




TUV NORD

INSPECTION REPORT

August 25, 2015

FAHSS / TÜV NORD

Third Party Inspection and Testing witness of Blast Resistant Single Leave Door

	Issued by	Checked by	Approved by
Name / Sig.	Said Waseem FAHSS/TÜV 	Maher El-khidir FAHSS/TÜV 	Maher El-khidir FAHSS/TÜV Riyadh Branch Manager 
Location	Riyadh		
Date of Fulfilled inspection	22-August-15.		
Special and Safety Work Nissren Factory Reference	SSW/15-197		
FAHSS/TÜV Reference	E-mail Sat 8/22/2015 3:21 PM		
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FAHSS/TÜV

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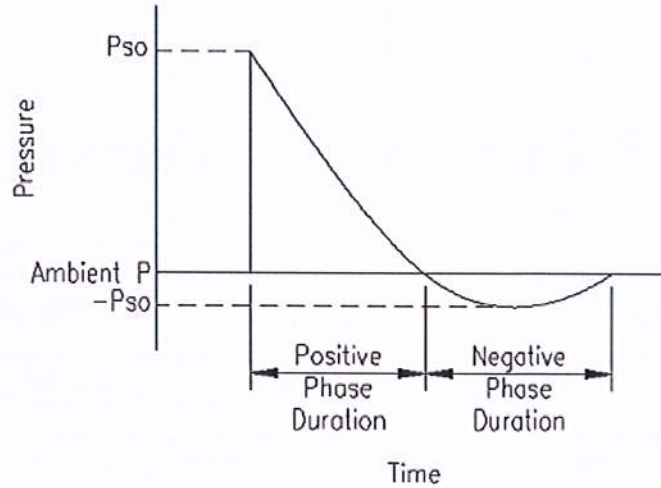
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www.tuev-nord.de



TESTING FOR BLAST RESISTANT SINGLE LEAF DOOR



SPECIAL AND SAFETY WORK – MANUFACTURING ENGINEER

TUV NORD – TEST ENGINEER

TUV NORD – QUALITY ASSURANCE

TUV NORD – TEST WITNESS

DATE.

DATE. 25-8-2015



DATE. 25-8-2015



DATE. 25-8-2015



To. **DAELIM . Co**

KUWAIT NATIONAL PETROLEUM COMPANY

PROJECT: SULPHUR FACILITY

TEST REPORT NO: SAM 1225 KU

TEST REPORT FOR BLAST RESISTANT DOOR – SINGLE LEAF

- Single Leaf : 1200 mmW x 2500 mmH x 59 mmT
- Pressure : 15.7 Psi
- Time : 3 Minutes
- Test Date : 22th August 2015
- Report Date : 25th August 2015
- Sample Identification of Specimen : SM – Single
- Manufacturer : SAMHOON CO. LTD.
- Source of Supply : SEAUF – SOUTH KOREA
- Sample Dimension : 1200 mmW x 2500 mmH x 59 mmT
- Model Number : _____
- Specimen Details : As Attached Drawings
- Test Standard : ASTM F2247 – 11 [Standard test method for metal doors used in

Blast resistant applications (Equivalent Static Load Method)]



- Procedure Test : Comply with B (Materials as specified on drawing)
- Category Required : Category 1

1. SPONSOR TEST STANDARD SCOPE - ASTM F 2247 :-

1	This test method covers the structural performance of metal doors and frames
2	Hardware (such as latches and hinges) used as a blast resistant doors by is applied
3	Equivalent static pressure
4	Static tests are valid for the unit size tested or for smaller units of analogous construction.
5	This test method requires knowledge of the principles of pressure, deflection, and when applicable, strain gauge measurement.
6	Specimens may be tested to determine ultimate static capacity or tested to specific static test loads.

2. SPECIMEN PREPARATION:-

1	Construction – The door panel shall meet the general definition of a metal door as outlined.
2	The design of the door panel is based upon the target pressure rating established by the specifier or door manufacturer.
3	Size of the specimen (door panel and frame) shall be representative or larger than the application under investigation.
4	Space between stiffeners may be filled with insulation.
5	In case no structural threshold door panel shall be considered as a three side supported, one edge free loading condition for a seating load case, the bottom edge of the door panel is free.
6	In case a structural threshold, door panel may be considered as a four side supported condition for a seating load case.
7	Door panel is supported by the restraining hardware During the unseating load case.
8	Door panel will be attached to the frame with the same quantity and size of hinge fasteners.
9	Door frame shall be attached to the test fixture using the same quantity, size, and spacing of fasteners or anchors.



3. CRITERIA CATEGORY:-

Category I	The specimen is unchanged (no permanent deformation) after the loading incident and the door is fully operable. The specimen remains intact and responds elastically. In field tests, a tolerance of 2 mm (5/64-inch) difference between pretest and post-test measurements is allowed for elastic response.
Category II	The door is operable, but measurable, permanent deformation to the door panel exceeding 2 mm (5/64-inch) has been experienced. The specimen remains as an integral system.
Category III	Non-catastrophic failure. No structural failure occurs to the specimen that prevents the specimen from providing a barrier to blast wave propagation. However, the specimen is permanently deformed and the door panel is inoperable.
Category IV	The door panel is severely deformed. For the seating direction, the deformation of the door panel must be limited to a level that does not cause the door panel to be forced through the door frame opening. For the unseating direction, the latching mechanism is permitted to fail, allowing the door to swing open; however, the door panel shall remain supported by the hinges and it is evident that the door panel will not become a flying debris hazard.



5. TEST PROCEDURE :-

1	The door and frame unit was installed into the test chamber as shown in Figures 2 and 3. The test fixture was positioned vertically, with the specimen hung in the operational mode.
2	The backside of the test chamber was covered with a rubber membrane and back plate, as shown in figures 2 and 4. The membrane allowed uninhibited load transfer to the specimen. The membrane did not prevent movement or failure of the specimen. The membrane was applied loosely, with extra folds of material at each corner and at all offsets and recesses.
3	The door unit was checked for proper adjustments and clearances in the closed position.
4	The required deflection devices were installed at their suggested locations. Refer figure 1.
5	The test chamber was pressurized until the desired static pressure load was achieved and maintained at a steady state until the deflections from the dial indicators were read and recorded. This step was repeated for each desired pressure increment.
6	After a set number of pressure increments, the pressure load was reduced to zero and deflection readings were taken to determine any permanent deformation. The latching device was also checked for proper operation.
7	The damage level category was determined in accordance to ASTM F2247 criteria.
8	When the behavior of the door unit under load indicated that sudden failure may occur, the dial indicators were removed to prevent damage to them. Once all the dial indicators were removed, the door unit was continuously loaded until the maximum was reached and the door failed.



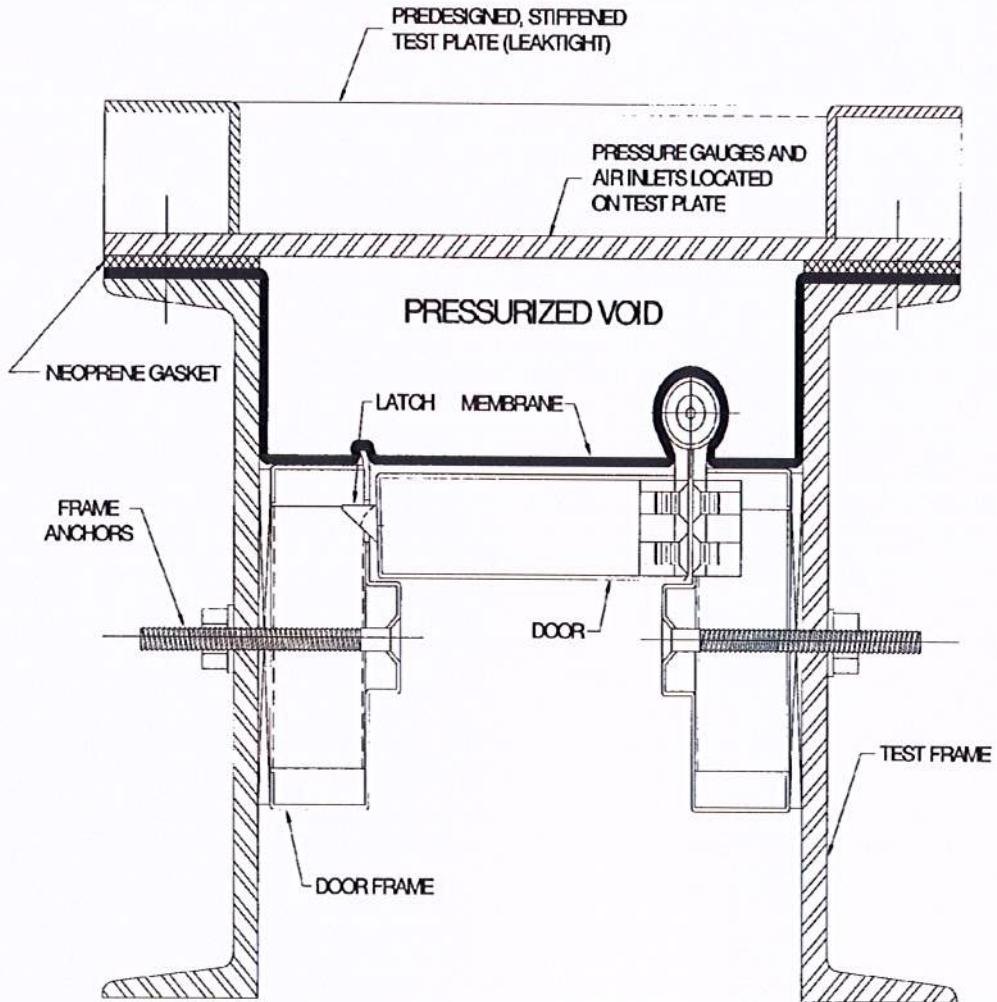


Figure 2



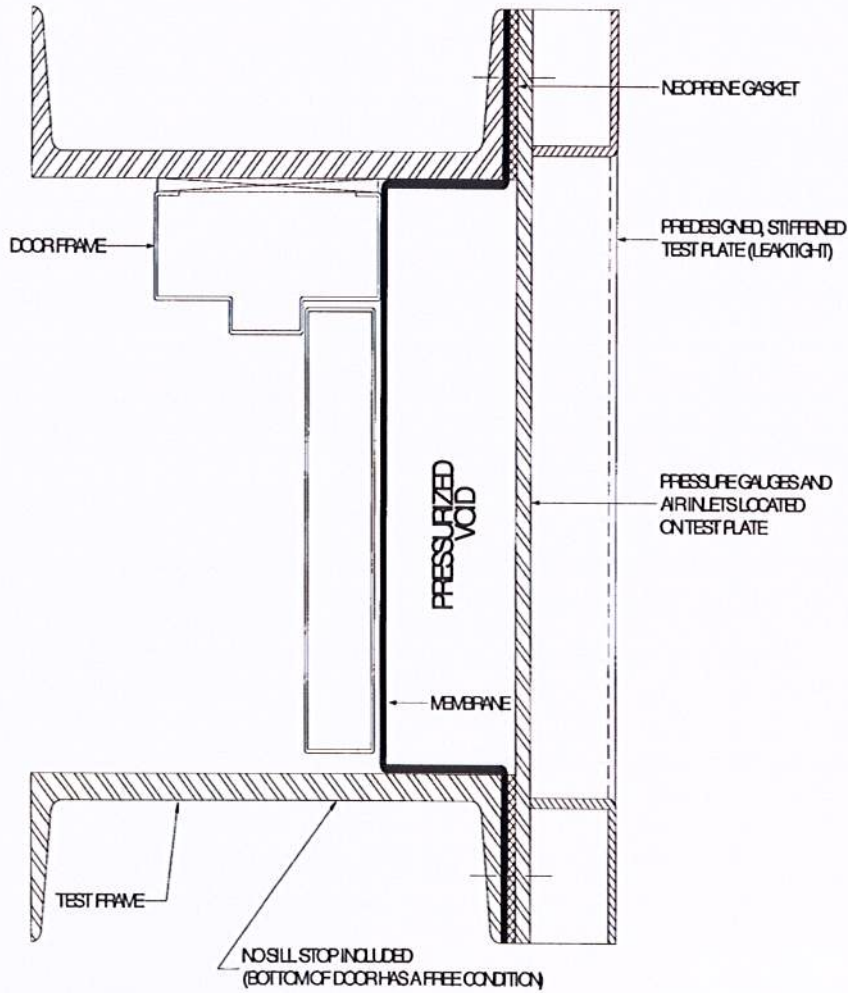


Figure 3



Single Door Test

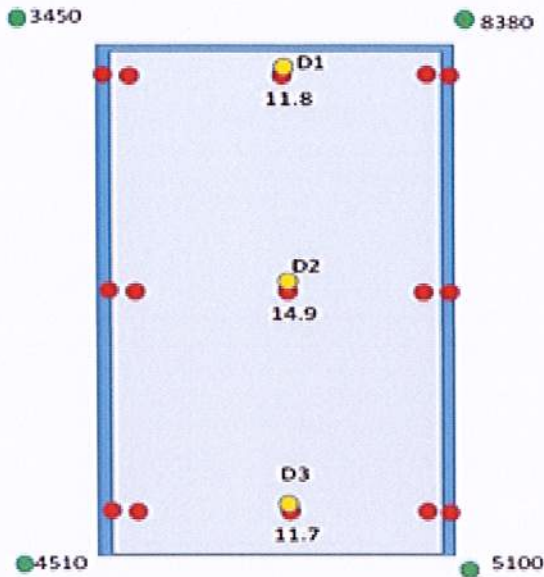
Static Test of Large Single Door																																								
Test Specimen																																								
<p>Single door as shown in drawings provided by SAMHOON Co. Ltd. Overall frame dimensions of the door were 1200 mm by 2500 mm. The hardware provided on the door was limited to two lever handles to operate a single latch point on the door leaf. The door was installed in the test frame with bearing supports on the non-load side of the door. No connection details were shown on the drawings. The bearing support approach was agreed upon by . The perimeter frame was not grout filled as shown on the drawings. The operated well before the test.</p>																																								
Response Description																																								
<p>The tested door was satisfied with Category 1 according to ASTM F 2247 criteria about your required test results which high pressure short duration triangular shock loading side-on overpressure of 10 psi (69kPa) with a duration of 20 milliseconds, and the pressure load can be converted 15.7 psi with 3 minutes duration according to ASTM standards.</p>																																								
<table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th rowspan="2" style="width: 20%;">Test Specimen Size</th> <th colspan="2" style="width: 20%;">Height</th> <th colspan="2" style="width: 20%;">Width</th> <th colspan="2"></th> </tr> <tr> <th style="width: 10%;">inches</th> <th style="width: 10%;">mm</th> <th style="width: 10%;">inches</th> <th style="width: 10%;">mm</th> <th style="width: 10%;"></th> <th style="width: 10%;"></th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Specimen</td> <td style="text-align: center;">98.43</td> <td style="text-align: center;">2500.00</td> <td style="text-align: center;">47.24</td> <td style="text-align: center;">1200.00</td> <td></td> <td></td> </tr> <tr> <td style="text-align: center;">Frame Contribution</td> <td style="text-align: center;">3.00</td> <td style="text-align: center;">76.20</td> <td style="text-align: center;">0.00</td> <td style="text-align: center;">0.00</td> <td></td> <td></td> </tr> <tr> <td style="text-align: center;">Total</td> <td style="text-align: center;">101.43</td> <td style="text-align: center;">2576.20</td> <td style="text-align: center;">47.24</td> <td style="text-align: center;">1200.00</td> <td></td> <td></td> </tr> </tbody> </table>							Test Specimen Size	Height		Width				inches	mm	inches	mm			Specimen	98.43	2500.00	47.24	1200.00			Frame Contribution	3.00	76.20	0.00	0.00			Total	101.43	2576.20	47.24	1200.00		
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<table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th colspan="7" style="text-align: left; padding: 5px;">Loaded Area {Height (max 120 inches) x Width (max 120 inches)}</th> </tr> <tr> <th style="width: 15%;">Height</th> <th style="width: 15%;">Width</th> <th style="width: 15%;">Area</th> <th style="width: 15%;"></th> <th style="width: 15%;"></th> <th style="width: 15%;"></th> <th style="width: 15%;"></th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">101.43</td> <td style="text-align: center;">47.24</td> <td style="text-align: center;">4791.74</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>							Loaded Area {Height (max 120 inches) x Width (max 120 inches)}							Height	Width	Area					101.43	47.24	4791.74																	
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Fielded Instrumentation						
Reaction Force Load Cells (Check Appendix A)						
Gauge	Guage Type	Serial Number	Sensitivity (mV/V)	Reaction at 50%	Reaction at 100%	
R1	LC8400-200-100K	328691	2.212	2255	4510	
R2	LC8400-200-100K	328696	2.218	2550	5100	
R3	LC8400-200-100K	328702	2.217	1725	3450	
R4	LC8400-200-100K	328708	2.211	4190	8380	
			Total	10720	21440	
			Effective Pressure (psi)	7.85	15.7	
			Effective Pressure (kPa)	54.1	108.23	
Laser Distance Meters (Check Appendix B)						
	Model	Manfactur Date	Sensitivity (mV/mm)	Deflectio at 50% Load (inches)	Deflection at 100% Load (inches)	Deflection at 100% Load
D1	OADM 20I6581/S14F	Feb-12	12.5	0.45	0.95	22.8
D2	OADM 20I6581/S14F	Feb-12	12.5	0.5	1.3	33
D3	OADM 20I6581/S14F	Oct-14	12.5	0.3	0.7	17.78

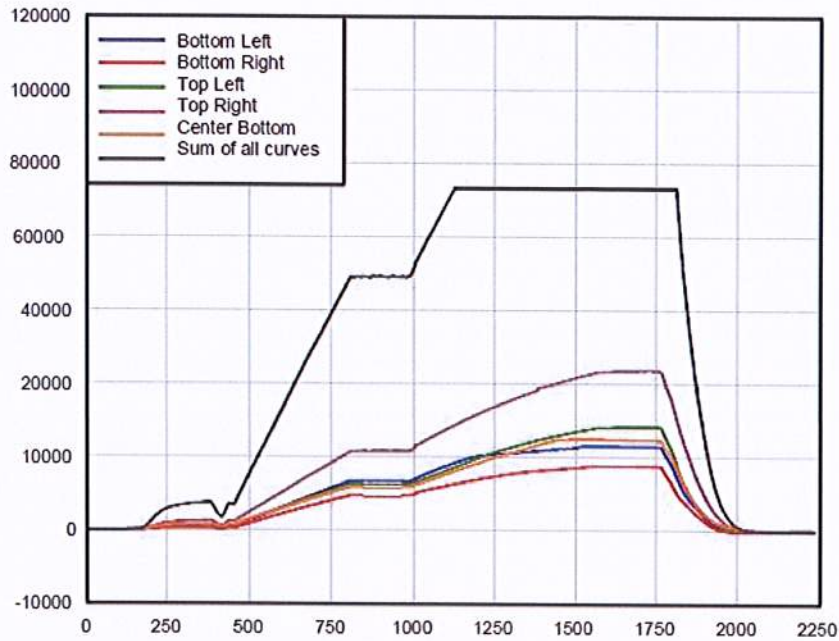
See measurement diagram for instrument locations.



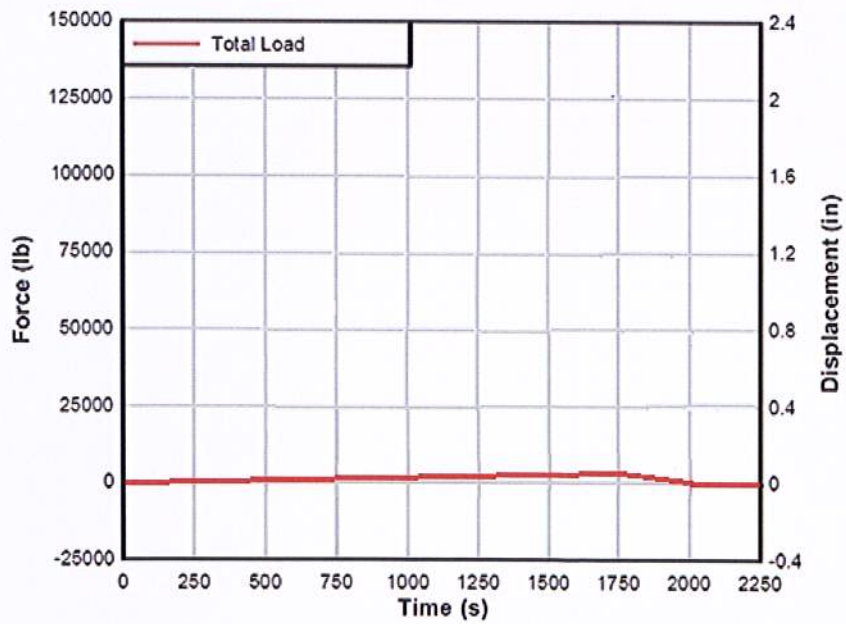



Deflection Measurements					
Measurement	Pre-Test (inches)	Post-Test (Cm)	Permanent Deflection (inches)	Permanent Deflection (mm)	
A1	0.08	2.1	0.05	1	
A2	0.29	7.3	0.05	1	
A3	0.48	11.8	0.05	1	
A4	0.45	11.5	0.05	1	
A5	0.46	11.7	0.05	1	
B1	0.13	3.2	0.05	1	
B2	0.39	9.8	0.05	1	
B3	0.22	14.9	0.05	1	
B4	0.56	14.3	0.05	1	
B5	0.57	14.4	0.05	1	
C1	0.09	2.3	0.05	1	
C2	0.29	7.3	0.05	1	
C3	0.47	11.7	0.05	1	
C4	0.44	11.1	0.05	1	
C5	0.44	11.3	0.05	1	





Force Measurements from Test 1



Deflection Measurements with Total Force Data



Appendix A

LARGE-ID THROUGH-HOLE LOAD CELLS 2.00 TO 3.13" ID

Compression
0-1000 lb to 0-100K lb
0-455 kgf to 0-45,372 kgf

1 Newton = 0.2248 lb
1 daNewton = 10 Newtons
1 lb = 454 g
1 t = 1000 kgf = 2204 lb

LC8313/LC8400 Large Series



- ✓ For Large-ID Applications
- ✓ All Stainless Steel Construction
- ✓ Rugged Industrial Design

The LC8313, LC8400, and LC8450 Series donut load cells are space-saving solutions to applications requiring a large through-hole. With their rugged construction and design, these load cells are ideal for applications such as loading forces on large bolts or other suspended load applications. These series, with their all stainless steel construction and environmental protection, have proved reliable in tough industrial applications.

SPECIFICATIONS

Output: 2 mV/V nominal
Input: 10 Vdc (15V maximum)
Accuracy Class: ±0.5% linearity, hysteresis and repeatability combined
Zero Balance: ±2.0% FSO
Operating Temp Range: -54 to 121°C (-65 to 250°F)
Compensated Temp Range: 16 to 71°C (60 to 160°F)
Thermal Effects:
Zero: ±0.009% FSO/°C
Span: ±0.018% rdg/°C
Safe Overload: 150% of capacity
Ultimate Overload: 300% of capacity
Input Resistance: 360 Ω minimum
Output Resistance: 350 ± 5 Ω
Construction: 17-4 PH stainless steel
Electrical: 1.5 m (5) 4-conductor shielded cable

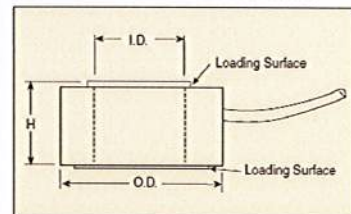


LC8400-213-10K shown smaller than actual size.

Dimensions: mm (inch)

MODEL	OD	H
LC8313	80 (3.13)	13 (0.50)
LC8400 (1K to 50K)	102 (4.00)	25 (1.00)
LC8400 (≥100K)	102 (4.00)	51 (2.00)
LC8450	114 (4.50)	32 (1.25)

WIRE	CONNECTION
GN	+Output
WT	-Output
BK	-Input
RD	+Input



INSIDE DIAMETERS (ID)	+ = MOST POPULAR X = AVAILABLE			
ID CODE	200	213	300	313
MODEL	2.00"	2.13"	3.00"	3.13"
LC8313	+	X		
LC8400	+	X		
LC8450			X	+

Also available in metric configurations, consult engineering for details.

To Order			
CAPACITY	MODEL NO.	COMPATIBLE METERS**	
Model LC8313 with a 3.13" OD and Selectable ID			
1 K lb	455 kg	LC8313-[*]-1K	DP41-S, DP25B-S, DPIS
3 K lb	1361 kg	LC8313-[*]-3K	DP41-S, DP25B-S, DPIS
5 K lb	2269 kg	LC8313-[*]-5K	DP41-S, DP25B-S, DPIS
7.5 K lb	3403 kg	LC8313-[*]-7.5K	DP41-S, DP25B-S, DPIS
10 K lb	4537 kg	LC8313-[*]-10K	DP41-S, DP25B-S, DPIS
Model LC8400 with a 4.00" OD and Selectable ID			
1 K lb	455 kg	LC8400-[*]-1K	DP41-S, DP25B-S, DPIS
3 K lb	1361 kg	LC8400-[*]-3K	DP41-S, DP25B-S, DPIS
5 K lb	2269 kg	LC8400-[*]-5K	DP41-S, DP25B-S, DPIS
10 K lb	4537 kg	LC8400-[*]-10K	DP41-S, DP25B-S, DPIS
25 K lb	11,343 kg	LC8400-[*]-25K	DP41-S, DP25B-S, DPIS
50 K lb	22,686 kg	LC8400-[*]-50K	DP41-S, DP25B-S, DPIS
100 K lb	45,372 kg	LC8400-[*]-100K	DP41-S, DP25B-S, DPIS
200 K lb	90,744 kg	LC8400-[*]-200K	DP41-S, DP25B-S, DPIS
Model LC8450 with a 4.50" OD and Selectable ID			
1 K lb	455 kg	LC8450-[*]-1K	DP41-S, DP25B-S, DPIS
3 K lb	1361 kg	LC8450-[*]-3K	DP41-S, DP25B-S, DPIS
5 K lb	2269 kg	LC8450-[*]-5K	DP41-S, DP25B-S, DPIS
10 K lb	4537 kg	LC8450-[*]-10K	DP41-S, DP25B-S, DPIS

Comes complete with 5-point NIST-traceable calibration and 59 kΩ shunt data.

** Visit us online for compatible meters.

[*] Select ID Code from table above to complete model number.

Ordering Examples: LC8313-200-3K, 3000 lb capacity load cell, 3.13" OD and 2.00" ID.

LC8400-200-10K, 10,000 lb capacity load cell, 4.00" OD and 2.00" ID.

LC8400-213-25K, 25,000 lb capacity load cell, 4.00" OD and 2.13" ID.

LC8450-313-5K, 5000 lb capacity load cell, 4.50" OD and 3.13" ID.

F-92

FM-AM-05 Rev8:1/1/2012



LOAD CELLS

Appendix B

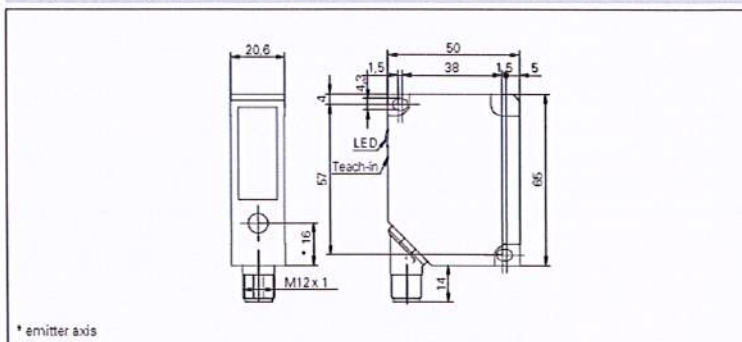
Baumer

Photoelectric sensors

Distance sensors

OADM 20 (Laser, connector 8 pins, > 300 mm)

sample drawing



* emitter axis

general data

adjustment	Teach-in: button / external
power on indication	LED green
soiled lens indicator	LED red
light source	pulsed red laser diode
wave length	650 nm
laser class	2
measuring distance Sd = 100 ... 600 mm	
Teach-in range min.	> 10 mm
resolution	0,015 ... 0,67 mm
linearity error	± 0,05 ... ± 2 mm
temperature drift	< 0,03 % Sde/K
measuring distance Sd = 200 ... 1000 mm	
Teach-in range min.	> 20 mm
resolution	0,12 ... 2,5 mm
linearity error	± 0,48 ... ± 10 mm
temperature drift	< 0,06 % Sde/K

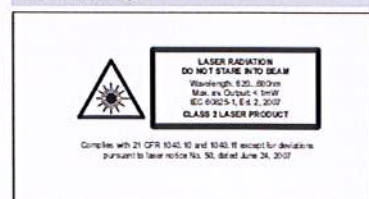
electrical data

response time / release time	< 0,9 ms
voltage supply range +Vs	12 ... 28 VDC
current consumption max. (no load)	100 mA
output circuit	analog
output signal	4 ... 20 mA / 0 ... 10 VDC
load resistance (analog I)	< (+Vs - 6 V) / 0,02 A
load resistance (analog U)	> 100 kOhm
output current	< 100 mA
alarm output	PNP
short circuit protection	yes
reverse polarity protection	yes, Vs to GND

sample picture



laser warning



remarks

For objects with a reflectivity < 7 % (OADM 20I6x80/S14F) or < 15 % (OADM 20I6x81/S14F) the response time/release time is increased automatically up to 2,8 ms.



Baumer

Photoelectric sensors

Distance sensors

ector 8 pins, > 300 mm)

mechanical data

width / diameter

height / length

depth

type

housing material

front (optics)

connection types

ambient conditions

operating temperature

protection class

order reference	measuring Sd
OADM 2016480/S14F	100 ... 600
OADM 2016481/S14F	200 ... 1000
OADM 2016580/S14F	100 ... 600
OADM 2016581/S14F	200 ... 1000



beam diameter	ambient light immunity
2 mm	< 10 kLux
2 mm	< 5 kLux
-	< 10 kLux
-	< 5 kLux

Pretest Photograph of Loaded Side of Door



Pretest Photograph of Non-Loaded Side of Door



Posttest Photograph of Door



Posttest Photograph of Loaded Side of Door





Posttest Photograph of Door Edge Plate Connection Failure

for the content

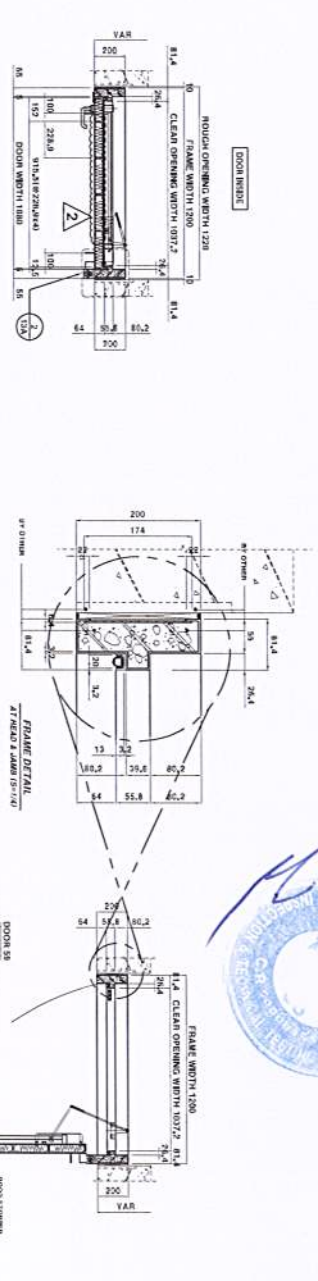
Eng. Maher El-khidir



FAHSS/TÜV SAUDI ARABIA

SINGLE DOOR DRAWINGS

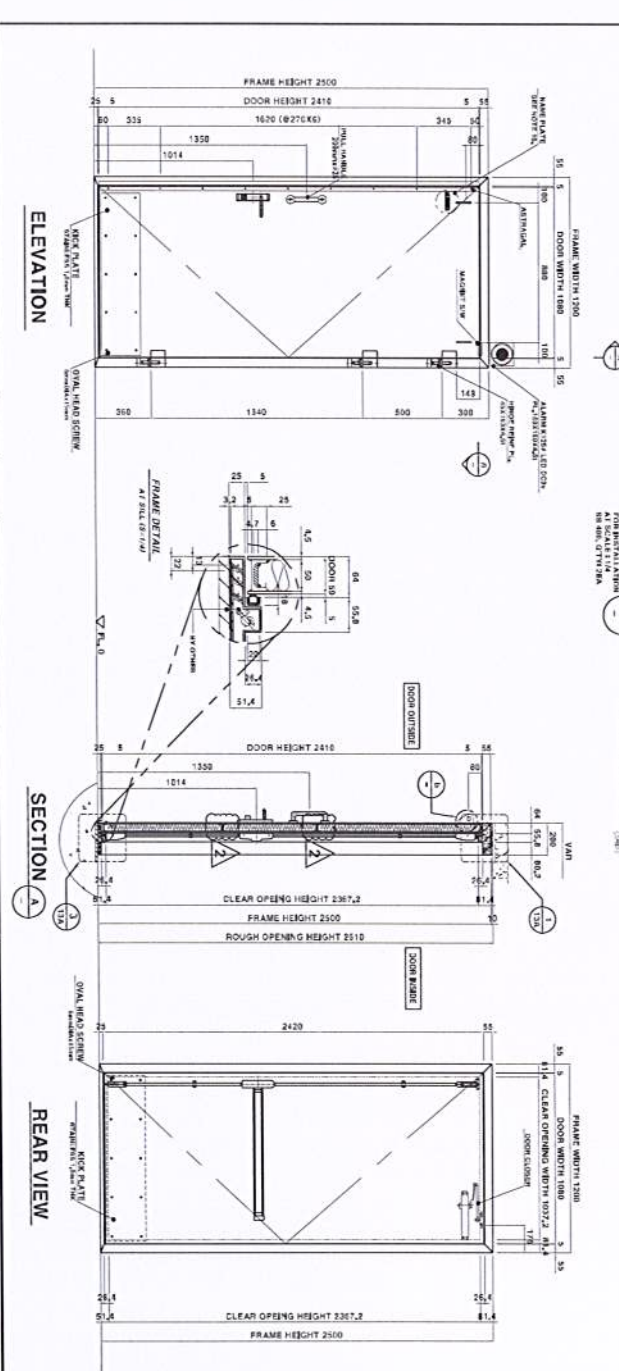




NOTES

1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. FOR GENERAL NOTES, ABREVIATIONS AND SYMBOLS FOR BUILDING WORKS REFER TO KRI-2008-01-15-031 Rev.2
3. BLAST ROOM SHALL BE TESTED IN ACCORDANCE WITH ASTM F551
4. MATERIALS
 - a. STEEL SHALL BE GRADE S460MP
 - b. ALL STEEL SHALL BE GRADE S460MP
 - c. ALL STEEL SHALL BE GRADE S460MP
 - d. ALL STEEL SHALL BE GRADE S460MP
5. THE FRAME SHALL BE TESTED BY THE MANUFACTURER.
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12. THE FRAME SHALL BE TESTED BY THE MANUFACTURER.

NO.	DESCRIPTION	MODEL NO. OR SPEC.	MAKER	REMARKS
1	HEAVY DUTY SPECIAL HINGE	TERBERG-HINGES	SAMHOON	STAINLESS
2	VERTICAL TYPE PANIC DEVICE	TERBERG-HINGES	SAMHOON	STAINLESS
3	DOOR FRAME	150	SAMHOON	STAINLESS
4	DOOR CLOSER	4-000001	KNOX	STAINLESS COVER
5	DOOR STOPPER	SH-00014	SAMHOON	STAINLESS
6	GASKET	SH-00014	SAMHOON	STAINLESS
7	KEY PLATE	SH-00014	SAMHOON	STAINLESS
8	PULL HANDLE	WHD-C000	SAMHOON	STAINLESS



REV	DATE	DESCRIPTION	BY	CHKD	APPRD	REFERENCE DRAWINGS
△	2024.01.15	ISSUED FOR APPROVAL	SAJAH	SAJAH	SAJAH	
△	2024.01.15	ISSUED FOR APPROVAL	SAJAH	SAJAH	SAJAH	
△	2024.01.15	ISSUED FOR APPROVAL	SAJAH	SAJAH	SAJAH	
△	2024.01.15	ISSUED FOR APPROVAL	SAJAH	SAJAH	SAJAH	
△	2024.01.15	ISSUED FOR APPROVAL	SAJAH	SAJAH	SAJAH	

PROJECT NO.	120588
CAD FILE REF.	
SHEET NO.	25 OF 53
SCALE	1/30

DAELIM	SEOUL, KOREA
CONTRACT NO.	CA/CSPO/0022
TITLE :	SUDHAR HANDLING FACILITIES (REVAMP AND NEW)
PROJECT (SHP) AT	WAA REFINERY
FRAME SIZE	1200.0(W)X2500.0(H)
(INSTRUMENT ROOM 06, 07, 11)	

SAMHOON ENGINEERING

SAMHOON ENGINEERING CO., LTD.

15, SEONGNAM-RO, SEONGNAM-SI, GYEONGGI-DO, KOREA

TEL: +82-31-950-0100 FAX: +82-31-950-0101

WWW.SAMHOON-ENG.CO.KR

VENDOR DWG NO. VP-43-703-001-A01-ALL-SK-5A

KUWAIT NATIONAL PETROLEUM CO.(K.S.C.)

MINA AL-AHMADI REFINERY

FILE NAME

