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TEST REPORT

NAME & ADDRESS OF THE CUSTOMER	TEST REPORT NO.: LSWG/2912 DATE: 11/03/2011	
CROMPTON GREAVES LIMITED SWITCHGEAR COMPLEX, S3 DIVISION, A-3, MIDC, AMBAD, NASIK – 422 010 INDIA.	**CUSTOMER REF. NO.**	**DATED**
	Nil	16/12/2010
	DATE OF SAMPLE RECEIPT	**DATE OF TESTING**
	07/01/2011	10/02/2011 to 03/03/2011

SAMPLE DESCRIPTION	SAMPLE IDENTIFICATION
145kV SF6 GAS CIRCUIT BREAKER (SPRING CLOSING – SPRING OPENING) Rated voltage : 145kV Rated normal current : 3150 A Rated frequency : 50 Hz No. of poles : 3 Quantity (Tested) : 1 No. Further details as per sheet 2 of 19	**ERDA sample code no. :** PLV-1186/01 **Type designation:** 120-SFM-32B **Sr. No. :** 32381C **Manufacturer's name :** M/s. Crompton Greaves Limited, Nasik **Drawing No.:** i) 3949604 R0 ii) 4949638 (Rev. 0) (Total 2 sheets)

TEST DETAILS	TEST SPECIFICATION
(Sub-contracted) **2.0 Mechanical operation test at ambient air temperature (Class M2)** (Further details as per sheet 3 of 19)	**As per customer's requirement & test procedure followed as per Cl. No. 6.101.2 of IEC 62271 – 100: 2008**

ENCLOSURE: 1) Oscillogram No. : 1186/01/19 to 54 (Total 36 Nos.)
2) Photograph No. : 1186/01/A to F
3) Drawing No. : i) 3949604 R0
ii) 4949638 (Rev. 0) (Total 2 Sheets)

NOTE: For Class M2, balanced 8000 mechanical operations are carried out in continuation with 2000 mechanical operations of Class M1 test, vide Test Report No.: LSWG/2911 Dated: 11/03/2011 to complete total 10000 operation.

REMARKS: Sample **conforms** to the requirement of the customer for the mechanical operation test at ambient air temperature (Class M2).

Prepared By	Checked By	Approved By

Note: 1. This report relates only to the particular sample tested in good condition received by ERDA at Crompton Greaves Limited, Nasik.
2. This report can not be reproduced in part under any circumstances
3. Publication of this report requires prior permission in writing from Director, ERDA.
4. Only the tests asked for by the customer have been carried out.

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TECHNICAL SPECIFICATION ASSIGNED BY THE CUSTOMER:

145 kV SF6 GAS CIRCUIT BREAKER
(SPRING CLOSING – SPRING OPENING)

1. Test Specification	: As per customer's requirement & test procedure followed as per Cl. No. 6.101.2 of IEC 62271-100: 2008
2. Manufacturer's name	: M/s. Crompton Greaves Ltd., Nasik
3. Type designation	: 120-SFM-32B
4. Serial no.	: 32381C
5. Rated voltage	: 145 kV
6. Rated normal current	: 3150 A
7. No. of pole	: 3
8. Rated frequency	: 50 Hz
9. Rated power frequency withstand voltage	: 275 kVrms
10. Rated lightning impulse withstand voltage	: 650 kVp
11. Rated short circuit breaking capacity	: 40 kA rms
12. Rated short circuit making capacity	: 100 kAp
13. Rated short time withstand current & its duration	: 40 kA rms for 3 seconds
14. Rated control supply voltage of closing device	: 110 V dc
15. Rated control supply voltage of tripping device	: 110 V dc
16. Rated voltage of the motor	: 125 Vac/dc
17. Rated maximum pressure of SF6 gas for interruption	: 7.0 Kg / cm² (g) at 20 ° C
18. Rated minimum pressure of SF6 gas for interruption	: 6.0 Kg / cm² (g) at 20 ° C
19. Rated operating sequence	: O- 0.3Sec. - CO - 3 Min. - CO
20. Operating mechanism	: Type BM – spring closing – Spring opening
21. Time – Speed parameters (Declared by the manufacturer)	:
- Closing time (millisecond)	: 80 to 110
- Contact mismatch (millisecond)	: ≤ 5 (Between pole)
- Opening time (millisecond)	: 20 to 34
- Contact mismatch (millisecond)	: ≤ 3.3 (Between pole)
- CO operation time (millisecond)	: ≤ 60
22. Contact resistance of the main circuit	: ≤ 37 micro-ohms
23. SF6 Gas leakage limit at each joint (for proving gas tightness)	: 10 ppm (Maximum)
24. Insulation class of closing coil	: F
25. Insulation class of tripping coil	: F
26. Insulation class of motor	: E

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Test Report No.: LSWG/2912
Date: 11/03/2011

TEST DETAILS: (Sub-contracted)	**Clause No.**
2.0 Mechanical operation test at ambient air temperature (Class M2) (Considering 2000 mechanical operations of Class M1 vide test Report No. LSWG/2911 Dated: 11/03/2011)	**As per customer's requirement & test procedure followed as per Cl. No. 6.101.2**
2.1 Characteristics and settings of the circuit breaker to be recorded before and after tests (After 4000 mechanical operations test)	6.101.1.3
2.2 Characteristics and settings of the circuit breaker to be recorded before and after tests (After 6000 mechanical operations test)	6.101.1.3
2.3 Characteristics and settings of the circuit breaker to be recorded before and after tests (After 8000 mechanical operations test)	6.101.1.3
2.4 Characteristics and settings of the circuit breaker to be recorded before and after tests (After 10000 mechanical operations test)	6.101.1.3
2.5 Condition of the circuit breaker during and after the tests. (After Mechanical operation test)	As per Customer's Requirement & test Procedure followed as per Cl. No. 6.101.1.4
2.6 Condition of auxiliary and control equipment during and after the tests. (After Mechanical operation test)	6.101.1.5

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Date: 11/03/2011

TEST RESULTS:

Sr. no.	Particulars of the tests & Clause No.	Requirements as per specifications	Obtained value	Remarks
2.0	**Mechanical Operation Test at Ambient Air Temperature (Class M2) (As per customer's requirement & test procedure followed as per Cl. No. 6.101.2)**			**Conforms**
	The circuit breaker was mounted as in Photograph no.: 1186/01/A during test.			
	Ambient air temperature (°C)	------	22.8	
	Total no. of operations	# 10000	10000 Completed	
	1) Operating sequence	$C - t_a - O - t_a$	$C - t_a - O - t_a$	
	t_a (Seconds) (*Specified by the manufacturer)	*45	45	
	Rated supply voltage			
	For Closing Coil (V DC)	100% of 110	110	
	For Tripping Coil (V DC)	100% of 110	110	
	For Spring charging motor (V AC)	100% of 125	125	
	No. of Operating sequence	500	500 completed	
	Maximum supply voltage			
	For Closing Coil (V DC)	110% of 110	121 V	
	For Tripping Coil (V DC)	110% of 110	121 V	
	For Spring charging motor (V AC)	110% of 125	137.5 V	
	No. of Operating sequence	500	500 completed	
	Minimum supply voltage			
	For Closing Coil (V DC)	85% of 110 V	93.5 V	
	For Tripping Coil (V DC)	70% of 110 V	77 V	
	For Spring charging motor (V AC)	85% of 125 V	106.2 V	
	No. of Operating sequence	500	500 Completed	

 # The operating cycles consists of 2000 mechanical operations are to be repeated five times to complete total 10000 mechanical operations, considering 2000 mechanical operations of Class M1, vide Test Report No. : LSWG/2911 Dated: 11/03/2011

Note : During the tests no maintenance such as lubrication & mechanical adjustment was performed.

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Date: 11/03/2011

Sr. no.	Particulars of the tests & Clause No.	Requirements as per specifications	Obtained value	Remarks
	2) Operating sequence	O-t-CO-t_a-C-t_a	O-t-CO-t_a-C-t_a	
	- t_a (seconds) - t (seconds)	*45 0.3	45 0.3	
	Rated supply voltage			
	For Closing Coil (V DC) For Tripping Coil (V DC) For Spring charging motor (V AC)	100% of 110 100% of 110 100% of 125	110 110 125	
	No. of operating sequence	250	250 completed	
	Where, O = Opening C = Closing CO = A closing operation followed immediately by an opening operation t_a= Time interval between two operations which is necessary to restore the initial conditions and / or to prevent undue heating of parts of the circuit breaker t = 0.3 Seconds for circuit breaker intended for rapid auto-reclosing (* Specified by the manufacturer)			

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Date: 11/03/2011

Sr. no.	Particulars of the tests & Clause No.	Requirements as per specifications	Obtained value	Remarks
2.1	**Characteristics and settings of the circuit breaker to be recorded before and after the test (Cl. No. 6.101.1.3)** (After 4000 mechanical operations test)			**Conforms**
	Reference ambient air temperature (°C)	------	22.1	
	1) Rated supply voltage			
	- For Closing coil (DC)	100% of 110V	110 V	
	- For Tripping coil (DC)	100% of 110V	110 V	
	- For spring charging motor (AC)	100% of 125V	125 V	
	- Closing time (millisecond)			
	R - Pole	80 - 110	95.40	
	Y - Pole	80 - 110	94.20	
	B - Pole	80 - 110	95.30	
	- Closing pole discrepancy (millisecond)	≤ 5.0	1.20	
	Oscillogram No.	---	1186/01/19	
	- Opening time (millisecond)			
	R - Pole	20 - 34	25.70	
	Y - Pole	20 - 34	26.40	
	B - Pole	20 - 34	25.90	
	- Opening pole discrepancy (millisecond)	≤ 3.3	0.70	
	Oscillogram No.	---	1186/01/20	
	- CO time (millisecond)			
	R - Pole	≤ 60	36.30	
	Y - Pole	≤ 60	38.00	
	B - Pole	≤ 60	36.60	
	Oscillogram No.	---	1186/01/21	
	- Spring charging time of motor (second)	---	10.06	
	-Spring charging motor current (A Max)	---	5.96	
	No. of operations [Cl. No. 6.101.2.5 a)]	5	5 Completed	

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Test Report No.: LSWG/2912
Date: 11/03/2011

Sr. no.	Particulars of the tests & Clause No.	Requirements as per specifications	Obtained value	Remarks
	2) Maximum supply voltage			
	- For Closing coil (DC)	110% of 110 V	121 V	
	- For Tripping coil (DC)	110% of 110 V	121 V	
	- For spring charging motor (AC)	110% of 125 V	137.5 V	
	- Closing time (millisecond)			
	R - Pole	80 - 110	94.40	
	Y - Pole	80 - 110	93.20	
	B - Pole	80 - 110	94.20	
	- Closing pole discrepancy (millisecond)	≤ 5.0	1.20	
	Oscillogram No.	---	1186/01/22	
	- Opening time (millisecond)			
	R - Pole	20 - 34	24.90	
	Y - Pole	20 - 34	25.70	
	B - Pole	20 - 34	25.10	
	- Opening pole discrepancy (millisecond)	≤ 3.3	0.80	
	Oscillogram No.	---	1186/01/23	
	- CO time (millisecond)			
	R - Pole	≤ 60	36.30	
	Y - Pole	≤ 60	38.10	
	B - Pole	≤ 60	36.60	
	Oscillogram No.	---	1186/01/24	
	- Spring charging time of motor (second)	---	8.89	
	-Spring charging motor current (A Max)	---	6.06	
	No. of operations [Cl. No. 6.101.2.5 a)]	5	5 Completed	

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Sr. no.	Particulars of the tests & Clause No.	Requirements as per specifications	Obtained value	Remarks
	3) Minimum supply voltage			
	- For Closing coil (DC)	85% of 110 V	93.5 V	
	- For Tripping coil (DC)	70% of 110 V	77 V	
	- For spring charging motor (AC)	85% of 125 V	106.2 V	
	- Closing time (millisecond)			
	R - Pole	80 - 110	97.60	
	Y - Pole	80 - 110	96.40	
	B - Pole	80 - 110	97.40	
	- Closing pole discrepancy (millisecond)	≤ 5.0	1.20	
	Oscillogram No.	---	1186/01/25	
	- Opening time (millisecond)			
	R - Pole	20 - 34	29.00	
	Y - Pole	20 - 34	29.80	
	B - Pole	20 - 34	29.30	
	- Opening pole discrepancy (millisecond)	≤ 3.3	0.80	
	Oscillogram No.	---	1186/01/26	
	- CO time (millisecond)			
	R - Pole	≤ 60	37.30	
	Y - Pole	≤ 60	39.00	
	B - Pole	≤ 60	37.60	
	Oscillogram No.	---	1186/01/27	
	- Spring charging time of motor (second)	---	12.76	
	-Spring charging motor current (A Max)	---	6.25	
	No. of operations [Cl. No. 6.101.2.5 a)]	5	5 Completed	

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Sr. no.	Particulars of the tests & Clause No.	Requirements as per specifications	Obtained value	Remarks
2.2	**Characteristics and settings of the circuit breaker to be recorded before and after the test (Cl. No. 6.101.1.3)** (After 6000 mechanical operations test)			**Conforms**
	Reference ambient air temperature (°C)	------	24.0	
	1) Rated supply voltage			
	- For Closing coil (DC)	100% of 110 V	110 V	
	- For Tripping coil (DC)	100% of 110 V	110 V	
	- For spring charging motor (AC)	100% of 125 V	125 V	
	- Closing time (millisecond)			
	R - Pole	80 - 110	94.80	
	Y - Pole	80 - 110	93.70	
	B - Pole	80 - 110	94.70	
	- Closing pole discrepancy (millisecond)	≤ 5.0	1.10	
	Oscillogram No.	---	1186/01/28	
	- Opening time (millisecond)			
	R - Pole	20 - 34	25.90	
	Y - Pole	20 - 34	26.70	
	B - Pole	20 - 34	26.10	
	- Opening pole discrepancy (millisecond)	≤ 3.3	0.80	
	Oscillogram No.	---	1186/01/29	
	- CO time (millisecond)			
	R - Pole	≤ 60	36.70	
	Y - Pole	≤ 60	38.20	
	B - Pole	≤ 60	36.80	
	Oscillogram No.	---	1186/01/30	
	- Spring charging time of motor (second)	---	10.11	
	-Spring charging motor current (A Max)	---	6.31	
	No. of operations [Cl. No. 6.101.2.5 a)]	5	5 Completed	

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Sr. no.	Particulars of the tests & Clause No.	Requirements as per specifications	Obtained value	Remarks
	2) Maximum supply voltage			
	- For Closing coil (DC)	110% of 110 V	121 V	
	- For Tripping coil (DC)	110% of 110 V	121 V	
	- For spring charging motor (AC)	110% of 125 V	137.5 V	
	- Closing time (millisecond)			
	R - Pole	80 - 110	93.90	
	Y - Pole	80 - 110	93.00	
	B - Pole	80 - 110	93.90	
	- Closing pole discrepancy (millisecond)	≤ 5.0	0.90	
	Oscillogram No.	---	1186/01/31	
	- Opening time (millisecond)			
	R - Pole	20 - 34	25.10	
	Y - Pole	20 - 34	26.00	
	B - Pole	20 - 34	25.60	
	- Opening pole discrepancy (millisecond)	≤ 3.3	0.90	
	Oscillogram No.	---	1186/01/32	
	- CO time (millisecond)			
	R - Pole	≤ 60	36.40	
	Y - Pole	≤ 60	37.90	
	B - Pole	≤ 60	36.40	
	Oscillogram No.	---	1186/01/33	
	- Spring charging time of motor (second)	---	9.02	
	-Spring charging motor current (A Max)	---	6.15	
	No. of operations [Cl. No. 6.101.2.5 a)]	5	5 Completed	

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	3) Minimum supply voltage			
	- For Closing coil (DC)	85% of 110 V	93.5 V	
	- For Tripping coil (DC)	70% of 110 V	77 V	
	- For spring charging motor (AC)	85% of 125 V	106.2 V	
	- Closing time (millisecond)			
	R - Pole	80 - 110	97.80	
	Y - Pole	80 - 110	96.70	
	B - Pole	80 - 110	97.90	
	- Closing pole discrepancy (millisecond)	≤ 5.0	1.20	
	Oscillogram No.	---	1186/01/34	
	- Opening time (millisecond)			
	R - Pole	20 - 34	29.20	
	Y - Pole	20 - 34	29.90	
	B - Pole	20 - 34	29.40	
	- Opening pole discrepancy (millisecond)	≤ 3.3	0.70	
	Oscillogram No.	---	1186/01/35	
	- CO time (millisecond)			
	R - Pole	≤ 60	37.50	
	Y - Pole	≤ 60	39.10	
	B - Pole	≤ 60	37.50	
	Oscillogram No.	---	1186/01/36	
	- Spring charging time of motor (second)	---	13.26	
	-Spring charging motor current (A Max)	---	6.35	
	No. of operations [Cl. No. 6.101.2.5 a)]	5	5 Completed	

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Sr. no.	Particulars of the tests & Clause No.	Requirements as per specifications	Obtained value	Remarks
2.3	**Characteristics and settings of the circuit breaker to be recorded before and after the test (Cl. No. 6.101.1.3)** (After 8000 mechanical operations test)			**Conforms**
	Reference ambient air temperature (°C)	------	22.0	
	1) Rated supply voltage			
	- For Closing coil (DC)	100% of 110 V	110 V	
	- For Tripping coil (DC)	100% of 110 V	110 V	
	- For spring charging motor (AC)	100% of 125 V	125 V	
	- Closing time (millisecond)			
	R - Pole	80 - 110	97.60	
	Y - Pole	80 - 110	96.50	
	B - Pole	80 - 110	97.60	
	- Closing pole discrepancy (millisecond)	≤ 5.0	1.10	
	Oscillogram No.	---	1186/01/37	
	- Opening time (millisecond)			
	R - Pole	20 - 34	26.00	
	Y - Pole	20 - 34	26.80	
	B - Pole	20 - 34	26.20	
	- Opening pole discrepancy (millisecond)	≤ 3.3	0.80	
	Oscillogram No.	---	1186/01/38	
	- CO time (millisecond)			
	R - Pole	≤ 60	37.96	
	Y - Pole	≤ 60	39.60	
	B - Pole	≤ 60	37.90	
	Oscillogram No.	---	1186/01/39	
	- Spring charging time of motor (second)	---	10.06	
	-Spring charging motor current (A Max)	---	5.98	
	No. of operations [Cl. No. 6.101.2.5 a)]	5	5 Completed	

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Sr. no.	Particulars of the tests & Clause No.	Requirements as per specifications	Obtained value	Remarks
	2) Maximum supply voltage			
	- For Closing coil (DC)	110% of 110 V	121 V	
	- For Tripping coil (DC)	110% of 110 V	121 V	
	- For spring charging motor (AC)	110% of 125 V	137.5 V	
	- Closing time (millisecond)			
	R - Pole	80 - 110	96.30	
	Y - Pole	80 - 110	95.20	
	B - Pole	80 - 110	96.30	
	- Closing pole discrepancy (millisecond)	≤ 5.0	1.10	
	Oscillogram No.	---	1186/01/40	
	- Opening time (millisecond)			
	R - Pole	20 - 34	25.20	
	Y - Pole	20 - 34	26.00	
	B - Pole	20 - 34	25.50	
	- Opening pole discrepancy (millisecond)	≤ 3.3	0.80	
	Oscillogram No.	---	1186/01/41	
	- CO time (millisecond)			
	R - Pole	≤ 60	37.30	
	Y - Pole	≤ 60	38.90	
	B - Pole	≤ 60	37.60	
	Oscillogram No.	---	1186/01/42	
	- Spring charging time of motor (second)	---	8.82	
	-Spring charging motor current (A Max)	---	5.96	
	No. of operations [Cl. No. 6.101.2.5 a)]	5	5 Completed	

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Sr. no.	Particulars of the tests & Clause No.	Requirements as per specifications	Obtained value	Remarks
	3) Minimum supply voltage			
	- For Closing coil (DC)	85% of 110 V	93.5 V	
	- For Tripping coil (DC)	70% of 110 V	77 V	
	- For spring charging motor (AC)	85% of 125 V	106.2 V	
	- Closing time (millisecond)			
	R - Pole	80 - 110	98.40	
	Y - Pole	80 - 110	97.30	
	B - Pole	80 - 110	98.20	
	- Closing pole discrepancy (millisecond)	≤ 5.0	1.10	
	Oscillogram No.	---	1186/01/43	
	- Opening time (millisecond)			
	R - Pole	20 - 34	29.20	
	Y - Pole	20 - 34	29.90	
	B - Pole	20 - 34	29.40	
	- Opening pole discrepancy (millisecond)	≤ 3.3	0.70	
	Oscillogram No.	---	1186/01/44	
	- CO time (millisecond)			
	R - Pole	≤ 60	38.10	
	Y - Pole	≤ 60	39.70	
	B - Pole	≤ 60	38.10	
	Oscillogram No.	---	1186/01/45	
	- Spring charging time of motor (second)	---	12.99	
	-Spring charging motor current (A Max)	---	6.27	
	No. of operations [Cl. No. 6.101.2.5 a)]	5	5 Completed	

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Test Report No.: LSWG/2912
Date: 11/03/2011

Sr. no.	Particulars of the tests & Clause No.	Requirements as per specifications	Obtained value	Remarks
2.4	**Characteristics and settings of the circuit breaker to be recorded before and after the test (Cl. No. 6.101.1.3)** (After 10000 mechanical operations test)			**Conforms**
	Reference ambient air temperature (°C)	------	24.0	
	1) Rated supply voltage			
	- For Closing coil (DC)	100% of 110 V	110 V	
	- For Tripping coil (DC)	100% of 110 V	110 V	
	- For spring charging motor (AC)	100% of 125 V	125 V	
	- Closing time (millisecond)			
	R - Pole	80 - 110	95.50	
	Y - Pole	80 - 110	94.40	
	B - Pole	80 - 110	95.30	
	- Closing pole discrepancy (millisecond)	≤ 5.0	1.10	
	Oscillogram No.	---	1186/01/46	
	- Opening time (millisecond)			
	R - Pole	20 - 34	25.70	
	Y - Pole	20 - 34	26.60	
	B - Pole	20 - 34	26.00	
	- Opening pole discrepancy (millisecond)	≤ 3.3	0.90	
	Oscillogram No.	---	1186/01/47	
	- CO time (millisecond)			
	R - Pole	≤ 60	37.50	
	Y - Pole	≤ 60	39.00	
	B - Pole	≤ 60	37.50	
	Oscillogram No.	---	1186/01/48	
	- Spring charging time of motor (second)	---	10.73	
	-Spring charging motor current (A Max)	---	6.14	
	No. of operations [Cl. No. 6.101.2.5 a)]	5	5 Completed	

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Sr. no.	Particulars of the tests & Clause No.	Requirements as per specifications	Obtained value	Remarks
	2) Maximum supply voltage			
	- For Closing coil (DC)	110% of 110 V	121 V	
	- For Tripping coil (DC)	110% of 110 V	121 V	
	- For spring charging motor (AC)	110% of 125 V	137.5 V	
	- Closing time (millisecond)			
	R - Pole	80 - 110	95.60	
	Y - Pole	80 - 110	94.40	
	B - Pole	80 - 110	95.60	
	- Closing pole discrepancy (millisecond)	≤ 5.0	1.20	
	Oscillogram No.	---	1186/01/49	
	- Opening time (millisecond)			
	R - Pole	20 - 34	25.10	
	Y - Pole	20 - 34	25.90	
	B - Pole	20 - 34	25.40	
	- Opening pole discrepancy (millisecond)	≤ 3.3	0.80	
	Oscillogram No.	---	1186/01/50	
	- CO time (millisecond)			
	R - Pole	≤ 60	37.40	
	Y - Pole	≤ 60	38.90	
	B - Pole	≤ 60	37.50	
	Oscillogram No.	---	1186/01/51	
	- Spring charging time of motor (second)	---	9.01	
	-Spring charging motor current (A Max)	---	6.03	
	No. of operations [Cl. No. 6.101.2.5 a)]	5	5 Completed	

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Sr. no.	Particulars of the tests & Clause No.	Requirements as per specifications	Obtained value	Remarks
	3) Minimum supply voltage			
	- For Closing coil (DC)	85% of 110 V	93.5 V	
	- For Tripping coil (DC)	70% of 110 V	77 V	
	- For spring charging motor (AC)	85% of 125 V	106.2 V	
	- Closing time (millisecond)			
	R - Pole	80 - 110	98.10	
	Y - Pole	80 - 110	96.90	
	B - Pole	80 - 110	97.90	
	- Closing pole discrepancy (millisecond)	≤ 5.0	1.20	
	Oscillogram No.	---	1186/01/52	
	- Opening time (millisecond)			
	R - Pole	20 - 34	29.00	
	Y - Pole	20 - 34	29.90	
	B - Pole	20 - 34	29.30	
	- Opening pole discrepancy (millisecond)	≤ 3.3	0.90	
	Oscillogram No.	---	1186/01/53	
	- CO time (millisecond)			
	R - Pole	≤ 60	37.50	
	Y - Pole	≤ 60	39.30	
	B - Pole	≤ 60	37.60	
	Oscillogram No.	---	1186/01/54	
	- Spring charging time of motor (second)	---	13.49	
	-Spring charging motor current (A Max)	---	6.34	
	No. of operations [Cl. No. 6.101.2.5 a)]	5	5 Completed	

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Sr. No	Particulars of the tests & Clause No.	Requirements as per Specifications	Obtained Value	Remarks
	4) SF6 gas pressure	7.0 Kg/cm2 at 20°C	7.4 Kg/cm2 at 24.0 °C	
	5) Power consumption of control circuit			
	- Resistance of closing coil	-----	19.6 Ω	
	- Power consumption of closing coil	-----	617.34 W	
	- Resistance of Tripping coil – 1	-----	19.7 Ω	
	- Power consumption of tripping coil- 1	-----	614.21 W	
	- Resistance of Tripping coil – 2	-----	19.6 Ω	
	- Power consumption of tripping coil -2	-----	617.34 W	
	6) Rated operating sequence (One operation performance)	O – 0.3 Sec.– CO – 3 Min. – CO	O – 0.3 Sec.– CO – 3 Min. – CO Completed	
	7) Tightness Test Gas leakage measured of complete system which includes all pole joints, pole gear box (which includes all casting & casting joints, pipe end connection), NRV joint, manometer joint.			
	Electron capture detector was used for leakage measurement			
	Time for stabilization 3 hours.			
	Reference ambient air temperature (°C)	----	24.0	
	-Sf6 Gas Pressure	7.0 Kg/cm2 at 20°C	7.4 Kg/cm2 at 24.0°C	
	-Complete system gas leakage acceptable rate/ joint (For proving gas tightness)	* ≤ 10 ppm	≤ 10 ppm	
	(* Declared by the manufacturer)			
	8) Measurement of the resistance of the main circuit			
	Reference ambient air temperature(°C)	---	24.0	
	Test current (A DC)	50 3150	100	
	- Contact Resistance measured (micro-ohms)			
	R - Pole	≤ 37	31.0	
	Y - Pole	≤ 37	29.0	
	B - Pole	≤ 37	30.0	

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Sr. No	Particulars of the tests & Clause No.	Requirements as per specifications	Obtained value	Remarks
2.5	**Condition of the circuit breaker during and after the test (As per customer requirement & test procedure followed as per Cl. No. 6.101.1.4 of IEC 62271-100-2008)**	Circuit breaker shall be capable of operating normally. All parts of the circuit breaker shall not show any undue wear.	Circuit breaker was capable of operating normally. All parts of the circuit breaker did not show any undue wear.	**Conforms**
	Test voltage applied : (Power frequency) (kVrms)			
	i) Across open contacts of each pole	# 275	275	
	# ii) Between phase to earth (Breaker contacts in closed position)	# 275	275	
	(As per Cl. No. 6.2.11 of IEC 62271-100:2008 & Table1a, column (2) of IEC 62271-1-2007)			
	Test duration (minute)	1.0	1.0	
	SF6 Gas pressure	6.0 Kg/cm2 at 20°C	6.0 Kg/cm2 at 24°C	
	Test results to be obtained (# Specified by the manufacturer)	- There shall be no unintentional disruptive discharge during the test.	- There was no unintentional disruptive discharge during the test.	
2.6	**Condition of the auxiliary and control equipment during and after the test. (Cl. No. 6.101.1.5)**	There shall be no undue wear. The functions of Auxiliary and control equipment shall fulfill as per standard	There was no undue wear. The functions of auxiliary and control equipment fulfilled as per standard.	**Conforms**
	Test voltage applied (Power frequency) (kVrms) (As per Cl. No. 6.2.10 of IEC 62271-1-2007)	2.0	2.0	
	Test duration (minute)	1.0	1.0	
	Test results to be obtained	No flashover or breakdown shall occur.	No flashover or breakdown occurred.	

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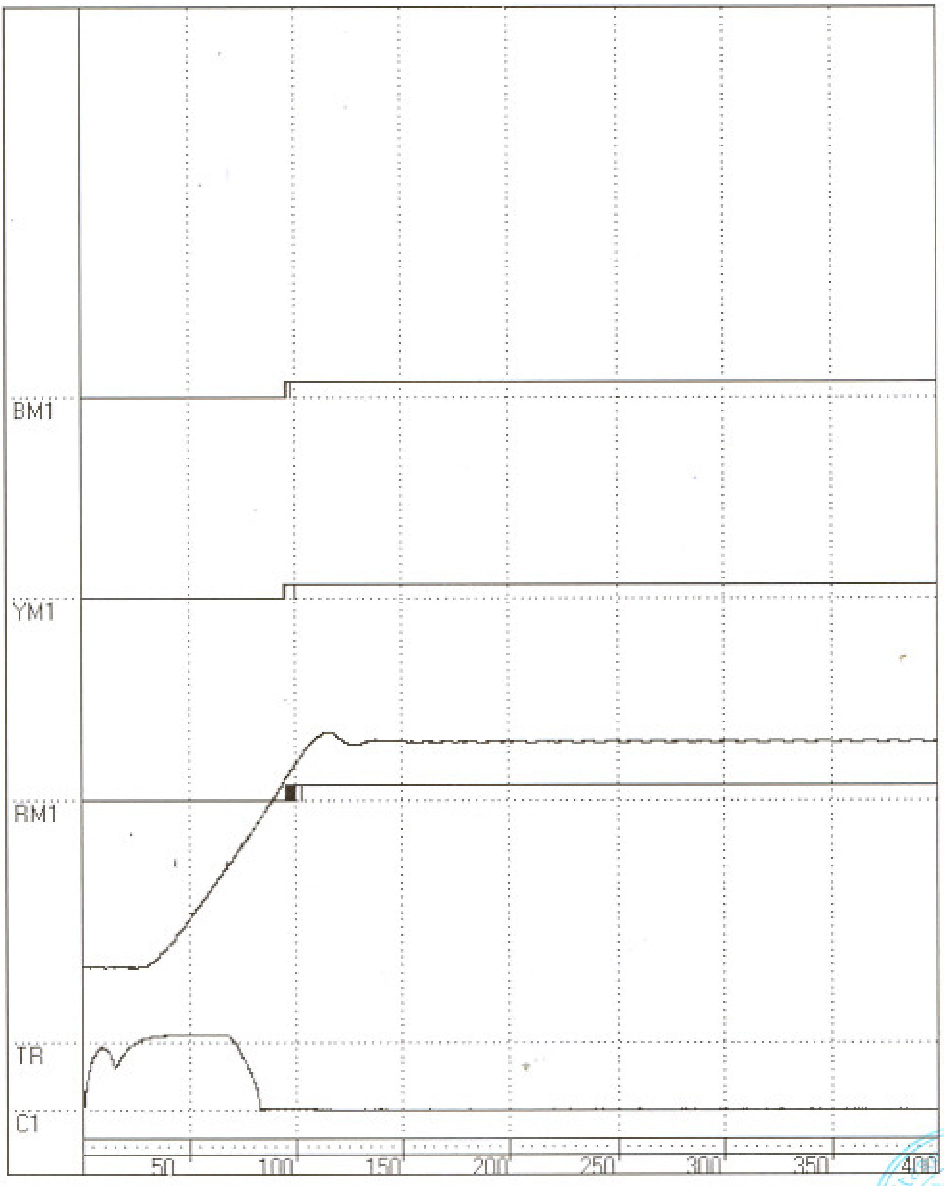
Date: 11/03/2011

Oscillogram No. 1186/01/19



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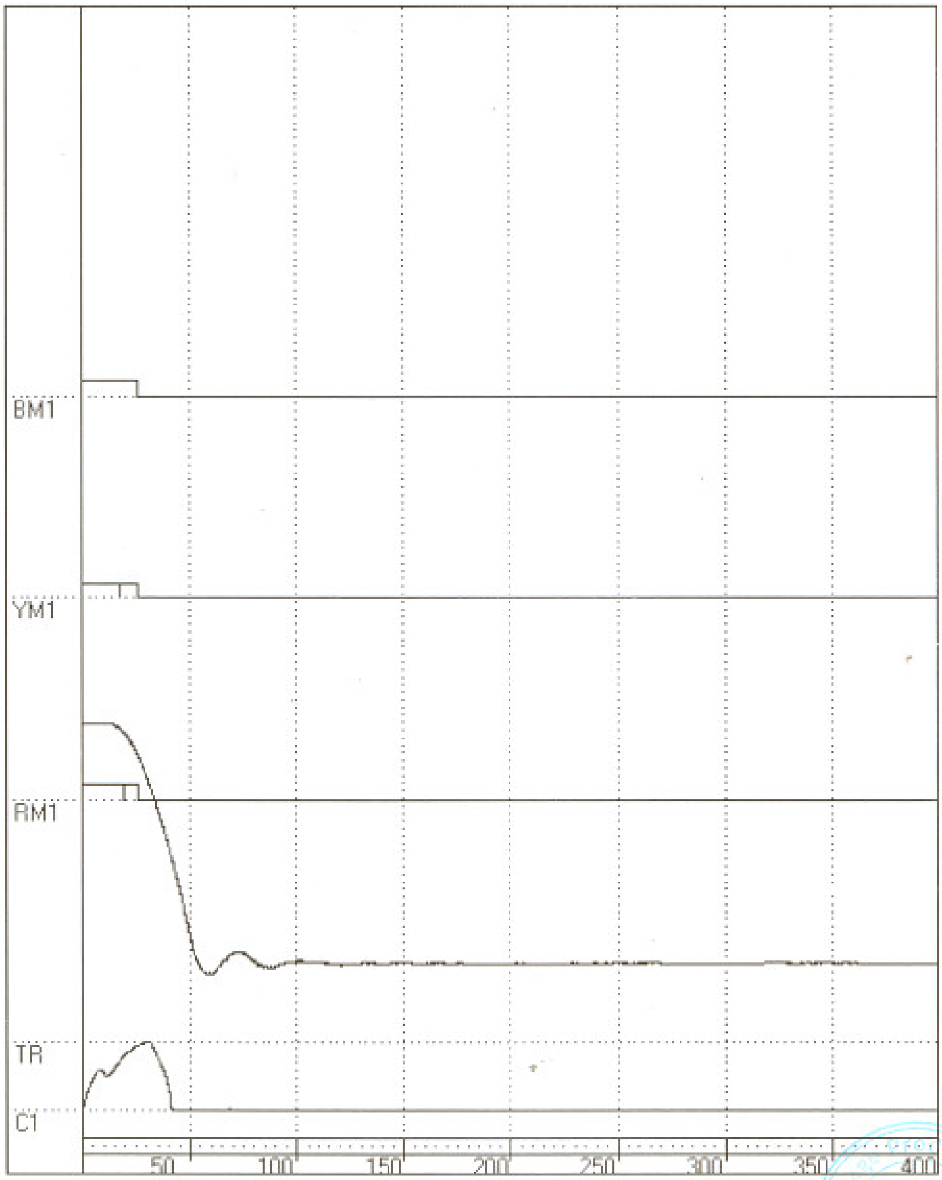
Test Report No. : LSWG/2912
Date: 11/03/2011

Oscillogram No. 1186/01/20



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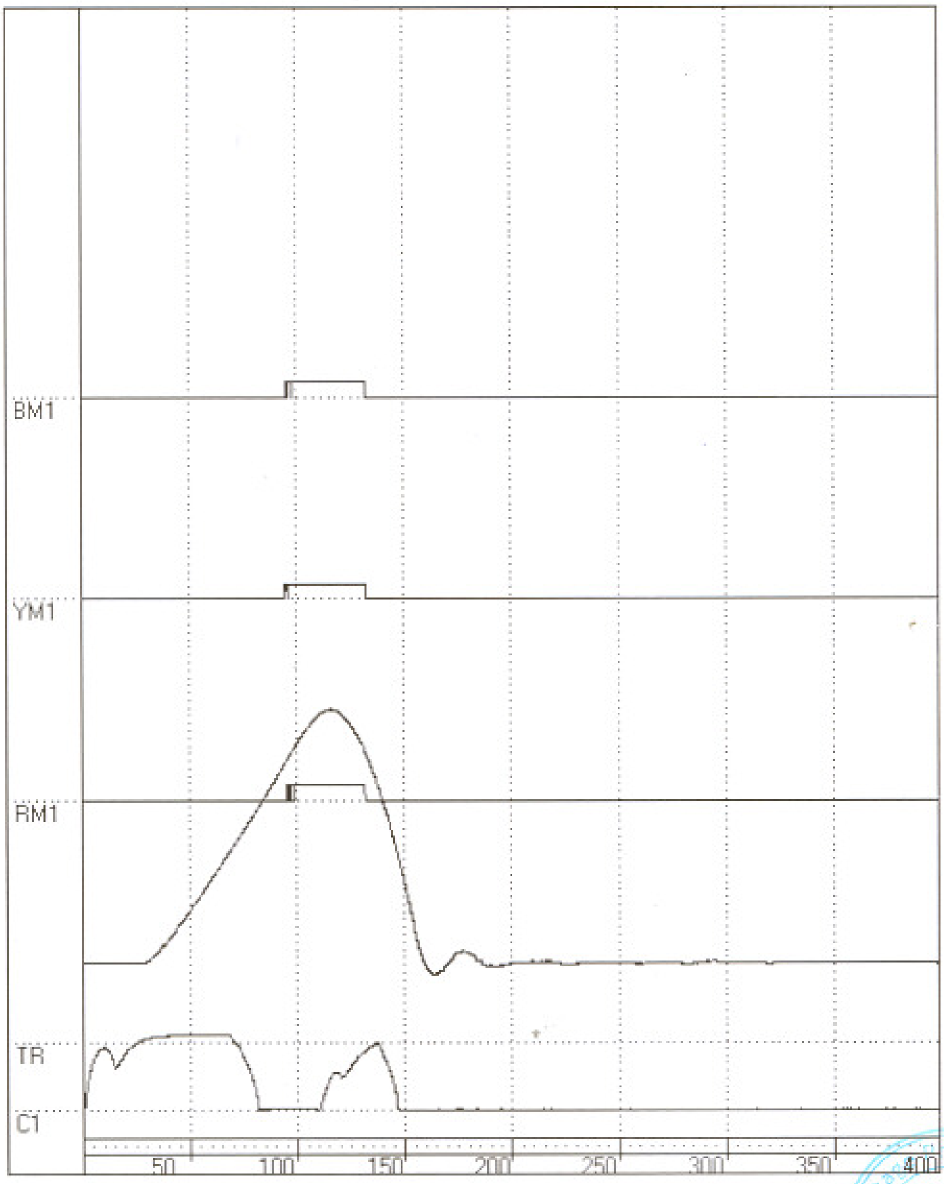
Test Report No. : LSWG/2912
Date: 11/03/2011

Oscillogram No. 1186/01/21



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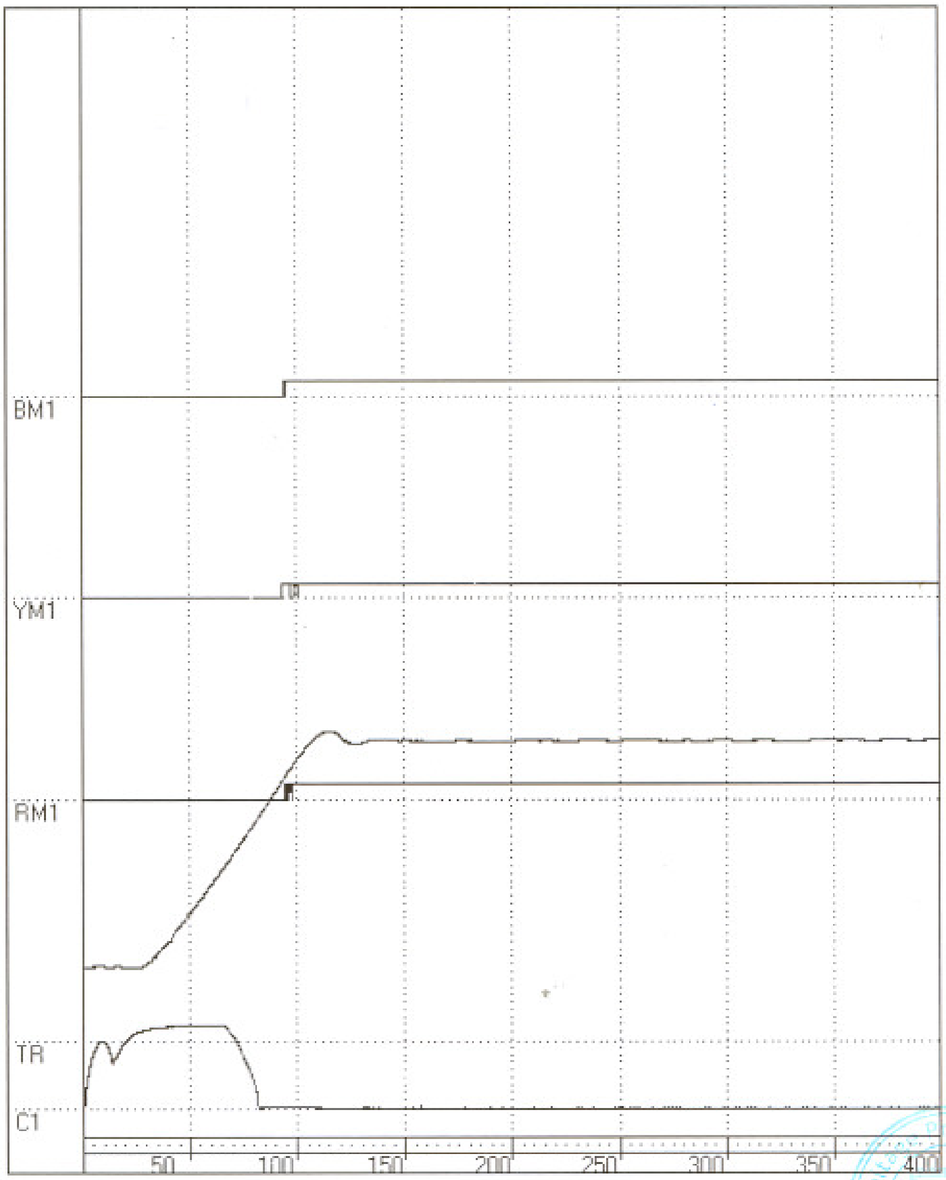
Date: 11/03/2011

Oscillogram No. 1186/01/22



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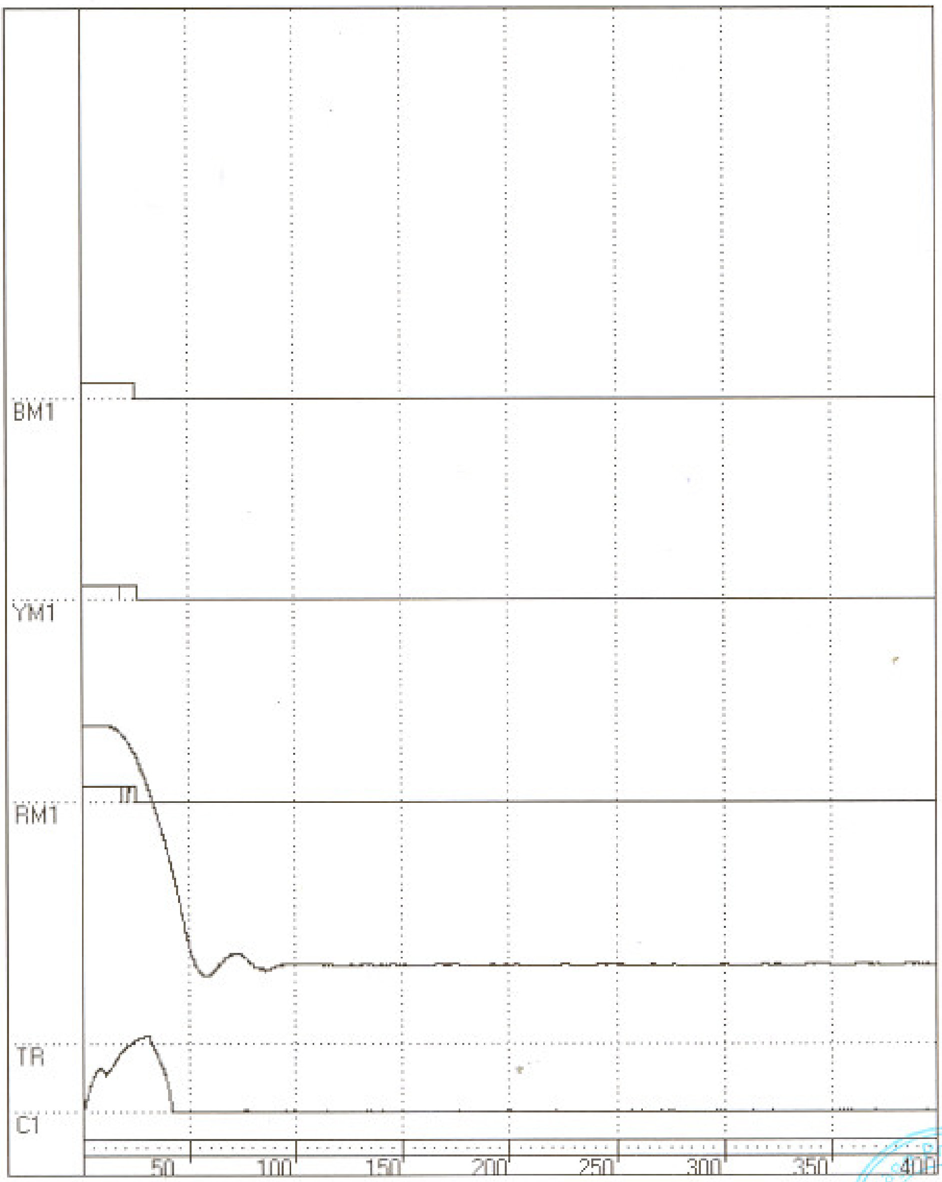
Test Report No. : LSWG/2912
Date: 11/03/2011

Oscillogram No. 1186/01/23



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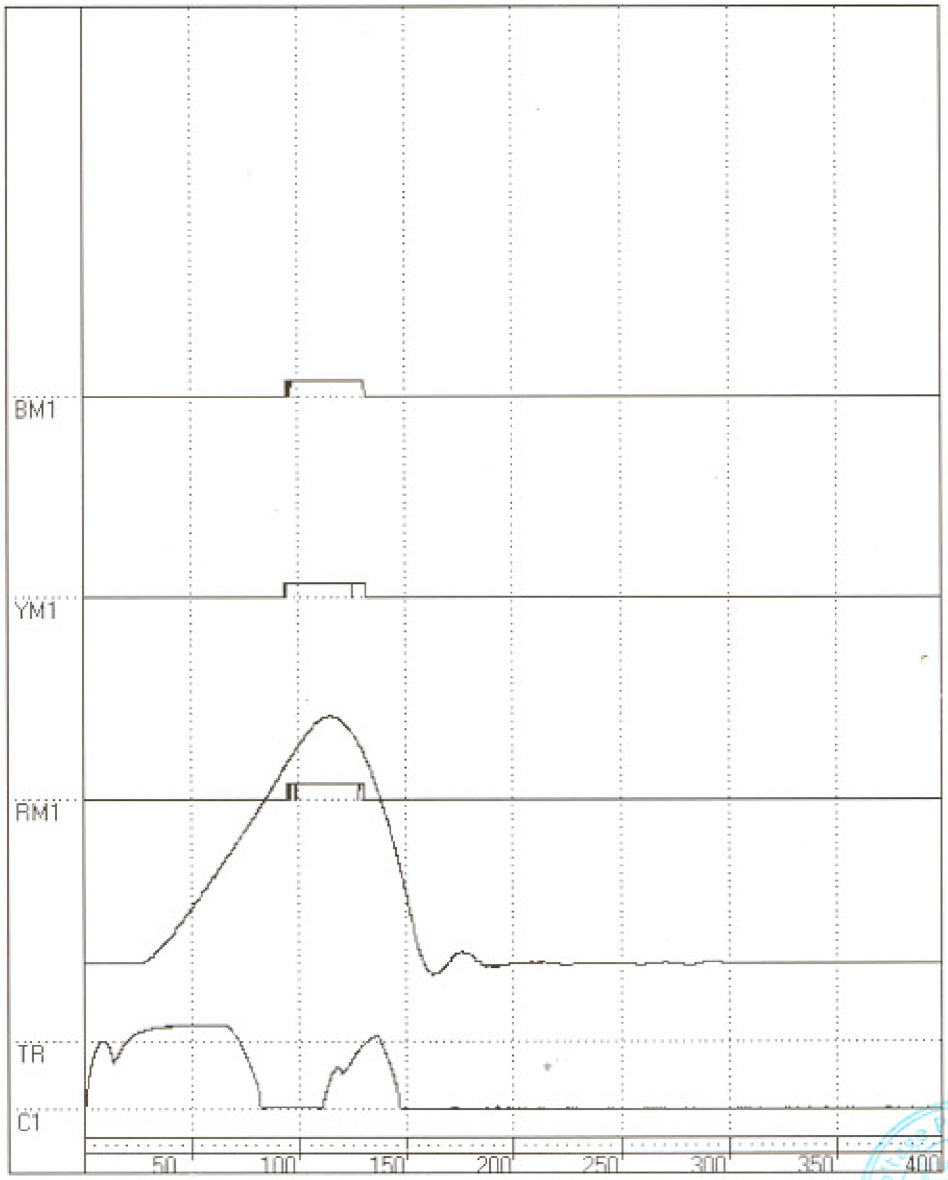
Test Report No. : LSWG/2912
Date: 11/03/2011

Oscillogram No. 1186/01/24



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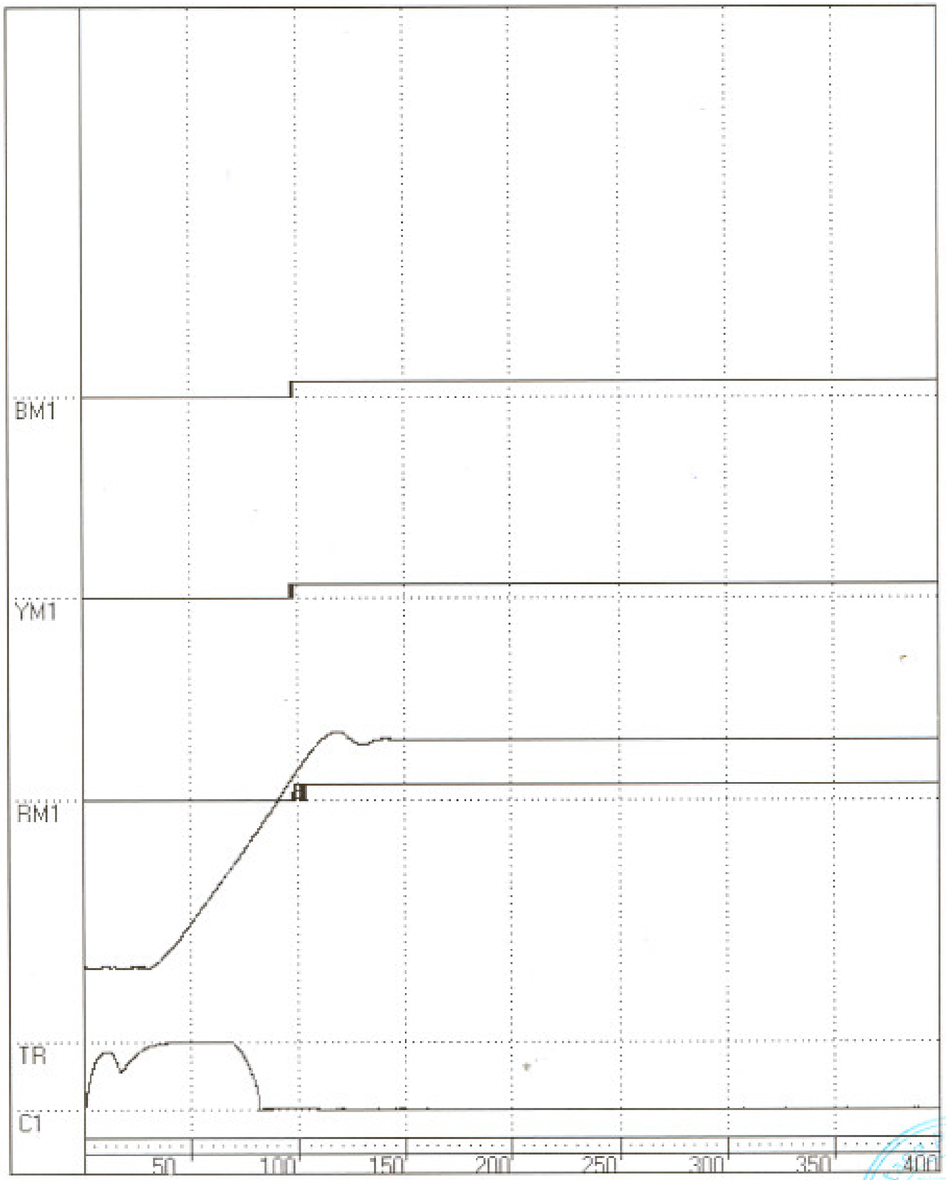
Date: 11/03/2011

Oscillogram No. 1186/01/25



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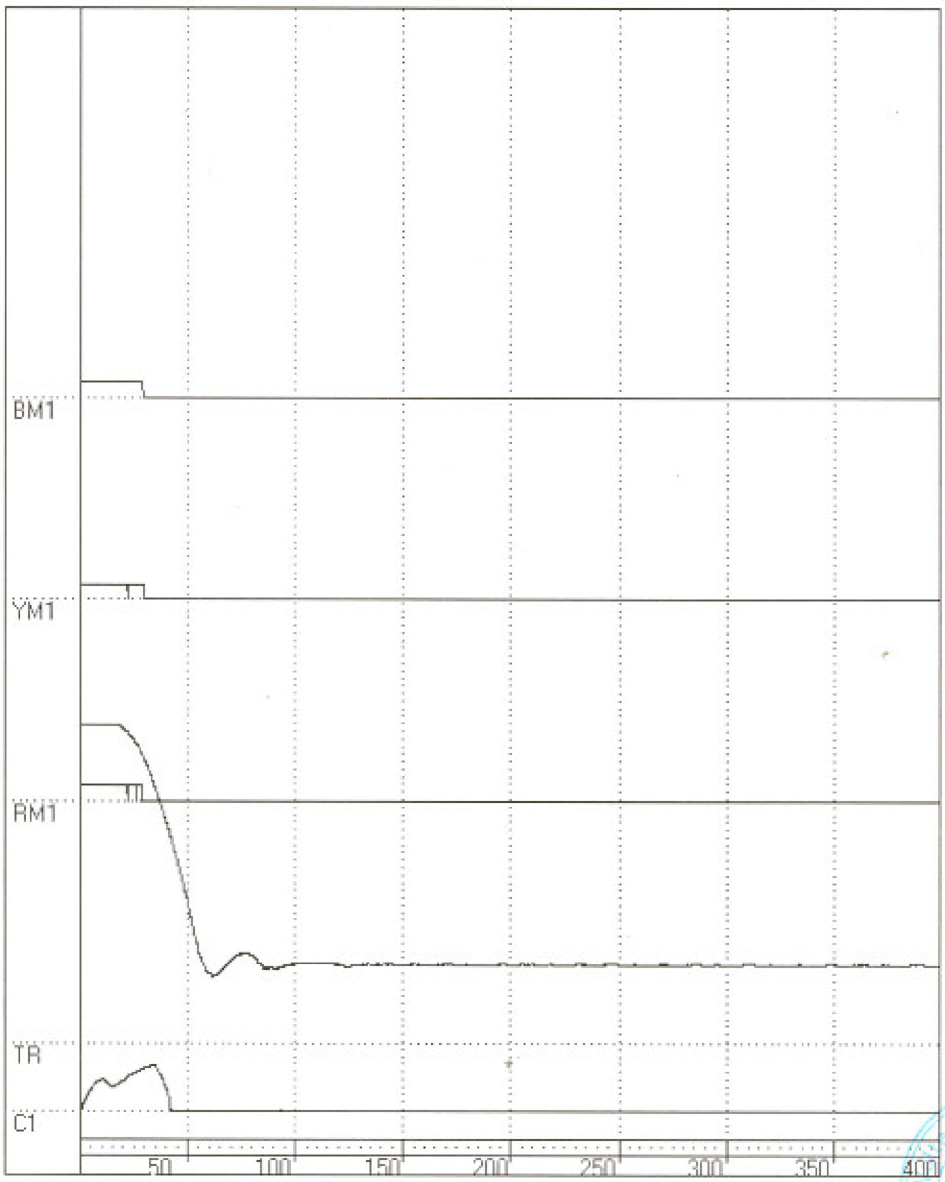
Date: 11/03/2011

Oscillogram No. 1186/01/26



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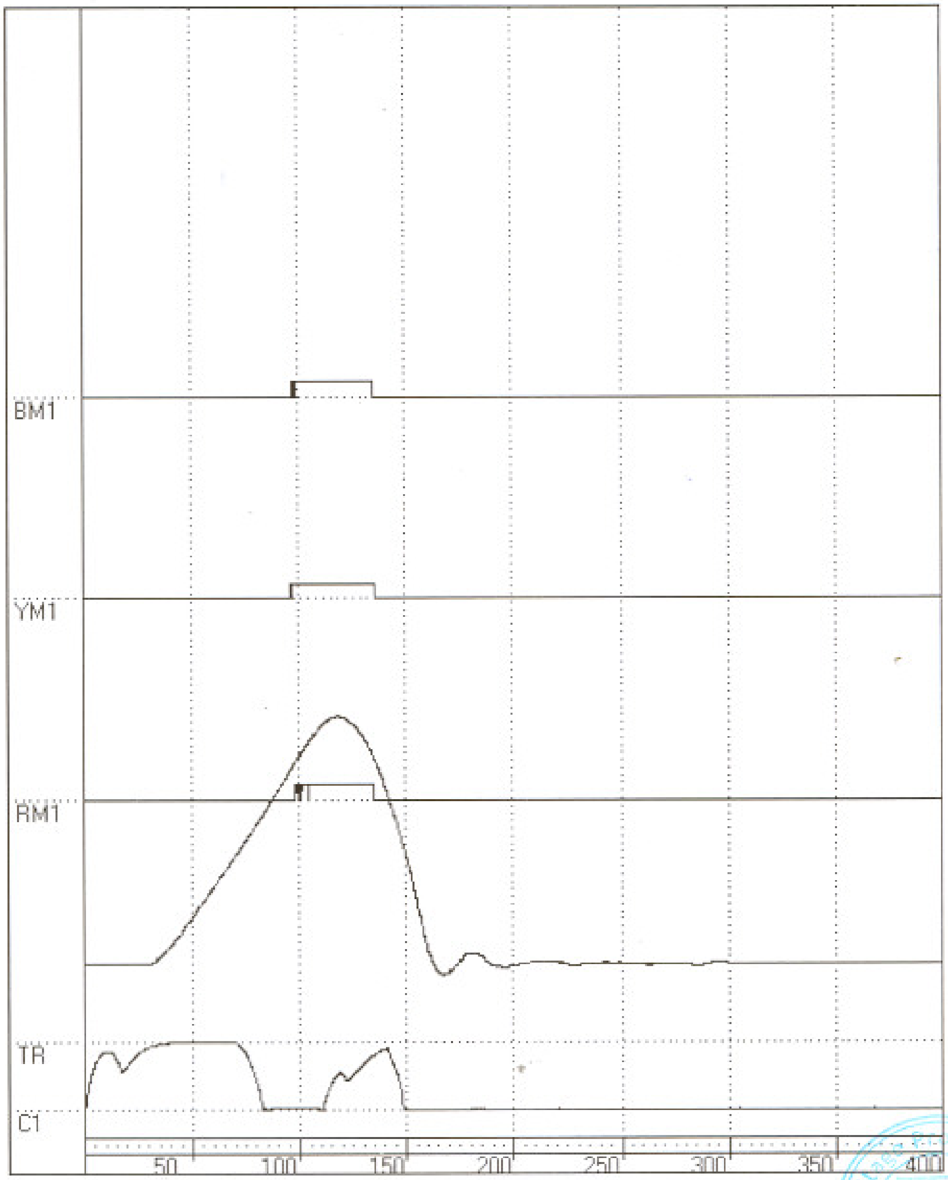
Oscillogram No. 1186/01/27



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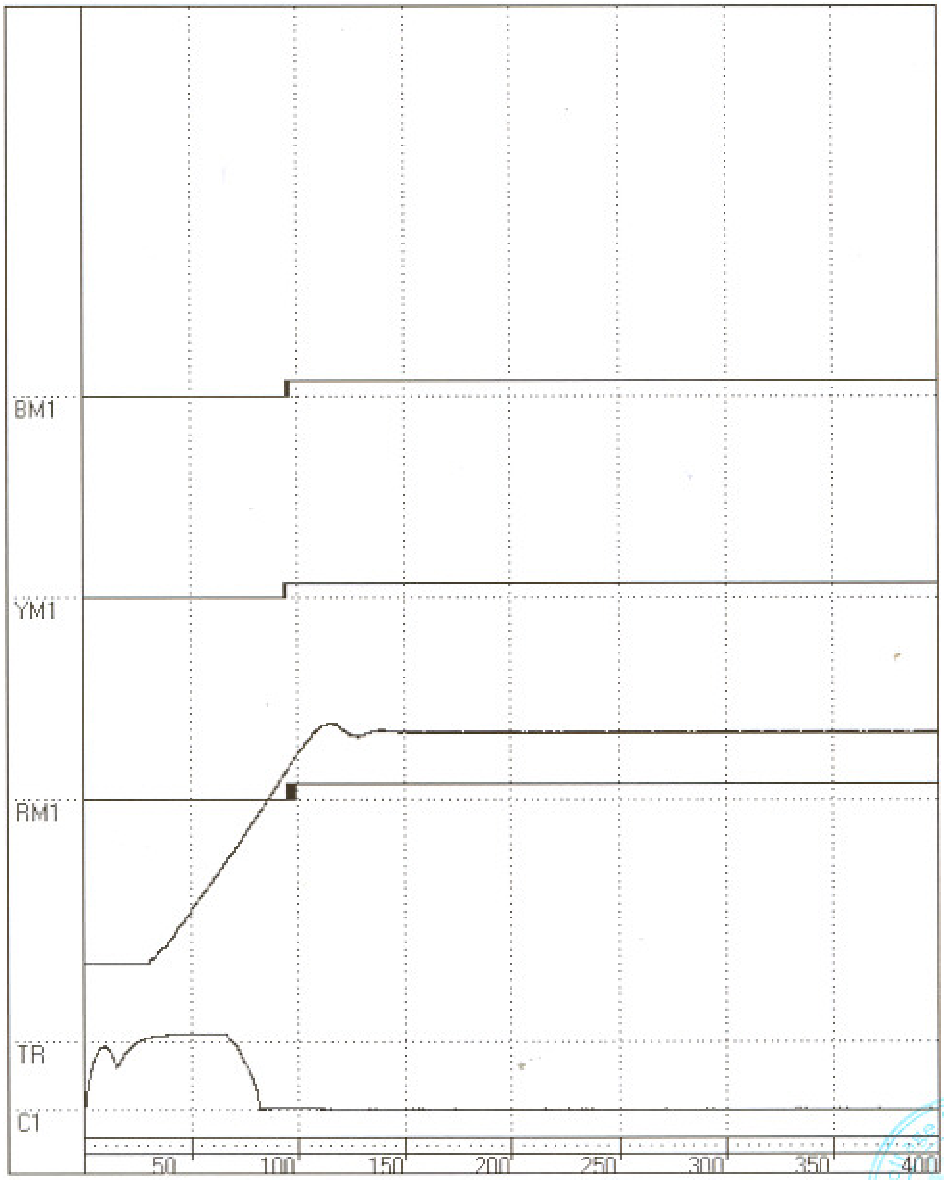
Date: 11/03/2011

Oscillogram No. 1186/01/28



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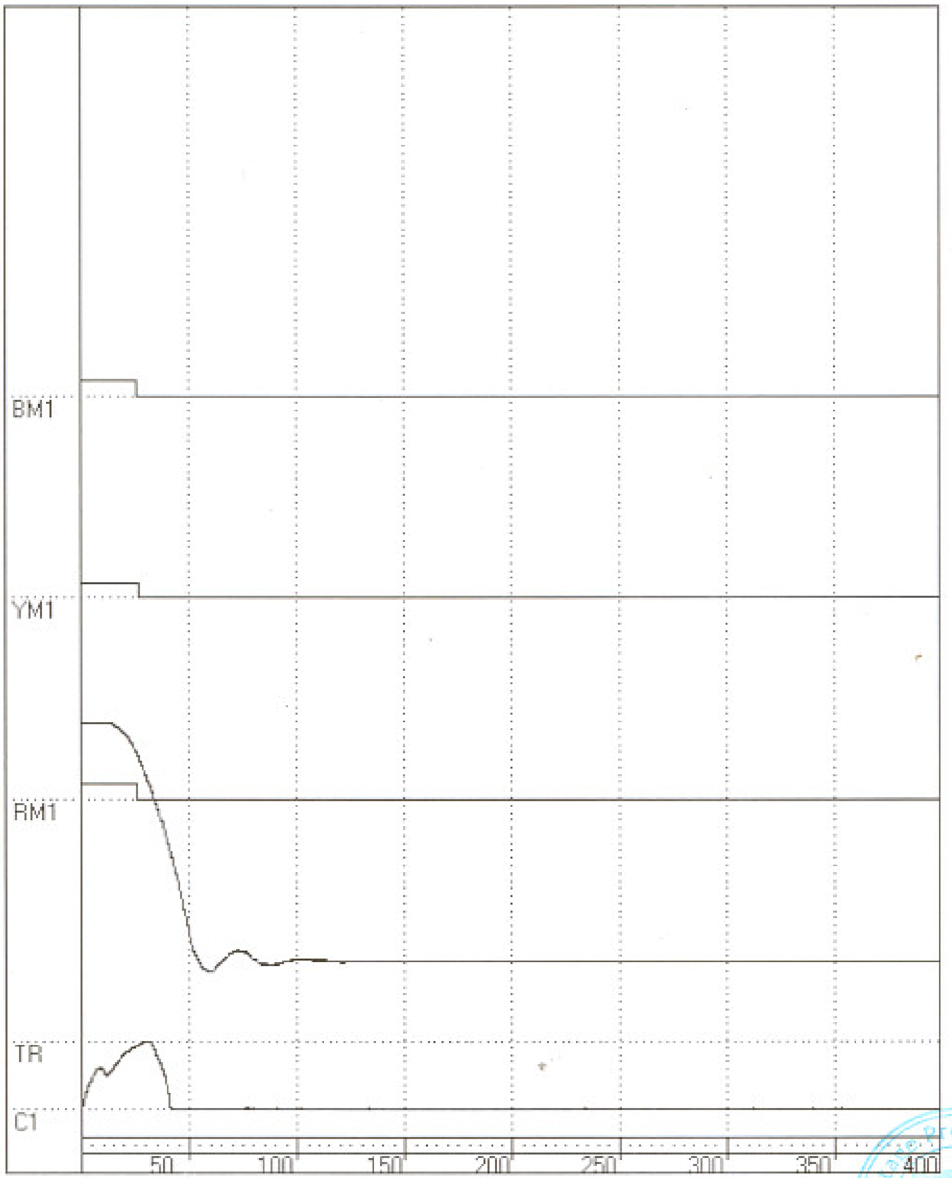
Oscillogram No. 1186/01/29



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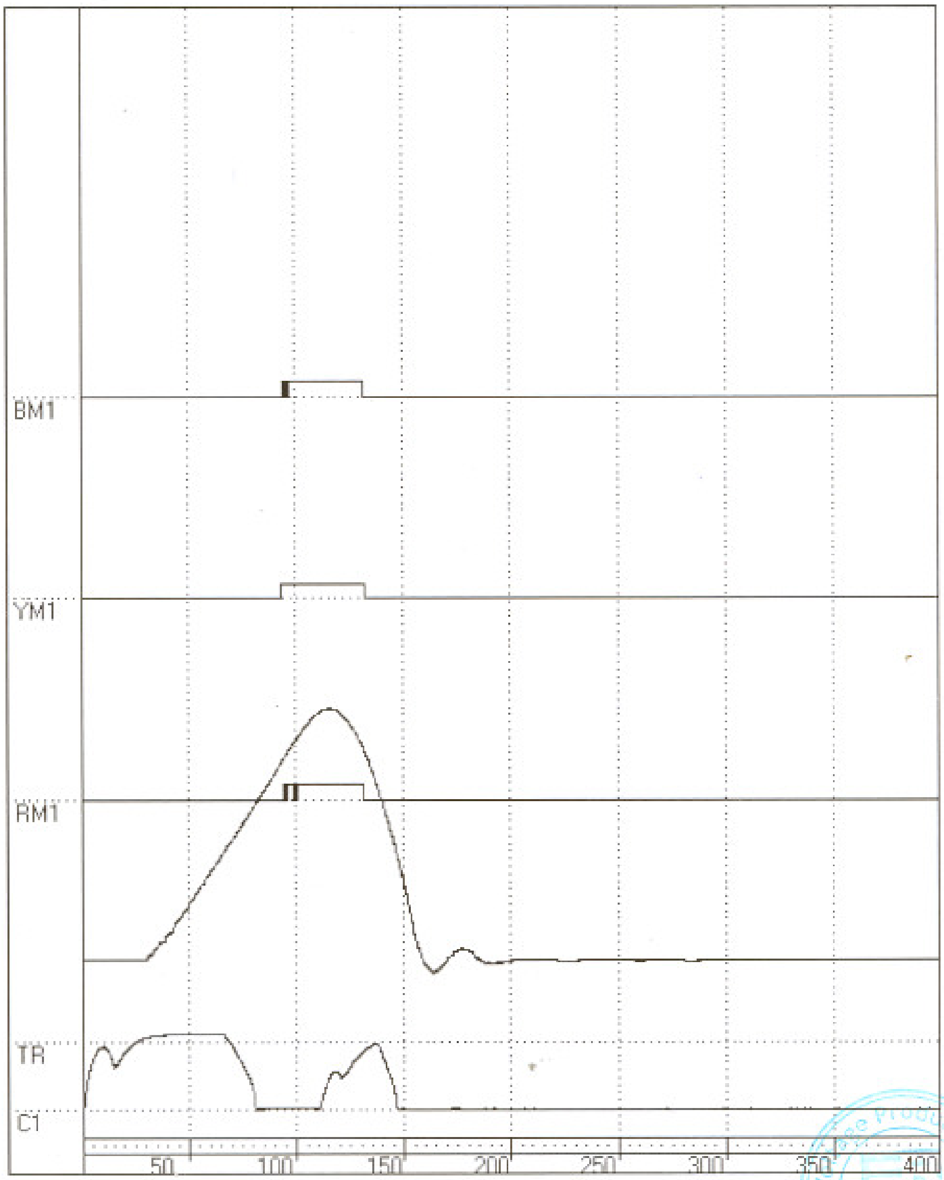
Oscillogram No. 1186/01/30



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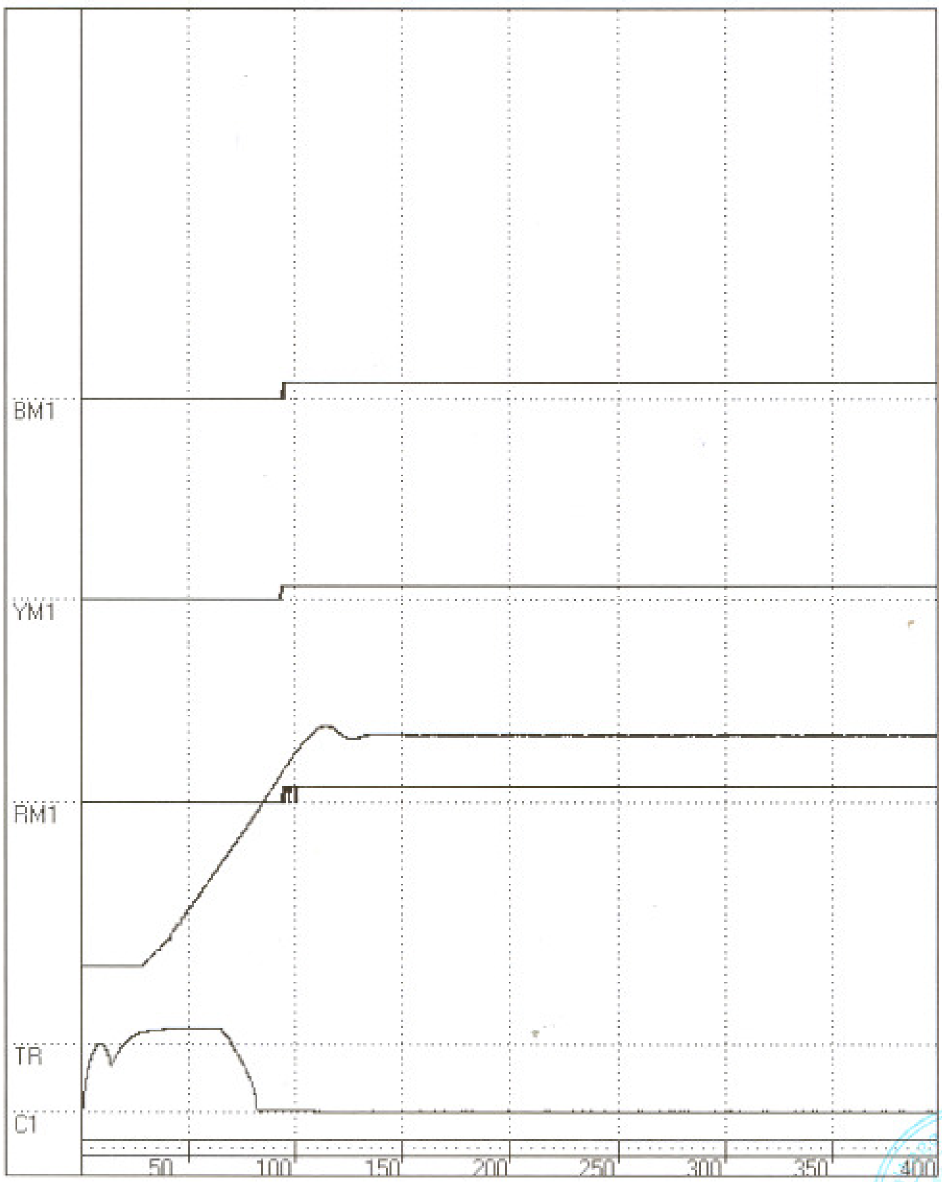
Oscillogram No. 1186/01/31



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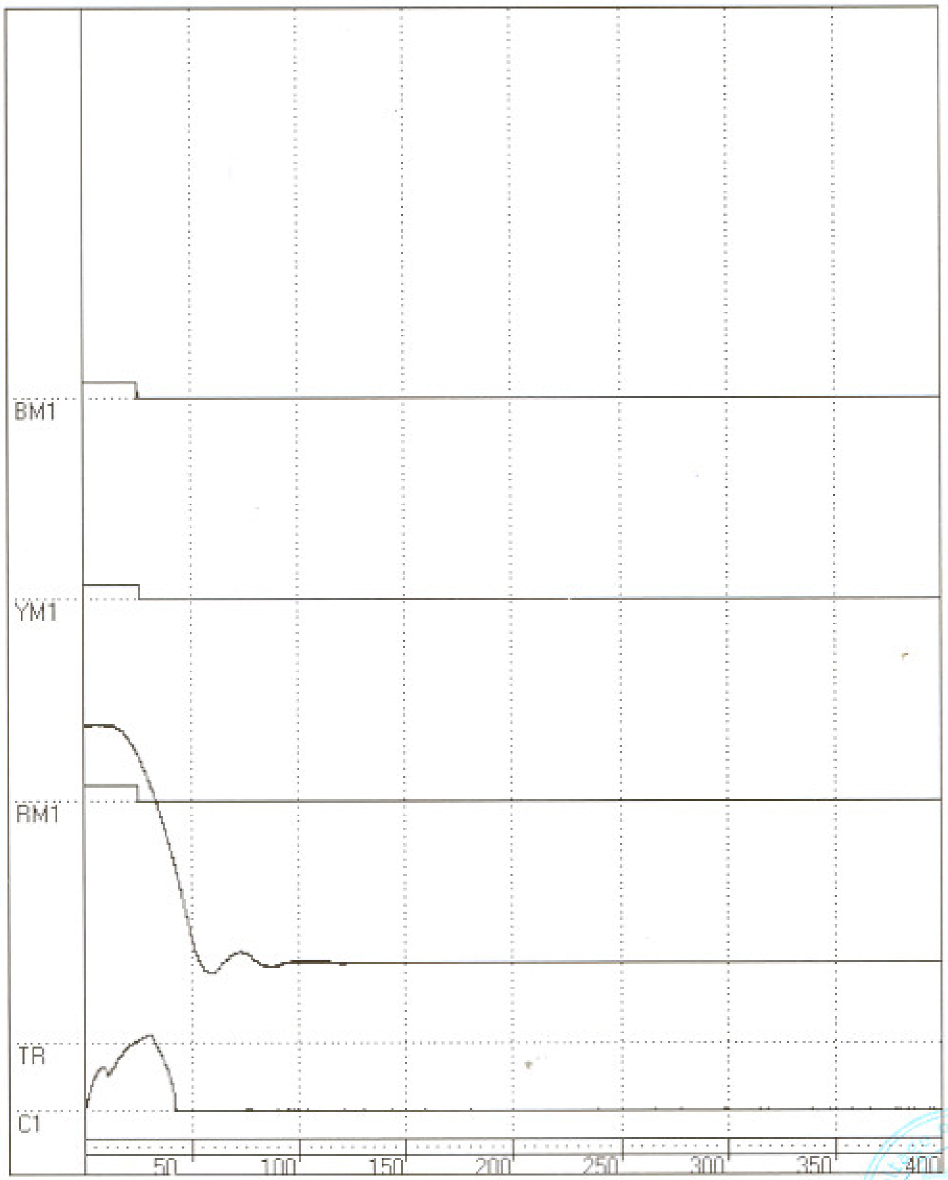
Test Report No. : LSWG/2912
Date: 11/03/2011

Oscillogram No. 1186/01/32



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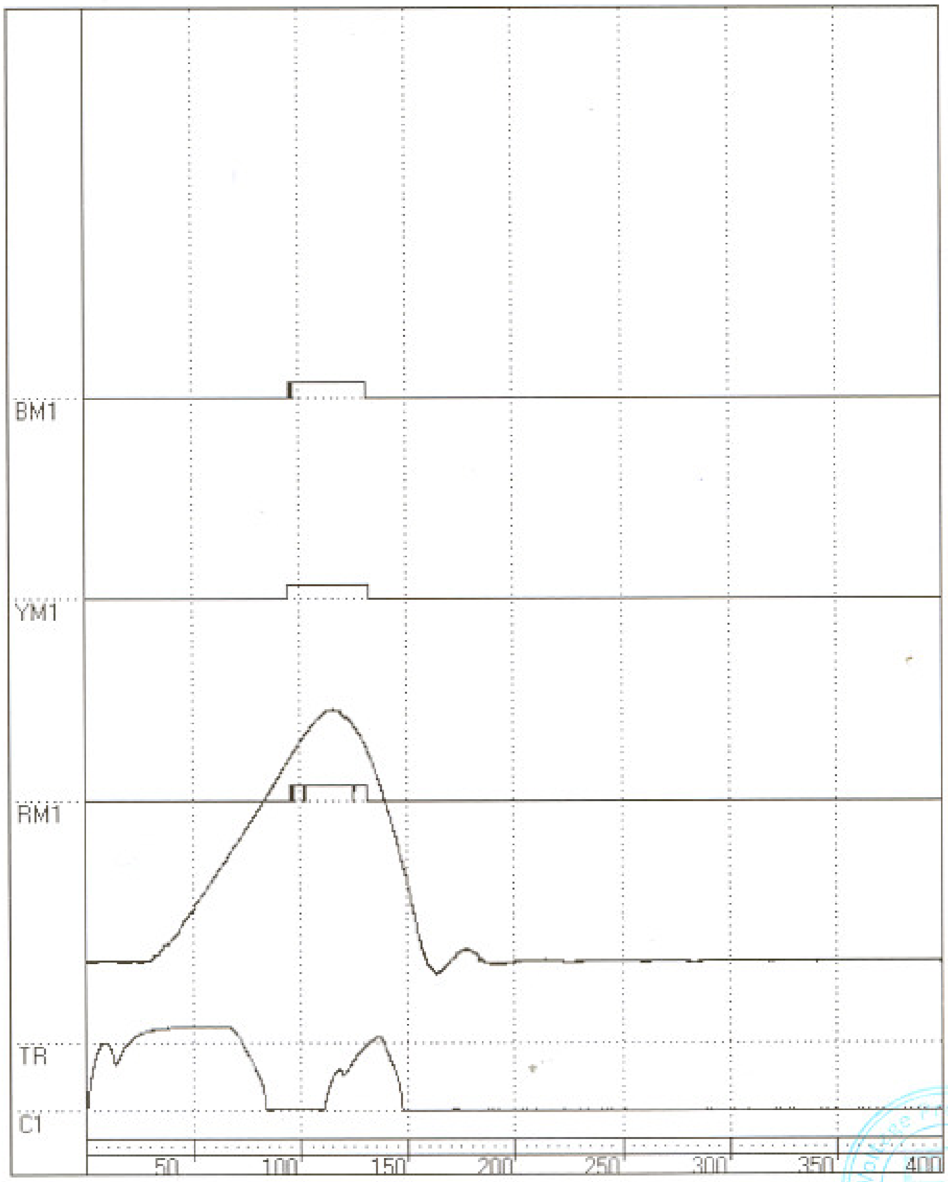
Oscillogram No. 1186/01/33



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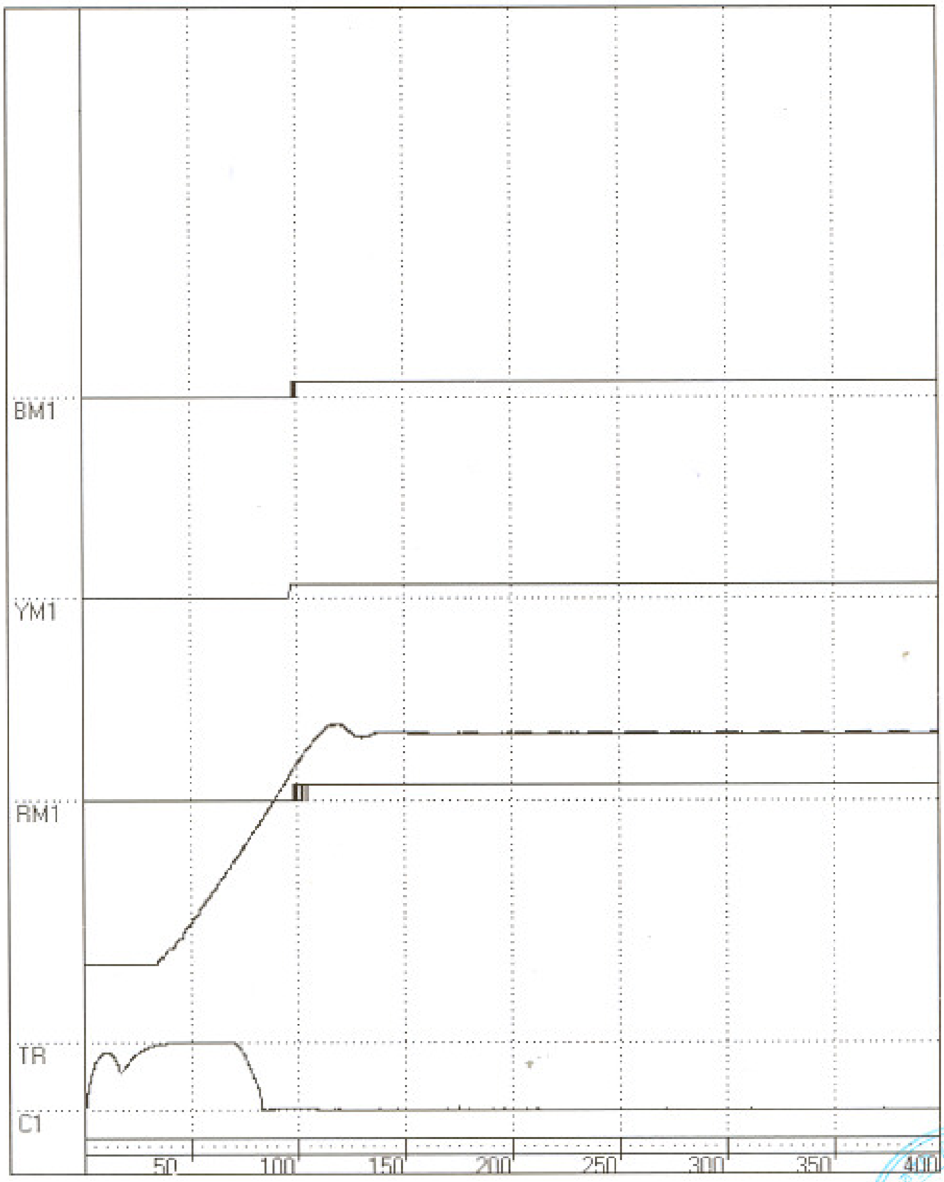
Oscillogram No. 1186/01/34



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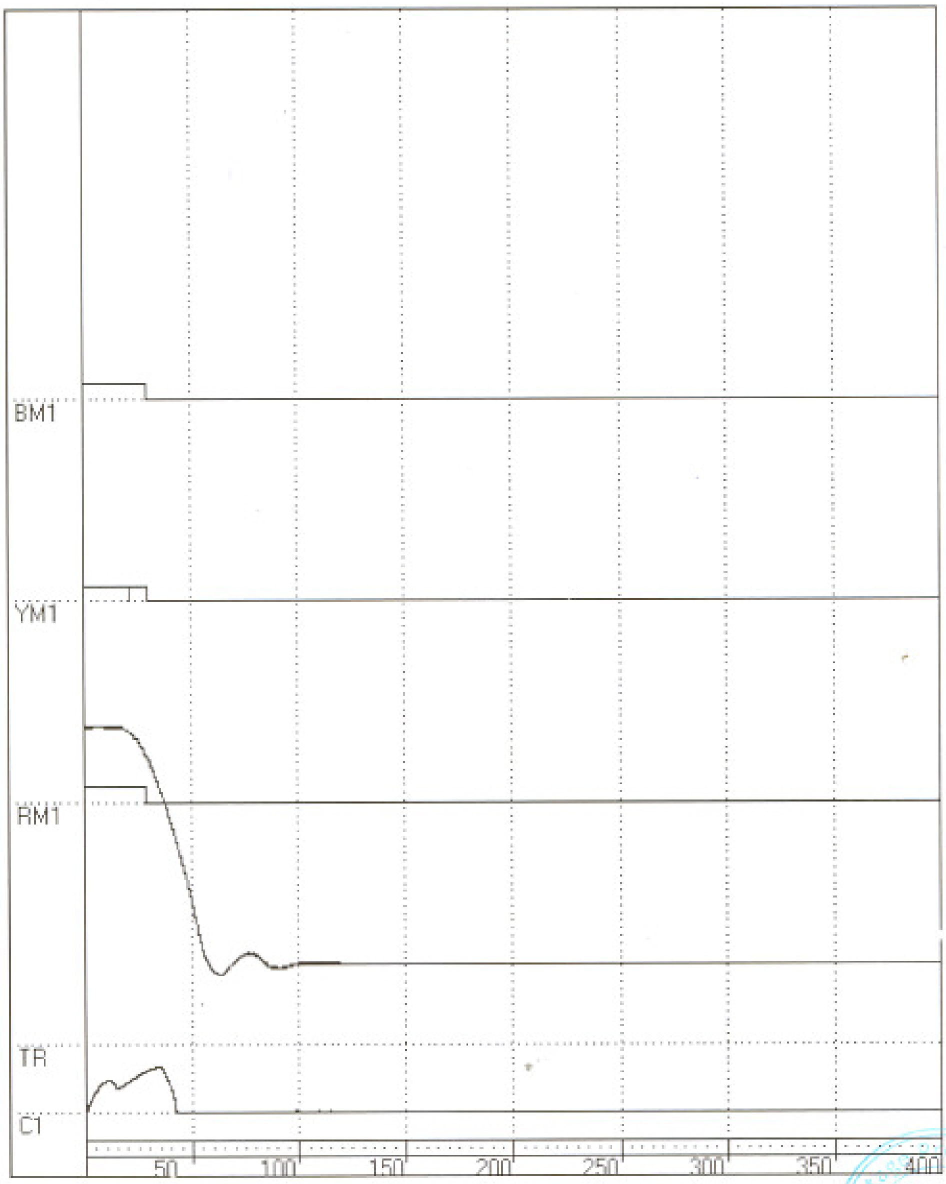
Oscillogram No. 1186/01/35



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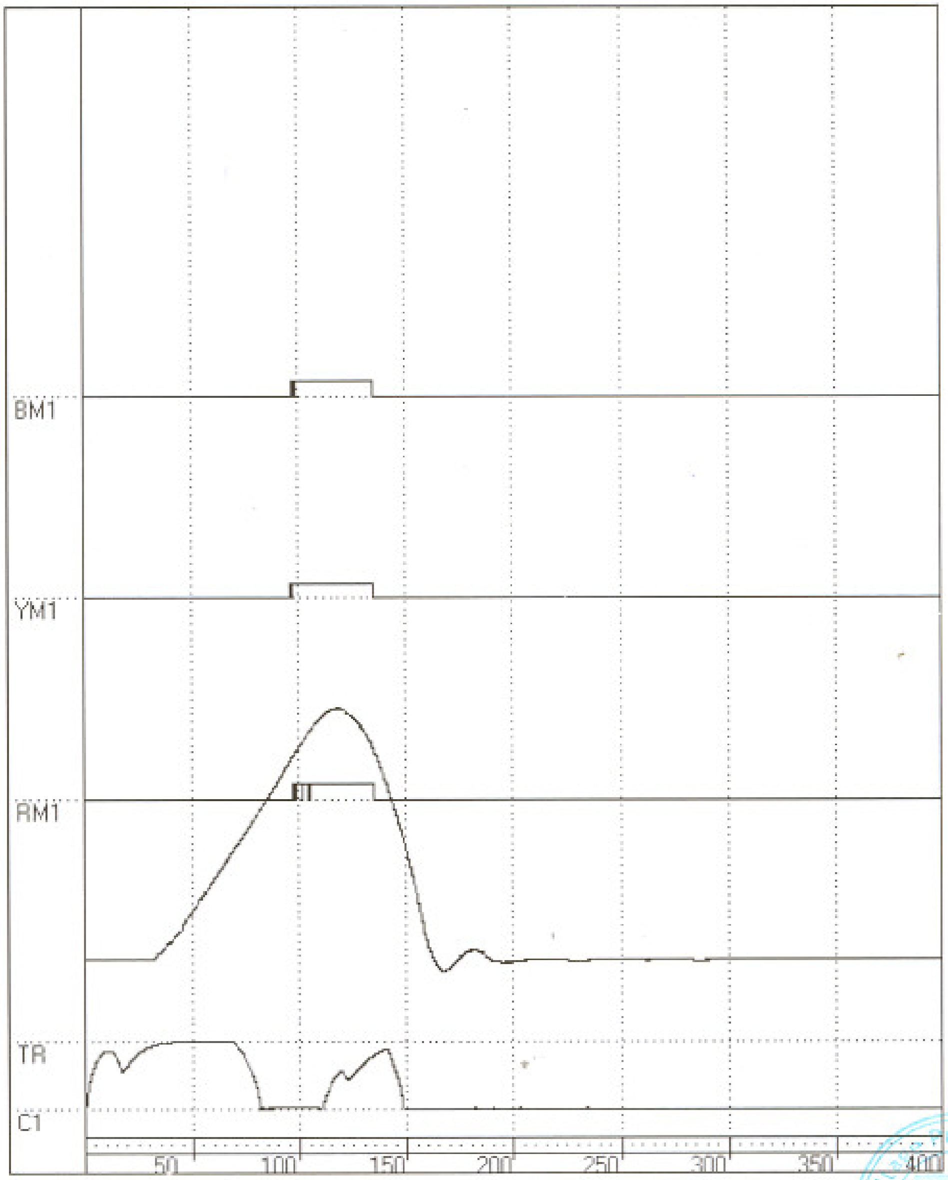
Oscillogram No. 1186/01/36



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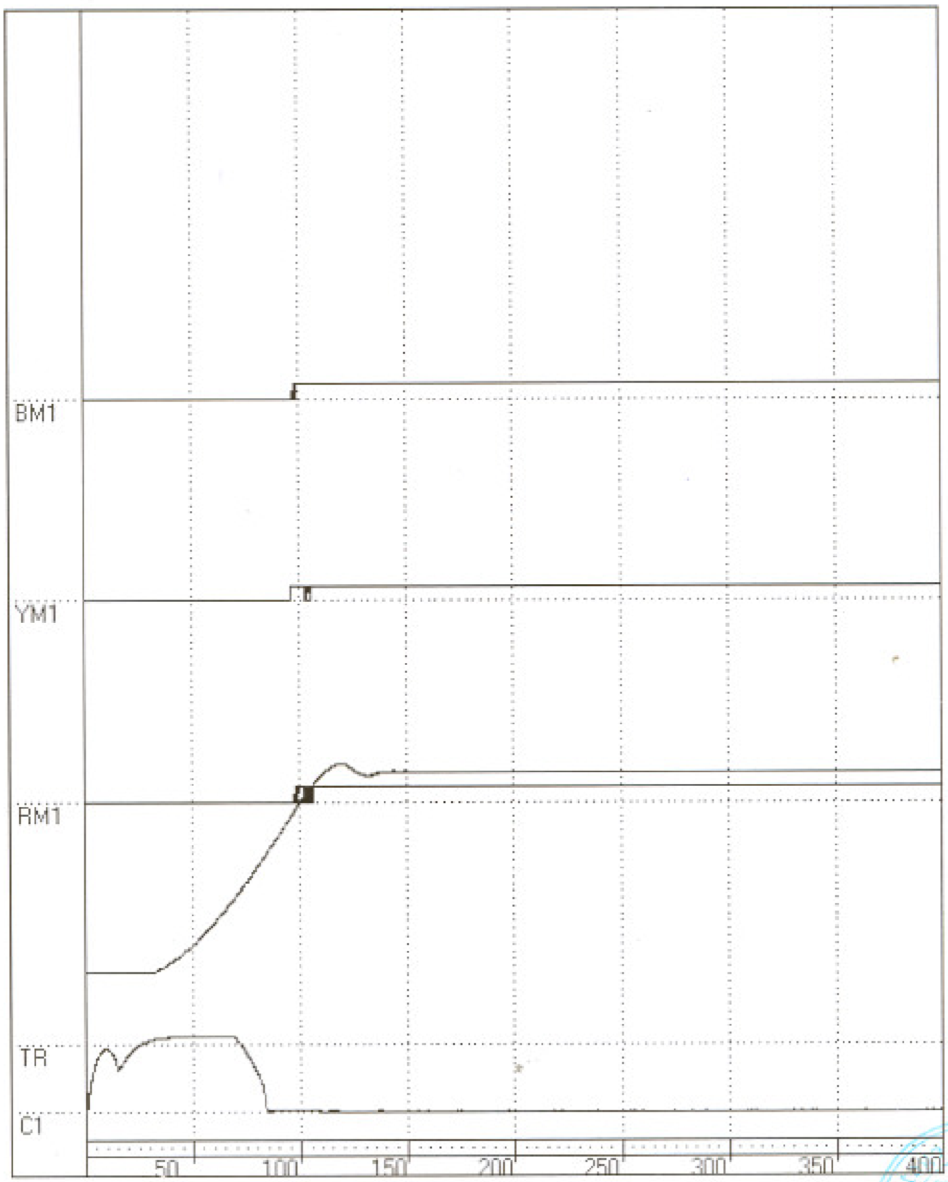
Test Report No. : LSWG/2912
Date: 11/03/2011

Oscillogram No. 1186/01/37

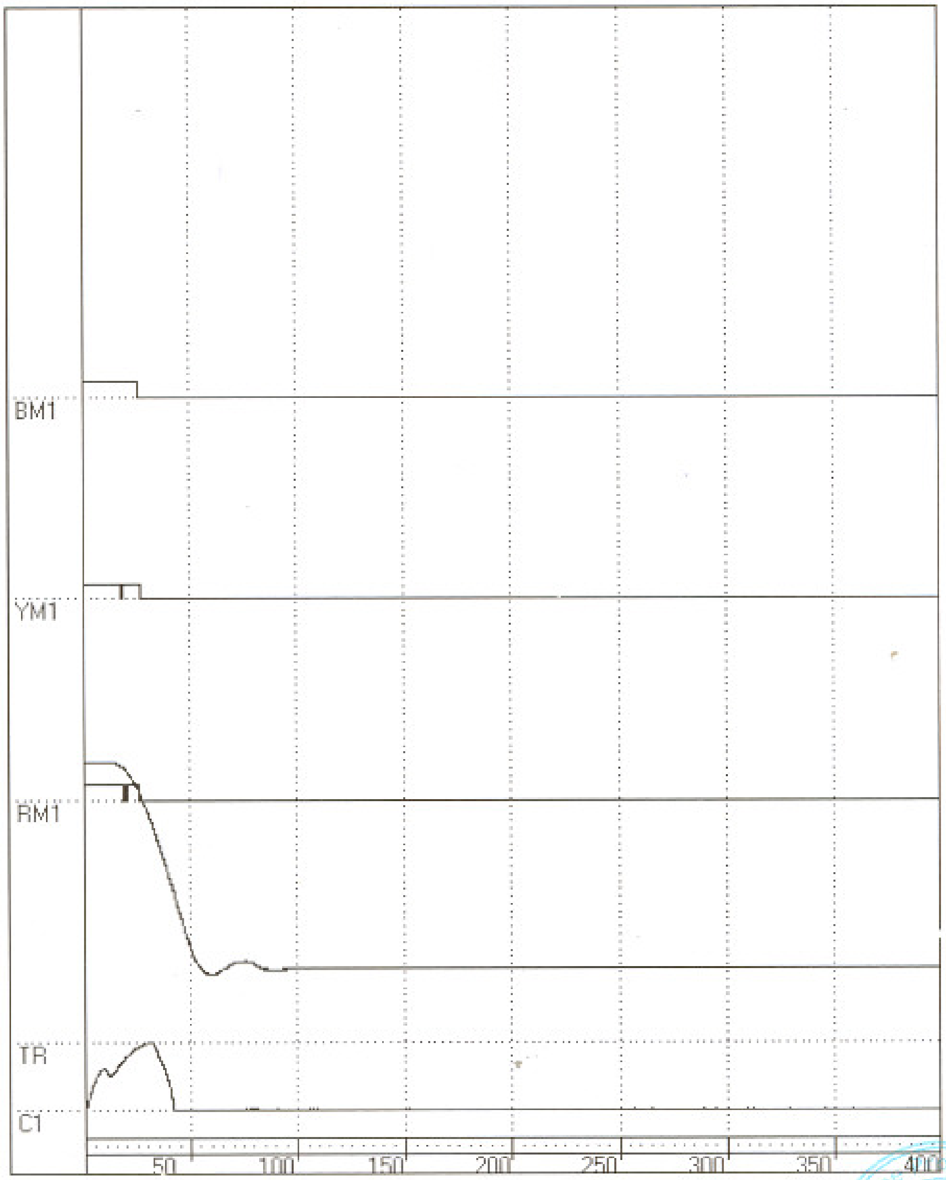


0661623

ELECTRICAL RESEARCH AND DEVELOPMENT ASSOCIATION
ERDA Road, Makarpura Industrial Estate, Vadodara-390 010, India.
EPABX: +91 (0265) 2642942, 2642964, 2642377, 3043128 / 29 / 30 / 31 / 33
Fax : +91 (0265) 2638382
E-mail : erda@erda.org
Web : http://www.erda.org

Test Report No. : LSWG/2912
Date: 11/03/2011

Oscillogram No. 1186/01/38



ELECTRICAL RESEARCH AND DEVELOPMENT ASSOCIATION
ERDA Road, Makarpura Industrial Estate, Vadodara-390 010, India.
EPABX: +91 (0265) 2642942, 2642964, 2642377, 3043128 / 29 / 30 / 31 / 33
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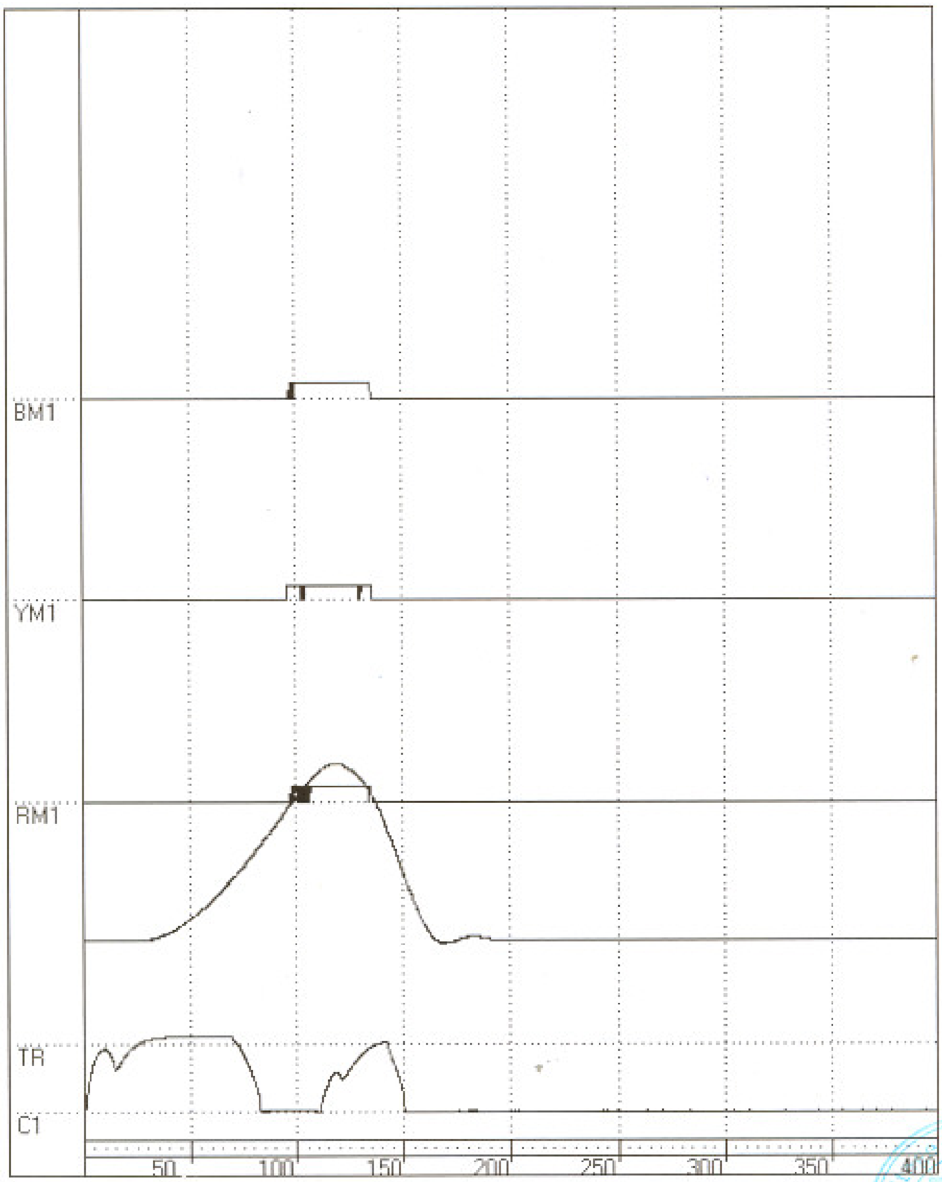
Test Report No. : LSWG/2912
Date: 11/03/2011

Oscillogram No. 1186/01/39



0661625

ELECTRICAL RESEARCH AND DEVELOPMENT ASSOCIATION
ERDA Road, Makarpura Industrial Estate, Vadodara-390 010, India.
EPABX: +91 (0265) 2642942, 2642964, 2642377, 3043128 / 29 / 30 / 31 / 33
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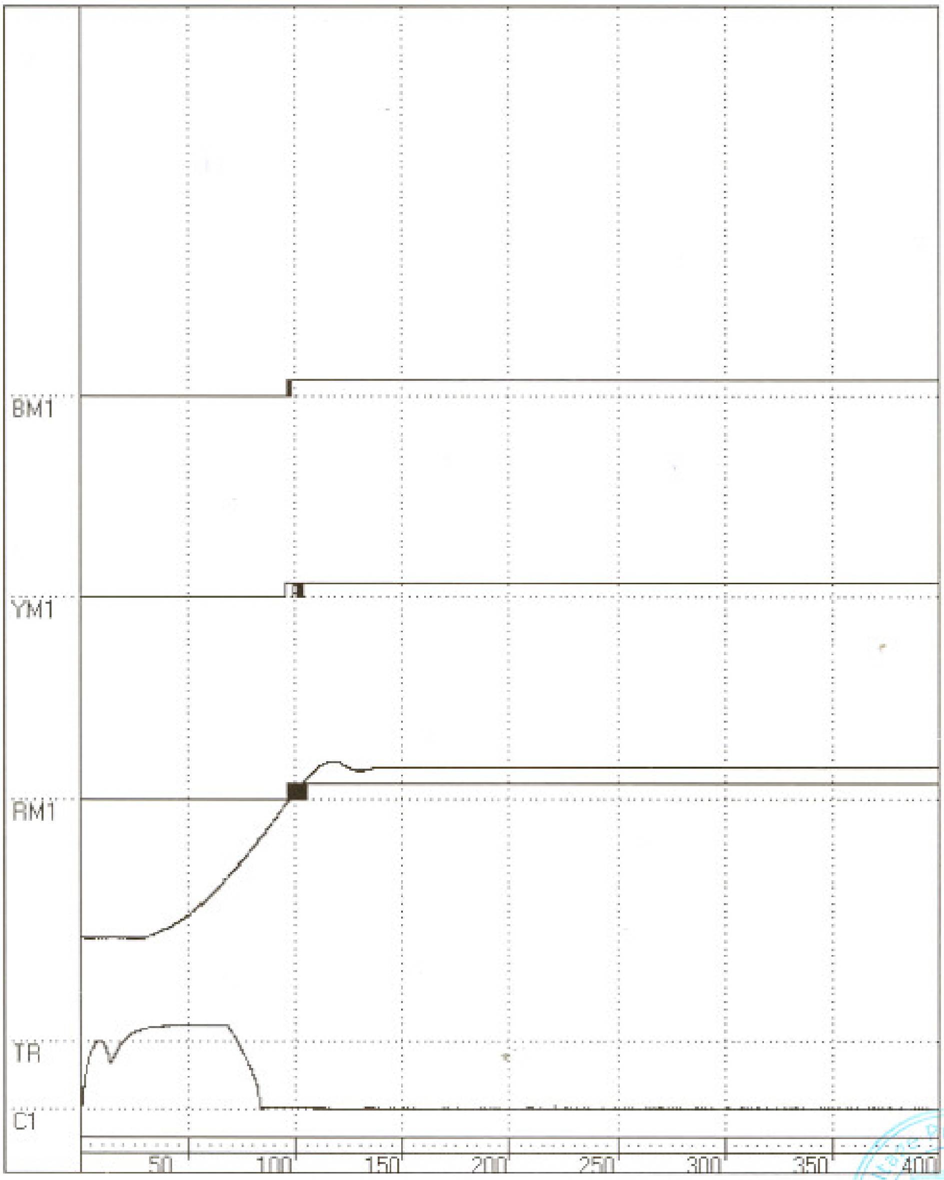
E-mail : erda@erda.org
Web : http://www.erda.org

Test Report No. : LSWG/2912
Date: 11/03/2011

Oscillogram No. 1186/01/40



ELECTRICAL RESEARCH AND DEVELOPMENT ASSOCIATION
ERDA Road, Makarpura Industrial Estate, Vadodara-390 010, India.
EPABX: +91 (0265) 2642942, 2642964, 2642377, 3043128 / 29 / 30 / 31 / 33
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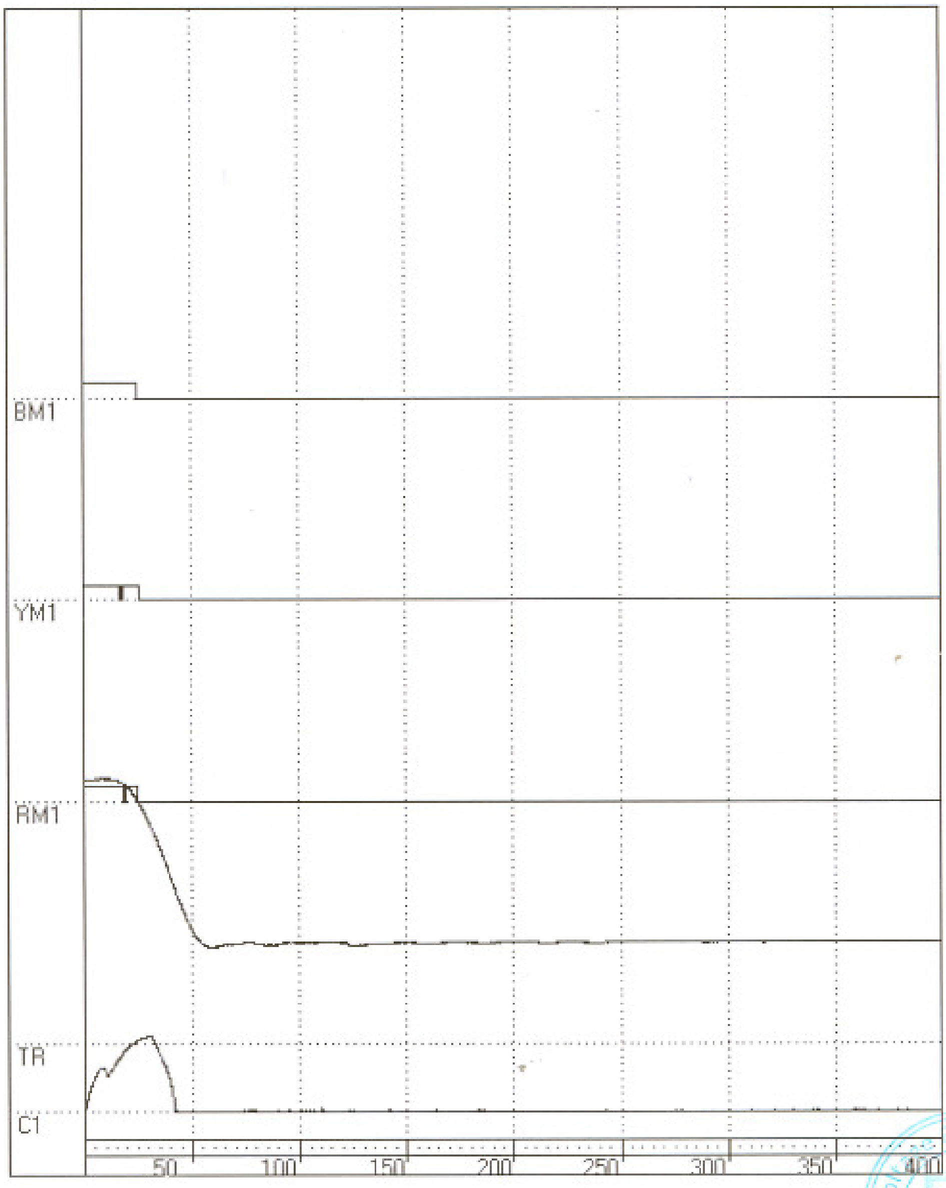
Web : http://www.erda.org

Test Report No. : LSWG/2912
Date: 11/03/2011

Oscillogram No. 1186/01/41

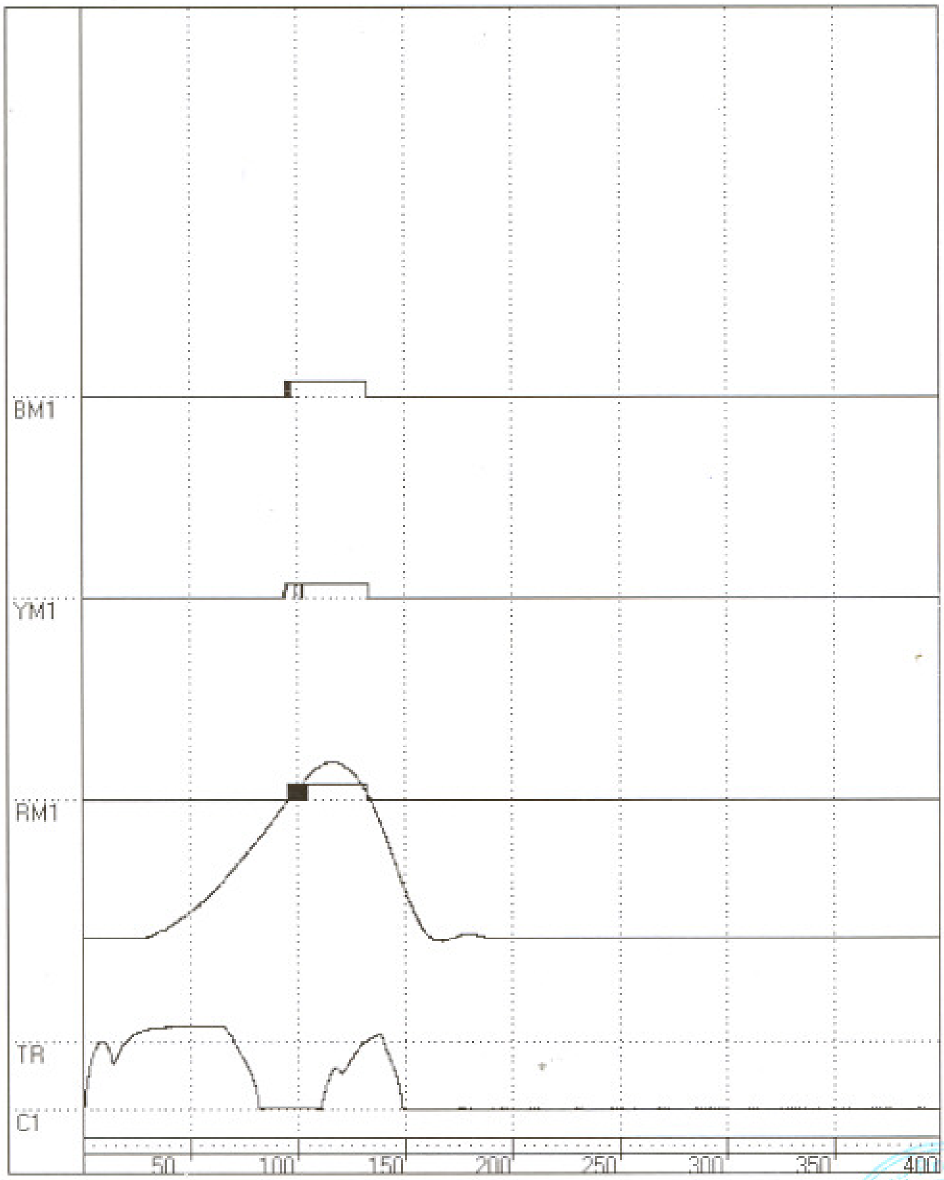


0661627

ELECTRICAL RESEARCH AND DEVELOPMENT ASSOCIATION
ERDA Road, Makarpura Industrial Estate, Vadodara-390 010, India.
EPABX: +91 (0265) 2642942, 2642964, 2642377, 3043128 / 29 / 30 / 31 / 33
Fax : +91 (0265) 2638382
E-mail : erda@erda.org
Web : http://www.erda.org

Test Report No. : LSWG/2912
Date: 11/03/2011

Oscillogram No. 1186/01/42



0661628

ELECTRICAL RESEARCH AND DEVELOPMENT ASSOCIATION
ERDA Road, Makarpura Industrial Estate, Vadodara-390 010, India.
EPABX: +91 (0265) 2642942, 2642964, 2642377, 3043128 / 29 / 30 / 31 / 33
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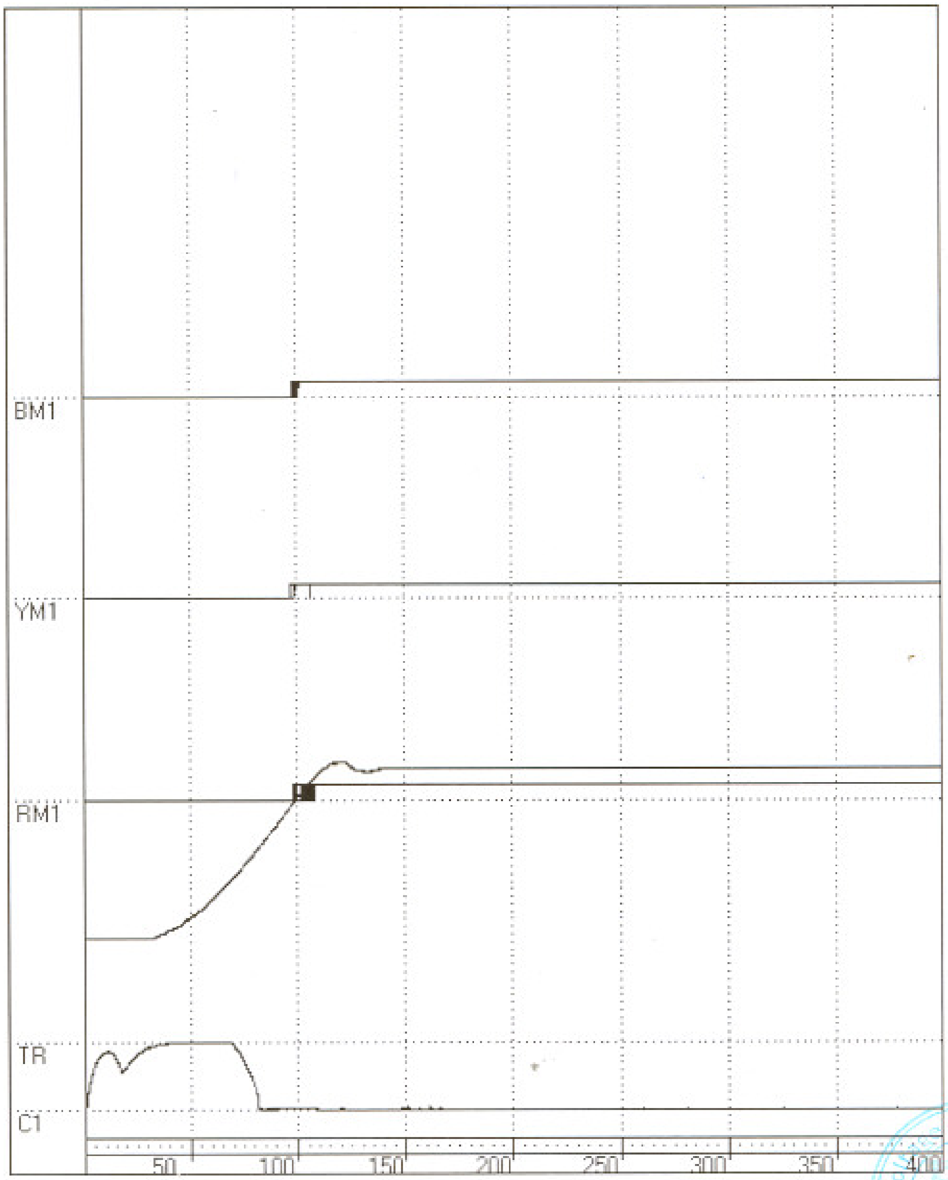
Web : http://www.erda.org

Test Report No. : LSWG/2912
Date: 11/03/2011

Oscillogram No. 1186/01/43

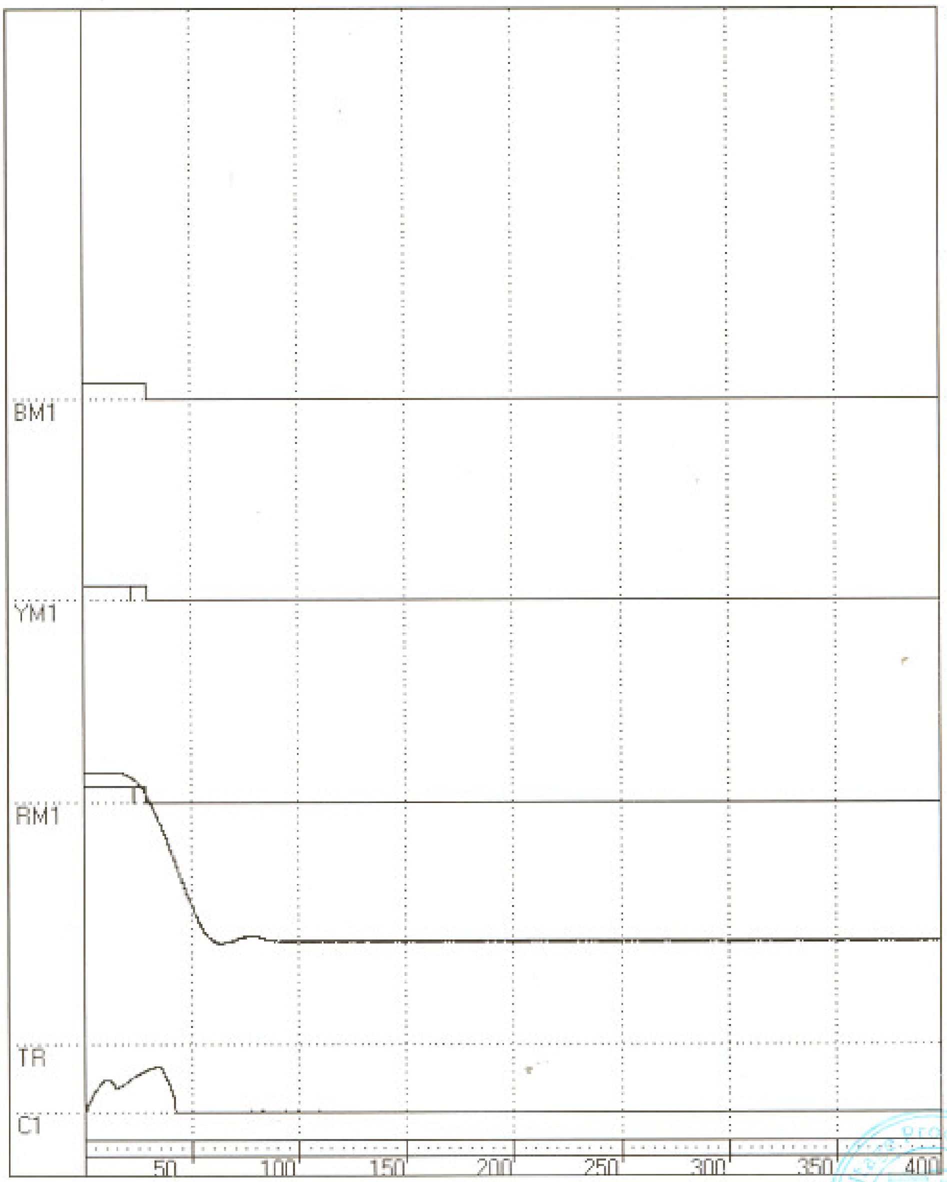


0661629

ELECTRICAL RESEARCH AND DEVELOPMENT ASSOCIATION
ERDA Road, Makarpura Industrial Estate, Vadodara-390 010, India.
EPABX: +91 (0265) 2642942, 2642964, 2642377, 3043128 / 29 / 30 / 31 / 33
Fax : +91 (0265) 2638382
E-mail : erda@erda.org
Web : http://www.erda.org

Test Report No. : LSWG/2912
Date: 11/03/2011

Oscillogram No. 1186/01/44

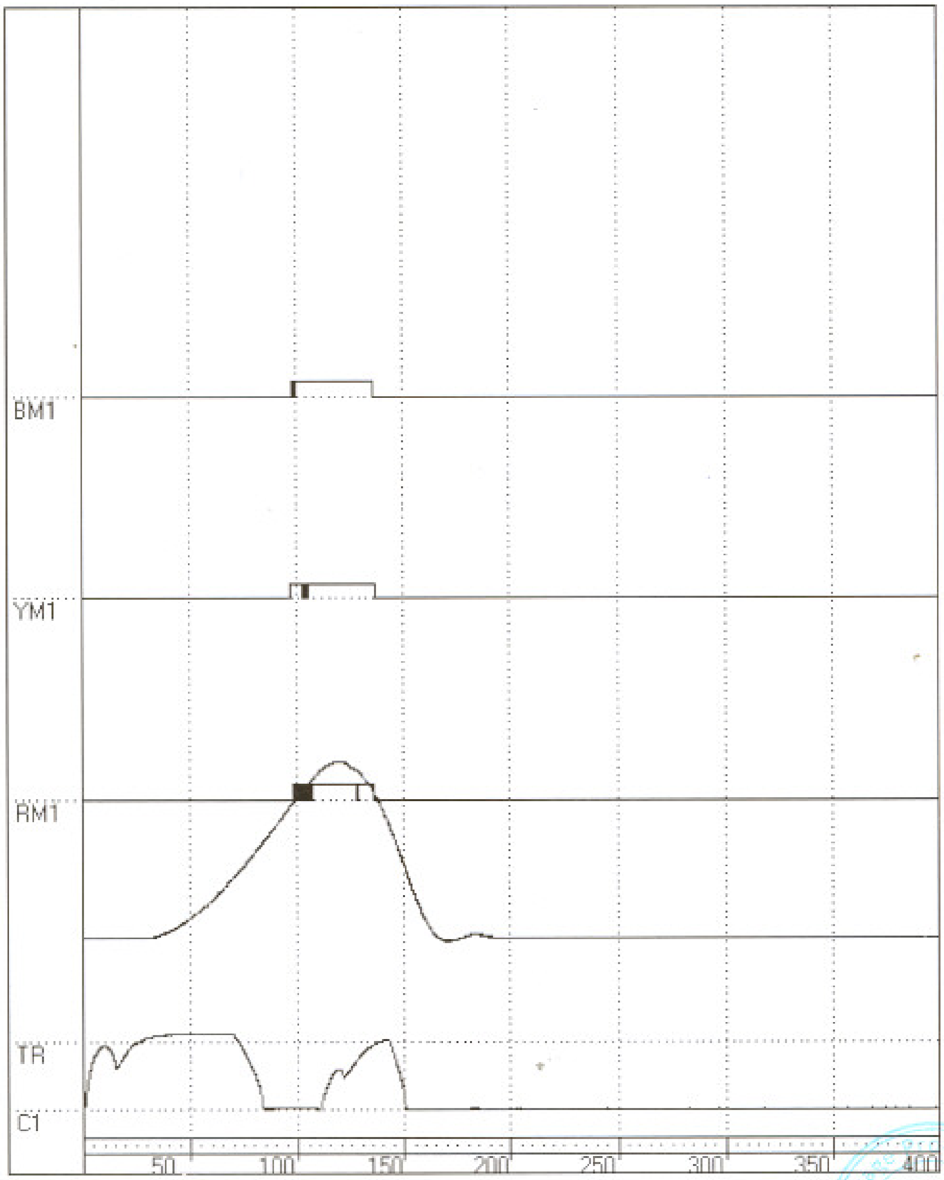


0661630

ELECTRICAL RESEARCH AND DEVELOPMENT ASSOCIATION
ERDA Road, Makarpura Industrial Estate, Vadodara-390 010, India.
EPABX: +91 (0265) 2642942, 2642964, 2642377, 3043128 / 29 / 30 / 31 / 33
Fax : +91 (0265) 2638382
E-mail : erda@erda.org
Web : http://www.erda.org

Test Report No. : LSWG/2912
Date: 11/03/2011

Oscillogram No. 1186/01/45



0661631

ELECTRICAL RESEARCH AND DEVELOPMENT ASSOCIATION
ERDA Road, Makarpura Industrial Estate, Vadodara-390 010, India.
EPABX: +91 (0265) 2642942, 2642964, 2642377, 3043128 / 29 / 30 / 31 / 33
Fax : +91 (0265) 2638382
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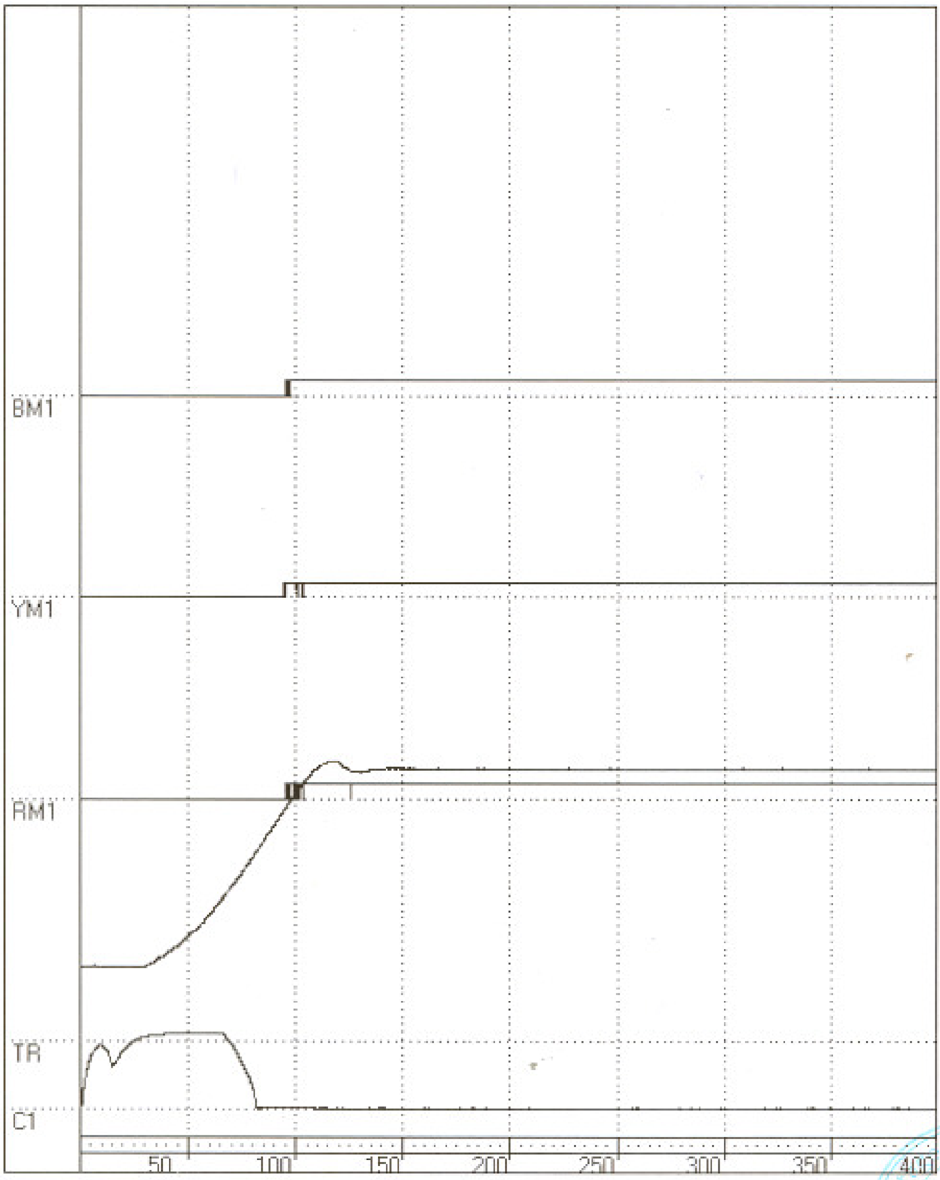
Web : http://www.erda.org

Test Report No. : LSWG/2912
Date: 11/03/2011

Oscillogram No. 1186/01/46



0661632

ELECTRICAL RESEARCH AND DEVELOPMENT ASSOCIATION

ERDA Road, Makarpura Industrial Estate, Vadodara-390 010, India.
EPABX: +91 (0265) 2642942, 2642964, 2642377, 3043128 / 29 / 30 / 31 / 33
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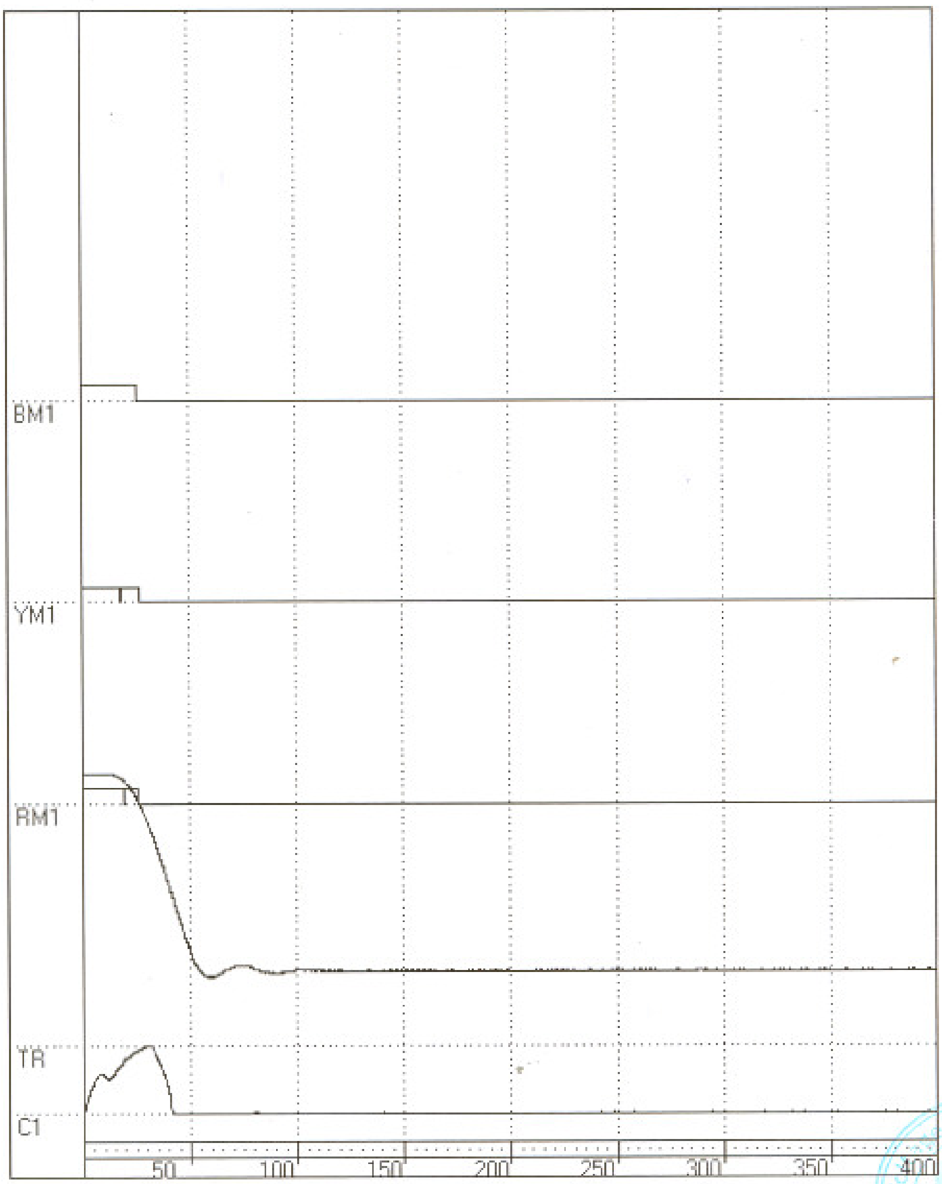
Web : http://www.erda.org

Test Report No. : LSWG/2912
Date: 11/03/2011

Oscillogram No. 1186/01/47



0661633

ELECTRICAL RESEARCH AND DEVELOPMENT ASSOCIATION
ERDA Road, Makarpura Industrial Estate, Vadodara-390 010, India.
EPABX: +91 (0265) 2642942, 2642964, 2642377, 3043128 / 29 / 30 / 31 / 33
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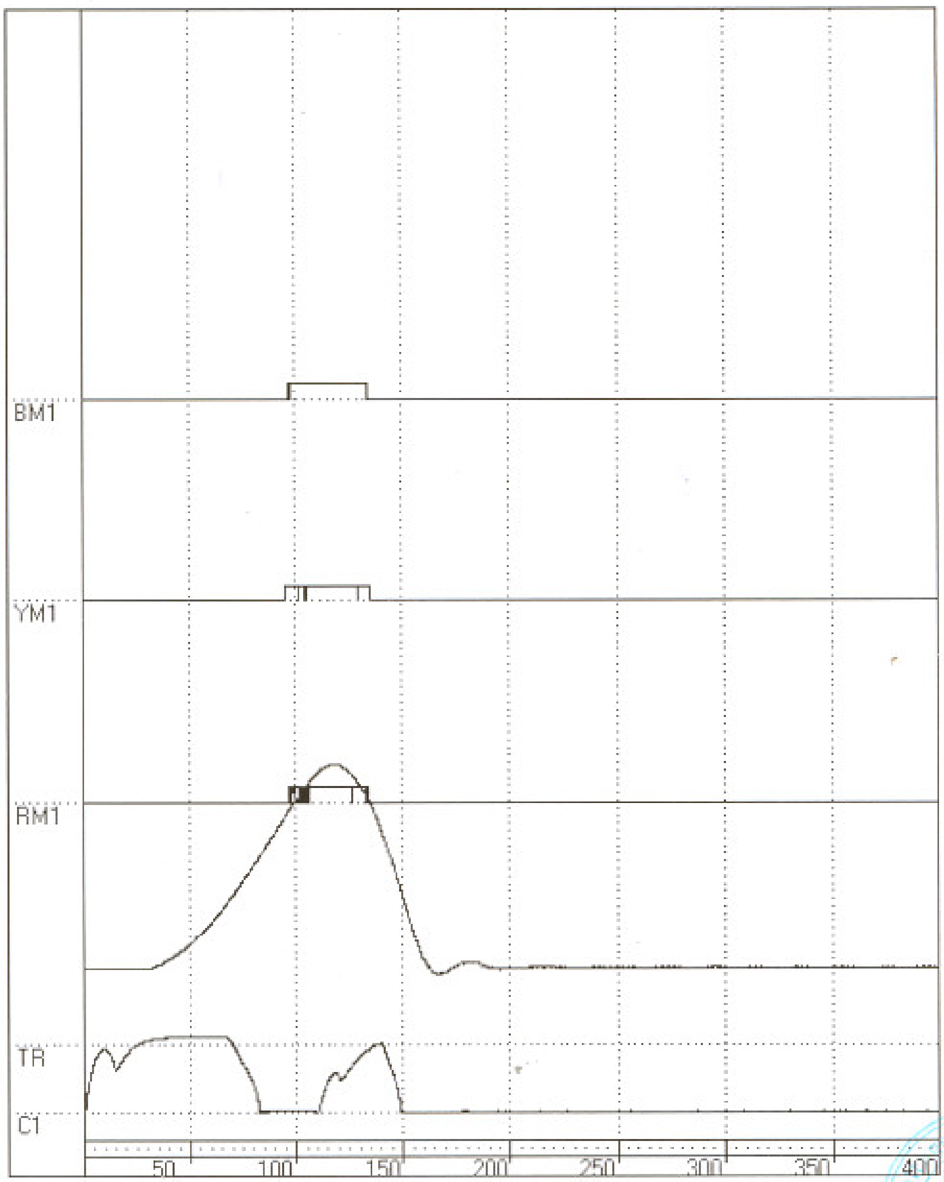
Test Report No. : LSWG/2912
Date: 11/03/2011

Oscillogram No. 1186/01/48



0661634

ELECTRICAL RESEARCH AND DEVELOPMENT ASSOCIATION
ERDA Road, Makarpura Industrial Estate, Vadodara-390 010, India.
EPABX: +91 (0265) 2642942, 2642964, 2642377, 3043128 / 29 / 30 / 31 / 33
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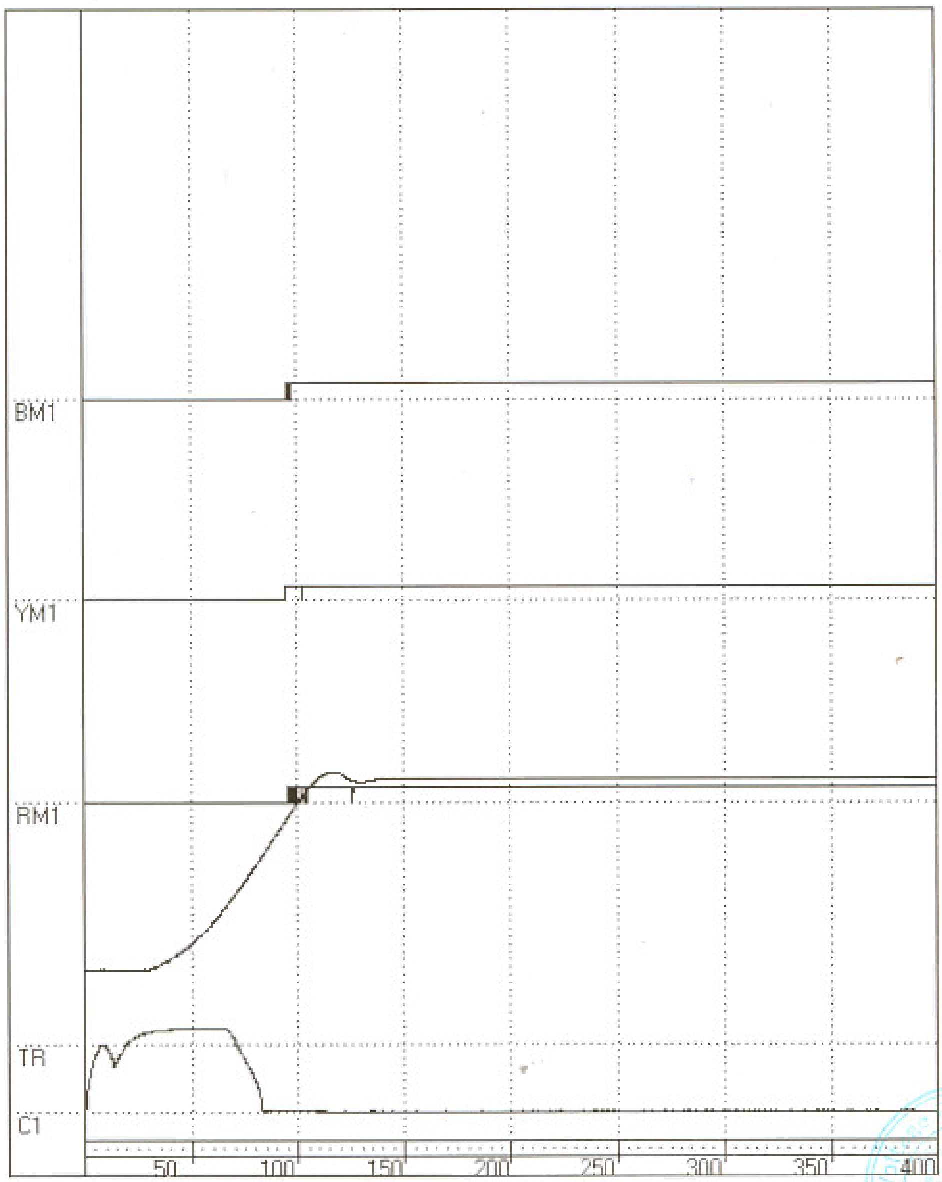
Test Report No. : LSWG/2912
Date: 11/03/2011

Oscillogram No. 1186/01/49

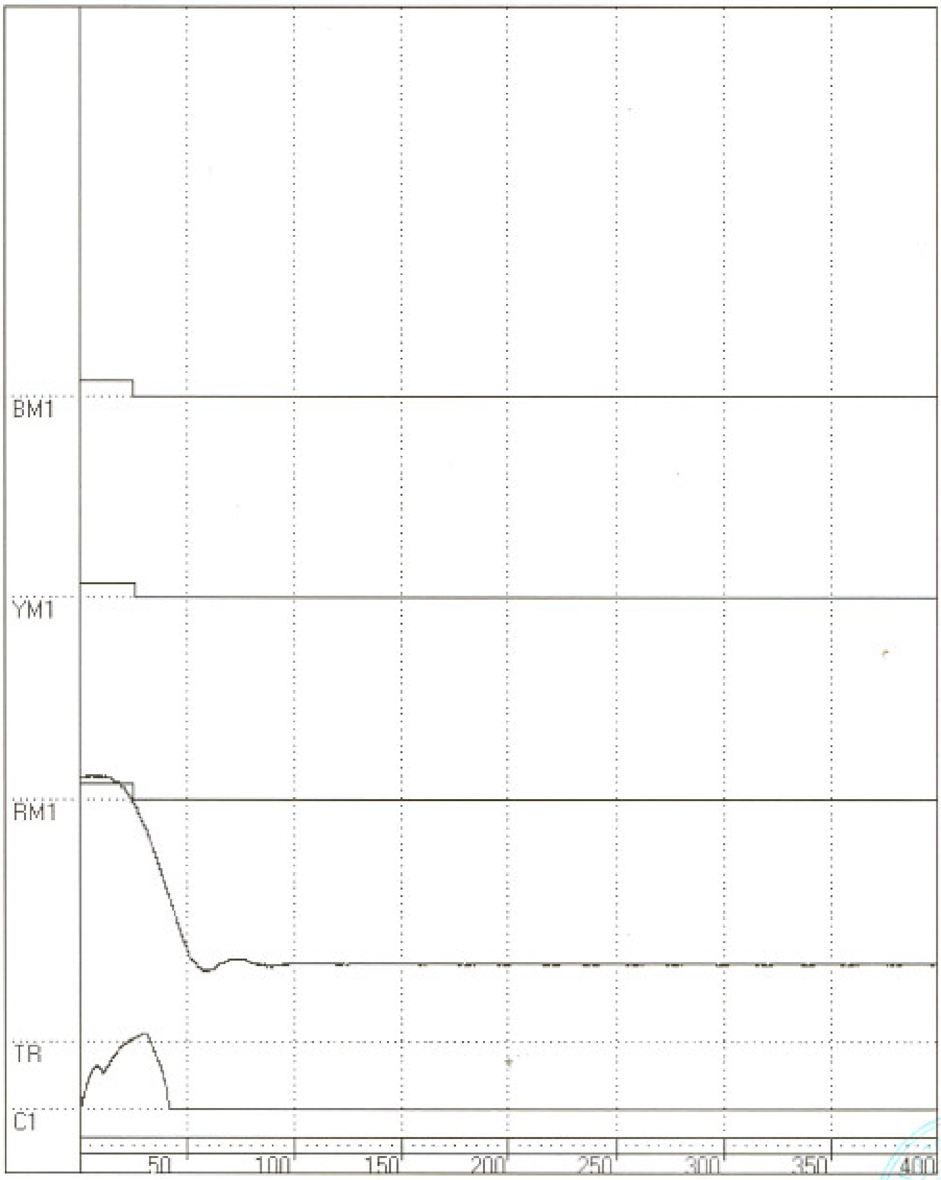


0661635

ELECTRICAL RESEARCH AND DEVELOPMENT ASSOCIATION
ERDA Road, Makarpura Industrial Estate, Vadodara-390 010, India.
EPABX: +91 (0265) 2642942, 2642964, 2642377, 3043128 / 29 / 30 / 31 / 33
Fax : +91 (0265) 2638382
E-mail : erda@erda.org
Web : http://www.erda.org

Test Report No. : LSWG/2912
Date: 11/03/2011

Oscillogram No. 1186/01/50

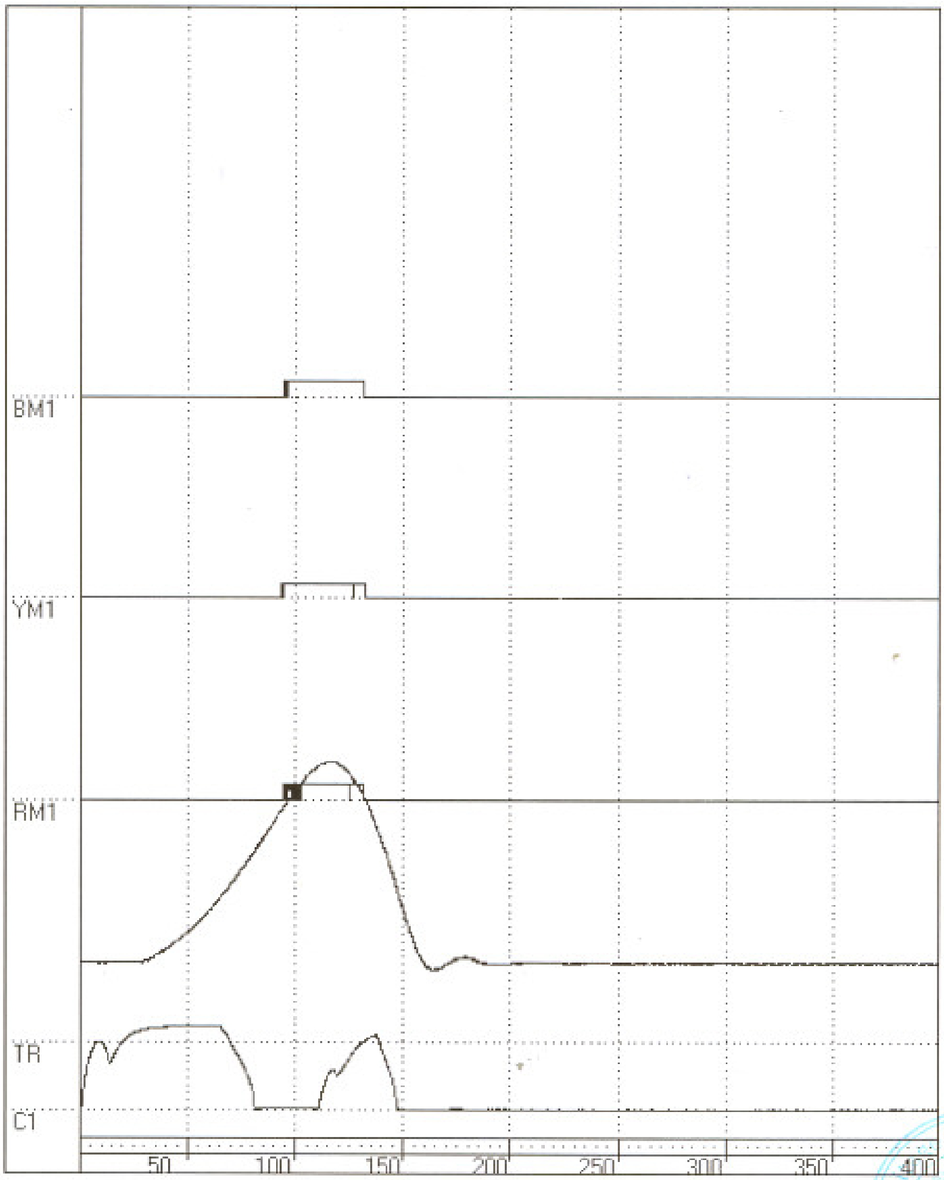


0661636

ELECTRICAL RESEARCH AND DEVELOPMENT ASSOCIATION
ERDA Road, Makarpura Industrial Estate, Vadodara-390 010, India.
EPABX: +91 (0265) 2642942, 2642964, 2642377, 3043128 / 29 / 30 / 31 / 33
Fax : +91 (0265) 2638382
E-mail : erda@erda.org
Web : http://www.erda.org

Test Report No. : LSWG/2912
Date: 11/03/2011

Oscillogram No. 1186/01/51



ELECTRICAL RESEARCH AND DEVELOPMENT ASSOCIATION
ERDA Road, Makarpura Industrial Estate, Vadodara-390 010, India.
EPABX: +91 (0265) 2642942, 2642964, 2642377, 3043128 / 29 / 30 / 31 / 33
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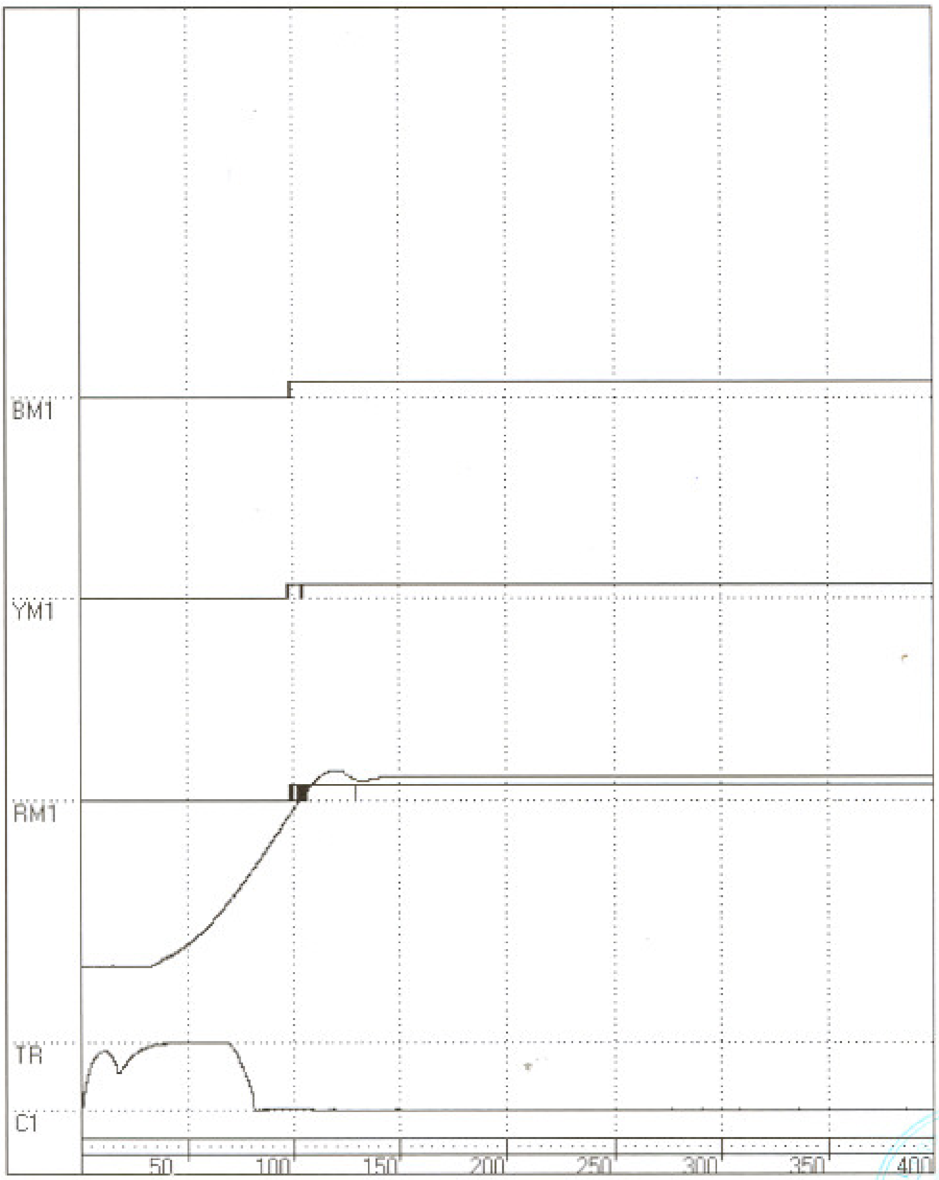
Test Report No. : LSWG/2912
Date: 11/03/2011

Oscillogram No. 1186/01/52

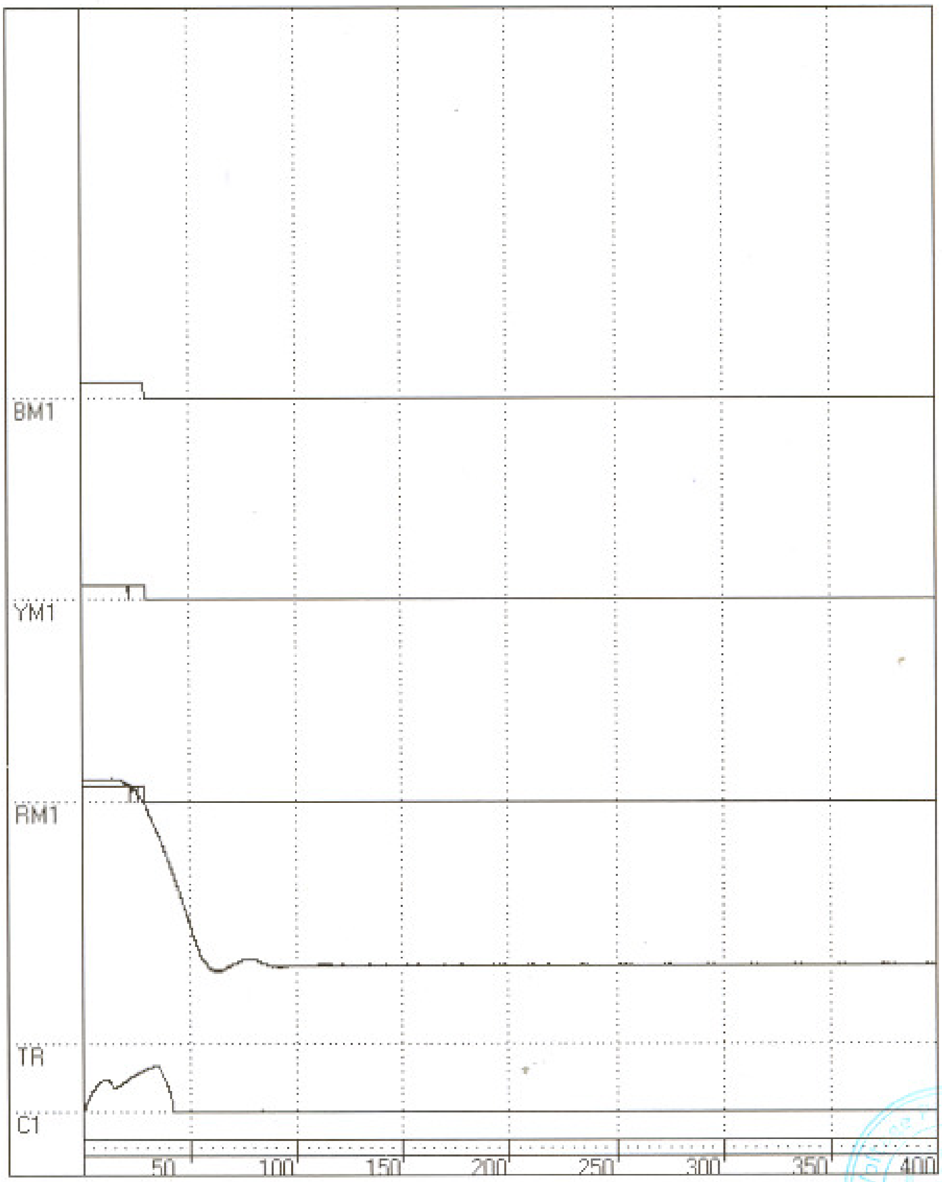


0661638

ELECTRICAL RESEARCH AND DEVELOPMENT ASSOCIATION
ERDA Road, Makarpura Industrial Estate, Vadodara-390 010, India.
EPABX: +91 (0265) 2642942, 2642964, 2642377, 3043128 / 29 / 30 / 31 / 33
Fax : +91 (0265) 2638382
E-mail : erda@erda.org
Web : http://www.erda.org

Test Report No. : LSWG/2912
Date: 11/03/2011

Oscillogram No. 1186/01/53



0661639

ELECTRICAL RESEARCH AND DEVELOPMENT ASSOCIATION
P.B.760, ERDA Road, Makarpura Industrial Estate, Vadodara–390 010. India Gram: ELECSEARCH
EPABX: +91 (0265) 2642942, 2642964, 2642377, 3043133, 3043128, 3043129, 3043130, 3043131.
Fax : +91 (0265) 2638382.
E-mail : erda@erda.org, dir@erda.org, phv@erda.org, ins@erda.org, plv@erda.org, mtd@erda.org, tdc@erda.org, ene@erda.org

Test Report No. : LSWG/2912
Date: 11/03/2011

Photograph no. : 1186/01/A

145kV SF6 GAS CIRCUIT BREAKER
(SPRING CLOSING – SPRING OPENING)

ELECTRICAL RESEARCH AND DEVELOPMENT ASSOCIATION

P.B.760, ERDA Road, Makarpura Industrial Estate, Vadodara–390 010. India Gram: ELECSEARCH
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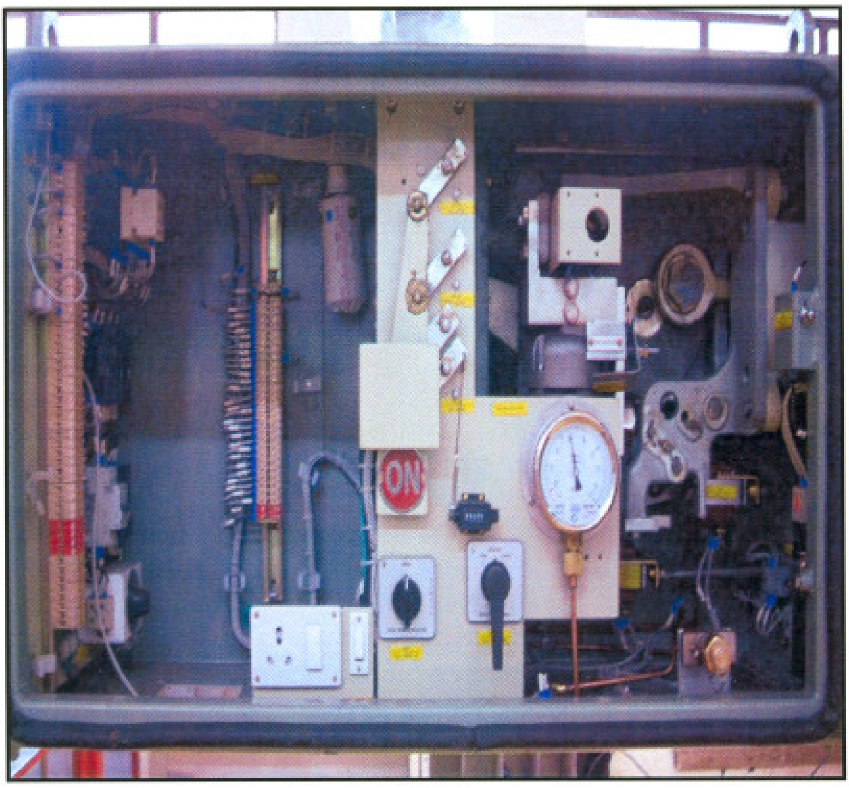
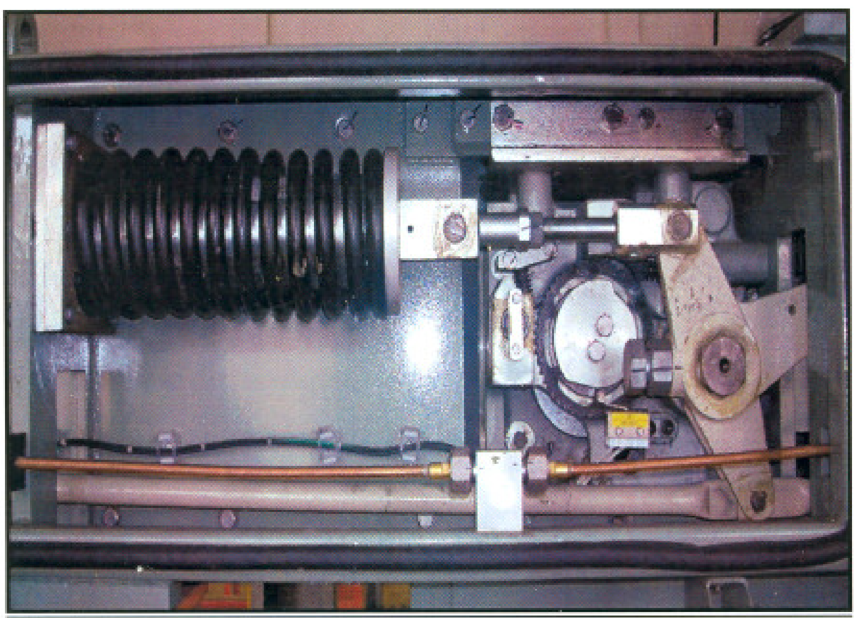
Fax : +91 (0265) 2638382.
E-mail : erda@erda.org, dir@erda.org, phv@erda.org, ins@erda.org, plv@erda.org, mtd@erda.org, tdc@erda.org, ene@erda.org

Test Report No. : LSWG/2912
Date: 11/03/2011





Photograph no. : 1186/01/B

MECHANISM OF
145kV SF6 GAS CIRCUIT BREAKER
(SPRING CLOSING – SPRING OPENING)

ELECTRICAL RESEARCH AND DEVELOPMENT ASSOCIATION
P.B.760, ERDA Road, Makarpura Industrial Estate, Vadodara–390 010. India Gram: ELECSEARCH
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Fax : +91 (0265) 2638382.
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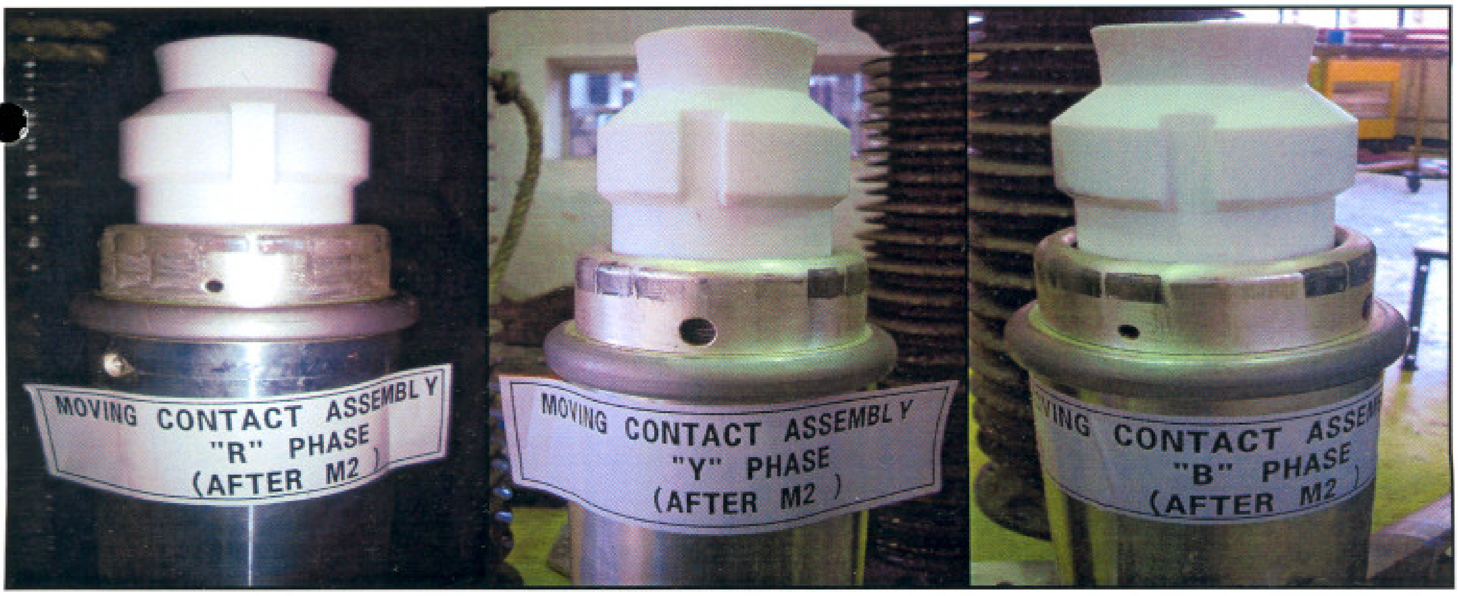
Test Report No. : LSWG/2912
Date: 11/03/2011

Photograph no. : 1186/01/C

STATIONARY & MOVING CONTACT ASSEMBLY OF
145kV SF6 GAS CIRCUIT BREAKER
(SPRING CLOSING – SPRING OPENING)
BEFORE MECHANICAL OPERATION TEST

ELECTRICAL RESEARCH AND DEVELOPMENT ASSOCIATION
P.B.760, ERDA Road, Makarpura Industrial Estate, Vadodara-390 010. India Gram: ELECSEARCH
EPABX: +91 (0265) 2642942, 2642964, 2642377, 3043133, 3043128, 3043129, 3043130, 3043131.
Fax : +91 (0265) 2638382.
E-mail : erda@erda.org, dir@erda.org, phv@erda.org, ins@erda.org, plv@erda.org, mtd@erda.org,
tdc@erda.org, ene@erda.org

Test Report No. : LSWG/2912
Test Report No. : LSWG/2912
Date: 11/03/2011

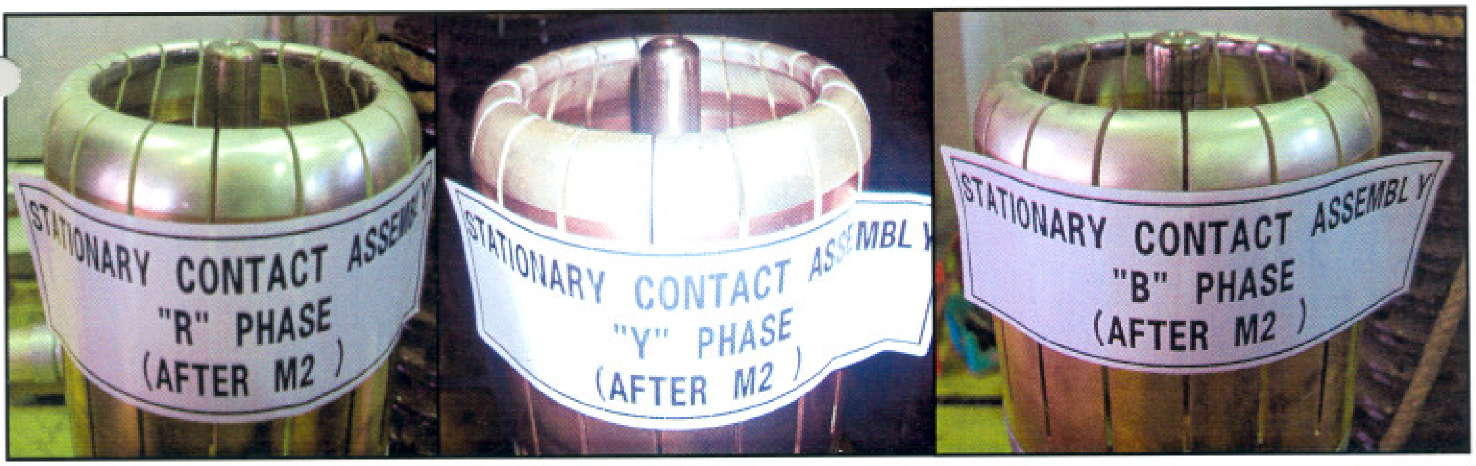


Photograph no. : 1186/01/D

MOVING CONTACT ASSEMBLY OF
145kV SF6 GAS CIRCUIT BREAKER
(SPRING CLOSING – SPRING OPENING)
AFTER MECHANICAL OPERATION TEST

ELECTRICAL RESEARCH AND DEVELOPMENT ASSOCIATION
P.B.760, ERDA Road, Makarpura Industrial Estate, Vadodara–390 010. India Gram: ELECSEARCH
EPABX: +91 (0265) 2642942, 2642964, 2642377, 3043133, 3043128, 3043129, 3043130, 3043131.
Fax : +91 (0265) 2638382.
E-mail : erda@erda.org, dir@erda.org, phv@erda.org, ins@erda.org, plv@erda.org, mtd@erda.org, tdc@erda.org, ene@erda.org

Test Report No. : LSWG/2912
Date: 11/03/2011



Photograph no. : 1186/01/E

STATIONARY CONTACT ASSEMBLY OF
145kV SF6 GAS CIRCUIT BREAKER
(SPRING CLOSING – SPRING OPENING)
AFTER MECHANICAL OPERATION TEST

ELECTRICAL RESEARCH AND DEVELOPMENT ASSOCIATION
ERDA Road, Makarpura Industrial Estate, Vadodara-390 010, India.
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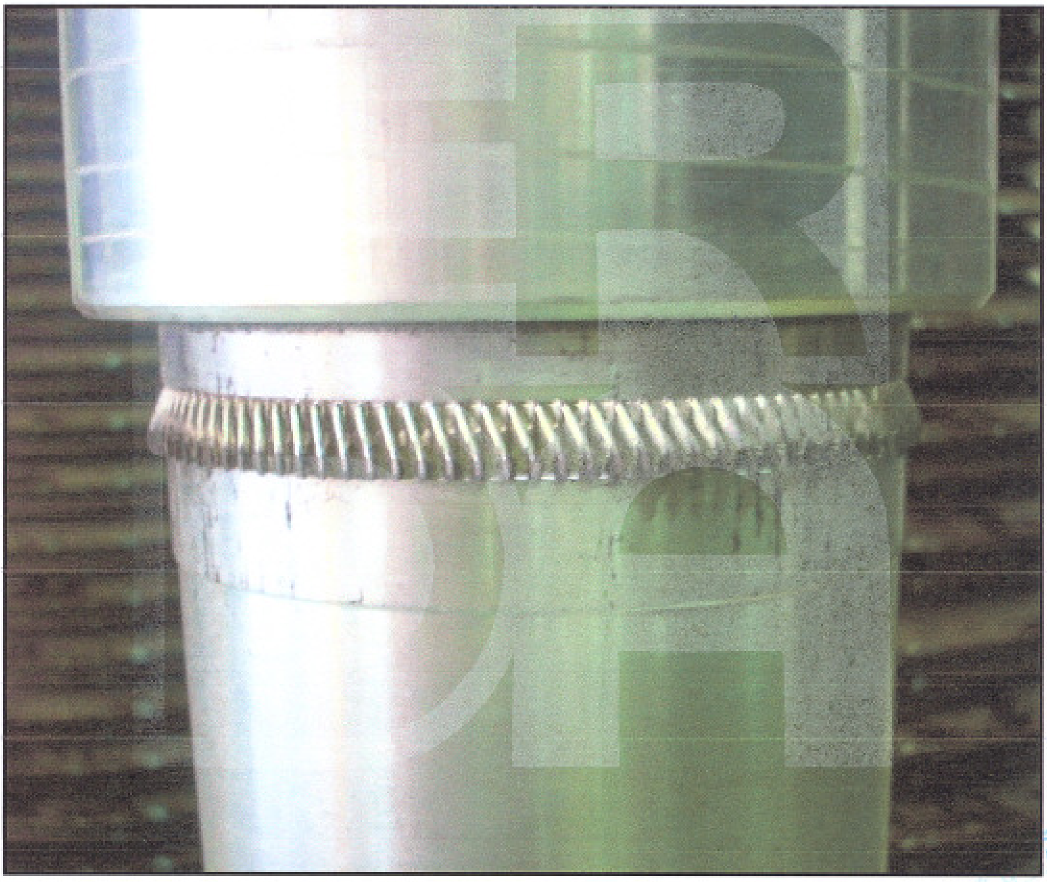
Test Report No. : LSWG/2912
Date: 11/03/2011



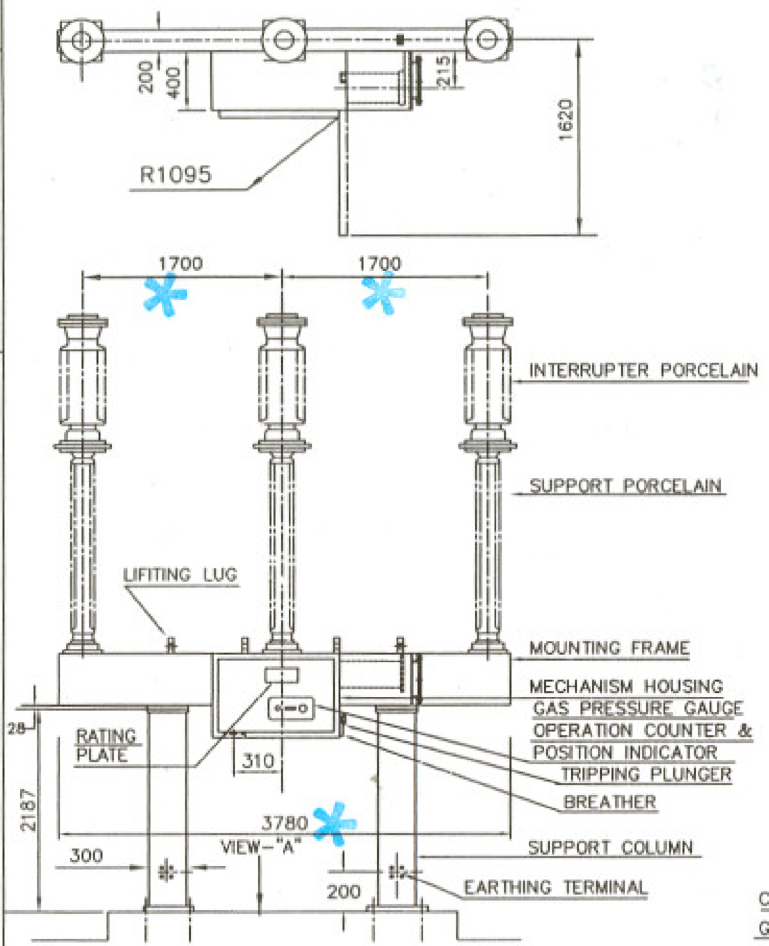
Photograph no. : 1186/01/F

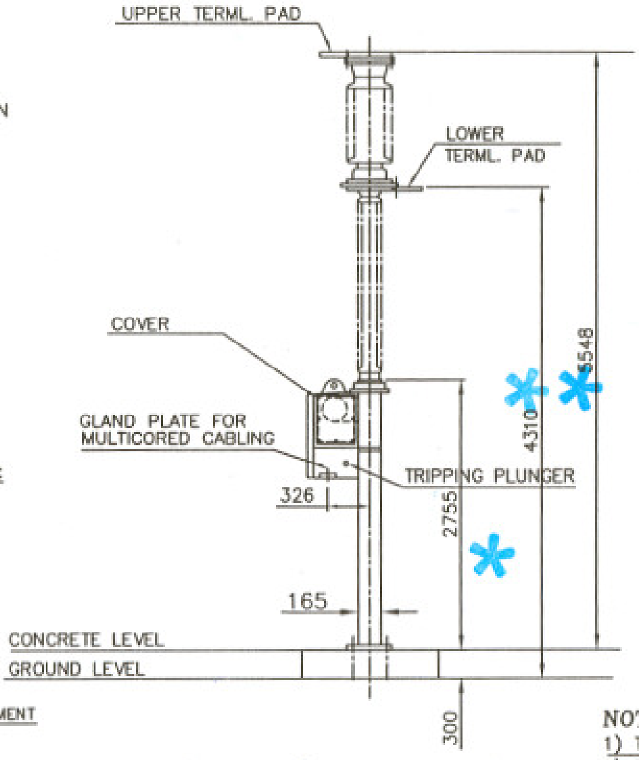
MULTILAM CONTACT ASSEMBLY OF
145kV SF6 GAS CIRCUIT BREAKER
(SPRING CLOSING – SPRING OPENING)

0624201

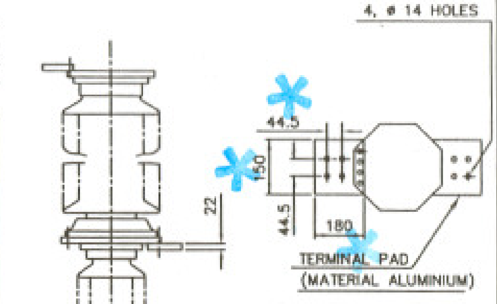
DRG.NO:- 3949604 R0

IF IN DOUBT ASK

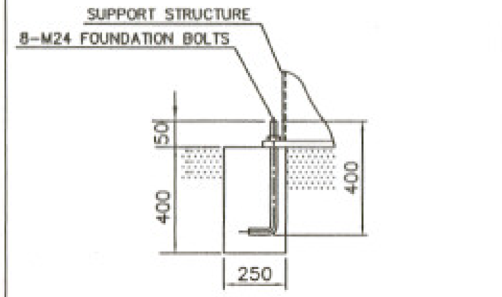




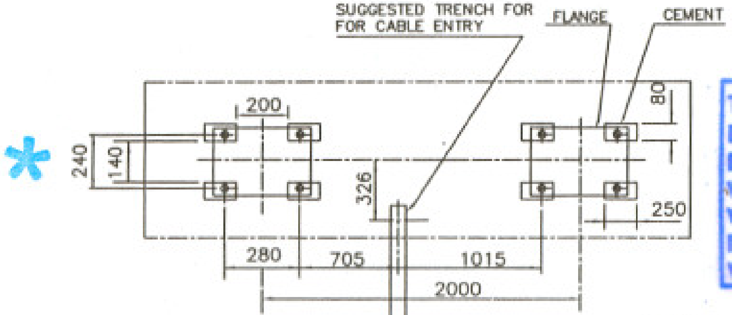
NOTE:- CLEAN BOTH CONNECTING SURFACES OF TERMINAL PADS AND TERMINAL FLANGE WITH SAND PAPER AND COAT SUPPLIED COMPOUND BEFORE CONNECTING.



DETAIL OF UPPER AND LOWER TERMINAL PADS



DETAIL OF FOUNDATION BOLT



FOUNDATION DESIGN
DETAILS OF VIEW - "A"

NOTE :-
1) TOTAL WEIGHT INCLUSIVE OF COLUMN:-1550Kg.(APPROX.)
2) TOTAL GAS WEIGHT :-7.5 Kg. (APPROX.) .
3) MAXIMUM SHOCK LOAD DURING OPERATION :-2000 Kg.
4) FINISH :- ALL EXPOSED FERROUS PARTS ARE PAINTED WITH SHADE 631 OF IS:5
5) CREEPAGE DISTANCE: 3625mm
6) HARDWARES EXPOSED TO ATMOSPHERE ARE H.D.G./S.S.

Test Report No.: LSWCG/2912
Date: 11/08/2011
Product: 145 KV SF6 GCB
Verified by: [signature]
Verification of this drawing by ERDA is limited to relevant dimensional checks only.
Verified dimensions are marked with *

NO	REVISION	SIGN	DATE		SIGN	NAME
2				DRN	[signature]	HCJ
1				CHD	[signature]	SSS
				APPD	[signature]	SSS
				SCALE	N.T.S.	DATE: 01/01/11

THIRD ANGLE PROJECTION
GENERAL ARRANGEMENT FOR 145KV-40KA SP SP SINGLE STACK GCB

Crompton Greaves Ltd.
SWITCHGEAR DIVISION S3
AMBAD, NASHIK.

DRG.NO.3949604 R0

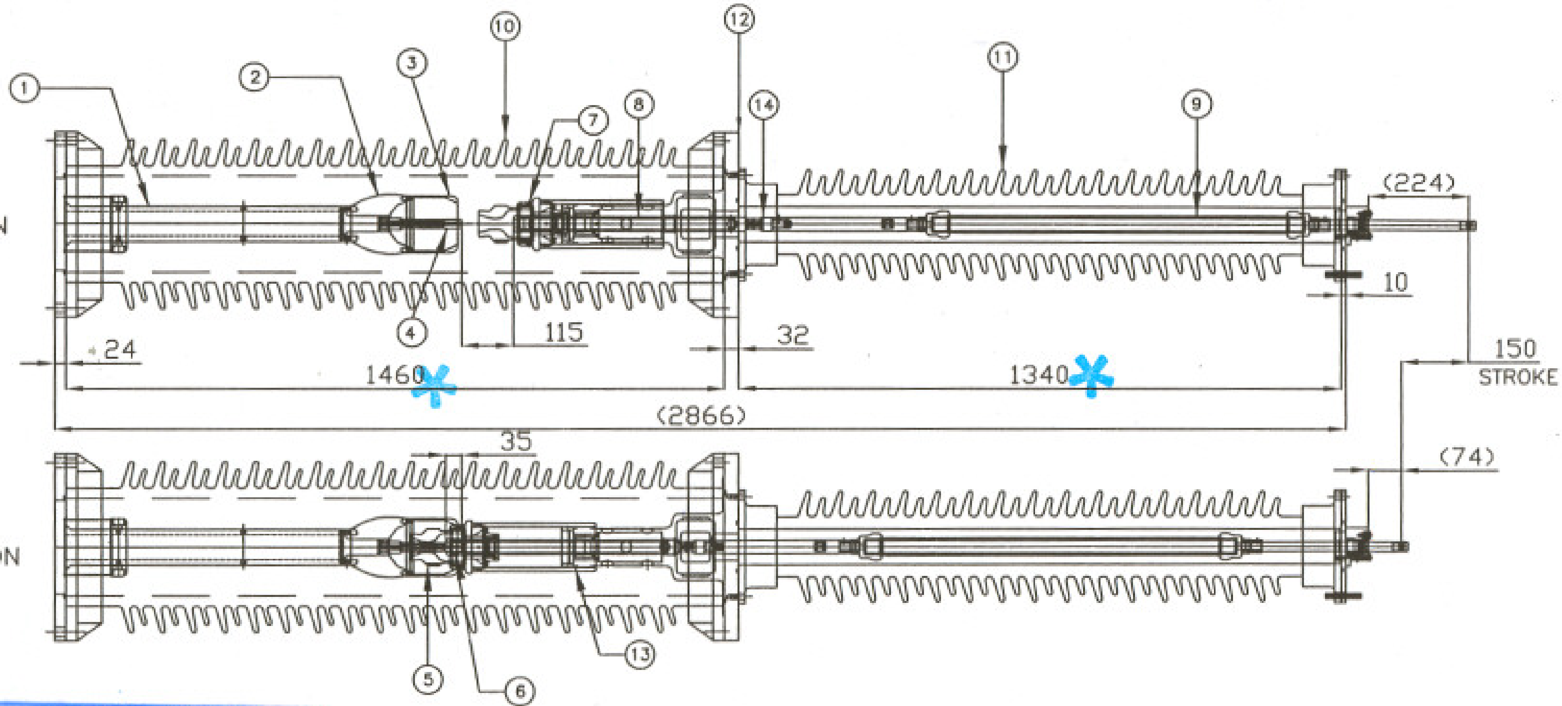
DRG. NO. 4949638 REV. 0

USED ON: 145kV, 40kA	ASSLY.DRG.NO.:	CODE NO.:	REF.DRG.NO.:	Wt.:

SR NO.	DESCRIPTION	SR NO.	DESCRIPTION
1	UPPER TERMINAL	8	PISTON ROD
2	JOINT (CASTING)	9	INSULATING ROD ASSEMBLY
3	STATIONARY MAIN CONTACT	10	INTERRUPTER PORCELAIN
4	STATIONARY ARC CONTACT	11	SUPPORT PORCELAIN
5	NOZZLE	12	LOWER TERMINAL
6	MOVING ARC CONTACT ASSEMBLY	13	MULTILAM CONTACT LA-CUDS/90/0.15/LAG
7	MOVING MAIN CONTACT	14	SOCKET

OPEN POSITION

CLOSE POSITION



IF IN DOUBT ASK

Test Report No.: LS(W)... /2012
Date: 11/03/2011
Product: 145 KV SF6 GCB
Verified by:
Verification of this drawing by ERDA is limited to relevant dimensional checks only.
Verified dimensions are marked with ★

NO.	REVISION	DATE
3		
2		
1		

ALL DIMENSIONS IN mm

	SIGN	NAME	DATE
DRN.	HJoshi	HCJ	05.04.11
CHD.	HJoshi	HCJ	05.04.11
APPD.		SSS	05.04.11
GENERAL TOLERANCES			
SCALE	NTS		

THIRD ANGLE PROJECTION

POLE UNIT ASSEMBLY-145kV
(TYPE: 120-SFM-32B)

Crompton Greaves Ltd.
SWITCHGEAR DIVISION S3
AMBAD, NASHIK

DRG.NO. 4949638 REV. 0