

Installation & Maintenance Manual — LUMIGLAS® Type 76 Fused Sight Glass for Welding Neck Flanges

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1. Product Description

The LUMIGLAS® Type 76 fused sight glass is a metal-fused borosilicate observation disc manufactured in conformance with DIN 7079 and DIN 7080. It is specifically designed for installation in welding neck flange assemblies to DIN 28121, as well as any other assembly where the glass dimensions are compatible — including welding neck flanges with flat or raised faces.

During manufacture, the metal ring and borosilicate glass disc are heated together to the temperature at which the glass melts and fuses with the ring. A controlled cooling phase follows, after which the disc is ground and polished on both contact faces. The mechanical prestressing created during this cooling process — where the steel ring remains under tensile stress and the glass insert sits in compressive stress — gives the Type 76 its fundamental safety advantage over conventional thermally toughened sight glass discs.

Safety Principle

The compressive prestress on the glass insert of a fused metal/glass sight glass causes it to behave mechanically like a tough material. This property offers superior safety compared to conventional thermally toughened borosilicate or soda-lime glass discs — and is why fused metal/glass sight glass units should be used in preference to toughened glass discs in hazardous process conditions.

2. Rated Operating Conditions & Approvals

Parameter	Value
Product Type	Type 76 Fused Sight Glass for Welding Neck Flanges to DIN 28121
Glass Material	Borosilicate glass fused to metal ring per DIN 7079; glass per DIN 7080
Operating Temperature	−60°C to +300°C (ring material dependent — see Section 2.1)
Operating Pressure	Up to 40 bar (standard dimensions); higher pressures available on request
Assembly Compatibility	DIN 28121 circular sight ports; welding neck flanges with flat or raised faces
Pressure Equipment Directive	PED 2014/68/EU, Module H/H1 (DIN/EN/ISO 9001)
AD Standards	AD-Merkblatt W0/TRD 100
TÜV	Manufactured in conformance with TÜV requirements
Material Certificates	EN 10204-3.1 or 3.2 Certificate of Conformity, supplied as standard

2.1 Ring Material Operating Temperature Reference

Ring Material	Service Temp. Range	Max. Temp. (TS)	Material Cert.
S355J2+N (Carbon Steel)	−10°C to +300°C	300°C	DIN 50049-3.1B
Duplex Stainless Steel (1.4462)	−30°C to +280°C	280°C	DIN 50049-3.1A
Hastelloy C-22 (2.4602)	−60°C to +300°C	300°C	DIN 50049-3.1A
Hastelloy C-276 (2.4605)	−60°C to +300°C	300°C	DIN 50049-3.1A
Hastelloy C-4 (2.4610)	−60°C to +300°C	300°C	DIN 50049-3.1A

3. Factors That Can Cause Damage or Failure

The following factors can lead to damage or destruction of the sight glass assembly. All personnel involved in installation, operation and maintenance must be familiar with these mechanisms.

Damage Factor	Mechanism, Limits & Prevention
Temperature	Minimum service temperature is set by the ring material — falling below it may cause the ring to become brittle and lose tensile strength, resulting in unit failure. Maximum service temperature is determined by the mechanical prestress of the glass and/or the ring material. Even a minor exceedance of the maximum rated temperature will result in sight glass failure. Always verify both limits for the ring material selected.
Pressure	Maximum operating pressure is determined by the dimensions (d1, d2) and the combination of construction

	materials. If pressure is exceeded, concentric or net-shaped cracks appear on the low-pressure face of the glass. Further pressure increase enlarges these cracks progressively until the glass fails. Never operate above the rated pressure for the specific disc size.
Temperature Shock	Avoid rapid heating or cooling of the fused sight glass assembly. In metal-fused sight glasses, the steel ring is under tensile stress and the glass insert is under compressive stress — the stress distribution in the two materials is not homogeneous. Thermal shock concentrates stress around the peripheral glass/metal joint, potentially causing concentric surface cracks or fine glass slivers. These cracks do not disturb pressure-tightness or create a direct safety risk as long as they remain shallower than 10% of the original glass thickness. However, the assembly must be inspected promptly and replaced when convenient.
Chemical Corrosion	Chemical resistance is determined by both the glass and the ring material. Glass: Borosilicate glass resists water, salt solutions, acids and organic substances — surpassing most metals and synthetic resins. It is attacked only by fluorine, strong alkalis and concentrated phosphoric acid at elevated temperatures. Condensate and salt solutions can also cause gradual corrosion, worsening at higher pH, higher concentration and higher temperature. Alternating acid/alkali exposure produces the greatest deterioration. Surface reactions can cause turbidity, spots, thin interference films or rough deposits. Metal ring: The user must verify that the ring material selected has adequate corrosion resistance for the specific process medium and operating conditions.
Mechanical Loading	Fused metal/glass sight glasses are generally more tolerant of distorting loads than conventional glass discs. However, incorrect installation can impair function and cause failure. Only install the sight glass after completing the pre-installation checks in Section 4. Avoid introducing additional mechanical stresses during installation. The assembly must not be subjected to impact loads at any time.

4. Installation Instructions

Important

Fused metal/glass sight glasses must only be installed by persons who are thoroughly familiar with: correct handling of sight glass discs; cleaning of housings, discs, gaskets and inserts prior to installation (including removal of all foreign bodies such as swarf); and even tightening of fastening bolts. During installation, no additional stresses should be imposed on the glass and the unit must not be exposed to mechanical impact loads.

4.1 Pre-Installation Checks

- Verify that the disc dimensions (d1, d2) match the housing drawing and the required pressure rating. Confirm the correct glass thickness S for the operating pressure.
- Inspect the housing seating face for corrosion, scores, residual gasket material or foreign bodies. Clean thoroughly before fitting.
- Select a gasket material compatible with the process medium, operating temperature and pressure. Consult Lumistar if the correct gasket material is uncertain.
- Inspect the fused sight glass disc for any chips, cracks or surface damage. Do not install a damaged disc under any circumstances.

4.2 Installation Procedure

1	Place the gasket centrally on the cleaned housing seating face. Verify the gasket is undamaged and correctly positioned.
2	Place the LUMIGLAS® Type 76 fused sight glass disc centrally on the gasket. Apply no lateral force.
3	Fit the retaining flange or cover plate. Insert all fastening screws or bolts finger-tight.
4	Tighten fastening bolts in a CROSS PATTERN (opposing pairs) to the housing manufacturer's specified torque value. Do not use impact tools.
5	Apply torque in two passes: first to 50% of target, then to full target — both passes in cross pattern sequence.
6	Inspect the assembly for gasket protrusion or misalignment. Re-torque if necessary.
7	Perform a leak test at operating pressure before returning the assembly to normal service.

Warning

Do not introduce additional mechanical stresses into the sight glass during installation. Impact loads — including hammer blows or use of impact tools on the assembly — must be strictly avoided at all times.

5. Inspection & Maintenance Schedule

Fused metal/glass sight glasses must be included in all planned maintenance procedures and inspected periodically — both visually and, where possible, by ultrasonic wall-thickness measurement. When a glass is found to be damaged, adequate visual checks should be maintained until the relevant vessel or line can be conveniently shut down for glass replacement. This approach supports a practical, planned glass exchange routine rather than unplanned emergency replacement.

Inspection Interval	Action
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Daily / Each Shift	Visually inspect the glass for cracks, cloudiness, surface deposits or any sign of leakage. Verify that level or flow reading is clear and unobstructed.
Weekly	Check the metal ring and housing flange faces for corrosion, scale or gasket weeping. Clean external glass surface with a soft, non-abrasive cloth.
Monthly	Verify isolation valve operation. Check fastening bolt torque is maintained. Record condition in the plant maintenance log.
Annually	Remove and inspect: examine glass surface under magnification for concentric micro-cracks. Measure glass thickness by ultrasonic wall-thickness gauge where possible. Replace if cracks exceed 10% of nominal thickness or if optical clarity is visibly impaired.
After Any Process Excursion	If the assembly has experienced over-pressure, over-temperature, or thermal shock — inspect immediately. Replace before returning to service if any cracking or surface damage is found.

6. Replacement Procedure

6.1 Isolation & Depressurisation

1	Isolate the sight glass assembly using upstream and downstream isolation valves.
2	Verify that system pressure is fully relieved before opening. Never open a sight glass assembly under pressure.
3	Allow the assembly to cool to ambient temperature if the operating temperature was above 60°C.

6.2 Removal

1	Loosen fastening bolts in a cross pattern to avoid uneven unloading of the glass. Remove bolts fully.
2	Carefully remove the retaining flange or cover plate. Do not use a lever against the glass disc.
3	Remove the used disc and gasket. Dispose of glass fragments safely.
4	Inspect the housing seating face for corrosion, scoring or damage. Repair or replace the housing if seating integrity is compromised.

6.3 Fitting New Disc

Follow the full installation procedure in Section 4. Always fit new gaskets — never reuse old gaskets, even if they appear undamaged.

Spare Parts

Maintain a minimum stock of one complete replacement set (glass disc + gaskets) per assembly on site. For critical process lines, stock two sets. Non-standard dimensions may require 2–4 weeks lead time.

7. Troubleshooting

Symptom	Probable Cause	Action
Leakage at glass/housing interface	Gasket failure or insufficient / uneven bolt torque	Re-torque bolts evenly in cross pattern. If leakage persists: depressurise, remove and replace gasket.
Cloudiness or discolouration of glass	Chemical attack by process medium	Review chemical compatibility. Consider Hastelloy ring upgrade. Replace disc if visibility is impaired.
Concentric cracks on glass surface	Pressure surge, thermal shock or over-temperature event	Remove from service. Replace disc. Review operating conditions before restart.
Scratched or abraded glass surface	Abrasive cleaning method or particulate in process medium	Use only soft non-abrasive cloth for cleaning. Fit upstream strainer if particulate present.
Glass disc loose in ring	Manufacturing defect or severe thermal cycling damage	Remove from service immediately. Return disc to Lumistar for inspection.

Technical Support & Spare Parts — LUMIGLAS® Type 76

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