Data Sheet

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GE Components
Marketing & Sales Operation

In halogen regenerative cycle lamps, the ideal material for the envelope must bridge the gap between quartz and the more common "hard glasses", combining the desirable properties of both. Type 180 glass tubing was designed to meet the exacting demands of this application.

Type 180 Glass Tubing

The growing acceptance of GE Type 180 glass tubing for halogen lamp envelopes reflects the many benefits this glass provides for both lampmakers and consumers.

This glass was developed and is used almost exclusively for these regenerative cycle lamps. When the lamps are lit, the halogen gas and the vapors from the burning filament combine to create a chemical reaction that keeps the bulb from blackening. But this reaction occurs at extremely high temperatures for an incandescent lamp—over 500 °C.

Type 180 glass not only exhibits the superior hot strength to handle these temperatures, it also has the required purity. Ordinary lamp glasses contain small amounts of sodium, lithium and other alkalis that could leach out at extremely high operating temperatures. Reacting with the halogen gas, these elements could potentially disrupt the regenerative cycle.

From a lamp manufacturing standpoint, GE 180 glass offers another important advantage: its ability to seal effectively with molybdenum wire leads.

Higher Quality

Continued process improvement at GE's manufacturing facilities over the last several years has been responsible for the high level of quality and superior manufacturing characteristics of today's Type 180 glass.

State-of-the-art furnaces, improved furnace linings and more sophisticated controls have given us a tight control over glass composition and tube forming characteristics.

Diameters and wall thicknesses are monitored and controlled to closer tolerances. Potentially troublesome alkalis have been all but eliminated as we continue to offer the highest purity glass available. The amount of bow is measured on every stick, assuring users of consistent properties from one order to the next.

GE Type 180 Glass Tubing:
Specially Tailored For Halogen Lamps...

With the growth of the halogen lamp market has come the demand for a higher quality glass, a greater range of sizes, and a product that can meet the various requirements of lamp producers around the world.

In an ordinary incandescent lamp, tungsten gradually burns off the filament during operation until it becomes too fragile to support its own temperature. During this cycle, some of the residue from the burning filament deposits on the inside of the bulb wall, darkening the glass and slowly degrading the light output.

Introduction of a halogen gas into the lamp atmosphere reverses this cycle, at least for a time. The evaporated tungsten combines with the halogen to form a gas that recycles the tungsten back to the hot filament. The tungsten is redeposited and the halogen is released for repetition of the cycle. As a result, lamps can operate at higher temperatures, higher pressures and higher lumens per watt.

Because higher pressures can also be used in lamp manufacturing, the rate of tungsten evaporation during lamp operation is reduced even further.

Bulb wall darkening is virtually eliminated. Because of the superior hot strength and high purity of 180 glass, these lamps also offer longer service life.

Strain Point

The operating temperature of high energy tungsten-halogen lamps requires a glass envelope with a strain point of at least 730 °C. During the cooling of the lamp, whether in manufacture or in operation, tensile stresses are initially set up in the glass-to-molybdenum wire seal. As the cooling continues toward room temperature, a cross-over point is reached where compressive stresses develop. Since the base temperature of tungsten-halogen lamps is approximately 500 °C during operation, the crossover point, and thus the strain point of the glass, should be as high a temperature as possible.

Expansion Coefficient

The excellent match of expansion/contraction curves between molybdenum and GE Type 180 glass presents definite advantages in both manufacture and performance of halogen lamps.

At operating temperatures of 500 °C, the lamp maintains a positive mismatch, i.e. it is in compression. This significantly reduces the conditions that lead to lamp failure.

Because Type 180 combines favorable costs with superior manufacturing characteristics, it is stimulating a great deal of design activity in regenerative cycle lamps, extending the technology beyond automotive to a broader classification of lighting.

Specific Benefits Of GE 180 Glass

- ***Tolerates the 500°C plus temperatures necessary to support the tungsten halogen cycle.***
- ***Has very low levels of alkalis that could interfere with the cycle.***
- ***Offers superior hot strength, permitting greater pressure in the lamp and extending service life.***
- ***Has very low mismatch to molybdenum at lamp operating temperatures.***
- ***Has thermal contraction/expansion characteristics that match the molybdenum lead wires to which the glass is sealed.***
- ***Offers glass working temperatures that are consistent with the lamp making process.***
- ***Is available in the diameters, wall thicknesses and lengths required by the lamp making industry worldwide.***

Halogen Lamps

Design Considerations

Although Type 180 possesses the desired properties for tungsten-halogen lamp manufacture, it does not follow that it can always be substituted directly in tungsten-halogen lamps that have been designed for other materials. Minor or possibly major redesign may be required to utilize this unique glass to its fullest advantage.

This is especially true in converting to Type 180 glass from another commonly used halogen lamp envelope material, fused quartz. Quartz has higher temperature tolerance, but it also requires higher bulb forming and sealing temperatures. Because of the very low thermal expansion of fused quartz, the lamps must be designed to utilize molybdenum foil tabs to promote sealing in the pinch area. These tabs, which are both costly and fragile, are not required with 180 glass.

Fewer Welds

With 180 glass, lead wires can be either a one part or two part wire requiring one weld per lead; foil tabs require two welds per lead. And the more rigid wire provides better mount control than the foil tab. Without the tabs, the pinch area can be much smaller. Fused quartz is also a more costly material.

Another candidate material, Grade 1724, doesn't have a cost disadvantage, but it lacks the purity of Type 180 glass. Its softening and strain points are lower and its negative mismatch at lamp operating temperatures is quite high (see table).

GE Type 179

When top sealing of halogen or other small gas filled lamps isn't practical, as in the case of a lamp with an optic surface at the top, GE offers an exhaust tubing that can accommodate bottom sealing. This material, GE 179 glass tubing, has a softening point that is 50% higher than 180 glass. This permits pinch sealing of the leads without closing off the exhaust tube.

Comparative Data

The properties of General Electric Type 180 aluminosilicate glass tubing compared to other materials currently used in halogen cycle lamps. (Published values, subject to normal manufacturing variations.)

	GE Type 180	GE Fused Quartz	CORNING Type 1724*
Softening Point °C	1015	1670	926
Anneal Point °C	785	1140	726
Strain Point °C	735	1070	674
Thermal Expansion (0-300 °C cm × 10^{-7}/cm/cm°C	45	5.5	44
Density (gms/cc)	2.77	2.20	2.64
Total Alkali %	<.045	<.005	<.150
Soda %	<.030	<.002	<.100
Electrical Resistivity ($\log_{10}$ ohm) × cm			
@ 250 °C	12.7	11.8	12.4**
@ 350 °C	11.1	10.2	10.8**
Reboil Rating (on a scale 1-poor to 10-excellent)	8	10	5**

*From Corning published data **GE calculated/measured data

Figure 1 — Typical Contraction Curves

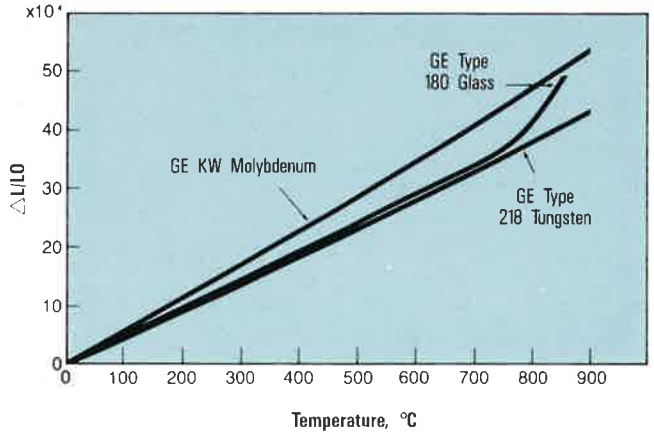
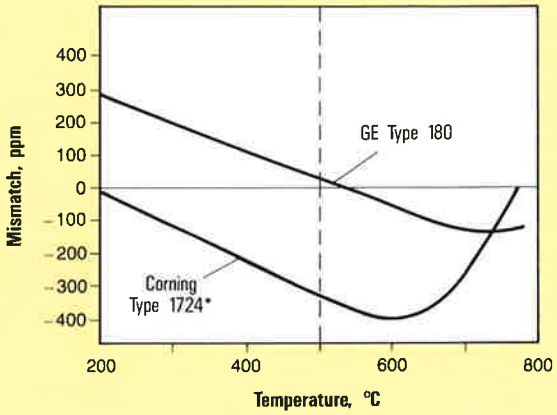


Figure 2 — Molybdenum-Glass Seal Mismatch Curves



*From Corning published data.

Figure 3 — Viscosity of Type 180 Glass

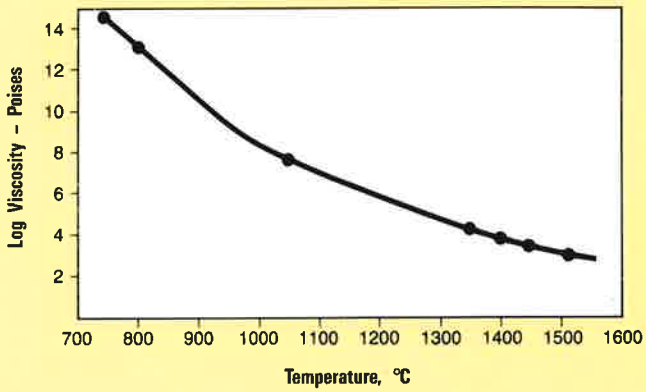
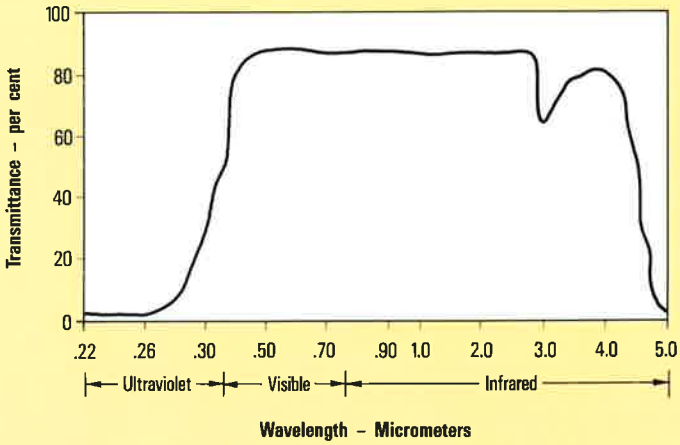


Figure 4 — Transmittence Curve



Typical Sizes Type 180 Glass

Tubing Outside Diameter, Millimeters		Tubing Wall Thickness, Millimeters	
Nominal	+/–	Nominal	+/–
1.90	0.13	0.35	0.05
2.54	0.13	0.51	0.08
3.60	0.13	0.60	0.08
4.50	0.13	0.43	0.05
4.67	0.13	0.51	0.08
5.11	0.13	0.51	0.08
6.10	0.18	0.63	0.08
7.11	0.18	0.71	0.08
7.25	0.18	0.61	0.08
8.00	0.18	0.63	0.08
8.82	0.18	1.02	0.10
9.00	0.18	0.68	0.08
9.40	0.18	1.00	0.10
10.00	0.18	0.63	0.08
10.30	0.18	0.68	0.08
11.50	0.18	0.62	0.08
11.80	0.18	1.00	0.10
12.15	0.18	0.90	0.10
12.50	0.20	0.63	0.08
13.50	0.20	0.80	0.10
14.20	0.20	1.00	0.10
15.20	0.20	1.20	0.12
16.00	0.20	1.20	0.12

Cane, Diameter, Millimeters	
Nominal	+/–
2.00	0.13
2.50	0.13
4.20	0.13
4.50	0.13
4.70	0.13
5.30	0.13

Type 179 Cut Exhaust Tubing, Millimeters		
Diameter	Wall	Length
1.90	0.35	69.5
2.50	0.51	69.5

Call GE For All Your Glass Requirements

For application engineering assistance or ordering information on Type 179 and 180 glass tubing and cane, contact your area sales representative or the office listed below. In addition to these grades, GE produces many other types of glass tubing as well as bulb blanks and pressed glass parts. Send for our complete glass catalog.

GE Components Marketing & Sales Operation
21800 Tungsten Road, Cleveland, OH 44117
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