

CORROSION RESISTANT SUPER ALLOYS™ AL-6XN® & HASTELLOY® C-22®



CSI

TUBING AND FITTINGS PRODUCT CATALOG

ABOUT CSI



Central States Industrial Equipment (CSI) is a leader in detail design and execution for hygienic process systems in the food, dairy, beverage, pharmaceutical, biotechnology, home and personal care industries. CSI also distributes a comprehensive range of sanitary processing equipment, including fittings, pumps, valves, tubing, and instrumentation.

Specializing in cleaning systems, process piping, system start-ups, and equipment testing, CSI leverages technology, intellectual property, and industry expertise to deliver solutions to processing problems. Experienced CSI engineers configure or reconfigure sanitary projects large and small, develop new systems from scratch, and optimize existing processes. They collaborate with internal design and fabrication teams to provide innovative solutions for specific customer needs using the latest CAD technology and 3D scanners.

State-of-the-art Clean-in-place (CIP) systems from CSI deliver reliable and repeatable cleaning to ensure product quality and consistency—with the expertise required to ensure proper specification and placement.

Experienced CSI fabricators of custom fittings, transfer and utility panels, valve manifolds, and large skid systems practice mechanical execution to the highest industry standards. Expert project managers use planning practices that ensure solutions meet customer needs and time lines.

CSI stocks complete lines of corrosion resistant Super Alloys™ AL-6XN® and Hastelloy® C-22®. With four warehouses located across the United States, CSI is the premiere source for hygienic piping, valves, fittings, pumps, heat exchangers, spray devices, and MRO supplies.

For over 40 years, processors, OEM's, mechanical and electrical contractors, and engineering firms and resellers in the processing industry have turned to Central States Industrial Equipment for its breadth of experience, its depth of expertise, and its commitment to innovation.



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REFERENCES

1. AL-6XN® alloy physical, mechanical, and corrosion properties product data sheet, Allegheny Technologies
2. Hastelloy® C-22® alloy, Bulletin H-2019G, Haynes International
3. Hastelloy® C-276 alloy, Bulletin H-2002E, Haynes International
4. Inconel® alloy 22 and alloy 625, Publication SMC-049, Special Metals Corporation

TRADEMARKS

1. AL-6XN is a registered trademark of ATI Properties, Inc., licensed to Allegheny Ludlum Group.
2. Hastelloy and C-22 are registered trademarks of Haynes International.
3. 254SMO is a registered trademark owned by Outokumpu OY.
4. Tri-Clamp is a registered trademark of Alfa Laval.
5. Inconel is a registered trademark of Special Metals Corporation.

INTRODUCTION

Since 1999, Central States Industrial (CSI) has proactively responded to the demand for more corrosion resistant alloys in the high-purity and sanitary markets by stocking tubing and fittings in both AL-6XN® and Hastelloy® C-22®.

Al-6XN and C-22 are widely used in the biotech, pharmaceutical, personal care, home care, food, dairy, and beverage industries. These alloys are recognized by the ASME BPE standard, which identifies several specifications in Part MM (Metallic Materials) and by the U.S. Food and Drug Administration (FDA).

Microbial contamination, system reengineering, maintenance downtime, production loss, and safety of employees and the environment are the main reasons why end-users, architects, and engineers select Super Alloys™.

When process media become aggressive, the oxide film on system components breaks down, resulting in corrosion. Finding the proper metal with a compatible chemical composition leads to a stable oxide film that resists media-specific corrosion.

The main types of corrosion affecting hygienic and high purity applications in aggressive chloride environments are pitting, crevice, and stress corrosion. Materials with a high composition of chromium, nickel, molybdenum, and nitrogen provide stronger resistance to these types of corrosion.

In chloride-induced solutions with high temperatures and low pH values, AL-6XN is a better option than 300 series alloys such as 316L/1.4404 and 1.4435 for more aggressive environments, a nickel-based alloy such as Hastelloy C-22 is a more resistant alternative.

When process equipment breaks down, it is vital to determine the cause of failure to prevent future replacement and production losses. For example, if a piping system made from 316L fails in an aqueous salt environment with high temperatures, a Super Alloy with a higher molybdenum content can be a solution for the life of the system.

INDUSTRY APPLICATIONS

BIOTECH AND PHARMACEUTICAL

- Buffer Solutions
- Chromatography Columns
- API
- Saline Solutions
- Ethanol Distillation
- Oral Rehydration Salts (ORS)

PERSONAL CARE

- Shampoo and Conditioner
- Toothpaste
- Deodorant/Antiperspirant
- Body Wash
- Liquid Soap

HOME CARE

- Fabric Softener
- Detergent
- Cleaning Supplies

FOOD, DAIRY, AND BEVERAGE

- Condiments: Ketchup, Salsa, Mayonnaise
- Sauces: Tomato, Soy, Barbecue, Fish, Chili
- Breaker Eggs/Liquid Eggs
- Soup Stock
- Brine Solutions
- Isotonic Drinks
- Cheese
- Vinegar-based Products



AL-6XN®

GENERAL PROPERTIES

AL-6XN® (UNS N08367) is a 6 moly superaustenitic alloy containing higher levels of chromium, nickel, molybdenum, and nitrogen than 316L stainless steel. The alloying elements provide more corrosion resistance to acidic oxidizing chloride solutions, making AL-6XN resistive to pitting and crevice corrosion and stress corrosion cracking.

AL-6XN outperforms 316L—and is a cost-effective alternative to more expensive nickel-based alloys in applications where excellent formability, weldability, strength, and corrosion resistance are essential.

TABLE 1A: CHEMICAL REQUIREMENTS OF AL-6XN® (UNS N08367); WT. %

ELEMENT	UNS N08367
Carbon	0.03*
Manganese	2.00*
Phosphorous	0.04*
Sulfur	0.03*
Silicon	1.00*
Chromium	20.0–22.0
Nickel	23.5–25.5
Molybdenum	6.0–7.0
Nitrogen	0.18–0.25
Copper	0.75*
Iron	Balance (44)

*Maximum unless otherwise specified
Disclaimer: Always consult current standards.

HASTELLOY® C-22®

GENERAL PROPERTIES

Hastelloy® C-22® (UNS N06022) is the most versatile nickel-chromium-molybdenum-tungsten alloy available today. With improved resistance to both uniform and localized corrosion, it will outperform other nickel alloys such as C-276, C-4, Alloy 20, and Alloy 625 in applications using a variety of mixed industrial chemicals.

The composition of Hastelloy C-22 has many benefits that help enhance resistance to pitting, crevice corrosion, and stress corrosion cracking. It has excellent resistance to oxidizing aqueous media, including wet chlorine, mixtures containing nitric acid, and oxidizing acids with chlorine ions.

C-22 is a great alternative when superaustenitic stainless steels (AL-6XN, 904L, and 254 SMO®) and duplex stainless steels (2205 and 2507) cannot withstand highly aggressive media.

TABLE 1B: CHEMICAL REQUIREMENTS OF HASTELLOY® C-22® (UNS N06022); WT. %

ELEMENT	UNS N06022
Carbon	0.015*
Manganese	0.50*
Phosphorous	0.02*
Cobalt	2.5*
Tungsten	2.5–3.5*
Silicon	0.08*
Sulfur	0.02*
Chromium	20.0–22.5
Nickel	Balance (56)
Molybdenum	12.5–14.5
Vanadium	0.35*
Iron	2.0–6.0

*Maximum unless otherwise specified
Disclaimer: Always consult current standards.

PRE NUMBER INFORMATION

The Pitting Resistance Equivalent Number (PREN or PRE) is used as a guide for comparing and ranking a material's corrosion resistance. The PRE Number is calculated from a formula based on chemical composition. Although different equations are used to calculate PRE Numbers for stainless steel and nickel alloys, the numbers can compare alloys for ranking purposes. The relative values for some stainless steels and nickel alloys are shown in the following table. The greater the number, the higher the resistance to pitting corrosion in chloride media.

In today's market, there is a wide range of austenitic, superaustenitic, duplex, superduplex, and nickel-based alloys. Besides corrosion resistance, other factors should be taken into consideration, such as commercial availability, appearance, good mechanical properties, and fabrication characteristics.

TABLE 2A: AUSTENITIC AND DUPLEX ALLOYS (NOTE 1)

ALLOY	UNS	EN NUMBER	Cr	Ni	Mo	N	PRE NUMBER	
316L	S31603	1.4404	16.5-18.5	10.0-14.5	2.0-3.0	0.1	23	Austenitic
	S31603	1.4435	17.0-19.0	12.5-15.0	2.5-3.0	0.1	26	Austenitic
904L	N08904	1.4539	19.0-23.0	23.0-28.0	4.0-5.0	0.1	34	Superaustenitic
2205	S32205	1.4462	22.0-23.0	4.5-6.5	2.5-3.5	0.14-0.20	35	Duplex
2507	S32750	1.4410	24.0-26.0	6.0-8.0	3.0-5.0	0.24-0.32	42.5	Duplex
254SMO	S31254	1.4547	19.5-20.5	17.5-18.5	6.0-6.5	0.18-0.25	42	Superaustenitic
AL-6XN®	N08367	-	20.0-22.0	23.5-25.5	6.0-7.0	0.18-0.25	43	Superaustenitic

TABLE 2B: NICKEL ALLOYS (NOTE 2)

ALLOY	UNS	EN NUMBER	Cr	Ni	Mo	N	PRE NUMBER	
625	N06625	2.4856	20.0-23.0	58	8.0-10.0	-	41	Nickel
C-276	N10276	2.4819	14.5-16.5	57	15.0-17.0	-	45	Nickel
C-22®	N06022	2.4602	20.0-22.5	56	12.5-14.5	-	46	Nickel

Maximum, unless range or minimum is indicated.

Values listed are primary elements only and are not complete chemical compositions as listed in specific product type specifications.

GENERAL NOTES:

The following are industry-accepted formulas. Other formulas may be used at the owner's discretion.

(1) For stainless steels: PRE Number = %Cr + 3.3 [%Mo + 0.5(%W)] + 16(%N).

(2) For nickel alloys: PRE Number = %Cr + 1.5 (%Mo + %W + %Nb).

PRODUCT FORMS AND SPECIFICATIONS

Corrosion resistant alloys are available in the most common product forms: plate, sheet, strip, bar, billet, wire, pipe, and tubing. Table 3 shows applicable ASME and ASTM specifications for Allegheny Technologies Incorporated (ATI) AL-6XN® and Haynes Hastelloy® C-22® associated with the various alloy products forms.

TABLE 3: COMMON SPECIFICATIONS FOR CORROSION RESISTANT ALLOYS

ALLOY FORM	AL-6XN ASME	AL-6XN ASTM	C-22 ASME	C-22 ASTM
Plate, Sheet, and Strip	SA240 SB688	A240 B688	SB575	B575
Rod, Bar, and Wire	SB691	B691	SB574	B574
Welded Pipe	SB675	B675	SB619	B619
Heat Exchanger Tubing	SA249	A249	-	-
Sanitary Tubing	-	A270	-	-
Welded Tubing (General Applications)	SB626	B626 A269	SB626	B626
Seamless Pipe and Tubing	SB690	B690	SB622	B622
Forged Pipe Flanges, Fittings, and Valves	SB462	B462	SB462	B462
Wrought Nickel Alloy Welded Fittings	SB366	B366	SB366	B366
Nickel Alloy Forgings	SB564	B564	SB564	B564
Castings	SA351 CN-3MN UNS J94651	A743 A744	SA494 CX2MW UNS N26022	A494
Bare Welded Rods and Wire	ERNiCrMo-10 UNS N06022	-	ERNiCrMo-10 UNS N06022	-

SURFACE FINISH DESIGNATOR

TABLE 4: FITTINGS AND TUBING, FINISH DESIGNATOR CODES, AND ACCEPTANCE STANDARDS

BPE SURFACE FINISH CODE	CSI SURFACE FINISH CODE	PROCESS CONTACT SURFACE		NON-PROCESS CONTACT SURFACE		DIMENSIONS & TOLERANCES (BPE) OR (CSI)
		MAXIMUM RA (ID)	FINISH CONDITION	MAXIMUM RA (OD)	FINISH CONDITION	
N/A	PU	N/A	Unpolished (Mill)	N/A	Unpolished (Mill)	CSI
N/A	7	32 µin (0.81 µm)	Polished or Drawn	32 µin (0.81 µm)	Mechanical Polished	CSI
SF1	PL	20 µin (0.51 µm)	Polished or Drawn	32 µin (0.81 µm)	Mechanical Polished	BPE
SF5	PO	20 µin (0.51 µm)	Electropolished	32 µin (0.81 µm)	Mechanical Polished	BPE
SF6	P25	25 µin (0.64 µm)	Electropolished	32 µin (0.81 µm)	Mechanical Polished	BPE

This catalog does not intend to address all acceptance criterion in the ASME BPE standard. The items offered within this catalog identified as “BPE” Dimensions and Tolerances are in accordance with ASME BPE. Items identified as “CSI” Dimensions and Tolerances are made to CSI standards.

ID FINISH PROCESS

PU – UNPOLISHED

The internal surface of the tubing shall be a bright annealed as welded or as drawn finish that is unpolished.

7 – POLISHED OR DRAWN

The internal surface of the tubing shall be polished with abrasives, honed, or “as drawn” to a 32Ra µin (0.81 µm) max.

PL – POLISHED OR DRAWN

The internal surface of the tubing shall be polished with abrasives, honed, or “as drawn” to a 20Ra µin (0.51 µm) max. and meet the acceptance criteria of ASME BPE for surface finish designation SF1.

PO – ELECTROPOLISHED

The internal surface of the electropolished tubing shall be polished with abrasives, honed, or “as drawn” to a 20Ra µin (0.51 µm) max. and then electropolished to meet the acceptance criteria for ASME BPE designation SF5.

P25 – ELECTROPOLISHED

The internal surface of the electropolished tubing shall be polished with abrasives, honed, or “as drawn” to a 25Ra µin (0.65 µm) max. and then electropolished to meet the acceptance criteria for ASME BPE designation SF6.

OD FINISH PROCESS

MECHANICAL POLISHED

The external surfaces of the tubing shall be polished with abrasives to less than 32Ra µin (0.81 µm).

UNPOLISHED

The external surfaces of the tubing shall be a bright annealed as welded or as drawn finish that is unpolished.

AL-6XN[®] DIMENSIONS & TOLERANCES

AL-6XN[®] TUBING SPECIFICATIONS

- Welded tubing in compliance with ASTM A270/A249/B676 and ASME SA249/SB676
- Tubing provided in random lengths, 20 ft. ± 1.0 in. is typical (not less than 17 ft. lengths)
- Full line stencil identification on tubing OD
- Plastic sleeved and capped on polished and electropolished tubing
- MTR according with EN 10204 3.1 with every order

For more specifications, visit csidesigns.com/products/superalloys

AL-6XN TUBING DIMENSIONS AND TOLERANCE

TUBING OD NOMINAL SIZE		OUTSIDE DIAMETER TOLERANCE		WALL THICKNESS NOMINAL SIZE		WALL THICKNESS TOLERANCE
IN	MM	IN	MM	IN	MM	
1/2	12.7	+/-0.005	+/-0.13	0.065	1.65	+/-10%
3/4	19.05	+/-0.005	+/-0.13	0.065	1.65	+/-10%
1	25.4	+/-0.005	+/-0.13	0.065	1.65	+/-10%
1-1/2	38.1	+/-0.008	+/-0.20	0.065	1.65	+/-10%
2	50.8	+/-0.008	+/-0.20	0.065	1.65	+/-10%
2-1/2	63.5	+/-0.010	+/-0.25	0.065	1.65	+/-10%
3	76.2	+/-0.010	+/-0.25	0.065	1.65	+/-10%
4	101.6	+/-0.015	+/-0.38	0.083	2.11	+/-10%

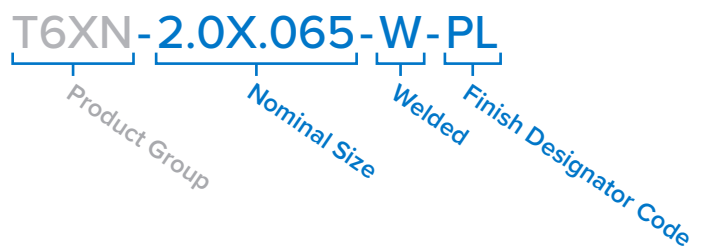
HOW TO ORDER

IDENTIFYING THE FINISH DESIGNATOR

The suffix will define the finishing requirements. See *Figure 1* for example.

See page 9 for surface finishes.

FIG. 1: ITEM NUMBER



C-22[®] DIMENSIONS & TOLERANCES

C-22[®] TUBING SPECIFICATIONS

- Welded tubing in compliance with specification ASTM B626 and ASME SB626
- Seamless tubing in compliance with specification ASTM B622 and ASME SB622
- Specification SB622 and SB626 are recognized by ASME BPE and acceptable for pharmaceutical applications
- Tubing provided in random lengths, 20 ft. + 1.0 in. is typical (not less than 17 ft. lengths)
- Full line stencil identification on tubing OD
- Plastic sleeved and capped protection on polished tubing and electropolishing
- MTR according with EN 10204 3.1 with every order

For more specifications, visit csidesigns.com/products/superalloys

C-22 TUBING DIMENSIONS AND TOLERANCE

TUBING OD NOMINAL SIZE		OUTSIDE DIAMETER TOLERANCE		WALL THICKNESS NOMINAL SIZE		WALL THICKNESS TOLERANCE
IN	MM	IN	MM	IN	MM	
1/2	12.7	+/-0.005	+/-0.13	0.065	1.65	+/-10%
3/4	19.05	+/-0.005	+/-0.13	0.065	1.65	+/-10%
1	25.4	+/-0.005	+/-0.13	0.065	1.65	+/-10%
1-1/2	38.1	+/-0.008	+/-0.20	0.065	1.65	+/-10%
2	50.8	+/-0.008	+/-0.20	0.065	1.65	+/-10%
3	76.2	+/-0.010	+/-0.25	0.065	1.65	+/-10%

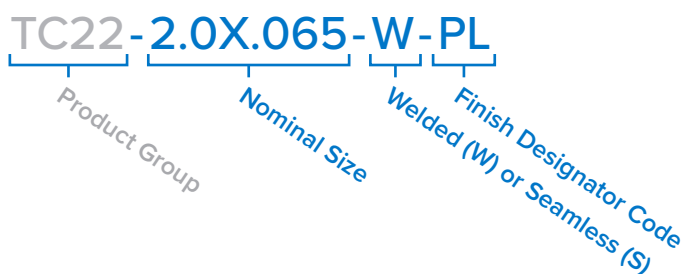
HOW TO ORDER

IDENTIFYING THE FINISH DESIGNATOR

The suffix will define the finishing requirements. See *Figure 1* for example.

See page 9 for surface finishes.

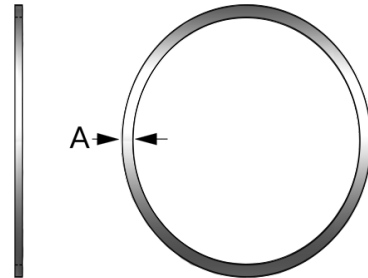
FIG. 1: ITEM NUMBER



WELD INSERTS FOR AL-6XN®

WELD INSERTS | AR6022W-SIZE

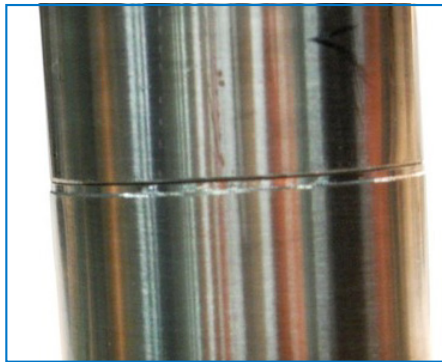
NOMINAL SIZE		A		ALLOY	UNS
IN	MM	IN	MM		
1/2	12.7	.065	1.65	C-22®/Alloy 22	N06022
3/4	19.05	.065	1.65	C-22®/Alloy 22	N06022
1	25.4	.065	1.65	C-22®/Alloy 22	N06022
1-1/2	38.1	.065	1.65	C-22/Alloy 22®	N06022
2	50.8	.065	1.65	C-22®/Alloy 22	N06022
2-1/2	63.5	.065	1.65	C-22®/Alloy 22	N06022
3	76.2	.065	1.65	C-22®/Alloy 22	N06022
4	101.6	.083	2.11	C-22®/Alloy 22	N06022



See page 42 for details on how to use weld inserts.
 Weld inserts are only required when welding AL-6XN.
 Weld inserts are not needed for welding C-22.



1. ALIGN WELD INSERT WITH THE TUBING



2. TACK THE COMPONENTS TOGETHER



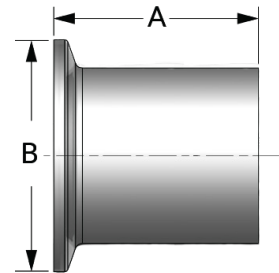
3. WELD MANUALLY OR ORBITALLY (AS PICTURED)

FERRULES

TRI-CLAMP FERRULE, LONG | B14AM-SIZE-MATERIAL-FINISH

NOMINAL SIZE		A		B	
IN	MM	IN	MM	IN	MM
1/2	12.7	1.750	44.45	0.984	25.00
3/4	19.05	1.750	44.45	0.984	25.00
1	25.4	1.750	44.45	1.984	50.39
1-1/2	38.1	1.750	44.45	1.984	50.39
2	50.8	2.250	57.15	2.516	63.91
2-1/2	63.5	2.250	57.15	3.047	77.39
3	76.2	2.250	57.15	3.579	90.91
4	101.6	2.250	57.15	4.682	118.92

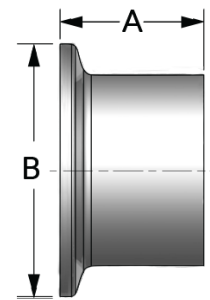
2019 BPE DT-4.1.4-1 | 2009 BPE DT-22



TRI-CLAMP FERRULE, MEDIUM | L14AM-SIZE-MATERIAL-FINISH

NOMINAL SIZE		A		B	
IN	MM	IN	MM	IN	MM
1/2	12.7	1.125	28.58	0.984	25.00
3/4	19.05	1.125	28.58	0.984	25.00
1	25.4	1.125	28.58	1.984	50.39
1-1/2	38.1	1.125	28.58	1.984	50.39
2	50.8	1.125	28.58	2.516	63.91
2-1/2	63.5	1.125	28.58	3.047	77.39
3	76.2	1.125	28.58	3.579	90.91
4	101.6	1.125	28.58	4.682	118.92

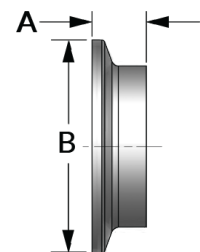
2019 BPE DT-4.1.4-1 | 2009 BPE DT-22



TRI-CLAMP FERRULE, SHORT | 14WMPS-SIZE-MATERIAL-FINISH

NOMINAL SIZE		A		B	
IN	MM	IN	MM	IN	MM
1/2	12.7	0.500	12.70	0.984	25.00
3/4	19.05	0.500	12.70	0.984	25.00
1	25.4	0.500	12.70	1.984	50.39
1-1/2	38.1	0.500	12.70	1.984	50.39
2	50.8	0.500	12.70	2.516	63.91
2-1/2	63.5	0.500	12.70	3.047	77.39
3	76.2	0.500	12.70	3.579	90.91
4	101.6	0.625	15.88	4.682	118.92

2019 BPE DT-4.1.4-1 | 2009 BPE DT-22

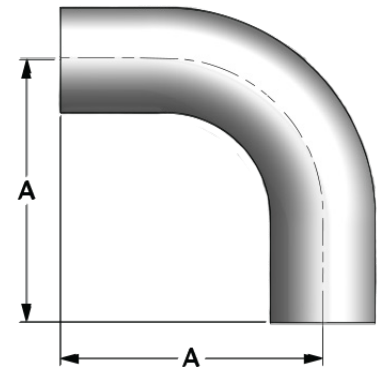


ELBOWS

90° BUTT WELD ELBOW | B2S-SIZE-MATERIAL-FINISH

NOMINAL SIZE		A	
IN	MM	IN	MM
1/2	12.7	3.000	76.20
3/4	19.0	3.000	76.20
1	25.4	3.000	76.20
1-1/2	38.1	3.750	95.25
2	50.8	4.750	120.65
2-1/2	63.5	5.500	139.70
3	76.2	6.250	158.75
4	101.6	8.000	203.20

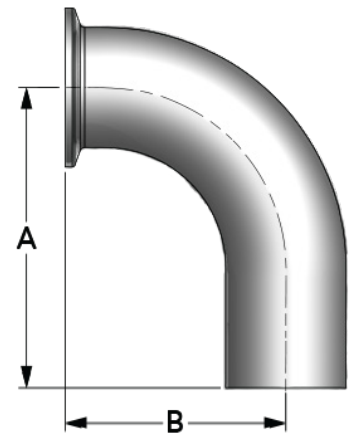
2019 BPE DT-4.1.1-1 | 2009 BPE DT-7



90° TRI-CLAMP X BUTT WELD ELBOW | B2CMW-SIZE-MATERIAL-FINISH

NOMINAL SIZE		A		B	
IN	MM	IN	MM	IN	MM
1/2	12.7	3.000	76.20	1.625	41.28
3/4	19.0	3.000	76.20	1.625	41.28
1	25.4	3.000	76.20	2.000	50.80
1-1/2	38.1	3.750	95.25	2.750	69.85
2	50.8	4.750	120.65	3.500	88.90
2-1/2	63.5	5.500	139.70	4.250	107.95
3	76.2	6.250	158.75	5.000	127.00
4	101.6	8.000	203.20	6.625	168.28

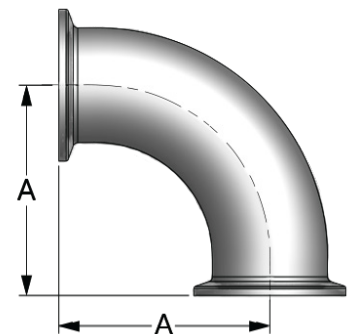
2019 BPE DT-4.1.1-2 | 2009 BPE DT-12



90° TRI-CLAMP ELBOW | B2CMP-SIZE-MATERIAL-FINISH

NOMINAL SIZE		A	
IN	MM	IN	MM
1/2	12.7	1.625	41.28
3/4	19.0	1.625	41.28
1	25.4	2.000	50.80
1-1/2	38.1	2.750	69.85
2	50.8	3.500	88.90
2-1/2	63.5	4.250	107.95
3	76.2	5.000	127.00
4	101.6	6.625	168.28

2019 BPE DT-4.1.1-3 | 2009 BPE DT-16

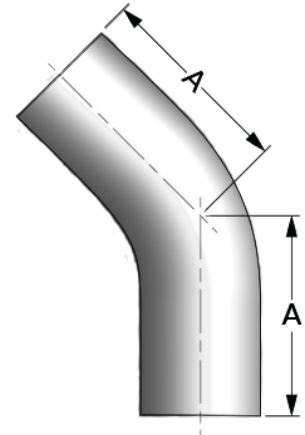


ELBOWS

45° BUTT WELD ELBOW | B2KS-SIZE-MATERIAL-FINISH

NOMINAL SIZE		A	
IN	MM	IN	MM
1/2	12.7	2.250	57.15
3/4	19.0	2.250	57.15
1	25.4	2.250	57.15
1-1/2	38.1	2.500	63.50
2	50.8	3.000	76.20
2-1/2	63.5	3.375	85.73
3	76.2	3.625	92.08
4	101.6	4.500	114.30

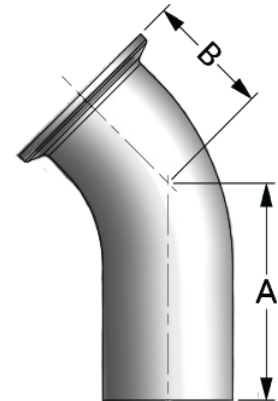
2019 BPE DT-4.1.1-4 | 2009 BPE DT-8



45° TRI-CLAMP X BUTT WELD ELBOW | B2KMW-SIZE-MATERIAL-FINISH

NOMINAL SIZE		A		B	
IN	MM	IN	MM	IN	MM
1/2	12.7	2.250	57.15	1.000	25.40
3/4	19.0	2.250	57.15	1.000	25.40
1	25.4	2.250	57.15	1.125	28.58
1-1/2	38.1	2.500	63.50	1.438	36.53
2	50.8	3.000	76.20	1.750	44.45
2-1/2	63.5	3.375	85.73	2.063	52.40
3	76.2	3.625	92.08	2.375	60.33
4	101.6	4.500	114.30	3.125	79.38

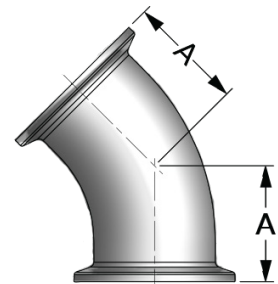
2019 BPE DT-4.1.1-5 | 2009 BPE DT-13



45° TRI-CLAMP ELBOW | B2KMP-SIZE-MATERIAL-FINISH

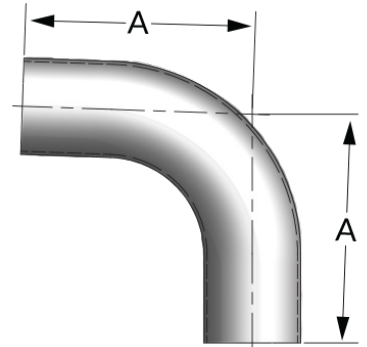
NOMINAL SIZE		A	
IN	MM	IN	MM
1/2	12.7	1.000	25.40
3/4	19.0	1.000	25.40
1	25.4	1.125	28.58
1-1/2	38.1	1.438	36.53
2	50.8	1.750	44.45
2-1/2	63.5	2.063	52.40
3	76.2	2.375	60.33
4	101.6	3.125	79.38

2019 BPE DT-4.1.1-6 | 2009 BPE DT-17



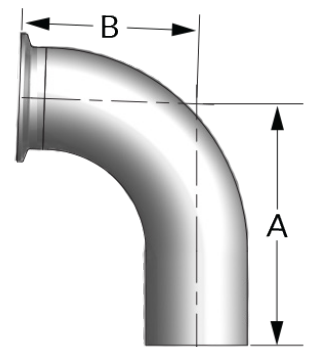
88° BUTT WELD ELBOW | B2S88-SIZE-MATERIAL-FINISH

NOMINAL SIZE		A	
IN	MM	IN	MM
1/2	12.7	2.961	75.21
3/4	19.0	2.961	75.21
1	25.4	2.949	74.90
1-1/2	38.1	3.673	93.29
2	50.8	4.647	118.03
2-1/2	63.5	5.371	136.42
3	76.2	6.096	154.84
4	101.6	7.794	197.97



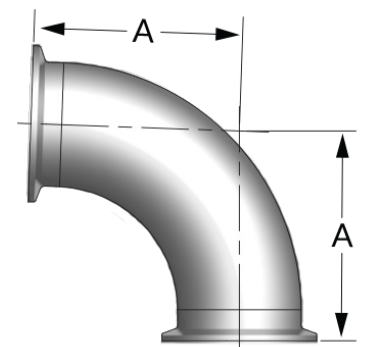
88° TRI-CLAMP X BUTT WELD ELBOW | B2CMW88-SIZE-MATERIAL-FINISH

NOMINAL SIZE		A		B	
IN	MM	IN	MM	IN	MM
1/2	12.7	2.961	75.21	1.586	40.28
3/4	19.0	2.961	75.21	1.586	40.28
1	25.4	2.949	74.90	1.949	49.50
1-1/2	38.1	3.673	93.29	2.673	67.89
2	50.8	4.647	118.03	3.397	86.28
2-1/2	63.5	5.371	136.42	4.121	104.67
3	76.2	6.096	154.84	4.846	123.09
4	101.6	7.794	197.97	6.419	163.04



88° TRI-CLAMP ELBOW | B2CMP88-SIZE-MATERIAL-FINISH

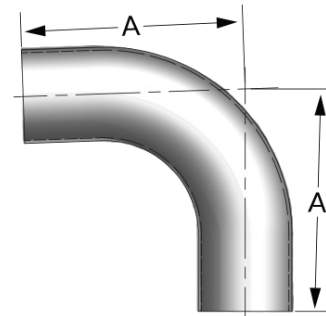
NOMINAL SIZE		A	
IN	MM	IN	MM
1/2	12.7	1.586	40.28
3/4	19.0	1.586	40.28
1	25.4	1.949	49.50
1-1/2	38.1	2.673	67.89
2	50.8	3.397	86.28
2-1/2	63.5	4.121	104.67
3	76.2	4.846	123.09
4	101.6	6.419	163.04



ELBOWS

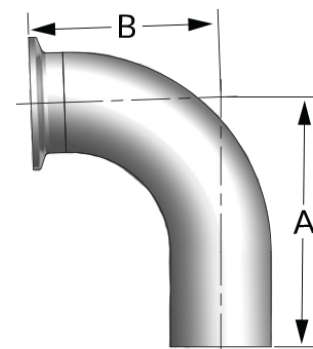
92° BUTT WELD ELBOW | B2S92-SIZE-MATERIAL-FINISH

NOMINAL SIZE		A	
IN	MM	IN	MM
1/2	12.7	3.040	77.22
3/4	19.0	3.040	77.22
1	25.4	3.053	77.55
1-1/2	38.1	3.830	97.28
2	50.8	4.857	123.37
2-1/2	63.5	5.633	143.08
3	76.2	6.410	162.81
4	101.6	8.213	208.61



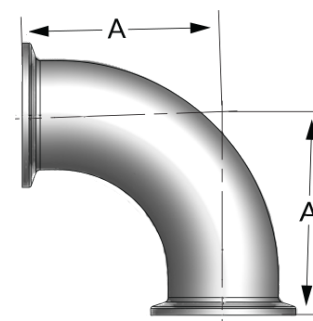
92° TRI-CLAMP X BUTT WELD ELBOW | B2CMW92-SIZE-MATERIAL-FINISH

NOMINAL SIZE		A		B	
IN	MM	IN	MM	IN	MM
1/2	12.7	3.040	77.22	1.665	42.29
3/4	19.0	3.040	77.22	1.665	42.29
1	25.4	3.053	77.55	2.053	52.15
1-1/2	38.1	3.830	97.28	2.830	71.88
2	50.8	4.857	123.37	3.607	91.62
2-1/2	63.5	5.633	143.08	4.383	111.33
3	76.2	6.410	162.81	5.160	131.05
4	101.6	8.213	208.61	6.838	173.69



92° TRI-CLAMP ELBOW | B2CMP92-SIZE-MATERIAL-FINISH

NOMINAL SIZE		A	
IN	MM	IN	MM
1/2	12.7	1.665	42.29
3/4	19.0	1.665	42.29
1	25.4	2.053	52.15
1-1/2	38.1	3.607	71.88
2	50.8	3.607	91.62
2-1/2	63.5	4.383	111.33
3	76.2	5.160	131.05
4	101.6	6.838	173.69

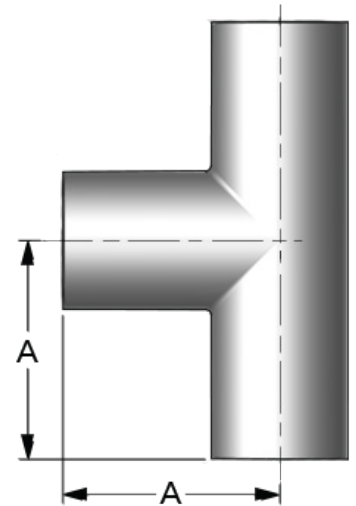


TEES

BUTT WELD TEE | B7WWW-SIZE-MATERIAL-FINISH

NOMINAL SIZE		A	
IN	MM	IN	MM
1/2	12.7	1.875	47.63
3/4	19.0	2.000	50.80
1	25.4	2.125	53.98
1-1/2	38.1	2.375	60.33
2	50.8	2.875	73.03
2-1/2	63.5	3.125	79.38
3	76.2	3.375	85.73
4	101.6	4.125	104.78

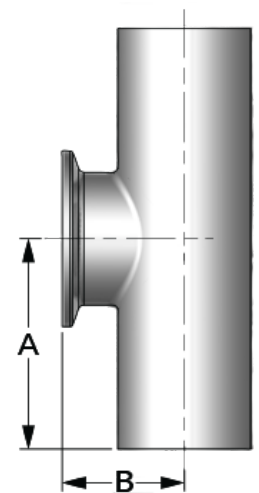
2019 BPE DT-4.1.2-1 | 2009 BPE DT-9



SHORT OUTLET TRI-CLAMP TEE | B7WWS-SIZE-MATERIAL-FINISH

NOMINAL SIZE		A		B	
IN	MM	IN	MM	IN	MM
1/2	12.7	1.875	47.63	1.000	25.40
3/4	19.0	2.000	50.80	1.125	28.58
1	25.4	2.125	53.98	1.125	28.58
1-1/2	38.1	2.375	60.33	1.375	34.93
2	50.8	2.875	73.03	1.625	41.28
2-1/2	63.5	3.125	79.38	1.875	47.63
3	76.2	3.375	85.73	2.125	53.98
4	101.6	4.125	104.78	2.750	69.85

2019 BPE DT-4.1.2-2 | 2009 BPE DT-15

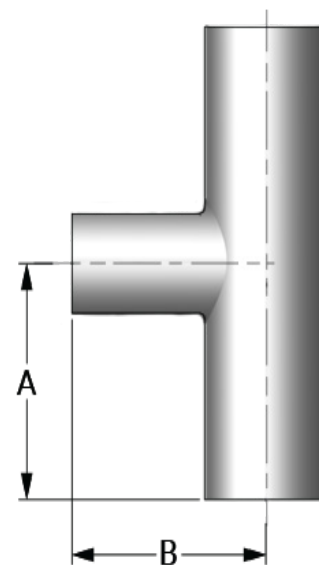


TEES

REDUCING BUTT WELD TEE | B7RWWW-SIZE-MATERIAL-FINISH

NOMINAL SIZE		A		B	
IN	MM	IN	MM	IN	MM
3/4 X 1/2	19.0 X 12.7	2.000	50.80	2.000	50.80
1 X 1/2	25.4 X 12.7	2.125	53.98	2.125	53.98
1 X 3/4	25.4 X 19.0	2.125	53.98	2.125	53.98
1-1/2 X 1/2	38.1 X 12.7	2.375	60.33	2.375	60.33
1-1/2 X 3/4	38.1 X 19.0	2.375	60.33	2.375	60.33
1-1/2 X 1	38.1 X 25.4	2.375	60.33	2.375	60.33
2 X 1/2	50.8 X 12.7	2.875	73.03	2.625	66.68
2 X 3/4	50.8 X 19.0	2.875	73.03	2.625	66.68
2 X 1	50.8 X 25.4	2.875	73.03	2.625	66.68
2 X 1-1/2	50.8 X 38.1	2.875	73.03	2.625	66.68
2-1/2 X 1/2	63.5 X 12.7	3.125	79.38	2.875	73.03
2-1/2 X 3/4	63.5 X 19.0	3.125	79.38	2.875	73.03
2-1/2 X 1	63.5 X 25.4	3.125	79.38	2.875	73.03
2-1/2 X 1-1/2	63.5 X 38.1	3.125	79.38	2.875	73.03
2-1/2 X 2	63.5 X 50.8	3.125	79.38	2.875	73.03
3 X 1/2	76.2 X 12.7	3.375	85.73	3.125	79.38
3 X 3/4	76.2 X 19.0	3.375	85.73	3.125	79.38
3 X 1	76.2 X 25.4	3.375	85.73	3.125	79.38
3 X 1-1/2	76.2 X 38.1	3.375	85.73	3.125	79.38
3 X 2	76.2 X 50.8	3.375	85.73	3.125	79.38
3 X 2-1/2	76.2 X 63.5	3.375	85.73	3.125	79.38
4 X 1/2	101.6 X 12.7	4.125	104.78	3.625	92.08
4 X 3/4	101.6 X 19.0	4.125	104.78	3.625	92.08
4 X 1	101.6 X 25.4	4.125	104.78	3.625	92.08
4 X 1-1/2	101.6 X 38.1	4.125	104.78	3.625	92.08
4 X 2	101.6 X 50.8	4.125	104.78	3.875	98.43
4 X 2-1/2	101.6 X 63.5	4.125	104.78	3.875	98.43
4 X 3	101.6 X 76.2	4.125	104.78	3.875	98.43

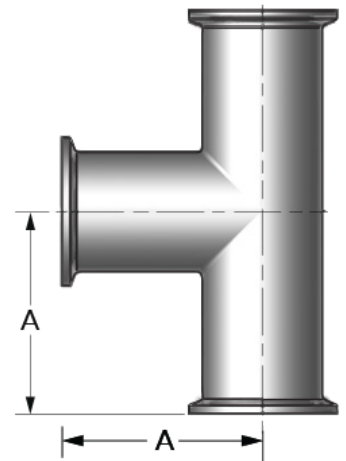
2019 BPE DT-4.1.2-6 | 2009 BPE DT-10



TRI-CLAMP TEE | B7MP-SIZE-MATERIAL-FINISH

NOMINAL SIZE		A	
IN	MM	IN	MM
1/2	12.7	2.375	60.33
3/4	19.0	2.500	63.40
1	25.4	2.625	66.68
1-1/2	38.1	2.875	73.03
2	50.8	3.375	85.73
2-1/2	63.5	3.625	92.08
3	76.2	3.875	98.43
4	101.6	4.750	120.65

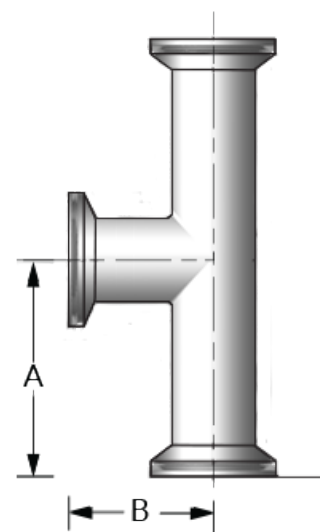
2019 BPE DT-4.1.2-4 | 2009 BPE DT-18



TRI-CLAMP SHORT OUTLET TEE | B7MPS-SIZE-MATERIAL-FINISH

NOMINAL SIZE		A		B	
IN	MM	IN	MM	IN	MM
1/2	12.7	2.375	60.33	1.000	25.40
3/4	19.0	2.500	63.50	1.125	28.58
1	25.4	2.625	66.68	1.125	28.58
1-1/2	38.1	2.875	73.03	1.375	34.93
2	50.8	3.375	85.73	1.625	41.28
2-1/2	63.5	3.625	92.08	1.875	47.63
3	76.2	3.875	98.43	2.125	53.98
4	101.6	4.750	120.65	2.750	69.85

2019 BPE DT-4.1.2-5 | 2009 BPE DT-27

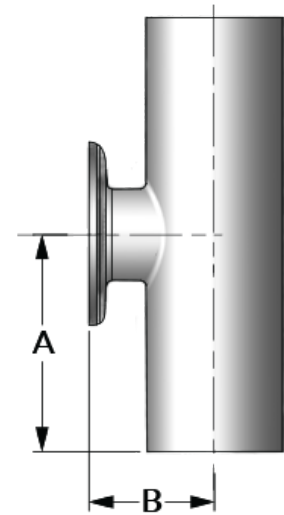


TEES

SHORT OUTLET TRI-CLAMP REDUCING TEE | B7RWWMS-SIZE-MATERIAL-FINISH

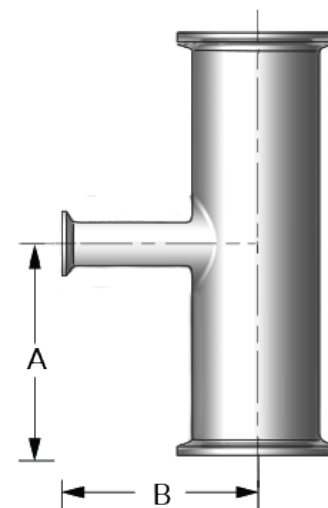
NOMINAL SIZE		A		B	
IN	MM	IN	MM	IN	MM
3/4 X 1/2	19.0 X 12.7	2.000	50.80	1.000	25.40
1 X 1/2	25.4 X 12.7	2.125	53.98	1.125	28.58
1 X 3/4	25.4 X 19.0	2.125	53.98	1.125	28.58
1-1/2 X 1/2	38.1 X 12.7	2.375	60.33	1.375	34.93
1-1/2 X 3/4	38.1 X 19.0	2.375	60.33	1.375	34.93
1-1/2 X 1	38.1 X 25.4	2.375	60.33	1.375	34.93
2 X 1/2	50.8 X 12.7	2.875	73.03	1.625	41.28
2 X 3/4	50.8 X 19.0	2.875	73.03	1.625	41.28
2 X 1	50.8 X 25.4	2.875	73.03	1.625	41.28
2 X 1-1/2	50.8 X 38.1	2.875	73.03	1.625	41.28
2-1/2 X 1/2	63.5 X 12.7	3.125	79.38	1.875	47.63
2-1/2 X 3/4	63.5 X 19.0	3.125	79.38	1.875	47.63
2-1/2 X 1	63.5 X 25.4	3.125	79.38	1.875	47.63
2-1/2 X 1-1/2	63.5 X 38.1	3.125	79.38	1.875	47.63
2-1/2 X 2	63.5 X 50.8	3.125	79.38	1.875	47.63
3 X 1/2	76.2 X 12.7	3.375	85.73	2.125	53.98
3 X 3/4	76.2 X 19.0	3.375	85.73	2.125	53.98
3 X 1	76.2 X 25.4	3.375	85.73	2.125	53.98
3 X 1-1/2	76.2 X 38.1	3.375	85.73	2.125	53.98
3 X 2	76.2 X 50.8	3.375	85.73	2.125	53.98
3 x 2-1/2	76.2 X 63.5	3.375	85.73	2.125	53.98
4 X 1/2	101.6 X 12.7	4.125	104.78	2.625	66.68
4 X 3/4	101.6 X 19.0	4.125	104.78	2.625	66.68
4 X 1	101.6 X 25.4	4.125	104.78	2.625	66.68
4 X 1-1/2	101.6 X 38.1	4.125	104.78	2.625	66.68
4 X 2	101.6 X 50.8	4.125	104.78	2.625	66.68
4 X 2-1/2	101.6 X 63.5	4.125	104.78	2.625	66.68
4 X 3	101.6 X 76.2	4.125	104.78	2.625	66.68

2019 BPE DT-4.1.2-7 | 2009 BPE DT-14



TRI-CLAMP REDUCING TEE | B7RMP-SIZE-MATERIAL-FINISH

NOMINAL SIZE		A		B	
IN	MM	IN	MM	IN	MM
3/4 X 1/2	19.0 X 12.7	2.500	63.50	2.500	63.50
1 X 1/2	25.4 X 12.7	2.625	66.68	2.625	66.68
1 X 3/4	25.4 X 19.0	2.625	66.68	2.625	66.68
1-1/2 X 1/2	38.1 X 12.7	2.875	73.03	2.875	73.03
1-1/2 X 3/4	38.1 X 19.0	2.875	73.03	2.875	73.03
1-1/2 X 1	38.1 X 25.4	2.875	73.03	2.875	73.03
2 X 1/2	50.8 X 12.7	3.375	85.73	3.125	79.38
2 X 3/4	50.8 X 19.0	3.375	85.73	3.125	79.38
2 X 1	50.8 X 25.4	3.375	85.73	3.125	79.38
2 X 1-1/2	50.8 X 38.1	3.375	85.73	3.125	79.38
2-1/2 X 1/2	63.5 X 12.7	3.625	92.08	3.375	85.73
2-1/2 X 3/4	63.5 X 19.0	3.625	92.08	3.375	85.73
2-1/2 X 1	63.5 X 25.4	3.625	92.08	3.375	85.73
2-1/2 X 1-1/2	63.5 X 38.1	3.625	92.08	3.375	85.73
2-1/2 X 2	63.5 X 50.8	3.625	92.08	3.375	85.73
3 X 1/2	76.2 X 12.7	3.875	98.43	3.625	92.08
3 X 3/4	76.2 X 19.0	3.875	98.43	3.625	92.08
3 X 1	76.2 X 25.4	3.875	98.43	3.625	92.08
3 X 1-1/2	76.2 X 38.1	3.875	98.43	3.625	92.08
3 X 2	76.2 X 50.8	3.875	98.43	3.625	92.08
3 X 2-1/2	76.2 X 63.5	3.875	98.43	3.625	92.08
4 X 1/2	101.6 X 12.7	4.750	120.65	4.125	104.78
4 X 3/4	101.6 X 19.0	4.750	120.65	4.125	104.78
4 X 1	101.6 X 25.4	4.750	120.65	4.125	104.78
4 X 1-1/2	101.6 X 38.1	4.750	120.65	4.125	104.78
4 X 2	101.6 X 50.8	4.750	120.65	4.375	111.13
4 X 2-1/2	101.6 X 63.5	4.750	120.65	4.375	111.13
4 X 3	101.6 X 76.2	4.750	120.65	4.375	111.13

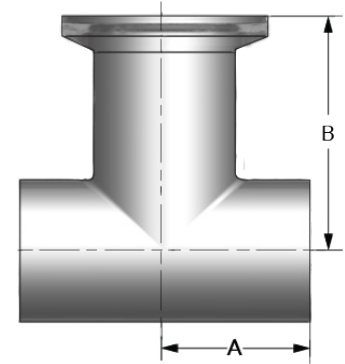


2019 BPE DT-4.1.2-8 | 2009 BPE DT-19

TEES

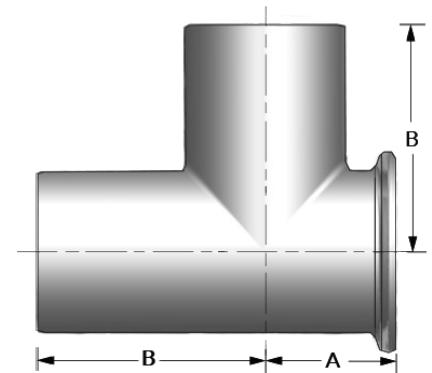
WELD X WELD X CLAMP TEE | B7WWM-SIZE-MATERIAL-FINISH

NOMINAL SIZE		A		B	
IN	MM	IN	MM	IN	MM
1/2	12.7	1.875	47.63	2.250	57.15
3/4	19.0	2.000	50.80	2.500	63.50
1	25.4	2.125	53.98	2.625	66.68
1-1/2	38.1	2.375	60.33	2.875	73.03
2	50.8	2.875	73.03	3.375	85.73
2-1/2	63.5	3.126	79.40	3.626	92.10
3	76.2	3.375	85.73	3.885	86.07
4	101.6	4.125	104.78	4.750	120.65



SHORT OUTLET RUN TEE | B7WMSW-SIZE-MATERIAL-FINISH

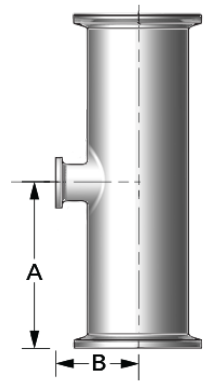
NOMINAL SIZE		A		B	
IN	MM	IN	MM	IN	MM
1/2	12.7	0.875	22.23	1.875	47.63
3/4	19.0	1.000	25.40	2.000	50.80
1	25.4	1.125	28.58	2.125	53.98
1-1/2	38.1	1.375	34.93	2.375	60.33
2	50.8	1.625	41.28	2.875	73.03
2-1/2	63.5	1.875	47.63	3.125	79.39
3	76.2	2.125	53.98	3.375	85.73
4	101.6	2.750	69.85	4.125	104.78



2019 BPE DT-4.1.2-3 | 2009 BPE DT-25

TRI-CLAMP SHORT OUTLET REDUCING TEE | B7RMPS-SIZE-MATERIAL-FINISH

NOMINAL SIZE		A		B	
IN	MM	IN	MM	IN	MM
3/4 X 1/2	19.0 X 12.7	2.500	63.50	1.000	25.40
1 X 1/2	25.4 X 12.7	2.625	66.68	1.125	28.58
1 X 3/4	25.4 X 19.0	2.625	66.68	1.125	28.58
1-1/2 X 1/2	38.1 X 12.7	2.875	73.03	1.375	34.93
1-1/2 X 3/4	38.1 X 19.0	2.875	73.03	1.375	34.93
1-1/2 X 1	38.1 X 25.4	2.875	73.03	1.375	34.93
2 X 1/2	50.8 X 12.7	3.375	85.73	1.625	41.28
2 X 3/4	50.8 X 19.0	3.375	85.73	1.625	41.28
2 X 1	50.8 X 25.4	3.375	85.73	1.625	41.28
2 X 1-1/2	50.8 X 38.1	3.375	85.73	1.625	41.28
2-1/2 X 1/2	63.5 X 12.7	3.625	92.08	1.875	47.63
2-1/2 X 3/4	63.5 X 19.0	3.625	92.08	1.875	47.63
2-1/2 X 1	63.5 X 25.4	3.625	92.08	1.875	47.63
2-1/2 X 1-1/2	63.5 X 38.1	3.625	92.08	1.875	47.63
2-1/2 X 2	63.5 X 50.8	3.625	92.08	1.875	47.63
3 X 1/2	76.2 X 12.7	3.875	98.43	2.125	53.98
3 X 3/4	76.2 X 19.0	3.875	98.43	2.125	53.98
3 X 1	76.2 X 25.4	3.875	98.43	2.125	53.98
3 X 1-1/2	76.2 X 38.1	3.875	98.43	2.125	53.98
3 X 2	76.2 X 50.8	3.875	98.43	2.125	53.98
3 X 2-1/2	76.2 X 63.5	3.875	98.43	2.125	53.98
4 X 1/2	101.6 X 12.7	4.750	120.65	2.625	66.68
4 X 3/4	101.6 X 19.0	4.750	120.65	2.625	66.68
4 X 1	101.6 X 25.4	4.750	120.65	2.625	66.68
4 X 1-1/2	101.6 X 38.1	4.750	120.65	2.625	66.68
4 X 2	101.6 X 50.8	4.750	120.65	2.625	66.68
4 X 2-1/2	101.6 X 63.5	4.750	120.65	2.625	66.68
4 X 3	101.6 X 76.2	4.750	120.65	2.625	66.68



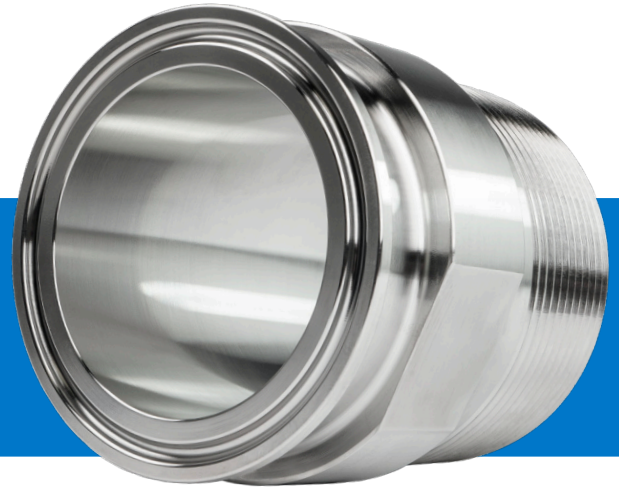
2019 BPE DT-4.1.2-9 | 2009 BPE DT-20

LOWER YOUR DOWNTIME NOT YOUR STANDARDS



As a person dedicated to maximizing plant and product efficiencies, the last thing you need is downtime and contamination in your process line caused by severe corrosion. Lower your downtime, not your standards with Super Alloys™ AL-6XN® and Hastelloy® C-22®!

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Choosing the right equipment and materials to avoid corrosion is a best practice for most processing environments.

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AVOID EQUIPMENT REPLACEMENT

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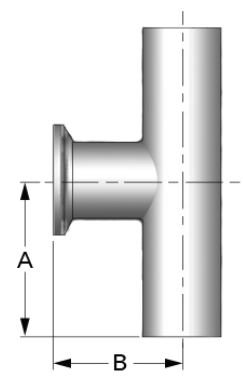


FOLLOW US
ON LINKEDIN

TEES

WELD X WELD X CLAMP REDUCING TEE | B7RWWM-SIZE-MATERIAL-FINISH

NOMINAL SIZE		A		B	
IN	MM	IN	MM	IN	MM
3/4 x 1/2	19.0 X 12.7	2.000	50.80	2.500	63.50
1 x 1/2	25.4 X 12.7	2.125	53.98	2.625	66.68
1 X 3/4	25.4 X 19.0	2.125	53.98	2.625	66.68
1-1/2 X 1/2	38.1 X 12.7	2.375	60.33	2.875	73.03
1-1/2 X 3/4	38.1 X 19.0	2.375	60.33	2.875	73.03
1-1/2 X 1	38.1 X 25.4	2.375	60.33	2.875	73.03
2 X 1/2	50.8 X 12.7	2.875	73.03	3.125	79.38
2 X 3/4	50.8 X 19.0	2.875	73.03	3.125	79.38
2 X 1	50.8 X 25.4	2.875	73.03	3.125	79.38
2 X 1-1/2	50.8 X 38.1	2.875	73.03	3.125	79.38
2-1/2 X 1/2	63.5 X 12.7	3.125	79.38	3.375	85.73
2-1/2 X 3/4	63.5 X 19.0	3.125	79.38	3.375	85.73
2-1/2 X 1	63.5 X 25.4	3.125	79.38	3.375	85.73
2-1/2 X 1-1/2	63.5 X 38.1	3.125	79.38	3.375	85.73
2-1/2 X 2	63.5 X 50.8	3.125	79.38	3.375	85.73
3 X 1/2	76.2 X 12.7	3.375	85.73	3.625	92.08
3 X 3/4	76.2 X 19.0	3.375	85.73	3.625	92.08
3 X 1	76.2 X 25.4	3.375	85.73	3.625	92.08
3 X 1-1/2	76.2 X 38.1	3.375	85.73	3.625	92.08
3 X 2	76.2 X 50.8	3.375	85.73	3.625	92.08
3 X 2-1/2	76.2 X 63.5	3.375	85.73	3.625	92.08
4 X 1/2	101.6 X 12.7	4.125	104.78	4.125	104.78
4 X 3/4	101.6 X 19.0	4.125	104.78	4.125	104.78
4 X 1	101.6 X 25.4	4.125	104.78	4.125	104.78
4 X 1-1/2	101.6 X 38.1	4.125	104.78	4.125	104.78
4 X 2	101.6 X 50.8	4.125	104.78	4.375	111.13
4 X 2-1/2	101.6 X 63.5	4.125	104.78	4.375	111.13
4 X 3	101.6 X 76.2	4.125	104.78	4.375	111.13

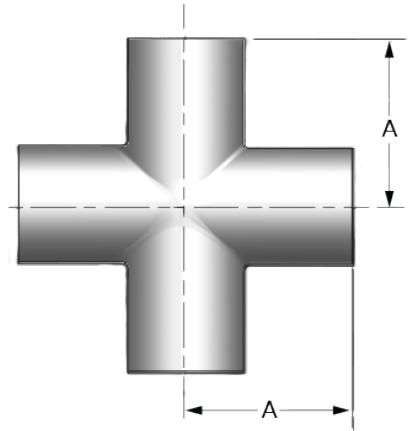


CROSSES

BUTT WELD CROSS | B9WWW-SIZE-MATERIAL-FINISH

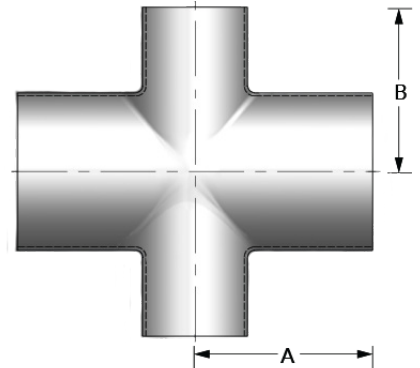
NOMINAL SIZE		A	
IN	MM	IN	MM
1/2	12.7	1.875	47.63
3/4	19.0	2.000	50.80
1	25.4	2.125	53.98
1-1/2	38.1	2.375	60.33
2	50.8	2.875	73.03
2-1/2	63.5	3.125	79.38
3	76.2	3.375	85.73
4	101.6	4.125	104.78

2019 BPE DT-4.1.2-1 | 2009 BPE DT-9



BUTT WELD REDUCING CROSS | B9RWWW-SIZE-MATERIAL-FINISH

NOMINAL SIZE		A		B	
IN	MM	IN	MM	IN	MM
3/4 X 1/2	19.0 X 12.7	2.000	50.80	1.875	47.63
1 X 1/2	25.4 X 12.7	2.125	53.98	1.875	47.63
1 X 3/4	25.4 X 19.0	2.125	53.98	2.000	50.80
1-1/2 X 1/2	38.1 X 12.7	2.375	60.33	1.875	47.63
1-1/2 X 3/4	38.1 X 19.0	2.375	60.33	2.000	50.80
1-1/2 X 1	38.1 X 25.4	2.375	60.33	2.125	53.98
2 X 1/2	50.8 X 12.7	2.875	73.03	1.875	47.63
2 X 3/4	50.8 X 19.0	2.875	73.03	2.000	50.80
2 X 1	50.8 X 25.4	2.875	73.03	2.125	53.98
2 X 1-1/2	50.8 X 38.1	2.875	73.03	2.375	60.33
2-1/2 X 1	63.5 X 25.4	3.125	79.38	2.125	53.98
2-1/2 X 1-1/2	63.5 X 38.1	3.125	79.38	2.375	60.33
2-1/2 X 2	63.5 X 50.8	3.125	79.38	2.875	73.03
3 X 1	76.2 X 25.4	3.375	85.73	2.125	53.98
3 X 1-1/2	76.2 X 38.1	3.375	85.73	2.375	60.33
3 X 2	76.2 X 50.8	3.375	85.73	2.875	73.03
3 X 2-1/2	76.2 X 63.5	3.375	85.73	3.125	79.38
4 X 1-1/2	101.6 X 38.1	4.125	104.78	2.375	60.33
4 X 2	101.6 X 50.8	4.125	104.78	2.875	73.03
4 X 2-1/2	101.6 X 63.5	4.125	104.78	3.125	79.38
4 X 3	101.6 X 76.2	4.125	104.78	3.375	85.73

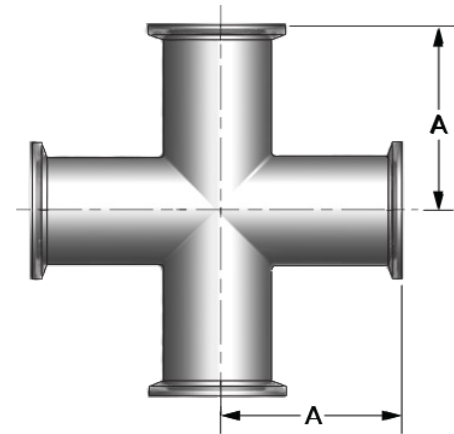


CROSSES

TRI-CLAMP CROSS | B9MP-SIZE-MATERIAL-FINISH

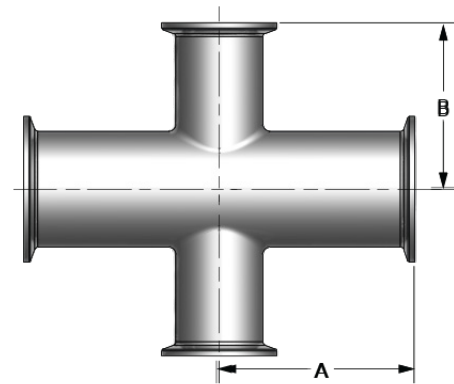
NOMINAL SIZE		A	
IN	MM	IN	MM
1/2	12.7	2.375	60.33
3/4	19.0	2.500	63.50
1	25.4	2.625	66.68
1-1/2	38.1	2.875	73.03
2	50.8	3.375	85.73
2-1/2	63.5	3.625	92.08
3	76.2	3.875	98.43
4	101.6	4.750	120.65

2019 BPE DT-4.1.2-4 | 2009 BPE DT-18



TRI-CLAMP® REDUCING CROSS | B9RMP-SIZE-MATERIAL-FINISH

NOMINAL SIZE		A		B	
IN	MM	IN	MM	IN	MM
3/4 X 1/2	19.0 X 12.7	2.500	63.50	2.375	60.33
1 X 1/2	25.4 X 12.7	2.625	66.68	2.375	60.33
1 X 3/4	25.4 X 19.0	2.625	66.68	2.500	63.50
1-1/2 X 1/2	38.1 X 12.7	2.875	73.03	2.375	60.33
1-1/2 X 3/4	38.1 X 19.0	2.875	73.03	2.500	63.50
1-1/2 X 1	38.1 X 25.4	2.875	73.03	2.625	66.68
2 X 1/2	50.8 X 12.7	3.375	85.73	2.375	60.33
2 X 3/4	50.8 X 19.0	3.375	85.73	2.500	63.50
2 X 1	50.8 X 25.4	3.375	85.73	2.625	66.68
2 X 1-1/2	50.8 X 38.1	3.375	85.73	2.875	73.03
2-1/2 X 1	63.5 X 25.4	3.625	92.08	2.625	66.68
2-1/2 X 1-1/2	63.5 X 38.1	3.625	92.08	2.875	73.03
2-1/2 X 2	63.5 X 50.8	3.625	92.08	3.375	85.73
3 X 1	76.2 X 25.4	3.875	98.43	2.625	66.68
3 X 1-1/2	76.2 X 38.1	3.875	98.43	2.875	73.03
3 X 2	76.2 X 50.8	3.875	98.43	3.375	85.725
3 X 2-1/2	76.2 X 63.5	3.875	98.43	3.625	92.08
4 X 1	101.6 X 25.4	4.750	120.65	2.625	66.68
4 X 1-1/2	101.6 X 38.1	4.750	120.65	2.875	73.03
4 X 2	101.6 X 50.8	4.750	120.65	3.375	85.73
4 X 2-1/2	101.6 X 63.5	4.750	120.65	3.625	92.08
4 X 3	101.6 X 76.2	4.750	120.65	3.875	98.43

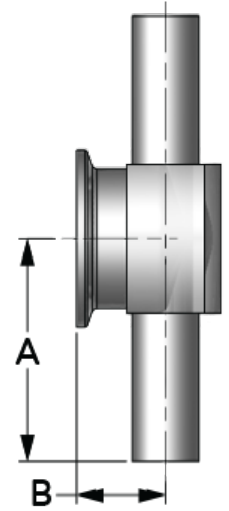


INSTRUMENT TEES

BUTT WELD INSTRUMENT TEE | B7IWWMS-SIZE-MATERIAL-FINISH

NOMINAL SIZE		A		B	
IN	MM	IN	MM	IN	MM
1/2 X 1-1/2	12.7 X 38.1	2.500	63.50	0.875	22.23
1/2 X 2	12.7 X 50.8	2.750	69.85	1.000	25.40
3/4 X 1-1/2	19.0 X 38.1	2.500	63.50	1.000	25.40
3/4 X 2	19.0 X 50.8	2.750	69.85	1.125	28.58
1 X 1-1/2	25.4 X 38.1	2.500	63.50	1.125	28.58
1 X 2	25.4 X 50.8	2.750	69.85	1.250	31.75
1-1/2 X 2	38.1 X 50.8	2.750	69.85	1.500	38.10

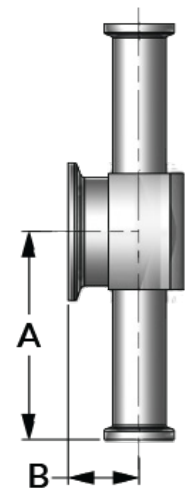
2019 BPE DT-4.1.2-10 | 2009 BPE DT-28



TRI-CLAMP INSTRUMENT TEE | B7IMPS-SIZE-MATERIAL-FINISH

NOMINAL SIZE		A		B	
IN	MM	IN	MM	IN	MM
1/2 X 1-1/2	12.7 X 38.1	3.000	76.20	0.875	22.23
1/2 X 2	12.7 X 50.8	3.250	82.55	1.000	25.40
3/4 X 1-1/2	19.0 X 38.1	3.000	76.20	1.000	25.40
3/4 X 2	19.0 X 50.8	3.250	82.55	1.125	28.58
1 X 1-1/2	25.4 X 38.1	3.000	76.20	1.125	28.58
1 X 2	25.4 X 50.8	3.250	82.55	1.250	31.75
1-1/2 X 2	38.1 X 50.8	3.250	82.55	1.500	38.10

2019 BPE DT-4.1.2-11 | 2009 BPE DT-29



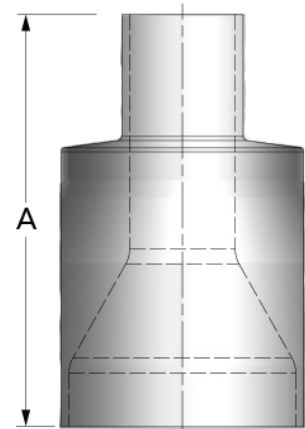
REDUCERS

BUTT WELD CONCENTRIC REDUCER | **C31-SIZE-MATERIAL-FINISH**

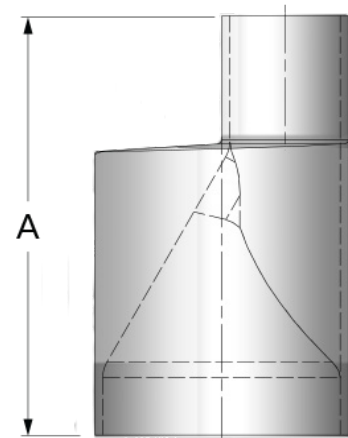
BUTT WELD ECCENTRIC REDUCER | **C32-SIZE-MATERIAL-FINISH**

NOMINAL SIZE		A	
IN	MM	IN	MM
3/4 X 1/2	19.05 X 12.7	2.125	53.98
1 X 1/2	25.4 X 12.7	2.500	63.50
1 X 3/4	25.4 X 19.0	2.125	53.98
1-1/2 X 3/4	38.1 X 19.0	3.000	76.20
1-1/2 X 1	38.1 X 25.4	2.500	63.50
2 X 1	50.8 X 25.4	3.375	85.73
2 X 1-1/2	50.8 X 38.1	2.500	63.50
2-1/2 X 1-1/2	63.5 X 38.1	3.375	85.73
2-1/2 X 2	63.5 X 50.8	2.500	63.50
3 X 1-1/2	76.2 X 38.1	4.250	107.95
3 X 2	76.2 X 50.8	3.375	85.73
3 X 2-1/2	76.2 X 63.5	2.625	66.68
4 X 2	101.6 X 50.8	5.125	130.18
4 X 2-1/2	101.6 X 63.5	4.250	107.95
4 X 3	101.6 X 76.2	3.875	98.43

2019 BPE DT-4.1.3-1



C31

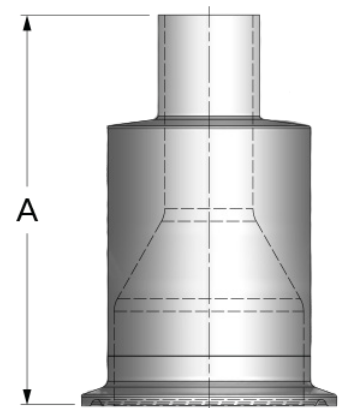


C32

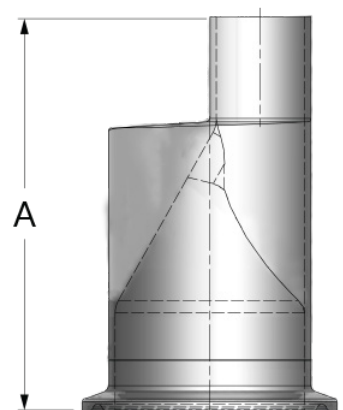
TRI-CLAMP X BUTT WELD CONCENTRIC REDUCER | C31M-SIZE-MATERIAL-FINISH
 TRI-CLAMP X BUTT WELD ECCENTRIC REDUCER | C32M-SIZE-MATERIAL-FINISH

NOMINAL SIZE		A	
IN	MM	IN	MM
3/4 X 1/2	19.05 X 12.7	2.625	66.68
1 X 1/2	25.4 X 12.7	3.000	76.20
1 X 3/4	25.4 X 19.0	2.625	66.68
1-1/2 X 3/4	38.1 X 12.7	3.500	88.90
1-1/2 X 1	38.1 X 25.4	3.000	76.20
2 X 1	50.8 X 25.4	3.875	98.43
2 X 1-1/2	50.8 X 38.1	3.000	76.20
2-1/2 X 1-1/2	63.5 X 38.1	3.875	98.43
2-1/2 X 2	63.5 X 50.8	3.000	76.20
3 X 1-1/2	76.2 X 38.1	4.750	120.65
3 X 2	76.2 X 50.8	3.875	98.43
3 X 2-1/2	76.2 X 63.5	3.125	79.38
4 X 2	101.6 X 50.8	5.750	146.05
4 X 2-1/2	101.6 X 63.5	4.875	123.83
4 X 3	101.6 X 76.2	4.500	114.30

2019 BPE DT-4.1.3-2



C31M



C32M

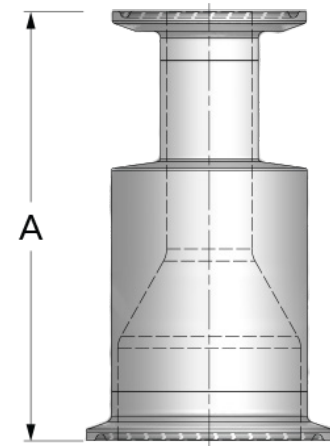
REDUCERS

TRI-CLAMP CONCENTRIC REDUCER | **C31-14MP-SIZE-MATERIAL-FINISH**

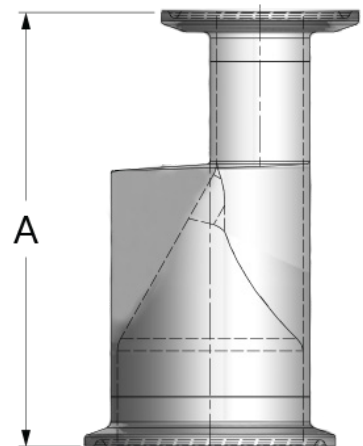
TRI-CLAMP ECCENTRIC REDUCER | **C32-14MP-SIZE-MATERIAL-FINISH**

NOMINAL SIZE		A	
IN	MM	IN	MM
3/4 X 1/2	19.0 X 12.7	3.125	79.38
1 X 1/2	25.4 X 12.7	3.500	88.90
1 X 3/4	25.4 X 19.0	3.125	79.38
1-1/2 X 1/2	38.1 X 12.7	3.500	88.90
1-1/2 X 3/4	38.1X 19.0	4.000	101.60
1-1/2 X 1	38.1 X 25.4	3.500	88.90
2 X 1	50.8 X 25.4	4.375	111.13
2 X 1-1/2	50.8 X 38.1	3.500	88.90
2-1/2 X 1-1/2	63.5 X 38.1	4.375	111.13
2-1/2 X 2	63.5 X 50.8	3.500	88.90
3 X 1-1/2	76.2 X 38.1	5.250	133.35
3 X 2	76.2 X 50.8	4.375	111.13
3 X 2-1/2	76.2 X 63.5	3.625	92.08
4 X 2	101.6 X 50.8	6.250	158.75
4 X 2-1/2	101.6 X 63.5	5.375	136.53
4 X 3	101.6 X 76.2	5.000	127.00

2019 BPE DT-4.1.3-3



C31-14MP



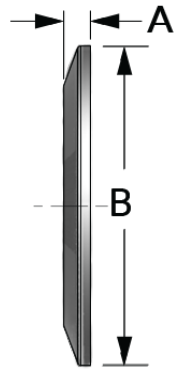
C32-14MP

END CAPS

TRI-CLAMP SOLID END CAP | 16AMP-SIZE-MATERIAL-FINISH

NOMINAL SIZE		A		B	
IN	MM	IN	MM	IN	MM
1/2	12.7	0.187	4.75	0.980	24.90
3/4	19.0	0.187	4.75	0.980	24.90
1	25.4	0.250	6.35	1.984	50.40
1-1/2	38.1	0.250	6.35	1.984	50.40
2	50.8	0.250	6.35	2.516	63.90
2-1/2	63.5	0.250	6.35	3.047	77.40
3	76.2	0.250	6.35	3.579	90.00
4	101.6	0.312	7.92	4.682	119.10

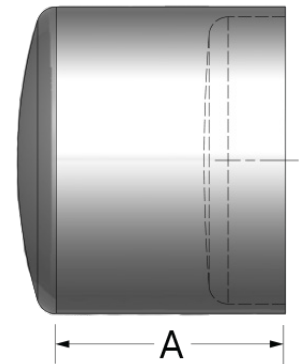
2019 BPE DT-4.1.5-2 | 2009 BPE DT-31



BUTT WELD END CAP | B16W-SIZE-MATERIAL-FINISH

NOMINAL SIZE		A	
IN	MM	IN	MM
1/2	12.7	1.500	38.10
3/4	19.0	1.500	38.10
1	25.4	1.500	38.10
1-1/2	38.1	1.500	38.10
2	50.8	1.500	38.10
2-1/2	63.5	1.500	38.10
3	76.2	1.750	44.45
4	101.6	2.000	50.80

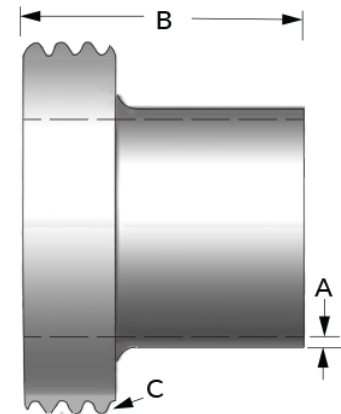
2019 BPE DT-4.1.5-1 | 2009 BPE DT-30



ADDITIONAL FITTINGS

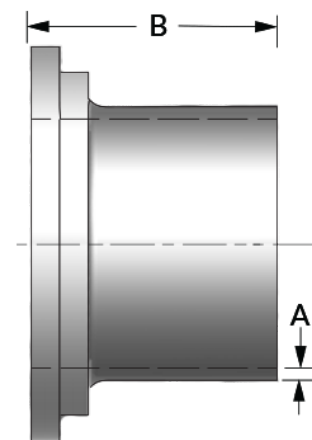
SMS MALE PART (THREADED)

CSI PART #	NOMINAL SIZE		A		B		C
	IN	MM	IN	MM	IN	MM	
CS000124	1	25.4	0.065	1.65	1.590	40.39	RD 40 X 1/6
CS00944	1-1/2	38.1	0.065	1.65	1.780	45.21	RD 60 X 1/6
CS00945	2	50.8	0.065	1.65	1.780	45.21	RD 70 X 1/6
CS000970	2-1/2	63.5	0.065	1.65	2.190	55.63	RD 85 X 1/6
CS00946	3	76.2	0.065	1.65	2.190	55.63	RD 98 X 1/6
CS000160	4	101.6	0.083	2.11	2.190	55.63	RD 132 X 1/6



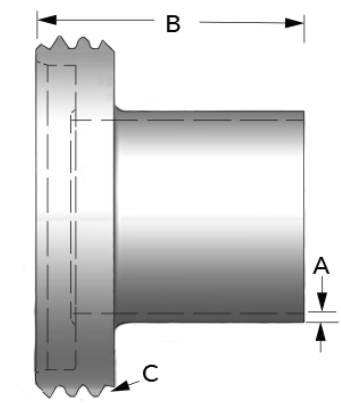
SMS WELD LINER

CSI PART #	NOMINAL SIZE		A		B	
	IN	MM	IN	MM	IN	MM
CS000161	1	25.4	0.065	1.65	1.290	32.77
CS00941	1-1/2	38.1	0.065	1.65	1.350	34.29
CS00942	2	50.8	0.065	1.65	1.350	34.29
CS00969	2-1/2	63.5	0.065	1.65	1.680	42.42
CS00943	3	76.2	0.065	1.65	1.680	42.42
CS000162	4	101.6	0.083	2.11	1.750	44.45



ASEPTIC MALE PART DIN 11864-1 FORM A SERIES C

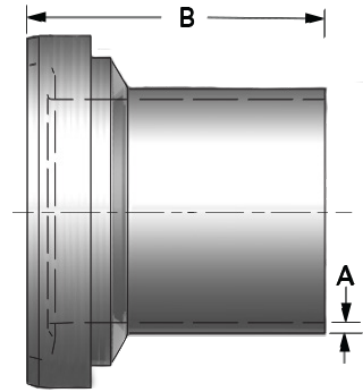
CSI PART #	NOMINAL SIZE		A		B		C
	IN	MM	IN	MM	IN	MM	
CS000813	1/2	12.7	0.065	1.65	1.614	41.00	RD 28 X 1/8
CS000814	3/4	19.0	0.065	1.65	1.614	41.00	RD 34 X 1/8
CS000119	1	25.4	0.065	1.65	1.693	43.00	RD 52 X 1/6
CS00979	1-1/2	38.1	0.065	1.65	1.909	48.50	RD 65 X 1/6
CS00955	2	50.8	0.065	1.65	1.909	48.50	RD 78 X 1/6
CS00956	2-1/2	63.5	0.065	1.65	2.362	60.00	RD 95 X 1/6
CS00957	3	76.2	0.065	1.65	2.520	64.00	RD 110 X 1/4
CS000121	4	101.6	0.083	2.11	2.520	64.00	RD 130 X 1/4



Note: DIN 11864-2 (flange) and 11864-3 (clamp) available upon request

ASEPTIC WELD LINER DIN 11864-1 FORM A SERIES C

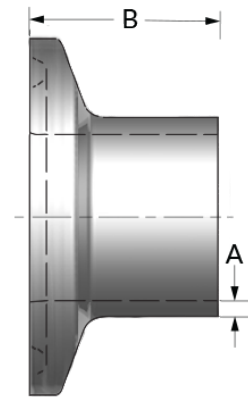
CSI PART #	NOMINAL SIZE		A		B	
	IN	MM	IN	MM	IN	MM
CS000815	1/2	12.7	0.065	1.65	1.535	39.00
CS000816	3/4	19.0	0.065	1.65	1.535	39.00
CS000122	1	25.4	0.065	1.65	1.575	40.00
CS00980	1-1/2	38.1	0.065	1.65	1.831	46.50
CS00958	2	50.8	0.065	1.65	1.870	47.50
CS00959	2-1/2	63.5	0.065	1.65	2.480	63.00
CS00960	3	76.2	0.065	1.65	2.402	61.00
CS000123	4	101.6	0.083	2.11	2.560	65.00



Note: DIN 11864-2 (flange) and 11864-3 (clamp) available upon request

CLAMP FERRULE DIN 32676 SERIES A

CSI PART #	NOMINAL SIZE	A		B	
	DN	IN	MM	IN	MM
CS00881	DN10	0.059	1.50	0.709	18.00
CS00925	DN15	0.059	1.50	0.709	18.00
CS00882	DN25	0.059	1.50	0.846	21.50
CS00883	DN40	0.059	1.50	0.846	21.50
CS00884	DN50	0.059	1.50	0.846	21.50
CS00885	DN65	0.079	2.01	1.102	28.00
CS00886	DN80	0.079	2.01	1.102	28.00
CS00887	DN100	0.079	2.01	1.102	28.00



Note: DIN 32676 Series B and Series C available upon request

ADDITIONAL FITTINGS

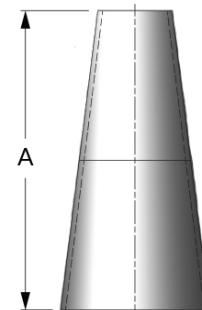
BUTT WELD END CAP | 16W-SIZE-MATERIAL-FINISH

NOMINAL SIZE		A	
IN	MM	IN	MM
1/2	12.7	0.252	6.40
3/4	19.0	0.312	7.92
1	25.4	0.375	9.53
1-1/2	38.1	0.418	10.62
2	50.8	0.750	19.05
2-1/2	63.5	1.000	25.40
3	76.2	1.250	31.75
4	101.6	1.149	29.18

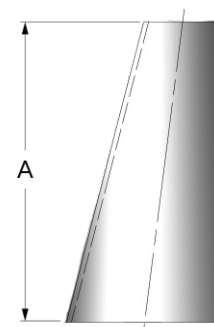


CONCENTRIC BUTT WELD REDUCER | 31W-SIZE-MATERIAL-FINISH ECCENTRIC BUTT WELD REDUCER | 32W-SIZE-MATERIAL-FINISH

NOMINAL SIZE		A	
IN	MM	IN	MM
3/4 X 1/2	19.0 X 12.7	1.000	25.40
1 X 1/2	25.4 X 12.7	1.500	38.10
1 X 3/4	25.4 X 19.0	1.000	25.40
1-1/2 X 1/2	38.1 X 12.7	2.500	63.50
1-1/2 X 3/4	38.1 X 19.0	2.000	50.80
1-1/2 X 1	38.1 X 25.4	2.007	50.98
2 X 3/4	50.8 X 19.0	5.000	127.00
2 X 1	50.8 X 25.4	4.000	101.60
2 X 1-1/2	50.8 X 38.1	2.000	50.80
2-1/2 X 1	63.5 X 25.4	6.000	152.40
2-1/2 X 1-1/2	63.5 X 38.1	4.000	101.60
2-1/2 X 2	63.5 X 50.8	2.000	50.80
3 X 1	76.2 X 25.4	8.000	203.20
3 X 1-1/2	76.2 X 38.1	6.000	152.40
3 X 2	76.2 X 50.8	4.014	101.96
3 X 2-1/2	76.2 X 63.5	2.007	50.98
4 X 1-1/2	101.6 X 38.1	10.000	254.00
4 X 2	101.6 X 50.8	8.000	203.20
4 X 2-1/2	101.6 X 63.5	6.000	152.40
4 X 3	101.6 X 76.2	4.000	101.60



31W



32W

FLANGE X TRI-CLAMP ADAPTER | 38MP-SIZE-MATERIAL-FINISH

NOMINAL SIZE		A		# OF BOLT HOLES
IN	MM	IN	MM	
1/2	12.7	1.625	41.28	4
3/4	19.0	1.688	42.88	4
1	25.4	1.750	44.45	4
1-1/2	38.1	1.875	47.63	4
2	50.8	1.938	49.23	4
2-1/2	63.5	2.063	52.40	4
3	76.2	2.125	53.98	4
4	101.6	2.125	53.98	8

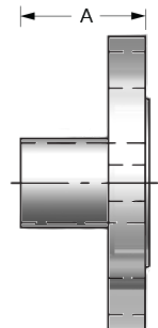
Note: Flange dimensions conform to ANSI 16.5, Class 150.



FLANGE X BUTT WELD ADAPTER | 38BW-SIZE-MATERIAL-FINISH

NOMINAL SIZE		A		# OF BOLT HOLES
IN	MM	IN	MM	
1/2	12.7	2.000	50.80	4
3/4	19.0	2.063	52.40	4
1	25.4	2.125	53.98	4
1-1/2	38.1	2.250	57.15	4
2	50.8	2.313	58.75	4
2-1/2	63.5	2.438	61.93	4
3	76.2	2.750	69.85	4
4	101.6	3.000	76.20	8

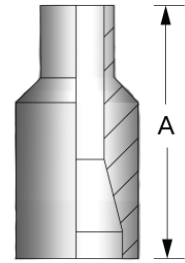
Note: Flange dimensions conform to ANSI 16.5, Class 150.



ADDITIONAL FITTINGS

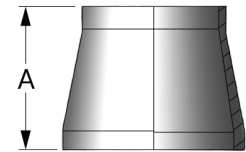
BUTT WELD PIPE ADAPTER | SW31S(PPIPE SIZE)PX(TUBE SIZE)T-MATERIAL

NOMINAL SIZE		TUBE WALL THICKNESS		SCH 10 PIPE WALL THICKNESS		PIPE OD		LENGTH A	
IN	MM	IN	MM	IN	MM	IN	MM	IN	MM
1/2	12.7	0.065	1.65	0.083	2.11	0.840	21.34	1.750	44.45
3/4	19.0	0.065	1.65	0.083	2.11	1.050	26.67	1.750	44.45



BUTT WELD PIPE ADAPTER | SW31S(PPIPE SIZE)PX(TUBE SIZE)T-MATERIAL

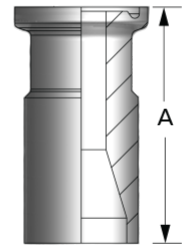
NOMINAL SIZE		TUBE WALL THICKNESS		SCH 10 PIPE WALL THICKNESS		PIPE OD		LENGTH A	
IN	MM	IN	MM	IN	MM	IN	MM	IN	MM
1	25.4	0.065	1.65	0.109	2.77	1.315	33.40	1.500	38.10
1-1/2	38.1	0.065	1.65	0.109	2.77	1.900	48.26	1.500	38.10
2	50.8	0.065	1.65	0.109	2.77	2.375	60.33	1.500	38.10
2-1/2	63.5	0.065	1.65	0.120	3.05	2.875	73.03	1.500	38.10
3	76.2	0.065	1.65	0.120	3.05	3.500	88.90	2.500	63.50
4	101.6	0.083	2.11	0.120	3.05	4.500	114.30	2.500	63.50



BUTT WELD X TRI-CLAMP PIPE ADAPTER | 14MPWS(PIPE SIZE)P-MATERIAL

NOMINAL SIZE		PIPE SCH 10 WALL THICKNESS		PIPE OD		LENGTH A	
IN	MM	IN	MM	IN	MM	IN	MM
1/2	12.7	0.083	2.11	0.840	21.34	1.750	44.45
3/4	19.0	0.083	2.11	1.050	26.67	1.750	44.45

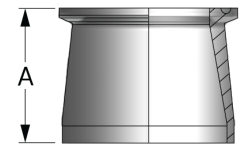
Note: Surface finish is in the "as machined" condition, typically less than 32Ra.



BUTT WELD X TRI-CLAMP PIPE ADAPTER | 14MPWS(PIPE SIZE)P-MATERIAL

NOMINAL SIZE		PIPE SCH 10 WALL THICKNESS		PIPE OD		LENGTH A	
IN	MM	IN	MM	IN	MM	IN	MM
1	25.4	0.109	2.77	1.315	33.40	1.500	38.10
1-1/2	38.1	0.109	2.77	1.900	48.26	1.500	38.10
2	50.8	0.109	2.77	2.375	60.33	1.500	38.10
2-1/2	63.5	0.120	3.05	2.875	73.03	1.500	38.10
3	76.2	0.120	3.05	3.500	88.90	1.500	38.10
4	101.6	0.120	3.05	4.500	114.30	1.500	38.10

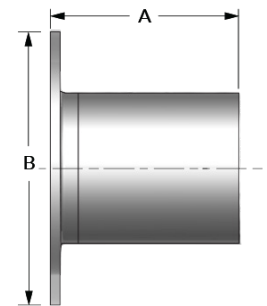
Note: Surface finish is in the "as machined" condition, typically less than 32Ra.



STUB END | 14VB-SIZE-MATERIAL-FINISH

NOMINAL SIZE		A		B	
IN	MM	IN	MM	IN	MM
1/2	12.7	2.000	50.80	1.375	34.93
3/4	19.0	2.000	50.80	1.687	42.85
1	25.4	2.000	50.80	2.000	50.80
1-1/2	38.1	2.000	50.80	2.875	73.02
2	50.8	2.500	63.50	3.625	92.07
2-1/2	63.5	2.500	63.50	4.125	104.77
3	76.2	2.500	63.50	5.000	127.00
4	101.6	2.500	63.50	6.188	157.17

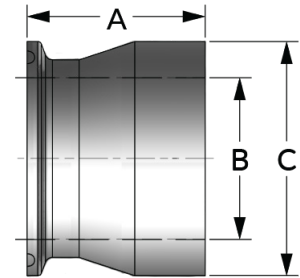
Note: Used with 38SL backup flange



ADDITIONAL FITTINGS

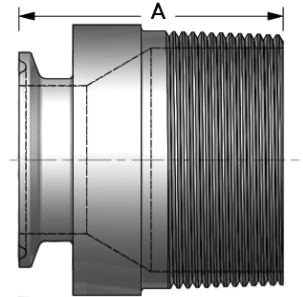
TRI-CLAMP FERRULE, EXTRA HEAVY WALL | 14MPWH(SIZE)(OAL)-MATERIAL

NOMINAL SIZE		A		B		C	
IN	MM	IN	MM	IN	MM	IN	MM
1/2	12.7	1.750	44.50	0.370	9.40	0.984	24.99
3/4	19.0	1.750	44.50	0.620	15.70	0.984	24.99
1	25.4	2.500	63.50	0.870	22.00	1.984	50.39
1	25.4	4.000	101.60	0.870	22.00	1.984	50.39
1-1/2	38.1	2.500	63.50	1.370	34.80	1.984	50.39
1-1/2	38.1	3.000	76.20	1.370	34.80	1.984	50.39
1-1/2	38.1	3.250	82.50	1.370	34.80	1.984	50.39
1-1/2	38.1	4.000	101.60	1.370	34.80	1.984	50.39
2	50.8	2.500	63.50	1.870	47.50	2.516	63.91
2	50.8	3.000	76.20	1.870	47.50	2.516	63.91
2	50.8	3.250	82.50	1.870	47.50	2.516	63.91
2-1/2	63.5	3.000	76.20	2.370	60.20	3.047	77.39
3	76.2	2.000	50.80	2.870	72.90	3.579	90.91
3	76.2	3.000	76.20	2.870	72.90	3.579	90.91
3	76.2	3.750	95.30	2.870	72.90	3.579	90.91
3	76.2	4.000	101.60	2.870	72.90	3.579	90.91
3	76.2	6.000	152.40	2.870	72.90	3.579	90.91
4	101.6	2.500	63.50	3.834	97.40	4.682	118.92
4	101.6	3.000	76.20	3.834	97.40	4.682	118.92
4	101.6	3.500	88.90	3.834	97.40	4.682	118.92
4	101.6	4.000	101.60	3.834	97.40	4.682	118.92



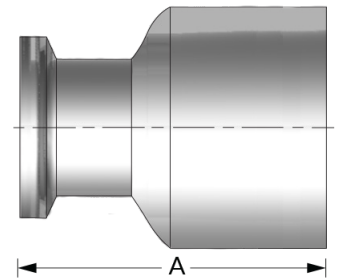
TRI-CLAMP X MALE PIPE THREAD ADAPTER | 21MP-SIZE-MATERIAL-FINISH

NOMINAL SIZE		A	
IN	MM	IN	MM
1/2	12.7	2.000	50.80
3/4	19.0	2.000	50.80
1	25.4	2.250	57.15
1-1/2	38.1	2.440	61.98
2	50.8	2.660	67.56
2-1/2	63.5	3.280	83.31
3	76.2	3.500	88.90
4	101.6	3.810	96.78



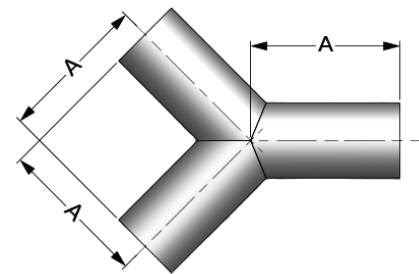
TRI-CLAMP X FEMALE PIPE THREAD ADAPTER | 22MP-SIZE-MATERIAL-FINISH

NOMINAL SIZE		A	
IN	MM	IN	MM
1/2	12.7	1.500	38.10
3/4	19.0	1.625	41.27
1	25.4	1.630	41.40
1-1/2	38.1	2.250	57.15
2	50.8	2.000	50.80
2-1/2	63.5	2.060	52.32
3	76.2	2.880	73.15
4	101.6	2.620	66.55



BUTT WELD TRUE Y | 28BW-SIZE-MATERIAL-FINISH

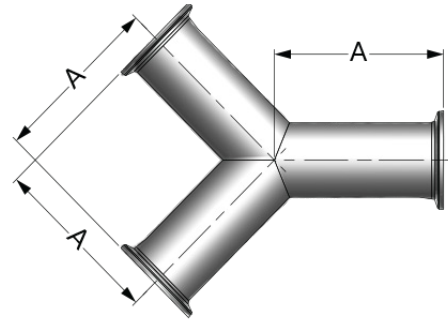
NOMINAL SIZE		A	
IN	MM	IN	MM
3/4	19.0	2.250	57.15
1	25.4	2.000	50.80
1-1/2	38.1	3.000	76.20
2	50.8	4.000	101.60
2-1/2	63.5	4.500	114.30
3	76.2	5.000	127.00
4	101.6	7.000	177.80



ADDITIONAL FITTINGS

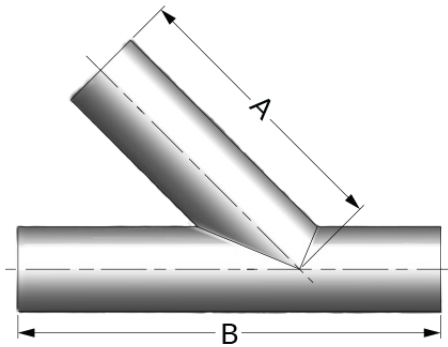
TRI-CLAMP TRUE Y | 28BMP-SIZE-MATERIAL-FINISH

NOMINAL SIZE		A	
IN	MM	IN	MM
3/4	19.0	2.750	69.85
1	25.4	2.500	63.50
1-1/2	38.1	3.500	88.90
2	50.8	4.500	114.30
2-1/2	63.5	5.000	127.00
3	76.2	5.500	139.70
4	101.6	7.630	193.70



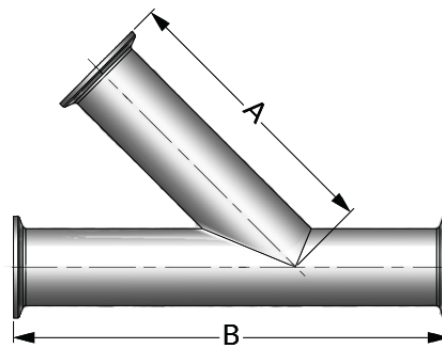
BUTT WELD LATERAL | 28WA-SIZE-MATERIAL-FINISH

NOMINAL SIZE		A		B	
IN	MM	IN	MM	IN	MM
1	25.4	5.000	127.00	7.500	190.50
1-1/2	38.1	5.000	127.00	7.500	190.50
2	50.8	6.000	152.40	9.000	228.60
2.5	63.5	6.500	165.10	9.750	247.70
3	76.2	7.000	177.80	10.500	266.70
4	101.6	9.000	228.60	13.500	342.90



TRI-CLAMP LATERAL | 28AMP-SIZE-MATERIAL-FINISH

NOMINAL SIZE		A		B	
IN	MM	IN	MM	IN	MM
1	25.4	5.500	139.70	8.500	215.90
1-1/2	38.1	5.500	139.70	8.500	215.90
2	50.8	6.500	165.10	10.000	254.00
2-1/2	63.5	7.000	177.80	10.750	273.05
3	76.2	7.500	190.50	11.500	292.10
4	101.6	9.625	244.50	14.750	374.70



AL-6XN[®] GENERAL WELDING RECOMMENDATIONS

AL-6XN alloy is easy to weld using similar parameters as Type 316L stainless steel, including travel speed (IPM) and weld current. It is common to use a weld insert ring for additional alloying when orbital or manual welding in the field.

USE WELD INSERT RINGS

When using weld insert rings for orbital or manual welding, never use filler wire in place of weld insert rings for sanitary tubing. Welding techniques that apply filler wire to the weld face risk the possibility of insufficient alloying in the weld root.

The alloy of the insert ring must have a higher molybdenum content than the AL-6XN to compensate for alloy dilution on cooling. Typically, Alloy C-22 (13% Mo) is used. If Alloy C-22 is not available, Alloy 625 (9% Mo) or Alloy C-276 (15% Mo) may be substituted. CSI stocks C-22 weld insert rings.

PLACE THE WELD INSERT RING AND FUSION WELD

The weld insert ring should be placed between the two sections and fusion-welded as usual. The weld current must be increased slightly to compensate for increased thickness due to the insert ring.

USE INERT GAS FOR WELD COVER AND BACKING

Inert gases such as helium may be used, although argon is more common. In some applications, the addition of 3-5% nitrogen to shielding gas can help compensate for the loss of nitrogen during welding.

REMOVE HEAT TINTS

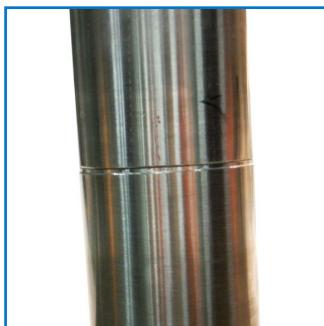
The weld heat-affected zone (HAZ) should be no darker than a light straw color. A color-free silver weld and heat-affected zone are best. Any darker weld heat tints must be removed before placing in service. Dark blue and black heat tints are the most susceptible to corrosion. Remove these tints by using abrasives followed by acid cleaning or passivation. A poorly cleaned surface may be just as susceptible to corrosion attacks as the original heat tint.

NOTE: When the temperature of the metal is below the dew point, allow it to warm above the condensation temperature to prevent moisture condensate on the surface, which can cause heat tint.

WELD INSERT RINGS



RING WELDED BETWEEN SECTIONS



ORBITAL WELD



HEAT TINTS REMOVED



WELDING AL-6XN®

WELDING PROCEDURES (WITH FILLER)

When welding AL-6XN, metallurgical changes occur in the weld pool that must be considered when developing welding procedures. For most installations of AL-6XN piping systems, the process of post-weld annealing is not feasible. The practice of adding an alloy filler, called over-alloying the weld, is required to improve the corrosion resistance of these welds.

Over-alloying replenishes elements in the weld pool that have previously segregated during the melting and re-solidification process. The as-solidified weld has dendrite cores that are depleted of chromium and molybdenum. These elements are essential in the material's ability to resist localized corrosion attacks. To compensate for the depleted elements, filler metals with high molybdenum content are needed to increase the molybdenum to levels above 6%.

CSI evaluated several alloys that could assist in the addition of molybdenum to the weld pool. We found that the 13% molybdenum content of Hastelloy C-22 worked well for over-alloying welds in AL-6XN.



AUTOGENOUS WELDING PROCEDURES (WITHOUT FILLER)

The as-solidified weld of autogenous welding has dendrite cores that are depleted of chromium and molybdenum. These regions of the weld are more susceptible to localized corrosion; consequently, autogenous welding can be used with the following precautions:

- Post-weld heat treatment is required. Anneal temperature above 2150°F (1180°C) followed by rapid cooling in a controlled atmosphere.
- The heat treatment duration for annealing must be sufficient to re-homogenize the weld segregation.
- Using mixed gases with a nitrogen volume of 3-5% for weld shielding can help improve properties of corrosion resistance.
- The ASTM G48-C critical pitting temperature test may be used to assess the quality of autogenously welded and annealed AL-6XN.

In the event that neither over-alloying nor heat treatment of the weld occurs, the exposure conditions must be carefully reviewed to determine if autogenous welds are satisfactory. Autogenous AL-6XN welds are more resistant to corrosion than similar welds in types 316L, 317L, and 904L.



WELD APPEARANCE

Weld appearance can be somewhat misleading when visually compared to hygienic welds made in 316L stainless steel. A typical AL-6XN weld has non-uniform freeze lines and oxide islands in the weld bead. These oxide islands appear as a thin film, having a varying color with tints from gray to dark brown that adhere to the surface. The appearance of “light” and “dark” spots on both the inside and the outside of the weld is typical. The heat-affected zone (HAZ) can also have discoloration and is generally a little darker than conventional 316L welds.

ACCEPTABLE WELD MADE IN AL-6XN ELECTROPOLISHED TUBING



ACCEPTABLE WELD MADE IN AL-6XN MECHANICALLY POLISHED TUBING



WELDING HASTELLOY® C-22®

GENERAL WELDING RECOMMENDATIONS

Welding Hastelloy C-22 in many ways is similar to traditional 316L material. There are no special welding requirements or concerns, given that proper techniques and procedures are followed. The GTAW process is the most common method and can be done manually or automatically with orbital welding equipment.

Orbital welding parameters for Hastelloy C-22 are also similar to those for welding 316L. Weld schedules for a given size are comparable in weld current inputs, pulsing, travel speeds (IPM), and gas shielding of weld pool for both cover and backing.

WELDING HASTELLOY C-22

Any modern welding power supply with adequate output and controls can be used for common fusion welding. Generally, weld heat input is controlled in the low to moderate range.

Nickel-based alloys generally exhibit sluggish welding and shallow penetration characteristics; therefore, the possibility of incomplete fusion increases. Care must be used to ensure a sound weld. If orbital or automatic welding equipment is used, programs should utilize a pulsed current. Pulsed current inputs can help control weld penetration without excessive heat input. Pulsing also helps control the weld pool, improving the uniformity of weld bead appearance.

Cleanliness is critical when welding nickel-based alloys. Contamination by grease, oil, lead, sulfur, or other low-melting-point elements can lead to severe cracking problems. The welding surface and adjacent areas should be cleaned thoroughly with an appropriate solvent, such as 99.9% isopropanol (IPA). Prior to welding, all foreign matter such as lubricates, cutting chips, burrs, and crayon markings should be removed.

POST-WELD ANNEALING

In the majority of corrosive environments, C-22 products are used in as-welded condition. Post-weld heat treatment such as full solution annealing or stress relief annealing is usually not required.

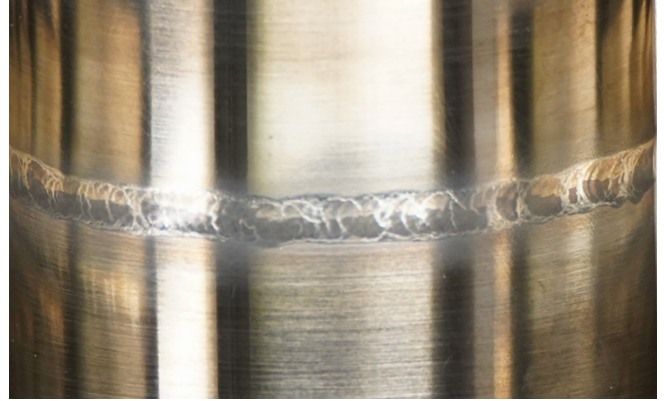
WELDING TO DISSIMILAR METALS

Orbital welding C-22 to other alloys such as AL-6XN or 316L can be done autogenously; however, performance expectations in corrosive environments should be kept low. Welding procedure development and mechanical testing should follow the requirements set by the applicable code or standard. Additional test methods should also be considered when evaluating corrosion. It is advisable to consult a metallurgist with corrosion experience to assess the service requirements for the specified application.

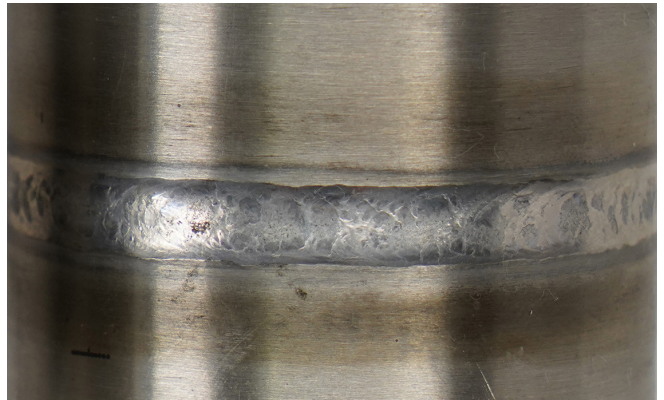
WELD APPEARANCE

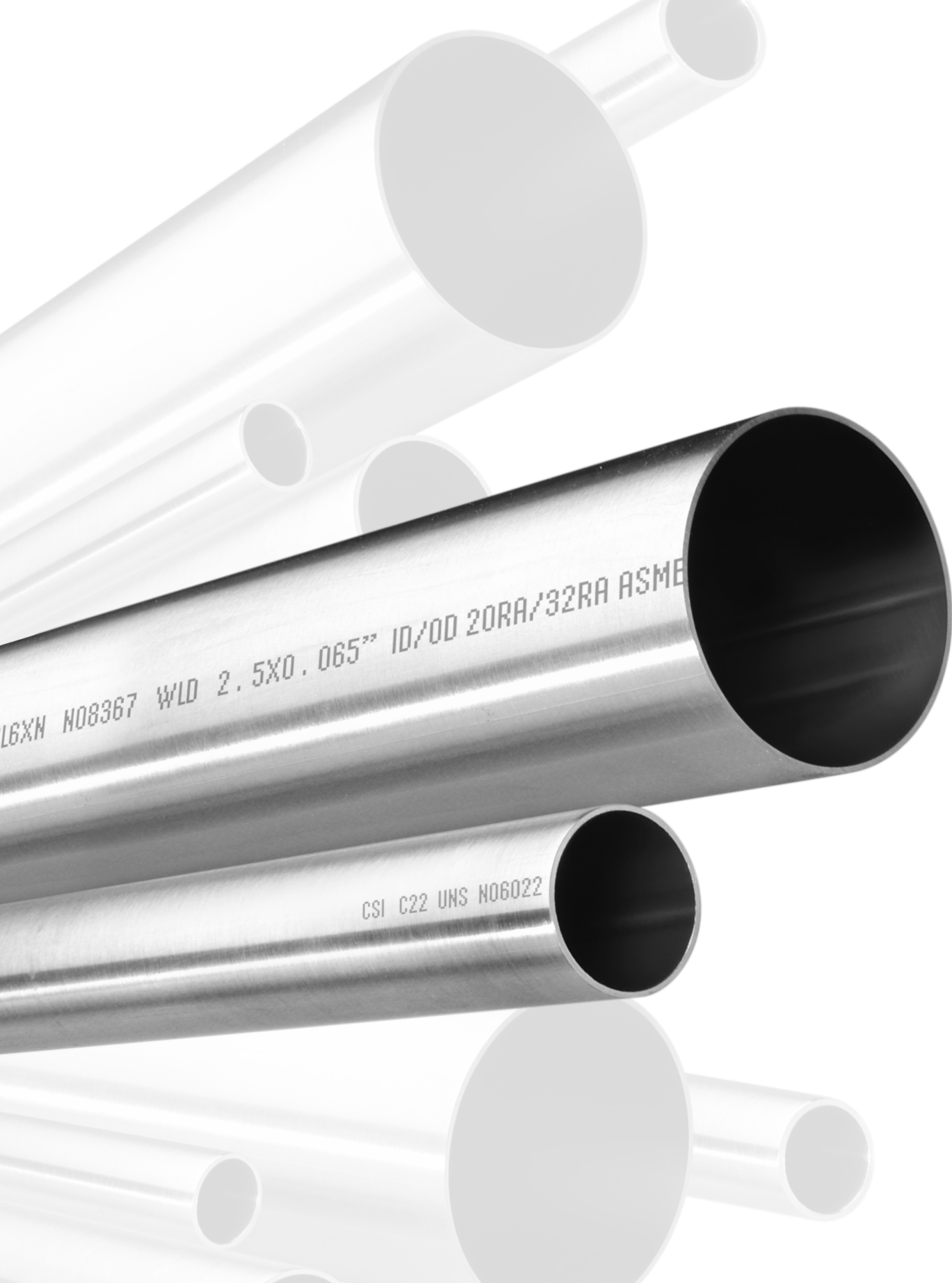
Weld appearance of Super Alloys can be somewhat misleading when visually compared with any hygienic weld made in 316L stainless steel. A typical Hastelloy C-22 weld will have oxide islands in the weld bead. These films that form in the weld pool and solidify on the weld have been identified as high-melting-point nonmetallic oxides. Oxide islands are common, and the appearance is permitted in standards such as ASME BPE. Discoloration in the heat-affected zone (HAZ) is also expected and is not necessarily the result of improper gas shielding. Discoloration in the HAZ can be caused by tube mill surface conditioning processes such as pickling, passivation, mechanical polishing, cleaning, and/or annealing furnace atmosphere. Discoloration in the HAZ from these processes is generally darker than it is in traditional stainless steel materials, but it does not indicate an improper weld.

HASTELLOY C-22 ID WELD



HASTELLOY C-22 OD WELD





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