

2/12

SS Piping and Fittings

S. No.	Description/Specification	Code	Qty Required
1	2	3	4
1	DN 750, PIPE, WELDED, SCH 40S, SS304L, ASME B36.19M, SA 312	PS-001	08 meter
2	DN 600, PIPE, SEAMLESS, SCH 40S, SS304L, ASME B36.19M, SA 312	PS-002	260 meter
3	DN 500, PIPE, SEAMLESS, SCH 40S, SS304L, ASME B36.19M, SA 312	PS-003	295 meter
4	DN 400, PIPE, SEAMLESS, SCH 40S, SS304L, ASME B36.19M, , SA 312	PS-005	65 meter
5	DN 300, PIPE, SEAMLESS, SCH 40S, SS304L, ASME B36.19M, , SA 312	PS-004	245meter
6	DN 150, PIPE, SEAMLESS, SCH 40S, SS304L, ASME B36.19M, , SA 312	PS-005	105 meter
7	DN 125, PIPE, SEAMLESS, SCH 40S, SS304L, ASME B36.19M, SA 312	PS-006	30 meter
8	DN 100, PIPE, SEAMLESS, SCH 40S, SS304L, ASME B36.19M, SA 312	PS-007	1900 meter
9	DN 80, PIPE, SEAMLESS, SCH 40S, SS304L, ASME B36.19M, SA 312	PS-008	1825 meter
10	DN 65, PIPE, SEAMLESS, SCH 40S, SS304L, ASME B36.19M, SA 312	PS-009	50 meter
11	DN 50, PIPE, SEAMLESS, SCH 40S, SS304L, ASME B36.19M, SA 312	PS-009	240 meter
12	DN 40, PIPE, SEAMLESS, SCH 40S, SS304L, ASME B36.19M, SA 312	PS-010	5 meter
13	DN 15, PIPE, SEAMLESS, SCH 40S, SS304L, ASME B36.19M, SA 312	PS-011	65 meter
14	DN 600, 90 LONG RADIUS ELBOW, SS304L, SCH 40S, ASME B16.9, SA-403	FS-001	45 Nos.
15	DN 600, EQUAL TEE, SCH 40S, SS304L, ASME B16.9, SA-403	FES-002	08 Nos.
16	DN 600X400, ECC REDUCER, SCH 40S, SS304L, ASME B16.9, SA-403	FS-003	05Nos.
17	DN 600, END CAP, SCH 40S, SS304L, ASME B16.9, SA-403	FS-004	05 Nos.
18	DN 600, WELDED NECK FLANGE, 150LB, SCH 40S, SS304L, ASME B16.5	FS-005	08 Nos.
19	DN 600, GASKET, 150LB 1/8" THK, ASME B16.5	FS-006	12Nos.
20	DN 500, 90 LONG RADIUS ELBOW, SS304L, SCH 40S, ASME B16.9, SA-403	FS-007	40 Nos.
21	DN 500, EQUAL TEE, SCH 40S, SS304L, ASME B16.9, SA-403	FS-008	08Nos.
22	DN 500 X 400, REDUCING TEE, SCH 40S, SS304L, ASME B16.9, SA-403	FS-009	12 Nos.
23	DN 500 X 300, REDUCING TEE, SCH 40S, SS304L, ASME B16.9, SA-403	FS-010	10 Nos.
24	DN 500 X 200, REDUCING TEE, SCH 40S, SS304L, ASME B16.9, SA-403	FS-011	05 Nos.
25	DN 500, END CAP, SCH 40S, SS304L, ASME B16.9, SA-403	FS-012	05 Nos.
26	DN 500, WELDED NECK FLANGE, 150LB, SCH 40S, SS304L, ASME B16.5	FS-013	40 Nos.
27	DN 500, GASKET, 150LB 1/8" THK, ASME B16.5	FS-014	50 Nos.
28	DN 400, 90 LONG RADIUS ELBOW, SS304L, SCH 40S, ASME B16.9, SA-403	FS-015	04 Nos.
29	DN 400 X 300, REDUCING TEE, SCH 40S, SS304L, ASME B16.9, SA-403	FS-016	05 Nos.
30	DN 400X300, ECC REDUCER, SCH 40S, SS304L, ASME B16.9, SA-403	FS-017	05 Nos.
31	DN 400X250, CONC REDUCER, SCH 40S, SS304L, ASME B16.9, SA-403	FS-018	05 Nos.
32	DN 400, END CAP, SCH 40S, SS304L, ASME B16.9, SA-403	FS-019	02 Nos.
33	DN 400, WELDED NECK FLANGE, 150LB, SCH 40S, SS304L, ASME B16.5	FS-020	45 Nos.
34	DN 400, EXPANSION JOINT, FLANGED, 150LB,	FS-021	04 Nos.
35	DN 400, GASKET, 150LB 1/8" THK, ASME B16.5	FS-022	50 Nos.
36	DN 300, 90 LONG RADIUS ELBOW, SS304L, SCH 40S, ASME B16.9, SA-403	FS-023	25 Nos.
37	DN 300, EQUAL TEE, SCH 40S, SS304L, ASME B16.9, SA-403	FS-024	10 Nos.
38	DN 300, END CAP, SCH 40S, SS304L, ASME B16.9, SA-403	FS-025	03 Nos.

4/12

S. No.	Description/Specification	Code	Qty Required
1	2	3	4
79	DN 65, WELDED NECK FLANGE,150LB , SCH 40S, SS304L , ASME B16.5	FS-065	08 Nos.
80	DN 65, GASKET,150LB 1/8" THK, ,ASME B16.5	FS-066	08 Nos.
81	DN 50, 90 LONG RADIUS ELBOW, SCH 40S, SS304L , ASME B16.9 , SA-403	FS-067	72 Nos.
82	DN 50x32, 90 REDUCING ELBOW, SCH 40S, SS304L , ASME B16.9 , SA-403	FS-068	04 Nos.
83	DN 50, EQUAL TEE, SCH 40S, SS304L , ASME B16.9 , SA-403	FS-069	26 Nos.
84	DN 50X 32, CONC REDUCER, SCH 40S, SS304L , ASME B16.9 , SA-403	FS-070	04 Nos.
85	DN 50 X 15, REDUCING TEE, SCH 40S, SS304L , ASME B16.9 , SA-403	FS-071	10 Nos.
86	DN 50, WELDED NECK FLANGE,150LB , SCH 40S, SS304L , ASME B16.5	FS-072	75 Nos.
87	DN 50, GASKET,150LB 1/8" THK, ,ASME B16.5	FS-073	75 Nos.
88	DN 40, WELDED NECK FLANGE,150LB , SCH 40S, SS304L , ASME B16.5	FS-074	04 Nos.
89	DN 40, GASKET,150LB 1/8" THK, ,ASME B16.5	FS-075	04 Nos.
90	DN 32, WELDED NECK FLANGE,150LB , SCH 40S, SS304L , ASME B16.5	FS-076	08 Nos.
91	DN 32, GASKET,150LB 1/8" THK, ,ASME B16.5	FS-077	16 Nos.
92	DN 15, 90 LONG RADIUS ELBOW, SCH 40S, SS304L , ASME B16.9 , SA-403	FS-078	15 Nos.
93	DN 15, 45 ELBOW, SCH 40S, SS304L , ASME B16.9 , SA-403	FS-079	20 Nos.
94	DN 15, EQUAL TEE, SCH 40S, SS304L , ASME B16.9 , SA-403	FS-080	18 Nos.
95	DN 15, WELDED NECK FLANGE,150LB , SCH 40S, SS304L , ASME B16.5	FS-081	10 Nos.
96	DN 15, GASKET,150LB 1/8" THK, ,ASME B16.5	FS-082	10 Nos.

Note: 1: Specification of Stainless Steel Fittings at *Annexure-B*; 2: Specification of Stainless Steel Piping at *Annexure-C*

S/17

ANNEXURE-B**SPECIFICATIONS OF STAINLESS STEEL FITTINGS****TABLE OF CONTENTS**

1	PURPOSE
2	SCOPE OF WORK
3	GENERAL REQUIREMENTS
4	APPLICABLE CODES AND STANDARDS
5	TECHNICAL REQUIREMENTS
5.1	MANUFACTURE
5.1.1	Forming
5.1.2	Heat Treating of the Fitting
5.1.3	Tolerances
5.1.4	Surface Quality of the Fittings
5.1.5	Fitting Ends Preparation
6	MATERIAL OF CONSTRUCTION
6.1	CHEMICAL COMPOSITION
6.2	MECHANICAL PROPERTIES
7	QUALITY ASSURANCE
8	DOCUMENTATION
9	TESTING, INSPECTION, SHIPMENT AND INSTALLATION
9.1	EXAMINATION
9.1.1	Intergranular Corrosion Test
9.1.2	Metallographic Examination
9.2	TEST METHODS
10	PREPARATION FOR PACKING AND SHIPMENT

LIST OF TABLES

Table 1: Reference Documents

Table 2: Mechanical Properties of Pipe (Billet)

Table 3: Mechanical Properties of Forging (Billet)

Table 4: Test and Examination of the Fittings

7/19

5 TECHNICAL REQUIREMENTS

5.1 MANUFACTURE

5.1.1 Forming

Forming may be made by the procedure of punching, extruding and forging. For that procedure, harmful defects shall not be generated in the stainless steel fittings. The fitting may be made of the stainless steel rod for $DN \leq 100\text{mm}$.

5.1.2 Heat Treating of the Fitting

a) All fittings shall be furnished in the solution treating; the heat-treated condition is as follows:

- i. Heating temperature: $1050^{\circ}\text{C} \sim 1100^{\circ}\text{C}$
- ii. Heat preservation time: $[(T/25) \times 20]$ minutes (but not less than 10 minutes)

Where T: thickness of material (mm)

iii. Cooling mode: rapidly cooling by water

b) Mechanical properties of all seamless stainless steel fittings (finished product) shall not be degraded.

5.1.3 Tolerances

The dimension and variation of all fittings except for the nozzle shall be conducted in accordance with Table-2 (Tolerances) of ASME B16.9.

5.1.4 Surface Quality of the Fittings

The surface of the fittings shall be smooth without defects such as scores, tear etc. The roughness R_a on inside (outside) surface of the fitting shall not be beyond $6.3\mu\text{m}$.

5.1.5 Fitting Ends Preparation

The details of the welding end preparation shall be in accordance with Section 8 (End Preparations) of ASME B16.9.

6 MATERIAL OF CONSTRUCTION

The material of the stainless steel fittings is the SS 304L. All pipe (billet) shall conform to the requirements prescribed in "Procurement Specification of Stainless Steel Pipes (SA-312)". All forgings (billets) shall conform to the requirements prescribed in SA 182.

6.1 CHEMICAL COMPOSITION

a) The chemical composition of billets for stainless steel fittings shall conform to the requirements as to ASME SA312 grade F304L.

9/10

8 DOCUMENTATION

Certified material test report (CMTR) including mechanical tests, chemical analysis and intergranular corrosion test shall be provided.

9 TESTING, INSPECTION, SHIPMENT AND INSTALLATION

9.1 EXAMINATION

9.1.1 Intergranular Corrosion Test

The specimen shall be sensitized. (Sensitized temperature will be $650^{\circ}\text{C} \pm 100^{\circ}\text{C}$, heat preservation is two hours, quenched in air) The test shall be conducted in accordance with the requirements of ASTM A262-practice E. The intergranular corrosion tendency shall not be present.

9.1.2 Metallographic Examination

- a) The austenitic grain size shall be examined in accordance with the requirements of methods ASTM E112. The grain size shall be grade 3 or finer.
- b) Inspections of the contents of non-metallic inclusions shall be conducted in accordance with method A of ASTM E45

9.2 TEST METHODS

- a) The chemical analysis of the pipe shall be made, one specimen of one pipe from each heat. The mechanical properties of the pipe, the intergranular corrosion test, the grain size examination, the non-metallic inclusions examination and the flattening test shall be made on each same heat-treated furnace, same dimension and same manufacture process to two specimens cut from two pipes for each lot.
- b) The items of the test and examination shall conform to the requirements prescribed in Table 4.
- c) If any result of dynamical tests of any group or lot do not conform to the requirements specified in the individual specification, the nonconforming portion should be removed, and retest should be made on additional fittings of double the original number from the else group or lot. Each fitting should conform to the requirement specified. Only one retest is permitted for each group or lot. If the results of the retest do not conform, the fitting of the group or lot will be rejected, but each fitting could be examined and reheat treated by the manufacturer and delivered as new fitting of group or lot. Only one reheat treating of any group or lot will be permitted.

ANNEXURE-C**SPECIFICATION OF SEAMLESS STAINLESS STEEL PIPES****TABLE OF CONTENTS**

1	PURPOSE
2	SCOPE OF WORK
3	GENERAL REQUIREMENTS
4	APPLICABLE CODES AND STANDARDS
5	TECHNICAL REQUIREMENTS
5.1	MANUFACTURE
5.2	PERMISSIBLE VARIATIONS IN SIZE
5.3	PERMISSIBLE VARIATIONS IN THICKNESS
5.4	PERMISSIBLE VARIATIONS IN OUTSIDE DIAMETER
5.5	QUALITY OF OUTSIDE AND INSIDE SURFACE OF PIPE
5.6	REPAIR BY WELDING
6	MATERIAL OF CONSTRUCTION
6.1	CHEMICAL COMPOSITION
6.2	MECHANICAL PROPERTIES
6.3	TENSILE REQUIRMENT
7	QUALITY ASSURANCE
7.1	CERTIFICATION
8	DOCUMENTATION
9	TESTING, INSPECTION, SHIPMENT AND INSTALLATION
9.1	TESTING
9.1.1	Intergranular Corrosion Test
9.1.2	Metallographic Examination
9.1.3	Ultrasonic Examination
9.1.4	Flattening Test
9.1.5	Hydrostatic Test
9.2	TEST METHODS
9.3	RETEST
10	PREPARATION FOR PACKING AND SHIPMENT

LIST OF TABLES

Table 1:	Applicable Codes and Standards
Table 2:	Permissible Variation in Wall Thickness
Table 3:	Permissible Variation in Outside Diameter
Table 4:	Tensile Requirements
Table 5:	Examination Requirements

5 TECHNICAL REQUIREMENTS

5.1 MANUFACTURE

- a) The steel shall be made by electric-furnace refining or other similar processes.
- b) The pipe shall be manufactured as per para 6.1 (Manufacture) of SA-312.
- c) The heat treatment shall be as per para 6.2 (Heat Treatment) of SA-312.

5.2 PERMISSIBLE VARIATIONS IN SIZE

- a) The finished pipe lengths (random lengths) shall exceed 6m, and no joint is permitted.
- b) The finished pipe shall be reasonably straight. For pipe, the maximum deviation from 1m straightedge placed so that both ends are in contact with the pipe shall be 1.1mm. The end of pipe shall be vertical with axis.

5.3 PERMISSIBLE VARIATIONS IN THICKNESS

- a) Permissible variations from the specified minimum wall thickness shall not exceed the amounts prescribed in following table 2

Table 2. Permissible Variation in Wall Thickness

Wall Thickness (mm)	Permissible Variation (mm)
> 1.0	± 10 % Nominal Wall Thickness

5.4 PERMISSIBLE VARIATIONS IN OUTSIDE DIAMETER

Permissible variations from the specified outside diameter shall not exceed the amounts prescribed in Table 3.

Table 3: Permissible Variation in Outside Diameter

Nominal Diameter DN (mm)	Outside Diameter (mm)	Permissible Variation (mm)	
		Over	Under
≤ 80	As per ASME B36.19M	0.4	0.38
100 ~ 200	As per ASME B36.19M	0.4	0.64
250 ~ 300		0.4	0.8
300 ~ 600		0.4	1.0

5.5 QUALITY OF OUTSIDE AND INSIDE SURFACE OF PIPE

Pipe appearance shall have a workmanship finish. Imperfections shall not be permitted on the pipe; such as scabs, seams, laps, tears or slivers. The imperfections may be removed by grinding.

When imperfections or defects are removed by grinding, a smooth curved surface shall be maintained and the wall thickness is not decreased to less than that permitted by this specification. The roughness R_a on inside (outside) surface of the pipe shall not be beyond 6.3 μm .

9 TESTING, INSPECTION, SHIPMENT AND INSTALLATION

9.1 TESTING

9.1.1 Intergranular Corrosion Test

The specimen shall be sensitized. (Sensitizing temperature shall be $650^{\circ}\text{C} \pm 100^{\circ}\text{C}$, heat preservation is two hours, quenched in air) The test shall be conducted in accordance with the requirements of ASTM A262-practice E. The intergranular corrosion tendency shall not be present.

9.1.2 Metallographic Examination

The austenitic grain size shall be examined in accordance with the requirements of methods ASTM E112. The grain size shall be grade 3 or finer.

Inspections of the contents of non-metallic inclusions shall be conducted in accordance with method A of ASTM E45

9.1.3 Ultrasonic Examination

All of the pipes shall be ultrasonically inspected in accordance with ASTM E213, and shall be marked.

9.1.4 Flattening Test

A section of pipe not less than 63.5 mm in length shall be flattened cold between parallel plates in two steps. During the first step, which is a test for ductility, no cracks or breaks on the inside, outside or end surfaces, shall occur until the distance between the plate is less than the value of H calculated as follows:

$$H = \frac{1.09t}{0.09 + \frac{t}{D}}$$

Where:

H: Distance between flattening plates (mm)

t: specified wall thickness (mm)

D: Specified Outside Diameter (mm)

During the second step, which is a test for soundness, the flattening be continued until the specimen breaks or the opposite walls of the tube meet. Evidence of laminated or unsound material that is revealed during the entire flattening test shall be cause for rejection.

For welded pipe, a transverse-guided face bend test of the weld may be conducted instead of a flattening test in accordance with the method outlined in the steel tubular product supplement of Test Methods and Definitions A 370. The ductility of the weld shall be considered acceptable when there is no evidence of cracks in the weld or between the weld and the base metal after bending. Test specimens from 5% of the lot shall be taken from the pipe or test plates of the same material as the pipe, the test plates being attached to the end of the cylinder and welded as a prolongation of the pipe longitudinal seam.

9.3 RETEST

If the results of the certification tests of any lot do not conform to the requirements specified in the individual specification, retests may be made on additional lengths of pipe of double the original number from the same lot, each of which shall conform to the requirements specified. Only one retest of any lot will be permitted. Nonconformance will be cause for the rejection of the lot. Any individual length of pipe that meets the test requirements is acceptable.

If individual lengths of pipe selected to represent any lot fail to conform to the test requirements, the lot represented may be reheat treated and resubmitted for test. Only one reheat treatment will be permitted.

It is permitted to retest individual lengths that do not conform to the test requirements, provided that the reason for nonconformance is established and the nonconforming portion is removed.

10 PREPARATION FOR PACKING AND SHIPMENT

- a) The pipe shall be treated by the pickling and passivating, or by polishing and passivating. After passivating, demineralized water is applied to flushing the pipe.
- b) The inside (outside) surface of the pipe shall be de-oiled by clean-up liquid and no contamination on the pipe.
- c) During shipping and storage, the packing shall be perfected to assure the pipes shall not be defective. Inside (outside) of the pipe shall be maintained dry and clean.
- d) The inside (outside) of the pipes shall not contact with the element of low melting point such as Cu, Pb, Zn, etc., and shall not be in contact with carbon steel, either.