance with [GS PLR 420](#).

All welds shall then be 100% examined by radiography in accordance with procedure, which shall have been previously submitted to and approved by the Inspector. The procedure shall meet the requirements of [GS PLR 420](#).

13.7 Weld acceptance criteria

The weld acceptance criteria for welding procedure qualification tests, welder qualification tests and production welds shall be as defined in [GS PLR 420](#).

14. Mill hydrostatic testing

The SUPPLIER shall certify that the flange (including pup pieces, if any) can withstand the hydrostatic test pressures of 95% of SMYS of matching pipe (using the Barlow's formula and the minimum specified wall thickness of matching pipe for calculation).

15. Protection

The bevelled ends and contact faces of flanges shall be protected by a peel-off varnish. When required in the PPS, flanges (or their pup pieces) shall be fitted with bevel protectors of a type approved by the COMPANY.

16. Marking of flanges

Marking shall be such that complete traceability is demonstrated in all stages of manufacture.

Each flange shall be clearly identified on the outside rim using the following marking:

- COMPANY's name
- Project name
- Purchase Order no.
- Mill Name/Mark
- Steel grade
- Item No./Requisition No.
- Heat number
- Pressure-temperature rating ([MSS SP 44](#))
- Nominal pipe diameter
- Weight (in kg).

Marking shall be approved by the Inspector prior to the flange production. The original marking of the matching pipes shall be transferred to each corresponding pup piece or scrap of pipe.

The flange number and class rating shall be stamped on the periphery of each flange ring. The mark of the Inspector shall also be added.

17. Handling, storage and packing

The SUPPLIER shall ensure that all finished flanges are handled and stored in such a manner so as to preserve the machined faces and general surface condition of the forging.

The SUPPLIER shall ensure that all flanges are adequately protected against corrosion on a temporary basis (until installation).

The flanges shall be stored clear of the ground and adequately protected from water and mud.

The SUPPLIER shall take suitable corrective action if damage is observed by the Inspector due to inadequate handling or storage conditions.

18. Documentation

Mill certificates 3.1.C according to [EN 10204 Std](#) are required for the flanges. Mill certificates shall be issued by the MANUFACTURER and signed and stamped by the Inspector.

Mill certificates shall make reference to [MSS SP 44](#) together with the present specification and related PPS.



The following documentation shall be submitted to the Inspector prior to the dispatch of the flanges:

- Mill test certificates signed by the MANUFACTURER to signify compliance with this specification. This shall contain the following:
 - MANUFACTURER's name and trademark
 - Product serial number/Requisition No.
 - Flange Diameter and rating
 - Reference/Contract number
 - Heat number
 - Test number
 - Chemical analysis (ladle and product) including Carbon Equivalent
 - All mechanical test results
 - Heat treatment batch number.
- Heat treatment chart signed by the Inspector, showing date of treatment and definition of scales
- Sketch showing test specimen removal (see para. 5.4)
- Dimensional and NDT reports
- Welding Procedure Qualification Records and Non-Destructive Testings made on production welds (if any)
- Hydrostatic testing certificate of compliance
- Quality Control Plan
- Compilation of concessions/deviations, if any, granted by the COMPANY during flange production.

The number of originals and copies of above documentation shall be stated in the Project Particular Specification.

The original documentation shall be stamped and signed by the Inspector. The copies shall be stamped by the Inspector.



Appendix 1 Flanges characteristics

(Table to be filled-in and incorporated in PPS)

Flange nominal dia.	.....	.....
Pipeline service	.....	.....
Flange steel grade (ASTM A 694)	.....	.....
Pressure-temperature rating (MSS SP 44)	.....	.....
Flange Nominal Internal Dia (Bore) (mm)	.....	.....
Matching pipe:	.....	.....
• Steel grade (API 5L)	.....	.....
• Nominal internal dia. (Bore) (mm)	.....	.....
• Nominal wall thickness (mm)	.....	.....
• Mill hydrostatic pressure (Barg)	.....	.....
Max. Design temperature (°C)	.....	.....
Min. Operating temperature (°C)	.....	.....
Min. Steel Design temperature (°C)	.....	.....
Design Pressure (Barg)	.....	.....
Corrosion Allowance (mm)	.....	.....

Appendix 2 Sampling of test specimens (all flanges)

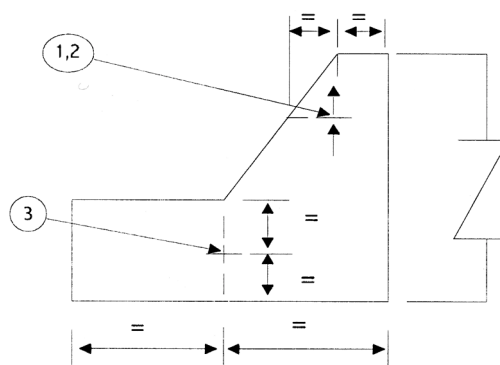


Figure 1 - Sampling position of test specimens

Positions for samples 1 and 2 may be floated down an equidistant line to enable sample removal where geometry is restrictive.

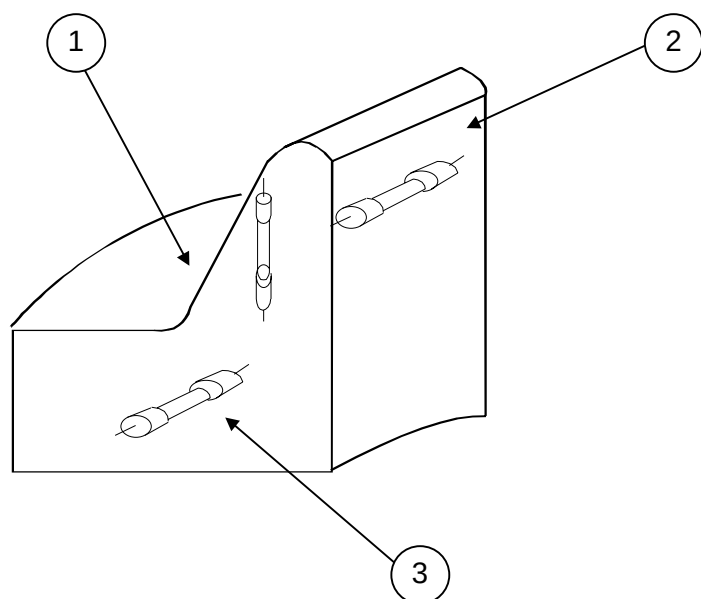


Figure 2

Location and orientation of tensile specimens

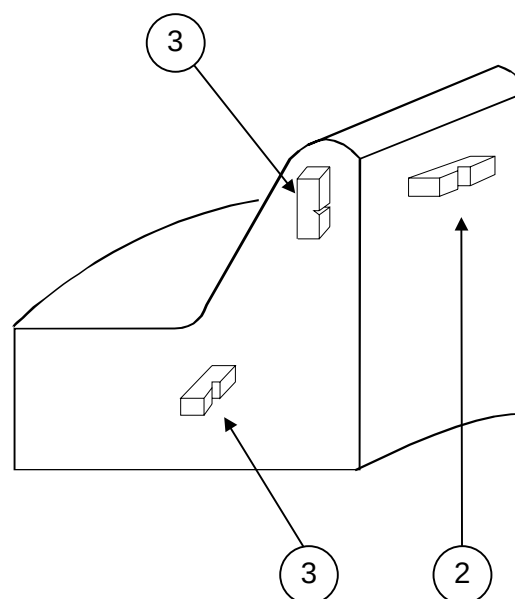


Figure 3

Location and orientation of impact specimens (3 samples from each location i.e. 9 samples in total)

Note: When thickness of flange hub or ring exceeds 100 m, then the specimens may be located at 50 m minimum from hub or ring surface

Appendix 3 Sampling of tests specimens (swivel rings)

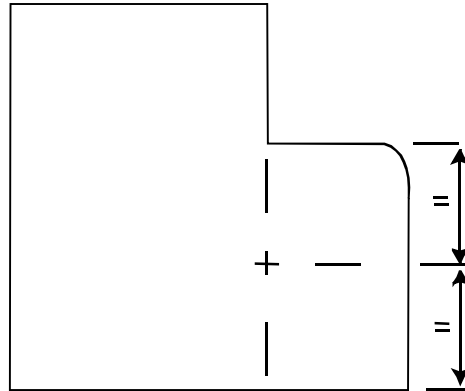


Figure 1 - Sampling position of mechanical test specimens

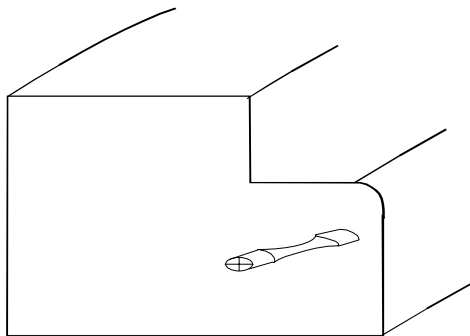


Figure 2

Location and orientation of tensile specimens

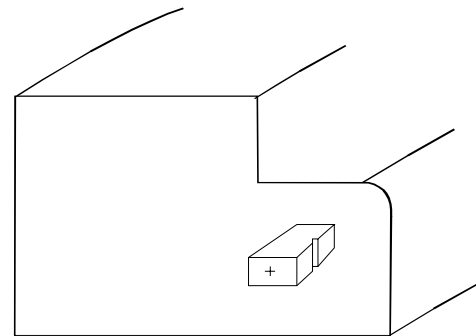


Figure 3

Location and orientation of impact specimens (3 samples from each location i.e. 9 samples in total)