



***Glass Bulbs
and
Tubes***

TUNGSRAM

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Though our data and figures have been compiled with utmost care, they are only informative ones and do not indicate our actual conditions of delivery. We reserve the right to introduce alterations in technical details without special notification.

PROPERTIES OF GLASSES

Glass is generally thought of as a hard, brittle substance made of silicates fused at high temperature. More technically, it would be considered as an inorganic product of fusion which has been cooled to a rigid condition without crystallization. This definition emphasizes the fact that all glasses are non-crystalline or amorphous in nature.

Most glasses are made by melting compounds which form oxides. The types and amounts used are determined by the properties desired in the glass. By varying the constituents glasses can be made with wide variations in expansion coefficients, differing degrees of transmission of various colors or wave lengths of light, great varieties of electrical properties and a great range of working characteristics.

When various articles are made from glass, only a few basic forming processes are used. Glass can be pressed into shapes or it can be blown into lamp bulbs, and can be pulled like taffy to form glass tubing, rod.

Viscosity

In order to perform any of these operations, the ability of the glass to flow or move at various temperatures when force is applied must be considered. The resistance to this movement, or flow, is called viscosity. This is usually expressed in units known as poises. A poise is the force required to produce shear movement at a unit rate. The change in viscosity when glass is heated and cooled is continuous and shows no abrupt changes from solid to liquid. As the glass compositions are changed, the glasses show varying viscosities at given temperatures and thus help us to define glasses, or distinguish between them by published physical properties based on viscosity curves. To better understand these properties, certain references or comparisons are made. Arbitrary values have been chosen for this purpose and agreed upon by the industry. Temperatures corresponding to these values identify this property.

The viscosity of glass at room temperatures has been experimentally evaluated as being above 10^{20} poises, which for most practical purposes can be considered infinite. As the temperature of glass is increased, its viscosity decreases rapidly in a smooth, functional relationship.

For forming and sealing operations glass must flow somewhat and may have a viscosity of approximately 10^4 poises. This point we have described is known as the **working point** of glass. As the glass cools, it reaches a temperature where its rate of deformation is very small. It is interesting to note that at this temperature glass just becomes sticky. This point, at which the viscosity is in the range of $10^{7.5}$, is known as the **softening point** of the glass. Upon further cooling the material becomes stiff and flow decreases. At the **annealing point** the glass is apparently rigid but can yield enough to allow for stress release at a rate fast enough to be suitable for ordinary annealing cycles. The viscosity here is $10^{13.0}$ poises. The lowest reference point which we employ in describing glass is at the bottom of the so-called annealing range and is known as the **strain point**. The viscosity here is $10^{14.5}$ poises. Below this temperature we usually consider that no permanent strains can be induced during heating and cooling cycles.

Working point — The temperature where the glass is soft enough for hot working by most of the common methods. Viscosity at the working point is approximately 10^4 poises.

Softening point — The temperature at which a uniform fiber, 0.55 to 0.75 mm (6.022 to 0.023 in.) in diameter and 23.5 cm (9.25 in.) long, elongates under its own weight at a rate of 1 mm (0.039 in.) per minute when the upper 10 cm (3.9 in.) of its length is heated at a rate of 5 °C (9 °F) per minute. For glass of density near 2.5 g/cm³ (156 lb/ft³), this temperature corresponds to a viscosity of $10^{7.5}$ poises. At the softening point glass deforms rapidly and starts to adhere to other bodies.

Annealing point — The temperature, at the upper end of the annealing range, at which the internal stress is reduced to a commercially acceptable value in approximately 15 minutes. The annealing point corresponds to a viscosity of approximately 10^{13} poises.

In an annealing operation the glass is slowly cooled from above the annealing point to somewhat below the strain point. Above the annealing point distortion of the glass article occurs easily and may become a problem.

Strain point — The temperature, at the lower end of the annealing range, at which the internal stress is reduced to a commercially acceptable value in approximately four hours. The strain point corresponds to a viscosity of approximately $10^{14.5}$ poises. In general, the strain point represents the extreme upper limit of serviceability for annealed glass. Tempered glasses are limited to a low maximum temperature because they begin to lose their temper in the region below the strain point.

Thermal Expansion

The other glass property which is listed and is of extreme importance to the glass worker is expansion coefficient. Usually this refers to the average expansion of the glass between 0°C and 300°C , and should be multiplied by 10^{-7} per $^{\circ}\text{C}$. Actually, the glass does not expand equally through all parts of the temperature range.

Frequently it will be found that the harder glasses are also those having lower expansion coefficients.

Types of Glasses

Soda-lime glass is the most common type. This is the glass of most bottles and windows. In composition it is similar to the earliest man-made glass—a mixture of the oxides of silicon, calcium and sodium. Approximately 90 per cent of all glass melted today is soda-lime (or simply lime glass as it is commonly called). This type is the lowest in cost of all glasses and is readily fabricated in a wide variety of shapes. Such glass has poor resistance to high temperatures and sudden changes of temperature, and resistance to attack by chemicals is fair.

Borosilicate glass is the oldest type of glass to have appreciable resistance to heat shock or sudden changes in temperature. It will withstand higher operating temperatures than either lime or lead glasses and shows markedly superior resistance to chemical attack.

Lead-alkali glass is somewhat more expensive than lime glass and is favoured for electrical applications because of its excellent electrical insulating properties.

Vitrit glass. Principal use: insulating glass for lamp glass.

UV glass. Principal use: UV lamps.

Glasses are also classified as **soft** or **hard**. This terminology merely means that hard glass softens at very high temperatures; while soft glass requires much lower temperatures. Lime and lead glasses are considered soft, and the borosilicate glass is considered hard. The more silica a glass contains the harder it is, the higher its resistance to temperature and to heat shock, and the lower its thermal expansion coefficient.

HOW TO ORDER

Please specify TUNGSRAM's glass bulbs and tubes by their type designation and code number.

Glass bulbs and tubes in dimensions and/or material differing from those listed in this catalogue are available upon request.

SODA-LIME GLASS

Type: Mg

Code: 0-5326-03650

Description

Colour: Clear

Forms Available: Bulbs, Tubing

Lampworking Characteristics:

Excellent

Seals to Type of Glass:

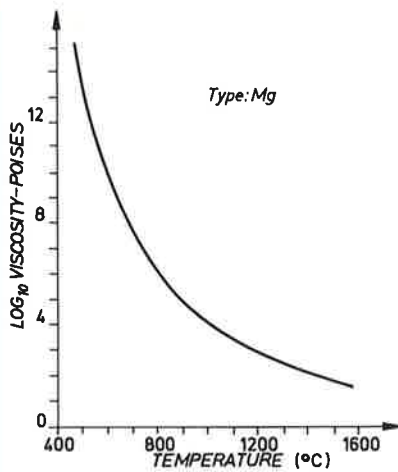
M22 (Code: 0-5326-03660)

Fe-Ni Alloy

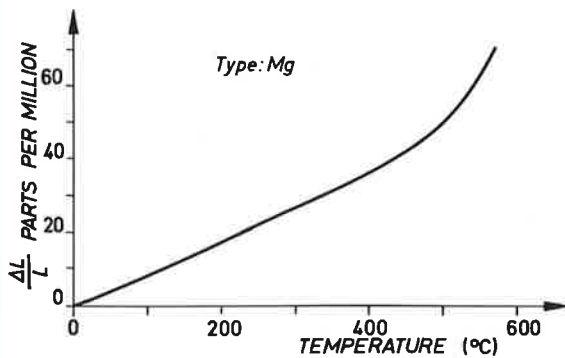
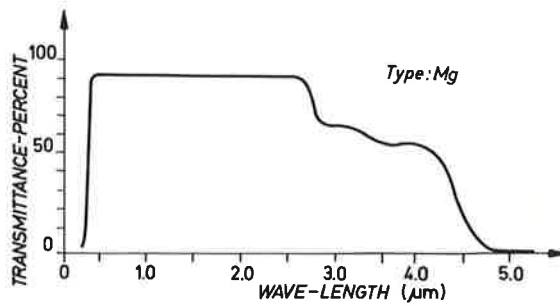
Dumet

Properties	International Scientific	Metric	English
Mechanical			
Density (20°C, 68°F)	$2.47 \times 10^3 \text{ kg/m}^3$	2.47 g/cm ³	154.1 lb/ft ³
Viscosity			
Working Point (10 ⁴ poises)	1,286 K	1,013 °C	1,855 °F
Softening Point (10 ^{7.6} poises)	969 K	696 °C	1,285 °F
Annealing Point (10 ¹³ poises)	787 K	514 °C	957 °F
Strain Point (10 ¹⁴ poises)	746 K	473 °C	883 °F
Thermal			
Expansion (0...300°C, 273...573 K, 32...572°F)	$93 \times 10^{-7}/\text{K}$	$93 \times 10^{-7}/^\circ\text{C}$	$51.6 \times 10^{-7}/^\circ\text{F}$

VISCOSITY vs. TEMPERATURE



TRANSMITTANCE—VISIBLE TO INFRARED (1 mm)



EXPANSION vs. TEMPERATURE

BOROSILICATE GLASS

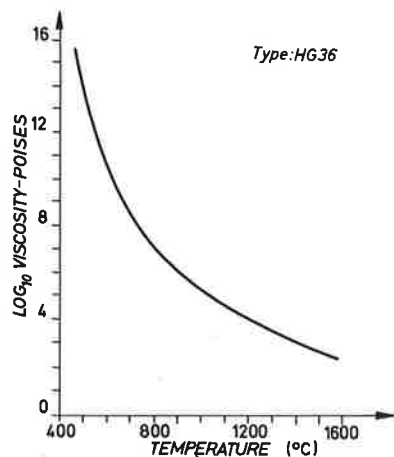
Type: Hg 36
Code: 0-5326-03700

Description

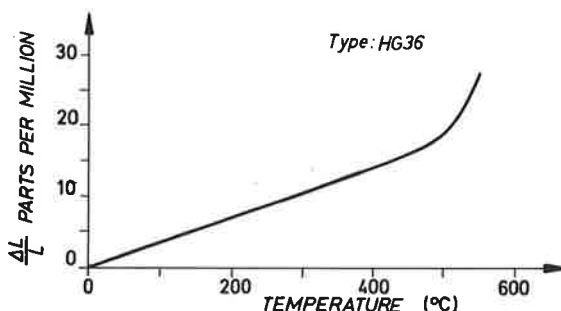
Colour: Clear
 Forms Available: blown, pressed
 Lampworking Characteristics:
 Good
 Seals to Tungsten

Properties	International Scientific	Metric	English
Mechanical			
Density (20 °C, 68 °F)	$2.26 \times 10^3 \text{ kg/m}^3$	2.26 g/cm ³	141.0 lb/ft ³
Viscosity			
Working Point (10 ⁴ poises)	1,473 K	1,200 °C	2,192 °F
Softening Point (10 ^{7.6} poises)	973 K	720 °C	1,328 °F
Annealing Point (10 ¹³ poises)	803 K	530 °C	986 °F
Strain Point (10 ¹⁴ poises)	773 K	500 °C	932 °F
Thermal			
Expansion (0 ... 300 °C, 273 ... 573 K, 32 ... 573 °F)	$36 \times 10^{-7}/\text{K}$	$36 \times 10^{-7}/^\circ\text{C}$	$20 \times 10^{-7}/^\circ\text{F}$

VISCOSITY vs. TEMPERATURE



EXPANSION vs. TEMPERATURE



LEAD-ALKALI GLASS

Type: M22

Code: 0-5326-03660

Description

Colour: Clear

Forms Available: Tubing

Lampworking Characteristics:

Excellent

Seals to:

Type of Glass Mg

(Code: 0-5326-03650)

Type of Glass UV

(Code: 0-5326-03670)

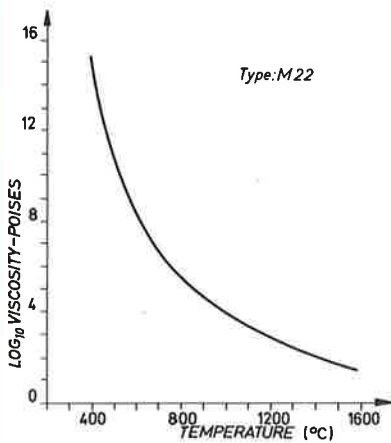
Fe-Ni Alloy

Dumet

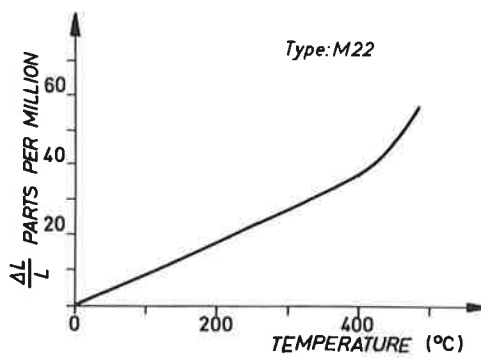
Platinum

Properties	International Scientific	Metric	English
Mechanical Density (20°C, 68°F)	2.85×10 ³ kg/m ³	2.85 g/cm ³	177.8 lb/ft ³
Viscosity Working Point (10 ⁴ poises)	1,273 K	1,000°C	1,832°F
Softening Point (10 ^{7.6} poises)	893 K	620°C	1,148°F
Annealing Point (10 ¹³ poises)	713 K	440°C	824°F
Strain Point (10 ¹⁴ poises)	673 K	400°C	752°F
Thermal Expansion (0...300°C, 273...573 K, 32...572°F)	92×10 ⁻⁷ /K	92×10 ⁻⁷ /°C	51.2×10 ⁻⁷ /°F

VISCOSITY vs. TEMPERATURE



EXPANSION vs. TEMPERATURE



ULTRAVIOLET GLASS

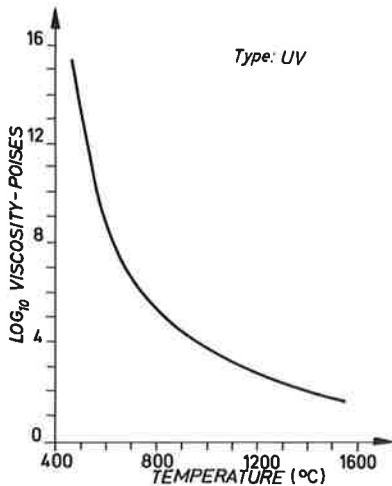
Type: UV
Code: 0-5326-03670

Description

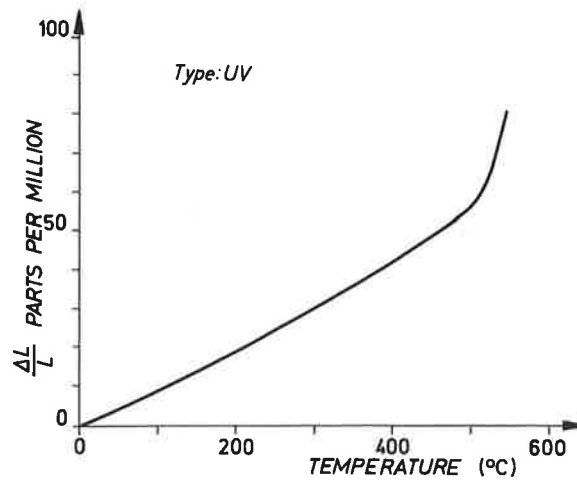
Colour: Dark
 Forms Available: Bulbs
 Lampworking Characteristics:
 Excellent
 Seals to Type of Glass M22
 (Code: 0-5326-03660)

Properties	International Scientific	Metric	English
Mechanical Density (20 °C, 68 °F)	$2.62 \times 10^3 \text{ kg/m}^3$	2.62 g/cm^3	163.6 lb/ft ³
Viscosity Working Point (10 ⁴ poises)	1,253 K	980 °C	1,796 °F
Softening Point (10 ^{7.6} poises)	923 K	650 °C	1,202 °F
Annealing Point (10 ¹³ poises)	793 K	520 °C	968 °F
Strain Point (10 ¹⁴ poises)	753 K	480 °C	896 °F
Thermal Expansion (0 ... 300 °C, 273 ... 573 K, 32 ... 572 °F)	$97.5 \times 10^{-7}/\text{K}$	$97.5 \times 10^{-7}/^\circ\text{C}$	$54.1 \times 10^{-7}/^\circ\text{F}$

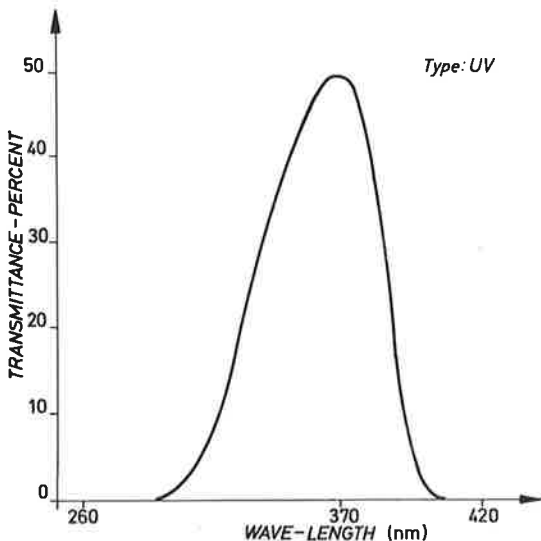
VISCOSITY vs. TEMPERATURE



EXPANSION vs. TEMPERATURE



ULTRAVIOLET SPECTRAL TRANSMITTANCE



VITRIT GLASS

Type: Vitrit

Code: 0-5326-00095

Description

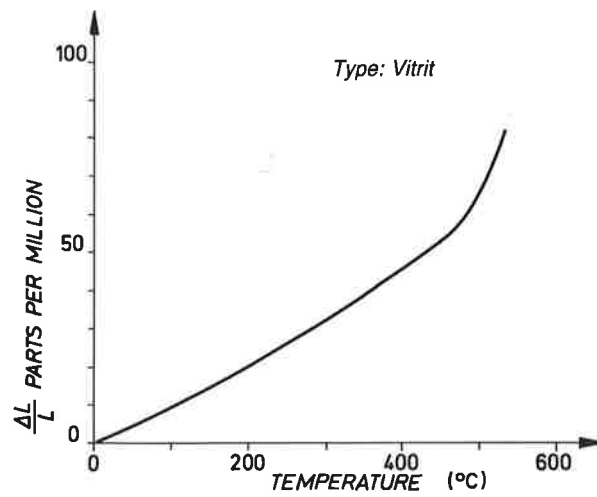
Colour: Dark

Forms Available: Frit

Particle Size: 1 ... 9 mm, packed in 50 kg bag

Properties	International Scientific	Metric	English
Mechanical			
Density (20°C, 68°F)	$2.65 \times 10^3 \text{ kg/m}^3$	2.65 g/cm ³	165.4 lb/ft ³
Viscosity			
Working Point (10 ⁴ poises)	1,218 K	945 °C	1,733 °F
Softening Point (10 ^{7.6} poises)	898 K	625 °C	1,157 °F
Annealing Point (10 ¹³ poises)	758 K	485 °C	905 °F
Strain Point (10 ¹⁴ poises)	718 K	445 °C	833 °F
Thermal			
Expansion (0 ... 300°C, 273 ... 573 K, 32 ... 572°F)	$108 \times 10^{-7}/\text{K}$	$108 \times 10^{-7}/\text{°C}$	$60 \times 10^{-7}/\text{°F}$

EXPANSION vs. TEMPERATURE



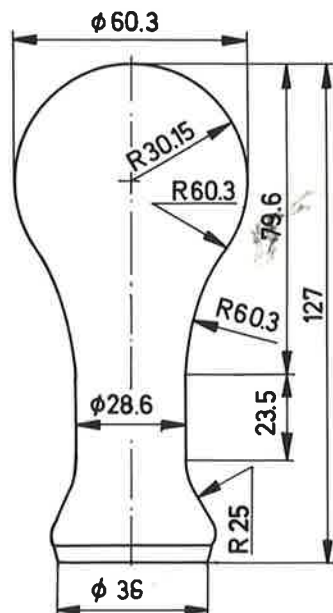
SODA-LIME GLASS BULBS

Glass Type: Mg

Glass Code: 0-5326-03650

BULBS SORT A

Type: ED 60B



Code — clear: 9-9-421-11940
 — inside frosted: 9-9-421-62670
 (Manufactured on Ribbon machine line)

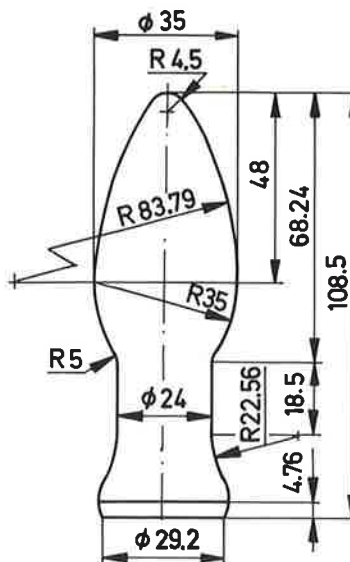
Specification

Neck inside diameter
 Flare outside diameter
 Flare inside diameter
 Overall length
 Neck wall thickness at 88 mm from top
 Side wall thickness at max. diameter
 Top wall thickness at centre

min. 26.16 mm
 max. 42.3 mm
 min. 31.0 mm
 125.0 ... 129.0 mm
 0.38 ... 0.66 mm
 min. 0.38 mm
 0.51 ... 1.14 mm

BULBS SORT C

Type: G 35/24A



Code — clear: 9-9-421-10800
 — inside frosted: 9-9-421-60980
 (Manufactured on Ribbon machine line)

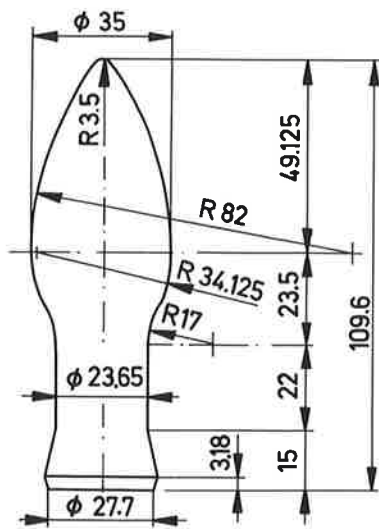
Specification

Neck inside diameter
 Flare outside diameter
 Flare inside diameter
 Overall length
 Neck wall thickness at 79.4 mm from top
 Side wall thickness at max. diameter
 Top wall thickness at centre

min. 21.65 mm
 max. 32.5 mm
 min. 23.5 mm
 106.5 ... 110.5 mm
 0.41 ... 0.84 mm
 min. 0.31 mm
 0.38 ... 1.27 mm

BULBS SORT C

Type: G 35/24C



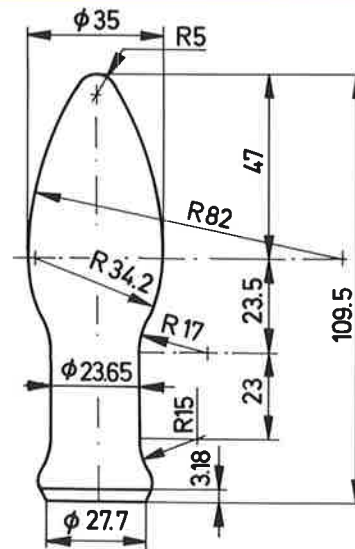
Code — clear: 9-9-421-11680
 — inside frosted: 9-9-421-62210
 (Manufactured on Ribbon machine line)

Specification

Neck inside diameter	min. 21.25 mm
Flare outside diameter	max. 31.5 mm
Flare inside diameter	min. 22.05 mm
Overall length	107.6 ... 111.6 mm
Neck wall thickness at 82 mm from top	0.38 ... 0.76 mm
Side wall thickness at max. diameter	min. 0.3 mm
Top wall thickness at centre	0.51 ... 1.52 mm

BULBS SORT C

Type: G 35/24D



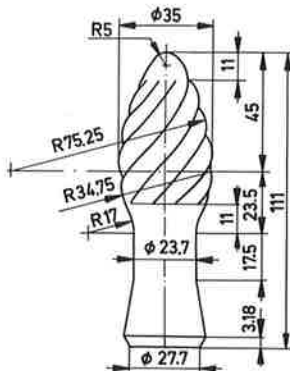
Code — clear: 9-9-421-12020
 — inside frosted: 9-9-421-62930
 (Manufactured on Ribbon machine line)

Specification

Neck inside diameter	min. 21.25 mm
Flare outside diameter	max. 31.5 mm
Flare inside diameter	min. 22.05 mm
Overall length	107.5 ... 111.5 mm
Neck wall thickness at 82 mm from top	0.41 ... 0.84 mm
Side wall thickness at max. diameter	min. 0.38 mm
Top wall thickness at centre	0.38 ... 1.27 mm

BULBS SORT CF

Type: GC 35/24A



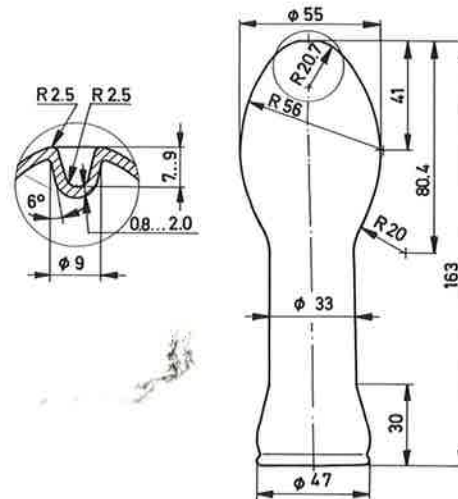
Code — clear: 9-9-421-11690
 — inside frosted: 9-9-421-62680
 (Manufactured on Ribbon machine line)

Specification

Neck inside diameter	min. 20.6 mm
Flare outside diameter	max. 32.2 mm
Flare inside diameter	min. 22.05 mm
Overall length	109.0 ... 113.0 mm
Neck wall thickness at 76 mm from top	0.38 ... 0.76 mm
Top wall thickness at centre	0.38 ... 1.27 mm

BULBS SORT ED

Type: HG 55/33



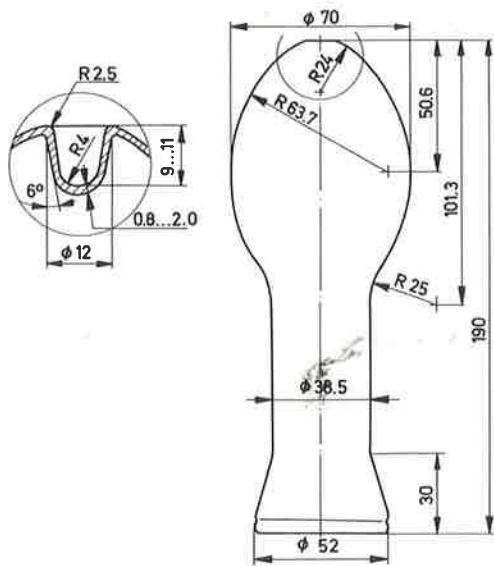
Code — clear: 9-9-421-11910

Specification

Neck inside diameter	min. 29.5 mm
Flare outside diameter	max. 47.0 mm
Flare inside diameter	min. 35.0 mm
Overall length	161.0 ... 165.0 mm
Neck wall thickness at 106 mm from top	0.5 ... 1.0 mm
Side wall thickness at max. diameter	min. 0.5 mm
Top wall thickness at centre	0.8 ... 2.0 mm

BULBS SORT ED

Type: HG 70/38



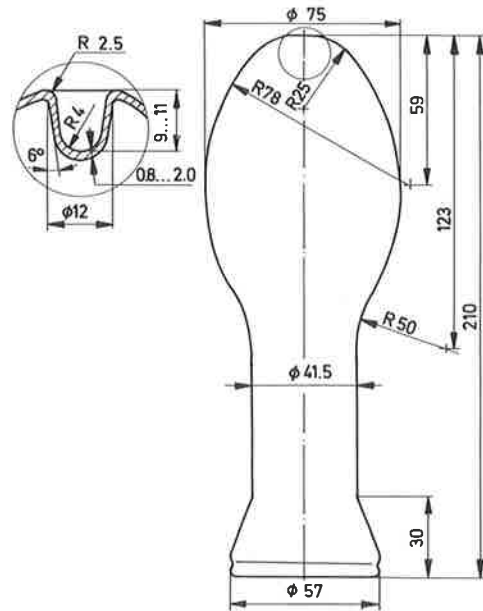
Code — clear: 9-9-421-11920

Specification

Neck inside diameter	min. 35.5 mm
Flare outside diameter	max. 52.0 mm
Flare inside diameter	min. 38.0 mm
Overall length	188.0...192.0 mm
Neck wall thickness at 133 mm from top	0.5...1.0 mm
Side wall thickness at max. diameter	min. 0.5 mm
Top wall thickness at centre	0.8...2.0 mm

BULBS SORT ED

Type: HG 75/41



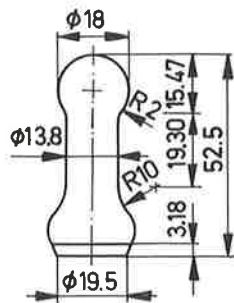
Code — clear: 9-9-421-11930

Specification

Neck inside diameter	min. 38.0 mm
Flare outside diameter	max. 57.0 mm
Flare inside diameter	min. 40.0 mm
Overall length	208.0...212.0 mm
Neck wall thickness at 153 mm from top	0.5...1.0 mm
Side wall thickness at max. diameter	min. 0.5 mm
Top wall thickness at centre	0.8...2.0 mm

BULBS SORT G

Type: 218/13A



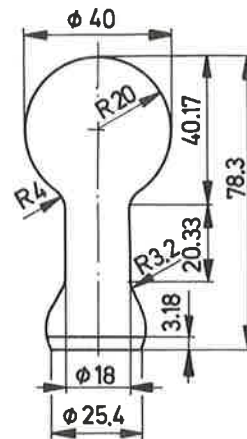
Code — clear: 9-9-421-10760
(Manufactured on Ribbon machine line)

Specification

Neck inside diameter	min. 11.8 mm
Flare outside diameter	max. 23.5 mm
Flare inside diameter	min. 15.0 mm
Overall length	51.0...54.0 mm
Neck wall thickness at 24.5 mm from top	0.4...0.8 mm
Side wall thickness at max. diameter	min. 0.31 mm
Top wall thickness at centre	0.33...1.14 mm

BULBS SORT G

Type: 240/18A



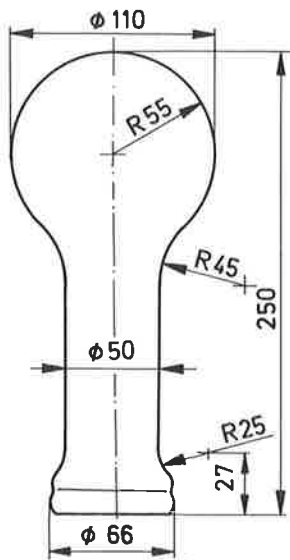
Code — clear: 9-9-421-10850
(Manufactured on Ribbon machine line)

Specification

Neck inside diameter	min. 15.9 mm
Flare outside diameter	max. 28.3 mm
Flare inside diameter	min. 19.7 mm
Overall length	76.3...80.3 mm
Neck wall thickness at 47.5 mm from top	0.41...0.84 mm
Side wall thickness at max. diameter	min. 0.38 mm
Top wall thickness at centre	0.51...1.53 mm

BULBS SORT G

Type: H 110/50



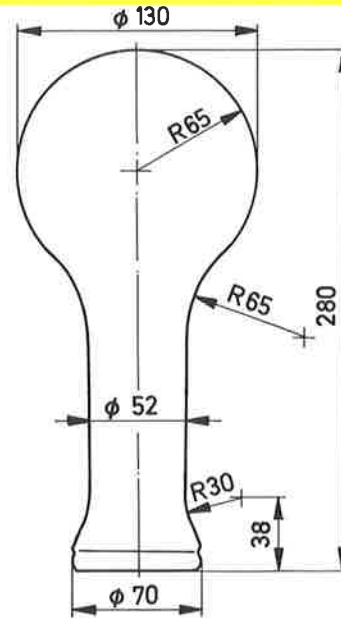
Code—clear: 9-9-421-10970

Specification

Neck inside diameter	min. 46.5 mm
Flare outside diameter	max. 66.0 mm
Flare inside diameter	min. 50.0 mm
Overall length	248.0 ... 252.0 mm
Neck wall thickness at 200 mm from top	0.6 ... 1.2 mm
Side wall thickness at max. diameter	min. 0.4 mm
Top wall thickness at centre	1.3 ... 2.8 mm

BULBS SORT G

Type: H 130/52



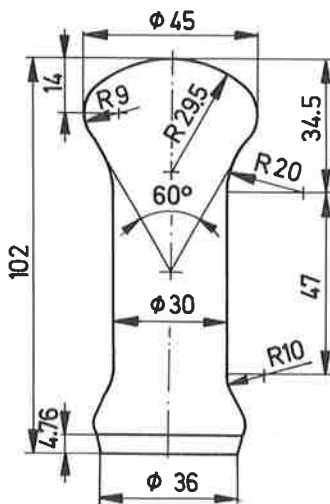
Code—clear: 9-9-421-10990

Specification

Neck inside diameter	min. 48.5 mm
Flare outside diameter	max. 70.0 mm
Flare inside diameter	min. 60.0 mm
Overall length	278.0 ... 282.0 mm
Neck wall thickness at 235 mm from top	0.6 ... 1.2 mm
Side wall thickness at max. diameter	min. 0.4 mm
Top wall thickness at centre	1.3 ... 2.8 mm

BULBS SORT K

Type: Kr 45/30A



Code—clear: 9-9-421-10890

—inside frosted: 9-9-421-61320

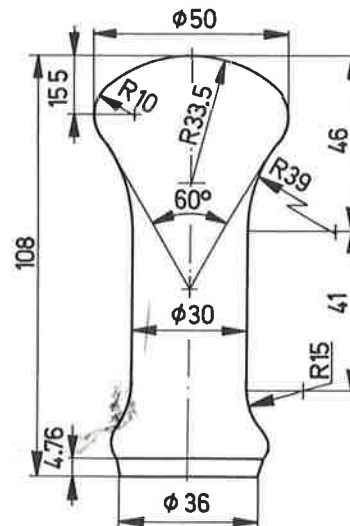
(Manufactured on Ribbon machine line)

Specification

Neck inside diameter	min. 27.6 mm
Flare outside diameter	max. 39.6 mm
Flare inside diameter	min. 30.3 mm
Overall length	100.0 ... 104.0 mm
Neck wall thickness at 64 mm from top	0.41 ... 0.76 mm
Side wall thickness at max. diameter	min. 0.38 mm
Top wall thickness at centre	0.51 ... 1.53 mm

BULBS SORT K

Type: Kr 50/30A



Code—clear: 9-9-421-10900

—inside frosted: 9-9-421-61360

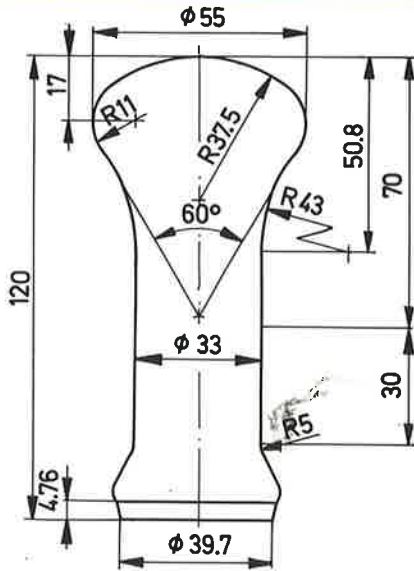
(Manufactured on Ribbon machine line)

Specification

Neck inside diameter	min. 27.6 mm
Flare outside diameter	max. 39.6 mm
Flare inside diameter	min. 30.3 mm
Overall length	106.0 ... 110.0 mm
Neck wall thickness at 65 mm from top	0.41 ... 0.76 mm
Side wall thickness at max. diameter	min. 0.38 mm
Top wall thickness at centre	0.51 ... 1.53 mm

BULBS SORT K

Type: Kr 55/33A



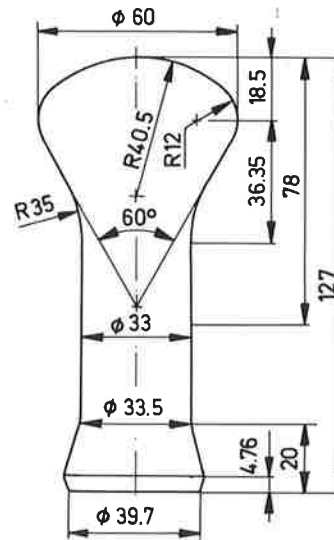
Code — clear: 9-9-421-10910
 — inside frosted: 9-9-421-61400
 (Manufactured on Ribbon machine line)

Specification

Neck inside diameter	min. 30.6 mm
Flare outside diameter	max. 43.3 mm
Flare inside diameter	min. 32.0 mm
Overall length	118.0 ... 122.0 mm
Neck wall thickness at 70 mm from top	0.38 ... 0.76 mm
Side wall thickness at max. diameter	min. 0.38 mm
Top wall thickness at centre	0.51 ... 1.53 mm

BULBS SORT K

Type: Kr 60/33A



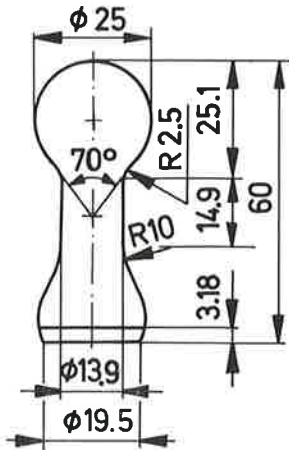
Code — clear: 9-9-421-12010
 — inside frosted: 9-9-421-62750
 (Manufactured on Ribbon machine line)

Specification

Neck inside diameter	min. 30.58 mm
Flare outside diameter	max. 43.28 mm
Flare inside diameter	min. 32.05 mm
Overall length	125.0 ... 129.0 mm
Neck wall thickness at 78 mm from top	0.41 ... 0.76 mm
Side wall thickness at max. diameter	min. 0.38 mm
Top wall thickness at centre	0.51 ... 1.52 mm

BULBS SORT PS

Type: 125/13A



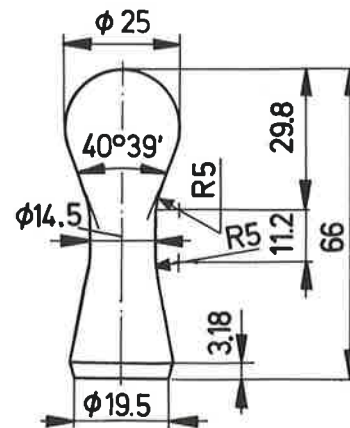
Code — clear: 9-9-421-10770
 (Manufactured on Ribbon machine line)

Specification

Neck inside diameter	min. 12.0 mm
Flare outside diameter	max. 23.5 mm
Flare inside diameter	min. 15.0 mm
Overall length	58.0 ... 62.0 mm
Neck wall thickness at 33 mm from top	0.41 ... 0.84 mm
Side wall thickness at max. diameter	min. 0.31 mm
Top wall thickness at centre	0.33 ... 1.14 mm

BULBS SORT PS

Type: 125/14B



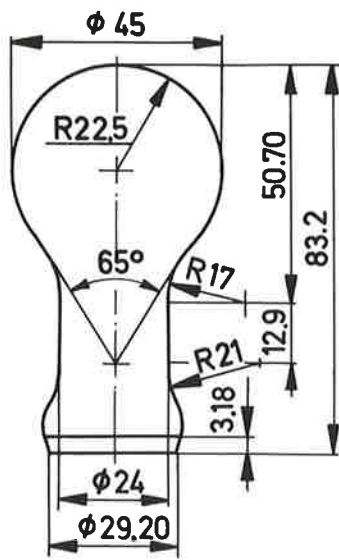
Code — clear: 9-9-421-10780
 (Manufactured on Ribbon machine line)

Specification

Neck inside diameter	min. 12.5 mm
Flare outside diameter	max. 23.5 mm
Flare inside diameter	min. 15.0 mm
Overall length	64.0 ... 68.0 mm
Neck wall thickness at 34.5 mm from top	0.4 ... 0.8 mm
Side wall thickness at max. diameter	min. 0.31 mm
Top wall thickness at centre	0.33 ... 1.14 mm

BULBS SORT PS

Type: 145/24A



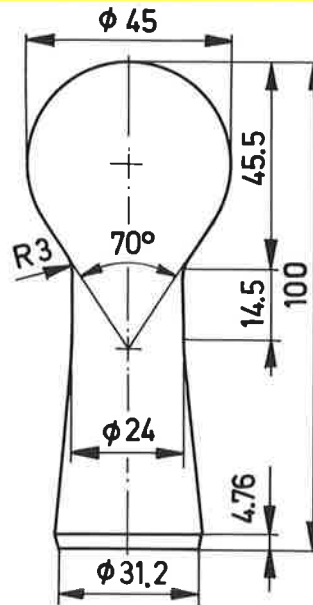
Code — clear: 9-9-421-10790
 — inside frosted: 9-9-421-60980
 (Manufactured on Ribbon machine line)

Specification

Neck inside diameter min. 21.85 mm
 Flare outside diameter max. 32.9 mm
 Flare inside diameter min. 23.5 mm
 Overall length 81.2 ... 85.2 mm
 Neck wall thickness at 54 mm from top 0.41 ... 0.84 mm
 Side wall thickness at max. diameter min. 0.38 mm
 Top wall thickness at centre 0.51 ... 1.53 mm

BULBS SORT PS

Type: 145/24C



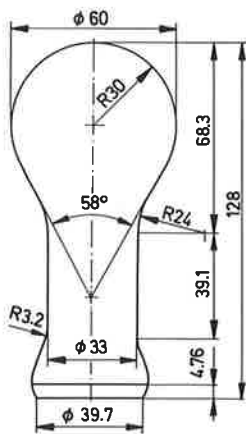
Code — clear: 9-9-421-12100
 (Manufactured on Ribbon machine line)

Specification

Neck inside diameter min. 21.85 mm
 Flare outside diameter max. 34.85 mm
 Flare inside diameter min. 25.45 mm
 Overall length 98.0 ... 102.0 mm
 Neck wall thickness at 53 mm from top 0.41 ... 0.84 mm
 Side wall thickness at max. diameter min. 0.38 mm
 Top wall thickness at centre 0.51 ... 1.53 mm

BULBS SORT PS

Type: ED 60A



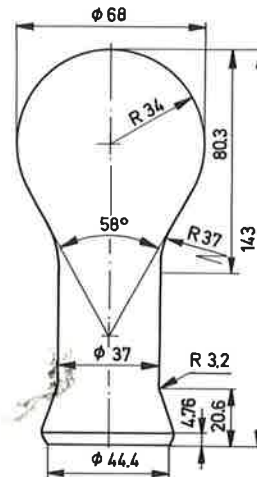
Code — clear: 9-9-421-10820
 — inside frosted: 9-9-421-61060
 (Manufactured on Ribbon machine line)

Specification

Neck inside diameter min. 30.0 mm
 Flare outside diameter max. 44.3 mm
 Flare inside diameter min. 32.0 mm
 Overall length 126.0 ... 130.0 mm
 Neck wall thickness at 82.5 mm from top 0.41 ... 0.71 mm
 Side wall thickness at max. diameter min. 0.38 mm
 Top wall thickness at centre 0.46 ... 1.27 mm

BULBS SORT PS

Type: ED 68/37A



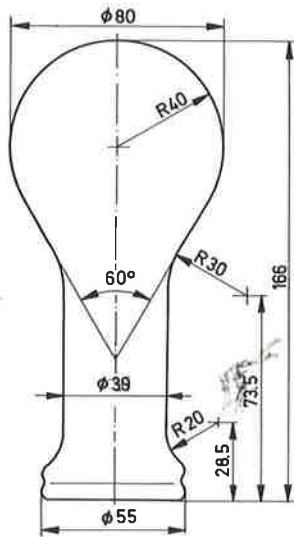
Code — clear: 9-9-421-10840
 — inside frosted: 9-9-421-61200
 (Manufactured on Ribbon machine line)

Specification

Neck inside diameter min. 34.6 mm
 Flare outside diameter max. 48.2 mm
 Flare inside diameter min. 36.85 mm
 Overall length 140.0 ... 146.0 mm
 Neck wall thickness at 104 mm from top 0.41 ... 0.76 mm
 Side wall thickness at max. diameter min. 0.38 mm
 Top wall thickness at centre 0.51 ... 1.52 mm

BULBS SORT PS

Type: T 80/39



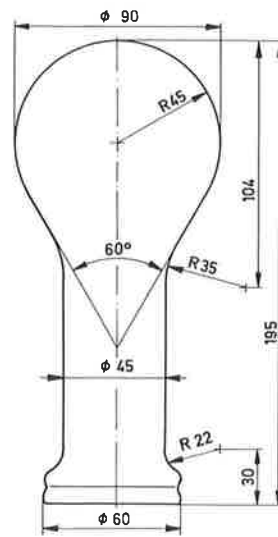
Code — clear: 9-9-421-10950
— inside frosted: 9-9-421-61490

Specification

Neck inside diameter	min. 36.0 mm
Flare outside diameter	max. 55.0 mm
Flare inside diameter	min. 37.0 mm
Overall length	164.0 ... 168.0 mm
Neck wall thickness at 125 mm from top	0.45 ... 0.91 mm
Side wall thickness at max. diameter	min. 0.4 mm
Top wall thickness at centre	0.8 ... 2.0 mm

BULBS SORT PS

Type: T 90/45



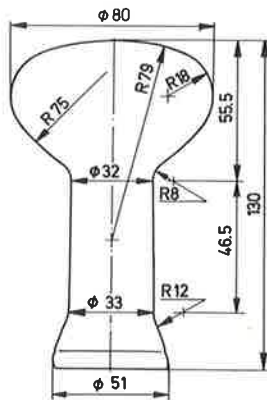
Code — clear: 9-9-421-10960
— inside frosted: 9-9-421-61520

Specification

Neck inside diameter	min. 42.0 mm
Flare outside diameter	max. 60.0 mm
Flare inside diameter	min. 44.0 mm
Overall length	193.0 ... 197.0 mm
Neck wall thickness at 150 mm from top	0.45 ... 0.9 mm
Side wall thickness at max. diameter	min. 0.4 mm
Top wall thickness at centre	0.8 ... 2.0 mm

BULBS SORT R

Type: 7080/33



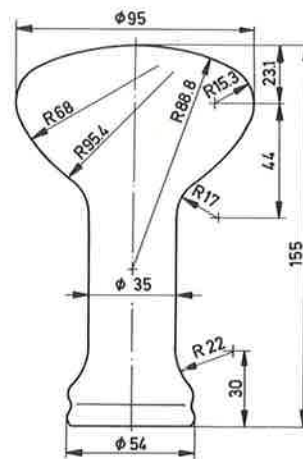
Code — clear: 9-9-421-10630

Specification

Neck inside diameter	min. 29.6 mm
Flare outside diameter	max. 51.0 mm
Flare inside diameter	min. 35.0 mm
Overall length	128.5 ... 131.5 mm
Neck wall thickness at 90 mm from top	0.45 ... 0.95 mm
Side wall thickness at max. diameter	min. 0.4 mm
Top wall thickness at centre	1.2 ... 2.5 mm

BULBS SORT R

Type: 95/35



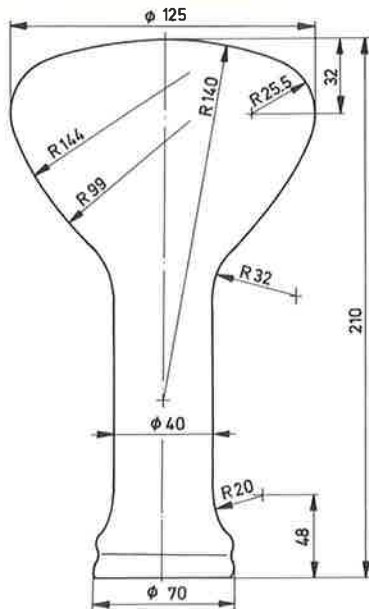
Code — clear: 9-9-421-10640

Specification

Neck inside diameter	min. 31.0 mm
Flare outside diameter	max. 54.0 mm
Flare inside diameter	min. 36.0 mm
Overall length	153.0 ... 157.0 mm
Neck wall thickness at 100 mm from top	0.45 ... 0.95 mm
Side wall thickness at max. diameter	min. 0.4 mm
Top wall thickness at centre	1.2 ... 2.5 mm

BULBS SORT R

Type: 7125/180



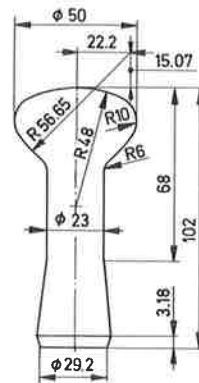
Code — clear: 9-9-421-10650

Specification

Neck inside diameter	min. 37.0 mm
Flare outside diameter	max. 70.0 mm
Flare inside diameter	min. 50.0 mm
Overall length	207.0 ... 213.0 mm
Neck wall thickness at 150 mm from top	0.6 ... 1.2 mm
Side wall thickness at max. diameter	min. 0.4 mm
Top wall thickness at centre	1.2 ... 2.5 mm

BULBS SORT R

Type: R 50/23A



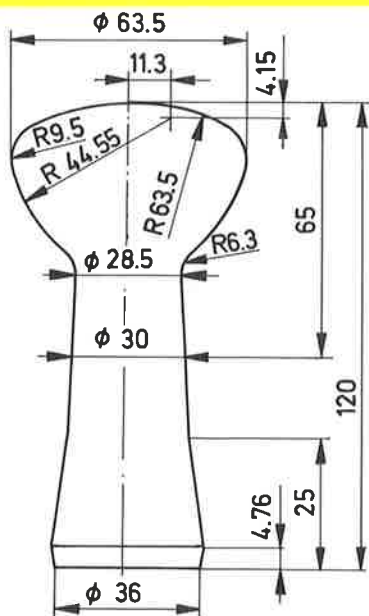
Code — clear: 9-9-421-11670
(Manufactured on Ribbon machine line)

Specification

Neck inside diameter	min. 20.6 mm
Flare outside diameter	max. 32.5 mm
Flare inside diameter	min. 22.1 mm
Overall length	100.0 ... 104.0 mm
Neck wall thickness at 65 mm from top	0.4 ... 0.75 mm
Side wall thickness at max. diameter	min. 0.35 mm
Top wall thickness at centre	0.45 ... 1.3 mm

BULBS SORT R

Type: R 63/28A



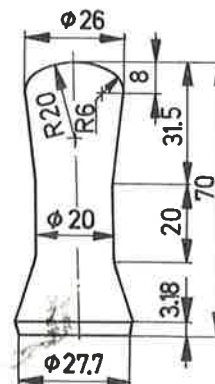
Code — clear: 9-9-421-11660
(Manufactured on Ribbon machine line)

Specification

Neck inside diameter	min. 26.1 mm
Flare outside diameter	max. 43.9 mm
Flare inside diameter	min. 34.0 mm
Overall length	118.0 ... 122.0 mm
Neck wall thickness at 76 mm from top	0.4 ... 0.75 mm
Side wall thickness at max. diameter	min. 0.35 mm
Top wall thickness at centre	0.45 ... 1.3 mm

BULBS SORT S

Type: B 26/20A



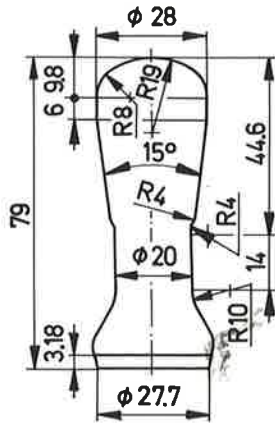
Code — clear: 9-9-421-10870
— inside frosted: 9-9-421-61280
(Manufactured on Ribbon machine line)

Specification

Neck inside diameter	min. 18.3 mm
Flare outside diameter	max. 32.9 mm
Flare inside diameter	min. 23.5 mm
Overall length	68.5 ... 71.5 mm
Neck wall thickness at 38 mm from top	0.45 ... 0.9 mm
Side wall thickness at max. diameter	min. 0.51 mm
Top wall thickness at centre	0.51 ... 1.53 mm

BULBS SORT S

Type: B 28/20A



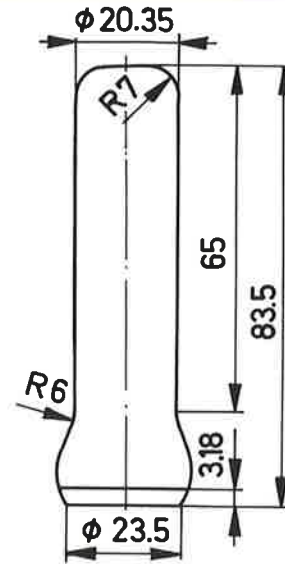
Code — clear: 9-9-421-10880
 — inside frosted: 9-9-421-61300
 (Manufactured on Ribbon machine line)

Specification

Neck inside diameter	min. 18.3 mm
Flare outside diameter	max. 32.9 mm
Flare inside diameter	min. 23.5 mm
Overall length	77.5 ... 80.5 mm
Neck wall thickness at 50 mm from top	0.45 ... 0.9 mm
Side wall thickness at max. diameter	min. 0.51 mm
Top wall thickness at centre	0.51 ... 1.53 mm

BULBS SORT T

Type: B 334A

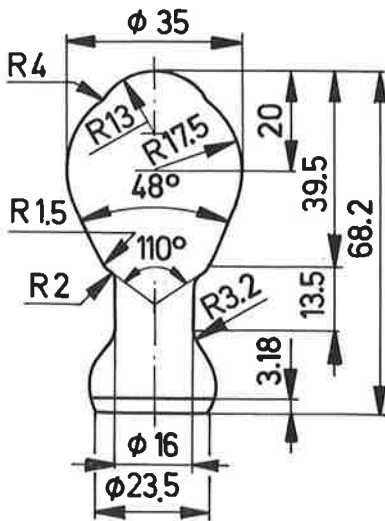


Code: 9-9-421-11280
 (Manufactured on Ribbon machine line)

Specification

Inside diameter at 11 mm from top	18.6 ... 19.2 mm
at 62 mm from top	18.9 ... 19.5 mm
Overall length	81.5 ... 85.5 mm
Side wall thickness at 11 mm from top	0.5 ... 0.9 mm
at 62 mm from top	0.4 ... 0.75 mm
Top wall thickness at centre	0.5 ... 0.9 mm

BULBS FOR VEHICLE LAMPS Type: T 35/16A



Code — clear: 9-9-421-10860
 (Manufactured on Ribbon machine line)

Specification

Neck inside diameter	min. 14.2 mm
Flare outside diameter	max. 26.25 mm
Flare inside diameter	min. 17.8 mm
Overall length	66.2 ... 70.2 mm
Neck wall thickness at 47.5 mm from top	0.41 ... 0.84 mm
Side wall thickness at max. diameter	min. 0.31 mm
Top wall thickness at centre	0.38 ... 1.27 mm

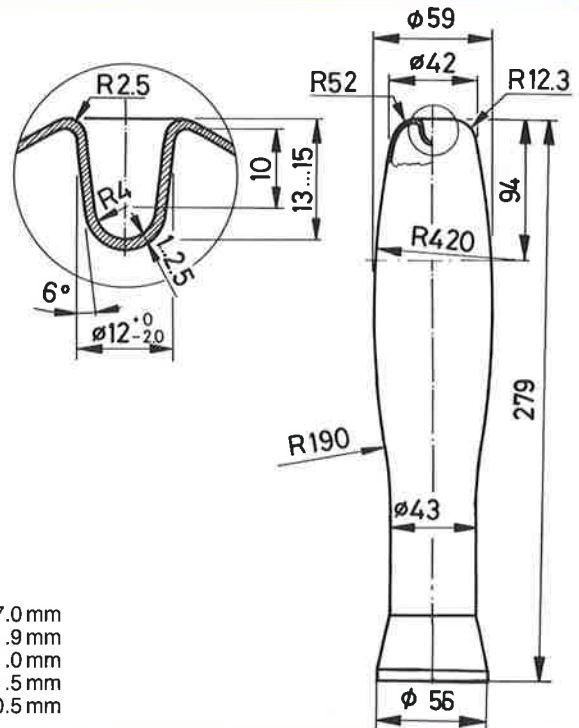
BOROSILICATE GLASS BULBS

Glass Type: Hg 36

Glass Code: 0-5326-03700

BULBS SORT BD

Type: B-H092/A



Code: 9-9-423-10440

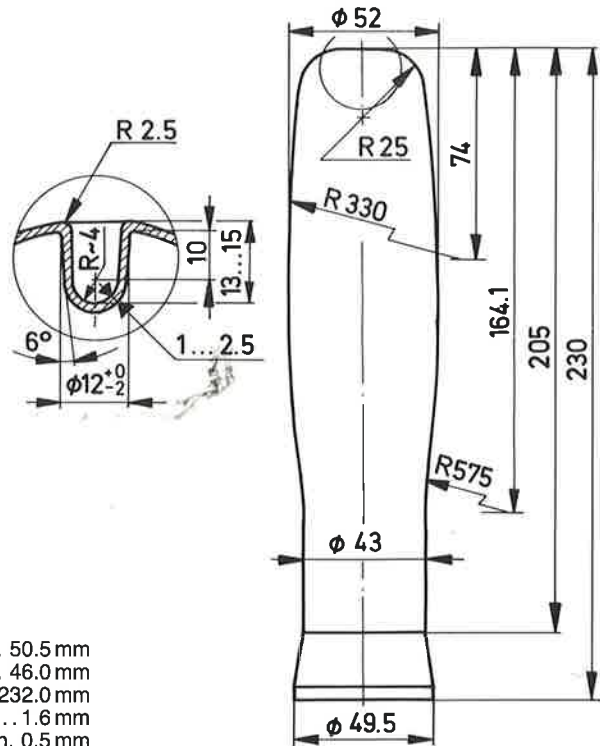
Specification

Flare outside diameter
 Flare inside diameter
 Overall length
 Neck wall thickness at 230 mm from top
 Side wall thickness at max. diameter

max. 57.0 mm
 min. 51.9 mm
 277.0 ... 281.0 mm
 0.9 ... 1.5 mm
 min. 0.5 mm

BULBS SORT BD

Type: BMI-005



Code: 9-9-423-10490

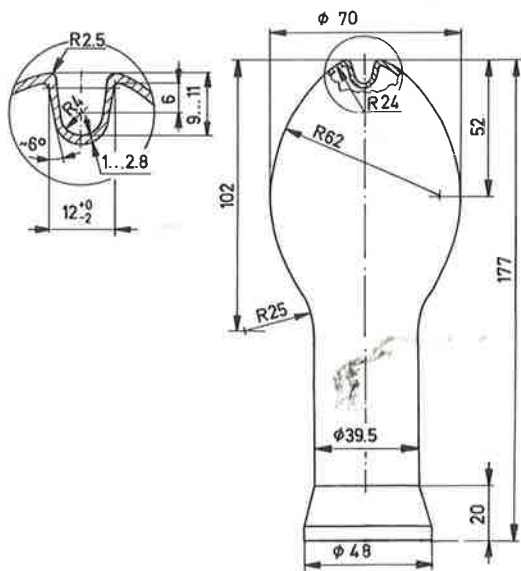
Specification

Flare outside diameter
 Flare inside diameter
 Overall length
 Neck wall thickness at 185 mm from top
 Side wall thickness at max. diameter

max. 50.5 mm
 min. 46.0 mm
 228.0 ... 232.0 mm
 1.0 ... 1.6 mm
 min. 0.5 mm

BULBS SORT ED

Type: HG 70/39



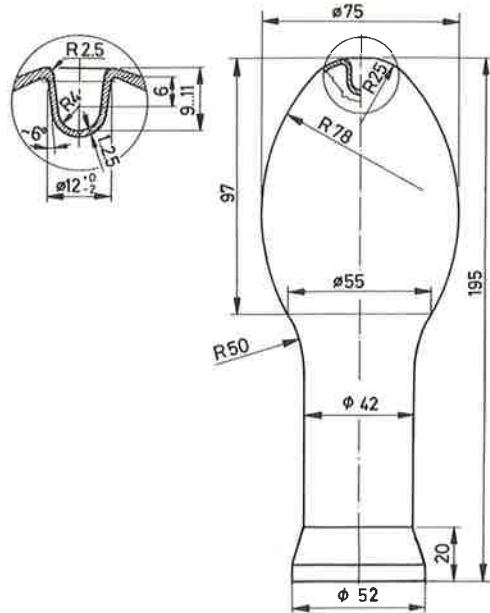
Code: 9-9-423-10370

Specification

Flare outside diameter max. 49.0 mm
 Flare inside diameter min. 41.0 mm
 Overall length 175.0 ... 179.0 mm
 Neck wall thickness at 133 mm from top 0.7 ... 1.3 mm
 Side wall thickness at max. diameter min. 0.5 mm

BULBS SORT ED

Type: HG 75/42



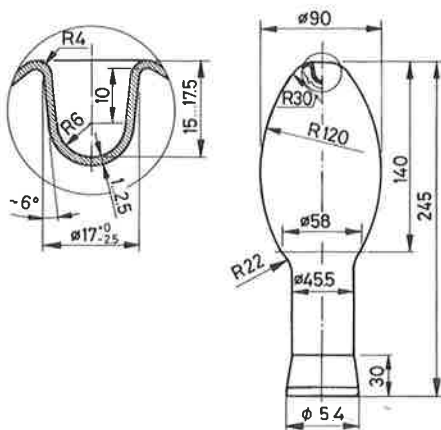
Code: 9-9-423-10380

Specification

Flare outside diameter max. 52.5 mm
 Flare inside diameter min. 45.0 mm
 Overall length 193.0 ... 197.0 mm
 Neck wall thickness at 153 mm from top 0.7 ... 1.3 mm
 Side wall thickness at max. diameter min. 0.5 mm

BULBS SORT ED

Type: HG 90/45



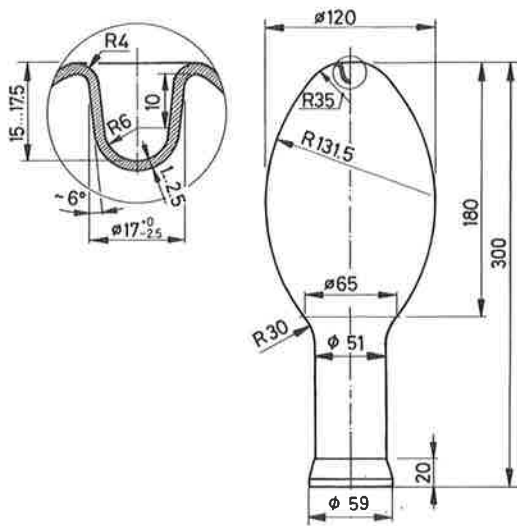
Code: 9-9-423-10390

Specification

Flare outside diameter max. 55.0 mm
 Flare inside diameter min. 47.0 mm
 Overall length 242.0 ... 248.0 mm
 Neck wall thickness at 194 mm from top 0.9 ... 1.5 mm
 Side wall thickness at max. diameter min. 0.5 mm

BULBS SORT ED

Type: HG 120/51



Code: 9-9-423-10400

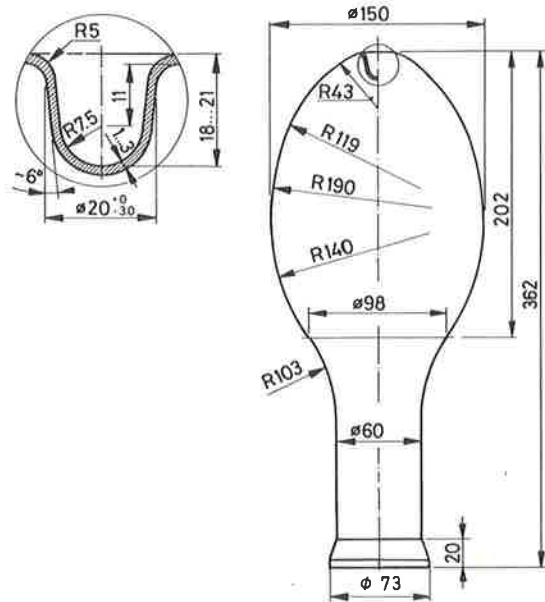
Specification

Flare outside diameter
 Flare inside diameter
 Overall length
 Neck wall thickness at 240 mm from top
 Side wall thickness at max. diameter

max. 60.0 mm
 min. 52.0 mm
 295.0 ... 305.0 mm
 0.9 ... 1.5 mm
 min. 0.5 mm

BULBS SORT ED

Type: HG 150/60



Code: 9-9-423-10410

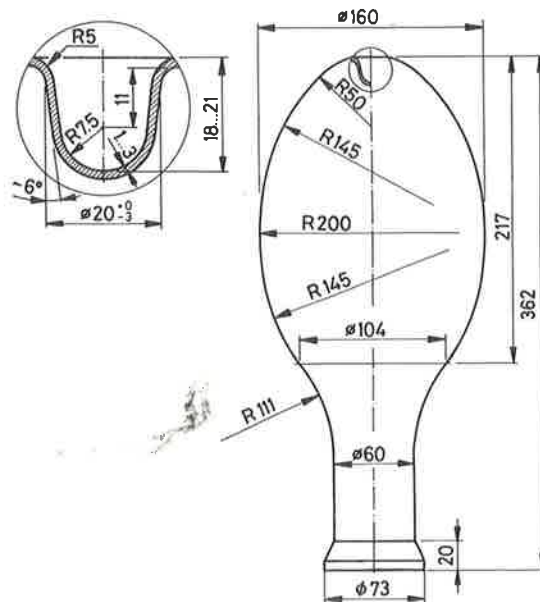
Specification

Flare outside diameter
 Flare inside diameter
 Overall length
 Neck wall thickness at 307 mm from top
 Side wall thickness at max. diameter

max. 74.0 mm
 min. 65.0 mm
 357.0 ... 367.0 mm
 1.0 ... 2.0 mm
 min. 0.5 mm

BULBS SORT ED

Type: HG 160/60



Code: 9-9-423-10420

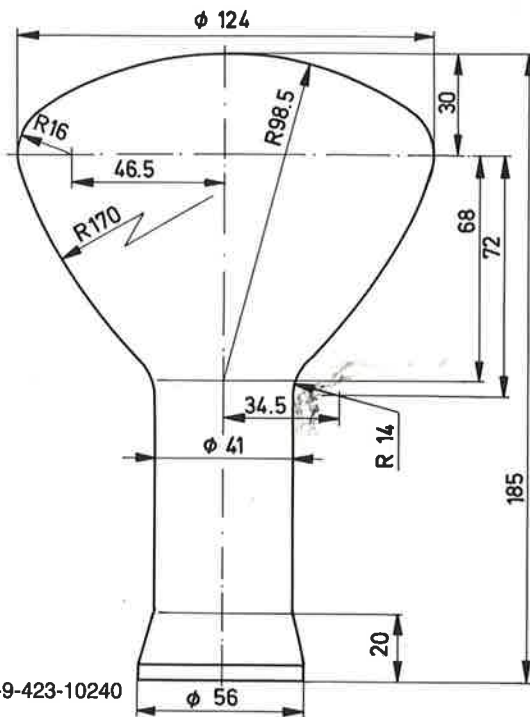
Specification

Flare outside diameter
 Flare inside diameter
 Overall length
 Neck wall thickness at 321 mm from top
 Side wall thickness at max. diameter

max. 74.0 mm
 min. 65.0 mm
 357.0 ... 367.0 mm
 1.0 ... 2.0 mm
 min. 0.5 mm

BULBS SORT R

Type: P 125/41



Code: 9-9-423-10240

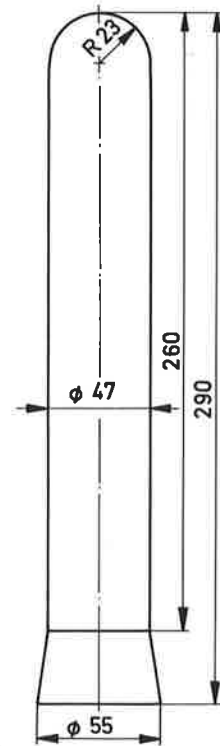
Speciflcation

Flare outside diameter
 Flare inside diameter
 Overall length
 Neck wall thickness at 142 mm from top
 Side wall thickness at max. diameter

max. 57.0 mm
 min. 50.0 mm
 182.0 ... 188.0 mm
 0.7 ... 1.5 mm
 min. 0.4 mm

BULBS SORT T

Type: B-H086



Code: 9-9-423-10430

Specification

Flare outside diameter
 Flare inside diameter
 Overall length
 Neck wall thickness at 235 mm from top
 Side wall thickness at max. diameter

max. 56.0 mm
 min. 51.0 mm
 288.0 ... 292.0 mm
 1.1 ... 1.6 mm
 min. 0.9 mm

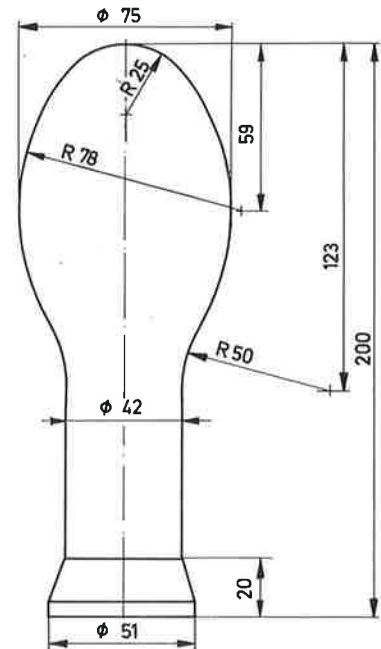
ULTRAVIOLET GLASS BULBS

Glass Type: UV

Code: 0-5326-03670

BULBS SORT E

Type: UV 75/41



Code: 9-9-421-12120

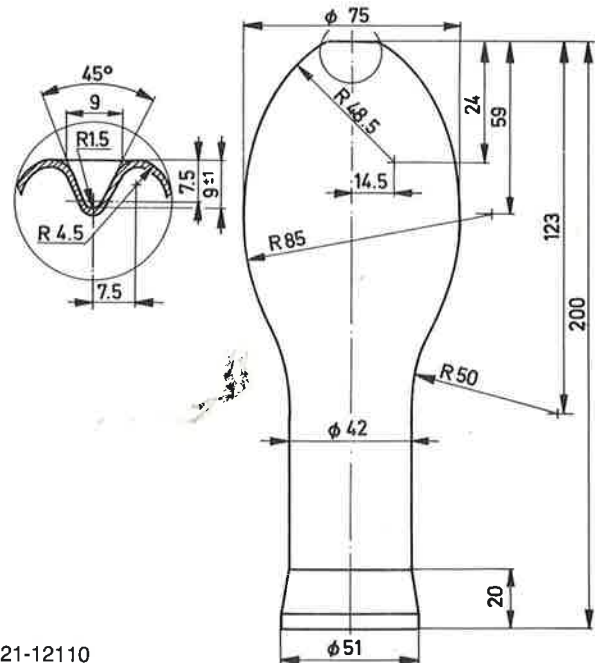
Specification

Flare outside diameter
 Flare inside diameter
 Overall length
 Neck wall thickness at 153 mm from top
 Side wall thickness at max. diameter

max. 51.5 mm
 min. 44.0 mm
 198.0 ... 202.0 mm
 0.7 ... 1.3 mm
 min. 0.5 mm

BULBS SORT ED

Type: UV-D 75/41



Code: 9-9-421-12110

Specification

Flare outside diameter
 Flare inside diameter
 Overall length
 Neck wall thickness at 153 mm from top
 Side wall thickness at max. diameter

max. 51.5 mm
 min. 44.0 mm
 198.0 ... 202.0 mm
 0.7 ... 1.3 mm
 min. 0.5 mm

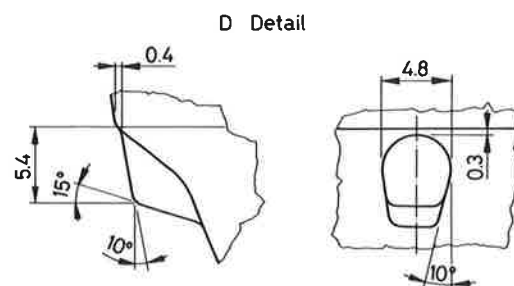
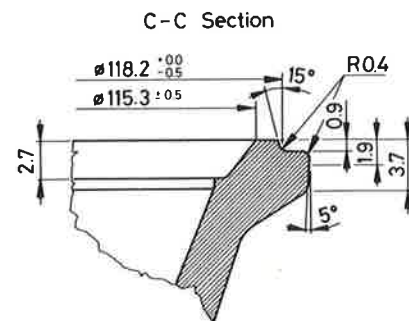
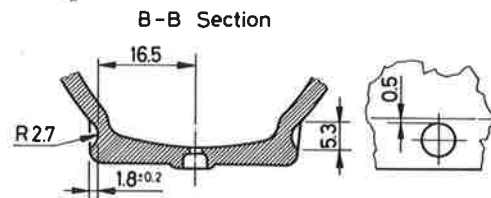
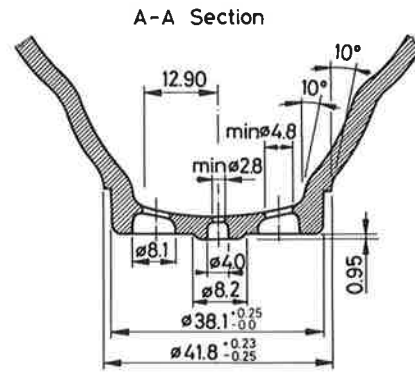
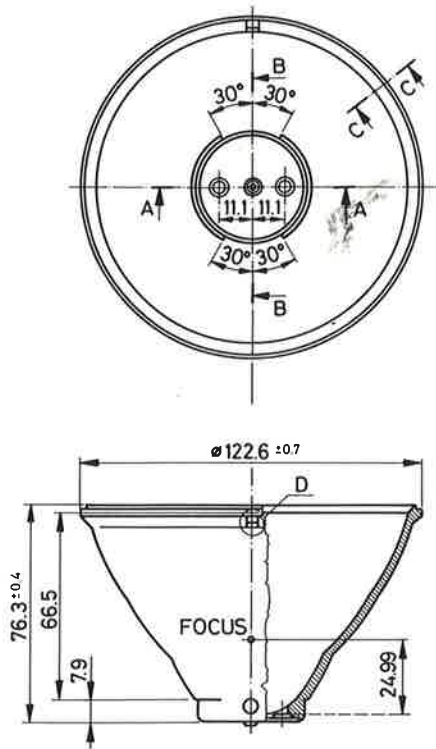
PRESSED BOROSILICATE WARE

Glass Type: Hg 36

Glass Code: 0-5326-03700

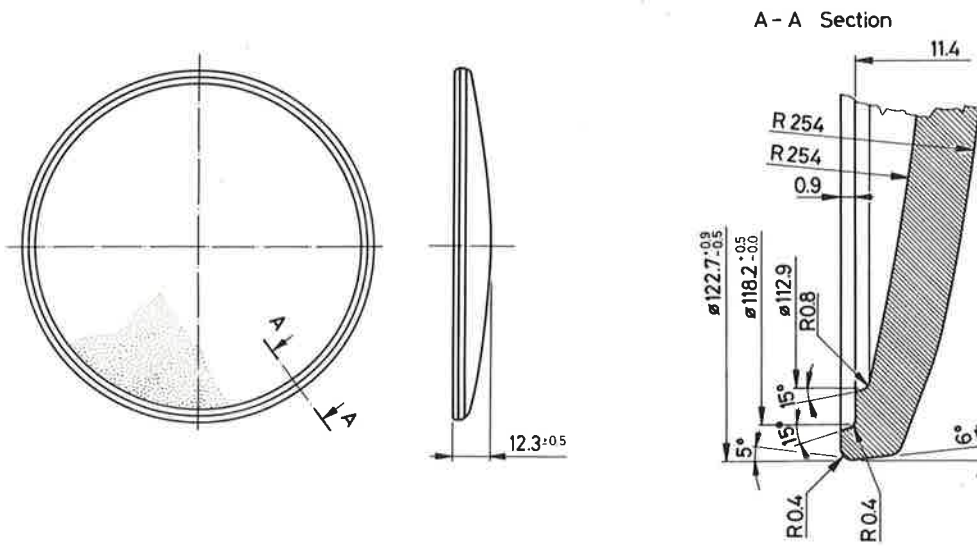
REFLECTORS

Code: 9-9-423-10260



CLEAR FRONT LENSES

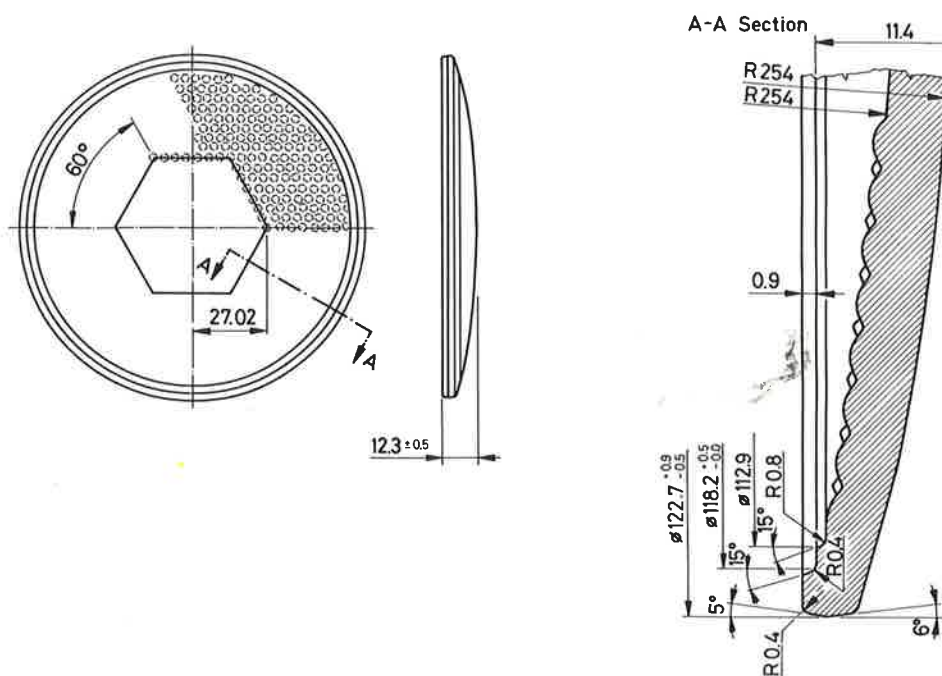
Type: Spot



Code: 9-9-423-10270

CLEAR FRONT LENSES

Type: Flood



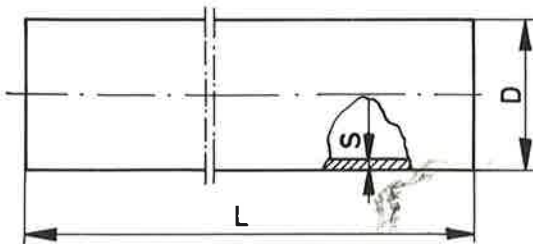
Code: 9-9-423-10280

GLASS TUBES FOR FLUORESCENT LAMPS

Glass Type: Mg

Glass Code: 0-5326-03650

TRIM- AND GLAZE-END GLASS TUBES



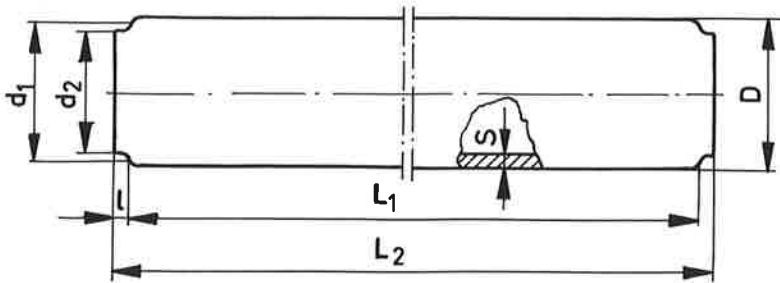
Ø 26 mm types

Type	18 W	36 W	58 W
Code	9-9-411-11460	9-9-411-11470	9-9-411-11480
Overall length, L, mm	665.0 ⁺⁰ ₋₂	1,275.0 ⁺⁰ ₋₂	1,575.0 ⁺⁰ ₋₂
Outside diameter, D, mm	25.5 ... 26.0		
Wall thickness, S, mm	0.7 ... 0.8		

Ø 38 mm types

Type	15 W	20 W, 40 W-2	30 W	25 W, 40 W-1	40 W	65 W, 80 W
Code	9-9-411-10770	9-9-411-10780	9-9-411-10790	9-9-411-10800	9-9-411-10810	9-9-411-10820
Overall length, L, mm	515.0 ⁺⁰ ₋₂	665.0 ⁺⁰ ₋₂	970.0 ⁺⁰ ₋₂	1,046.0 ⁺⁰ ₋₂	1,270.0 ⁺⁰ ₋₂	1,575.0 ⁺⁰ ₋₂
Outside diameter, D, mm	Ø 36.9 ... 38.2					
Wall thickness, S, mm	0.76 ... 0.89					

END-FORMED GLASS TUBES



Ø 38 mm standard types

Type	20 W	40 W	65 W, 80 W
Code	9-9-411-11,520	9-9-411-11,530	9-9-411-11,540
Overall length, L, mm	577.3±0.5	1,187±0.5	1,487.8±0.5
Base line length, L ₁ , mm	568±0.3	1,177.7±0.3	1,478.5±0.3
Body outside, diameter, D, mm		36.9... 38.2	
Wall thickness, S, mm		0.76... 0.89	
Base line diameter, d ₁ , mm		34.9	
Collar length, l, mm		4.25±0.75	
Collar outside diameter, d ₂ , mm		31.5... 32.5	

Ø 38 mm special size types

Type	F 40 W PE-I	F 40 W PE-III	F 40 W PE-IV	F 40 W PE-V	F 40 W PE-VI
Overall length, L, mm	—	—	—	—	1187.6... 1190.8
Base line length, L ₁ , mm	1180.1±0.5	1180.1±0.4	1180.7±0.5	1180.1±0.5	1179.4... 1180.4
Body outside diameter, D, mm	36.9... 38.2	36.96... 38.23	36.8... 38.25	36.7... 38.0	36.2... 37.5
Wall thickness, S, mm	0.76... 0.89	0.76... 0.91	0.7... 0.9	0.78... 0.9	0.7... 0.84
Base line diameter, d ₁ , mm	34.9	34.9	34.9	34.9	35.0
Collar length, l, mm	4.35±0.85	4.2±0.8	3.0... 5.2	4.0... 5.4	4.1... 5.3
Collar outside diameter, d ₂ , mm	31.0... 32.0	31.9±0.5	31.3... 32.2	31.3... 32.3	30.9... 31.7

LEAD-ALKALI GLASS TUBES

Glass Type: M22

Glas Code: 0-5326-03660

TRIM- AND GLAZE-END CUT LEAD GLASS TUBES

Outside diameter, mm	Wall thickness, mm	Length ± 1.00 mm											
		55.0	75.0	80.0	90.0	95.0	100.0	105.0	110.0	115.0	120.0	125.0	130.0
3.0 ± 0.15 ± 0.3	0.7 ± 0.1		X				X	X	X				
			X		X			X	X				
3.7 ± 0.15 ± 0.3	0.7 ± 0.1						X			X	X	X	X
									X	X	X	X	X
5.8 ± 0.15 ± 0.3	0.8 ± 0.05			X									
				X									
6.3 ± 0.15 ± 0.3	0.8 ± 0.05		X	X									
			X	X									
6.8 ± 0.15 ± 0.3	0.8 ± 0.05		X	X	X								
7.2 ± 0.15 ± 0.3	1.05 ± 0.05		X			X							
			X	X	X								
8.3 ± 0.15 ± 0.3	1.05 ± 0.05		X	X	X								
			X		X								

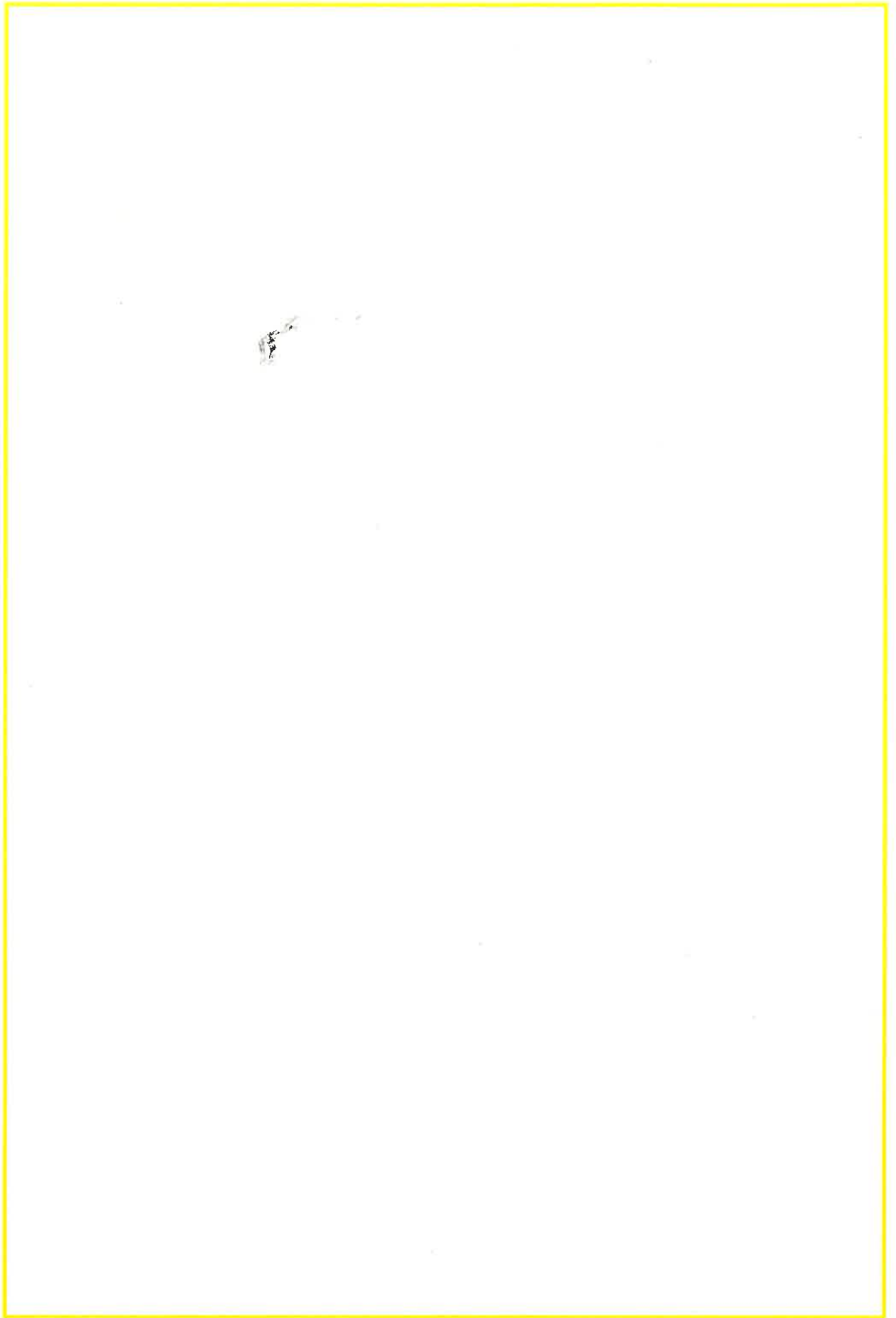
TRIM- AND GLAZE-END LEAD GLASS TUBES

Assortment

Outside diameter	Length
≤ 4.40 mm	$1,370 \pm 50$ mm
5.00 to 10.00 mm	$1,280 \pm 50$ mm
≥ 11.40 mm	$1,220 \pm 10$ mm

Dimensions

Outside diameter, mm	Wall thickness, mm	Outside diameter, mm	Wall thickness, mm	Outside diameter, mm	Wall thickness, mm	Outside diameter, mm	Wall thickness, mm
$3.00_{-0.3}^0$	0.70 ± 0.1	$6.30_{-0.3}^0$	0.80 ± 0.05	$10.00_{-0.3}^0$	1.05 ± 0.15	$14.50_{-0.5}^0$	1.30 ± 0.05
3.00 ± 0.15		6.30 ± 0.15		10.00 ± 0.15		14.50 ± 0.25	
$3.00_{+0.3}^0$		$6.30_{+0.3}^0$		$10.00_{+0.3}^0$		$14.50_{+0.5}^0$	
$3.70_{-0.3}^0$	0.70 ± 0.1	6.80 ± 0.15	0.85 ± 0.05	$11.40_{-0.4}^0$	0.65 ± 0.05	$15.00_{-0.5}^0$	1.10 ± 0.05
3.70 ± 0.15		6.90 ± 0.1		11.40 ± 0.2		15.00 ± 0.25	
$3.70_{+0.3}^0$		$7.20_{-0.3}^0$		$11.40_{+0.4}^0$		$15.00_{+0.5}^0$	
$4.40_{-0.3}^0$	0.70 ± 0.1	7.20 ± 0.15	1.05 ± 0.05	$11.40_{-0.4}^0$	1.05 ± 0.05	$16.50_{-0.5}^0$	1.45 ± 0.05
4.40 ± 0.15		$7.20_{+0.3}^0$		11.40 ± 0.2		16.50 ± 0.25	
$4.40_{+0.3}^0$		$7.20_{-0.3}^0$		$11.40_{+0.4}^0$		$16.50_{+0.5}^0$	
$5.00_{+0.3}^0$	0.50 ± 0.1	7.20 ± 0.15	0.85 ± 0.05	11.50 ± 0.2	0.90 ± 0.07	$18.50_{-0.5}^0$	1.50 ± 0.1
$5.00_{-0.3}^0$	0.70 ± 0.1	$7.20_{+0.3}^0$		12.00 ± 0.3		18.50 ± 0.25	
$5.00_{+0.2}^0$		8.17 ± 0.17		12.20 ± 0.3		$18.50_{+0.5}^0$	
$5.20_{+0.3}^0$	0.70 ± 0.1	$8.30_{-0.3}^0$	0.85 ± 0.05	$12.40_{-0.4}^0$	1.15 ± 0.05	$21.00_{-0.50}^0$	1.50 ± 0.1
$5.20_{-0.3}^0$	0.80 ± 0.1	8.30 ± 0.15		12.40 ± 0.2		21.00 ± 0.25	
5.20 ± 0.15		$8.30_{+0.3}^0$		$12.40_{+0.4}^0$		$21.00_{+0.50}^0$	
$5.20_{+0.3}^0$	0.80 ± 0.1	8.65 ± 0.15	0.70 ± 0.1	$13.60_{-0.4}^0$	1.10 ± 0.05	$24.60_{-0.5}^0$	2.30 ± 0.1
$5.80_{-0.3}^0$		$9.10_{-0.3}^0$	1.60 ± 0.1	13.60 ± 0.2		24.60 ± 0.25	
5.80 ± 0.15		9.10 ± 0.15		$13.60_{+0.4}^0$		$24.60_{+0.5}^0$	
$5.80_{+0.3}^0$	$9.10_{+0.3}^0$	$13.80_{-0.4}^0$		1.40 ± 0.05			
		13.80 ± 0.2					
				$13.80_{+0.4}^0$			



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