



**SOUTHWEST GAS CORPORATION**

® ENGINEERING STAFF

**MATERIAL SPECIFICATION**

*Prepared By:* Engineering Staff 

*Approved By:* Jerome T. Schmitz 

<b>Section No:</b>	MS B-2
<b>Page No.:</b>	1 of 27
<b>Issue Date:</b>	02/26/20
<b>Superseded Date:</b>	05/07/18

**PIPE FITTINGS**

Fittings, Butt-Welded Steel

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**1. SCOPE**

This specification covers 1/2" NPS through 36" NPS steel butt-welded fittings including ells, tees, reducers and caps for use in natural gas transmission and distribution systems.

**2. APPLICABLE DOCUMENTS**

- 2.1 ANSI (American National Standards Institute), B-16.9, "Factory-Made Wrought Steel Butt-Welding Fittings."
- 2.2 ANSI (American National Standards Institute), B-16.28, "Wrought Steel Butt-Welding Elbows and Returns."
- 2.3 ANSI (American National Standards Institute), B-31, "Code for Pressure Piping."
- 2.4 API (American Petroleum Institute), Standard 1104, "Welding of Pipelines and Related Facilities."
- 2.5 ASME (American Society of Mechanical Engineers), Boiler and Pressure Vessel Code, Section VIII, Division I, "Pressure Vessels."
- 2.6 ASME (American Society of Mechanical Engineers), Boiler and Pressure Vessel Code, Section IX, "Welding Qualifications."
- 2.7 ASTM International (American Standard for Testing and Material), A-234, "Standard Specification for Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures."
- 2.8 ASTM International (American Standard for Testing and Material), A-370, "Mechanical Testing of Steel Products, Annex II, Steel Tubular Products."
- 2.9 ASTM International (American Standard for Testing and Material), A-751, "Standard Methods, Practices and Definition for Chemical Analysis of Steel Products."
- 2.10 MSS (Manufacturers Standardization Society), Standard Practice (SP) 75-2004, "Specification for High Test Wrought Butt-Welding Fittings."



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**2. APPLICABLE DOCUMENTS** (Cont'd)

2.11 Title 49, Code of Federal Regulations (CFR), Title 49, Part 192, "Transportation of Natural and Other Gas by Pipeline; Minimum Safety Standards" (49 CFR 192).

**NOTE:** Unless otherwise specified, the editions of the document incorporated in whole or in part by 49 CFR 192 are applicable. The above documents, and parts of documents (including annexes), not incorporated by 49 CFR 192 are incorporated by this Material Specification and will be the most recent edition. If a conflict exists between the applicable documents and/or this Material Specification, the requirements of 49 CFR 192 shall govern, and in the event of all other conflicts, the more stringent requirement shall govern.

**3. TERMINOLOGY**

3.1 General

3.1.1 "Southwest Gas," "Southwest" or "SWG" wherever used in this specification and other related documents will refer exclusively to Southwest Gas Corporation.

3.1.2 The terms "approve," "as approved," "satisfactory," "as directed," "or equal," or other similar terms wherever used in this specification and other related documents, will mean "as determined by Southwest Gas," unless specifically stated otherwise.

3.1.3 "Product Information Package" or "PIP" wherever used in this specification and other related documents will mean the required information that a manufacturer must submit to SWG to determine if the product is suitable for use by SWG, unless specifically stated otherwise.

3.1.4 The term "wrought," as defined by ANSI B-16.9, will denote fittings made of pipe, tubing, plate or forgings.



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**4. MATERIALS AND MANUFACTURE**

- 4.1 Fittings purchased to this specification will be manufactured, as a minimum, in accordance with ASTM A-234, MSS SP-75, ANSI B-16.9 and any additional requirements as defined in this specification.
- 4.2 Killed steel, made by one or more of the following processes; open hearth, basic oxygen or electric furnace, will be used exclusively in the manufacturing of fittings to this specification.
- 4.3 Steel fittings will be one of the following grades, manufactured to the designated standard and posses the corresponding specified minimum yield strength (SMYS):

Grade	Common Description	SMYS (psig)	Standard
WPB	STD	35,000	ASTM A-234
WPHY-42	Y-42	42,000	MSS SP-75
WPHY-46	Y-46	46,000	MSS SP-75
WPHY-52	Y-52	52,000	MSS SP-75
WPHY-60	Y-60	60,000	MSS SP-75

**TABLE B-2.1**

- 4.4 Fittings may be fabricated by forging, hammering, pressing, piercing, rolling, extruding, upsetting, welding or any combination of these operations. All welds will conform to ASME Boiler and Pressure Vessel Code or API Standard 1104.
- 4.5 All fittings may be heat treated using one or more of the following procedures: stress relieving, normalizing or normalizing and tempering. Only WPHY grade fittings may be heat treated using the quenching and tempering technique.
- 4.6 Fitting ends will be beveled for welding in accordance with ANSI B-16.9.



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**4. MATERIALS AND MANUFACTURE (Cont'd)**

4.7 Each type of fitting will have a prototype hydrostatically tested to ensure that the bursting pressure is at least the pressure determined in Equation B-2.1. All fittings will be manufactured in accordance with quality assurance procedures sufficient to ensure that each fitting meets the design and quality requirements equal to the prototype fitting.

$$P = \frac{2 St}{D}$$

WHERE:

- P = Burst Pressure
- S= Minimum Specified Tensile Strength
- t = Wall Thickness
- D = Outside Diameter

The following is the Southwest Gas Corporation requirements for prototype testing:

- One fitting of a type and design may be used to represent fittings from 1/2 to 2 times the size of fittings of same type.
  - A fitting of a material grade and/or wall thickness if the design is essentially the same and only the material grade and/or wall thickness are varied. Manufacturers must be able to verify the tensile strength use in accordance with the applicable material standard.
  - Fitting type differentiation will be approved by Southwest Gas.
- 4.8 Fittings may be painted or treated with corrosion inhibiting agents to prevent rusting.
- 4.9 Fittings will not be taper bored to obtain the specified wall thickness without prior approval from the requestor at Southwest Gas. The reduced end of reducers and reducing tees are exempt from this requirement. All taper boring will be completed in accordance with the specifications in API/ASME B-31.8, Appendix I.



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## **5. PERFORMANCE REQUIREMENTS**

- 5.1 All grades of steel used to make fittings to this specification will meet the tensile requirement of ASTM A-234 or MSS SP-75. Testing procedures will conform to the requirements of ASTM A-370. All testing will include yield strength, ultimate yield strength and elongation at room temperature. Southwest may, at their discretion, require the results of such tests if specified on the purchase order.
- 5.2 All fittings under this specification will be able to withstand a hydrostatic test at a pressure level equivalent to that required to develop a hoop stress equal to the specified minimum yield strength (SMYS) of pipe of equivalent grade and wall thickness, without failure, leakage or damage. These pressures are shown in Appendix A of this specification under the column "AT 100% SMYS".
- 5.3 Bursting (proof) test pressure will be equal to or greater than the design test pressure as determined by ANSI/ASME B-31, Code for Pressure Piping. Record of design and successful proof test will be available for inspection to Southwest Gas at their discretion.

## **6. DIMENSIONS AND TOLERANCES**

All butt-welding fittings manufactured to this specification will meet the dimension and tolerance requirements of ANSI B-16.9 for regular radius fittings and ANSI B-16.28 for short radius ells. Common sizes and their dimensions are shown in Appendices M, N, O, P, Q and R of this document.

## **7. INSPECTION**

- 7.1 Successful review of the Product Information Package (PIP), as well as any future reference by SWG to the Seller's part number or internal code number in any future contract or purchase, will mean only that no conflict with the specification was found and will not relieve the Seller from meeting all the requirements of this specification.
- 7.2 SWG retains the option to inspect the manufacture and testing of all materials and products referenced in this specification that are sold to Southwest Gas.



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**7. INSPECTION** (Cont'd)

- 7.3 Southwest will make appropriate inspections and tests of all materials, products, or systems supplied to this specification. SWG will have the right, at their option, to reject any material which fails to conform to this specification. Any such rejection may take place at the manufacturer's facility; the supplier's warehouse or any subsequent delivery location, before or after Southwest assumes possession. Notice of rejection will be made promptly thereafter by SWG. The defective product will be replaced or returned for credit at the manufacturer's expense.
- 7.4 Any changes in the manufacturing of previously approved materials, products or systems described in this material specification, for sale to SWG must be approved by SWG's Engineering Staff. **Failure to obtain SWG's approval may be cause for rejection and disqualification as an approved supplier.**

**8. CERTIFICATION**

The manufacturer's or supplier's certification will be furnished to Southwest. This certification shall state that samples representing each lot have been manufactured, tested, and inspected in accordance with this specification and that all requirements have been met. When requested or specified in the purchase order or contract, a report of test results will be provided.

For components with material yield strength grades of 42,000 psi (X42) or greater and with nominal diameters of greater than 2 inches, testing documentation demonstrating the physical characteristics of the components which include, at a minimum, diameter, yield strength, ultimate tensile strength, wall thickness, seam type and chemical composition shall be provided to Southwest in accordance with 49 CFR 192.

Upon the request of Southwest, the certification of an independent third-party indicating conformance to the specification may be considered at Southwest's expense.



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**9. SAFETY DATA SHEETS**

In accordance with law, the Seller will supply Safety Data Sheets for all applicable items supplied under this specification to the following:

- 1) The Receiving Location
- 2) Engineering Staff
- 3) Southwest Gas Corporation  
Corporate Safety  
Mail Station LVA-120  
P.O. Box 98510  
Las Vegas, NV 89193-8510

**10. PRODUCT MARKING**

All fittings sold to Southwest will be marked with the following:

- Manufacturer's name or trademark
- Manufacturer's part number
- Material identification (see Table B-2.1)
- Nominal pipe size
- Schedule or nominal wall thickness.

Southwest retains the right to require the fittings to be marked with Southwest's purchase order number and/or heat code identity.

**11. PACKAGING AND PACKAGE MARKING**

All fittings covered in this specification will be packaged in a manner to prevent damage during transportation and storage.



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**12. STOCK CLASSIFICATION DESCRIPTION**

\_\_\_\_\_ ELL, STEEL WELD, \_\_\_\_\_-INCH, \_\_\_\_\_ STANDARD WALL THICKNESS,  
GRADE B, ANSI 16.9.



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**APPENDIX A**

<b>GRADE WPB (Based on SMYS = 35000 psi)</b>									
Nominal Pipe Size (NPS)	O.D. (Inches)	Designation *	Wall Thickness (Inches)	At 100% SMYS	At 20% SMYS	Design Pressure (psig) for CLASS LOCATIONS			
						1	2	3	4
1/2"	0.840	STD	0.109	9083	1817	6540	5450	4541	3633
	0.840	XS	0.147	12250	2450	8820	7350	6125	4900
	0.840	XXS	0.294	24500	4900	17640	14700	12250	9800
3/4"	1.050	STD	0.113	7533	1507	5424	4520	3766	3013
	1.050	XS	0.154	10267	2053	7392	6160	5133	4106
	1.050	XXS	0.308	20533	4107	14784	12320	10266	8213
1"	1.315	STD	0.133	7080	1416	5097	4247	3539	2831
	1.315	XS	0.179	9529	1906	6860	5717	4764	3811
	1.315	XXS	0.358	19057	3811	13721	11434	9528	7622
1-1/4"	1.660	STD	0.140	5904	1181	4250	3542	2951	2361
	1.660	XS	0.191	8054	1611	5799	4832	4027	3221
	1.660	XXS	0.382	16108	3222	11598	9665	8054	6443
1-1/2"	1.900	STD	0.145	5342	1068	3846	3205	2671	2136
	1.900	XS	0.200	7368	1474	5305	4421	3684	2947
	1.900	XXS	0.400	14737	2947	10610	8842	7368	5894
2"	2.375	STD	0.154	4539	908	3268	2723	2269	1815
	2.375	XS	0.218	6425	1285	4626	3855	3212	2570
	2.375	XXS	0.436	12851	2570	9252	7710	6425	5140
3"	3.500	STD	0.216	4320	864	3110	2592	2160	1728
	3.500	XS	0.300	6000	1200	4320	3600	3000	2400
	3.500	XXS	0.600	12000	2400	8640	7200	6000	4800
4"	4.500	STD	0.188	2924	585	2105	1754	1462	1169
	4.500		0.237	3687	737	2654	2212	1843	1474
	4.500		0.337	5242	1048	3774	3145	2621	2096
	4.500		0.674	10484	2097	7548	6290	5242	4193
6"	6.625	STD	0.219	2314	463	1666	1388	1156	925
	6.625		0.280	2958	592	2130	1775	1479	1183
	6.625		0.432	4565	913	3286	2738	2282	1825
	6.625		0.864	9129	1826	6572	5477	4564	3651

\* STD – Standard  
 XS – Extra Strong  
 XXS – Double Extra Strong

**TABLE B-2.2**



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**APPENDIX B**

<b>GRADE WPB (Based on SMYS = 241320 kPa)</b>										
Nominal Pipe Size (NPS)	O.D. (mm)	Designation*	Wall Thickness (mm)	At 100% SMYS (kPa)	At 20% SMYS (kPa)	Design Pressure (kPa) for CLASS LOCATIONS				
						1	2	3	4	
1/2"	21.34	STD	2.769	62625	12528	45092	37576	31309	25049	
	21.34	XS	3.734	84461	16892	60812	50676	42203	33784	
	21.34	XXS	7.468	168921	33784	121624	101353	84461	67569	
3/4"	26.67	STD	2.870	51938	10390	37397	31164	25966	20774	
	26.67	XS	3.912	70788	14155	50966	42472	35391	28310	
	26.67	XXS	7.823	141570	28317	101932	84943	70782	56627	
1"	33.40	STD	3.378	48815	9768	35143	29282	24401	19519	
	33.40	XS	4.547	65700	13141	47298	39417	32847	26276	
	33.40	XXS	9.093	131393	26276	94603	78835	65693	52552	
1-1/4"	42.16	STD	3.556	40707	8143	29303	24421	20346	16279	
	42.16	XS	4.851	55530	11107	39983	33315	27765	22208	
	42.16	XXS	9.703	111061	22215	79965	66639	55530	44423	
1-1/2"	48.26	STD	3.683	36832	7364	26517	22098	18416	14727	
	48.26	XS	5.080	50800	10163	36577	30481	25400	20319	
	48.26	XXS	10.16	101608	20319	73153	60963	50801	40637	
2"	60.33	STD	3.912	31295	6260	22532	18774	15644	12514	
	60.33	XS	5.537	44299	8860	31895	26519	22146	17720	
	60.33	XXS	11.07	88605	17720	63790	53159	44299	35439	
3"	88.90	STD	5.486	29785	5957	21443	17871	14893	11914	
	88.90	XS	7.620	41369	8274	29785	24821	20684	16547	
	88.90	XXS	15.24	82737	16547	59571	49642	41369	33095	
4"	114.3	STD	4.775	20160	4033	14513	12093	10080	8060	
	114.3		6.020	25421	5081	18299	15251	12707	10163	
	114.3		XS	8.560	36142	7226	26021	21684	18071	14451
	114.3		XXS	17.11	72285	14458	52042	43368	36142	28910
6"	168.3	STD	5.563	15954	3192	11487	9570	7970	6378	
	168.3		7.112	20395	4082	14686	12238	12238	8156	
	168.3		XS	10.97	31475	6295	22656	18878	15734	12583
	168.3		XXS	21.95	62942	12590	45312	37763	31468	25173

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**TABLE B-2.3**



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**APPENDIX C**

GRADE WPB (Based on SMYS = 35000 psi)									
Nominal Pipe Size (NPS)	O.D. (Inches)	Designation*	Wall Thickness (Inches)	At 100% SMYS	At 20% SMYS	Design Pressure (psig) for CLASS LOCATIONS			
						1	2	3	4
8"	8.625		0.219	1777	355	1279	1066	888	710
	8.625		0.250	2029	406	1460	1217	1014	811
	8.625		0.277	2248	450	1618	1348	1124	899
	8.625	STD	0.322	2613	523	1881	1568	1306	1045
	8.625	XS	0.500	4058	812	2921	2434	2028	1623
	8.625	XXS	0.875	7101	1420	5113	4260	3550	2840
10"	10.750		0.219	1426	285	1026	855	713	570
	10.750		0.250	1628	326	1172	976	813	651
	10.750	STD	0.365	2377	475	1711	1426	1188	950
	10.750	XS	0.500	3256	651	2344	1953	1627	1302
	10.750	XXS	1.000	6512	1302	4688	3906	3255	2604
12"	12.750		0.250	1373	275	988	823	686	549
	12.750	STD	0.375	2059	412	1482	1235	1029	823
	12.750	XS	0.500	2745	549	1976	1647	1372	1098
	12.750	XXS	1.000	5490	1098	3952	3294	2745	2196
16"	16.00		0.250	1094	219	787	656	546	437
	16.00		0.312	1365	273	982	819	682	546
	16.00	STD	0.375	1641	328	1181	984	820	656
	16.00	XS	0.500	2188	438	1575	1312	1093	875
20"	20.00		0.250	875	175	630	525	437	350
	20.00	STD	0.375	1313	263	945	787	656	525
	20.00	XS	0.500	1750	350	1260	1050	875	700
24"	24.00	STD	0.375	1094	219	787	656	546	437
	24.00	XS	0.500	1458	292	1050	875	729	583
	24.00		0.688	2007	401	1444	1204	1003	802

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**TABLE B-2.4**



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**APPENDIX D**

GRADE WPB (Based on SMYS = 241320 kPa)										
Nominal Pipe Size (NPS)	O.D. (mm)	Designation*	Wall Thickness (mm)	At 100% SMYS (kPa)	At 20% SMYS (kPa)	Design Pressure (kPa) for CLASS LOCATIONS				
						1	2	3	4	
8"	219.1	STD	5.563	12252	2447	8818	7350	6123	4895	
	219.1		6.350	13989	2799	10066	8391	6991	5592	
	219.1		7.036	15499	3103	11156	9294	7750	6198	
	219.1		8.179	18016	3606	12969	10811	9005	7205	
	219.1		12.70	27979	5599	20140	16782	13983	11190	
	219.1		XXS	22.23	48960	9791	35253	29372	24476	19581
10"	273.1	STD	5.563	9832	1965	7074	5895	4916	3930	
	273.1		6.350	11225	2248	8081	6729	5605	4488	
	273.1		9.271	16389	3275	11797	9832	8191	6550	
	273.1		XS	12.70	22449	4488	16161	13465	11218	8977
	273.1		XXS	25.40	44899	8977	32323	26931	22442	17954
12"	323.9	STD	6.350	9467	1896	6812	5674	4730	3785	
	323.9		9.525	14196	2841	10218	8515	7095	5674	
	323.9		XS	12.70	18926	3785	13624	11356	9460	7570
	323.9		XXS	25.40	3785	7570	27248	22711	18926	15141
16"	406.4	STD	6.350	7542	1510	5426	4523	3764	3013	
	406.4		7.925	9411	1882	6771	5647	4702	3765	
	406.4		9.525	11314	2261	8143	6784	5654	4523	
	406.4		XS	12.70	15086	3020	10859	9046	7536	6033
20"	508.0	STD	6.350	6033	1207	4344	3620	3013	2413	
	508.0		9.525	9053	1813	6516	5426	4523	3620	
	508.0		XS	12.70	12066	2413	8687	7239	6033	4826
24"	609.6	STD	9.525	7543	1510	5426	4523	3765	3013	
	609.6		XS	12.70	10053	2013	7239	6033	5026	4020
	609.6		17.48	13838	2765	9956	8301	6915	5530	

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**TABLE B-2.5**

**SOUTHWEST GAS CORPORATION**

ENGINEERING STAFF

**MATERIAL SPECIFICATION***Prepared By:* Engineering Staff*Approved By:* Jerome T. Schmitz

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**PIPE FITTINGS**

Fittings, Butt-Welded Steel

**APPENDIX E**

<b>GRADE WPHY-42 (Based on SMYS = 42000 psi)</b>									
Nominal Pipe Size (NPS)	O.D. (Inches)	Designation*	Wall Thickness (Inches)	At 100% SMYS	At 20% SMYS	Design Pressure (psig) for CLASS LOCATIONS			
						1	2	3	4
4"	4.500		0.188	3509	702	2526	2105	1754	1403
	4.500	STD	0.237	4424	885	3185	2654	2212	1769
	4.500	XS	0.337	6291	1258	4529	3774	3145	2516
6"	6.625		0.219	2777	555	1999	1666	1388	1110
	6.625	STD	0.280	3550	710	2556	2130	1775	1420
	6.625	XS	0.432	5477	1095	3943	3286	2738	2190
8"	8.625		0.219	2133	427	1535	1279	1066	853
	8.625		0.250	2435	487	1753	1460	1217	973
	8.625		0.277	2698	540	1942	1618	1348	1079
	8.625	STD	0.322	3136	627	2257	1881	1568	1254
	8.625	XS	0.500	4870	974	3506	2921	2434	1947
10"	10.750		0.219	1711	342	1232	1026	855	684
	10.750		0.250	1953	391	1406	1172	976	781
	10.750	STD	0.365	2852	570	2053	1711	1426	1140
	10.750	XS	0.500	3907	781	2813	2344	1953	1562
12"	12.750		0.250	1647	329	1185	988	823	658
	12.750	STD	0.375	2471	494	1778	1482	1235	988
	12.750	XS	0.500	3294	659	2371	1976	1647	1317
16"	16.000		0.250	1313	263	945	787	656	525
	16.000		0.312	1638	328	1179	982	819	655
	16.000	STD	0.375	1969	394	1417	1181	984	787
	16.000	XS	0.500	2625	525	1890	1575	1312	1050
20"	20.000		0.250	1050	210	756	630	525	420
	20.000	STD	0.375	1575	315	1134	945	787	630
	20.000	XS	0.500	2100	420	1512	1260	1050	840
24"	24.000		0.375	1313	263	945	787	656	525
	24.000	STD	0.500	1750	350	1260	1050	875	700
	24.000	XS	0.688	2408	482	1733	1444	1204	963

\* STD – Standard  
XS – Extra Strong  
XXS – Double Extra Strong

**TABLE B-2.6**

**SOUTHWEST GAS CORPORATION**

ENGINEERING STAFF

**MATERIAL SPECIFICATION***Prepared By:* Engineering Staff*Approved By:* Jerome T. Schmitz

<b>Section No:</b>	MS B-2
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**PIPE FITTINGS**

Fittings, Butt-Welded Steel

**APPENDIX F**

<b>GRADE WPHY-42 (Based on SMYS = 289580 kPa)</b>									
Nominal Pipe Size (NPS)	O.D. (mm)	Designation*	Wall Thickness (mm)	At 100% SMYS (kPa)	At 20% SMYS (kPa)	Design Pressure (kPa) for CLASS LOCATIONS			
						1	2	3	4
4"	114.3	STD XS	4.775	24194	4840	17416	14513	12093	9673
	114.3		6.020	30502	6102	21960	18299	15251	12197
	114.3		8.560	43375	8674	31226	26021	21684	17347
6"	168.3	STD XS	5.563	19146	3827	13783	11487	9570	7653
	168.3		7.112	24476	4895	17623	14686	12238	9791
	168.3		10.97	37763	7550	27186	22656	18879	15099
8"	219.1	STD XS	5.563	14707	2944	10583	8818	7350	5881
	219.1		6.350	16789	3358	12087	10066	8391	6709
	219.1		7.036	18602	3723	13390	11156	9594	7439
	219.1		8.179	21622	4323	15562	12969	10811	8646
	219.1		12.70	33577	6715	24173	20140	16782	13424
10"	273.1	STD XS	5.563	11797	2358	8494	7074	5895	4716
	273.1		6.350	13465	2696	9694	8081	6729	5385
	273.1		9.271	19664	3930	14155	11797	9832	7860
	273.1		12.70	26938	5385	19395	16161	13465	10770
12"	323.9	STD XS	6.350	11356	2268	8170	6812	5674	4537
	323.9		9.525	17037	3406	12259	10218	8515	6812
	323.9		12.70	22711	4544	16347	13624	11356	9080
16"	406.4	STD XS	6.350	9053	1813	6516	5426	4523	3620
	406.4		7.925	11294	2261	8129	6771	5647	4516
	406.4		9.525	13576	2716	9770	8143	6784	5426
	406.4		12.70	18099	3620	13031	10859	9046	7239
20"	508.0	STD XS	6.350	7239	1448	5212	4347	3620	2896
	508.0		9.525	10859	2172	7819	6516	5426	4344
	508.0		12.70	14479	2896	10425	8687	7239	5792
24"	609.6	STD XS	9.525	9053	1813	6516	5426	4523	3620
	609.6		12.70	12066	2413	8687	7239	6033	4826
	609.6		17.48	16603	3323	11949	9956	8301	6640

\* STD – Standard  
XS – Extra Strong  
XXS – Double Extra Strong

**TABLE B-2.7**

**SOUTHWEST GAS CORPORATION**

® ENGINEERING STAFF

**MATERIAL SPECIFICATION***Prepared By:* Engineering Staff*Approved By:* Jerome T. Schmitz

<b>Section No:</b>	MS B-2
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**PIPE FITTINGS**

Fittings, Butt-Welded Steel

**APPENDIX G**

<b>GRADE WPHY-46 (Based on SMYS = 46000 psi)</b>									
Nominal Pipe Size (NPS)	O.D. (Inches)	Designation*	Wall Thickness (inches)	At 100% SMYS	At 20% SMYS	Design Pressure (psig) for CLASS LOCATIONS			
						1	2	3	4
4"	4.500	STD	0.188	3844	769	2767	2306	1921	1537
	4.500		0.237	4845	969	3488	2907	2422	1938
	4.500		0.337	6890	1378	4960	4133	3444	2755
6"	6.625	STD	0.219	3041	608	2189	1824	1520	1216
	6.625		0.280	3888	778	2799	2332	1944	1555
	6.625		0.432	5999	1200	4319	3599	2999	2399
8"	8.625	STD	0.219	2336	467	1681	1401	1168	934
	8.625		0.250	2667	533	1920	1600	1333	1066
	8.625		0.277	2955	591	2127	1772	1477	1181
	8.625		0.322	3435	687	2472	2060	1717	1373
	8.625		0.500	5333	1067	3840	3200	2666	2133
10"	10.750	STD	0.219	1874	375	1349	1124	937	749
	10.750		0.250	2140	428	1540	1283	1069	855
	10.750		0.365	3124	625	2249	1874	1561	1249
	10.750		0.500	4279	856	3080	2567	2139	1711
12"	12.750	STD	0.250	1804	361	1298	1082	901	721
	12.750		0.375	2706	541	1948	1623	1352	1082
	12.750		0.500	3608	722	2597	2164	1803	1443
16"	16.000	STD	0.250	1438	288	1035	862	718	575
	16.000		0.312	1794	359	1291	1076	897	717
	16.000		0.375	2156	431	1552	1293	1078	862
	16.000		0.500	2875	575	2070	1725	1437	1150
20"	20.000	STD	0.250	1150	230	828	690	575	460
	20.000		0.375	1725	345	1242	1035	862	690
	20.000		0.500	2300	460	1656	1380	1150	920
24"	24.000	STD	0.375	1438	288	1035	862	718	575
	24.000		0.500	1917	383	1380	1150	958	766
	24.000		0.688	2637	527	1898	1582	1318	1054

\* STD – Standard  
 XS – Extra Strong  
 XXS – Double Extra Strong

**TABLE B-2.8**



**SOUTHWEST GAS CORPORATION**

ENGINEERING STAFF

**MATERIAL SPECIFICATION**

Prepared By: Engineering Staff

Approved By: Jerome T. Schmitz

Section No: MS B-2  
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**PIPE FITTINGS**

Fittings, Butt-Welded Steel

**APPENDIX H**

GRADE WPHY-46 (Based on SMYS = 317159 kPa)									
Nominal Pipe Size (NPS)	O.D. (mm)	Designation*	Wall Thickness (mm)	At 100% SMYS (kPa)	At 20% SMYS (kPa)	Design Pressure (kPa) for CLASS LOCATIONS			
						1	2	3	4
4"	114.3	STD	4.775	26503	5302	19078	15899	13245	10597
	114.3		6.020	33405	6681	24049	20043	16699	13362
	114.3		8.560	47505	9501	34198	28496	23746	18995
6"	168.3	STD	5.563	26967	4192	15093	12576	10480	8384
	168.3		7.112	26807	5364	19298	16079	13403	10721
	168.3		10.97	41362	8274	29778	24814	20677	16541
8"	219.1	STD	5.563	16106	3220	11590	9660	8053	6440
	219.1		6.350	18388	3675	13238	11032	9191	7350
	219.1		7.036	20374	4075	14665	12218	10184	8143
	219.1		8.179	23683	4737	17044	14203	11838	9467
	219.1		12.70	36770	7357	26476	22063	18381	14707
10"	273.1	STD	5.563	12921	2586	9301	7756	6460	5164
	273.1		6.350	14755	2951	10618	8846	7370	5895
	273.1		9.271	21539	4309	15506	12921	10763	8612
	273.1		12.70	29503	5902	21236	17699	14748	11797
12"	323.9	STD	6.350	12438	2489	8949	7460	6212	4971
	323.9		9.525	18657	3730	13431	11190	9322	7460
	323.9		12.70	24876	4978	17906	14920	12431	9949
16"	406.4	STD	6.350	9915	1986	7136	5943	4950	3964
	406.4		7.925	12369	2475	8901	7419	6185	4944
	406.4		9.525	14865	2972	10701	8915	7433	5943
	406.4		12.70	19822	3964	14272	11893	9908	7929
20"	508.0	STD	6.350	7929	1586	5709	4757	3964	3172
	508.0		9.525	11893	2379	8563	7136	5943	4757
	508.0		12.70	15857	3172	11418	9515	7929	6343
24"	609.6	STD	9.525	9915	1986	7136	5943	4950	3964
	609.6		12.70	13217	2641	9515	7929	6605	5281
	609.6		17.48	18181	3634	13086	10908	9087	7267

\* STD – Standard  
 XS – Extra Strong  
 XXS – Double Extra Strong

**TABLE B-2.9**





**SOUTHWEST GAS CORPORATION**

ENGINEERING STAFF

**MATERIAL SPECIFICATION**

Prepared By: Engineering Staff

Approved By: Jerome T. Schmitz

Section No: MS B-2  
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**PIPE FITTINGS**

Fittings, Butt-Welded Steel

**APPENDIX I**

GRADE WPHY-52 (Based on SMYS = 52000 psi)									
Nominal Pipe Size (NPS)	O.D. (Inches)	Designation*	Wall Thickness (inches)	At 100% SMYS	At 20% SMYS	Design Pressure (psig) for CLASS LOCATIONS			
						1	2	3	4
4"	4.500	STD	0.188	4345	869	3128	2606	2172	1737
	4.500		0.237	5477	1095	3943	3286	2738	2190
	4.500		0.337	7788	1558	5607	4673	3894	3115
6"	6.625	STD	0.219	3438	688	2475	2062	1718	1375
	6.625		0.280	4395	879	3164	2637	2197	1758
	6.625		0.432	6782	1356	4882	4068	3390	2712
8"	8.625	STD	0.219	2641	528	1901	1584	1320	1056
	8.625		0.250	3014	603	2170	1808	1507	1205
	8.625		0.277	3340	668	2404	2004	1670	1336
	8.625		0.322	3883	777	2795	2329	1941	1553
	8.625		0.500	6029	1206	4340	3617	3014	2411
10"	10.750	STD	0.219	2119	424	1525	1271	1059	847
	10.750		0.250	2419	484	1741	1451	1209	967
	10.750		0.365	3531	706	2542	2118	1765	1412
	10.750		0.500	4837	967	3482	2902	2418	1934
12"	12.750	STD	0.250	2039	408	1468	1223	1019	815
	12.750		0.375	3059	612	2202	1835	1529	1223
	12.750		0.500	4078	816	2936	2447	2039	1631
16"	16.000	STD	0.250	1625	325	1170	975	812	650
	16.000		0.312	2028	406	1460	1216	1014	811
	16.000		0.375	2438	488	1755	1462	1218	975
	16.000		0.500	3250	650	2340	1950	1625	1300
20"	20.000	STD	0.250	1300	260	936	780	650	520
	20.000		0.375	1950	390	1404	1170	975	780
	20.000		0.500	2600	520	1872	1560	1300	1040
24"	24.000	STD	0.375	1625	325	1170	975	812	650
	24.000		0.500	2167	433	1560	1300	1083	866
	24.000		0.688	2981	596	2146	1788	1490	1192

\* STD – Standard  
 XS – Extra Strong  
 XXS – Double Extra Strong

**TABLE B-2.10**



**SOUTHWEST GAS CORPORATION**

ENGINEERING STAFF

**MATERIAL SPECIFICATION**

*Prepared By:* Engineering Staff

*Approved By:* Jerome T. Schmitz

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**PIPE FITTINGS**

Fittings, Butt-Welded Steel

**APPENDIX J**

GRADE WPHY-52 (Based on SMYS = 358527 kPa)									
Nominal Pipe Size (NPS)	O.D. (mm)	Designation*	Wall Thickness (mm)	At 100% SMYS (kPa)	At 20% SMYS (kPa)	Design Pressure (kPa) for CLASS LOCATIONS			
						1	2	3	4
4"	114.3	STD	4.775	29958	5996	21567	17968	14975	11976
	114.3		6.020	37763	7550	27186	22656	18879	15100
	114.3		8.560	53696	10742	38660	32219	26848	21477
6"	168.3	STD	5.563	23704	4744	17065	14217	11845	9480
	168.3		7.112	30302	6060	21815	18181	15148	12121
	168.3		10.97	46760	9349	33660	28048	23373	18699
8"	219.1	STD	5.563	18209	3640	13107	10921	9101	7281
	219.1		6.350	20781	4158	14962	12466	10390	8308
	219.1		7.036	23028	4606	16575	13817	11514	9211
	219.1		8.179	26772	5357	19271	16058	13383	10708
	219.1		12.70	41568	8315	29923	24938	20781	16623
10"	273.1	STD	5.563	14610	2923	10515	8763	7302	5840
	273.1		6.350	16678	3337	12004	10004	8336	6667
	273.1		9.271	24345	4868	17526	14603	12169	9735
	273.1		12.70	33350	6667	24008	20009	16672	13334
12"	323.9	STD	6.350	14058	2813	10122	8432	7026	5619
	323.9		9.525	21091	4220	15182	12652	10542	8432
	323.9		12.70	28117	5626	20243	16871	14058	11245
16"	406.4	STD	6.350	11204	2241	8067	6722	5599	4482
	406.4		7.925	13983	2799	10066	8384	6991	5592
	406.4		9.525	16809	3365	12100	10080	8398	6722
	406.4		12.70	22408	4482	16134	13445	11204	8963
20"	508.0	STD	6.350	8963	1793	6453	5378	4482	3585
	508.0		9.525	13445	2689	9680	8067	6722	5378
	508.0		12.70	17926	3585	12907	10756	8963	7171
24"	609.6	STD	9.525	11204	2241	8067	6722	5599	4482
	609.6		12.70	14941	2985	10756	8963	7467	5971
	609.6		17.48	20553	4109	14796	12328	10273	8219

\* STD – Standard  
 XS – Extra Strong  
 XXS – Double Extra Strong

**TABLE B-2.11**



**SOUTHWEST GAS CORPORATION**

ENGINEERING STAFF

**MATERIAL SPECIFICATION**

Prepared By: Engineering Staff

Approved By: Jerome T. Schmitz

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**PIPE FITTINGS**

Fittings, Butt-Welded Steel

**APPENDIX K**

GRADE WPHY-60 (Based on SMYS = 60000 psi)									
Nominal Pipe Size (NPS)	O.D. (inches)	Designation*	Wall Thickness (inches)	At 100% SMYS	At 20% SMYS	Design Pressure (psig) for CLASS LOCATIONS			
						1	2	3	4
4"	4.500	STD	0.188	5013	1003	3609	3008	2506	2005
	4.500		0.237	6320	1264	4550	3792	3160	2528
	4.500		0.337	8987	1797	6470	5392	4493	3594
6"	6.625	STD	0.219	3967	793	2856	2380	1983	1586
	6.625		0.280	5072	1014	3651	3043	2535	2028
	6.625		0.432	7825	1565	5633	4694	3912	3129
8"	8.625	STD	0.219	3047	609	2193	1828	1523	1218
	8.625		0.250	3478	696	2504	2086	1739	1391
	8.625		0.277	3854	771	2774	2312	1926	1541
	8.625		0.322	4480	896	3225	2688	2240	1792
	8.625		0.500	6957	1391	5008	4173	3478	2782
10"	10.750	STD	0.219	2445	489	1760	1466	1222	977
	10.750		0.250	2791	558	2009	1674	1395	1116
	10.750		0.365	4074	815	2933	2444	2037	1629
	10.750		0.500	5581	1116	4018	3348	2790	2232
12"	12.750	STD	0.250	2353	471	1694	1411	1176	941
	12.750		0.375	3529	706	2541	2117	1764	1411
	12.750		0.500	4706	941	3388	2823	2352	1882
16"	16.000	STD	0.250	1875	375	1350	1125	937	750
	16.000		0.312	2340	468	1684	1404	1170	936
	16.000		0.375	2813	563	2025	1687	1406	1125
	16.000		0.500	3750	750	2700	2250	1875	1500
20"	20.000	STD	0.250	1500	300	1080	900	750	600
	20.000		0.375	2250	450	1620	1350	1125	900
	20.000		0.500	3000	600	2160	1800	1500	1200
24"	24.000	STD	0.375	1875	375	1350	1125	937	750
	24.000		0.500	2500	500	1800	1500	1250	1000
	24.000		0.688	3440	688	2476	2064	1720	1376

\* STD – Standard  
 XS – Extra Strong  
 XXS – Double Extra Strong

**TABLE B-2.12**



**SOUTHWEST GAS CORPORATION**

ENGINEERING STAFF

**MATERIAL SPECIFICATION**

Prepared By: Engineering Staff

Approved By: Jerome T. Schmitz

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**PIPE FITTINGS**

Fittings, Butt-Welded Steel

**APPENDIX L**

GRADE WPHY-60 (Based on SMYS = 413685 kPa)									
Nominal Pipe Size (NPS)	O.D. (mm)	Designation*	Wall Thickness (mm)	At 100% SMYS (kPa)	At 20% SMYS (kPa)	Design Pressure (kPa) for CLASS LOCATIONS			
						1	2	3	4
4"	114.3	STD XS	4.775	34563	6915	24883	20739	17278	13824
	114.3		6.020	43575	8715	31371	26145	21787	17430
	114.3		8.560	61963	12390	44609	37177	30978	24780
6"	168.3	STD XS	5.563	27352	5468	19691	16410	13672	10935
	168.3		7.112	34970	6991	25173	20981	17478	13983
	168.3		10.97	53951	10790	38838	32364	26972	21574
8"	219.1	STD XS	5.563	21008	4199	15120	12604	10501	8398
	219.1		6.350	23980	4799	17264	14382	11990	9591
	219.1		7.036	26572	5316	19126	15941	13279	10625
	219.1		8.179	30889	6178	22236	18533	15444	12355
	219.1		12.70	47967	9591	34529	28772	23980	19181
10"	273.1	STD XS	5.563	16858	3372	12135	10108	8425	6736
	273.1		6.350	19243	3847	13852	11542	9618	7695
	273.1		9.271	28089	5619	20222	16851	14045	11232
	273.1		12.70	38480	7695	27703	23084	19237	15390
12"	323.9	STD XS	6.350	16223	3247	11680	9729	8108	6488
	323.9		9.525	24332	4868	17520	14596	12162	9729
	323.9		12.70	32447	6488	23359	19464	16216	12976
16"	406.4	STD XS	6.350	12928	2586	9308	7757	6460	5171
	406.4		7.925	16134	3227	11611	9680	8067	6453
	406.4		9.525	19395	3882	13962	11631	9694	7757
	406.4		12.70	25855	5171	18616	15513	12928	10342
20"	508.0	STD XS	6.350	10342	2068	7446	6205	5171	4137
	508.0		9.525	15513	3103	11170	9308	7757	6205
	508.0		12.70	20684	4137	14893	12411	10342	8274
24"	609.3	STD XS	9.525	12928	2586	9308	7757	6460	5171
	609.3		12.70	17237	3447	12411	10342	8618	6895
	609.3		17.48	23718	4744	17071	14231	11859	9487

\* STD – Standard  
 XS – Extra Strong  
 XXS – Double Extra Strong

**TABLE B-2.13**



**SOUTHWEST GAS CORPORATION**

ENGINEERING STAFF

**MATERIAL SPECIFICATION**

Prepared By: Engineering Staff

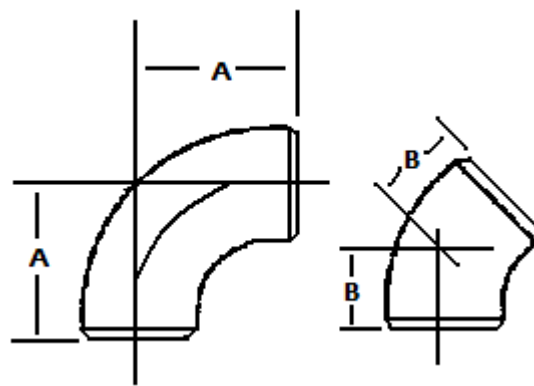
Approved By: Jerome T. Schmitz

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**PIPE FITTINGS**

Fittings, Butt-Welded Steel

**APPENDIX M**



DIMENSION FOR LONG, SHORT AND 3X RADIUS ELBOWS					
Center-to-End					
Nominal Pipe Size (NPS) (Inches)	Outside Diameter at Bevel D	Long		Short	3R
		90° Elbows A	45° Elbows B	90° Elbows A	90° Elbows A
		Inches	Inches	Inches	Inches
1/2	0.84	1.50	0.62	—	—
3/4	1.05	1.12	0.44	—	—
1	1.32	1.50	0.88	1.00	—
1-1/4	1.66	1.88	1.00	1.25	—
1-1/2	1.90	2.25	1.12	1.50	—
2	2.38	3.00	1.38	2.00	6.00
3	3.50	4.50	2.00	3.00	9.00
4	4.50	6.00	2.50	4.00	12.00
6	6.62	9.00	3.75	6.00	18.00
8	8.62	12.00	5.00	8.00	24.00
10	10.75	15.00	6.25	10.00	30.00
12	12.75	18.00	7.50	12.00	36.00
16	16.00	24.00	10.00	16.00	48.00
20	20.00	30.00	12.50	20.00	60.00
24	24.00	36.00	15.00	24.00	72.00

**TABLE B-2.14**



**SOUTHWEST GAS CORPORATION**

ENGINEERING STAFF

**MATERIAL SPECIFICATION**

*Prepared By:* Engineering Staff

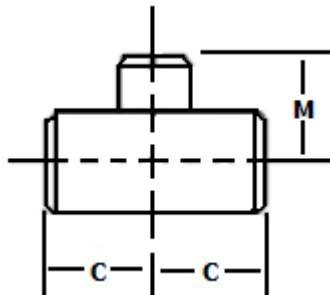
*Approved By:* Jerome T. Schmitz

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**PIPE FITTINGS**

Fittings, Butt-Welded Steel

**APPENDIX N**



Nominal Pipe Size (NPS) (Inches)	Outside Diameter at Bevel D		Center-to-End	
	Run	Outlet	Run C	Outlet M
	Inches	Inches	Inches	Inches
1 x 1 x 1/2 1 x 1 x 3/4 1 x 1 x 1	1.32	0.84 1.05 1.32	1.50	1.50
1 1/4 x 1 1/4 x 3/4 1 1/4 x 1 1/4 x 1 1 1/4 x 1/1/4 x 1 1/4	1.66	1.05 1.32 1.66	1.88	1.88
1 1/2 x 1 1/2 x 3/4 1 1/2 x 1 1/2 x 1 1 1/2 x 1 1/2 x 1 1/4 1 1/2 x 1 1/2 x 1 1/2	1.90	1.05 1.32 1.66 1.90	2.25	2.25
2 x 2 x 3/4 2 x 2 x 1 2 x 2 x 1 1/4 2 x 2 x 1 1/2 2 x 2 x 2	2.38	1.05 1.32 1.66 1.90 2.38	2.50	1.75 2.00 2.25 2.38 2.50
3 x 3 x 1 1/4 3 x 3 x 1 1/2 3 x 3 x 2 3 x 3 x 3	3.50	1.66 1.90 2.38 3.50	3.38	2.75 2.88 3.00 3.38
4 x 4 x 1 1/2 4 x 4 x 2 4 x 4 x 3 4 x 4 x 4	4.50	1.90 2.38 3.50 4.50	4.12	3.38 3.50 3.88 4.12
6 x 6 x 3 6 x 6 x 4 6 x 6 x 6	6.62	3.50 4.50 6.62	5.62	4.88 5.12 5.62

**TABLE B-2.15**



**SOUTHWEST GAS CORPORATION**

ENGINEERING STAFF

**MATERIAL SPECIFICATION**

*Prepared By:* Engineering Staff

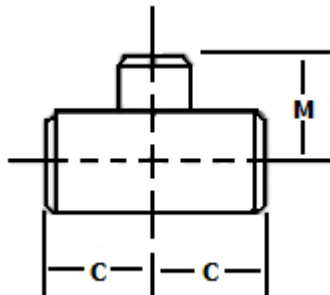
*Approved By:* Jerome T. Schmitz

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**PIPE FITTINGS**

Fittings, Butt-Welded Steel

**APPENDIX O**



**DIMENSIONS FOR TEES AND REDUCING OUTLET TEES**

Nominal Pipe Size (NPS) (Inches)	Outside Diameter at Bevel D		Center-to-End	
	Run	Outlet	Run C	Outlet M
	Inches	Inches	Inches	Inches
8 x 8 x 4	8.62	4.50	7.00	6.12
8 x 8 x 6	8.62	6.62	7.00	6.62
8 x 8 x 8	8.62	8.62	7.00	7.00
10 x 10 x 4	10.75	4.50	8.50	7.25
10 x 10 x 6	10.75	6.62	8.50	7.62
10 x 10 x 8	10.75	8.62	8.50	8.00
10 x 10 x 10	10.75	10.75	8.50	8.50
12 x 12 x 6	12.75	6.62	10.00	8.62
12 x 12 x 8	12.75	8.62	10.00	9.00
12 x 12 x 10	12.75	10.75	10.00	9.50
12 x 12 x 12	12.75	12.75	10.00	10.00
16 x 16 x 6	16.00	6.62	12.00	10.38
16 x 16 x 8	16.00	8.62	12.00	10.75
16 x 16 x 10	16.00	10.75	12.00	11.12
16 x 16 x 12	16.00	12.75	12.00	11.62
16 x 16 x 10	16.00	16.00	12.00	12.00
20 x 20 x 8	20.00	8.62	15.00	12.75
20 x 20 x 10	20.00	10.75	15.00	13.12
20 x 20 x 12	20.00	12.75	15.00	13.62
20 x 20 x 16	20.00	16.00	15.00	14.00
20 x 20 x 20	20.00	20.00	15.00	15.00
24 x 24 x 10	24.00	10.75	17.00	15.12
24 x 24 x 12	24.00	12.75	17.00	15.62
24 x 24 x 16	24.00	16.00	17.00	16.00
24 x 24 x 20	24.00	20.00	17.00	17.00
24 x 24 x 24	24.00	24.00	17.00	17.00

**TABLE B-2.16**



**SOUTHWEST GAS CORPORATION**

® ENGINEERING STAFF

**MATERIAL SPECIFICATION**

*Prepared By:* Engineering Staff 

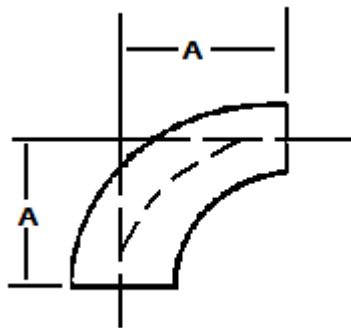
*Approved By:* Jerome T. Schmitz 

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**PIPE FITTINGS**

Fittings, Butt-Welded Steel

**APPENDIX P**



DIMENSION OF LONG RADIUS REDUCING ELBOWS							
Nominal Pipe Size (NPS) (Inches)	Outside Diameter at Bevel		Center-to-End A Inches	Nominal Pipe Size (NPS) (Inches)	Outside Diameter at Bevel		Center-to-End A Inches
	D				D		
	Large End Inches	Small End Inches			Large End Inches	Small End Inches	
2 x 1	2.38	1.32	3.00	10 x 6	10.75	6.62	15.00
2 x 1-1/4	2.38	1.66	3.00	10 x 8	10.75	8.62	15.00
2 x 1-1/2	2.38	1.90	3.00				
3 x 1-1/2	3.50	1.90	4.50	12 x 6	12.75	6.62	18.00
3 x 2	3.50	2.38	4.50	12 x 8	12.75	8.62	18.00
				12 x 10	12.75	10.75	18.00
4 x 2	4.50	2.38	6.00	16 x 10	16.00	10.75	24.00
4 x 3	4.50	3.50	6.00	16 x 12	16.00	12.75	24.00
6 x 3	6.62	3.50	9.00	20 x 10	20.00	10.75	30.00
6 x 4	6.62	4.50	9.00	20 x 12	20.00	12.75	30.00
				20 x 16	20.00	16.00	30.00
8 x 4	8.62	4.50	12.00	24 x 12	24.00	12.75	36.00
8 x 6	8.62	6.62	12.00	24 x 16	24.00	16.00	36.00
				24 x 20	24.00	20.00	36.00



**TABLE B-2.17**





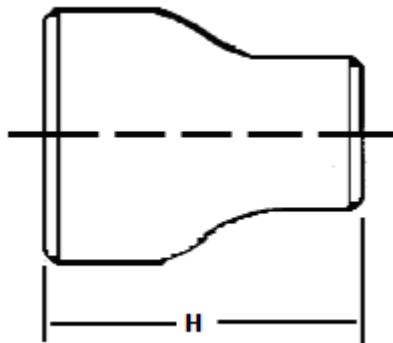
**SOUTHWEST GAS CORPORATION**  
 ENGINEERING STAFF  
**MATERIAL SPECIFICATION**

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*Prepared By:* Engineering Staff   
*Approved By:* Jerome T. Schmitz 

**PIPE FITTINGS**  
 Fittings, Butt-Welded Steel

**APPENDIX Q**



DIMENSION OF REDUCERS							
Nominal Pipe Size (NPS) (Inches)	Outside Diameter at Bevel D		End-to-End A	Nominal Pipe Size (NPS) (Inches)	Outside Diameter at Bevel D		End-to-End A
	Large End	Small End			Large End	Small End	
	In	In	In		In	In	In
1 x 3/4	1.32	1.05	2.00	8 x 4	8.62	4.50	6.00
				8 x 6	8.62	6.62	6.00
1-1/4 x 3/4	1.66	1.05	2.00	10 x 4	10.75	4.50	7.00
	1-1/4 x 1	1.66		1.32	10 x 6	10.75	6.62
				10 x 8	10.75	8.62	7.00
1-1/2 x 3/4	1.90	1.05	2.50	12 x 6	12.75	6.62	8.00
	1-1/2 x 1	1.90		1.32	12 x 8	12.75	8.62
				12 x 10	12.75	10.75	8.00
2 x 3/4	2.38	1.05	3.00	16 x 8	16.00	8.62	14.00
	2 x 1	2.38		1.32	16 x 10	16.00	10.75
				16 x 12	16.00	12.75	14.00
3 x 1-1/4	3.50	1.66	3.50	20 x 12	20.00	12.75	20.00
	3 x 1-1/2	3.50		1.90	20 x 16	20.00	16.00
4 x 1-1/2	4.50	1.90	4.00	24 x 12	24.00	12.75	20.00
	4 x 2	4.50		2.38	24 x 16	24.00	16.00
				24 x 20	24.00	20.00	20.00
6 x 3	6.62	3.50	5.50				
	6 x 4	6.62		4.50			

**TABLE B-2.18**

**SOUTHWEST GAS CORPORATION**

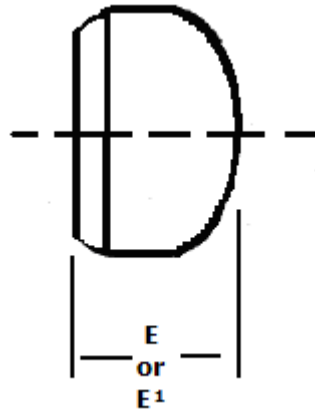
® ENGINEERING STAFF

**MATERIAL SPECIFICATION***Prepared By:* Engineering Staff *Approved By:* Jerome T. Schmitz 

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**PIPE FITTINGS**

Fittings, Butt-Welded Steel

**APPENDIX R**

<b>DIMENSIONS OF CAPS</b>				
<b>Nominal Pipe Size (NPS) (inches)</b>	<b>Outside Diameter at Bevel D</b>	<b>Length <sup>1</sup> E</b>	<b>Limiting Wall Thickness Length E</b>	<b>Length 2 E<sup>1</sup></b>
		<b>Inches</b>	<b>Inches</b>	<b>Inches</b>
1/2	0.84	1.00	0.18	1.00
3/4	1.05	1.00	0.15	1.00
1	1.32	1.50	0.18	1.50
1 1/4	1.66	1.50	0.19	1.50
1 1/2	1.90	1.50	0.20	1.50
2	2.38	1.50	0.22	1.75
3	3.50	2.00	0.30	2.50
4	4.50	2.00	0.34	3.00
6	6.62	3.50	0.43	4.00
8	8.62	4.00	0.50	5.00
10	10.75	5.00	0.50	6.00
12	12.75	6.00	0.50	7.00
16	16.00	7.00	0.50	8.00
20	20.00	9.00	0.50	10.00
24	24.00	10.50	0.50	12.00

1) Length E applies for wall thickness not exceeding that given in the column titled "Limiting Wall Thickness Length E."  
2) Length E<sup>1</sup> applies for wall thickness greater than that given in the column titled "Limiting Wall Thickness Length E."

**TABLE B-2.19**