

CORNING

Corning® Pharmaceutical Glass Tubing

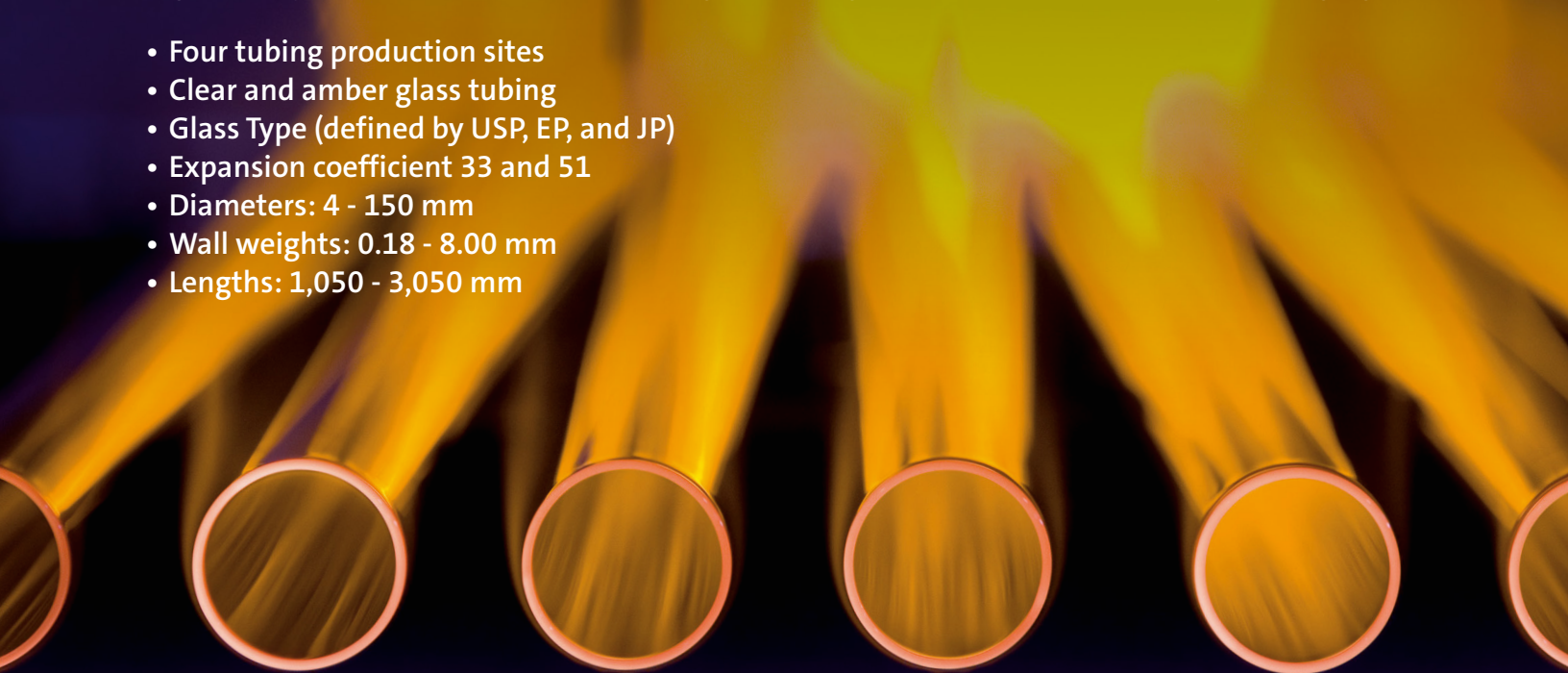




Production Sites to Serve Our Global Customers

Corning Incorporated owns four pharmaceutical glass tubing subsidiaries: Corning Pharmaceutical Glass, LLC in Vineland, NJ (USA); Corning Pharmaceutical Glass Co., LTD in Bengbu, China; Corning Technologies India Private Limited in Vemula, India; and Corning Pharmaceutical Glass S.p.A. in Pisa, Italy. With over 170 years of experience in specialty glass and materials science innovation, Corning Pharmaceutical Glass is uniquely suited to supply high-quality clear and amber borosilicate glass tubing for pharmaceutical primary packaging.

- Four tubing production sites
- Clear and amber glass tubing
- Glass Type (defined by USP, EP, and JP)
- Expansion coefficient 33 and 51
- Diameters: 4 - 150 mm
- Wall weights: 0.18 - 8.00 mm
- Lengths: 1,050 - 3,050 mm



Glass Composition and Chemical Resistance Classification



Glass Composition (approximate oxide weight [%])

Oxide Component	Symbol	Corning® 51-V	Corning 51-D*	Corning 51-L (Amber)	Corning 33
Silicon Dioxide	SiO ₂	72.0	73.0	69.0	80.0
Boron Oxide	B ₂ O ₃	11.5	11.2	10.0	12.7
Aluminum Oxide	Al ₂ O ₃	6.8	6.8	6.0	2.6
Calcium and Magnesium Oxide	CaO + MgO	0.7	1.0	1.0	< 0.1
Sodium Oxide	Na ₂ O	6.5	6.8	6.0	4.3
Potassium Oxide	K ₂ O	2.4	1.2	2.0	0.1
Iron Oxide	Fe ₂ O ₃	< 600 ppm**	< 400 ppm**	1.0	< 500 ppm**
Barium Oxide	BaO	< 400 ppm**	< 400 ppm**	1.5	< 400 ppm**
Titanium Dioxide	TiO ₂	< 400 ppm**	< 300 ppm**	3.0	< 400 ppm**

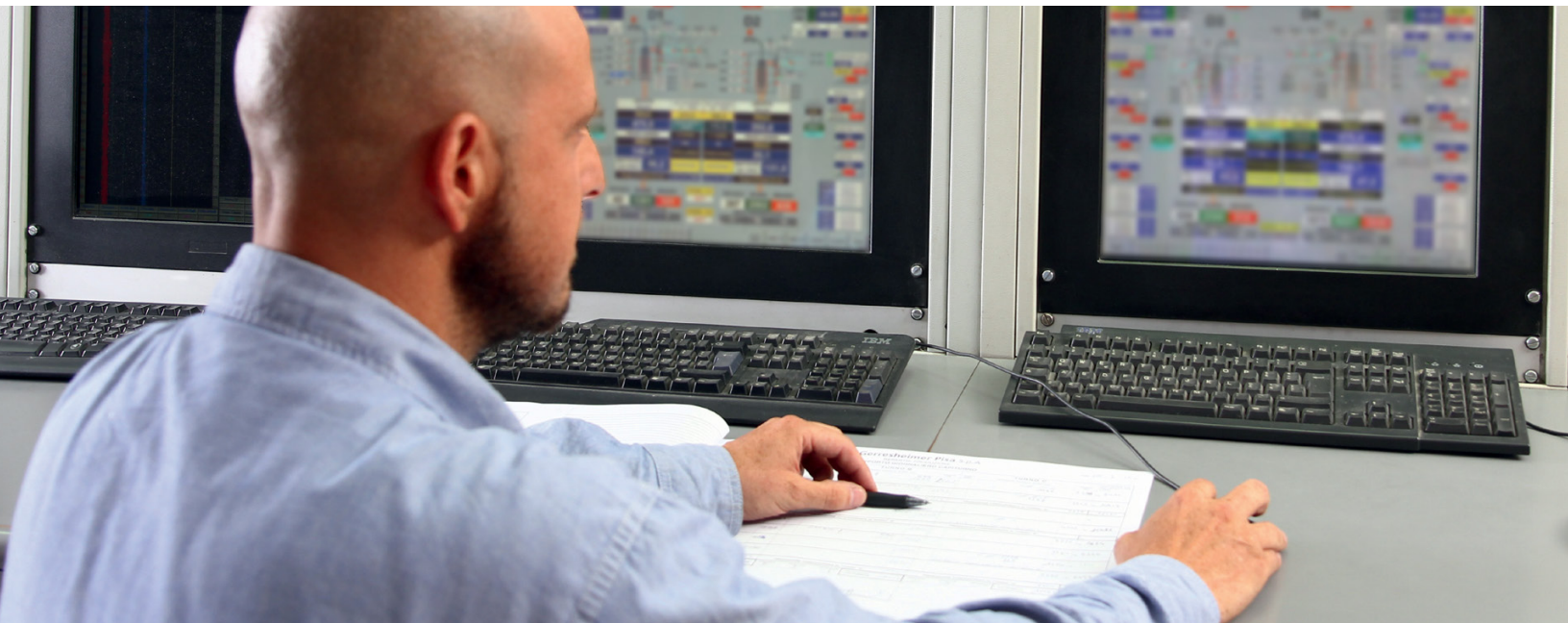
*Formulated for closed ampoules.

**Not introduced in the batch composition.

Chemical Resistance Classification

Resistance Class	Specification	Corning 51-V	Corning 51-D	Corning 51-L	Corning 33
Hydrolytic Resistance (Glass Grain)	EP (3.2.1B)/USP <660>	Type I	Type I	Type I	Type I
Hydrolytic Resistance (Glass Grain)	ISO 720	HGA1	HGA1	HGA1	HGA1
Soluble Alkali Test	JP 7.01	Complies	Complies	Complies	Complies
Acid Resistance Class	DIN 12116	Class S1	Class S1	Class S1	Class S1
Alkali Resistance Class	ISO 695	Class A2	Class A2	Class A2	Class A2
ASTM Laboratory Glass Class	ASTM E 438	Class B	—	—	Class A

Fully Controlled and Automated Production Process



From raw material preparation to final packaging, tubing production is seamlessly integrated. Innovative process controls monitor the entire production flow through built-in feedback loops and dedicated in-line inspections.

- Raw material/laboratory
- Melting
- Forming
- In-line inspection
- Packaging
- Traceability

Traceable to a Single Bundle

Labeling allows for complete traceability down to a single, specific bundle.



Quality Inspection



Online Inspection

1. Dimensional inspection

- Proprietary Drawline Metrology System (DMS)
- 100% of dimensional attributes are inspected
- Automated reject of defect pieces

2. Cosmetic inspection system

- 100% cosmetic inspection with automated reject
- Defect types: airlines, knots, and stones



Offline Inspection

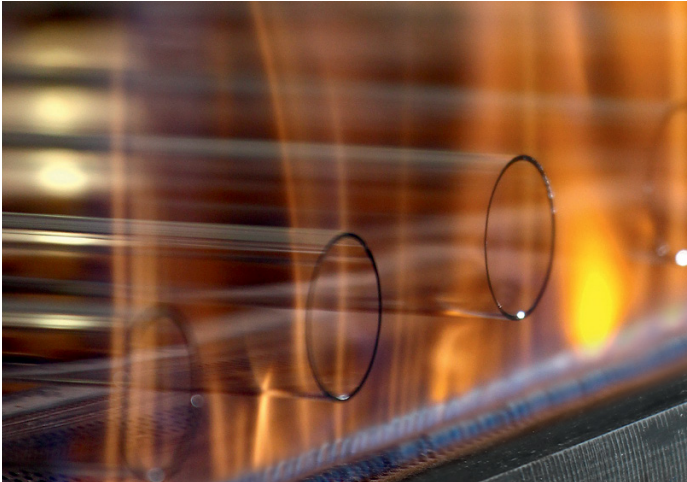
3. SPC Infinity

- In process control by shift operators and quality inspectors
- Final acceptance by QC
- Cp/Cpk monitoring

4. Lab testing

- Glass composition
- Chemical durability
- Extractables and leachables
- Density, stress, strain, microscopy

Finishing and Packaging



1. Active particle prevention and removal

- Sharper and cleaner cut by O₂/H₂ burners
- Thread burners on every line to prevent glass threads
- Particle removal system using ultrasonic vibration with air purge



2. Tubing end finishing inspection

- Defect types: glaze, end cracks, cosmetic defects
- Micron-scale feature resolution
- 100% inspection with automated reject



3. Fully automated packaging station

- Tubes are automatically stacked in single packs
- Compact bundles are formed using plastic shrink film
- Bundle labeling assures traceability
- Staggered bundle configuration reduces scratches

About Corning

Corning is one of the world's leading innovators in materials science. For more than 170 years, Corning has applied its unparalleled expertise in specialty glass, ceramics, and optical physics to develop products that have created new industries and transformed people's lives. Corning succeeds through sustained investment in R&D, a unique combination of material and process innovation, and close collaboration with customers to solve today's technology challenges.

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