Fittings, Gaskets, O-Rings and Tubes

- Available in tube sizes from 1/16 to 2 in. and 2 to 50 mm
- Radius junction design with elbows provides smooth flow path
- Easy to disconnect and retighten
- Wide variety of materials and configurations
- Every fittings is stamped with size, material
- Consistent gaugeability upon initial installation

CAVAL®

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General Technical

System temperatures may be limited by the thread sealant or, when applicable, the gasket or O-Ring material.

Fittings Materials

Material	Maximum Temperature
316 stainless steel	1000°F (53°C)
Brass	400°F (20°C)
Carbon Steel	375°F (19°C)
PFA	400°F (20°C)
PTFE	550 F (280 C)

Gasket, O-Rings Materials

Component	Material	Maximum Temperature	Minimum Temperature
GA gaskets	Buna N	250°F (121°C)	-40°F (-40°C)
	Fluorocarbon FKM	400°F (204°C)	-20°F (-28°C)
GB, GC gaskets	Copper	400°F (204°C)	-375°F (-198°C)
SAE O-Rings	Fluorocarbon FKM		-20°F (-28°C)

Pressure Ratings Basis

Ratings are based on ASME Code for Pressure Piping B31.3.

Material	Allowable Stress Value
316 stainless steel	20 000 psi (1378 bar)
Brass	10 000 psi (689 bar)
Carbon Steel	20 000 psi (1378 bar)

To determine Pressure rating in accordance with ANSI/ASME B31.1, multiply by factor shown in the table below.

Material	Factor
316 stainless steel	0.94
Brass	0.85
Carbon Steel	1.0

Material Standards

Material	Bar Stock	Forgings
316 stainless steel	ASME SA479 ASTM A276	ASME SA182 ASTM A182
316L stainless steel		
304 stainless steel		
304L stainless steel		
321 stainless steel		
Duplex 2205		
Titanium	ASTM B348	ASTM B381
Alloy 20	ASTM B473	ASTM B462
Alloy 400	ASTM B164	ASTM B564
Alloy 600	ASTM B166	ASTM B564
Alloy 625	ASTM B446	ASTM B564
Alloy 825	ASTM B425	ASTM B564
Alloy C-276	ASTM B574	ASTM B462
Brass	ASTM B16/B453	ASTM B283
Carbon Steel	ASTM A108	ASTM A105

Thread Specifications

Thread	Specification
NPT	ASME B1.20.1, SAE AS71051
ISO/BSP (parallel)	ISO 228, BS 2779, JIS B0202
ISO/BSP (tapered)	ISO 7, BS 21, JIS B0203
ISO/BSP (gage)	ISO 228, BS 2779
Unified (SAE)	ASME B1.1

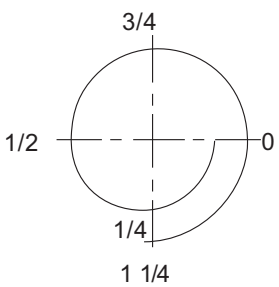

Fig.1

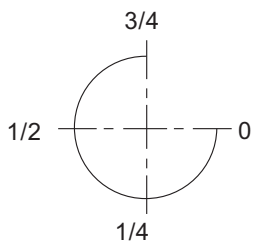

Fig.2

Installation Instructions

CAVAL tube fittings up to 1 in. or 25 mm

1. Simply insert the tubing into the caval bute fitting. Make sure that the tubing rests firmly on the shoulder of the fitting and that the nut is finger-tight.

2. Before tightening the caval nut, scribe the nut at the 1/4 position.

3. Tighten the nut 1*1/4* turns with wrench while holding steady the body of the fitting or the valve(See Fig.1). For small-sized fittings (1/16", 1/8" and 3/16", 2mm, 3mm and 4mm), tighten the nut 3/4 turn with wrench (See Fig.2).

CAVAL tube fittings over 1" or 25 mm

1. Use presetting tool to install the ferrules onto the tube, please refer to the instruction of Hydraulic Presetting Tool for details.

2. Insert the preset tubing with ferrules and nut into the body of fitting and finger tight.

3. Tighten the nut 1 *1/2* turn with wrench.

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Ordering Information

316	-	T	-	FN	8	-	NS	8	-	FN	8
A		B		C	D		C	D		C	D

A Body Material

316 = 316 SS
316L = 316L SS
304 = 304 SS
304L = 304L SS
321 = 321 SS
D5 = Duplex 2205
CS = Carbon Steel
BR = Brass
A20 = Alloy 20
400 = Alloy 400
600 = Alloy 600
C276 = Alloy C-276
TI = Titanium
T = PTFE
A = PFA

B Fittings Types

S = Straight Fittings
L = Elbow Fittings
L1 = 45° Elbow Fittings
T = Tee Fittings
C = Cross Fittings
SB = Bulkhead Fittings

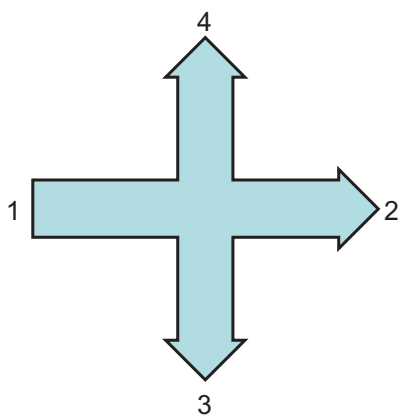
C Connections Types

M = Metric Tube Fittings
F = Fractional Tube Fittings
MTB = Metric Tube Butt Weld
TB = Fractional Tube Butt Weld
PB = Pipe Butt Weld
MTS = Metric Tube Socket Weld
TS = Fractional Tube Socket Weld
PS = Pipe Socket Weld
FN = Female NPT
NS = Male NPT
FRC = Female ISO 7-1
RC = Male ISO 7-1
FG = Female ISO 228
G = Male ISO 228
FM = Female ISO 261
MS = Male ISO 261
FO = Male FO Fittings
FR = Male FR Fittings
UMB = Nut+Gasket+Metric Bulge Nipple
UFB = Nut+Gasket+Fractional Bulge Nipple

D Connections Sizes

Fractional, in.	Metric, mm
2 = 1/8 in.	6 = 6 mm
4 = 1/4 in.	8 = 8 mm
6 = 3/8 in.	10 = 10 mm
8 = 1/2 in.	12 = 12 mm
12 = 3/4 in.	14 = 14 mm
16 = 1 in.	16 = 16 mm
20 = 1 *1/4* in.	18 = 18 mm
24 = 1 *1/2* in.	20 = 20 mm
32 = 2 in.	22 = 22 mm
40 = 2 *1/2* in.	25 = 25 mm
	28 = 28 mm

Tees and Crosses



- Tees are described by first sizing the run (1 to 2) and then the branch(3).
- Crosses are described by first sizing the run (1 to 2) and then the branch (3 to 4).

Example: 316-T-F4-M6-NS4
(Body material of Tee is 316 SS, Connection 1 is 1/4 in. fractional tube fitting, Connection 2 is 6 mm metric tube fitting, Connection 3 is 1/4 in. male NPT)

Additional Information

- Fittings are available individually bagged; add **-BG** to the ordering number.
  Example: 316-T-F4-M6-NS4-BG

- On request, fittings can be cleaned and packaged in accordance with CAVAL Special Cleaning and Packaging; add **-AC11** to the ordering number.
  Example: 316-T-F4-M6-NS4-AC11

Tubing Data

Tubing Selecton

Proper selection, handling, and installation of tubing, when combined with proper selection of CAVAL tube fittings, are essential to reliable tubing systems.
The following variables should be considered when ordering tubing for use with CAVAL tube fittings:

- ◎ *Surface finish*
- ◎ *Material*
- ◎ *Hardness*
- ◎ *Wall thickness*

Surface Finish

- ◎ *Acid pickling*
- ◎ *Mechanical polishing*
- ◎ *Bright annealing*
- ◎ *Electrolytic polishing*

Material

There are various material for preference, such as carbon steel, stainless steel, copper, alloy 400, alloy C-276, alloy 20, alloy 600, Grade 2 Titanium and alloy 625 etc..

Hardness

The key to selecting proper tubing for use with metal CAVAL tube fittings is that the tubing must be softer than the fitting material.
CAVAL stainless steel tube fittings have been repeatedly tested successfully with tubing with hardness up to 200 HV and 90 HRB.

Wall Thickness

The following tables show working pressure ratings of tubing in a wide range of wall thicknesses. Except as noted, allowable pressure ratings are calculated from S values as specified by ASME B31.3, Process Piping. CAVAL tube fittings are not recommended for tube wall thicknesses outside the ranges shown in the following tables for each size.

Suggested Allowable Working Pressure for Tubing

Fractional carbon steel tubing

Allowable working pressure are calculated from an S value of 15700 psi(108.2 Mpa) for ASTM A179 tubing at -20 to 100 °F (-28 to 37 °C), as listed in ASME B31.3-2008 Table A-1, For working pressure in accordance with ASME B31.1, multiply by 0.85.

Tube OD (in.)	Tube Wall Thickness, (in.)												
	0.028	0.035	0.049	0.065	0.083	0.095	0.109	0.120	0.134	0.148	0.165	0.180	0.220
	Working Pressure, (psi) Note: For gas service, select a tube wall thickness outside of the shaded area.												
1/8	8000	10200											
3/16	5100	6600	9600										
1/4	3700	4800	7000	9600									
5/16		3700	5500	7500									
3/8		3100	4500	6200									
1/2		2300	3200	4500	5900								
5/8		1800	2600	3500	4600	5300							
3/4			2100	2900	3700	4300	5100						
7/8			1800	2400	3200	3700	4300						
1			1500	2100	2700	3200	3700	4100					
1 *1/4*				1600	2100	2500	2900	3200	3600	4000	4600	5000	
1 *1/2*					1800	2000	2400	2600	2900	3300	3700	4100	5100
2						1500	1700	1900	2100	2400	2700	3000	3700

Refer to ASTM A179, hardness of soft annealed seamless carbon steel hydraulic tubing is not to exceed 72 HRB or 130 HV. Tubing to free of scratches, suitable for bending and flaring.

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Tubing Data

Metric stainless steel seamless tubing

Allowable working pressure are based on equations from ASME B31.3-2008 for EN ISO 1127 tubing, using a stress value of 137.8MPa (20000 psi) and tensile strength of 516.4 MPa (74900 psi).

Tube OD (mm)	Tube Wall Thickness, (mm)												
	0.8	1.0	1.2	1.5	1.8	2.0	2.2	2.5	2.8	3.0	3.5	4.0	4.5
	Working Pressure, (bar) Note: For gas service, select a tube wall thickness outside of the shaded area.												
3	670												
6	310	420	540	710									
8		310	390	520									
10		240	300	400	510	580							
12		200	250	330	410	470							
14		160	200	270	340	380	430						
15		150	190	250	310	360	400						
16			170	230	290	330	370	400					
18			150	200	260	290	320	370					
20			140	180	230	260	290	330	380				
22			140	160	200	230	260	300	340				
25					180	200	230	260	290	320			
28						180	200	230	260	280	330		
30						170	180	210	240	260	310		
32						160	170	200	220	240	290	330	
38							140	160	190	200	240	270	310

Refer to EN ISO 1127 or equivalent, hardness of fully annealed seamless stainless steel hydraulic tubing is not to exceed 90HRB or 200 HV. Tubing to free of scratches, suitable for bending and flaring.
For welded tubing, the basic quality factor must be applied for weld integrity:
for electric fusion weld tube, double butt seam, multiply working pressure by 0.85①
for electric fusion weld tube, single butt seam, multiply working pressure by 0.80.

① *Refer to ASME B31.3-2008 table A-1B.*

Pressure Ratings at Elevated Temperature

Elevated temperature factors②

Temperature		Tubing Materials											
°F	°C	304/304L	316/316L	Alloy C-276	Alloy 20	Alloy 400	Alloy 600	Alloy 625	Alloy 825	Copper	Carbon Steel	Duplex 2205	Ti
200	93	1.00	1.00	1.00	1.00	0.87	1.00	0.93	1.00	0.80	0.95	1.00	0.86
400	204	0.93	0.96	0.96	0.96	0.79	0.96	0.85	0.90	0.50	0.87	0.93	0.61
600	315	0.82	0.85	0.85	0.85	0.79	0.85	0.79	0.84			0.90	0.45
800	426	0.76	0.79	0.79	0.79	0.75	0.79	0.75	0.81				
1000	537	0.69	0.76	0.76			0.35	0.73					

② *The elevated temperature factors are calculated from ASME B31.3-2008 table A-1.*

To determine allowable working pressure of welded tubing at elevated temperature, multiply basic quality of factors, multiply allowable working pressures by a factor shown in the above table.

Example: *Type 316 stainless steel tubing, double butt seam, 12 mm OD x 1.5 mm wall at 800 °F.*
1. The allowable working pressure of type 316 stainless steel tubing at -20 to 100 °F is 330 bar.
2. The basic quality factors of double butt seam is 0.85.
330 bar x 0.85 = 280.5 bar
3. The elevated temperature factor for 800 °F is 0.79.
280.5 bar x 0.79 = 221.5 bar.
The allowable working pressure of type 316 stainless steel tubing , double butt seam, 12 mm OD x 1.5 mm wall at 800 F is 221.5 bar.