

ASME B16.11 Forged Pipe Fittings, ASME B16.11 Specification, ASME B16.11 Production Standards, ASME B16.11 Forged Steel Fittings, ASME B16.11 Forged Fittings, ASME B16.11 Socket Weld Fittings, ASME B16.11 Threaded Fittings.

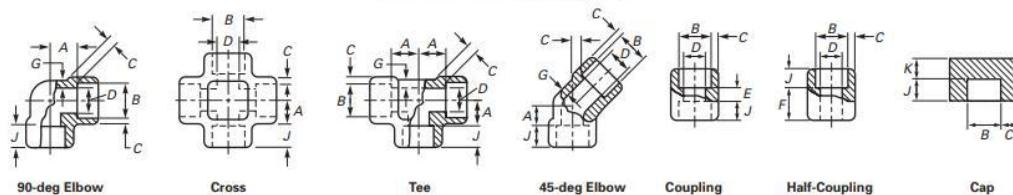
1. ASME B16.11 Specification Detailed Dimensions and Tolerances

ASME B16.11 Socket-Weld Fittings:

- Diameter of Socket Bore:
 - This dimension corresponds to the pipe's outside diameter and is critical for ensuring a proper fit. The bore diameter is slightly larger than the pipe's OD to allow for insertion.
- Socket Depth :
 - The **socket weld fittings**' socket depth is designed to ensure proper pipe insertion while allowing a gap for expansion due to welding.
- Overall Length:
 - The overall length varies depending on the type of fitting, such as elbows, tees, etc.
- Center-to-End Dimensions:
 - For **socket welding elbows** and **socket welded tees**, the center-to-end dimensions determine how much space the fitting will take up in the piping layout. This dimension must be consistent to ensure accurate pipe alignment.

Socket-Weld Fittings Dimension

Table 1 **Socket-Weld Fittings**



Nominal Pipe Size	Socket Bore Diameter, <i>B</i>	Bore Diameter of Fittings, <i>D</i> [Note (1)]			Socket Wall Thickness, <i>C</i> [Note (2)]			Body Wall, <i>G</i>			Center-to-Bottom of Socket, <i>A</i>						Laying Lengths						End Wall Thickness, <i>K_{ext}</i>					
		3000 6000 9000			3000 6000 9000			3000 6000 9000			Min. Depth of Socket, <i>J</i>	90-deg Elbows, Tees, and Crosses			45-deg Elbows			Couplings, <i>E</i>	Half Couplings, <i>F</i>	Tolerances, <i>s</i>	3000 6000 9000							
		Class Designation	Avg.	Min.	Class Designation	Avg.	Min.	Class Designation	Avg.	Min.		3000	6000	9000	3000	6000	9000	3000	6000	9000	3000	6000	9000					
1/8	11.2	7.6	4.8	...	3.18	3.18	3.96	3.43	...	...	2.41	3.15	...	9.5	11.0	11.0	...	8.0	8.0	...	6.5	16.0	1.0	1.5	1.0	4.8	6.4	...
10.8	10.8	6.1	3.2	...	3.02	3.02	3.68	...	...	...	3.02	3.68	...	9.5	11.0	13.5	...	8.0	8.0	...	6.5	16.0	1.0	1.5	1.0	4.8	6.4	...
14.6	10.0	7.1	...	3.78	3.30	4.60	4.01	...	...	3.02	3.68	...	9.5	11.0	13.5	...	8.0	8.0	...	6.5	16.0	1.0	1.5	1.0	4.8	6.4	...	
14.2	8.5	5.6	...	4.01	3.50	5.03	4.37	...	...	3.20	4.01	...	9.5	13.5	15.5	...	8.0	11.0	...	6.5	17.5	1.5	3.0	1.5	4.8	6.4	...	
1/8	18.0	13.3	9.9	...	4.01	3.50	5.03	4.37	...	...	3.20	4.01	...	9.5	13.5	15.5	...	8.0	11.0	...	6.5	17.5	1.5	3.0	1.5	4.8	6.4	...
17.6	18.0	13.3	9.9	...	4.01	3.50	5.03	4.37	...	...	3.20	4.01	...	9.5	13.5	15.5	...	8.0	11.0	...	6.5	17.5	1.5	3.0	1.5	4.8	6.4	...
1/2	22.2	16.4	12.5	7.2	4.67	4.09	5.97	5.18	9.35	8.18	3.73	4.78	7.47	9.5	15.5	19.0	25.5	11.0	12.5	15.5	9.5	22.5	1.5	3.0	1.5	6.4	7.9	11.2
21.8	21.8	15.0	11.0	5.6	4.01	3.50	5.03	4.37	...	...	3.20	4.01	...	9.5	15.5	19.0	25.5	11.0	12.5	15.5	9.5	22.5	1.5	3.0	1.5	6.4	7.9	11.2
1/4	27.6	21.7	16.3	11.8	4.90	4.27	6.96	6.04	9.78	8.56	3.91	5.56	7.82	12.5	19.0	22.5	28.5	13.0	14.0	19.0	9.5	24.0	1.5	3.0	1.5	6.4	7.9	12.7
27.2	20.2	14.8	10.3	...	4.90	4.27	6.96	6.04	9.78	8.56	3.91	5.56	7.82	12.5	19.0	22.5	28.5	13.0	14.0	19.0	9.5	24.0	1.5	3.0	1.5	6.4	7.9	12.7
1	34.3	27.4	21.5	16.0	5.69	4.98	7.92	6.93	11.38	9.96	4.55	6.35	9.09	12.5	22.5	27.0	32.0	14.0	17.5	20.5	12.5	28.5	2.0	4.0	2.0	9.6	11.2	14.2
33.9	25.9	19.9	14.4	...	5.69	4.98	7.92	6.93	11.38	9.96	4.55	6.35	9.09	12.5	22.5	27.0	32.0	14.0	17.5	20.5	12.5	30.0	2.0	4.0	2.0	9.6	11.2	14.2
1 1/4	43.1	35.4	30.2	23.5	6.07	5.28	7.92	6.93	12.14	10.62	4.85	6.35	9.70	12.5	27.0	32.0	35.0	17.5	20.5	22.5	12.5	32.0	2.0	4.0	2.0	9.6	11.2	14.2
42.7	34.3	28.7	22.0	...	6.07	5.28	7.92	6.93	12.14	10.62	4.85	6.35	9.70	12.5	27.0	32.0	35.0	17.5	20.5	22.5	12.5	32.0	2.0	4.0	2.0	9.6	11.2	14.2
1 1/2	49.2	41.6	34.7	28.7	6.35	5.54	8.92	7.80	12.70	11.12	5.08	7.14	10.15	12.5	32.0	38.0	38.0	20.5	25.5	25.5	12.5	32.0	2.0	4.0	2.0	11.2	12.7	15.7
48.8	40.2	33.2	27.2	...	6.35	5.54	8.92	7.80	12.70	11.12	5.08	7.14	10.15	12.5	32.0	38.0	38.0	20.5	25.5	25.5	12.5	32.0	2.0	4.0	2.0	11.2	12.7	15.7
2	61.7	53.3	43.6	38.9	6.93	6.04	10.92	9.50	13.84	12.12	5.54	8.74	11.07	16.0	38.0	41.0	54.0	25.5	28.5	28.5	19.0	41.0	2.0	4.0	2.0	12.7	15.7	19.0
61.2	51.7	42.1	37.4	...	6.93	6.04	10.92	9.50	13.84	12.12	5.54	8.74	11.07	16.0	41.0	...	...	28.5	...	...	19.0	43.0	2.5	5.0	2.5	15.7	19.0	...
2 1/2	74.4	64.2	54.7	48.0	8.76	7.67	...	...	...	7.01	...	...	...	16.0	41.0	...	...	28.5	...	...	19.0	43.0	2.5	5.0	2.5	15.7	19.0	...
73.9	61.2	51.2	44.0	...	8.76	7.67	...	...	...	7.01	...	...	...	16.0	41.0	...	...	28.5	...	...	19.0	43.0	2.5	5.0	2.5	15.7	19.0	...
3	90.3	79.4	69.6	62.0	9.52	8.30	...	...	...	7.62	...	...	...	16.0	57.0	...	...	32.0	...	...	19.0	44.5	2.5	5.0	2.5	19.0	22.4	...
89.8	76.4	66.4	58.0	50.0	9.52	8.30	...	...	...	7.62	...	...	...	16.0	57.0	...	...	32.0	...	...	19.0	44.5	2.5	5.0	2.5	19.0	22.4	...
4	115.7	103.8	90.0	80.0	10.69	9.35	...	...	...	8.56	...	...	...	19.0	66.5	...	...	41.0	...	...	19.0	48.0	2.5	5.0	2.5	22.4	28.4	...
115.2	100.7	88.0	75.0	65.0	10.69	9.35	...	...	...	8.56	...	...	...	19.0	66.5	...	...	41.0	...	...	19.0	48.0	2.5	5.0	2.5	22.4	28.4	...

GENERAL NOTE: Dimensions are in millimeters.

NOTES:

(1) Upper and lower values for each size are the respective maximum and minimum dimensions.

(2) Average of socket wall thickness around periphery shall not be less than listed values. The minimum values are permitted in localized areas.

ASME B16.11 Threaded Fittings:

- Threaded Length:

- The length of the threaded portion must comply with NPT standards for a tight, secure fit.

- Nominal Pipe Size (NPS):

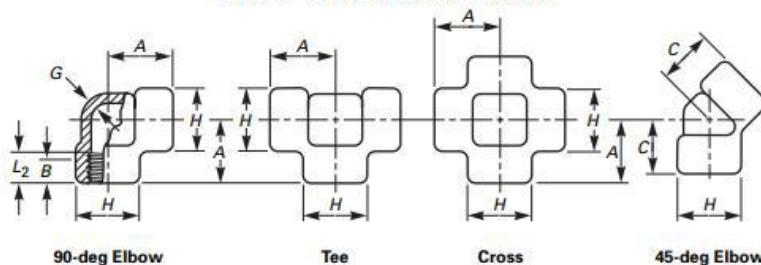
- The NPS is used to designate the size of the **forged threaded fittings**. For example, a 1/2" fitting has a 1/2" NPS.

- Wall Thickness:

- The **threaded elbows** and **threaded tees** wall thickness must comply with the class designation (2000, 3000, or 6000) to handle the pressure rating associated with that class.

ASME B16.11 Threaded Fittings Dimension

Table 2 Forged Threaded Fittings



Nominal Pipe Size	Center-to-End Elbows, Tees, and Crosses, A			Center-to-End 45-deg Elbow, C			Outside Diameter of Band, H			Minimum Wall Thickness, G			Minimum Length of Thread [Note (1)]	
	2000	3000	6000	2000	3000	6000	2000	3000	6000	2000	3000	6000	B	L ₂
1/8	21	21	25	17	17	19	22	22	25	3.18	3.18	6.35	6.4	6.7
1/4	21	25	28	17	19	22	22	25	33	3.18	3.30	6.60	8.1	10.2
3/8	25	28	33	19	22	25	25	33	38	3.18	3.51	6.98	9.1	10.4
1/2	28	33	38	22	25	28	33	38	46	3.18	4.09	8.15	10.9	13.6
3/4	33	38	44	25	28	33	38	46	56	3.18	4.32	8.53	12.7	13.9
1	38	44	51	28	33	35	46	56	62	3.68	4.98	9.93	14.7	17.3
1 1/4	44	51	60	33	35	43	56	62	75	3.89	5.28	10.59	17.0	18.0
1 1/2	51	60	64	35	43	44	62	75	84	4.01	5.56	11.07	17.8	18.4
2	60	64	83	43	44	52	75	84	102	4.27	7.14	12.09	19.0	19.2
2 1/2	76	83	95	52	52	64	92	102	121	5.61	7.65	15.29	23.6	28.9
3	86	95	106	64	64	79	109	121	146	5.99	8.84	16.64	25.9	30.5
4	106	114	114	79	79	79	146	152	152	6.55	11.18	18.67	27.7	33.0

GENERAL NOTE: Dimensions are in millimeters.

NOTE:

(1) Dimension B is minimum length of perfect thread. The length of useful thread (B plus threads with fully formed roots and flat crests) shall not be less than L_2 (effective length of external thread) required by American National Standard for Pipe Threads (ASME B1.20.1; see para. 6.3).

Forged Fittings Tolerances:

- Wall Thickness Tolerances:

- Specific tolerances ensure that the wall thickness does not fall below a minimum standard, which is essential for maintaining the pressure integrity of the **forged fittings**.

- Center-to-End Tolerances:

- Tight tolerances on the center-to-end dimensions are required to maintain the proper layout and ensure that the piping system fits together as intended.

- Thread Engagement:

- Thread tolerances are critical to ensure proper engagement and to prevent leakage under pressure.

2. Markings

- Manufacturer's Identification:
 - Each **ss forged fitting** must be permanently marked with the manufacturer's identification. This ensures traceability and accountability.
- Material Grade and Specification:
 - The material grade must be marked, along with any specific ASTM or equivalent specification, such as ASTM A105, A182, etc.
- Pressure Rating (Class):
 - The pressure class, such as 2000, 3000, 6000, or 9000, must be clearly marked on each fitting.
- Nominal Pipe Size (NPS):
 - The nominal size must be marked to identify the **forged socket weld fittings**' size in the system.
- Optional Heat Code:
 - Some manufacturers may include a heat code to identify the production batch, aiding in material traceability.

3. Materials

- Carbon Steel:
 - Common grades include ASTM A105, ASTM A694 F52 and ASTM A350 LF2. **ASTM A105 Forged Pipe Fitting** is typically used for high-temperature services, **ASTM A694 Forged Fitting** is required in high-pressure application, while **ASTM A350 Forged Pipe Fitting** is used in low-temperature applications.
- Alloy Steel:
 - Alloy steels like ASTM A182 F11, F22, and F5 are used for high-pressure and high-temperature applications due to their enhanced strength and heat resistance.
- Stainless Steel:
 - Stainless steel grades like ASTM A182 F304 and F316 are commonly used in corrosive environments. These **stainless steel forged fittings** materials offer excellent corrosion resistance and can handle high pressures and temperatures.
- Duplex Stainless Steel:
 - Duplex stainless steels, such as ASTM A182 F51, are used for applications requiring both high strength and excellent corrosion resistance.
- Nickel Alloys:
 - Nickel alloys, like Inconel and Monel, are used in extreme environments where high temperature and corrosion resistance are critical.

4. ASME B16.11 Forged Steel Fittings Pressure-Temperature Ratings

- Pressure Class Ratings:
 - Class 2000: Typically used for lower pressure systems and only available for threaded fittings.
 - Class 3000: This is the most commonly used class for both socket-weld and threaded fittings. **Class 3000 Forged Steel Fitting** is suitable for medium pressure applications.
 - Class 6000: Used in higher pressure systems and is available for both socket-weld and threaded fittings.
 - Class 9000: This is the highest pressure class available in ASME B16.11, typically used for the most demanding applications and available only for **socket-weld fittings**.
- Temperature Considerations:
 - The pressure ratings are dependent on the **Forged Steel Fitting** material and temperature. For instance, a fitting made from ASTM A105 carbon steel will have different pressure ratings at room temperature compared to elevated temperatures (e.g., 400°F or 700°F).
 - De-rating Factors: At higher temperatures, the material's strength may decrease, leading to a lower allowable pressure rating. ASME B16.11 provides guidance on de-rating pressure based on temperature.

5. Fitting Types Covered

- **ASME B16.11 Forged Elbows:**
 - Available in 90° and 45°, elbows change the direction of flow. The center-to-face dimension is critical for ensuring proper fit in the piping layout.
- **ASME B16.11 Forged Tees:**
 - Straight Tees: Allow branching of the flow with the same diameter.
 - Reducing Tees: Allow branching with a smaller diameter than the main pipe.
- Unions:
 - Provide a disconnection point in the system, allowing for easy assembly and disassembly. They are crucial in systems requiring regular maintenance.
- **ASME B16.11 Forged Caps:**
 - Used to close off the end of a piping system. Caps are important for pressure sealing.
- Couplings:
 - **ASME B16.11 Forged Full Couplings:** Join two pipes together end-to-end.
 - **ASME B16.11 Forged Half Couplings:** Typically used for smaller branch connections.
- Plugs:
 - **ASME B16.11 Forged Threaded Plugs** close off open ends of pipes or fittings. Plugs must ensure a tight seal to prevent leaks.

Summary

ASME B16.11 Standards provides a comprehensive set of guidelines to ensure the safety and reliability of forged steel fittings used in high-pressure and high-temperature applications. Adhering to these standards ensures that the fittings will perform as expected under specified conditions, maintaining the integrity of the piping system.