ENCLOSURES :
DRG. NOS.: CLW/ES/3/SK-1/~~0015B~~ C
CLW/ES/3/SK-2/0015~~B~~ C
CLW/ES/3/SK-3/0015~~B~~ C
CLW/ES/3/SK-4/0015~~B~~ C

TECHNICAL SPECIFICATION FOR

RESISTOR HARMONIC FILTER FOR WAG-9H/WAP-7(Co-Co) ELECTRIC LOCOMOTIVES

.

SPECIFICATION NO: CLW/ES/3/0015

ISSUE DATE: 04.05.2018

ISSUED BY:

DY. CHIEF ELECTRICAL ENGINEER/D-II
CHITTARANJAN LOCOMOTIVE WORKS
P.O. CHITTARANJAN– 713331
DIST.-BARDHAMAN (WEST), WEST BENGAL (INDIA)

PREPARED BY	CHECKED BY	APPROVED BY
JE/SSE-Design	AEE/SEE-Design	Dy. CEE/D-II

ALTERATION RECORD SHEET

Alt. No.	Date	Page No.	Reason	Authority	Remarks
A	10-09-2014		i) Alteration record sheet added. ii) sheet no 3 modified.	Sd/-	This modification has been done with the approval of competent authority of CLW vide this office note no ELDD/3694, dated 16-08-2014
B	04.05. 2018		i) Typographical error in sheet no 3, Clause no- 4 i.e. ribbon-parallel path of R1 & R2 interchanged. ii) Typographical error in sheet no-6, SK-1. (850 in place of 800) iii) For clear visibility retyped the specification.	Sd/-	This specification has been retyped.
C	---		i) Deletion of short circuit test ii) Weight review at drawing No. CLW/ES/3/SK-3/0015.	--	----

Note: Specifications have been digitized and all alterations have been incorporated.

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SPECIFICATION FOR RESISTOR HARMONIC FILTER FOR WAG-9H / WAP-7

TABLE OF CONTENTS

SPECIFICATION FOR RESISTOR HARMONIC FILTER FOR WAG-9H/WAP-7(COCO)

1. SCOPE:

Resistor harmonic filter is used in the harmonic filter of traction winding of transformer on the WAG-9/WAP-7 electric locomotive

2. CLIMATE AND ENVIRONMENTAL CONDITION:

2.1 **The maximum atmospheric temperatures:** **Under sun:** 70°C

In Shed: 55°C

2.2 **Humidity**: 100% saturation during rainy season

2.3 **Reference site condition:**

i Ambient temperature max. 55°C min. 0°C
ii. Humidity :60%
iii. Altitude :1000 m above sea level

2.4 **Rainfall :** Very heavy in certain areas, the locomotive will be designed to permit its running level at 10 KM/H in flood water level of 102 mm above rainfall

2.5 **Atmosphere during hot weather:** Extremely dusty and desert terrain in certain areas

2.6 Coastal areas: Locomotive and equipment will be design to work in coastal areas in humid and salt laden Atmosphere.

2.7 Vibration: The equipment and its mounting arrangement will be design to withstand vibration and shocks encountered in service as per IEC-61373 unless otherwise prescribed.

3. STANDARDS:

1. Assistance has been taken for the preparing the specification from ABB documents, and from following standards IEC-60038, IEC-60322 and IEC-60077.

2. Unless otherwise specified, latest revision of standard to be used.

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4. **TECHNICAL DATA:**

Parameter	R_1	R_2
Resistance	:0.2 Ω	:0.2 Ω
Tolerance	: ±5%	: ±5%
Power losses (continuous)	:40 KW (Fundamental wave and Harmonic)	:60 KW (Fundamental wave and Harmonic)
Nominal current (continuous)	:450 A (Fundamental wave and Harmonic)	:550 A (Fundamental wave and Harmonic)
Fundamental waves	:50Hz ±3%	:50Hz ±3%
Voltage stress between terminal and support	:2800V AC RMS	:2800V AC RMS

5. CHARACTERISTICS

Resistor	R_1	R_2
Resistance Hot	:0.2 Ohm	:0.2 Ohm
Resistance Cold	:0.194 Ohm	:0.194 Ohm
Ribbon	Two parallel paths of 02 ribbons of 40mmX0.5mm thick together in each layer.	Two parallel paths of 04 ribbons of 40mmX0.4mm thick together in each layer.

6 MATERIAL:

6.1	Resistor	R_1	R_2
	Resistance element	The resistor element should be nickel, chromium and iron alloy (antimagnetic) with Ni 57-60%, Cr 14-18%, rest Fe and traces of other elements of M/s Krupp VDM Germany, M/s Kanthal, Sweeden.	The resistor element should be nickel, chromium and iron alloy (antimagnetic) with Ni 57-60%, Cr 14-18%, rest Fe and traces of other elements of M/s Krupp VDM Germany, M/s Kanthal, Sweeden
6.2	**Mounting base**	Stainless steel	Stainless steel

7. Temperatures

Resistor	R_1	R_2
Max. values peak	645˚C	609 ˚C
Ribbon	200 ˚C	170 ˚C

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8. Insulation

Resistor	R_1	R_2
Voltage stress between terminal and support	2800V AC	2800V AC
Insulation Voltage	3000V	3000V
Test Voltage	9500V/50Hz/1 Min	9500V/50Hz/1 Min

9. OTHER TECHNICAL DETAILS:

Creepage Path	70mm
Voltage Clearance	40mm
Mounting place	Roof (Outside of Locomotive)
Cooling	Heat dissipation by air circulation (No forced cooling air cooling)

10. CONSTRUCTION:

The constructional design of the filter resistor is shown on drawing No. CLW/ES/3/SK-3/0015

The resistor consists of a frame no.1 containing 20 folds (2), and a frame No.2 with 12 folds of tape (3). The two frames are mounted on a support (1). A grid protection covers the frames and is fixed onto the support by means of hexagon bolts. Each frame has 2 decks of resistor tapes.

The Corrugated resistor tape with a certain pre-tension is wound in the form of Meanders around ceramic insulators, which are fixed with transverse rods onto the frame. The elasticity due to the Corrugation of the resistor tape ensures good stability of its shape, even at high temperatures.

The complete filter resistor assembly is mounted on six Micaver insulators (Item no.4)

11. TYPE TEST & ROUTINE TEST:

The type test and routine test should be done according to following standards:

i.	IEC 60038	: Standard voltages
ii.	IEC 60322	: Rules of Ohmic resistors used in the power circuits of electrically power vehicles.
iii.	IEC 61373	Shock and vibrations
iv.	IEC 60077	Railway application-Electric Equipment for Rolling Stock.

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12. INSPECTION AND TESTING: The following tests shall be conducted as per relevant governing specification.

Sl. No.	Test Description	Type test	Routine Test
i)	Check on characteristics of resistor element material,	√	
ii)	Check on rated value of resistance,	√	√
iii)	Temperature rise test,	√	
iv)	Di-electric test,	√	√
v)	Test for performance in rain,	√	
vi)	Test for with standing vibration and shock,	√	
vii)	Hygroscopic test and	√	
~~viii)~~	~~Short circuit test~~	~~√~~	

13. DRAWINGS:

i)	CLW/ES/3/SK-1/0015	Overall dimension of resistors
ii)	CLW/ES/3/SK-2/0015	Connection Diagram
iii)	CLW/ES/3/SK-3/0015	Layout filter Resistors
iv)	CLW/ES/3/SK-4/0015	Complete filter Resistors Assembly

14. REFERENCE

The equipment used by M/s ABB for WAG-9 locomotives

Types of resistors: i) BW40-30-2.12
ii) BW40-30-2.20

Supplier: Secheron Ltd.
Ch-1211, Geneva 21
Case postal 116
Fax:041/22/7394361

Schematic Position: 8.3

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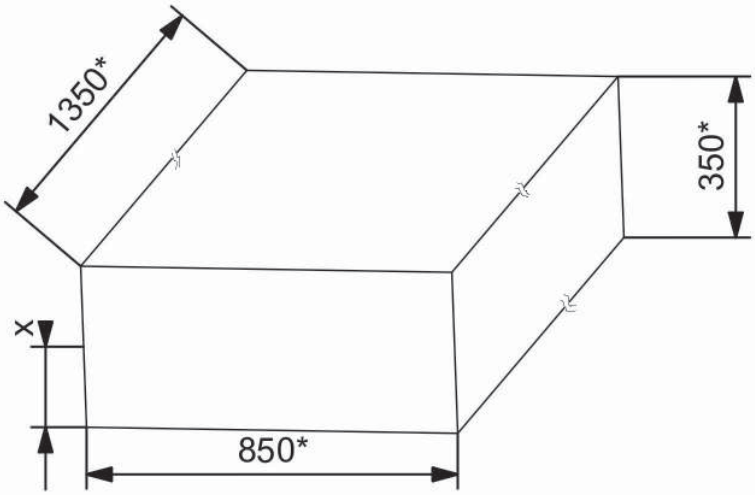
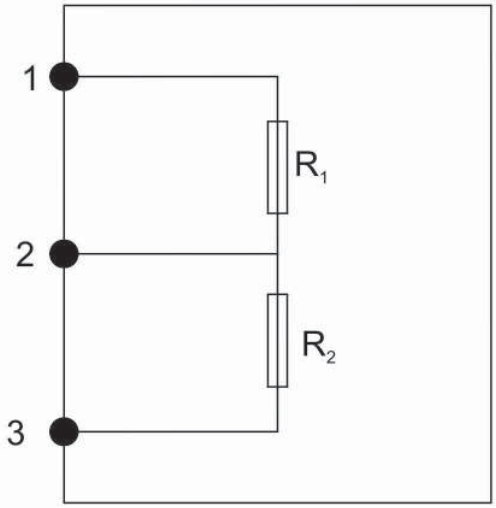
15 DESCRIPTION OF THE ITEMS.

Sl. no.	Description	Quantity	Item no.
1	Support	1	1
2	Tape resistor frame no.1	1	2
3	Tape resistor frame no.2	1	3
4	Insulator Mv 86	6	4
5	Insulator Mv 35/8 lacquered	2	5
6	Connection 25x5x556- Copper	1	6
7	Connection 25x5x504- Copper	1	7
8	Connection 25x5x462- Copper	1	8
9	Identification plate (2)	1	9
10	Identification plate (1)	1	10
11	Identification plate (3)	1	11
12	Perfored steel sheet	1	12
13	Protective cover	1	13
14	Support Rod Inth. 184	1	14
15	Support Rod Inth. 59	1	15
16	Screw tcy 6CP M8X42-INX A4	1	16
17	Screw 6P M8X16-INX A4	2	17
18	Screw 6P M8X14-INX A4	1	18
19	Screw 6P M10X25-INX A4	6	19
20	Screw 6P M10X40-INX A4	1	20
21	Screw 6P M16X25-INX A4	6	21
22	Screw 6P M5X10-INX A4	25	22
23	Screw 6P M5X16-INX A4	12	23
24	Screw rivet 2.94X4.7-INX A4	6	24
25	Screw 6P M6X12-INX A4	6	25
26	Washer A5.3/10X1.0-INX A4	25	27
27	Washer A8.4/16X1.6-INX A4	7	28
28	Washer A10.5/20X2.0-INX A4	3	29
29	Washer ELA 6.1/18.2X1.4-INX A4	6	32
30	Washer ELA 5.1/10.2X1.0-INX A4	25	33
31	Washer ELA 8.2/16.2X1.4-INX A4	4	34
32	Washer ELA 10.2/22.2X1.6-INX A4	9	35
33	Washer ELA 16.4/32.3X2.5-INX A4	6	36
34	Nut 6P 0.8D M10INX A4	9	40
35	Resistor filter Co-Co	x	9000



X: HEIGHT OF CONNECTIONS=141 mm

*MAX.VALUES FOR CAGE DIMENSION



CONNECTIONS ON THE LEFT SIDE

CONNECTIONS NOT IN OVERALL DIMENSIONS INCLUDED

ALL DIMENSIONS ARE IN mm.

परिवर्तन संख्या ALT.NO.	प्राधिकार AUTHY	वर्णन DESCRIPTION	दिनांकित आद्यक्षर DATED INITIAL

सतह – रुक्षता का मान भा. मा. 3073 / अ. मा. सं. 1302 SURFACE ROUGHNESS VALUE TO IS:3073 / ISO:1302	अनिर्दिष्ट सद्य – सीमा भा. मा. : 2102 / अ. मा. सं. : 2768 UNSPECIFIED TOLEARANCE TO IS : 2102 / ISO : 2768	TOL. CLS.
	धातु–वेल्डन चिन्ह भा. मा. : 813 / अ. मा. सं. :2553 WELDING SYMBOLS TO IS:813 / ISO:2553	

पदांक GRADE NO.	सं1 N1	सं2 N2	सं3 N3	सं4 N4	सं5 N5	सं6 N6	सं7 N7	सं8 N8	सं9 N9	सं10 N10	सं11 N11	सं12 N12
Rz	0.16-0.3	0.5-0.7	0.9-1.1	1.5-2.0	2.5-3.8	5.0-6.3	9.0-12	16-25	30-40	50-63	75-100	160-250
Ra μm	0.025	0.05	0.1	0.2	0.4	0.8	1.6	3.2	6.3	12.5	25	50
चिन्ह SYMBOL												

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दिनांक DATE	
रैखिक अनुपात SCALE	N.T.S
संदर्भ / REF.	ALT.-

चित्तरंजन रेलइंजन कारखाना
CHITTARANJAN LOCOMOTIVE WORKS, INDIA

पदार्थ MAT'L	प्रति भार कि. ग्रा. WT. EACH IN KG
विशिष्टि SPECN	
वर्णन DESCRIPTION	RESISTOR HARMONIC FILTER
आरेखण संख्या DRAWING NO.	CLW/ES/3/SK-1/0015/~~B~~C
परिवर्तन संख्या ALTERATION. NO.	पर्ण SHEET OF A4

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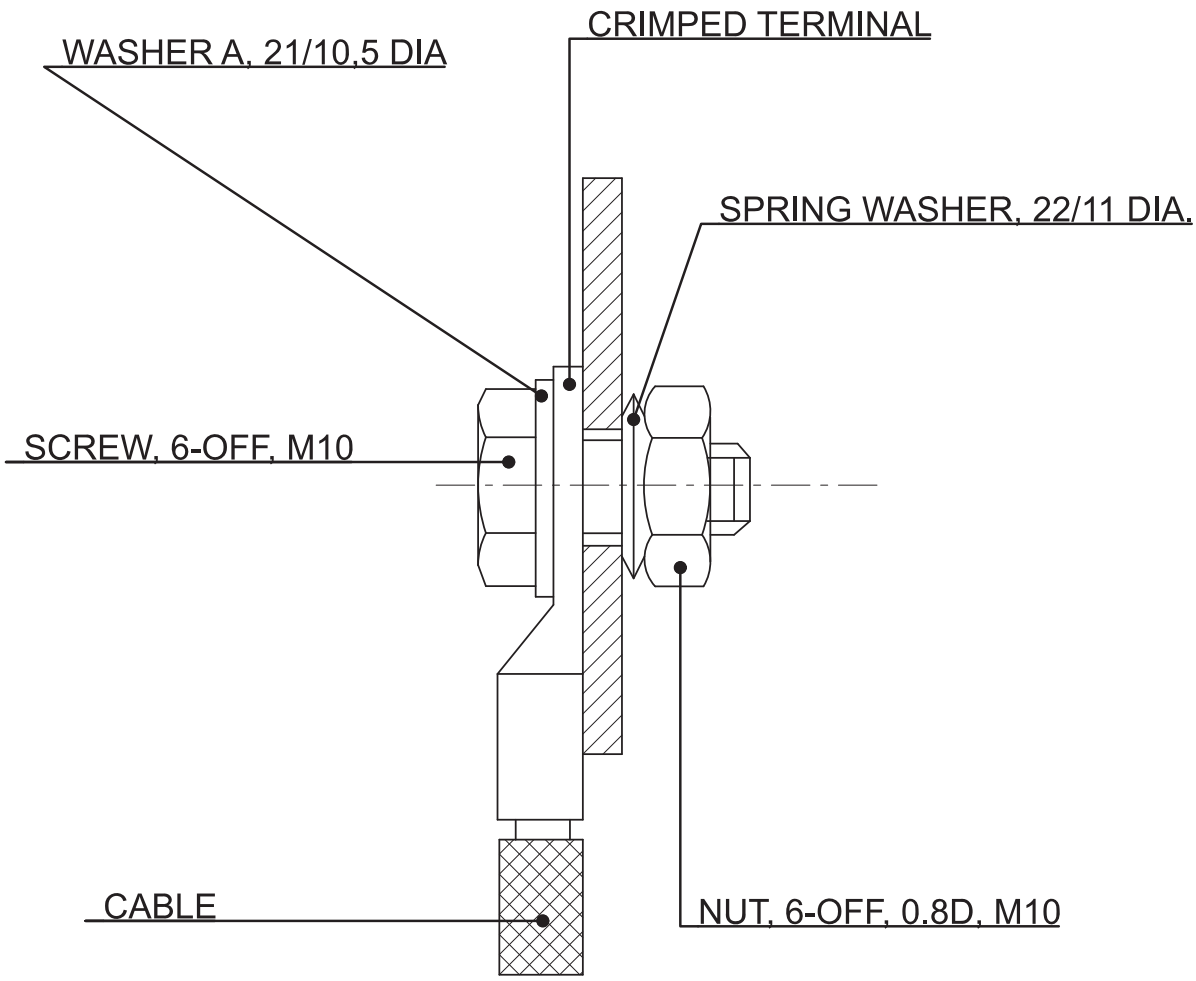

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दिनांक DATE		
रैखिक अनुपात SCALE	N.T.S	
संदर्भ / REF.		
ALT.-		

चितरंजन रेलइंजन कारखाना
CHITTARANJAN LOCOMOTIVE WORKS, INDIA

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विशिष्टि SPECN	
वर्णन DESCRIPTION	RESISTOR HARMONIC FILTER
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परिवर्तन संख्या ALTERATION. NO.	पर्ण SHEET OF A4

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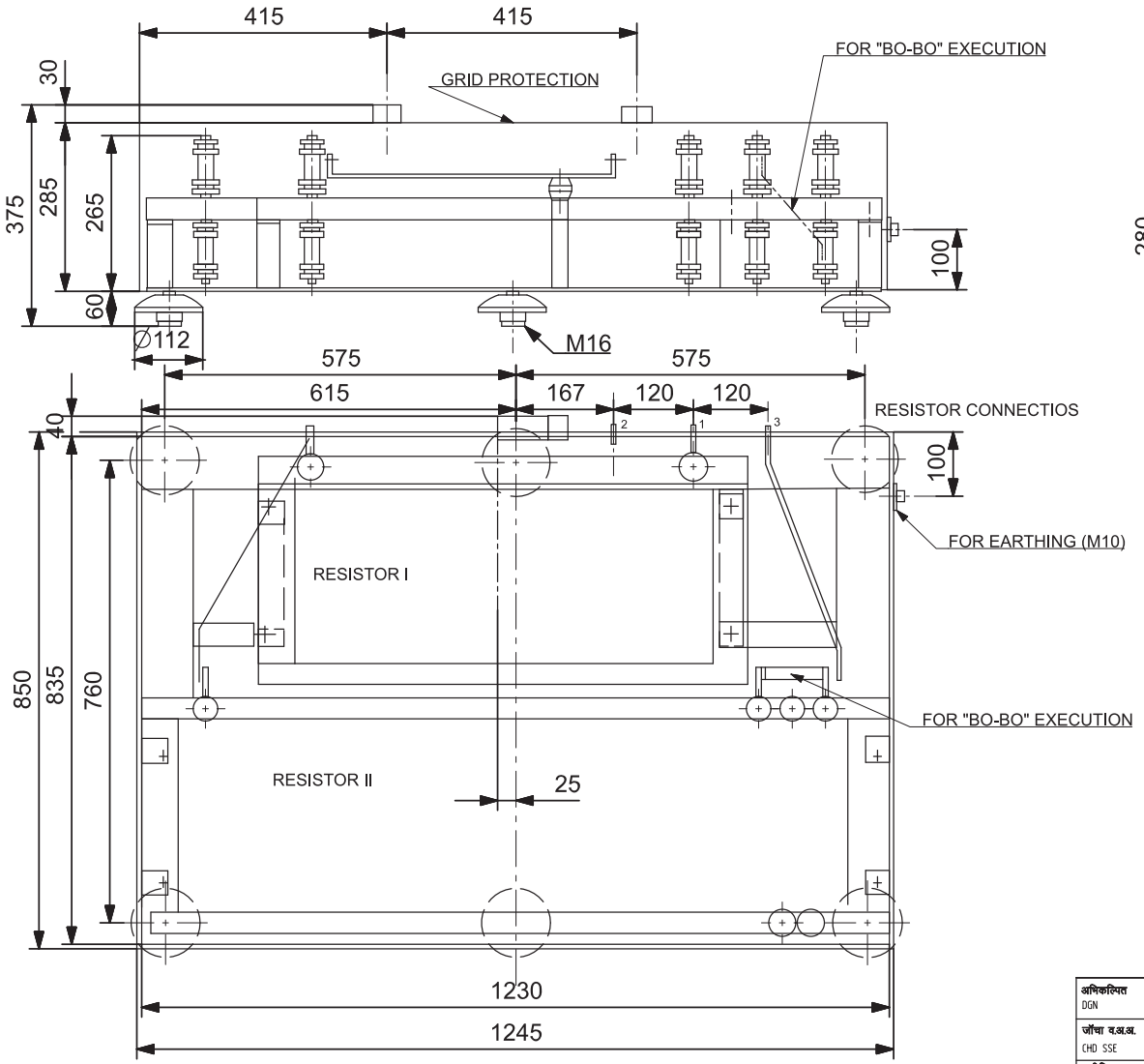

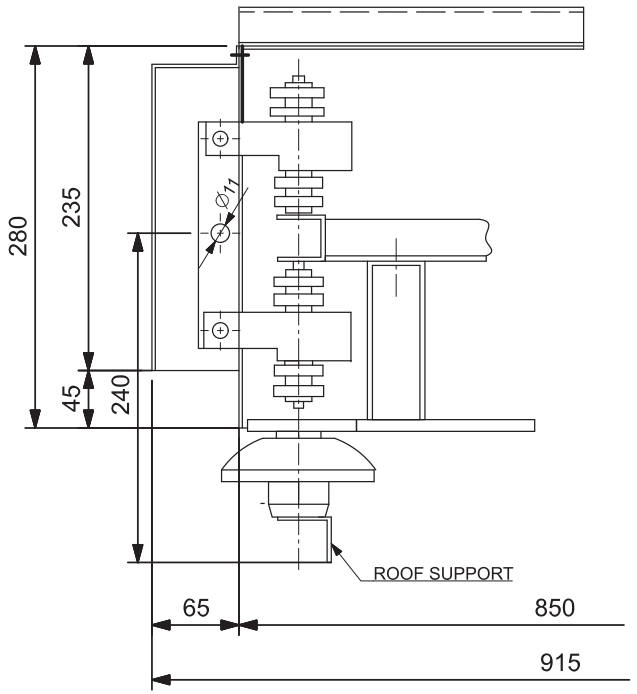

TOTAL WEIGHT

Bo-Bo ~~100 Kg.~~ 115 Kg(Approx)

Co-Co ~~125 Kg.~~ 145 Kg(Approx)

ALL DIMENSIONS ARE IN mm.

धातु–वेल्डन चिन्ह भा. मा. : 813 / अ. मा. सं. :2553 WELDING SYMBOLS TO IS:813 / ISO:2553	अनिर्दिष्ट सह्य – सीमा भा. मा. : 2102 / अ. मा. सं. : 2768 UNSPECIFIED TOLEARANCE TO IS : 2102 / ISO : 2768											TOL. CLS.	
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अभिकल्पित DGN		चित्तरंजन रेलइंजन कारखाना CHITTARANJAN LOCOMOTIVE WORKS, INDIA
जाँचा व.अ.अ. CHD SSE	SUBIR KUMAR MONDAL	
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अनुमोदित उ.मु.वि.अ. APPROVED DYCEE	ANSHU KUMAR VERMA	विशिष्ट SPECN
दिनांक DATE		वर्णन DESCRIPTION: RESISTOR HARMONIC FILTER
रैखिक अनुपात SCALE	N.T.S	आरेखण संख्या DRAWING NO.: CLW/ES/3/SK-3/0015~~/B~~ C
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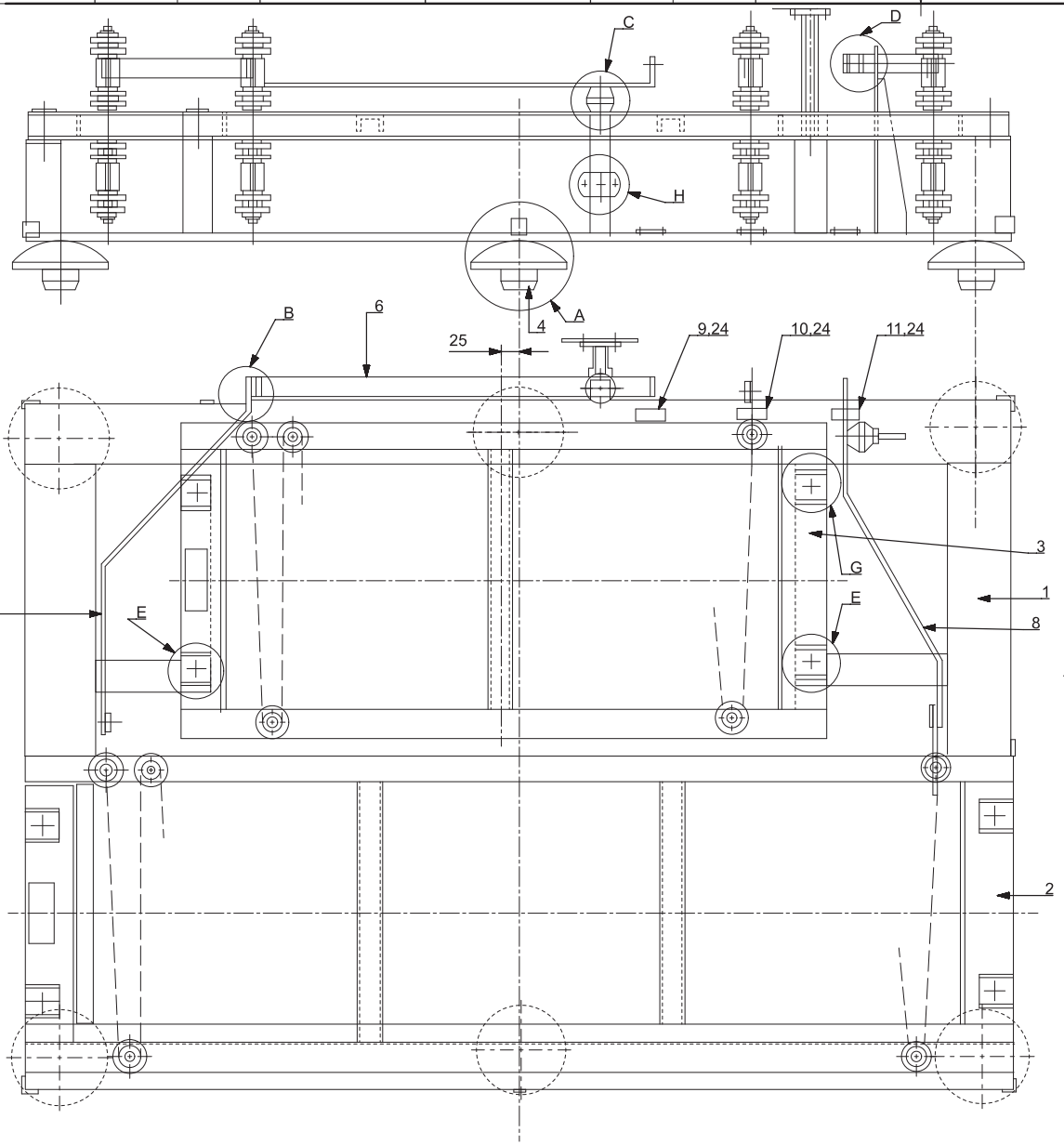

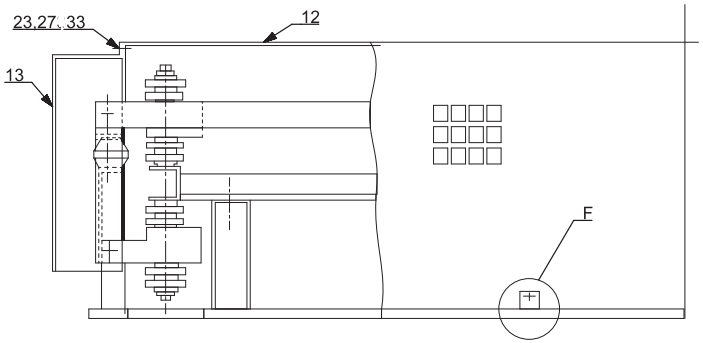

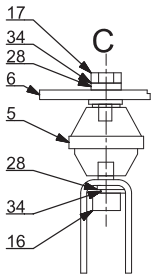

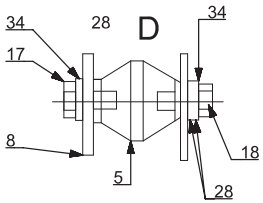

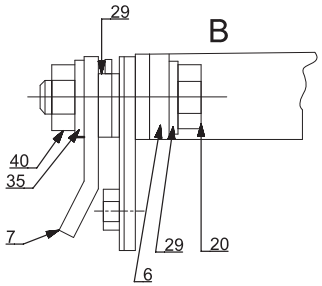

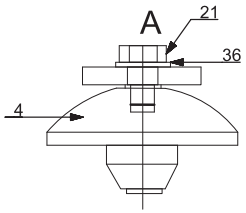

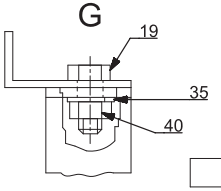

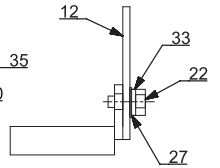

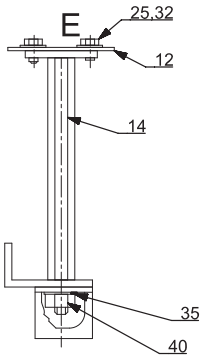

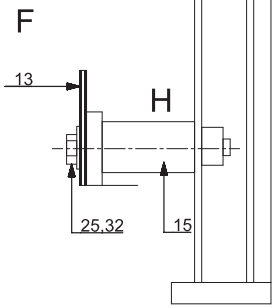

धातु–वेल्डन चिन्ह भा. मा. : 813 / अ. मा. सं. :2553 WELDING SYMBOLS TO IS:813 / ISO:2553	अनिर्दिष्ट सच – सीमा भा. मा. : 2102 / अ. मा. सं. : 2768 UNSPECIFIED TOLERANCE TO IS : 2102 / ISO : 2768
चराद – चक्राता का माप भा. मा. 3073 / अ. मा. सं. 1302 SURFACE ROUGHNESS VALUE TO IS:3073 / ISO:1302	

ग्रेड GRADE NO.	सं1 N1	सं2 N2	सं3 N3	सं4 N4	सं5 N5	सं6 N6	सं7 N7	सं8 N8	सं9 N9	सं10 N10	सं11 N11	सं12 N12
Rz	0.16-0.3	0.3-0.7	0.8-1.1	1.5-2.0	2.5-3.0	3.8-6.3	8.0-17	16-25	30-40	50-63	75-100	100-250
Ra μm	0.025	0.05	0.1	0.2	0.4	0.8	1.6	3.2	6.3	12.5	25	50
चिन्ह SYMBOL												

परिवर्तन संख्या ALT. NO.	प्राधिकार AUTHY	वर्णन DESCRIPTION	दिनांकित हस्ताक्षर DATED INITIAL	अभिकल्पित DGN	
				जोधा र.अ.का. CHD SSE	
				तकनीकि रा.नि.अ. / रा.नि.अ. REVIEWED AEE / SSE	
				अनुमोदित व.कु.नि.अ. APPROVED DYEEE	
				दिनांक DATE	
				वैधिक अनुपात SCALE	N.T.S
				संदर्भ / REF. ALT.-	

चित्तरंजन रेलइंजन कारखाना
CHITTARANJAN LOCOMOTIVE WORKS, INDIA

प्रयार्ण MAKE	प्रति भार कि. ग्रा. WT. EACH IN KG
विशिष्टि SPECN	
वर्णन DESCRIPTION	RESISTOR HARMONIC FILTER
आरेखण संख्या DRAWING NO.	CLW/ES/3/SK-4/015 ~~/B~~ C
परिवर्तन संख्या ALTERATION NO.	पृष्ठ SHEET OF A2

REDRAWN BY COE