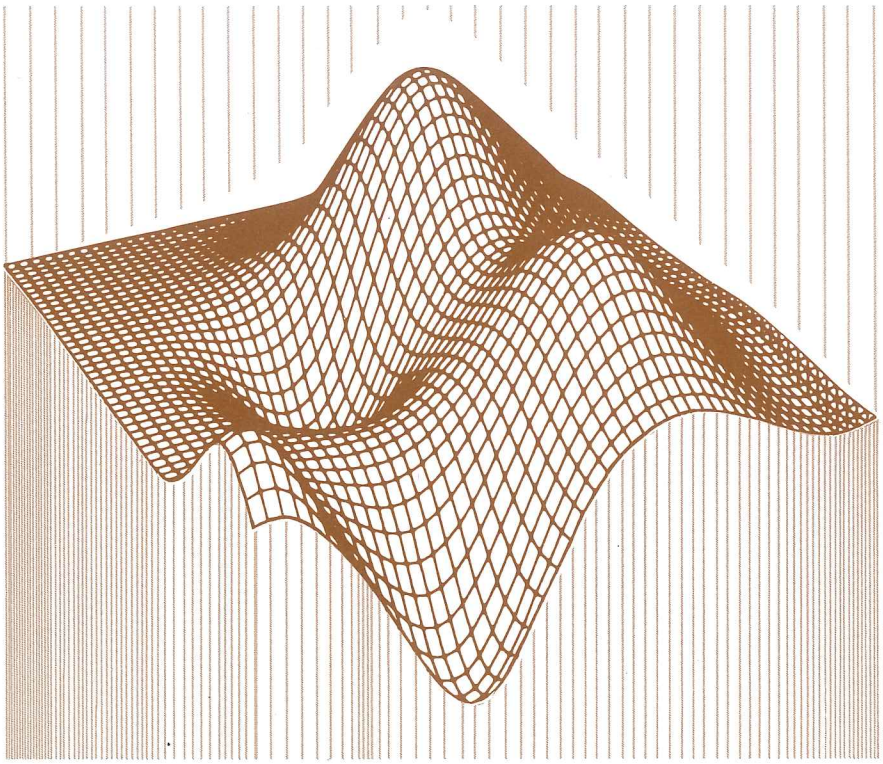
Gasket Design Considerations

amg INDUSTRIES



Since it is usually not economical to obtain fluid-tight joints by machining, a gasket is commonly inserted between the contact faces of a joint. Tightening the fastening bolts causes the gasket material to flow into the minor imperfections resulting in a fluid-tight seal.

The following information is intended only as a general overview of the factors involved in the proper application of a gasket-type seal. The amg Application Engineering Department will be pleased to put its decades of design and production experience to work solving your specific sealing problems.

General Recommendations

The accompanying chart illustrates some of the common applications of metallic and semi-metallic gaskets.

Metallic and Semimetallic Gasket Recommendations

Application	First Choice	Second Choice	Third Choice
Cast Iron flanges	Corrugated with filler	Spiral wound	Single Jacket
Forged steel fittings Raised face	Spiral wound with metal spacer ring	Corrugated jacket	Corrugated with filler
Tongue and groove joint and large male-female	Spiral wound	Flat metal, serrated	Plain flat metal
Ammonia fittings	Spiral wound	Plain flat metal	Corrugated, coated
Autoclave	Delta or Bridgeman	Spiral wound	Two-piece metal jacket
Hydraulic cylinder bench presses	Plain flat metal	Spiral wound	Two-piece metal jacket
Gas mains	Corrugated	French jacket	Two-piece metal jacket
Heat exchanger	Two-piece metal jacket	Plain flat metal	
Boiler openings	Spiral wound	One-piece jacket	Corrugated metal
Vacuum lines	Round solid metal, or round solid metal with jacket	One-piece French jacket	Plain flat metal
Valve bonnets Screwed, less than ¼ in. Screwed, more than ¼ in. Bolted, round Bolted, rectangular	 One-piece French jacket Flat metal, serrated Spiral wound Two-piece French jacket	 Flat metal, serrated Corrugated Flat metal, serrated Corrugated	 One-piece metal jacket One-piece French jacket One-piece French jacket

Electro/Chemical Corrosion

Gasket material must be compatible with the surfaces it contacts. The tendency for a metal to enter into solution (corrode) is a function of its electrode potential which is an inherent property of each element.

If dissimilar metals are externally connected, galvanic action occurs in which the metal with the higher electrode potential exerts a voltage which causes the lower (less noble) metal to corrode. The farther apart the metals are in the table, the greater the potential difference with a resulting greater rate of corrosion.

Galvanic Series of the Common Metals, Alloys and Carbon

Corroded End (anodic, or least noble)

Magnesium
Magnesium alloys
Zinc
Aluminum 2S
Cadmium
Aluminum 17ST
Steel or Iron
Cast Iron
Chromium-iron (active)
Ni-Resist*
18-8 Chromium-nickel-iron (active)
18-8-3 Chromium-nickel-molybdenum-iron (active)
Lead-tin solders
Lead
Tin
Nickel (active)
Inconel (active)
Brasses
Copper
Bronzes
Copper-nickel alloys
Monel
Silver solder
Nickel (passive)
Inconel (passive)
Chromium-iron (passive)
18-8 Chromium-nickel-iron (passive)
18-8-3 Chromium-nickel-molybdenum-iron (passive)
Silver
Graphite
Gold
Platinum

Protected End (cathodic, or most noble)

Temperature Limitations

Operating temperatures must be considered in the selection of gasket material. In general, non-metallic gasket material is not acceptable at temperatures over 750°F.

Temperature Limits of Metallic Gasket Metals

MATERIAL	MAX TEMPERATURE (DEG. F)
Lead	212
Common brasses	500
Copper	600
Aluminum	800
Stainless steel type 301	800
Stainless steel type 316	800
Soft iron, carbon steel	1000
Stainless steel type 502	1150
Stainless steel type 410	1200
Silver	1200
Nickel	1400
Monel	1500
Stainless steel type 309	1600
Stainless steel type 321	1600
Stainless steel type 347	1600
Inconel	2000

Gasket material must be compatible with its chemical environment also.

Corrosion Resistance of Metal Gasket Metals

SOME MATERIAL TO WHICH GASKETS ARE EXPOSED	LEAD	COPPER	ALUMINUM	MONEL	NICKEL	IRON STEEL	304 ST STEEL	316 ST STEEL	347 ST STEEL
Air	S	S	S	S	⁓	S	S	⁓	S
Beer	⁓	S	S	S	⁓	S	S	S	⁓
Carbon Dioxide Dry	S	S	S	S	⁓	S	S	S	⁓
Coke Oven Gas	⁓	S	⁓	S	⁓	S	⁓	S	⁓
Gasoline Refined	S	S	S	S	⁓	S	S	S	⁓
Kerosene	S	S	⁓	S	⁓	S	S	S	⁓
Natural Gas	S	⁓	S	S	⁓	S	S	S	⁓
Oxygen	S	S	S	S	⁓	S	S	S	⁓
Propane	S	⁓	⁓	S	⁓	S	S	S	⁓
Steam 500°F or Less	⁓	S	S	S	S	S	S	S	⁓
Steam 1000°F or Less	U	⁓	⁓	⁓	⁓	S	S	S	S
Water-Fresh	S	S	S	S	⁓	⁓	S	S	S
Water-Sea	S	⁓	U	S	⁓	⁓	F	F	F

CODE
S = satisfactory
F = fair
U = unsatisfactory

⁓ Denotes material is dependent on specific service conditions, and should not be selected without careful investigation.

Bolting Specifications

A gasket's mechanical environment must be known. Are the flanges flat, raised, grooved, etc.? Flange and bolt size is determined by the size of piping and the operating pressure. Bolts should be located central to the flange width. The bolt spacing for low pressure service should not exceed seven (7) times the bolt diameter. The bolt spacing for high pressure service should not exceed 3½ times the bolt diameter. Weak flanges and high internal pressure may both reduce the maximum workable bolt spacing.

Forged Steel Flanges

Dimensions in Inches

CLASS	PIPE SIZE	O.D.	THK.	I.D.	B.C.	NO.	BOLTS DIA.
150 Pound	1/2	3-1/2	7/16	1-3/8	2-3/8	4	1/2
	3/4	3-7/8	1/2	1-11/16	2-3/4	4	1/2
	1	4-1/4	9/16	2	3-1/8	4	1/2
	1-1/4	4-5/8	5/8	2-1/2	3-1/2	4	1/2
	1-1/2	5	11/16	2-7/8	3-7/8	4	1/2
	2	6	3/4	3-5/8	4-3/4	4	5/8
	2-1/2	7	7/8	4-1/8	5-1/2	4	5/8
	3	7-1/2	15/16	5	6	4	5/8
	3-1/2	8-1/2	15/16	5-1/2	7	8	5/8
	4	9	15/16	6-3/16	7-1/2	8	5/8
	5	10	15/16	7-5/16	8-1/2	8	3/4
	6	11	1	8-1/2	9-1/2	8	3/4
	3	13-1/2	1-1/8	10-5/8	11-3/4	8	3/4
	10	16	1-3/16	12-3/4	14-1/4	12	7/8
	12	19	1-1/4	15	17	12	7/8
	14	21	1-3/8	16-1/4	18-3/4	12	1
	16	23-1/2	1-7/16	18-1/2	21-1/4	16	1
	18	25	1-9/16	21	22-3/4	16	1-1/8
	20	27-1/2	1-11/16	23	25	20	1-1/8
	24	32	1-7/8	27-1/4	29-1/2	20	1-1/4
300 Pound	1/2	3-3/4	9/16	1-3/8	2-5/8	4	1/2
	3/4	4-5/8	5/8	1-11/16	3-1/4	4	5/8
	1	4-7/8	11/16	2	3-1/2	4	5/8
	1-1/4	5-1/4	3/4	2-1/2	3-7/8	4	5/8
	1-1/2	6-1/8	13/16	2-7/8	4-1/2	4	3/4
	2	6-1/2	7/8	3-5/8	5	8	5/8
	2-1/2	7-1/2	1	4-1/8	5-7/8	8	3/4
	3	8-1/4	1-1/8	5	6-5/8	8	3/4
	3-1/2	9	1-3/16	5-1/2	7-1/4	8	3/4
	4	10	1-1/4	6-3/16	7-7/8	8	3/4
	5	11	1-3/8	7-5/16	9-1/4	8	3/4
	6	12-1/2	1-7/16	8-1/2	10-5/8	12	3/4
	8	15	1-5/8	10-5/8	13	12	7/8
	10	17-1/2	1-7/8	12-3/4	15-1/4	16	1
	12	20-1/2	2	15	17-3/4	16	1-1/8
	14	23	2-1/8	16-1/4	20-1/4	20	1-1/8
	16	25-1/2	2-1/4	18-1/2	22-1/2	20	1-1/4
	18	28	2-3/8	21	24-3/4	24	1-1/4
	20	30-1/2	2-1/2	23	27	24	1-1/4
	24	36	2-3/4	27-1/4	32	24	1-1/2
400 Pound	4	10	1-3/8	6-3/16	7-7/8	8	7/8
	5	11	1-1/2	7-5/16	9-1/4	8	7/8
	6	12-1/2	1-5/8	8-1/2	10-5/8	12	7/8
	8	15	1-7/8	10-5/8	13	12	1
	10	17-1/2	2-1/8	12-3/4	15-1/4	16	1-1/8
	12	20-1/2	2-1/4	15	17-3/4	16	1-1/4
	14	23	2-3/8	16-1/4	20-1/4	20	1-1/4
	16	25-1/2	2-1/2	18-1/2	22-1/2	20	1-3/8
	18	28	2-5/8	21	24-3/4	24	1-3/8
	20	30-1/2	2-3/4	23	27	24	1-1/2
	24	36	3	27-1/4	32	24	1-3/4

CLASS	PIPE SIZE	O.D.	THK.	I.D.	B.C.	NO.	BOLTS DIA.
600 Pound	1/2	3-3/4	9/16	1-3/8	2-5/8	4	1/2
	3/4	4-5/8	5/8	1-11/16	3-1/4	4	5/8
	1	4-7/8	11/16	2	3-1/2	4	5/8
	1-1/4	5-1/4	13/16	2-1/2	3-7/8	4	5/8
	1-1/2	6-1/8	7/8	2-7/8	4-1/2	4	3/4
	2	6-1/2	1	3-5/8	5	8	5/8
	2-1/2	7-1/2	1-1/8	4-1/8	5-7/8	8	3/4
	3	8-1/4	1-1/4	5	6-5/8	8	3/4
	3-1/2	9	1-3/8	5-1/2	7-1/4	8	7/8
	4	10-3/4	1-1/2	6-3/16	8-1/2	8	7/8
	5	13	1-3/4	7-5/16	10-1/2	8	1
	6	14	1-7/8	8-1/2	11-1/2	12	1
	8	16-1/2	2-3/16	10-5/8	13-3/4	12	1-1/8
	10	20	2-1/2	12-3/4	17	16	1-1/4
	12	22	2-5/8	15	19-1/4	20	1-1/4
	14	23-3/4	2-3/4	16-1/4	20-3/4	20	1-3/8
	16	27	3	18-1/2	23-3/4	20	1-1/2
	18	29-1/4	3-1/4	21	25-3/4	20	1-5/8
	20	32	3-1/2	23	28-1/2	24	1-5/8
	24	37	4	27-1/4	33	24	1-7/8
900 Pound	3	9-1/2	1-1/2	5	7-1/2	8	7/8
	4	11-1/2	1-3/4	6-3/16	9-1/4	8	1-1/8
	5	13-3/4	2	7-5/16	11	8	1-1/4
	6	15	2-3/16	8-1/2	12-1/2	12	1-1/8
	8	18-1/2	2-1/2	10-5/8	15-1/2	12	1-3/8
	10	21-1/2	2-3/4	12-3/4	18-1/2	16	1-3/8
	12	24	3-1/8	15	21	20	1-3/8
	14	25-1/4	3-3/8	16-1/4	22	20	1-1/2
	16	27-3/4	3-1/2	18-1/2	24-1/4	20	1-5/8
	18	31	4	21	27	20	1-7/8
	20	33-3/4	4-1/4	23	29-1/2	20	2
	24	41	5-1/2	27-1/4	35-1/2	20	2-1/2
1500 Pound	1/2	4-3/4	7/8	1-3/8	3-1/4	4	3/4
	3/4	5-1/8	1	1-11/16	3-1/2	4	3/4
	1	5-7/8	1-1/8	2	4	4	7/8
	1-1/4	6-1/4	1-1/8	2-1/2	4-3/8	4	7/8
	1-1/2	7	1-1/4	2-7/8	4-7/8	4	1
	2	8-1/2	1-1/2	3-5/8	6-1/2	8	7/8
	2-1/2	9-5/8	1-5/8	4-1/8	7-1/2	8	1
	3	10-1/2	1-7/8	5	8	8	1-1/8
	4	12-1/4	2-1/8	6-3/16	9-1/2	8	1-1/4
	5	14-3/4	2-7/8	7-5/16	11-1/2	8	1-1/2
	6	15-1/2	3-1/4	8-1/2	12-1/2	12	1-3/8
	8	19	3-5/8	10-5/8	15-1/2	12	1-5/8
	10	23	4-1/4	12-3/4	10	12	1-7/8
	12	26-1/2	4-7/8	15	22-1/2	16	2
	14	29-1/2	5-1/4	16-1/4	25	16	2-1/4
2500 Pound	1/2	5-1/4	1-3/16	1-3/8	3-1/2	4	3/4
	3/4	5-1/2	1-1/4	1-11/16	3-3/4	4	3/4
	1	6-1/4	1-3/8	2	4-1/4	4	7/8
	1-1/4	7-1/4	1-1/2	2-1/2	5-1/8	4	1
	1-1/2	8	1-3/4	2-7/8	5-3/4	4	1-1/8
	2	9-1/4	2	3-5/8	6-3/4	8	1
	2-1/2	10-1/2	2-1/4	4-1/8	7-3/4	8	1-1/8
	3	12	2-5/8	5	9	8	1-1/4
	4	14	3	6-3/16	10-3/4	8	1-1/2
	5	16-1/2	3-5/8	7-5/16	12-3/4	8	1-3/4
	6	19	4-1/4	8-1/2	14-1/2	8	2
	8	21-3/4	5	10-5/8	17-1/4	12	2
	10	26-1/2	6-1/2	12-3/4	21-1/4	12	2-1/2
	12	30	7-1/4	15	24-3/8	12	2-3/4

Flange Clamping Pressure

The flange clamping pressure is derived from the clamping bolts and directly relates to the tightening torque. Numerous variables in bolting efficiencies prevent charting from being exact. The following chart assumes the bolts are not dry, rough or rusted and that high friction items are not used. Also that the flanges and bolt spacings are such that the pressure is constant over the entire gasket area. The chart gives a range of estimated pressure. The compression pressure will normally fall in this range near the lower figure. The high figure should be considered as the possible load applied to the bolt at this rate of torque. The compression in pounds per bolt is multiplied by the number of bolts to determine the total gasket load in pounds.

Bolt Torque Loads

SCREW SIZE	MACHINE SCREWS 1010 STEEL		BOLTS AND CAP SCREWS SAE GRADE 1		SAE GRADE 2		SAE GRADE 3		SAE GRADE 5	
	TORQUE (LB./FT.)	BREAKING LOAD (LB.)	TORQUE (LB./FT.)	BREAKING LOAD (LB.)	TORQUE (LB./FT.)	BREAKING LOAD (LB.)	TORQUE (LB./FT.)	BREAKING LOAD (LB.)	TOURQUE (LB./FT.)	BREAKING LOAD (LB.)
1/4-20	5.0	1620	5.5	1750	7.0	2200	10.8	3500	10.8	3800
1/4-28	6.1	1854	6.4	2000	7.9	2500	12.1	4000	12.1	4350
5/16-18	12.1	2672	11.5	2000	14.2	3000	22.3	5750	22.3	6300
5/16-18	14.0	2963	12.7	3200	16.1	4000	24.5	6400	24.5	6950
3/8-16	19.0	3952	20.4	4250	25.4	5350	39.3	8550	39.3	9300
3/8-24	23.4	4480	23.0	4850	28.8	6050	44.6	9650	44.6	10,550
7/16-24	32.5	5428	32.6	5850	41.0	7350	63.8	11,750	63.8	12,750
7/16-20			36.5	6550	45.4	8200	70.3	13,050	70.3	14,250
1/2-13			49.7	7800	62.4	9800	96.0	15,600	96.0	17,050
1/2-20			56.2	8800	70.3	11,000	109	17,500	109	19,150
5/8-11			96.0	12,450	117	14,450	180	22,000	198	27,100
5/8-13			112	14,100	132	16,400	201	25,600	217	30,700
3/4-10			176	18,350	209	19,400			310	40,100
3/4-16			198	20,500	233	23,850			380	44,750
7/8-9			283	25,400					502	53,150
7/8-14			314	28,000					556	58,500
1-8			426	33,350					756	69,700
1-14			476	36,450					844	76,250

Markings on Bolt Heads

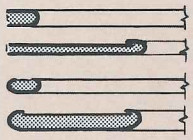
	SAE GRADE 1 or 2 		SAE GRADE 5 Manufacturer's marks may vary 		SAE GRADE 6 		SAE GRADE 8 	
DIAMETER INCHES	TORQUE FT./LB.	COMPRESSION	TORQUE FT./LB.	COMPRESSION	TORQUE FT./LB.	COMPRESSION	TORQUE FT./LB.	COMPRESSION
1/4	5	1200 660	7	1680 924	10	2400 1320	10.5	2520 1386
5/16	9	1728 950	14	2688 1478	19	3648 2006	22	4224 2323
3/8	15	2400 1320	25	4000 2200	34	5440 2992	37	5920 3256
7/16	24	3291 1810	40	5486 3017	55	7543 4149	60	8229 4526
1/2	37	4440 2442	60	7200 3960	85	10200 5610	92	11040 6072
9/16	53	5653 3109	88	9387 5163	120	12800 7040	132	14080 7744
5/8	74	7104 3907	120	11520 6336	167	16032 8818	180	17280 9504
3/4	120	9600 5280	200	16000 8800	280	22400 12320	296	23680 13024
7/8	190	13029 7166	302	20709 11390	440	30171 16594	473	32434 17839
1	282	16920 9306	466	27960 15378	660	39600 21780	714	42840 23562

Compression: P = T 60/D & P = T 33/D

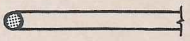
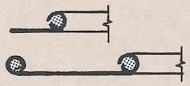
Gasket Seating Stress

Consult the following chart to determine the seating stress required to properly seal the gasket in question. To obtain the estimated requirement of flange clamping pressure, simply multiply the above value by the gasket contact area in square inches. Add this value to any internal separating pressure the joint will be subjected to. Charted minimum seating forces may exceed bolt stress limits. Proceed accordingly.

Minimum Gasket Seating Stress

TYPE	MATERIAL	THICKNESS (IN.)	MINIMUM SEATING STRESS*
 Corrugated	Aluminum	1/8	1500 psi
	Copper		2000 psi
	Soft Steel (Iron)		4000 psi
	Monel		4500 psi
	Stainless Steel		6000 psi
 Corrugated Coated	Aluminum	1/8	2000 psi
	Copper		2500 psi
	Soft Steel (Iron)		3000 psi
	Monel		3500 psi
	Stainless Steel		4000 psi
 Spiral	Carbon Steel	1/8	2500-15,000 psi
	Carbon Steel	3/16	2500-15,000 psi
	Stainless Steel	1/8	3000-30,000 psi
	Stainless Steel	3/16	3000-30,000 psi
 Metal Jacketed, Soft-Filler	Lead	1/8	500 psi
	Aluminum		2500 psi
	Copper		4000 psi
	Soft Steel (Iron)		6000 psi
	Nickel		6000 psi
	Monel		7500 psi
	Stainless Steel		10,000 psi
 Corrugated Jacketed, Soft-Filler	Lead	approximately 9/64	500 psi
	Aluminum		1000 psi
	Copper		2500 psi
	Soft Steel (Iron)		3500 psi
	Monel		4500 psi
	Stainless Steel		6000 psi
 Flat Metal	Aluminum	1/8	16,000 psi
	Copper		36,000 psi
	Soft Steel (Iron)		55,000 psi
	Monel		65,000 psi
	Stainless Steel		75,000 psi
	Aluminum	1/32 and 1/16	20,000 psi
	Copper		45,000 psi
	Soft Steel (Iron)		68,750 psi
	Monel		81,250 psi
	Stainless Steel		93,750 psi

*Seating stress values shown do not apply to ASME Code. Also, they are based on optimum surface finish and clean flange surface, i.e., no grease, oil or gasket compound.

TYPE	MATERIAL	THICKNESS (IN.)	MINIMUM SEATING STRESS*
 Flat Metal, Serrated or Grooved	Aluminum	1/8-in. pitch all thicknesses	25,000 psi
	Copper		35,000 psi
	Soft Steel (Iron)		55,000 psi
	Monel		65,000 psi
	Stainless Steel		75,000 psi
	Aluminum	1/16-in. pitch all thicknesses	30,000 psi
	Copper		40,000 psi
	Soft Steel (Iron)		60,000 psi
	Monel		70,000 psi
	Stainless Steel		80,000 psi
	Aluminum	1/32-in. pitch all thicknesses	35,000 psi
	Copper		45,000 psi
	Soft Steel (Iron)		65,000 psi
	Monel		80,000 psi
	Stainless Steel		95,000 psi
 Round Cross-Section	Aluminum	Any diam.	1300 lb/ circular in.
	Copper		4500 lb/ circular in.
	Soft Steel (Iron)		6000 lb circular in.
	Stainless Steel		
 Wrapped Wire-Core	Aluminum Jacket Aluminum Cores	Any diam.	1500 lb/ circular in.
	Aluminum Jacket Stainless Steel Cores	Any diam.	1500 lb/ circular in.
	Stainless Steel Jacket Stainless Steel Cores	Any diam.	6000 lb/ circular in.

Gasket Compressiblity

The flange pressure must be great enough to force the gasket into surface imperfections of the flange and to stop fluid from passing through the interface.

The porous structure of the non-metallic and semi-metallic gaskets must be compressed sufficiently to make them impervious to fluids. The amount of compression required is a function of the gasket material and the fluid pressure. It is the percentage difference between the original gasket thickness and the gasket thickness in service.

Traditional Gasket Designs

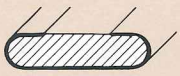
The various metallic gasket configurations are designed to reduce the contact area so that a seal can be secured without an excessive bolting load. Typical amg designs and their applications are described below.

STYLE PM Solid metal construction. Any metal. No size limitation. Recommended where bolt load is sufficient and condition of seating surface is good.

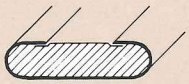
STYLE PMR Round cross section wire is formed and welded. Recommended for low pressure and low bolt load. Generally installed in narrow machined grooves.

STYLE C Low pressure seals recommended where bolt load is low. Requires machined flanges. Eight or four corrugations per inch. Available for full face flanges with bolt holes punched.

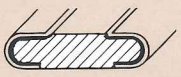
STYLE AR Made of corrugated metal with asbestos cord cemented in the corrugations on both sides of gasket. Use for rough flanges.



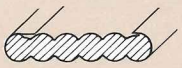
STYLE SS Made of a single metal jacket lapped over the O.D. and I.D. and one flange surface of a soft filler. Especially suited for narrow flanges.



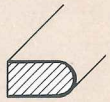
STYLE DS Soft filler is completely encased. Will not stick to flanges. More compressible and more resilient than solid metal. Use for glass lined pipe flanges.



STYLE FDS Made with an extra jacket covering the style SS gasket, producing a gasket completely encased in metal, and with double metal laps for added strength. A wide range of uses.



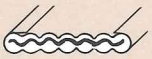
STYLE DC Greater resiliency than style DS. Ideal where high temperatures and high pressures are prevalent. Especially adapted for use in oil refineries, chemical, power and light plants, etc., on flanged joints, tongue and groove joints and manhole plates.



STYLE F Made with narrow flanges, 1/8" to 1/4" wide, with filler exposed on outside edge. Used where gasket is confined in groove or recess.

STYLE IF Same as style F except filler is exposed on inside edge.

STYLE SF Essentially the same as style F except for wider flanges. Used on wide straight flange work.

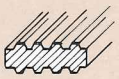


STYLE DM Designed for temperatures which exceed non-metal fillers. Offers high temperature range but is less resilient than the soft filled gasket.

STYLE SRS Same as style SS except cross section is round. Used where bolt load will not allow use of style PMR. The traditional boiler tube cap gasket design.

STYLE FRS Offers more rigidity than style SRS.

STYLE P Recommended in those applications where style PM is required but bolt load is insufficient to seal a flat gasket.



STYLE S Concentric serrations are machined to reduce bolting pressure required to seal joint. Recommended for flanged joints, ship piping and valve flanges.

FILLERS The traditional use of millboard asbestos for gasket fillers has been discontinued due to manufacturing hazards that violate Federal health and safety laws. Instead, an improved filler material is now standard. For corrosive acids and alkalines special fillers can be provided.

QUAL-O-SEAL amg qual-O-seal round metallic rings offer significant savings over rings stamped or turned from blanks with high material waste, scrap and tooling costs. **qual-O-seal** rings, formed from rod stock of the required cross-section are welded, dressed, sized to exact specifications, then heat treated to provide uniform specified metallurgical properties. Expensive scrap loss is eliminated.

Available in standard round, square and rectangular cross-sections, up to 160 inches diameter, there are no tooling charges for sizes, 1-1/2 inches to 40 inches in diameter, **amg's** wire drawing capabilities eliminate mill delivery delays and premium charges for small lots.

ECON-□-FORM If your design or application includes odd-shaped closures requiring sealing, **amg's econ-O-form** custom-shaped metal seals could solve your problems, efficiently and economically.

econ-O-form seals are **qual-O-seal** round rings precision shaped to your specifications, contoured to provide an optimum seal of the closure. Shaping is accomplished on specially designed production equipment perfected by **amg** engineers.

STEEL-TITE Developed by **amg** metallurgical engineers, **Steel-Tite** gasket material provides the same "softness" and sealing characteristics as copper, yet at costs approximately one-third lower. **Steel-Tite** can be formed or drawn. Consistent hardness throughout a given heat is approximately Rockwell B-O. **Steel-Tite** can often be softened to as low as Rockwell H-70 by special annealing procedures. Available in a wide range of gages in sheet and coil form; **Steel-Tite** wire can be provided in a range from .095" to .312" diameter.

STANDARD MATERIALS

amg gaskets are available in virtually all metals. Standard inventory materials include:

Copper	Steel	Brass	Inconel
Aluminum	Stainless Steel	Monel	Lead

Flat stock, in coil, sheet and strip form is carried in normal gasketting gages ranging from .001" to .250". Round cross section wire is available from .080" to .312" diameter.

Though they are not stock items, rare and exotic metals are readily available by special order.

DIES AND TOOLING

Three characteristics of **amg** combine to offer you the best in tool and die service. Tooling inventories developed over decades of gasket manufacture provide "tool free" production of thousands of sizes and designs. Secondly, **amg** specially designed machinery replaces stereotyped methods for many items, and tooling charges generally are not a factor. Finally, **amg** maintains its own tool and die department to serve your special needs, thus assuring costs are kept to a minimum.

Other amg Products and Services

• Metal Stampings • Metal Shims • Shim Packs • Shim Kits • Commutator Rings • Collector Rings • Contact Rings • Non-seal Wire Forms • Expansion Joints • Rotating Joints • Steam Line Compensators

Caution: The information supplied herein is intended solely as a general presentation of various factors involved in the application of gasket-type seals. It should not be construed as a definitive design manual. It is indicative only of the nature of information that must be provided to a qualified engineer for the design of a gasket-type seal for a specific application. The **amg** Application Engineering Department is available to solve your specific sealing problem.

amg INDUSTRIES

INDUSTRIAL PARK, MT. VERNON, OHIO 43050
614-397-4044