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AEROSPACE RECOMMENDED PRACTICE

SAE ARP674 | REV. C

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Reaffirmed 2012-10

Superseding ARP674B

Groove Design, Metal O-Ring Gasket

RATIONALE

ARP674C has been reaffirmed to comply with the SAE five-year review policy.

1. SCOPE:

Groove designs presented herein are applicable for use with the following "MS" metal O-ring gaskets conforming to the applicable "AS" standard drawings listed in 1(a) or 1(b), or to dimensionally equivalent gaskets of other materials:

a. AMS 5570 or AMS 5576 Plain

1. AS9141 - 0.035 tube x 0.006 wall
2. AS9142 - 0.062 tube x 0.006 wall
3. AS9202 - 0.062 tube x 0.010 wall
4. AS9203 - 0.094 tube x 0.006 wall
5. AS9204 - 0.094 tube x 0.010 wall
6. AS9205 - 0.125 tube x 0.010 wall

b. AMS 5570 or AMS 5576 Silver Plated

1. AS9371 - 0.035 tube x 0.006 wall
2. AS9372 - 0.062 tube x 0.006 wall
3. AS9373 - 0.062 tube x 0.010 wall
4. AS9374 - 0.094 tube x 0.006 wall
5. AS9375 - 0.094 tube x 0.010 wall
6. AS9376 - 0.125 tube x 0.010 wall

NOTE: The term "AS gasket" as used in this document refers to the 'MS' part numbers defined on the applicable 'AS' standards listed in 1(a) or 1(b).

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http://www.sae.org/technical/standards/ARP674C

2. APPLICABLE DOCUMENTS:

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

ARP674	Groove Design, Metal O-Ring Gasket (First Edition)
AMS 5582	Nickel Alloy, Corrosion and Heat Resistant, Seamless Tubing, 72Ni 15.5Cr 0.95Cb 2.5Ti 0.70Al 7.0Fe, Annealed

2.2 ASME Publications:

Available from ASME, 22 Law Drive, Box 2900, Fairfield, NJ 07007-2900.

ASME Y14.36M Surface Texture Symbols

3. CLASSIFICATION:

Two groove designs are provided for each gasket size as follows:

a. Type 1: Two-plane contact with gasket, axially on both faces, groove bottom and flange face.

b. Type 2: Three-plane contact with gasket, axially on both faces and radially on outside diameter, groove bottom and outer wall, and mating flange face.

4. APPLICATION:

Use Type 1 grooves for normal pressure when flange loads must be held to a minimum, and Type 2 grooves for high pressure where higher flange loads can be tolerated. Normal pressure versus high pressure for each gasket cross-section is defined in Section 7, and load to compress the gasket in Type 1 and Type 2 grooves is given in Section 6. Type 1 grooves are recommended for use with plain "AS" gaskets or with "AS" gaskets silver plated 0.0015 in maximum thickness, except as noted in 4.1. Type 2 grooves are recommended for plain "AS" gaskets, and also for plated "AS" gaskets after groove diameter H is adjusted for plating thickness as noted under Table 1.

TABLE 1 - Dimensions for Grooves Shown in Figures 1 and 2

Nom Tube Dia	Dia B Max	Dia C +0.010 -0.000	Dia D Max	G Min	Dia H +0.005 -0.000	J Groove Depth	K Min	Dia L Max	Gasket Compression
0.035	---	---	---	---	A*+0.005	0.023 - 0.027	0.055	A*-0.090	0.007 - 0.015
0.062	A*-0.148	A*+0.027	A*-0.159	0.093	A*+0.005	0.045 - 0.050	0.090	A*-0.150	0.011 - 0.020
0.094	A*-0.216	A*+0.027	A*-0.227	0.127	A*+0.010	0.074 - 0.079	0.125	A*-0.220	0.014 - 0.023
0.125	A*-0.278	A*+0.027	A*-0.289	0.158	A*+0.010	0.100 -0.105	0.160	A*-0.290	0.019 - 0.028

NOTES:

* "A" dimension is minimum gasket OD per applicable part drawing.

Plated gaskets used in Type 2 groove design require dia H to be increased by 2X max plating thickness. For example: Silver plating thickness of 0.0010 - 0.0015 on a 0.094 tube dia gasket requires dia H min = A*+0.010 + 0.003; dia H max = dia H min + 0.005.

Dimensions in inches. Fillets at bottom of groove = R 0.016 - 0.030.
Break edges 0.003 to 0.015.

4.1 0.035 Tube Gaskets:

The use of the 0.035 tube diameter gaskets is not recommended in Type 1 groove design because this size tubing deflects beyond the yield of the Type 321 (UNS S32100) material to the extent that it does not have enough springback to maintain a satisfactory seal. If design requires the use of the 0.035 tube diameter gasket, Type 2 groove design should be used to support the gasket outside diameter.

5. GASKET AND GROOVE DATA:

Figures 1 and 2 and Table 1 establish standard groove dimensions. Figure 1 shows the Type 1 groove; Figure 2 shows the Type 2 groove.

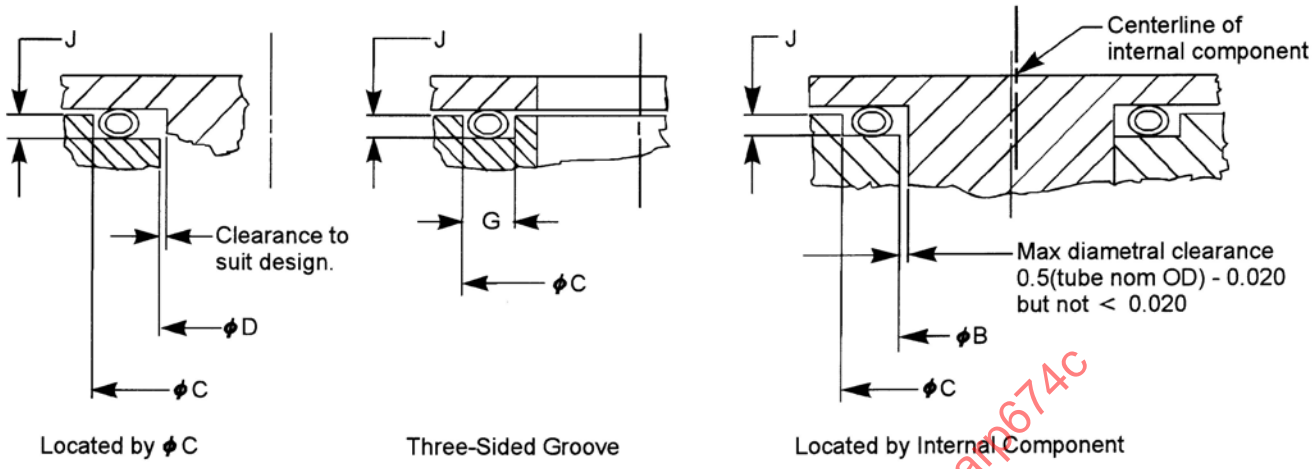

FIGURE 1 - Type 1, Two-Plane Contact Grooves

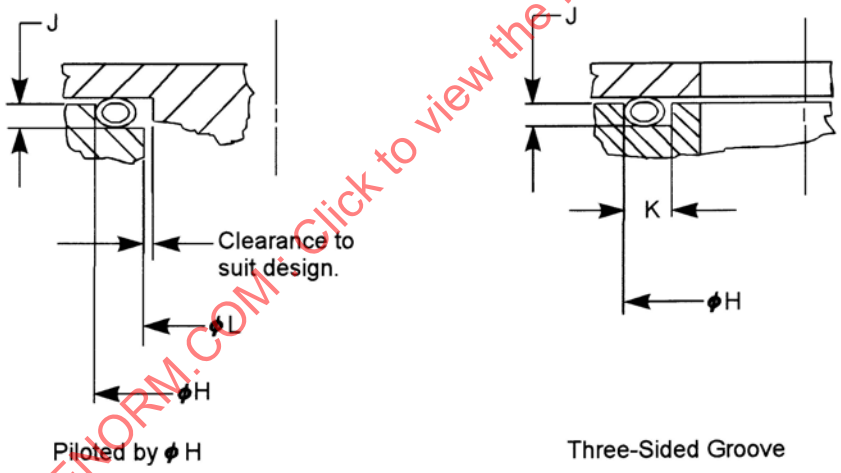

FIGURE 2 - Type 2, Three-Plane Contact Grooves

5.1 Surface Texture:

All surfaces in contact with the seal (groove bottom and outside wall, and the mating flange face) shall have a surface roughness of 32 µin Ra; the bottom of the groove and the mating flange shall have circular lay (concentric with the gasket), and no flaws specified in accordance with ASME Y14.36M.

6. LOAD TO COMPRESS GASKET:

The load per inch of seal circumference required to axially seat the mating flanges under extreme tolerance conditions of maximum gasket free height and the minimum groove depth (equals maximum compression) is given in Figure 3 for Type 1 grooves and in Table 2 for Type 2 grooves.

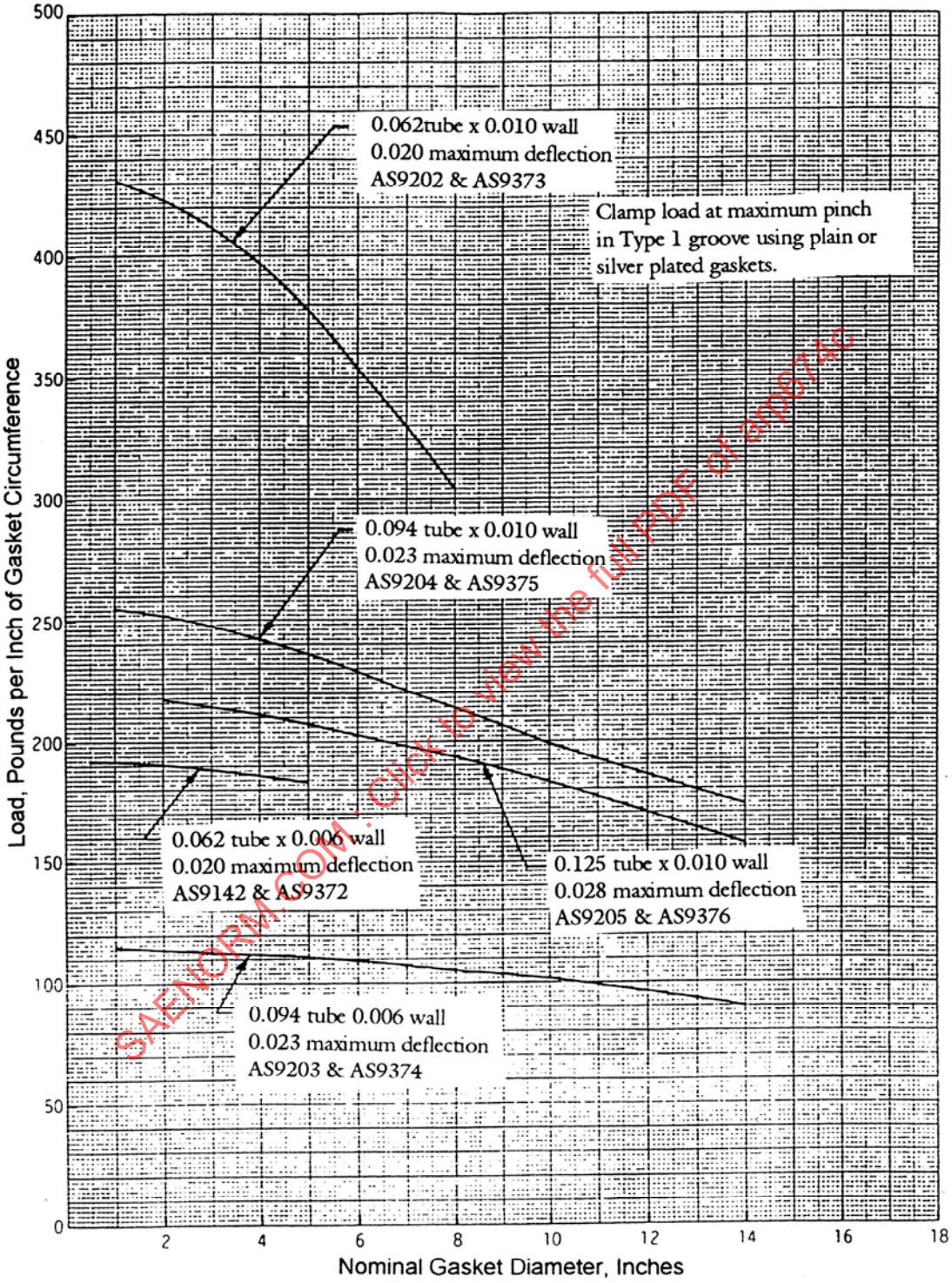

FIGURE 3 - Load to Compress Gasket, Type 1 Grooves

TABLE 2 - Type 2 Groove, Load to Compress Gasket

"AS" Gaskets	Nominal Tube Diameter	Nominal Wall Thickness	Deflection Maximum	Load, lb/in of Circumference
AS9141 AS9371	0.035	0.006	0.015	500
AS9142 AS9372	0.062	0.006	0.020	252
AS9202 AS9373	0.062	0.010	0.020	465
AS9203 AS9374	0.094	0.006	0.023	105
AS9204 AS9375	0.094	0.010	0.023	370
AS9205 AS9376	0.125	0.010	0.028	250

Dimensions in inches.

7. LIMITING PRESSURE, TYPE 1 GROOVE:

Limiting internal pressure for "AS" gaskets, or for gaskets of other materials but with the same cross-section as the "AS" gaskets, may be determined from the following relationships for gaskets installed in Type 1 grooves under minimum compression. For pressures that exceed these limits, use Type 2.

a. Internal pressure to overcome static friction due to compression load on gasket. Two surfaces are to be considered, that is, bottom of groove and mating flange. Hence, the following relationship:

$$P_1 \text{ max} = 2(Ff/J \text{ max}) \quad \text{(Eq.1)}$$

where:

P_1 max = Maximum internal pressure to overcome static friction, groove bottom, and mating flange
F = Clamp load at minimum pinch, lb/in of circumference
f = Static coefficient of friction
J max = Maximum groove depth, inch

b. Internal pressure to expand gasket to its tensile yield strength. Two cross-sectional areas of the gasket are to be considered. In the free state, the gasket is elliptical in shape; hence, the minimum cross-sectional area of the gasket, A_t, is as follows:

$$A_t = \frac{\pi}{4}[d_1 d_2 - (d_1 - 2t)(d_2 - 2t)] \quad \text{(Eq.2)}$$

where:

A_t = Minimum cross-sectional area of gasket
d_1 = Gasket minimum free height
d_2 = Gasket minimum free radial width
t = Gasket minimum wall thickness

Maximum internal pressure, P_2 maximum, to expand gasket to its tensile yield strength is as follows:

$$P_2 \text{ max} = \frac{2A_t S_{ty}}{J \text{ max } (A - 2d_2)} \quad \text{(Eq.3)}$$

where:

S_{ty} = Tensile yield strength for gasket material
A = Minimum gasket OD