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APPROVAL REPORT

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

Prepared for:

**Herberts Industrieglas, 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	Room Temp.		Pressure Rating @	
Inches	Inches (mm)	Psig	(bar)	536°F	280°C
				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

FM Approvals
Project ID: 0Z2A2.AF

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 Industrieglas 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

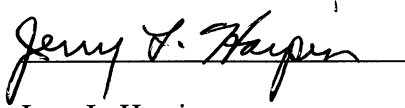
The equipment listed in paragraph 1.2 of this report meets FM Approvals requirements. Approval is effective when the Approval Agreement is signed and received by FM Approvals.

FM Approvals
Project ID: 0Z2A2.AF

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.

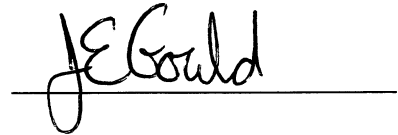
EXAMINATION AND REPORT BY:



Jerry L. Harpin
Engineer,
Systems

JLH

REVIEWED BY:



Jeffrey E. Gould
Technical Team Manager,
Materials Group

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.

Drawing No.	Drawing Title	Revision
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	-

FM Approvals
Project ID: 0Z2A2.AF

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 @			
	Room Temperature		536°F (280°C)	
	Psig	(bar)	Psig	(bar)
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)

FM Approvals
Project ID: 0Z2A2.AF

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)	797	(55)	270	(19)
	2.76 X 1.57 X 0.39 (70 X 40 X 10)	686	(47)	233	(16)
	2.76 X 1.57 X 0.59 (70 X 40 X 15)	797	(55)	270	(19)
	3.23 X 1.77 X 0.47 (82 X 45 X 12)	725	(50)	248	(17)
1 1/2	3.62 X 1.97 X 0.59 (92 X 50 X 15)	797	(55)	270	(19)
	3.62 X 1.97 X 0.79 (92 X 50 X 20)	797	(55)	270	(19)
2	3.94 X 2.17 X 0.59 (100 X 55 X 15)	797	(55)	270	(19)
	4.21 X 1.97 X 0.79 (107 X 50 X 20)	797	(55)	270	(19)
3	5.28 X 2.76 X 0.59 (134 X 70 X 15)	435	(30)	145	(10)
	5.71 X 2.76 X 0.79 (145 X 70 X 20)	797	(55)	270	(19)
	5.71 X 2.76 X 0.98 (145 X 70 X 25)	797	(55)	270	(19)
4	6.73 X 3.15 X 0.79 (171 X 80 X 20)	686	(47)	233	(16)
	6.73 X 3.15 X 0.98 (171 X 80 X 25)	797	(55)	270	(19)
	7.48 X 3.15 X 1.18 (190 X 80 X 30)	797	(55)	270	(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)	686	(47)	233	(16)
	9.61 X 4.72 X 1.18 (244 X 120 X 30)	686	(47)	233	(16)
	10.35 X 4.72 X 1.18 (263 X 120 X 30)	686	(47)	233	(16)
8	10.75 X 4.72 X 1.18 (273 X 120 X 30)	686	(47)	233	(16)
	12.01 X 4.92 X 1.18 (305 X 125 X 30)	435	(30)	145	(10)
	12.40 X 4.92 X 1.18 (315 X 125 X 30)	435	(30)	145	(10)
10	13.23 X 5.91 X 1.18 (336 X 150 X 30)	435	(30)	145	(10)
	14.09 X 5.12 X 1.18 (358 X 130 X 30)	435	(30)	145	(10)

FM Approvals
 Project ID: 0Z2A2.AF

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	280°C
	Room Temp. Psig	(bar)	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)

DWG NO. 173
SHEET NO. 1



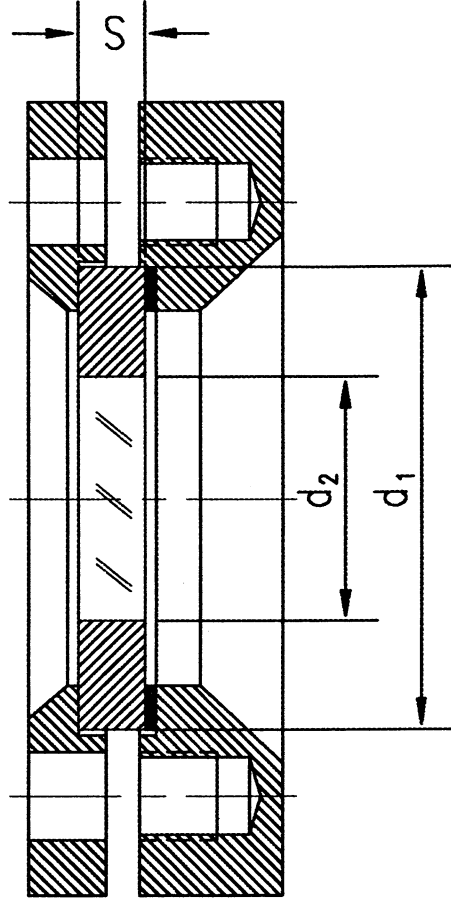
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SIGHT GLASS FUSED TO METAL CONFORMING TO DIN 7079

GLASS: BOROSILICATE (DIN 7080)

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

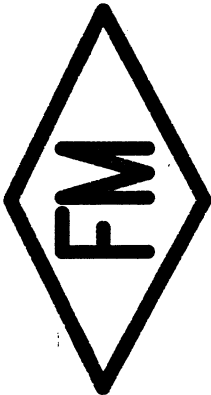
NOTE: FM must authorize all changes to drawings



d1	d2	RECOMMENDED THICKNESS					
		150 psi	250 psi	350 psi	600 psi	S	
INCH (MM)	INCH (MM)	INCH (MM)	INCH (MM)	INCH (MM)	INCH (MM)	INCH (MM)	INCH (MM)
1.77 (45)	0.98 (25)	0.39 (10)	0.47 (12)				
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)	0.79 (20)		
3.94 (100)	2.17 (55)	0.47 (12)	0.59 (15)	0.79 (20)	0.98 (25)		
4.92 (125)	2.56 (65)	0.59 (15)	0.79 (20)	0.98 (25)	1.06 (27)		
5.91 (150)	2.76 (70)	0.79 (20)	0.98 (25)	1.18 (30)			
6.89 (175)	3.15 (80)	0.79 (20)	0.98 (25)	1.18 (30)	1.26 (32)		
7.87 (200)	3.94 (100)	0.98 (25)	1.18 (30)	1.26 (32)			
9.84 (250)	4.72 (120)	1.18 (30)	1.26 (32)	1.50 (38)			

RING MATERIAL	MAX. WORKING TEMPERATURE
Carbon Steel (1.0570)	536°F (280°C)
Duplex Stainless Steel (1.4462)	536°F (280°C)
Hastelloy C-4 (2.4610)	536°F (280°C)

METAGLAS® SIGHT GLASS DISC FOR LUMIGLAS® SERIES DIN 28120 OR SIMILAR		L. J. STAR INCORPORATED P. O. BOX 280 FREDONIA, N. Y. 14063 TELEPHONE 716-366-0508 FAX 716-366-0509	
DESIGNED	DATE	NAME	
Feb. 1996		Schulley	
CHECKED			
Herberts Industrieglas GmbH & Co. KG GEWERBESCHULSTRASSE 72 D-42289 WUPPERTAL GERMANY		MANUFACTURED BY:	
CHANGE	DESCRIPTION OF CHANGE	DATE	NAME



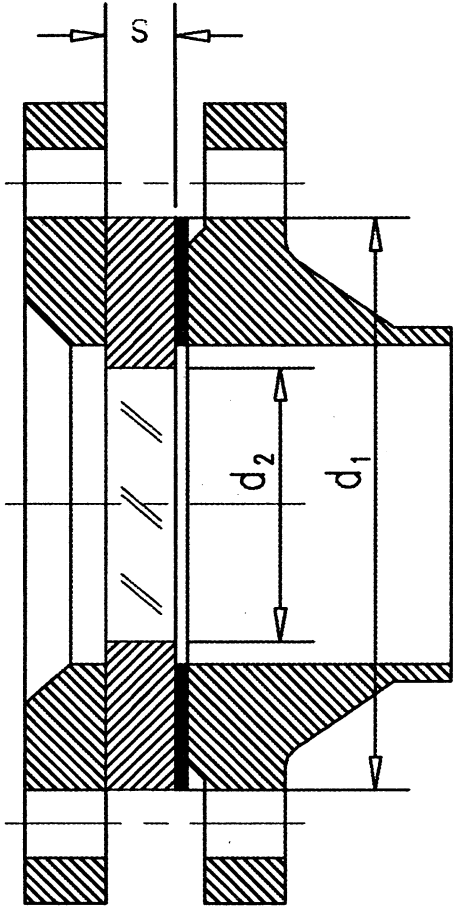
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SIGHT GLASS FUSED TO METAL CONFORMING TO DIN 7079

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												RING MATERIAL	MAXIMUM WORKING TEMP.
	150 PSI				300 PSI				600 PSI					
	d1	d2	S	d1	d2	S	d1	d2	S	d1	d2	S		
1"	2.48 (63)	1.38 (35)	0.39 (10)	2.76 (70)	1.57 (40)	0.47 (12)	2.76 (70)	1.57 (40)	0.71 (18)	2.76 (70)	1.57 (40)	0.71 (18)	Carbon Steel (1.0570)	536°F (280°C)
1 1/2"	3.23 (82)	1.77 (45)	0.47 (12)	3.62 (92)	1.97 (50)	0.59 (15)	3.62 (92)	1.97 (50)	0.87 (22)	3.62 (92)	1.97 (50)	0.87 (22)	Duplex Stainless Steel (1.4462)	536°F (280°C)
2"	3.94 (100)	2.17 (55)	0.59 (15)	4.21 (107)	1.97 (50)	0.79 (20)	4.21 (107)	1.97 (50)	0.79 (20)	4.21 (107)	1.97 (50)	0.79 (20)	Hastelloy C-4 (2.4610)	536°F (280°C)
3"	5.28 (134)	2.76 (70)	0.59 (15)	5.71 (145)	2.76 (70)	0.79 (20)	5.71 (145)	2.76 (70)	1.10 (28)	5.71 (145)	2.76 (70)	1.10 (28)		
4"	6.73 (171)	3.15 (80)	0.79 (20)	6.73 (171)	3.15 (80)	0.98 (25)	7.48 (190)	3.15 (80)	1.26 (32)	7.48 (190)	3.15 (80)	1.26 (32)		
5"	7.56 (192)	3.94 (100)	0.79 (20)											
6"	8.58 (218)	3.94 (100)	0.98 (25)	9.61 (244)	4.72 (120)	1.38 (35)	10.35 (263)	3.94 (100)	1.57 (40)	10.35 (263)	3.94 (100)	1.57 (40)		
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)	12.40 (315)	3.94 (100)	1.57 (40)		
10"	13.23 (336)	5.91 (150)	1.18 (30)	14.09 (358)	5.12 (130)	1.38 (35)								

MANUFACTURED BY:

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

DESIGNED: *[Signature]*
CHECKED: *[Signature]*

DATE: **Feb. 1996**

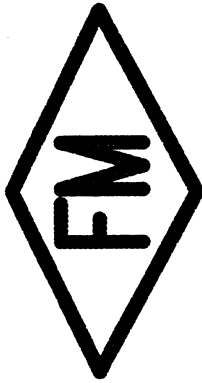
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METAGLAS®
SIGHT GLASS DISC FOR ANSI BOLT-ON RAISED FACED FLANGES

RING MATERIAL: Carbon Steel (1.0570)
Duplex Stainless Steel (1.4462)
Hastelloy C-4 (2.4610)

MAXIMUM WORKING TEMP.: 536°F (280°C)
536°F (280°C)
536°F (280°C)

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



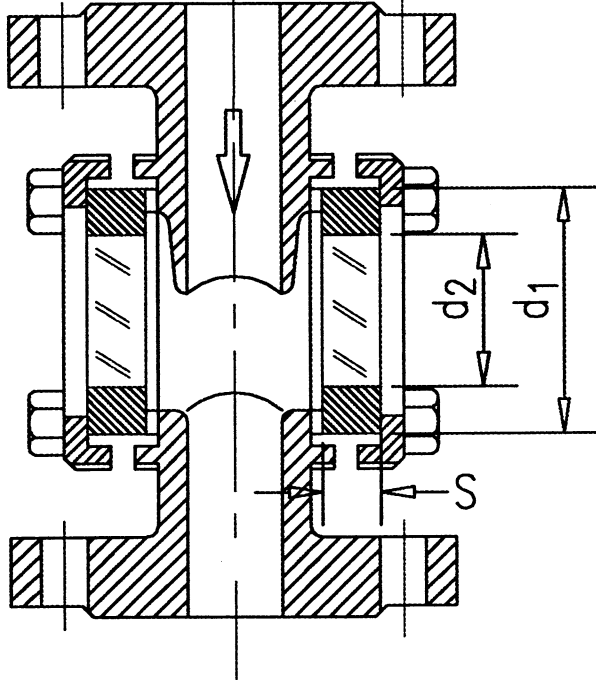
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SIGHT GLASS FUSED TO METAL CONFORMING TO DIN 7079

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												RING MATERIAL	MAXIMUM WORKING TEMP.						
	150 PSI				300 PSI				600 PSI											
	d1	d2	S	d1	d2	S	d1	d2	S	d1	d2	S								
1/2"	1.77	45	0.98	25	0.39	10	1.77	45	0.98	25	0.39	10	1.77	45	0.98	25	0.47	12	Carbon Steel (1.0570)	536°F (280°C)
3/4"	1.77	45	0.98	25	0.39	10	1.77	45	0.98	25	0.39	10	1.77	45	0.98	25	0.47	12	Duplex Stainless Steel (1.4462)	536°F (280°C)
1"	1.97	50	0.98	25	0.39	10	1.97	50	0.98	25	0.39	10	1.97	50	0.98	25	0.47	12	Hastelloy C-4 (2.4610)	536°F (280°C)
1 1/2"	2.60	66	1.38	35	0.47	12	2.60	66	1.38	35	0.47	12	2.60	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	2.99	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		
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	1.57	40		
8"																				

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

METAGLAS®
 SIGHT GLASS DISC
 FOR L.J. STAR VISUAL FLOW INDICATORS
 OR SIMILAR

DESIGNED: *[Signature]*
 CHECKED: *[Signature]*
 DATE: Feb. 1996

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

CHANGE	DESCRIPTION OF CHANGE	DATE	NAME