

Thermocouple Insulators

PRODUCT INFORMATION



Saint-Gobain's high purity ALUNDUM® fused Al₂O₃ and MAGNORITE® fused MgO crushable insulators provide the electrical insulation resistance in swaged or drawn metal sheathed thermocouples.

The insulators are carefully "threaded" on thermocouple conductor wired and inserted inside seamless metal tubing. The entire assembly is then swaged or drawn down to the desired dimensions. During swaging the insulators crush readily into a powder which is compacted around the thermocouple wired to provide electrical insulation resistance.



A. Saint-Gobain insulators before swaging
 B. Insulator sheathed and partially swaged
 C. Finished thermocouple shaped for application

TYPICAL CHEMICAL ANALYSIS %

Alundum® (fused Al₂O₃) Crushable Insulators AN 900

	Typical	Minimum or Maximum
Al ₂ O ₃	99.85%	99.65% Min
Fe ₂ O ₃	0.06%	0.10% Max
SiO ₂	0.02%	0.08% Max
CaO	0.02%	0.08% Max
MgO	0.02%	0.08% Max
ZrO ₂	0.0001%	0.08% Max
Na ₂ O	0.02%	0.06% Max
C	0.004 – 0.01%	0.01% Max
S	0.003%	0.005% Max
Cd	None Detected	0.001% Max
B	None Detected	0.001% Max

MAGNORITE® (fused MgO) Crushable Insulators MN 399A

	Typical	Minimum or Maximum
MgO	99.48%	99.40% Min
SiO ₂	0.10%	0.13% Max
Al ₂ O ₃	0.08%	0.15% Max
CaO	0.24%	0.35% Max
Fe ₂ O ₃	0.10%	0.15% Max
C	0.01%	0.02% Max
B	0.001%	0.0025% Max
S	0.001%	0.005% Max
Cd	None Detected	0.001% Max

QUALITY CONTROL

Controlling physical and chemical properties is required to provide high quality thermocouple insulators. Raw materials are controlled to rigid specifications. In-process control checks and complete final inspections are made on all Saint-Gobain insulators before shipment. Certifications are available on request for a nominal charge.

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INSPECTION

Saint-Gobain conducts a Mil. Std. 105E, 6.5 AQL, level II inspection on OD and ID for each order. All insulators are 100 percent inspected for contamination, cracks and warpage. Samples from each order are also inspected for twist, modulus or rupture (MOR), wall/web thickness, hole spacing and length.

Standard Manufacturing Capabilities and Tolerances

OD Tolerances

0.022" (0.5mm) minimum OD

From	To	Tolerance (in)	Tolerance (mm)
0.022" 0.5 mm	0.056" 1.4 mm	+ 0.002" - 0.001"	+ 0.050 mm - 0.025 mm
0.057" 1.4 mm	0.090" 2.3 mm	3 0.002"	3 0.050 mm
0.091" 2.3 mm	0.125" 3.2 mm	+ 0.003" - 0.002"	+ 0.080 mm - 0.050 mm
0.126" 3.2 mm	0.250" 6.3 mm	3 0.003	3 0.080 mm
0.251" 6.3 mm	0.375" 9.5 mm	3 0.004	3 0.100 mm
0.376" 9.5 mm	0.500" 12.7 mm	3 0.006	3 0.150mm

Hole Diameter (ID) Tolerances

0.077" (0.18mm) minimum ID

From	To	Tolerance (in)	Tolerance (mm)
0.007" 0.18 mm	0.016" 0.41 mm	+ 0.002" - 0.001"	+ 0.050 mm - 0.025 mm
0.017" 0.43 mm	0.068" 1.73 mm	3 0.002"	3 0.050 mm
0.069" 1.75 mm	0.285" 7.24 mm	3 0.003"	3 0.08 mm

Length +0.250", -0" (+6mm, -0mm)

WALL AND WEB THICKNESS

Manufacturing limitations on wall and web thickness are shown below.

Holes	Insulators OD		Hole Diameter ID		Bolt Circle Diameter	Wall/Web Thickness
	Minimum	Maximum	Minimum	Maximum		
1	0.22" 0.5 mm	0.500" 12.7 mm	(0.07XOD)+0.006" (0.07xOD)+0.15 mm	0.57XOD 14.5 mm	NA	((OD/2)- (BCD(2))-(ID/2))
2	0.32" 0.8 mm	0.500" 12.7 mm	(0.07XOD)+0.005" (0.07xOD)+0.13 mm	0.28XOD 7.1 mm	(OD+ID)/3.00	((OD/2)- (BCD(2))-(ID/2))
3	0.061" 1.5 mm	0.500" 12.7 mm	(0.07XOD)+0.003" (0.07xOD)+0.08 mm	0.25XOD 6.4 mm	(OD+ID)/2.73	((OD/2)- (BCD(2))-(ID/2))
4	0.076" 1.9 mm	0.500" 12.7 mm	(0.07XOD)+0.002" (0.07xOD)+0.05 mm	0.21XOD 5.3 mm	(OD+ID)/2.41	((OD/2)- (BCD(2))-(ID/2))
5	0.90" 2.3 mm	0.500" 12.7 mm	(0.07XOD)+0.003" (0.07xOD)+0.08 mm	0.20XOD 5.1 mm	(OD+ID)/2.18	((OD/2)- (BCD(2))-(ID/2))
6	0.100" 2.5 mm	0.500" 12.7 mm	(0.07XOD)+0.003" (0.07xOD)+0.08 mm	0.20XOD 5.1 mm	(OD+ID)/2.00	((OD/2)- (BCD(2))-(ID/2))
5+ ^{1c}	0.100" 2.5 mm	0.500" 12.7 mm	(0.07XOD)+0.003" (0.07xOD)+0.08 mm	0.20XOD 5.1 mm	(OD+ID)/2.00	

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WARPAGE

OD Size	Maximum Camber*		Maximum Length
0.022" to 0.031" 0.56 mm to 0.79 mm	0.003 in/in.	0.080 mm/mm	1
0.32" to 0.049" 0.81 mm to 1.24 mm	0.003 in/in.	0.080 mm/mm	2
0.050" to 0.109" 1.27 mm to 2.77 mm	0.003 in/in.	0.080 mm/mm	3
0.110" to 0.500" 2.79 mm to 12.7 mm	0.003 in/in.	0.080 mm/mm	4

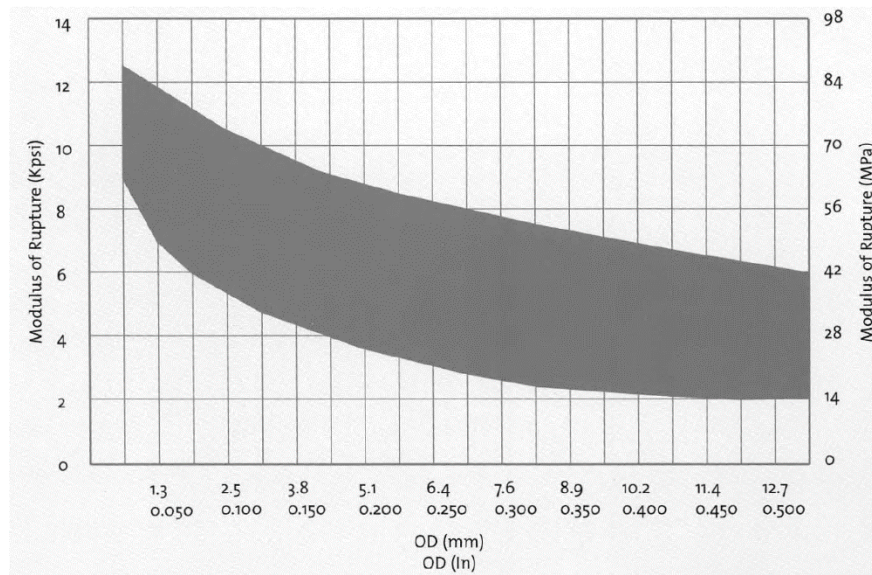
*Measured from maximum OD

TWIST

Insulator Length	Maximum Tolerance
1" (25 mm)	4-1/3°
2" (51 mm)	8-2/3°
3" (76 mm)	13°
4" (102 mm)	17-1/3°

MODULUS OF RUPTURE

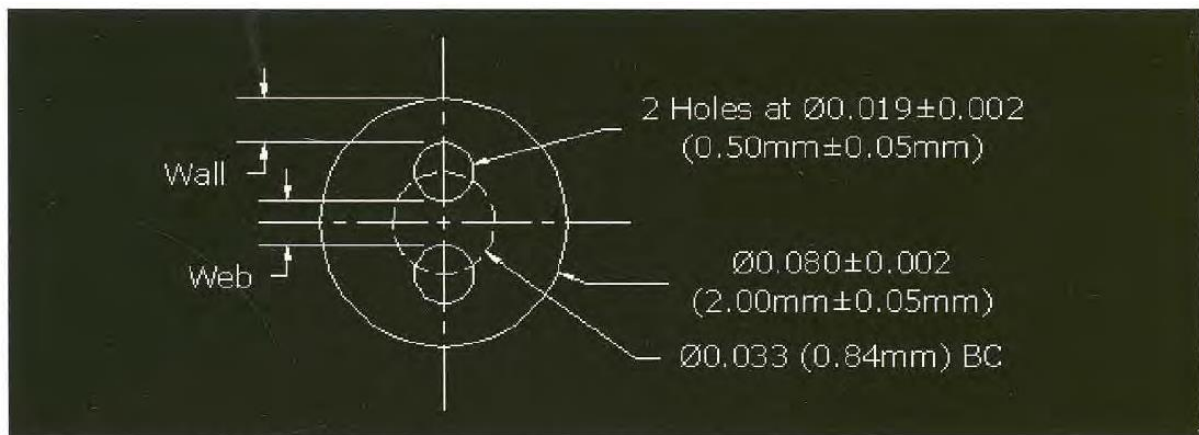
(Typical range inclusive of number of holes)



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EXAMPLE

2 Hole Insulator with OD of 0.080" and Calculated ID of 0.019"



Minimum Hole Diameter determined using the equation:

Minimum Hole ID = (0.07 x Insulator OD) + Hole Quantity Factor

Minimum Hole ID = (0.07 x 0.080") + 0.005"

Minimum Hole ID = 0.006" + 0.005"

Minimum Hole ID = 0.011"

Maximum Hole Diameter determined using the equation:

Maximum Hole ID = 0.57 x Insulator OD

Maximum Hole ID = 0.57 x 0.080"

Maximum Hole ID = 0.046"

Bolt Circle Diameter (BCD) determined using the equation:

The BCD is twice the distance of the centers of the insulator holes from the center of the insulator OD

Bolt Circle Diameter = (OD + ID) / Hole Quantity Factor

BCD = (0.080" + 0.019") / 3.00

BCD = 0.099" / 3.00

BCD = 0.033"

Wall and Web Thickness

W/W Thickness = ((OD/2) - (BCD/2)) - (ID/2)

W/W Thickness = ((0.080"/2) - (0.033"/2)) - (0.019"/2)

W/W Thickness = ((0.040") - (0.0165")) - 0.0095"

W/W Thickness = 0.0235" - 0.0095"

W/W Thickness = 0.014 3 0.002"