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# APPROVAL REPORT

## METAGLAS SERIES SIGHT GLASSES AND L.J. STAR SERIES SIGHT FLOW INDICATORS

**Prepared for:**

**Herberts Industrielglas, GmbH & Co. KG  
Gewerbeschulstrasse 72  
Wuppertal, Germany 42289**

**Project ID. 0Z2A2.AF  
Class 6076  
Date: February 3, 2003**

FM Approvals  
1151 Boston-Providence Turnpike  
P.O. Box 9102  
Norwood, MA 02062

An  FM Global Enterprise

**METAGLAS SERIES SIGHT GLASSES  
AND  
L.J. STAR SERIES SIGHT FLOW INDICATORS**

**February 3, 2003**

**from**

**Herberts Industrielglas GmbH & Co. KG  
Gewerbschulstrasse 72  
Wuppertal, Germany 42289**

**I INTRODUCTION**

- 1.1 Herberts Industrielglas GmbH & Co. KG requested FM Approval of their Metaglas Series sight glasses and L.J. Star series sight flow indicators.
- 1.1.1 Sight glasses are installed in ports on chemical processing tanks or other vessels and in pipelines to permit observation of conditions within the vessel or pipeline.
- 1.1.2 Sight flow indicators are installed in pipelines to permit observation of the flow through the pipeline.
- 1.2 This equipment meets the requirements of FM Approvals and will appear in the Flammable Liquid Equipment section of the FM Approvals' *Approval Guide*. The listing information is in the Appendix to this report.
- 1.3 This report may be freely reproduced only in its entirety and without modification.

**II DESCRIPTION**

- 2.1 The variations in product design are too numerous to be explained in writing. A description of each design is best served by referring to the manufacturer's information included at the end of this report.
- 2.2 The metallic rings for the Metaglas Series sight glasses and L.J. Star series sight flow indicators are available in Hastelloy, carbon and stainless steels.

**III MARKING**

The sight glass ring is engraved with the size, type, material, and pressure rating. A nameplate with the FM Approval Mark is attached to the ring.

#### IV EXAMINATIONS AND TESTS

- 4.1 The following samples were examined and tested at the manufacturer's facility in Wuppertal, Germany.

##### Metaglas Sight Glasses, Lumiglas Series DN 28120

Ring O.D. X Glass Dia. X Thickness	Room Temperature	Pressure Rating @	
Inches (mm)	Psig (bar)	536°F (280°C)	Psig (bar)
1.77 X 0.98 X 0.39 (45 X 25 X 10)	1163 (114)	565	(39)
3.15 X 1.77 X 0.47 (80 X 45 X 12)	725 (50)	248	(17)

##### Metaglas Sight Glasses for ANSI Bolt-On Raised Face Flanges

ANSI Nominal Size	O.D. X Glass Dia. X Thickness	Pressure Rating @ 536°F 280°C	
Inches	Inches (mm)	Psig (bar)	Psig (bar)
2	3.94 X 2.17 X 0.59 (100 X 55 X 15)	797 (55)	270 (19)
3	5.71 X 2.76 X 0.79 (145 X 70 X 20)	797 (55)	270 (19)
5	7.56 X 3.94 X 0.79 (192 X 100 X 20)	435 (30)	145 (10)
8	10.75 X 4.72 X 1.18 (273 X 120 X 30)	686 (47)	233 (16)
10	13.23 X 5.91 X 1.18 (336 X 150 X 30)	435 (30)	145 (10)

- 4.2 Examination found the samples to be in conformance with the manufacturer's published information and drawings with respect to materials, dimensions, components, markings, and workmanship, and to comply with FM Approval requirements.
- 4.3 The samples were subjected to a five minute pressure test at four times their respective rated pressure, while at the maximum rated temperature.
- 4.3.1 Each sample was heated to a minimum temperature of 536°F (280°C). The samples were then subjected to a pressure of four times their respective rated pressure. The heat source was removed during the pressure test.
- 4.3.2 Each sample maintained the test pressure during the five minute period and none of the lenses showed signs of cracking during the test. The samples passed this test.
- 4.4 The samples were subjected to an impact test while at rated temperature and pressure.
- 4.4.1 Each sample was heated to a minimum temperature of 536°F (280°C). While at rated temperature

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the heat source was removed and the samples were in turn pressurized to their respective rated pressure. A 1.1 lb (0.51 kg) steel ball was dropped onto the glass surface of each sample from a height of 5 ft. (153 cm).

- 4.4.2 Each sample's window chipped, which is allowed by the test procedure, but none of the samples lost pressure. The samples passed this test.
- 4.4.3 The samples were then subjected to a thermal shock test while at rated temperature and pressure.
- 4.4.4 Each sample was in turn heated to a minimum temperature of 536°F (280°C). The heat source was removed and the samples were in turn pressurized to their respective rated pressure. A stream of water at room temperature and at a minimum pressure of 40 psi (275 kPa) was directed onto each sample's glass surface for one minute. Each sample's window developed cracks, which is allowed by the test procedure, but none of the samples lost pressure. The samples passed this test.

**V      REMARKS**

This equipment shall be used only in accordance with the manufacturers instructions.

**VI     FACILITIES AND PROCEDURES AUDIT**

A first Facilities and Procedures Audit was conducted at the site manufacturing these products, Herberts Industrielglas GmbH & Co. KG, Gewerbeschulstrasse 72, Wuppertal, Germany, in connection with this examination. Conditions were found to be satisfactory. This facility will be included in FM Approvals' Facilities and Procedures Audit program for future follow-up audits.

**VII    MANUFACTURERS RESPONSIBILITIES**

As part of the listing requirements, FM Approvals requires assurance that subsequent units produced will present the same quality and reliability as the specific unit examined. The manufacturer shall maintain a Quality Assurance Program which includes as a minimum: incoming inspection and testing, in-process inspection and testing, final inspection and testing, equipment calibration, and drawing change control. The specific procedures used to control quality are best determined by the manufacturer.

**VIII   DOCUMENTATION**

A documentation file is attached.

**IX     CONCLUSION**

The equipment listed in paragraph 1.2 of this report meets FM Approvals requirements. Approval is effective when the Approval Agreement is signed and received by FM Approvals.

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**ORIGINAL DATA:** Project Data Record 0Z2A2.AF.

**ATTACHMENTS:** Documentation File.

Appendix

Drawing No. 173, Sheet 1, Sight Glass Disc for Lumiglas Series DIN 28120.

Drawing No. 176, Sheet 1, Sight Glass Disc for ANSI Bolt-On Raised Face Flanges.

Drawing No. 177, Sheet 1, Sight Glass Disc for L.J. Starr Visual Flow Indicators.

**EXAMINATION AND REPORT BY:**



Jerry L. Harpin  
Engineer,  
Systems

JLH

**REVIEWED BY:**



Jeffrey E. Gould  
Technical Team Manager,  
Materials Group

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**DOCUMENTATION FILE**

The following drawings/information are on file at FM Approvals. No change to this information is permitted without prior written consent of FM Approvals. Requests for changes to the drawings (information) shall be submitted to FM Approvals on Form 797, Approved Product-Revision Report. Unauthorized changes may result in withdrawal of Approval.

<b>Drawing No.</b>	<b>Drawing Title</b>	<b>Revision</b>
173 Sheets 1 - 34	Sight Glass Disc for Lumiglas Series DIN 28120	-
176 Sheets 1 - 25	Sight Glass Disc for ANSI Bolt-On Raised Face Flanges	-
177 Sheets 1 - 16	Sight Glass Disc for L.J. Starr Visual Flow Indicators	-

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Appendix

*FM Approvals' Approval Guide. Listing Information for Sight Glasses*

Metaglas Sight Glasses, Lumiglas Series DN 28120

O.D. X Glass Dia. X Thickness Inches (mm)	Pressure Rating @		536°F (280°C) Psig (bar)
	Room Temperature Psig (bar)	(114)	
1.77 X 0.98 X 0.39 (45 X 25 X 10)	1163	(114)	565 (39)
2.36 X 1.38 X 0.39 (60 X 35 X 10)	797	(55)	270 (19)
2.36 X 1.38 X 0.47 (60 X 35 X 12)	797	(55)	270 (19)
2.36 X 1.38 X 0.59 (60 X 35 X 15)	1163	(114)	561 (39)
2.48 X 1.38 X 0.39 (63 X 35 X 10)	797	(55)	270 (19)
2.48 X 1.38 X 0.47 (63 X 35 X 12)	797	(55)	270 (19)
2.48 X 1.38 X 0.59 (63 X 35 X 15)	1163	(114)	561 (39)
3.15 X 1.77 X 0.39 (80 X 45 X 10)	435	(30)	145 (10)
3.15 X 1.77 X 0.47 (80 X 45 X 12)	725	(50)	248 (17)
3.15 X 1.77 X 0.59 (80 X 45 X 15)	797	(55)	270 (19)
3.15 X 1.77 X 0.79 (80 X 45 X 20)	1163	(114)	561 (39)
3.94 X 2.17 X 0.47 (100 X 55 X 12)	435	(30)	145 (10)
3.94 X 2.17 X 0.59 (100 X 55 X 15)	797	(55)	270 (19)
3.94 X 2.17 X 0.79 (100 X 55 X 20)	797	(55)	270 (19)
3.94 X 2.17 X 0.98 (100 X 55 X 25)	1163	(114)	561 (39)
4.92 X 2.56 X 0.59 (125 X 65 X 15)	435	(30)	145 (10)
4.92 X 2.56 X 0.79 (125 X 65 X 20)	797	(55)	270 (19)
4.92 X 2.56 X 0.98 (125 X 65 X 25)	1163	(114)	561 (39)
5.91 X 2.76 X 0.79 (150 X 70 X 20)	797	(55)	270 (19)
5.91 X 2.76 X 0.98 (150 X 70 X 25)	797	(55)	270 (19)
5.91 X 2.76 X 1.18 (150 X 70 X 30)	1163	(114)	561 (39)
6.89 X 3.15 X 0.79 (175 X 80 X 20)	686	(47)	233 (16)
6.89 X 3.15 X 0.98 (175 X 80 X 25)	797	(55)	270 (19)
6.89 X 3.15 X 1.18 (175 X 80 X 30)	797	(55)	270 (19)
7.87 X 3.94 X 0.98 (200 X 100 X 25)	686	(47)	233 (16)
7.87 X 3.94 X 1.18 (200 X 100 X 30)	797	(55)	270 (19)
9.84 X 4.72 X 1.18 (250 X 120 X 30)	686	(47)	233 (16)

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*FM Approvals' Approval Guide.* Listing Information for Sight Glasses - Continued

**Metaglas Sight Glasses for ANSI Bolt-On Raised Face Flanges**

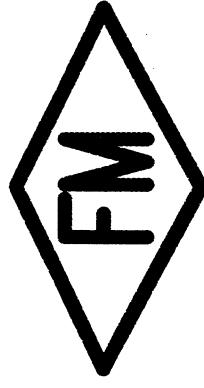
ANSI Nominal Size	O.D. X Glass Dia. X Thickness	Pressure Rating @			
		Room Temp.	536°F	280°C	
Inches	Inches (mm)	Psig	(bar)	Psig	(bar)
1	2.48 X 1.38 X 0.39 (63 X 35 X 10) 2.76 X 1.57 X 0.39 (70 X 40 X 10) 2.76 X 1.57 X 0.59 (70 X 40 X 15) 3.23 X 1.77 X 0.47 (82 X 45 X 12)	797 686 797 725	(55) (47) (55) (50)	270 233 270 248	(19) (16) (19) (17)
1 1/2	3.62 X 1.97 X 0.59 (92 X 50 X 15) 3.62 X 1.97 X 0.79 (92 X 50 X 20)	797 797	(55) (55)	270 270	(19) (19)
2	3.94 X 2.17 X 0.59 (100 X 55 X 15) 4.21 X 1.97 X 0.79 (107 X 50 X 20)	797 797	(55) (55)	270 270	(19) (19)
3	5.28 X 2.76 X 0.59 (134 X 70 X 15) 5.71 X 2.76 X 0.79 (145 X 70 X 20) 5.71 X 2.76 X 0.98 (145 X 70 X 25)	435 797 797	(30) (55) (55)	145 270 270	(10) (19) (19)
4	6.73 X 3.15 X 0.79 (171 X 80 X 20) 6.73 X 3.15 X 0.98 (171 X 80 X 25) 7.48 X 3.15 X 1.18 (190 X 80 X 30)	686 797 797	(47) (55) (55)	233 270 270	(16) (19) (19)
5	7.56 X 3.94 X 0.79 (192 X 100 X 20)	435	(30)	145	(10)
6	8.58 X 3.94 X 0.98 (218 X 100 X 25) 9.61 X 4.72 X 1.18 (244 X 120 X 30) 10.35 X 4.72 X 1.18 (263 X 120 X 30)	686 686 686	(47) (47) (47)	233 233 233	(16) (16) (16)
8	10.75 X 4.72 X 1.18 (273 X 120 X 30) 12.01 X 4.92 X 1.18 (305 X 125 X 30) 12.40 X 4.92 X 1.18 (315 X 125 X 30)	686 435 435	(47) (30) (30)	233 145 145	(16) (10) (10)
10	13.23 X 5.91 X 1.18 (336 X 150 X 30) 14.09 X 5.12 X 1.18 (358 X 130 X 30)	435 435	(30) (30)	145 145	(10) (10)

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FM Approvals' *Approval Guide*. Listing Information for Sight Flow Indicators

Metaglas Sight Glasses for L.J. Star Visual Flow Indicators

O.D. X Glass Dia. X Thickness Inches (mm)	Pressure Rating @		536°F Psig	280°C (bar)
	Room Temp. Psig	(bar)		
1.77 X 0.98 X 0.39 (45 X 25 X 10)	1163	(114)	565	(39)
1.97 X 0.98 X 0.39 (50 X 25 X 10)	1163	(114)	565	(39)
2.60 X 1.38 X 0.47 (66 X 35 X 12)	797	(55)	270	(19)
2.60 X 1.38 X 0.59 (66 X 35 X 15)	1163	(114)	561	(39)
2.99 X 1.57 X 0.47 (76 X 40 X 12)	797	(55)	270	(19)
2.99 X 1.57 X 0.59 (76 X 40 X 15)	797	(55)	270	(19)
4.92 X 2.56 X 0.79 (125 X 65 X 20)	797	(55)	270	(19)
8.58 X 3.94 X 0.98 (218 X 100 X 25)	686	(47)	233	(16)
8.58 X 3.94 X 1.18 (218 X 100 X 30)	797	(55)	270	(19)



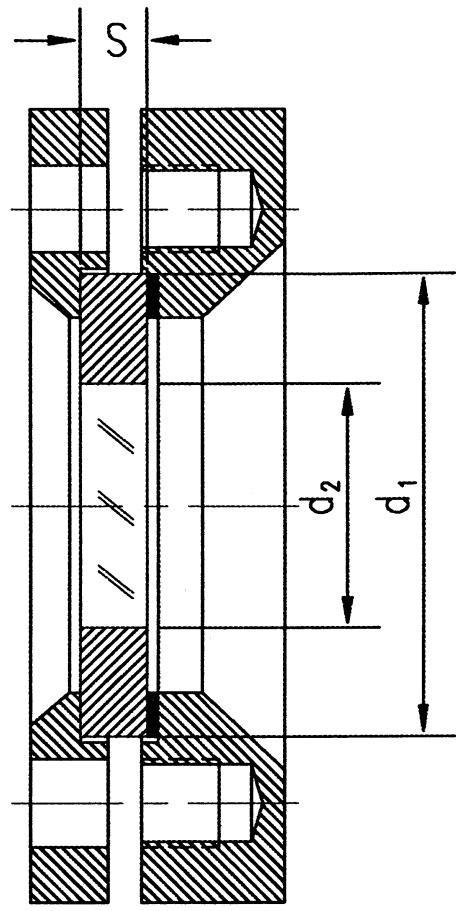
APPROVED

SIGHT GLASS FUSED TO METAL CONFORMING  
TO DIN 7079

GLASS: BOROSILICATE (DIN 7080)

PRESSURE/TEMPERATURE CHARTS FOR EACH DISC  
SIZE IS AVAILABLE UPON REQUEST

NOTE: FM must authorize all changes to drawings



$d_1$	$d_2$	RECOMMENDED THICKNESS			RING MATERIAL	MAX. WORKING TEMPERATURE
		150 psi	250 psi	350 psi		
1.77	(45) 0.98	(25) 0.39	(10) 0.47	(12) 0.59	(15)	
2.36	(60) 1.38	(35) 0.39	(10) 0.47	(12) 0.59	(15)	
2.48	(63) 1.38	(35) 0.39	(10) 0.47	(12) 0.59	(15)	
3.15	(80) 1.77	(45) 0.39	(10) 0.47	(12) 0.59	(15)	
3.94	(100) 2.17	(55) 0.47	(12) 0.59	(15) 0.79	(20) 0.98	
4.92	(125) 2.56	(65) 0.59	(15) 0.79	(20) 0.98	(25) 1.06	
5.91	(150) 2.76	(70) 0.79	(20) 0.98	(25) 1.18	(30) 1.32	
6.89	(175) 3.15	(80) 0.79	(20) 0.98	(25) 1.18	(30) 1.26	Carbon Steel (1.0570)
7.87	(200) 3.94	(100) 0.98	(25) 1.18	(30) 1.26	(32) 1.32	Duplex Stainless Steel (1.4462)
9.84	(250) 4.72	(120) 1.18	(30) 1.26	(32) 1.50	(38) 1.73	Hastelloy C-4 (2.4610)
						METAGLAS® SIGHT GLASS DISC FOR LUMIGLAS® SERIES DIN 28120 OR SIMILAR

MANUFACTURED BY:

L. J. STAR INCORPORATED  
 P. O. BOX 280  
 FREDONIA, N. Y. 14063  
 TELEPHONE 716-366-0508  
 FAX 716-366-0509

Herberts Industrieglas  
 GmbH & Co.  
 KG  
 GEWERBESCHULSTRASSE 72  
 D-42289 WUPPERTAL GERMANY

DATE	NAME
DESIGNED Feb. 1996	Schulz
CHEKED	

DATE	NAME
CHANGED	
DESCRIPTION OF CHANGE	DATE NAME

DWG NO. 173  
 SHEET NO. 1



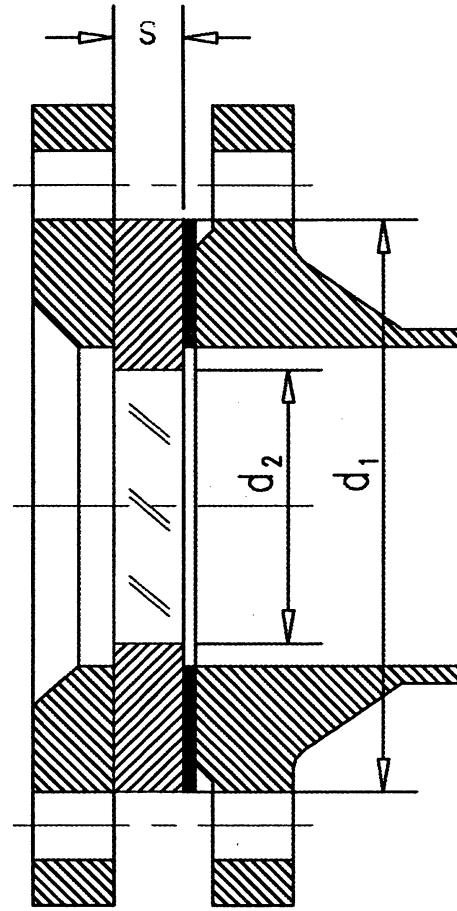
APPROVED

SIGHT GLASS FUSED TO METAL CONFORMING  
TO DIN 7079

GLASS: BOROSILICATE (DIN 7080)

PRESSURE/TEMPERATURE CHARTS FOR EACH DISC  
SIZE IS AVAILABLE UPON REQUEST

NOTE: FM must authorize all changes to drawings



ANSI NOMINAL SIZE	RECOMMENDED ANSI PRESSURE CLASS DISC SIZE						MAXIMUM WORKING TEMP.
	150 PSI	300 PSI	600 PSI	d <sub>1</sub>	d <sub>2</sub>	S	
INCH (MM)	INCH (MM)	INCH (MM)	INCH (MM)	INCH (MM)	INCH (MM)	INCH (MM)	INCH (MM)
1"	2.48 (63)	1.38 (35)	1.0 (30)	2.76 (70)	1.57 (40)	0.47 (12)	2.76 (70) 1.57 (40) 0.71 (18)
1 1/2"	3.23 (82)	1.77 (45)	1.47 (37)	3.62 (92)	1.97 (50)	0.59 (15)	3.62 (92) 1.97 (50) 0.87 (22)
2"	3.94 (100)	2.17 (55)	1.5 (38)	4.21 (107)	1.97 (50)	0.79 (20)	4.21 (107) 1.97 (50) 0.79 (20)
3"	5.28 (134)	2.76 (70)	1.59 (40)	5.71 (145)	2.76 (70)	0.79 (20)	5.71 (145) 2.76 (70) 1.10 (28)
4"	6.73 (171)	3.15 (80)	1.79 (45)	6.73 (171)	3.15 (80)	0.98 (25)	7.48 (190) 3.15 (80) 1.26 (32)
5"	7.56 (192)	3.94 (100)	1.79 (45)				
6"	8.58 (218)	3.94 (100)	1.98 (50)	9.61 (244)	4.72 (120)	1.38 (35)	10.35 (263) 3.94 (100) 1.57 (40) Carbon Steel (1.0570) 536°F (280°C)
8"	10.75 (273)	4.72 (120)	1.18 (30)	12.01 (305)	4.92 (125)	1.38 (35)	12.40 (315) 3.94 (100) 1.57 (40) Duplex Stainless Steel (1.4462) 536°F (280°C)
10"	13.23 (336)	5.91 (150)	1.18 (30)	14.09 (358)	5.12 (130)	1.38 (35)	Hastelloy C-4 (2.4610) 536°F (280°C)

MANUFACTURED BY:

Herberts Industrieglas  
GmbH & Co. KG  
GEWERBESCHULSTRASSE 72  
D-42289 WUPPERTAL GERMANY

METAGLAS®

SIGHT GLASS DISC  
FOR ANSI BOLT-ON  
RAISED FACED FLANGES

NAME	
DATE	
DESIGNED	Feb. 1996
CHECKED	<i>[Signature]</i>

L. J. STAR INCORPORATED

P. O. BOX 280  
FREDONIA, N. Y. 14063  
TELEPHONE 716-366-0508  
FAX 716-366-0509

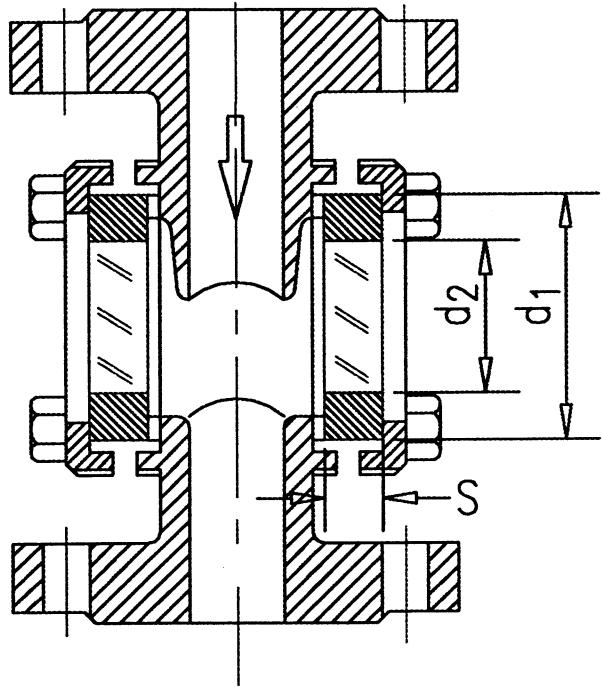


SIGHT GLASS FUSED TO METAL CONFORMING  
TO DIN 7079

GLASS: BOROSILICATE (DIN 7080)

PRESSURE/TEMPERATURE CHARTS FOR EACH DISC  
SIZE IS AVAILABLE UPON REQUEST

NOTE: FM must authorize all changes to drawings



ANSI NOMINAL SIZE	ANSI PRESSURE CLASS DISC SIZE						MAXIMUM WORKING TEMP.
	150 PSI		300 PSI		600 PSI		
	d <sub>1</sub> INCH (MM)	d <sub>2</sub> INCH (MM)	S INCH (MM)	d <sub>1</sub> INCH (MM)	d <sub>2</sub> INCH (MM)	S INCH (MM)	
1/2"	1.77 (45)	0.98 (25)	0.39 (10)	1.77 (45)	0.98 (25)	0.39 (10)	177 (45) 0.47 (12)
3/4"	1.77 (45)	0.98 (25)	0.39 (10)	1.77 (45)	0.98 (25)	0.39 (10)	177 (45) 0.47 (12)
1"	1.97 (50)	0.98 (25)	0.39 (10)	1.97 (50)	0.98 (25)	0.39 (10)	197 (50) 0.47 (12)
1 1/2"	2.60 (66)	1.38 (35)	0.47 (12)	2.60 (66)	1.38 (35)	0.47 (12)	260 (66) 1.38 (35) 0.59 (15)
2"	2.99 (76)	1.57 (40)	0.47 (12)	2.99 (76)	1.57 (40)	0.47 (12)	299 (76) 1.57 (40) 0.67 (17)
3"	4.92 (125)	2.56 (65)	0.79 (20)	4.92 (125)	2.56 (65)	0.79 (20)	4.92 (125) 2.56 (65) 1.06 (27)
4"	5.71 (145)	2.76 (70)	0.79 (20)	5.71 (145)	2.76 (70)	0.79 (20)	5.71 (145) 2.76 (70) 1.18 (30) Carbon Steel (1.0570) 536°F (280°C)
6"	8.58 (218)	3.94 (100)	0.98 (25)	8.58 (218)	3.94 (100)	1.18 (30)	8.58 (218) 3.94 (100) 1.18 (30) Duplex Stainless Steel (1.4462) 536°F (280°C)
8"							Hastelloy C-4 (2.4610) 536°F (280°C)

METAGLAS®

L. J. STAR INCORPORATED  
SIGHT GLASS DISC  
FOR L.J. STAR VISUAL FLOW INDICATORS  
OR SIMILAR  
P. O. BOX 280  
FREDONIA, N. Y. 14063  
TELEPHONE 716-366-0508  
FAX 716-366-0509

MANUFACTURED BY:

Herberts Industrieglas  
GmbH & Co. KG  
GEWERBESCHULSTRASSE 72  
D-42289 WUPPERTAL GERMANY

DATE	NAME
DESIGNED	Feb. 1996
CHECKED	

DATE	NAME
CHANGE	
DESCRIPTION OF CHANGE	