

# ASTM FITTING SPECIFICATIONS

This general requirements covers summary information and common requirements data extracted from relevant ASTM standards. These standards are used to fittings in conjunction with the dimensional standards. The ASTM standards for wrought fittings, A 403 and A 774

## Applications and General Coverage

Summary of applications and features identified in ASTM fittings standards

Application or Feature	A 403	A 774
Low temperature use	✓	✓
Moderate temperature use	✓	✓
High temperature use	✓	
Fittings (general)	✓	✓
Butt welding fittings	✓	✓
Socket welding and threaded fittings	✓	✓
Light weight butt-welding fittings	✓	
Swaged nipples and bull plugs	✓	
Non standard fittings	✓	

A tick in the table indicates that the standard *specifically* identifies (but is not necessarily restricted to ) the application or feature listed. Other features are covered in further summary on the following pages ASTM Standards for cast fittings are not covered in this manual.

## Dimensions and Tolerances

**Dimensions and Tolerances.** The ASTM standards for fittings do not specify dimensions and tolerances since they are defined in applicable ASME/ANSI, MSS and API specifications. None standard pipe fittings are allowable in the ASTM standards, provided they conform to defined requirements.

## Manufacture

Summary of manufacturing processes covered by ASTM fittings standards

	A403	A774
Starting materials (made from)	F, B r, P, ST, WT	FRS
Forming: Forging & shaping	H, Pr, Pi, Ex, U, R, B, FW, M	Either
Hot/Cold Formed	✓	✓
Welded		
Filler metal <sup>1</sup> used	✓ <sup>3</sup>	With or without
Classes of fittings <sup>2</sup>	WP-S, -W, -WX, -WU; CR	
Final Heat Treatment	As Spec'd	

Notes

1. Filler metal specifications are not covered.
2. See individual specifications for a description of the classes of fittings.

### Starting materials:

F = Forgings  
 Br = Bars  
 P = Plates  
 ST = Seamless Tube  
 WT = Welded Tube  
 FRS = Flat Rolled Steel

### Forming alternatives:

H = Hammering  
 Pr = Pressing  
 Pi = Piercing  
 Ex = Extruding  
 M = Machining  
 U = Upsetting  
 R = Rolling  
 B = Bending  
 FW = Fusion Welding

# ASTM FITTING SPECIFICATIONS

## Summary of materials covered by ASTM fitting standards

	A 403	A 774
Austenitic	✓	✓

**Materials.** Materials used for the manufacture of stainless steel fittings are specified in the individual ASTM Standards. These are summarised in the table above (refer to page 1-10 for a detailed breakdown of grades applicable to each ASTM standard).

**Manufacturing processes.** A summary of ASTM fitting manufacturing process is provided in the table above.

**Heat Treatments.** Heat treatments are specified in each ASTM fitting standard. There are no general requirements; treatment is dependent on the individual stainless steel grade, on the method of forming used and on the final use of the fitting. Retreatment to obtain properties required by the standard (up to two times without purchaser agreement) is permissible.

**Test Reports.** Typically, the application of the product marking is certification that a fitting conforms to specification. The purchaser may

### Finish and Repair

**Finish.** A workmanlike finish is required for all fittings.

**Defects.** Defects may be removed, as permitted in individual ASTM fitting standards, by the following methods:

- **Grinding, machining, or chipping** provided that the wall thickness is not reduced below the specified minimum (87.5% of nominal, or as specified).

additionally request a certified test report containing the following items as applicable:  
 Manufacturer and date. Specification and year date. Heat number and chemical analysis  
 Product analysis results.  
 Specified test results (e.g. tensile, hardness, and grain size tests).  
 Examination results (e.g. visual inspection, radiographic, ultrasonic).  
 Starting material and type of manufacture (e.g. plate, bar, pipe, seamless or welded).  
 Heat treatment.

Purchaser requirements (optional and supplementary requirements).

**Product Marking.** Each fitting is marked in paint, ink, vibrating pencil or stamped if thickness permits. Bar coding is acceptable. Minimum marking requirements are for manufacturer's name or brand, specification number (not year), and grade.

- **Welding**, as agreed by the purchaser.

Discontinuities must be completely removed before welding. Discontinuities >33.3% of nominal wall thickness, or >25% of nominal diameter (or >10% of surface area) of the fitting, are not permitted.

**Scale and contaminating particles.** These are removed, but methods are not usually specified.

**Passivation.** Performed when specified.

## Summary of finish and repair requirements covered by ASTM fitting standards

	A 403	A 774
Defect removal	W(spa for special fittings), M, G	W(spa), M, G, C, Other
Scale removal	Cleaned free of scale	NS
Passivation	Yes	NS

Notes

NS=Not Specified,  
 spa/spr=subject to purchaser approval/request.

G=Grinding  
 M=Machining

W=Welding  
 C=Chipping

# ASTM FITTING SPECIFICATIONS

## Mandatory Testing

Summary of mandatory tests as specified by ASTM fitting standards

	A 403	A 774
Heat Analysis <sup>1</sup>	✓	✓
Tension Test <sup>2</sup>	✓	✓
Hardness		
Grain Size (austenitic steels only)		
Surface Quality Inspection	✓	✓

### Notes

1. To be performed on the starting material used to make the fitting, in accordance with ASTM A 751.
2. To be performed on material used to make the fitting, in accordance with test methods and definitions in ASTM A 370.

**Introduction.** Each ASTM fitting standard specifies the mandatory and optional/ supplementary test requirements. The table above shows the mandatory tests. Other tests may be specified by the purchaser.

**Heat Analysis.** Heat analysis is the chemical analysis of the cast or heat used to produce the starting material from which a flange or fitting is made. It is usually performed by the steel manufacturer and results accompany the steel and products made from it.

**Test Specimens.** A test specimen, suitable for the test to be performed, is taken from a representative fitting, or a representative test piece may be prepared from the same base and weld materials, having approximately the same amount of working and cross sectional dimensions as the finished fitting it represents. Such specimens or test pieces are required for destructive testing.

### Optional and Supplementary Requirements

Each ASTM standard identifies optional and supplementary requirements. These usually provide for additional testing and are identified on test certificates.

**Product Analysis.** Product analysis of a test specimen shows the chemical composition of the finished flange or fitting. This may vary from that obtained from the heat analysis made by the steel manufacturer. ASTM flanges and fittings standards chemical composition tables show the amount each element as a range or as a maximum value. ASTM flanges and fittings standards also define tolerances within which the product analysis results may be considered as in conformance with the standard. Methods of chemical analysis are listed in ASTM A 751.

**Mechanical Testing Methods.** Mechanical testing methods of testing are defined in ASTM A 370 and A 450.

**Nondestructive Tests and Examinations.** These include radiographic and ultrasonic examinations.

**Retesting and Retreatment.** Retreatment is permitted if results of mechanical tests do not conform to requirements. Retreated fittings must have mechanical tests repeated also

The following table summarises the supplementary requirements listed in the ASTM fittings standards.

# ASTM FITTING SPECIFICATIONS

Summary of supplementary requirements as specified by ASTM fitting standards

		A 403	A 774
Product analysis	S2	S1	S1
Tension test	S3	S2	S2
Hardness test	S12		
Intergranular corrosion bend test		S3	
Hydrostatic test	S6		
Ultrasonic examination (test)		S4	S3
Nondestructive electromagnetic (eddy current) test			S5
Microetch test	S1		
Photomicrographs		S5	
Liquid penetrant examination (test)	S5	S7	S4
Magnetic particle examination	S4		
Corrosion tests	S10		
Grain size (for austenitic grades)	S15		
Special fittings		S9	
Material for optimum resistance to stress corrosion	S9		
Special filler metal	S11	S8	
Repair welding	S7		
Stabilising heat treatment		S10	
Special heat treatment (for austenitic forgings)	S14		
Heat treatment details (test report)	S8		
Surface finish		S6	

FITTINGS THROUGH 100" PIPE SIZE ARE AVAILABLE

## Sumitec Int'l, Inc

Phone (877)-837-9618 Fax (866) 311-5335 email:sumitecsales@comcast.net

We also Supply Carbon and Stainless Steel Flanges and Pipes

# ASTM A 403/A 403M - 96

## Wrought Austenitic Stainless Steel Pipe Fittings

This specification covers two general classes, known as WP (Wrought Pipe) and CR (Corrosion Resistant) stainless steel fittings of both seamless and welded construction.

### Dimensions and Tolerances

**Dimensions and Tolerances.** ASME/ANSI B16.9, B16.11 and B16.28, and MSS SP-43, SP-79 and SP-95 are referenced. Supplementary requirement S9 applies for non-standard fittings.

**Wall Thicknesses** are as defined in appropriate pipe specifications. Minimum thickness must not be encroached.

### Manufacture

**Materials.** Refer to chemical composition table. Fittings may be made from forgings, bars, plates, or seamless or welded tubular products, provided the materials conform to the chemical composition table.

**The steel** may be melted by electric-furnace, or vacuum-furnace, or by either of these followed by vacuum or electroslag-consumable remelting.

**Forming.** Fittings may be formed by hammering, pressing, piercing, extruding, upsetting, rolling, bending, fusion welding, machining or any combination of these processes.

**Heat Treatment.** All fittings are heat treated in accordance with the heat treatment table. All welding must be done prior to heat treatment.

**Class WP-S Fittings.** Fittings marked WP-S are of seamless construction and meet all the requirements of ANSI B16.9, B16.11, B16.28 or MSS SP-79.

**Class WP-W Fittings.** Fittings marked WP-W contain welds with or without filler metal. All welds made with filler metal are radiographically examined throughout the entire length. The fittings conform with ANSI B16.9 or B16.28.

**Class WP-WX Fittings.** Fittings marked WP-WX are of welded construction and have *all* welds radiographically examined throughout their entire length. The fittings conform to the requirements of ANSI B16.9 or B16.28.

**Class WP-WU Fittings.** Fittings marked WP-WU are of welded construction and have *all* welds are ultrasonically examined throughout their entire length. The fittings conform to the requirements of AMSI B16.9 or B16.28.

**Class CR fittings.** These fittings are manufactured to the requirements of MSS SP-43. They need not be radiographically or ultrasonically examined.

**Small Fittings** machined from bar shall be restricted to NPS 4 or smaller. No elbows, return bends or tees shall be machined from bar. Supplementary requirement S7 applies to caps machined from bar.

**Stub ends.** Weld build up is permitted to dimensionally correct unfilled areas produced during cold forming of stub ends. Weld repair is also permitted. Radiographic examination is not necessary if prescribed procedures are followed. Stub ends may also be produced with the entire lap added as weld metal to a straight pipe section.

**Weld Materials:** Any deposited weld metal should conform in its alloy content to that of the fitting base metal, or as given in the AWS filler metal specification A5.4 or A5.9. Exceptions are when welding on 304, 304L or 321 base metal, in which cases the weld metal should correspond to AWS Types E308 (ER308L), or E347 (ER347 or ER321) respectively. Also, when welding on S31725, S31726, S31254, or S33228 the weld metal should correspond to the base metal or to UNS W86112/N06625.

**Marking.** MSS SP-25 applies. For butt-welded fittings marking includes: manufacturer's name or trademark, schedule number or nominal wall thickness, size, class, grade, heat number or heat identification, supplementary requirement 'S' suffix unless threaded or socket-welded.

For cold-format stub ends with weld build up: add 'WBU' to grade.

For threaded or socket welding fittings: pressure rating may be used in place of schedule number. Bar coding may be used as a supplementary identification.

### Ordering Information

Item	Notes
Specification number	ASTM A 403/A 403M - 96
Quantity	Number of fittings of each kind
Description of fittings	Standard or special
Grade of steel	Selected from chemical composition table
Class	WP or CR, WP fittings may also be WP-S, WP-W, WP-WX or WP-WU. If not specified, furnished at the option of the supplier.
Additional Requirements	Refer to optional and supplementary requirements S1 to S10

# ASTM A 403/A 403M - 96

## Wrought Austenitic Stainless Steel Pipe Fittings

### Finish and Repair

**Surface discontinuities** deeper than 5% of nominal wall thickness to be removed.

**Defect removal by grinding or machining.** The following are removed:

- Surface discontinuity as above.
- Surface checks (fish scale) deeper than 1/64 in (0.4 mm).
- Mechanical marks deeper than 1/16 in (1.6 mm).
- When removal reduces wall thickness below 87 1/2% of nominal, the fitting is rejected or repaired.

### Mandatory Testing

**Heat Analysis.** Composition of each cast or heat is required to conform to the chemical composition table. Weld material conforms to the same requirements, except as identified in Manufacture above.

**Tensile Tests.** Tension test made on starting material is acceptable provided the heat treatments are the same. If they differ, one test is made on material representative of the fitting from each heat and in the same heat treated condition as the fittings.

**Visual Inspection.** All fittings are to be examined for surface imperfections.

### Optional and Supplementary Requirements.

- S1 **Product Test.** Analysis made for each heat of base metal and from each lot number of material if appropriate.
- S1 **Tension Test.** One test on one fitting or representative test piece per lot. A weld should be at the centre of any test piece, if the fitting is of welded construction.

### **Defect repair by welding**

- Permitted for fitting made to specifications.
- Purchaser agreement is necessary for weld repair of special fitting.
- Repair is limited to 10% of outside surface and 33 1/3% of nominal wall thickness.
- All weld repairs are examined using liquid penetration test.
- There should be no cracks in prepared cavities, or in finished weld, or in the surrounding

**Hydrostatic Test.** Not required. However:

**Class WP fittings** shall be capable of withstanding pressures prescribed for the specified matching pipe or equivalent material.

**Class CR fittings** shall be capable of withstanding pressures based on ratings in MSS SP-43, except for CR tees fabricated using intersection welds which shall withstand pressures based on 70% of the ratings in MSS SP-43.

**Nondestructive Testing.** Radiographically or ultrasonically examined in accordance with the Class of fitting.

- S1 **Intergranular Corrosion Bend Test.** One test on one fitting or representative test piece per lot. A weld should be at the centre of and at position of maximum bend, if the fitting is of welded construction.

# ASTM A 403/A 403M - 96

## Wrought Austenitic Stainless Steel Pipe Fittings

Grade	Carbon C	Manganese Mn	Phosphorus P	Silicon Si	Nickel Ni	Chromium Cr	Molybdenum Mo
304	0.08	2.00	0.045	1.00	8.0-11.0	18.0-20.0	-
304H	0.04-0.10	2.00	0.045	1.00	8.0-11.0	18.0-20.0	-
304L	0.035	2.00	0.045	1.00	8.0-13.0	18.0-20.0	-
304LN	0.03	2.00	0.045	0.75	8.0-10.5	18.0-20.0	-
304N	0.08	2.00	0.045	0.75	8.0-11.0	18.0-20.0	-
309	0.15	2.00	0.045	1.00	12.0-15.0	22.0-24.0	-
310	0.15	2.00	0.045	1.50	19.0-22.0	24.0-26.0	-
316	0.08	2.00	0.045	1.00	10.0-14.0	16.0-18.0	2.00-3.00
316H	0.04-0.10	2.00	0.045	1.00	10.0-14.0	16.0-18.0	2.00-3.00
316LN	0.03	2.00	0.045	0.75	11.0-14.0	16.0-18.0	2.00-3.00
316L	0.035	2.00	0.045	1.00	10.0-16.0	16.0-18.0	2.00-3.00
316N	0.08	2.00	0.045	0.75	11.0-14.0	16.0-18.0	2.00-3.00
317	0.08	2.00	0.045	1.00	11.0-15.0	18.0-20.0	3.0-4.0
317L	0.03	2.00	0.045	1.00	11.0-15.0	18.0-20.0	3.0-4.0
321	0.08	2.00	0.045	1.00	9.0-13.0	17.0-20.0	-
321H	0.04-0.10	2.00	0.045	1.00	9.0-13.0	17.0-20.0	-
347	0.08	2.00	0.045	1.00	9.0-13.0	17.0-20.0	-
347H	0.04-0.10	2.00	0.045	1.00	9.0-13.0	17.0-20.0	-
348	0.08	2.00	0.045	1.00	9.0-13.0	17.0-20.0	-
348H	0.04-0.10	2.00	0.045	1.00	9.0-13.0	17.0-20.0	-
XM-19	0.06	4.0-6.0	0.04	1.00	11.5-13.5	20.5-23.5	1.5-3.00
	0.02	1.00	0.03	0.80	17.5-18.5	19.5-20.5	6.0-6.5
	0.03	2.00	0.045	0.75	13.5-17.5	18.0-20.0	4.0-5.0
	0.03	2.00	0.045	0.75	13.5-17.5	17.0-20.0	4.0-5.0
	0.03	5.0-7.0	0.03	1.00	16.0-18.0	23.0-25.0	4.0-5.0
	0.04-0.08	1.00	0.02	0.30	31.0-33.0	26.0-28.0	-

### Composition Notes

1. Nitrogen 0.10-0.16%
2. Carbon 0.040% max is necessary where many drawing passes are required, as with outside diameter <0.5 in (12.7 mm), or nominal wall thickness <0.049 (1.2 mm).
3. On pierced tube, Nickel may be 11.0-16.00%
4. Titanium >5 x Carbon, 0.70% max
5. Titanium >4 x Carbon, 0.70% max
6. Niobium + Tantalum: >10 x Carbon, 1.10% max
7. Niobium + Tantalum: >8 x Carbon, 1.00% max
8. Tantalum 0.10%
9. Niobium + Tantalum 0.10-0.30%, Vanadium 0.10-0.30%
10. Nitrogen 0.20-0.40%
11. Nitrogen 0.18-0.22%, Copper 0.50-1.00%
12. Nitrogen 0.10% max, Copper 0.75%
13. Nitrogen 0.10-0.20%, Copper 0.75%
14. Nitrogen 0.4-0.6%, Niobium 0.1%
15. Cerium 0.05-0.10%, Aluminum 0.025%, Niobium 0.6-1.0%

# ASTM A 774/A 774M - 95a

## As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures

This specification covers five grades of as-welded wrought austenitic stainless steel fittings for low-pressure piping and intended for low and moderate temperatures and general corrosive service.

Refer to ASTM A 403/A 403M for products requiring heat treatment or full pressure rating.

### **Manufacture**

Exceptions are when welding on 304L or 321 base metal, in which cases the weld metal should correspond to AWS Types E308 (E308L), or E347 (E347 or ER321) respectively.

**Heat Treatment:** Not required.

**Manufacture:** Fittings will be made from flat-rolled steel which has been solution annealed. The fittings may be hot or cold formed and then welded by a shielded welding process, with or without the addition of filler metal.

**Welding:** All joints will be full penetration double welded or single welded butt joints using a fusion-welding process, with or without the addition of filler metal.

**Marking:** Manufacturers name or brand, schedule number or pressure class or thickness, size, specification number, grade, heat number or heat identification. Also "HT-0" to indicate not heat treated. Bar coding may be used. If used on small fittings the bar code may be applied to the box or to substantial tag.

**Materials:** Refer to chemical composition table.

### **Finish and Repair**

**Finish:** Fittings are to be furnished clean and free of scale.

**Surface discontinuities:** deeper than 5% of nominal wall thickness to be removed.

**Defect removal by grinding or machining:** The following are removed:

- Surface discontinuity as above.
- Surface checks (fish scale) deeper than 1/64 in (0.4 mm)
- Mechanical marks deeper than 1/16 in (1.6mm) wall thickness tolerance
- When removal reduces wall thickness below 87 1/2% of nominal, the fitting is rejected or repaired.

**Defect repair by welding**

- Permitted for fittings made to specifications.
- Purchaser agreement is necessary for weld repair of special fittings.
- Defects must be entirely removed by chipping, machining or grinding before welding.

Weld materials must comply with manufacturing requirements

### **Ordering Information**

Item	Notes
Specification number	ASTM A 774/A 774M - 95a
Quantity	Number of fittings of each kind
Description of fitting	Standard or special
Dimension	Outside diameter and specified wall thickness
Grade of steel	Selected from chemical composition table
End Use	If known
Additional Requirements	Refer to optional and supplementary requirements S1 to S5.

# ASTM A 774/A 774M - 95a

## As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures

### Mandatory Testing

**Heat Analysis:** Mill certificates of analysis of each heat provided on request. Composition shall comply with the chemical composition table. No unspecified elements shall be present.

**Visual Inspection:** All fittings are to be examined for surface imperfections.

**Hydrostatic Tests:** Not required by the specification.

**Tensile and Hardness Tests:** Manufacturers tests on the sheet or plate qualify material before manufacture. Fittings need not be mechanically tested after manufacture unless requested by purchaser (see S2, S3)

### Optional and Supplementary Requirements

**Product Analysis:** This will be made for each heat of base metal and for each heat of welding material if appropriate.

**Liquid Penetrant Test:** All surfaces shall be liquid penetrant examined in accordance with Practice E 165.

**Tension Test:** One test on one fitting per lot. A weld should be at the centre of any test piece, if of welded construction.

**Nondestructive Electromagnetic Test (Eddy Current Test):** Tested against a calibration tube with a drilled hole, transverse tangential notch or longitudinal notch discontinuity in the surface, to establish minimum sensitivity level for rejection.

**Ultrasonic Examination:** The base material from which each fitting is made is tested for soundness.

### Tensile and Hardness Requirements

Grade	UNS	Tensile Strength Min		Yield Strength Min	Elongation in 2 in (50 mm) Min	Brinell Hardness HB max	Rockwell Hardness HRB max
		ksi	MPa				
304L	S30403	70-95	485-655	170	40	183	88
316L	S31603	70-95	485-655	170	40	217	95
317L	S31703	75-100	515-690	205	35	217	95
321	S32100	75-100	515-690	205	40	217	95
347	S34700	75-100	515-690	205	40	202	92

### Heat Treatment

Heat treatment is not required for fittings provided under this specification.

# ASTM A 774/A 774M - 95a

As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures

## Chemical Composition

Grade	Carbon	Manganese	Phosphorus	Silicon	Nickel	Chromium	Molybdenum
	C	Mn	P	Si	Ni	Cr	Mo
TP304L	0.03	2	0.045	1	8.0-13.0	18.0-20.0	-
TP316L	0.03	2	0.045	1	10.0-15.0	16.0-18.0	2.00-3.00
TP317L	0.03	2	0.045	1	11.0-15.0	18.0-20.0	3.00-4.00
TP321	0.08	2	0.045	1	9.0-12.0	17.0-19.0	-
TP347	0.08	2	0.045	1	9.0-13.0	17.0-19.0	-
Tolerance	0.005	0.04	0.01	0.05	0.1	0.2	0.1

Tolerances = Product analysis tolerances (% over the max or under the min limit). These are not applicable to heat analysis.

## Composition Notes

1. Nitrogen max 0.10%
2. Titanium >5 x Carbon, 0.7% max
3. Niobium + Tantalum > 10 x Carbon, 1.10% max
4. Product analysis tolerance for Nitrogen = 0.005

Note

Niobium is sometimes referred to as Columbium

**FITTINGS THROUGH 100" PIPE SIZE ARE AVAILABLE**

## Sumitec Int'l, Inc

Phone (877)-837-9618 Fax (866) 311-5335 email:sumitecsales@comcast.net

**We also Supply Carbon and Stainless Steel Flanges and Pipes**