



BEYOND GLASS

Glas und mehr

ILMADUR®



Sight and Gauge Glass Range

Das Schauglasprogramm



BEYOND GLASS - COMPETENCE IN GLASS

It is in Europe's most modern glass works that TGI (the abbreviation for "Technische Glaswerke Ilmenau", Germany) produces its high-quality glass for customers all over the world. Most products fall into one of four product categories: laboratory glassware, pressed glass (in particular sight glasses and light engineering), tubular products (glass tubes, capillaries, rods) and household glassware.

The name TGI stands for quality, reliability and flexibility in all these categories. Thanks to our technological facilities in four melting tanks, the skills of our workforce here in Ilmenau, a region with a long history of glass manufacture, our wide range and our service-based approach, we are in the position of being able to realise (almost) all customer requests. TGI – as an independent supplier of total solutions – is proud of its comprehensive competence in all matters involving glass. For your success in the marketplace.





ILMADUR® – SIGHT AND GAUGE GLASSES

TGI sight glasses are world-leaders in terms of quality and safety. All the well-known, discerning fittings and armature manufacturers and operators worldwide agree on one thing: ILMADUR® sight glasses “Made in Germany” by TGI are a real safe bet. Our specially developed “I-420” borosilicate glass can withstand the highest loads. Whether you need to monitor liquid levels in steam boilers in power plants or complex processes in chemical plants, ILMADUR® sight glasses can resist both high pressures and extreme temperatures. And of course, our sight glasses comply with the latest DIN standards and the most important standards worldwide. But the hardest standard to meet is the one we set ourselves: the TGI measuring and testing methods guarantee the safety of our customers’ personnel at their workplaces.

ILMADUR®
DIN 7080-25

ILMADUR®
DIN 7080-16



Certified quality

The most important aim of our work is to supply our customers with the very best quality. Because with sight glasses in particular, absolute safety is paramount. That is why our company is regularly certified according to DIN EN 9001:2000. In addition, we can also verify that the production and development organisation in our company complies with all the requirements of the EU’s Pressure Equipment Directive 97/23/EC: TGI is an approved manufacturer according to this directive. And of course, our sight glasses also satisfy all the specifications of the world’s leading armature manufacturers and the respective national rules and regulations. We do everything we can to achieve a product quality you can depend on every time.



ILMADUR® sight glasses are in use worldwide: wherever production processes in boilers, tanks, apparatus, vessels and pipelines have to be monitored safely.



ILMADUR® sight and gauge glasses for your application: best processes for best quality.

Leading technology right from the beginning: our I-420 borosilicate glass is produced from strictly controlled raw materials that pass through a high-tech melting process in one of Europe's most modern melting tanks. The result is a glass with high thermal stability, excellent transparency and extreme resistance to chemicals.



The modern rotary table press gives our sight glasses their shapes.



Nothing escapes the watchful eyes of our specialists. They check every individual glass after every stage of the production.



In order to achieve the high final quality we demand, high parallelism and flatness with minimum surface roughness are an absolute "must". To achieve this, the blanks are ground twice between the diamond pellets of our automatic twin-disc grinding and lapping machines before they are carefully polished.



Trained staff carry out another visual inspection: The surfaces must be perfect, the dimensions exact. Every scratch, every inaccuracy could put the strength and hence the safety of the product at risk. We therefore measure the surface roughness constantly and check dimensions and tolerances.



Our sight glasses are subjected to a very special thermal treatment so that they can withstand the stresses they will later be exposed to in use. In the toughening facility, their normal tensile bending strength is increased by a factor of 2 at least. Custom software controls the demanding process of heating and cooling.



Sight glasses viewed in polarised light: The sequence of colours in the visual inspection shows that the desired compressive prestress has been reached.



Loading test: Sight glasses from every toughening batch are tested in the very latest testing apparatus.



Before they are carefully and safely packaged, every TGI sight glass is printed with its own code so that we can trace its history in our database – even years later. Detailed information for our customers is included with every sight glass to ensure optimum handling and installation.

We developed and patented the special “I-420” glass so that we would have a material ideally suited to producing particularly high-quality sight glasses. Our “I-420” glass combines the best properties that good sight glasses need: freedom from bubbles and cords to guarantee high optical quality and thus a good view even in the case of thicker safety glass. This glass is extremely resistant, making it ideal for tough industrial applications involving boiler water even with ph-values greater than 10 and chemical substances like acids or alkalis. And the specific thermal toughening in conjunction with the inherent high thermal shock resistance means that our ILMADUR® sight glasses are especially safe, especially durable.

We offer a comprehensive range of top-quality sight glasses manufactured from this material: round sight glasses to DIN 7080 and gauge glasses to DIN 7081 plus custom sight glasses to meet your individual specifications. Full details of our range of products can be found on the following pages.



Incidentally, we also manufacture other technologically exacting products from this special glass, e.g. lenses, reflectors and diffusers for further processing and applications in lighting engineering.



Chemical composition:

77 % by wt. SiO_2
11 % by wt. B_2O_3
5 % by wt. Na_2O
4 % by wt. Al_2O_3
1 % by wt. K_2O
1 % by wt. ZrO_2

Chemical properties:

■ Water resistance
tested to DIN ISO 719 (at 98 °C):
HGB 1 with a typical consumption
of 0.03 ml hydrochloric acid $[\text{c}(\text{HCl})$
= 0.01 mol/l] per one gram glass grit

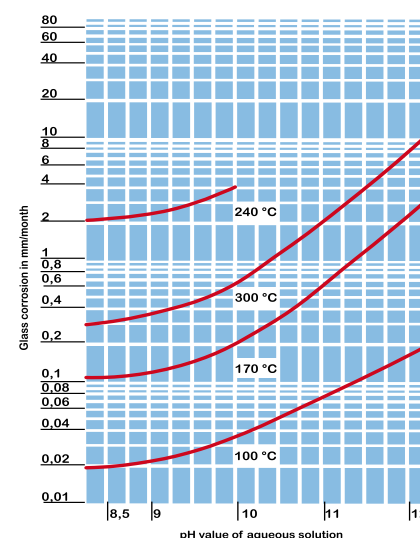
■ Water resistance
tested to DIN ISO 720 (at 121 °C):
HGA 1 with a typical consumption
of 0.03 ml hydrochloric acid $[\text{c}(\text{HCl})$
= 0.02 mol/l] per one gram glass grit

■ Alkali resistance
tested to DIN ISO 695:
class A2 with a typical mass loss of
100 mg/dm²

■ Acid resistance
tested to DIN 12 116:
class S1

■ Acid resistance
tested to DIN ISO 1776 with a typical
alkali delivery of 50 $\mu\text{g Na}_2\text{O}/\text{dm}^2$

Glass corrosion by boiler water



The glass corrosion, in this case for unprotected sight glasses, essentially depends on the pH value and the temperature of the boiler water.

Physical properties:

■ Mean linear thermal expansion:
 α (20 °C...300 °C) = $4,2 \pm 0,1 \times 10^{-6} \text{ K}^{-1}$

■ Density at 20 °C: $\rho = 2,28 \text{ g/cm}^3$

■ Mean thermal conductivity
(20 °C... 100 °C) $\lambda = 1,4 \text{ W m}^{-1} \text{ K}^{-1}$

■ Working point:
 $\vartheta_{\text{fl}} = 1225 \text{ °C}$ at a
viscosity of $\eta_{\text{fl}} = 10^4 \text{ dPa} \cdot \text{s}$

■ Littleton/Softening point:
 $\vartheta_{\text{L}} = 810 \text{ °C}$ at a
viscosity of $\eta_{\text{L}} = 10^{7,6} \text{ dPa} \cdot \text{s}$

■ Annealing point:
 $\vartheta_{\text{B}} = 580 \text{ °C}$ at a
viscosity of $\eta_{\text{B}} = 10^{13} \text{ dPa} \cdot \text{s}$

■ Strain point:
 $\vartheta_{\text{P}} = 520 \text{ °C}$ at a
viscosity of $\eta_{\text{P}} = 10^{14,7} \text{ dPa} \cdot \text{s}$

■ Transformation temperature:
 $t_{\text{g}} = 560 \text{ °C}$

■ Max. permissible service
temperature:
500 °C for the material (280 °C for
toughened sight glasses)

■ Modulus of elasticity:
 $E = 66 \text{ GPa}$

■ Poisson number:
 $\mu = 0,20 \cdot 10^{-3} \text{ N/mm}^2$

Electrical properties:

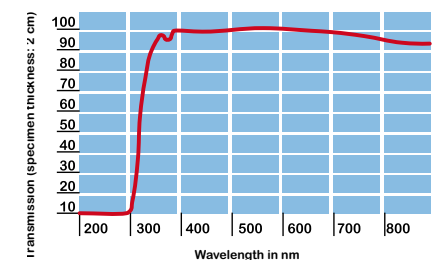
■ Volume resistivity
at 25 °C = $6.6 \times 10^{13} \Omega \text{ cm}$
at 300 °C = $1.4 \times 10^6 \Omega \text{ cm}$

■ Dielectric properties
at 25 °C and 1 MHz:
Dielectric constant $\epsilon_1 = 4.6$
Loss factor $\tan \delta = 1.4 \times 10^{-2}$

Optical properties:

■ Refractive index
 $\lambda = 587,6 \text{ nm } n_{\text{D}} = 1,4816$
 $\lambda = 480,0 \text{ nm } n_{\text{F}} = 1,4869$
 $\lambda = 546,0 \text{ nm } n_{\text{E}} = 1,4831$
 $\lambda = 644,0 \text{ nm } n_{\text{C}} = 1,4802$

Transmission curve



Where properties and compositions are specified without tolerances, they represent rounded long-term mean values that are subject to minimal fluctuations due to the manufacturing process.

Our range of products embraces all the sizes in DIN 7080 and a few more that are requested by customers. If you cannot find the size you need in the table on the right, simply contact us. We can make just about anything possible!

Mechanical properties

- Tensile bending strength:
≥ 160 N/mm²
- Compressive prestress:
≥ 100 N/mm²

The thermal toughening increases the tensile bending strength by a factor of 2.5 at least. That guarantees the level of safety demanded of sight glasses according to DIN 7080.

Thermal properties and service conditions

- Max. service temperature: 300 °C
Where the operating temperature exceeds 280 °C a permanent drop in the prestress is to be expected unless suitable measures are taken. The actual maximum permissible load on a sight glass always depends on the specific service conditions in situ (pressure, temperature, nature of medium, type of apparatus).
- Thermal shock resistance:
Δ T min. 265 K
- Finishes
 - Surfaces: polished
 - Lateral Surfaces:
plain moulded or ground (for manufacturing reasons beveled 1,5°)
 - Edges: beveled

Dimensional tolerances to DIN 7080

- Diameter (d₁):
d₁ ≤ 125 mm ± 0,5 mm
125 mm < d₁ ≤ 200 mm: ± 0,8 mm
d₁ > 200 mm ± 1,0 mm
- Thickness (s):
s ≤ 20 mm + 0,5 mm / -0,25 mm
s > 20 mm + 0,8 mm / -0,40 mm
- Flatness (e):
d₁ ≤ 100 mm 0,05 mm
100 mm < d₁ ≤ 150 mm 0,08 mm
150 mm < d₁ ≤ 200 mm 0,12 mm
d₁ > 200 mm 0,15 mm
- Parallelism (p):
d₁ ≤ 100 mm 0,20 mm
100 mm < d₁ ≤ 200 mm 0,25 mm
d₁ > 200 mm 0,30 mm

Calculation of glass thickness

We calculate the glass thickness to DIN 7080, even for the sizes in our range not included in the DIN standard. The Timoshenko equation serves as a basis for this:

$$s \geq c \cdot d_m \sqrt{\frac{\rho \cdot S}{10 \cdot \sigma}}$$

s = glass thickness in mm

$$d_m = \frac{d_1 + d_2}{2} \text{ in mm}$$

ρ = maximum permissible operating pressure in bar

S = factor of safety = 5

σ = minimum value of compressive prestress in N/mm²

c = correction factor = 0.55

RANGE OF PRODUCTS

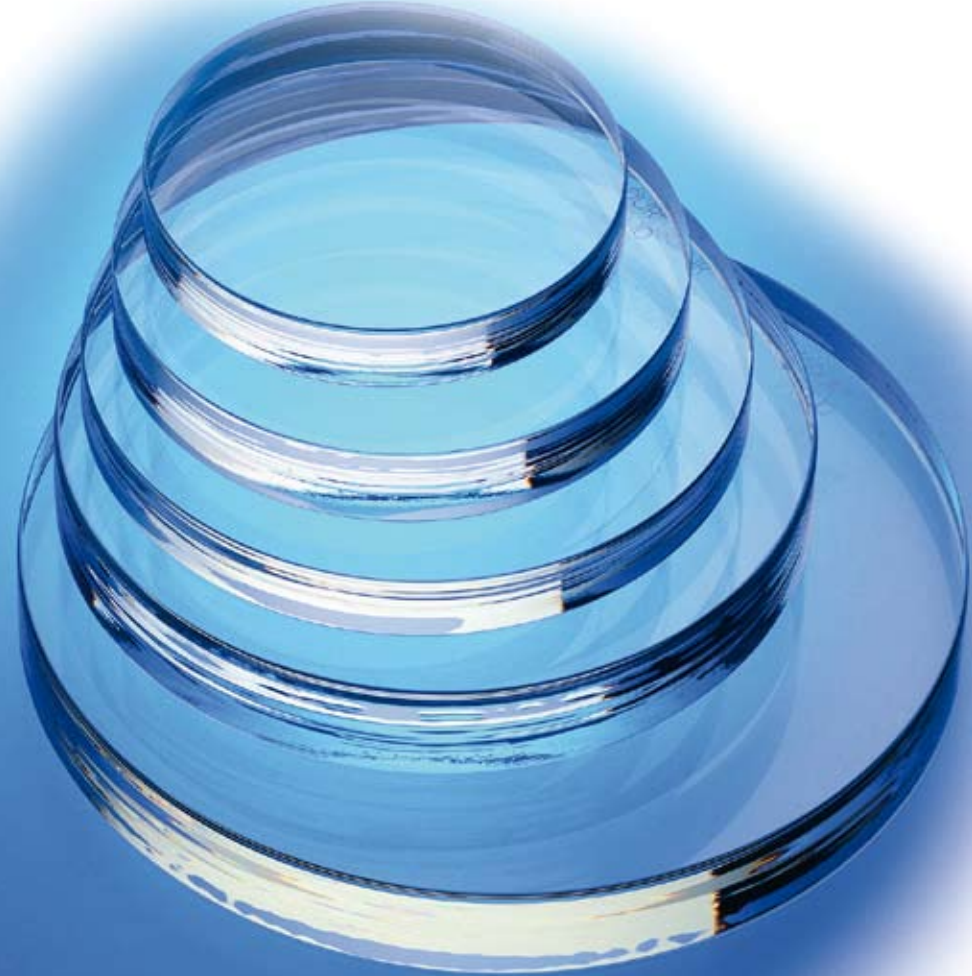
Dimensions d ₁ x s mm	Inner diameter gasket d ₂ mm	Permissible operating pressure (bar)	Part No.
30 x 15 *	20	200	42 610 001
35 x 7 *	25	25	42 610 005
40 x 12 *	30	50	42 610 010
45 x 10	32	40	42 610 015
45 x 12	32	50	42 610 016
50 x 10	35	25	42 610 020
50 x 12	35	40	42 610 021
55 x 10 *	40	25	42 610 025
60 x 10	45	16	42 610 030
60 x 12	45	25	42 610 031
60 x 15	45	40	42 610 035
63 x 8 *	48	8	42 610 040
63 x 10	48	16	42 610 041
63 x 12	48	25	42 610 042
63 x 15	48	40	42 610 045
70 x 12 *	55	16	42 610 050
70 x 15 *	55	25	42 610 055
80 x 10 *	65	10	42 610 060
80 x 12	65	16	42 610 061
80 x 15	65	25	42 610 062
80 x 20	65	40	42 610 063
90 x 10 *	70	8	42 610 070

Dimensions d ₁ x s mm	Inner diameter gasket d ₂ mm	Permissible operating pressure (bar)	Part No.
95 x 15 *	75	16	42 610 075
100 x 10 *	80	7	42 610 080
100 x 15	80	16	42 610 083
100 x 20	80	25	42 610 085
100 x 25	80	40	42 610 086
113 x 15 *	88	10	42 637 113
125 x 15	100	10	42 610 090
125 x 20	100	16	42 610 092
125 x 25	100	25	42 610 094
125 x 30 *	100	40	42 610 096
135 x 25	110	25	42 610 097
150 x 15 *	125	8	42 610 101
150 x 20	125	10	42 610 103
150 x 25	125	16	42 610 105
150 x 30	125	25	42 610 107
175 x 20	150	10	42 610 110
175 x 25	150	16	42 610 112
175 x 30	150	25	42 610 115
200 x 20	175	8	42 610 120
200 x 25	175	10	42 610 122
200 x 30	175	16	42 610 125
250 x 25	225	8	42 610 130
250 x 30	225	10	42 610 132
265 x 30	240	8	42 610 134

* Supplementary to the DIN standard



Round ILMADUR® sight glasses to DIN 7080 and Austrian standard Ö-Norm M 7353 – packed



We can offer two basic versions of level gauge glasses, according to DIN 7081 and MIL-standard:

- Reflex glasses, which enable the level of a liquid to be read off easily and safely even from a distance, and
 - Transparent glasses, which we can also supply in "High Pressure" quality for higher operating pressures.
- If you cannot find the size you need in the following tables on the right, simply contact us. We can make just about anything possible!

Mechanical properties

- Tensile bending strength
Standard: $\geq 150 \text{ N/mm}^2$
High Pressure: $\geq 180 \text{ N/mm}^2$
- Compressive prestress
Standard: $\geq 80 \text{ N/mm}^2$
High Pressure: $\geq 100 \text{ N/mm}^2$

The thermal toughening increases the tensile bending strength by a factor of 2 at least. That guarantees the safety demanded of level gauge glasses according to DIN 7081.

Thermal properties and service conditions

- Max. service temperature: 300 °C
Where the operating temperature exceeds 280 °C a permanent drop in the prestress is to be expected unless suitable measures are taken.
- Unprotected level gauge glasses: 35 bar at 243 °C
- Transparent level gauge glasses protected with mica: 103 bar at 320 °C
- Transparent level gauge glasses in contact with media without significant glass corrosion: 180 bar at 400 °C
- High Pressure transparent level gauge glasses: 415 bar at 35 °C

Where the operating temperature exceeds 280 °C a permanent drop in the prestress is to be expected unless suitable measures are taken.

The actual maximum permissible load on a sight glass always depends on the specific service conditions in situ (pressure, temperature, nature of medium, type of apparatus).

- Thermal shock resistance: $\Delta T \text{ min. } 265 \text{ K}$

Finishes

- Surfaces: polished
- Lateral Surfaces: plain moulded or ground (for manufacturing reasons beveled 1,5°)
- Edges: beveled at an angle of 30° or 45°
- Width of sealing surface: min. 5 mm for 30 mm wide level gauge glasses, min. 6 mm for 34 mm wide level gauge glasses

Applications

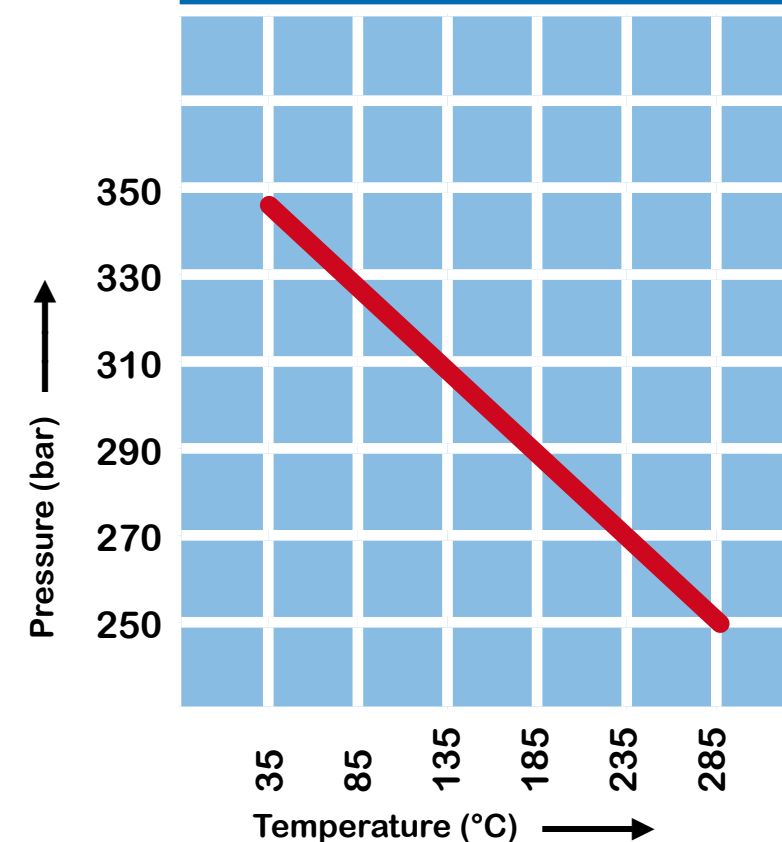
Max. service temperature: 300 °C

	Pressure (bar)	Temperature (°C)
Unprotected level gauge glasses subjected to saturated steam or hot water	35	243
Transparent level gauge glasses protected by mica subjected to saturated steam or hot water	103	320 *
For media without a technically significant glass corrosion effect	180	400 *

* Where the operating temperature exceeds 280 °C a permanent drop in the prestress is to be expected unless suitable measures are taken.

The actual maximum permissible load on a sight glass always depends on the specific service conditions in situ (pressure, temperature, nature of medium, type of armature).

Temperature–pressure diagram



Temperature–pressure diagram for transparent level gauge glasses and media without a technically significant glass corrosion effect

RANGE OF PRODUCTS

Standard						High Pressure		
Reflex			Transparent			Transparent		
Size	Dimensions l x b x s / mm	Part No.	Size	Dimensions l x b x s / mm	Part No.	Size	Dimensions l x b x s / mm	Part No.
0	95 x 34 x 17 *	42 601 200	0	95 x 34 x 17 *	42 601 400	0	95 x 34 x 17,5 *	42 610 400 00 03
1	115 x 34 x 17 *	42 601 205	1	115 x 34 x 17 *	42 601 405	1	115 x 34 x 17,5 *	42 610 405 00 03
2	140 x 34 x 17	42 601 210	2	140 x 34 x 17	42 601 410	2	140 x 34 x 17,5 *	42 610 410 00 03
3	165 x 34 x 17	42 601 215	3	165 x 34 x 17	42 601 415	3	165 x 34 x 17,5 *	42 610 415 00 03
4	190 x 34 x 17	42 601 220	4	190 x 34 x 17	42 601 420	4	190 x 34 x 17,5 *	42 610 420 00 03
5	220 x 34 x 17	42 601 225	5	220 x 34 x 17	42 601 425	5	220 x 34 x 17,5 *	42 610 425 00 03
6	250 x 34 x 17	42 601 230	6	250 x 34 x 17	42 601 430	6	250 x 34 x 17,5 *	42 610 430 00 03
7	280 x 34 x 17	42 601 235	7	280 x 34 x 17	42 601 435	7	280 x 34 x 17,5 *	42 610 435 00 03
8	320 x 34 x 17	42 601 240	8	320 x 34 x 17	42 601 440	8	320 x 34 x 17,5 *	42 610 440 00 03
9	340 x 34 x 17	42 601 245	9	340 x 34 x 17	42 601 445	9	340 x 34 x 17,5 *	42 610 445 00 03
10	370 x 34 x 17	42 601 250	10	370 x 34 x 17	42 601 450	10	370 x 34 x 17,5 *	42 610 450 00 03
11	400 x 34 x 17	42 601 255	11	400 x 34 x 17	42 601 455	11	400 x 34 x 17,5 *	42 610 455 00 03
1	115 x 30 x 17 *	42 601 605	1	115 x 30 x 17 *	42 601 805	1	115 x 30 x 17,5 *	42 610 805 00 03
2	140 x 30 x 17	42 601 610	2	140 x 30 x 17	42 601 810	2	140 x 30 x 17,5 *	42 610 810 00 03
3	165 x 30 x 17	42 601 615	3	165 x 30 x 17	42 601 815	3	165 x 30 x 17,5 *	42 610 815 00 03
4	190 x 30 x 17	42 601 620	4	190 x 30 x 17	42 601 820	4	190 x 30 x 17,5 *	42 610 820 00 03
5	220 x 30 x 17	42 601 625	5	220 x 30 x 17	42 601 825	5	220 x 30 x 17,5 *	42 610 825 00 03
6	250 x 30 x 17	42 601 630	6	250 x 30 x 17	42 601 830	6	250 x 30 x 17,5 *	42 610 830 00 03
7	280 x 30 x 17	42 601 635	7	280 x 30 x 17	42 601 835	7	280 x 30 x 17,5 *	42 610 835 00 03
8	320 x 30 x 17	42 601 640	8	320 x 30 x 17	42 601 840	8	320 x 30 x 17,5 *	42 610 840 00 03
9	340 x 30 x 17	42 601 645	9	340 x 30 x 17	42 601 845	9	340 x 30 x 17,5 *	42 610 845 00 03

* Supplementary to the DIN standard



Packed ILMADUR® level gauge glasses to DIN 7081, BS 3463, JIS B 8286, Ö-Norm M 7354 and MIL G 16356 D

RANGE OF PRODUCTS

Standard						High Pressure		
Reflex			Transparent			Transparent		
Size	Dimensions l x b x s / mm	Part No.	Size	Dimensions l x b x s / mm	Part No.	Size	Dimensions l x b x s / mm	Part No.
0	3.750 x 1.347 x 0.688	42 620 200	0	3.750 x 1.347 x 0.688	42 620 400	0	3.750 x 1.347 x 0.688	42 620 400 00 03
1	4.5 x 1.347 x 0.688	42 620 205	1	4.5 x 1.347 x 0.688	42 620 405	1	4.5 x 1.347 x 0.688	42 620 405 00 03
2	5.5 x 1.347 x 0.688	42 620 210	2	5.5 x 1.347 x 0.688	42 620 410	2	5.5 x 1.347 x 0.688	42 620 410 00 03
3	6.5 x 1.347 x 0.688	42 620 215	3	6.5 x 1.347 x 0.688	42 620 415	3	6.5 x 1.347 x 0.688	42 620 415 00 03
4	7.5 x 1.347 x 0.688	42 620 220	4	7.5 x 1.347 x 0.688	42 620 420	4	7.5 x 1.347 x 0.688	42 620 420 00 03
5	8.625 x 1.347 x 0.688	42 620 225	5	8.625 x 1.347 x 0.688	42 620 425	5	8.625 x 1.347 x 0.688	42 620 425 00 03
6	9.875 x 1.347 x 0.688	42 620 230	6	9.875 x 1.347 x 0.688	42 620 430	6	9.875 x 1.347 x 0.688	42 620 430 00 03
7	11 x 1.347 x 0.688	42 620 235	7	11 x 1.347 x 0.688	42 620 435	7	11 x 1.347 x 0.688	42 620 435 00 03
8	12.625 x 1.347 x 0.688	42 620 240	8	12.625 x 1.347 x 0.688	42 620 440	8	12.625 x 1.347 x 0.688	42 620 440 00 03
9	13.375 x 1.347 x 0.688	42 620 245	9	13.375 x 1.347 x 0.688	42 620 445	9	13.375 x 1.347 x 0.688	42 620 445 00 03

Dimensional and shape tolerances

Level gauge glass width 34 mm			Level gauge glass width 30 mm			Imperial Size		
(in mm)	Standard	High Pressure	(in mm)	Standard	High Pressure	(in inch)	Standard	High Pressure
Length (l)	+ 0/-1,5	+ 0/-1,5	Length (l)			Length (l)	-0.031	-0.031
Width (b)	+ 0,2/-0,8	+ 0,2/-0,8	≤ 220	± 0,8	± 0,8	Width (b)	-0.04	-0.040
Thickness (s)	+ 0,5/-0,5	+ 0/-0,1	≥ 250	± 1,0	± 1,0	Thickness (s)	-0.032	-0.004
Flatness (e)			Width (b)	± 0,8	± 0,8	Flatness (e)		
l ≤ 165	0,05	0,05	Thickness (s)	± 0,5	+ 0/-0,1	l ≤ 6.5	0.002	0.002
165 < l ≤ 220	0,08	0,05	Flatness (e)			7.5 < l ≤ 8.6	0.003	0.002
l > 220	0,13	0,05	l ≤ 165	0,05	0,05	9.875 < l ≤ 13.375	0.005	0.002
Parallelism	≤ 0,08	≤ 0,08	165 < l ≤ 220	0,08	0,05	Parallelism	≤ 0.003	≤ 0.003
			l > 220	0,13	0,05			
			Parallelism	≤ 0,08	≤ 0,08			

Experience shows that our ILMADUR® sight glasses to DIN 7080 and level gauge glasses to 7081 cover the majority of applications and requirements. However, if you have specific requirements for a particular application, simply contact us. Following detailed discussions we can supply you with (almost) any type of custom sight glass.

For example, if you need dimensions other than those in our range of sizes, we – as a full-service supplier – can provide you with suitable alternatives. Or we can propose suitable special glasses, especially when thermal, chemical or pressure loads exceed the applications specified in the DIN standard. It is always your specific technical application parameters that determine the material, geometry and production of your custom glasses. Our specialists will be pleased to advise you. Together we develop your individual solution and devise a sensible method of implementation. And we of course provide you with the necessary test certificates. We look forward to receiving your inquiry.



Safety information for the use of ILMADUR® sight and gauge glasses

Every one of our sight and gauge glasses is manufactured with great care and checked several times during production. However, a sight glass can fulfil its task only 100% reliably when the features of the glass match the in situ conditions and when our advice regarding installation and use are fully adhered to. The following information is intended to supplement that advice.

The first priority in the application of any sight and gauge glass is the safety of the process. This is why we have listed the general relationships for the most important process parameters (pressure and temperature under known in situ conditions) in the tables on pages 9, 10, 12 and 13 of this catalogue. Following the additional advice on this page means you are always on the safe side.

■ Apparatus

Always follow the recommendations of the manufacturer when installing or changing sight and gauge glasses. The housings and flanges of armature must meet the customary requirements resulting from the pressure and temperature conditions of the particular application. Guaranteeing that the sealing surfaces are flat and free from distortion is especially important. These surfaces must fulfil at least the same requirements as those specified for the glasses. Check the flatness after cleaning the sealing surfaces thoroughly. Never use a sight or gauge glass that has already been subjected to the operating conditions.

■ Sealing material

Always use new seals when fitting a sight or gauge glass. Use the sealing material recommended by the armature manufacturer. This material, too, must be flat and undamaged.

■ Correct sequence

Always fit the glass and seals in the right order.

■ Mica protection

You can use mica protection to weaken the effect of a specific medium on

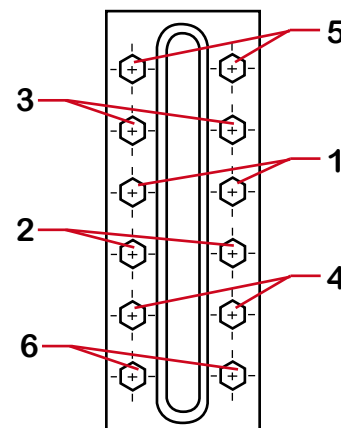
the surface of the glass and therefore prolong the service life of the sight or gauge glass. This type of protection cannot be used on Reflex level gauge glasses.

■ Installation

Always install the sight or gauge glass in the armature so that contact between glass and metal is avoided.

■ Tightening the screws

First of all, tighten the cleaned and greased screw/nuts by hand. Then tighten them in the following sequence: always start in the middle and then proceed outwards, alternating either side of the middle screws. Finally, tighten the flange screws/nuts with the exact torque as recommended by the manufacturer.



■ During operation

Never attempt to clean the glass by mechanical means, retighten the screws of the armature or carry out other work on the apparatus that could damage the glass.

■ Transport packaging

Leave the glasses in their safe transport packaging until you are ready to install them. Avoid knocking them against other glasses and metal parts.

■ Scratches

Never install sight and gauge glasses that have scratches, spalling, impact damage or other surface damage.

■ Inspections

Check the condition of the glasses regularly, every day when used in new, unknown processes. Keep records of maintenance and replace the glasses regularly. Never ignore any damage, scratches or corrosion.

■ Cleaning

Use only conventional glass cleaning products for cleaning the outside of the glasses. Never use wire brushes, metal scrapers or other sharp objects that could scratch the glass and render it unusable. Replace any obscured and rough glasses that can no longer be cleaned with simple cleaning products.

It is our aim to advise and inform our customers conscientiously and comprehensively. However, general empirical values and test results cannot necessarily be transferred to specific applications in situ. Many factors play a role here over which we have no control. We therefore ask for your understanding that no claims can be derived from our advice. Please check carefully yourself in every individual case.



Technische Glaswerke Ilmenau GmbH

1. General

1.1 (Conflicting conditions, written form) Contracts are subject to our General Standard Terms and Conditions only; other conditions do not form a part of the contract, even when we have not expressly repudiated them. Ancillary agreements made before and during finalization of the contract can only be invoked by the customer if these are confirmed immediately in writing.

1.2 (Offers, reservation of the right to make improvements, data acquisition) Our offers are without engagement. We reserve the right to make technical improvements to our products. Important data for processing orders can be stored in an electronic data processing system.

1.3 (Offsets, retentions) Offset or retention by the customer is only permissible for undisputed or legally enforceable counterclaims.

1.4 (Place of performance, place of jurisdiction, legal system) The place of performance for delivery and payment is Ilmenau. We are entitled to take legal proceedings against a customer before the court which is competent for our place of business. German law is applicable; UN purchasing law (CISG) is excluded.

2. Risks, delivery charges, over/under supply, call-up orders, default in acceptance

2.1 The risk for delivered goods passes to the customer when the goods leave our premises. This applies even when additional services have been undertaken such as despatch, export or assembly.

2.2 Costs for transport, packaging and insurance up to the place of

delivery are to the customer's account. We are only obliged to obtain transport insurance on the customer's expressed request.

2.3 Customary over/under supply up to 5% is permitted. The customer must pay for the amount delivered at the agreed unit price.

2.4 For call-up orders the amount to be delivered must be accepted within 120 days from confirmation at the latest. Call-ups must be made at least 4 weeks before the required delivery date.

2.5 If default in acceptance occurs we are entitled to transfer the goods to a warehouse for storage at the customer's cost; our right to performance is maintained. We will threaten the customer with the disposal of the goods; one month after our threat has been issued we are entitled to dispose of the goods as we see fit to the customer's account.

3. Time of delivery, delay

3.1 A time of delivery only exists when it has been confirmed by us in writing. It begins only when all technical questions still open when the contract was signed have been cleared up and the customer has provided us with all the documentation, authorizations and releases which he was required to obtain for us. Furthermore, it does not begin until any initial payment which might have been stipulated has been received. Notification that the goods are ready for despatch or the actual despatch of the goods themselves is sufficient to fulfil the time of delivery.

3.2 Acts of God, as well as strikes, lockouts and similar events beyond our control increase the time of delivery accordingly; if for such reasons it proves to be impossible to make delivery then we are released from

our obligation to supply. This also applies to equipment failure, plant interruption, shortage of raw materials and operating resources, delayed delivery or non-delivery by suppliers or additional performances required by the customer when such circumstances are beyond our control.

3.3 Before a delay can be presumed a reminder must have been issued. We are liable only for damages caused by delay as a result of intentional or gross negligence on the part of our managers, employees and vicarious agents. The liability is limited to those damages which could be foreseen at the time the contract was finalized.

4. Prices, terms of payment, interest on arrears, advance payment

4.1 All prices are to be understood ex works and do not include the current value-added tax. The currently valid list price will be charged for spare parts.

4.2 Invoices are to be paid within 30 days without any deductions. We only accept bills of exchange and cheques at the customer's cost and on account of performance.

4.3 For delays in making payment and subject to further-reaching claims for damages the customer must pay interest on arrears at a rate 4% above the federal bank interest rate, unless he can prove that the damages amount to less than this.

4.4 If there are reasonable doubts about a customer's creditworthiness we can demand payment in advance for each individual delivery or make such deliveries dependent on appropriate securities being provided.

5. Reservation of ownership, assignment in advance, right to information

5.1 The goods supplied remain our property complete and unconditional payment has been made. If we have other accounts receivable from the customer then ownership is reserved until these have also been paid. The customer may only resell goods whose ownership is reserved – in the course of ordinary business – if claims arising from their selling have not been assigned, pledged or otherwise encumbered. This prohibition on resale also applies when the claims can be offset against counterclaims.

5.2 The customer does not acquire any ownership of goods whose ownership is reserved by processing them. The customer must not combine goods whose ownership is reserved with other articles which are subject to third-party rights. If goods whose ownership is reserved are combined with other articles to become a part of a new (total) article then we become directly proportional co-owners of this article. This also applies if a different article is regarded as being the main object. The proportion of co-ownership is calculated from the proportion of the invoice amount of the goods whose ownership is reserved to the value of the new article at the time of the combination. Goods whose ownership is reserved or on which we have a proportional co-ownership are to be stored by the customer free of any charge to us.

5.3 The customer assigns us his claims against his customers arising from the sales of goods whose ownership is reserved (§5.1 and 5.2) to the amount of the invoice for the goods whose ownership is reserved in advance as security. In the case of factoring the customer may only sell goods whose ownership we have reserved or of which we are co-owners when the factor is aware of the assignment in advance

to us and pays our delivery invoice directly to us.

5.4 At the customer's request we will release securities of our choice when and so far as the value of these securities exceeds the value of our open accounts receivable due from the customer by more than 10%.

5.5 If the customer defaults in the payment for the goods then his rights to their processing or combination with other articles and/or the redemption of assigned accounts receivable expire (§5.3). The share of revenue concerning the assignment may only be used to pay for the goods. We can demand the return of any goods still present and separable on the customer's premises.

5.6 In the case of default in payment we are furthermore entitled to have the customer's books examined by person(s) bound by an oath of professional secrecy with regard to all circumstances affecting our reserved rights. The customer must notify us immediately of seizure or attachment of the goods whose ownership is reserved or other dispositions made by third parties.

6. Guarantee, damages, availability of spare parts

6.1 Information in promotional material and operating instructions or reference to industrial standards do not form the basis for the warranty of a quality or the acceptance of particular initial duties.

6.2 The customer relinquishes all claims for guarantee and replacement arising from obvious defects or the lack of assured properties if the goods are not carefully inspected immediately on receipt or, at the latest, before use, assembly or resale – also for product safety – and we are notified immediately of any complaints. Complaints must be made in writing.

6.3 In the case of justified complaints and after the customer has set us a reasonable time limit we are initially only obliged to either rectify, exchange or make subsequent delivery of the goods or their individual components at no charge to the customer.

6.4 For unfounded rejection, failure or the impossibility of the above guarantee measures the customer can demand cancellation of the sales or reduction in the purchase price and, if assured properties are missing, demand damages. The liability for damages resulting from defects is limited to those damages which could be foreseen at the time the contract was finalized.

6.5 Claims for damage by the customer which arise from positive breach of an obligation, advice, maintenance, operating instructions or faults when finalizing the contract only exist against us for damage caused intentionally or by gross negligence.

6.6 Claims by the customer arising from unauthorized acts are limited to three years. Guarantee claims are limited to 6 months; the same applies to other claims mentioned in §6.5. The limitation period starts with the delivery of the goods.

6.7 Warranty claims and claims for damages are excluded if they are caused by improper handling, maintenance or operation of the goods through no fault of ours, or if the operating instructions have not been followed, or if they are caused by normal wear and tear. The same applies to transport damage. Furthermore we are not liable for any damages which could have been avoided if the customer had carefully checked the goods upon arrival. Our liability for the customer's production losses is excluded.



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6.8 Warranty claims and claims for damages concerning rectified, exchanged or subsequently delivered goods are also based on §6.1 to 6.7. They expire at the end of the limitation period which applies to the original article. Guarantee measures do not interrupt the original limitation period.

6.9 Inasmuch as we are obliged to maintain a stock of spare parts then this is limited to a period of 5 years after delivery.

7. Industrial property rights, compensation for performances before finalization of contract, secrecy

7.1 We retain the ownership and all industrial property rights and copyright of all designs, drawings, devices, samples, illustrations, technical documentation, estimates and invoices made or supplied by us. This also applies when the customer has paid the design costs, etc. The customer may only use the designs, etc., in the agreed manner. He may not produce the goods himself nor allow then to be produced without our written authorization.

7.2 If we supply products made from drawings, samples, models, or tools, patterns or other devices with which the customer has provided us then it is the customer's responsibility to us that their manufacture and supply has not infringed the industrial property rights and other rights of third parties. He must compensate us for all damages resulting from such legal infringements.

7.3 For performances carried out within the framework of the contractual negotiations such as designs or offers we can demand the customary payment for such performances even without making a subsequent delivery, in particular if the customer utilizes these performances

as the basis for obtaining competitive offers.

7.4 The customer is to keep secret all information he receives from us as a result of our business connection and which is not public knowledge.

8. Tools, patterns

8.1 We retain the ownership of all patterns, tools and other devices made by us or supplied by third parties which are necessary for carrying out an order. This also applies even when the customer has paid part or all of the costs. There is no obligation on our part to transfer ownership of the items to the customer. We will store these items until the agreed contractual amount has been reached. No obligation for us to make subsequent deliveries or to store the items for longer than 2 years exists, provided that no special agreement has been made.

8.2 Tools, patterns or other devices which the customer has provided us with will be kept within the framework of our own customary care. Liability arising from wear and tear is excluded. We will service the tools, etc., only on the basis of a special agreement. The risk of accidental loss remains with the customer. The customer is also responsible for insuring his tools, etc. Until our justified claims have been fully met we have the right of retention of the tools, etc.

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LABORATORY GLASSWARE

LABORGLAS

ILMABOR®
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HAUSHALTSGLAS

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PRESSED TECHNICAL GLASS PRODUCTS

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