केन्द्रीय खनन एवं ईंधन अनुसंधान संस्थान
(वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद)
बरवा रोड, धनबाद – 826 001, झारखण्ड, भारत

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Central Institute of Mining and Fuel Research
Formerly : Central Mining Research Institute
(Council of Scientific & Industrial Research)
BARWA ROAD, DHANBAD-826 001, JHARKHAND, INDIA

REGISTERED POST/COURIER SERVICE

No. CIMFR/TC/P/H210
Equipment ID NO. 51A/07

Dated: 14th June, 2007
Code No. FLP/215A/07

To
M/S. Rotex Manufacturers & Engineers Pvt. Ltd.,
Manpada Road, Near Bhopar Village,
Dombivli (E) – 421 204 (Maharashtra)

Sub: Flameproof Testing as per IS: 2148- 2004 (IEC 60079-1/2001) and weatherproof testing as per IS: 12063-1987 for IP-67 of your enclosure for **Flameproof cum Weatherproof Limit Switch housing,** in Cast Aluminium Alloy construction, designated by Model: **DNLF**, for use in Gas Groups: IIA & IIB and Zone 1 atmospheres only.

- Report on (PROTOTYPE)

Your Ref. No.: ROTEX/CMRI/IIA & IIB/01 Dated 12-04-2007 and subsequently
Nil Dated 02/06/2007

Dear Sir,

Please find enclosed the **Test Report (Prototype)** of the above sample submitted by you.

Charges of **Rs. 49,498/- (Rupees Forty nine thousand Four Hundred & ninety nine only)** including applicable service charges involved towards the testing/issuing the schedule have been adjusted against the advance deposit made by you.

Kindly arrange to collect the sample within 90 days from the date of receipt of this letter failing which CIMFR would dispose off the sample by public auction without any further NOTICE to you.

Kindly acknowledge receipt.

Thanking you.

Yours faithfully,

(G.M. PRASAD)
HEAD OF THE DEPARTMENT
TESTING CELL

Enc: As above.
Proto. Test Report in triplicate.
Copy to: 1. Head, Flame & Explosion Lab.
2. Bill Section.

फोन-निदेशक Director
Ph.: 0091-326-2202326/2203043
पी० ए० एक्स PAX
Ph.: 0091-326-2203010/2203070/2203090/2205045/2209041
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कार्यालय के दिन : सोमवार से शुक्रवार तक Working days : Monday to Friday

के० ख० एवं ई० अ० सं० परीक्षण प्रकोष्ठ-CIMFR TESTING CELL

केन्द्रीय खनन एवं ईंधन अनुसंधान संस्थान

(वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद)

TESTING CELL ESTD 1956

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CENTRAL INSTITUTE OF MINING AND FUEL RESEARCH

Formerly Central Mining Research Institute
(Council of Scientific & Industrial Research)

बरवा रोड, धनबाद – 826 001 (भारत) – BARWA ROAD, DHANBAD-826 001 (INDIA)

परीक्षण प्रमाण पत्र - TEST CERTIFICATE

FORMAT NO.: (CIMFR: DQM: FLP02: F-01)
(Flame & Explosion Laboratory)

ID NO. 51A/07 Code No FLP/215A/2007

SCHEDULE: FIRST

[For association with the report of test sent (under cover of this office letter No. CIMFR /TC/P/1112 Dated: 29th June, 2007) to M/S. Rotex Manufacturers & Engineers Pvt. Ltd., Manpada Road, Near Bhopar Village, Dombivli (E) – 421 204 (Maharashtra)]

1. **Applicant:** M/S. Rotex Manufacturers & Engineers Pvt. Ltd., Manpada Road, Near Bhopar Village, Dombivli (E) – 421 204 (Maharashtra)

2. **Manufacturer:** Same as above

3. **Title of Apparatus: Flameproof cum Weatherproof Limit Switch housing,** in Cast Aluminium Alloy construction, designated by Model: **DNLF** for use in Gas Groups: IIA & IIB and Zone 1 atmospheres only.

4. **Type of Ex Protection:** Flameproof Ex 'd'

5. **Type of Ingress Protection**. IP-67

6. **Model No:** DNLF

7. **Rating of Apparatus:** As given in Second Schedule of this Report.

8. **Temperature Class:** As given in the **TABLE # 3**.

9. **Zones and Gas Group:** Gas Groups: IIA & IIB and Zone 1 only.

10. **Standard reference:**
    (a) As to flameproof construction: IS: 2148-2004 (IEC 60079-1/2001).
    (b) As to general design, rating, performance & T-class IS: 13346-2004 (IEC 60079-0/2000).
    (c) As to weatherproof construction IP-67: IS: 12065-1987.

11. **Material of construction and minimum thickness:** Cast Aluminium Alloy and 3mm minimum wall thickness

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12. Weight of the empty enclosure: 1.29 kg.

13. Inspection window: Not available.

14. Description of Apparatus:

Sl No.	Name of Enclosure	Dimension	Volume in CC		Type of Cover/ Joint	No. and size of bolts (HTS)	Max No of Aperture on Cover
			Gross	Net			
1	Main Enclosure	148 (W)x155 (L)x154 (H) mm	490cc	410cc	Flanged	8Nos. of M6 size	One no. on the cover shaft and one no. main body for passing

Flame paths and gaps (for IIA & IIB):

No.	Description	Type of cover	Flamepath Length in mm			Maximum Gap in mm or Pitch in mm		
			Req.	Specified	Meas.	Req.	Spec.	Meas.
1	Main Enclosure (Single enclosure)	Flanged joint between cover and Terminal stud plate	≥9.5	≥13	13.5	≤0.2	<0.2	≤0.1
		Cylindrical joint between cover & Shaft	≥9.5	≥26.1	27	≤0.2	<0.2	≤0.05
		Cylindrical joint between Main body and shaft	≥9.5	≥ 28	<28.5	≤0.2	<0.2	≤0.05

Max no. & size of cable entries and terminals:

Sl No.	Name of Enclosure	Max No of Entry
1	Main Enclosure (Single enclosure)	Maximum 2nos. of both ¾"NPT/BSC/ET or ½" NPT or M20 with direct thread axial length 16mm (min.) with less than 1.25mm (min.) pitch.

15. Name and warning inscription: "ISOLATE SUPPLY ELSEWHERE BEFORE OPENING"

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(Flame & Explosion Laboratory)

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16. Drawing:

Sl. No.	Drg. No.	Date	Title
1.	12-60-83-02B	31/05/07	FLAMEPROOF/EXPLOSIONPROOF JOINT DETAIL (DNLF GROUP I, IIA & IIB) HOUSING & COVER FLANGE JOINT MN
2.	12-60-83-03B	31/05/07	FLAMEPROOF/EXPLOSIONPROOF JOINT DETAILS (DNLF GROUP I, IIA & IIB) JOING AND SHAFT ROTATING JOINT MO
3.	12-60-83-04B	31/05/07	FLAMEPROOF/EXPLOSIONPROOF JOINT DETAILS (DNLF GROUP I, IIA & IIB) COVER & SHAFT ROTATING JOINT MM
4.	12-60-83-05B	31/05/07	FLAMEPROOF/EXPLOSIONPROOF JOINT DETAILS (DNLF GROUP I, IIA & IIB)
5.	12-60-83-48B	25/07/05	GASKET FOR DNLF
6.	12-60-83-67B	28/04/05	SHAFT FOR DNLF
7.	12-60-83-311	16/01/07	FLAMEPROOF LIMIT SWITCH (DNLF GROUP I, IIA & IIB) ASSEMBLEY DRAWING.

18. Declaration by the applicant:

(A) Declaration by the Applicant/Manufacturer as to standards with which the apparatus complies in respect of:

(a) As to flameproof construction: IS: 2148-2004 (IEC 60079-1/2001)
(b) As to general design, rating, performance & T class. IS: 13346-2004 (IEC 60079-0/2000)
(c) As to weatherproof construction IP-67: IS: 12063-1987

(B) Composition of the cast aluminum alloy declared by the manufacturer: Composition of cast aluminum alloy purported to be forming the material of construction of the enclosure has been declared by the manufacturer that material should not contain more than 7.5% magnesium by mass. However no sample of the alloy was drawn from the prototype enclosure for verifying its chemical composition declared by the manufacturer. The Report of test for Frictional Incendivity Test of the material of the enclosure is given in the **point C of Details of Test.**

SCOPE OF CERTIFICATE

Certificate issued by the certifying authority test by that the apparatus has been found to comply with the Definition of Flameproof Enclosure contained in the relevant Standard specification. They do not vouch for the quality of the equipment in any other respect. The chemical composition are as given below in table.

This Institute reserves the right to review, amend or withdraw this Test Report at any time if, considered necessary in the interest of safety.

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SCHEDULE: SECOND

The following are alternative permissible variation to otherwise identical unit covered by this Test Report:

1. The alternate material of construction of the **Flameproof cum Weatherproof Limit Switch housing** may be Cast Iron, SS, MS instead of Cast Aluminium Alloy for group– I, IIA & IIB.
2. Alternatively cable entries may be provided on enclosure of upto ¾" ET/NPT/BSP/MM/PG threads.

3. The following micro switch may be housed inside the flameproof enclosure without affecting flameproof properties:

Roller Level Type Microswitch (Honeywell Make)

DNLF1A1 =	Microswitch – V5C010EB3D	10Amps, 125 or 250 VAC, 220 VDC, 50Hz/60Hz
DNLF1A2 =	Microswitch – V5C010EB3D	10Amps, 125 or 250 VAC, 220 VDC, 50Hz/60Hz
DNLF1A3 =	Microswitch – V5C010EB3D	10Amps, 125 or 250 VAC, 220 VDC, 50Hz/60Hz
DNLF11A2=	Microswitch – V7-1C17E9-201	15Amps, 125 or 250 VAC, 220 VDC, 50Hz/60Hz
DNLF1A4 =	Microswitch – V5C010EB3D	10Amps, 125 or 250 VAC, 220 VDC, 50Hz/60Hz
DNLF11A4 =	Microswitch – V7-1C17E9-201	15Amps, 125 or 250 VAC, 220 VDC, 50Hz/60Hz

Roller Lever Type Microswitch (Cherry Make)

DNLF1B1 =	Microswitch – D43 CQ1 RA	5Amps, 125 or 250 VAC, 220 VDC, 50Hz/60Hz
DNLF1B2 =	Microswitch – D43 CQ1 RA	5Amps, 125 or 250 VAC, 220 VDC, 50Hz/60Hz
DNLF1B3 =	Microswitch – D43 CQ1 RA	5Amps. 125 or 250 VAC, 220 VDC, 50Hz/60Hz
DNLF1B4 =	Microswitch – D43 CQ1 RA	5Amps, 125 or 250 VAC, 220 VDC, 50Hz/60Hz
DNLF11B2 =	Microswitch – D45 CQ1 RA	15Amps, 125 or 250 VAC, 220 VDC, 50Hz/60Hz
DNLF1B4 =	Microswitch – D43 CQ1 RA	5Amps, 125 or 250 VAC, 220 VDC, 50Hz/60Hz
DNLF11B4 =	Microswitch – D45 CQ1 RA	15Amps, 125 or 250 VAC, 220 VDC, 50Hz/60Hz

Cylindrical Proximity Sensor (P & F Make)

DNLF2A1 =	NJ-2-12-GMN	8VDC, 3mA
DNLF2A2 =	NJ-2-12-GMN	8VDC, 3mA
DNLF12A2 =	NCB2-12GM35-NO	8 VDC, 24 VDC, 100mA
DNLF22A2 =	NBN4-12GMN-40-ZO	6 VDC, 24 VDC, 100mA
DNLF32A2 =	NCN4-12GMN-35-NO	8 VDC, 24 VDC, 100mA
DNLF42A2 =	NJ4-12GM50-WO	220VAC, 200mA, 50Hz/60Hz

Cylindrical Proximity Sensor (OSNA Make)

DNLF2B1 =	NJ-2-12-GMN	8VDC, 3mA
DNLF2B2 =	NJ-2-12-GMN	8VDC, 3mA
DNLF12B2 =	NCB2-12GM35-NO	8 VDC, 24 VDC, 100mA
DNLF22B2 =	NBN4-12GMN-40-ZO	6 VDC, 24 VDC, 100mA
DNLF32B2 =	NCN4-12GMN-35-NO	8 VDC, 24 VDC, 100mA
DNLF42B2 =	NJ4-12GM50-WO	220VAC, 200mA, 50Hz/60Hz

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Flat Type Proximity Sensor (P & F Make)

DNLF3A1 = NJ-2-V3N	8 VDC, 3mA
DNLF3A2 = NJ-2-V3N	8 VDC, 3 mA
DNLF3A3 = NJ-2-V3N	8 VDC, 3 mA
DNLF 13A2= NBB3-V3-Z4	10-60 VDC, 100mA

Flat Type Proximity Sensor (OSNA Make)

DNLF3B1 = NJ-2-V3N	8 VDC, 3mA
DNLF3B2 = NJ-2-V3N	8 VDC, 3 mA
DNLF3B3 = NJ-2-V3N	8 VDC, 3 mA
DNLF13B2= NBB3-V3-Z4	10-60 VDC, 100mA

Slot type Proximity Sensor (P & F Make)

DNLF4A1 = SJ-3.5-N	8 VDC, 3mA
DNLF4A2 = SJ-3.5-N	8 VDC, 3mA

Slot type Proximity Sensor (OSNA Make)

DNLF4B1 = SJ-3.5-N	8 VDC, 3mA
DNLF4B2 = SJ-3.5-N	8 VDC, 3mA

Roller Lever Type Microswitch (Honeywell Make)

DNLF5A2 = Microswitch – V5C010EB3D	10Amps, 125 or 250 VAC, 220VDC
DNLF15A2 = Microswitch – V7-1C17E9-201	15Amps, 125 or 250 VAC, 220VDC

Roller Lever Type Microswitch (Cherry Make)

DNLF5B2 = Microswitch – V5C010EB3D	10Amps, 125 or 250 VAC, 220VDC
DNLF15B2 = Microswitch – V7-1C17E9-201	15Amps, 125 or 250 VAC, 220VDC

Reed Switch (Cobra Make)

DNLF6A2 = Reed Switch	2 Amps, 220VAC, 110VAC

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FORMAT NO.: (CIMFR: DQM: FLP02: F-01)
(Flame & Explosion Laboratory)

ID NO. 51A/07 Code No. FLP/215A/2007

[Accompanies this office letter No: CIMFR/TC/P/H.210 dated: 14th June, 2007 and pertains to the report of testing as regards **Flameproof cum Weatherproof Limit Switch housing,** manufactured and submitted for test by M/S. Rotex Manufacturers & Engineers Pvt. Ltd., Manpada Road, Near Bhopar Village, Dombivli (E) – 421 204 (Maharashtra)]

REPORT OF TEST

Date of Test: 27/04/2007 and 16/05/2007 to 17/05/2007.

Details of Test:

A. Tests as per IS: 13346-2004:

Sl. No	Cl. 23.4.3 Mechanical tests			Results (P, F, N) / Reference
1	Test for resistance to Impact	23.4.3.1	Ability to withstand impact	P / As per Table#1
2	Drop test	23.4.3.2	Ability to withstand impact	N
	Cl. 23.4.4 : Tests for the Degree of protection IP			
3	IP of enclosure	23.4.4	Ability to prevent ingress of dust and water	P / As per Table#2
	Cl. 23.4.5 : Torque Test			
4	Torque test for bushings	23.4.5	Ability of bushing to withstand torque	N
	23.4.6 : Thermal tests			
5	Temperature measurement	23.4.6.1	To establish the maximum surface temperature	P / As per Table#3
6	Thermal shock test – for glass parts	23.4.6.2	Ability to withstand instant temperature gradient	N
	23.4.7 : Tests for Non- Metallic enclosures or parts			
7	Plastic parts and enclosures	23.4.7.2	Thermal Endurance: a. Heat b. Cold Mechanical Test Specific to Protection	N
8	Plastic Enclosures	23.4.7.5	Resistance to light For un-protected plastic & Group-1 Luminaries	N
9	Plastic Materials	23.4.7.8	Insulation resistance test	N
10	Non- Metallic enclosures	23.4.7.9	Earth continuity	N
11	Type of protection Ex 'd'	23.4.8	Withstand explosion	P / As per Table#4

Legend: P- Pass, F – Fail, N- Not applicable

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Table#1: 1kg mass of hardened steel fallen vertically on the surface of the enclosure to create impact energy for Gr. II apparatus. The impact should be done for gas group I.

Table#2: ; IP-Protection: Neoprene O ring rubber gasket (3.0mm thick) is provided at the end of the each joint for Weatherproof IP-67 degree of protection for each enclosure. Tests have been conducted as per IS: 12063 –1987(IEC-60529/1989) as tabulated below.

Sl.No.	Type tests			Results
1	Dust Test (First Numeral 6)	Clause 7.6	No dust had entered inside the enclosure	Pass
2	Water Test (Second Numeral 7)	Clause 8.7	No water had entered inside the enclosure	Pass

Table#3: The surface temperature rise classifications of the above apparatus have been determined with the following micro switch at an ambient temperature of 30^{0}C.

1. DNLF1A1 = Microswitch - V5C010EB3D, 10Amps/250 VAC/50Hz - **T6**
2. DNLF11A4 = Microswitch - V7-1C17E9-201, 15Amps/250 VAC/50Hz - **T6**
3. DNLF1B1 = Microswitch – D43 CQ1 RA, 5Amps/250 VAC/50Hz - **T6**
4. DNLF11B4 = Microswitch – D45 CQ1 RA, 15Amps/250 VAC/50Hz - **T6**
5. DNLF2A1 = NJ-2-12-GMN, 8VDC, 3mA - **T6**
6. DNLF12A2 = NCB2-12GM35-NO, 24 VDC, 100mA - **T6**
7. DNLF42A2 = NJ4-12GM50-WO, 220VAC, 200mA, 60Hz - **T6**
8. DNLF12B2 = NCB2-12GM35-NO 24 VDC, 100mA - **T6**
9. DNLF42B2 = NJ4-12GM50 WO 220VAC, 200mA, 50Hz - **T6**
10. DNLF5A2 = Microswitch - V5C010EB3D 10Amps/250 VAC - **T6**

Table#4: The details are given below in the B. Tests as per IS: 2148-2004.

B. Tests as per IS: 2148-2004

Sl.No.	Type tests			Results (P, F, N) / Reference
1	Pressure Test	15.1.1	Test of ability of the enclosure to withstand pressure	**P / As per Table # A & #B**
2	Reference Pressure	15.1.2	Determination of Internal Explosion Pressure	**P / As per Table #A**
3.	Over Pressure Test	15.1.3	Determination as per Static / Dynamic	**P / As per Table #B**
4.	Non-transmission of Internal ignition	15.2	Without gaskets	**P / As per Table #C**
5	Sealing	15.3	Stopping Box with setting compound	N
6	Flame proof enclosure	15.4	Test for equipment with breathing and draining devices	N

Legend: P- Pass, F – Fail , N- Not applicable

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Table # A:

Explosion pressure (Reference Pressure) test*

Type of test	Gas group	Gas Mixture % in Air	No. of tests
Preliminary Test (reference pressure)	IIB	24% H2/CH4 (85/15)	Five

Test Ref. No.	Ignition	Gauge Position	Max. Pressure in Bar	Time of Pressure rise in millisecond	Remark
Single Enclosure					
PPM/5100701	Body	Body	4.37	13.32	No evidence of distress
PPM/5100702	Body	Body	3.77	10.92	-do-
PPM/5100703	Body	Body	3.93	9.72	-do-
PPM/5100704	Body	Body	3.1	9.78	-do-
PPM/5100705	Body	Body	3.97	10.02	-do-

***Results shown for the pressure time curve (enclosed) are the highest recorded value obtained in the test.**

Table # B:

A pressure of 10.0 Kg/cm^2 was applied hydraulically to the above enclosure and the pressure being maintained for one minute. Test reference nos. is for above test OPM/5100711.

Table # C:

Non transmission of internal ignition test

Type of test	Test Ref. No.	Gas group	Gas Mixture % in Air	No. of Test	Result
Flame Transmission test (External ignition test)	EIT /5100706 to EIT/ 5100710	IIB	37% Hydrogen	Five	Pass

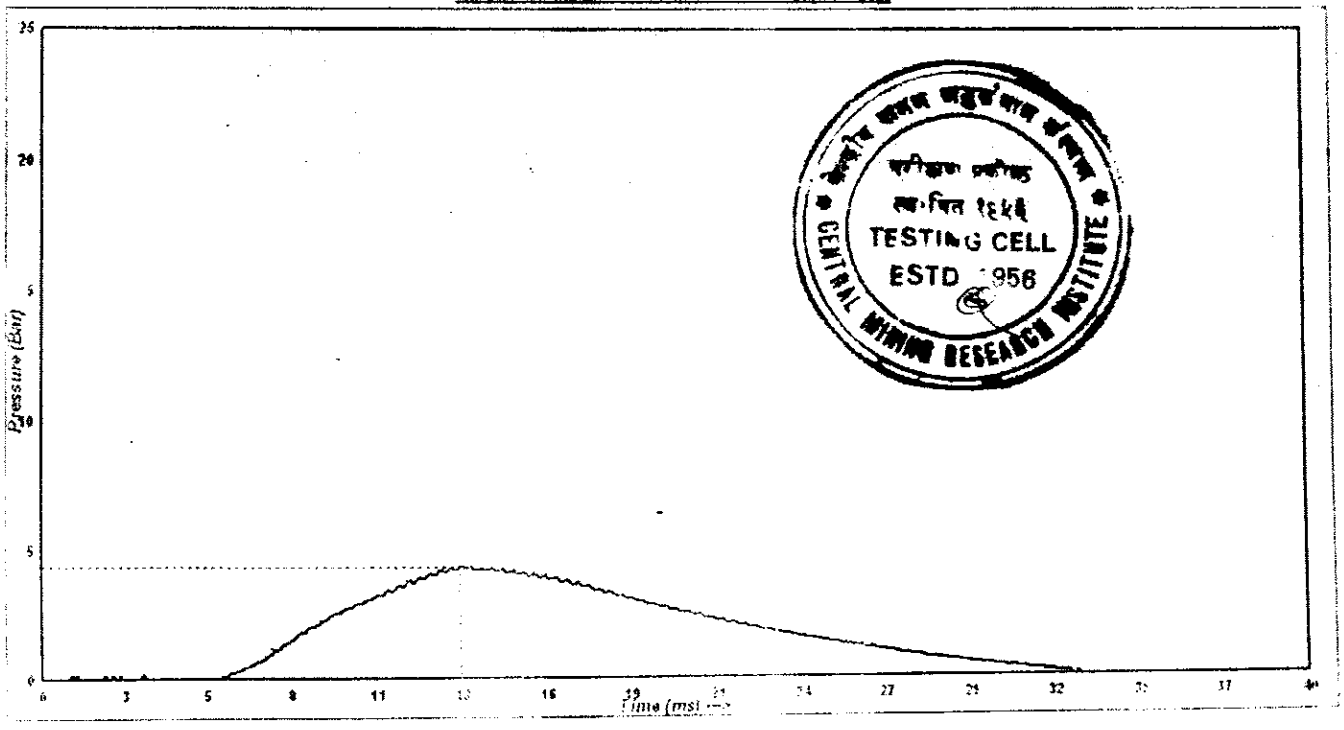
Continuation Sheet

केंद्रीय खान एवं ईंधन अनुसंधान संस्थान परीक्षण प्रकोष्ठ-CIMFR TESTING CELL

TEST CERTIFICATE

ID Number:	51A/07	Code Number:	FLP/215A/07
Test Date :	27/04/2007		
Manufacturer Details :	M/S ROTEX MANUFACTURERS & ENGINEERS PVT. LTD.		
Manufacturer Address :	DOMBIVLI (E) - 421 204 MAHARASHTRA, INDIA		
Model / Type :	MODEL - DNLF		
Category No. :	NA		
Gas :	H2+CH4		
Gas Group :	IIA IIB		
Equipment Details :	FLP/WP LIMIT SWITCH		
Enclosure Details :	SINGLE ENCLOSURE		
Serial / Badge No. :	NA		
Peak Pressure :	4.37 Bar at 13.32 ms		

Explosion Pressure vs Time Graph



13/6/07
(Testing Officer)

(Discipline Head) 26/07

केंद्रीय खनि एवं ईंधन अनुसंधान संस्थान CIMFR TESTING CELL

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C. Tests as per IS: 4013-1967

Type of test	Clause	Gas Mixture % in Air	Result
Test For Frictional Incendivity	9.7	21% Hydrogen	Cast Aluminium Alloy (Material of construction) is non-incendive with respect to Gas Group - IIB

TEST EQUIPMENT USED AND THEIR CALIBRATION STATUS:

(i) Computer, Kistler Piezo Electric Transducer & Charge Amplifier for conducting Explosion Pressure Tests.

(ii) Fabricated set up for Dust Protection & Water Protection Testing.

Calibration: Calibration was performed as per in house procedure and are within the permissible range.

ENVIRONMENTAL CONDITION WHERE APPLICABLE: NA

CONCLUSION: Flameproof cum Weatherproof Limit Switch housing, designated by **Model: DNLF,** in Cast Aluminum Alloy LM 6 construction under reference meets the test requirements of IS: 2148-2004 in respect of flameproofness, IS: 12063-1987 in respect of IP-67 degree of protection and IS:13346-2004 in respect of general requirements for suitable in gas group IIA & IIB and Zone 1 only.

Reported by

(B. AHIRWAL)
SCIENTIST
Dated: 13th June, 2007
Flame & Explosion Laboratory,
Central Institute of Mining & Fuel Research, (CSIR-INDIA)
(Formerly: Central Mining Research Institute)
Barwa Road, Dhanbad -826001, Jharkhand, INDIA

Approved by

(A. K. SINGH)
HEAD OF THE DEPARTMENT

E.O.D.