ASME B16.11

(For Internal Use by Huitong Only)

PIPELINE

Forged Fittings, Socket-Welding and Threaded

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ASME B16.11 is a standard established by the American Society of Mechanical Engineers (ASME) that covers ratings, dimensions, tolerances, marking, and material requirements for forged fittings, both socket-welding and threaded. The following are the types of fittings by class designation and NPS size range covered by ASME B16.11:

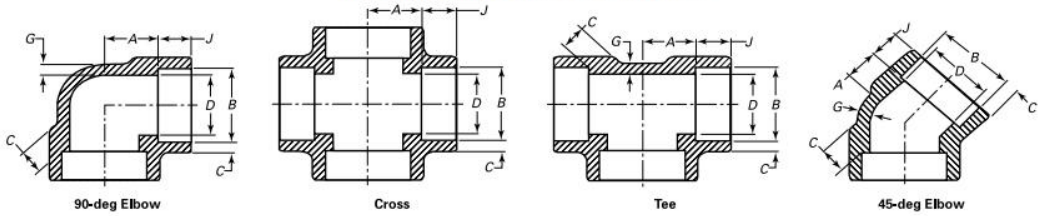
	Socket-Welding			Threaded		
	Class Designation			Class Designation		
Description	3000	6000	9000	2000	3000	6000
45-deg, 90-deg elbows, tees, crosses, couplings, half-couplings, caps, bosses, and couplets	⅛-4	⅛-2	½-2	⅛-4	⅛-4	⅛-4
	⅛-4	⅛-2	½-2	⅛-4	⅛-4	⅛-4
	⅛-4	⅛-2	½-2	...	⅛-4	⅛-4
	⅛-4	⅛-2	½-2	...	⅛-4	¼-2
Street elbows	...	...	...	...	⅛-2	⅛-2
Square, hex, round plug, hex, and flush bushing	...	...	...	⅛-4 [Note (1)]	⅛-4 [Note (1)]	⅛-4 [Note (1)]
	...	...	...	⅛-4 [Note (1)]	⅛-4 [Note (1)]	⅛-4 [Note (1)]

NOTE: (1) Plugs and bushings are not identified by class designation. They may be used for ratings up to Class 6000 designation.

This standard applies to pipe fittings in classes 2000, 3000, and 6000 for threaded end fittings and classes 3000, 6000, and 9000 for socket weld end fittings.

ASME B16.11 standard forged fittings include socket-welded elbows, tees, crosses, socket-welded couplings, bosses, caps, couplets, threaded elbows, threaded street elbows, threaded couplings, plugs and bushings. It is as illustrated in Tables 1 through 6 inclusive.

Table 1 Socket-Welding Elbows, Tees, and Crosses

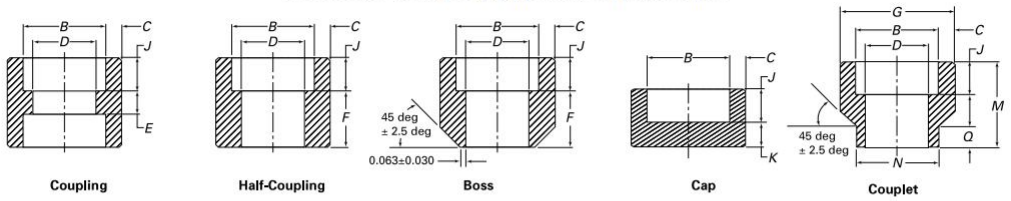


Nominal Pipe Size	Socket Bore Diam., *B*		Bore Diameter of Fittings, *D*						Socket Wall Thickness, *C* [Note (1)]						Body Wall, *G*			Socket Depth, *J*	Center-to-Bottom of Socket, *A*						Tol
			3000		6000		9000		3000		6000		9000		3000	6000	9000		90 El, Cross, Tee			45-deg Elbow			
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Avg.	Min.	Avg.	Min.	Avg.	Min.	Min.	Min.	Min.	Min.	3000	6000	9000	3000	6000	9000	±
⅛	11.2	10.8	7.6	6.1	4.8	3.2	...	...	3.18	3.18	3.96	3.43	...	...	2.41	3.15	...	9.5	11.0	11.0	...	8.0	8.0	...	1.0
¼	14.6	14.2	10.0	8.5	7.1	5.6	...	...	3.78	3.30	4.60	4.01	...	...	3.02	3.68	...	9.5	11.0	13.5	...	8.0	8.0	...	1.0
⅜	18.0	17.6	13.3	11.8	9.9	8.4	...	...	4.01	3.50	5.03	4.37	...	...	3.20	4.01	...	9.5	13.5	15.5	...	8.0	11.0	...	1.5
½	22.2	21.8	16.6	15.0	12.5	11.0	7.2	5.6	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	1.5
¾	27.6	27.2	21.7	20.2	16.3	14.8	11.8	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	1.5
1	34.3	33.9	27.4	25.9	21.5	19.9	16.0	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	2.0
1¼	43.1	42.7	35.8	34.3	30.2	28.7	23.5	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	2.0
1½	49.2	48.8	41.6	40.1	34.7	33.2	28.7	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	2.0
2	61.7	61.2	53.3	51.7	43.6	42.1	38.9	37.4	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	2.0
2½	74.4	73.9	64.2	61.2	...	...	...	...	8.76	7.67	...	...	...	...	7.01	...	...	16.0	41.0	...	...	28.5	...	...	2.5
3	90.3	89.8	79.4	76.4	...	...	...	...	9.52	8.30	...	...	...	...	7.62	...	...	16.0	57.0	...	...	32.0	...	...	2.5
4	115.7	115.2	103.8	100.7	...	...	...	...	10.69	9.35	...	...	...	...	8.56	...	...	19.0	66.5	...	...	41.0	...	...	2.5

GENERAL NOTE: Dimensions are in millimeters.

NOTE: (1) Average of socket wall thickness around periphery shall not be less than listed values. The minimum values are permitted in localized areas.

Table 2 Socket-Welding Couplings, Bosses, Caps, and Couplets



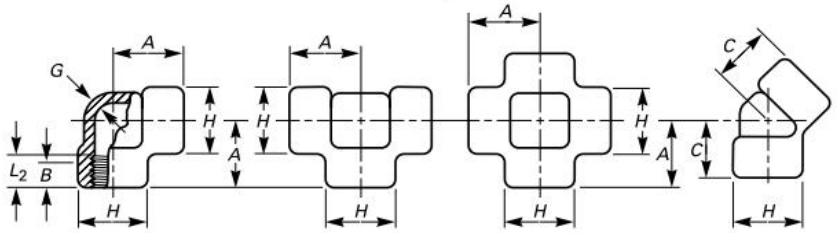
Coupling | Half-Coupling | Boss | Cap | Couplet

Nominal Pipe Size	Socket Bore Dia., *B*		Bore Diameter of Fittings, *D*						Socket Wall Thickness, [Note (1)], *C*						Outside Dia. Couplet, *G*		Tol.	Socket Depth, *J*	Laying Lgth., *E*	Tol.	Laying Lgth., *F*	Tol.	End Wall Thickness, *K*			End to End Couplet, *M*	Tol.	Weld Ring Diameter, *N*	Tol.	Weld Ring Length, *Q*	Tol.
			3000		6000		9000		3000		6000		9000																	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Avg.	Min.	Avg.	Min.	Avg.	Min.	3000	6000	±	Min.		±		±	Min.	Min.	Min.		±		±	3000/6000	±
⅛	11.2	10.8	7.6	6.1	4.8	3.2	...	...	3.18	3.18	3.96	3.43	...	...	...	...	±1.5/−0.0	9.5	6.5	1.5	16.0	1.5	4.8	6.4	...	...	...	...	...	...	...
¼	14.6	14.2	10.0	8.5	7.1	5.6	...	...	3.78	3.30	4.60	4.01	...	...	23.8	25.4	±1.5/−0.0	9.5	6.5	1.5	16.0	1.5	4.8	6.4	...	30.2	±0.8/−0.0	17.5	±1.5/−0.0	9.5	0.8
⅜	18.0	17.6	13.3	11.8	9.9	8.4	...	...	4.01	3.50	5.03	4.37	...	...	27.0	31.8	±1.5/−0.0	9.5	6.5	3.0	17.5	3.0	4.8	6.4	...	30.2	±0.8/−0.0	20.7	±1.5/−0.0	9.5	0.8
½	22.2	21.8	16.6	15.0	12.5	11.0	7.2	5.6	4.67	4.09	5.97	5.18	9.35	8.18	33.4	38.1	±1.5/−0.0	9.5	9.5	3.0	22.5	3.0	6.4	7.9	11.2	33.4	±0.8/−0.0	23.8	±1.5/−0.0	9.5	0.8
¾	27.6	27.2	21.7	20.2	16.3	14.8	11.8	10.3	4.90	4.27	6.96	6.04	9.78	8.56	38.1	44.5	±1.5/−0.0	12.5	9.5	3.0	24.0	3.0	6.4	7.9	12.7	34.9	±0.8/−0.0	27.0	±1.5/−0.0	9.5	0.8
1	34.3	33.9	27.4	25.9	21.5	19.9	16.0	14.4	5.69	4.98	7.92	6.93	11.38	9.96	46.1	57.2	±1.5/−0.0	12.5	12.5	4.0	28.5	4.0	9.6	11.2	14.2	47.6	±0.8/−0.0	42.9	±1.5/−0.0	9.5	0.8
1¼	43.1	42.7	35.8	34.3	30.2	28.7	23.5	22.0	6.07	5.28	7.92	6.93	12.14	10.62	55.6	63.5	±1.5/−0.0	12.5	12.5	4.0	30.0	4.0	9.6	11.2	14.2	47.6	±0.8/−0.0	42.9	±1.5/−0.0	9.5	0.8
1½	49.2	48.8	41.6	40.1	34.7	33.2	28.7	27.2	6.35	5.54	8.92	7.80	12.70	11.12	63.5	76.2	±1.5/−0.0	12.5	12.5	4.0	32.0	4.0	11.2	12.7	15.7	50.8	±0.8/−0.0	49.2	±1.5/−0.0	9.5	0.8
2	61.7	61.2	53.3	51.7	43.6	42.1	38.9	37.4	6.93	6.04	10.92	9.50	13.84	12.21	79.4	92.1	±1.5/−0.0	16.0	19.0	4.0	41.0	4.0	12.7	15.7	19.0	57.2	±1.5/−0.0	61.9	±1.5/−0.0	9.5	0.8
2½	74.4	73.9	64.2	61.2	...	...	...	...	8.76	7.67	...	...	...	...	92.1	108.0	±1.5/−0.0	16.0	19.0	5.0	43.0	5.0	15.7	19.0	...	63.5	±1.5/−0.0	73.0	±1.5/−0.0	9.5	0.8
3	90.3	89.8	79.4	76.4	...	...	...	...	9.52	8.30	...	...	...	...	111.1	127.0	±1.5/−0.0	16.0	19.0	5.0	44.5	5.0	19.0	22.4	...	69.9	±1.5/−0.0	88.9	±1.5/−0.0	9.5	0.8
4	115.7	115.2	103.8	100.7	...	...	...	...	10.69	9.35	...	...	...	...	141.3	158.8	±1.5/−0.0	19.0	19.0	5.0	48.0	5.0	22.4	28.4	...	76.2	±1.5/−0.0	114.3	±1.5/−0.0	9.5	0.8

GENERAL NOTE: Dimensions are in millimeters.

NOTE: (1) Average of socket wall thickness around periphery shall not be less than listed values. The minimum values are permitted in localized areas.

Table 3 Threaded Elbows, Tees, and Crosses

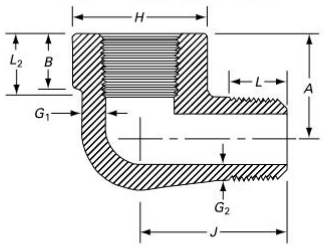


Nominal Pipe Size	Center-to-End Elbows, Tees, and Crosses, *A*			Center-to-End 45-deg Elbow, *C*			Outside Diameter of Band, *H*			Minimum Wall Thickness, *G*			Minimum Length of Thread [Note (1)]	
	2000	3000	6000	2000	3000	6000	2000	3000	6000	2000	3000	6000	*B*	L_2
1/8	21	21	25	17	17	19	22	22	25	3.18	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 the 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 L2 (effective length of external thread) required by the American National Standard for Pipe Threads.

Table 4 Threaded Street Elbows



Nominal Pipe Size, NPS	Center-to-Female End Street Ells, *A* [Note (1)]		Center-to-Male End Street Ells, *J*		Outside Diameter of Band, *H* [Note (2)]		Minimum Wall Thickness, G_1		Minimum Wall Thickness, G_2 [Note (3)]		Minimum Length Internal Thread [Note (4)]		Minimum Length Male Thread, *L*
	Class Designation		Class Designation		Class Designation		Class Designation		Class Designation				
	3000	6000	3000	6000	3000	6000	3000	6000	3000	6000	*B*	L_2	
1/8	19	22	25	32	19	25	3.18	5.08	2.74	4.22	6.4	6.7	10
1/4	22	25	32	38	25	32	3.30	5.66	3.22	5.28	8.1	10.2	11
3/8	25	28	38	41	32	38	3.51	6.98	3.50	5.59	9.1	10.4	13
1/2	28	35	41	48	38	44	4.09	8.15	4.16	6.53	10.9	13.6	14
3/4	35	44	48	57	44	51	4.32	8.53	4.88	6.86	12.7	13.9	16
1	44	51	57	66	51	62	4.98	9.93	5.56	7.95	14.7	17.3	19
1 1/4	51	54	66	71	62	70	5.28	10.59	5.56	8.48	17.0	18.0	21
1 1/2	54	64	71	84	70	84	5.56	11.07	6.25	8.89	17.8	18.4	21
2	64	83	84	105	84	102	7.14	12.09	7.64	9.70	19.0	19.2	22

GENERAL NOTE: Dimensions are in millimeters.

NOTES:

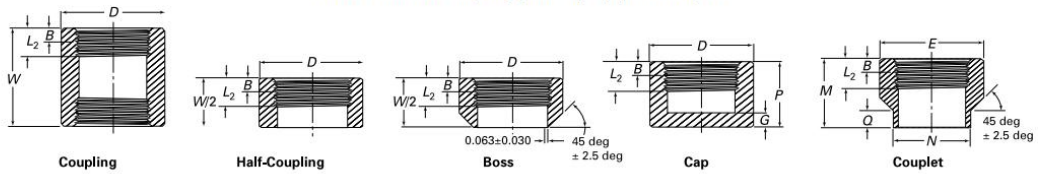
(1) Dimension A of Table 2 for the appropriate fitting size may also be used at the option of the manufacturer.

(2) Dimension H of Table 2 for the appropriate fitting size may also be used at the option of the manufacturer.

(3) Wall thickness before threading.

(4) Dimension B is the 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 L2 (effective length of external thread) required by the American National Standard for Pipe Threads (ASME B1.20.1).

Table 5 Threaded Couplings, Bosses, Caps, and Couplets



Coupling | Half-Coupling | Boss | Cap | Couplet

Nominal Pipe Size	Outside Diameter, *D*		Outside Diameter Couplet, *E*		Tol.	End-to-End Coupling, *W*	End-to-End Caps, *P*		End-to-End Coupling	Tol.	Minimum End Wall Thickness, *G*		Weld Ring Length, *Q*	Tol.	Wled Ring Diameter, *N*	Tol.	Minimum Length of Thread [Note (1)]	
	3000	6000	3000	6000	±	3000/6000	3000	6000	3000/6000	±	3000	6000	3000/6000	±	3000/6000	±	3000/6000	
																	B	L_2
⅛	16	22	...	...	...	32	19	22	...		4.8	6.4	...	...	...	...	6.4	6.7
¼	19	25	23.8	25.4	±1.5/−0.0	35	25	27	30.2	±0.8/−0.0	4.8	6.4	9.5	0.8	17.5	±1.5/−0.0	8.1	10.2
⅜	22	32	27.0	31.8	±1.5/−0.0	48	32	27	30.2	±0.8/−0.0	4.8	6.4	9.5	0.8	20.7	±1.5/−0.0	9.1	10.4
½	28	38	33.4	38.1	±1.5/−0.0	48	32	33	33.4	±0.8/−0.0	6.4	7.9	9.5	0.8	23.8	±1.5/−0.0	10.9	13.6
¾	35	44	38.1	44.5	±1.5/−0.0	51	37	38	34.9	±0.8/−0.0	6.4	7.9	9.5	0.8	27.0	±1.5/−0.0	12.7	13.9
1	44	57	46.1	57.2	±1.5/−0.0	60	41	43	42.9	±0.8/−0.0	9.7	11.2	9.5	0.8	33.4	±1.5/−0.0	14.7	17.3
1¼	57	64	55.6	63.5	±1.5/−0.0	67	44	46	47.6	±0.8/−0.0	9.7	11.2	9.5	0.8	42.9	±1.5/−0.0	17.0	18.4
1½	64	76	63.5	76.2	±1.5/−0.0	79	44	48	50.8	±0.8/−0.0	11.2	12.7	9.5	0.8	49.2	±1.5/−0.0	17.8	18.4
2	76	92	79.4	79.4	±1.5/−0.0	86	48	51	57.2	±1.5/−0.0	12.7	15.7	9.5	0.8	61.9	±1.5/−0.0	19.0	19.2
2½	92	108	92.1	92.1	±1.5/−0.0	92	60	64	63.5	±1.5/−0.0	15.7	19.0	9.5	0.8	73.0	±1.5/−0.0	23.6	28.9
3	108	127	111.1	111.1	±1.5/−0.0	108	65	68	69.9	±1.5/−0.0	19.0	22.4	9.5	0.8	114.3	±1.5/−0.0	25.9	30.5
4	140	159	141.3	141.3	±1.5/−0.0	121	68	75	76.2	±1.5/−0.0	22.4	28.4	9.5	0.8	114.3	±1.5/−0.0	27.7	33.0

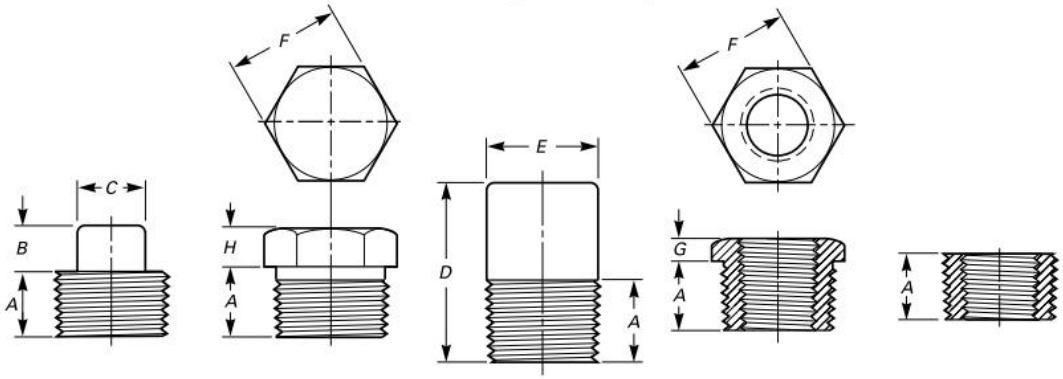
GENERAL NOTES:

(a) Dimensions are in millimeters.

(b) The wall thickness away from the threaded ends shall meet the minimum wall thickness requirements of Table I-2 for the appropriate NPS and Class Designation fitting.

NOTE: (1) Dimension B is the 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 L2 (effective length of external thread) required by the American National Standard for Pipe Threads (ASME B1.20.1).

Table 6 Plugs and Bushings



Square Head Plug | Hex Head Plug | Round Head Plug | Hex Head Bushing [Note (1)] | Flush Bushing

		Square Head Plugs		Round Head Plugs		Hex Plugs and Bushings		
Nominal Pipe Size	Minimum Length, *A*	Minimum Square Height, *B*	Minimum Width Flats, *C* [Note (2)]	Nominal Head Diameter, *E*	Minimum Length, *D*	Nominal Width Flats, *F* [Note (2)]	Minimum Hex Height	
							Bushing, *G*	Plug, *H*
1/8	10	6	7.15	10	35	11.11	...	6
1/4	11	6	9.55	14	41	15.88	3	6
3/8	13	8	11.11	18	41	17.46	4	8
1/2	14	10	14.29	21	44	22.23	5	8
3/4	16	11	15.88	27	44	26.99	6	10
1	19	13	20.64	33	51	34.93	6	10
1 1/4	21	14	23.81	43	51	44.45	7	14
1 1/2	21	16	28.58	48	51	50.80	8	16
2	22	18	33.27	60	64	63.50	9	18
2 1/2	27	19	38.10	73	70	76.20	10	19
3	28	21	42.86	89	70	88.90	10	21
4	32	25	63.50	114	76	117.48	13	25

GENERAL NOTE: Dimensions are in millimeters.

NOTES:

(1) Cautionary Note Regarding Hex Bushings: Hex head bushings of one-size reduction should not be used in services where they might be subject to harmful loads and forces other than internal pressures.

(2) Manufacturer's applied tolerance shall ensure dimension will fit U.S. Customary tooling.

Correlation of Fittings Class With Schedule Number or Wall Designation of Pipe Table

Class Designation of Fittings	Type of Fitting	Pipe Used for Rating Basis	
		Schedule No.	Wall Designation
2000	Threaded	80	XS
3000	Threaded	160	...
6000	Threaded	...	XXS
3000	Socket-welding	80	XS
6000	Socket-welding	160	...
9000	Socket-welding	...	XXS

NOTE: (1) This table is not intended to restrict the use of pipe of thinner or thicker wall with fittings. The pipe actually used may be thinner or thicker in nominal wall than that shown in the table. When thinner pipe is used, its strength may govern the rating. When thicker pipe is used (e.g., for mechanical strength), the strength of the fitting governs the rating.

Nominal Wall Thickness of Schedule 160 and Double Extra Strong Pipe

NPS	Schedule 160		XXS	
	mm	In.	mm	In.
1/8	**3.15**	**0.124**	**4.83**	**0.190**
1/4	**3.68**	**0.145**	**6.05**	**0.238**
3/8	**4.01**	**0.158**	**6.40**	**0.252**