

OGP-Series, PGP-Series, PB-Series Overvoltage Spark Gaps



Key Features

- High surge current capability
- Fast switching operation
- High voltage holdoff
- Ceramic-metal construction
- No warm up period
- Long life

Applications

- Crowbar circuit protection

Description

Overvoltage Spark Gaps from Excelitas Technologies Corp. are a family of rugged ceramic-metal hermetically sealed switches or voltages ranging from 500 volts to 100 kV. These switches have peak current capabilities of up to 50 kA. They are ideal for protecting equipment from damaging high voltage surges when they are used in “crowbar” applications. They are also suitable for capacitor switching applications. The OGP- series offer the broadest operating range, while the PGP and PB series offer fast switching for high dv/dt applications. The PB series is intended for direct mounting on printed circuit boards.

OGP Series

Table 1 shows ratings for Excelitas' OGP ceramic-metal overvoltage spark gaps when they are used in crowbar service. Note that for each "family" type, a range is shown for Static Breakdown Voltage (SBV); for any given gap, there can be only a single value for SBV.

For rating purposes, crowbar service is defined as being single-shot or very low repetition rate operation such that gap heating is nil. For applications where the various discharge parameters simultaneously approach the values shown, gap life will be on the order of 1000-5000 operations. Longer life can be obtained when operating at reduced power levels; alternatively, operation at higher levels is possible, but life will be reduced.

For applications involving repetitive operation such that gap heating is significant, the ratings of Table 2 apply. For discharge conditions simultaneously approaching the maximums shown, gap life is typically one million to five million operations. Again, a trade off exists between discharge severity and service life.

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Overvoltage Spark Gaps

PGP and PB Series

Table 3 shows ratings for Excelitas' PGP and PB Series pulse overvoltage spark gaps. These have been specifically designed to protect critical components against damage caused by fast high voltage transients. The dynamic breakdown voltage (the voltage at which the gap breaks down under transient conditions) is a function of the rate of rise of the applied voltage (dv/dt). In general, it will be higher for higher dv/dt. The breakdown time of these gaps is much faster than that of conventional overvoltage types, and their dynamic breakdown voltage is relatively close to their static breakdown voltage over a wide range of operating conditions.

PGP Series: In single-shot protection service, these gaps can divert a transient energy as high as 10 joules and conduct a total charge as high as 300 millicoulombs. Dynamic breakdown voltage is typically less than twice their static breakdown voltage for applied voltage transients as fast as 300 kilovolts per microsecond.

PB Series

Peak currents up to 1500 amperes with current rise times on the order of 1-5 nanoseconds are possible. The small size of these devices makes them well suited for use on circuit boards and in other applications where space is restricted. For best results the gap should be tightly coupled across the component to be protected. On nanosecond time scales, the inductive drop across even a few inches of excess wiring can easily exceed the rated turn-on voltage of the gap.

Typical rating for inter-electrode capacitance is 3 pf, dynamic voltage drop is 50 volts, and open circuit resistance at 500 volts is 1000 megohms.

Table 1 Specifications

Environmental Specifications	
Ambient temperature range	
Operating temperature range	-54 to +100°C
Nonoperating temperature range	-65 to +125°C
Vibration	15 to 500 Hz at 10 g maximum
Shock	50 g, 11 milliseconds
Thermal Shock	-65 to +125°C
Electrical Specifications	
Electrode capacity	Less than 5 pf.
Interelectrode resistance	Greater than 10^{10} ohms at 500V.
Mechanical Specifications	
Envelope	Ceramic-metal, hermetically sealed, exposed metal parts nickel plated
Torque applied to studs	6 inch-pounds maximum



These products contain radioactive Kr85. The activity level is less than 30 μCi ($1.1 \text{ E}+06 \text{ Bq}$) at the time of shipment from Excelitas in compliance with US NRC regulation 10 CFR 32.14. Users of these products are exempt from licensing in the US in accordance with 10 CFR 30.15. Regulations may vary outside the United States.

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Overtoltage Spark Gaps

Table 2 OGP-Series Spark Gap Ratings

Crowbar Service		Maximum Discharge Conditions (4)		
Family Type (1)	Available Static Breakdown Voltage Range (kV) Min-Max (2)	Peak Current (kA)	Total Conducted Charge per Pulse (millicoulombs)	
OGP-57	1-9	5	200	
OGP-62	1-9	5	200	
OGP-64	1-9	5	200	
OGP-44	9-25 (3)	5	200	
OGP-49	2-25 (3)	7.5	400	
OGP-75	10-30	20	500	
OGP-35	8-42 (3)	50	1000	
OGP-83	8-42 (3)	25	800	
OGP-67, 73	30-65 (3)	20	500	
OGP-76	30-120 (3)	50	1000	
OGP-1501	30-120 (3)	50	1000	
Repetitive Switching Service		Maximum Discharge Conditions (5)		
Family Type (1)	Available Static Breakdown Voltage Range (kV) Min-Max (2)	Conducted Charge per Pulse (millicoulombs)	Avg. Current Ib (mA, DC) (6)	RMS (Current IP) (A, AC) (7)
OGP-57	1-9	4	40	6
OGP-62	1-9	4	40	6
150GP-64	1-9	4	40	6
100GP-44	9-25 (3)	4	40	6
OGP-49	2-25 (3)	8	60	8
OGP-75	10-30	20	150	10
OGP-35	8-42 (3)	20	200	15
OGP-83	8-42 (3)	8	100	10
OGP-67, 73	30-65 (3)	20	150	10
OGP-76	30-120 (3)	20	200	15
OGP-1501	30-120 (3)	20	200	15

Notes

- The general family type is listed. Mechanical variations with differing connections are shown in the accompanying drawings. These are designated by the addition of another digit or a letter to the basic family number. For example, the OGP-44 family includes the 44G, 441, 442, 443, 444, 445, 446, 44L and 44R.
- Each overtoltage gap is manufactured with a specific static (or DC) breakdown voltage (SBV). this voltage can be set anywhere within the available min-max range. The SBV is specified by the addition of a dash number to the mechanical type number, giving the SBV in kilovolts.
- These units must be operated in a dielectric medium to prevent external corona or breakdown: OGP-76, above 50kV; OGP-1501, above 35kV; OGP-44, above 15kV; OGP-67 and OGP-73, above 40kV; OGP-49, above 15kV; OGP-83 and OGP-35, above 20kV. Some of the more important derating factors that determine the safe operating voltage in air are the cleanliness of the tube's ceramic insulators, the rate of rise of anode voltage, the dwell time at the operating peak anode voltage, the pulse repetition rate, and ambient pressure, temperature, humidity and contaminant level.
- The ratings shown apply for single-shot service. Under these maximum duty conditions, gap life is typically 1000-5000 operations.
- For conditions approaching these maximum ratings, life is typically one million to five million operations. Longer life can be obtained when operating at reduced levels; alternatively, operation at higher levels is possible, but life will be reduced.
- Ib is the average current through the gap. It is equal to the conducted charge per pulse x pulse repetition rate (ppr).
- Ip is the RMS current through the gap. For rectangular current pulses, $I_p = \sqrt{I_b \times \text{peak current}}$.

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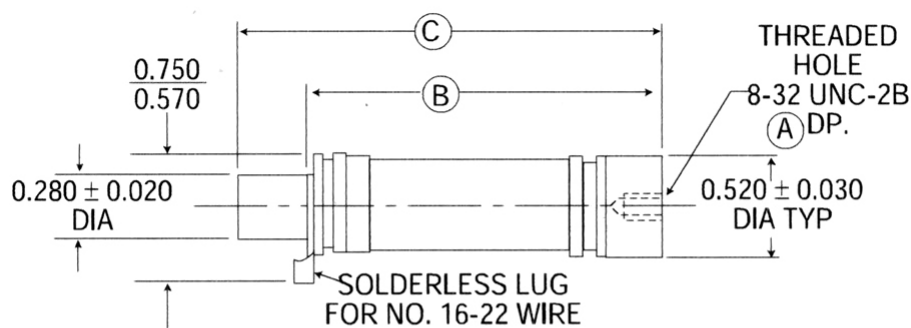
Table 3 PGP and PB Spark Gap Ratings

	Available Static Breakdown Voltage Range (kV) Min-Max (1)	Typical Maximum Operating Standoff Voltage (2)	Dynamic Breakdown Voltage, DBV (typical)	Peak Current (kA)	Conducted Charge per Pulse (micoulombs, maximum) (5)
PGP Series PGP-571, 574, 575	0.5-6	80% of SBV	120-200% of SBV (3)	10	300
PB Series PB-23, 23A, 23C, 23D	0.5-5	80% of SBV	120-200% of SBV (3)	1.5	50

Notes

- The DC voltage at which the gap switches from the open to the conducting state. (For any given gap, SBV has a single fixed value).
- The SBV of an individual gap may be +/- 10% of its nominal value. Therefore, the recommended maximum operating (standoff) voltage is 80% of SBV.
- The range shown is typical for dv/dt between 75 and 300 kV/us.
- The maximum dynamic breakdown voltage is 1000 volts for gaps having SBV between 500 and 750 volts. For higher SBV, DBV is approximately 1.3 times SBV.
- Typical life at rated conducted charged is 500-1000 operations. Life increases substantially at lower operating levels.

Figure 1 Mechanical Specifications OGP-44G, OGP-57, OGP-64



TYPE	A USABLE THREAD	B ±0.080	C ±0.100
OGP-44G	0.187 MIN	1.940	2.190
OGP-57	0.187 MIN	1.195	1.445
OGP-64	0.187 MIN	1.940	2.190

Figure 2 Mechanical Specifications OGP-67, OGP-73, OGP-75

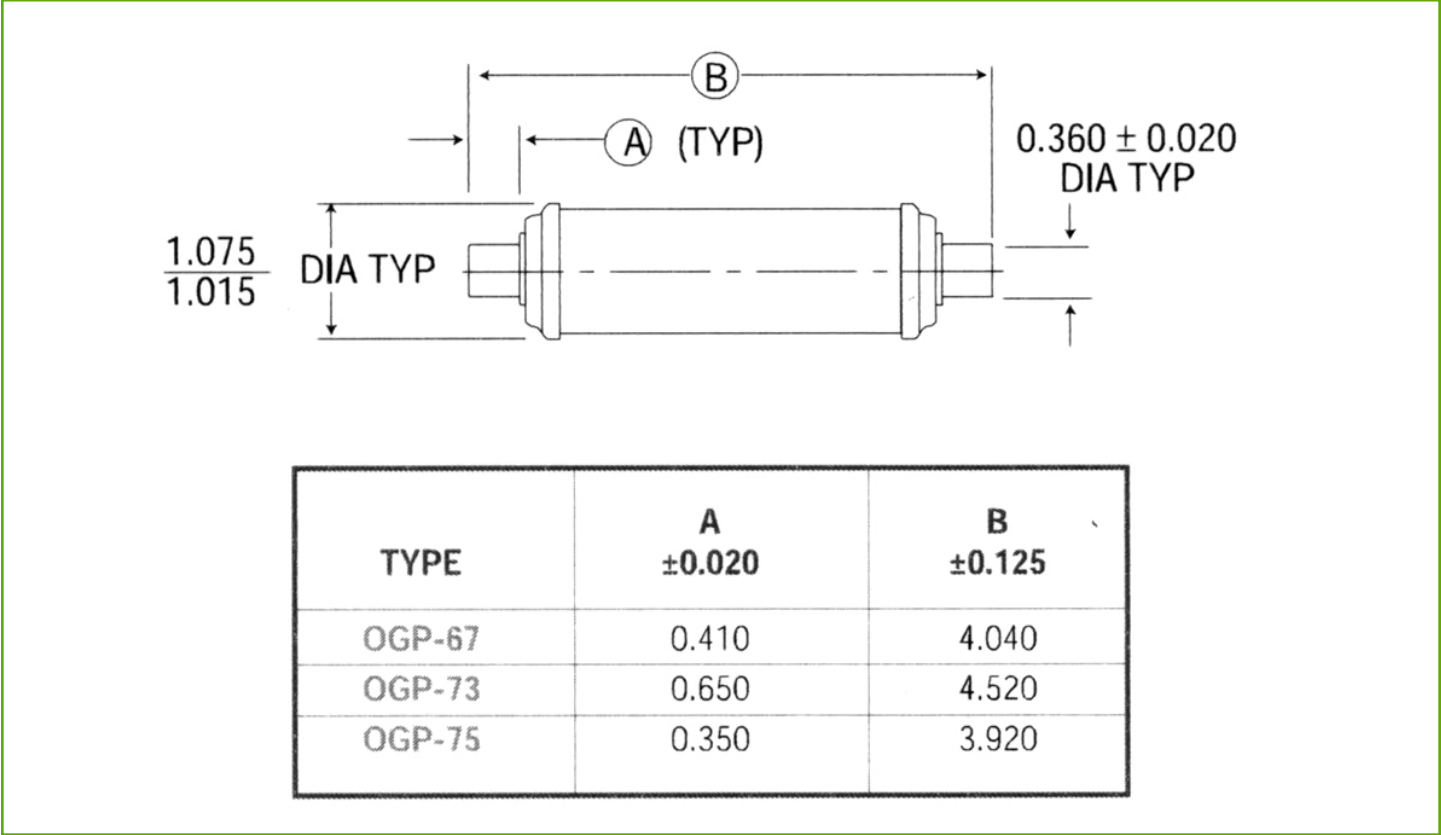


Figure 3 Mechanical Specifications OGP-44L

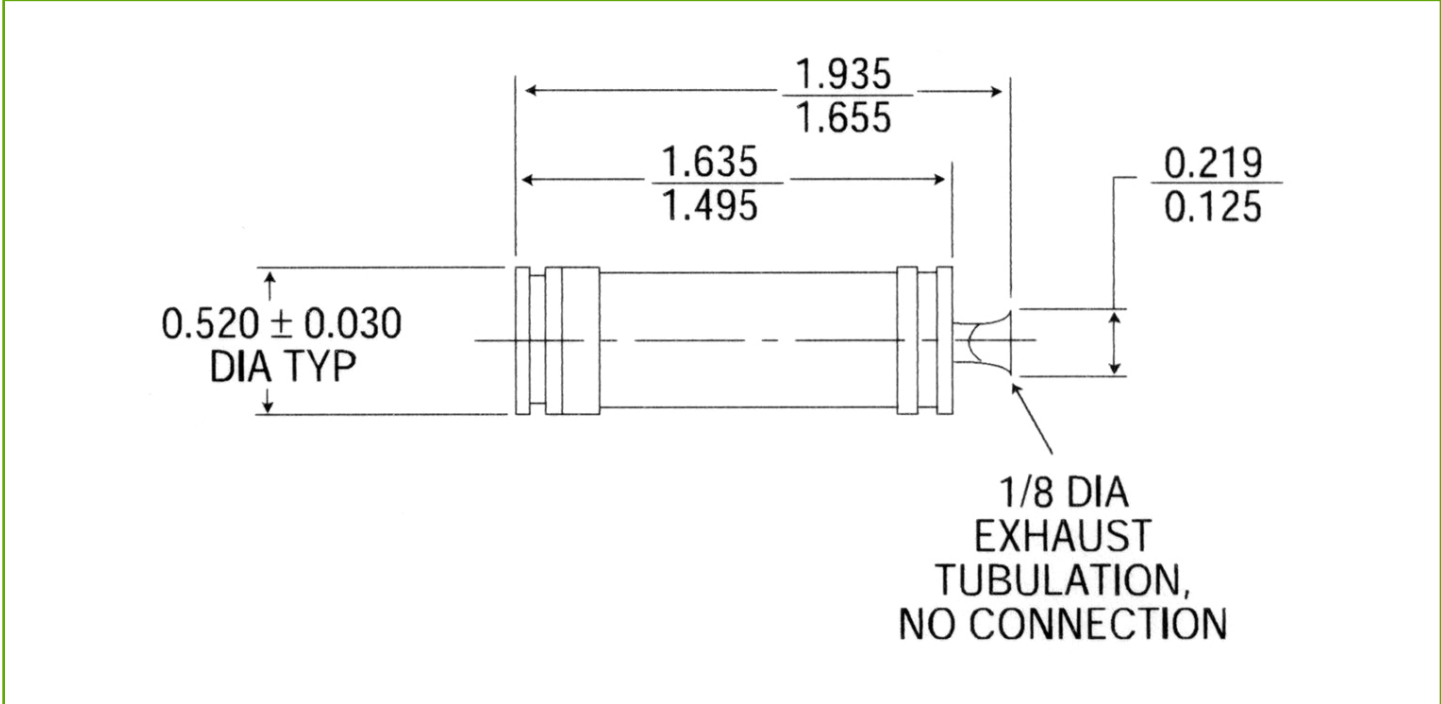
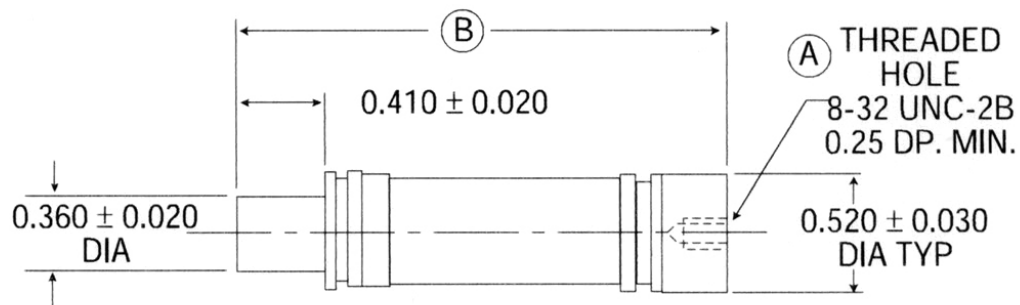


Figure 4 Mechanical Specifications OGP-44R



Figure 5 Mechanical Specifications OGP-442, OGP-443, OGP-642



TYPE	A USABLE THREAD	B ±0.125
OGP-442	0.187 MIN	2.315
OGP-642	0.187 MIN	2.315
OGP-443	0.250 MIN	2.100

Figure 6 Mechanical Specifications OGP-444, OGP-445, OGP-446

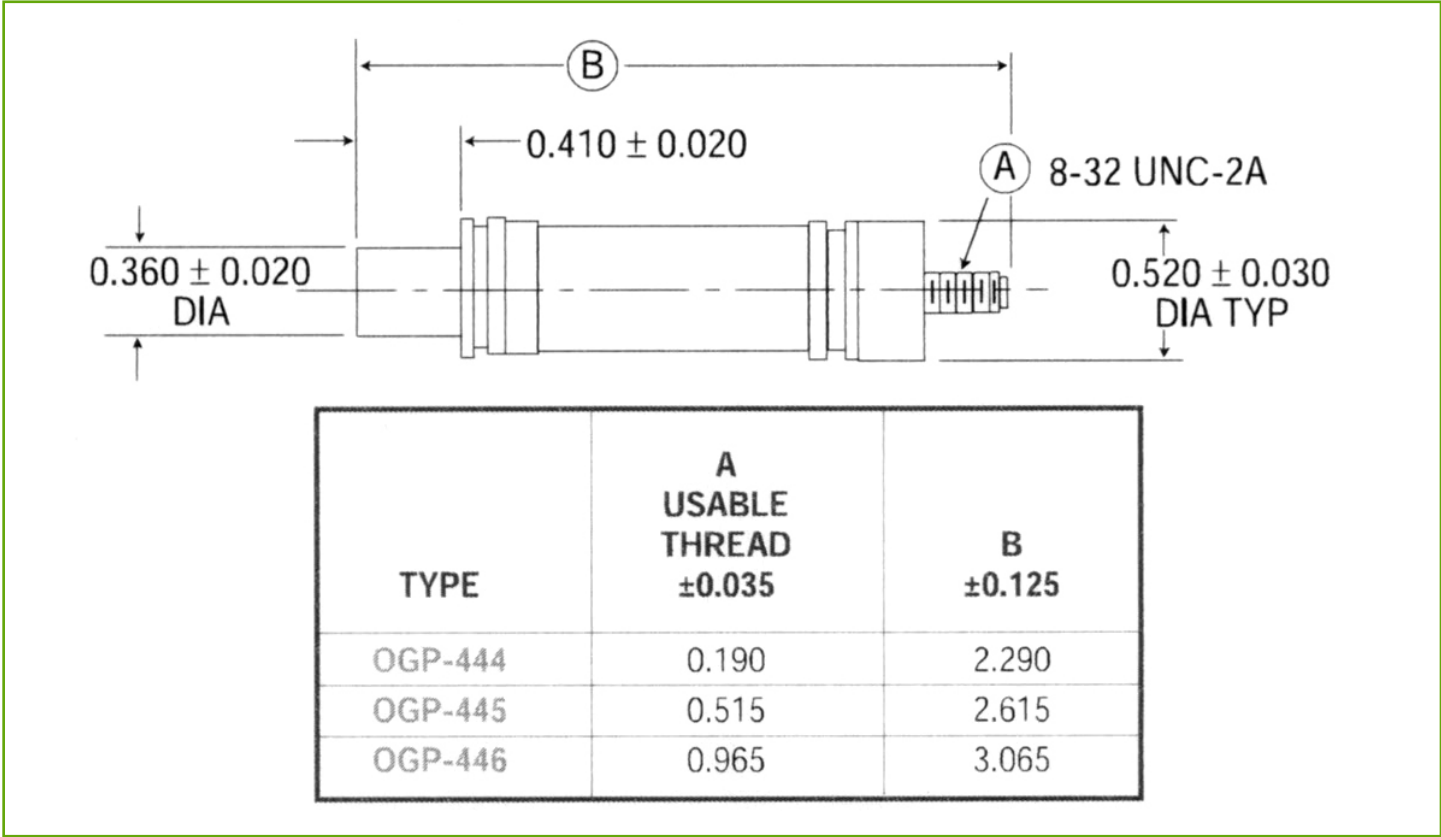


Figure 7 Mechanical Specifications OGP-441, OGP-641

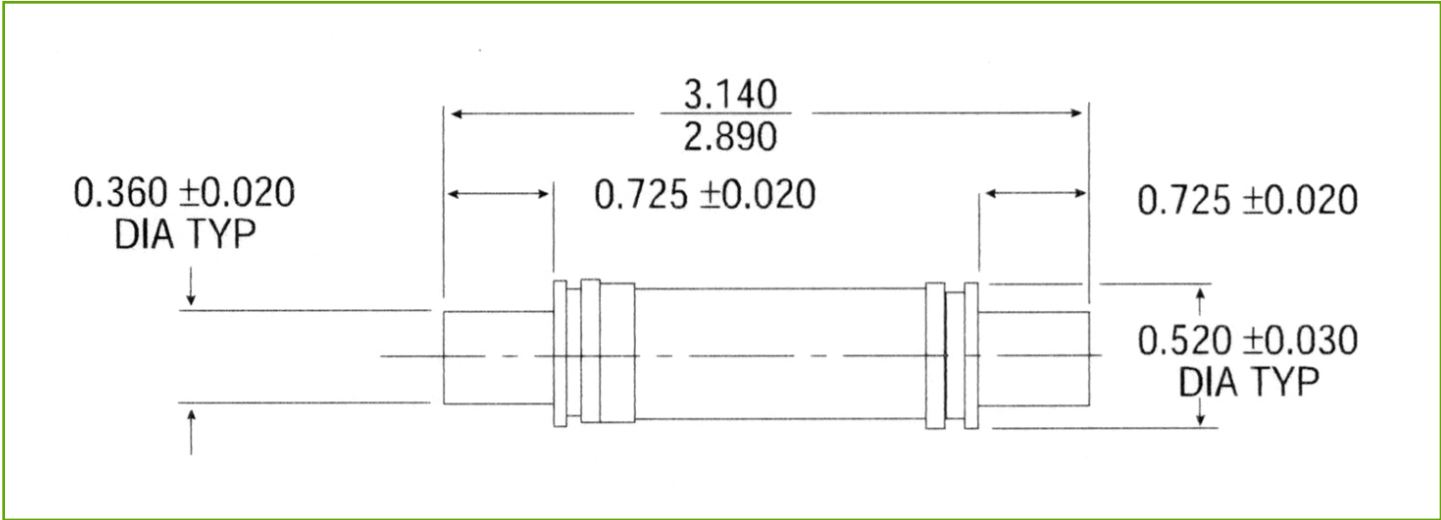
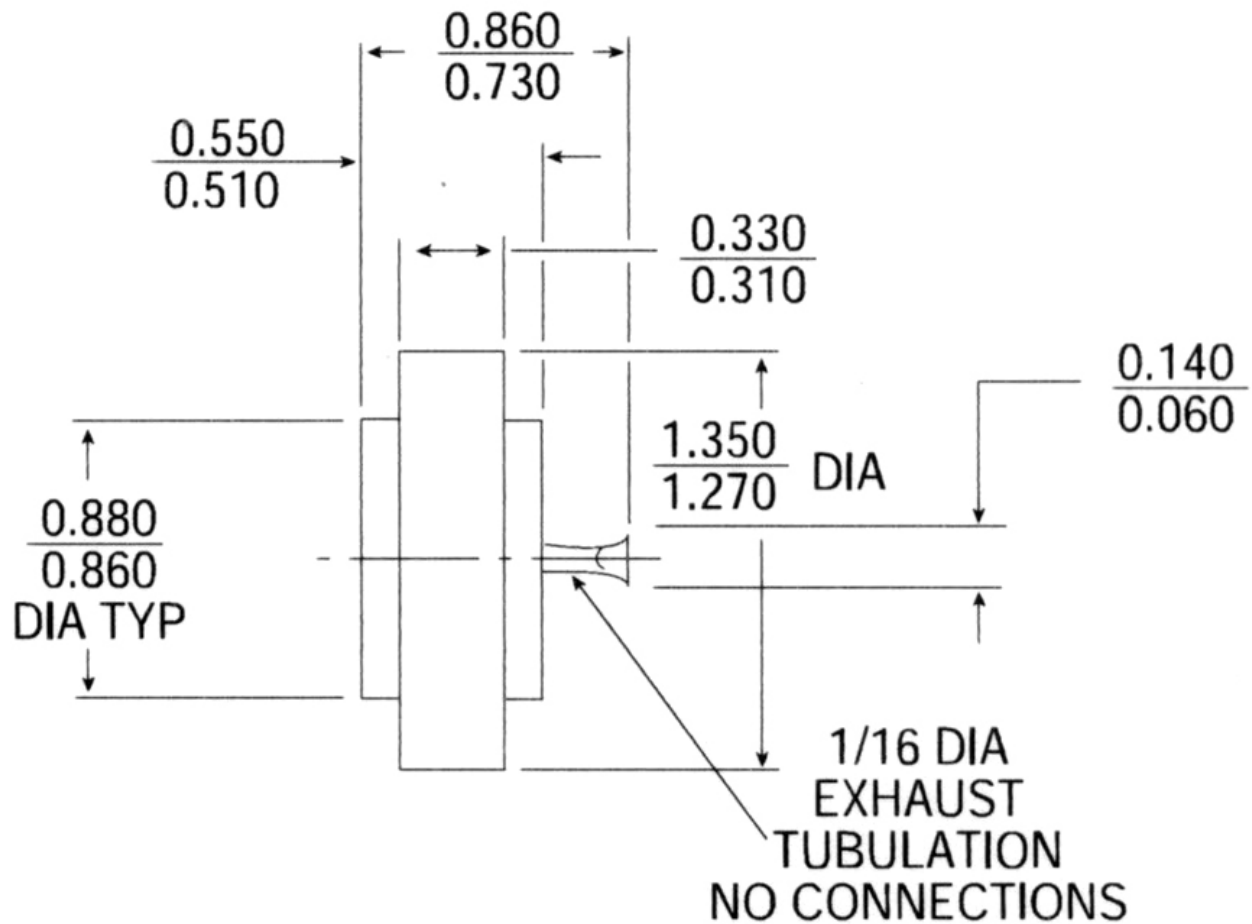


Figure 8 Mechanical Specifications OGP-62



Technical drawing of a mechanical part showing dimensions and thread specifications:

- Overall length: 4.200
- Length of main body: 3.820
- Length of threaded section: 3.350
- Length of threaded section (minimum): 3.150
- Thread specification (right side): 8-32 UNC-2A, 0.300 MIN. USABLE THREAD
- Thread specification (left side): THREADED HOLE 8-32 UNC-2B, 0.300 MIN. USABLE THREAD
- Dimension (bottom right): 1.075 / 1.015 DIA TYP

Technical drawing of a wellhead component, showing front and side views with dimensions and a table.

Front View Dimensions:

- 60° TYP (Taper)
- CLEARANCE FOR A NO. 8 SCREW 6 HOLES EACH END ON A 3.937 B.C.
- 4.275 / 4.225 DIA TYP (Inner diameter)
- 3.050 / 2.950 DIA (Outer diameter)
- EXHAUST TUBULATION NO CONNECTION

Side View Dimensions:

- A (Overall length)

TYPE	A ±0.125
OGP-35	2.250
OGP-1501	3.500

Figure 11 Mechanical Specifications OGP-49

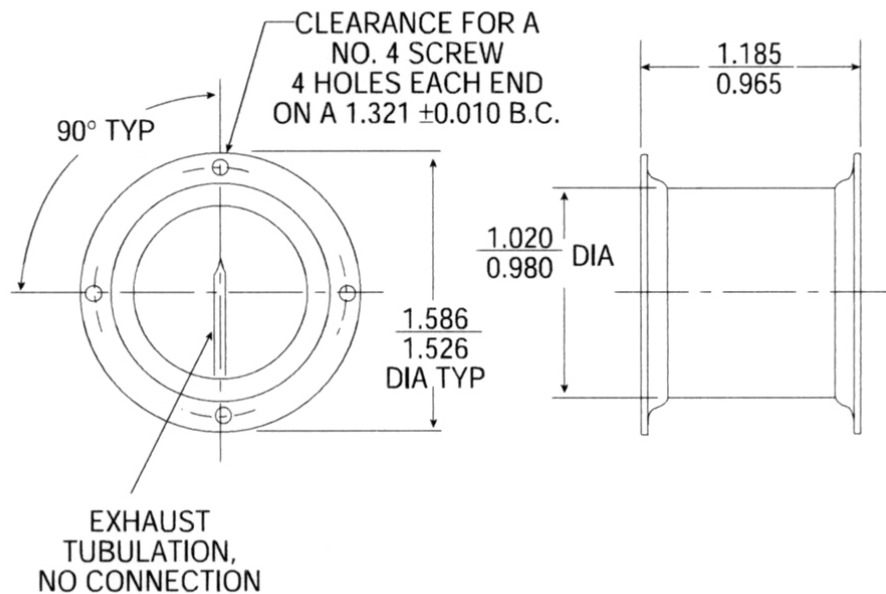


Figure 12 Mechanical Specifications OGP-76

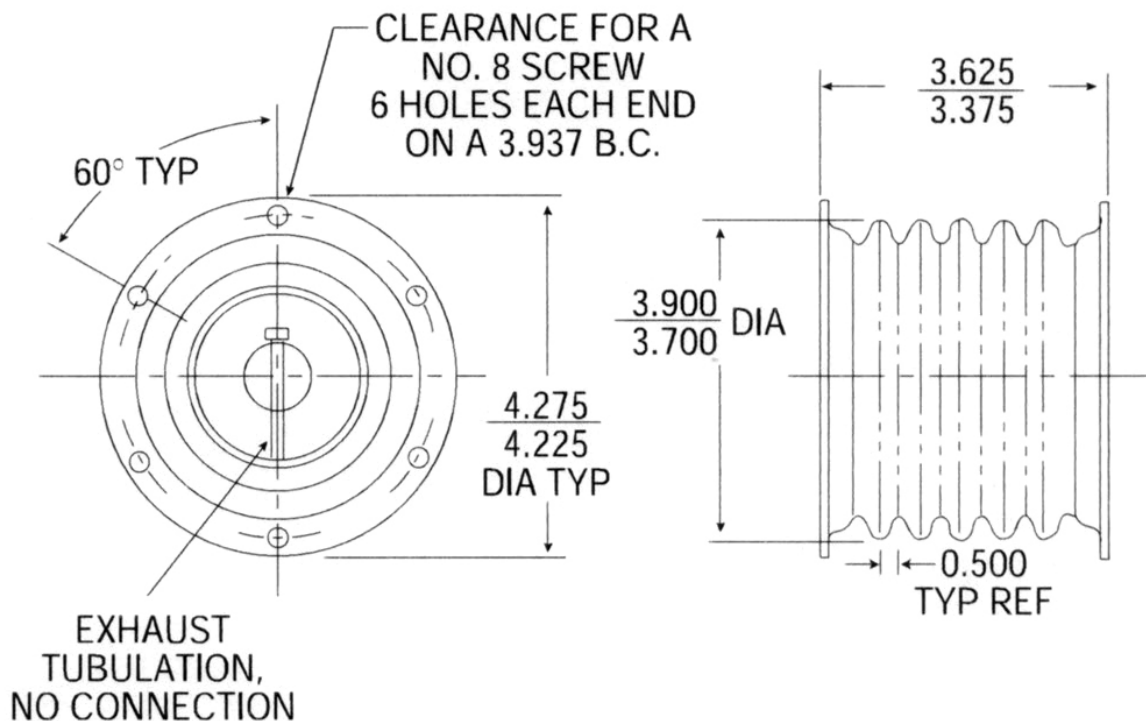


Figure 13 Mechanical Specifications OGP-83

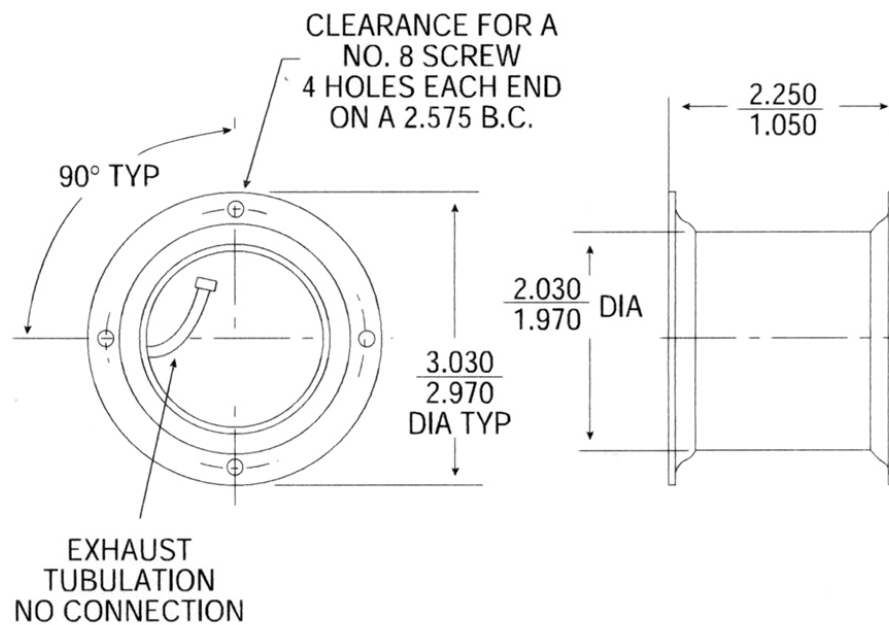


Figure 14 Mechanical Specifications PB-23

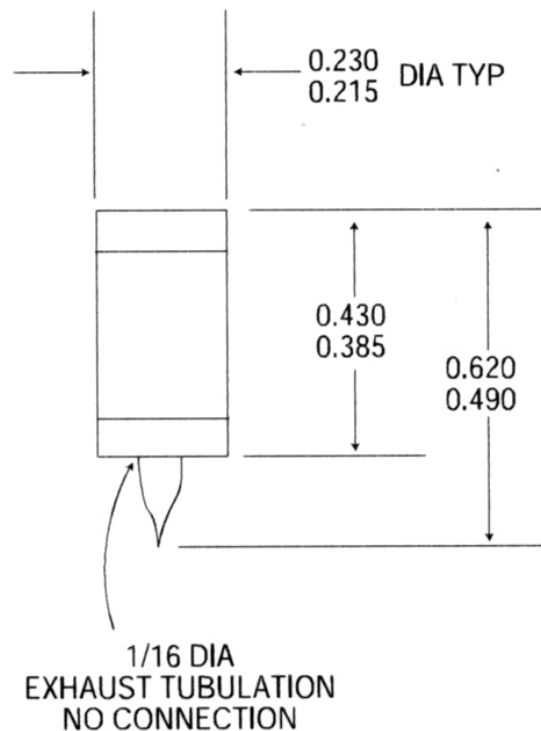
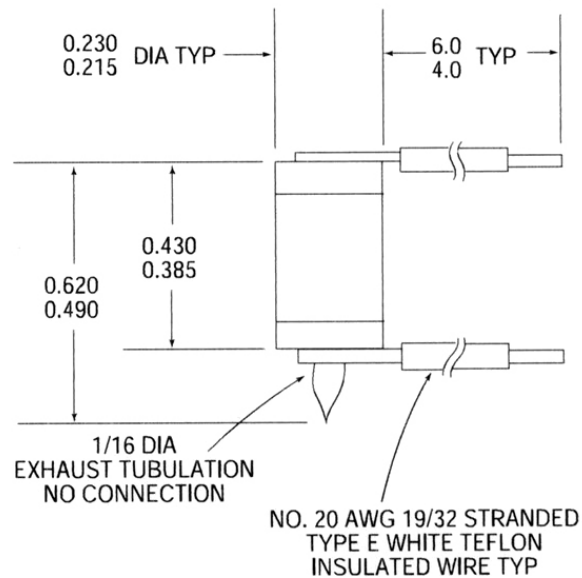


Figure 15 Mechanical Specifications PB-23A



PB-23B – Same as PB-23A except for
No. 20 AWG tinned copper bus wire

Figure 16 Mechanical Specifications PB-23D

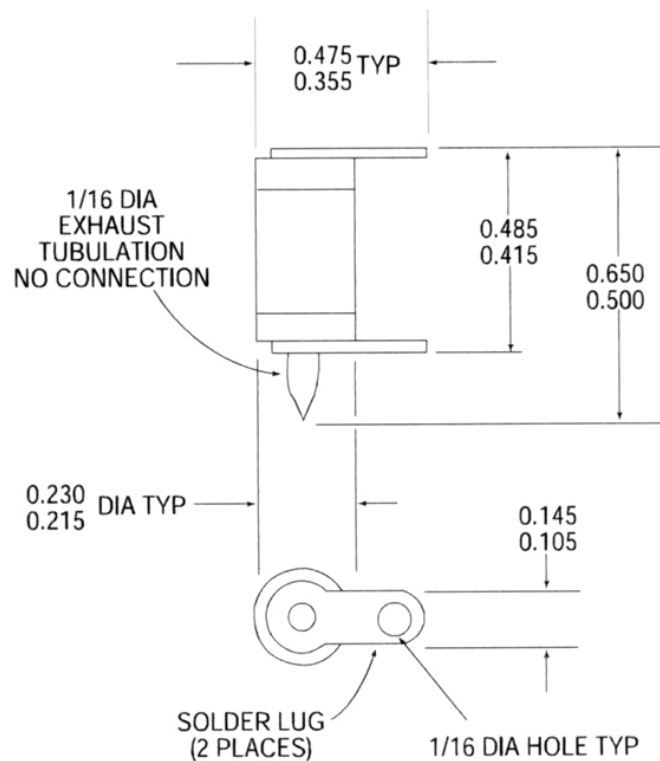


Figure 17 Mechanical Specifications PB-23C

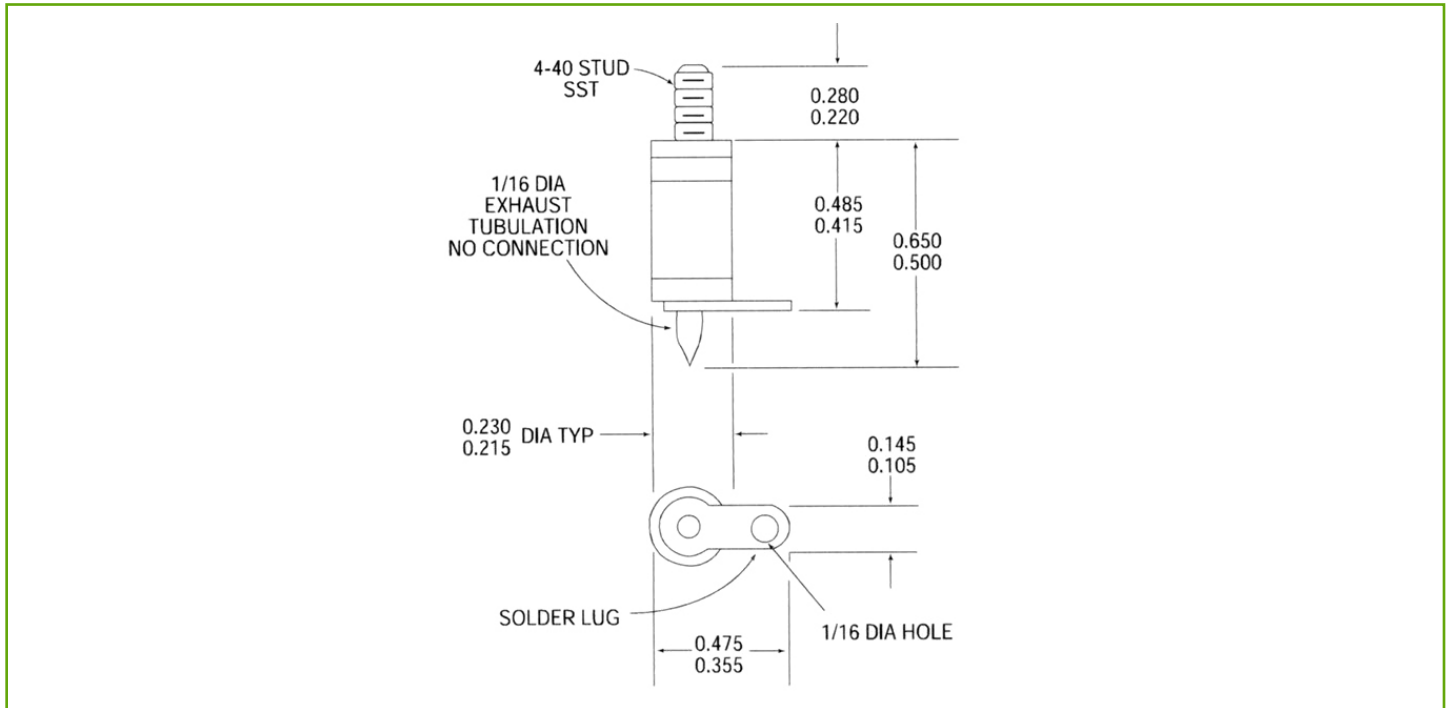


Figure 18 Mechanical Specifications PGP-571

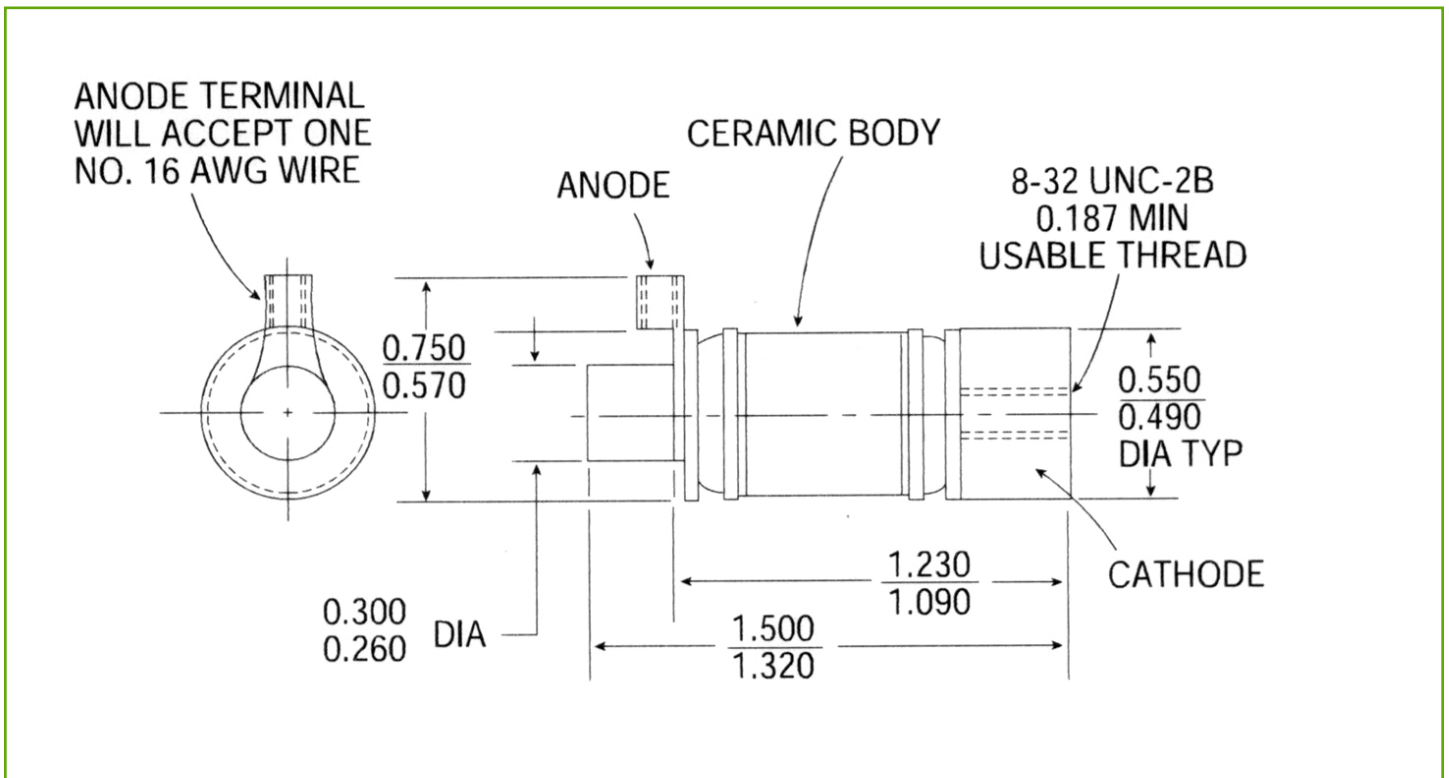


Figure 19 Mechanical Specifications PGP-574

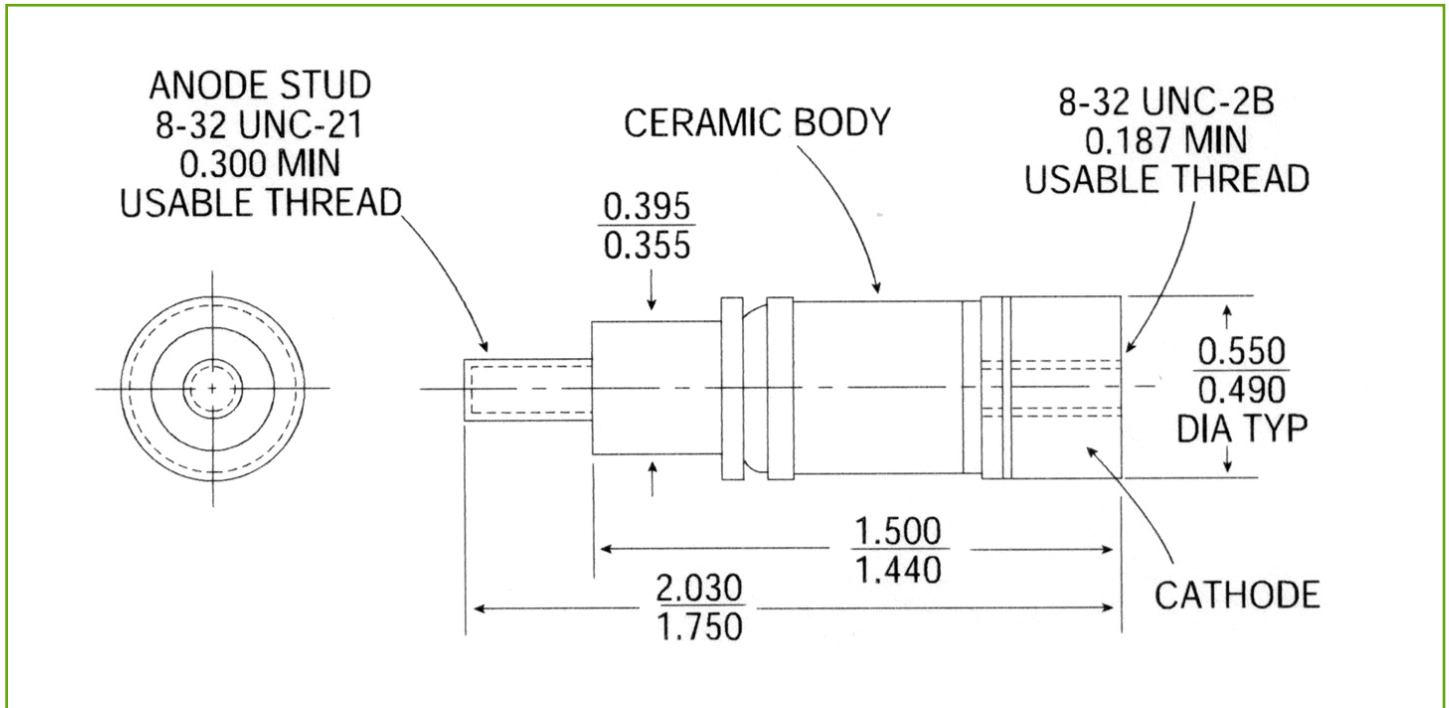


Figure 20 Mechanical Specifications PGP-575

