

LEVEL MEASUREMENT

Reflex Level Gauges

Direct visual liquid level indication for high-temperature and high-pressure service.



01 / Principle of Operation

Working Principle & Selection

Measuring Principle

A reflex gauge operates on two optical laws: refraction and total internal reflection. The rear face of the gauge glass features precision-molded prismatic grooves (V-profile, 90° included angle) facing the process chamber. In the vapor space, light entering the glass strikes the groove faces at an angle exceeding the critical angle for the glass-gas interface (42° for borosilicate against gas). Consequently, it is totally internally reflected back to the observer, making the vapor zone appear bright silver. In the liquid space, the liquid wets the grooves. Its refractive index (water 1.33, hydrocarbons 1.35–1.45) is close enough to the glass that the critical-angle condition is destroyed. Light passes into the liquid and is absorbed in the chamber, making the liquid zone appear dark (black). The sharp silver/black boundary provides clear, unambiguous level indication without illumination.

Construction Principle

The chamber is a machined solid bar (not tube) with a milled liquid slot, providing a flat gasket seating surface and high pressure integrity. The assembly stack-up from the process side is: chamber, sealing gasket, reflex glass, cushion gasket, and cover plate, compressed by U-bolts or studs. The cushion gasket distributes bolt load and prevents glass-to-metal point contact. Correct, staged torquing is essential because borosilicate fails in bending, not compression. For center-to-center distances beyond a single glass length, the gauge is built as multiple overlapping sections so no level position is hidden at a joint.

Communicating-Vessel Accuracy

The gauge chamber connects to the vessel at two points and behaves as a communicating vessel. The gauge level equals the vessel level only when densities in both legs match. Flashing, boiling, or a cold gauge leg on hot service will cause the gauge to read lower than the actual vessel level by the density ratio.

Service Limitations (Misapplication)

Reflex gauges rely on specific optical and physical conditions. They are **unsuitable** for the following services (transparent or magnetic gauges must be selected instead):

- **Colorless liquid-liquid interfaces:** Both liquids wet the prisms and appear dark, providing no contrast.
- **Steam/condensate above 30 bar:** Hot condensate attacks borosilicate glass. Reflex glass cannot accept a protective mica shield because the shield would defeat the prisms.
- **Viscous, dirty, or crystallizing media:** Deposits in the prismatic grooves destroy the optical effect.

02 / Product overview & technical data

Design and Construction

Globe United Reflex Level Gauges provide direct observation of liquid levels in tanks and vessels. The gauge is assembled with a gasket, reflex glass, cushion gasket, and gauge cover secured to the machined body by U-bolts. A special reflex-type gauge glass features a wider V-shaped refractive groove. The reflex surface provides high contrast between liquid and gas spaces, ensuring clear observation. Toughened borosilicate glass is utilized where high temperatures may occur.

Applications

Suitable for high-temperature (up to 320°C) and high-pressure (up to 200 kg/cm²) service. For applications exceeding 320°C, transparent or magnetic level gauge designs are required. The design is effective for boiling, dense, viscous, and foamy liquids. Gauges can be constructed for critical, acidic, cryogenic (down to -196°C), and temperature-zone services.



Vertical construction detail. Final dimensions and orientation subject to approved order documents.

Technical Specifications

Parameter	Specification
Pressure Classes	Low (30 kg/cm ²), Medium (85 kg/cm ²), High (165 kg/cm ²), Very High (200 kg/cm ²)
Temperature Rating	Up to 320°C (limited by reflex glass)
Mounting Orientation	Top-bottom vertical, side-side right, side-side left, side-side back
Center-to-Center Distance	Maximum up to 3000 mm
Chamber Materials	CS, SS316/L, Monel, Titanium, Inconel 600/625/825, Hastelloy B/C, Duplex*, Super Duplex*
Cover Plate Materials	CS, SS316/L, Monel, Titanium, Inconel 600/625/825, Hastelloy B/C, Duplex*, Super Duplex*
Cushion / Gasket	PTFE, Flexible Graphite with SS impregnated
Fasteners	SS, ASTM A193 Gr B7 / A194 Gr 2H, CS Plated
Scale	SS304 / SS316 engraved in mm (Non-wetted)
Glass	Toughened borosilicate (up to 320°C per DIN 7081, BS 3463, JIS B 8211)

* Note: Duplex and Super Duplex stainless steels are subject to embrittlement at elevated temperatures. Service temperature is limited to ~300–315°C depending on the specific alloy grade.

03 / Options & Connections

Process Connections & Options

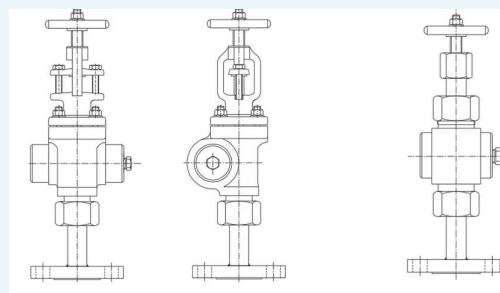
Process Connections

Available with screwed, flanged, or socket weld connections. Standard vent and drain options include 1/2" plugged, needle valve, ball valve, globe valve, or gate valve configurations.

Isolation Valves

Auto ball check valves are provided.

- **Screwed Bonnet Offset:** Suitable up to 50 kg/cm². Fully forged construction.
- **Bolted Bonnet Offset:** Suitable above 50 kg/cm². Designed for durability, high stability, and high leakage class.



Representative construction: Isolation valve variations.

Special Applications

Cryogenic Service (Non-Frost)

For extreme low temperatures, a non-frosting acrylic plate is mounted in front of the gauge to improve readability when the front tends to freeze. Available for temperature bands down to -196°C.

Heating Jacket

Used for highly congealable and ebullient liquids. Steam or cold water may be circulated through the jacket. Standard jacket inlet is 1/2" NPT(M) or 15 NB flange.

Drawing & Specification Control

Sample drawings and images are for visual reference only. Final supplied geometry, dimensions, materials, ratings, process connections, accessories, inspection scope, and documentation are governed exclusively by the approved order data sheet, approved drawings, and nameplate.

Technical Data Availability

Exact dimensional drawings (including visible length vs C-C), section counts for long gauges, weight tables, and ASME B31.3 / PED compliance status are provided on a project-specific basis. Consult Globe United technical sales to confirm specific design-code applicability and obtain approved engineering data for your configuration.

04 / Ordering Guide & Document Control

Ordering Information & Support

To configure a Series RLG Reflex Level Gauge, specify the following parameters based on the application requirements. For full model code generation, refer to the complete ordering guide or contact Globe United technical sales. Fields X4 and X5 are mutually exclusive; use code Z (Nil) for the unused connection type.

Example Code: RLG - C - TB - 1000 - F3 - Z - ZE - VD - Z - SR - RU - QU - UX - XX - WX - VW - WD

X1	Pressure Type
A	Low Pressure (30 kg/cm ²)
B	Medium Pressure (85 kg/cm ²)
C	High Pressure (165 kg/cm ²)
D	Very High Pressure (200 kg/cm ²)

X2	Orientation
TB	Top-Bottom Vertical
SR	Side-Side Right
SL	Side-Side Left
SB	Side-Side Back

X3	Center-to-Center Distance
XXXX	Specify required distance in mm

X4	Flanged Connection
F1-F5	1/2" to 2" 150# RF
F9-F13	1/2" to 2" 300# RF
F19-F21	1" to 2" 600# RF
XX	Other (Specify)

X5	Threaded Connection
B4-B8	1/2" to 2" BSP(M)
N4-N8	1/2" to 2" NPT(M)
XX	Other (Specify)

X6	MOC Connection
ZA/ZB	CS (A105) / CS (A106)
ZE/ZF	SS316 / SS316L
ZJ/ZK	Monel 400 / 500
ZL	Titanium
ZM/ZN	Hastelloy B / C
ZO	Inconel 600 / 625 / 825
ZP/ZQ	Duplex / Super Duplex

X7	MOC Chamber
VA	CS
VD/VE	SS316 / SS316L
VG/VH	Monel 400 / 500
VI	Titanium
VJ/VK	Hastelloy B / C
VL	Inconel 600 / 625 / 825
VM/VN	Duplex / Super Duplex

X8	Optional Features
NF	Non-Frost Extension
HJ	Heating Jacket
Z	Nil

X9	Calibration Scale
SQ/SR	SS304 / SS316 (Non-wetted)

X10	Drain Option
RU/RV	1/2" / 3/4" NPT(F) Plug
RW	1/2" Needle Valve
RX	1/2" Ball Valve
RY/RZ	1/2" Gate / Globe Valve

X11	Vent Option
QU/QV	1/2" / 3/4" NPT(F) Plug
QW	1/2" Needle Valve
QX	1/2" Ball Valve
QY/QZ	1/2" Gate / Globe Valve

X12	Isolation Valve
UW	Screwed Bonnet Offset
UX	Bolted Bonnet Offset
UY/UZ	Nipple / Needle Valve

04 / Ordering Information (Cont.)

X13	Gasket Material
XX	PTFE
XY	Flexible Graphite

X14	Cushion Material
WX	PTFE
WY	Flexible Graphite

X15	Fasteners
VV	ASTM A193 Gr. B7 / A194 Gr. 2H
VW	SS
VY	CS Plated

X16	MOC Cover Plate
WA	CS
WD/WE	SS316 / SS316L
WG/WH	Monel 400 / 500
WI	Titanium
WJ/WK	Hastelloy B / C
WL	Inconel 600 / 625 / 825
WM/WN	Duplex / Super Duplex

04 / Support & Document Control

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Document Control

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