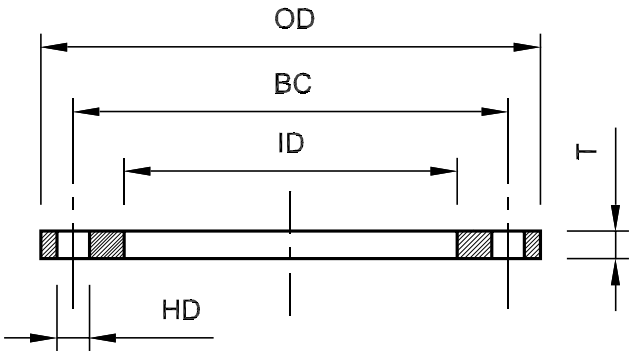
DUCTILE IRON BACK-UP FLANGES

DUCTILE IRON

- Dimensions are given in inches.
- Prime Painted or Hot Dipped Galvanized.
- OD and drilling are 150# class.
- AFR and FFR flanges have a bevel on one side of ID.
- Sizes larger than 48" are available upon request as carbon steel A36.



NOMINAL PIPE SIZE	ID		OD	T	DRILLING PATTERN - 150#			BOLT SIZE	LBS
	AFR	FFR			BC	HD	NUMBER OF BOLT HOLES		
1/2	1.250	1.000	3 1/2	1/2	2 3/8	5/8	4	1/2	1.00
3/4	1.440	1.180	3 7/8	1/2	2 3/4	5/8	4	1/2	1.40
1	1.750	1.440	4 1/4	1/2	3 1/8	5/8	4	1/2	1.70
1 1/4	2.060	1.810	4 5/8	1/2	3 1/2	5/8	4	1/2	1.80
1 1/2	2.375	2.060	5	1/2	3 7/8	5/8	4	1/2	2.00
2	2.880	2.630	6	1/2	4 3/4	3/4	4	5/8	3.00
2 1/2	3.380	3.130	7	1/2	5 1/2	3/4	4	5/8	3.90
3	4.000	3.750	7 1/2	1/2	6	3/4	4	5/8	4.00
4	5.125	4.750	9	1/2	7 1/2	3/4	8	5/8	6.50
5	6.100	5.750	10	1/2	8 1/2	7/8	8	3/4	7.00
6	7.250	6.880	11	5/8	9 1/2	7/8	8	3/4	8.00
8	9.375	8.880	13 1/2	5/8	11 3/4	7/8	8	3/4	11.50
10	11.440	11.000	16	5/8	14 1/4	1	12	7/8	15.00
12	13.630	13.000	19	3/4	17	1	12	7/8	26.00
14	14.880	14.250	21	3/4	18 3/4	1 1/8	12	1	34.00
16	16.910	16.250	23 1/2	3/4	21 1/4	1 1/8	16	1	37.00
18	18.910	18.250	25	3/4	22 3/4	1 1/4	16	1 1/8	42.00
20	20.910	20.250	27 1/2	7/8	25	1 1/4	20	1 1/8	51.00
24	24.910	24.250	32	1	29 1/2	1 3/8	20	1 1/4	76.00
30	30.910	30.375	38 3/4	1	36	1 3/8	28	1 1/4	104.00
36	36.910	36.500	46	1 1/8	42 3/4	1 5/8	32	1 1/2	150.00
42	42.910	42.280	53	1 1/8	49 1/2	1 5/8	36	1 1/2	208.00
48	48.910	48.280	59 1/2	1 1/8	56	1 5/8	44	1 1/2	246.00

SPECIFICATIONS

Material
All Stainless Steel Sheet and Plate shall be extra low carbon (.03% max) and meet ASTM/ASME standards.

Test Reports
Chemical and physical reports on material will be furnished upon request at time of order shipment.

Finish
Standard finish for material greater than .100 thick is No. 1 Hot-Rolled Annealed and Pickled. After all shop operations have been completed, all stainless steel material shall be pickled and passivated (completely immersed for a minimum of 15 minutes in 10% nitric acid and 3% hydrofluoric acid at 125˚F, followed by a neutralizing rinse).

Wall Thickness
Thickness may vary by the allowable limits of ASTM/ASME standards. Weight calculations based on Felker average thickness.

Welding
All welding is done using the GTAW, GMAW and plasma arc welding processes. Felker uses ASME qualified welders and ASME procedures designed to provide full penetration welds. Automatic or semi-automatic positioning fixtures are used on pipe, tube and fittings. Interior surfaces are smooth, even and uniform.

ASTM Pipe and Tube
All Felker pipe and tube conform to ASTM A-778, A-312, A-358, A-269 or A-249 specifications unless otherwise specified. Various lengths can be ordered upon request to meet your needs.

ASTM Fittings
All Felker pipe and tube fittings conform to ASTM A-403 or A-774 specifications unless otherwise specified. Felker fittings conform to ANSI B16.9/MSS SP 43 requirements.

Polishing
Suitability for polishing - unless specifically stated on our quotation, we do not warrant that our products are suitable for polishing and will not accept back charges or returns for this reason.

Marking
All pipe, tube and fittings are marked in accordance with the requirements of the pertinent ASTM/ASME standard.

Certifications
Felker Brothers' quality system is registered to the ISO 9001 standard. Our IAS accredited third party auditor is Hartford Steam Boiler Registration Services. Our quality program utilizes the following inspection and test methods: liquid penetrant, eddy current, x-ray and hydrostatic.

Felker Brothers Corporation is a European Union, PED 2014/68/EU Annex 1 Par. 4.3/EN 10204 3.1 certified.

All Felker pipe, tube and fittings are product certified to NSF/ANSI Standard 61, Drinking Water System Components-Health Effects and NSF/ANSI Standard 372-Drinking Water System Components-Lead Content

Shipping
Material is shipped uncrated unless specified. When requested, all plain ends shall be plugged, flanged ends shall be wired to protect lap ring surface.

Routing
Please state your choice of routing or delivery carrier when ordering.

TAPPI Specification
All Felker products are produced as outlined in this catalog and conform, unless otherwise noted, to the recommended specifications for stainless steel piping, fittings and accessories of the Technical Association of the Pulp and Paper Industry.

MSS Specification
Felker manufactures to MSS dimensions where noted in this catalog.

END CONFIGURATIONS

Our standard A778/A774product is provided with square cut plain ends. With your special request, we will provide the following End Configurations:

- Flanged Ends: All sizes can be furnished flanged with either flat or angle face rings and back-up flanges (ductile iron, carbon or stainless steel). A full range of metal to metal connectors, through 36" and larger, is also available for use with either metal to metal clamps or back-up flanges. Sizes of 3" and 4" long radius 45˚ elbows require long tangent to be flanged.
- Belled Ends: All sizes 2” through 36” (maximum .188 wall thickness) can be belled.
- Roll Grooved End: Our standard roll grooving capabilities are described in the chart on the right and are suitable for use with victaulic couplings and others. Victaulic Advanced Groove System (AGS) available upon request.
- Beveled Ends.

ROLL GROOVE CAPABILITIES	
NOMINAL PIPE/TUBE SIZE	**WALL THICKNESS**
3/4" - 24"	through Sch10S
2" - 24"	through Sch40S

NOTE: All elbows and cone reducers must have 2” long tangents to accommodate roll grooving.

COMPARISON OF SPECIFICATIONS

	A-778/774	A-312/403	A-249/269
PRODUCT AFFECTED	Pipe/Tube/Fittings	Pipe/Fittings	Tube Only
SIZE RANGE	3"-48"	1/8"-24" (A-312) 1/2"-24" (A-403)	1/4" and Larger
DIMENSIONAL TOLERANCE	A-778 and A-312 both refer to A-999 for their requirements. A-774 and A-403 CR both refer to MSS SP-43 for their requirements. A-403 WP-W refers to ASME/ANSI B16.9 for their requirements.		A-249/269 both refer to A-1016 for their requirements.
APPLICATION	Low and Moderate[2,4]	General Corrosive Service[1] (includes high heat applications)	High Temp Service (A-249) General (A-269)
TEMPERATURE RANGE	Low and Moderate	High[3,4]	High[4] Temp Service (A-249) General (A-269)
FORMING METHODS	Hot or Cold	Hot or Cold	Hot or Cold
WELDING-FILLER METHOD	Allowed	Not Allowed (A-312) Allowed (A-403)	Not Allowed (A-249) Allowed (A-269)
HEAT TREATMENT (ANNEALING)	Not Required	Annealed Min. 1900˚F & Rapidly Cooled	Annealed Min. 1900˚ & Rapidly Cooled
PHYSICAL TESTING	Weld zone physical testing (destructive) required		
	Transverse Tensile (70,000 psi min.) Face Bend (no cracks) Root Bend (no cracks)	Transverse Tensile (70,000 psi min.) Face Bend or Flattening (no cracks)	Transverse Tensile (70,000 psi min.) Flattening Test Flange Test Reverse Bend Test Hardness Test
	Weld zone physical testing (nondestructive) Although not required by ASTM/ASME A-778 and A-312 pipe standards, Felker eddy current tests every inch of weld in conformance with nondestructive testing standard ASTM E426 and E309 requirements.		
HYDROSTATIC TESTING	Not required but may be requested as supplementary requirement	Hydro Test or Eddy Current Test (A-312) Not Required (A-403)	Hydro Test or Eddy Current Test
CLEANING REQUIREMENTS	Clean and Free of Scale (Felker standards include pickling)	Pickling per ASTM A-380 (Felker standards include pickling) Free of scale and contaminating iron particles. Pickling, blasting, or surface finishing is not mandatory when pipe is bright annealed. The purchaser is permitted to require that a passivating treatment be applied to the finished product.	Pickled free of scale. When bright anneal is used, pickling is not necessary.

1 – A-403 fittings service application requirements fall under ANSI B 16.9 & MSS SP-43.
2 – 400˚F maximum when the service environment is known to be capable of causing intergranular corrosion.
3 – Above 400˚F.
4 – For applications where temperatures range over 800˚F, grades of stainless other than 304L and 316L may need to be considered.

WHY ASTM A-778?

The old and familiar ASTM A-312 pipe spec was originally published in 1948 before the advent and popular acceptance of the ELC stabilized grades of the austenitic 300 series of stainless steel, (see previous page on ELC). At that time, high temperature heat treating (annealing) after welding operations on Type 304 and Type 316 grades was the only practical available procedure that would eliminate the potential of intergranular corrosion failure in the heat-affected zones adjacent to the welds.

However, the intergranular corrosion protection provided by annealing is:

- Lost in the heat affected zones when field welding or thermal cutting is required without annealing (i.e., installation, field modification and repair).
- An additional manufacturing cost incurred in fabrication.

With the development of extra low carbon stainless alloys, a cost effective means of stabilizing against the harmful effects of heating above the sensitizing range was established in the industry. As a result:

- Costly post-weld heat (annealing) was no longer required for all but high temperature applications.
- Installation, field modification and repair no longer required expensive post-heat field annealing to preserve corrosion protection.

ASTM A-778 and A-774 were developed in 1980 long after the use of ELC as a stabilizer had been well established. The spec included only grades of stainless steel which were stabilized, this later spec does not call for annealing after welding.

As the comparison chart on the next page shows, A-778 and A-774 have some clear user advantages:

1. They include a greater range of diameters.
2. They include tube as well as pipe size.
3. They require the same dimensional tolerances as A-312, although Felker standard tolerances are tighter.
4. They allow the use of filler metal additions thereby permitting ferrite control in welds.
5. They include only the stabilized (ELC) grades of the 300 series of austenitic stainless steel which are the appropriate grades to be used for materials fabricated by welding when post-weld annealing is not practical.

Therefore it is difficult, if not impossible to justify the additional cost of finished product annealing (A-312) when further welding operations will be performed to:

- Accomplish installation at jobsite.
- Field modify or repair.
- Factory-fabricate either custom systems or desired end configurations.

Standard industry practice does not include post-weld annealing after fabrication. The result of this is product being placed in service with an unannealed weld.

A-774 VS. A-403

ASTM A-774

- Specification covers:
  - Five grades of stainless
  - 3” - 48”
  - Wall thickness from .062 - .500
- Does not require annealing
- Specification is for low pressure piping and is intended for low and moderate temperatures and general corrosive service

ASTM A-403

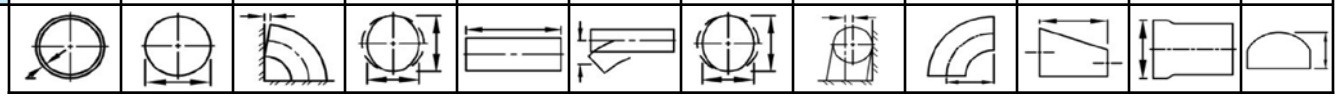
- Specification covers:
  - Wrought stainless steel fittings and pressure applications
  - Many types of stainless steel
- Two major grades: A-403 CR and A-403 WP

GRADE CR ● MSS-SP43 ● 24” Diameter & Smaller	Product does not require non-destructive examination of welds produced with the addition of filler metal. ● Pressure rating - Sch10S = 275 PSI @ 100°F ● Taper boring to match pipe ● No crosses
GRADE WP **CLASS W** ● B16.9 ● 48” Diameter & Smaller	Product produced with the addition of filler metal to be examined with either the radiographic or ultrasonic methods. If made from pipe that has not had filler metal added, additional examination not required. ● Pressure rating - 105% of pipe bursting pressure ● Taper boring defined in specification ● No fabricated fittings (i.e., branch welded tees) ● Cross accepted - buldge formed
GRADE WP **CLASS S** ● B16.9 ● 48” Diameter & Smaller	Seamless
GRADE WP **CLASS WU** ● B16.9 ● 48” Diameter & Smaller	Requires all welds to be ultrasonic examination.
GRADE WP **CLASS WX** ● B16.9 ● 48” Diameter & Smaller	Requires all welds to be radiographic examined.

STANDARD TOLERANCES

FOR PIPE, TUBE AND FITTINGS

NOMINAL PIPE, TUBE AND FITTING SIZE (IN.)	ALL PIPE, TUBE AND FITTINGS			ALL PIPE AND TUBE			ALL FITTINGS		90° ELLS 45° ELLS LATERALS TEE'S, Y'S	REDUCERS STUB ENDS CONNECTORS	BELLED ENDS	WELD CAPS
	WALL THICKNESS (2) (3)	OUTSIDE DIAMETER (IN.) (1)	OFF ANGLE (SQUARENESS) (IN.) (5)	OVALITY (IN.) (1) (6)	SPECIFIED LENGTHS (IN.) (2) (4)	STRAIGHTNESS (IN./FT.) (2)	OVALITY AT WELD END (IN.) (1) (6)	OFF PLANE (IN.) (5)	CENTER TO END DIMENSION (IN.) (3)	OVERALL LENGTH (IN.) (3)	ID OF BELL TO BE NOM. OD +0.03 (IN.)	OVERALL LENGTH (IN.) (3)
1/2-1"	NOT LESS THAN 87½% OF NOMINAL THICK-NESS	+0.016 -0.031	0.031	0.047	+0.250 -0.000	0.025	0.047	0.063	+/-0.063	+/-0.063	+0.031 -0.000	+/-0.125
1 1/2"												
2"		+/-0.031		0.063			0.063					
3"												
4"												
5"		+0.063 -0.031	0.063	0.094			0.094	0.125			+0.063 -0.000	+/-0.250
6"												
8"				0.094(t≥1/4) 0.120(t<1/4)			0.094(t≥1/4) 0.120(t<1/4)					
10"		+0.094 -0.031	0.094	0.125(t≥5/16) 0.150(t<5/16)			0.125(t≥5/16) 0.150(t<5/16)	0.188	+/-0.094	+/-0.094	+0.094 -0.000	
12"				0.125(t≥3/8) 0.180(t<3/8)			0.125(t≥3/8) 0.180(t<3/8)					
14"				1.5% OF NOMINAL DIAMETER			1.5% OF NOMINAL DIAMETER	0.250				
16"												
18"			0.125					0.375				
20"		+0.125 -0.031									+0.125 -0.000	
24"												
30"		+0.156 -0.031	0.188						+/-0.125	+/-0.125	+0.156 -0.000	+/-0.375
36"		+0.188 -0.031						0.5000	+/-0.188	+/-0.188	+0.188 -0.000	
>36" - 96"		+0.220 -0.031	0.5% OF NOMINAL DIAMETER			0.038		1.4% OF NOMINAL DIAMETER	+/-0.5% OF NOMINAL DIAMETER	+/-0.5% OF NOMINAL DIAMETER	NA	NA



(1) Tolerances per ASTM A-999 (as referred by A-778 & A-312 specifications).
(2) Tolerances per ASTM A-778 & A-312 specifications.
(3) Tolerances per MSS SP-43 (as referenced by A-774 & A-403). NOTE: MSS only covers fitting sizes through 24".
(4) The tolerances for random 21 foot lengths on continuous mill products are +1"/-0.250". The tolerances for random 20 foot lengths on non-continuous mill products are +1"/-0.500".
(5) Tolerances per ANSI B16.9.
(6) Felker Brothers uses the same ovality tolerances as given for pipe & tube fittings 8" and larger.

NOTE: These are industry standard tolerances, in most cases Felker Brothers can meet more exacting tolerances that may be required by either the customer or the governing specification.

SPECIFICATIONS