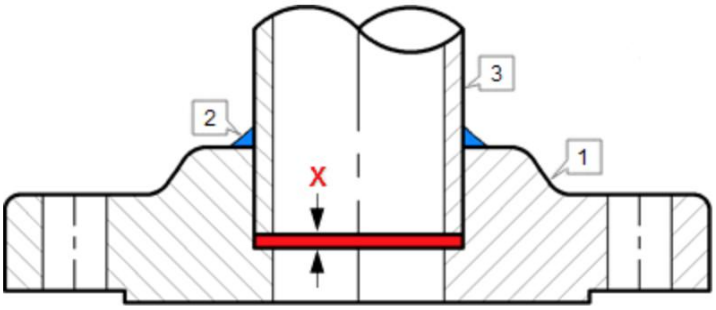
WHAT IS A SOCKET WELD FLANGE?

Design, connection principles, standards and application guidance

SOCKET WELD (SW)
A compact flange connection for small-bore piping, using a recessed socket and an external fillet weld.

Details of Socket Weld Flange



1. Socket Weld flange 2. Filled weld 3. Pipe
X = Expansion gap

1. What Is a Socket Weld Flange?

A **socket weld flange** is a forged pipe flange with a machined recess (socket) at its bore. The pipe end is inserted into this socket and joined to the flange by an external fillet weld around the hub. The socket provides a locating shoulder that helps position the pipe during fit-up.

Socket weld flanges are commonly selected for small-bore piping where a compact, permanent welded connection is required. They are often considered for higher-pressure service, but suitability must always be confirmed against the applicable piping code, pressure-temperature rating, material, fluid and operating conditions.

How the connection works

1. The pipe is cut square and prepared in accordance with the approved fabrication procedure.
2. The pipe is inserted into the flange socket to the required engagement depth.
3. Before welding, the pipe is withdrawn slightly from the socket shoulder to establish the specified assembly gap.
4. The pipe is aligned and tack-welded as required by the qualified welding procedure.
5. An external fillet weld is applied around the pipe-to-hub interface, followed by the specified inspection.

Important assembly note: ASME B31.3 Figure 328.5.2-2 illustrates an approximately 1.5 mm (1/16 in.) gap before welding for socket-welding flanges. The applicable construction code, project specification and qualified welding procedure govern the actual joint preparation. This is an assembly detail—not a general-purpose allowance for operating thermal expansion.

2. Main Components and Design Features

Flange body: Usually a forged component selected for the required pressure class, temperature and service environment.
Socket / counterbore: A machined recess sized to receive the matching pipe outside diameter.
Internal shoulder: The step at the bottom of the socket that establishes the pipe insertion position.
Hub: The raised section surrounding the socket where the external fillet weld is made.
Flange facing: The gasket-contact surface, which may be supplied in a facing configuration permitted by the applicable standard and size/class combination.

3. Common Facing Types

Facing	Description	Selection notes
Raised Face (RF)	A raised gasket seating area around the bore.	Common in many industrial bolted flange joints; gasket type and dimensions must match.
Flat Face (FF)	The gasket contact surface is flat across the flange face.	Used where required by mating equipment or system design; check flange compatibility.
Ring Type Joint (RTJ)	A precision-machined ring groove receives a metallic ring gasket.	Used for specified high-integrity joints; groove, ring and flange class must be compatible.

4. Advantages and Limitations

Potential advantages

• **Self-locating fit-up:** The socket helps position the pipe and can simplify alignment during fabrication.
• **Compact construction:** The design is useful where installation space is limited.
• **External weld access:** The pipe-to-flange fillet weld is made from the outside, which can be helpful where internal welding access is restricted.
• **No pipe-end bevel normally required:** Unlike a conventional butt-weld end preparation, a socket connection generally uses a square-cut pipe end, subject to the applicable procedure.
• **Permanent welded joint:** It avoids reliance on threaded engagement at the pipe connection.

Limitations and engineering considerations

• **Small-bore focus:** Socket weld flanges are generally used on smaller nominal pipe sizes. For larger sizes or demanding cyclic service, other connection types may be more appropriate.
• **Crevice / corrosion considerations:** The socket geometry can create a potential crevice at the pipe end. Evaluate this carefully for corrosive, stagnant, hygienic or contamination-sensitive services.
• **Fatigue and vibration:** Repeated thermal or mechanical cycling can affect welded joints. The piping stress analysis and applicable code should determine whether the connection is suitable.
• **Inspection access:** The weld is a fillet weld, and examination methods and acceptance criteria differ from those for full-penetration butt welds. Confirm project inspection requirements in advance.
• **Welding quality:** Incorrect insertion, inadequate gap, poor alignment or an undersized/defective fillet weld can compromise joint integrity.

5. Socket Weld vs. Slip-On vs. Weld Neck Flanges

Type	Pipe connection	Typical characteristics	Common selection context
Socket Weld (SW)	Pipe inserted into a socket; external fillet weld.	Compact; socket assists alignment; small-bore application.	Small-bore lines where permitted by code and service conditions.
Slip-On (SO)	Pipe passes through flange bore; commonly fillet-welded at hub and bore side.	Simple fit-up; typically requires two welds.	General piping applications where its rating and code limits are acceptable.
Weld Neck (WN)	Tapered hub joined to pipe by butt weld.	Butt-weld configuration; suited to a broad range of demanding services when properly designed.	Higher stress, larger-bore or cyclic-duty applications where specified.

No flange type is universally superior. Selection depends on the governing code, design pressure and temperature, piping loads, fluid characteristics, inspection requirements and project specifications.

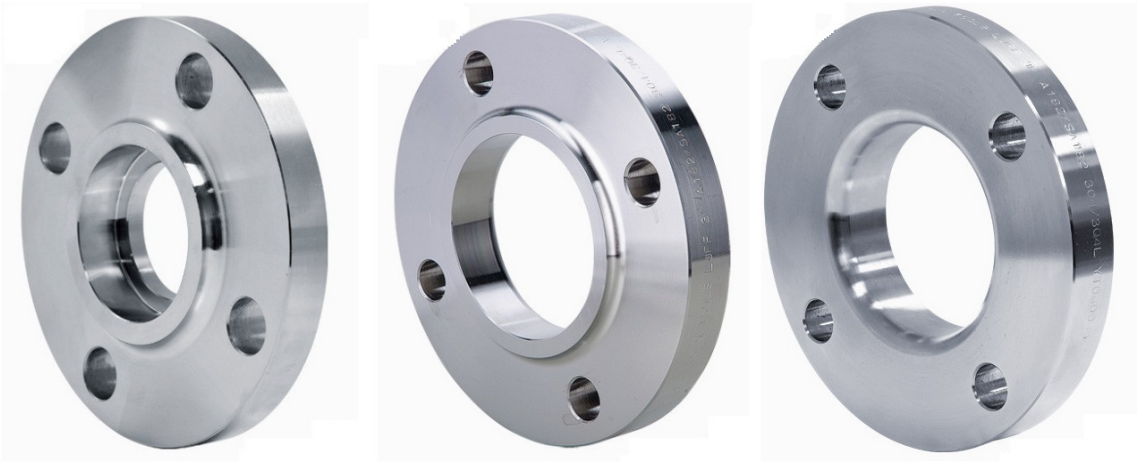
6. Standards, Materials and Pressure Ratings

ASME B16.5 is a commonly specified dimensional and pressure-temperature rating standard for pipe flanges and flanged fittings within its scope. The relevant piping construction code (for example, ASME B31.3 for process piping or ASME B31.1 for power piping) provides additional requirements for fabrication, welding, examination and assembly.

Typical material specifications include ASTM A105 for carbon steel forgings and ASTM A182 grades for alloy and stainless steel forgings, such as F11, F22, F304/F304L and F316/F316L. The exact grade must be selected for the design conditions and confirmed by the purchase specification and material test documentation.

Pressure classes such as ASME Class 150, 300, 600, 900, 1500 and 2500 are rating designations—not direct pressure values in psi. The allowable pressure depends on the flange material group and design temperature. Do not assume that an ASME Class rating is directly interchangeable with a PN or JIS rating.

Other standards, including EN or JIS specifications, may be used when explicitly required by the project. Dimensions, facing, drilling, material and pressure-temperature ratings should be checked within the same specified standard system; different standards should not be treated as automatically interchangeable.



7. Installation and Inspection Checklist

Before welding

• Verify flange standard, nominal size, pressure class, facing and material grade against the approved drawings and purchase specification.
• Confirm that the pipe outside diameter, wall thickness and socket dimensions are compatible.
• Check material identification and traceability, and review the applicable WPS and welder qualifications.
• Clean the joint surfaces and check fit-up, alignment and insertion depth.
• Establish the pre-weld gap required by the governing code and approved procedure.

During and after welding

• Apply the specified welding process, consumables, preheat and heat-treatment requirements, where applicable.
• Ensure the fillet weld size, profile and continuity meet the approved design and code requirements.
• Carry out visual examination and any additional NDE required by the project specification or governing code.
• Check flange face condition and alignment; protect the gasket seating surface from weld spatter and mechanical damage.
• Record inspection results and maintain material and weld traceability documents.

8. Typical Applications

Subject to code approval and service suitability, socket weld flanges may be found in small-bore utility and process lines, instrumentation connections, sampling lines, chemical and petrochemical plants, power-generation facilities and other industrial piping systems. The final selection must account for fluid corrosivity, erosion, solids, cleanliness, vibration, thermal cycling and maintenance requirements.

9. Frequently Asked Questions

Q1. What is the main purpose of a socket weld flange?
It provides a permanent flanged connection by inserting the pipe into a recessed socket and securing it with an external fillet weld.

Q2. Why is a small gap left before welding?
Applicable piping codes show an approximately 1.5 mm (1/16 in.) pre-weld gap for socket-weld flange assembly. Follow the governing code and approved welding procedure; do not treat this as a universal thermal-expansion allowance.

Q3. Is a socket weld flange suitable for corrosive service?
It depends on the fluid, material, temperature, corrosion mechanism and project requirements. The socket region may create a crevice, so corrosion and inspection considerations should be reviewed by the piping engineer.

Q4. What is the difference between a socket weld and a slip-on flange?
A socket weld flange has a recessed socket and is joined by an external fillet weld. A slip-on flange has a plain bore through which the pipe passes and is commonly attached with fillet welds at the hub and bore side.

Q5. Which materials are available?
Common options include carbon steel, alloy steel and stainless steel forgings. Other materials may be considered when supported by the applicable standard and project requirements.

Q6. What information should be provided when requesting a quotation?
Specify the flange standard, size, pressure class or PN rating, facing type, material grade, pipe schedule or bore, quantity, inspection/documentation requirements and any special service conditions.

10. Specification Checklist for Enquiries

Item	Information to confirm
Standard	ASME B16.5 / EN / JIS / other specified standard and edition
Size & rating	NPS or DN; Class or PN; confirm compatibility with the piping system
Facing	RF / FF / RTJ, as applicable
Material	ASTM grade / material group; service temperature and fluid
Bore / pipe	Matching pipe OD, schedule or wall thickness; socket dimensions if non-standard
Inspection & documents	MTC / EN 10204 3.1, dimensional inspection, PMI, NDE or other specified requirements

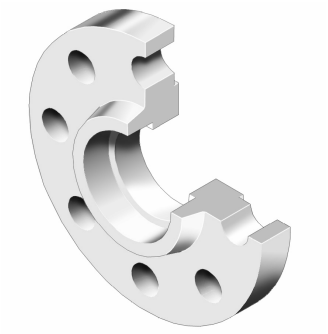
Contact Sunny Steel

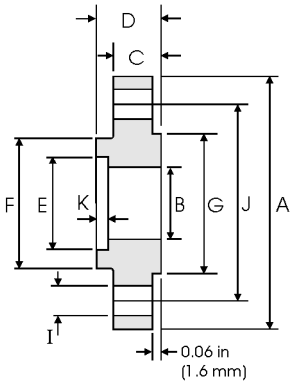
For socket weld flange enquiries, please provide your required standard, size, pressure class, facing, material and quantity. Sunny Steel can review requirements against your drawings and project specifications.

SUNNY STEEL ENTERPRISE LTD.
Website: www.sunnysteel.com
Email: sales@sunnysteel.com
Tel.: 0086-21-33780199
WhatsApp: 0086-139-16927033

Technical note: This document is for general information only. It is not a substitute for the current editions of applicable standards, project specifications, engineering calculations or qualified welding procedures. Always verify the requirements applicable to the specific piping system.

Socket Welding Flanges - ANSI B16.5





Class 150 lb

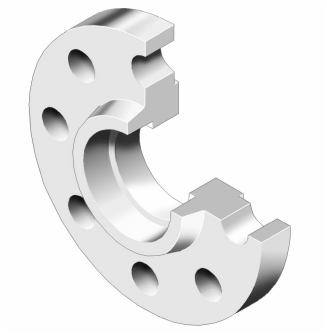
Pipe		Flange						Hub	Raised Face	Drilling Data			Weight
Nominal Pipe Size		A	B	C	D	E	K	F	G	H	I	J	
	Outside Diameter	Overall Diameter	Inside Diameter	Flange Thickness min	Overall Length	Socket Diameter	Depth of Socket	Hub Diameter	Face Diameter	No. of Holes	Bolt Hole Diameter	Diameter of Circle of Holes	kg/ piece
	in mm	in mm	in mm	in mm	in mm	in mm	in mm	in mm	in mm		in mm	in mm	
1/2	0.840 21.30	3.500 88.90	0.620 15.70	0.440 11.20	0.620 15.70	0.880 22.40	0.380 9.600	1.190 30.20	1.380 35.10	4	0.620 15.70	2.380 60.45	0.42
3/4	1.050 26.70	3.880 98.60	0.820 20.80	0.500 12.70	0.620 15.70	1.090 27.70	0.440 11.10	1.500 38.10	1.690 42.90	4	0.620 15.70	2.750 69.85	0.59
1	1.315 33.40	4.250 108.0	1.050 26.70	0.560 14.20	0.690 17.50	1.360 34.50	0.500 12.70	1.940 49.30	2.000 50.80	4	0.620 15.70	3.120 79.25	0.81
1 1/4	1.660 42.20	4.620 117.3	1.380 35.10	0.620 15.70	0.810 20.60	1.700 43.20	0.560 14.20	2.310 58.70	2.500 63.50	4	0.620 15.70	3.500 88.90	1.07
1 1/2	1.900 48.30	5.000 127.0	1.610 40.90	0.690 17.50	0.880 22.30	1.950 49.50	0.620 15.70	2.560 65.00	2.880 73.15	4	0.620 15.70	3.880 98.60	1.36
2	2.375 60.30	6.000 152.4	2.070 52.60	0.750 19.10	1.000 25.40	2.440 62.00	0.690 17.50	3.060 77.70	3.620 91.90	4	0.750 19.10	4.750 120.7	2.10
2 1/2	2.875 73.00	7.000 177.8	2.470 62.70	0.880 22.40	1.120 28.40	2.940 74.70	0.750 19.00	3.560 90.40	4.120 104.6	4	0.750 19.10	5.500 139.7	3.33
3	3.500 88.90	7.500 190.5	3.070 78.00	0.940 23.90	1.190 30.20	3.570 90.70	0.810 20.60	4.250 108.0	5.000 127.0	4	0.750 19.10	6.000 152.4	3.90

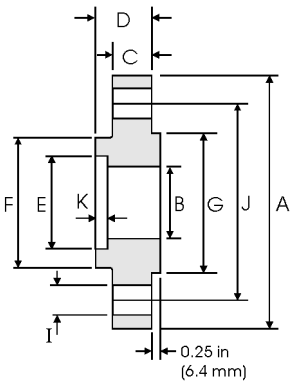
Class 300 lb

Pipe		Flange						Hub	Raised Face	Drilling Data			Weight
Nominal Pipe Size		A	B	C	D	E	K	F	G	H	I	J	
	Outside Diameter	Overall Diameter	Inside Diameter	Flange Thickness min	Overall Length	Socket Diameter	Depth of Socket	Hub Diameter	Face Diameter	No. of Holes	Bolt Hole Diameter	Diameter of Circle of Holes	kg/ piece
	in mm	in mm	in mm	in mm	in mm	in mm	in mm	in mm	in mm		in mm	in mm	
1/2	0.840 21.30	3.750 95.20	0.620 15.70	0.560 14.20	0.880 22.30	0.880 22.40	0.380 9.600	1.500 38.10	1.380 35.10	4	0.620 15.70	2.620 66.55	0.66
3/4	1.050 26.70	4.620 117.3	0.820 20.80	0.620 15.70	1.000 25.40	1.090 27.70	0.440 11.10	1.880 47.70	1.690 42.90	4	0.750 19.10	3.250 82.50	1.15
1	1.315 33.40	4.880 123.9	1.050 26.70	0.690 17.50	1.060 26.90	1.360 34.50	0.500 12.70	2.120 53.80	2.000 50.80	4	0.750 19.10	3.500 88.90	1.40
1 1/4	1.660 42.20	5.250 133.3	1.380 35.10	0.750 19.00	1.060 26.90	1.700 43.20	0.560 14.20	2.500 63.50	2.500 63.50	4	0.750 19.10	3.880 98.60	1.75
1 1/2	1.900 48.30	6.120 155.4	1.610 40.90	0.810 20.60	1.190 30.20	1.950 49.50	0.620 15.70	2.750 69.85	2.880 73.15	4	0.880 22.30	4.500 114.3	2.55
2	2.375 60.30	6.500 165.1	2.070 52.60	0.880 22.30	1.310 33.20	2.440 62.00	0.690 17.50	3.310 84.00	3.620 91.90	8	0.750 19.10	5.000 127.0	2.93
2 1/2	2.875 73.00	7.500 190.5	2.470 62.70	1.000 25.40	1.500 38.10	2.940 74.70	0.750 19.00	3.940 100.0	4.120 104.6	8	0.880 22.30	5.880 149.3	4.40
3	3.500 88.90	8.250 209.5	3.070 78.00	1.120 28.40	1.690 42.90	3.570 90.70	0.810 20.60	4.620 117.3	5.000 127.0	8	0.880 22.30	6.620 168.1	5.92

Notes
- Dimension B corresponds to the pipe inside diameter. Values quoted assume 40S/Standard wall thickness.
- Weights are based on manufacturer's data and are approximate.

Socket Welding Flanges - ANSI B16.5





Class 600 lb

Pipe		Flange						Hub	Raised Face	Drilling Data			Weight
Nominal Pipe Size		A	B	C	D	E	K	F	G	H	I	J	
	Outside Diameter	Overall Diameter	Inside Diameter	Flange Thickness min	Overall Length	Socket Diameter	Depth of Socket	Hub Diameter	Face Diameter	No. of Holes	Bolt Hole Diameter	Diameter of Circle of Holes	kg/ piece
	in mm	in mm	in mm	in mm	in mm	in mm	in mm	in mm	in mm		in mm	in mm	
1/2	0.840 21.30	3.750 95.20	To be specified by the Purchaser	0.560 14.20	0.880 22.30	0.880 22.40	0.380 9.600	1.500 38.10	1.380 35.10	4	0.620 15.70	2.620 66.55	0.76
3/4	1.050 26.70	4.620 117.3		0.620 15.70	1.000 25.40	1.090 27.70	0.440 11.10	1.880 47.70	1.690 42.90	4	0.750 19.10	3.250 82.50	1.29
1	1.315 33.40	4.880 123.9		0.690 17.50	1.060 26.90	1.360 34.50	0.500 12.70	2.120 53.80	2.000 50.80	4	0.750 19.10	3.500 88.90	1.55
1 1/4	1.660 42.20	5.250 133.3		0.810 20.60	1.120 28.40	1.700 43.20	0.560 14.20	2.500 63.50	2.500 63.50	4	0.750 19.10	3.880 98.60	2.06
1 1/2	1.900 48.30	6.120 155.4		0.880 22.30	1.250 31.75	1.950 49.50	0.620 15.70	2.750 69.85	2.880 73.15	4	0.880 22.30	4.500 114.3	3.00
2	2.375 60.30	6.500 165.1		1.000 25.40	1.440 36.60	2.440 62.00	0.690 17.50	3.310 84.00	3.620 91.90	8	0.750 19.10	5.000 127.0	3.67
2 1/2	2.875 73.00	7.500 190.5		1.120 28.40	1.620 41.10	2.940 74.70	0.750 19.00	3.940 100.0	4.120 104.6	8	0.880 22.30	5.880 149.3	5.35
3	3.500 88.90	8.250 209.5		1.250 31.75	1.810 46.00	3.570 90.70	0.810 20.60	4.620 117.3	5.000 127.0	8	0.880 22.30	6.620 168.1	7.06

Class 1500 lb

Pipe		Flange						Hub	Raised Face	Drilling Data			Weight
Nominal Pipe Size		A	B	C	D	E	K	F	G	H	I	J	
	Outside Diameter	Overall Diameter	Inside Diameter	Flange Thickness min	Overall Length	Socket Diameter	Depth of Socket	Hub Diameter	Face Diameter	No. of Holes	Bolt Hole Diameter	Diameter of Circle of Holes	kg/ piece
	in mm	in mm	in mm	in mm	in mm	in mm	in mm	in mm	in mm		in mm	in mm	
1/2	0.840 21.30	4.750 120.6	To be specified by the Purchaser	0.880 22.30	1.250 31.70	0.880 22.40	0.380 9.600	1.500 38.10	1.380 35.10	4	0.880 22.30	3.250 82.50	1.80
3/4	1.050 26.70	5.120 130.0		1.000 25.40	1.380 35.00	1.090 27.70	0.440 11.10	1.750 44.40	1.690 42.90	4	0.880 22.30	3.500 88.90	2.41
1	1.315 33.40	5.880 149.3		1.120 28.40	1.620 41.10	1.360 34.50	0.500 12.70	2.060 52.30	2.000 50.80	4	1.000 25.40	4.000 101.6	3.55
1 1/4	1.660 42.20	6.250 158.7		1.120 28.40	1.620 41.10	1.700 43.20	0.560 14.20	2.500 63.50	2.500 63.50	4	1.000 25.40	4.380 111.2	4.02
1 1/2	1.900 48.30	7.000 177.8		1.250 31.75	1.750 44.50	1.950 49.50	0.620 15.70	2.750 69.85	2.880 73.15	4	1.120 28.40	4.880 123.9	5.45
2	2.375 60.30	8.500 215.9		1.500 38.10	2.250 57.15	2.440 62.00	0.690 17.50	4.120 104.6	3.620 91.90	8	1.000 25.40	6.500 165.1	10.2
2 1/2	2.875 73.00	9.620 244.3		1.620 41.10	2.500 63.50	2.940 74.70	0.750 19.00	4.880 123.9	4.120 104.6	8	1.120 28.40	7.500 190.5	13.9

Notes

- Class 400 socket weld flanges may be provided in NPS 1/2 to 2 1/2 using Class 600 dimensions
- Dimension B corresponds to the pipe inside diameter. Values quoted assume 40S/Standard wall thickness.
- Weights are based on manufacturer's data and are approximate.