

Diary

2016

(DRAFT)

अभ्यास RDS
रेल अग्रदूत Transforming Railways



Indian Railways
Centre for Advanced Maintenance Technology

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2016



Diary of Important Signalling Parameters & Safety in Railways (Draft Copy)



Maharajpur Gwalior 474 005

PERSONAL MEMORANDA

Personal Details

Name _____

Designation _____ Division/Rly./Org. _____

Home Address _____

Office Address _____

Contact Information

Home Tele (Rly.) _____

Office (Rly.) _____

Home Tele (Other) _____

Office (Other) _____

Cell No.(1) _____

Cell No. (CUG) _____

Cell No.(2) _____

FAX No. _____

Other Information

PF A/c No. _____

Salary Savings A/c No. _____

Duty Card Pass No. _____

Metal Token No. _____

ID Card No. _____

Blood Group _____

In case of Emergency

Notify _____

Relation _____

Tele No. _____

Mob. _____

Address _____

About Indian Railways

The first railway on Indian sub-continent ran over a stretch of 21 miles from Bombay to Thane. The idea of a railway to connect Bombay with Thane, Kalyan and with the Thal and Bhore Ghats inclines first occurred to Mr. George Clark, the Chief Engineer of the Bombay Government, during a visit to Bhandup in 1843.

The formal inauguration ceremony was performed on 16th April 1853, when 14 railway carriages carrying about 400 guests left Bori Bunder at 3.30 pm "amidst the loud applause of a vast multitude and to the salute of 21 guns." The first passenger train steamed out of Howrah station destined for Hooghly, a distance of 24 miles, on 15th August, 1854. Thus the first section of the East Indian Railway was opened to public traffic, inaugurating the beginning of railway transport on the Eastern side of the subcontinent.

In south the first line was opened on 1st July, 1856 by the Madras Railway Company. It ran between Vyasarpadi Jeeva Nilayam (Veyasarpandy) and Walajah Road (Arcot), a distance of 63 miles. In the North a length of 119 miles of line was laid from Allahabad to Kanpur on 3rd March 1859. The first section from Hathras Road to Mathura Cantonment was opened to traffic on 19th October, 1875.

These were the small beginnings which in due course developed into a network of railway lines all over the country. By 1880 the Indian Railway system had a route mileage of about 9000 miles. **INDIAN RAILWAYS**, the premier transport organization of the country is the largest rail network in Asia and the world's second largest under one management.

Indian Railways is a multi-gauge, multi-traction system covering the following:

Track Kilometers	Broad Gauge (1676 mm)	Meter Gauge (1000 mm)	Narrow Gauge (762/610 mm)	Total
	86,526	18,529	3,651	108,706
Route Kilometers	Electrified	Total		
	16,001	63,028		

Other Interesting facts of Indian Railways:

Indian Railways runs around 11,000 trains everyday, of which 7,000 are passenger trains

7566 - locomotives	37,840 - Coaching vehicles	222,147 - Freight wagons	6853 - Stations
300 - Yards	2300 - Good sheds	700 - Repair shops	1.54 million - Work force

Gauges used on Indian Railways

The clear distance between the running faces of the rails is called "the gauge". The following gauges are in use over Indian Railways:

Broad Gauge 1676 mm

Meter Gauge 1000 mm

Narrow Gauge 762 mm

Classification of Routes

The permanent way sections are classified by IR according to the maximum speed proposed for the immediate future that the tracks are capable of supporting. In most cases this classification is an indication of the priority of the route and IR's plans for it in the future, rather than an indication of the speeds allowed on it today. Also, some small stretches of a line may have much higher (or lower) allowed speeds than the classification of the line might indicate because of local conditions, ghat sections, curves, etc.

On Indian Railways Broad Gauge (BG) and Meter Gauge (MG) lines have been classified as follows

Route	Gauge	Brief description
A	BG	BG sections rated for speeds upto 160 kmph
B	BG	BG sections with speeds up to 130 kmph
C	BG	Suburban sections of metropolitan areas
D Special	BG	BG lines rated up to 100 km/h, with high traffic density or high expected growth in traffic
D	BG	B G l i n e s rated up to 100 kmph
E Special	BG	BG lines with sanctioned speeds below 100 kmph, with high traffic density or high expected growth in traffic
E	BG	All other BG lines with sanctioned speeds below 100 kmph
Q	MG	MG lines rated for speeds above 75 kmph and traffic
R	MG	MG lines rated at up to 75 kmph.
S	MG	Remaining MG lines rated for below 75 kmph and/or with low traffic densities

Note: Narrow gauge tracks are not classified as above

Rail Sections

Sr. No.	Section	Weighing	Used on
1.	60 Kg	60 Kg per metre	On BG routes where traffic density is more than 20 GMT (Gross Million Tones)
2.	52 Kg	52 Kg per metre	On BG routes other than at Sr. No.1 above
3.	90 R	90 Pounds per yard	Generally used for loop lines on all the routes and Main lines of MG routes depending upon traffic density and speed
4.	75 R	75 Pounds per yard	On MG routes depending upon traffic density and speed
5.	60 R	60 Pounds per yard	On MG routes depending upon traffic density and speed

Indian Railways Zones with their headquarters and divisions

Sr. No.	Zone	Headquarters	Divisions
1.	Central Railway	Mumbai CST	Bhusawal, Nagpur, Mumbai CST, Pune, Solapur
2.	Northern Railway	Baroda House, New Delhi	Ambala, Ferozpur, Lucknow, Moradabad, Delhi
3.	Southern Railway	Park Town, Chennai	Chennai, Madurai, Palghat, Trichy, Trivandrum
4.	Eastern Railway	Fairly Place, Kolkata	Malda, Howrah, Sealdah, Asansol
5.	Western Railway	Mumbai Churchgate	Bhavnagar, Mumbai Central, Ratlam, Rajkot, Vadodara, Ahmedabad
6.	North Eastern Railway	Gorakhpur	Lucknow, Varanasi, Izzatnagar
7.	North East Frontier Railway	Maligaon, Guwahati	Katihar, Lumding, Tinsukhia, Alipurduar, Rangiya
8.	North Central Railway	Allahabad	Allahabad, Agra, Jhansi
9.	North Western Railway	Jaipur	Ajmer, Bikaner, Jodhpur, Jaipur
10.	South Central Railway	Secunderabad	Secunderabad, Hyderabad, Guntakal, Guntur, Vijaywada, Nanded
11.	South Western Railway	Hubli	Bangalore, Mysore, Hubli
12.	South East Central Railway	Bilaspur	Bilaspur, Nagpur, Raipur
13.	South Eastern Railway	Garden Reach, Kolkata	Kharagpur, Chakradharpur, Adra, Ranchi
14.	East Central Railway	Hajipur	Danapur, Dhanbad, Sonpur, Mughalsarai, Samastipur
15.	East Coast Railway	Bhubaneswar	Khurda Road, Waltair, Sambalpur
16.	West Central Railway	Jabalpur	Jabalpur, Bhopal, Kota

Organization of Commission of Railway Safety

The Commission is headed by a Chief Commissioner of Railway Safety (CCRS), at Lucknow, who also acts as Principal Technical Advisor to the Central Government in all matters pertaining to railway safety.

There are nine Commissioners of Railway Safety (CRS), each one exercising jurisdiction over one or more of the 16 Zonal Railways. In addition, Metro Railway/Kolkata, DMRC/Delhi, MRTD/Chennai and Konkan Railway also fall under their jurisdiction. The organizational structure is as given below:

Sr. No.	Designation	Headquarter	Jurisdiction
1.	CCRS	RDSO Lucknow	Administrative control over all the nine CRS
2.	CRS Central Circle	Mumbai	CR, WCR, Konkan
3.	CRS Western Circle	Mumbai	WR, NWR
4.	CRS Northern Circle	New Delhi	NR, DMRC
5.	CRS Southern Circle	Bangalore	SR, SWR
6.	CRS Eastern Circle	Kolkata	ER, ECR
7.	CRS South Eastern Circle	Kolkata	SER, SECR, ECoR
8.	CRS North East Frontier Circle	Kolkata	NFR, Metro Kolkata
9.	CRS South Central Circle	Secunderabad	SCR
10.	CRS North Eastern Circle	Lucknow	NER, NCR

There are 5 Dy. Commissioners of Railway Safety posted in the Headquarters at Lucknow for assisting the CCRS as and when required namely:

- 1 Dy. CRS S&T
- 2 Dy. CRS Optg.
- 3 Dy. CRS Elec.
- 4 Dy. CRS Mech.
- 5 Dy. CRS Gen.

In addition, there are 2 field Dy. Commissioners, one each in Mumbai and Kolkata, to assist the Commissioners of Railway Safety in matters concerning the Signalling and Telecommunication disciplines namely:

- 1 Dy. CRS S&T Mumbai
- 2 Dy, CRS S&T Kolkata

Revised Codal life of assets As per Advance correction slip. No. 62 (of Indian Railway Finance Code Vol-1 para 219) dated 24.5.06

Signalling System

Sr. No.	Class of Assets	Routes	Average life in years
1.	Electrical/ Mechanical Signalling System	Route- A Route-/ Suburban Section Big yards on all routes	25 Years
		Routes-B Routes-D Routes-D- "special"	25 to 28 Years depending Upon location & condition
		Routes-'E' Routes-'E'-'special'	30 Years
2.	Electronic signaling system like SSI, Axle counter, AWS,AFTC,IPS etc.,		15 years or based on Obsolescence.

Telecommunication Equipment

Sr. No.	Class of Assets	Average life in years
1.	Microwave Equipments	12-15 Years
2.	Exchange & accessories including Telephone equipment	12-15 Years
3.	Under Ground Cables	Quad-20 Years
		OFC -20 Years
4.	Overhead alignment	25 Years
5.	All other electronic /wireless items including OFC equipment	12-15 Years
6.	Cell Phones	5-8 Years
7.	FAX	10 Years
8.	Walkie –Talkie Sets/VHF	5-8 Years
9.	Datacomm. Equipment, Routers, Modems, PCs etc	5-8 Years

Computer & other IT system

Sr. No.	Class of Assets	Average life in years
1.	Passive Networking equipment (viz .Network Cabling)	10
2.	Larger Multiuser system (s) & Active Networking Equipment viz. MIS systems including external storage systems and their inter connects)	6
3.	PRS systems	4
4.	Small Multi-user system (s) and Power Supply equipments viz. Individual office LANs, UPS)	4
5.	PCs	3
6.	Secondary Systems (viz. Painters, Portable computers, Dumb Terminals)	3

Average life of Signalling Equipments

Sr. No.	Class of Assets	Life in terms of operation	Average life in years				
			Routes				
			A	B	C/Sub-urban	D & D Spl.	E & E Spl.
1.	Point Machine	3,00,000	12	12	7	15	15
2.	Plug in and shelf type relays	10,00,000	25	28	25	28	30
3.	Track feed battery charger	--	10	10	10	10	10
4.	Signal Transformers, Transformer	--	12	12	12	12	12
5.	Battery chargers, DG Sets, inverters	--	10	10	10	10	10
6.	Batteries	--	4	4	4	4	4
7.	Block instruments	--	25	25	25	25	25
8.	Cable	--	20	20	20	20	20

Standard/Metric conversions

Length		
inches	X 2.54	= centimetres
inches	X 25.4	= millimetres
feet	X 0.3048	= metres
yards	X 0.9144	= metres
miles	X 1.6093	= kilometres
millimetres	X 0.04	= inches
centimetres	X 0.4	= inches
metres	X 3.3	= feet
kilometres	X 0.62	= miles
Area		
acres	X 0.4047	= hectares
acres	X 100	= sq. metres
sq. inches	X 6.5	= sq. centimetres
sq. feet	X 0.09	= sq. metres
sq. yards	X 0.8	= sq. metres
sq. miles	X 2.6	= sq. kilometers
sq. centimetres	X 0.16	= sq. inches
sq. metres	X 1.2	= sq. yards
sq. kilometers	X 0.4	= sq. miles
hectares	X 2.47	= acres
Mass (Weight)		
ounces	X 28	=grams
pounds	X 453.592	=grams
pounds	X 0.45	=kilograms
tons	X 1016.05	=Kilograms
grams	X 0.035	=ounces
grams	X 0.00220462	=pounds
kilograms	X 2.2	=pounds
kilograms	X 0.0009842	=tons

Volume		
pints	X 0.47	= litres
quarts	X 0.95	= litres
gallons	X 3.8	= litres
cubic feet	X 0.03	= cubic metres
cubic yards	X 0.76	= cubic metres
litres	X 2.1	= pints
litres	X 1.06	= quarts
litres	X 0.26	= gallons
cubic metres	X 35	= cubic feet
cubic metres	X 1.3	= cubic yards
Temperature		
Fahrenheit	Subtract 32 then Multiply by 5/9	= Celsius
Celsius	Multiply by 9/5 then add 32	= Fahrenheit

Geometric Formulae

Legends : b= Base, C = circumference, D = Diameter, h = Height, L = Length, r = Radius,
w=width, p= 3.1416

Circle Area = πr^2 Area of sector = $L/2r \times \text{length of arc}$ Circumference = $\pi \times d$ or $2\pi \times r$ Diameter = $C \div \pi$ Radius = $C \div 2\pi$ Cylinder Area = $L \times w$ Triangle Area = $L/2b \times h$ Cone Volume = $h \times (\text{Area of the base}) \div 3$	Sphere Circumference = $\pi \times d$ Diameter = $C \div \pi$ Surface Area = $\pi \times d^2$ Volume = $1/6 (\text{Surface Area}) \times d$ Cylinder or Prism Volume = $h \times (\text{Area of the base})$ Cube or Rectangular Box Volume = $L \times w \times h$
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Some useful conversion factors

Prefix	Times unit	Prefix	Times unit
Tera	1000,000,000,000 times unit (10^{12})	Deci	1/10 of unit (10^{-1})
Giga	1000,000,000 times unit (10^9)	Centi	1/100 of unit (10^{-2})
Mega	1000,000 times unit (10^6)	Milli	1/1000 of unit (10^{-3})
Kilo	1000 times unit (10^3)	Micro	1/1000,000 of unit (10^{-6})
Hecto	100 times unit (10^2)	Nano	1/1000,000,000 of unit (10^{-9})
Deca	10 times unit	Pico	1/1000,000,000,000 of unit (10^{-12})

International Paper sizes

Size	Millimeters	Inches	Size	Millimeters	Inches
A0	841 X 1189	33.1 X 46.8	A4	210 X 297	8.3 X 11.7
A1	594 X 841	23.4 X 33.1	A5	148 X 210	5.8 X 8.3
A2	420 X 594	16.5 X 23.4	A6	105 X 148	4.1 X 5.8
A3	297 X 420	11.7 X 16.5	A7	74 X 105	2.9 X 4.1

2015

January

Su	Mo	Tu	We	Th	Fr	Sa
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

May

Su	Mo	Tu	We	Th	Fr	Sa
31					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

September

Su	Mo	Tu	We	Th	Fr	Sa
		1	2	3	4	5
6	7	8	9	10	11	12
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February

Su	Mo	Tu	We	Th	Fr	Sa
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28

June

Su	Mo	Tu	We	Th	Fr	Sa
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7	8	9	10	11	12	13
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October

Su	Mo	Tu	We	Th	Fr	Sa
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4	5	6	7	8	9	10
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March

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July

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November

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April

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August

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December

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2017

January

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May

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September

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February

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October

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March

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July

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November

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April

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August

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December

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2016

January

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September

Su	Mo	Tu	We	Th	Fr	Sa
				1	2	3
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11	12	13	14	15	16	17
18	19	20	21	22	23	24
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February

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14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29					

June

Su	Mo	Tu	We	Th	Fr	Sa
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5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

October

Su	Mo	Tu	We	Th	Fr	Sa
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16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

March

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27	28	29	30	31		

July

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27	28	29	30			

April

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August

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28	29	30	31			

December

Su	Mo	Tu	We	Th	Fr	Sa
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

List of General Holidays (wherever applicable) and National Holidays 2016

Sr. No.	Date	Day	Holiday
1	January 05	Tue	Guru Govind Singh Jayanti
2	January 15	Fri	Pongal /Makar Sankranti
3	January 26	Tue	Republic Day
4	February 26	Fri	Maha Shivratri
5	March 23	Wed	Holi Dahan
6	March 23	Wed	Holi
7	March 25	Fri	Good Friday
8	April 13	Wed	Vaisakhi
9	April 14	Thu	Dr Ambedkar Jayanti
10	April 15	Fri	Ram Navami
11	April 19	Tue	Mahavir Jayanti
12	May 21	Sat	Buddha Purnima
13	June 30	Thu	Jumat-ul-Wida
14	July 05	Tue	Idul Fitr
15	August 15	Mon	Independence Day
16	August 18	Thu	Raksha Bandhan
17	August 25	Thu	Janmashtami
18	September 11	Sun	Idul Juha
19	October 02	Sun	Mahatma Gandhi Jayanti
20	October 02	Sun	Muharram
21	October 11	Tue	Dussehra
22	October 30	Sun	Diwali
23	November 14	Mon	Guru Nanak Jayanti
24	December 12	Mon	Milad-un-Nabi
25	December 25	Sun	Christmas

About CAMTECH

It was decided by Railway Board in 1987 to set up an institute to undertake studies and evolve strategies for maintenance of all types of assets. Accordingly CAMTECH started functioning from 1991 onwards at Gwalior under the administrative control of Director General, RDSO, Lucknow with a main objective of Upgrading maintenance Technologies & Methodologies and achieve improvement in productivity and performance of all Railway assets and Manpower. This covers reliability, availability, utilisation and efficiency.

CAMTECH is headed by Executive Director who is assisted by four Directors – one each of Civil, Electrical, Mechanical and S&T, apart from Staff. The present incumbents:

Executive Director	Shri A.R.Tupe
Director (S&T)	Shri D.K.M. Yadav
Director (Electrical)	Shri Peeyoosh Gupta
Director (Mechanical)	Shri K.P.Yadav
Director (Civil)	Shri S.K.Saxena

Quality Policy

To develop safe, modern and cost effective Railway technology complying with Statutory and Regulatory requirements, through excellence in Research, Designs & Standards and Continual improvements in Quality Management System to cater to growing demand of passenger and freight traffic on the Railways.

Disclaimer

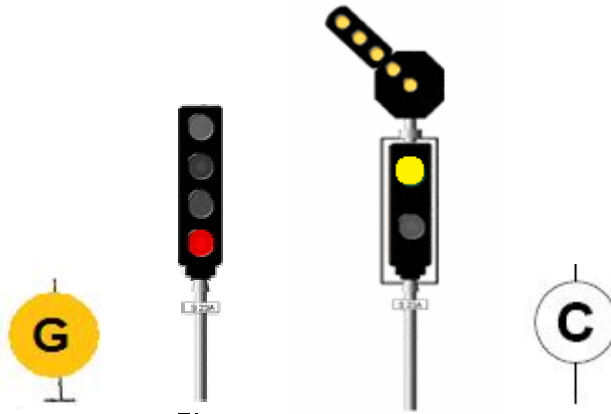
It is clarified that the information given in this diary does not supersede any existing provisions laid down in the Signal Engineering Manual, Railway Board and RDSO publications. This document is not statutory and instructions given are for the purpose of guidance only. If at any point contradiction is observed, then SEM, Railway Board/RDSO guidelines may be referred or prevalent Zonal Railways instructions may be followed.

Contact Person

Director (S&T), Indian Railways Centre For Advanced Maintenance Technology,
Maharajpur, Gwalior (M.P.) 474 005.

Tele: 0751-2470185, FAX: 0751-2470841, e-mail: dirtsntcamtech@gmail.com

SIGNALLING BASICS



JANUARY 2016

PLANNER

JANUARY 2016

1	Fri	
2	Sat	
3	Sun	
4	Mon	
5	Tue	
6	Wed	
7	Thu	
8	Fri	
9	Sat	
10	Sun	
11	Mon	
12	Tue	
13	Wed	
14	Thu	
15	Fri	
16	Sat	
17	Sun	
18	Mon	
19	Tue	
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23	Sat	
24	Sun	
25	Mon	
26	Tue	
27	Wed	
28	Thu	
29	Fri	
30	Sat	
31	Sun	
	--	

Visibility of Signals (MACLS)

Sr. No.	Signal	Visibility
1	Distant	400 m
2	Inner Distant (where provided)	200 m
3	All Stop Signals	200 m

Suitable speed restriction to be provided if a stop signal is not visible within 200 m

02 JANUARY 2016
Saturday



Aspect sequence chart for Approaching signals used in MAUQ/MACL

Distant	Home	Indication
Y	R	Stop at Home Signal
YY	Y	Enter on Loop line. Stop at Starter if 'ON'
G	Y	Enter on main line. Stop at Starter
G	G	Run through via main line

Where "Distant" and "Inner Distant" signals are provided the Distant shall display only "attention" or "proceed" aspect

Criteria for classification of Level Crossing Gates

Conducting the census of Train Vehicle Unit (TVU) once in 3 years by a team of supervisors of Engg. and traffic department for seven days generally and taking average per day.

TVU = No of trains x No of road vehicles

Where, Train motor vehicle, bullock card and tanga = 01 unit

Cycle rickshaw and auto rickshaw = ½ unit

Classification of level crossing gate is as given below:

Sr. No.	Class	Criteria	Interlocking/Remarks
1	Special class	TVU > 50,000	R.O.B to be provided Gate to be interlocked till ROB is not functioning
2	'A' class	TVU between 30,000 - 50,000 and No. of road vehicles > 1000	Compulsory
3	B' class	TVU between 20,000- 30,000 and number of road vehicles > 750	
	'B1' class	TVU between 25,000- 30,000	Compulsory
	'B2' class	TVU between 20,000- 25,000	--
6	'C' class	All other LC Gates not covered in above classes	If TVU > 6000 OR LC Gate visibility is poor then gate to be manned
7	'D' class	For cattle crossing	--

For road vehicles :- Special class, A Class , B Class , C Class, For cattle crossings :- D Class

Aspect sequence chart for Approaching signals using two Distant Signals in MACL

Distant	Inner Distant	Home	Indication
YY	Y	R	Stop at Home Signal
YY	YY	Y (with route)	Enter on Loop line. Stop at Starter if 'ON'
G	YY	Y	Enter on main line. Stop at Starter
G	G	G	Run through via main line

Intermediate Starter is provided between starter & advanced starter where necessary, and is placed in rear of the point, which it protects.

Aspect sequence chart for Departure signals in 2- aspect signalling

Starter	Advanced Starter	Indication
R	R	Stand in rear of starter
G	R	Shunt upto Advanced Starter
G	G	Proceed line is clear

Passenger warning boards shall be located at not less than 1 km in rear of first stop signal

06 JANUARY
Wednesday 2016



Aspect sequence chart for Departure signals in MACL signalling

Starter	Advanced Starter	Indication
R	R	Stand in rear of starter
Y	R	Shunt upto Advanced Starter
Y/G	G	Proceed line is clear

Shunt signals authorise movement only at such slow speeds as to be able to stop short of any obstruction and control shunting movements



Distant Signal: On single line or double line, at an adequate distance i.e. Normal breaking distance in rear of the first stop signal of the station or gate stop signal (not less than 1 km)

Goods Warning Board shall be located not less than 1.4 km in rear of the first stop signal

Location of signals in MAUQ/MACL signalling

Home Signal: Normally placed at Normal breaking distance in rear of next stop signal and 180m in rear of the point upto which the line may be obstructed, after the line clear has been given to the station in rear.

On single line, at not less than 300m i.e. BO + SO (180m + 120m) in rear of the first facing point if the facility of shunting in the face of an approaching train is desired, so that BO is available between the Home and the opposite advance starter/SLB.

On double line, at a distance of BO (180m) in rear of the facing point or Block section Limit Board (if first point in the approach is trailing or no point).

Shunt signals can be placed on a separate post by itself close to the ground or can be placed below a stop signal other than the first and last stop signal of a station

2016 09 JANUARY
Saturday

Location of signals in MAUQ/MACL signalling

Routing Signal: A routing signal must be placed just in rear of the points to which it protects. Generally they are used in junction stations

Starter Signal: Starter signals are usually placed in rear of the facing point or fouling mark of the converging lines such that they should protect the adjacent running line or lines.

Intermediate Starter: It shall be placed in rear of the point to which it protects. They are generally used at Junction stations to inform the driver of the train that to which direction he is being dispatched.

Repeating signals are provided, to repeat the condition of the main fixed signal, at a place where the main signal is required to be sighted.

10 JANUARY
Sunday 2016



Signal Overlap -The length of track in advance of a stop signal, which should be kept clear before the signal next in rear can be taken 'OFF'
In other words, to take off a stop signal, the portion of the track not only upto the next stop signal but also for an adequate distance beyond it has to be kept clear. This adequate distance is known as signal overlap.

Block Overlap - The overlap provided for last stop signals in Absolute Block territories is greater than for other stop signals and this is referred to as the block overlap. Thus the extra length of track in advance of the first stop signal of a next block station, which should be kept clear before line clear can be given to the station in rear

Overlap	Type of signalling			
	2 Aspect	Multi- aspect	Automatic signalling on double line	Automatic signalling on single line
Signal Overlap	180 m	120 m	120 m	120 m
Block Overlap	400 m	180 m	N.A.	N.A.

More than one shunt signal may be placed on the same post. The top-most signal shall apply to the extreme left hand line and the second from the top shall apply to the next line from the left and so on.

Location of signals in MAUQ/MACL signaling

Advanced Starter: It is placed outside all connections on the line to which it applies. On single line, not be less than 120 metres from the outermost point. On double line not be less than 120 metres from the the starter. However, if this distance is not adequate for working of trains may be reckoned from the outermost point or fouling mark and in special cases up to a distance of full train length beyond the outermost point where frequent shunting is involving the main line. In such cases the track between the starter and advanced starter shall be track circuited

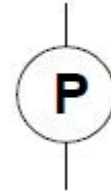
Under approved special instructions, a "calling on" signal may be provided below any other stop signal except the last stop signal.

12 JANUARY
Tuesday 2016



Markers provided on the Signal post

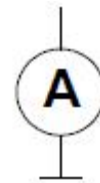
Colour light Distant or Warner Signal on a post by itself -
Letter 'P' in black on White circular Disc.



Shunt signal when taken 'OFF' authorises the driver to draw ahead with caution even though the stop signal, if any, above it is at 'ON' position

Markers provided on the Signal post

Automatic stop signals - 'A' Marker (letter 'A' in black on white circular disc) to distinguish the signal as a full automatic signal



Under approved special instructions, a Shunt signal may be provided below any other stop signal except the First stop signal.

14 JANUARY 2016
Thursday



Markers provided on the Signal post

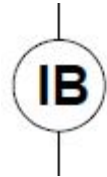
Semi-automatic stop signals - 'A' (white illuminated letter 'A' against black background) lit when working as an automatic signal.



When a Shunt Signal is placed below a Stop Signal, it shall show no light in the "ON" position

Markers provided on the Signal post

Intermediate Block stop signal - Letter 'IB' in black on White circular Disc.



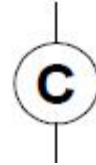
In automatic block there is no block overlap and the signal overlap is 120m as in MAUQ.

16 JANUARY
Saturday 2016



Markers provided on the Signal post

Calling ON Signal - Letter 'C' in black on White circular Disc



Shunting Permitted indication (SPI) works in conjunction with the stop signal such that either the SPI or the associated stop signal can be taken off at a time.

Slip siding & Catch siding

On Indian Railways for all gauges the maximum gradient permitted is 1:400, whereas 1:1200 is usually allowed within the station yard. No station yard should be constructed on a gradient steeper than 1:260 except due to geographic condition. Where such a gradient cannot be avoided within the station yard, previous sanction of Railway Board through CRS has to be obtained and special arrangements like "Slip siding" has to be provided

Slip siding- When there is a gradient within the station yard steeper than 1:100 falling away from the station in its close neighbourhood, Slip siding has to be provided. This is to prevent vehicles escaping from the station and trying to enter into the next block section.

Catch siding – When there is a gradient steeper than 1:80 falling towards the station. Catch siding has to be provided to trap vehicles coming uncontrolled from the block section and trying to enter into the station.

Slip siding" and 'catch siding' points must be interlocked with the block instruments, and such sidings should not be used for shunting or stabling purposes

In Automatic Signalling, space intervals are secured automatically by the use of Track Circuits or Axle Counters.

18

Monday

2016



Markers provided on the Signal post

Repeating signal - White illuminated letter 'R' against black back ground



In a semi-automatic signal protecting a level crossing gate and also Points, when the points protected by the signal are correctly set and the gate is also closed, 'A' marker shall be lit.

Markers provided on the Signal post

Gate stop signal - Letter 'G' in black on Yellow circular Disc.

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

In Absolute Block system, space intervals are secured by human agencies in the form of two Station Masters located at the ends of a block section.

20 JANUARY 2016
Wednesday



Markers provided on the Signal post

Gate stop signal in automatic block territory - Letter 'G' in black on Yellow circular Disc and White illuminated letter 'A' against black back ground



In a semi-automatic signal protecting a level crossing gate and also Points, if the points are correctly set but the gate is defective, then 'AG' marker shall be lit.

2016 21 JANUARY
Thursday

22

Friday

2016



Indian Railways

Centre for Advanced Maintenance Technology

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Normally most of the stations are Class 'B'

2016 23 JANUARY
Saturday

Systems of Train working

In Indian Railways, six systems of train working are adopted and they are

- (a) Absolute Block System
- (b) Automatic Block System
- (c) Following Trains System
- (d) Pilot Guard System
- (e) Train Staff and Ticket System
- (f) One Train Only System

Out of the above six systems of train working, the Absolute Block System and the Automatic System only shall be used, unless the adoption of other systems are especially permitted by the Railway Board.

Standards of Interlocking

On the basis of speed the revised standards of interlocking are:

Standard I – Speeds upto 50 Kmph

Standard II – Speeds upto 110 Kmph

Standard III – Speeds upto 140 Kmph

Standard IV – Speeds upto 160 Kmph

Shunting in the face of approaching train is not possible in Class 'A' station



Class 'C' stations or Block Huts: Where permission to approach may not be given for a train unless the whole of the last proceeding train has passed complete at least 400 metres beyond the Home Signal (IBS / IBH) and is continuing its journey. This will also include an Intermediate Block Post.

Shunting in the face of approaching train is possible within station section in Class 'B' station.

26 JANUARY
Tuesday 2016



Block Section means that portion of the running line between two block stations on to which no running train may enter until Line Clear has been received from the block station at the other end of the block section.

Station Section is that portion of station limits which can be used for shunting even after granting Line clear to station in Rear. It exists only for Class B Station

Although the two switches of a turnout are invariably coupled by at least two stretchers & operated together, wherever a lock is provided, each switch is to be locked independently to safeguard against the possibility of both stretchers being broken at the same time.



When a driver finds such a signal at 'ON' he is permitted to pass it in the same manner as he would and under the same procedure for an automatic signal displaying the red aspect, provided the 'A' marker light is lit. In the event, the 'A' Marker light is extinguished, the driver is permitted to pass the signal after waiting for one minute by day and two minutes by night, draw his train cautiously ahead and stop in rear of the crossing. After ascertaining that the gates are locked against road traffic and on getting hand signal from the gateman, the driver may then proceed cautiously upto the signal in advance.

A slotted signal cannot be taken 'OFF' unless the controls from all remote locations have been operated, but it should be possible for any one of the controlling agencies to replace the signal to its most restrictive aspect.

28 JANUARY
Thursday **2016**



Procedure for passing an automatic stop signal provided with Illuminated AG marker and illuminated 'A' marker displaying the red aspect (on Double line)

Automatic signals interlocked with level crossing gates and a point just ahead of gate are distinguished by the provision of illuminated AG and illuminated 'A' marker. When a driver finds the signal at 'ON', he is permitted to pass it with same manner as he would and under such procedure for an automatic signal displaying the red aspect provided the 'A' marker light is lit whereas when he finds the signal at 'ON', with 'AG' marker is lit, he is permitted to pass it in such manner as he would and under such procedure for an automatic signal displaying red aspect with 'G' marker below. If both the markers are not lit, the driver should treat this signal, as an absolute stop signal, showing red aspect.

Station Limits means the portion of a railway, which is under the control of a Station Master and is situated between the outermost signals of the station or as may be specified by special instructions.

2016 29 JANUARY
Friday

Calling On Signal

Calling on signals are used only for the specific purpose of indicating to the driver that he is required to draw ahead when OFF and be prepared to stop short of any obstruction even though the stop signal above it, is at ON. Calling on signals are taken OFF only after the train has come to a stop. Calling on signals of the colour light type are provided with a marker plate with letter 'C'. Under approved special instructions, a "calling on" signal may be provided below any other stop signal except the last stop signal.

A calling on signal is a subsidiary signal and has no independent existence

Normal position of Level Crossing Gate

- (i) Special class -Open to Road traffic
- (ii) A class - Open to Road traffic
- (iii) B class - Closed to road traffic. Can be kept open to road traffic provided either gates are interlocked with signals and provided telephone communication with adjacent station/cabin or when the following conditions are satisfied:
 - (a) LC should not be located in suburban section
 - (b) LC should not be in automatic block Signalling territory.
 - (c) Should be provided with lifting barriers
 - (d) Should have a telephone connection with the nearest station with exchange of private numbers
 - (e) Visibility at the level crossing should be good
 - (f) Should be provided with Whistle boards on either side at adequate distance to enjoin the drivers of approaching trains to give audible warning of the approach of the train to the road users.
 - (g) As long as the L.C gate is kept open to road traffic, a red flag by day and red light during night should be displayed towards approaching trains on either side of level crossings.

Emergency Braking Distance is the distance travelled by train before coming to a stop by sudden application of brake at one stretch.

Isolation

The term 'Isolation' denotes the condition in which a line for a particular movement is separated from all adjoining lines connected to it in such a manner that the isolated line cannot be fouled or interfered with by any movement taking place on the adjoining lines Isolation is compulsory in the following cases.

- (a) A line on which train movements at speeds higher than 50KMPH are permitted should be isolated from all connected lines.
- (b) Passenger lines should be isolated from all connected goods lines and sidings, whatever the speed may be.
- (c) The isolation of goods reception lines from sidings is considered desirable.
- (d) It is not necessary to isolate one goods reception line from another or one passenger line from another when dealing with speeds of 50KMPH and less.

Isolation between	Passenger line	Goods line	Siding
Passenger line	Not Required if speed < 50 Kmph. Required if speed \geq 50 Kmph	Required irrespective of speed	
Goods line	Required irrespective of speed	Not Required if speed < 50 Kmph Required if speed \geq 50 Kmph	Desirable
Siding		Desirable	NA

Isolation of passenger lines from good lines & sidings is required in all standards of interlocking.

SIGNALS



12A

Stop



12A

Caution



12A

Attention



12A

Proceed

MACL



FEBRUARY 2016

PLANNER
FEBRUARY 2016

1	Mon	
2	Tue	
3	Wed	
4	Thu	
5	Fri	
6	Sat	
7	Sun	
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16	Tue	
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25	Thu	
26	Fri	
27	Sat	
28	Sun	
29	Mon	

LED Signal Operating parameters

Main Signal

Model	Rated Voltage	Wattage	Current at rated voltage per unit	Colour
AC Model	110 V AC $\pm 15\%$	15 W	125 mA to 130 mA	R/Y/G
DC Model	110 V DC $\pm 15\%$	12 W	100 mA to 105 mA	R/Y/G

Select Blanking Mode for OFF aspects and Non-Blanking mode for ON aspect in current regulator of main LED signals.

02 FEBRUARY
Tuesday 2016



LED Signal Operating parameters

Calling - On Signal

Model	Rated Voltage	Wattage	Current at rated voltage per unit	Colour
AC Model	110 V AC $\pm 15\%$	15 W	125 mA to 130 mA	Y
DC Model	110 V DC $\pm 15\%$	12 W	100 mA to 105 mA	Y

Ensure all terminations in CT rack, Junction Box, LED Signal Lighting Unit, Current Regulator, HMU, Route Signals, Shunt Signals & Calling-on are tight and clean.

LED Signal Operating parameters

Route Indicator

Model	Rated Voltage	Wattage	Current at rated voltage per unit	Colour
AC Model	110 V AC $\pm 15\%$	--	25 mA to 28 mA	Lunar White
DC Model	110 V DC $\pm 15\%$	--	22 mA to 25 mA	Lunar White

Poly Carbonate cover of LED Signal Lighting Unit may be cleaned with soft and antistatic cloth periodically.

LED Signal Operating parameters

Position Light Shunt Signal

Model	Rated Voltage	Wattage	Current at rated voltage per unit	Colour
AC Model	110 V AC $\pm 15\%$	--	55 mA to 58 mA	Lunar White
DC Model	110 V DC $\pm 15\%$	--	45 mA to 48 mA	Lunar White

Check installation once a year by disconnecting the interconnecting Cable between CR & LED Signal Lighting Unit of Main Signal to check audio-visual alarm and correspondence of ECR.



2016 05 FEBRUARY
Friday

LED Signal

Wattage of LEDs:

Wattage of Main LED Signal Lighting units Red, Yellow and green aspect: around 20 W.

Wattage of Red and Yellow LED: approx. 6mw

Wattage of Green and white LED: approx. 10mw

Ensure upgradation / modification, if any, as advised by RDSO.

Conventional ECR pick up and drop away current

	Conventional ECR	Suitability with LED Signal				Pick Up current	Drop Away Current
M/s ABB	ON – Metal to Metal	Yes	Yes	--	--	160 to 180 mA	110 to 130 mA
M/s Siemens	OFF - Metal to Metal	Yes	Yes	--	--	160 to 180 mA	50 to 70 mA
M/s CGL & M/s Hytronics	On –Metal to Carbon	Yes	Yes	Yes	Yes	110 to 150 mA	70 to 95 mA

Always spray CRC spray after every tightening / opening of terminals of LED signal lighting unit and current regulator.



LED ECR pick up and drop away current

Make	LED ECR	Suitability with LED Signal				Pick Up current	Drop Away Current
M/s CGL & M/s Hytronics	LED ECR AC Metal to Carbon	Yes	Yes	Yes	Yes	80 to 90 mA	60 to 70 mA

Check health monitoring device on each visit.

08

FEBRUARY
Monday

2016



Protection for Red Lamp Failure in automatic sections

When red lamp in the automatic signal fails, the cutting in arrangement cannot restore the signal to a more restrictive aspect, as there is no other restrictive aspect than Red in the signal. Hence, the signal goes blank and it is not in a position to protect the automatic signal section especially when a train occupies this section. Under these conditions, the usual practice is to force the rear signal to danger so that it assumes the protection of not only its section, but also the section in advance and as a result the rear signal will remain at red till the train clears two sections ahead. This arrangement is called as Red Lamp protection

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are approximately 20 lines visible. The paper has a slight shadow on the right side, suggesting it's resting on a surface.

Check all connections and screws are tightened.

LED Signal aspect unit

It comprises of a cluster of LEDs in series and parallel combinations. LEDs in a signal aspect are arranged in more than one array so that in the event of failure of even a single LED, whole unit does not become blank. All aspects (except route and shunt) use two arrays for higher noise immunity and also provide the redundancy. The optical sensors are provided for each aspect and output from optical sensors is given to the current regulator unit for corrective / alarm action. A few LEDs in the signal unit are so arranged as to ensure near visibility of 5 meters so that the signal is clearly visible to a driver stopping at the foot of the signal.

Operate audio alarm and check acknowledge button to silence the alarm

Current regulator unit

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are approximately 20 lines visible. The paper has a slight shadow on the right side, suggesting it's resting on a surface.

Select AC/DC mode in AC/DC current regulator as desired



Items to be removed from existing unit

- CLS Transformer
- Bulb and bulb holder
- Inner colour lens
- Outer clear lens

Keep shut the signal-housing door properly

12 FEBRUARY **2016**
Friday



For installation of LED Signal lighting unit in existing CLS unit :

Items to be fitted in existing unit

- Current regulator
- LED lighting unit

Health Monitoring Unit is installed at a central location in station

[illegible]

Don't leave loose connectors between LED Signal lighting unit and current regulator. This may cause false operation.



ECR (AC LED ECR, AC Conv. ECR, DC LED ECR) is connected in series with each aspect of LED/Signal lighting unit.

It remains picked up at 50% illumination of LED/Signal Lighting Unit

*Don't leave loose wires on input terminals of LED signal lighting unit and current regulator.
This may cause false operation.*

14 FEBRUARY **2016**
Sunday



Current Regulator mode selection

Calling-ON :

AC LED ECR : Short Pins 2-3, 5-6

AC Convl. ECR : Short Pins 2-3, 4-5

DC ECR : Short Pins 1-2, 5-6

(Pins are counted from bottom to top from input terminal side).

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are approximately 20 lines visible. The paper has a slight shadow on its right side, suggesting it's resting on a surface.

Don't connect wires at wrong input terminals for AC/DC power supply



In **blanking mode**, a Main Signal Lighting Unit shall extinguish when input current drawn by the current regulator falls outside specified limits of rated input current or illumination falls to a value which is not less than 40% of nominal illumination due to a failure or any other reason. In such case, current regulator should not draw input current more than 30 mA at maximum rated voltage.

Don't try to interchange connections of LED Signal lighting unit, Current regulator and HMU.

Blanking & Non-Blanking failure modes of Main LED signal lighting units

In **non-blanking mode**, a Main Signal Lighting Unit shall remain lit when input current drawn by the current regulator falls outside specified limits of rated input current or illumination falls to a value which is less than 40% of nominal illumination due to a failure or any other reason. In such case, input current drawn by current regulator shall be limited to less than 40 mA to ensure dropping of ECR. Limit on input current shall apply when illumination has deteriorated to a value which is not less than 40% of nominal illumination

Don't over tighten the LED lead connector to the LED signal lighting unit.

2016 17 FEBRUARY
Wednesday

DC ECR : Short Pins 2-3, 5-6, 8-9

Do not try to give direct supply to the LED signal lighting unit of Main signal, Route Signals, Shunt signals and Calling-on Signals.

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Thursday

2016



LED Signal

Current Regulator mode selection

Main Signal:

AC LED ECR : Short Pin 2-3, 6-7, Blanking off aspect : Short Pin 8-9

AC Convl. ECR : Short Pin 2-3, 5-6, Non blanking ON aspect : Short Pin 9-10

DC ECR : Short Pin 1-2, 4-5

Don't try to open the cover for replacement of LEDs.

2016 19 FEBRUARY
Friday

ECR should remain picked-up at input rated voltage 88 to 132 VAC/DC.

Don't use fuse of more than 600mA rating in signalling circuit

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Saturday

2016



LED Signal

Functioning of ECR

Shunt Signals:

ECR should pick up with two shunt LED signal lighting units in parallel & both lit from 88 V to 132 V. ECR should drop when one shunt LED signal lighting unit is taken out from circuit.

Don't try to drill the hole on the base of LED signal lighting unit for fixing on the existing signal unit.

2016 21 FEBRUARY
Sunday

Alignment & Focusing of Signal

Ensure that the signal is in proper plumb and all the fixing bolts of foundation base and unit base are tight.

For correct alignment tilt the unit either vertically or horizontally and adjust with the help of nuts on the turntable bolts.

Turn the unit and adjust it through sighting aperture for maximum visibility at a fixed point on track.

Don't carry Current Regulator of LED Signal by its cable.

22

Monday

2016



LED Signal

Functioning of ECR

Direction type Route Indicator:

With two healthy and three defective lighting units in circuit, ECR should drop and total input current drawn by the Route Indicator Signal should be less than specified minimum release current of ECR

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Don't carry hanging LED Signal Lighting Unit connected with Current Regulator.



Functioning of ECR

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are approximately 20 lines visible. The paper has a slight shadow on the right side, suggesting it's resting on a surface.

Use True RMS multimeter for measurement in of AC supply



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LED Signal

Functioning of ECR

Calling ON signal lighting unit shall extinguish when input current drawn by the lighting unit falls outside specified limits of rated input current or illumination falls to a value which is just less than 40% of nominal illumination due to a failure or any other reason. In such case, input current drawn should not be more than 30 mA.

5

Use LED ECR for all signal aspects.



AC and DC LED Models

LED Signal Unit - DC Model: It is suitable for all new works in RE and Non-RE Areas. The ECR used in this model is DC ECR, which is common ECR for all type of signals.

Use individual ECR for every signal aspect

LED Signal

DC LED Models

These have AC immunity of more than 300 VAC, no cutting in relays are required in RE area and even for second distant signal.

Common ECR for all types of signals helps in reducing number of spares and hence spare parts cost.

Ensure that Red lamp Protection is provided



- (a) Universal Plug-in-type, tractive armature AC lamp proving relay is used.
- (b) Maximum pickup current = 90 mA / AC, 50Hz.
- (c) Minimum release current = 60 mA / AC, 50Hz.
- (d) This ECR withstands for a continuous current of 250 mA / AC 50Hz.
- (e) Contact configuration: 4F-4B identically in A to D rows.
- (f) Voltage drop across R1 and R2 is less than 10V @ 125 mA /AC (normal working current).

Ensure that every aspect has individual return path

Salient features of LED Signal Unit

- a. LED lamp is Pre-focussed and do not need external lenses or periodic focusing.
- b. LED lamps are compatible with existing signal housings, hence can be retrofitted
- c. Traffic hazards while bulbs are being changed by maintenance staff is eliminated
- d. LED signals use less energy
- e. DC power feeding to signals possible, thereby eliminating transformers.
- f. Wide voltage variation in power feed is tolerated
- g. AC immunity up to 300 volts dispenses with cut-in relays
- h. One design of ECR for all LED signal lamp application including shunt signal and route indicator
- i. Maintenance costs reduced, as they don't need frequent replacement. Only occasional cleaning of transparent cover needed in dusty areas.
- j. There is no Phantom effect

Proper jumper Selection and wiring termination on CR should be done as per manufacturer's manual as applicable.

DC ECR for LED Signal Unit of DC Model

- (a) Universal Plug-in-type, tractive armature DC lamp proving relay is used.
- (b) Maximum pickup current = 80 mA / DC.
- (c) Minimum release current = 55 mA / DC.
- (d) This ECR withstands & continuous current of 200 mA / DC.
- (e) Contact configuration: 4F-4B identically in A to D rows.
- (f) Voltage drop across R1 and R2 is less than 10 V @ 100 mA (normal working current).

This image shows a single sheet of white paper with horizontal blue ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Ensure MOV is connected to MOV/input terminals of CR

TRACK CIRCUITS



MARCH 2016

PLANNER

MARCH 2016

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Track Circuits

Minimum permissible resistance of a concrete sleeper

Type of area	Minimum Permissible Resistance
(a) In Non - RE and AC RE area	500W after six months from the date of manufacture.
(b) In DC RE area.	800 W for Single Rail Track Circuits of up to 200m length and Double Rail Track circuits of up to 400m length
	1000 W for Single Rail track circuits of more than 200m length and Double Rail Track circuits of more than 400m length.

Measurement of resistance of concrete sleeper shall be made with a sensitive Multimeter of not less than 20 KW/Volt resistance of coil. Megger should not be used.

02 MARCH
Wednesday 2016



Maximum permissible rail resistance

Maximum Track circuit length in station yard 700m (C.S.R length).

Outside the station sections, track circuits may be longer.

The rail resistance should be kept minimum outside station yard.

Track circuit length	Maximum permissible rail resistance per kilometer
Up to 700m	1.5 Ω
More than 700m	0.5 Ω

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

In DC Track circuits the regulating resistance protects the feed equipment when the track is shunted, by avoiding a short across it as battery internal resistance is less.

Track Circuits

Train Shunt Resistance (TSR)

The highest resistance which, when applied across the track, can open the track relay front contacts is known as its '**Train Shunt Resistance**' (TSR). Specific values are:

(a) 0.5 Ohm	For D.C. Track Circuits.
	For Audio frequency Track Circuits outside their tuned lengths
(b) 0.15 Ohm	For Conventional AC Track Circuits and the tuned portions of Audio Frequency Track Circuits

In DC Track circuits the regulating resistance causes voltage drop (when track is occupied) to reduce voltage at relay end to drop the relay.

Train Shunt Resistance

For D.C. Track Circuits, it is desirable that if a Track relay drops with 0.5Ω shunt across rails, it will be able to detect any vehicle such as Motor Trolley, Light engine, Full train which give better shunting effect if rails & wheels are not in rusted condition. Thus higher value of TSR $>0.5 \Omega$ should always be aimed at to ensure safety in train working.

In DC Track circuit, the Regulating Resistance is connected in series at feed end to alter relay end voltage.

DC Track Circuit

TSR increases with the increase in regulating resistance upto some limit, after which it starts decreasing.

T.S.R. at the relay end of track circuit is lesser than that at its feed end due to the reduced track voltage there. It means that increase in rail resistance decreases the value of T.S.R. Thus track circuit rail resistance shall be kept low.

The increased ballast resistance of a track circuit causes a decrease in Train Shunt Resistance value.

Increase in Relay voltage requires decrease of T.S.R as more current is now to be diverted away through lower shunt value in order to de-energise the relay.

In DC Track circuits, B Type Choke ($R=3\text{ Ohm}$ & $Z=120\text{ Ohm}$ at 50 HZ) may also be used in series to increase Immunity level of Track Relay in RE areas.

2016



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Drop Shunt : The highest value of such shunting resistance that can cause the track relay to drop is referred to as '**Drop Shunt Value**'. The drop shunt value must be higher than the minimum permissible TSR (0.5 Ohms for DC T.C) for safe working of Track circuit. It shall be measured with TSR Meter once in quarter and adjusted if required. During regular inspections all the parallel portion of the track circuit should be checked for Drop-shunt. **Shunt test** shall be taken not only at Relay end but also at other parallel portions of the track such as turnouts and crossovers.

Track relay must drop when shunted by any Vehicle other than Insulated Push trolleys.

2016 07 MARCH
Monday

DC Track Circuit

Pick Up Shunt: The least resistance value at which a dropped track relay picks up again is called the '**Pick up Shunt Value**' of this track circuit. If this shunting resistance is very high, the track relay may not pick up properly.

With PSC (Pre-Stressed Concrete) sleepers, availability of insulated liners up to a minimum level of 97% shall be ensured.

Tuesday



Typical Parameters Of D.C Track Circuits in Non-RE area

Type of Track Circuit	Type of Relay	Resistance of Track Relay (L= Length of the track Circuit)	Cells at Feed end	PU Voltage Approx	PU Current Approx
DC TC for Non-RE	Non ACI shelf type	9 Ohm for L < 100 m	1 cells (2 V)	0.4 V	40 mA
		2.25 Ohm for L > 100 m	1 cells (2 V)	0.2 V	80 mA
	Non ACI Plug in Type (QT2)	9 Ohm for L < 100 m	1 cells (2 V)	1.4 V	150 mA
		4 Ohm for L > 100 m	2 cells (4 V)	0.5 V	125 mA

*Insulation Resistance of Glued joint in wet condition: shall not be less than **3 Kilo Ohm** when obtained with application of 100V DC and by dividing the voltage reading with that of current.*

Typical Parameters Of D.C Track Circuits in Non-RE area

Sr. No.	Sleeper	Section Yard/ Block	Min. RB per Km	TSR in Ohm	Max. Length of Track Circuit in meters	Type of Track Relay to be used	Remarks (L= Length of the Track circuit)
1.	Wooden /PSC	Block	4	0.5 Ohm	1000 m	QT2 of 40hm or 9 Ohm / Shelf type track relay of 2.25 Ohm or 9 Ohm	<ul style="list-style-type: none"> If $L \leq 100\text{m}$, 9 Ohm QT2 or Shelf type Track relay. If $L > 100\text{m}$, 4 Ohm for QT2 or 2.25 Ohm for Shelf type Track relay
2.	Wooden /PSC	Yard	2	0.5 Ohm	670 m	QT2 of 4W or 9 Ohm / Shelf type track relay of 2.25 Ohm or 9 Ohm	<ul style="list-style-type: none"> If $L \leq 100\text{m}$, 9 Ohm QT2 or Shelf type Track relay. If $L > 100\text{m}$, 4 Ohm for QT2 or 2.25 Ohm for Shelf type Track relay.

A regulating resistance of 0-30 Ohm (with tappings at 2, 4, 8, 16 Ohms) is used in DC Track circuits in RE area.

10 MARCH
Thursday **2016**



Typical Parameters of D.C Track Circuits RE area

Type of Track Circuit	Type of Relay	Resistance of Track Relay	Cells at Feed end	PU Voltage Approx	PU Current Approx
DC Single Rail Track circuit – AC RE Area	ACI Shelf type	9 Ohm	1 cell (2 V)	0.68 V	72 mA
	ACI Plug in Type QTA2 Plug in Type (QT2)	9 Ohm	2 cells up to < 100m 3 cells > 100 m	1.4 V	140 mA
	ACI Plug in Type QBAT	9 Ohm	2 cells up to < 100m 3 cells > 100 m to 450m 4 cells up to 750m	1.75 V	175 mA

Insulation Resistance of Glued Joints in Dry condition: Resistance shall not be less than **25 Mega Ohm** when a meggering voltage of 100V DC is applied across the joint.

Nylon insulated rail joints

The insulation components of the rail joint are:

- 1) End post -1No
- 2) Left hand Side channels- 2 Nos.
- 3) Right hand Side channels -2 Nos.
- 4) Ferrules or Bushes -8 Nos.
- 5) Nylon backing plates with collar- 4 Nos.
- 6) Nylon backing plates without collar or as required for packing nylon washers.
- 7) Iron backing plates -4 Nos.

Insulation components for track circuits are available in different sizes to suit different weights of rails, Viz. 60 kg, 52 kg, 90 R, 75R etc.

12 MARCH
Saturday 2016



Parameters for precaution against over energisation of track relay

Parameter	Under Conditions	Track Relay Voltage VR
Minimum Excitation at Track Relay	Max leakage (RB Minimum) & Minimum Battery voltage	<ul style="list-style-type: none"> • Not less than 125% of rated PU voltage for all Track Relays except QBAT. • Not less than 122% of rated PU voltage for QBAT
Maximum Excitation at Track Relay	Min Leakage (RB Maximum), Rr Minimum and Fully charged Battery voltage	<ul style="list-style-type: none"> • Not more than 250% of rated PU voltage for Shelf Type Track Relay • Not more than 300% of rated PU voltage for Plug in Type Track Relay except QBAT • Not more than 235% of rated PU voltage for QBAT
Dropping of Track Relay	Irrespective of RB conditions, with the application of TSR=0.5 _	Not more than 85% of rated DA voltage

In insulated rail joints and glued joints, the metal burrs at the ends of rails shall be removed well in time to avoid short circuiting through them. This work shall be done skillfully avoiding damage to end posts.

Typical Parameters of D.C Track Circuits in RE area

Sr. No.	Sleeper	Section Yard/ Block	Min. RB per Km	TSR in Ohm	Max. Length of Track Circuit in meters	Type of Track Relay to be used	Remarks (L= Length of the Track circuit)
1.	Wooden /PSC	Block	4	0.5 Ohm	450 m	QTA2 / Shelf Type 9 Ohm AC Immunised Track Relay	QSPA1 Relay shall be used as a 1 st repeater relay for QTA2 Track Relay.
2.	Wooden	Yard	2	0.5 Ohm	450 m	QTA2 / Shelf Type 9 Ohm AC Immunised Track Relay	QSPA1 Relay shall be used as a 1 st repeater relay for QTA2 Track Relay
3.	PSC	Yard	2	0.5 Ohm	350 m	QTA2 / Shelf Type 9 Ohm AC Immunised Track Relay	QSPA1 Relay shall be used as a 1 st repeater relay for QTA2 Track Relay
4.	PSC	Yard	2	0.5 Ohm	750 m	QBAT (ACI level = 80V AC, PU. 1.75 V, 175 mA) in conjunction with QSPA1 With B-type Choke at relay end.	QSPA1 Relay shall be used as a 1 st repeater relay for QBAT Track Relay.

Note :- (i) B type choke shall be connected in series with the relay also for its protection to enhance the AC immunity of the track relay.

(ii) In the case of shelf type ACI track relay with this choke in series, 450 m long track circuit can be worked even with traction return current up to 1000 Amps. Without this choke, 450 m long track circuit can be worked only when the traction return current is within 600 Amps.

Voltage drop in the track lead cables shall be kept within limits so as to work sufficiently long track circuits with minimum power application.

14 MARCH
Monday **2016**



Additional insulations on point turnouts in a track circuit

The insulation components of each William's stretcher bar are:

- (i) Nylon Backing plates 2 Nos.
- (ii) Nylon bushes for bolts 3 Nos.
- (iii) Nylon washers for bolts & nuts 6 Nos.

The insulation components for each gauge tie plate are:

- (i) Nylon end post with 3 holes 1 No.
- (ii) Nylon bushes for bolts 3 Nos.
- (iii) Nylon washers for bolts & nuts 6 Nos.

The ballast used on track in the vicinity of glued joints shall be cleaned to ensure efficient packing and drainage.

2016 15 MARCH
Tuesday

The rail at whose block joint, traction return current flow is stopped is called the '**Insulated Rail**'.

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Wednesday

2016



Siemens type point machine

Insulation components provided between each switch rail and D-bracket for rodding attachments are:

- (i) Nylon insulation plate 1 No.
- (ii) Nylon Bushes for bolts 2 Nos.
- (iii) Nylon washers for nuts 2 Nos

The clearance from the underside of rail below a glued must not be less than 50mm.

2016 17 MARCH
Thursday

Glued Rail Joints are available in two types:

(a) G3 (L) type having 6 bolts
(b) G3 (S) type having 4 bolts

Testing of Glued Joints i.e. Insulation Resistance test in Dry condition:

Resistance shall not be less than **25 M Ohm** when a meggering voltage of 100V DC is applied across the joint.

In wet condition: Resistance shall not be less than **3 K Ohm** when obtained with application of 100V DC and by dividing the voltage reading with that of current.

The rail at whose block joint, traction return current is given an alternate path through transverse bonds is called the '**Un-Insulated Rail**'.

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Friday

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Dead sections in track circuits

The dead section shall not accommodate a four-wheeler vehicle entirely in itself without shunting any 'live' portion of the track circuit at the same time.

In B.G sections, the distance between the two axles of a four-wheeler is 6m (20') and in MG /NG sections, it is 3.6m (12').

Packing of a couple of sleepers on either side of insulated rail joints and prevention of water logging near them shall always be good.

2016 19 MARCH
Saturday

Dead sections in track circuits

If one trolley of an eight-wheeler gets entirely accommodated in a dead section, the second trolley of the same vehicle shall not go beyond the live portion of that track circuit in either direction.

In B.G sections, the distance between the two axles of this trolley is 1.8m (6') and in MG/NG sections, it is 1.125m (3'9"). In this case, the track circuit shall extend on either side of dead section by more than 12m (40').

In multiple line sections traction return rails in track circuits are cross connected with bonding straps at an interval of about 100metres in between them.

20 MARCH
Sunday 2016



Ballast Resistance is the net resistance of various leakage paths across track circuit rails offered by ballast and sleepers. Ballast resistance is inversely proportional to length of Track circuit and also it varies as per condition (Dry/Wet) of the ballast and soil as explained below:

- It reduces with increase in the length of track circuit as leakage paths in parallel are more.
- Clean ballast is not a good conductor. Water across the tracks causes leakage.
- So ballast resistance falls during rainy season.
- A good drainage is essential to avoid water logging and for maintaining a higher ballast resistance.
- Periodical screening of the ballast is not only necessary to improve the strength of track bed but it also improves the track circuit ballast resistance.

While providing continuity bonding in track circuit, holes for bonding shall be as close to the fish plates as possible.

2016 21 MARCH
Monday

Dead sections in track circuits

Dead section on point's zone shall not be more than 1.8m (6') for B.G and 1.125m (3'9") for MG/NG sections.

If the dead section is longer than 10.8m(36') as in the case of long bridges underneath the track, a 'Trap Circuit' shall be provided including the control of dead section track by two other track circuits on either side

At the end of last track circuit, a cross bond is provided to connect the two track circuited rails.

**Audio Frequency Track Circuit
Testing with external shunt**

1. Apply a non-inductive 0.5 Ohm resistance in any position on the track circuit (except for portion of tuned zone/electric separation joints). The respective track relay should de-energize.
2. Check whether a non-inductive resistance of 0.15 Ohm interposed anywhere inside the tuned zone/ESJ causes deenergization of at least one of the two successive track circuits.
3. Apply a non-inductive resistance of 0.15 Ohm in overlap zone of ESJ (Overlap zone as prescribed by manufacturer). Track relay of both the AFTCs should drop.

Overlap zone is the portion of tuned zone in which both the AFTC Relays drop when it is shunted by 0.15 Ohms resistance.

2016 23 MARCH
Wednesday

Track Relays

Extract of para SEM-II Para 19.141)

(i) Minimum percentage release of track relays should be 68% of its rated pickup value.

Deterioration of 15% in operating characteristics is considered for safety reasons. Hence Drop away value shall be taken as 85% of 68. i.e 57.8% of rated pickup value.

While providing continuity bonds in track circuits, the bonds shall be fixed without much delay after drilling holes so that the holes do not get rusty.

24 MARCH
Thursday 2016



Track Relays

Shelf type track relays shall normally be overhauled every 10 years subject to a maximum of 12 years. (May also be reduced depending upon the intensity of traffic and other local conditions of the section such as heavy suburban and major Route Relay Interlocking installation).

Plug in type track relays have to be replaced on completion of 12 years or earlier if warranted by the actual condition of the relay and / or its usage

While providing continuity bonds in track circuits, bond wires shall not be provided between the rails and fish plates, as they cannot be easily checked.

Technical data of ABB -TI-21 AFTC (Type- Non-coded)

- Maximum Working Length of AFTC End Fed -450 m, Centre Fed - 700 m
- Basic (Carrier) Frequency (Fc) A-1699.,B-2296 C-1996 , D-2593 E-1549,
- F-2146 G-1848 , H-2445 (Hz)
- Modulating Frequency (Fm) 4.8 Hz
- Remote Feeding possible upto 1 Km
- Bonds Used at boundary- Z bond
- Number of Lines - four
- Card File TX, RX, PSU,
- Relay 1000-OHM-QS3
- Overlap Zone length -22 m

Maximum Working Length of AFTC End Fed -450 m, Centre Fed - 700 m.

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Saturday **2016**



Technical data of US&S-UM-71 AFTC (Type- Non-coded

- Basic (Carrier) Frequency (Fc) V1F1-1700, V1F2-2300, V2F1-2000, V2F2-2600 (Hz)
- Modulating Frequency(Fm) F/128 Hz
- Remote Feeding possible upto 1 Km
- Bonds Used at boundary - Air core inductor
- Number of Lines - Two
- Card File TX,RX,PSU
- Relay 1000-OHM-QS3

After a change in outdoor installation/ interconnection of AFTC, do all the adjustments as applicable for initial installation.

Track Circuiting at Fouling marks & protection

- (a) A track circuit shall extend beyond fouling marks on both straight road and diversion portions to afford protection to the standing vehicles. In case, it is not possible to provide the block joints beyond fouling marks on any portion, the point operation to a position connecting the fouled line shall be prevented until the time the fouling vehicle clears the adjoining track circuit also.
- (b) With parallel connection of turnout track circuits, the non-clearance of fouling mark by a vehicle may not be detected when any connection in the parallel portion is broken. This shall be checked and avoided especially in case of the 1 in 8 1/2 and 1 in 12 turnouts. Hence, it is preferable to have series connection track circuits to have fouling mark protection on running lines.

The end position block joints on turnout track circuits shall be so located that not only the last axle wheels but also the overhanging portions of vehicle (1.8m) clear the fouling mark before the track relay picks up. So, in case of Crossovers, Block joints shall be provided away from Fouling mark at a distance of NOT LESS THAN 3 m (towards divergence).

While providing continuity bonds in track circuits, drilling of holes and driving the channel pins through them shall be done in the same direction to ensure proper riveting of the pins.

28 MARCH
Monday 2016



Technical data of Alstom-DTC-III AFTC (Type- Coded)

- Basic (Carrier) Frequency (Fc)
DTC-24 2.1, 2.5, 2.9 3.3 , 3.7, 4.1 (KHz)
DTC-921 9.5 ,11.1 12.7 , 14.3 , 15.9 , 17.5 , 19.1, 20.7 (KHz)
 - Modulating Frequency (Fm) 400 bps
 - Remote Feeding possible upto 3.5 Km
 - Bonds Used at boundary- S-bond, alpha bond, double alpha
 - Number of Lines - Any
 - Card File TX, RX, RT, Relay -Miniature
 - Overlap Zone length -5 m
-

In failure of AFTC during monsoon, increase gain adjustment till satisfactory operation is attained. Check TSR without fail.

2016 29 MARCH
Tuesday

Track Circuiting Turnouts

For track circuiting turnouts, depending on the mode of connection between the rails of different track circuit portions three types of arrangement are possible, viz. (i) Parallel connection (ii) Series connection and (iii) Series - Parallel connection. Specific Choice of arrangement adopted depends on site condition, Zonal railways practices, Required Degree of safety/Reliability etc.

It is preferable to have the block joints in the middle on a less used track to increase their life of insulation.

DC Track Circuit

Series-Parallel Connection of Turnout

In this arrangement of track circuit, only positive polarity rails are connected in series while keeping rails of negative polarity in parallel, to provide multiple paths for traction return current, so as to prevent traction current from passing through the track circuit equipment and interfere with its working if any path is interrupted. In non-RE areas also, this arrangement is sometimes adopted to minimize cable requirement.

While providing continuity bonds in track circuits, channel pins shall be driven with a 1½ kg. Hammer for their proper hugging in the holes.

2016 31 MARCH
Thursday

Technical data of Siemens-FTGS AFTC (Type- Coded)

ELECTRIC POINT MACHINE

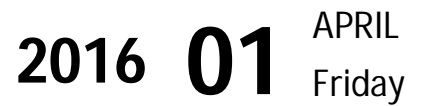


APRIL 2016

PLANNER

APRIL 2016

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It should be understood that LH and RH do not refer to the fixing of the point machine on the left hand side or right hand side of the point but to the point layout. An RH turnout is one in which the right hand tongue rail is set with its stock rail in the normal position. An LH turnout is one in which the left hand tongue rail is normally set with the stock rail.

At the time of installation of Electric Point Machine the initial opening of the switch rail at the toe shall be ensured within limits of 115 mm+3mm on BG and 100+3 mm on MG.

APRIL

Saturday

2016



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The friction clutch is a part of transmission assembly and it is fitted between the motor and the mechanism to absorb shock at the end of the operation or in case the machine is obstructed from completing the movement due to an obstruction between switch and the stock rail. The compression spring assembly is inserted in the slip ring. The spring load on the slip ring can be increased or decreased by tightening or loosening a hexagonal adjustable bolt provided in its assembly. This increases and decreases the friction load on main gear rim. Since it is pre-adjusted in the manufacturing place it self, there is no need to adjust at site.

As per standard layout two long sleepers, either wooden or PSC shall be provided for point machine mounting.

Positions of detection and control contacts of switch pedestals in DC Electric Point machines

Sr. No.	Position/Setting of point	Position of Control/Detection contacts
1.	Point is Normal (N) and locked	ND Make RC Make
2.	While starting the operation from N to R	NC Make after ND Break
3.	During operation from N to R	RC Make NC Make
4.	At the end of N to R operation	RD Make after RC Break
5.	Point is Reverse (R) and locked	RD Make NC Make
6.	While starting the operation from R to N	RC Make after RD Break
7.	During operation from R to N	NC Make RC Make
8.	At the end of R to N operation	ND Make after NC Break

For mounting of Electric Point Machine, both long sleepers are to be fixed on equal horizontal level and are to be spaced to suit point machine fixing without any off-set in ground connections.

- The inner contacts of switch pedestal are detection contacts and outer contacts are control contacts.
- The internal wiring of point machine depends upon the type of turn-out and not the position of the machine with respect to the track/point.
- The internal wiring of point machine installed at left hand side of point is similar to that fitted at right hand side.
- The position of short and long connection detection rods depends upon the position of point machine. If the machine is installed at left side of the point, the first one should be short connection detection rod and the second long connection detection rod. If the machine is at right side of the point the rods should be interchanged.

For installation of Electric Point Machine, extended gauge tie plate duly insulated shall be fixed on the first long sleeper i.e. on the toe sleeper.

- The point machine is installed on sleeper No. 3 & 4 of the point layout.
- Sleeper No. 2, 3 & 4 are 3750 mm. long while other sleepers are 2750 mm long.
- Extended gauge tie plate is provided on sleeper No. 3 and MS plate is provided on sleeper No.4.
- The spacing between sleeper No. 3 & 4 depends upon the type of point machine.(Given under parameters of Electric Point Machine)
- Toe of the switch should be 27 mm in advance of the centre line of the sleeper no.3.

There shall be a gap of 1.5 mm. to 1.75 mm. between the bottom of the rail and leading stretcher bar.

Parameters of Electric Point Machine

Description	Siemens point machine	IRS Point Machine	IRS Point Machine (Clamp type)	GRS 5 E Point Machine
Normal Working Voltage	110 V DC	110 V DC	110 V DC	110 V DC
Minimum Working Voltage	60VDC	60VDC	60VDC	88 V DC
Normal Working Current	2-3 Amps	2-3 Amps	3-5 Amps	3-5 Amps

While installing Electric Point Machine, following stretcher bars shall also be provided as per P.W. drawing to meet provisions of P.Way standards.

Parameters of Electric Point Machine

Description	Siemens point machine	IRS Point Machine	IRS Point Machine (Clamp type)	GRS 5 E Point Machine
Slipping Current	Upper Limit- shall not be more than 1.5 to 2 times of Normal working current. Lower Limit- Difference between normal working current & slipping current shall not be less than 0.5 Amp			

Points shall be checked for proper housing of switch rail with stock rail for not less than 5 sleepers on both Normal and Reverse settings.

Parameters of Electric Point Machine

Description	Siemens point machine	IRS Point Machine	IRS Point Machine (Clamp type)	GRS 5 E Point Machine
Stroke of the Point Machine	143 mm	143 mm	220 mm	150 mm
Minimum AC immunity level	160V AC	160V AC	160V AC	--

Adequate ballast shall be provided and well packed for proper working of point machine, especially under/surrounding the long sleepers.

Parameters of Electric Point Machine

Description	Siemens point machine	IRS Point Machine	IRS Point Machine (Clamp type)	GRS 5 E Point Machine
Stroke of the Point Machine	143 mm	143 mm	220 mm	150 mm
Minimum AC immunity level	160V AC	160V AC	160V AC	--

Thinner half headed stud bolts only to be used over planed length of tongue rail which butts against the stock rail.

10 APRIL
Sunday 2016



Parameters of Electric Point Machine

Description	Siemens point machine	IRS Point Machine	IRS Point Machine (Clamp type)	GRS 5 E Point Machine
Mode of Locking	Rotary type locking	Rotary type locking	Rotary & Clamp type locking.	In & out type of locking
Locking of switches	Common one lock slide	Independently by Two lock slides	Independently by Two lock slides as well as Physically by clamp lock on open & close switch	Independently by Two lock slides

RDSO Drawing No.SA 8800-01 for Layout facing point B.G. fitted with Siemens electric point machine.(52 Kg & 90R, Wooden sleepers, 1 in 8.5).

Parameters of Electric Point Machine

Description	Siemens point machine	IRS Point Machine	IRS Point Machine (Clamp type)	GRS 5 E Point Machine
Operating time	3-5 Secs	3-5 Secs	5 -6 Secs	3-5 Secs
Friction clutch	Self adjustable	Self adjustable	Self adjustable	Adjustable

RDSO Drawing No.SA 9151-52 is for Layout facing point 1 in 12 turnout for B.G. on pre-stressed concrete sleepers fitted with Siemens Electric point machine. (60 Kg UIC rail & 52 Kg).

Parameters of Electric Point Machine

Description	Siemens point machine	IRS Point Machine	IRS Point Machine (Clamp type)	GRS 5 E Point Machine
Sleeper spacing between No.3&4 (Centre of hole of chair plate)	685 mm	710 mm	745 mm	565 mm
Snubbing	Mechanical	Mechanical	Mechanical	Electrical

Drawing No.RDSO/S 3262-63 is for Layout facing point B.G. fitted with IRS Electric point machine.(52 Kg & 90R, Wooden sleepers).

Parameters of Electric Point Machine

Description		Siemens point machine	IRS Point Machine	IRS Point Machine (Clamp type)	GRS 5 E Point Machine
Contacts on normal & reverse side	Control	02+02	02+02	02+02	01+01
	Detection	02+02	02+02	02+02	02+02& (01+01 snubbing)

RDSO/S 3361-62 – Layout facing point 1 in 12 turnout -B.G. on pre-stressed concrete sleepers fitted with IRS Electric point machine.(143 mm throw). (60 Kg UIC rail & 52 Kg).

Parameters of Electric Point Machine

Description	Siemens point machine	IRS Point Machine	IRS Point Machine (Clamp type)	GRS 5 E Point Machine
Motor Type	DC series Split field Motor	DC series Split field Motor	DC series Split field Motor	DC series Split field Motor (or) Permanent magnet
Insulation grade	10 m Ω Class – 'B'			

Leading stretcher bar (insulated) is to be located at a distance of 470 mm from the toe for BG & MG layouts.

Parameters of Electric Point Machine

Description	Siemens point machine	IRS Point Machine	IRS Point Machine (Clamp type)	GRS 5 E Point Machine
R.P.M	1700	1700	1700	1500
Power	440 Watts	440 Watts	440 Watts	590 Watts

For flood prone areas the point machine may be fixed at raised level as per standard policy prevailing on the railway

16 APRIL
Saturday 2016



Parameters of Electric Point Machine

Description	Siemens point machine	IRS Point Machine	IRS Point Machine (Clamp type)	GRS 5 E Point Machine
Rated motor working time	10 minutes	10 minutes	10 minutes	10 minutes
Rated motor current	5.3 Amps	5.3 Amps	5.3 Amps	--

Unless any special instruction are issued by the Railway, adjustment for driving rod and lock rod shall be done for the close switch nearest to the point machine first.

Parameters of Electric Point Machine

Description	Siemens point machine	IRS Point Machine	IRS Point Machine (Clamp type)
Lubrication	Oil & Grease Type Oil SAE 30 (Specification IS: 1628) /Quatity 100 ml /Frequency once in 6 month/10000 operations. Grease non-corrosive all temperature (specification Nos. IS:507 or IS:508) once in 6 months or as local conditions need		
Rated motor current	5.3 Amps	5.3 Amps	5.3 Amps

Friction clutch should be so adjusted that slipping current is between one and half times to twice the normal operating current or as specified by the manufacturer.

18 APRIL
Monday 2016



Parameters of Electric Point Machine

Description	Siemens point machine	IRS Point Machine	IRS Point Machine (Clamp type)	GRS 5 E Point Machine
Inspection schedule	Maintainer – fortnightly, JE/ SE (Sig)- monthly & SE / SSE (Sig.) (In Charge) Quarterly			

When difference between normal operating current and operating current under obstruction is less than 0.5 Amp., the clutch requires adjustment. Such machine should be replaced.

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Wednesday

2016



Obstruction Test (Ref: SEM Part II Para 19.38)

The point driving rod and the lock connections of the machine must be so adjusted that with 5 mm thick test piece obstruction placed between the switch and the stock rail at 150 mm from the toe of the switch:

- The point cannot be locked.
- The point detector contacts should not assume the position indicating point closure and
- Friction clutch should slip.

Ensure cleaning and lubricating of moving parts of Electric Point Machine.

Correspondence testing

Correspondence testing of point at site with respect to point group/relay and panel indication must be done after cable meggering and each time the point is reconnected after disconnection for maintenance/repair.

[illegible]

Ensure that all bolts and nuts including point machine mounting bolts are tight and split pins are opened properly, during every maintenance visit of Electric Point Machine.

22 APRIL
Friday 2016



Track locking testing

Shunt any one of the track circuit on point portion with proper track shunt and ensure that the point track indication on the lever frame/panel is showing occupied. Operate the point from the cabin/panel. Ensure that the point does not operate in this condition. Remove the shunt and ensure that the point gets operated. This test shall be done both for normal to reverse and reverse to normal operation. Track locking should be tested once in three months

Check that electrical wire connections inside the cable termination box and inside the machine are tight and the wiring is laced properly.



Operating values of point machine, point motor insulation and switch bracket insulation should be tested once in three months.

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.

Check the rodding connections of Electric Point Machine for tightness and friction free movement.

Positions of detection and control contacts of switch pedestals in 380 V 3 phase AC Electric Point machines

Sr. No.	Position/Setting of point	Position of Control/Detection contacts
1.	Point is Normal (N) and locked	ND Make RC Make
2.	While starting the operation from N to R	NC makes before ND breaks
3.	During operation from N to R	RC Make NC Make
4.	At the end of N to R operation	RD makes before RC breaks
5.	Point is Reverse (R) and locked	RD Make NC Make
6.	While starting the operation from R to N	RC makes before RD breaks
7.	During operation from R to N	ND Make RC Make
8.	At the end of R to N operation	ND makes before NC breaks.

Lubricate the slide chair plates frequently for smooth working of points.

Detection contact testing of Electric Point Machine

To check the individual integrity of point detection contacts,

- Open the transparent cover of switch pedestal.
- Break each detection contact one by one manually.
- Check that the corresponding detection relay in the relay room drops each time the detection contact is broken.
- Operate the machine by power and check that the contacts are making with sufficient pressure.

Ensure that the rodent entry points in the point machine and Cable Termination Box etc. if any are properly plugged.

26 APRIL **2016**
Tuesday



Crank handle cut out contact testing

Check the wire connections to the terminals of voltage cut-out switch of point machine and ensure their intactness. Open the voltage cut-out switch and ensure that the contact is not giving break in circuit and making with sufficient pressure.

Lubricate all moving parts of Electric Point Machine with lubricating oil/grease as per manufacture's specifications.

Voltage measurement

Measure the voltage for normal and reverse operation by connecting voltmeter probes directly to the motor terminals (1 & 2 for Reverse operation, 2 & 3 for Normal operation).

The above parameters of current and voltage measurement should be taken every 3 months and recorded as given in following table:

[illegible][illegible]

Inside the contact assembly of Electric Point machine, check that the spring contacts press against the fixed contacts with sufficient pressure.

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Thursday

2016



Check that the carbon brushes inside motor of Electric Point Machine are exerting sufficient pressure on the commutator.



Once in three months check the carbon brushes and commutator, clean the commutator with chamois leather until carbon deposits are disappeared.

30 APRIL **2016**
Saturday



Overhauling of point machine should be done only at an authorized centralized depot of the division or S & T workshop.

ELECTRIC LIFTING BARRIER



MAY 2016

PLANNER

MAY 2016

1	Sun	
2	Mon	
3	Tue	
4	Wed	
5	Thu	
6	Fri	
7	Sat	
8	Sun	
9	Mon	
10	Tue	
11	Wed	
12	Thu	
13	Fri	
14	Sat	
15	Sun	
16	Mon	
17	Tue	
18	Wed	
19	Thu	
20	Fri	
21	Sat	
22	Sun	
23	Mon	
24	Tue	
25	Wed	
26	Thu	
27	Fri	
28	Sat	
29	Sun	
30	Mon	
31	Tue	

Electric Lifting barrier -Parameters as per RDSO Spec. No. RDSO/SPN/208/2012

The control panel shall consist of switches & Indications as follows

For barrier without hand generator

Sr.No.	Description	Nomenclature	Colour
1	One LED Indication indicating AC/DC power (indication shall lit when power supply is available)	POWER	Amber
2	Two push button switches for closing / opening of the barrier. The barrier shall operate as long as corresponding button is pressed and shall stop when button is released.	CLOSE OPEN	Close-Green Open -Amber
3	One Push Button for Emergency clearing of Train Signal in case of failure of main detection contact	EMERGENCY	Red
4	Two LED Indications indicating positive boom lock proving of individual boom.	BARRIER A LOCKED BARRIER B LOCKED	Green Green
5	Two LED Indications indicating boom closed position of individual boom.	BARRIER A CLOSED BARRIER B CLOSED	Amber Amber

Check for smooth operation of Barrier.

02 MAY 2016
Monday

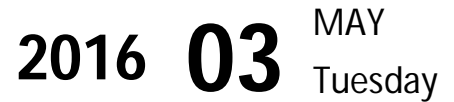


Electric Lifting barrier shall conform to **Specification No. RDSO/SPN/208/2012**. Electric Lifting Barrier facilitate electrical operation of lifting barrier in normal condition when suitable AC/DC power supply is available and manual operation in case power supply is not available These are of two types :

- a) Barrier without hand generator
b) Barrier with hand generator

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Clean the inside & outside of mechanism, boom & channels, and Hand Generator



- a) With push button switch in case power supply (110V AC or 24V/110V DC) is available.
- b) With direct crank handle manually on one boom at a time in case of power supply failure. The insertion of this crank handle shall disconnect the power supply to the motor and it shall not be possible to reconnect the power supply to the motor until the hand crank is withdrawn

Check for auto stop of Barrier in the fully open and closed position. Adjust circuit controllers, if required.

Wednesday



Electric Lifting barrier - Mode of operation

For barriers with hand generator –

- a) With push button switch in case power supply (24V/110V DC) is available.
- b) With hand generator located in Gate Lodge/ Cabin for manual operation of both lifting barriers simultaneously.
- c) With direct crank handle on one boom at a time in case of both power supply failure and hand generator failure. The insertion of this crank handle shall disconnect the power supply to the motor and it shall not be possible to reconnect the power supply to the motor until the hand crank is withdrawn

Check tightness of all fixing nuts and bolts of the mechanism base, gear box, motor, boom & counterbalance channels & the adjusting screws of the circuit controllers.

Electric Lifting barrier -Parameters as per Specification No. RDSO/SPN/208/2012

The rated voltage and normal operating current / maximum rated current of the motor of lifting barrier :

For barriers without hand generator

Type	Rated Voltage	Normal (max.) Optg. Current per barrier, boom length upto 9.76 m (\approx 10 m)	Max. rated current for each barrier, boom length upto 9.76 m (\approx 10 m)
AC	110 V	2.5 Amps	4 Amps
DC	24 V	4 Amps	7Amps
DC	110 V	1.0Amps	1.8Amps

Please ensure that the cover of the locking mechanism is properly replaced after the routine check as it makes it all weather proof.

Electric Lifting barrier -Parameters as per Specification No. RDSO/SPN/208/2012

The rated voltage and normal operating current / maximum rated current of the motor of lifting barrier :

For barriers with hand generator

Type	Rated Voltage	Normal (max.) Optg. Current per barrier, boom length upto 9.76 m (\approx 10 m)	Max. rated current for each barrier, boom length upto 9.76 m (\approx 10 m)
DC	24 V	3 Amps	5 Amps
DC	110 V	0.7 Amps	1.2 Amps

While installation, please ensure that the top end of locking arrangement should be at the same height as of the main shaft of the pedestal.

2016 07 MAY
Saturday

08 MAY 2016
Sunday



(1) Electric Lifting barrier -Parameters as per RDSO Spec. No. RDSO/SPN/208/2012

The control panel shall consist of switches & Indications as follows

For barriers with hand generator

Sr No.	Description	Nomenclature	Colour
1	One LED Indication indicating AC/DC power (indication shall lit when power supply is available)	POWER	Amber
2	A selector switch to select hand generator operation / auto push button operation.	HAND GENT/ PUSH BUTTON	--
3	Two push button switches for closing / opening of the barrier. The barrier shall operate as long as corresponding button is pressed and shall stop when button is released.	CLOSE OPEN	Close-Green Open -Amber
4	One Push Button for Emergency clearing of Train Signal in case of failure of main detection contact	EMERGENCY	Red
5	Two LED Indications indicating positive boom lock proving of individual boom.	BARRIER A LOCKED BARRIER B LOCKED	Green Green
6	Two LED Indications indicating boom closed position of individual boom.	BARRIER A CLOSED BARRIER B CLOSED	Amber Amber

*Quarterly maintenance- Check Timing Belt tension for both barriers & Hand Generator.
Adjust if required.*



The total length of the boom shall be in maximum 4 sections (depending on total length). Each section shall be of 2.44 m (8 ft) joined by nuts and bolts for easy replacement. The length of the boom of the lifting barrier shall be 4.88/ 7.32/ 9.76m (16/24/32 ft) as specified by the purchaser

Quarterly maintenance-Check contacts of copper ring with carbon bushes of all circuit controllers.

10

Tuesday

2016



Electric Lifting barrier -Parameters as per RDSO Spec. No. RDSO/SPN/208/2012

The boom shall be painted alternately with 300-mm bands of black and yellow colour and additionally provided with luminous stripes (reflective tape) as per RDSO Drq. No. RDSO/S 11600.

When the gate is closed to road traffic, clearance between the road surface and the boom shall be 0.8 to 1 metre.

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are approximately 20 lines visible. The paper has a slight shadow on its right side, suggesting it's resting on a surface.

Annual maintenance -Replace the oil in the barrier gear unit. Old oil is removed from the bottom of the gear unit by opening the bottom plug. New oil is filled from the top of the gear unit, by opening the top plug provided.

2016 11 MAY
Wednesday

Operation of Electric Lifting Barrier

Push button electric operation

Check that on opening, the operating feed disconnects at 85 deg. and above and on closing, at 5 deg. and below. Stop pushing the button during operation, the barriers should stop in this position. After a delay of 2 sec., press opposite button, the reverse operation should start.

Use gear oil SAE 90 or equivalent in the barrier gear unit. Qty. 1.5 liters in each barrier gear box.

12 MAY
Thursday **2016**



Operation of Electric Lifting Barrier

Hand generator operation (where provided)

Keep Auto/ manual switch in "MANUAL". Rotate the hand generator crank anti-clockwise for opening and clockwise for closing. Both lifting barriers should operate simultaneously. On stopping the cranking, the operation should stop For reversing, crank in opposite direction after at least 2 sec.

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Annual Maintenance-Replace Timing Belts if worn out.

2016 13 MAY
Friday

Operation of Electric Lifting Barrier

Emergency direct crank operation

Insert the barrier crank into the hole provided in the mechanism box rear door and engage into the shaft of the gear drive unit. For closing rotate handle clockwise and for opening anti-clockwise

[illegible]

Annual maintenance-Replace Clutch plate if required.

14 MAY **2016**
Saturday



Adjustments of Electric Lifting Barrier

Balancing of Boom

Adjust counter balance weights until operating current is almost the same in opening and closing of barrier and the boom tip rests properly on the boom stand rubber. Applying a slight finger force at the tip should lift the boom. On removing the force, the boom should again close and rest on the rubber pads

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are approximately 20 lines visible. The paper has a slight shadow on its right side, suggesting it's resting on a surface.

Annual maintenance- Oil the clutch slippage bush.

At the center of the boom, the lifting barrier shall be provided with a 600 mm dia red disc made from minimum 20 SWG GI Sheet with a vertical Stiffening "V" or "U" bend in the middle having red reflector buttons/ luminous stripes facing the road traffic.

The disc shall be marked with "STOP" sign of 50mm width in white luminous paint/ stripes (or similar signage in language specified by purchaser). LED type boom light having terminal with built-in fuse shall also be provided at the centre of boom

Strictly follow the instructions and procedure serially for Installation of Pedestal & boom balancing as described in the manual.

16 MAY **2016**
Monday



As per Essentials of Interlocking(Para 7.82 of SEM part-1, 1988 Edition)

It must not be possible to take 'OFF' a running signal unless all the interlocked level crossing gates not only in the actual portion of the track on which the train has to travel, but also in the overlap are closed and locked against road traffic.

Once the signal has been taken OFF, it must not be possible to unlock and open the relevant level crossing gate.

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.

Ensure to cutoff power supply before replacing any component or doing periodic maintenance of Electric Lifting Barrier.



Completely loosen adjusting nut until gate fails to operate when motor is started, and the clutch slips continuously. Tighten the nut until the slippage torque of clutch is just sufficient to drive the barrier.

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are approximately 20 lines visible. The paper has a slight shadow on the right side, suggesting it's resting on a surface.

Always use recommended spare parts and Gear Oil.

Adjustments of Electric Lifting Barrier

Boom Lock adjustment

For barriers with locking lever & solenoid

Adjust the position of lock box and boom hook so that boom hook falls properly into the lock box opening.

Adjust the position of switch and magnet so that switch contact makes when boom hook falls in and lock lever engages it.

Check the integrity of switch contact with the help of continuity meter.

The contact should not break by physically shifting the boom in horizontal and vertical directions.

By moving the locking lever to unlocked position by hand, the contact should break.

Never grease or oil the SS locking shaft where provided.

2016 19 MAY
Thursday

Do not mount the counter weights before mounting of boom.

20 MAY 2016
Friday



Adjustments of Electric Lifting Barrier

Limit switch adjustment.

Adjust the position of contoured cams fixed on gear box shaft and main boom shaft actuating limit switches inside pedestal:

Loosen the cam fixing screws with Allen Key.

Adjust the position of the cam as required, by rotating it on the boom shaft.

Tighten all fixing screws after cam position is finally adjusted.

Clean the inside of Solenoid locking device and ensure that the boom hook falls properly into the Boom Lock Post. Adjust position of Boom Hook/ lock unit if required.



Timing belt adjustment

Adjust the position of the motor, until desired belt tension is achieved, by providing suitable packing below motor/adjusting the motor.
Re-tighten the fixing bolts.

This image shows a single page of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page, leaving small margins at the top and bottom. There are no vertical margin lines, text, or other markings on the page.

22 MAY **2016**
Sunday



Electric Lifting Barrier- General Testing

1. Operate the barrier and measure opening and closing current.
2. Ensure that measured current for opening and closing are almost equal.
3. If not same then adjust counter balance (push forward or backward on the slots on counter balance fitting channel) to make operating current same.
4. Check that feed for opening is getting disconnected at 85 deg. and for closing after hitting boom lock hook at LS-1 on boom lock.
5. Check that after closing, locking rack locks the hook on boom. 'Barrier A/B closed' and 'Barrier A/B locked' indication appear on panel. Power supply to boom lock motor is disconnected.
6. Press open switch and check that
Locking rack disengages boom lock hook. Power supply to boom lock motor gets disconnected. 'Barrier A/B locked' indication disappears. Opening of boom begins and it stops automatically at 85 deg.

[illegible]

2016 23 MAY
Monday

Electric Lifting Barrier

The General items which may be required for replacement periodically are:

a) Limit Switch **b)** Gear Box Oil, **c)** Selector Switches, **d)** Push Button Switches, **e)** Motor, **f)** Timing Belt, **g)** Carbon brushes, **(h)** Boom (In case of any accident)

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.

Check adjustment of Boom Lock Magnet Switches & Backup Limit Switch.

24 MAY
Tuesday 2016



Electric Lifting Barrier

Periodicity of Replacement of parts

- 1) The spring loaded Carbon Brushes are meant for permanent usage. However the contacts made by the carbon brushes need to be closely watched so that the circuit controller operation is not affected.
- 2) This should be watched every three months.
- 3) Check Gear Box for any leakage of oil every three months. Oil has to be replaced after 1 Lac operation or One year whichever is earlier.
- 4) For rest of the item periodic maintenance of 6 months is sufficient

As the timing belt does not transmit power by friction (unlike V Belts) it should be left a little loose & not tightened fully. A tight timing belt will break very soon.

Electric Lifting Barrier Motorised Locking arrangement

The motorized lock works on 110V AC supply.

Following points should be taken care of in the Circuit for giving feed to the motor:

1. Motorized lock gets feed only when the boom is at about 5 deg from the horizontal.
2. The motor activates when the boom plunger presses the Boom detection Lever in the locking box and thus locking takes place.
3. The motor works in the reverse direction while opening and thus opens the Lock.
4. In case of power failure, motorized locking will be accomplished manually with the help of locking/unlocking handle.

[illegible]

While joining two parts of the boom avoid use hammer, as boom may buckle due to column effect.

26 MAY **2016**
Thursday



Where lifting barriers are operated from the nearest cabin, the distance from the cabin to the L.C. is limited to 150 meters. It is necessary that the operator have a clear view of the L.C. and approach road on either side to ensure that speedy vehicles do not damage the lifting barriers or get trapped between the barriers. To prevent speeding vehicles damaging the barriers at the time of closing, the present directives are to provide humps or speed breakers on both sides of approach of level crossings

While installing the boom, always install the boom first and then the balance weights.

2016 27 MAY
Friday

28 MAY
Saturday 2016



Balance weights should be so adjusted that effort for raising & lowering is almost the same. However, balance should be slightly tilted towards the boom side so that in closed position the boom tips sits properly in the end post.

Emergency Sliding Boom

Emergency Sliding Boom is provided in addition to Electric Lifting Barrier at Level Crossing gates for passage of trains on proper signal when Electric lifting barrier is defective or damaged due to hitting of any road vehicle or failed due to any other reason and barriers cannot be closed properly.

Two Emergency Sliding Booms are installed on either side of the track. Emergency Sliding Booms are operated and locked manually to close and lock the LC gate for passage of trains on proper signal when Electric lifting barrier is defective due to any reason and gate cannot be closed and locked against road traffic.

Limit switch / cam adjustment should be proper for auto stop of motors, boom lock detection & position feedback.

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Monday

2016



Indian Railways

Centre for Advanced Maintenance Technology

Packing below gear box should be properly adjusted to ensure correct position of connecting link.



Seal nuts with an adhesive where possible to avoid loosening due to vibrations.

POWER SUPPLY



JUNE 2016

PLANNER

JUNE 2016

1	Wed	
2	Thu	
3	Fri	
4	Sat	
5	Sun	
6	Mon	
7	Tue	
8	Wed	
9	Thu	
10	Fri	
11	Sat	
12	Sun	
13	Mon	
14	Tue	
15	Wed	
16	Thu	
17	Fri	
18	Sat	
19	Sun	
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22	Wed	
23	Thu	
24	Fri	
25	Sat	
26	Sun	
27	Mon	
28	Tue	
29	Wed	
30	Thu	

Lead Acid Cell parameters

Fully charged lead acid cell voltage	2.2 Volts.
End point voltage of a discharged lead acid cell	1.85 Volts.
Specific gravity of a charged lead acid cell	1220 \pm 5
Specific gravity of a discharged lead acid cell	1180 +5
Electrolyte used in lead acid cell	Dilute Sulphuric Acid
Electrodes	PbO ₂ is + ve Sponge Pb is - ve

Batteries should be placed in well ventilated room. Normally natural ventilation is sufficient. For large installation, forced ventilation by exhaust fan may be provided.

VRLA Cell parameters

Fully charged VRLA cell voltage	2.2 Volts.
End point voltage of a Discharged VRLA cell	1.75 Volts.
Boost Charge Voltage	2.3 V per cell (for 16 Hrs.)
Float Charge Voltage	2.25 V per cell & Charging Current should be limited to 20% of its AH capacity
Electrolyte used in VRLA cell	Dilute Sulphuric Acid
Electrodes	PbO ₂ is + ve Sponge Pb is - ve

Batteries should be kept away from any heat radiating equipment.

Saturday



Battery Charger parameters

IRS Specification no. of a battery charger	IRS-S-86/2000 Amdt- No. 4
In put voltage range of a battery charger	160 –270 V AC
Current rating of a charger	Load current +AH Capacity of the cell/10

Keep the batteries from moisture, oil and dirt.

SMPS based Integrated Power Supply

The SMPS based IPS consist of the following:

AC Distribution Panel (ACDP)

This cabinet consists of

- Inverters.
- Ferro resonant based Automatic Voltage Regulator (AVR) or Bypass CVT.
- Transformers.

SMPS based Float cum Boost Charger (FRBC) Panel

This panel consists of

- FRBC (Float Rectifier cum Boost Charger) module.
- Distribution/Supervisory control/Alarm (DSA) unit.

DC Distribution Panel (DCDP)

This panel consists of

- DC-DC converters.
- Common Digital Voltmeter for measurement.

Do not hold the batteries/cells by the electrode terminals at the time of transportation/installation.

Ferro Resonant Voltage Regulator (FRVR) parameters

IRS Specification no. of FRVR	RDSO/SPN/165/2012 (Ver.3.0)
Input voltage range of FRVR	160 -270 Volts
FRVR output voltage	230 +1% Volts AC
Operating Frequency	50 Hz \pm 2.5

Apply a coat of petroleum jelly or non-oxidizing grease on the battery connection to avoid corrosion.

2016 07 JUNE
Tuesday

08

Wednesday

2016



$$\text{Total DC Load} = \frac{\text{Voltage X Current}}{\text{Power Factor X Efficiency}}$$

$$= \frac{\text{Voltage X (Boost Charging Current of the cell+Load Current)}}{\text{Power Factor X Efficiency of Charger}}$$

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Electrical connections should always be kept tight. Loose connections get heated up and produce spark, leading to failures.

2016 09 JUNE
Thursday

10 JUNE 2016
Friday



Load on Primary Side of 230 V/110 V Signal Transformer

$$= \frac{\text{Load on Secondary side of the transformer}}{\text{Efficiency}}$$

Efficiency of 230 V/110 V Signal Transformer = 85% or 0.85

After resumption of power supply failure, battery should be charged on boost mode to maintain the battery in fully charged condition.



Factor of safety = 1.5

Remove dust and foreign particles within the chassis of power equipments like transformer, battery charger, inverter etc. using compression air or blower.

12 JUNE
Sunday 2016



Integrated Power Supply system

The function of Integrated Power Supply system is to provide a stable and reliable AC and DC power supply to the Railway signalling installations against all AC mains variations or even interruptions. This is very essential for proper movement of trains. As the name indicates, it is designed and developed with a view to provide complete power solutions from single system to all signalling circuits. The IPS for Railway Signalling circuits shall be manufactured as per Latest RDSO specification no. RDSO/SPN/165/2012 Version3.0.

At present following are the RDSO approved firms for supply and installation of IPS system on Indian Railways:

- 1 M/s Amara Raja Power Systems Pvt. Ltd., Tirupati.(A.P.)
- 2 .M/s Statcon Power Controls Ltd., Noida (U.P.)
- 3 .M/s HBL Nife Power System Ltd. Hyderabad (A.P.)

Clean electrical contacts of power equipments with a cloth dampened in with carbon tetra chloride. Do not use cleaning solvents on electrical contacts. Replace if found defective.

2016 13 JUNE
Monday

14 JUNE **2016**
Tuesday



DC Track circuits Load

$$= \frac{\text{No. of track circuits} \times \text{Voltage of Track Circuit X (Boost Charging Current + Load Current)}}{\text{Power Factor} \times \text{Efficiency of Track Feed Battery Charger}}$$

$$= \frac{n \times 6V \times (4A + 0.5A)}{0.8 \times 0.5}$$

Do not over load the inverter or connect loads like tube light, fan ,drilling machine to output.

2016 15 JUNE
Wednesday

16 JUNE **2016**
Thursday


$$\text{Capacity of DG Set} = \text{Total Load in VA} \times \text{Factor of safety}$$

Where Factor of Safety = 1.3

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Once in a month, switch OFF Stand-by Converter in IPS and observe if the main is taking the load.

Integrated Power Supply (IPS) parameters

IRS Specification no. of IPS	RDSO/SPN/165/2012 (Ver.3.0)
Input voltage range of SMR	160 – 270 Volts AC
SMPS output voltage	160 – 270 V AC
CVT input voltage	230 V AC
Input voltage of DC - DC converter in IPS	110V DC

Cleaning of dust collected inside the IPS panels (SMPS, DCDP & ACDP) should be done with the help of blower once in a month.

18 JUNE
Saturday **2016**



SMPS based Integrated Power Supply Auto Float Mode

The float voltage of each rectifier module shall be set as given in the following table:

No. of cells	Auto Float mode voltage	
	VRLA Cells	Conv. LA Cells
55	123.8 V	118.25 V

Normal Float voltage for VRLA battery is 2.25 V/Cell and for conventional battery it shall be 2.15 V/Cell.

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Keep the AC Input MCBs of at least 2 SMRs in IPS always ON.

SMPS based Integrated Power Supply

DC-DC Converters

DC-DC Converters provide different DC voltage from input DC voltage range of 98 V to 138 V.

DC-DC Converters are connected in the following order:

Sr. No.	Equipment	Rating
1	Relay Internal	24-32V, 5A OR 60- 66V,5A
2	Relay External	24-32V, 5A OR 60- 66V,5A
3	Axle Counter	24V, 5A
4	Block Local UP	12-40V, 1 A
5	Block Local DN	12-40V, 1A
6	Panel Indication	12-28 V,5A
7	Block Line UP	12-40V, 1 A
8	Block Line DN	12-40V, 1A
9	Block Tele UP	3-6V, 0.1A
10	Block Tele DN	3-6V, 0.1A

DC-DC Converter of 12-40V, 1A is suitable for double line block instrument. For other type of block instruments any of the following ranges can be selected:

- 40-60V
- 60-100V
- 100-150V

Whenever block proving by axle counter is used, the DC-DC Converter of 24V/5A (2 Nos.) is used in place of block line DC-DC Converters.

Keep the Inverter Input MCBs in IPS always ON.

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Monday



SMPS based Integrated Power Supply

Auto Boost Mode

The Boost voltage of each rectifier module shall be set as given in the following table:

No. of cells	Auto Boost mode voltage	
	VRLA Cells	Conv. LA Cells
55	126.5 V	133.1 V

Normal Boost voltage for VRLA battery is 2.3 V/Cell and for conventional battery it shall be 2.42 V/Cell

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Keep the AC Input switches always ON in Step Down Transformers in an IPS.



Inverter

The Inverter provided in an IPS is of Pulse Width Modulation (PWM) type. The Inverter is designed for continuous operation for an input voltage of 98 V to 138 V DC at a nominal voltage of 110 V DC and shall be rated for an output of 230 V.

Keep the DC Input switches always ON in Converters of IPS.

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Wednesday

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Indian Railways
Centre for Advanced Maintenance Technology

SMPS based Integrated Power Supply

Ferro Resonant type AVR or Bypass CVT

The AVR works satisfactorily within a range of 160 V to 270 V input at 50 Hz mains supply. The output voltage shall be maintained within 230V+/-1% when the unit is connected to rated load.

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Keep the AC Input switches always ON in Bypass CVT Regulator of IPS.

SMPS based Integrated Power Supply

Transformers

The supply from AC Bus (either from Inverter or from Bypass CVT/AVR) is fed to each Transformer through an AC input ON/OFF switch. Necessary tapplings (100 V, 110 V, 120 V, 130 V) are provided at the secondary of each transformer.

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Check the healthiness of SPD periodically and whenever you feel surge is occurred.

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Indian Railways
Centre for Advanced Maintenance Technology

SMPS based Integrated Power Supply

FRBC or SMR Module

The FRBC module is of 110 V/20 A rating. The module is capable of operating in “Auto Float cum Boost Charger” mode. It is programmed to operate as a float rectifier or a Boost charger depending on the condition of the battery being sensed by the switching/control unit. Sometimes it is also called as Switch Mode Rectifier (SMR) Module. The module comprises of a number of (3 or 4) SMRs.

Do not connect the Battery Bank to the IPS without removing the battery fuse.



IPS system is suitable for charging 110 V battery bank of Low maintenance cells as per as per IRS S88/93 or VRLA Maintenance free cells as per IRS:S-93/96A. Purchaser shall specify about type of batteries to be used. The battery is to be installed in a separate room.

26 JUNE
Sunday 2016



Capacity of a Transformer

The capacity of a transformer depends on the load to be connected on the secondary side, which is calculated in terms of VA (Volt Amperes).

The capacity of the transformer is calculated as

Capacity = Load on Secondary in VA X 1.5 (where 1.5 is factor of safety)

Nearest higher ratings may be selected which are 1KVA, 2KVA, 3KVA, 4kVA & 5KVA

Do not disturb the potentiometers used in PCBs in an IPS. They have to be adjusted at factory only.

2016 27 JUNE
Monday

SMPS based Integrated Power Supply

The DC-DC converter for Axle Counters, SSI and Data loggers are optional. The distribution cabinet shall have provision for accommodation of optional DC-DC converters. For 60 V operated metal to metal relay installation, the ratings of DC-DC converter for relay internal and relay external shall be 60-66 V/5A in lieu of 24-32V/5A modules.

Do not restart the IPS system without knowing the basic cause.

28 JUNE **2016**
Tuesday



Initial Charging

In initial charging, output DC voltage of the charger is set at about 2.7 V per cell. . It happens when the selection switch is changed to INITIAL mode position and no adjustments need to be done. This mode is used only when the charger is used to charge uncharged (new) cells. This mode can also be used temporarily for a short duration to charge the bank where more than the specified numbers of cells are connected. For example to charge the bank consisting of 14 cells from a 24V battery charger.

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.

Never use wire fuses. Always use prescribed standard rating fuses.

In float charging, output DC voltage of the charger is set at about 2.15 V per cell. This voltage can be varied from 2.12 V to 2.3 V per cell by adjusting the voltage control provided on the charger. The cells get charged as long as the float voltage is more than the cell voltage. The maximum current that can be pumped into the cells is controlled by the current knob provided inside the charger. The float charging is like giving a normal diet to a healthy person

Once in a month, check for Auto changeover operation between Inverters and Bypass CVT as described in instruction manual.

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Indian Railways

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Boost Charging

In boost charging, output DC voltage of the charger is set at 2.4 V per cell. It happens when the selection switch is changed to BOOST mode position and no adjustments need to be done. The maximum current that can be pumped into the cells is controlled by the current knob provided inside the charger. The boost charging is recommended when the cells have run down. The boost charging is like giving a special diet to a recouping patient.

IPS system shall be provided with Class B and Class C type two stage protection.

AXLE COUNTERS



JULY 2016

PLANNER

JULY 2016

1	Fri	
2	Sat	
3	Sun	
4	Mon	
5	Tue	
6	Wed	
7	Thu	
8	Fri	
9	Sat	
10	Sun	
11	Mon	
12	Tue	
13	Wed	
14	Thu	
15	Fri	
16	Sat	
17	Sun	
18	Mon	
19	Tue	
20	Wed	
21	Thu	
22	Fri	
23	Sat	
24	Sun	
25	Mon	
26	Tue	
27	Wed	
28	Thu	
29	Fri	
30	Sat	
31	Sun	

Eldyne AzLM / AzLS

Earthing

- Mushroom/Dust Cover to be earthed with 25 sq mm copper cable along with lug.
- Earthing value should be ≤ 1 Ohm.
- Earthing of quad cable armour ≤ 1 ohm
- Earthing of ACE cabinet of AzLM - ACE cabinet to be earthed with 25 sq mm copper cable along with lug.(Earthing value ≤ 1 ohm)

On each visit, carry out visual inspection of trackside equipment i.e. EJB, track devices and integral cables (connecting leads), earthing etc.

Fixing of track devices

1. Rail height -The rail height should be within vertical limit of worn out (13mm for 60 Kg rail, 8mm for 52 Kg rail, 5mm for 90R rail)
2. There should be no embossing on the rail web where holes are to be drilled.
3. Recommended distance from rail joint (fish-plated or welded or insulating joint)
 - not less than 1 metre, in normal conditions.
 - not less than 2 metre, if the condition of the track is poor
4. Mandatory distance from rail contact of same type (Sk30, Sk30H) of a neighbouring detection - not less than 2 metre

Ensure the proper size and tightness of deflectors and that these are fitted at least 250 mm away from rail contacts (Tx/Rx coils).

Multiple Section Digital Axle Counter

Multi Section Digital Axle Counter consists of axle detectors and field units configuring upto (n-1) track sections, where n is the number of detection points. It is capable of counting axles, count comparison, finding direction of axle movement, supervision, relay drive and transmission of counts and health of axle detectors and field units. The field units are connected to the Central Evaluator by transmission medium where transmission is in VF range.

Track clear indication shall only be given when IN count and OUT count are equal and equipment is functioning all right. Axle counter shows occupied when any of its sub- assemblies belonging to the section is damaged, missing or has become faulty.

MSDAC works on high frequency and using 'Phase Modulation' with phase reversal of 180 degree out of phase unlike conventional axle counter which works on 'Amplitude Modulation'. On Indian Railways Multi Section Digital Axle Counters are designed as

per RDSO Specification No. RDSO/SPN/176/2013 Ver.-3 & Manufacturers's Spec.

For transmission of data between field units and Central Evaluator following communication links can be used:

- a) Telecomm. Quad cable (0.9 mm. dia.) – ½ quad (As per IRS:TC:30/97).
- b) PIJF cable (0.9 mm. dia.) – 1 pair (IRS:TC 41/97).
- c) OFC – One 2 wire voice channel.

Ensure that cable armours are properly earthed in location box.

Height of mounting hole from the foot of the rail for different rail profiles is given below:

Rail Profile	90 lb	52 Kg	60 Kg
Height	56 mm	63 mm	68 mm

Drill the final three holes of diameter 13mm on the rail web with the help of drilling jig.

Inter hole distance = 148 mm + 0.2 mm

Diameter of mounting holes = 13 mm + 0.2 mm

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are approximately 20 lines visible. The paper has a slight shadow on its right side, suggesting it's resting on a surface.

Check for proper spacing (min. 350 mm) and packing of sleepers on which track devices are fitted.

Tightening of M8 bolts - 4 nos. of M8 bolts on Tx heads to be tightened with adjustable torque wrench (supplied with tool kit ETU001) set at 25Nm.

Check that cable pairs used are properly dressed and terminated in such a way that no conductors remain exposed and check that no individual conductor are made spiral. These should be twisted in pair to improve its Electromagnetic compatibility.

Eldyne AzLM

- Power Supply Voltage range to EJB - 54V to 72V (at Terminal 3 & 13)
- Minimum voltage required on EJB $\geq 54V$ DC
- Transmitter freq. Sk1 30 to 31.25KHz (Terminal Sk1/S1 & Sk1/S2)
- Transmitter volt. Sk1 40 to 85 VAC (Terminal Sk1/S1 & Sk1/S2)
- Transmitter freq. Sk2 27.4 to 28.6KHz (Terminal Sk2/S1 & Sk2/S2)
- Transmitter volt. Sk2 40 to 85 VAC (Terminal Sk2/S1 & Sk2/S2)
- ACE Voltage > 21.5 V DC
- Input to PDCU > 54 V DC

Measure the earth resistance and paint its value on earth enclosures/nearest wall. If required take suitable steps to improve the earth resistance. It should be less than 1 Ohm.

Eldyne AzLS

- Power Supply Voltage range to EJB **21.5V to 28.8V** (at Terminal 2 & 18)
- Minimum voltage required on EJB $\geq 21.5V$ DC
- Transmitter frequency Sk1 30 to 31.25KHz (at Terminal Sk1/S1 & Sk1/S2)
- Transmitter voltage Sk1 40 to 85 VAC (at Terminal Sk1/S1 & Sk1/S2)
- Transmitter frequency Sk2 27.4 to 28.6KHz (at Terminal Sk2/S1 & Sk2/S2)
- Transmitter voltage Sk2 40 to 85 VAC (at Terminal Sk2/S1 & Sk2/S2)

Eldyne AzLM/AzLS- For reduction in temperature, paint the inside and outside of mushroom cover (apparatus case for EAK) with temperature retardant paint (white).

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Friday

2016



Indian Railways
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Siemens Az S 350 U MSDAC

Fixing of track devices

Different rail profiles and the associated distances (X) from bottom of rail base to centre of hole:

Rail profile	60 Kg	52 Kg	90 R
Distance X [mm] + 1.5 mm	85 mm	69 mm	56 mm
Height of new rail [mm]	172 mm	156 mm	143 mm
Permissible wear-and-tear [mm]	13 mm	8 mm	5 mm

For drilling the holes (Ø 13 mm) and a drilling jig (C25326-A28-A1) is to be used

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.

Always use proper size (13mm) high speed drill bit to drill holes on rail web.

Siemens Az S 350 U MSDAC

Pre-requisites for mounting DEK 43 Electronic Double Wheel Detector

- (1) DEK 43 should be installed in the space between sleepers. A gap of minimum 400 mm is required between two sleepers.
- (2) It should not be next to a rail joint or weld. A distance of minimum four sleeper spaces is to be maintained from the rail joint or weld.
- (3) The DEK 43 should not be mounted to rails showing signs of excessive wear and gauge widening either.
- (4) The ballast should be well tamped and the rail firmly attached to the sleeper.

Never use any kind of hand spanner to fix the track device nuts/ bolts. Use only prescribed torque wrench.

Multi Section Digital Axle Counter

The possibility of reset will be as per table below:

Sr. No.	Condition	Whether Reset permitted Yes/No
1	No in-count, No out-count, Section clear and healthy.	No
2	No in-count, No out-count, Error has occurred.	Yes
3	Only in-count, No out-count, System healthy.	No
4	Only in-count, No out-count, Error has occurred.	Yes
5	In-count and out-count started, System healthy.	Yes
6	In-count and out-count started, Error has occurred.	Yes
7	No in-count, but only out-count started, System goes to error.	Yes
8	System in preparatory mode.	No

Never set the addresses while the detection point is live.

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Monday

Siemens Az S 350 U MSDAC

Earthing the Trackside Connection Box

The earth terminal of trackside connection box of ZP 43 Wheel Detection Equipment must be connected to the railway earth conductor or earth rail, the cable shield, the cable armouring and the lightning protection module board by 35 sq mm Copper or 96 sq mm Steel earthing cable.

Never plug in or pull out any card/PCB from the EJB while the detection point is live (power is on).

12 JULY
Tuesday 2016



Siemens Az S 350 U MSDAC

Power Supply

Power supply module accepts input voltage 24 VDC to 60 VDC (+20%; -10%). and provides controlled output voltages **5 V** for operation of Evaluation computer, **70 V for operation of max. five counting heads.**

Power supply provided to Evaluation Computer shall be ripple free and continuous. Max permissible ripple content is 50mV. Preferably supply to Evaluation Computer shall be given through IPS having specification no RDSO/SPN/165/2012

Avoid any kind of loops in the track devices (Tx & Rx) connecting cables.



- Power supply to EJB -23 V to 28.8 V DC (at terminals TS1/1 & 5)
- TX1 Voltage & Frequency 30 to 40 V/ 20.8 to 21.2 KHz (at terminals TS4/1 & 2)
- TX2 Voltage & Frequency 30 to 40 V/ 22.8 to 23.2 KHz (at terminals TS4/3 & 4)

Take all the measurements whenever the Detection Point is adjusted.

14 JULY 2016
Thursday



CEL DACF 710 A/P

Earthing

Earth Electrode should be Galvanised iron pipe(s) of internal diameter ≥ 38 mm and length ≥ 2.5 mtr. in length with spike at one end and lug at the other end for connecting with earth lead. The lead wires used for connecting the installation and the earth electrode – 29 sq mm (19 strand wires of 1.4 mm diameter). In areas where copper wire may be frequently stolen due to theft, ACSR of size 64 sq.mm (19 strands of 2.11 mm diameter) may be used. The maximum values of earth resistance specified for earthing of SSDAC and its accessories are as follows:

S. No.	Equipment to be earthed	Value of Earth resistance
1	Apparatus case connected to Earth (SSDAC and vital relay box if housed in apparatus case are connected to same earth). All cable armours connected to same earth.	≤ 1 Ohms
2.	Reset box connected to earth (indoor) near SM's Room.	≤ 1 Ohms

Check that all earth connections are intact and making good contact and earth lead wire, not connecting earth wires etc. are not corroded.

CEL DACF 710 A/P

Fixing of Axle detectors

- The marking jig is to be fixed from top of the rail and tightened to the rail with clamps.
- The marking for 3 holes with punch is to be made on the Web of rail using marking jig.
- The marking for 3 holes is given at a distance of 0 - 170 – 340 mm.
- The 3 Holes of specified dimension given in table below are to be drilled on the web as per the markings at each location.

Rail Profile	90 lb	52 Kg	60 Kg
Distance from top of the rail	86 mm	86 mm	86 mm

- The drilling is to be carried out on the web of rail at marked places with the help of drill machine by ratchet drill method.
- The burr is to be removed from the holes after drilling

Ensure that all the indications of DP on Evaluator are displaying the normal function.

CEL DACF 710 A/P

Pre-requisites for installation of Axle detectors

- The Axle detector separation between two sets of different SSDAC systems should be at least 2 meters so as to avoid mutual interference.
- The detectors have to be fixed on the clear spacing between two sleepers.
- It should be ensured that the rail is not badly worn causing the wheel flanges to graze over the fittings.
- Transmitter and Receiver cables are to be laid in the 40mm HDPE pipe for safety and buried underground below ballast at the depth of approx. 0.3mts.
- Transmitter and Receiver cables should run separately at a minimum separation of 400mm in different HDPE pipes.
- The transmitter and Receiver coils are provided with 23/0.2mm, 2 core shielded PVC cable with gray sheath and have to be taken to location box directly without any loops.

In MSDAC, never plug in or pull out any card while the Evaluator is live.



Inspect the battery charger/IPS module and check its charging current and ensure it is properly charging the battery where provided.

18 JULY
Monday 2016



GG Tronis G36 SSDAC

- Input voltage to EJB -22 V to 30 V DC (at FTB 1 & 2)
- TX1 Voltage & Frequency 40 to 70 V DC/ 20.802 to 21.302 KHz (at FTB 31 & 32)
- TX2 Voltage & Frequency 40 to 70 V/ 24.750 to 25.250 KHz (at FTB 33 & 34)

Any interference with power supply and connections should be done only after ensuring that no train is occupying or approaching the section.

(3) **GG Tronis G36**

Power Supply Arrangement

The SSDAC system works on 24V DC supply. This has to be provided by the respective station through power cables. The continuous current drain, requirement of battery and battery charger are as indicated in Table below:

S. No.	Configuration	Continuous current drain	Battery capacity	Charger capacity
1.	2DP1S version	< 2 Amp.	24 V/40 A.H. – 1 set	5 Amp. – 2 Nos.
2.	3DP1S version	< 3 Amp.	24 V/40 A.H. – 1 set	5 Amp. – 1 No.
3.	3DP2S version	< 3 Amp.	24 V/40 A.H.–3 sets	5 Amp. – 3 Nos.

The key actuator and Reset button of reset box should not be disturbed when the train is occupying the track section.

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Wednesday

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GG Tronis G36 SSDAC **Fixing of Track Devices**

- The 3 Holes of 13 mm dia. are required to be marked and drilled for fixing web mounted TX/RX coils at each location with spacing of 183mm.
- From bottom of the rail drill the holes at 68 mm for 52 KG, 84 mm for 60 KG and 57 mm for 90 R.

Before declaring any card is faulty, the fault should be analysed and confirmed.



Sr. No.	Signal	Visibility
1	Distant	400 m
2	Inner Distant (where provided)	200 m
3	All Stop Signals	200 m

Suitable speed restriction to be provided if a stop signal is not visible within 200 m

[illegible]

Repair of cards is a highly technical job and is not possible at site. Hence staff should not carry it out. The card should be sent to the firm or authorized workshop for repair.

22 JULY
Friday 2016



Applications of Digital Axle counters:

Digital Axle counters both Single section and Multi section have a variety of applications. Following are the types applications :

- Berthing tracks in station areas and yards.
- Point zones in station areas and yard.
- Automatic Signalling sections.
- Block working through axle counters.
- Level Crossing warning system using axle counter.
- Intermediate Block Signalling (IBS) in Double line sections

While installation, ensure that Receiver and Transmitter coil cables have been laid in different pipes.

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Saturday

Boundary of track circuit ahead of signal

The first insulated rail/block joint or device of axle counters or jointless track circuit shall be located at not more than 3 metres *(earlier 13 metres) from the foot of the signal controlled by that track section. (* *Ref.: Railway Board's letter No.2012/Sig/SEM-II/Misc dated 10.10.2012*)

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Ensure that packing of sleepers with ballast on both sides of Axle detector is proper.

Resetting of Digital Axle Counter

There are three types of reset applied for a Digital Axle Counter, namely:

Direct Hard Reset

Direct hard reset shall not be provided normally, which resets the axle counter directly to clear the axle counter without any verification/co-operation/piloting or out count.

Preparatory Reset

After doing preparatory reset, axle counter continues to show occupied until one train movement takes place in the section by piloting.

Conditional Hard Reset

This reset is activated after physical verification of clearance of track section from site using line verification box. The axle counter will show clear after conditional hard reset. Depending on the application of axle counter, different types of procedures are followed as given in the following table:

S. No.	Axle Counter Track Section	Type of reset
1.	Points zone	Conditional Hard Reset
2.	Loop line and Sidings	Conditional Hard Reset
3.	Main line	Preparatory Reset
4.	Section between Advance Starter and IBS	Preparatory Reset
5.	Automatic section	Preparatory Reset
6.	Block Proving by Axle Counter	Preparatory Reset

- A reset operation is only possible when section is occupied or disturbed or there is an error in the system.
- Reset key operation (including line verification switch) should be performed by an authorized person only.

Check that metal sheaths of the outdoor cable are connected to earth at both ends.

2016 25 JULY
Monday

SSDAC application for Block working through axle counters

BPAC is achieved by using SSDAC and UFSBI

AT station A, one set of axle detectors are installed not more than 3 m* (earlier 13 metres) ahead of Advance Starter and another set of axle detectors at more than 180 m beyond Home Signal. Similar arrangement for station B. (* Ref.: *Railway Board's letter No.2012/Sig/SEM-II/Misc dated 10.10.2012*).

Cabling requirement for SSDAC

1/2 quad or 2 wire voice channel in OFC for each direction i.e. UP & DN for Double Line.

1/2 quad or 2 wire voice channel in OFC for Single Line.

[illegible]

Ensure that the M.S Circular connectors of EJB (if provided) are tightened and maintained firmly.

Use of 470:600 Ω isolation transformer in BPAC

For the BPAC system which has to run on Copper cable in RE area V/F tapping transformer is required as per IRS:TC 76-2006. Characteristics impedance for V/F transformer is 600 Ω on primary side (i.e. BPAC side) and Quad cable impedance on secondary side (normally it is 470 Ω). The 470:600 Ω isolation transformer is provided to transfer the maximum power. It prevents surges/interference of RE. The Transformer is housed in the metallic case filled with insulating compound and is hermetically sealed, to withstand extreme weather conditions. Terminals are taken out on the top of the transformer case through proper feed through terminals.

Resetting should be done only after ensuring that there is no train in the section

Instruments to be used for measurement of various parameters of quad cables

- (i) **Selective Level Meter (SLM)**
For measurement of attenuation loss at working frequency.
- (ii) **Sophosometric Meter**
For cross talk measurement.
- (iii) **LCR Meter**
For loop resistance measurement
- (iv) **Earth Meter**
For Earth resistance measurement.

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.

Don't install the Axle detectors near the rail joint (should be more than 6 sleepers away).

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Thursday

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Centre for Advanced Maintenance Technology

Separation of UP & DN DAC circuits in BPAC

DAC circuits in BPAC of UP and DN lines in double line sections shall be in **separate quads** and kept one/two quad distance away from each other to avoid mutual interference in long parallel circuits.

This image shows a single sheet of white paper with horizontal blue ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Don't install the Axle detectors where the rail is badly worn out.



DAC circuits in location shall not be bunched along with parallel relay/power circuits. Relay circuits are known to generate switching transients that can couple enough energy in parallel circuits nearby and **interfere** with low power DAC data circuits.

Don't cut or join the Transmitter / Receiver cables supplied along with the coil. It would result in change of frequency of signal.

30 JULY **2016**
Saturday



As per Technical Advisory Note No.TAN/6001 vide letter No. STS/E/AC/Digital/Genl dated 04.10.2011:

Relay circuits shall preferably not be taken in same cable as DAC circuits. In unavoidable circumstances relay circuits shall be in furthest quad (spatially) from the one containing DAC circuits

Avoid installing the Axle detectors on curve of rail / too much slope of rail to the possible extent.

As per Technical Advisory Note No.TAN/6001 vide letter No. STS/E/AC/Digital/Genl dated 04.10.2011:

Twisting of cable pair

- a. Twisted pairs are required to avoid **mutual interference** between low level data signals. Even short lengths of non- twisting (few inches) can couple enough noise to interfere low voltage DAC communication signals.
- b. Quad cable twisting shall be ensured during termination so that **minimum one twist per inch** is maintained till the last inch into terminations.
- c. Any wiring from quad cable terminations to equipment shall be done using **twisted singles** of indoor signalling cable (1 mm square) or any other approved indoor twisted pair cable.
- d. Signalling cable or any other untwisted cable pair **shall never** be used in DAC communication circuits to avoid intermittent type of failure.

Remove any card in the EJB or Evaluator if necessary only after Switching OFF the power to the unit.

Panel & Route Relay Interlocking



AUGUST 2016

PLANNER
AUGUST 2016

1	Mon	
2	Tue	
3	Wed	
4	Thu	
5	Fri	
6	Sat	
7	Sun	
8	Mon	
9	Tue	
10	Wed	
11	Thu	
12	Fri	
13	Sat	
14	Sun	
15	Mon	
16	Tue	
17	Wed	
18	Thu	
19	Fri	
20	Sat	
21	Sun	
22	Mon	
23	Tue	
24	Wed	
25	Thu	
26	Fri	
27	Sat	
28	Sun	
29	Mon	
30	Tue	
31	Wed	

Approach Locking distances

Signal	Distance
For Main line Home in absolute Block	Dead Approach
For Main Line Starter	Up to Home if Main home cleared otherwise berthing track
For loop line starter	Berthing track
Shunt signal	Track circuit just in rear of shunt signal
For L.S.S	Free (No approach locking required as there are no points ahead of LSS)
For signals which do not have track circuits behind the signal or the track circuited portion behind the signal is does not cover full approach locking distance	Dead approach

One Signal One Movement: - Signal re-clearing automatically after a train completely passed the route which is prevented by a relay LS or SR or TSR.

02 AUGUST
Tuesday **2016**



Siemens PI/RRI

GNR : Signal push button relay.

GNCR : All signal push button normal checking relay.

GNR relay is provided in the respective Signal groups

GNCR relay is provided seperately in a K-50 mini group

[illegible]

Wherever facility is provided to cancel a signalled move by normalising the signal lever after a specified time delay, it shall be proved before clearing a signal that the concerned timer circuit NJPR/JR is normal.



UNR : - Route push button relay.
 UNCR: - All route push button normal checking relay.
 WWNR:- Common Point Button Relay for regular operation
 EWNr :- Common Point Button Relay for emergency operation.
 WNR :– Point push button relay.
 WNCr :- All point button normal checking relay

All the above relays are provided separately in a K-50 mini group

In case of Last Stop Signal (LSS), the line clear condition shall be proved to ensure that the proper line clear has been obtained in addition to SM's control, if any.

04

AUGUST
Thursday



Siemens PI/RRI

NNCR :- All (NNCR) button Normal checking relay

When all the button checking relays (GNCR, UNCR, WNCR), EUUYNR, EUYNR, EGGNR, ZDUCR, EWNr, WWNR, their repeater relays are in dropped condition, the button-checking relay NNCR relay energizes

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.

If an interlocked LC gate falls in the route or overlap of a signal, then it shall be ensured that it is closed and locked against road traffic. This is achieved by proving LXPR/LCPR in energised condition.

Siemens PI

The relays of points group involved in *point control initiation*

Z1WR1(1) - Pick up coil of First Point control Initiating Relay (common for 'N' & 'R' operations).

Z1WR1(2) - Hold coil of the above relay.

Function : Proves Route and Track locking conditions of the point to be operated.

If Sidings of locally worked points, if any, in route or overlap (for running signals like Home, Calling-on and Starter signals) is set in normal condition, it is proved by Siding NPR in energised condition.

06 AUGUST 2016
Saturday



Siemens PI

The relays of points group involved in point control initiation

WKR3(1) -Pickup coil of Third Point Detection Relay

Function - Detects Normal condition of Point control disconnects detection supply for initiating its Reverse operation

WJR- Point operation Time limiting Relay.

Function-Proves Reverse condition of point control for initiating its Normal operation

WKR1 - First Point Detection Relay.

Function - Drops to remove Point detection before initiating its operation

Unless concerned signal lever/switch is reversed 'signal controlling relay (HR/HHR/DR/UHR'S) should not be energized.

Siemens PI/RR1

Back Locking Testing

- (i) Clear the concerned signal. Flicker each TPR in the main route of the signal, its overlap and isolation. The signal should go to danger when TPR is dropped and should re-clear when track circuit is picked up.
- (ii) Now fail the TPR permanently and after a few seconds pick it up. The signal should not re-clear indicating that GR1 has dropped.
- (iii) Again fail the TPR permanently and do three button cancellation by signal button and leave the buttons with TPR failed. No sub route should get released.
- (iv) Again do three button cancellation and keep GN and UN buttons pressed and pick up the TPR being tested. All sub-routes and Ovs should get released as soon as the TPR is picked up in case the track circuit is Berthing track, Overlap track or isolation track. The routes will get released even with TPR dropped. In case of Dead approach Signal, the above testing must be done after the final timer relay AJTR3 has picked up. Repeat the above testing till the last OV track.

Instead of having individual TSR for each signal in the yard, wherever possible a common TSR may be provided to reduce number of relays required in an installation.

08

AUGUST
Monday

2016



Siemens PI

W(R)R/ W(N)R (Interlocked) - Points Operating circuit switching Relay/ Points Detection circuit switching Relay.

Function - Latches in Reverse to connect the operating feed to motor when final control relay (WR) is energized.

Common TSR can be provided for (a) The signals which are of conflicting nature and (b) Having common controlling track circuit.

2016 09 AUGUST
Tuesday

Siemens PI

Z1NWR - Point Normal control Initiating relay

Function - Energises when normal point control is established and remain in energised condition as long as the buttons are in pressed condition

Z1RWR - Point Reverse control Initiating relay

Function - Energises when Reverse point control is established and remain in energised condition as long as the buttons are in pressed condition.

For signals leading to more than one route, separate slots must be obtained for each route.

10

AUGUST
Wednesday

2016



Sub-Routes in Siemens PI/RRI

In Siemes Relay Interlocking system the entire layout is divided into a signal route and further into a sub-route to facilitate the sectional route release.

Each sub-route includes one or more point in it. Sometimes, sub-routes without point can also exist for achieving special condition of interlocking. Sub-routes are numbered as per the number of any one of the points which exist in it. If there is no point, such sub-route will be numbered as per the signals controlled by it.

A signal, which is capable of being worked as a manual stop signal as well as an automatic signal, is known as semi-automatic signal.

12 AUGUST **2016**
Friday



Route Sections in Siemens PI/RRI

Each sub-route is further divided into route sections.

Each route section usually giving certain specified setting of points. The straight movement over a sub-route requiring points in normal position is called "A" route section and the diverging route requiring points in reverse is called B or C or D route section. A sub-route can have one route section or more number of route sections.

Track Locking is provided to prevent operation of point while train is still on point zone section.

To record each emergency operation, counters of emergency operations are provided close to the concerned buttons at the top of the panel as below:

CH1Z/ CH2Z/CH3Z/etc - Crank handle Release Operation Counter (Individual for each group.)

Indication Locking is provided to prevent out of correspondence between function position at site and control of that function.

Siemens PI/RRI

Approach Locking Testing

Approach locking must be checked with each track circuit failed individually as per selection table. If selection table says ATR, then each track which is a part of ATR must be failed. The approach lock timer will start on doing three button cancellation. Try to do three button cancellation with the timer flashing, it must not be possible to release the route with timer flashing. Only after the timer becomes steady it should be possible to release the route by three button.

Siemens PI/RRI

Track Locking Testing

Track locking must be checked for each track circuit of any point/crossover individually in two steps.

(i) Fail the track circuit with the other track circuit of the point/crossover as pick up and it must not be possible to individually operate the points through WWN common points button. It must be possible to operate the point through EWN (Emergency point button) and EWN counter must increment.

(ii) Fail the other track circuit with first track circuit of the point/cross over as pick up.

Approach locking is effective when signal is taken to OFF and train within normal breaking distance from signal.

The minimum requirement of approach track circuit for various signals is as under:

- (a) Main Line Starter - 1 Km (BD) in approach of signal i.e. upto Home Signal in rear.
- (b) Loop Line Starter - Berthing Track circuit.
- (c) Shunt Signal - One Track circuit before the signal.
- (d) Home Signal - 1 Km (BD) in approach of signal.

But no approach track circuit is provided for home signal and a different type of approach locking called Dead Approach Locking is provided.

Sectional Release locking is defined in B.S.I Specification No. 719-4936 as "Route locking so arranged that train in clearing each section of the route, release the locking effecting that section.

16 AUGUST 2016
Tuesday



British PI

SMCR/SMR: Station Masters Control Relay

This relay is energized when the SM's panel key is 'IN' and turned to Normal. The Energisation of SMCR/SMR relay provides authorized operation of all the functions on the panel. When SM's key is turned to reverse and taken out from panel by SM, prevents unauthorized operation and locks the panel in the last operated position

P.I. is called as 'Non-route setting type Relay Interlocking System' and RRI as 'Route setting type Relay Interlocking System.'

Track Stick Relay (TSR)

When a signal is taken off for a train and the train passes the signal, the TSR ensures that the signal is put back to 'ON' immediately. The TSR also ensures that the signal does not reclear automatically, though knob is left in Reverse and all other conditions favourable. The stick relay is controlled by the first track circuit immediately in advance of the signal and the normal position of the concerned signal knob. This is a one signal-one train (one movement) circuit. The pickup contact of the relay is used in the signal control circuit (HR).

In Siemens PI/RR1, ZR relay normally remains energized and drops when the power supply for the track circuit fails.

18

Thursday

2016



Signal knob Reverse Relay (RR)

On panels where knobs/switches are provided for operation of signals, the knob reverse relay 'RR' is used. After the points are correctly set and locked, the signal knob is turned with SM's key 'IN', the 'RR' picks up, then the UCR picks up, ASR drops and HR picks up and the signal is taken off. On complete arrival of train the signal knob is turned back to normal position and RR drops and the route gets released.

In Siemens PI/RR1, OYN is the common Overlap Release button.

British Pl

Route Checking Relay (UCR)

Each signal will have its own UCR.

This relay is normally de-energized relay. It energizes when ever signal knob is reversed or signal knob reversed and route button pressed, provided all other required conditions are available, viz., all points in route, overlap and isolation are set & locked.

Front Contact of ASRs or back contacts of UCRs of conflicting signals are proved in UCR circuit. Concerned LR front contact also will be proved in UCR Circuits.

CH IN is also proved in UCR.

UCR front contact is proved in HR circuit.

UCR back contact is proved in ASR circuit.

[illegible]

In Siemens PI/RR1, Emergency Signal Push-button Relay (EGNR) operates when the signal button 'GN' and common emergency button 'ERN' are pressed simultaneously for throwing a clear signal to ON position.

British PI

Approach (Lock) Stick Relay (ASR/ALSR)

ALSR is a normally energized relay. Whenever a route is set and route-checking relay UCR is energized it causes ALSR to drop and there by locks the route i.e., locks all the points in the route including in overlap & isolation.

It is necessary to lock the route before a signal is taken off. Every signal will be having one ALSR and the drop contact of ALSR is proved in HR pick up circuit to ensure locking of that signal route before the signal is cleared. It mainly consists of 3 circuits (a) Indication locking (b) Back locking & (c) Approach locking

Once ASR picks up the locking effect on the signal route is released and all the points will become free. Hence before a route is released, it must be ensured that the signal is normal and the movement is completed and the route tracks are clear. To achieve that indication locking, route locking & approach locking applicable to a signal, are proved in ASR circuit.

In Siemens PI/RRI, Point Switching Group is provided at the point location for controlling of point machine other than Siemens type. This group functions in conjunction with the main point group located at the central relay room.

British PI

Route / back locking testing

For testing of back, route locking either of the following two methods may be adopted.

Method – I

Take off the signal for each and every route. Drop the track circuit and pick up the same sequentially, so as to pick up UYRs correctly.

Now drop the back lock track circuit. Put back the signal knob to normal. Route will be still in locked up condition (ASR dropped). Now all conditions are favorable for ASRs to pick up except the back lock track circuit, which is in dropped position.

Now pick up the above back lock track circuit and observe the route getting released (ASR picks up).

This operation shall be repeated for each back lock track circuit and for each and every route of each signal. The above method is suitable for way side stations.

Method – II

Take the ASR circuit (any ASR), put through UYRI, UYR2 contacts in ASR circuit and disconnect the ASR stick circuit. As per the circuit drop the back lock track circuit one by one and observe the ASR drops and picks up as and when the track circuit has picked up. This test shall be done for all the conditions. This test shall be done for all the ASRs, individually check up the parallel paths if any are defective in back lock circuit. The above method is most suitable for major yards. Do not forget to remove shorts for UYRI UYR2 contacts after the testing is completed.

As part of route holding test, attempt shall be made to release the route by cancellation when back lock track circuit is in dropped condition. It shall not be possible to initiate cancellation.

Note:

Apart from the above test the following test is also to be conducted to check the effectiveness of point locking:

Clear the signal. Observe the points free indication and compare it with the Table of Control. Attempt shall be made to operate a locked point by operating the point operating knobs. The point indication shall remain steady. Do not clear any signal. The point free indication shall be available. Drop the point controlling track circuits one by one and make attempt to operate the point. The point indication shall remain steady. In both these cases, observe the WLR relay in the relay room.

22 AUGUST 2016
Monday



British PI

Sequential Route Release Relays (UYRs)

The Route locked for a signalled Train movement should get released only after the train has arrived on proper signal in proper direction and the track circuits have been sequentially actuated by the train. This is registered by picking up of sequential proving relays UYR's. (some railways call them as TPZR, TSSLR etc.). The pick up contact of UYR's are used to energise ASR in the normal route release path.

To ensure that the route is getting released only after the sequential occupation of tracks by a train arriving in proper direction, the UYRs are picked up in a pre-determined fashion and not by accidental dropping /bobbing of back lock track circuits or power supply fluctuations

As per subsequent & recent specifications, PI stations should also be provided with route setting type feature. And the panel should be of Domino type with self restoring type buttons and with automatic route release facility on arrival of a train.



Overlap Stick Relay - OVSR

held in locked position till the train completely passes and clears them. As far as points in the route are concerned, they are locked till the train clears and the back lock tracks have picked up and the ASR picks up. But once ASR pick up, the locking affect on overlap points is released and the points in the overlap can be operated, which is undesirable. To avoid this, OVSR circuit is adopted. OVSR is normally energized and drops whenever the signal is taken 'OFF' leading towards that overlap.

[illegible]

Point knobs used in British RRI are of 3 position type.

24

Wednesday

2016



British P

Overlap Timer Release Relay OVJSLR

Home signal ASR picks up after the train clears the back lock tracks, but the train is still rolling on berthing track, where as the overlap points beyond starter become free if starter is not given. This is considered undesirable. If starter is given then they are held further. In case starter is not given, still the overlap points should be held in locked position for a specified time (120 seconds) to ensure that the train stopped in rear of starter, only then the points should become free. This is achieved through OVJSLR Relay. OVJSLR will pick up with Home Signal ASR pick up contact. With OVJSLR up, timer circuit starts and after 120 seconds NJPR picks up. With JSLR & NJPR up, OVSR pick up and gets its stick feed. The stick path of OVSR is to prevent dropping of OVSR during track circuit failure. Once OVSR picks up OVJSLR drops which in turn cut off power to timer & NJPR drops.

The points will be set automatically in RRI when signal button and route button are pressed simultaneously.

26 AUGUST 2016
Friday



British PI

Point Lock Relay WLR

WLR is a normally a de-energized relay. So normally the point is locked electrically. WLR relay gets energized whenever the point knob is turned from R to N i.e. NCR energized or point knob turned from N to R i.e. RCR energized, provided all other conditions are satisfied.

When the point is set and indication relay is energized, drops the WLR and locks the point electrically.

A Calling on signal shall detect all points in the route, which the main signal above detects excluding those in the overlap.

2016 27 AUGUST
Saturday

British PI

Relays associated with point operation

NWR / RWR -Normal / Reverse point operating Relay - Final Relay for point operation

NWPR / RWPR -Repeaters of NWR / RWR -Final Relay for point operation

Point Contactor Relay (Normal /Reverse) NWCR / RWCR- Switches 110 v DC to point motor

NWKR Normal Point indication Relay Picks up when point set and locked in Normal

RWKR Reverse point indication Relay Picks up when point set and locked in Reverse

NWSR / RWSR - Normal / Reverse point indication stick Relay

NWKLR/RWKLR-Normal / Reverse point indication stick Relay - Proves all controlling relays are down

At stations where SM controls the reception and despatch of trains, such control shall be extended to Calling-on signals also.

British PI

Sectional Route release test

Take off the signal for each and every route. Drop the back lock track circuits and pickup only three numbers of track circuits just ahead of the signal sequentially. So as to pick up UYR1, UYR2 relay correctly.

Now drop any one back lock track circuit of these three track circuits and put back the signal knob to normal position. Route will be still in locked up condition (ASR dropped).

Now pick up the above back lock track circuit, the route sections (parts of the route) within these three track circuits will get released (ASR picked up and concerned WLRs picked up). Now points in above said back lock track circuits (route sections) can be operated for next operation of train.

Now pick up back lock track circuits ahead of these three track circuits one by one sequentially as per train movement simulation and observe that as train moves ahead and clears track circuits, route sections getting released (TRSR/TLRS picks up and concerned WLRs picks up) and points within these route sections are free for their operation. This test shall be repeated for each and every route of the signal.

Dead Approach Locking

For approach locking path for picking up of ASR is TSR pick up and approach track relay pick up. For cancellation process the path for picking up ASR is JSLR pick up and NJPR pick up.

Testing: Clear the signal. Put back the signal by normalizing the knob. Check that the route is held. Apply cancellation. Route is released after 120 seconds and the respective counter is incremented.

Approach locking Testing

Clear the signal. Keep the approach track clear. Put back the signal knob to normal. The route gets released immediately.

Clear the signal. Drop the approach track circuit. Put back the signal knob to normal.

The route shall not get released. The route is released by cancellation only.

When approach locked by signals, testing shall be done by taking off the signal in rear.

The route shall not get released when the signal (starter) knob is normalized. In case of conditional approach locking, the free condition of approach locking shall also be tested.

Siemens Major Point Relay Group

Indications

- | | |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 st Yellow | - Steady normally when the points are correctly set, locked, detected and is in correspondence with the point group.
Flashes during operation of points, or faulty condition of points. |
| 2 nd Red (Middle) | -Steady when the point group is involved in a route set, as points in route, overlap or isolation.
Flashes when the group initiation fails under route setting condition if initiation stops with Z1WR- and WLR- or with both the relays alone operated. |
| 3 rd Red | - lits when point zone track circuit is occupied or failed. |

The major Point relay group is used only in Siemens Route Relay Interlocking.

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Tuesday

2016



Indian Railways

Centre for Advanced Maintenance Technology

Siemens major points group

The major point relay group operates the point during automatic route setting and individual point operation.

Under route setting condition, the point group can get operated automatically if the point falls in the route, overlap or isolation. In case of individual point operation, pressing of WWN and WN or EWN and WN operate the point group

Code pins are provided to prevent the plugging of wrong relay in a base.

2016 31 AUGUST
Wednesday



PLANNER
SEPTEMBER 2016

1	Thu	
2	Fri	
3	Sat	
4	Sun	
5	Mon	
6	Tue	
7	Wed	
8	Thu	
9	Fri	
10	Sat	
11	Sun	
12	Mon	
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28	Wed	
29	Thu	
30	Fri	

- Vital Input
- Non- Vital Input
- Vital Output
- Non-Vital Output

Friday



Vital is related to physical movement of train e.g. point, signal & track.

Non-Vital is anything which is not related to physical movement of train e.g. Control cum Indication Panel (CCIP), alarms, buzzers

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are approximately 20 lines visible. The paper has a slight shadow on its right side, suggesting it's resting on a surface. There is no handwriting or other markings on the paper.

In Electronic Interlocking, alteration due to yard remodelling does not require any wiring change, only data of the CPU card is required to be changed.

This image shows a single sheet of white paper with horizontal blue ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

EEPROM s (Electrically Erasable Programmable Read Only Memory) are used for storing Executive and Application software.

Policy on type of Interlocking to be adopted

Board has decided the following policy to be adopted on IR vide Board's letter Nos. 2003/Sig/G/5 dt. 10-09-2003 and 2003/Sig/G/5/Pt. Dated 30th January, 2006

Up to 50 routes	Relay based interlocking of Metal to Carbon or Metal to Metal type according to the expertise available on the railway. (In special cases, EI may also be adopted in installations below 50 routes on a case to case basis. Such proposals for EI at signaling installations below 50 routes have to be justified on a case to case basis based on life cycle cost including capital cost, annual maintenance cost, depreciation provision, saving due to avoidance of repeated relay wiring due to anticipated yard remodeling etc. and concurrence of the associate finance obtained.
50 to 200 routes	Electronic interlocking
Above 200 routes	RRI with relay based interlocking of Metal to Carbon or Metal to Metal type according to the expertise available on the railway.

As per revised (draft) guidelines of Railway Board:

Upto 800 routes	Electronic Interlocking with distributed interlocking (not centralized) is to be provided
More than 800 routes	RRI (British or Siemens) is recommended

Executive software corresponds to Principles of Interlocking.

2016 05 SEPTEMBER
Monday

Examples of Non-Vital Inputs and Outputs:

Non- Vital Input

Panel inputs –GN (Signal Button), UN (Route Button), WN (Point Button).

Non-Vital Output

Panel Indications, Alarms, Buzzers

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Application software corresponds to Selection table of a station.

06

SEPTEMBER
Tuesday

2016



Redundancy

Redundancy means using resources more than required. Redundancy can be both in hardware and software.

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.

Do not try to repair a faulty module at site. It should be returned to the firm.



Availability of additional hardware identical to the normally working hardware for taking over at the time of failure

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Keep all spare modules received for installation or kept as a reserve for maintenance in anti-static packaging.

Availability of additional software identical to the normally working software for taking over at the time of failure.

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Module fitted with batteries may require special packaging.

2016 09 SEPTEMBER
Friday

Warm standby

In this arrangement only one system is in power on mode while the other is in power off mode. There is no communication between the two systems. Once powered on system is failed, the other system will be powered on after a time delay.

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Avoid wearing clothing made of synthetic fabric when handling modules.

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SEPTEMBER
Saturday

2016



Hot standby

In this system the Main and standby systems are powered on. Both the systems take inputs, process it, communicate with each other and finally give one output. If any one of the two systems shuts down, there is no interruption in the output. The load is automatically taken over by the other equipment without any time delay.

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Keep the EI room free from dust and moisture.

Various Design aspects of the System to achieve viability & safety

Design of electronic Railway Signalling Equipment based on processor and/or software has to ensure that safety integrity of whole system/sub-system is maintained through out the life of the equipment.

Safety integrity is specified as one of 4 discrete levels by IEC/CENELEC Standards (European standards). Level-4 has highest level of safety integrity. For Safety Integrity Level - 4, dangerous failure rate per hour for continuous mode of operation should be less than 10^{-10} . Safety integrity of any system covers mainly two components:

(a) Systematic failure integrity.

(b) Random failure integrity.

It is necessary to specify both the Systematic & Random failure integrity requirements of the system if adequate safety is required to be achieved.

SIL 4 - Safety Integrity Level 4

MTBWSF – Mean Time Between Wrong Side Failures

As per SIL 4 standards $MTBWSF = 1 / 10^a$ where $a = 9$
i.e. out of 10^9 (where $a = 9$), only 1 failure on unsafe side

Ensure all terminations are fully tight.

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Monday

2016



Cold Standby

In this arrangement only one system is in power on mode while the other is in power off mode. There is no communication between the two systems. Once powered on system is failed, the changeover to the other system will have to be done manually.

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins or other markings on the paper.

Place the faulty modules removed from the system with an identity tag into a conductive shielding bag.

2016 13 SEPTEMBER
Tuesday

El system Architectures

Dual Hardware Redundancy (2 out of 2)

Final output is given only when both hardware give identical output

[illegible]

Check the system fuses at regular interval.



El system Architectures

Dual Hardware Redundancy with 100% standby

The outputs from the two hardware are duplicated and the original and the duplicated outputs are compared to give final outputs

This image shows a full page of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page, providing a template for writing. There are no margins, text, or other markings on the page.

Use card extractor for removing of WESTRACE EI modules.

2016 15 SEPTEMBER
Thursday

El system Architectures

Triple Hardware Redundancy (TMR) (2 out of 3)

This system works on the assumption that two units will not fail simultaneously. Minimum two units should work otherwise the system will shutdown.

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are approximately 20 lines visible. The paper has a slight shadow on the right side, suggesting it's resting on a surface.

Use vacuum cleaner for the EXTERNALLY accumulated dust and dirt.

El system Architectures

Software Redundancy - Single Hardware (1 out of 1) with diverse software

There is software redundancy in the above system. This system works on the assumption that two independent software will react differently for a hardware fault.

This image shows a single sheet of white paper with horizontal blue ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Don't remove modules, relays, Fuses, Links, I/O module connectors etc. when the System is ON.

Control Cum Indication Panel (Operator's panel)

CCIP is provided with push buttons/control switches for individual operation of points, clearing of signals, releasing of crank handle interlocking/ground lever frame/gate controls, cancellation of routes and other functions including block signalling, auto signal, IB signal, adjacent yard layout, to facilitate indication or operation cum indication as per requirement.

A control terminal with VDU in lieu of or in addition to conventional CCIP is provided as per requirement. It consists of:

- A latest PC, colour VDU monitor with minimum size of 17" (43 cm.) as specified by purchaser.
- A Key board and Mouse

Don't force the modules into the slots during insertion.

18 SEPTEMBER
Sunday **2016**



Types of Electronic Interlocking working on Indian Railways

Ansaldo MICROLOK II (Originally by US & S)

1 out of 1
Hot/Warm standby
Single Hardware, Diverse Software

Siemens-WESTRACE VLM6 (Originally by Invensys Rail Australia)

WESTRACE stands for **W**ESTinghouse **T**rain **R**adio **A**dvanced **C**ontrol **E**quipment
1 out of 1
Hot standby
Single Hardware, Diverse Software

GE –VHLC

VHLC stands for Vital Harmon Logic Controller
2 out of 2
Warm standby
Diverse software

Medha Servo – MEI 633

2 out of 2, Hot standby

Kyosan

2 out of 2 , Hot standby, Diverse software

AZA Praha ESA11

2 out of 2 , Hot standby, Diverse software

Siemens VLC

1 out of 1, Warm standby

Siemens SIMIS S

2 out of 2, Diverse software





MLK II Hardware

MLK II hardware consists of the following components accommodated in a cardfile:

- Slot No. 1 to 15 & 20 accommodate Non-Vital Input/Output or Vital Input or Vital Output boards. (Slot No. 20 is used to accommodate Coded System Interface Card or CSI Card for CTC).
- Slot No. 16 & 17 accommodate Power Supply Board.
- Slot 18 & 19 accommodate CPU board.

This image shows a single sheet of white paper with horizontal blue ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Don't use any kind of solvents, detergents or abrasive cleaners on the housings or internal components.

WESTRACE EI

The **WEST**inghouse Train Radio **A**dvanced **C**ontrol **E**quipment (WESTRACE) VLM6 is a Vital Railway Signalling System which comprises following modules:

1. Vital Logic Module (VLM)
2. Network Communication Diagnostic Module (NCDM)
3. Vital Parallel Input Module (VPIM)
4. Vital Relay Output Module (VROM)
5. Power Supply Unit (PSU) module
6. Blanker Card (BLANKER)
7. Protection and Filter Modules (PFM) (at the rear of each module)

Don't remove optic fibre cable connector when optical modem is ON.

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Thursday

2016



GE VHLC EI

The VHLC itself consist of a chassis assembly and several plug-in and plug-on modules. The front chassis provides card slots up to 12 plug-in modules (slot 1 through 12). The first three slots are dedicated to VLP (Vital Logic Processor) Module, ACP (Auxiliary Communication Processor) Module and the SSM (Site Specific Module). These three modules are required for all VHLC systems. The remaining nine slots are for any combination of VGPIO (Vital General Purpose Input/Output) Modules, 16VGPI (Vital General Purpose Input) Modules and NVIO (Non-Vital Input/Output) Modules.

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.

The VHLC is programmed by using the ACE (Application Compiler/Editor).

WESTRACE EI

Output Power Control Relay (OPCR)

Every WESTRACE system that uses parallel output (VROM) has a vital Output Power Control Relay (and optional repeat relays i.e. OPCPRs) which provide power to the outputs when the system is proved healthy. Power supply to vital output cards is extended through OPCR (vital relay QN1, 50V DC) front contacts. On detecting failure, the system cuts power supply to OPCR and safety is ensured.

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

The relay used for the OPCR must be a vital signalling relay to BRB Spec 930 (e.g. Invensys Rail Style QN1). The minimum coil resistance of the OPCR must be 833 Ohms

24

Saturday

2016



Lithium Batteries

WESTRACE Network Communications Module (NCDM) has Lithium batteries installed. Replace Lithium batteries of WESTRACE NCDM module every 5 years.

MICROLOK II CPU also consists of Lithium batteries. Replace these once in a year

[illegible]

When handling any EI circuit board/module or board component, observe all Electrostatic Discharge (ESD) Precautions. Improper handling of boards or components may result in damage to static sensitive circuitry.

Executive Software or System Software

The Executive Software is programmed in system EPROMs. This Software defines what the system can do and how the various parts of the system operate together. It includes all start up and operational safety tests (including checking the Executive software itself) that are the parts of the processor for continual assurance of safety operation. Executive software pertains to 'Principles of Interlocking'.

Application Software

The application software is programmed in Data EPROMs. It contains the logic that defines how the inputs and outputs for a particular station are related. It pertains to 'Table of Control' of yard. This shall be station specific.

The Executive Software and Application Software are programmed into Read Only Memories (ROMs) by the manufacturer. Both the ROMs shall be separated and isolated from each other

Sr. No.	Executive software	Application software
1.	Common to all EIs for the same manufacturer.	Yard specific. Different for different station.
2.	Factory installed	Can be installed at site by signal engineers.
3.	Performs all operations.	Performs operations as per table of control of specific station.
4.	It is not possible to modify Executive Software.	Application engineers have the facility to modify application software as and when required

Monday



MICROLOK II EI

Vital Cut-Off Relay (VCOR)

Each cardfile will have one Vital Cut-off relay (VCOR) to ensure the healthiness of the system.

VCOR has 6 F/B dependent contacts each rated for 3 Amps.

The VCOR contacts are used to control the power to all card file vital outputs.

The VCOR is controlled by the CPU board.

When the system is healthy the coil receives voltage from PS PCB on the power supply board.

On failure of a safety-critical diagnostic, the DC supply to the VCOR is removed thereby opening the contacts that provide battery power to the vital output boards.

Once in a year, remove the VCOR relay from the installation and inspect it.

MICROLOK II EI

Non-Vital Panel (NVP)

Non-Vital Panel (NVP) or Operator VDU is a computer based GUI application that displays geographical layout of the signalling plan of a station. It acts as an interface between the operator and Signalling Interlocking System and displays the status of various field equipments on the monitor. It allows user to playback the earlier events. It can be used as Local Control Panel (LCP) which displays the state of the interlocking on the screen and allows the operator to send commands to the interlocking. It can also be used as a Maintenance Panel (MP) which displays the state of the interlocking on the screen, but no operator commands can be sent to the interlocking.

Don't delete any files and log from NVP folder without authorization.

MoviolaW

MoviolaW works as the maintenance terminal and data logger for the WESTRACE. It helps in easy identification of faults and diagnosis of any failure in WETRACE. It also helps in monitoring the interlocking. The purpose of MoviolaW is to:

- Monitor WESTRACE events and other railway signal logic in near real time;
- Collect the data from WESTRACE and then play it back at the user's convenience.

[illegible]

MoviolaW detects failures by associating them with defined combinations of its inputs; Conversely, MoviolaW cannot detect failures that are not defined, therefore some failures may not be observed.

WESTRACE VLM6 EI

Ports at the rear of NCD PFM

- Serial 2 (External) DB9 – to connect Diagnostic or Control system e.g. Data Logger.
- Serial 3 (External) DB9 - Diagnostic or Control system e.g. Panel Processor
- INCL (External) Tx & Rx Optical - Inter NCDM Communication Link , A fibre optic connection used in a Hot Standby system to transfer data between the main and standby NCDMs.
- Network/Ethernet RJ45 (External) - Diagnostic, Control system or vital communications e.g. VDU or MoviolaW.

NCDM is placed in 4th slot in 1st housing of WESTRACE. Only one NCDM is used in the system.

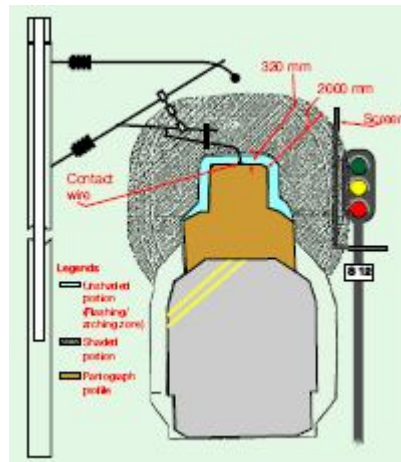
RDSO Approved Firms

At present the following firms are approved by RDSO for design, supply and installation of Electronic Interlocking Systems on Indian Railways:

- M/s Ansaldo STS Transportation Systems Pvt. Ltd., 35 SLV Complex, AVS Compound, 80 feet Road, 4th Block, Koramangala, Bangalore -560 034.
- M/s Siemens Rail Automation Pvt. Ltd. (SRAPL) Engineering, Semicon Park, Plot No.31 (P1), Ground Floor, Tower - II, Electronic City Phase -II, Electronic City, Bangalore – 560 100.
- M/s GE Transportation Systems, AIFACS Building, 1, Rafi Marg, New Delhi – 110 001
- M/s Medha Servo Devices Pvt. Ltd., P-4/5, IDA Nacharam, Hyderabad -500076

Perform System changeover schedule in a hot standby EI system once in a month.

SIGNALLING IN 25 KV RE AREA



OCTOBER 2016

PLANNER
OCTOBER 2016

1	Sat	
2	Sun	
3	Mon	
4	Tue	
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29	Sat	
30	Sun	
31	Mon	

Installation of Signals

For existing installations, min. horizontal distance of nearest part of signal from the centre of track - 2135 mm.

For new or alterations to existing installations - not less than 2360 mm from the centre of track.

Signal ladder erected at a distance of less than 2360 mm from centre of adjacent track should be blanked off to a height of 300 mm between 2060 mm and 2360 mm above rail level.

OHE with automatic tensioning is called "Regulated" OHE.

Types of earthing arrangements

There are two types of earthing arrangements normally provided for S&T installations of Indian Railways:

Conventional Earthing

In this type of arrangement, the earthing is achieved with the help of Earth electrode (normally GI pipe) buried in the ground (earth pit).

The earth electrode is surrounded by filling material (Common salt and Charcoal) and it is connected to the equipment with the help of GI or copper wire to extend earth to the equipment.

This type of earthing is normally provided for apparatus cases, signalling cables, block instruments, conventional power supply equipments etc.

Effective or Maintenance-free earthing

This type of earthing is provided with earth electrode of a highly conductive, corrosion-resistant material with low soil resistivity earth enhancement compound around it.

This arrangement eliminates the drawbacks of conventional earthing such as corrosion of electrode and high and fluctuating earth resistance.

Maintenance free earthing is provided for signalling and telecomm. equipments with solid state components requiring low earth resistance of the order of 1 Ohm such as Integrated Power Supply, Digital Axle Counter, Data Logger, Electronic Interlocking etc.

Earthing of signalling cables and equipments is done to ensure reliable and safe operation of the equipments by limiting or eliminating the induced voltages in signal and Block circuits.

2016 03 OCTOBER
Monday

Tuesday



Additional precautions for signals in RE area

Under no circumstances, a signal post or any of its fittings must infringe within a vertical or lateral distance of 320 mm (Flashing/Arching zone) from any live part of OHE or Pantograph.

When signal post or its fittings have to be installed closer than 2 metres from the live parts of the OHE, a screen of wire mesh shall be provided between the signal post and the OHE to protect the staff during working.

[illegible]

Metallic sheath wherever applicable and armouring of all underground cables shall be earthed.

2016 05 OCTOBER
Wednesday

06

OCTOBER
Thursday



Additional precautions for signals in RE area

For better visibility, it is preferable to erect the signals on the opposite side of the OHE masts but if this is not possible then

(a). The distance between the signal and the mast in front of it must not be less than 30 metres.

(b) At the same time, the signal should not be located closer than 10 metres from the mast behind it. However, this distance may be reduced to 3 metres provided:

(i) The mast is not anchored and (ii) It is ensured that the contact wire is staggered away from the signal.

In the vicinity of 25KV AC OHE, no aerial lines are permitted to be used as they are subjected to induction. Hence, all the circuits are transferred to underground cables.

Additional precautions for signals in RE area

The height of the centre line of the red signal should be 3.65 metres (12 ft.) above rail level.

Post height (i) For Signal without Route Indicator – 3.5 Mtr. (ii) For Signal with route Indicator (Main unit on Offset bracket) – 4.5 Mtr.

No part of a signal without route indicator shall normally be higher than 5.2 metres above rail level.

The depth of tail cables, which serve the track apparatus, shall not be less than 0.5m

In the vicinity of TSS, the cables shall be laid at least 1 m away from any metallic body of the substation that is fixed in the ground and at least 1 m away from the substation earth.

Limits of Earth Resistance

Maximum values of earth resistances specified for earthing of Signalling and Telecommunication equipments are as under:

Sr. No.	Description	Max. Earth Resistance
1.	Telegraph & Block Instrument using earth return circuit	10 Ohm
2.	Earths for Surge Arrestors/lightning dischargers	10 Ohm
3.	Earthing of signalling equipment	10 Ohm
4.	Earthing of signaling cable screen in AC electrified areas	10 Ohm
5.	Earthing of Telephone Exchange	5 Ohm
6.	Earthing of Aluminium sheathed Telecom. Cable in AC Electrified areas	1 Ohm
7.	Earthing of equipment in VF Repeater stations and cable huts	5 Ohm
8.	Axle Counter (screened) in AC Electrified areas	1 Ohm
9.	Electronic Interlocking installation	1 Ohm
10.	Integrated Power Supply System & its individual modules	2 Ohm
11.	Digital Axle Counter EJB and its apparatus case connected to same earth. All cable armours connected to same earth.	1 Ohm
12.	Reset box of Digital Axle Counter connected to earth (indoor) near SM's room.	1 Ohm

When signalling cables and LT or HT power cables are laid in the same trench, they must be separated by a row of bricks between them.

As per Signal Engineering Manual (1988)

Inner Distant Signal - 200 Metres where this signal is provided

All Stop Signals - 200 Metres

For stop signals if 200 Metres continuous visibility is not available on approach, a suitable speed restriction shall be imposed.

When signalling and main telecom cables are laid in the same trench, a distance of 100 mm is to be maintained between them.



All new signals/modified signals and warning boards etc. shall be inspected and passed by "Signal Sighting Committee" consisting of (i) SSE/SE/JE (Signal) (ii) Loco Inspector & (iii) Traffic Inspector as per standard proforma. For existing signals the above inspection should be carried out quarterly.

[illegible]

The cable route shall be properly marked to allow easy indication in case of need.



Indian Railways

Centre for Advanced Maintenance Technology

Types of earthing arrangements

There are two types of earthing arrangements normally provided for S&T installations of Indian Railways:

- (i) Conventional Earthing
- (ii) Effective or Maintenance-free earthing

Outside station limits, the cables shall be laid at a distance of 8 to 10 metres from the centre of the nearest track.

- (a) Only single rail (one rail common for traction return current)
- (b) Track relay should be AC immunized.
- (c) B type chokes at feed-end.
- (d) Surge arrestors at feed-end and at relay end.
- (e) Longitudinal bonds for rail continuity
- (f) Cross bonding at every 100m between un-insulated rails.
- (g) Transverse /short bonds at ends of each track circuits.
- (h) Only 09 ohms track relay should be used in AC RE area

Within station limits, where there are no OHE masts along the route of the cable, the trenches shall preferably be dug at a distance of 3 metres (nearest edge of the trench) from the centre of track.

14 OCTOBER
Friday 2016



The maximum length track circuit to suit higher catenary currents

DC Single Rail Track Circuit	Maximum permissible length	
	Single Line section	Double Line Section
Without additional protection	200 m	300 m
With additional protection of 120 Ohm. Choke at relay end	450 m	450 m

Within station limits, when there are OHE masts along the route of the cable, the trenches shall be dug at a distance of not less than 5.5 metres (nearest edge of the trench) from the centre of the track.

Length of DC circuits as per revised design

Line Relays with Unscreened cable shall be restricted as given below:

Sr. No.	Relay	AC Immunity Level in volts	Maximum permissible length	
			Single Line	Double Line
1.	Shelf Type AC Immunized	750 V	2.1 Km	2.8 Km
2.	QNA1	1000 V	2.1 Km	2.8 Km
3.	K-50 (B-1)	170 V	1.0 Km	1.2 Km
4.	K-50	130	750 Mtr	900 Mtr
Ref:- SEM correction slip No.5 dated 30.1.2007				

In 25 KV AC Electrified RE area, relays which are inherently AC immunised.

OCTOBER

Sunday

2016



Indian Railways

Centre for Advanced Maintenance Technology

Direct Feeding of Signals with unscreened cable as per Revised design of signalling system to suit High catenary currents

As per revised design, unscreened cables would be used and that the induced voltages have been calculated as 95V/KM for double line and 116V/KM for single line.

Direct Feeding	Single Line	Double Line
By using 110 V.	180 Mts	220 Mts
By using 300 V (Not to be used for Future installations as per Rly Bd. instructions.)	440 Mts	605 Mts

To control the signals beyond direct feeding range two methods are in use.

(a) Local Feed (b) Remote Feed

As per revised design, the factor of safety for the designs of line-side equipments shall be 1.5.

Maximum Permissible length of direct feed of Point Machine from Point Contactor unit

Sr. No.	Type of Point Machine	AC Immunity Value (Volts)	Maximum permissible separation (metres) between Point Contractor and Point Machine on	
			Single Track	Double Track
1.	GRS – 5E	90	515	630
2.	IRS.24	160	910	1100
3.	Siemens IA	160	910	1100
4.	Siemens IB	300	1650	2100
5.	Siemens IC	400	2200	2800

RDSO specification No.S24/90 - for Electrical Point Machine non-trailable type, specifies the A.C. immunity level of Electrical Point Machine shall not be less than 160 V at 50 Hz.

Even though non-immunised relay like QNI and K-50 have got inherent AC immunity, these relays should be avoided for use in the external circuits.

Use of QBAT relays in track circuits

In view of the increased AC immunity due to the presence of biased magnetic arrangement, QBAT relays can be used up to a maximum length of track circuit of 750 meters using one 'B' type choke at the relay end, under minimum ballast resistance of 2 ohms/km.

Operation of track circuit with this type of relay will require four cells delivering 8.8V. QBAT relays shall be used in conjunction with QSPA1 relays conforming to BRS 933A. (Ref: 68th **SSC Para 22.11.5.7**).

As per revised design, the Safe handling voltage is 400 V.

In an AC electrified section one of the following track circuits can be used

- (a) DC Single Rail Track Circuits
- (b) AC Track Circuits single rail or double rail working on a frequency different from the frequency of the traction supply
- (c) Electronic Track Circuits.

Track circuit on ac-electrified section may use IRJs (Insulated Rail Joints) or ESJs (Electrical Separation Joints) and may be configured as single rail or double rail track circuits. Track circuits, which use electric separation joints, shall be configured only as double rail track circuits.

D.C. single rail track circuit length shall not exceed 350 metres when concrete sleepers are used.

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Thursday 2016



Cabling from AT/Local Supply to CLS Power Panel and from CLS Power Panel to Signalling Equipment room

Source of power supply(AT/Local)	Size of cable
5 KV A	2 x 25 sq mm Aluminium Conductor
10 KV A	2 x 70 sq mm Aluminium Conductor
25 KVA	2 x 150 sq mm Aluminium Conductor
50 KV A	2 x 300 sq mm Aluminium Conductor

Adequate spare conductors up to a minimum of 10% of the total conductors used shall be provide in each cable. No spare conductors are required if the total number of conductors used is three or less.

Type of Signalling Cables

PVC insulated PVC sheathed and armoured signalling cables to specification IRS 5. 63 shall be used for carrying signalling circuits. The conductors used shall be of copper and of approved size. The cables used in signalling installations are broadly classified as:

- (a) Indoor cables.
- (b) Outdoor cables.
- (c) Power cables

Where a number of cables have been laid along a route, the circuits shall be so distributed that cables can be disconnected for maintenance purposes with the least possible dislocation to traffic.

Indoor Cables

Indoors cables are without Armour wire. In this, all the PVC insulated conductors are bunched and kept in thin PVC insulation tube. Following types are used in signalling:

60C, 40C, 24C and 20C with copper conductor diameter 0.6mm

60C, 40C, 24C and 16C with copper conductor diameter 1mm

Before preparing cable route plan a foot survey along the track should be taken, as far as possible, to avoid cinder stocking yard, water mains, oil pipes, drain/sewage pipes, water columns etc.

Additional Requirements for laying of cables in 25KV A.C. Electrified Areas

- The cable shall be laid so that it is not less than one meter from the nearest edge of the mast supporting the catenary or any other live conductor provided the depth of the cable does not exceed 0.5 meters. When the cable is laid at a depth greater than 0.5 meters, a minimum distance of 3 meters between the cable and the nearest edge of the OHE structure must be maintained. If it is difficult to maintain these distances, the cables shall be laid in concrete pipes for a distance of 3 meters on either side from the mast. When so laid, the distance between the cable and the mast may be reduced to 0.5 meters. These precautions are necessary to avoid damage to the cable in the event of the failures of an overhead insulator.
- In the vicinity of traction sub-station and feeding posts, the cable shall be at least one meter away from any metallic art of the O.H.E. and other equipment at the sub-station, which is fixed on the ground, and at least one meter away from the sub-station earthing. In addition, the Cable shall be laid in concrete pipes for a length of 500 meters on either side of the feeding As far as possible, the cable shall be laid on the side of the track opposite the feeding post.
- In the vicinity of the switching stations, the cable shall be laid at least one meter away from any metallic body of the station, which is fixed in the ground, and at least 5 meters away from the station earthing. The distance of 5 meters can be reduced to one meter provided the cables are laid in concrete pipes.
- Where an independent earth is provided for an OHE structure i.e. where the mast is connected to a separate earth instead of being connected to the rail, the cables shall be laid at least one meter away from the earth.
- Where there is O.H.E. structure along x the cable route the cable trenches shall, as far as possible, be dug not less than 5.5 meters from the centre of the track.

24

Monday

2016



Use of loose wire

- 1mm. dia. copper-single strand wire is used for high current circuits such as signal lamp
- circuit, point operation circuit, gate circuit, etc.
- 0.6mm. dia. copper-single strand wire is used for relay wiring.
- 0.4mm. dia. copper-single strand wire is used for indication lamps and panel wiring.
- 16 strand 0.2mm. dia. flexible loose wire is used for Q-Series relay wiring.

The desired cable route should be shown clearly on cable route plan showing the actual alignment of track, giving offsets from permanent way or permanent structures.

Outdoor Cables

In these cables, all conductors used are copper conductors having equal diameter with PVC insulation which in turn are kept in PVC insulation tube. This tube is again covered with galvanised iron rectangular or circular cross section wires called Armour to protect the cable from damages. On this Armour PVC insulated thick tube is provided to give the more mechanical strength and good insulation resistance in addition to (water proof arrangement) preventing the water entering inside the cable.

Generally, used conductor core sizes are 1.5 sq.mm., 2.5sq.mm., 4sq.mm. Each size is available in the core of all the cables as mentioned below. Most commonly used cores are 2C, 4C, 6C, 8C, 9C, 12C, 18C, 20C, 24C, 30C and 37C. But, rarely used cores are 3C, 5C, 7C, 11C, 14C, 18C, 19C, 21C, 24C, and 30C.

Cables may be laid underground either in trench or in ducts or in cement troughs or in pipes.

Specifications of Signalling cables in A.C. Electrified Sections:

- (i) The main cables shall ordinarily be PVC insulated screened and armoured cable to I.R.S specification No. S.35/1970 or, Paper Insulated lead sheathed and armoured to I.R. specification No.E.17/1959. However, any metallic sheathed armoured cable having a cable reduction factor of not more than 0.4 at a field strength of 87.5 to 450 volts per km may be used in lieu of the paper insulated lead *sheathed* and armoured (P.I.L.C) cable.
- (ii) The tall cables shall be P.V.C. cables to Specification No. IRS S.63.

While laying cables on platforms, it should be taken in a suitable duct along the platform or under the coping of the platform where they would not be exposed to the sun.

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Thursday

Power cables

Power cables laid by Signal & Telecommunication Department for carrying power supply up to 440 volts shall be PVC insulated PVC sheathed and armoured cables to specification IS: 1554-PART I- 1964 with alluminium conductors. The conductor shall suit the electrical load.

Where cables are laid in ducts, RCC or earthenware ducts may be used. The ducts shall have suitable covers

Friday



Generally used power cables are -

50 Sq.mm. aluminum core single strands - 3 & 3 1/2 core cable.

25 Sq.mm. (Multi-strand-7) aluminum conductor core, also available in 2C, 3C, 3½C, 4C.

08 Sq.mm. copper conductor single strand - 2C.

06 Sq.mm. copper conductor single strand - 2C.

For paying out cables, the cable drums shall be mounted on cable wheels.

Laying of different types of cables in same trench

Where several cables of different types have to be laid in the same trench, they shall be laid as far as possible in the following order starting from the main trackside, so that in the event of failures, the maintenance staff can easily recognise the cables:

- i) Telecommunication cable
- ii) Signalling cable or cables
- iii) L.T. power cable (less than 660 Volts)
- iv) H.T. power cables (greater than 660 volts)

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.

If the cable drums are damaged, the cable shall be rewound on a good drum and then only, it shall be transported.

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2016



Separation between Signalling & Telecom cables

A separation of about 10 *cm.* must be maintained between telecommunication cables and signalling cables. The signalling cables must be separated from power cables by a row of bricks between them. Cables belonging to the Posts & Telegraphs Department or the Electrical Department must not be have laid in the same trench along with Signal & Telecommunication cables.finalising the route plan.

While laying of cables, the drum on the wheel shall be brought to one end of the trench and the end of the cable freed and laid in the trench.

SIGNALLING RELAYS



NOVEMBER 2016

PLANNER
NOVEMBER 2016

1	Tue	
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Do not tamper with the code pins of the relay while replacing.

2016



QNN1: DC Twin Neutral Line Relay. (Spec: BRS 960)

Two neutral relays with common heel piece, common base. Both relays are independent of each other and can be used for two different circuits. (Unrelated)

Contact combination: 6F/2B, 4F/4B each. (Both relays will have same contact combination).

Coil Resistance: 470 ohms

Normal working voltage: 24v

Max PU: 19.2V, Min DA: 3.6V.

Application: All circuits of Non RE and Internal circuits of RE.

Saving of space and used in circuits needing less number of contacts.

[illegible]

Check that each relay is properly plugged, clipped/sealed.



Application: All external control and detection circuits in railway electrification.

Ensure writing/painting of nomenclature on the relay immediately after replacement.

2016



QS3: Q series sensitive neutral relay (Spec BRS 930A)

This is a sensitive line relay designed to work on low voltage and current in a manner similar to shelf type neutral line relay.

Working voltage : 12V DC , Coil resistance : 1000 ohms, Operating current : 12mA

Contact configuration : 4F/4B contacts

.Max: PU voltage : 9.35V, Min PU voltage : 7.5V, Min DA voltage : 3.75V

This relay is classified as 'A' class relay and % release is more than 60 %.

Designed originally to replace shelf type 1000 ohms line relays in axle counters, i.e. evaluator relay and supervisory relay (EVR, SUPR)

QSA3: Q Series sensitive AC immunized dc neutral relay. (12V, 1000 ohms, 4F/4B).

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

For K-50 Relays – While conducting break test before commissioning, break contacts with the help of thin flexible insulation strip only.

2016 05 NOVEMBER
Saturday

Line Relays and Track Relays of shelf type.

Sr. No.	Feature	Line Relay	Track Relay
1.	Working Voltage	Normal 12V D.C	Minimum: 125% of Relay P.U.V. Maximum: 250% of Relay P.U.V.
2.	Coil Resistance	Two coils of 500 Ohm $\pm 10\%$ Two coils of each (to be connected in series or parallel as required.)	4.5 Ohm $\pm 5\%$ two coils of each (to be connected in series or parallel as required)
3.	Standard contact arrangements	2F/B, 4F/B and 6F/B (all dependent)	2F/B and 2F, 2F/B for Non-ACI relay. 2F.2F/B and 4F/B for ACI Relays.
4.	AC Immunity of relay.	300V (achieved intrinsically without using any external means).	50V (achieved by the provision of copper sleeves and magnetic shunt
5.	Periodical Overhauling	10-12 years	15 years

For K-50 Relays - During testing before commissioning, avoid deformation of contacts.

QBA1: Biased AC Immunized DC Neutral Line Relay. (Spec: BRS 932A)

This is a DC biased AC Immunized neutral line relay. It operates when rated DC voltage of correct polarity is connected. It does not get attracted for 20 times the rated 24 VDC in reverse polarity. To make the relay AC Immunized Copper slug is provided at its armature end and biasing feature is achieved by providing a permanent magnet adjacent to copper slug.

This relay is used in "DAIDO" Single line Block Instrument, used in RE area.

Coil resistance : 200 Ohms coil., Working voltage : 24V DC.

Contact combinations : 12F/4B, 8F/4B, and 8F/8B.

AC immunity level : 120 VAC as per BRS931.

Contact current rating: 3A (continuous) and 2A (Switching).

For K-50 Relays – Remove all strips/sticks from relays before commissioning after the testing is over.

The relay is immune to the affects of 1000V AC 50Hz in the de-energised condition.

If any contact/contacts make physically but fail to provide electrical continuity, then replace the relay.

QSPA1: Q series Slow to pick up AC immunized DC neutral relay (Spec. BRS 933A)

This is a slow pick up relay. To make the relay AC Immunized, Copper slug is provided at the heel piece end. In case of catenary snapping/shorth circuiting of OHE supply, the TPR should not pick up before tripping of OHE circuit breaker. Hence this relay is used as TPR where Q-series AC immunized track relays are provided

Pick up time : 540-600 m seconds., Release time : 140-200 m seconds.

Working voltage : 24 V DC, Coil resistance : 208 ohms

Contact configuration : 8F / 4B

A/C Immunity level : 300 V AC

If gliding points of support plates in a K-50 interlocked relay are extremely soiled then replace the relay.

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QSRA1: Slow to release AC immunized DC Neutral Relay (BRS Spec. No. 934A)

Magnetic shunt is provided at the heel piece end to make the relay slow to release.

Copper slug is provided for AC immunization.

DA time : 260ms., Working voltage : 24 V DC, Coil resistance : 208 ohms

Contact configuration: 8F/4B, A/C Immunity level : 300V AC

Used as HPR, DPR in RE area. Insensitive to momentary track circuit bobbing and power supply fluctuations

Always store/transport the new/spare relays inside plastic bag and cardboard/thermocol box.

QL1: Q – Series Magnetic Latch Relay (BRS Spec. No. 935A)

Relay latches magnetically in the operated position. This is achieved by the use of a permanent magnet, provided at the heel piece end.

There is no residual pin as it is a latched relay and requires power supply for releasing the relay.

This relay contains two coils namely Reverse Coil (Operating coil) (150 ohms) and Normal Coil (Release Coil) (680 Ohms). They are wound on the same core in opposite direction to each other.

Working Voltage : 24V., Coil resistance (reverse) : 145 ohms, (Release) : 680 ohms

Contact combinations : 11F/4B, 8F/6B.

Application : TCFR, TGTR, TAR and TOLAR in PTJ push button block instruments

Avoid direct contact with thermocol, dust, water and sunlight

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Saturday

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Siemens K50 Neutral Relay Mini-groups (Drg. RSSK 30/0011)

Two K50A relays with eight contacts each are fixed one below the other on a frame fitted into a back plate.

Coding pins at the base plate ensure that no group can be plugged in a base with relay contact positions interchanged.

Available in 6F/2B, 5F/3B & 4F/4B combination

Visually inspect and functionally test the relay before installation.

	B5	C5	
	B6	C6	
	B7	C7	
	B8	C8	

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Monday



Siemens K.50 Relay Mini Groups (to Drg. Rs Sk 30/0078)

The top relay of this group is provided with extra provisions for greater immunization.

Both the relays of this group have 5F.3B contacts each. In all other respects, this group is similar to any other neutral relay mini - group except that it has a different pin code.

Always use fresh relay for new installation.



In this, two 'tiered' K50 relays are mounted on a channel plate fitted to a frame with a common back plate. These relays are mechanically so interlocked by two support plates that at a time only one relay can remain in the released position.

In the normal condition of this unit, the bottom relay armature is latched in its operated position as its support plate is held up by that of the top relay which is dropped.

Do not touch/disturb the pre-wired components of a relay.

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Siemens K- 50 Relays Coil Resistance

Neutral relays: 5F/3B and 4F/4B: 1260 ohms, 6F/2B: 1840 ohms,

Interlocked relays: All contact configurations: 615 Ohms.

Lamp checking relays: 64.1 ohms (UECR, ON / OFF ECR).

AC immunized Relays: 1840 ohms (All contact combinations)

Don't touch/squeeze relay contacts with fingers during testing.

D.C. Track Relays with carbon to metal contacts

QT2 Style Track Relay made to Relay Spec. 26/6

Coil resistance: 4 Ohms and 9 ohms., Contacts 2F/1B

4 ohms relay is used for longer length track circuits and 9 ohms relay for shorter length track circuits.

Maximum permissible excitation is 300% of the rated PU value.

Minimum excitation is 125% of pick up voltage

% Release must not be less than 68%.

Use: As TR in Non RE areas.

9 ohms relay: PU current: 103mA- 117mA, PU voltage: 1.5V.

4 ohm relay P U voltage: 0.3V to 0.5V.

Don't work on relay contacts using sharp objects like knife, screw driver etc.

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QTA2: AC immunized DC neutral track relay. Spec: BRS 939A.

In all other respects, it is similar to QT2 relay in construction. Its coil resistance is 9 ohms, which can ensure A.C. immunity of not less than 50V. 9 ohm relay is standard and 20 ohms relays is also available

Only QSPA1 relay is permitted to be used as TPR with this track relay.

Max length of Track circuit is 450mtrs

A/C Immunity level 50V AC rms.

Contacts 2F/1B.

20 ohm relay: PU volts: 1.4 to 2.0V, PU current: 80mA to 90mA.

9 ohm relay: PU volts: 1.0 to 1.4V, PU current: 120mA to 140 mA.

[illegible]



In case of block joint defective, a normal neutral track relay may pick up by the polarity from the adjoining track but a biased track relay will not pick up.

This image shows a single sheet of white paper with horizontal blue ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Siemens K-50 Mini Group Relays Contact & Coil Terminal Numbering

K-50 Mini Group Relay (Front view) with contact No. and Amphenol terminal numbering (in brackets)

Top Relay	Coil 11 (91-92)
02 (11-12)	12 (81-82)
03 (21-22)	13 (71-72)
04 (31-32)	14 (61-62)
05 (41-42)	15 (51-52)
Bottom Relay	Coil (93-94)
02 (13-14)	12 (83-84)
03 (23-24)	13 (73-74)
04 (33-34)	14 (63-64)
05 (43-44)	15 (53-54)

K-50 Mini Group Relay Base Plate (Rear view) Amphenol Terminal numbering

SP-SP	SP-SP
SP-SP	SP-SP
94-93	92-91
84-83	82-81
74-73	72-71
64-63	62-61
54-53	52-51
44-43	42-41
34-33	32-31
24-23	22-21
14-13	12-11
4-3	2-1



Function of Electrolytic Condenser

Discharges through the coil of WJR relay WJR in point group, which in turn switches off the supply to point motor within specified time delay thereby preventing damage to the motor.

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.

For long life of electrolytic condenser, ensure that rated voltage is within 54 V to 72 V DC and ripple below 5%.

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Slow to release relays

Sometimes, a rectifier is connected across the relay coil to make it slow to release, with its cathode on the positive side and anode on the negative side. The release time lag so obtained is about 250 to 500 milliseconds.

The use of a condenser across a relay also makes it slow to release. A resistance may be connected in series with the condenser to limit the initial charging current.

First Signal Aspect Control Relay in Siemens PI,, GR1 has a condenser discharge circuit across its coil to prevent its dropping in times of momentary failure of power and track circuits.

Slow to pick up relays

With a resistance in series and suitable value of capacitance across the relay coil direct, the relay becomes slow to pick up due to the simultaneous charging of condensor in parallel. During release, the condensor discharges quickly through the relay coil, neutralising the effect of its inductance.

Examples of slow to pick up relays are TSR, JSLR, RJPR, UYR, etc.

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Siemens Thermo Flasher Unit

The thermo flasher serves the purpose of periodically interrupting light circuits there by bringing about flashing operation of light signals and indicating lamps

Coil (heating circuit input) -12V D.C/A.C or 110V/220V AC
(With built in transformer).

Flashing frequency - 60/ minute.

Siemens Thermo Flasher Relays are used in Siemens RRI Installations.

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Saturday



T.M. type AC Immunized Neutral Relay Units

Single ACI relay units as well as two relay units, (i) with one ACI relay and one ordinary relay and also (ii) with both ACI relays are available.

No additional provisions can be noticed in the construction of these relays. These relays can be identified separately by the following:-

- Red dots on the screw heads over the marking plate holders.
- The coil wrapper is blue in colour for non-immunized relays and yellow for A.C.I. Relays.
- The coil code number has a prefix IM
- Its coil resistance is 1512 ohms while that of non-immunized relays is 1550 ohms.

For wiring of TM Type relays, 0.6 mm copper wires are soldered to the holes of contact springs (clips).

Siemens K- 50 Relays Standard Contact configuration:

Neutral and Inter Locked - 6F/2B, 5F/3B, 4F/4B

ECRs (ON/OFF) - 3F/3B. UECR - 5F/1B

4F/4B

02 (11-12)	F	12 (81-82)	F
03 (21-22)	F	13 (71-72)	F
04 (31-32)	B	14 (61-62)	B
05 (41-42)	B	15 (51-52)	B

5F/3B

02 (11-12)	F	12 (81-82)	F
03 (21-22)	F	13 (71-72)	F
04 (31-32)	B	14 (61-62)	F
05 (41-42)	B	15 (51-52)	B

6F/2B

02 (11-12)	F	12 (81-82)	F
03 (21-22)	F	13 (71-72)	F
04 (31-32)	F	14 (61-62)	F
05 (41-42)	B	15 (51-52)	B

3F/3B (ON/OFF ECR)

02 (11-12)	F	12 (81-82)	F
03 (21-22)	B	13 (71-72)	F
04 (31-32)	B	14 (61-62)	B

5F/1B (UECR)

02 (11-12)	F	12 (81-82)	F
03 (21-22)	F	13 (71-72)	F
04 (31-32)	B	14 (61-62)	F

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Features of K-50 Relays

- Plug in proved type DC miniature relays.
- Independent type of contacts.
- Operate times are very fast: PU time is 25 to 60 m seconds and release time is to 15 m seconds. AC immunized timings are 200 m seconds.
- Wiping action of contacts also called as self cleaning.

Faster operating times reduces chance of welding.

K-50 AC immunized Relays

Uses copper slug for AC immunization

A Brass strip is provided on contact bar to reduce the release time. This acts as counter weight on the armature.

Immunized to 450 V AC

Coil resistance 1840 ohms. (All contact combinations)

PU time: 200 msec. DA time: 50 msec.

Guide pins will not allow plugging of relay in inverted position and will enable plugging of the relay in proper alignment.

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Proved type Relays are those whose normalization after each operation shall be proved in circuit controlled by their contacts. Contacts in which both the springs have metal surfaces on their tips. They may get fused due to high sparking current across them during operation. These may prevent relay normalization and causes unsafe condition in traffic control. To avoid this, proving of relay normalization after each operation is necessary

Non - proved type need not to be proved to have been normalized after each operation as their contacts have at least one non-fusible contact (carbon contact).

MISCELLANEOUS



DECEMBER 2016

PLANNER
DECEMBER 2016

1	Thu	
2	Fri	
3	Sat	
4	Sun	
5	Mon	
6	Tue	
7	Wed	
8	Thu	
9	Fri	
10	Sat	
11	Sun	
12	Mon	
13	Tue	
14	Wed	
15	Thu	
16	Fri	
17	Sat	
18	Sun	
19	Mon	
20	Tue	
21	Wed	
22	Thu	
23	Fri	
24	Sat	
25	Sun	
26	Mon	
27	Tue	
28	Wed	
29	Thu	
30	Fri	
31	Sat	

- The operating characteristics of the track relay should be checked once every two years.
- Track Relays of shelf type must be overhauled at intervals not exceeding 10 years. Plug-in type track relays are to be replaced after 12 years (or earlier if warranted).
- Main cable should be tested once a year and tail cables once in 6 months.
- Train shunt test must be taken every time a track circuit is adjusted. It should be taken at parallel portions of the track also with minimum 0.5 ohm resistance

Meggering of Signalling cable is done to test the continuity and insulation of the cable conductors.

Friday



Electric Point Machine – Periodicity of testing

The operating voltage and current of the machine must be tested at least once in 3 months

Obstruction test should be carried out fortnightly by Signal Technician, Monthly by Sectional SE/JE (Sig.) & Quarterly by SSE/SE (Sig.) Incharge.

Insulation tests on the point machine to be conducted Half yearly by Sectional SE/JE (Sig.) & Yearly by SSE/SE (Sig.) Incharge

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

The Meggering should be carried out at initial stages, before and after cable laying. For maintenance purposes these tests shall be performed periodically.



Block earths and their connections must be examined at intervals not exceeding one month and should be tested for resistance once a year. Where the resistance exceeds 10 ohms, action should be taken to reduce the resistance.

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Before commencement of cable meggering, obtain necessary disconnection from traffic or observe precautions as per the extant rules in division/zonal railways.

Foot-plate Inspection

In order to check visibility of signals from Driver's view, Signal Staff have to travel by Locomotive. This is known as Foot-plate Inspection. All SSE/SE/JE(S) shall carry out Foot-Plate Inspection of all signals by day and by night in both Up and Down directions once in a month or once in 3 months as applicable over their entire jurisdiction and submit record of observations in the prescribed format. During the inspection they shall take special notice of the following.

- (a) Signals should be correctly focused and should be burning brightly
- (b) All cabins should be provided with sufficient lighting arrangements
- (c) No fixed light should be interfering with the sighting of signals
- (d) The speed of the train should not exceed the maximum permissible speed
- (f) Examine the visibility of signals from the driver side. If a signal is seen obstructed by tree branches or other obstructions the detail should be noted for remedial action.
- (g) Note down the signals found drooping or improperly taken off or incorrectly replaced to "ON" position and bring it to the notice of the SM concerned for necessary action from the next station where the train stops. Cases requiring special attention, such as, trees in private lands shall be referred through the DSTE to DEN with full particulars of the topography of the areas for his information, necessary action and instructions. In other cases the In-charge SSE/SE(S) shall arrange to remove the obstruction as early as possible through P-Way staff. If, for reasons of safety immediate action is necessary, the train may be stopped at the station for giving necessary information to the SM.
- (h) All signals should have adequate visibility as specified preferably from the driver side of the foot-plate.
- (i) Anything that may endanger safety or may interfere with signalling gears shall be brought to the notice of the concerned department. If immediate action is necessary, the train may be stopped at the next station for giving necessary information to the SM.
- (j) All warning boards should be in proper fettle. Signal that are to be replaced to "ON" by the passage of trains are being so replaced.
- (k) Fireman/Asst. Driver should be calling out signals clearly and loudly Speed Restrictions & Caution Orders should be observed precisely by the crew

Day Foot-Plate Inspection should be done during broad day light hours preferably at noon and night foot-plate Inspection should be done between odd hours (midnight) to 0400 Hrs (4AM).

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Approach locking, indication locking, track locking, time release, cross protection, route locking and back locking should be tested once in three years.

Insulation is the property of insulated material and can be measured in off line condition.

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Wednesday

The official-in-charge of the trolley / motor trolley / lorry shall also be in possession of a watch in addition to the prescribed equipment.

2016 09 DECEMBER
Friday

As per Schedule of dimensions

- Opening of tongue rail in B.G 113 – 115 mm
- Clear Standing Length (CSL/ CSR) - Existing 686 Mts., New 715 Mts.
- Minimum distance between centre to centre of track in BG - 4.25 Mts.
Existing, 5.3 Mts. for new works.
- Minimum clearance of check rail at level crossing -51 mm
- Minimum depth of space for wheel flange from rail level - 38 mm
- The clearance between bottom of the rail and top of leading stretcher
bar under the Switch rail - 1.5 to 3 mm

The power line of Electronic Signaling equipments shall have class B & C 2 stage protection against surge.

Indian Railway Standard Drawings

Indian Railway Standard Drawings, designated by the code word IRS have been issued by the Director-General, Research Designs and Standards Organization, Ministry of Railways, Lucknow. The signal drawings are marked IRS (S) where "S" stands for "Signal". The particulars of the drawings and their reference numbers are detailed in an "Index of Indian Railway Standard Signalling and Interlocking Drawings- IRS.(S)". This index shows all the IRS.(S) drawings arranged alphabetically, as well as serially, in the order of their numbers. Each drawing number is either prefixed with letters 'SA' or letter 'S'. The letter 'SA' stands for a signal assembly and 'S' stands for a part of a signal assembly.

New designs and drawings which are accepted for adoption as standards have the word 'Advance' suffixed to their number e.g. S: 6085 (Advance), pending their final adoption as Indian Rly. Standard drawing. The drawings are prepared in the first instance by the RDSO and circulated to the Railways for offering their comments. The drawings together with the comments are put up for discussion before the SSC (Signal Standard Committee) who, if considered in order, will recommend that the particular drawing be issued as "Advance Standard". The Railway Board will order whether it is acceptable or not. When Railway Board orders, the drawing is issued as "Advance Standard".

The word Advance is deleted when no further comments are received and when the design is seized.

IRS drawings should not be traced by the Zonal Railway. Copies in reproduction tracings should be obtained from the Director General, Research, Designs and Standards Organization (Signal and Telecommunication), Ministry of Railways, Lucknow, whenever required.

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Speed of Motor Trolleys

- At night a Motor Trolley shall run at a speed not exceeding 30 KMPH.
- The speed of a Motor Trolley shall not exceed 15 KMPH over points and crossings.

No trolley, motor trolley or lorry shall be placed on the line except by a qualified person appointed in this behalf by special instructions.



- Maximum number of persons allowed to travel on a push trolley - 10
- Maximum number of persons allowed to travel on a motor trolley with 4 HP motor - 7
- Maximum number of persons allowed to travel on a motor trolley with 6 HP motor - 10
- Minimum number of persons to travel on a motor trolley - 4

No trolley / motor trolley/ lorry shall be attached to a train.

- Maximum height of equipment provided between the rails of the track is 64 mm above the rail level.
- For a distance of 229 mm outside and 140 mm inside the gauge faces of the rail, no gear or track fittings must project above rail level except such parts as are required to be actuated by the wheels or wing rails
- Point machine/ electrical point detector should be provided at a Min. distance of 1.6 m from nearest centre line of track.
- TLJB should be provided at a Min. distance of 1905 mm from nearest Centre line of track

Any material stacked by the side of line is to be considered as structure. These items also apply to projections of rock etc.

As per Schedule of dimensions

- If the edge of a signal foundation height is within 305 mm from above the rail level, then it should be at a Min. distance 1905 mm from nearest centre line of track
- Location Box should be provided at a Min. distance 2360mm from nearest centre line of track.
- Signal post should be provided at a Min. distance 2360mm from nearest centre line of track.
- Minimum height of signal post should be 3355 mm from above the rail level (if the post is within 2360 mm from nearest Centre Line of track).

No work within a yard can be taken up till such time the Engineering Plan and subsequently the SIP/IP (wherever required) are issued to the effect.

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As per Schedule of dimensions

- Red aspect of a signal should be at a height 3.65 m from above the rail level.
- If a signal's post is at a distance 2360mm from nearest C/L of track and if its height is 3355mm above the rail level then the Signal unit should be at a Min. distance 2135mm from nearest centre line of the track.

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Signalling Plan/SI Plan/IP is prepared on the basis of Engineering Plan.

As per Schedule of dimensions

Route indicator of a signal

- (i) if it is at a height about 4420mm to 4610 mm above rail level then it should be at a Min. distance 2135 to 1980 mm from the nearest C/L of the track.
- (ii) if it is at a height about 4610mm to 6250 mm above rail level ,then it should be at a Min. distance 1600 mm from the nearest C/L of the track.

If a Ladder of signal erected at a distance with in 2360 mm from centre line of adjacent track then it should be blanked off (strap around by a sheet around ladder) to a height of 300mm between 2060mm and 2360mm above rail level.

Indian Railway Standard Specifications

Specifications for materials used for signalling purposes have been drawn out by the Director General, Research, Designs and Standard Organisation (DG/RDSO), Ministry of Railways, Lucknow and are titled as "Indian Railways Standards Specifications". The procedure for issuing a new specification is the same as that of the new drawings.

Tentative specifications are drawn out by RDSO and circulated to Railways for comments. Later on the same is discussed in Signal Standards Committee (SSC) and the SSC will recommend to the Railway Board that the specifications be accepted as Tentative Standard. The same are issued as tentative standard specification by RDSO, when approved by Board. These specifications are issued under a fixed serial number e. g. S-12-54, the letter "S" denoting "Signals" the number "12" representing the serial number of the specifications and the final number "54" indicating the year of original adoption as standard, or in the case of revision, the year of last revision.

Other Specifications

Specifications issued by the British Standards Institution, the Indian Standards Institution and the British Railway have also been adopted for items of equipment used for signaling purposes for which no IRS specifications exist.

Supply of Specifications

Each Divisional Signal and Telecommunication Engineer and Assistant Signal and Telecommunication Engineer should have a copy of all Indian Railway Standard (Signal) specifications in his office. Copies of such British Standard and Indian Standard specifications that are generally required may also be kept. He should also have a copy of all specifications issued by Chief Signal and Telecommunication Engineer for local use.

Double Line Block Instrument

For Non RE area	For RE area
a) Line wire: Three line wire & individual earth as return wire	a) Line wire 4 line wire, with Phantom circuit & earth.
b) Supply (i) Line supply 12V + line drop (ii) Local supply 12V	b) Supply (i) Line supply 12V + line drop (ii) Local supply 12V
c) Other Equipment- NIL	c) Other Equipment (i) Block bell unit (ii) Filter Unit (iii) Isolation Transformer 2 Nos

When the Station Master's key is out the operation of block handle for cancellation of "Line Clear" is prevented.

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Types of double line Block Instruments

There are 3 types of Double Line Block Instruments: -

- (a) SGE Type (Byculla Make)
(b) Modified SGE Type (PTJ Make)
(c) IRS Type (HWH Make)

The main differences among them are

- (i) Contact arrangement
- (ii) Housing of components like polarised relay, Bell Assembly, Bell Relay, Telephone etc.
- (iii) Design of TOL Lock (Mechanical stick or Electrical Stick).

[illegible]

The block handle is provided with electro-mechanical locking device with forced dropping arrangement, which locks the handle after it is turned from "Line Clear" to "Train On Line".

Double Line Block Instrument Top Indicator (Upper Needle)

The coil of this indicator is wound to a resistance of 140 Ohms and it works on an operating current of 17 to 25 mA.

Bottom Indicator (Lower Needle)

The coil of this indicator is also wound to a resistance of 140 Ohms and it works on an operating current of 17 to 25 mA.

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

The indications of the Bottom indicator correspond to the positions of the commutator.

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Double Line Block Instrument

Block Bell Relay

A single stroke block bell is worked by a relay. The resistance of this relay is 500 Ohms and it requires a minimum operating current of 7.5 mA. The relay and the bell form a separate unit. A separate line wire works the bell relay.

This image shows a single sheet of white paper with horizontal blue ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

SR relay picks up when the commutator is turned to TOL at the receiving end.

Double Line Block Instrument

Block Bell

This is a single stroke bell actuated by the bell relay. The resistance of the bell coil is 60 Ohms. It requires a minimum operating current of 85 milli amp, whenever the plunger at the distant station is pressed, this bell registers one beat.

This image shows a single sheet of white paper with horizontal blue ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

For reason of safety it is essential that the commutator having been turned to TOL allowing SR to pick up at the distant end must get locked in TOL position.

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Double Line Block Instrument

Bell Plunger

This is threaded through the centre of the Commutator Handle. every time the plunger is pressed, the battery positive is applied on the bell line completing the circuit through the bell relay at the distant station and earth. Thus the bell at the distant station is actuated when the plunger is pressed.

[illegible]

When there is no current flowing through the polarized relay its arm remains in the centre.

Signal Sighting Committee

All new signals/modified signals and warning boards etc. shall be inspected and passed by "Signal Sighting Committee" consisting of (i) SSE/SE/JE(S) (ii) Loco Inspector and (iii) Traffic Inspector as per proforma given below. For existing signals the above inspection should be carried out quarterly.

.....RAILWAY
 SIGNAL & TELECOMMUNICATION DEPARTMENT
 SIGHTING SIGHTING COMMITTEE REPORT
 Division/District.....
 Name of work.....
 Sighting of

FORM No. S&T/SC
Annexure 'A'
 Para.311(a)

We the undersigned members of the Signal Sighting Committee having met atand sighted the view of the signals noted below recommend that their dimensions and locations should be as given against each.

Name of the station and reference of signal (giving Up or Down)	Height of existing signal above rail level	Height of proposed signal above rail level	Distance in metres of the existing signal from the adjacent track	Distance in metres of the proposed signal from the adjacent track	Distance in metres of the existing signal from a fixed point	Distance in metres of the proposed signal from a fixed point
1	2	3	4	5	6	7

Is the existing signal on the left hand side or right hand side of the track to which it refers?	Is the proposed signal on the left hand side or right hand side of the track to which it refers?	Visibility of the proposed signals from Driver's point of view in normal weather (metres)	Are Light indicator and Arm repeater provided to the existing signal?	Are Light indicator and Arm repeater required for the new signal?	Remarks
8	9	10	11	12	13

SE/SSE(Signal)

Loco Inspector

Traffic Inspector

Double Line Block Instrument Commutator Handle

Commutator Handle turns to 200 left and to 200 right from the vertical position, marked by an arrow. The Commutator Handle cannot be turned from one position to the other unless the Bell plunger is pressed. This means every time the Commutator has to be turned, the Bell plunger must be pressed. Incidentally single stroke Bell is actuated at the other end drawing the attention of the SM, whenever the Commutator is turned.

SR relays in LSS circuit have minimum pick time of 300 milliseconds, achieved by having them as slow Shelf type relays or QSPA1 type or two Nos. of QNA1 Type relays.

Double Line Block Instrument

The Commutator Handle is free to be turned

- (a) From Line Closed to Line Clear
- (b) From Line Clear to Line Closed. and
- (c) From Line Closed to Train on Line.

The lock is effective only in TOL position, that too 'conditionally' such that

- (i) The commutator Handle is locked when it is turned from Line Clear to TOL
- (ii) The Commutator Handle is not locked in TOL position when it is turned directly from Line Closed to Train on Line.

The SR relay is dropped at the sending end on entry of the train in the Block Section.

A separate polar relay has to be included in series with the top indicator and the last stop signal is controlled through the same. The relay has one arm with three positions corresponding to the three indications of the top indicator needle i.e. Line closed, Line Clear (LC) and Train on Line (TOL).

This image shows a single sheet of white paper with horizontal blue ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

The IRS specification of the polarised relay is S31 / 80 and having a coil resistance of 77 Ohms, it works on a rated current of 25 mA.

Network of Data loggers

Data logger in various stations can be interconnected in a network with the use of Main Telecom cable or Quad cable or Microwave or OFC (Optical Fiber Cable). Data is brought to the centralized system called Front End Processor (FEP) which is connected to the station data loggers through the modems. FEP in turn is connected to a PC placed in Control room/HQ office called Central Monitoring Unit (CMU). The CMU is having the Graphical User Interface (GUI) software to retrieve data from all networked data loggers. CMU collects the data from the FEP, stores it and processes for report generation and analysis.

The network of data logger system consists of Data logger, Remote Terminal Unit (RTU), Front End Processor (FEP), Central Monitoring Unit (CMU).

Friday



Inspection & Maintenance of Surge arrestors

In lightning arrestors of Class B, aging phenomena may occur in rare cases, adversely affecting the protective function of the devices, because of frequent overloading/lightning. It is therefore advisable to check the arrestors every two to four years, and after direct lightning strikes.

Surge arrestors of Class C contain varistors having an indicator, which shows whether the device is faulty. The indicators of these should be checked, especially after a period of thunderstorms. If the indicator changes from green to red, the device must be replaced, since it no longer gives protection.

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Stage 1 and stage 2 (Class B & C) protection for IPS should be from the same manufacturer/supplier.



[illegible]

This image shows a full page of primary-ruled paper. It features multiple sets of horizontal dashed lines spaced evenly down the page, providing a guide for handwriting practice. The lines are light gray and extend across the entire width of the page. There are no margins, text, or other markings present.

Meetings/Inspections/Important events

2016

January

February

March

April

[illegible][illegible][illegible][illegible]

May

June

July

August

[illegible][illegible][illegible][illegible]

September

October

November

December

[illegible][illegible][illegible][illegible]

Travel Planner

[illegible]

Addresses & Contact Numbers

A B C D

[illegible]

E F G H

[illegible]

I J K L

[illegible]

M N O P

[illegible]

Q R S T

[illegible]

U V W X

[illegible]

YZ

[illegible]

YEAR PLANNER 2016

	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Jan					1	2	3
	4	5	6	7	8	9	10
	11	12	13	14	15	16	17
	18	19	20	21	22	23	24
	25	26	27	28	29	30	31
Feb	1	2	3	4	5	6	7
	8	9	10	11	12	13	14
	15	16	17	18	19	20	21
	22	23	24	25	26	27	28
	29						
Mar		1	2	3	4	5	6
	7	8	9	10	11	12	13
	14	15	16	17	18	19	20
	21	22	23	24	25	26	27
	28	29	30	31			
Apr					1	2	3
	4	5	6	7	8	9	10
	11	12	13	14	15	16	17
	18	19	20	21	22	23	24
	25	26	27	28	29	30	
May							1
	2	3	4	5	6	7	8
	9	10	11	12	13	14	15
	16	17	18	19	20	21	22
	23	24	25	26	27	28	29
	30	31					
Jun			1	2	3	4	5
	6	7	8	9	10	11	12
	13	14	15	16	17	18	19
	20	21	22	23	24	25	26
	27	28	29	30			

	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Jul					1	2	3
	4	5	6	7	8	9	10
	11	12	13	14	15	16	17
	18	19	20	21	22	23	24
	25	26	27	28	29	30	31
Aug	1	2	3	4	5	6	7
	8	9	10	11	12	13	14
	15	16	17	18	19	20	21
	22	23	24	25	26	27	28
	29	30	31				
Sep				1	2	3	4
	5	6	7	8	9	10	11
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	19	20	21	22	23	24	25
	26	27	28	29	30		
Oct						1	2
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	17	18	19	20	21	22	23
	24	25	26	27	28	29	30
	31						
Nov		1	2	3	4	5	6
	7	8	9	10	11	12	13
	14	15	16	17	18	19	20
	21	22	23	24	25	26	27
	28	29	30				
Dec				1	2	3	4
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	19	20	21	22	23	24	25
	26	27	28	29	30	31	

