



दक्षिण रेलवे  
SOUTHERN RAILWAY

**दर की अनुसूची**  
**SCHEDULE OF RATES**  
**2022**

एसओआर का विस्तृत विवरण-2022  
**Detailed description of SOR-2022**

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**सिग्नल व दूरसंचार विभाग**  
**SIGNAL & TELECOMMUNICATION DEPARTMENT**

**केवल कार्यालय उपयोग के लिए**  
**(FOR OFFICE USE ONLY)**

**प्रधान मुख्य सिग्नल एवं दूरसंचार इंजीनियर**  
**PRINCIPAL CHIEF SIGNAL AND TELECOMMUNICATION**  
**ENGINEER**

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### Detailed description of Schedule of Rates 2024

<b>CHAPTER-1</b> <b>(Electronic Interlocking Items)</b>				
<b>Sl No.</b>	<b>SOR No.</b>	<b>Brief description of work</b>	<b>Unit</b>	<b>Rate (Rs.)</b>
1.	01_1	Supply of Electronic Interlocking (Hot Standby) for stations with Signalling functions up to 125 units as per Function table enclosed along with 15% spares, tools, manuals and Instruments. Centralised E.I to be provided as per RDSO Spec. No. RDSO/SPN/192/2019/Ver 2.0 or latest. (Functions include all vital and non vital inputs and outputs to EI except read back inputs)	Set	1,14,34,483.51
2.	01_2	Incremental rate for signalling functions in EI SYSTEM over and above 125 functions under item No 1 (Per Unit=Per Function)	Per Unit	1,04,018.64
3.	01_3	Supply of fan less embedded industrial grade computers (Similar to Moxa V2406 or better) with all accessories such as key board, mouse, antivirus etc. of industrial grade as per approved Specification as recommended by latest RDSO Specification(RDSO/SPN/192 or 203 or latest) for EI	Nos	3,75,562.03
4.	01_4	Supply of portable work station to run along with EI configuration tool, Data Inputs, Simulation and Functional testing, diagnostic and troubleshooting and commissioning of EI system. Prior technical Approval to be obtained from Engineer In-charge	Nos	1,85,885.65
5.	01_5	Supply of Power Supply arrangement for VDU and Embedded PC. This includes supply of 2Nos of 110VDC/24DC, 10A DC-DC converter and 2Nos of 110VDC/110V AC, 500VA Inverter in (1+1) configuration. (as per Technical Specification enclosed)	Set	2,14,096.98
6.	01_6	Supply of Double Key Lock	Nos	481.77
7.	01_7	Supply and Installation of work space as per enclosed drawing No PROJ/SG/MS/70/2019 – work space (as approved by engineer in charge) with control desk for 2 monitors, 2 operators & one module to be provided for storage - should include space for housing Two nos of Embedded PCs, 2 nos FDMS and their Power supply arrangement for with proper ventilation with two chairs (as per Drawing enclosed or as per site requirement)	Nos	9,48,672.10

<b>CHAPTER-1 (Electronic Interlocking Items)</b>				
<b>SI No.</b>	<b>SOR No.</b>	<b>Brief description of work</b>	<b>Unit</b>	<b>Rate (Rs.)</b>
8.	01_8	Installation, Wiring, testing, Soldering of all EI equipments, earthing of EI Equipment, Relay Racks and Power Equipment etc. including supply of power cable and Documents/Manuals etc. (Per Unit= Per EI Hut)	Per Unit	9,25,301.63
9.	01_9	Design and drawing for complete indoor signalling work for new PI/RRI/EI (Per unit = Per PI/RRI/EI)	Per Unit	3,55,737.90
10.	01_10	Commissioning of Electronic Interlocking system (Per Unit = Per EI)	Per Unit	31,901.72
11.	01_11	Training of Railway Personnel in installation, commissioning, testing, troubleshooting and in diagnosing faults using diagnostic tools/flow charts including supply of necessary documents. (Per Unit= 60 Man Days)	Per Unit	72,995.54
12.	01_12	Training on application software for designing, change in the logics and converting it suitable for system and loading the programme into the working system for alteration of SIP/TOC. The training should be comprehensive with complete document. (Per Unit=90 Man Days)	Per Unit	1,09,493.30
13.	01_13	Carrying out Automatic Factory Acceptance test for any station having Centralized EI configuration	Stn	1,56,701.19
14.	01_14	Carrying out Automatic Factory Acceptance test for any station having Distributed EI configuration	Stn	3,05,105.92
15.	01_15	Carrying out Automatic Site Acceptance test for any station having Centralized EI configuration.	Stn	6,31,595.00
16.	01_16	Carrying out Automatic Site Acceptance test for any station having Distributed EI configuration	Stn	9,73,868.46
17.	01_17	Preparation and Submission of NI drawings/ Plans, Rule Diagrams, Station Working Rules, CRS Documents, TSAA documents	Stn	5,29,000.45
18.	01_18	Testing and commissioning the RRI/PI signalling installations jointly with the Railway representative at site at the stations/ LC gates covered under various schedules of the Contract and ensuring that all the signalling gears are installed and adjusted as per the existing rules. The work also involves supply of required number of		

<b>CHAPTER-1</b> <b>(Electronic Interlocking Items)</b>				
<b>SI No.</b>	<b>SOR No.</b>	<b>Brief description of work</b>	<b>Unit</b>	<b>Rate (Rs.)</b>
		bound registers with good quality papers with all updated details of cable meggering, relays, batteries, block joints, route cancellation, relay room key entries, block instrument key, earth resistance etc., and handing over to Railways.  (Supply of 'As made' is not covered in this schedule).		
	a	a)Testing and commissioning of stations (upto 5 roads)	per station	38,884.69
	b	Testing and commissioning of stations (more than 5 roads)	per station	67,941.71
	c	Testing and commissioning of LC gates	per LC	15,037.73
19.	01_19	Submission of all relevent final 'As made' of circuit diagrams, contact analysis charts, termination particulars of apparatus cases and cable termination rack, power supply arrangements, relay index board, cable plans, cable route plans, red boundary plans and all other particulars covered under various schedules. All 'As made' shall be prepared by the Contractor in AUTOCAD 2000 or latest and submitted in CDs. One copy of the 'As made' check print shall be submitted before Testing the circuits. The final negatives shall be made in tracing sheet (80 to 90 gsm). All 'As made' except cable plan, cable route plan, bonding diagram & power supply diagram shall be prepared in A3 size. On approval the contractor shall submit along with the negatives, 8 copies in each, duly making booklet neatly bound. Out of 8 sets, 2 sets of drawings and other plans shall be kept in transparent plastic cover (2 sheets back to back in one plastic cover) and handed over to Railways. Also the contractor has to supply one set of As made in 'Reproduction Film'.  The approved circuit diagram will be issued by Railways in soft copy as well as two sets of hard copies. Wherever alterations to	per sheet	382.12

<b>CHAPTER-1</b> <b>(Electronic Interlocking Items)</b>				
<b>SI No.</b>	<b>SOR No.</b>	<b>Brief description of work</b>	<b>Unit</b>	<b>Rate (Rs.)</b>
		existing circuits are involved, the existing as-made circuit diagrams will be supplied by Railways either in CDs or RP film. The Contractor shall incorporate the details of all the new wirings and alterations in the CD/ RP film and submit them to Railways. On approval 8 copies shall be made for As-made circuit diagrams also as mentioned above.		
20.	01_20	Preparation of circuits, location diagrams, power diagrams, cable plan, bonding plan etc in Auto Cad 200o or latest. The drawings shall be prepared in A3/A2/U size as required by Railways. The hard copies of the documents will be supplied by Railways. The Contractor has to draw the drawings in Auto Cad very carefully and submit one copy of check print along with the soft copy in CD. The drawings shall be checked and returned by Railways indicating corrections if any. The corrections have to be made and final copy submitted in A3/ A2/ U size as required by Railways along with the final soft copy in CD. The hard copy given by Railways have to be returned back without any damage. The size of sheet given in the unit column is for the hard copy given by Railways.		
	a	a) Preparation of soft copy in AUTO CADD from A3 size hard copy	per A3 sheet	218.30
	b	Preparation of soft copy in AUTO CADD from A2 size hard copy	per A2 sheet	436.60
	c	Preparation of soft copy in AUTO CADD from U size hard copy	per mtr of U size	1,548.45

<b>CHAPTER-1</b> <b>(Electronic Interlocking Items)</b>				
<b>SI No.</b>	<b>SOR No.</b>	<b>Brief description of work</b>	<b>Unit</b>	<b>Rate (Rs.)</b>
21.	01_21	<p>Designing of Signalling plan in AUTOCAD 2000 or latest and submission of negatives in 80/90 gsm tracing paper in 'U' size along with 2 copies and also the soft copy in compact disks induplicate. First, 2 sets of prints shall be supplied to Railways for checking. One set will be returned by Railways to the contractor for making corrections in AUTOCAD. The final corrected drawings shall be supplied to Railways on 80/90 gsm tracing paper and 2 CDs.</p> <p>[2 interlocked sidings will be considered equal for one loop line]</p> <p>(Approved permanent way plan will be supplied by Railways).</p>		
	a	Designing of Signalling plan in AUTO CADD - 'U' size - for stations upto 4 roads	per station	9547.85
	b	Designing of Signalling plan in AUTO CADD - 'U' size - for stations from 5 to 8 roads	per station	17,147.65
	c	Designing of Signalling plan in AUTO CADD - 'U' size - for stations from beyond 8 roads	Per station	28,308.70

<b>CHAPTER-1</b> <b>(Electronic Interlocking Items)</b>				
<b>SI No.</b>	<b>SOR No.</b>	<b>Brief description of work</b>	<b>Unit</b>	<b>Rate (Rs.)</b>
22.	01_22	<p>Designing of circuits diagrams/ table of control in AUTOCAD 2000 or latest (including contact numbers on the circuit) and submission of negatives in 80/90 gsm tracing paper in 'A3' size along with 2 copies and also the soft copy in compact disks induplicate. First, 2 sets of prints shall be supplied to Railways for checking. One set will be returned by Railways to the contractor for making corrections in AUTOCAD. The final corrected drawings shall be supplied to Railways on 80/90 gsm tracing paper and 2 copies of blue prints and the soft copy in 2 CDs.</p> <p>(Approved Signalling plan will be supplied by Railways for preparing table of control. Approved table of control will be supplied by Railways for preparing circuits diagrams).</p>		
	a	a) Designing of circuits/TC in AUTO CADD 2000 - A3 SIZE	per sheet	1,089.28
	b	Designing and Submission of Circuit diagram in A3 size (without Tracing sheets and Ammonia prints)	per sheet	647.32



**CHAPTER-2**  
**(Datalogger and RTU)**

23.	02_1	Supply, of Datalogger with 512 Digital Input and 32 Analog Input as per RDSO specification No. IRS:S-99/2006 Amdt 3 (or) latest with power supply arrangements. (This work does not includes wiring of inputs from Relay to Intermediate tag block & from intermediate tag block to Datalogger equipment)	Nos	4,46,627.20
24.	02_2	Supply of data logger with 512 digital and 96 Analog inputs as per RDSO spec .no IRS-S-99/2006 or latest including Power Supply and Back-up arrangements(This work does not includes wiring of inputs from Relay to Intermediate tag block & from intermediate tag block to Datalogger equipment)	Nos	4,94,420.00
25.	02_3	Supply of Datalogger of Capacity 1024 Digital and 32 Analog as per RDSO spec .no IRS-S-99/2006 or latest including Power Supply and Back-up arrangements(This work does not includes wiring of inputs from Relay to Intermediate tag block & from intermediate tag block to Datalogger equipment)	Nos	4,91,478.26
26.	02_4	Supply of RTU of Capacity 32 Digital and 16 Analog as per RDSO spec .no IRS-S-99/2006 or latest including Power Supply and Back-up arrangements	Nos	2,07,199.04
27.	02_5	Supply of RTU of Capacity 64 Digital and 16 Analog as per RDSO spec .no IRS-S-99/2006 or latest including Power Supply and Back-up arrangements	Nos	2,38,238.84
28.	02_6	Supply of RTU of Capacity 128 Digital and 16 Analog as per RDSO spec .no IRS-S-99/2006 or latest including Power Supply and Back-up arrangements	Nos	2,47,800.00
29.	02_7	Supply of RTU of Capacity 128 Digital and 32 Analog as per RDSO spec .no IRS-S-99/2006 or latest including Power Supply and Back-up arrangements	Nos	2,83,200.00
30.	02_8	Supply of Fault Analysis Terminal for analysis of fault and generating reports for Datalogger installed at stations. As per Technical Specifications.	Nos	54,723.27
31.	02_9	Supply of Protocol Converter suitable for Electronic Interlocking system equipment	Nos	68,051.41
32.	02_10	Supply of Dual Card RS232 to EI/OFC converter suitable to insert in the Datalogger Eurorack for inter-linking Datalogger/MFEP	Nos	45,367.61
33.	02_11	Supply of Data Concentrator along with one Dual Card modem as per RDSO specification IRS:S-99/2006 or latest. As per technical	Nos	97,008.14

**CHAPTER-2**  
**(Datalogger and RTU)**

		Specification		
34.	02_12	Supply of External 4wire leased line modem for enabling RTU connectivity with Dataloggers at Stations	Nos	39,622.80
35.	02_13	Supply of 8 Port Multi Port Front End Processor (MFEP) with 8 nos of dual card modems with and 230/24V/10A charger and 24V, 42AH maintenance free battery as per Specification No. IRS:S-99/2006 (Amdt-3) or latest.	Nos	1,18,000.00
36.	02_14	Supply and Provision of 64 Input Digital Stack Card (Digital Input Card) to suit Datalogger as per IRS S-99/2006 amt 3 or latest	Nos	26,458.78
37.	02_15	Supply and Provision of External Mother Board to suit Datalogger as per IRS S-99/2006 amt 3 or latest	Nos	73,529.86
38.	02_16	Supply and Provision of 128 input tag block for termination of relay wiring inside Datalogger	Nos	7,349.87
39.	02_17	Supply and Provision of Euro Rack for housing additional cards and Mother Boards of Datalogger	Nos	17,247.76
40.	02_18	Supply and Provision of Housing Rack for Housing Euro Rack, Power arrangement, terminations etc.	Nos	18,698.79
41.	02_19	Supply of 24V Opto Converter for Interfacing RTU with Data Analyser	Nos	14,755.08
42.	02_20	Supply of isolation transformer 600:470 ohms as per IRS TC 76-2001 amd 1 or latest	Nos	791.12
43.	02_21	Supply of Opto to USB Ports for Interfacing Datalogger with Data Analyser	Nos	7,377.54
44.	02_22	Supply of Central Monitoring Unit (CMU) suitable for Data logger system or other application as per IRS S-99/2006 or latest	Nos	3,03,112.50
45.	02_23	Supply, Installation, Testing and Commissioning of Failure Alarm SMS system integrated with Datalogger. This includes a) Software and configuring the SMS features in the NMDL/CMU. b) GSM Modem for Each Network. c)PCI Serial Port Adopter card.	Set	1,42,809.29
46.	02_24	Supply of High end Datalogger/RTU Server with Windows 2012 or Latest Server OS	Nos	8,61,272.52
47.	02_25	Installation of Datalogger of Capacity 512 Digital and 32 Analog. This includes transportation of materials to Site location and provision of Ladder and cable trough	Nos	29,500.00

**CHAPTER-2**  
**(Datalogger and RTU)**

		arrangements including connection to the BRC earth. Also includes carrying out of pre-commission checklist and Networking of datalogger.  (This schedule doesn't cover wiring and preparation of simulation chart)		
48.	02_26	Installation, testing and commissioning of 512 Digital & 96 Analog data logger. This includes transportation of materials to Site location and provision of Ladder and cable trough arrangements including connection to the BRC earth. Also includes carrying out of pre-commission checklist and Networking of datalogger.  (This schedule doesn't cover wiring and preparation of Simulation chart)	Nos	29,500.00
49.	02_27	Installation of Datalogger of Capacity 1024 Digital and 32 Analog. This includes transportation of materials to Site location and provision of Ladder and cable trough arrangements including connection to the BRC earth. Also includes carrying out of pre-commission checklist and Networking of datalogger.  (This schedule doesn't cover wiring and preparation of Simulation chart)	Nos	41,300.00
50.	02_28	Preparation of Simulation Database which includes chart preparation for on-line and off-line simulation for display in VDU for station or Auto section. (Per Unit = Per Datalogger)	Per Unit	59,000.00
51.	02_29	Installation of RTU of Capacity 32 Digital and 16 Analog. This includes transportation of materials to Site location and provision of cable trough arrangements including connection to the BRC/Location earth. This also includes carrying out of pre-commission checklist and Networking of datalogger.  (This schedule doesn't cover wiring and preparation of Simulation chart)	Per Unit	18,836.28
52.	02_30	Installation of RTU of Capacity 64 Digital and 16 Analog. This includes transportation of materials to Site location and provision of cable trough arrangements including connection to the BRC/Location earth. This also includes carrying out of pre-commission checklist and Networking of datalogger.	Per Unit	21,650.89

**CHAPTER-2**  
**(Datalogger and RTU)**

		(This schedule doesn't cover wiring and preparation of Simulation chart)		
53.	02_31	Installation of RTU of Capacity 128 Digital and 16 Analog. This includes transportation of materials to Site location and provision of cable trough arrangements including connection to the BRC/Location earth. This also includes carrying out of pre-commission checklist and Networking of datalogger.  (This schedule doesn't cover wiring and preparation of Simulation chart)	Nos	23,600.00
54.	02_32	Installation of RTU of Capacity 128 Digital and 32 Analog. This includes transportation of materials to Site location and provision of cable trough arrangements including connection to the BRC/Location earth. This also includes carrying out of pre-commission checklist and Networking of datalogger. (This schedule doesn't cover wiring and preparation of Simulation chart)	Nos	23,600.00
55.	02_33	Wiring of Relay Inputs to Wago Block and Wago block to Datalogger. Necessary Wagos required is included as per schedule	Unit	285.86
56.	02_34	Wiring of Analog Voltages from IPS Room to Datalogger. Necessary Wagos required is included as per schedule	Nos	285.86
57.	02_35	Installation of Fault Analysis Terminal (for analysis of fault and generating reports for Datalogger installed at stations)	Nos	23,452.83
58.	02_36	Installation of Data Concentrator (along with one Dual card Modem.)	Nos	41,574.92
59.	02_37	Installation of 8 Port Multi Port Front End Processor (MFEP) as per IRS 99/2006 or latest	Nos	17,700.00
60.	02_38	Installation of isolation transformer 600:470 ohms as per IRS TC 76-2001 or latest	Nos	339.05
61.	02_39	Installation of Central Monitoring Unit as per IRS S-99/2006 or latest	Nos	11,547.14
62.	02_40	Installation of High end Datalogger/RTU Server with Windows 2012 or Latest Server OS	Nos	18,764.11
63.	02_41	Preparation of station specific Train Arrival and departure logics for a six road station or less	Nos	1,63,559.06
64.	02_42	Preparation of station specific Train Arrival and departure logics for a seven-road station to Ten road or less	Nos	2,63,646.59

<b>CHAPTER-2 (Datalogger and RTU)</b>				
65.	02_43	Carrying out Embedded software modification in Datalogger to communicate with the data entry terminal of the ASM and pass the information through the datalogger network.	Nos	32,711.81
66.	02_44	Carrying out Embedded software modification in (1) FEP in control office and (2) CMU in control office, to accept and transfer the relevant station data to a client PC	Nos	1,36,299.22

**CHAPTER-3**  
**(Earthing)**

67.	03_1	Supply of indicative type Surge Protection Device as per RDSO Spec. No. SPN/165/2023, Version 4.0 Amdt.1 or latest (Lightning and Transient surge protection for power line). The system shall have stage1 (class B) and stage 2 (class C) type against Lightning electromagnetic Impulse configuration. The protection of Type 1 and 2 against Lightning electromagnetic Impulse (LEMP) and other high surge, shall be provided at the incoming of the power line at the stations, LC gates before the power equipment's as per the instructions of Engineer in-charge at site. Supply of surge protection with Potential free contacts shall be of approved make like OBO, DEHN, PHOENIX, LPT or better make. All other miscellaneous materials required for the work shall be supplied by the contractor. <i>(as per Technical Specification enclosed)</i>	Nos	22,756.39
68.	03_2	Supply and Provision of indicative type Class D Surge Protection Device for 24V DC/48V DC (spark gap type), with Potential Free contacts and installed as per the instructions of the Engineer in charge at site ( OBO, DEHN, PHOENIX, LPI, ZOTUP, HAKEL or better make).  All other miscellaneous materials required for installation shall be supplied by the contractor.	Nos	6,328.80
69.	03_3	Supply and Provision of indicative type Class D SPD of Operating Voltage of 110V AC/DC with Potential Free contacts and installed as per the instructions of the Engineer in charge at site (OBO, DEHN, PHOENIX, LPI, ZOTUP, HAKEL or better make).  All other miscellaneous materials required for installation shall be supplied by the contractor.	Nos	6,830.72
70.	03_4	Supply and Provision of Earthing as per RDSO Specification RDSO/SPN/197/2008 or latest <i>(as per Technical Specification enclosed)</i>	Nos	28,118.51
71.	03_5	Supply and Installation of Copper tape of size 25mm x 3mm for Down conductor from Franklin Rod to Maintenance free earth. This work includes installation of insulated stand-offs at every 1 Mtr. interval for fixing the Copper tape. This work also includes	Mtr	690.54

		Exothermic welding of Copper tape to the Franklin rod and the maintenance free earth for high conductivity. (All the materials required for the above work shall be supplied by the Contractor)		
72.	03_6	Supply and provision of Earthing arrangements for EI/MSDAC buildings as per RDSO specifications as required for the EI system along with supply of all required materials. Earthing shall be carried out as per RDSO/SPN/197/2008 and RDSO Lr .No STS/L/SSI/CA/US&S Dt 26.07.2011 for Typical Earthing connections for EI. Painting of earthing diagram as replica of the ground on backside wall of relay room as per the instruction of Site In-charge.(Per unit= Per goomty/station)	Per unit	2,91,723.20
73.	03_7	Supply, Installation and Commissioning of Active Class 'A' Protection with Lightning Event Counter as per RDSO Spec No. SPN/197/2008 with Three Year Warranty (Make Erico, LPI or Similar). This schedule includes supply of 30 mtrs cable for connecting Air terminal & earth as specified by OEM. ( <i>as per Technical Specification enclosed</i> )	Nos	4,83,896.58
74.	03_8	Supply of earth electrodes (GI) as per Drg no SG/CN/02/13	Nos.	1,618.75
75.	03_9	Provision of earth electrodes as per drawing No.SG/CN/02/13 and earthing of metallic sheath and armour of all cables in all apparatus cases, relay room, equipment room, SM's room for block and control, and earthing of all equipments in apparatus cases, power room, relay rack, cable termination rack, control panel, signals, lever frames with MS flat 35mm X 6mm/19c cable (MS flat for closer by areas and MS flat/19c cable combination for farther areas) as per the instructions of Railway representative at site. The work includes painting of earth resistance value on the earth pit. (Supply of 19C cable is not covered in the scope of this schedule). [MS flat for earthing 35mm X 6mm, cement, GI earth electrodes, common salt, charcoal, country bricks, M sand, soldering materials and all other miscellaneous materials required for the work shall be supplied by the Contractor].	Nos	1,707.55
76.	03_10	Full Location: Supply and fixing of GI Flat of size 1050x25x3mm as given in enclosed drawing to connect all cable armours to earth point with suitable nuts/bolts as given	Per Locati on Box	1,370.66

		below.  A) GI nuts/bolts of size 8x25mm with Two flat and one spring washer of 23set. B) GI nuts/bolts of size 12x40mm with two flat and one spring washer of 02set as per site incharge		
77.	03_11	Half Location: Supply and fixing of GI Flat of size 550x25x3mm as given in enclosed drawing to connect all cable armours to earth point with suitable nuts/bolts as given below.  A) GI nuts/bolts of size 8x25mm with Two flat and one spring washer of 23set. B) GI nuts/bolts of size 12x40mm with two flat and one spring washer of 02set as per site incharge	Per Location Box	846.75
78.	03_12	Installation of 230V Class B & Class C Surge Protection Device. This includes transportation of materials to site. Installation to be carried out as per the direction of Railway Engineer. Necessary copper wire for Power Wiring and connecting the earth to be supplied as part of the schedule. All other miscellaneous materials required for installation shall be supplied by the contractor.	Nos	9,752.74



<b>CHAPTER-4 (Power Supply)</b>				
79.	04_1	Supply of 8-Channel Earth Leakage Detector as per RDSO Specifications RDSO/SPN/256/2002 or latest	Nos	1,10,759.06
80.	04_2	Supply of 12-Channel Earth Leakage Detector as per RDSO Specifications RDSO/SPN/256/2002 or latest	Nos	1,50,841.73
81.	04_3	Supply of 16-Channel Earth Leakage Detector as per RDSO Specifications RDSO/SPN/256/2002 or latest	Nos	1,70,020.00
82.	04_4	Supply of SMR of capacity 230V AC/110V DC, 20A as per RDSO Specifications RDSO/SPN/165 /2012 Ver 3.0 or latest	Nos	58,730.08
83.	04_5	Supply of DC-DC Converter of Capacity 110V DC/24-40V, 5A as per RDSO Specifications RDSO/SPN/165 /2012 Ver 3.0 or latest	Nos	18,095.30
84.	04_6	Supply of DC-DC Converter of Capacity 110V DC/24-40V, 10A as per RDSO Specifications RDSO/SPN/165 /2012 Ver 3.0 or latest	Nos	21,381.60
85.	04_7	Supply of DC-DC Converter of Capacity 110V DC/12-40V, 1A as per RDSO Specifications RDSO/SPN/165 /2012 Ver 3.0 or latest	Nos	20,060.00
86.	04_8	Supply of DC-DC Converter of Capacity 110V DC/12-28V, 5A as per RDSO Specifications RDSO/SPN/165 /2012 Ver 3.0 or latest	Nos	15,391.63
87.	04_9	Supply of DC-DC Converter of Capacity 110V DC/40-100V, 1A as per RDSO Specifications RDSO/SPN/165 /2012 Ver 3.0 or latest	Nos	16,166.00
88.	04_10	Supply of DC-DC Converter of Capacity 110V DC/2-12V, 10A as per RDSO Specifications RDSO/SPN/165 /2012 Ver 3.0 or latest	Nos	13,452.00
89.	04_11	Supply of DC-DC Converter of Capacity 110V DC/24V 10 A for EI systems as recommended by OEM or Railway	Nos	32,901.29
90.	04_12	Supply of Inverter of Capacity 110V DC/230V AC, 1.5KVA as per RDSO Specifications RDSO/SPN/165 /2012 Ver 3.0 or latest or IRS:S 82-92	Nos	57,921.89
91.	04_13	Supply of Inverter of Capacity 110V DC/230V AC, 2KVA as per RDSO Specifications RDSO/SPN/165 /2012 Ver 3.0 or latest or IRS:S 82-92	Nos	74,455.98
92.	04_14	Supply of Inverter of Capacity 110V DC/230V AC, 3KVA as per RDSO Specifications RDSO/SPN/165 /2012 Ver 3.0 or latest or IRS:S 82-92	Nos	88,880.86
93.	04_15	Supply of AVR of Capacity 230V AC, 2KVA suitable for retrofittable in IPS as per RDSO Specifications RDSO/SPN/165 /2012 Ver 3.0 or latest or IRS S 74-89	Nos	65,718.92
94.	04_16	Supply of AVR of Capacity 230V AC, 3KVA suitable for retrofittable in IPS as per RDSO	Nos	72,504.51

<b>CHAPTER-4 (Power Supply)</b>				
		Specifications RDSO/SPN/165 /2012 Ver 3.0 or latest or IRS S 74-89		
95.	04_17	Supply of Transformer of Capacity 230V AC/110V AC, 1000VA as per RDSO Specifications RDSO/SPN/165 /2012 Ver 3.0 or latest or IRS: S-72	Nos	8,996.32
96.	04_18	Supply of Transformer of Capacity 230V AC/110V AC, 3000VA as per IRS S-72	Nos	25,699.57
97.	04_19	Supply of Stabiliser of Capacity 230V AC, 3KVA as per IRS Specifications No S-74-89	Nos	72,775.78
98.	04_20	Supply and Provision of HRC Fuse ( base and carrier with 4/6/10/16/20A/32 A fuse as per the load condition at location boxes, cable huts etc. as per approved circuit diagram. This work also includes painting of particulars of HRC fuse block installed in power panel instructed by Railway representative at site. (HRC fuse block, Fuses, wires, Cu. lugs and all other miscellaneous materials required for the work shall be supplied by the contractor.)	Nos	459.97
99.	04_21	Supply and Fabrication of Power Equipment Stand at stations/Huts/Power room at station. As per drawing enclosed	Nos	26,575.63
100.	04_22	Supply of Power Panel for IPS Room (using phynolic sheet 1200mm x 1200mm x 10mm and erecting it using MS angles 25mm x 25mm x 6mm and fixing of meters, stabilizer and ammeter by pass switches, HRC fuse blocks, PBT terminals 60mm centre and connecting the power equipments to the power panel as per approved power diagram, in the power room.)	Nos	31,873.70
101.	04_23	Supply of Self Regulating Battery Charger 230V AC/24V DC, 15A (signalling) shall be suitable for axle counter as per RDSO spec no.IRS S : 86/2000 with amendment 4 or latest.	Nos	36,000.00
102.	04_24	Supply of Self Regulating Battery Charger 230V AC/24V DC, 30A (signalling) shall be suitable for axle counter as per RDSO spec no.IRS S : 86/2000 with amendment 4 or latest.	Nos	64,414.09
103.	04_25	Supply of Self Regulating Battery Charger 230V AC/24V DC, 40A (signalling) shall be suitable for axle counter as per RDSO spec no.IRS S : 86/2000 with amendment 4 or	Nos	82,500.00

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		latest.		
104.	04_26	Supply of Self Regulating Battery Charger 230V AC/110V DC, 30A (signalling) shall be suitable for axle counter as per RDSO spec no.IRS S : 86/2000 with amendment 4 or latest.	Nos	94,023.43
105.	04_27	Supply of Self Regulating Battery charger 230V/110 Volt DC,40amp (signalling) shall be suitable for axle counter as per RDSO spec no.IRS S : 86/2000 with amendment 4 or latest.	Nos	1,11,304.55
106.	04_28	Supply of Self Regulating Battery Charger 230V AC/110V DC, 50A (signalling) as per RDSO spec no. IRS S: 86/2000 with amendment 4 or latest.	Nos	1,43,946.58
107.	04_29	Supply of Stackable type VRLA batteries 2V, 120Ah - 1 Cell as per RDSO Specifications IRS S: 93/96 with Amnd 1 or latest	Nos	2,933.76
108.	04_30	Supply of Stackable type VRLA batteries 2V, 200Ah - 1 cell as per RDSO Specifications IRS S: 93/96 with Amnd 1 or latest	Nos	4,074.88
109.	04_31	Supply of Stackable type VRLA batteries 2V, 300Ah - 1 cell as per RDSO Specifications IRS S: 93/96 with Amnd 1 or latest	Nos	5,575.00
110.	04_32	Supply, installation and wiring of 230/24V - 1A transformer rectifier conforming to RDSO spec. IRS S 91/2014 with latest Amendment in power room for LVR	Nos	12,335.32
111.	04_33	Supply of IPS to suit 4 Line RE station as per RDSO Specifications RDSO/SPN/165 or latest, (This schedule does not include Batteries) As per drawing enclosed	Set	12,76,951.75
112.	04_34	Supply of IPS to suit 4 Line Non RE station as per RDSO Specifications RDSO/SPN/165 or latest (This schedule does not include Batteries) As per drawing enclosed	Set	13,92,113.85
113.	04_35	Supply of IPS to suit 6 Line RE station as per RDSO Specifications RDSO/SPN/165 or latest (This schedule does not include Batteries) As per drawing enclosed	Set	13,07,398.11
114.	04_36	supply of IPS to suit 6 Line Non RE station as per RDSO Specifications RDSO/SPN/165 or latest (This schedule does not include Batteries) As per drawing enclosed	Set	14,22,559.62
115.	04_37	Supply of IPS for Auto section (Quadruple Line) as per RDSO Specifications RDSO/SPN/165 or latest (This schedule does not include Batteries)	Set	15,02,534.71
116.	04_38	Supply of IPS for Auto section (Double Line) as per RDSO Specifications RDSO/SPN/165	Set	13,87,372.02

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		or latest (This schedule does not include Batteries)		
117.	04_39	Supply and installation of ASM panel, pre-wired(without Integrated power supply as per RDSO/SPN/165 or latest). Necessary interface cable from IPS to ASM panel is not covered.	Nos	29,500.00
118.	04_40	Supply of Low maintenance secondary cells of the following capacities with necessary inspection as per specification/ drawing/ description enclosed in this document.		
	a	Supply of Secondary cells - 2V-40AH capacity	Nos.	2,041.60
	b	Supply of Secondary cells - 2V-80AH capacity	Nos.	3,379.20
	c	Supply of Secondary cells - 2V-120AH capacity	Nos.	4,224.00
	d	Supply of Secondary cells - 2V-200AH capacity	Nos.	7,040.00
	e	Supply of Secondary cells - 2V-300AH capacity	Nos.	9,574.00
119.	04_41	Supply of track feed battery charger IRS:S 89-2013	Nos.	4,375.25
120.	04_42	Supply of 'B type choke IRS:S 65-83	Nos.	2,855.60
121.	04_43	Supply of Battery charger 110V/24V-15A (As per IRS Spec. No. IRS:S 86-2000).	Nos.	33,496.46
122.	04_44	Installation of 110V/24V/15A Battery charger in apparatus Case/Power Room and wiring using wire PVC 3/0.75mm copper as per approved circuit diagram. The work also includes painting of particulars on the inside of the doors of the apparatus cases. (As per IRS Spec. No. IRS:S 86-2000).	Nos.	1,400.45
123.	04_45	Supply and installation of Battery charger 110V/24V-10A in the apparatus cases/Power Room, and wiring using wire PVC 3/0.75mm copper as per approved circuit diagram. The work also includes painting of particulars on the inside of the doors of the apparatus cases. (As per IRS Spec. No. IRS:S 86-2000).  [Battery charger 110V/24V-10A, wire PVC 3/0.75mm copper, fixing materials, paint, and all other miscellaneous materials required for this work shall be supplied by the Contractor].	Nos.	29,411.06

<b>CHAPTER-4 (Power Supply)</b>				
124.	04_46	Supply, installation and wiring of Transformer rectifier 110VAC/24V DC - 2A capacity at Power room/ apparatus cases and connecting it to the relevant circuit as per approved circuit diagram using wire PVC 3/0.75mm copper and painting of particulars as per Railway practice. (As per IRS Spec. No. IRS:S 91-2014). [Transformer rectifier 110V AC/24VDC - 2A capacity, wire PVC 3/0.75mm copper and all other miscellaneous materials shall be supplied by the Contractor].	Nos.	9,557.10
125.	04_47	Supply, of Transformer 110VAC/110VAC - 500VA capacity	Nos.	5,256.90
126.	04_48	Installation of Transformer 110VAC/110VAC - 500VA capacity at Power Room/Apparatus cases and connecting it to the relevant circuit as per approved circuit diagram using wire PVC 3/0.75mm copper and painting of particulars as per standard Railway practice. [PVC 3/0.75mm copper wire and all other miscellaneous materials shall be supplied by the Contractor]	Nos.	1,190.38
127.	04_49	Supply, of Transformer 400VAC/110VAC - 500VA capacity	Nos.	5,256.90
128.	04_50	Installation Transformer 400VAC/110VAC - 500VA capacity at Power Room/Apparatus cases and connecting it to the relevant circuit as per approved circuit diagram using wire PVC 3/0.75mm copper and painting of particulars as per standard Railway practice. The work also includes provision of protective arrangements to cover the bare terminals with high voltages. [PVC 3/0.75mm copper wire and all other miscellaneous materials shall be supplied by the Contractor]	Nos.	1,239.13
129.	04_51	Supply, fabrication and provision of suitable power equipment stand in the power room at stations (with more than 5 roads) using M.S. Angles 65mm x 65mm x 8mm and MS flats 50mmx6mm covered with 100mmx50mm hardwood reapers, installation of power equipments and wiring the same using wire PVC 7/1.4mm and 3/0.75mm copper as per approved wiring diagram, fabrication and installation of Power panel Box type using powder coated 16G MS sheet with inbuilt locking facility	Set	2,19,668.82

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		with a power distribution board fitted inside made of Phynolic synthetic industrial fibre base fine weave cotton fibre sheet of size 1200mm X 1200mm X10mm. Terminations using circuit breakers, HRC fuse blocks and PBT terminals shall be provided on the phynolic sheet. DIGITAL Voltmeters, ammeters and by pass switches shall be fitted on the front side of the MS power panel. This work includes installation of power distribution diagram board using phynolic sheet 6mm thick of size 1800mm x 1200mm with Aluminium grooved channel frame in the relay room. The particulars shall be digitally using good quality laminated gum sheet. (Supply of power equipments is not covered in this schedule).[MS angles 65mmx65x8mm, Phynolic synthetic industrial fibre base fine weave cotton fibre sheet of size 1200x1200x10mm, Hard Wood planks for reapers 100x50mm, Power coated 16G MS sheet, teakwood base planks 25mm x 150mm and 50mm x 50mm for fixing cables, 50mm, bolts & nuts required for manufacturing power panel & power rack, circuit breakers, HRC Fuses with base and carrier, ammeters, voltmeter- 3 Nos., by-pass switches for stabilisers-63A capacity - 3 Nos., power distribution diagram board using phynolic sheet - 6mm thick of size 1200X1800mm with Aluminium grooved channel frame, paints, wire PVC 7/1.4mm and 3/0.75mm copper, and all other miscellaneous materials required shall be supplied by the Contractor		
130.	04_52	Supply, fabrication and provision of suitable power equipment stand in the power room at stations (up to 5 roads) using M.S.Angles 65mmx65mmx8mm and MS flats 50mmx6mm covered with 100mmx50mm hardwood reapers, installation of power equipments and wiring the same using wire PVC 7/1.4mm and 3/0.75mm copper as per approved wiring diagram, manufacture of power panel using phynolic sheet 1200mm x 1200mm x 10mm and erecting it using MS angles 25mm x 25mm x 6mm and fixing of meters, stabilizer and ammeter by pass switches, HRC fuse blocks, PBT terminals 60mm centre and connecting the power	Set	1,61,805.53



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		equipments to the power panel as per approved power diagram, in the power room. This work includes installation of power distribution diagram board using phynolic sheet 6mm thick of size 1200mm x 1200mm with Aluminium grooved channel frame in the relay room. The particulars shall be digitally using good quality laminated gum sheet. (Supply of power equipments like battery charger, transformers, transformer rectifiers, voltage stabilisers, DC-DC convertor, invertors etc., is not included in this schedule).		
131.	04_53	Supply of Modular terminal block as per RDSO specification No 18/2004 or latest which consists as per following: a) 2 Conductor disconnect type terminal block as per Model No wago 280-870 or similar - 6 Nos b) End Plate type 280-374 suitable for disconnect terminal of Model No wago 280-870 or similar - 1 No c) End Stop terminal block type as per model no wago 249-117 or similar - 2 Nos d) Shorting Links (16A) as per Model wago 280-402 or similar - 1 No	Set	772.74
132.	04_54	Supply of Modular Terminal Block of 2.5sq.mm 2 IN 2 OUT type disconnect type of Wago/Phoenix make or similar along with accessories as per RDSO Spec.No. RDSO/SPN/189/2004/ rev 2 or latest.	Nos	194.95
133.	04_55	Supply of FUSE terminals block with LED indication upto 2.5sq.mm screw type 1 IN 1 OUT ( Suitable 400mA, 630mA, 1A, 1.6A, 2A, 4A, 6.3A, & 10A) (Without Fuse) as per RDSO Spec.No. RDSO/SPN/189/2004/ rev 2 or latest.	Nos	219.87
134.	04_56	Supply of DIN channel for the terminal	Mtr	344.87
135.	04_57	Supply of END plates for modular terminal block	Nos	36.86
136.	04_58	Supply of END clamp for modular terminal block	Nos	26.35
137.	04_59	Supply of Shorting Link insulated Grey in color	Nos	21.20
138.	04_60	Supply of operating tool, screw driver and stripper for modular terminal. These tools shall be of Wago/Phoenix make or similar anfd model suitable for the modular terminal supplied	Nos	12,246.29

<b>CHAPTER-4 (Power Supply)</b>				
139.	04_61	Supply of FUSE links of (400mA, 630mA, 1A, 1.6A, 2A, 4A, 6.3A & 10A)	Nos	61.74
140.	04_62	Supply of 2 pin socket - 5A with switch, fixing the same on the hardwood plank available and extending the 110VAC using wire PVC 3/0.75mm copper, in all the apparatus cases, as per the instructions of Railway representative at site. [2 pin socket - 5A with switch, wire PVC 3/0.75mm copper and all other miscellaneous materials required for the work shall be supplied by the Contractor].	Nos.	736.30
141.	04_63	Supply of Distilled water for topping of secondary cells to be supplied at site, IS 1106	Ltr	11.08
142.	04_64	Supply of distilled water plant similar to 'KILBURN' make capacity 3.5 to 4.5 Lits. per hour, with two detachable heating elements of 1500W each to work on 230VAC, single phase, fitted with automatic cut-outs and removable connectors, with Stainless Steel boiling chambers, condenser pipe, toughened glass lid; Distilled water plant, tank 200 Litres capacity similar to sintex make, GI pipe 25mm dia, power plug with socket, regulating valves, jelly, cement, sand and other materials shall be supplied by the Contractor	Nos.	25,774.20
143.	04_65	Installation of distilled water plant with provision of water supply connection from water tap to water tank, water tank to distilled water plant using G.I Pipes 25mm dia and with regulating valves, provision of separate power supply socket and wiring. This work includes fixing of 2 Nos. of rails on the wall and grouting as instructed by Railway representative at site. (Cut rails will be supplied by Railways).	Nos.	11,745.65
144.	04_66	Installation of 8-Channel Earth Leakage Detector. This includes transportation of materials to Site location and provision of cable trough arrangements including connection to the BRC earth. Also includes carrying out of pre-commission checklist.	Nos	11,320.00



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145.	04_67	Installation of 12-Channel Earth Leakage Detector. This includes transportation of materials to Site location and provision of cable trough arrangements including connection to the BRC earth. Also includes carrying out of pre-commission checklist.	Nos	13,725.36
146.	04_68	Installation of 16-Channel Earth Leakage Detector. This includes transportation of materials to Site location and provision of cable trough arrangements including connection to the BRC earth. Also includes carrying out of pre-commission checklist.	Nos	17,586.67
147.	04_69	Installation and Wiring of Stabilizer of Capacity 230V AC, 3 to 5KVA. Necessary wire coils required is covered under the scope including connection to earth bus bar.	Nos	6,360.00
148.	04_70	Installation and Wiring of Transformer of Capacity 1/2/3KVA. Necessary wire coils required is covered under the scope including connection to earth bus bar.	Nos	4,400.00
149.	04_71	Installation of Power Panel for IPS Room	Nos	7,246.46
150.	04_72	Commissioning of IPS, this schedule includes arrangement of OEM engineer for checking the Installation and carrying out adjustments of IPS modules and submission of Pre-commissioning checklist	Set	59,000.00
151.	04_73	Installation, wiring and testing of IPS as per RDSO Specification No. RDSO /SPN /165 or latest. This work includes transporting the IPS from the Stores by loading without any damages and installation of the same at site. This also includes wiring of all modules, proper earthing of equipments and all other works connected for testing and commissioning of the same. Necessary powdered coated Aluminium ladder arrangements including cable trench, pipes, bolts, and other accessories is included in this schedule. [Earthing is not covered under this schedule]	Set	77,160.07
152.	04_74	Installation of power equipments like battery chargers, transformers, transformer rectifiers, invertors, DC-DC convertors etc., in the apparatus cases and wiring the same using wire PVC 7/1.4mm and 3/0.75mm	Nos.	1,708.01

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		<p>copper as per the approved wiring diagram and painting of particulars in the inside of the doors of the apparatus cases. The work also includes provision of protective arrangements in bare terminals carrying high voltages. (Supply of power equipments is not included in this schedule).</p> <p>[Wire PVC 7/1.4mm and 3/0.75mm copper, protective arrangements, paint and all other miscellaneous materials required for the work shall be supplied by the Contractor].</p>		
153.	04_75	<p>Installation of power equipments on the existing stands/ RCC slabs in the power room stations (with more than 5 roads) and wiring the same using wire PVC 7/1.4mm and 3/0.75mm copper as per approved wiring diagram, fabrication and installation of Power panel Box type using powder coated 16G MS sheet with inbuilt locking facility with a power distribution board fitted inside made of Phynolic synthetic industrial fibre base fine weave cotton fibre sheet of size 1200mm X 1200mm X10mm. Terminations using circuit breakers, HRC fuse blocks and PBT terminals shall be provided on the phynolic sheet. Voltmeters, ammeters and by pass switches shall be fitted on the front side of the MS power panel. This work includes installation of power distribution diagram board using phynolic sheet 6mm thick of size 1800mm x 1200mm with Aluminium grooved channel frame in the relay room. The particulars shall be digitally using good quality laminated gum sheet. (Supply of power equipments is not covered in this schedule).</p> <p>[Phynolic synthetic industrial fibre base fine weave cotton fibre sheet of size 1200x1200x10mm, Powder coated 16G MS sheet, teakwood base planks 25mm x 150mm and 50mm x 50mm for fixing cables, 50mm, bolts &amp; nuts required for manufacturing power panel &amp; power rack, circuit breakers, HRC Fuses with base and carrier, ammeters, voltmeter- 3 Nos., by-pass switches for stabilisers-63A capacity - 3 Nos., power distribution diagram board using phynolic sheet 6mm thick of size 1200X1800mm with Aluminium grooved channel frame, paints, wire PVC 7/1.4mm and 3/0.75mm copper and all other</p>	Set.	1,84,957.45

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		miscellaneous materials required for the work shall be supplied by the contractor].		
154.	04_76	Installation of power supply equipments for stations (up to 5 roads) on existing equipment stand/ RCC slabs and wiring the same using wire PVC 7/1.4mm and 3/0.75mm copper, manufacture of power panel using phynolic sheet 1200mm x 1200mm x 10mm and erecting it using MS angles 25mm x 25mm x 6mm and fixing of meters, stabilizers and ammeter by pass switches, HRC fuse blocks, PBT terminals 60mm centre and connecting the power equipments to the power panel as per approved power diagram, in the power room. This work includes installation of power distribution diagram board using phynolic sheet 6mm thick of size 1200mm x 1200mm with Aluminium grooved channel frame in the relay room. The particulars shall be digitally using good quality laminated gum sheet. (Supply of power equipments like battery charger, transformers, transformer rectifiers, voltage stabilisers, DC-DC convertor, invertors etc., is not included in this schedule). [MS Angles 25x25x6mm, phynolic sheet of size 1200x1200x10mm, teakwood planks 25x150mm for fixing cables, teakwood cable clamps 50x50mm, bolts & nuts required for manufacturing power panel, HRC Fuses base and carrier, Ammeters, Voltmeters, main switch, by-pass switches for ammeter and stabilisers-63A capacity, power distribution diagram board using phynolic sheet - 6mm thick of size 1200X1200mm with Aluminium grooved channel frame, paints, PBT terminal blocks 60mm centre wherever required, wire PVC 7/1.4mm and 3/0.75mm copper and all other miscellaneous materials shall be supplied by the contractor].	Set.	1,28,492.12
155.	04_77	Fixing of Modular terminal block/fuse block along with accessories with provision of fixing holes on hylam sheet/side angles of Location Box and fixing by Galvanized nuts and bolts. This includes fixing of DIN channel for cable termination on Modular terminal	Nos	28.97

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156.	05_1	Supply of 24 Core x 1.5 Sq.mm PVC insulated Armoured, unscreened underground Railway Signalling copper cable as per IRS: S-63/2014 REV.4	Mtr	388.15
157.	05_2	Supply of 12Cx1.5 SQMM PVC insulated Armoured, unscreened underground Railway Signalling copper cable as per IRS: S-63/2014 REV.4	Mtr	215.92
158.	05_3	Supply of 2x25 sqmm PVC insulated Armoured, unscreened underground Railway Signalling Aluminium cable as per IRS: S-63/2014 REV.4	Mtr	93.01
159.	05_4	Supply of 2x2.5 sq.mm PVC insulated Armoured, unscreened, underground Railway Signalling Copper cable as per spec IRS.S.63/2014(Rev.4.0) or latest	Mtr	98.76
160.	05_5	Supply of 3Cx 10SQMM PVC insulated Armoured, unscreened, underground Railway Signalling Aluminium power cable as per as per spec IRS.S.63/2014(Rev.4.0) or latest	Mtr	80.97
161.	05_6	Supply of 6 CORE X 1.5 SQ.MM PVC insulated Armoured, inscreened underground Railway Signalling copper cable as per IRS: S-63/2014 REV.4	Mtr	170.92
162.	05_7	Supply of 2x0.5 Sqmm (16/0.20) Flexible Annealed Tinned Copper (ATC) PVC Insulated Twin Twisted Un Sheathed Cable IRS:S: 76/89 with all latest amendments (Red & Black)	Mtr	15.34
163.	05_8	Supply of 1x0.5 Sq.mm (16/0.20mm) Flexible ATC PVC Insulated Unsheathed Single Core Cable as per IRS:S: 76/89 with all latest amendments	Mtr	7.08
164.	05_9	Supply of 1x4 Sq.mm (56/0.30mm) Flexible Annealed Pure Copper (APC) PVC Insulated Unsheathed Single Core Cable as per IRS:S: 76/89 with all latest amendments	Mtr	53.10
165.	05_10	Supply of 1x10 Sq.mm (140/0.30mm) Flexible Annealed Pure Copper (APC) PVC Insulated Unsheathed Single Core Cable as per IRS:S: 76/89 with all latest amendments	Mtr	143.15
166.	05_11	Supply of 16 Sq.mm multistrand Flexible APC PVC insulated copper cable as per IS 694	Mtr	228.14
167.	05_12	Supply of 35 Sq.mm multistrand Flexible APC PVC insulated copper cable as per IS 694	Mtr	475.77
168.	05_13	Supply of 70 sq. mm multi strand Flexible APC PVC insulated copper cable as per IRS:S: 76/89 with all latest amendments.	Mtr	814.20

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169.	05_14	Supply of 40Cx1 mm Solid APC PVC Insulated, Binder Taped and PVC Sheathed Unarmoured Cable as per IRS:S: 76/89 with all latest amendments..	Mtr	377.60
170.	05_15	Supply of 60Cx1 mm Solid PVC Insulated, Binder Taped and PVC Sheathed Unarmoured Cable as per IRS:S: 76/89 with all latest amendments	Mtr	696.20
171.	05_16	Supply of Underground jelly filled 6 QUAD, 0.9MM Dia as per spec IRS:TC 30-05 with amd 5 or latest	Mtr	301.05
172.	05_17	Supply of 24 Fibre armoured OFC cable as per RDSO Specification RDSO/SPN/TC/ 110/2020 Rev. 0 or latest	Mtr	95.23
173.	05_18	Supply of 48 Fibre armoured OFC cable as per RDSO Specification RDSO/SPN/TC/ 110/2020 Rev. 0 or latest	Mtr	126.32
174.	05_19	Supply of Polythene Insulated Polythene Sheathed armoured Jelly Filled Telephone Cable with Poly-AL Moisture Barrier, 10 Pairs , 0.63 MM Conductor Diameter as per RDSO Specification No. IRS:TC-41/97 with amendment 1 or latest	Mtr	123.90
175.	05_20	Supply of Polythene Insulated Polythene Sheathed armoured Jelly Filled Telephone Cable with Poly-AL Moisture Barrier, 20 Pairs, 0.63 MM Conductor Diameter as per RDSO Specification No. IRS:TC-41/97 with amendment 1 or latest	Mtr	258.20
176.	05_21	Supply of Polythene Insulated Polythene Sheathed armoured Jelly Filled Telephone Cable with Poly-AL Moisture Barrier, 50 Pairs, 0.63 MM Conductor Diameter as per RDSO Specification No. IRS:TC-41/97 with amendment 1 or latest	Mtr	354.74
177.	05_22	Supply of FCPC To SCPC 5 meter long patch cords with 0 db adaptors as TEC spec G/OJC-O1/03 JAN 99 or latest.	Mtr	832.51
178.	05_23	Supply of OFC Patch cord (FC-PC/SC-PC/LC-PC to FC-PC/SC-PC/LC-PC so as to suit for switches and FMS supplied)	Mtr	374.03
179.	05_24	Supply of Switch Board cable, Finolex/ Deltron make or better 0.5mm/10Pairs, conforming to IRS/TC/24-91 cable	Mtr	55.28
180.	05_25	supply of switch board cable, finolex/Deltron make or better 0.5mm, 20 pair conforming to IRS/TC/24-91	Mtr	102.81

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181.	05_26	supply of switch board cable, finolex/Deltron make or better 0.5mm, 50 pair conforming to IRS/TC/24-91	Mtr	230.13
182.	05_27	Supply of UTP Cable /CAT6/6A cable ETL or UL or CE3P certified panduit or Systimax or R&M or AMP or Molex or Krone Or D-Link Makes	Mtr	34.73
183.	05_28	Supply of PVC insulated, unsheathed, Flame retarding type Single core flexible wire 16/0.2 mm dia. With annealed, tinned copper conductor of colour code ( Red =50% ,Black=50%,) as per IRS-S-76/89 Amd-3(with amdt. upto date if any).	Mtr	6.83
184.	05_29	Supply of Polythene insulated polythene sheathed jelly filled telephone cable with Poly-AL Moisture Barrier, 0.5mm dia, 100 pair underground cable as per RDSO specification No.IRS-TC-41/97 with amendment No.2.	Mtr	644.28
185.	05_30	Supply and fixing of 20 pair Krone module housed in MS box and termination of Cables	Nos	3,962.00
186.	05_31	Supply and fixing of 10 pair CT box and termination of cables	Nos	4,004.72
187.	05_32	Supply and fixing of 20 pair CT box and termination of cables	Nos	4,761.16
188.	05_33	Supply of cable (Krone) termination box 10 pair.	Nos	1,800.00
189.	05_34	Supply of Digital Distribution Frame (120 ohms)for terminating 16 E1s of wrapping type & Mountable on 19" rack similar to TVS make or better.	Nos	6,309.53
190.	05_35	Supply and fixing of 32 way U-Link panels (Wrapping type )with U links and mountable on 19"rack.	Nos	13,523.03
191.	05_36	Supply of 10way Annunciator with Push button switches and having conference facility. Model No AM-10 similar to Epsilon, Telelinks or better	Nos	17,790.89
192.	05_37	Supply and provision of normal joint using Thermo shrink jointing kit (RDSO specs No TC/77/2012 ( Rev.3) with amendment No.1&2 or latest.& jointing kit to be inspected by RDSO) for 4/6 quad cable normal joint. The work includes excavation of joint pit of size 1mX1.5mX1.5m and closing the same after completion of cable joint as per the instruction of Railway representative at site.	Nos	4,628.91

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193.	05_38	Supply and provision of derivation joint complete for 6 Quad cables using thermoshrink jointing kit for LC's/stations	Nos	4,901.27
194.	05_39	Supply and installation of 24 Fibre Joint enclosure for armoured optical fibre cable conforming to RDSO spec.RDSO/SPN/TC/68/2014 rev2.0 or latest	Nos	13,647.37
195.	05_40	Supply and installation of 48 fibre Joint enclosure for armoured optical fibre cable conforming to RDSO spec.RDSO/SPN/TC/68/2014 rev2.1 or latest	Nos	20,060.00
196.	05_41	Supply of RCC cable markers (Supply of RCC cable markers as per drawing No.CSTE/CN/OFC/1. The lettering on the cable marker shall be "SIG" / "TELE" / "OFC" as per the instructions of Railway representative at site.) as per drawing enclosed	Nos.	262.65
197.	05_42	Preparation of Cement concrete for covering of GI Pipes/cables. Providing & Laying in position cement concrete of specified proportion including cost of cement, centering and shuttering with 1:3:6 composition 1 Cement: 3 Sand: 6 grade stone aggregate 25mm nominal size) (Cement, M-Sand, stone jelly of 25mm and all other misc materials required for the work should be supplied by Contractor).	CUM	9,361.46
198.	05_43	Laying of STP/OFC/Power Cable/ switch board (10 pair/ 20 pair/50 pair) Cables in 1" PVC conduit/case capping and clamping on the wall/Roof tops/ Shelters with suitable clamping and hose to be provided where ever bends/ curves (PVC conduit/ Case capping and other accessories to be supplied by the contractor)	Mtr	37.30
199.	05_44	Excavation of cable trench in all kinds of soil except hard rocky areas including clearing of roots of trees, rocks, bushes etc. to a depth of 1.0 Mtrs and to a width of 0.3 Mtrs. (Laying of cables is not included in this schedule)	Mtrs	64.10
200.	05_45	Excavation of cable trench in all kinds of soil except hard rocky areas including clearing of roots of trees, rocks, bushes etc. to a depth of 0.5 Mtrs and to a width of 0.3 Mtrs. (Laying of cables is not included in this schedule.)	Mtrs	32.05



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**(Cable)**

201.	05_46	Excavation of cable trench in all kinds of soil except hard rocky areas including clearing of roots of trees, rocks, bushes etc. to a depth of 1.0 Mtrs and to a width of 0.5 Mtrs. (Laying of cables is not included in this schedule.)	Mtrs	79.51
202.	05_47	Excavation of cable trench in all kinds of soil except hard rocky areas including clearing of roots of trees, rocks, bushes etc. to a depth of 0.5 Mtrs and to a width of 0.5 Mtrs. (Laying of cables is not included in this schedule.)	Mtrs	39.82
203.	05_48	Excavation of cable trench in all kinds of soil except hard rocky areas including clearing of roots of trees, rocks, bushes etc. to a depth of 1.65 Mtrs and to a width of 0.3 Mtrs. (Laying of cables is not included in this schedule.)	Mtrs	159.14
204.	05_49	Removing/breaking of existing RCC slabs on the Passenger Platform, trenching to a depth of 0.6m to accommodate the additional cables, replacing the slabs removed after the cables are laid and replastering with cement mortar, refilling the trench by ramming and consolidating it as per the instructions of Railway Representatives at site. (Laying of cables is not included in this schedule).	Mtrs.	314.41
205.	05_50	Breaking of Platform concrete having 0.3 feet thickness - 0.5 feet thickness and to a width of 0.3 Mtr using cutter machine and removal of RCC slabs on the Passenger Platform, trenching to a depth of 0.6m to accommodate the additional cables, replacing the slabs removed after the cables are laid and replastering with cement mortar, refilling the trench by ramming and consolidating it as per the instructions of Railway Representatives at site.  (Laying of cables is not included in this schedule).	Mtrs.	2,224.44
206.	05_51	Excavation of trench along route of existing cable duct, opening the slabs to accommodate additional cable laying, REPOSITIONING the slabs removed after the cables are laid and PLASTERING with cement mortar, and refilling the trench by ramming and consolidating it as per the instructions of Railway Representatives at site. (Laying of cables is not included in this schedule.) [Cement, M Sand and all other	Mtrs.	161.92



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		miscellaneous materials required for the work shall be supplied by the Contractor].		
207.	05_52	Excavation of trench to a depth of 1 Mtr. for track crossing of cables, refilling of trench by ramming and consolidating it as per the instructions of Railway representative at site after laying of DWC/RCC pipes. During excavation of trench, it has to be ensured that the excavated soil does not mix with the ballast available. The depth of 1m trench shall be from the bottom of sleepers for track crossings. Laying of cables and DWC pipes is not included in this schedule. (Supply of DWC/RCC pipes with couplers/ collars is not included in this schedule).	Mtrs	385.45
208.	05_53	Excavation of trench to a depth of 1 Mtr. for road crossing of cables, laying of DWC/ RCC pipes with collar/ coupling, refilling of trench by ramming and consolidating it and resurfacing it to the original position. Laying of cables is not included in this schedule. (Supply of DWC/RCC pipes with couplers/ collars is not included in this schedule).	Mtrs	501.03
209.	05_54	Provision of GI pipes (50/100mm dia) for cable laying with offset at both ends and with couplings over RCC bridges, drainage, culverts, and girder bridges. For RCC bridges, drainage, and culverts, the pipes shall be mounted on concrete masonry supports of size 300mm x 300mm x 300mm at an interval of 2 meters. For girder bridges, the pipes shall be fixed on suitable MS clamps at an interval of 2 meters. The ends of the pipes shall be closed with brick masonry abutments to ensure that no cable is exposed. The work shall be carried out as per the instructions of the Railway representative at the site. (Supply of GI pipes with couplings and laying of cables is not included in this schedule). Stone jelly (20/25mm size), bricks, sand, cement, MS angles, flats, bolts, nuts for manufacturing and fixing clamps, bricks, M sand, cement, and other miscellaneous materials for the work shall be supplied by the contractor.	Mtrs.	208.54
210.	05_55	Construction of Support for the GI pipes laid in RCC Box type bridges	Nos.	367.41

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211.	05_56	Provision of GI pipes 50mm/100mm dia on excavated trenches/platforms/over the ground without abutments and supports	Mtrs.	118.22
212.	05_57	Fabrication and installation of MS clamps on Girder Bridges for the support of GI pipes laid over the girder bridge	Nos.	570.26
213.	05_58	Provision of GI pipes (50/100mm dia) for cable laying in hard rocky area with off sets at both ends duly supported by concrete blocks of size 300mm x 300 mm x 300 mm at an interval of 2m. The ends of the pipes shall be closed with brick masonry abutments work so that no cable is exposed, The work shall be carried out as per the instructions of Railway representative at site.  (Supply of GI pipes with couplings and laying of cables is not included in this schedule).  [Stone jelly of size 20/25mm, bricks, sand, cement, and all other miscellaneous materials required for the work shall be supplied by the Contractor].	Mtrs.	182.87
214.	05_59	Laying of signaling/power/telecommunication cables as per cable plan in cable trenches, masonry ducts, RCC Pipes, DWC pipes, GI Pipes etc.  (Supply of cables is not included in this schedule).	Mtrs.	18.18
215.	05_60	Placing of one layer of country bricks of size approximately 220mm x 100mm x 60mm lengthwise vertically in the trench.  [Country bricks of size 220mm x 100mm x 60mm (approximately) shall be supplied by the Contractor].	Mtrs.	30.53
216.	05_61	Placing of one row of country bricks of size approximately 220mm x 100mm x 60mm breadth wise horizontally above the cables in 0.3m width trench.  [Country bricks of size 220mm x 100mm x 60 mm (approximately) shall be supplied by the Contractor].	Mtrs.	62.99
217.	05_62	Placing of two rows of country bricks of size approximately 220mm x 100mm x 60mm breadth wise horizontally above the cables in 0.5mtr width trench.	Mtrs.	116.41

**CHAPTER-5**  
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		[Country bricks of size 220mm x 100mm x 60mm (approximately) shall be supplied by the Contractor].		
218.	05_63	Refilling of cable trench 1m depth by 0.3m width throughout, with earth after laying of cables, and consolidating the trench by ramming and levelling.	Mtrs.	15.40
219.	05_64	Refilling of cable trench 0.5m depth by 0.3m width throughout, with earth after laying of cables, and consolidating the trench by ramming and leveling.	Mtrs.	7.77
220.	05_65	Refilling of cable trench 1m depth by 0.5m width throughout, with earth after laying of cables, and consolidating the trench by ramming and levelling.	Mtrs.	19.29
221.	05_66	Refilling of cable trench 0.5m depth by 0.5m width throughout, with earth after laying of cables, and consolidating the trench by ramming and levelling.	Mtrs.	9.30
222.	05_67	Refilling of cable trench 1.65m depth by 0.3m width throughout, with earth after laying of cables, and consolidating the trench by ramming and levelling.	Mtrs.	23.17
223.	05_68	Digging of pit to a depth of 800mm of size 300mmX300mm, casting of concrete foundation of size 300mmX300mmX300mm and Placing of RCC cable markers on top of the foundation and refilling the pit and consolidating it by ramming. The cable markers shall be provided at an interval of 20 Mtrs. within station limits and 50 Mtrs. outside station limits throughout the cable route, diversions and also at every track/road crossing.	Nos.	123.35
224.	05_69	Excavation of cable coil pit to a size of 1.5mx1.5m and depth as instructed by Railway representative at site, for coiling the cables in rear of relay rooms/ AFTC huts, apparatus cases etc. The work includes coiling the underground cables and placing closely one layer of country bricks of size approx. 220mm x 100mm x 60mm breadth wise above the cables to cover all the cables in the cable pit, closing and consolidating the pit by ramming and levelling.  [Country bricks of size 220mmx100mmx60mm (approximately) shall be supplied by the Contractor].	CUM	949.05

**CHAPTER-5**  
**(Cable)**

225.	05_70	Cutting of rock up to a depth of 300 mm and width of 300mm where rock is visible from surface, concreting to ground level after laying cables with 1 cement: 2 sand: 4 graded stone aggregate 20mm nominal size and curing of concrete to the required number of days, except in bridges, culverts, level crossings, track crossings, cable pits, rocky soil including marking of cable alignment, clearing of debris etc., complete to the finished item of work as directed by site in-charge. Drg.No.SK/CN/NEW/1. All the material is to be arranged by contractor	Mtr	600.96
226.	05_71	Cutting of rock to a depth of 200 mm and width of 200 mm where rock is visible from surface to a depth more than 300 mm up to 550mm, excavation of trench with width 300mm above rock concreting 200mmx200mm after laying of cable with / cement: 2 sand : 4 graded stone aggregate 20mm nominal size and curing of concrete to the required number of days, refilling with excavated soil ramming and consolidation except in bridges, culverts, level crossings, track crossings, cable pits, rocky soil including marking of cable alignment, clearing of debris etc., complete to the finished item of work as directed by site in charge. Drg No.SK/CN/NEW/3. All the material is to be arranged by contractor	Mtr	314.85
227.	05_72	Road crossing/ Track Crossing through Horizontal Drilling at approximately depth of 1.5 to 2m below the formation level of the earth including insertion of HDPE pipe/DWC pipe along with couplers, drawl of cable (or) direct drawl of cables etc. (Note: The pilot used for HDD should be of sufficient size to suit insertion of HDPE /DWC pipe of size 120mm (outer dia.) or direct drawl of three cables (Signalling/Power/Quad/OFC) or three nos.of 40mm dia HDPE pipe or any other combination as directed by the site engineer) ( Supply of HDPE pipe is not covered in this schedule)	Mtr	1,351.45
228.	05_73	Cutting/Breaking of RCC platform or concrete to a width of 0.5mtrs 0.3 mtrs using cutter machine without damaging the platform. And plastering the removed slabs after laying of cables with proper finishing. (required material should be supplied by the contractor).	Mtr	3,764.41

**CHAPTER-5**  
**(Cable)**

229.	05_74	Blowing/Drawing of OFC cable/Power cable/Signalling cable inside permanently solid lubricated HDPE Pipe already laid. This work includes necessary duct integrity test for solid lubricated HDPE pipe. ( This includes Transportation of materials from nominated stores to site)	mtr	23.43
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**CHAPTER-6**  
**(LED Signals)**

230.	06_1	Supply of Main LED Signal Aspect - Green as per RDSO Specifications No.RDSO/SPN/199/2010 Rev1.1 or latest	Nos	10,030.00
231.	06_2	Supply of Main LED Signal Aspect - Yellow as per RDSO Specifications RDSO/SPN/199/2010 Rev1.1 or latest	Nos	8,850.00
232.	06_3	Supply of Main LED Signal Aspect - Red as per RDSO Specifications RDSO/SPN/199/2010 Rev1.1 or latest	Nos	9,233.50
233.	06_4	Supply of MAIN LED SIGNAL 4 ASPECT SET CONSISTING OF RED-01, YELLOW, -02 AND GREEN-01 as per RDSO Specification RDSO/SPN/199/2010 Rev1.1 or latest	Nos	35,612.40
234.	06_5	Supply of subsidiary Signal Aspect - Route LED as per RDSO Specifications SPECIFICATION NO. RDSO/SPN/153/2023 Revision 5.0 or latest	Nos	5,703.33
235.	06_6	Supply of subsidiary Signal Aspect - Calling on LED as per RDSO Specifications SPECIFICATION NO. RDSO/SPN/153/2023 Revision 5.0 or latest	Nos	5,726.13
236.	06_7	Supply of subsidiary Signal Aspect - Shunt LED as per RDSO Specification SPECIFICATION NO. RDSO/SPN/153/2023 Revision 5.0 or latest	Nos	5,740.70
237.	06_8	Supply of subsidiary Signal Aspect - "A" marker as per RDSO specification SPECIFICATION NO. RDSO/SPN/153/2023 Revision 5.0 or latest	Nos	5,150.70
238.	06_9	Supply of Multi Lamp Route indicator (LED Double Digit) from 1 to 9 with white LED (With Housing) as per technical specification	Nos	64,900.00
239.	06_10	Supply of Multi Lamp Route indicator (LED Double Digit) from 1 to 19 with white LED (With Housing) as per technical specification	Nos	76,700.00
240.	06_11	Supply of LED based stencil type route indicator (1Way) white LED (With Housing) as per technical specification	Nos	44,545.00
241.	06_12	Supply of LED based stencil type route indicator (2Way) white LED (With Housing) as per technical specification	Nos	67,260.00
242.	06_13	Manufacture and supply of Enameled Number plates as per drawing No.TY/08/2008 with fixing arrangements and fixing them on the existing Signals as per the instructions of Railway representative at site. [Enameled number plates with fixing arrangements with bolts and nuts shall be supplied by the Contractor].	Nos.	305.25

**CHAPTER-6**  
**(LED Signals)**

243.	06_14	Supply and provision of Screening arrangement for Signals in RE area as per standard practice. The work comprises of providing MS angle frame and wire mesh in order to avoid close proximity of OHE wires. The work also includes provision of earthing wire using 4 SWG GI wires from the screening arrangement up to surface base as per the instructions of Railway representative at site.  [All materials required for this work shall be supplied by the Contractor].	Nos.	1,880.71
244.	06_15	Supply of Colour light Signal pole 140mm dia, 4.6m/ 3.6m tall with necessary inspection as per specification/ drawing/ description enclosed in this document.		
	a	Supply of colour light Signal pole 4.6m tall and 140 mm dia(Galvanised)	Nos.	5,841.00
	b	Supply of colour light Signal pole 3.6m tall and 140 mm dia (Galvanised)	Nos.	4,737.70
246.	06_16	Supply of surface base to suit CLS Signal pole 140mm dia with necessary inspection as per specification/ drawing/ description enclosed in this document.	Nos.	6,814.50
247.	06_17	Supply of ladder with platform and shoes to suit CLS pole 4.6m/ 3.6m tall, with necessary inspection as per specification/ drawing/ description enclosed in this document.		
	a	Supply of ladder with platform (4.6m) for CLS(Galvanised)	Nos.	5,698.00
	b	Supply of ladder with platform (3.6m) for CLS(Galvanised)	Nos.	5,494.50
248.	06_18	Supply of post type shunt signal - complete with hood etc., with necessary inspection as per specification/ drawing/ description enclosed in this document.	Nos.	5,087.50
249.	06_19	Supply of Ground type shunt signal - complete with surface base, signal pole, hood etc., with necessary inspection as per specification/ drawing/ description enclosed	Nos.	7,463.50

**CHAPTER-6**  
**(LED Signals)**

		in this document.		
250.	06_20	Supply of Colour Light Signal Multi Unit type - complete for 4/ 3/ 2 aspect with mounting socket, with necessary inspection as per specification/ drawing/ description enclosed in this document.		
	a	a) Supply of colour light Signal unit (4 aspect)	Nos.	19,470.00
	b	Supply of colour light Signal unit (3 aspect)	Nos.	16,874.00
	c	Supply of colour light Signal unit (2 aspect)	Nos.	14,278.00
251.	06_21	Supply of Junction type route indicator – 5 unit arm – 1/ 2/ 3/ 4/ 5/ 6 way with mounting sockets, with necessary inspection as per specification/ drawing/ description enclosed in this document.		
	a	a) Supply of Junction type route indicator - 1 way	Nos.	15,121.70
	b	Supply of Junction type route indicator - 2 way	Nos.	18,691.20
	c	Supply of Junction type route indicator - 3 way	Nos.	22,260.70
	d	Supply of Junction type route indicator - 4 way	Nos.	25,960.00
	e	Supply of Junction type route indicator - 5 way	Nos.	29,529.50
	f	Supply of Junction type route indicator - 6 way	Nos.	33,099.00
252.	06_22	Supply of Calling On Signal / 'A' marker light - complete with necessary inspection as per specification/ drawing/ description enclosed in this document.		



**CHAPTER-6  
(LED Signals)**

	a	Supply of Calling On Signal	Nos.	3,663.00
	b	Supply of "A" marker light	Nos.	2,596.00
253.	06_23	Supply of Off-set brackets - large/ small made of cast iron with necessary inspection as per specification/ drawing/ description enclosed in this document.		
	a	Supply of Off set bracket - large	Nos.	3,569.50
	b	Supply of Off set bracket - small	Nos.	2,645.50
256.	06_24	Supply of cable termination box (FRP type) with necessary inspection as per specification/ drawing/ description enclosed in this document.	Nos.	7,788.00
257.	06_25	Supply of C-marker/A-marker Name Plate	Nos.	253.91
258.	06_26	Supply of Enamelled Paint	Per Ltr	399.42
259.	06_27	<p>Supply of Signal post telephone with facility of paging and talk-back including voice communication equipment with suitable switching arrangement at the Signal post and at SM's room as per specification enclosed in this document. This includes drawl of tail cable through GI pipe 25mm dia and 2 mtrs long duly clamped to Signal post with bend as required at site, termination of tail cable at one end in the apparatus case and other end in the console. In the SM's room, console shall be fixed on a table top. The wiring shall be done using wire PVC 16/0.2mm copper.</p> <p>[Talk-back equipment complete including housing box, wire PVC 16/0.20mm and all other miscellaneous materials required for the work shall be supplied by the Contractor].</p>	Nos.	11,897.35

**CHAPTER-7  
(Relay)**

260.	07_1	Supply of plug-in type, Style QL1, Magnetically Latched Neutral Line 24V DC, 11F/4B contacts Relay complete with plug board (base plate), connectors and retaining clips and conforming to BRS 935A and RDSO Spn. No IRS S-34 and S-23 or latest. The interlocking code for this unit shall be "ABDEG"	Nos	7,076.52
261.	07_2	Supply of Plug-in type style relay non-ac immune, style QS3, sensitive neutral line, 12 v, 1000 ohms, 4F/4B contacts, front and back contacts metal to carbon, complete with plug board, retaining clips and connectors conforming to BRS:930, IRS:s-34 & IRS:S-23(Amendment upto date as applicable). The interlocking code for this unit shall be CDEKX.	Nos	5,544.82
262.	07_3	Supply of Relay Non – AC immune plug in type Style 'QN1K' DC neutral line, 24V 1000 ohms 6F.6B contacts front contacts metal to carbon & back contacts metal to metal/carbon complete with plug board retaining clip and connectors conforming to BRS:930, IRS:S- 34 & IRS:S-23 and RDSO Spec. STS/E/Relays/UEA(PI) dt. 30.5.97 (Annexure-1) (as applicable). The interlocking code for this unit shall be BDEKX.	Nos	4,720.00
263.	07_4	Supply of Relay Non – AC immune plug in type Style 'QN1K' DC neutral line, 24V 1000 ohms 8F.8B contacts front contacts metal to carbon & back contacts metal to carbon complete with plug board retaining clip & connectors conforming to BRS:930, IRS:S-34 & IRS:S-23 (as applicable). The interlocking code for this unit shall be ABCDF.	Nos	4,720.00
264.	07_5	Supply of Relay Non – AC immune plug in type Style 'QN1K' DC neutral line, 24V 1000 ohms 12F.4B contacts front contacts metal to carbon & back contacts metal to carbon complete with plug board retaining clip & connectors conforming to BRS:930, IRS:S-34 & IRS:S- 23 (as applicable). The interlocking code for this unit shall be ABCDE.	Nos	4,720.00
265.	07_6	Supply of Relay, AC Immune, plug-in-type, Style 'QNA1K', DC Neutral line, 24V, 1000 ohms 6F.6B, contacts, front contacts metal to carbon and back contacts metal to	Nos	5,890.80

**CHAPTER-7  
(Relay)**

		carbon, complete with plug board, retaining clip & connectors conforming to BRS:931A, IRS:S60, IRS:S 34, IRS:S 23 & RDSO Spec. No. STS/ E/Relays/UEA (PI) dt.30.05.97 (Annexure-II) (as applicable). The interlocking code for this unit shall be CDEKY.		
266.	07_7	Supply of Plug in Type Q-Series Relay QBAT (2F/2B)(Miniature, Tractive armature, AC Immune, D.C Biased Track Relay) A.C. immunity level of 80 Volt A.C, coil nominal resistance of 9 Ohms, confirming to BRS spec no. 939A & 966F2 and RDSO specification No. 84 / 88 or latest. The interlocking code for this unit shall be "ABEJX"	Nos	9,858.79
267.	07_8	Supply of KLCR relays 24V, ACI (Supply of Key Lock Checking Relay (KLCR) with one number K-50 neutral Relay to work on 24V DC non AC immunized as per specification No.RDSO/SPN/219/2016 Ver 1.0 with Amdt-1 or latest (with one extra ward plate and with case) contact configuration-4F/4B and as per IRS:S-23, IRS:S:34, IRS:46 or latest.	Nos	10,722.72
268.	07_9	Supply of Relay, Non-AC Immune, plug-in type , Style 'QN1',DC neutral line, 50V, 8F.8B contacts front and back contacts metal to carbon with plug board , retaining clip & connectors confirming to BRS:930, IRS:S 34 & IRS:S 23 or latest. The interlocking code for this unit shall be ABDEF.	Nos	4,484.00
269.	07_10	Supply of Relay, Non-AC Immune, plug-in type , Style 'QN1',DC neutral line, 50V, 12F.4B contacts front and back contacts metal to carbon with plug board , retaining clip & connectors confirming to BRS:930, IRS:S 34 & IRS:S 23 or latest. .The interlocking code for this unit shall be ABCEF.	Nos	4,484.00
270.	07_11	Supply of Relay, Non-AC Immune, plug-in type , Style 'QN1',DC neutral line, 24V, 8F.8B contacts front and back contacts metal to carbon with plug board , retaining clip & connectors confirming to BRS:930, IRS:S 34 & IRS:S 23 or latest. The interlocking code for this unit shall be ABDEF.	Nos	4,366.63
271.	07_12	Supply of Relay, Non-AC Immune, plug-in type , Style 'QN1',DC neutral line, 24V, 12F.4B contacts front and back contacts metal to carbon with plug board , retaining	Nos	4,366.63

**CHAPTER-7**  
**(Relay)**

		clip & connectors confirming to BRS:930, IRS:S 34 & IRS:S 23 or latest. The interlocking code for this unit shall be ABCEF.		
272.	07_13	Supply of Relay, AC Immune, plug-in-type, Style 'QNA1', DC Neutral line, 24V, 8F.8B contacts, front and back contacts metal to carbon, with plug board, retaining clip and connectors confirming to BRS:931A, IRS:S 60, IRS:S 34 and IRS:S 23 or latest. The interlocking code for this unit shall be ABDGH.	Nos	4,639.03
273.	07_14	Supply of Relay, AC Immune, plug-in-type, Style 'QNA1', DC Neutral line, 24V , 12F.4B contacts, front and back contacts metal to carbon, with plug board, retaining clip & connectors confirming to BRS:931A, IRS:S 60, IRS:S 34 & IRS:S 23 or latest. The interlocking code for this unit shall be ABDFH.	Nos	4,720.00
274.	07_15	Supply of Relay, AC immune plug- in -type, style "QBA1" DC biased line, 24V, 8F/8B contacts, front and back contacts metal to carbon complete with plug board, retaining clip and connectors conforming to BRS:932A, IRS:S- 60, IRS:S- 34 AND IRS:S -23 or latest. The interlocking code for this unit shall be ACDEH.	Nos	6,195.00
275.	07_16	Supply of Relay rack universal type as per drg.No.S&T/ MFT/ 291 with scaffolding, POWDER COATED with stainless steel nuts and bolts for fixing the racks. Supporting angles, frame mounting triangle base with 'J' bolts and insulation of required numbers complete to suit QN1 / K-50 pre wired tag blocks with suitable inner frames. a) 1 way	Nos	8,184.90
276.	07_17	Supply of Relay rack universal type as per drg.No.S&T/ MFT/ 291 with scaffolding, POWDER COATED with stainless steel nuts and bolts for fixing the racks. Supporting angles, frame mounting triangle base with 'J' bolts and insulation of required numbers complete to suit QN1 / K-50 pre wired tag blocks with suitable inner frames. b) 2 way	Nos	16,459.48
277.	07_18	Supply of electronic time delay units (120/60 secs) with plug boards, connectors and retaining clips with necessary inspection as per specification/ drawing/ description enclosed in this document.	Nos.	2,742.03
278.	07_19	Supply of lamp proving relays(QECX-61) for	Nos.	5,901.50

**CHAPTER-7  
(Relay)**

		LED aspects with plug boards, connectors and retaining clips with necessary inspection as per specification/		
279.	07_20	Supply of QBCA1 - heavy duty contact relays with necessary inspection as per specification/	Nos.	6,613.75
280.	07_21	Supply of Computer based Relay Testing Kit suitable for testing all types of Relays	Nos	3,54,000.00
281.	07_22	<p>Manufacture and supply of M.S. relay frames of suitable size to hold up to 4/ 8/ 12/ 20 relays /plug in type as required by Railways and fixing them in apparatus cases for all types of signal control circuits, LC gate control circuit and Point control circuits, fixing of plug boards, relays, resistors and electrolytic condensers on Phynolic synthetic industrial fibre base fine weave cotton fibre sheet - 6mm thick to IS specification 2036 - 1995 - Type F5, wiring and termination as per approved circuit diagram and painting the particulars.</p> <p>[Wire PVC copper, 3/0.75mm and 16/0.2mm copper, Phynolic synthetic industrial fibre base fine weave cotton fibre sheet - 6mm thick to IS specification 2036 - 1995 - Type F5, for fixing resistors and condensers, MS flats 25mm x 6mm brass bolts and nuts, paints, soldering materials, resistors, condensers and all other miscellaneous materials required for the work shall be supplied by the contractor].</p>		
		a. Wiring of Signal/ point/ LC control circuit (up to 4 relays/Plug in type)	Set	4,945.51
		b.Wiring of Signal/ Point/ LC control circuit (up to 8 relays/plug in type)	Set	8,786.26
		c.Wiring of Signal/ Point/ LC control circuit (up to 12 relays/plug in type)	Set	11,355.02
		d.Wiring of Signal/ Point/ LC control circuit (up to 20 relays/Plug in type)	Set	13,597.41
282.	07_23	Supply of QTA2 - track relays with plug boards, connectors and retaining clips with necessary inspection as per specification	Nos.	4,070.00
283.	07_24	Supply of QSPA1 type relays with plug boards, connectors and retaining clips with necessary inspection as per specification/	Nos.	7,139.00

**CHAPTER-7  
(Relay)**

		drawing/		
284.	07_25	Supply of Electric key transmitter - rotary type of required ward Nos. with keys, with necessary inspection as per specification/ drawing/	Nos.	6,344.80
285.	07_26	Supply of relay rack to hold 168 relays, with necessary inspection, as per specification/ drawing	Nos.	40,700.00
286.	07_27	Supply of powder coated FTOT of 500 capacity	Nos	50,593.80
287.	07_28	Supply of powder coated FTOT of 210 capacity	Nos	41,627.08
288.	07_29	Supply of 'A' type foundation made of cast iron as per Drg No.CWM.00902, and as per drawing.	Nos.	8,978.88
289.	07_30	Supply of Phase Selection Switch	Nos	2,512.76
290.	07_31	Supply of MS Angle Ladder for cable throughing	Mtr	557.78
291.	07_32	Fabrication and Supply of box suitable for 8 Nos of KLCRs	Nos	28,143.00
292.	07_33	Fabrication and Supply of box suitable for 4 Nos of KLCRs	Nos	15,009.60
293.	07_34	Erection of Relay Rack 1way/2way/4way with scaffolding suitably concreting tri-pod bases using J-bolts, fixing rack supporting of size 50x50x6mm on to the wall. Reel insulators are to be provided for insulating the rack from the scaffolding & tri-pod bases. (Payment based on number of equivalent 1way relay racks) (per Unit = Per 1way Relay Rack)	Per Unit	596.38
294.	07_35	Fabrication and supply of MS Frames to suit 'Q' series relays to accommodate 6 Nos in each set as per Drg No B.SG.CN.MISC.9.98 duly drilling required holes for relay bases.  (All materials such as frames, bolts, nuts and washers to be supplied by the contractor) (Relay bases will be supplied by Railways)	Nos	514.19
295.	07_36	Concreting and erection of cable termination rack 500/210/140 Terminals capacity on teakwood base frame of size 50mmx150mm of suitable length and width		

**CHAPTER-7  
(Relay)**

		<p>with rectangular slot in the centre for taking in the cables and painting as per standard practice.</p> <p>(Supply of cable termination racks are not included in this schedule).</p> <p>[Foundation bolts and nuts with washers, cement, sand, stone jelly, teak wood base frame 50mmx150mm of suitable length and breadth, paint, varnish and all other miscellaneous materials required for the work shall be supplied by the contractor].</p>		
	a	Concreting and erection of cable termination rack 140/210 capacity	Nos.	9,752.74
	b	Concreting and erection of cable termination rack -500 terminal capacity	Nos.	13,668.26
301.	07_37	<p>Fixing of PBT terminal block/ PBT fuse block, rubber grommets, clamping of cables using teakwood cable clamps and base planks, termination of cables, provision of ND type fuses of required capacities, provision of copper bus bar for supply terminals, wiring, provision of termination particulars diagram board using plywood of thickness 12mm - teakwood finish of size 1800mm x 1200mm with Aluminium grooved channel frame in the relay room. The blank spaces over the top of the cable termination rack shall be covered with phynolic sheet of thickness 3mm wherever required. The termination and cable core particulars shall be painted on the PVC/ nylon sleeves. The work also includes identification of cables using aluminium tags provided on each cable with letters punched neatly.</p> <p>(Supply of PBT terminal blocks 25mm &amp; 60mm centers and PBT Fuse blocks is not covered in the schedule)</p> <p>[Wire PVC 3/0.75mm copper, brass bolts and nuts and washers, for fixing PBT terminal/Fuse Block, other fixing bolts and nuts, rubber grommets, PVC/ Nylon sleeves, copper bus bars, teakwood 50mm x 50mm for cable clamps, 25mmx 100mm for base planks, phynolic sheet 6mm thick of size</p>		



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(Relay)**

		1200mm x 1800mm with aluminium grooved channel frame, phynolic sheet 3mm thick, paint and all other miscellaneous materials shall be supplied by the Contractor].		
	a	Fixing of PBT terminal blocks (25mm/60mm centre) and termination	Per Terminal Block	167.99
	b	Termination using PBT fuse block in cable termination rack	Per Fuse Block	201.27
302.	07_38	<p>Concreting and erection of Relay racks-168/56 relay capacity using 'J' type bolts and painting of relay rack as per the instructions of Railway representative at site.</p> <p>(Supply of relay rack is not covered in this schedule).</p> <p>['J' type bolts and nuts with washers, nylon bushes, concreting materials, paint and all other miscellaneous materials required for the work shall be supplied by the Contractor].</p>		
	a	Concreting and erection of relay rack - 168 capacity	Nos.	6,818.18
	b	Concreting and erection of relay rack - 56 capacity	Nos.	3,015.04
303.	07_39	<p>Fixing of plug boards, 50 way terminal blocks with 2BA terminals, and wiring of relays as per the approved circuit diagram using wire PVC 16/0.2mm copper. Suitable wire supporting tray with cover made of PVC shall be provided horizontally and vertically in the relay racks.. While running the wires on the aluminium ladder proper care shall be taken to provide smooth materials like rubber beading in the openings on Phynolic sheets, to avoid damage to wires. The work also includes wiring of contacts for data logger and terminating them in tag blocks, provision of relay index board.</p> <p>(Supply of relays, plug boards, connectors and retaining clips is not covered in this schedule).</p> <p>[Wire PVC 16/0.2mm copper, tag blocks, 2BA terminals, hard wood plank of size</p>	Per Relay	1,045.76



**CHAPTER-7  
(Relay)**

		600mmx 900mmx25mm with decolum finish, MS angles of size 25mmX25mmX6mm, relay fixing bolts and nuts, teakwood plank 25mm thick for fixing resistors and condensers, phynolic sheet 6mm thick of size 1200mmX1800mm with aluminium grooved channel frame for relay index board, paints, soldering materials, bunching thread, wire wound resistance, condenser, wire supporting tray with cover of suitable size made of PVC, paint, varnish and all other miscellaneous materials required for the work shall be supplied by the Contractor].		
304.	07_40	<p>Fixing of additional plug boards, 50 ways terminal blocks and wiring of additional relays as per the approved circuit diagram using wire PVC 16/0.2mm copper. Additional wire supporting tray with cover made of PVC shall be provided wherever required. Alterations to Relay particulars shall be incorporated in the relay Index board.</p> <p>(Supply of relays, plug boards, connectors and retaining clips and 50 way terminal boards is not covered in this schedule).</p> <p>[Wire PVC 16/0.2mm copper, 2 BA terminals, teakwood plank 25mm thick for fixing resistors and condensers, soldering materials, bunching thread, wire wound resistance, condenser, wire supporting tray with cover of suitable size made of PVC, paint, varnish and all other miscellaneous materials required for the work shall be supplied by the Contractor ]</p>	Per Relay	726.50
305.	07_41	<p>Carrying out alterations to the existing relays in the relay racks/apparatus cases as per the approved circuit diagram using wire PVC 16/0.2mm copper. The work includes painting alterations and releasing the unwanted wires carefully without disturbing the existing wiring.</p> <p>[Wire PVC 16/0.2mm copper, soldering materials, bunching threads, condensers, resistances and teakwood plank for fixing them and all other miscellaneous materials required for the work shall be supplied by the Contractor].</p>	Per Relay	695.67

**CHAPTER-7**  
**(Relay)**

306.	07_42	<p>Provision of Interconnections between relay racks, cable termination racks, SM's control panel, battery room, power room, termination and wiring. The work involves laying of underground cables in the duct as well as with clamping arrangements on the walls, supply and fixing of aluminium ladders and supports with 3mm thick phynolic sheet for running the cables in the relay room. Interconnection shall be carried out with signaling multi core cable (skinned/unskinned) and power cables as per the instructions of Railway representative at site. The work also include termination of the interconnection cables on 50 way terminals in the relay rack/ control panel, cable termination rack etc. After the interconnection cables are laid, the ducts shall be filled with M sand and closed. Wherever required the cables shall be taken to other floors in the building by clamping them on MS angles and flats grouted on the walls. (Supply of interconnection cables is not included in this schedule).</p> <p>[2BA terminals, Aluminium ladder arrangements using 37mmx37mmx5mm aluminium angles and 25mmx6mm aluminium flats, aluminium supports, phynolic sheet - 3mm thick for bottom of aluminium ladders, MS angles and flats, bolts and nuts, concreting materials, and all other materials required for the work shall be supplied by the contractor].</p>		
	a	Provision of interconnections -upto 5 roads.	LS	77,187.74
	b	Provision of interconnection - more than 5 roads (same floor)	LS	1,47,833.50
	c	Provision of interconnections -more than 5 roads (different floors)	LS	1,75,746.30

**CHAPTER-8**  
**(Fire Alarm System)**

307.	08_1	Supply of aspiration type smoke detector. Highly sensitive smoke aspiration system for Monitoring of rooms and equipment's for earliest possible fire detection For Relay rooms as per RDSO spec No.RDSO/SPN/217/2021 Ver.3.0 or latest.	Nos	7,08,081.12
308.	08_2	Supply of single Loop Analog addressable Fire Alarm system with loop capacity of connecting maximum 50 devices. The panel shall have a built in power supply and battery charger RDSO Spec. No.RDSO/SPN/217/2021 Ver.3.0 or latest.	Nos	3,11,682.08
309.	08_3	Supply of Multi Sensor detector Dual Optical/ Thermal as per RDSO specifications No.RDSO/SPN/217/2021 Ver.3.0 or latest.	Nos	16,042.23
310.	08_4	Supply of Addressable Single action indoor manual call point with back box (RED) as per RDSO specifications No.RDSO/SPN/217/2021 Ver.3.0 or latest.	Nos	9,494.38
311.	08_5	Supply of Sounder having range of 81 dbA to 92 dbA as per RDSO specifications No.RDSO/SPN/217/2021 Ver.3.0 or latest.	Nos	11,420.51
312.	08_6	Supply of Intelligent addressable Monitor module as per RDSO specifications No.RDSO/SPN/217/2021 Ver.3.0 or latest.	Nos	9,494.38
313.	08_7	Supply of Intelligent addressable control module as per RDSO specifications No.RDSO/SPN/217/2021 Ver.3.0 or latest.	Nos	9,494.38
314.	08_8	Supply of Auto-dialer for SMS alarm generation & routing in case of Fire Alarm to concerned persons as per RDSO No.RDSO/SPN/217/2021 Ver.3.0 or latest.	Nos	43,931.48
315.	08_9	Supply of 2core 1.5sq.mm FRLS Copper unarmoured cable as per RDSO specifications No.RDSO/SPN/217/2021 Ver.3.0 or latest.	Mtrs	296.94
316.	08_10	Supply of LHS Cable RDSO Spec. No.RDSO/SPN/217/2021 Ver.3.0 or latest.	Mtrs	2,246.07
317.	08_11	Supply of LHS control module. RDSO Spec. No.RDSO/SPN/217/2021 Ver.3.0 or latest.	Nos	1,55,660.6
318.	08_12	Supply and Installation of Air sampling CPVC Pipes with all required accessories for Aspiration system)	set	76,137.76
319.	08_13	Supply and Installation of Automatic Independent inbuilt device (Fire Extinguisher) with UL approved clean gas "NASA 2T" or similar having capacity of 0.3kg, operating temperature:56+/-2 degree Celsius and made of stainless steel 304 grade with Indian Railway logo put on each unit.	Per unit	9,090.72

**CHAPTER-8**  
**(Fire Alarm System)**

320.	08_14	Supply of BIS listed semi-automatic stainless steel fire extinguisher with UL approved clean gas with auto manual reverse stainless steel valve 'NASA 200 MAR' or similar having capacity of 2kg, and made of stainless steel 304 grade with Indian Railway logo put on each unit.	Per unit	24,780.00
321.	08_15	Supply of BIS listed Semi-automatic Stainless Steel preventive device with UL approved clean gas with Auto manual Reverse Stainless Steel valve 'NASA 400 MAR' or similar having capacity of 4kg, and made of stainless steel 304 grade with Indian Railway logo put on each unit.	Per unit	35,219.46
322.	08_16	Supply Of BIS listed Semi automatic SS Fire extinguishers with UL approved clean gas auto manual reverse SS valves NASA 600 MAR Cap & made of SS 304 grade or similar having capacity of 6kg, and made of stainless steel 304 grade with Indian Railway logo put on each unit.	Per unit	44,840.00
323.	08_17	Supply Of movable tender at doorstep with UL approved having capacity of 10kgs made of SS 304 grade with Indian Railway logo put on each unit and clean gas shelf life with 10 years warranty for leakage. Note: Warranty of OEM and Test certificates of any NABL approval LAB for clean gas along with the offer.	Per unit	1,03,181.84
324.	08_18	Supply of Relay Module as per RDSO specification No.RDSO/SPN/217/2021 Ver.3.0 or latest.	Nos	9,867.99
325.	08_19	Supply of TCIP Module /Networking card for interfacing the Fire Alarm and Detection systems	Nos	30,881.44
326.	08_20	Supply, installation, configuring, testing and commissioning of remote monitoring software along with license for 99 control panels as per No.RDSO/SPN/217/2021 Ver.3.0 or latest.. This includes necessary gateway card and network interface card for the system fully functional as desired by railways. (software suitable for 8 stations)	LS	5,21,517.86
327.	08_21	Installation, testing and commissioning charges of fire alarm system including programming of devices and fire alarm panel	Set	95,933.57
328.	08_22	Supervision, programming, testing & Commissioning of Aspiration smoke detection	Set	83,751.53

**CHAPTER-9**  
**(Measuring Instruments)**

329.	09_1	Supply of Handheld True RMS Multi Meter, as per Technical specification	Nos	23,192.34
330.	09_2	Supply of Handheld True RMS clamp Meter, as per Technical specification	Nos	33,510.29
331.	09_3	Supply of Handheld Digital Insulation Resistance Tester, as per Technical specification	Nos	51,165.02
332.	09_4	Supply of OTDR (mini) with standard accessories for 1310/1550nm with all standard accessories as per TEC specification GR/OTD-02/02 Jan 2005 or latest, ( this item should have valid TEC approval certificate) as per Technical specification	Nos	3,07,856.22
333.	09_5	Supply of SPD Life tester, designed for on-site testing of surge protective devices (SPD). It shall indicate the health status of GDT/ MOV based SPD of voltage range upto 1000V. It shall indicate the status of SPD by measuring its electrical parameters.	Nos	1,20,729.41
334.	09_6	Supply of Digital Insulation tester (Megger) 50V-500V/1000 mega ohm battery operated with all complete accessories, as per Technical specification	Nos	11,844.52
335.	09_7	Supply of Cable Route Tracer as per Technical specification	Nos	5,78,788.99
336.	09_8	Supply of Portable Cable Fault Locator as per Technical specification	Nos	1,86,694.53
337.	09_9	Supply of Block Bell equipment to be used in conjunction with block instrument in 25KV 50Hz AC electrified area as per specification No IRS:TC-44/88 Amd 1 including latest amendments.	Nos	2,406.36
338.	09_10	Supply of Block Filter Unit used in conjunction with block instrument in 25KV, 50Hz AC traction area as per specification No IRS:S-68/89 including latest amendment	Nos	18,161.86
339.	09_11	Supply of Digital Earth clamp Tester as per Technical specification	Nos	71,129.79
340.	09_12	Supply of VRLA Battery Analyzer. as per Technical specification	Nos	3,13,043.90
341.	09_13	Supply of Hand Held Thermometer, as per Technical specification	Nos	8,437.00
342.	09_14	Supply of OFC Power Meters, as per Technical specification	Nos	47,200.00

**CHAPTER-9**  
**(Measuring Instruments)**

343.	09_15	Supply of digital Cross Talk Measuring set as per spec.no.IRS.TC.45/88 with latest and, as per Technical specification	Nos	70,308.00
344.	09_16	Supply of Transmission measuring set (TMS) with accessories as per IRS Spec No. IRS:TC 43-87 or latest, as per Technical specification	Nos	57,699.40
345.	09_17	Supply of Laser source and Power meter with accessories as per Technical specification	Nos	40,710.00
346.	09_18	Supply of Fusion Splicing Machine with accessories as per Technical specification	Nos	2,95,000.00
347.	09_19	Supply of Thermal Imager Pocket, with accessories as per Technical specification	Nos	1,06,188.20
348.	09_20	Supply of Fiber Visual Fault Locator with accessories, as per Technical specification	Nos	17,110.00
349.	09_21	Supply of Coating Thickness Gauge, with accessories, as per Technical specification	Nos	29,500.00
350.	09_22	Supply of Thermo hygrometer, with accessories, as per Technical specification	Nos	1,180.00
351.	09_23	Supply of Rodometer as per Technical specification	Nos	4,252.24
352.	09_24	Supply of Battery Tester as per Technical specification	Nos	715.95
353.	09_25	Supply of Hydrometer	Nos	228.94

<b>CHAPTER-10</b> <b>Other Supply items</b>				
354.	10_1	Supply of Double walled corrugated pipe - 103.5mm inner dia & 120mm outer dia conforming to specification No. IS 14930(Part 2): 2001 with one coupler for every 6m of pipe as per Technical specification	Mtrs	365.19
355.	10_2	Supply of GI pipes - 50mm dia -3.65mm thick as per Technical specification	Mtrs	457.88
356.	10_3	Supply of GI pipes - 100mm dia-4.5mm thick as per Technical specification	Mtrs	1,119.16
357.	10_4	Supply of GI pipes - 150mm dia-4.8mm thick as per Technical specification	Mtrs	1,698.99
358.	10_5	Supply of High-Density Polyethylene Pipes (HDPE) of 110 mm Outer Dia, 10 mm Wall Thickness, along with one coupler for every 6 Meters as per specification No. IS 4984: 2016 with latest amendments and Material Grade:PE 80	Mtr	853.55
359.	10_6	Supply and laying of PVC Warning Tape colour Orange, width of 250mm (10") by printing with black letters 'Indian Railway Signal/Telecom/OFC Cable' on both sides	Mtr	46.15
360.	10_7	Supply of Electronic Cable Route Marker 3M make or similar, Model: RFID (1421) and installation, cable detection of capacity to detect the cable upto 5 feet depth.	Nos	2,441.72
361.	10_8	Supply of HDPE Pipe 40mm (outer dia)/33 mm (inner dia) with couplers	Mtr	60.93
362.	10_9	Supply and Installation of Wall/Rack mountable 12 Fibre management system (FMS) conforming to RDSO/SPN/TC-37/2000(rev-3 amdt-1 or latest similar to COMMScope make or better, suitable for splicing and front patching 12F cable with all accessories and terminating the optical fibre cable with splicing and front patching in FMS in the Location Box. This includes Supply and Provision of 4 nos of Patch cords of required length (All other materials required for splicing are to be supplied by contractor)	Nos	10,502.00
363.	10_10	Supply and Installation of Wall/Rack mountable 24 Fibre management system (FMS) conforming to RDSO/SPN/TC-37/2000(rev-3 amdt-1 or latest similar to COMMScope make or better, suitable for splicing and front patching 24F cable with all accessories and terminating the optical fibre cable with splicing and front patching in FMS in the Location Box. This includes Supply and Provision of 4 nos of Patch cords of required length (All other materials required for	Nos	18,686.74



CHAPTER-10 Other Supply items				
		splicing are to be supplied by contractor)		
364.	10_11	Supply and Installation of Wall/Rack mountable 48 Fibre management system (FMS) conforming to RDSO/SPN/TC-37/2000(rev-3 amdt-1 or latest similar to COMMSCOPE make or better, suitable for splicing and front patching 48F cable with all accessories and terminating the optical fibre cable with splicing and front patching in FMS in the Location Box. This includes Supply and Provision of Wooden Plank, L clamps and 4 nos of Patch cords of required length (All other materials required for splicing are to be supplied by contractor)	Nos	32,885.01
365.	10_12	Supply of 2U wall mountable rack for fixing of telecom equipment	Nos	5,782.00
366.	10_13	Supply and Installation of 19", 6U rack of size 600mm x 600mm with complete accessories	Nos	4,936.26
367.	10_14	Supply and Installation of surface Wall mountable type 19 inch 12U network Rack with front glass door with lock and rack fixing multipoint AC Power trip & all accessories (Power extension board with one set of MCB, exhaust fan, cable manager)	Nos	6,761.51
368.	10_15	Supply and Installation of covered 19inch Racks of size 1950mm x600mm x 600mm or higher (Make: HCL/ Vero/President/ Rittal/ Puncom or better) complete with all fittings including DC Fans (24V/48V)-2nos, separator sheet/ plate to keep testing equipment-1no and AC power distribution panel ( Horizontal fitting) with power sockets and fuse protection ( min 6 nos of 230V – 15/5A combined and other accessories	Nos	65,734.12
369.	10_16	Supply of nylon Insulations for IRS point machine	Set	1,671.75
370.	10_17	Supply of Galvanised Ground Connection for 143mm Stroke Point Machine,	Set	8,982.27
371.	10_18	Supply of track lead junction box - FRP type with 4 terminals and stumps with necessary inspection as per specification/ drawing/ description enclosed in this document.	Nos.	1,622.50
372.	10_19	Supply of Track Feed Resistance	Nos.	287.77
373.	10_20 10_278	Supply of Bond Pins (pack of 100)	Nos.	191.85
374.	10_21	Supply of Bond Clips (pack of 100)	Nos.	960.80
375.	10_22	Supply of gauge Tie Plate Insulation	Set	210.72
376.	10_23	Supply and Provision of hardwood Plank (Full BOX)	Nos.	3,187.09



<b>CHAPTER-10</b> <b>Other Supply items</b>				
377.	10_24	Supply and Provision of hardwood Plank (Half/Quarter BOX)	Nos.	1,593.54
378.	10_25	Supply of PBT terminals 25mm/ 60mm centre and PBT Fuse blocks with necessary inspection as per specification/ drawing/ description enclosed in this document.		
	a	Supply of PBT terminals 25mm centre.	Nos.	61.44
	b	Supply of PBT terminals 60mm centre.	Nos.	93.02
	c	Supply of PBT fuse block without ND fuse	Nos.	103.84
379.	10_26	Supply of apparatus cases (full/ half/ quarter size) to suit Southern Railway standard with necessary inspection as per specification/ drawing/ description enclosed in this document		
	a	Supply of apparatus case - Full size	Nos.	18,821.00
	b	Supply of apparatus case - Half size	Nos.	15,576.00
	c	Supply of apparatus case - Quarter size	Nos.	7,636.88
380.	10_27	Supply of E-Type Locks	Nos.	1,234.88
381.	10_28	Supply of EWS Locks	Nos.	302.48
382.	10_29	Supply of Red Oxide Paint	Per Ltr	203.96
383.	10_30	Supply of Aluminium Paint	Per Ltr	352.43
384.	10_31	Supply and wiring of LEDs with resistance and fixing on the cable termination rack for indicating "FUSE BLOWN OUT" for each circuit. The LEDs and resistances shall be fixed on a phynolic sheet 50mm width and 3mm thick. The phynolic sheet shall be fixed by the side of the corresponding Fuse Blocks. Separate switch shall be provided for each circuit.  [LEDs 10mm, holders, resistance, switch, phynolic sheet, soldering materials and all other miscellaneous materials required for the work shall be supplied by the Contractor].	Per Fuse	60.68
385.	10_32	Supply and wiring of Diagnostic panel in the relay room similar to control panel for displaying the relay positions for signals, points, track etc by fixing LEDs of required colors on phynolic sheet of size 1200mmx900mmx6mm with teak wood frame on which the yard plan shall be digital drawn and pasted using good quality gum sheet. The LEDs shall be wired using	Nos.	60,742.53

**CHAPTER-10**  
**Other Supply items**

		<p>16/0.2mm copper and terminated on tag blocks inside the diagnostic panel. From the panel to the relay racks the wiring shall be done using switch board cables up to the 50 way terminal blocks. From the 50 way block to the relay contacts wiring shall be done using 16/0.2mm copper wire. The wiring shall be done as per approved circuit diagram and as per the instructions of Railway representative at site.</p> <p>[Phynolic sheet of size 1200mmx900mmx6mm, LED-5mm/ 3mm size, with holders, wire PVC, switch board cables, soldering materials, paint, frame for the boards, fixing bolts and nuts with washers and all other miscellaneous materials required for the work shall be supplied by the contractor].</p>		
386.	10_33	<p>Supply and wiring of Diagnostic panel in the relay room similar to control panel for displaying the relay positions for signals, points, track etc by fixing LEDs of required colors on phynolic sheet of size 1800mmx1200mmx6mm with teak wood frame on which the yard plan shall be digital drawn and pasted using good quality gum sheet. The LEDs shall be wired using 16/0.2mm copper and terminated on tag blocks inside the diagnostic panel. From the panel to the relay racks the wiring shall be done using switch board cables up to the 50 way terminal blocks. From the 50 way block to the relay contacts wiring shall be done using 16/0.2mm copper wire. The wiring shall be done as per approved circuit diagram and as per the instructions of Railway representative at site.</p> <p>[Phynolic sheet of size 1800mmx1200mmx6mm, LED-5mm/ 3mm size, with holders, wire PVC, switch board cables, soldering materials, paint, frame for the boards, fixing bolts and nuts with washers and all other miscellaneous materials required for the work shall be supplied by the contractor].</p>	Nos.	1,06,610.78
387.	10_34	Supply of 4 wire DTMF based way station equipment complete as per RDSO specification No.IRS.TC-60/93 and 4 wire control telephone with audio visual indication	Set	9,086.00

<b>CHAPTER-10</b> <b>Other Supply items</b>				
		and reset button fitted on telephone conforming to specification No.IRS-TC-38/97 or latest.		
388.	10_35	<p>Supply and installation of yard layout diagram board in the station master's room. The board shall be made of Phynolic synthetic industrial fibre base fine weave cotton fibre board (matt finish) 6mm thick size 1800mm X 1200mm with aluminium channel frame. The yard layout shall be neatly painted and fixed as instructed by Railway representative at site.</p> <p>[All materials required for the work shall be supplied by the Contractor].</p>	Nos.	16,722.15
389.	10_36	<p>Manufacture and supply of teak wood tool box of size 1000X750X100mm made of 25mm thick teak wood persplex sheet fronted 6mm (Colourless) fixed on the wall at a convenient location as instructed by Railway representative at site. The board should have provision of pad lock and locking arrangements and shall be equipped with the following tools[reputed make]:</p> <ol style="list-style-type: none"> <li>Digital Mulltimeter similar to Model No. Rish Multi 18S with suitable carrying case and test probes.</li> <li>Centre zero ammeter 30-0-30 Amps - 1 No.</li> <li>Screw drivers of different types and sizes with common handle - 1 set</li> <li>Spanner double ended 33mm - 1 No.</li> <li>Spanners double ended 3/8x1/2" - 1 No.</li> <li>Spanners double ended 5/8x3/4" - 1 No.</li> <li>Spanners double ended 7/8x1" - 1 No.</li> <li>Hammer 1 1/2 lbs ball pane - 1 No.</li> <li>Hacksaw frame - 1 No.</li> <li>Adjustable screw spanner 12" - 1 No.</li> <li>Insulated cutting pliers- 1 No.</li> <li>Insulated nose plier- 1 No.</li> <li>Electric soldering iron 230V 60W Soldron/Philips make - 1 No.</li> <li>Electric soldering iron 110V 35W Soldron/Philips make - 1 No.</li> <li>Megger 500V/ 500Mohms. with Probe - 1 No.</li> </ol>	Set	29,185.60

CHAPTER-10 Other Supply items				
		<p>The above tools shall be purchased from Reputed manufacturers only in consultation with the Railway representative at site.</p> <p>[Teak wood tool box made of 25mm teak wood plank, perspex sheet, all the tools mentioned above, padlock and other miscellaneous items shall be supplied by the Contractor].</p>		
390.	10_37	Supply of magneto telephone handle type and supply of Ni-cad power pack 4V-2.2AH with charger to work on 110VAC	Nos.	8,106.70
391.	10_38	Supply and installation of teakwood glass fronted box of size 300mm x 600mm x 75mm with hooks to keep various keys with description engraved on the tags. [TW Glass fronted box of size 300mmx600mmx 75mm with built in lock, hooks, engraved tags and all other miscellaneous materials required for the work shall be supplied by the Contractor].	Nos.	7,505.45
392.	10_39	Supply of Jerry can 20 Ltrs capacity white as per the requirements of SSE at site.	Nos	164.77
393.	10_40	Supply of 3/0.75mm or 4 Sq.mm Copper cable(per coil=100 mtrs) APC)	Per Coil	3,459.50
394.	10_41	Supply of 16/0.2 mm copper(per coil=100 mtrs)ATC)	per Coil	1,327.19
395.	10_42	Supply of 7/1.4mm or 10 Sq.mm Copper cable(per coil=100 mtrs) APC)	Per Coil	18,448.57
396.	10_43	Supply of ND Fuse of various capacities	Per Fuse	37.74
397.	10_44	Supply and Provision of Lead wool	Per Kg	1,258.00
398.	10_45	Supply and provision of Rubber mat of not less than 6mm thick and with an insulation to withstand 650VAC, on the floor of relay room etc at places as indicated by railway representative at site.	Sft	144.86
399.	10_46	Supply of Aluminium Angles (Full Description)	Km	3,40,150.62
400.	10_47	Supply of Aluminium Flat (Full Description)	Km	1,38,365.85
401.	10_48	Supply of External Solid-state Drive (SSD) of 1TB capacity.	Nos	15,498.45

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402.	11_1	Excavation of pit, erection of cable termination boxes on rails and concreting as per Drg. No.SG/CN/02/8, drilling of suitable holes in the box, fixing of 2 Nos. of GI pipes 32mm dia and 300mm long at the bottom with clamp nuts - 12 mm thick, one at the inner side and another at the outer side for each pipe for cable entry and one GI pipe 150mm long 32mm dia for drawl of jumper wires for Point machines etc., fixing of hardwood plank 37mm thick on the bottom, provision of one EWS lock, and painting the boxes inside and outside with one coat of red-oxide and two coats of aluminium paints.	Nos.	5,029.69
403.	11_2	<p>Installation of combined type point machine - IRS type and connecting all ground connections including wiring and termination in point machine and interconnections between point machine and CT box through PVC hose pipe with 3/0.75mm and 7/1.40mm copper wire and painting. This work includes provision of insulation to stretcher bars, throw bar lug and "D" bracket wherever required, cutting of notches on the point machines covers to suit crank handle configuration.</p> <p>(Combined type point machine with ground connection, uninsulated stretcher bar, throw bar lug and 'D' brackets will be supplied by Railways.</p> <p>[All types of insulations connected to point work, coal bengal, all type of bolts and nuts, washers spring/flat wire PVC 7/1.4mm copper, PVC hope pipe, paints, PVC/nylon sleeves and all other miscellaneous materials required for the work shall be supplied by the Contractor].</p>	Nos.	16,383.88
404.	11_3	Installation of Signal post telephone (paging and talk back)	Nos.	5,392.75
405.	11_4	Fixing and wiring of platform repeaters. The work involves fixing of platform repeater using suitable fixing arrangements at places indicated, wiring the same and painting as per the instructions of Railway representative at site. The signal shall be connected to the apparatus case using cables neatly clamped. The work also includes provision of one EWS lock. (Laying of cable is not included in the scope of this	Nos.	6,063.56

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		work.)  (Supply of repeater signals and cables is not included in this schedule).  [Wire PVC 3/0.75mm copper, paint, EWS lock and all other miscellaneous materials required for the work shall be supplied by the Contractor].		
406.	11_5	Painting of existing colour light Signals as per standard practice. The work involves scraping of old paint, applying one coat of Red oxide and two coats of Aluminium/enamel paint on the Signals - complete as instructed by Railway representative at site.  [Aluminium paint, red-oxide and all other miscellaneous materials required for the work shall be supplied by the Contractor].	Nos.	2,442.00
407.	11_6	Filling earth around location boxes/signal foundations for a width of 0.5m on all sides, up to a level 150mm below the foundation top. This work includes consolidation of earth by watering and ramming.  The earth shall be taken from Railway premises as instructed by Railway representative at site.	CUM	231.30
408.	11_7	Excavation of pit, casting concrete foundation as per Drg.No.SG/CN/02/9 using metallic templates, for erection of colour light signals up to 4 aspects.  [Foundation bolts, cement, M sand, stone jelly of size 20/25mm dia and all other miscellaneous materials required for the work shall be supplied by the Contractor].	Nos.	9,213.28
409.	11_8	Erection of surface base, signal pole, mounting of colour light signal up to 4 aspects complete on Signal pole/ Off-set bracket, (for LED/ filament bulbs) with lenses, triple pole lamp holder, filament switching units, CLS transformer, current regulators (whichever is applicable), fixing of ladder with platform complete and concreting of ladder shoe, fixing of number plates, marker board, lens guard, fixing of speed limit board wherever necessary, termination of tail cables, wiring of signal unit with PVC wire 3/0.75mm copper, provision of EWS locks, and painting of one coat of red oxide and two coats of	Nos.	8,287.08

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		<p>aluminium/ enamel paints. When the aspect is fixed on Offset bracket using 'U' bolts and nuts, a through bolt shall be provided by drilling a hole in the signal pole to prevent the offset bracket from sliding down. (Supply of surface base, Offset bracket, CLS pole, CLS aspects complete, ladder with shoes and platform, Speed limit board, LED aspects, current regulators, lamp holders, lamps, filament switching unit and CLS transformer is not covered in this schedule).</p> <p>['U' bolts and nuts, through bolts and nuts, cement, stone jelly 20/25mm dia, M sand, Signal Collar Rings, wire PVC 3/0.75mm copper, lens-guard, all fixing bolts and nuts, lead wool, paints PVC/Nylon sleeves, enameled number plates. enameled marker boards, EWS locks, and all other miscellaneous materials for the work shall be supplied by the Contractor].</p>		
410.	11_9	<p>Excavation of pit and casting concrete foundation as per Drg, No.SG/CN/02/10 using metallic templates, for erection of ground type colour light shunt signal. [Foundation bolts and nuts, cement, M sand, stone jelly of size 20/25mm and all other miscellaneous materials for the work shall be supplied by the Contractor].</p>	Nos.	4,645.17
411.	11_10	<p>Erection of Ground type shunt signal complete including surface base, signal pole, LED aspects/ lenses, bulbs with holders (whichever is applicable), fixing of lens guards, number plate, termination of tail cables, wiring of signal unit with PVC wire 3/0.75mm copper, provision of EWS locks and painting of one coat of red oxide and two coats of Aluminium/ enamel paint.(Supply of Ground type shunt signal complete including surface base, signal pole, LED aspects, holder, bulbs, and lenses is not covered in this schedule).[Wire PVC 3/0.75mm copper, lens guards, EWS locks, Enameled number plates, bolts and nuts, lead wool, paints and all other miscellaneous materials shall be supplied by the Contractor].</p>	Nos.	3,170.44
412.	11_11	<p>Fixing of Offset brackets using 'U' bolts and nuts, erection of Post type shunt Signals, termination of tail cables and wiring using wire PVC 3/0.75mm copper, provision of EWS lock and painting of one coat of red-</p>	Nos.	2,306.03



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		oxide and two coats of aluminium/ enameled paint. The work also includes drilling suitable holes on the CLS post and provision of a through bolt with nut to prevent the Off-set bracket from slipping down.		
413.	11_12	Fixing and wiring of Multi lamp route indicator [Fixing bolts and nuts, EWS locks wires PVC 3/0.75mm & 16/0.2mm copper, wire mesh, PVC/Nylon sleeves, paints and all other miscellaneous materials shall be supplied by the Contractor]	Nos.	4,507.99
414.	11_13	Fixing and wiring of Stencil type route indicator [Fixing bolts and nuts, EWS locks wires PVC 3/0.75mm & 16/0.2mm copper, wire mesh, PVC/Nylon sleeves, paints and all other miscellaneous materials shall be supplied by the Contractor]	Nos.	3,135.75
415.	11_14	Fixing of junction type route indicators - 1 way to 6 ways - complete/ fixing of additional limb to the existing route indicators, termination of tail cables, wiring as per approved circuits diagram using wire PVC 3/0.75mm copper, provision of required No of EWS locks, wire mesh, and painting.  (Supply of junction type Route Indicators - complete and additional limb is not covered in this schedule).  [3/0.75mm wire PVC, fixing bolts and nuts, EWS locks, wire mesh, PVC/Nylon sleeves, paints and all other miscellaneous materials shall be supplied by the Contractor].		
	a	Fixing and wiring of direction type route indicator - 1 way	Nos.	2,238.04
	b	Fixing and wiring of direction type route indicator - 2 way	Nos.	2,460.04
	c	Fixing and wiring of direction type route indicator - 3 way	Nos.	2,679.26
	d	Fixing and wiring of direction type route indicator - 4 way	Nos.	4,363.69
	e	Fixing and wiring of direction type route indicator - 5 way	Nos.	4,582.91
	f	Fixing and wiring of direction type route indicator - 6 way	Nos.	4,674.49
	g	Fixing and wiring of additional limb to existing route indicator	Nos.	1,083.64



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416.	11_15	<p>Fixing of Offset brackets using 'U' bolts and nuts, erection of Calling On Signals/ 'A' marker lights, termination of tail cables and wiring using wire PVC 3/0.75mm copper, provision of EWS lock, number plates/ marker boards and painting. The work also includes drilling suitable holes on the CLS post and provision of a through bolt with nut to prevent the Off-set bracket from slipping down.</p> <p>(Supply of Calling on Signal/ 'A' marker light, LED aspects/holders &amp; bulbs and Off set brackets is not covered in this schedule).</p> <p>['U' bolts and nuts, through bolts with nut, wire PVC 3/0.75mm copper, EWS lock, Enameled number plates, wire mesh, PVC/Nylon sleeves, paints and all other miscellaneous materials shall be supplied by the contractor].</p>	Nos.	2,081.25
417.	11_16	<p>Releasing of existing tail cables and drawl of new tail cables for colour light signals up to four aspects with or without route indicator, post type shunt signal and Calling on signals, termination of new tail cables and wiring using wire PVC 3/0.75mm copper. This work includes drawl of new tail cables into the signal post duly releasing the existing tail cables from the relevant signals and re-surfacing the earth excavated as instructed by Railway representative at site. [Wire PVC 3/0.75mm copper, paints and all other miscellaneous materials shall be supplied by the Contractor].</p>	Per Cable	1,524.86
418.	11_17	<p>Excavation of pit in and around the existing signals very carefully without causing damage to the working cables and shifting the Signals along with the concrete foundations for approximately 1m to a nearby position so as to clear the infringement from the nearest track centre as instructed by Railway representative at site.</p> <p>The existing cable coils shall be released carefully so as to give access for shifting. Necessary masonry work and earth work shall be carried out in and around the signals after shifting as instructed by Railway representative at site.</p> <p>[All materials required for the work shall be supplied by the Contractor].</p>	Nos.	4,793.81

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419.	11_18	Removal of existing CLS units, fixing of new CLS units with LED aspects/ lamps, holders etc., up to four aspects, directly or using off set brackets duly drilling holes on the signal poles, provision of EWS locks wherever necessary, termination of tail cables and wiring using wire PVC3/0.75mm copper and painting of aspect. The new tail cables shall be taken through the signal poles and the unwanted cables duly released	Nos.	10,296.64
420.	11_19	Excavation of pit and construction of masonry platform as per drawing No. SG/CN/02/12 with country bricks of size 220mmx 100mmx60mm (app) at the foot of signal post telephones as per the instructions of Railway representative at site.  [Country bricks of size 220mmx100mmx60mm (app), cement, M sand and all other miscellaneous materials required for the work shall be supplied by the Contractor].	Nos.	5,355.94
421.	11_20	Painting of existing boards like LEGEND boards, warning boards, STOP boards etc., as per standard practice and as per the instructions of Railway representative at site.  (Supply of boards is not included in this schedule).  [Paint and all other miscellaneous materials required for the work shall be supplied by the Contractor].	Nos.	1,262.63
422.	11_21	Alteration to existing Illumination diagram board. The work involves drilling of holes and fixing of LEDs and wiring using wire PVC 16/0.2mm copper, removing the unwanted LEDs and wires, closing the holes, and carrying out painting alterations as per the instructions of Railway representative at site.  [All materials required for this work shall be supplied by the Contractor].	Nos.	3,873.90
423.	11_22	Hot dip Galvanization of signal post and ladder (4.6m tall, 140 mm dia /3.60 m tall, 140 mm dia), clamps, point roddings and other materials related to Signalling. Minimum DF thickness shall be 80 microns. Transportation of materials from site/stores to galvanization workshop and back to site/stores not included in this schedule. Transportation charges will be as per	Kg	25.31

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		<p>relevant SOR schedules. Test certificate showing the DFT, type of galvanization, materials used etc., from galvanizing firm for each batch to be submitted.</p> <p>(Unit is calculated based on the weight of the Signal poles, ladders, clamps, rodding's etc.,)</p>		
424.	11_23	<p>Provision of DC Single/ Double rail track circuit to suit RE/ Non-RE areas as per approved signaling plan using Plug-in type track relays. This work includes provision of double bonding, and parallel jumpers, provision of bond wire clips, provision of track lead connections using 2c X 2.5 sq.mm cable, provision of TLD boxes 2 Nos. at Relay end, 2 Nos. at Feed end and 2 No's for parallel jumpers as necessary to suit layouts, for each Track Circuit, and termination of jumpers and tail cables in track lead junction boxes, installation of relays, track feed battery chargers to charge up to 4 cells, track feed resistance, 'B' type choke' and secondary cells - 80 AH capacity in apparatus cases and wiring with wire PVC 3/0.75mm copper. The work also includes painting of track Circuit No. with Feed end/ Relay end details on the TLD boxes. The work also includes provision of insulations for gauge tie plates and nose crossing plates wherever required. (Provision of rail joint insulation is not covered in this schedule.)</p> <p>(Uninsulated gauge type plate and nose crossing plate will be supplied by Railways. Supply of track feed battery charger, 'B' type choke, track relays, un-charged secondary cells (2V - 80AH), TLD boxes with stumps, 2cX2.5 sq.mm cable, is not covered in this schedule).</p>		
	a	a)Provision of track circuit in RE/Non RE area (point zone)	Nos.	8,914.50
	b	Provision of track circuit in RE/Non RE area (other than point zone)	Nos.	7,145.44
425.	11_24	Alteration to existing DC Track Circuits to suit RE/Non RE standard as per approved signaling plan. This work includes provision of double bonding and parallel jumpers, provision of bond wire clips, wherever required, shifting of relay end and feed end equipments and re-wiring them, provision of track lead connections wherever necessary		

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		using 2c x 2.5 sq.mm cable		
	a	Alteration to existing track circuits at feed end	Nos.	4,234.65
	b	Alteration to existing track circuits at relay end	Nos.	3,850.31
426.	11_25	Provision of Rail Joint Insulations. This work includes milling of fish plates, provision of rail joint insulation with MS backing plates etc. and insulating the joints as per Railway standard.  (Supply of Rail Joint insulations, unfilled fish plates, fish bolts and nuts is not covered in this schedule).	Set.	565.13
427.	11_26	Excavation of pit, casting concrete foundation and erection of apparatus case <b>full size</b> as per Drg. No.SG/CN/02/6 and fixing of 2 Nos. of 'E' type locks, one for the front door and another for the back door, fixing of one hard wood shelf plank 37mm thick and painting the apparatus case inside and outside with one coat of red-oxide and two coats of aluminium paints.  (Supply of apparatus case is not included in this schedule).  [Foundation bolts & nuts, 'E' type locks, cement, M sand, stone jelly of size 20/25 mm, hardwood plank of 37mm thick, paints, varnish, fixing bolts & nuts and all other miscellaneous materials required for the work shall be supplied by the Contractor.]	Nos.	11,333.10
428.	11_27	Fixing of E-Type Lock	Nos.	308.03
429.	11_28	Excavation of pit, casting concrete foundation and erection of apparatus case <b>half size</b> as per Drg, No.SG/CN/02/7, fixing one 'E' type lock for the front door and latching arrangement for the back door, and fixing of one hardwood shelf plank 37mm thick and painting the apparatus case inside and outside with one coat of red-oxide and two coats of aluminium paints.  (Supply of apparatus case is not included in this schedule).  [Foundation bolts and nuts, cement, 'E' type locks, M sand, stone jelly of size 20/25mm, 37mm hard wood planks, latching	Nos.	8,787.04

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		arrangements, paints, varnish, fixing bolts & nuts and all other miscellaneous materials required for the work shall be supplied by the Contractor]		
430.	11_29	<p>Excavation of pit, casting concrete foundation and erection of apparatus case Quarter size as per Drg. No.SG/CN/02/8 and fixing of one hardwood base plank 37mm thick, provision of one EWS lock, and painting the apparatus case inside and outside with one coat of red-oxide and two coats of aluminium paints.</p> <p>(Supply of apparatus case is not included in this schedule).</p> <p>[Foundation bolts and nuts, cement, M sand, stone jelly of size 20/25mm, 37mm hard wood planks, EWS locks, paints, varnish, fixing bolts and nuts and all other miscellaneous materials required for the work shall be supplied by the Contractor]</p>	Nos.	8,885.55
431.	11_30	<p>Excavation of pit, erection of cable termination boxes on rails and concreting as per Drg. No.SG/CN/02/8, drilling of suitable holes in the box, fixing of 2 Nos. of GI pipes 32mm dia and 300mm long at the bottom with clamp nuts - 12 mm thick, one at the inner side and another at the outer side for each pipe for cable throughing, fixing of hardwood plank 37mm thick on the bottom, provision of one EWS lock, and painting the boxes inside and outside with one coat of red-oxide and two coats of aluminium paints.</p> <p>(Supply of CT boxes is not covered in this schedule. Rails of different length shall be supplied by Railways. The contractor shall cut lengthy rails wherever required.)</p> <p>[Cement, M sand, stone jelly of size 20/25mm, paint, varnish, GI Pipes 32mm dia with clamp nuts - 12mm thick - 2 Nos. for each pipe, fixing bolts and nuts with washers, EWS locks, paints and all other miscellaneous materials shall be supplied by the Contractor].</p>	Nos.	4,999.16

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432.	11_31	Fabrication and erection of rail staging, concreting, construction of stock brick, masonry support, supply and provision of concrete slabs 3 Nos. of size 300mm x 1700mm x 80mm for platform on stage support for erecting apparatus case full size on embankment and casting concrete foundation and erection of apparatus case full size over the compacted earth and masonry , fixing 2 Nos. of 'E' type locks, one for the front door and another for the back door, supply and fixing of one hardwood shelf plank of 37mm thick and painting the boxes inside and outside with one coat of red-oxide and two coats of aluminium paints.	Nos.	20,609.19
433.	11_32	Fabrication and erection of rail staging, concreting, construction of stock brick, masonry support, supply and provision of concrete slabs for platform, 3 Nos. of size 300mm x 1000mm x 80mm for platform stage support for apparatus case half size on embankment and casting concrete foundation and erection of apparatus case half size over the compacted earth and masonry work , fixing 1 No. of 'E' type locks, for the front door and the latching arrangements for the back door and fixing one H.W shelf plank of 37mm thick and painting the boxes inside and outside with one coat of red-oxide and two coats of aluminium paints.  (Supply of apparatus case is not included in this schedule. Rails of different lengths will be supplied by Railway and the Contractor has to cut the rails to required lengths).	Nos.	16,011.20
434.	11_33	Excavation of pit in and around the existing location boxes very carefully without damaging the working cables and shifting and turning the location boxes to clear of the infringement as instructed by the Railway representative at site. The work includes ensuring the safety of the signaling system, releasing the cable coils to give access for shifting/turning the location boxes. Necessary masonry work and earth work in and around the location boxes to the required level shall be done as instructed by the Railway representative at site. If the existing earth connections to the location boxes are disturbed, the earth wires shall be		

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		properly re-connected.		
	a	a. Shifting of apparatus case (full)	Nos.	5,348.81
	b	b. Shifting of apparatus case (half)	Nos.	3,545.06
	c	c. Shifting of apparatus case (Quarter)	Nos.	2,929.01
435.	11_34	<p>Termination of new main/tail cables on the existing terminals/ fuse blocks in apparatus cases/ battery boxes/ CT boxes/ cable termination racks as per approved circuit diagram. The terminal particulars are to be repainted /corrected on the doors of apparatus cases/ battery boxes/ cable termination boxes and FTOT index board as instructed by Railway representative at site. This work includes closing the opening created for entry of new cables in the apparatus cases with masonry brick work and sealing the bottom of the apparatus cases/ cable termination racks with cable compound.</p> <p>[Paints, wire PVC 3/0.75mm and 16/0.2mm copper, sealing compound, bricks, cement, M sand and all other required miscellaneous materials shall be supplied by the contractor].</p>	Per Terminal block	73.59
436.	11_35	<p>Termination of main, tail, Signaling and power cables and internal wiring on terminal/ fuse blocks in new apparatus cases, cable termination boxes and in gate Lodges excluding cable termination rack at relay room. The work includes fixing of all new cables by teakwood clamp on teakwood base plank, fixing of Phynolic synthetic industrial fibre base fine weave cotton fibre board 6mm thick for terminal board to suit each apparatus case, varnishing all teakwood items, fixing of terminals/ fuse blocks on the terminal board, drilling of necessary holes, termination of cables, wiring, identification of cables using aluminium tags with letters punched neatly, as per approved circuit diagram and cable plan, painting of particulars on sleeves and also on the inner side of the doors of apparatus cases. After terminations are</p>		



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		over, the side openings of apparatus case foundation shall be closed with brick work, cement plastered, the inter-space filled with M sand up to base level and the bottom surface shall be sealed with sealing compound. (Supply of PBT terminals and Fuse blocks is not covered in this schedule).		
	a	Termination on 25/60mm PBT terminals (new location)(Phynolic sheet)	Per Terminal block	172.14
	b	Termination on PBT fuse block (new location) (Phynolic sheet)	Per Fuse Block	209.93
437.	11_36	Termination of main, tail, Signaling and power cables and internal wiring by fixing additional terminals/ fuse blocks on the existing terminal boards of apparatus cases, cable termination boxes etc. The work includes fixing of all new cables by teakwood clamp on teakwood base plank, varnishing all teakwood items, fixing of terminals/ fuse blocks, on the existing terminal boards, drilling of necessary holes, termination of cables, wiring, identification of cables using aluminium tags with letters punched neatly, as per approved circuit diagram and cable plan, painting of particulars on sleeves and also on the inner side of the doors of apparatus cases. After terminations are over, the side openings of apparatus case foundation shall be closed with brick work, cement plastered, the inter-space filled with M sand up to base level and the bottom surface shall be sealed with sealing compound.		
	a	Termination of cables on 25/60mm PBT terminals (existing location)	Per Terminal Block	151.09
	b	Termination of cables on PBT fuse block (existing location)	Per Fuse Block	188.86
438.	11_37	Painting of existing apparatus case (Inside and Outside) - Full size	Nos.	2,365.69
439.	11_38	Painting of existing apparatus case (Outside) - Full size	Nos.	1,182.15
440.	11_39	Painting of existing apparatus case (Inside and Outside) - Half size	Nos.	2,263.01



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441.	11_40	Painting of existing apparatus case (Outside) - Half size	Nos.	1,132.20
442.	11_41	Supply, fabrication and provision of suitable battery stand in the battery room using M.S.Angles 65mmx65mmx8mm and MS flats 50mmx6mm covered with 100mmx50mm hardwood reapers, and installation of secondary cells. The work involves charging of secondary cells, fixing and connecting the batteries with strips, manufacture and fixing of teakwood terminal box, termination of cables, wiring with suitable wire PVC 7/1.40mm and 3/0.75mm copper through suitable PVC pipes/ casing properly clamped, provision of battery particulars board made of phynolic sheet 6mm thick of size 900mm x 1200mm with Aluminium grooved channel frame in the relay room. The particulars shall be digitally using good quality laminated gum sheet, provision of hydrometer -1 No. on a stand and battery tester-1 No. Charging of secondary cells shall be done by the contractor through reputed agencies.  (Supply of secondary cells is not covered in this schedule).		
	a	a) Provision of battery stand and installation of 2V-300AH cell	Per cell	1,562.33
	b	Provision of battery stand and installation of 2V-200AH cell	Per cell	1,354.20
	c	Provision of battery stand and installation of 2V-120AH cell	Per cell	1,130.81
	d	Provision of battery stand and installation of 2V-80AH cell	Per cell	969.03
443.	11_42	Charging and installation of secondary cells of the following capacities, on existing battery stand/ RCC slabs in the battery room. The work involves charging of secondary cells, fixing and connecting the batteries with strips, manufacture and fixing of teakwood terminal box, termination of cables, wiring with suitable wire PVC 7/1.40mm and 3/0.75mm copper through suitable PVC pipes/ casing properly clamped, provision of battery particulars board made of phynolic sheet 6mm thick of size 900mm x 1200mm with Aluminium grooved channel frame in the relay room. The particulars shall be digitally using good quality		

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		laminated gum sheet, provision of hydrometer -1 No. on a stand and battery tester-1 No. Charging of secondary cells shall be done by the contractor through reputed agencies.  (Supply of secondary cells is not covered in this schedule).  [Teakwood plank 25mm thick for manufacturing termination box with locking facility, wire PVC 7/1.4mm and 3/0.75mm copper, anti-corrosive paint, varnish, PVC pipes/ casing, and all other miscellaneous materials required for this work shall be supplied by the contractor].		
	a	Installation of 2V-300AH cell on existing stand / slabs	Per cell	1,077.53
	b	Installation of 2V-200AH cell on existing stand/ slabs	Per cell	869.41
	c	Installation of 2V-120AH cell on existing stand/ slabs	Per cell	793.17
	d	Installation of 2V-40/80AH cell on existing stand/ slabs	Per cell	615.08
444.	11_43	Installation of charged secondary cells of the following capacities in apparatus cases, connecting them with strips, wiring with wire PVC 3/0.75mm copper and termination. This work also includes charging of cells through reputed agencies. The details of the batteries shall be written on the inside of the doors of the apparatus cases.  (Supply of secondary cells is not included in this schedule).[Wire PVC 3/0.75mm copper, connecting strips, paint and all other miscellaneous materials required for the work shall be supplied by the Contractor].		
	a	Installation of 2V-120AH cells in apparatus cases	Per cell	576.37
	b	Installation of 2V-40/80AH cells in apparatus cases	Per cell	491.59
445.	11_44	Installation of DTMF equipment	Set	5,339.10
446.	11_45	Erection and concreting of SM's control panel on teakwood base frame 50mm x 150mm of suitable length and breadth, varnishing, termination of cables and wiring of knobs, buttons, indications, counters, etc., as per the approved circuit diagram with wire PVC 16/0.2mm copper. The work includes fixing of one digital voltmeter, required No.		

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		<p>of buzzers and wiring. The termination particulars shall be painted on the back doors of the panel.</p> <p>(Supply of SM's control panel is not included in the schedule).</p> <p>[Foundation bolts and nuts with washers, concreting materials, wire PVC 16/0.2mm copper, 50mmx150mm teakwood base frame, soldering materials, buzzers to work on 24VDC, one digital voltmeter 0-300V AC and all other miscellaneous materials required for the work shall be supplied by the Contractor].</p>		
	a	Concreting, erection and wiring of SM's Control Panel (upto 5 roads)	Nos.	44,347.28
	b	Concreting, erection and wiring of SM's Control Panel (more than 5 roads)	Nos.	64,099.73
447.	11_46	<p>Carrying out alterations to the existing SM's control panel. The work includes drilling of holes on the Top plate wherever required, fixing and wiring of knobs, buttons, counters, LEDs with holder, closing of unwanted holes, carrying out painting alterations on the panel, termination of additional cables and carrying out alteration to the existing wiring as per approved circuit diagram, releasing of unused wires, and painting of particulars as per the instructions of Railway representative at site.</p> <p>(Supply of knobs, buttons and counters is not included in the scope of this schedule). [LED lamps with holder, paint, soldering materials and all other miscellaneous materials required for the work shall be supplied by the Contractor].</p>	LS	15,967.35
448.	11_47	<p>Installation of double line SGE type block instruments on the block counter. The work involves termination of cables on the test panel and block counter, block wiring, interconnection between test panels and block instrument by underground signaling cable and painting the instrument as per the instructions of Railway representative at site.</p> <p>(Supply of block instruments, block counters and underground cables is not covered in this schedule).</p> <p>[Phynolic sheet for fixing terminals, wire</p>	Nos.	11,238.75

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		PVC 16/0.2mm copper, 3/0.75mm, paint, and all other miscellaneous materials required for the work shall be supplied by the contractor].		
449.	11_48	<p>Installation of single line push button token less block instruments on teakwood base frame. The work involves termination of cables on the test panel, block wiring including duplicating switch for "Train Arrival" and interconnection between test panel and block instrument by underground signaling cable and painting the instrument in consultation with Railway representative at site.</p> <p>(Supply of block instrument and underground cables is not included in this schedule).</p> <p>[Wire PVC 16/0.2mm copper, 3/0.75mm, Teak Wood base frame of size 50mmx 150mm, foundation bolts, paint, concreting materials and all other miscellaneous materials required for the work shall be supplied by the contractor].</p>	Nos.	15,773.10
450.	11_49	<p>Installation of single line FM type tokenless block instruments on the block counter. The work involves termination of cables on the test panel and block counter, block wiring, interconnection between test panels and block instrument by underground signaling cable and painting the instrument as per the instructions of Railway representative at site.(Supply of block instruments, block counters and underground cables is not covered in this schedule).fixing terminals, wire PVC 16/0.2mm copper, 3/0.75mm, paint, and all other miscellaneous materials required for the work shall be supplied by the contractor].</p>	Nos.	16,783.20

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451.	11_50	<p>Provision of signaling arrangement during Non-Interlocked working of Signals and Points, such as erection and wiring of temporary relay racks and wiring of relays, SM's slide instruments, wiring alterations in the cable termination rack, apparatus cases, signals, Control panel etc, as per the instructions of Railway representative at site.</p> <p>(Supply of relay rack, relays, and SM slide instrument is not included in this schedule).</p> <p>[All other miscellaneous materials required for the work shall be supplied by the Contractor].</p>	Per station	33,631.06
452.	11_51	<p>Provision of PA system and Magneto telephone communication at stations/ tents as per the instructions of Railway representative at site. The PA system and magneto telephones will be returned to the contractor after the completion of NI working. Signalling cables available may be used for the communication.</p> <p>(Hiring of PA system equipments and magneto telephones shall be done by the Contractor)</p> <p>[All other miscellaneous materials required for the work shall be supplied by the Contractor].</p>	Per tent per day	1,637.25
453.	11_52	<p>Hiring of tarpaulin tents and providing the same at places as instructed by Railway representative at site. The spacing inside the tent shall be app 8ft x 8 ft. Each tent shall be provided with a table, chair, tube lights and pedestal fan. Drinking water in cans. The tents shall be fixed firmly to withstand rain, strong wind etc.</p>	Per tent per day	1,328.30
454.	11_53	<p>Fixing of Annunciator at SM's Room as required by Railways, wiring it as per circuit diagram and painting of particulars. The work includes connecting 1 No. of magneto telephone with Ni-cad power pack 4V-2.2AH with charger to work on 110VAC and connecting the annunciator to the different telephone circuits. The particulars of the circuits and the ringing codes shall be painted on the top of the annunciator box.</p> <p>(Supply of annunciator is not included in this schedule).</p>	Nos.	4,094.05

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		[Magneto telephone handle type with Nicad power pack 4V-2.2AH with charger to work on 110VAC, wire PVC 16/0.2mm copper, paint and all other miscellaneous materials required for the work shall be supplied by the Contractor].		
455.	11_54	<p>Installation and wiring of existing Way station equipment DTMF and control telephones. The work involves fixing the released way station equipment on the wall at an appropriate place in consultation with Railway representative at site, wiring and interconnecting the same with test panel, control telephones and batteries.</p> <p>(Supply of way station equipment, control telephones and batteries is not included in this schedule).</p> <p>[Wire PVC 3/0.75mm &amp; 16/0.2mm copper, MS clamps for fixing arrangements, PVC tubes 25mm dia for interconnections and all other miscellaneous items required for the work shall be supplied by the Contractor].</p>	Nos	8,016.98
456.	11_55	Installation of magneto telephones with Nicad pack	Nos.	3,322.60
457.	11_56	<p>Installation of 2 Slide SM's control Instrument at LC gate on a hard wood plank (not less than 25mm thick) supported by MS angle 50 x 50 x 6 mm duly grouted on wall. This work includes provision of teak wood termination box with cover with locking facility, termination of cable inside the box and wiring of SM's control instrument. The termination details shall be painted on the door of the terminal box.(Supply of SM slide instrument is not covered in this schedule).</p> <p>[Teakwood termination box with cover, hardwood plank, MS angle 50 x 50 x 6mm, fixing materials, paint, GI lock, wire PVC 3/0.75mm and 16/0.2mm copper, and other required miscellaneous materials shall be supplied by the Contractor].</p>	Nos.	9,052.05
458.	11_57	Installation of LC control panel cum illuminated diagram board at Level Crossing gate lodge and wiring the same including interconnections and painting. (Supply of LC control panel cum illuminated diagram board is not included in this schedule). [Wire PVC 16/0.2mm copper, soldering materials,	Nos.	6,359.19

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		LEDs, resistances and all other required miscellaneous materials shall be supplied by the Contractor.].		
459.	11_58	<p>Excavation of pit, concreting 'A' type foundation and fixing ground lever frames single/double as per Drg.No.SG/CN/02/11 complete with ground connection. The work includes concreting of 'A' type foundations and fixing of HP lock and connecting the ground lever frame with the HP lock using MS rod as instructed by Railway representative at site. (Refer Chapter-20, 17.1)</p> <p>(Supply of ground lever frames, hand plunger locks and 'A' type foundations is not covered in this schedule).</p> <p>[Cement, M sand, stone jelly of size 20/25mm, fixing bolts and nuts with washers and all other miscellaneous materials shall be supplied by the Contractor].</p>	Nos.	8,351.55
460.	11_59	<p>Interlocking of level crossing gate with Swing Gates: This work consists of fixing of gate locks on the gates as per instructions of Railway representative at site. The arrangement shall be painted as per standard Railway practice. (Supply of gate locks is not covered in this schedule).</p> <p>[paint, all types of bolts and nuts and all other miscellaneous materials shall be supplied by the Contractor]</p>	Nos.	5,849.70
461.	11_60	<p>Interlocking of level crossing gate with Lifting Barrier: This work consists cutting of notches on the drum of the winch, , fixing and leveling of trestles, rod roller assembly, leveling and concreting of 'A' type foundations, fixing of rod diversion cranks, vertical cranks, running of rods (app. 30mtrs.) and connecting them to lever tail at one end and boom locking arrangement at the other end, and painting as per standard practice. The work also includes fixing of wiring of one limit switch for each boom as per the instructions of Railway representative at site. (Supply of HP locks, rods, 'A' type foundations, trestles, segments, rod roller assembly complete and cranks is not covered in this schedule).</p>	Nos.	22,772.95



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		[Cement, M sand, stone jelly of size 20/25mm dia, coal bengal, paints, all types of bolts & nuts and all other miscellaneous materials shall be supplied by the Contractor].		
462.	11_61	Casting concrete foundation of size 900mmX900mm for pedestal, 400mmX400mmX 600mm for meeting post, fixing of lifting barrier boom, contact makers, termination of cables, wiring and painting as per the instructions of Railway representative at site. (Supply of pedestals, meeting posts, contact maker, electric lifting barriers, rail posts, cranks and 'A' type foundation is not covered in this schedule). [Concreting materials, bolts and nuts, wire PVC 3/0.75mm copper and all other miscellaneous materials required for the work shall be supplied by the Contractor].	per boom	20,297.74
463.	11_62	Provision of boom locking arrangement for both the lifting barrier which involves running of about 30m to 50m of rodding with a spacing of 2m interval between trestles with rod roller segments, fixing of about 8 Nos. of cranks on 'A' type foundation/ MS plates and concreting of 'A' bases to a size of 1mX0.6mX0.5m as instructed by Railway representative at site. Solid joints/ insulated joints shall be provided wherever required. The work also includes running of rods by track crossings/ road crossings wherever required.  (Supply of MS rods, cranks, trestles', segments, rollers etc., is not covered in this schedule).  [All other materials required for the work shall be supplied by the Contractor].	per LC	12,056.36
464.	11_63	Fixing and wiring of Two Nos. of Electronic Gate Warning equipment for each level crossing gate, one on each road warning signal, amplifier in the apparatus case with wire PVC 3/0.75mm and 16/0.2mm copper, and painting.  (Electronic Gate Warning Equipment and amplifier will be supplied by Railways).  [All wiring, fixing and painting materials shall be supplied by Contractor].	Set	4,491.34



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465.	11_64	Panel of 16 SWG, powder coated MS sheet of size 450mm x 300mm x 100mm approximately consisting of different colour LEDs with holders suitable to work on 24VDC supply. Indications on the front panel shall be as per typical diagram supplied by Railways. All descriptions on the front panel have to be neatly painted. The Panel shall then be wired using wire PVC 16/0.2mm copper as per the approved circuit diagram and installed in the gate lodge as instructed by Railway representative at site. [All materials required for the work shall be supplied by the Contractor].	Nos.	14,510.48
466.	11_65	Installation of hand plunger lock with [single/double] on gauge tie plate for locally operated point/ on suitable fixing arrangements for LC gate winch interlocking, connecting the same and adjusting them. The work includes cutting suitable notches on split stretcher bars, provision of suitable MS cover of 3mm thick for the hand plunger lock, provision of point/trap indicator and painting. Supply of hand plunger locks and point/ trap indicator is not covered in this schedule). [Un-cut split stretcher bars for HP Lock Single/Double, MS cover 3mm thick, coal bengal, fixing bolts and nuts with washers, paint and all other miscellaneous materials required for the work shall be supplied by the contractor]. a) Installation of hand plunger lock (Single/double)	Nos.	12,034.25
467.	11_66	Fixing of point/ trap indicator	Nos.	2,160.34
468.	11_67	Fixing of electrical detectors on extended gauge tie plate, providing insulations, connecting ground connections, wiring with wire PVC 3/0.75mm copper, connecting the detector and TLD box through a hose pipe, drawl of jumper wires from the detector to TLD box and painting. (Supply of Electrical detectors complete, switch extension pieces, ground connections, extended gauge tie plate, TLD boxes with stumps is not covered in this schedule). [Wire PVC 3/0.75mm copper, PVC hose pipe, all fixing bolts and nuts, all types of insulations, paint and all other miscellaneous materials required for this work shall be supplied by the contractor].	Nos.	6,181.31

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469.	11_68	Fixing of EKT instrument with (or) without crank handle or on suitable fixtures at station/apparatus case, provision of economiser push switch with locking facility, wiring with wire PVC 16/0.2mm copper, provision of teakwood terminal box covered with decolum along with locking facility and painting. (Supply of electric key transmitter and crank handles is not covered in this schedule). [wire PVC 16/0.2mm copper, wire wound resistance, decolum covered terminal box with locking facility by using 25mm thick teakwood, bolts and nuts, paints, push switches, padlocks and other miscellaneous materials required for this work shall be supplied by the contractor].	Nos.	5,445.94
470.	11_69	Casting concrete foundation and erection and painting of boards with 'LEGEND' such as "Draw close if signal is at on" at the required places as per the Signalling plan. The work involves concreting of rail post to a size of 600mm x 600mm x 900mm and fixing the board to the rail using MS clamps, bolts and nuts. (Supply of boards is not covered in this schedule. Rails of different lengths will be supplied by Railways and the Contractor has to cut them to the required lengths) [Stone jelly of size 20/25mm dia, M sand, cement, M.S.flats, fixing bolts and nuts, paint and all other miscellaneous materials required for the work shall be supplied by the Contractor].	Nos.	3,972.14
471.	11_70	Painting, erection and concreting of Goods warning boards on rails as per the Signalling plan. The work includes manufacturing of clamps and fixing the board to the rails, supply and fixing of scotch lite reflectors and concreting the rail post to a size of 600mm x 600mm x 900mm. (Supply of goods warning boards are not covered in this schedule. Rails of different lengths will be supplied by Railways and the Contractor has to cut them to the required lengths). [Stone jelly of size 20/25mm dia, M sand, cement, M.S.flats, scotch lite strips (14 Nos) for each board, fixing bolts and nuts, paint and all other miscellaneous materials shall be supplied by the Contractor].	Nos.	5,398.39

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472.	11_71	Provision of E type lock with key for fixing the same in LC/HP/FP Locks/SM slides	Nos.	697.45
473.	11_72	Provision of HDPE Pipe of dia 40/33 mm	Mtr	26.11
474.	11_73	Laying of DWC/Split DWC Pipes for Track Crossing/Road Cutting/Trenches	Mtr	42.46
475.	11_74	Releasing of existing relay racks/ cable termination racks along with all the terminals, fuse blocks, relays, with jacks, holding clips etc., 50 way boards, terminals, connecting wires, cables etc., carefully without causing any damage, accounting and stacking them neatly at a place as instructed by Railway representative at site. After releasing, the floor shall be levelled and cement plastered	Per rack	1,977.19
476.	11_75	Releasing of existing Route Indicators of different types including tail cables, carefully without causing any damage, accounting and stacking them neatly at a place as instructed by Railway representative at site.	Nos.	1,541.51
477.	11_76	Breaking of concrete and releasing of STOP board/Warning board/ LEGEND boards along with rails, accounting and stacking them neatly at a place as instructed by Railway representative at site. Also the resultant pits shall be re-surfaced and consolidating by ramming and levelling	Nos.	1,580.36
478.	11_77	Releasing of existing point lay-out with facing point lock, split stretchers, electrical detector, lock bars, point/trap indicators cranks, rods etc., carefully without damaging the materials, accounting and stacking them neatly at a place as instructed by Railway representative at site.	Set	2,852.70
479.	11_78	Removal of obstructing sleepers, and rails available in the path of cable trench (Above the ground)	Nos	235.47
480.	11_79	Removal of obstructing sleepers, and rails available in the path of cable trench (buried inside ground)	Nos	3,205.70
481.	11_80	Jungle cutting along with the cable route	Mtr	5.84

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482.	11_81	Releasing of hand plunger lock single/double along with switch extension pieces, stretcher bars, point/ trap indicators and other fixtures carefully without damaging the materials, accounting and stacking them neatly at a place as instructed by Railway representative at site.	Set	2,389.28
483.	11_82	Releasing of S.M's Control instrument upto 24 Slides, Illuminated Diagram, block counter and other connected gadgets without any damage to the materials, accounting and stacking them neatly at a place as instructed by Railway representative at site.	Set	4,709.18
484.	11_83	Releasing of existing apparatus cases (Full/ Half/ Quarter size) without damage after releasing the shelf planks, Terminal blocks, Fuse Blocks, Terminal Boards, Relays of all types EKTs, Secondary Cells, power equipments, 'E' type locks, etc., and breaking the concrete foundation. After releasing, the resultant pits are to be closed and consolidated by ramming and levelling. The released materials shall be accounted and stacked at a place as instructed by Railway representative at site.	Nos.	3,006.71
485.	11_84	Breaking of concrete and releasing the existing cable termination boxes, after releasing the base plank, Terminal blocks, Fuse Blocks, Terminal Boards, cut rails, pipes, etc., closing the resultant pits and consolidating it by ramming and levelling. The released materials shall be accounted and stacked neatly at a place as instructed by Railway representative at site.	Nos.	2,004.94
486.	11_85	Releasing of existing SM's control panel including base plank, and other gadgets connected very carefully without causing any damage to the panel, accounting and stacking them neatly at a place as instructed by Railway representative at site. The resultant pit in the flooring shall be removed of all cable bits, levelled and cement plastered	set	5,257.24
487.	11_86	Dismantling and releasing of existing Colour light Signals complete (upto 4 aspects) with or without Route Indicators, calling on signals, shunt signals etc., carefully without any damage to the gadgets, accounting and stacking them neatly at a place as instructed by Railway representative at site. The work includes breaking the concrete foundation,	Nos.	3,083.03

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		closing the resultant pit and resurfacing it by ramming and levelling.		
488.	11_87	Dismantling and releasing of existing Point machines (all types) including ground connections and other accessories available complete without any damage to the gadgets, accounting and stacking them neatly at a place as instructed by Railway representative at site.	Nos.	2,698.69
489.	11_88	Dismantling and releasing of ground lever frame along with all connected gadgets like lever locks, 'E' type locks, HP locks, etc., accounting and stacking them neatly at a place as instructed by Railway representative at site. The work also involves breaking and removal of concrete foundation and the resultant pit shall be filled and consolidated by ramming and levelling.	Set.	5,550.00
490.	11_89	Releasing of Secondary cells and battery stands available in the battery room along with connecting strips, wires and terminal boxes carefully without causing any damage to the batteries, accounting and stacking them neatly at a place as instructed by Railway representative at site. After releasing any holes in the walls/ flooring shall be filled with cement mortar and plastered.	Set	5,395.99
491.	11_90	Releasing of existing Block Instruments (all types), Block counters, batteries, block filter, block bell equipment etc., carefully without any damage, accounting and stacking them neatly at a place as instructed by Railway representative at site	Nos.	1,773.23
492.	11_91	Releasing of point rods with rod roller trestles, complete assembly. This includes releasing of all cranks, compensators and 'A' type concrete foundation on the rod run. The resultant pits are to be covered with earth and consolidated by ramming and levelling.		
	a	Releasing of trestles 1/2 way	Nos.	86.30
	b	Releasing of trestles 3/4 way	Nos	117.11
	c	Releasing of point roddings	per Rod/ Mtr.	14.71
	d	Releasing of A type foundations	Nos.	632.15
493.	11_92	Releasing of all the S & T gadgets at LC gates like SM slide instruments, illuminated	Set	9,557.10

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		diagram board, block counter, termination box, telephones, emergency key box, etc and concerned wiring, accounting and stacking them neatly at a place as instructed by Railway representative at site. After releasing any holes on the walls/ floor are to be filled with cement mortar and plastered.		
494.	11_93	Releasing of existing ground type shunt signals along with surface base, signal post etc carefully without any damage, accounting and stacking them neatly at a place as instructed by Railway representative at site. The work also includes breaking and removal of concrete foundation and refilling of the resultant pit by ramming and levelling.	Nos.	2,196.41
495.	11_94	Releasing of existing TLD boxes with stumps and terminals after releasing all the bond wires. The released materials shall be accounted and stacked neatly at a place as instructed by Railway representative at site.	Nos.	159.29
496.	11_95	Releasing of all power equipments including equipment stands, terminal boards, power panel etc., in the power room carefully without causing any damage to the equipments after disconnecting all the supply wires. The released equipments shall be accounted and stacked at a place as instructed by Railway representative at site. After releasing any holes in the walls/ flooring shall be filled with cement mortar and plastered.	Set	12,640.13
497.	11_96	Releasing of existing control equipments - complete including way station equipments, telephones, power supply for way station equipment and telephones, along with all wiring, accounting and stacking them neatly at a place as instructed by Railway representative at site.	Set.	6,012.04
498.	11_97	Survey of Cable Route and Preparation of Cable Route Plan	Km	716.01
499.	11_98	Provision of one skilled and 2 unskilled staff round the clock to attend the teething trouble of the installation along with SSE/JE after the installation has been brought into commissioning. The work includes routine maintenance, failure restoration as per the direction of the SSE/JE	Month	73,903.01
500.	11_99	Videography of cable Route	Kms	519.85
501.	11_100	Providing the services of Computer oriented technical manpower to carryout works like	Man Days	913.28

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		Drawing, computation, writeup etc., using computer, using software like AUTOCAD, MS Office etc., for 08.00 hrs in a day with all expenses of transportation, accommodation, food, consumables etc., with all ascents, descents, taxes, octroi, cess, fees, duties, duties with contractors cost etc., as per special conditions/ specifications/ regulations and as directed by Engineer-in-charge. Note: The person engaged for providing the services shall be convergent with computer working knowledge in above software.		
502.	11_101	Protection adjustments and re-instating of S&T gears by deputation of Helpers/Unskilled labour for executing additional S&T portion of the works. The work can involve fixing, releasing, dismantling, replacement, excavation, clearing of vegetation, loading and unloading of material and assisting skilled persons etc as per instruction of Railway representative.	Man Days	847.59
503.	11_102	Protection, adjustment and reinstating of S&T gears by deputation of Fitter/Wireman/Painter/Welder/ Mason/Cable Jointer (Skilled Labour or Technician ) etc., for executing additional S&T portion of works. The work can involve fixing, releasing, dismantling, replacement, painting or alteration of various signalling assets or parts, termination of cables, minor patch work on damages at location box, Plastering, Concreting brick work, wiring alterations, cable jointing etc as per instruction of Railway representatives at site.	Man Days	1,073.45
504.	11_103	Transportation of Signalling materials by road as per the instructions of Railway representative at site. The work also includes loading and unloading of the materials		
	a	Transportation of Signalling materials upto 100kms	per ton. Km.	22.75
	b	Transportation of Signalling materials more than 100km	per ton. Km.	13.91
505.	11_104	Engaging mechanical excavators like JCB or other machineries for regarding and levelling the formation, dismantling any infringing structures, clearing and removing debris etc., with all leads and lifts etc., complete and as per the instruction of Railway	per hour	1,202.50

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		representative at site.		



### Specification/Technical Specification

	<b>GENERAL:</b>
	The detailed Specifications for the work which are to be carried out by the contractor are as stipulated here under. Not with standing whatever contained in the specifications, the field supervisor/Executive engineer for the work shall decide as per site conditions and shall be binding on the contractor. In case of any dispute regarding soil condition/type of trenching and other conditions the decision of the Engineer for the work shall be final and binding.
	The work shall be carried out according to the drawings approved by the Railways and shall confirm to the provision of Codes, Signal Engineering Manuals, RE Manual, Block Manual and Schedule of Dimensions are deemed to be a part of the Contract Agreement. The contractor shall be solely responsible for the proper execution of the work as per specification.

#### 1.0 Electronic Interlocking

<b>1.0</b>	<b>ELECTRONIC INTERLOCKING:</b>
<b>a.</b>	The whole interlocking of a yard shall be controlled either by <b>central operation or distributed operation.</b>
<b>b.</b>	The system shall have facility of <b>monitoring of internal variables as well as status of I/O. Through the maintenance terminal and data logger network of the Railway.</b>
<b>c.</b>	<b>External data logger shall be connected in such a way both for logging of analog/digital inputs of external functions and for EI modules inherent diagnostics.</b> It shall be possible to connect EI with central monitoring unit kept at HQ control unit.
<b>d.</b>	MT shall be used to diagnose problems/events related to hardware and software of EI. MT shall have facility for automatic serial data transfer to a central monitoring unit. The common protocol for this communication shall be as per data logger specification no. IRS: S-99 latest version for interface only.
<b>e.</b>	The system shall be capable for working in non air-conditioned environment and ambient temperature range between -10° c to 70 ° c and relative humidity upto 95% at 40° c.
<b>f.</b>	EI shall have user-friendly graphic based design tool to generate station specific application software to carry out future yard modifications. It shall be possible for Railway to carryout minor yard modifications without the help of firm and the training shall be imparted to Railway maintenance staff for the same as per agreement with the Railway.
<b>g.</b>	<b>For all vital inputs/ outputs, going out of EI room's double cutting arrangement shall be provided.</b>
<b>h.</b>	The RTC of EI system(s) should be updated/ synchronized with the external data logger and it shall be possible to log the events in chronological order in case of use of either single/multiple EI with data logger through CMU (central monitoring unit) if provided in network otherwise through protocol converter.
<b>i.</b>	In case any peripheral equipment (such as VDU, MT, Data Logger etc.) Needs to be connected to the EI through serial ports and then EI system shall be isolated from the peripheral systems, suitable isolators shall be used for connecting the peripheral devices.

j.	<b>Requirements of earthing and lightening protection as laid down in relevant clause of latest version of RDSO/SPN/197/2008 shall be complied.</b>
k.	<b>The terminals through which common positive or negative supply is provided to EI, must be duplicated, this shall also require duplicated power supply cables from power supply source to EI.</b>
l.	The system shall have log of all the counters like emergency route cancellation, calling on signal, emergency point operation, overlap release operation etc. And that will be logged in maintenance terminal. It shall be possible to read all counters as and when required. If Railway required, it shall also be possible to provide a counter box having non-resettable counters.
m.	The next level signal control circuits like cascading of signal aspects, red lamp protection etc., shall be achievable through software only.
n.	<b>The audio-visual alarm shall be available for approach locking, button stuck up etc. Command held high for more than a specified duration in EI as specified by the user Railway.</b>
o.	<b>The VDU system as well as central interlocking unit shall have back up information on log of all counters provided on VDU like emergency route cancellation, calling on signal, emergency point operation, overlap release operations etc.</b>
p.	Cycle time and response time to read and process the input shall be fast enough to ensure safety and avoid any apparent delay. Cycle time and response time of the system shall be clearly indicated. The longest route for which all points are in favor shall not take more than 5 seconds from initiation of Command to display of lowered signal aspect on control panel.
q.	The medium of communication between CIU and OCs shall be OFC provided on a ring basis. In case of communication failure between CIU & OC, all the outputs shall be brought to safe state whenever two consecutive telegrams are not received in stipulated time period.
r.	All the inputs and outputs of OCs shall be isolated.
s.	OC shall carry out the supervisory function to check the proper level of system voltages at critical points to ensure proper working of the system and shall also check the health of the complete system. OCs when placed at multiple locations shall be connected through diversified/duplicated OFC ring and the protocol shall comply to EN-50159-1 for closed loop transmission, additionally vital radio link as per the Indian telecom standards to connect between object controllers and CIU can also be used which should comply with EN-50159-2 for open loop transmissions. LED/LCD display shall be provided on all the modules of EI's to indicate status/ errors of the module.
t.	The EI system including its equipment and subsystems shall be <b>under warranty for <u>one year</u> from the date of commissioning system of working in the specified section.</b>
u.	<p>i. Additional software work due to change in scope of signal Interlocking plan shall be carried out by the contractor without any extra cost up to 10% increase in routes and 15% increase Input/output functions. The tenderer shall submit the clause by clause compliance to the RDSO specification RDSO/SPN/192/2019 with latest amendment including any deviation if any, to the specification along with tender document. <b>Tenderer shall submit clause by clause compliance to Technical advisory notes/improvements suggested by RDSO from time to time.</b></p> <p>ii. EI system shall comply with instructions issued by RDSO from time to time in terms of Technical Advisory Notes and improvements.</p> <p>iii. The EI equipment shall be installed, tested and commissioned by OEM only. The EI shall comply with all items specified in the pre commissioning check list for EI's issued by RDSO from time to time and items specified in technical system approval by RDSO. OEM shall</p>

certify the installation as specified by RDSO.

- iv. It shall be possible to connect EI's in a network fashion with central monitoring unit kept at divisional/zonal HQ control unit.
- v. Supply, installation, wiring, testing and commissioning of dual operator VDU with 55" LED monitor. This shall be fanless embedded industrial grade personal computer as per approval spec and their connectivity to EI shall be either on Ethernet or through an optical fiber cable. Optical fiber cable is preferred medium. It shall display yard and Automatic signals on either side in one screen. Yard to be displayed in bigger size at the top and Automatic signals in smaller size at the bottom of the monitor. Display of yard and Automatic signals shall be shown as per instructions of the site in-charge.
- vi. **Supply**, installation, wiring, testing and commissioning of VDU of 55" LED to display Entire yard section in one screen. This shall be industrial grade as per approved spec and their connectivity to EI and Maintainer Terminal shall be either on Ethernet or through an optical fiber cable. Optical fiber cable is preferred medium.
- vii. **Supply**, installation, wiring, testing and commissioning of Maintainer VDU with 32" monitor. This shall be industrial Grade fanless embedded personal computers as per approval spec.
- viii. VDU shall be provided with hard SM key along soft controlled touch to prevent unauthorized operation in addition to password protection.
- ix. Non resettable counters with necessary wiring and fixing arrangements as per instructions of engineer shall be provided in the Dy.SS room.
- x. Blocking of functions (points, signals, track circuits etc.) Shall be possible through VDU.
- xi. Input/output functions of Object controller shall be selected in such a way that failure of one object controller shall not paralyze the entire yard.
- xii. 230 V AC power supply provided by Railways. Supply will be made available in the equipment room. From 230 v ac conversion of 230v ac to 110 V DC shall be provided by the contractor. Further extension to EI, DC-DC converters of EI shall be carried out by the contractor. **Power supply conversion required for EI shall be provided by the tenderer.** The maximum current requirement and the load calculations shall be furnished along with the tender document by the tenderer. The DC- DC converters used for EI shall be provided in N+1 configuration with a safety factor of 1.5. Segregation between the DC-DC converters for system A & B shall be made so that if any DC-DC converter fails whole system should not get affected. **The DC-DC converters shall be of approved make as recommended in RDSO Specification/Technical Advisory notes.** The power cable and the terminals bringing from IPS/battery charger shall be duplicated with minimum 16 sq. Mm. Copper cable so as to provide redundancy. Availability of pure DC supply (harmonics and ripples free) for working of different modules/cards shall be the responsibility of the contractor.
- xiii. Input and output interface relays (QECR, QNI, QNAI, QN1K, QTA2 & QBCA1 **working on 24 V except track relays**) are known to the Railways. Any other relays required for changeover of the systems etc., shall be supplied and installed by the Contractor only.
- xiv. The System shall be supplied with properly interfaced Data logger with protocol converter and adequate capacity of digital and analog inputs, which meets the latest specification of Data logger specification No.IRS.S.99/2006 or latest. The Data logger PC shall be provided separately and it shall not be combined with maintenance VDU as per approved Spec.
- xv. Maintenance free ring earthing arrangements along with the protection against Electromagnetic and Electrostatic interference for the equipment and to the S&T Rooms respectively shall be provided by the tenderer. The requirements laid down in clause 6.3 of RDSO/SPN/192/2019 with latest amendment shall be complied. The earthing shall be as per Railway board letter no.2010/SIG/SGF/EI (Ansaldo) dated 22.6.2011. As per RDSO letter no.STS/L/SSI dated 28.3.2012 (Para-24), all the EI vendors were advised to use the same drawing. **If the earth resistance prescribed by the RDSO is not achieved, additional earth**

	<p><b>pits shall be provided. No additional payment will be made by Railways.</b></p> <p>xvi. All the accessories like communication equipment, relay racks, wiring materials, wire coils Aluminum Ladder, fuses, indoor signaling cables, Tag blocks etc., required for EI shall be provided by the Contractor. Outdoor signaling cables required will be provided by the Railways.</p>
<b>1.1</b>	<p><b>OPERATOR AND MAINTENANCE VDU DISPLAY requirements:</b></p> <ul style="list-style-type: none"> <li>• The software of VDU shall be certified by independent safety assessor.</li> <li>• Shall have Ethernet/OFC communication with the CIU either on OFC, with suitable isolators.</li> <li>• Shall have required level of security features &amp; access control for the operator/maintainer</li> <li>• Shall have key board/mouse operation.</li> <li>• It shall synchronize the counters/clocks all the time and particularly when resuming from a failure.</li> <li>• Shall support buzzers/alarms as in CCIP.</li> <li>• It is desired that it shall be possible to analyses the operation and run the play back of the yard for the events of last 30 days.</li> <li>• Embedded industrial grade fanless PC with latest PC configuration shall be provided and suitable compact flash disc memory space shall be catered for the backup requirements.</li> <li>• Shall have required no. Of serial ports and Ethernet ports. The serial ports shall have inbuilt isolation or external isolation shall be provided.</li> <li>• A flashing indication shall be provided on the VDU to indicate healthy condition of the main system, communication channel. Three dot markers in red, blue &amp; green colors respectively shall also be displayed prominently at conspicuous location on the VDU terminal to indicate that the colour monitor is healthy and all the three colours (red, blue &amp; green) are present in right proportion.</li> <li>• It shall be possible to display the status of the yard by distinguishing with two differ colours (i.e., system active and system inactive).</li> <li>• It shall be possible to display the complete yard layout including the section on the monitor. It shall also have facility for displaying a portion of the yard or section in an enlarged mode or with scrolling arrangement, if required.</li> <li>• The current position/ status of various field equipment's and track circuits shall be displayed on the VDU using different colors/ symbols, as desired by the purchaser.</li> <li>• Availability of communication channel shall be indicated by a constantly flashing indication. Whenever the communication channel goes faulty, a suitable error message shall be displayed on the terminal.</li> <li>• Blocking of functions (points, signals, track circuits etc.) Shall be possible through VDU. The blocking operations shall be achieved in fail-safe manner.</li> <li>• If VDU and CIU are in separate building, then they shall be interfaced using FOM (fiber optic modem) to protect against lightning and surges.</li> <li>• Operation of signal gear shall not be possible simultaneously through both VDUs. In case of VDU's used in hot standby, VDU switch over is required as per Railway requirements.</li> </ul>
<b>1.2</b>	<p><b>MAINTENANCE AND DIAGNOSTIC AIDS:</b></p> <p>MT consisting of an Industrial grade embedded fanless PC with printer from a reputed manufacturer shall be provided for following operations: -</p> <ul style="list-style-type: none"> <li>• Display of the current status of points, signals, controls etc. Of the yard.</li> </ul>

	<ul style="list-style-type: none"> <li>• Storage of minimum one month data or 10, 00,000 events.</li> <li>• Display of recorded events and</li> <li>• Data transfer to floppy, CD, flash memory or any other storage media.</li> <li>• Transfer of recorded events to external data logger.</li> <li>• Generation of exception reports shall be possible on MT for analysis purpose and past events simulation on yard layout etc.</li> <li>• The soft copy of signalling circuits/manuals provide at the station shall also be loaded on MT for ready reckoner of ESM in simple/local language.</li> <li>• MT shall be preferably connected to EI through OFC. If copper cable is used for connectivity the mt port shall be isolated from the port of EI. At both ends RS232 isolator/industrial grade opto- isolator shall be used.</li> <li>• Result of the failure of any card/module in the system should be clearly indicated. The supplier should also indicate process of replacing such defective cards / modules.</li> <li>• MT shall be user friendly and the displays on MT shall be self guiding type for identifications of faults as well as for maintenance of system.</li> <li>• In case of any module/ card becoming faulty, this fact should be displayed on MT with diagnostic facility to identify faulty module/ card.</li> </ul>
<b>1.3</b>	<p><b>POWER SUPPLY REQUIREMENTS:</b></p> <ul style="list-style-type: none"> <li>• Non-regulated 230 volts, 50 Hz. Single phase or three phase, one or multiple supply shall be provided by Railways for EI functioning to the vendor/manufactures and rest all subsequent power supply requirements for EI, MT, VDU, OC etc. Including backup of at least four hours (to prevent shutting down of system due to fluctuations in main supply) for EI system shall be arranged by the vendor. The system shall work satisfactorily with input voltage variation from 150 V to 275 V AC and frequency variation from 48 Hz to 52 Hz. This shall also include provision of power supply change over panel for selection of power supply from available multiple sources. The details of power supply shall be specified by the purchaser.</li> <li>• Two different voltages shall be used, one to drive EI equipment and the other for receiving the inputs from the field gears.</li> <li>• All the DC-DC converters used to provide the different supply to the EI Shall be provided for main and standby EI system separately.</li> <li>• DC-DC converters shall be capable for working in non-air conditional environment and ambient temperature range between -10o c to 70 o c and relative humidity up-to 95% at 40o c.</li> <li>• The short circuit &amp; over voltage protection of self restoring type shall be provided.</li> <li>• The required protection shall be provided to protect from any malfunctioning due to false/spurious feed.</li> <li>• Suitable surge protection and proper earthing arrangement shall be provided in the power supply system to protect against transient voltages, lightning &amp; spikes etc. As per iec normative.</li> <li>• Tenderer shall provide a document capturing the installation / maintenance methods / work instruction prior to installation.</li> <li>• A detailed power supply arrangement diagram/ circuit shall be provided.</li> <li>• Power supply arrangement for individual processor should be such that, in case of fault in power supply of one processor, all processors should not cease to function simultaneously. It should be possible to switch off and take out faulty processor for repairing/replacement without affecting working of the balance system.</li> </ul>

### 1.1 DC-DC Converters():

Tenderer has to supply DC-DC converters for EI cabin and for S&T Huts, in case, object controllers are provided. DC-DC converters are to be procured as per RDSO recommendation. DC-DC converter having different capacities/voltages may be provided as per the requirement of OEM.

- a) Total of 16 converters (12V/10A, 24V/10A or 50V/5A or combination of both) are to be provided in N+1 configuration for System –A and System-B individually to achieve reliability. These converters are to be placed close to the EI room or in EI rack as directed by engineer-in-charge

### 1.2 Work space for VDU's():

- (i) Ventilation of the workspace
  - Rear shutters of each console should have provision of Airflow opening for cooling and heat dissipation effect.
  - Rear panel/door-mounted ventilation fans (optional).
- (ii) Service light should be provided inside the cabinet enclosure for maintenance of equipment which should switch on with opening of back panel automatically with optional provision of manual on/off switch. The internal wiring of the panel and the signaling cables coming from Relay Room shall be terminated on WAGO terminals through SPD as per OEM practice and instructions of the Engineer-in-charge of the work. Wiring of VDUs, Network Switch, power Supply etc. dressing, bunching & latching must be neat and clean with such that rodents or outside interference are avoided.

### 1.3 Automatic FAT and Square Sheet Testing

Testing the Interlocking Logic designed by OEM as per the Table of Control (TOC) through software based systems and creating evidence of the Tests conducted and their results. Document proof of all test results to be submitted in a hardcopy for verification and scrutiny by Railways

The following tests to be carried out:

- i. Negative Test as per TOC
- ii. Route Release Test for light engine and long train
- iii. Route hold Test
- iv. Route Locking Test
- v. Approach Locking Test
- vi. SM lock effectiveness Test
- vii. Point track Locking Test
- viii. One signal – One train Test
- ix. 5 Sec delay test for Starter Signals
- x. Square Sheet test
- xi. Other tests specified by Railways.

Note: The tests carried out shall be exhaustive and cover all possible combinations of negative tests to identify the issues in TOC or Logic Design.

Test Results shall be submitted in the following proforma:

Test	Operation	Expected	Actual Result	Success
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Name	Attempted [with time stamp]	Result [status of relays/ soft bits]	[status of relays/ soft bits with time stamp]	

i. If any deviation to TOC is found as a result of Test, the same will be set right by the Railways. The specific test shall be repeated after setting right of the interlocking by Railways.

ii. Two printed copies of Test Results and three soft copies of Test Results on a CD have to be submitted by the Contractor.

#### **1.4 Datalogger and RTU**

- The Datalogger supplied by the contractor should seamlessly interface with existing Datalogger network of specification IRS.S.99/2006 or latest. And all the data Loggers are networked to Test Room at Chennai and in turn integrated into Train Charting system and Passenger Information Integration System). The Tenderer shall take the responsibility to supply Data Loggers which should interface seamlessly with the existing Data Logger network.

- Data loggers shall conform to RDSO Spec No.IRS.S.99/2006 or latest.
- Data loggers are proposed to be provided in the mid-section in location boxes / AFTC Huts on 25 KV electrified section for monitoring the status of auto signalling/LC Gate relays and power supplies.
- These Data loggers are to be networked on quad cable provided by Railways. In case of Quad cable communication, Network protection against medium failures shall be catered by bi-direction data flow i.e. data of each Data loggers shall reach both end station data loggers.
- Modem link status shall be displayed visually at CMU for real time monitoring of network status.
- Track circuit/axle counter, LC gate and signal's and Analog status shall be shown in the CMU in simulation.

#### **1.5 Technical Specifications For Fault Analysis Terminal For Datalogger**

S.No	Description	parameter
1	Make/Model	Dell Optiplex 7480 AIO or similar
2	Processor	Intel
3	Processor Generation	10 or higher
4	Processor Description	Intel Core i7 or higher
5	Operating System	Windows 10 Professional
6	RAM	16 GB DDR4 or higher

7	Speed	2.9 GHz or higher
8	Storage	1 TB (SSD) or higher
9	Display	23.8 Inches or higher
10	Resolution	1920 x 1080 or higher
10	On Site OEM Warranty	2 years

## 1.6 Technical Specifications For Data Concentrator:

### System Description:

- Data Concentrator receives data from various equipments (Data Logger, Point HMU, BHMS, etc.) through serial ports and transfer into Data Logger network with validation.

### Specifications:

- It shall have 10 Serial ports for interfacing various equipment like Data Logger, SSDAC, HMU, IPS, HMU AND Battery HMU.
- It shall also have provision for 2 numbers if ZIGBEE communication module Interface ports to receive data from Point HMUs which installed at location boxes. (One or Two ZIGBEE communication modules to be procured separately based on site condition).
- It shall also have provision for 3 numbers of E1 interface and 2 numbers of Voice Modem Interface ports. (E1 converters and Voice modems to be procured separately).
- Uses both data and command formats of “Data-Logger system specification No.IRS99/2006” to communicate with all equipment.
- Contains Real Time Clock.
- Time Synchronization with CMU or DL based on connectivity.
- Visual Indications for health of ports and system.
- ID Setting: Contains configurable unique 8-bit ID
- 10 lakh events storage capacity.
- Watch dog reset: Watch dog facility enables automatic restart of the equipment whenever it goes to abnormal state.
- Power Supply: 18V-32V DC (24 V Nominal)
- Working Environment: -10 C to +70 C, upto 95% at ambient temperature of +40 C.

## 1.7 CENTRAL MONITORING UNIT:

E7500 Intel core2 duo processor, 2.93 GHz or higher with 3Mb L2 casche,1333 Mhz FSB, Industrial ATX mother board, 4GB/1066 Mhz RAM. 160 GB SATA Hard Disk Drive from Seagate/Maxtor/Toshiba, 4U industrial chassis with 400W ATX power supply, 16x DVD Writer/reader with Dual + & - support, 17" TFT monitor of Samsung or equivalent, 100 Mbps Ethernet NIC card on board/PCI, wireless LAN “G” card in built, 4 USB ports, one serial port and one parallel port Multimedia Key Board from Logitech/ Microsoft, High resolution Optical Mouse from Logitech/Microsoft, High quality Audio on board, Creative 2.1 Inspire Speakers, 56 Kbps Modem, Genuine Microsoft Windows XP/vista professional OS with recovery CD, one head phones port, Antivirus licensed software with 1 year validity.



**2.1 Multi Lamp Route Indicator (LED Double Digit) from 1 to 9 with white LED (With housing) Note: It can display the characters: 1 to 9, G.**

**1-9 Single Digit with 'G' Indication**

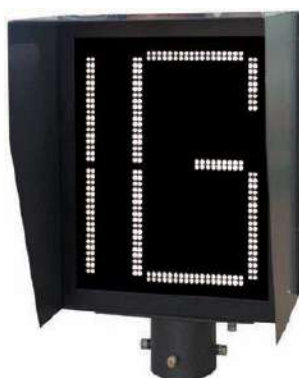


**Specification:**

S.no.	Parameter	Value
1.	Operating I/P Voltage	110V AC +/-20% (88V to 132V)
2.	Operating temperature	-10°C to +70°C
3.	Operating I/P Current	140mA-25%, +20% (105mA to 168mA)
4.	Digit Display	Numeric- 1 to 9 & "G"
5.	Colour of the display	White
6.	Visibility in clear day light	400 Meters
7.	Make	Efftronics
8.	Version	Ver1.4 or latest

**3 Multi Lamp Route Indicator (LED Double Digit) from 1 to 19 with white LED (With housing) Note: It can display the characters: 1 to 19, G.**

**1-19 Double Digit with 'G' Indication**



**Specification:**

S.no.	Parameter	Value
1.	Operating I/P Voltage	110V AC +/-20% (88V to 132V)
2.	Operating temperature	-10°C to +70°C
3.	Operating I/P Current	140mA-25%, +20% (105mA to 168mA)
4.	Digit Display	Numeric- 1 to 19 & “G”
5.	Colour of the display	White
6.	Visibility in clear day light	400 Meters
7.	Make	Efftronics
8.	Version	Ver1.4 or latest

#### 4 LED based Stencil type Route Indicator (1 way) white LED (With housing) do display-M.

##### Specification:

S.no.	Parameter	Value
1.	Operating I/P Voltage	110V AC +/-20% (88V to 132V)
2.	Character Power Rating	Approx. 5W per Character
3.	Visibility in clear Day sun light	300 Meters
4.	Colour of the Display	Lunar White (X=0.310, Y=0.320)
5.	Character size	254x254(mm)(approx.)
6.	Display type	Alphabet/Numeral as per requirement
7.	Operating temperature	-10°C to +70°C
8.	Mechanical Housing Dimensions	1way-550x299x312 (mm) (approx.)

- 5 LED based Stencil type Route Indicator (2 way) white LED (With housing) to display S, N & 2A.

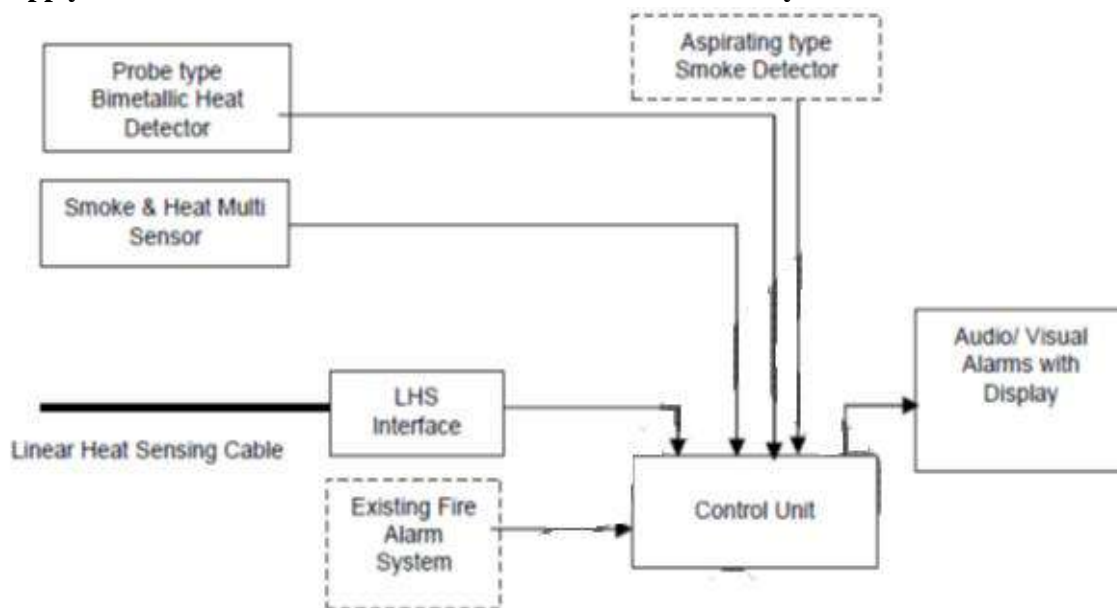
**2 Way LED Alphanumeric Stencil Route Indicator**



**Specification:**

S.no.	Parameter	Value
1.	Operating I/P Voltage	110V AC +/-20% (88V to 132V)
2.	Character Power Rating	Approx. 5W per Character
3.	Visibility in clear Day sun light	300 Meters
4.	Colour of the Display	Lunar White (X=0.310, Y=0.320)
5.	Character size	254x254(mm)(approx.)
6.	Display type	Alphabet/Numeral as per requirement
7.	Operating temperature	-10°C to +70°C
8.	Mechanical Housing Dimensions	2-way-550x565x311 (mm) (approx.)

- 6 Supply and Provision of Automatic Fire Detection and Alarm System



Automatic Fire Detection & Alarm System (AFDAS) shall consist of all or any of the following:

- a) Heat and Smoke multi sensors for Diesel Generator room, Power Supply Room, Non-air conditioned Relay Rooms, ASM Room, and other rooms connected with signalling Installations.
- b) Linear Heat Sensing (LHS) cable along with its interface module (for cable trays, cable troughs, & cable bunch etc.)
- c) Aspirating (air sampling) type smoke detector for air -conditioned Relay Room.
- d) Control Panel - For reading the signals from sensors/detectors, giving audio/visual alarms.
- e) Other Items (OI) - like Manual Call Points at the entry and exit of various rooms, connecting cables, relays, Audio Visual alarms etc. necessary for commissioning & reliable operation of the AFDAS.
- f) In case it is felt necessary by the railways to add more or additional sensors to the existing Fire Alarm System, the sensors/ detectors covered in this specification shall be backward and forward compatible for future expansions.
- g) The Automatic Fire Detection and Alarm System covered in this specification shall also be able to generate requisite commands to activate 'Automatic Fire Suppression System', where provided.
- h) It shall be possible to extend the alarm to remote location.
- i) The working of the equipment shall not cause interference to other electrical/electronic circuits/systems.
- j) In case of low battery, the system shall give alarm and indication.
- k) The system shall not degrade the performance of relays, power equipments, wiring, cables etc. when subjected to Fire Detection & Alarm process.
- l) The response time for alarm generation from the time of detection by sensors/detectors shall not exceed ten seconds. It shall reliably transmit the detected signal to the Control Panel, so that it can translate this detected signal into suitable alarm signal and warn the railway personal for taking corrective action.
- m) It shall monitor the health of the system.
- n) The Fire Alarm systems being provided in Auto location huts are to be interfaced with Dataloggers – necessary interface modules to be provided as part of installation.
- o) It shall Indicate or display the location of fire, status of detectors with all stages of alarms.
  - For Heat & Smoke Multi Sensor For Power Equipment Room, Battery Room, Asm Room, Non-Air conditioned Relay Rooms, Diesel Generator Rooms Refer Para 4.3 Of RDSO Specification RDSO/SPN/217/2018 Ver 2.0
  - Aspirating (Air Sampling) Type Smoke Detector: refer Para 4.4 Of RDSO Specification RDSO/SPN/217/2018 Ver 2.0
  - Linear Heat Sensing (Lhs) Cable: Refer Para 4.6 Of RDSO Specification RDSO/SPN/217/2018 Ver 2.0

- Linear Heat Sensing (LHS) Interface Module: Refer Para 4.7 Of RDSO Specification RDSO/SPN/217/2018 Ver 2.0.

## **5.1 INSTALLATION IN POWER ROOM:**

Transformers, battery chargers, transformer rectifiers, voltage stabilizers, inverter, etc., as detailed in the schedule shall be installed and wired as per approved power diagram in power room. The list of materials to be supplied by Railways and contractor is given in Vol.I.

**5.2** The contractor shall manufacture a power supply panel using 1200x1200mm hylum sheet not less than 10mm thick for mounting meters, switches/fuses, etc. as required by Railways. It shall be installed on a frame made of MS angles of size 25x25x6mm, MS flat of size 50x6mm and grouted to the wall after leaving sufficient space from the wall for testing and replacement. The cable shall be fixed on TW base plank of size 25x150mm using TW cable clamps of size 50x50mm and terminated on PBT Terminal blocks.

**5.3** For mounting transformers, battery chargers, voltage stabilizers and other power supply equipments, a suitable stand made of MS angles of size 65mmx65mmx8mm and MS flats 50mmx6mm and with Hard Wood reapers of size 100mmx50mm. shall be grouted to the wall and at floor. The power supply arrangements wiring shall be carried out using 7/1.4 mm PVC Copper wire as per the approved circuit diagram. The voltage stabilizer shall be installed at a suitable place as required by Railways and arrangements shall be made to isolate and put through the stabilizers if it becomes defective without disconnecting the leads.

**5.4** Ammeter and Stabiliser by-pass arrangements shall be provided on the panel to prevent ammeter being always in the circuit. After wiring, the power rack shall be tested jointly. The power rack shall be energised to its rated capacity and kept in that condition for not less than a week before commencement and any defect notice shall be rectified by the contractor. The Guarantee Certificates and Technical Pamphlets for the power supply equipments shall be handed over to Railways. Any addition/alteration to power supply arrangement shall be carried out during Testing and Commissioning.

**5.5** The power rack and power supply equipments shall be painted suitably and uniformly before installation as required by Railways. Schematic diagram of power supply arrangement and distribution details shall be painted on plywood 12mm thick-TW/rough finish as per instructions of site in charge with Aluminium grooved channel frame of size 1200x1800mm and fixed in the power room. As made power diagram shall be submitted in RP film duly indicating the power supply details and position of the equipments.

**5.6** The power panel and power rack should be provided with separate earth.

**5.7** The power room shall be provided with single door lock arrangement.

## **5.8 INTEGRATED POWER SUPPLY ARRANGEMENT:**

Integrated power supply arrangement shall be carried out as per drawing

## **5.9 PROVISION OF POWER EQUIPMENTS AT LOCATIONS/LC GATE:**

The power equipments like Transformer Rectifier, Isolation Transformer, transformers, etc. as mentioned in the schedule should be procured by the contractor and the same shall be installed at the apparatus cases/LC gates as indicated by Railways. The equipments should be wired with 3/0.75mm copper wire. On 400V/230V side, the terminals should be protected suitably to avoid any shock. The particulars of equipments and the description of the circuit should be painted

inside the Apparatus case as well as on inner doors. Sufficient HW planks (25mm thick) shall be provided for fixing equipments inside the apparatus case. In case of LC gates, one changeover switch shall be fixed on a hylum board and mounted on the wall inside the gate lodge using MS angles and suitably painted. As per the circuit, the required capacity of HRC Fuse should be provided and wired.

#### **5.10 INSTALLATION OF SECONDARY CELLS AT BATTERY ROOM/LOCATION:**

- 5.10.1** This work includes manufacturing of battery stand, charging and installation of the cells as specified in the schedule. Secondary cells shall be initially charged by reputed firms only and shall undergo not less than 3 cycles of charges and discharges as detailed under **Item No.5.12.**
- 5.10.2** The various sets of charged secondary cells for different circuits shall be installed on battery stands in the Battery room/ Cable Hut of the station. The battery stand will be manufactured using MS angle 65x65x8mm, MS Flats 50x6mm and covered with 100x50mm Hardwood reaper. It shall be painted suitably with anti-corrosive black paint before installation of battery.
- 5.10.3** Battery links (copper/lead) with copper lugs crimped and suitable bolts and nuts shall be used for connecting cells. The charged Cells shall be fixed leaving sufficient working space for taking specific gravity reading and distilled water topping. Cells are to be connected with suitable copper lead links sufficient to carry the full load. Immediately after connection, petroleum jelly shall be applied on battery terminals.
- 5.10.4** In the Battery room/ Cable Hut wiring of the batteries shall be carried out by PVC 7/1.40mm copper wire with colour codes through PVC Pipes properly clamped and terminated in the T.W terminal box with locking facility in the battery room.
- 5.10.5** The details of batteries and the capacity, circuit, date of installation, etc., shall be painted on a board using water proof Plywood of thickness 12mm - TW finish with Aluminium grooved Channel frame of size 1200mmx 1800mm. The specific gravity and voltage reading shall be recorded for each cell in a separate register along with the Guarantee Certificate of the supplier and handed over to the Railway duly signed.
- 5.10.6** One Hydro Meter on suitable TW Stand and one battery tester shall be kept in the battery room.
- 5.10.7** In case of installation of secondary cells at location boxes, anticorrosive black paint to be coated inside the apparatus case. Additional ventilation arrangements shall be made. The date of installation, capacity serial No. and circuit particulars shall be painted on each cell and inner side of the door.
- 5.10.8** All connections/termination shall be tested by the contractor and after satisfying himself then to be tested jointly with Railway Representative. Any alterations shall be carried out by the contractor during testing and commissioning of installation.

#### **5.11 INSTALLATION OF DISTILLED WATER PLANT:**

- a) The work involves supply and installation of Distilled water Plant capacity- 3.5 to 4.5 Litres/Hr., with two detachable heating elements of 1500W each to work on 230V AC, single phase, fitted with automatic cut-outs and removable connectors, with stainless steel boiling chambers, steel condenser pipe, toughened glass lid shall be installed at Distilled Water Plant Room on suitable stand.
- b) For water supply, a fibre tank similar to 'SINTEX' make – 200 litres capacity shall be installed on cut rails, grouted to wall at suitable place indicated by Railway Representative.

- c) The water supply connection from water tap towards fibre tank and Distilled Water tank shall be made using good quality of GI pipes, bends, taps and valves of 25mm dia wherever required.
- d) The water pipelines shall be clamped at required places using proper size of clamps. One separate power socket with fuse indication shall be provided and wired for distilled water plant.
- e) The Distilled water plant shall be tested for its satisfactory working jointly with Railways.

## **5.12 PROCEDURE FOR INITIAL CHARGING OF SECONDARY CELLS:**

- a) All the cells in the battery set shall be of the same type and capacity.
- b) Electrolyte shall be prepared by mixing battery grade Sulphuric Acid and distilled water in the ratio 1:5 in a glass/Porcelain container by adding Acid to water and not vice-versa.
- c) The new cells shall be cleaned with distilled water and filled with this electrolyte upto 12-15mm above the plates.
- d) Allow the plates of cells to soak in the electrolyte for 12 hours.
- e) Charge shall be applied at the rate of 4% of AH value of the cells to the correct terminals of the battery set duly interconnected.
- f) Specific Gravity and voltage of each cell shall be measured and recorded once in 8 hours.
- g) Charging shall be stopped when specific gravity becomes 1210 +/- 5
- h) If the specific gravity does not attain this value, little quantity of electrolyte shall be taken out and with electrolyte of higher value (1400 – obtained by adding acid and added water in the ratio 7:11) and charging shall be started afresh.
- i) On charge, the cells shall be discharged with lamp load upto the limit when the specific gravity becomes 1190 and voltage 1.85 volts.
- j) Charge and discharge cycle shall be repeated once again.
- k) Final charge shall be given before wiring the cells to use.

All apparatus cases, battery boxes, CT boxes, armours of cables, battery chargers, transformers, power panels, Control panel, Block Instruments/Control test panel/Cable Termination rack/Relay Racks, etc., shall be earthed. If number of apparatus cases is grouped at a place, one earth shall be provided for all. Otherwise, separate earth is to be provided for each apparatus case. The earth resistance shall not be more than 10 Ohms.

- 6.1** This work includes excavation of pit at a given location as per Drg.No.SG/CN/02/13 on natural soil, supply and fixing earth pipe covering the same with the mixture of 2kgs. of charcoal, 2 kgs. of common salt and earth. A concrete enclosure has to be provided around the earth pipe as per drawing. The earthing shall be done with MS flat of size 35mmx6mm/19 C cable as required by Railways.

## **6.2 Technical specification for Earthing:**

- a) Supply and installation of 8 no's of maintenance free earth as per RDSO/SPN/197/2008 along the building.
- b) Supply of GI (Galvanised Iron) for interconnection between earth pits in a ring manner.
- c) Supply of 25mm x 3 mm copper tape for Relay room, Power room and other S&T equipment rooms as directed by engineer-in-charge.
- d) Supply of 35 sq.mm copper cable for interconnection between Earth pit to Relay Room/Power Room etc.,

- e) Catenary wire also to be welded to the earthing system. Catenary wire will be provided by Railways, if available.
- f) The complete layout with dimensions of the Earthing & bonding system shall be submitted by the supplier after commissioning.

## 6. Technical specification for Class A Earthing:

### GENERAL

#### AIR TERMINAL: -

Provision of suitable direct strike protection for Buildings and Towers utilizing “corona minimizing” air terminals that function as Controlled Advanced Triggering (“CAT”) or Controlled Streamer Emission (“CSE”). The corona minimizing air terminal shall be tailored to the height of installation, as per recent findings in the international literature, e.g., via different sizes / shapes proven to minimise corona discharge via testing in an accredited HV laboratory.

Air terminal number, height and position shall be achieved with a “leader propagation method” such as the Collection Volume Method (“CVM”), which provides a quantitative account for the leader propagation and attachment process between the lightning channel and the air terminal. The method shall take into account key parameters such as structure height, structure geometry, electric field intensification of structural projections, altitude above sea level, etc.

The air terminal shall be designed to launch a “streamer-leader system” at precisely the right time so that the approaching “downward leader” is intercepted and brought under control. The concept of controlled triggering is important because, if the streamer-leader system (SLS) is launched too early, the ambient field will be too weak to sustain propagation and the SLS will stall or die, leave space charge behind which may inhibit subsequent SLS development attempts. Hence, the key performance / function of the air terminal is to minimize corona discharge prior to the descent of the downward leader and then responding dynamically to the downward leader as it approaches the structure with the launch of a well-timed SLS ensures reliable lightning capture with the largest possible area of protection.

The air terminal shall be installed at a minimum of 10 meters above the ground in a free-standing arrangement and shall be insulated from all surrounding points and features of the structure being protected. The air terminal shall:

- Be manufactured using stainless steel grade 316 material and be suitable for use in corrosive environments.
- Have no moving parts and will have no dependence on an external power supply or batteries.



- Not have a high-impedance static drain unit between the central rod and the outer panel(s).
- Have an insulation material to electrically isolate the panels that is comprised of a base polymer with high ozone and UV resistance and a dielectric strength of 24-38 kV/mm.
- Have an external shape that limits the development of corona discharge under static thunderstorm conditions (before the descent of the downward leader). The upper section of the central finial shall be rounded to provide a blunt surface to minimize corona discharge. Dome shapes and pointed central rods will not be acceptable.
- Arcing shall occur between the panel sections of the spheroid and the blunt rod tip only upon the progression of a downward lightning leader.

The air terminal shall have been tested to withstand a single-shot 200 kA ( $\square$  5%) surge current at 10/350  $\mu$ s per UNE-EN / IEC 62305-1 in an ILAC-accredited laboratory, or three shots of 100 kA ( $\square$  10%) surge current at 10/350  $\mu$ s per IEC 62561-1.

The air terminal shall have been tested and certified in a nationally or internationally ILAC-accredited laboratory, using the techniques of IEC 60060-1, per the following sections of IEC 62561-2 and IEC 62561-1:

- a) Electrical Resistivity Test – per Clause 5.2.5 of IEC 62561-2.
- b) Environmental Test – per Clause 5.2.4 of IEC 62561-2.
- c) Marking Test – per Clause 5.5 of IEC 62561-2.
- d) (d) Electrical Test – per Clause 6.4 of IEC 62561-1.
- e) (e) Static Mechanical Test – per Clause 6.5 of IEC 62561-1.

The advanced lightning terminal shall not be of the ESE type and all lightning terminals claiming compliance to NFC 17-102 shall not be considered suitable.

#### **AIR TERMINATION SUPPORT: -**

- The Mounting Pole used to support the air terminal shall be a circular insulating FRP pipe (Fiberglass Reinforced Plastic) at a minimum height of 2 meters above the highest competing point.
- The support shall be fixed securely with brackets and guy wires where required to enable the air termination and mast system to withstand maximum locally recorded wind velocities.

#### **DOWN CONDUCTOR: -**

Once the lightning strike is captured by the air terminal, it shall be conducted safely to a dedicated lightning earth grid via HVSC PLUS type of cable that is specially designed for handling lightning transients and minimizing the risk of lightning energy “side flashing” to adjacent structures. The cables shall be suitable for structures containing high density human occupancy, sensitive electronic equipment, volatile or explosive materials, and other sensitive applications.

#### **The cable shall:**

- Minimum 25 meters of Down Conductor to be supplied.

- Be comprised of 8 layers or components, namely a central filler, concentric stranded aluminium conductor, binder tape, semi-conductive screen for the conductor, cross-linked polyethylene insulator, insulator screen, copper tape screen, and outer sheath.
- Have a main aluminum conductor with a minimum cross-sectional area of 50 mm<sup>2</sup>.
- Have a minimum insulation thickness of 4.75 mm.
- Have an outer diameter 36 mm  $\pm$  8%.
- Have been tested to withstand impulse voltages of at least 500 kV at 1.2/50 ms in accordance with the procedures outlined in AS 1931 - Part 1 (2), IEC 60052 and IEC 60060-1.
- Be directly connected to the air terminal at the upper end through the use of a compression lug, where the upper end has an engineered, factory-installed, upper termination. The terminated lower end of the cable shall be connected to the nearest earth electrode at the base, e.g., earth rod in an earth pit.
- The cable shall be fixed to the structure through the use of suitable saddles every two meters for the length of the cable route.

#### **LIGHTNING STRIKE RECORDER: -**

- Each air terminal shall have a lightning strike recorder (LSR). The LSR shall:
- Register all lightning discharges with a current of 1500 A or more when measured with an 8/20  $\mu$ s current impulse.
- Be housed in an IP 65 rated enclosure.
- Be a non-resettable type.
- Certificate of compliance to IEC 62651-6: 2023 standards.
- Be installed as per the manufacturer's instructions.

#### **7.1 ERECTION OF RELAY RACK(PODANUR/SIEMENS):**

- 7.1.1 Siemen's relay rack, (to accommodate 56Nos. of 'Q' series relays) shall be anchored using 'J' type foundation bolts and nuts (12mmx100mm) with washers. In places where 'J' type bolts can not be used, special headed bullet type foundations shall be used. An insulator shall be provided for each foundation bolts and also to the ladders for carrying the cables. A MS wall angle of size 35x35x5mm shall be provided- one end grouted to wall and the other end fixed to the relay rack as tie.
- 7.1.2 The relay rack shall be painted soon after the installation before plugging of the Plug Board.

#### **7.2 WIRING OF RELAYS(NEW/ADDITIONAL/ALTERATION):**

- 7.2.1 Based on the circuit diagram, contact analysis chart shall be prepared by the contractor. The required number of 50-way terminal boards, plug boards and plug in type relays shall be fixed on the new/existing rack in the nominated places as instructed by Railway representative. The configuration of plug boards should be checked with the contact analysis chart. The nomenclature both on the rear and the front side of the plug board and on front side of the relays in the relay frame shall be painted.
- 7.2.2 Suitable arrangements shall be made in the relay rack for fixing condenser and resistance unit, required for slow to pick up or slow to release feature. Letter painting shall be made against each unit to identify the circuit for which it is used. Suitable wire supporting Tray

made of PVC shall be provided for each row in relay rack to accommodate the complete bunch wherever the new wiring is carried out.

- 7.2.3 The wiring shall be carried out as per approved circuit diagram. The wiring shall be done on connectors and terminated on terminal clips by soldering process neatly, using high grade solder. PVC flexible wire 650V grade 16/0.20mm copper conductor shall be used. Potential free contacts of various relays required to be monitored by the Data logger should also be wired on the tag block of the data logger. In case of alteration to existing wiring, the wires and relays not required shall be removed. After completing the alteration work, the new wires have to be bunched neatly and brought to original condition. The relay rack wiring shall be tested initially by the contractor and then jointly with Railway Representative. Any addition/alteration to wiring in the course of testing shall be carried out free of cost by the contractor. Different colours of wire shall be used for identify the power supply circuit wiring. In case of alteration, a different colour of wire from the existing one shall be used for easy identification.
- 7.2.4 8.2.4 Before plugging, the relays shall be checked visually and defective ones noticed shall be replaced duly reporting the same to the railways.
- 7.2.5 The painted Relay Index board using plywood of thickness 12mm T.W/rough finish as per instructions of railway representative with Aluminium grooved channel of size 1200x1800mm – 2 Nos. shall be manufactured and fixed in the relay room giving the details of the relays and their position in the relay rack. In case of alteration/additional relay wiring, the relay particulars shall be incorporated in the existing relay index board available in the relay room. If sufficient space is not available for fixing the board in one piece, it may be provided in parts retaining the overall size as per instructions of site in charge.
- 7.2.6 Hardwood stand with decolum finish of size 500mmx700mm of 25mm thick shall be fixed on M.S angles grouted to wall at relay room for keeping 'As made' circuit diagram at suitable height as required by Railway Representative. In case of additional/alteration to existing relay wires, the latest 'as made' circuit diagram shall be kept in the relay room on the existing hardwood stand.
- 7.2.7 The new relay room shall be provided with Double Key Door Lock arrangement.

- 7.3 Rubber mat having sufficient width should be placed in front and rear of all the relay rack and FTOT. The mat should not be less than 6mm thick and it should withstand 650V AC.

#### **7.4 FUSE BLOWN OUT INDICATION:**

Fuse Blown out indication shall be provided using Hylum sheet 5mm thick and 50mm width and fixing of 5mm LEDs and resistance. The Hylum sheet shall be fixed by the side of the corresponding Fuse Blocks. Separate switch shall be provided for each circuit. This Arrangement shall be made near FTOT inside the relay room.

#### **7.5 INTERCONNECTIONS:**

Interconnection arrangements between the cable termination rack, relay rack, control panel, power and battery room shall be carried out as follows: -

- 7.5.1 Interconnection between relay rack and FTOT, relay rack to control panel shall be carried out with cable having plain, annealed copper, multi core/single core conductor of 1/1.5 sq.mm PVC insulated, unarmoured, unsheathed 1100v grade cable.

- 7.5.2 Relay rack to relay rack wiring shall be done with 16/0.2mm PVC copper conductor by soldering process.
- 7.5.3 The inter-connection between the relay rack and power room, power room and FTOT, Block Instruments and FTOT shall be carried out with underground, armoured, sheathed, power/ signalling cables of adequate length. The termination shall be carried out using suitable size of copper eyelets/sockets. Inter-connection between power rack and battery room, shall be carried out by using suitable underground cables.
- 7.6 All the interconnecting wires shall be supported by means of Aluminium ladder. Ladder of suitable capacity shall be manufactured using Aluminium angles of size 37mmx37mmx5mm and Aluminium flats of size 25mmx6mm. The inter spacing between two rods of the ladder shall not be more than 125mm. The corners of the ladders as well as the inner path of the ladders shall be of curved shape and shall not damage the insulation of the interconnection wire. The bends also shall not be steep. The bottom of the ladders shall be provided with hylum sheet of 3mm thickness. The ladder shall be fixed firmly with proper Aluminium flats.
- 7.7 The interconnection arrangement includes laying of signalling cables in ducts wherever necessary as indicated by Railways. Wherever cables are taken through cable ducts inside relay room/ battery room etc., the ducts shall be filled with river sand upto the floor level and covered with RCC slabs.
- 7.8 All connections/terminations shall be tested by the contractor and after satisfying himself jointly with Railway Representative. Any alterations required shall be carried out by the contractor free of cost.
- 7.9 Cable details, functions allotted to each core and terminal numbers shall be prepared in standard size RP film and handed over to Railways.

#### **7.10 INSTALLATION OF DIAGNOSTIC PANEL:**

- 7.10.1 The work includes manufacture, installation and wiring of Diagnostic Panel. The diagnostic panel will be fabricated from plywood 25mm thick of suitable size depending on yard layout and covered with white decolum sheet. The sides will be covered with Aluminium grooved channel. The yard layout will be painted on the decolum sheet.
- 7.10.2 The interconnections between independent relay contacts wired and terminated and 50 way terminal board on the diagnostic panel will be as per the approved circuit diagram using wire PVC 16/0.2mm copper. The interconnection wires shall be taken through ladders already available. The indications of points, signal, track, slots, LC gate if any, and important relays like LR, ASR, UCR, CHR, etc. shall be indicated in the panel by providing LED. The work also includes provision of (30 - 0 - 30) voltmeter for the internal supply and wiring the same. Test pin and sockets are to be provided and wired.

#### **8. Technical Specifications for Cable Route Tracer:**

A lightweight yet rugged receiver that provides all the information needed for faster, more accurate locates. Target line and guidance arrows quickly identify distortion. Trace any frequency from 10 Hz to 35 kHz.

**Specifications:**

- **Active Line Trace Frequencies:** 128 Hz, 1 kHz, 8 kHz and 33 kHz
- **Passive Power Trace:** 50 Hz, 60 Hz, <4 kHz Broadband.
- **Passive Radio Trace:** 4 kHz-15 kHz, 15 kHz-36 kHz
- **Sonde Frequencies:** 16 Hz, 512 Hz, 640 Hz, 850 Hz, 8 kHz, 16 kHz, 33 kHz.
- **Power Source:** 4 C-Cell batteries (included) or Rechargeable RIDGID® Professional 18V battery with RIDGID SeekTech® 18V Adaptor (optional)
- **Battery Life:** Varies with battery rating, use and operating factors. Four size C, alkaline batteries provide approximately 10 to 15 hours. RIDGID® Professional 18V battery provides approximately 18 to 22 hours.
- **Weight:** 3.5 lbs. (1.6 kg)
- **Meets FCC Class A and EN 55022 Class A requirements.:** 30 user definable frequencies can be set from 10 Hz to 35 kHz.

**8.1 Technical Specification for Portable Cable Fault Locator:**

The specification shall be similar to model No.TFL5 of TELEMETRICS Make as given below: -

S.No.	Description	Specification
1.	Fault Distance Range (in Meters)	240m, 480m, 1000m, 2000m, 4000m, 8000m
2.	Measurement Mode	Auto or Manual
3.	Fault Measurement Accuracy	1m
4.	Pulse Width	40 nsec to 10usec
5.	Pulse Wave form	Two Polarity Pulse

6.	Pulse Amplitude	0-30 V Adjustment Adaptive
7.	Cable Constant (VOP) range	100 to 300
8.	Measurement dead zone	0 meter
9.	Auto measurement dead zone	0 meter
10.	Output impedance	25-120 Adaptive
11.	Sampling Speed	100 MHz
12.	Serial port for PC/Printer	USB
13.	Resolution	1 Metre
14.	Gain Range Control	1 to 99
15.	Display Readout	Color LCD and 480*280
16.	Power supply	7.4 V re-chargeable Li- Ion battery
17.	Charging Voltage	230V AC +/- 10%, 50Hz, Single Phase
18.	Timer	Built in timer automatically switches off after 5 minutes to save the battery power
19.	Alarm	It gives audible alarm when high voltage (>50V) appears on test leads, ensuring operator's safety.
20.	Weight	1.27 kg approx.
21.	Dimensions	212 x 170 x 90 mm approx.
22.	Accessories	Operation /Service Manual Connecting Test Cables PC Software CD 8GB Pen Drive Rechargeable Battery Charger/Adapter Carrying Case
23.	Environmental Spec.	Storage : -15o C to 55o C
24.	Working Temperature	-15o C to 45o C
25.	Charging Time	3 hours
26.	Operating Time	8 hours
27.	Gain Adjustment	Automatic and Manual

## 8.2 Technical Specifications for Clamp Tester:

### **320 Series True-rms Clamp Meters**

Fluke rugged. Fluke precise. Fluke reliable.



The Fluke 323, 324 and 325 Clamp Meters are designed to perform in the toughest environments and provide noise-free, reliable results users can trust to confidently diagnose problems. True-rms measurements and optimized ergonomics make the 320 Series Clamp Meters the best general troubleshooting tools for commercial and residential electricians.

**New**



## Technical Data

### Measurement capability

- 400 A ac current measurement (ac and dc current; 325 only)
- 600 V ac and dc voltage measurement
- True-rms ac voltage and current for accurate measurements on non-linear signals
- Resistance measurement to up to 40 k $\Omega$  with continuity detection
- Temperature and capacitance measurement (324 and 325 only)
- Frequency measurement (325 only)

### Features

- Slim, ergonomic design
- Large, easy to read backlight display (324 and 325 only)
- CAT IV 300 V/CAT III 600 V safety rating
- Hold button
- Two-year warranty
- Soft carrying case

### 8.3 Technical Specifications for Fusion Splicing Machine:

**FirstFiber**



**Description:** FF-790MAX Fiber fusion splicer is a 6-motor fusion splicer with the latest fiber core to core alignment technology, it has very stable performance and low fusion loss, it is suitable for different fiber optical projects, including backbone, FTTx etc.

**Specifications: -**

<b>Applicable fiber</b>	SM(ITU-T G.652),MM(ITU-T G.651),DS(ITU-T G.653),NZDS(ITU-T G.655)
<b>Diameter of cladding</b>	80 -150μm
<b>Diameter of coating</b>	160-900μm
<b>Typical splice loss</b>	SM: 0.02dB, MM: 0.01dB, DS: 0.04dB, NZDS: 0.04dB
<b>Return loss</b>	> 60dB
<b>Fiber cleaved length</b>	10-16mm (coating diameter < 250um), 16mm (coating diameter:250-1000um)
<b>Splicing program</b>	40 groups
<b>Operate mode</b>	Automatic/Manual
<b>Auto-heating</b>	Available
<b>Typical splicing time</b>	6 seconds
<b>Typical heating time</b>	16 seconds
<b>Fiber magnification</b>	250X (X or Y view), 125X (X and Y view)
<b>Display screen</b>	5.0 inch color LCD monitor
<b>Records storage</b>	4000 results
<b>Loss evaluation</b>	Available
<b>Tension test</b>	1.8-2.2N
<b>Interface</b>	GUI menu interface, easy for operation
<b>Battery</b>	5200mAh Li-battery, typical 300 cycles splicing and heating, support separating charging
<b>Power supply</b>	Adapter, input: AC 100-240V(50/50HZ), output: 11-13.5V
<b>Electrodes life</b>	More than 4000 ARC discharges, can be replaced conveniently
<b>Terminal</b>	USB2.0 port, for software upgrading and records exporting
<b>Operating conditions</b>	Altitude: 0-5000m, Humidity: 0-95%, Temperature: -10°C~+50°C, Wind speed: Max 15m/s
<b>Dimension</b>	160mm(L) * 136mm(W) * 140mm(H) (including rubber armor)
<b>Weight</b>	2.20kg (including battery)

#### 8.4 Technical specifications Thermal Imager:

##### Compact Fluke PTi120 Pocket Thermal Camera





Key Features	
IFOV (spatial resolution)	7.6 mRad
Infrared resolution	120 x 90 (10,800 pixels)
Field of view	50° H x 38° V
Distance to spot	130:1
Temperature measurement range (not calibrated below -10 °C)	-20 °C to +400 °C and -20 °C to +150 °C models
Focus system	Fixed focus, minimum focus distance 22.8 cm
USB	Mini USB used to transfer image to PC
Wifi	Yes
Image quality	
IR-Fusion technology	Yes, adds the context of the visible details to your infrared image
Auto Blend mode	Continuous 0% to 100%
Touchscreen display	3.5" (landscape), 320 x 240 LCD
Rugged, ergonomic design	Yes
Thermal sensitivity (NETD)	60 mK
Frame rate	9 Hz
Data storage and image capture	
Memory	≥ 2GB internal flash memory
Image capture, review, save mechanism	One-handed image capture, review, and save capability
Image file formats	Non-radiometric (jpeg), or fully radiometric (.is2); no analysis software required for non-radiometric (jpeg) files
Software	Fluke Connect® desktop software—full analysis and reporting software with access to the Fluke Connect system
Export file formats with software	JPG, IS2
Measurement range	-20 °C to +400 °C and -20 °C to +150 °C models
Battery	
Batteries (rechargeable)	Internal rechargeable lithium ion battery
Battery life	≥ 2 hours continuous (without WiFi)
Battery charging time	≤ 1.5 hours
Battery charging system	Mini USB cord from product to PC
AC operation	With separate AC to USB adapter. Not included in box.

<b>Key Features</b>	
Power saving	Automatic Shutdown: 5, 10, 15 and 20 minutes or never
<b>Temperature measurement</b>	
Temperature measurement range (not calibrated below -10 °C)	-20 °C to +400 °C and -20 °C to +150 °C models
Accuracy	Target temp at or over 0 °C: Accuracy: $\pm 2$ °C or $\pm 2\%$
On-screen emissivity correction	Yes
On-screen reflected background temperature compensation	Yes
<b>Color palettes</b>	
Standard palettes	6: Iron bow, Blue-Red, High Contrast, Amber, Hot Metal, Grayscale
<b>General specifications</b>	
Infrared spectral band	8 $\mu\text{m}$ to 14 $\mu\text{m}$ (long wave)
Operating temperature	-10 °C to +50 °C (14 °F to 122 °F)
Storage temperature	-40 °C to +70 °C (-40 °F to 158 °F)
Relative humidity	95% non-condensing
Center-point temperature	Yes
Spot temperature	Hot and cold spot markers
Safety	EN 61010-1: CAT none, pollution degree 2, EN 60825-1: Class 2, EN 60529, EN 62133 (lithium battery)
Electromagnetic compatibility	EN301 489-1 V2.1.1 EN301489-17 V3.1.1
US FCC	CFR, Part 15C
Vibration and shock	2G, IEC 68-2-6 and 25G, IEC 68-2-29
Drop	1 meter
Size (H x W x L)	8.9 cm x 12.7 cm x 2.5 cm (3.5 in x 5.0 in x 1.0 in)
Weight (battery included)	0.233 kg (0.514 lb)
Enclosure rating	IP54
Warranty	Two-years
Supported languages	Czech, Dutch, English, Finnish, French, German, Hungarian, Italian, Japanese, Korean, Polish, Portuguese, Russian, Simplified Chinese, Spanish, Swedish, Traditional Chinese, and Turkish

## 8.5 Technical specification for Visual Fault locator:

# FirstFiber



## Visual Fault Locator

Model No: FF-VFL-B50

### Specifications:-

Model	FF-VFL-B50
Laser Launcher Level①	CLASS IIIB
Output Power②	$\geq 50\text{mW}$
Detecting Range③	About 35km
CW Mode Battery Life④	About 2 hours
2Hz Mode Battery Life④	About 4 hours
Laser Launcher Type	LD
Optical Connector	universal 2.5mm adapter (FC/SC/ST)
Output Wavelength	$650\text{nm} \pm 10\text{nm}$
Modulation Frequency	CW / 2Hz
Power	2*AAA dry batteries
Working Temperature	$-10^{\circ}\text{C} \sim +50^{\circ}\text{C}$ ; <90%RH
Storage Temperature	$-20^{\circ}\text{C} \sim +70^{\circ}\text{C}$ ; <90%RH
Dimension & Weight	L120mm×W33mm×H30mm / about 67.8g
<b>Standard Accessories:</b>	
2*AAA batteries, carrying bag, user manual	
<b>Optional Accessories (Sold Separately):</b>	
Male FC to female LC adapter for LC connector	

## 8.6 Technical specification for Coating Thickness Gauge:



**Model No.: UNI-T UT343D Coating Thickness Gauge**

**UNI-T UT343D Coating Thickness Gauge**

**Specifications: -**

- Measuring range: 0~1250um
- Accuracy :  $\pm(3\%H+1)\mu\text{m}$
- Resolution: 0.1um (0~99.9um); 1um (100~1250um)
- Measurement method: Single/Continuous
- Measurement mode: Max/Min/Avg
- Metal type : Ferrous/ non-ferrous
- Display type :2.0-inches TFT LCD (320 x 240 pixels)
- LCD brightness control ✓
- Auto rotatable screen ✓
- Unit conversion ✓
- Audio alarm ✓
- LED alarm ✓
- PC analysis software ✓
- USB communication ✓
- Quick test mode ✓
- Data storage : 500 groups
- Auto power off ✓
- Low battery indication ✓
- Power : 1.5V AA battery (LR6) x 2
- Display 48mm x 36mm
- Product net weight :175g
- Product size :153.5mm x 64.5mm x 41mm
- **Standard accessories** : Micro USB interface cable, standard piece, batteries, cloth bag
- **Standard individual:** packing box, English manual
- **Warranty:** 1 Year

## 8.7 Technical specification for Thermo Hygrometer:

### HTC THERMO HYGROMETER MODEL NO: - 288-ATH



#### **Specifications: -**

- Environment Comfort Display :“COMFORT”, “WET”, “DRY”
- Temperature Range:(IN/OUT)-50°C ~70°C(-58°F ~ 158°F)
- Temperature Accuracy :0.5 °C (0°C%~40%) or +1%
- Humidity Range: (10% ~ 90%)
- Humidity Accuracy : +3% RH (50%~80%) or +5%
- Battery : AAA 1.5V
- Time / Temp / Humidity indicate
- Temperature reading for °F &°C
- MAX and MIN Temperature and Humidity
- 12/24 hours system clock.
- Sensor Length: 3 Meters
- **Warranty: 1 year**

## 9. Cable/Cable Laying

### 9.1 CABLE LAYING: -

#### 9.1.1 CABLE TRENCH: -

Excavation of cable trench shall be made in all kinds of soils including clearing roots of trees, rocks bushes etc., to a depth of 1.0M/1.65M and a width of 0.3M/ 0.5M as required, for laying cables. Trenches shall be straight as far as possible and steep angles shall be avoided. Alignment of the main cable route as well as track/ road crossing will be given by Railways. While taking the trench, all the roots of trees, bushes, rocks, if any, should be cleared. The bottom of the trench shall be leveled and got rid of any sharp materials. Proper protection to cables to be given while crossing power cables, pipe lines, etc., as required by Railways.

- a. Signalling/power cables will be laid as close to the track as possible. The cable, track separation distance both within station limits and in the block section shall generally not exceed 6 Meters.
- b. It is desirable that the excavation of trenches is not done in long lengths and does not remain uncovered overnight. It is preferable that trenches are dug, cables laid and refilling done on the same day.
- c. The contractor who supervises the excavation work shall have the shoring materials ready on hand so that on banks where ashes or loose materials are encountered, shoring can be adopted.
- d. During excavation, the earth of the trenches should not be thrown on the ballast. The earth should be thrown by the side of the trenches away from the track. Plastic sheets/gunny bags may be used wherever necessary to cover the ballast.

9.1.2 In RE area the following clear distances shall be maintained between the signalling cables and the OHE mast or other structures likely to develop high potentials or switching stations earth.

- a) Minimum distance between the signalling cables and OHE masts or other structures likely to develop high potential or switching stations earth.

Depth of Cable (Metres)	Distance (Metres)	Remarks
Upto 0.5	1.0	Provided cable is laid in concrete pipe/DWC pipe for 3M on either side of the mast/structure.
	0.5	
More than 0.5	3.2	

- b) Minimum distances between signalling cables and OHE mast or switching station earth.

Description	Distance	Remarks
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**10.2.1 LAYING OF CABLES:**

	(Metres)	
Switching station viz., feeding posts, sectioning post or sub-sectioning post	5.0	Provided cable is laid in concrete pipes/DWC pipe.
	1.0	
Earth, OHE mast or substation earth	1.0	

shall be tested for insulation and continuity of the cores. The insulation resistance of a new cable shall not be below 500 M. Ohms per Km. at 20 deg C. The cable insulation should be measured using a 500V insulation Tester (Megger). If there is wide disparity between insulation of different conductors, the condition of the cable should be thoroughly checked before permitting its use. Bedding and armouring shall be inspected to see that there has been no damage during transit or in storage. In case where the wheels are not available or the area is not convenient for rolling the wheels, along the routes, the drum shall be mounted on the axle at one end of the trench and cable payed out. It should be carried out by adequate number of men, ensuring that the insulation of the cables is not damaged, and no kink/twist is formed. In no case shall the drum be rolled on the road for laying of cables and the cable dragged on the ground for laying purposes. The cables shall be laid gently into the trench and not thrown out under any circumstances. Before laying of cable in the trench, a visual inspection shall be adequate for any damage or defect throughout its length. Normally cable laying should be commenced only after the relay room and apparatus cases, cable termination box on the route at the respective stations are ready and the cable should be duly brought inside at the relay room/apparatus cases immediately after the cables are laid, however, if for any reasons the cable is be laid in advance, special care should be taken to ensure that the coiled cable near the relay room/apparatus cases is fully protected before and during the construction of the relay room/apparatus cases and during final termination. The coiled cable shall be buried well in the ground such that the depth from the ground level to the top layer of the coil shall not be less than 1 M and shall be fully covered with a layer of bricks horizontally in its entire length and provided with adequate number of the cable markers. On no occasion, the ends of the cable should be left unsealed unless terminated properly.

**10.2.2 Cable laying shall commence after the depth and width of the cable trench, quality of bricks are jointly inspected by Railway Engineer's representative and contractor's representative and approved.**

**10.2.3 PLACING OF CABLES: -**

When several cables of different types have to be laid down in the same trench, they shall be as far as possible in the following order starting from the track side.

- i) Telecommunication cables.
- ii) Signalling cables.
- iii) Power cables.

**10.2.4 Cable shall not be normally taken over the running track at the time of cable laying by the contractor as this is likely to cause accident to trains and damage to cables. If at any time the cable has to be taken across the track either in full drums or in spread out conditions it shall be done only in the presence of Railway's Supervisory staff and also after safety precautions have been taken to post flagmen on all the sides as may be required to stop any trains approaching the site of the fouled line.**

10.2.5 At each end of the main cable/tail cable/power cable an extra coil length of 6 to 8 Metres should be kept.

10.2.6 At the time of commissioning of the cable, the insulation values of the cable should again be checked, and the value obtained shall not be below 500 Meg. Ohms per Km at 20 deg.C. If there is wide disparity between insulation of different conductors, the condition of the cable should be thoroughly checked before permitting its use. The reading shall be recorded in a register based on Annexure 'C' for all power cables, main and tail cables.

10.2.7 The contractor shall furnish the final as made cable plan and cable route plan and in R.P film with eight prints showing the distance of cables from the nearest track centre.

#### **10.2.8 LAYING OF CABLE IN RCC DUCTS:**

Cable laying in RCC ducts shall be as per schedule.

#### **10.3 PLACING OF BRICKS:**

10.3.1 One layer of country bricks of size of approximately 220mm x100mmx60mm shall be placed closely in breath-wise horizontally in the 1m X 0.3m trench over the cables. Two rows of country bricks of size of approximately 220mm x100mmx60mm shall be placed closely in breath-wise horizontally over the cables in the 1m X 0.5m trench.

#### **10.3.2 SEPARATION OF POWER CABLES: -**

The signalling cable shall be separated from the power cable carrying 230V or above by a row of bricks placed vertically lengthwise between them wherever required.

#### **10.4 RE-FILLING THE CABLE TRENCH:**

After the bricks are placed over the cable without any gap between two bricks properly, the excavated earth, shall be again put up in the trench. It shall be ensured that there are no stones or any sharp materials present. The refilled earth shall be consolidated and extra earth also shall be placed on the trench to compensate the shrinkage and consolidation of earth.

#### **10.5 TRACK/ROAD CROSSING/MECHANISED OR METALISED ROAD:**

10.5.1 Wherever signalling/power cable has to cross the track/road it shall be ensured that:

- i. The cable crosses the track/road at right angles.
- ii. The cables do not cross in between or inside points and crossings.
- iii. The track/road crossings to be carried out as per the instructions of Railway representative at site.

10.5.2 In case of track crossing, work includes removal of ballast, excavation of trench 1m/0.5m below the ground level and across the track at places indicated by the Railways and covering, resurfacing the trenches and ballast to the original condition after placing RCC pipe/pipes in position.

10.5.3 RCC Pipes 100mm I.D & 150mm O.D or DWC pipe, shall be provided for track/ road crossings. For each track crossings two numbers of RCC pipes with collar each 2M long



shall be provided. For each road crossing required number of RCC pipes each 2m long with collar shall be provided depending upon the width of the road.

- 10.5.4 In cases where more than one RCC pipe is used, the bottom-most RCC pipe should be 1m below the bottom surface of sleeper for track crossing and road level for road crossing.

#### **10.6 CABLE LAYING ON BRIDGES: -**

On bridges, the cables are to be laid through GI Pipes 50mm dia- 3.65mm thick/100mm dia- 4.5mm thick/DWC pipe with off-set both ends and with coupling wherever required as per Railway requirement. The pipes shall be suitably supported over the bridges/drainage/culverts with brick masonry works of size 300x300x300mm at an interval of 2M in box type bridges and suitable MS clamps at an interval of 1M in Girder bridges. The end of pipes will be closed with brick masonry abutments of size 0.5mx0.5mx0.5m.

#### **10.7 CABLE LAYING ON PLATFORM:**

The work includes removing/breaking of existing RCC slabs on the Passenger Platform, trenching to a depth of 0.6m to accommodate the additional cables laid, covering the trench after the cables are laid, replacing the slabs removed or re-plastering with cement mortar and restoring to the original condition as per the instructions of Railway Representative at site.

#### **10.8 CABLE LAYING IN ROCKY AREA:**

In Rocky area, Cable Laying using GI pipe shall be done as per the description prescribed in schedule no SOR 10-110.

- 10.9 Wherever the cable coil pits are required to be provided, the cable coil pit shall be excavated to a size of 1.5mx1.5m and a depth as instructed by railway representative at site in rear of Relay room/AFTC huts, location boxes etc. After all the cables are drawn and coiled, over the coiled cable one layer of country bricks of size 220mmx100mmx60mm shall be placed throughout entire area of the bottom of the pit without any gap and then refilled with earth and consolidated.

#### **10.10 PROVISION OF RCC CABLE MARKERS: -**

The work involves supply of RCC cable markers as per drawing No.CSTE/CN/OFC/1. The lettering on the cable marker shall be "SIG" /"TELE" / "OFC" as per the instructions of Railway representative at site, digging of pit to a depth of 800mm of size 300mmX300mm, casting of concrete foundation of size 300mmX300mmX300mm and placing of RCC cable markers on top of the foundation and refilling the pit and consolidating it by ramming. The cable markers shall be provided at an interval of 20 Mtrs. within station limits and 50 Mtrs. outside station limits throughout the cable route, diversions and also at every track/road/crossing.

### **10.11 CONCRETING & ERECTION OF CABLE TERMINATION RACK [F.T.O.T]:**

10.11.1 Cable termination racks shall be erected on suitable teak wood base frame of size 50mm x 50mm in the relay room/ Cable Hut at the required location as directed by Railway with suitable foundation bolts and concreted. The cable termination racks shall be painted soon after installation before cable termination work is taken up. Suitable cable ducts wherever required shall be provided to bring all outside cables to the termination rack. All the cables are to be neatly skinned, fixed by wooden clamps, bunched individually, and terminated in order. The cable armours and the rack shall be earthed. PVC/Nylon sleeves/indication sleeves shall be used for each cable and internal wiring termination and particulars written with paint on the PVC/Nylon sleeves.

10.11.2 The un-used space over the top of the cable termination rack shall be blanked using Hylum sheet of 3mm thick and suitable bolts and nuts.

### **10.12 TERMINATION OF CABLES:**

10.12.1 The PBT terminal and fuse blocks shall be fixed firmly on the cable termination racks and serially numbered with paint for easy identification. Tags shall be provided for each terminal and painted, giving description of the circuit. Suitable rubber gromite shall be provided on the holes of termination racks. Copper tape of width 20mm x 1.5mm shall be used for providing bus bars. Suitable holes shall be drilled in copper tape for this purpose.

10.12.2 All the cables shall be identified by a punched label, tied on to each cable. Painted cable termination index board using Plywood of thickness 12mm –TW/rough finish as per instructions of site in charge with Aluminium grooved Channel frame of overall size 1200mmx1800mm –1no. shall be fixed in the relay room showing the terminal numbers circuit-wise. In case sufficient space is not available for fixing the board in one piece, it may be provided in parts retaining the overall size as per instructions of site in charge. 'As made' terminal particulars shall be prepared in RP Film duly signed and handed over to the Railway at the time of commissioning.

### **Point Machine**

#### **12.1 INSTALLATION OF POINT MACHINES**

12.1.1 Electrically operated point machines shall be fitted in level to all facing points as per standard drawing on long sleepers on extended gauge tie plate, clear of infringement.

12.1.2 The point machine shall be installed after cleaning the machine (both inside and outside) and greasing/oiling all the moving parts. The point machines shall be hand operated, detection and motor controlling contact adjusted before taking to site. All unwanted openings shall be covered with MS Sheets.

12.1.3 The point machines shall be fixed with proper size of bolts and nuts and flat/spring washers with correct size of holes on special sleepers to avoid lateral play.

12.1.4 All point connecting rods shall be connected to point machines as per standard layout/drawings without any strain and with minimum offset. All connecting rods shall be in level and correct size of pins shall be used to avoid longitudinal play. Any changes in the connecting roddings during installation which necessitates welding and off sets shall be carried out by the contractor at site. The welding shall be by smithy process. Lengthy roddings shall be supported suitably.

- 12.1.5 6.1.5 All the wooden sleepers on which the point machine is installed shall be strapped on both side with 2"x3/4" MS strap. Necessary holes [22mm] be drilled on the strap and 20mm bolts and nuts shall be used for fixing to the sleepers.
- 12.1.6 Suitable eyelet shall be used for termination of power cables using Crimping tool. The jumper wires from the point machines to the CT boxes shall be taken through flexible conduit PVC pipes and securely fixed with suitable clips. The wiring inside the point machine for motor and detector circuit shall be tested for insulation and earth and the connections tightened. 7/1.4mm 3/0.75mm PVC copper wire shall be used for wiring point machines. PVC/Nylon sleeves shall be used for identification of cable cores/jumper wires and marked with paint. Necessary grooves/wards shall be cut on the point machine at the place of insertion of crank handle, for crank handle interlocking purpose.

## **12.2 ADJUSTMENT AND TESTING OF POINT MACHINES:**

- 12.2.1 The point machines shall be worked by hand crank and the housing of switch rail with the stock rail shall be checked. All the electrical wiring shall be carried out neatly.
- 12.2.2 The point machines shall be worked both ways with proper feed. It should work without undue friction and working current shall be recorded.
- 12.2.3 The point stretcher bar and lock connections should be adjusted in such a way that with a 5mm thick obstruction piece placed between the switch and stock rail at 150mm from the toe of switch,
- The point does not get locked.
  - The point detection circuit is not completed.
  - The friction clutch disengages.
  - The tripping current does not exceed 200% of normal working current
- 12.2.4 The point machine shall be provided with EWS locks/pipe locks.

## **11 SIGNAL UNIT**

### **11.1 CASTING OF COLOUR LIGHT SIGNAL FOUNDATION:**

- 11.1.1 The work includes excavation of pit and casting of colour light signal foundations with M.S foundation bolts as per Drg.No. SG/CN/02/9. The position of signals will be indicated by Railways.
- 11.1.2 The foundations are to be plastered on all sides. Necessary earth work shall be made around the signal foundation and sufficient earth work shall be made up to the required level in the normal terrain and the cable entries shall be closed as per the instructions of Railway Representative at Site.

### **11.2 ERECTION AND WIRING OF SIGNALS:**

- 11.2.1 Signal pole shall be securely fixed to surface base and erected on signal foundation and plumbed. The gap between the signal pole and surface base shall be filled with suitable putty to avoid tilting. Soon after installation, the pole shall be painted with two coats of Aluminium paint after a coat of primer and the signal unit shall be provided with two coats of black enamel paint.
- 11.2.2 Multi-unit colour light signals up to 4 aspects shall be properly mounted on the top of signal pole where there is no route indicator. If there is route indicator a large off set bracket shall be fixed firmly with 2 nos. of 'U' bolts 3/4" thick on the signal pole for

mounting multi unit colour light signals. One 22mm through hole shall be drilled on signal pole just below the off set bracket and a 20mm through bolt shall be the provided to prevent offset bracket from sliding down.

- 11.2.3 Signal ladders with platform complete fittings, cast iron shoe and adequate number of support to suit signal pole 3.6/4.6m, shall be firmly fixed clear of infringement with suitable bolts and nuts and painted in black. The ladder shoes shall be concreted. This work also includes fixing of marker boards, enamelled number plates with suitable clamps at the required place. Speed board if any, shall be fixed on the pole with proper clamp clear of infringement as required by Railways.
- 11.2.4 Signal tail cable shall be taken through the signal pole without damaging insulation and armour, skinned and terminated on signal units. If the signal units are mounted on large offset brackets a vertical slotted hole of 50mmx50mm in size shall be made on signal pole for taking signal tail cable. Suitable protection shall be provided on the slotted hole to avoid damage to insulation of cable. Necessary lenses guard shall be provided for CLS/ Route Indicator/ Calling-on signal.
- 11.2.5 This work includes fixing of filament switching units, Triple pole double filament lamp holders in each aspect of Colour Light Signal Unit and wiring lamp circuit between Signal Transformer and Signal Aspect as per the approved circuit diagram. The Signals shall be focussed for correct visibility after fixing the Signal lamps. The unwanted aspects shall be blanked using MS sheets of 3mm thick.
- 11.2.6 All the multi unit colour light signals shall be wired with 3/0.75mm copper wire and terminated. For each aspect 2 separate wires shall be used from the terminals and the wiring shall be tested jointly. The signal shall be focussed in day time and at bright light at 90% of rated voltage. The outside 'V' cut prism section shall be correctly fixed to the respective track side for close up visibility to drivers.

**Note: Wherever LED aspects are required to be provided, fixing of CLS transformers, filament switching units, lenses, lens guards, holders and wire mesh are not necessary.**

#### 11.2.7 **BLANKING ARRANGEMENTS FOR SIGNALS:**

In case of signals with a horizontal clearance between 2.21m and 2.36m (in B.G) from the nearest track center, blanking arrangement shall be provided. MS plate not less than 8mm thick, 30cm length shall be fixed on the ladder at a height of 6.3 feet from the rail level. The end portions of the plates should be folded and made smooth so that it will not harm the person climbing the ladder. This plate shall be painted with black.

- 11.2.8 The signals shall be properly earthed in RE area only.
- 11.2.9 Necessary wooden cross shall be fixed on the newly erected signals before being brought into use.

### 11.3 **ROUTE INDICATORS: -**

Necessary lens and guarding shall be provided as required by Railways. The tail cables for route indicators shall be taken through signal pole without any damage to the insulation and armour, skinned and terminated on route indicators. Route indicators shall be wired with Wire PVC 3/0.75mm copper as per the approved circuit diagram. Hoods shall be fixed properly and examined during day time and if required extension of hoods shall be made to have proper visibility. The route indicator lamps shall be fed at 90% of rated voltage and focussed in bright day light. The route indicators shall be painted as required by Railways.

#### **11.4 CALLING - ON SIGNALS/'A' MARKER LIGHTS: -**

Calling on signals/'A' marker shall be fitted on the signal posts at required height using off-set bracket. Suitable hole shall be drilled on the signal poles to bring the cable/jumper wires. The cable/jumper wires shall be taken to calling on signal/ 'A' marker through suitable steel hose pipes and wired by using 3/0.75mm copper wire. The calling on signals shall be provided with 'C' marker and 'A' for 'A' marker. Number plates to be fixed and painted as per the standard practice in this Railway. The calling on signals/'A' marker, shall be energised at 90% of the rated voltage and focussed.

#### **11.5 REPLACING THE TAIL CABLES IN SIGNALS:**

Wherever necessary the existing tail cables shall be released from the existing signals and new tail cables shall be drawn to the aspects and terminated. The termination particulars shall be painted.

#### **11.6 SHIFTING OF SIGNALS:**

Wherever required the existing Colour Light Signals shall be shifted to clear any infringement from the tracks as instructed by Railway representative at site. The earth surrounding the foundation shall be excavated and the cable coils shall be loosened very carefully without causing any damage to the cables. The Signal shall be moved along with the foundation slowly to the new position and earthwork shall be done around the foundation. The loosened cables shall be buried at 1m depth.

#### **11.7 REPLACEMENT OF SIGNAL UNITS:**

The existing CLS units shall be removed from the signal post duly disconnecting the cables and new signal units (required as per signalling plan) shall be mounted on the existing signal pole. The tail cable is to be terminated and the signal aspect shall be wired by providing FSU, Lamps, etc. /LED and focused. If there is any blank aspect, the same shall be covered with round MS plate. Lens guard should be provided to the new CLS unit and painted.

#### **11.8 SCREENING ARRANGEMENTS:**

For the Colour Light signals in RE area which are coming in the infringing zone, screening arrangement shall be provided as required by Railways. The screen made of MS wire-mesh will be fixed on MS angles of size 25x25x6mm with suitable fixing clamps, bolts and nuts and finally painted with black.

#### **11.9 POSITION LIGHT GROUND TYPE SHUNT SIGNAL:**

11.9.1 The work involves excavation of pits and casting of shunt signal foundations as per Drg.No. SG/CN/02/10. The position of shunt signals will be indicated by the Railways. Foundation for shunt signals shall be casted with cement concrete in the ratio 1:3:6 using stone jelly of size 20/25mm. The foundations are to be plastered on all sides. Necessary earthwork shall be made for each position light shunt signals as required by the Railways.

11.9.2 The position light shunt signal shall be properly mounted and plumbed.

11.9.3 The cables are to be taken through the unit, skinned and terminated. The post type/Ground type shunt signals shall be wired with 3/0.75mm copper wire and terminated and the wiring shall be tested jointly. The shunt signal shall be focussed in day time and at bright light at 90% of rated voltage.

11.9.4 This work includes fixing of lens guard and number plates. The post shall be painted with Aluminium while the signal unit and surface base with black enamel paint.

11.9.5 The CLS units, Route Indicators, Calling-on signals, position light shunt signals post type and ground type shall be provided with EWS locks.

#### **11.10 POST TYPE SHUNT SIGNAL:**

Small off-set bracket shall be firmly fixed with 'U' bolts of suitable size on signal pole for mounting Post type shunt signals. One 22mm through hole shall be drilled on signal pole just below the off set bracket and a 20mm through bolt shall be provided to prevent offset bracket from sliding down. A vertical slotted hole of 50x50mm in size shall be made on signal pole for taking the signal tail cable. Suitable protection shall be provided on the slotted hole to avoid damage to insulation of cable. The cables are to be taken through the unit, skinned and terminated. The post type/Ground type shunt signals shall be wired with 3/0.75mm copper wire and terminated and the wiring shall be tested jointly. The shunt signal shall be focussed in day time and at bright light at 90% of rated voltage. This work includes fixing of lens guard and number plates. The post and signal unit shall be painted with Aluminium and enamel black respectively. One EWS lock shall be provided for the signal.

### **12 Track Circuit**

#### **12.1 INSTALLATION:**

12.1.1 The work includes drilling of holes, bonding of rail joints with 8 SWG GI soft solid wires. 7.2mm holes are to be drilled close to Fish Plates on the web of rail and the bond wires are to be fixed by driving channel bond pin tightly. Two bond wires are to be provided for each joint in parallel. One bond wire clip is to be provided for each joint to keep the bond wire intact. In point track circuit, parallel jumpers/ bond wires/cables shall be provided as required by the Railways with proper supporting arrangements.

12.1.2 Four TLD boxes, two each at track feed end relay end shall be fixed clear of infringement and the respective track circuit tail cables 2 x 2.5 sq.mm PVC copper conductor from the apparatus case shall be terminated in these boxes. In Point zones additional TLD boxes shall be provided for parallel jumpers as per the instruction of Railway representative at site. The connection from the TLD boxes to the rail should be through 8 SWG GI soft solid wire which should be taken through PVC sleeve if required and fixed to the rail both at feed and relay ends. The GI Wire should be clipped on to the sleepers to prevent shorting with rails.

12.1.3 Wherever glued joints are not provided, Rail Joint insulation RDSO type shall be provided with long bolts and nuts at places marked by Railways. In case of point zone track circuit, necessary insulation shall be provided for switch extension pieces/'D' brackets, throw bar lugs, gauge tie plates, crossing plates, stretcher bars, etc., as per site conditions and fixed by the contractor in the presence of Railway representative. Only non insulated gauge tie plate/crossing plate/stretcher bar for the above work will be supplied by Railways. Contractor shall use proper 10mm thick MS flat, bolts and nuts for insulating them. All the insulation shall be tested jointly. Wherever the rodding crosses track circuit zone, it shall be provided with rod joint insulation and tested.

12.1.4 Polarity bonding in each point track circuits shall be provided using 8 SWG soft wire, insulated and clipped on to sleeper. Parallel bonding shall be done wherever required. In RE area transverse bonding should be provided at both feed and relay ends by connecting 2GI 8SWG wire across the block joint as per the bonding plan.

- 12.1.5 Track circuit work includes fixing of track feed and track relay equipments in the apparatus cases as indicated by the Railway. The shelf type track relay shall be provided with suitable anti-tilting arrangement. Track relay details shall be painted on the inner side of the apparatus case door. Suitable flexible copper wire shall be used for wiring the track relay, track feed equipment, batteries, chokes, etc. and finally terminated at the terminal block. For each track circuit, secondary cell 80 AH shall be charged and installed in the apparatus case. The no. of cells and chokes to be used for each track circuit will be as per the following table.

**APPLICABLE TO PLUG-IN-TYPE TRACK RELAYS:**

Length of track circuit	No. Of cells (2.2v)	No. Of chokes (in re area only)
Upto 450M	Two	One
450M to 700M	Three	Two
Above 700 M	Four	Two

- 12.1.6 The secondary cells shall be charged by the contractor through reputed agencies. The charging of secondary cells shall be done as indicated under Item No.39.

- 12.1.7 All the TLD boxes shall be painted and Track Circuit numbers along with feed end or relay end particulars shall be neatly painted as required by Railways.

**12.2 ALTERATIONS TO TRACK CIRCUIT:**

- 12.2.1 Alterations to the existing track circuits involves by shifting the Feed end equipments/ Relay end equipments/block joints and installing them at a different locations and re-wiring them.

- 12.3** After completing the installation/alteration of track circuit, it shall be energised, tested, adjusted and readings recorded in track test record.

**13 APPARATUS CASE**

- 13.1** The work consists of pit excavation, casting foundation with bolts of adequate size having cement concrete of ratio 1:3:6 as per:-

- i) The position of apparatus case will be indicated by Railways.

- 15.1.1 Two 'E' types locks on the doors of full size apparatus case and one 'E' type lock on the front door for half size apparatus cases shall be firmly fixed and tested with 'E' type key. Locking and unlocking shall be smooth with least force. Suitable fixing arrangements for 'E' type lock on the door of apparatus case shall be fabricated by the contractor, if such arrangements does not exist. One hard wood shelf plank 37mm thick, planed and varnished shall be firmly fixed for all types apparatus cases/ battery boxes. Also latching arrangement for the back door shall be provided, if required.

- 15.1.2 All the apparatus cases (Full/Half/Quarter) are to be painted with Aluminium on the outsides and the location numbers are to be painted in 'Bold' letters.

## **15.2 CABLE TERMINATION BOX FOR CABLE THROUGHING, POINT MACHINE:**

- 15.2.1 Excavating earth and casting concreted foundation as per Drg.No. SG/CN/02/8 and C.T. boxes are to be erected on Rail vertically by using suitable size of bolts and nuts. The cables shall be taken through 2 Nos. of G.I. Pipes of size 32mm inner dia and 300mm length fixed at the bottom of the CTB with suitable fixing arrangements. It shall be ensured that there should be no break in the cable core during the process of taking the cables through pipes.
- 15.2.2 In case of CTB for Point machine, one no. of GI pipe 150mm long shall be fixed at the side of the CTB for drawal of jumper wires from point machines/lever locks with proper fixing arrangements. The CTB should be provided with EWS lock.
- 15.2.3 CT Box shall be painted with Aluminium paint and rails with black paint. The circuit particulars shall be painted neatly on the CT Box cover and the location number have to be painted in 'BOLD' letter.

## **15.3 SHIFTING OF APPARATUS CASES/ CT BOXES:**

The work consists of excavation of pit around the existing apparatus cases full/ half size and CT boxes, shifting of the location box along with foundation clear of infringement from the track. The pit shall be excavated with maximum care to avoid any possibility of damage to the existing cables. The location box shall then be shifted carefully along with the foundation and cable termination, equipments etc., without disturbing the wiring. While shifting apparatus cases of full size, the brick wall covering the cables shall be broken before shifting the location box. After the location box is shifted, brick masonry walls shall be constructed on the front and back sides of the location box foundation. River sand shall be filled upto to the floor of the location and the bottom shall be sealed with sealing compound.

## **15.4 CABLE TERMINATION IN APPARATUS CASES/CTB's:**

- 15.4.1 At each apparatus case/CTB, the work consists of fixing all cables, fixing of Phynolic synthetic industrial fibre base fine weave cotton fibre sheet - 6mm thick to IS specification 2036 - 1995 - Type board along with terminal blocks and termination of cables/cores (conductors) using PVC/Nylon sleeves.
- 15.4.2 The underground signalling cable-main, tail and power shall be properly secured by wooden clamps of 50mm x 50mm teak wood inside apparatus case on 25mm x 100mm base plank. The cables shall be neatly skinned duly mending and taping of cable ends for termination bunched and terminated on the terminal board at the required place in order as per approved apparatus case circuit diagram. All the aluminium power cables of size 10 Sq.mm and above shall be provided with Aluminium lugs using crimping tool of appropriate size.
- 15.4.3 Railway will indicate approximate total number of cable core, terminations to be made in the apparatus cases/cable termination boxes. The contractor shall fix Phynolic synthetic industrial fibre base fine weave cotton fibre sheet - 6mm thick to IS specification 2036 - 1995 - Type F5 sheet as required by Railway. Terminal blocks with links, fuse blocks with fuse shall be fixed on the terminal board pertaining to each apparatus case and cable termination box using proper size of wood screws. Two suitable holes shall be made on either side of terminal block and fuse block for bringing cable for termination. The contractor shall prepare cable termination and wiring details of apparatus cases and C.T. boxes and obtain the approval of the Railway Engineer before execution as per the approved cable plan. Termination of main cables, tail cables, power cables, core/cores shall be made at the proper terminal as per approved wiring diagram pertaining to each apparatus case and C.T. Boxes. Before final termination, each cable shall be tested for continuity, insulation etc. and readings recorded and jointly tested and signed.



- 15.4.4 As per site conditions, the termination of new cables may be required on the existing terminal blocks or by fixing new terminal/fuse blocks in old apparatus cases which shall be done as per approved circuit diagram wherever required. The terminal particulars are to be re-painted or corrected on the doors of apparatus cases as instructed by Railways. Suitable clamping arrangements have to be made for the new cables and also the bottom the opening of the apparatus cases shall be closed with masonry brick work and sealed with cable compound.
- 15.4.5 After fixing all the signalling cables inside the apparatus case, the side opening shall be closed with masonry work and plastered. The inner side is filled with Sand and finally the bottom is sealed with sealing compound.
- 15.4.6 All the underground cables shall be provided with punched name plates showing total no. of cores, cross section of each core, Aluminium or copper conductor and from and to details etc. and also painted inside each apparatus case.
- 15.4.7 The contractor shall submit final 'As made' details for each apparatus case and C.T. box in R.P. Film duly signed. As made shall also show the position of various equipment fixed in each CT Box, apparatus case and battery box, cable details, from and to etc. PVC/NYLON sleeves shall be provided on each cable and cable core number and name of circuit shall be painted on them.

#### **15.5 WIRING OF SIGNALS/LC GATE CONTROL/TRACK CIRCUIT/POINT CONTROL RELAYS IN LOCATIONS:**

- 15.5.1 Relays, Plug in type HMUs, transformers, heavy duty contact relays and other gadgets controlling the above functions shall be firmly fixed on suitable relay frames using MS Angles of size 25mmx25mmx6mm and MS Flats of size 25mmx6mm inside respective apparatus cases. The MS relay frame shall be painted before fixing. Laminated Termite Proof Particles board of 25mm thick of requisite size shall be fixed in side the apparatus case for fixing Resistance and Electrolytic condensers. In case of shelf type relays, the relays shall be mounted on shelf planks with suitable anti-tilting arrangement. If plug in type relays are used, 16/0.2mm flexible copper wire shall be used for wiring. For shelf type relay and point motor circuit, 3/0.75mm copper wire shall be used. There shall be no joint in the wire. For soldering the wire to relay clips of Plug-in-type relays in relay racks, best quality rosin core solder shall be used. The complete wiring shall be tested jointly and linked to tail cable.
- 15.5.2 The description of all relays, fixed in each apparatus case shall be painted inside apparatus case doors. PVC/Nylon sleeves shall be provided on each wire before termination on terminal block. The name of the circuit and wire where connected shall also painted on the sleeves.
- 15.5.3 Wire should be soldered to relay clips and suitable copper eyelets crimped with crimping tools shall be adopted before the termination. The wiring and termination shall be carried out as per the approved circuit diagram. The relays details shall be painted. PVC/Nylon sleeves shall be provided for each wire before termination and the details of circuit and where the wires connected etc., shall be painted on the sleeves. The complete wiring shall be tested.

#### **15.6 ALTERATIONS TO PAINTING PARTICULARS AT LOCATION BOXES:**

Consequent to introduction of new circuits or alterations to existing circuits in apparatus cases/CTB, new nomenclature should be painted on the cable sleeve. And also the new particulars should be painted on the inner side of the doors at apparatus cases/CTB.

## **15.7 FILLING OF EARTH AROUND LOCATIONS:**

The work consists of filling of earth around the foundations of signals and apparatus cases for a width of 0.5m on all sides from 150mm below the foundation top to ground level. The earth shall be consolidated after filling.

## **14 Block Instrument**

16.1 Double line block instruments, Neale's Token instruments and Daido single line block instrument FM type shall be mounted on a block counter. All the outer sides and top of the counter shall be pasted with decolum sheets of required colour as indicated by railways.

16.2 Podanur type single line push button tokenless instrument shall be fixed on the ground as indicated by Railways.

16.3 Necessary Terminal Blocks and Fuse Blocks shall be fixed inside the Block Counter for termination of jumper wires and cables. Cable shall be fixed properly inside block counter and terminated. The Block relays shall be placed inside the Counter and shelf type relays shall be fixed firmly using antitilting arrangements. The relays shall be wired and properly identified.

16.4 In case of overhead alignment, the control and block lines shall be brought separately to the glass fronted test panel and terminated using wire PVC 3/0.75mm copper, through PVC tubes of 15/20mm, clamped to the wall. The test Panel shall be manufactured using T.W 25mm thick and separate doors shall be provided for block and controls. 4 Nos. of DPDT switches and required number of Lightning Discharger shall be fixed. The lead-in wires shall be soldered to the Block and Control Lines at the Wall Bracket.

16.4.1 From the termination box, block wires should be taken through PVC tube of suitable size suitably clamped in the wall and terminated inside the block counter.

16.4.2 The inter connection between the instrument and line battery (provided in the battery room) shall be done with underground cables.

16.5 In RE area block filters and block bell equipments should be installed and wired. The work involves installation of Block Filters and Block Bell equipments on a stand made with MS angles 50mmx50mmx6mm grouted to wall with T.W top plank of 25mm thick, termination of jumper wires in T.W Terminal box of size 300mmx450mmx100mm, and wiring including interconnection between Terminal Box.

16.6 The block counter shall be provided with a suitable lock with 2 keys.

16.7 Separate block earth shall be provided for each section on either side.

## **16.8 INSTALLATION OF WAY STATION EQUIPMENTS:**

The way station equipment such as selector, selector bell box shall be fixed at appropriate places and wired. The control telephone and battery shall be installed in suitable place and battery boxes manufactured out of TW. The wiring between the test panel/termination box and telephone cum battery box shall be carried out with PVC copper wire 3/0.75mm. The wiring from the equipment and telephone shall be carried out by using signalling cable.

#### **14.1 ERECTION AND WIRING OF CONTROL PANEL CUM ILLUMINATED DIAGRAM: -**

- 14.1.1 The LC control panel cum illuminated diagram shall be installed firmly as indicated by the Railways on suitable supports. Before commencing wiring, the particulars shall be painted in the inner side. This shall be wired with 16/0.2mm PVC flexible copper wire by soldering process using best quality of solder. The wires shall be taken through suitable PVC pipes from the Terminal box. Precautions shall be taken such that there is no break in the wire and damage to the insulation for the connecting wires. Each wire shall be identified properly. Sufficient spare wires shall be run and terminated duly identified.
- 14.1.2 The wiring shall be done in such a manner that enough working space is available for replacement of indication lamps and attend to wiring. The wiring shall be neatly bunched. The frames and board doors shall be painted as required.

#### **14.2 INTERLOCKING OF LEVEL CROSSING GATES WITH LIFTING BARRIERS:**

- 14.2.1 Excavation of pit, concreting foundation as per Drg.No.SG/CN/ 11 and erection of ground lever frame using suitable bolts and nuts. Casting of A type foundations for mounting the cranks is included in the scope of this work. All the foundations will be plastered on the top.
- 14.2.2 Making rod connection from the Ground lever frame to the boom locking mechanism through cranks, adjusting and testing the boom locking from ground lever frame. The rod run shall be at rail level and gap of not less than 40mm shall be maintained while crossing the track. All the joints of rod connecting cranks and levers shall be smithy welded. The rod run between the track shall be insulated while crossing the track circuited portion. The Lengthy roddings shall be run on roller stands fixed on trestle located not more than 2.2 Metres between adjacent supports.
- 14.2.3 The gate interlocking arrangement shall be carried out as per the standard practice of S.Rly. as per the instructions of the Railway representative at site. Necessary interlocking shall be carried out in the locking tray of the ground frame wherever required by the railways. The locking tray is to be locked and sealed.
- 14.2.4 The lifting Barrier will be painted with two coats of enamel paint of approved quality as given below:
- a) Stands-Black
  - b) Boom with fringes: Black and Yellow stripe 300 mm wide alternatively
  - c) Stop Disc on the boom: Red.
- 14.2.5 Florescent paper strips should be pasted on both the lifting barrier boom.

#### **14.3 INTERLOCKING OF SWING GATES:**

This work consists of fixing of gate locks on the each gate. The gate lock consists of 2 Nos. of 'E' type locks. for each gate fixed on suitable MS flat min.10 mm thick as instructed by Railway representative at site. The arrangement shall be painted as per standard Railway practice.

#### **14.4 INSTALLATION OF ELECTRONIC GATE WARNING EQUIPMENT:**

The work includes fixing of Gate warning equipment on suitable fixtures as per Railway standard for LC gates - 2 Nos. one on each side of the track, fixing of amplifier at apparatus case and hooter at Road warning signal post, wiring as per approved circuit diagram and painting.

#### **14.5 ERECTION AND WIRING OF CONTROL PANEL:**

##### **14.5.1 ERECTION:**

The control panel shall be erected on suitable teak wood base frame of size 50mmx150mm in the SM's room at suitable place on proper foundation bolts and cement concreted. Before erecting the control panel, suitable duct shall be made for bringing the jumper cable into the control panel from relay room/power room if necessary. The interspace of the cable duct after placing all the cables shall be filled with river sand, before closing the duct with slabs.

14.5.2 The cables shall be clamped using TW 25mmx150mm base plank and 50mmx50mm TW clamp and the cable entries sealed using cable compound.

#### **14.6 WIRING:**

14.6.1 The control panel shall be wired including all thumb switches, Push buttons, indicators, counters, bell/buzzers and emergency push, etc. The wiring shall be done with flexible PVC copper wire 16/02mm or by switch board cable by soldering the wire to the terminal clips. High grade solder wire should be used. The wiring shall be done in such a manner that enough working space is available for replacement of knobs/buttons and attend to wiring. The wiring shall be neatly bunched.

14.6.2 Spare contacts in thumb switches and push buttons shall be paralleled. The contractor shall protect the control panel top plates while doing the wiring. The terminal particulars, power supply points, thumb switch/push button numbers, signals/track numbers shall be neatly painted on the inner side of the top plate. Before commencing wiring, all thumb switches, push buttons, indications shall be tested for proper contact and defectives shall be replaced in the initial stage itself. The indication lamp details shall be painted on the inner side of the top plate at respective places. Precautions shall be taken such that there is no break in the wires and damage to the insulation. There shall be no joint in the connecting wires. Each wire shall be identified properly.

14.6.3 One Voltmeter 0-300V AC for signal supply shall be mounted in Panel/panel room.

14.6.4 The required number of buzzers operating on 24V DC as per approved circuit diagram for low voltage monitoring, signal blanking and approach warning, etc. shall be provided in the panel and wired.

14.6.5 One TW stand/tray shall be manufactured and kept at the Panel room for keeping different types of caps.

14.6.6 During the course of work, any modification to the panel/panel wiring shall be done by the contractor at site as required by the Railways at free of cost before final commissioning.

14.6.7 The work of alteration to control panel wiring includes drilling of holes on the Top plate wherever required and fixing of switches, push buttons, LEDs/ indication lamps with holder, termination of cables and carrying out alteration to the existing wiring as per approved circuits diagram, releasing of wires, and painting of particulars on the panel. If there are any small holes after releasing the switches or buttons, etc., the same may be plugged, covered with putty and painted neatly.

14.6.8 The cable termination and internal wiring terminal particulars of control panel shall be made on R.P Film duly signed by the contractor and handed over to the Railways.

14.6.9 The frames and the back doors shall be painted as required.

14.6.10 **INSTALLATION OF SM's SLIDE INSTRUMENT AT STATION/LC:**

**i) AT STATION**

a. SM's Slide Instruments shall be installed at the Station on suitable block counters. T.W plank 25mm thick shall be fixed on the top of the Block counter over which the S.M's Slide control instrument shall be fixed. Sufficient working space shall be left for carrying out wiring. Wiring shall be done with 3/0.75mm copper wire. Care shall be taken to keep the wiring free from the slides. The spare contacts shall be paralleled.

b. Wiring leads brought out from SM's Control Instrument shall be terminated inside the counter. The signalling cables shall also be terminated inside the counters using PBT terminals fixed on Phynolic synthetic industrial fibre base fine weave cotton fibre sheet - 6mm thick to IS specification 2036 - 1995 -Type F5 sheet. The terminals particulars shall be neatly painted on the inner side of the doors. No wiring shall be exposed. Suitable colour decolum sheets shall be pasted on all outsides and top of the block counter.

14.6.11 At LCs the SM slide instrument shall be installed on a shelf made using hardwood plank of size 25mm thick. The plank shall be fixed on 2 MS angles 50x50x6mm of suitable length and grouted on the wall. The cable shall be taken through GI pipe from ground level. For termination of cables, a termination box of size 50cmx60cm made up of HW with decolum finish fitted with PBT terminals shall be fixed below the SM's slide instrument. The SM's control instrument shall be wired as per the approved circuit diagram. The particulars of the terminal shall be painted on the inside door of the termination box.

14.6.12 The SM's Slide Instrument shall be painted suitably as desired by Railways.

14.6.13 The SM's Control Instrument shall be earthed.

**14.7 ELECTRIC KEY TRANSMITTER AT STATION HOUSE:**

14.7.1 Electric key transmitter with/without crank handle fixed to the key shall be installed firmly on suitable angle supports and teakwood boards in the place indicated by Railways, with economiser push switch and wired. The cables shall be terminated on a terminal box made using 25mm thick T.W. Planks with decolum finish and locking

facilities. Required number of terminal blocks shall be fixed inside the terminal box for termination of cables and jumper wires. The wiring shall not be exposed. The cables shall be taken to the terminal box using HDPE pipes of 50mm dia. The crank handle shall be welded to the key in such a manner that there is no undue strain to the EKT contacts. The EKT should be painted and the circuit particulars and ward nos. are to be painted in bold letters.

#### **14.7.2 INSTALLATION OF EMERGENCY KEY PROVING CONTACT:**

- a. E' type lock having long plunger and key contact shall be assembled and shall be kept in a glass fronted decorated box and wired. The box shall have the locking and sealing facility using 6 levers NAVTAL LOCK with duplicate keys.
- b. The contacts shall be made when the key is 'IN' and contacts shall break when the key is disturbed or taken 'OUT' using a limit switch.

### **14.8 INTERLOCKING OF SIDING POINTS/TRAP POINTS: -**

- 14.8.1 For siding points with succession key lock arrangements and trap points, hand plunger lock fitted with "E" type locks shall be provided on gauge tie plates with suitable bolts and nuts. This work includes fixing of switch extension pieces and split stretcher bars. Notches on split stretcher bars shall be cut at site.
- 14.8.2 It shall be ensured that, it is not possible to lock the points with an obstruction of 5mm test piece placed between switch and stock rail at 150mm from the toe of the switch.
- 14.8.3 'E' type lock shall be fitted to the hand plunger locks with proper bolts and nuts. After ensuring the free as well as the full movement of the plunger, marking shall be done and notches cut on the plunger.
- 14.8.4 Proper lubrication shall be done for the smooth operation of points, HP locks and 'E' type locks.

### **14.9 FIXING OF FACING POINT LOCK:**

- 14.9.1 For points single end and double end, the required Facing point locks should be fixed on the gauge tie plats. Necessary holes are to be drilled for fixing FPL. On split stretchers, necessary notches are to be cut for correct functioning. The FPL is to be connected to the Rod Transmission through cranks. Necessary smithy work, if required, should be carried out for achieving correct length of the rods. For facing point lock, the lock bar also is to be fixed. All the fittings like FPL, split stretchers are to be painted with black. A MS cover is to be provided for FPL.

#### **14.9.2 PROTECTION BAR/LOCK BAR:**

The protection bar/lock bar, if required, should be fixed close to the stock rail as per Signalling plan. The required lock bar clips (12 Nos.) and stops (4 Nos.) are to be fixed correctly. Necessary holes are to be drilled on the protection bar/lock bar for fixing lock bar clips and the lock bar driving arrangement should be riveted. The same is to be connected to the crank through 32mm solid rods and solid joints. Necessary cranks are to be fitted on the sleeper and connected. The protection bar, clips, stops, etc. are to be painted with black paint. Finally, it should be tested for correct functioning.

### **14.9.3 FIXING OF POINT/TRAP INDICATORS:**

Point indicators and Trap indicators shall be provided at places indicated in the Signalling plan. These indicators shall be firmly fitted on indicator stand on long sleepers/CI stands concreted firmly to the ground through suitable bolts and nuts complete with all ground connections, clear of infringements. Proper size of pins shall be used to avoid longitudinal play. All joints shall be smithy welded only. The indicators shall be adjusted properly and painted suitably.

### **14.10 FIXING OF ELECTRICAL DETECTOR:**

14.10.1 The electrical detector shall be fixed on the extended gauge tie plate firmly. The switch extension piece shall be fixed on the switches and the point is to be connected with electrical detector by using ground connections. If any smithy work is involved, the same shall be carried out on the ground connection rods.

14.10.2 A TLD box shall be fixed near the electrical detector and the cable is terminated inside the TLD box. The electrical detector shall be wired with 3/0.75mm copper and the jumper wire shall be taken through hose pipe between electrical detector and TLD box.

14.10.3 The electrical detector shall be painted with Aluminium paint and the point ground connections, TLD box with black paint. The working of electrical detector shall be tested in presence of Railway representative to conform to obstruction test.

## **15 Releasing**

### **15.1 RELEASING OF S & T GEARS:**

15.1.1 An inventory of all the S&T gears to be released in the yard should be taken up jointly with Railway's representative duly indicating as serviceable or unserviceable before NI working commences. The same should be submitted and approved by the Engineering in-charge.

15.1.2 The S&T gears as mentioned in the schedule should be released carefully without damage and stacked at a place indicated by the Railway representative.

15.1.3 All the concrete foundation of the released gears like signals, location boxes, 'A' type bases, etc. should be broken completely. The resultant pit shall be refilled with earth, rammed and re-surfaced. In case of releasing the stands grouted on the walls/floor should be restored to original condition and neatly plastered.

15.1.4 All the unserviceable released materials shall be guarded by the contractor till they are auctioned.

### **15.2 TRANSPORTATION OF SERVICEABLE MATERIALS: -**

The released serviceable materials shall be transported from the work spot to the Stores Depot as mentioned in Vol. I. Loading and Unloading of materials shall be done by the contractor. The released material shall be stacked neatly by the contractor in the Railway Stores.

## 16 Miscellaneous

### 16.1 PROVISION OF LOCKS:

Universal locks (EWS Locks)/GI locks/Navtal Locks shall be provided for CLS units, Route Indicators, point machines, apparatus cases, battery boxes and C.T. boxes wherever necessary.

### 16.2 PAINTING:

16.2.1 Block instruments, Block counters, control panel, EKT's and all signalling gears installed shall be painted in accordance with the standard practice of Southern Railway and as per Signal Engineering Manual.

16.2.2 While painting, initially one coat of primer and afterwards 2 coats of enamel paint shall be applied.

16.2.3 The details of paints to be used on the signaling gears are shown below: -

S.No.	Signalling Gadgets	Colour to be painted. (Outside)
I.	Signal (Colour Light Signal) & Shunt Signal: (i) Surface base (ii) Post (iii) Aspect unit complete	Black Aluminium Black
II.	All types of apparatus cases and cable termination box	Aluminium
III.	Track Lead Disconnection Box	Black
IV.	SM's Control Frame Instrument	Green Enamel
V.	Point machines	Black
VI.	Electrical Detectors	Aluminium
VII.	Electrical Lever locks & Circuit Controller	Black
VIII.	Key Transmitters	Red or Black
IX.	(i)Double line SGE Block Instrument (ii)Single Line Token Instrument (iii)Single Line Tokenless Instrument	Green Enamel Grey Enamel Green Enamel
X.	(i)Interlocking frame supports, quadrants, lever below quadrants, locking trough, catch handle connection & Indication plates (ii)Down rods between Lever tail and crank (iii)All types of cranks, compensators, Facing point Locks, lock bars & Detectors. (iv)Roddings & Rod Rollers	Black Black Black  Red Oxide Paint
XI.	i)Point Lever (ii)Lock Lever (iii)LC Gate Control Lever (iv)Spare Lever (v)Signal Lever	Black Blue Chocolate White Red
XII.	Rails	Black



**16.3 ROCUREMENT OF CEMENT:**

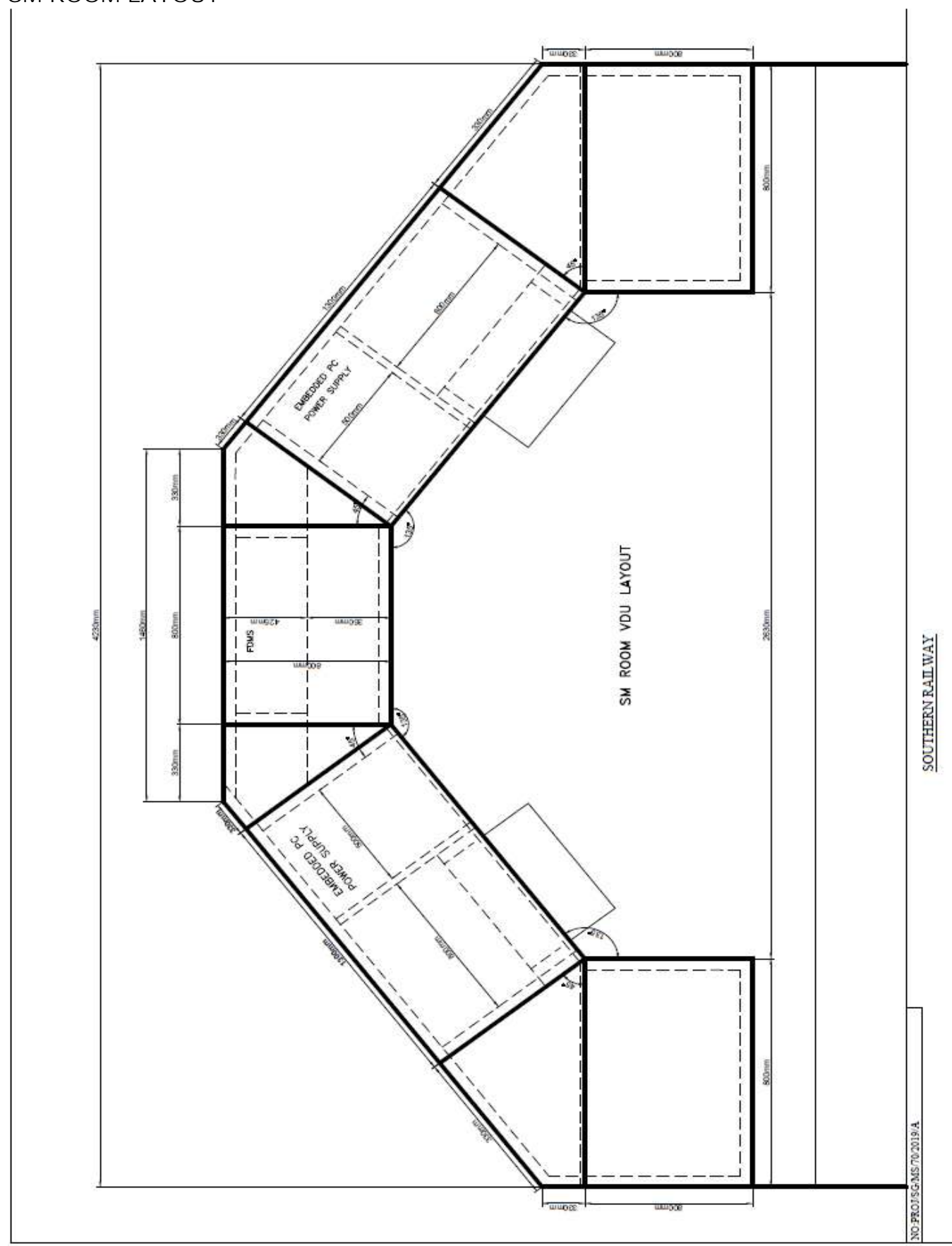
- 16.3.1 Cement for use in the works shall be procured by the contractor from the main producers/their authorised dealers/ authorised stock yards which shall conform to BIS Specifications.
- 16.3.2 Cement bags preferably in paper bag packing should bear the following information in legible marking:
- (i) Manufacturer's name
  - (ii) Registered Trade Mark of manufacturer, if any
  - (iii) Type of cement
  - (iv) Weight of each bag in kgs. or No. of bags/tonne.
  - (v) Date of manufacturer, generally marked as week of the year/year of manufacturer, e.g., 30/93 which means of 30th week of 1993.
- 16.3.3 To ensure quality control, test certificates from the manufacturer should be produced by the contractors, which should confirm to the relevant specifications [latest may be incorporated].
- 16.3.4 Railways may also take samples during the course of the work and get the cement tested to ascertain their conformity to specifications.
- 16.3.5 When such sampling is done, it shall be as per IS Specifications.
- 16.3.6 Test on the cement as per IS: 4301 shall be carried out in the field level. Some of the tests which may be carried out are:
- (i) Compressive strength
  - (ii) Initial and final setting time
  - (iii) Consistency
  - (iv) Soundness

## LIST OF DRAWINGS

Sl.No	Description
1	Sm Room Layout
2	Provision Of Power Equipment Stand
3	Earthing Electrode
4	Earthing Arrangement For Signals, Location Boxes
5	Copper Plate Earthing Arrangement
6	Bonding & Earthing Connections For Signalling Equipments
7	"A" Marker Retro Reflective Sheet
8	Clamp For Main Signal
9	SM TABLE WITH DUAL Vdus
10	Sm's Room Vdu Layout
11	Able Termination And Relay Room Layout
12	Thickweb Switch Point Machine And Layout
13	MS AND GI FLAT EARTHING BOXES
14	Drawing of Earth Electrodes
15	CABLE TERMINATION IN APPARATUS CASES/CTB's
16	DRAWING FOR RCC CABLE MARKER
17	DRAWING FOR CABLE LAYING WHEN ROCK FACED AT 300 MM DEPTH FROM GROUND LEVEL
18	DRAWING FOR RCC DUCT 500 MM
19	DRAWING OF DWC SPLIT PIPE (120 MM DIA.)
20	RCC DUCT
21	DRAWING FOR ROAD / TRACK CROSSING
22	DRAWING FOR ROAD / TRACK CROSSING
23	HORIZONTAL BORING
24	DRAWING FOR LAYING ON CULVERTS
25	.DRAWING FOR CABLE LAYING ON CULVERTS WITH HIGH FLOOD LEVEL
26	CABLE PLAN FOR ELECTRIC LIFTING BARRIER (ELB) AT STATION
27	SCHEME OF POWER SUPPLY ARRANGEMENT FOR DISTRIBUTED EI WITH TWO END GOOMTIES (NON-RE

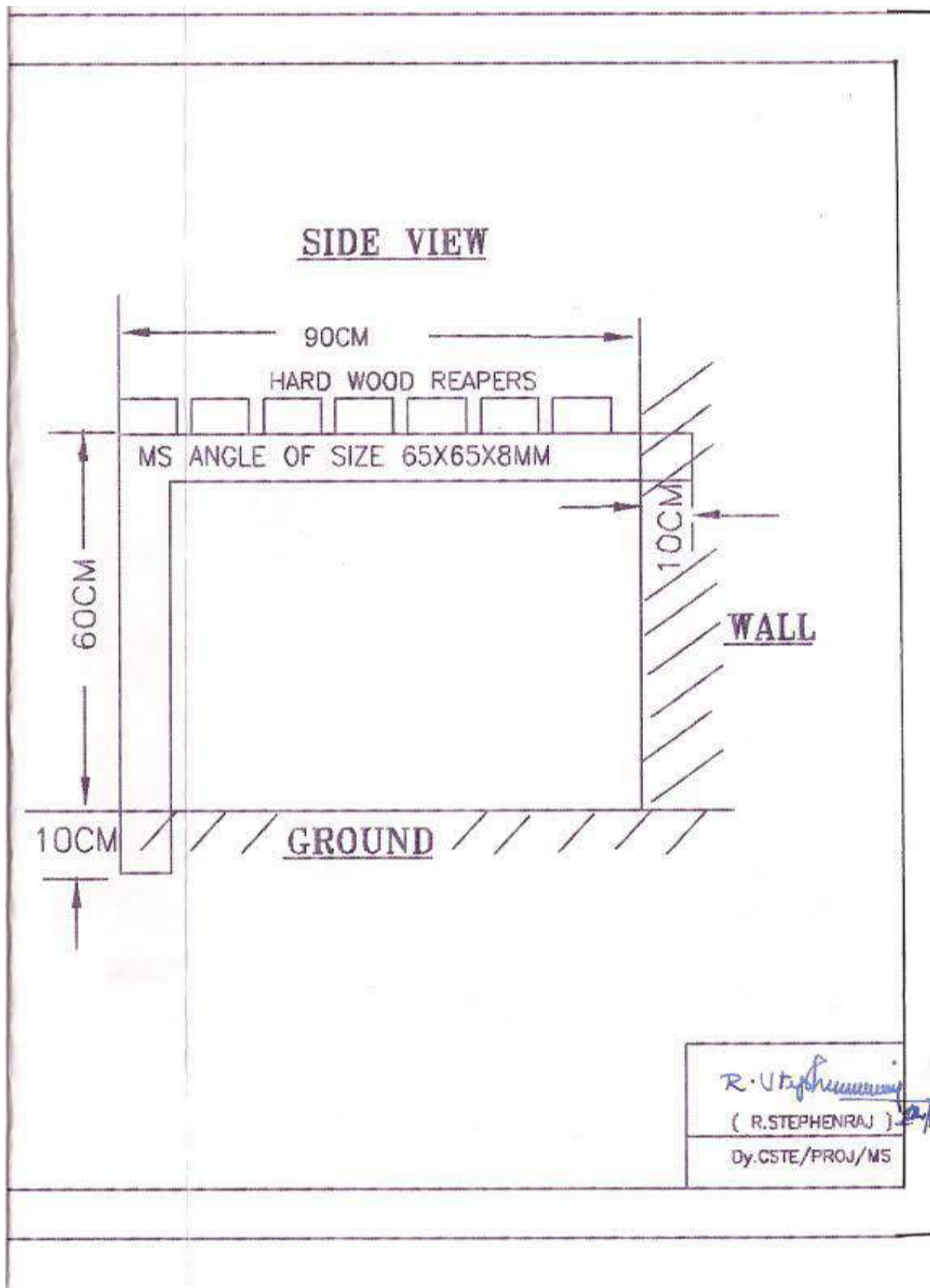
28	SCHEME OF POWER SUPPLY ARRANGEMENT FOR DISTRIBUTED EI WITH TWO END GOOMTIES (RE)
29	POWER SUPPLY ARRANGEMENT FOR DISTRIBUTED EI (NON-RE) FOR A 6 ROAD JUNCTION STATION
30	POWER SUPPLY ARRANGEMENT FOR DISTRIBUTED EI (RE) FOR A 6 ROAD JUNCTION STATION
31	POWER SUPPLY ARRANGEMENT FOR CENTRAL EI (NON-RE) FOR A 4 ROAD JUNCTION STATION
32	POWER SUPPLY ARRANGEMENT FOR CENTRAL EI (RE) FOR A 4 ROAD JUNCTION STATION
33	POWER SUPPLY ARRANGEMENT FOR CENTRAL EI (NON-RE) FOR A 6 ROAD JUNCTION STATION
34	POWER SUPPLY ARRANGEMENT FOR DISTRIBUTED EI (RE) FOR A 6 ROAD JUNCTION STATION
35	IPS ARRANGEMENT FOR INTERLOCKED LC GATE & IBS
36	DRAWING FOR TRACK LEAD CABLE CONNECTIONS
37	FILTER UNIT FOR BLOCK CIRCUITS
38	APPARATUS CASE FULL SIZE FOUNDATION
39	APPARATUS CASE HALF/QUARTER SIZE FOUNDATION
40	MAIN SIGNAL POST FOUNDATION
41	SHUNT SIGNAL FOUNDATION
42	CHASE CUTTING IN ROCKY AREA
43	CHASE CUTTING IN ROCKY AREA
44	FOUNDATION FOR APPARATUS CASE (HALF/QUARTER)
45	FOUNDATION FOR CABLE TERMINATION BOX
46	FOUNDATION FOR COLOUR LIGHT SIGNAL
47	FOUNDATION FOR SHUNT SIGNAL
48	FOUNDATION FOR GROUND LEVEL FRAME
49	MASONARY PLAT FORM FOR SIGNAL POST TELEPHONE
50	LADDER
51	Earthing Arrangement ABS Hut
52	CLASS A LIGHTENING PROTECTION
53	TYPICAL BONDING AND EARTHING CONNECTIONS FOR SIGNALLING EQUIPMENTS
54	Enamelled Number plate

## SM ROOM LAYOUT



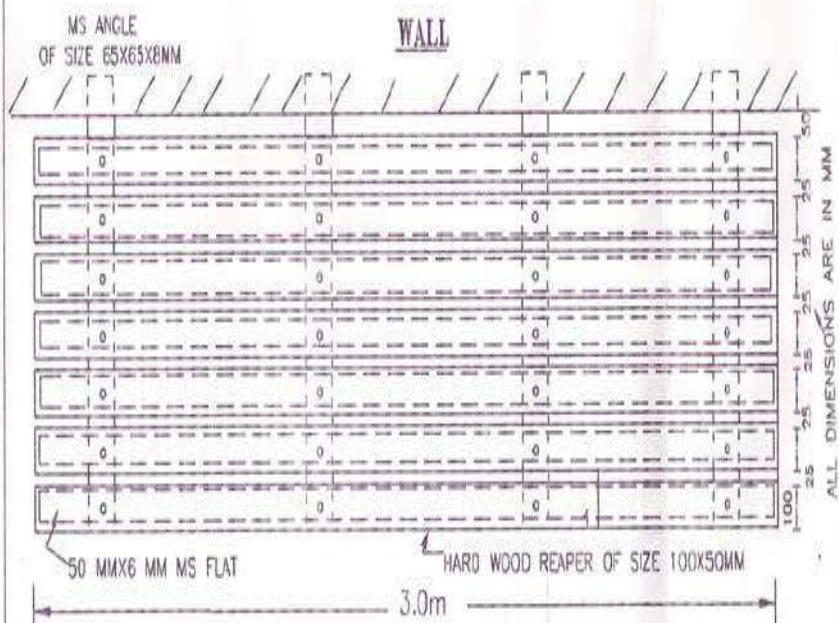
Provision of power equipment Stand:

Drawing No. Proj/SG/MS/54/2008



# PROPOSED POWER RACK

## TOP VIEW



PROJ/SG/MS/54/2008

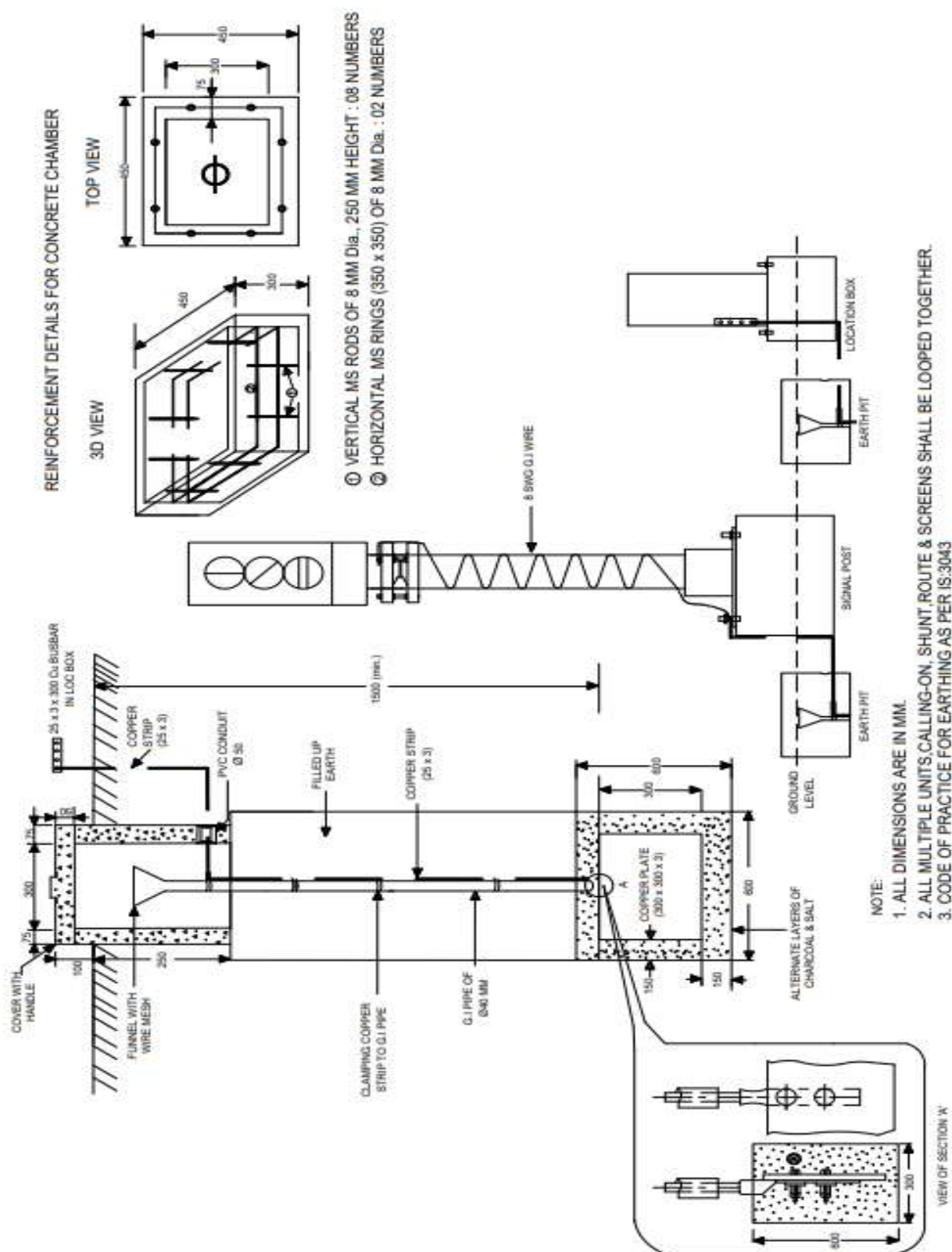
DRAWN	SANTOSH KUMAR
CHECKED SSE/DRG/P/MS	<i>[Signature]</i>
XSTE/PROJ/MS	<i>[Signature]</i>



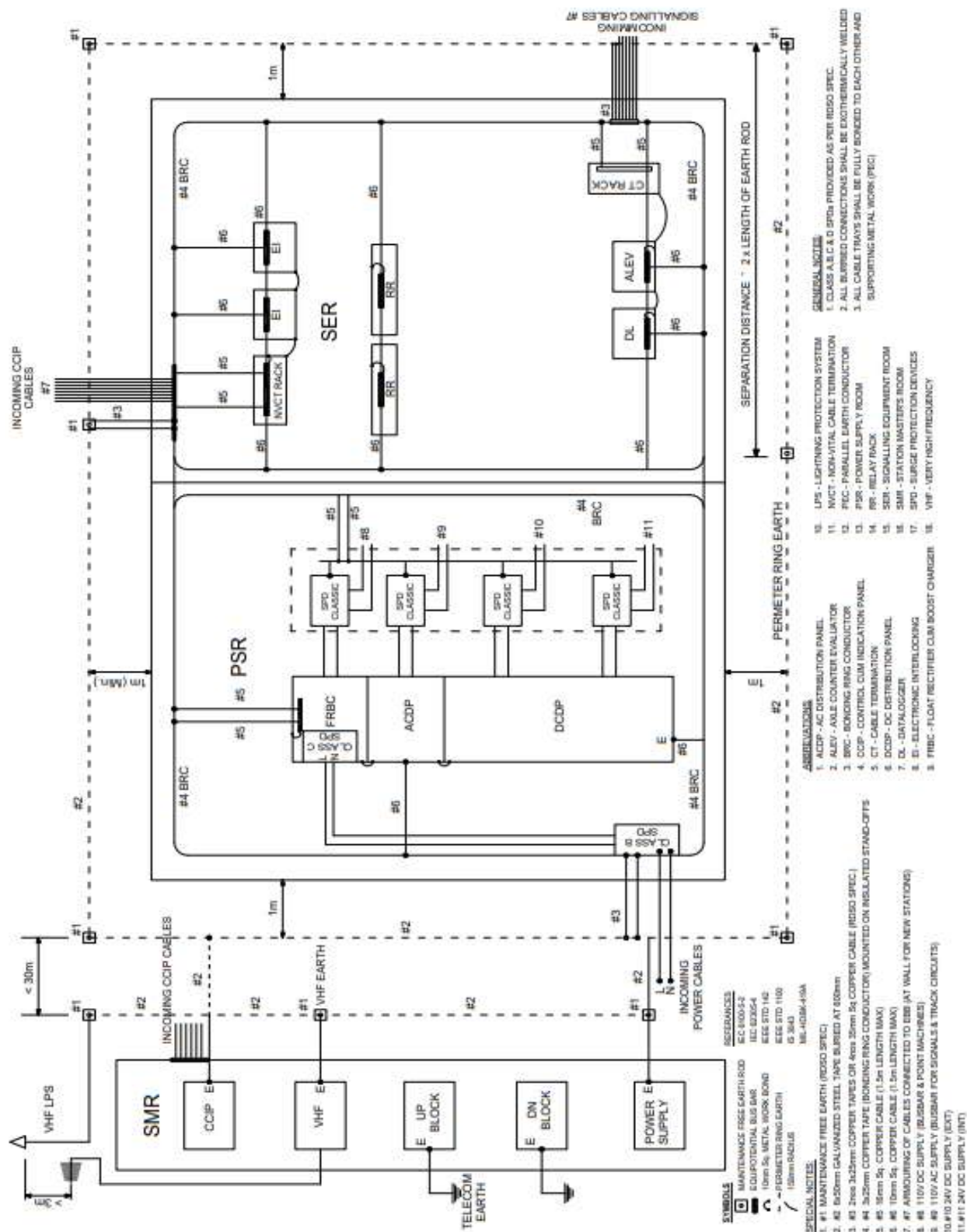




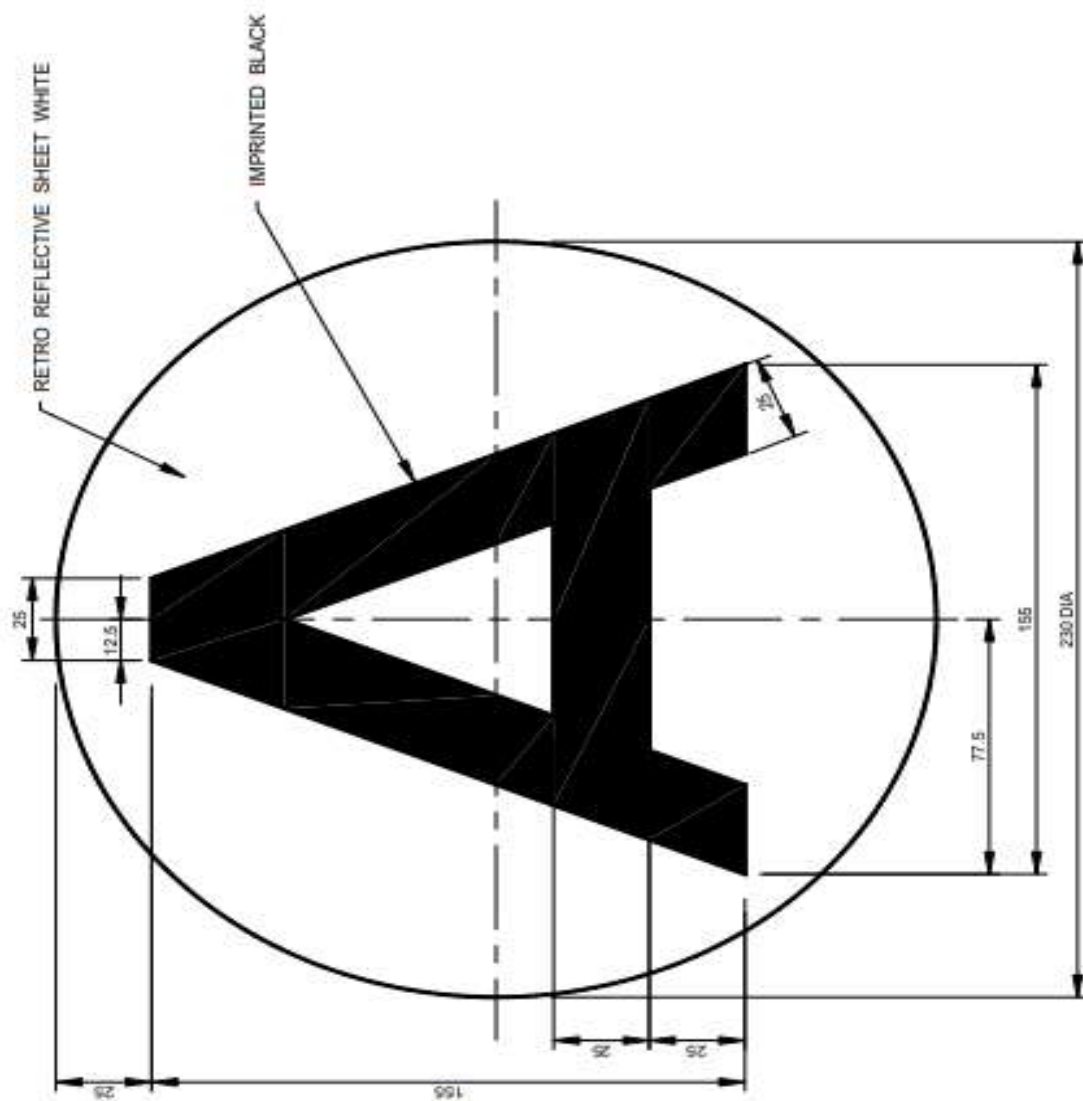
## COPPER PLATE EARTHING ARRANGEMENT



## BONDING &amp; EARTHING CONNECTIONS FOR SIGNALLING EQUIPMENTS



# "A" MARKER RETRO REFLECTIVE SHEET



## MATERIAL :-

RETRO REFLECTIVE SHEET HIGH INTENSITY GRADE WHITE WITH

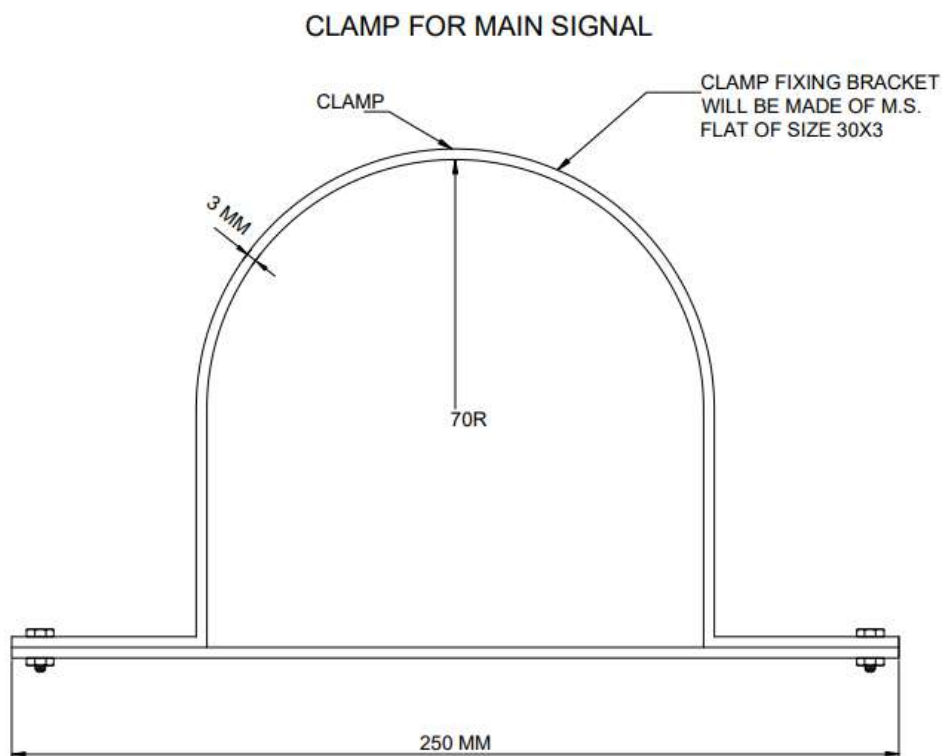
IMPRINTED 'A' IN BLACK

WITH FILM THICKNESS 0.3 mm

TOLERANCE AS PER APPLICABLE

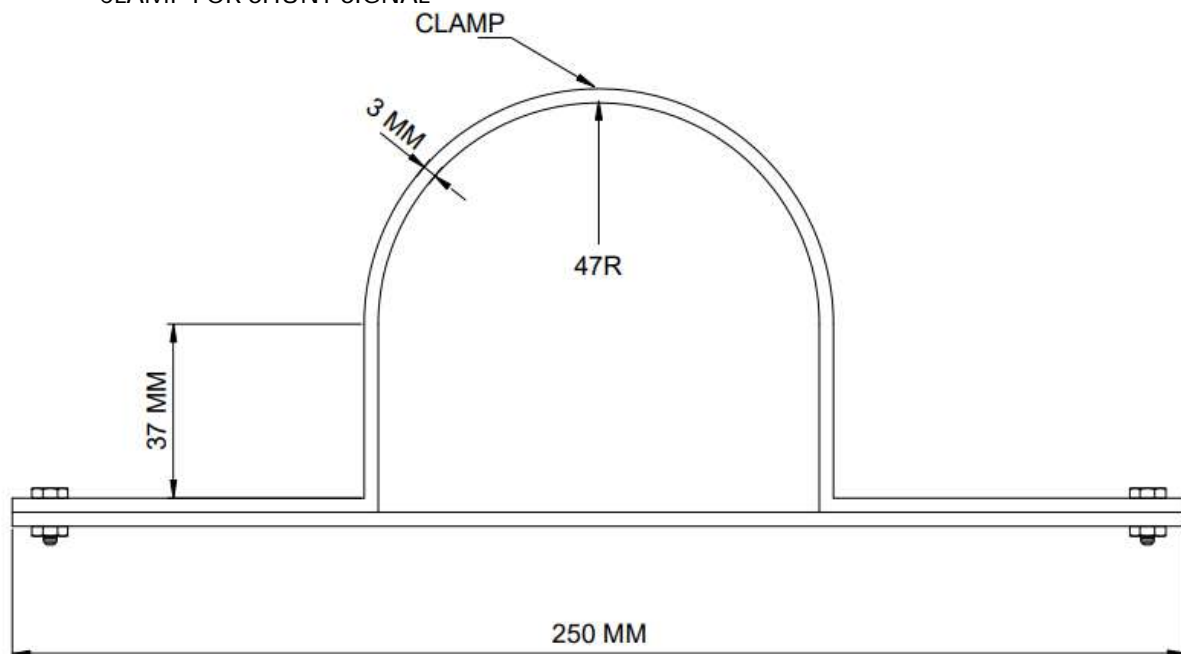
NOTE :- ALL DIMENSIONS ARE IN mm

## CLAMP FOR MAIN SIGNAL



All dimensions are in mm

## CLAMP FOR SHUNT SIGNAL



All dimensions are in mm





## SM's ROOM VDU LAYOUT



SM's ROOM VDU LAYOUT

## CABLE TERMINATION AND RELAY ROOM LAYOUT



CABLE TERMINATIONS



RELAY ROOM LAYOUT



## THICKWEB SWITCH POINT MACHINE AND LAYOUT



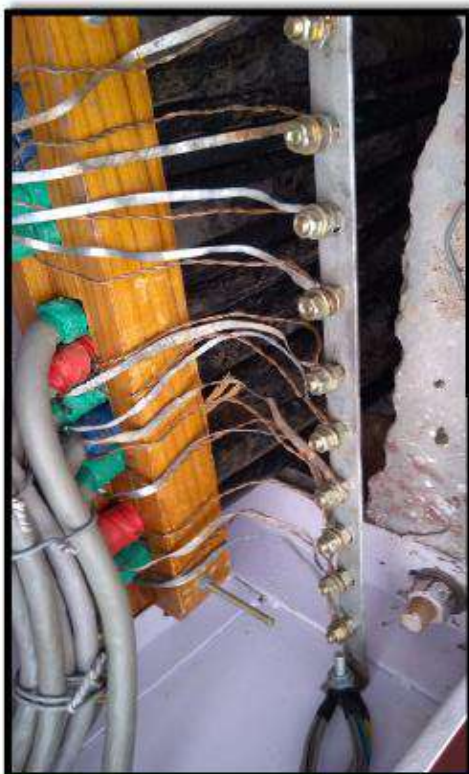
THICKWEB SWITCH POINT LAYOUT



THICKWEB SWITCH POINT MACHINE



## MS AND GI FLAT EARTHING BOXES

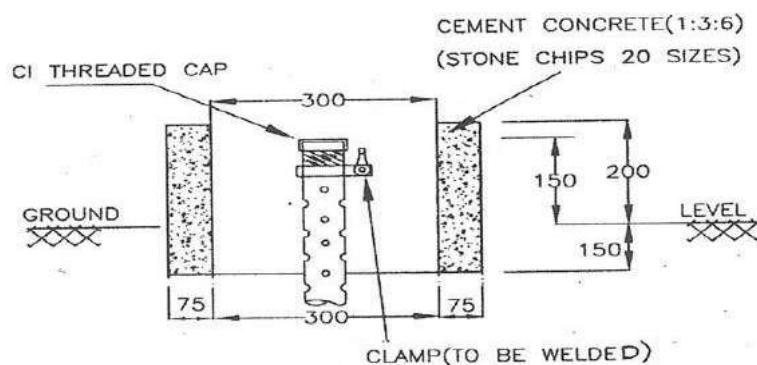


GI FLAT FOR ARMOUR EARTHING IN BOXES

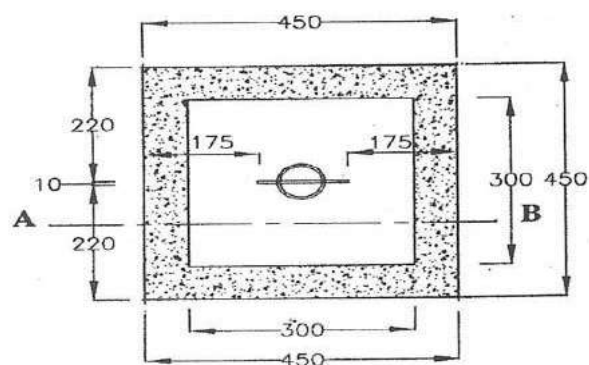


MS FLAT EARTHING AT LOCATION BOXES

## Drawing of Earth Electrodes:

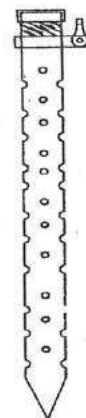


SECTION VIEW AT 'AB'



PLAN



## EARTH PIPE



G.I. PIPE 3.17 mm (1/8") THICK, 2.5 m  
LONG (8'-0") 50.8mm DIA PERFORATED  
STAGGERED 4.76mm (3/16") HOLES  
2 NoS. PER 304.8mm(FOOT)

## Note:

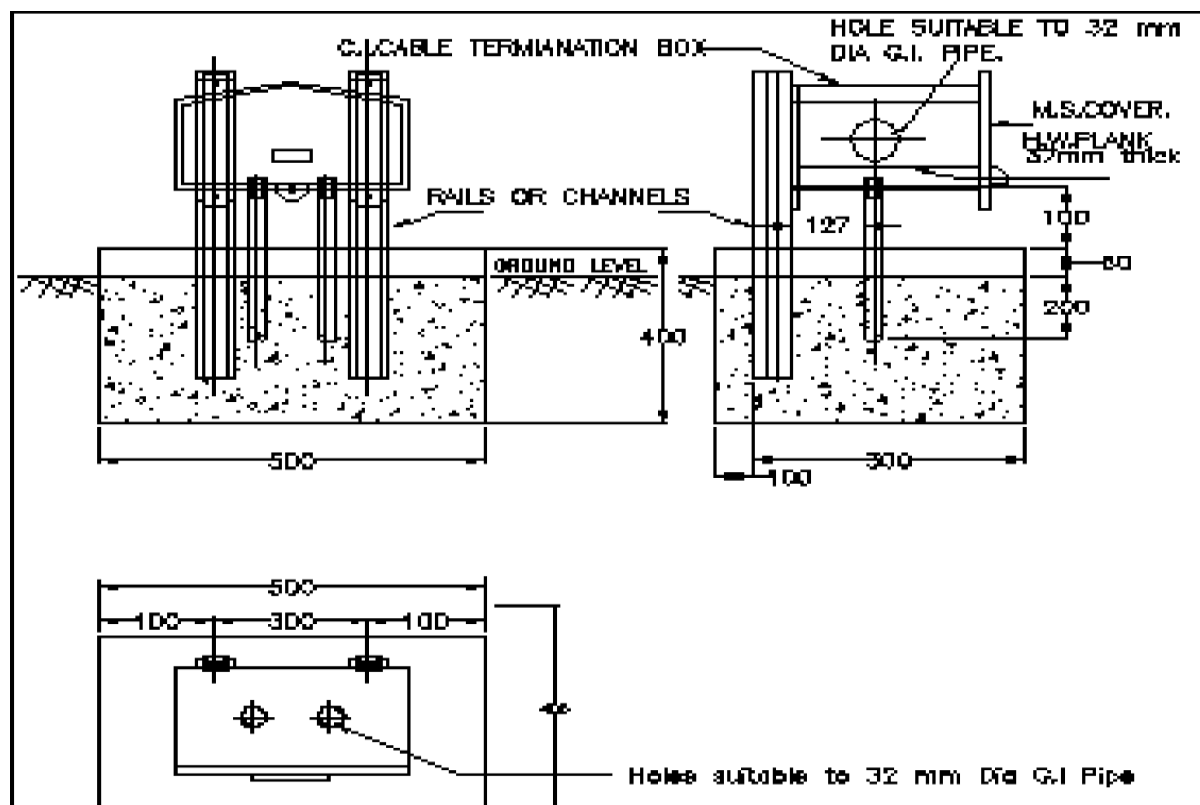
1. All dimensions are in mm
2. Outer surface above ground level should be plastered with 1:4 cement sand

Drg No	SG/CN/02/13		
MASONARY WORK FOR EARTH ELECTRODE			
Reference	CORE/S&T/Sig/Tender/SK/13/85.	Checked	 CASTE
Scale	NOT TO SCALE	Approved	 MAWLA

f STE/CN

## CABLE TERMINATION IN APPARATUS CASES/CTB's:

## FOUNDATION FOR CABLE TERMINATION BOX:

Note:

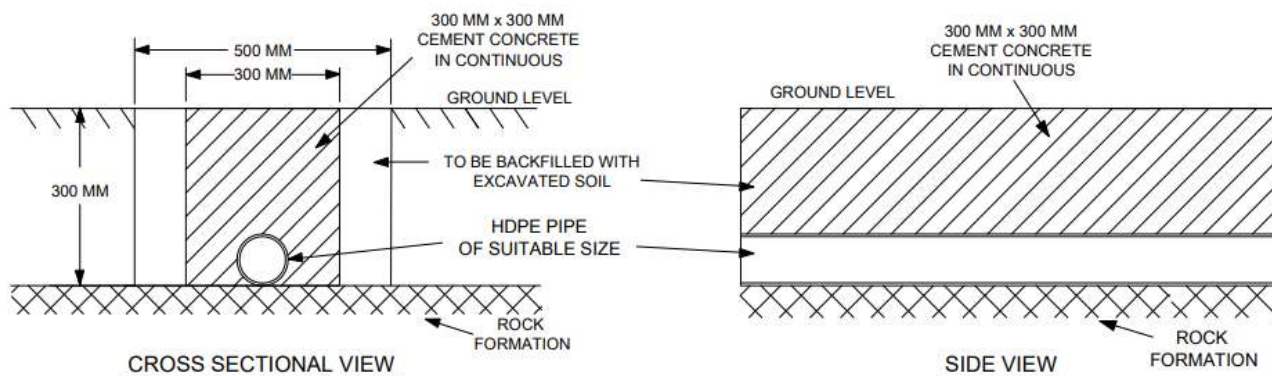
1. All dimensions are in mm.
2. Two Nos. of GI pipe of 32 mm dia and 300 mm long to be inserted for Cable troughing during casting foundation at bottom side.
3. M 20 bolts and nuts to be used.
4. Holes to be drilled on Rails to suit CTB at site.
5. Overall length of rail shall be 1.2 Metres length.
6. Foundation to be cast with concrete mix ratio of Cement, Sand and Stone Jelly of size 20/2 mm, 1:3:6.
7. GI Pipe 32 mm dia & 150 mm long to be provided at the side for point machine CT Box.
8. GI Pipe shall be fixed on CT Box with 2 clamp nuts of thickness 12 mm. one at the inner side and one at the outer side.

Drwg No	SG/CN/02/8		
FOUNDATION FOR CABLE TERMINATION BOX			
Reference	SG-100B	Checked	ASTE/CN
Scale	NOT TO SCALE	Approved	1 CSTE/CN



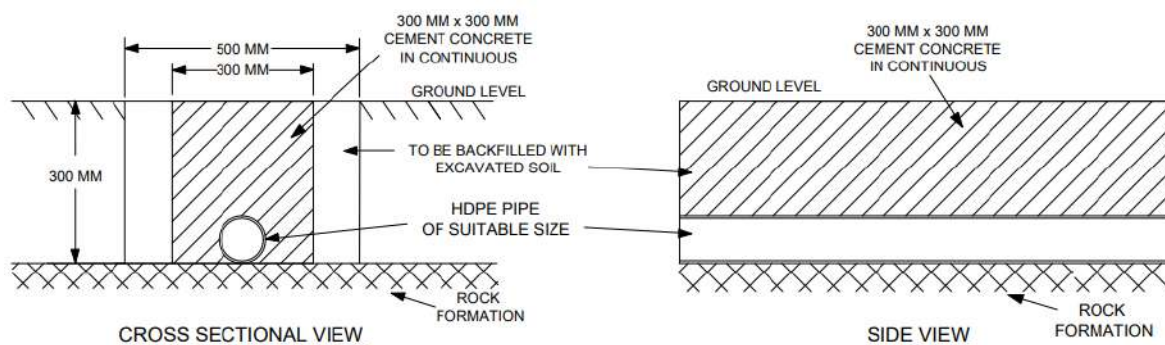


## DRAWING FOR CABLE LAYING WHEN ROCK FACED AT 300 MM DEPTH FROM GROUND LEVEL



### NOTE :

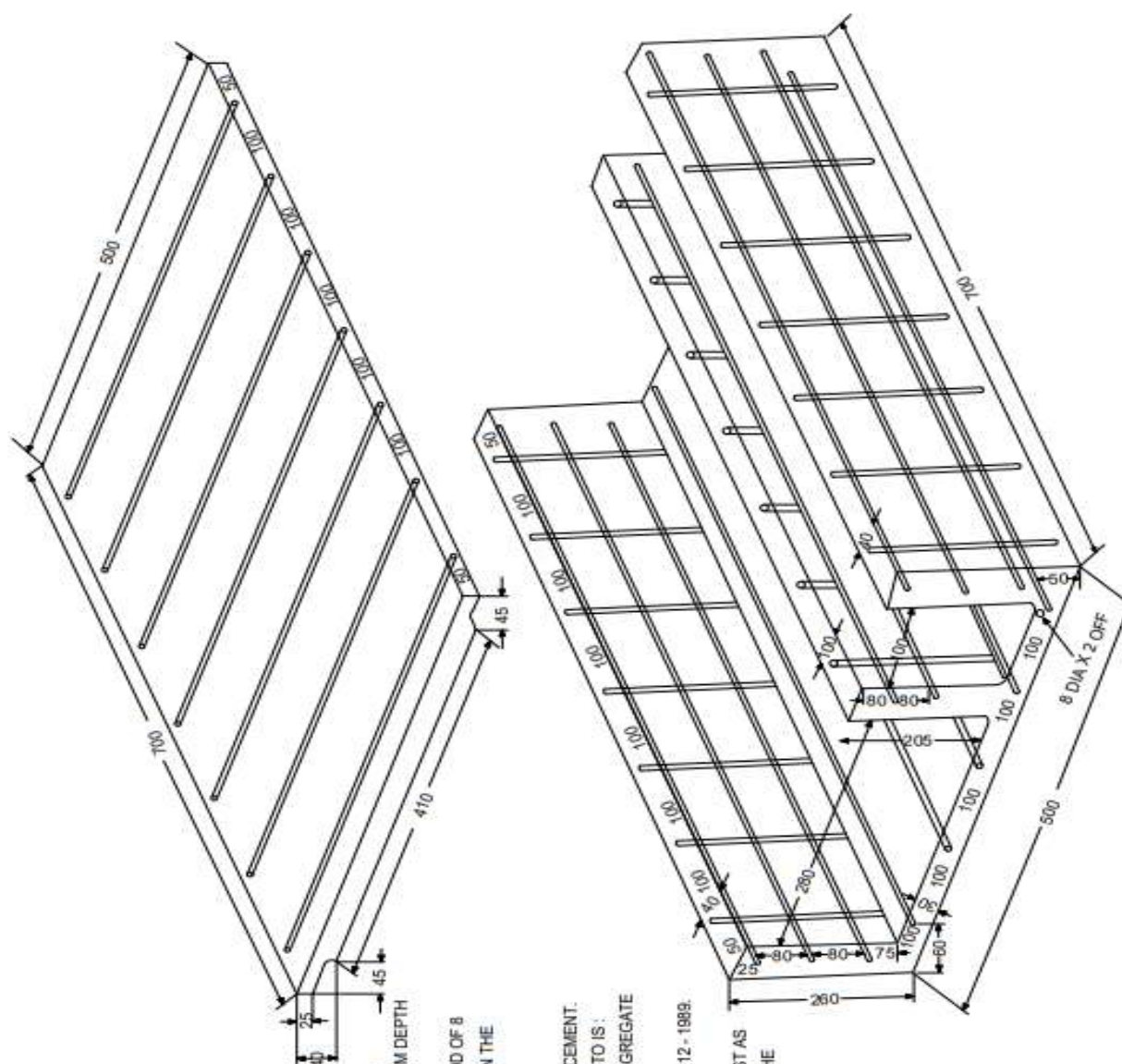
- 1) ALL DIMENSIONS ARE IN MILLIMETER.
- 2) CEMENT CONCRETING OF 300 MM x 300 MM SHALL BE PROVIDED IN CONTINUOUS.
- 3) CONCRETING WITH MIXTURE OF CEMENT RIVER SAND/ M-SAND AND JELLY CHIPS OF SIZE 20 MM WITH RATIO 1:3:6.
- 4) HDPE PIPE AS PER IS-4984 TO BE USED.
- 5) REFILLED SOIL SHALL BE RAMMED TO THE EARTH LEVEL.



### NOTE :

- 1) ALL DIMENSIONS ARE IN MILLIMETER.
- 2) CEMENT CONCRETING OF 300 MM x 300 MM SHALL BE PROVIDED IN CONTINUOUS.
- 3) CONCRETING WITH MIXTURE OF CEMENT RIVER SAND/ M-SAND AND JELLY CHIPS OF SIZE 20 MM WITH RATIO 1:3:6.
- 4) HDPE PIPE AS PER IS-4984 TO BE USED.
- 5) REFILLED SOIL SHALL BE RAMMED TO THE EARTH LEVEL.

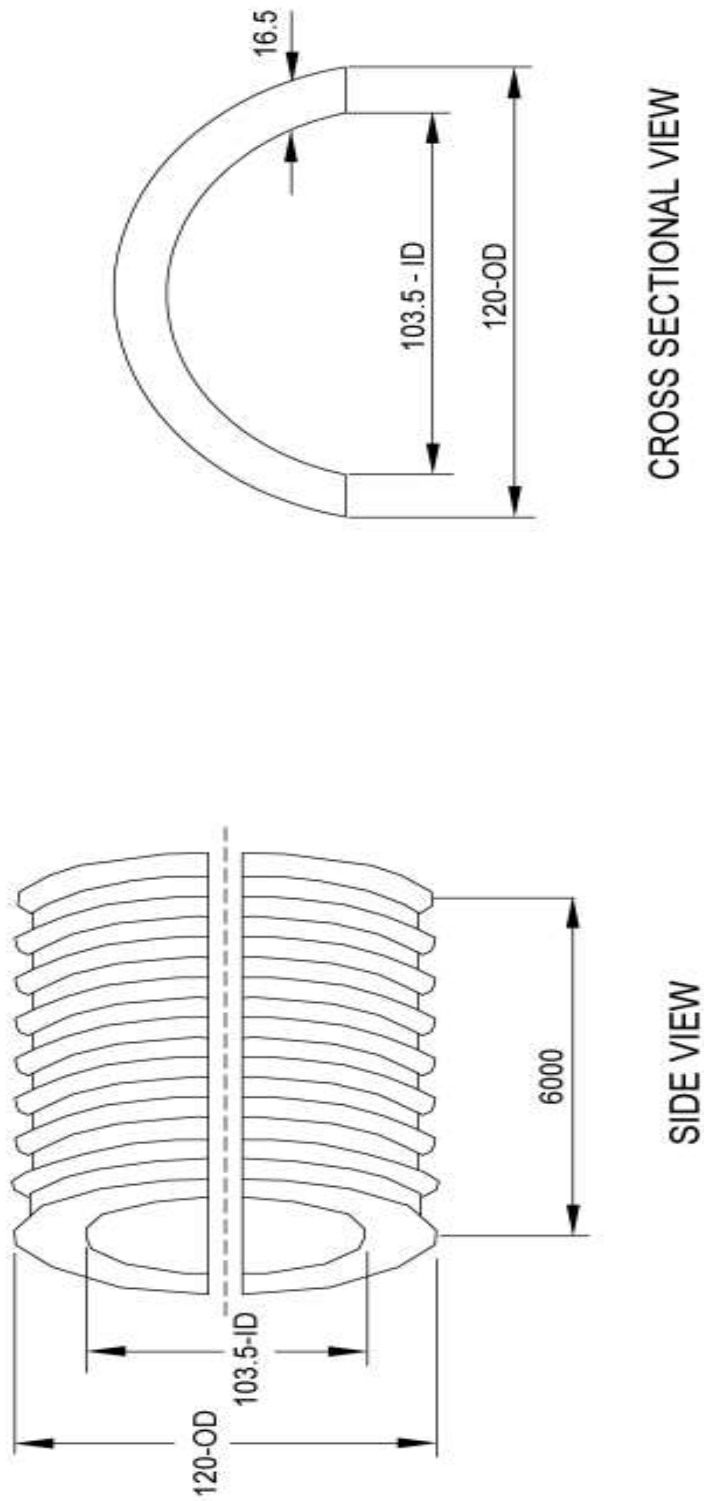
## DRAWING FOR RCC DUCT 500 MM



Note :-

1. TRUNKING AND CAPPING ARE SUITABLE FOR BURYING ADJACENT TO THE TRACKS IN TRENCHES WITH MINIMUM DEPTH OF 600 MM.
2. THE TRUNKING TO BE ALIGNED BY PUTTING AN MS ROD OF 8 MM DIA. x 100 MM LONG AS PER IS : 432 PART (1) - 1982 IN THE TWO HOLES PROVIDED.
3. 6.0 MM DIA. HIGH STRENGTH DEFORMED STEEL BARS CONFORMING TO IS : 11786 TO BE USED FOR REINFORCEMENT.
4. M-25 GRADE OF CONCRETE TO BE USED CONFORMING TO IS : 10262 - 1982 AND IS : 456 - 2000 - 10 MM SIZE COARSE AGGREGATE TO BE USED .
5. OPC OF 43 GRADE TO BE USED CONFORMING TO IS : 8112 - 1989.
6. THE ACCEPTANCE TEST SHALL BE CONDUCTED IN A RECOGNISED LABORATORY AND THE COST OF THE TEST AS CHARGED BY THE LABORATORY SHALL BE BORNE BY THE CONTRACTOR.
7. CURING SHALL BE DONE AS PER THE IS : 456 - 2000.
8. DUCT MAY BE IN SITU OR FACTORY MADE.
9. ALL DIMENSIONS ARE IN MILLIMETER.

## DRAWING OF DWC SPLIT PIPE (120 MM DIA.)



1. DWC SPLIT PIPE OF ID 103.5 MM DIA. AND OD 120 MM DIA. OF STANDARD LENGTH OF 6 Mtrs.  
WITH COUPLERS SHALL BE PROVIDED SUITABLE FOR BURYING ADJACENT TO THE TRACKS.
2. PIPE SHALL BE FACTORY MADE AS PER IS SPEC.NO.14830(PART-2):2001.
3. ALL DIMENSIONS ARE IN MILLI METER.



# RCC DUCT



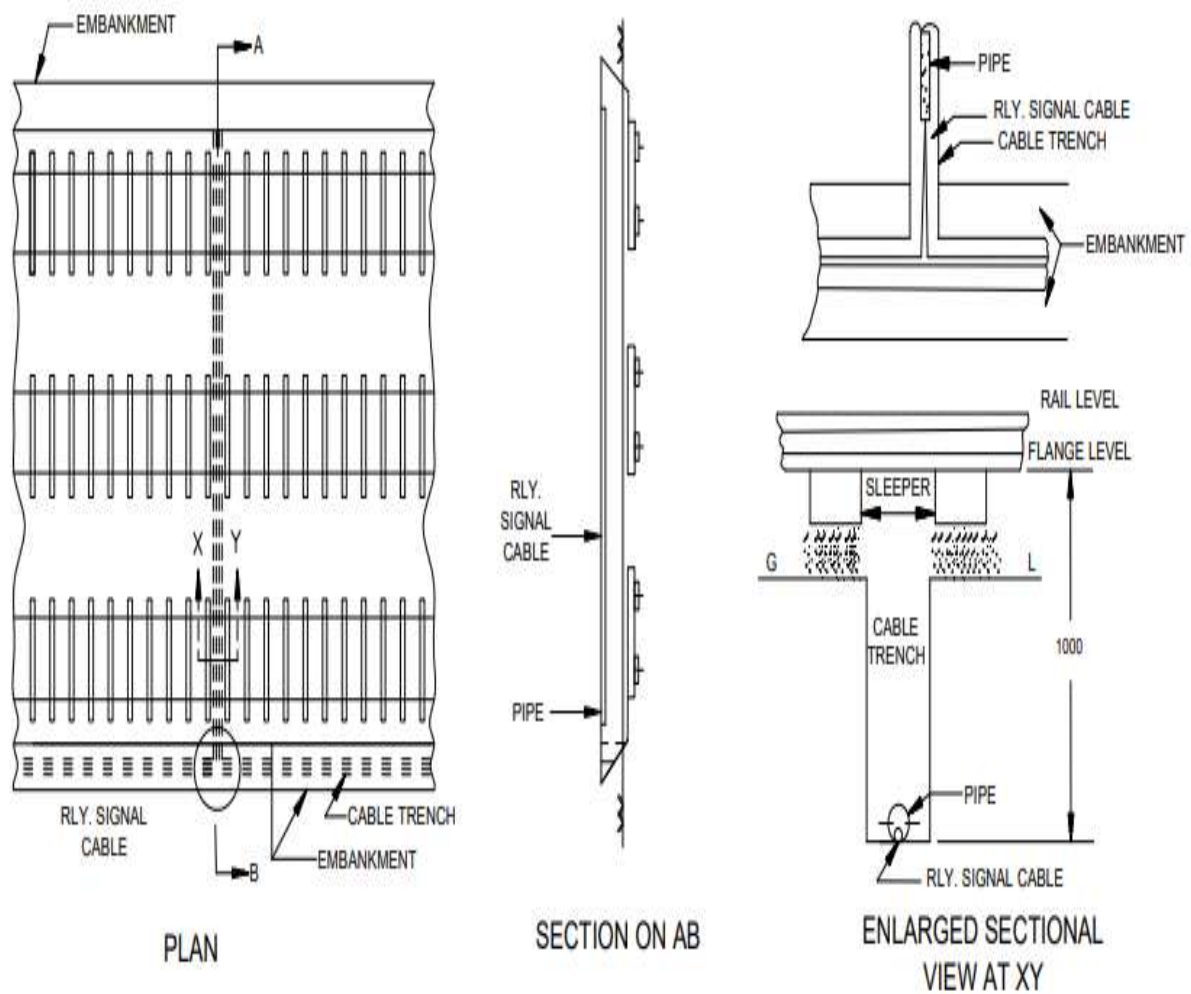
RCC DUCT - 2



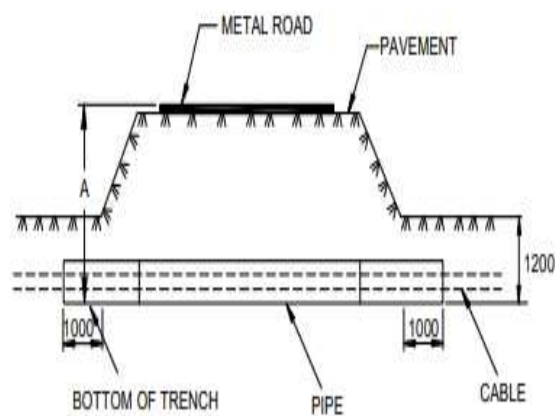
RCC DUCT - 1



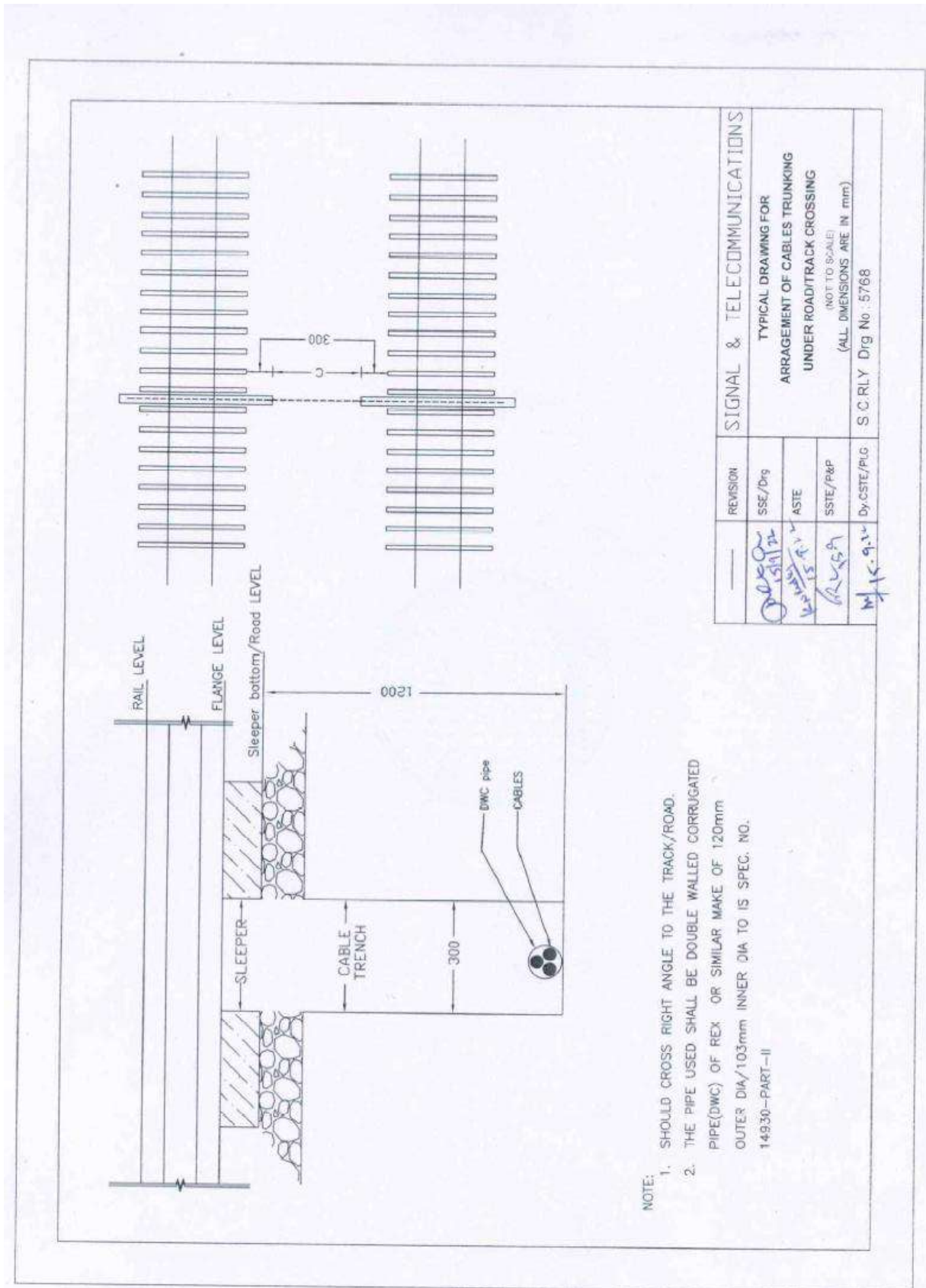
## DRAWING FOR ROAD / TRACK CROSSING



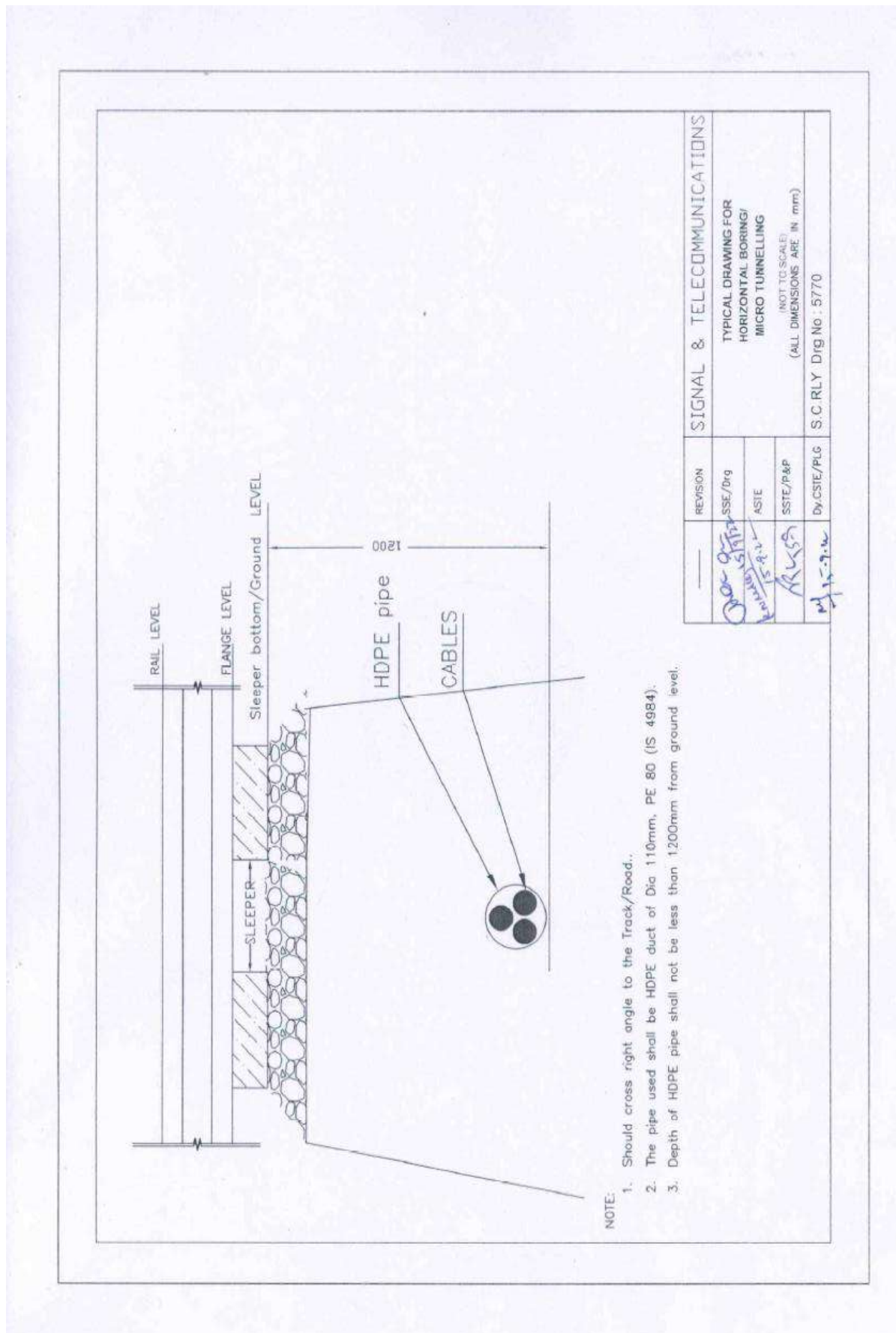
NOTE: ALL DIMENSIONS ARE IN MILLIMETER.



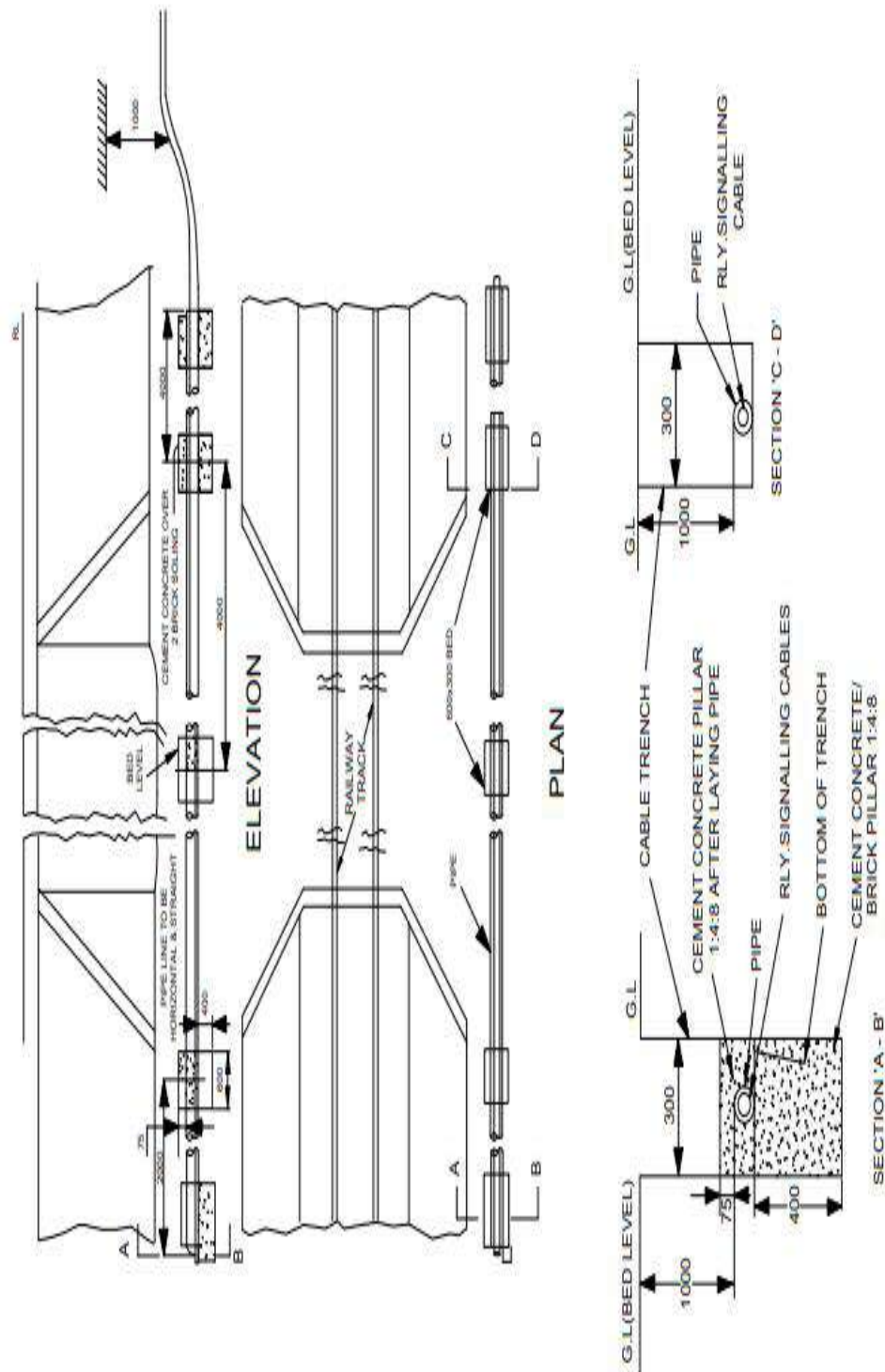
## DRAWING FOR ROAD / TRACK CROSSING



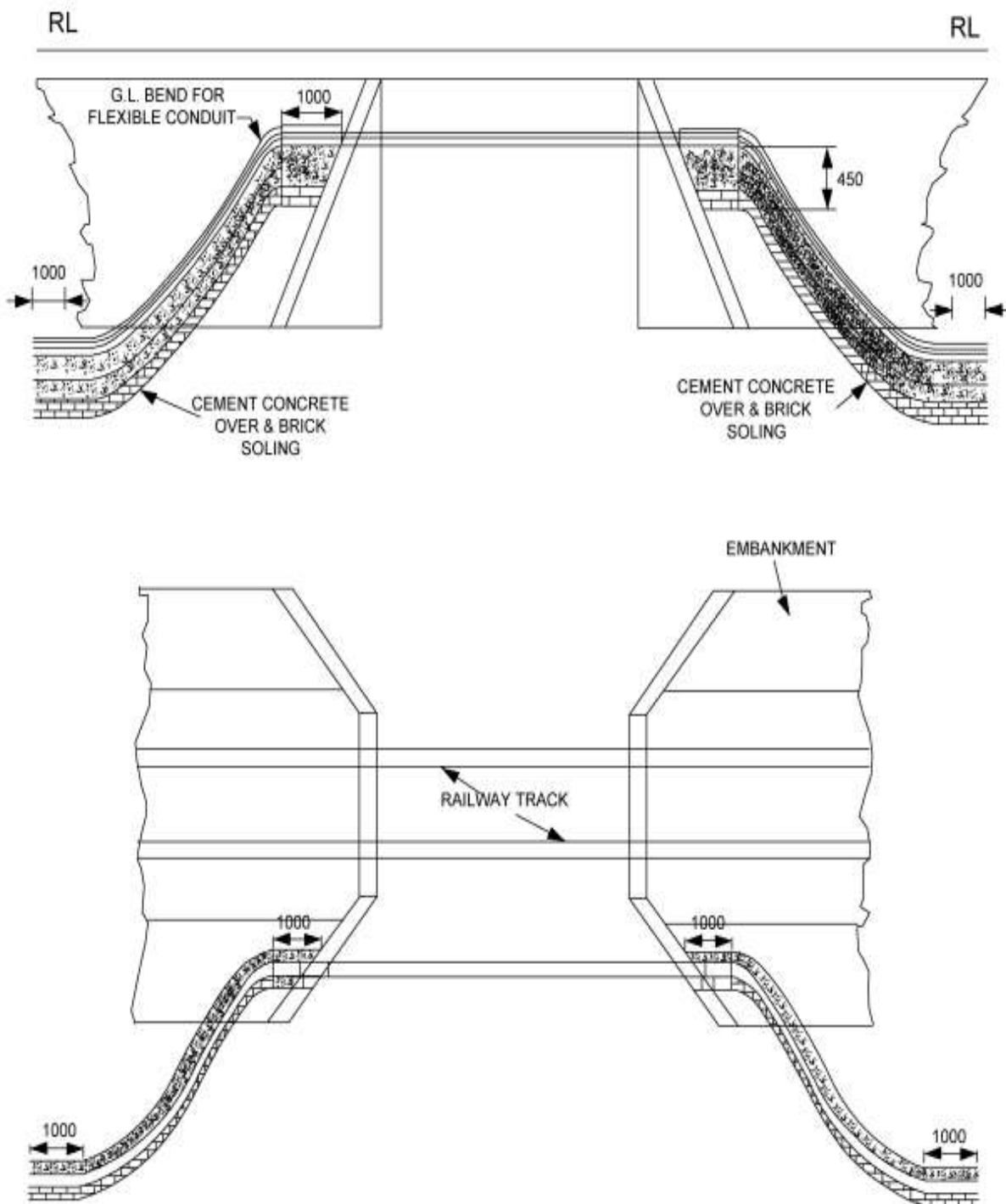
## HORIZONTAL BORING



## DRAWING FOR LAYING ON CULVERTS



## DRAWING FOR CABLE LAYING ON CULVERTS WITH HIGH FLOOD LEVEL

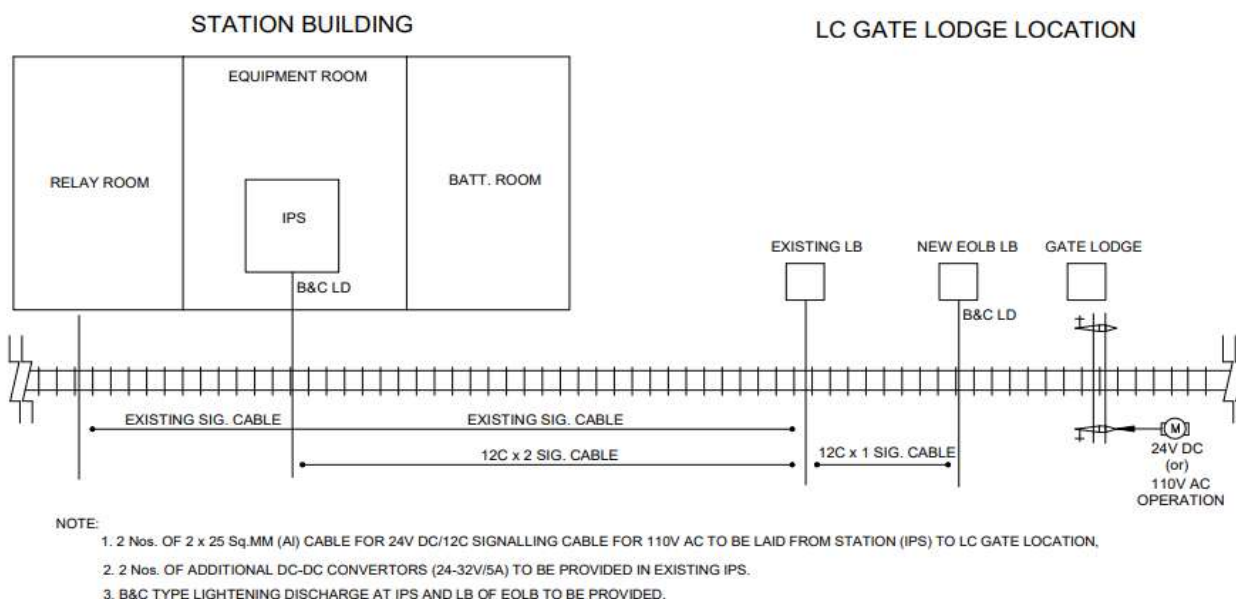


NOTE:-

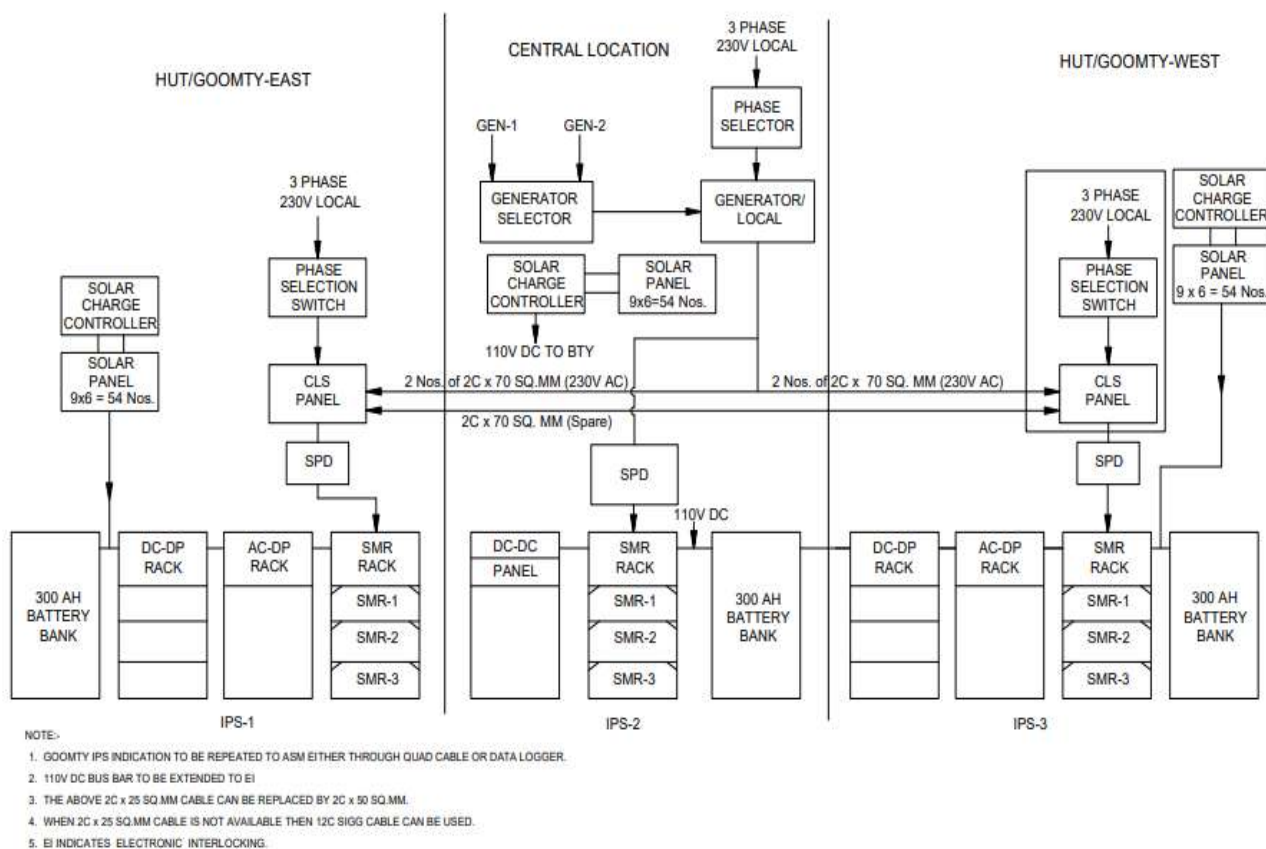
1. ALL DIMENSIONS ARE IN MILLIMETER.



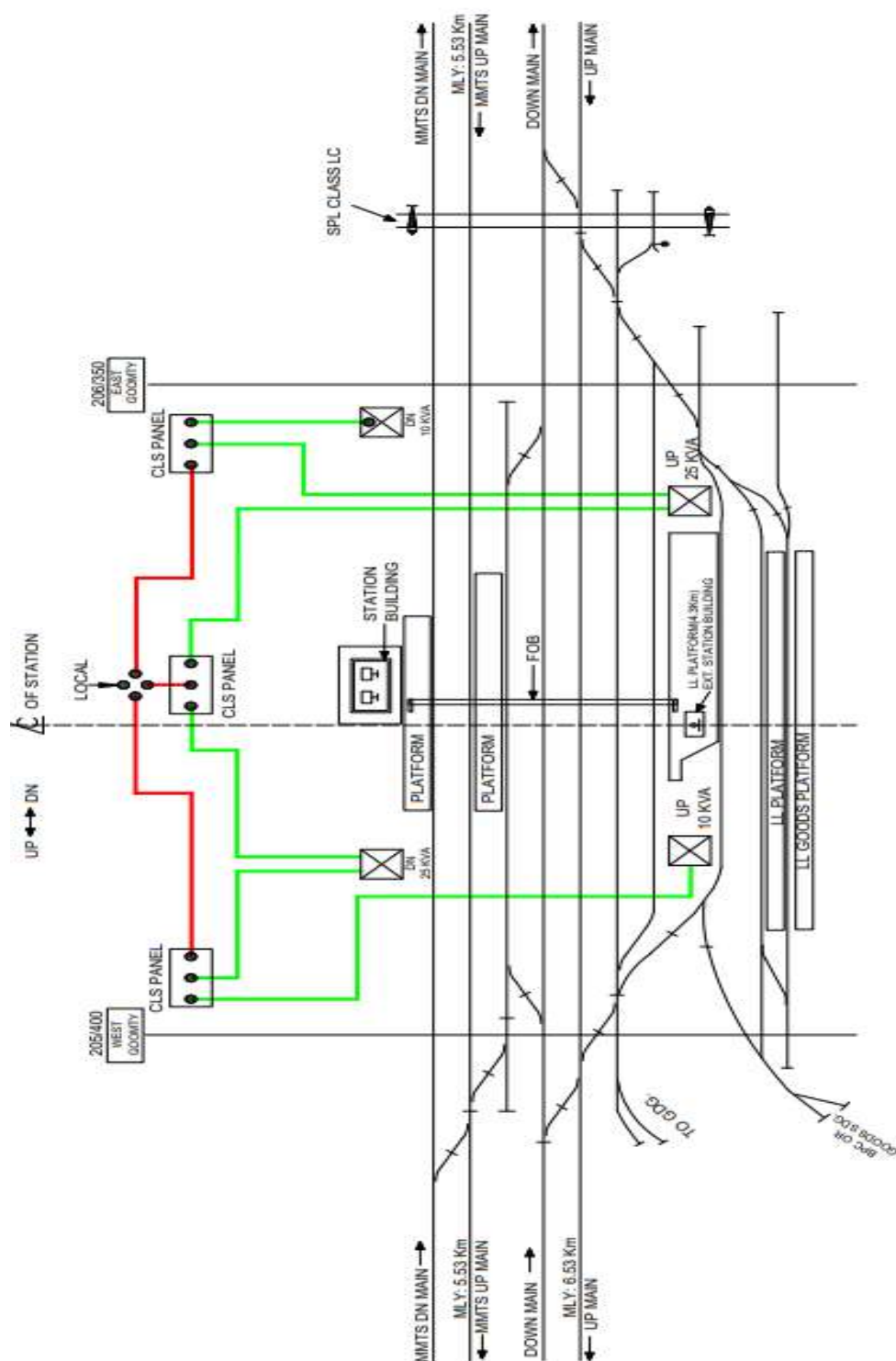
## CABLE PLAN FOR ELECTRIC LIFTING BARRIER (ELB) AT STATION



## SCHEME OF POWER SUPPLY ARRANGEMENT FOR DI STRIBUTED EI WITH TWO END GOOMTIES (NON-RE)



# SCHEME OF POWER SUPPLY ARRANGEMENT FOR DISTRIBUTED EI WITH TWO END GOOMTIES (RE)



NOTE : 1. AT TRANSFORMER ARE PLACING AT THE END OF PLATFORMS OF THE STATION'S

2. LOCAL POWER SUPPLY TO BE EXTENDED FOR STATION THROUGH CABLES

3. STATION REQUIRES 25 KVA AT DUE TO S&T PA SYSTEM/OFC LOADS etc.

4. EI INDICATES ELECTRONIC INTERLOCKING.

RED DENOTES CONVENTIONAL SCHEME

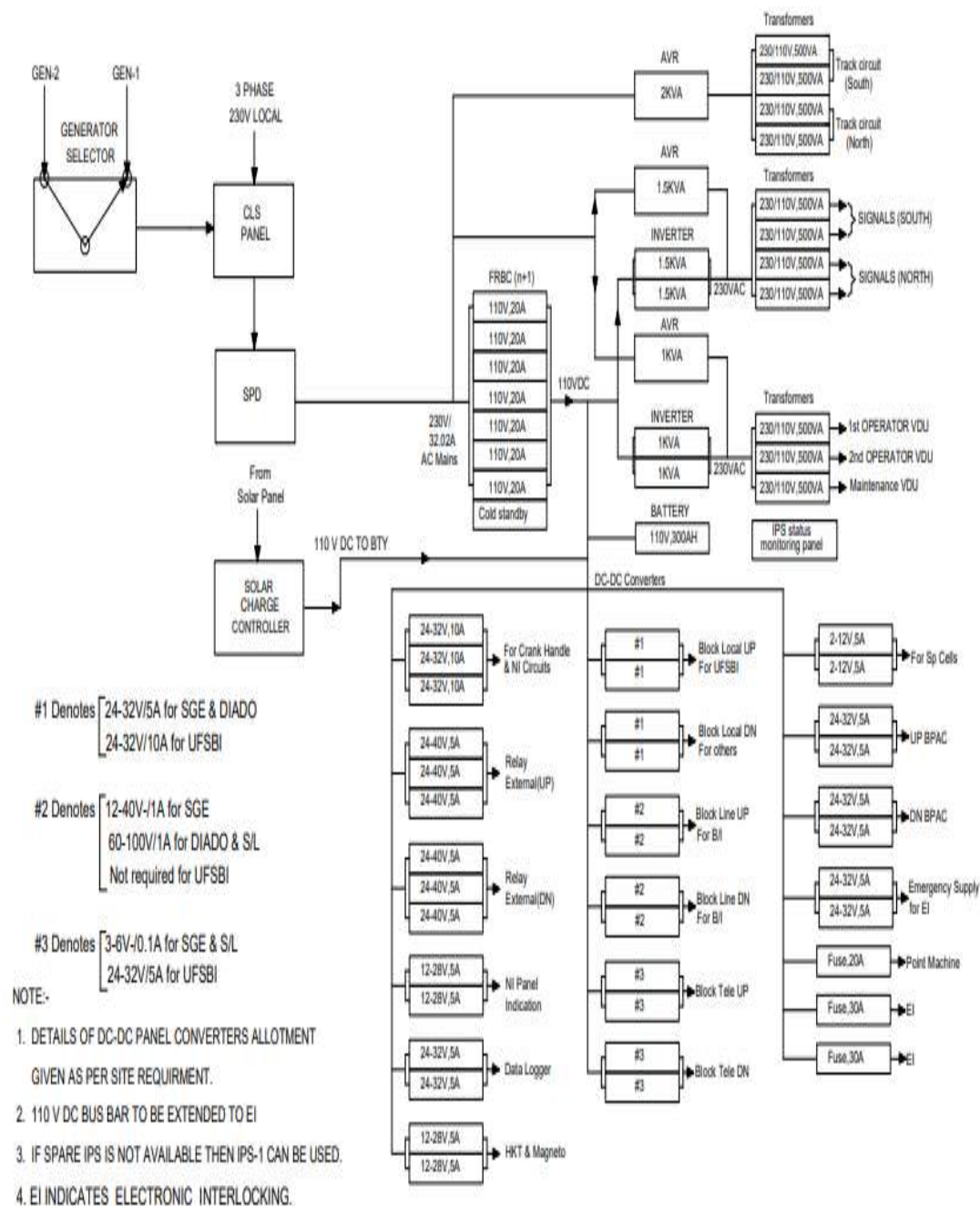
GREEN DENOTES POWER CABLE OF 20 x 50 SQ MM OR MORE TO BE USED



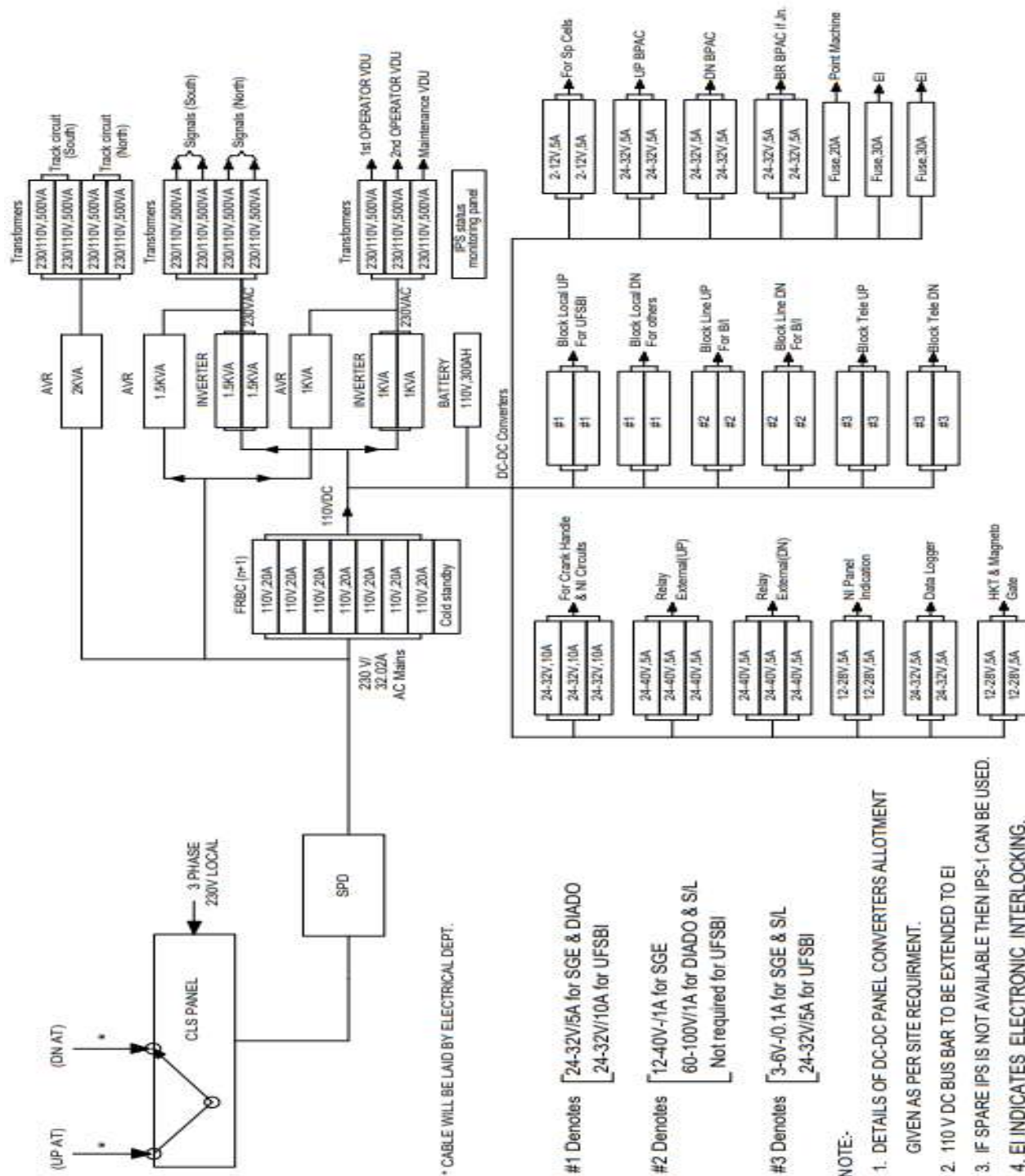




## POWER SUPPLY ARRANGEMENT FOR CENTRAL EI (NON-RE) FOR A 4 ROAD JUNCTION STATION



# POWER SUPPLY ARRANGEMENT FOR CENTRAL EI (RE) FOR A 4 ROAD JUNCTION STATION



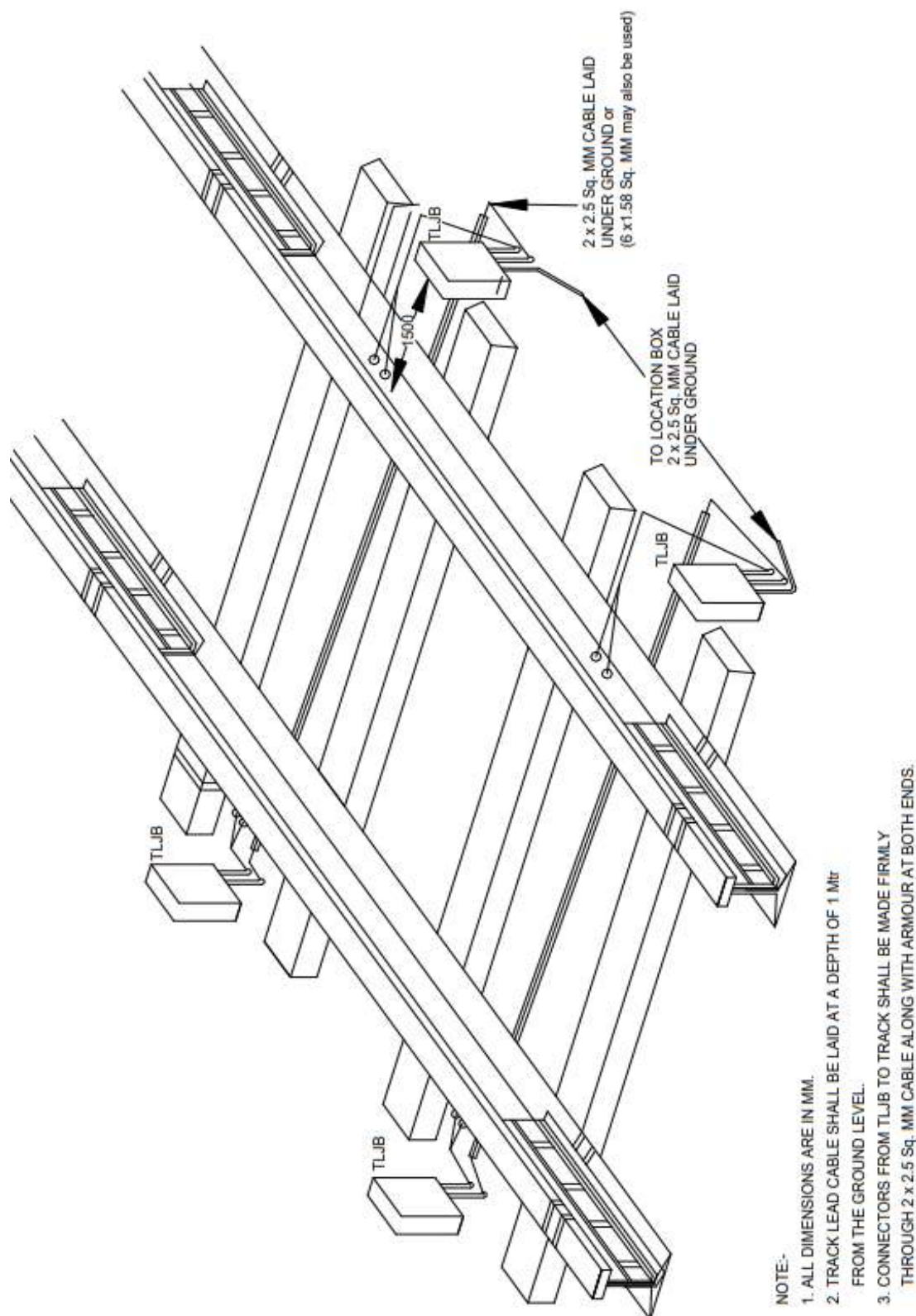






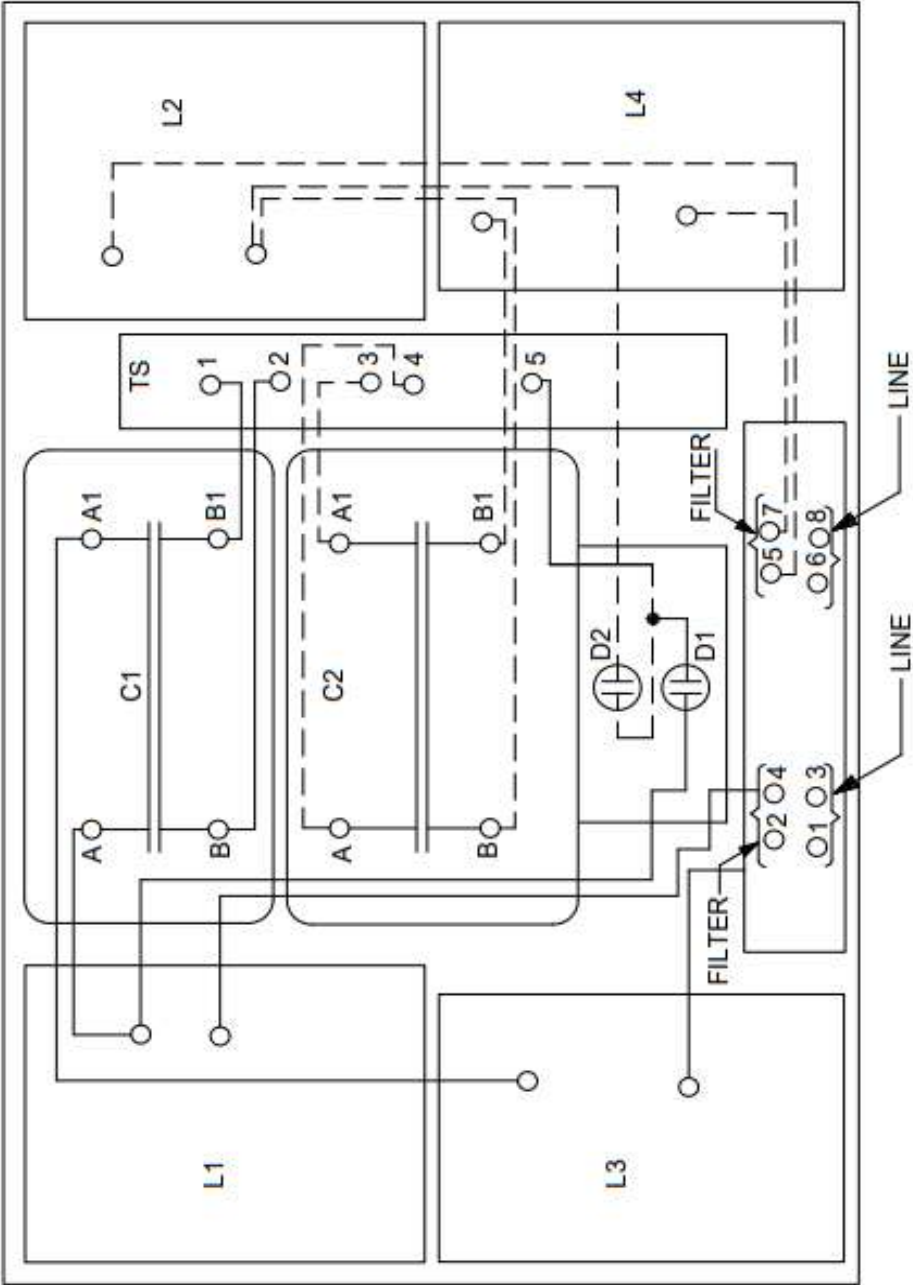


## DRAWING FOR TRACK LEAD CABLE CONNECTIONS



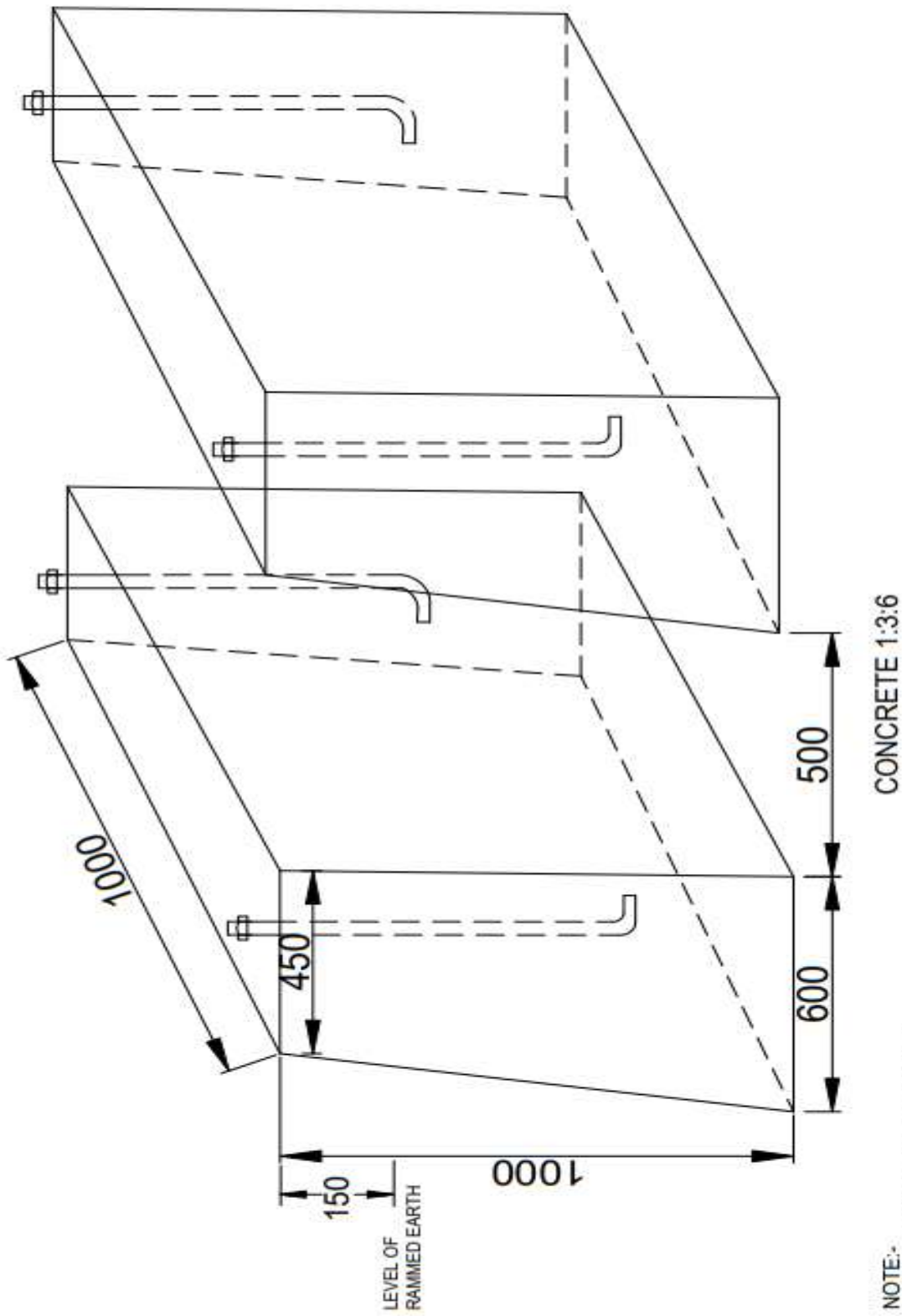


FILTER UNIT FOR BLOCK CIRCUITS

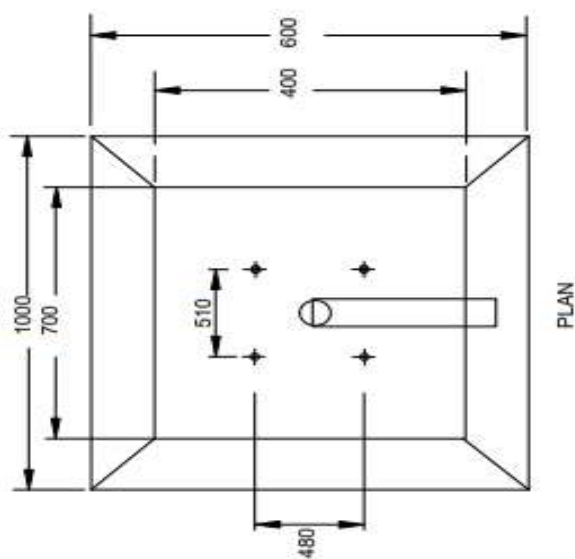
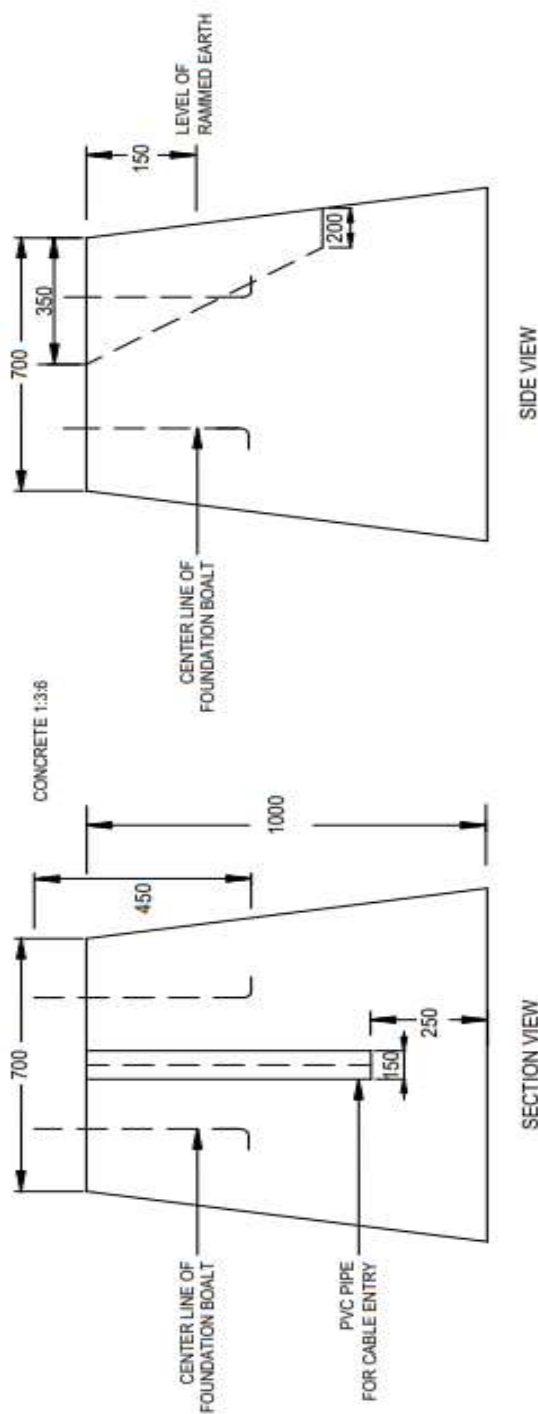


- NOTE : (1) Terminals 1 and 2, 3 and 4, 5 and 6, 7 and 8 are linked when covers placed over the filter.
- (2) Wiring shown thus for UP block section - - - - -
- (3) Wiring shown thus for DOWN block section ———

## APPARATUS CASE FULL SIZE FOUNDATION



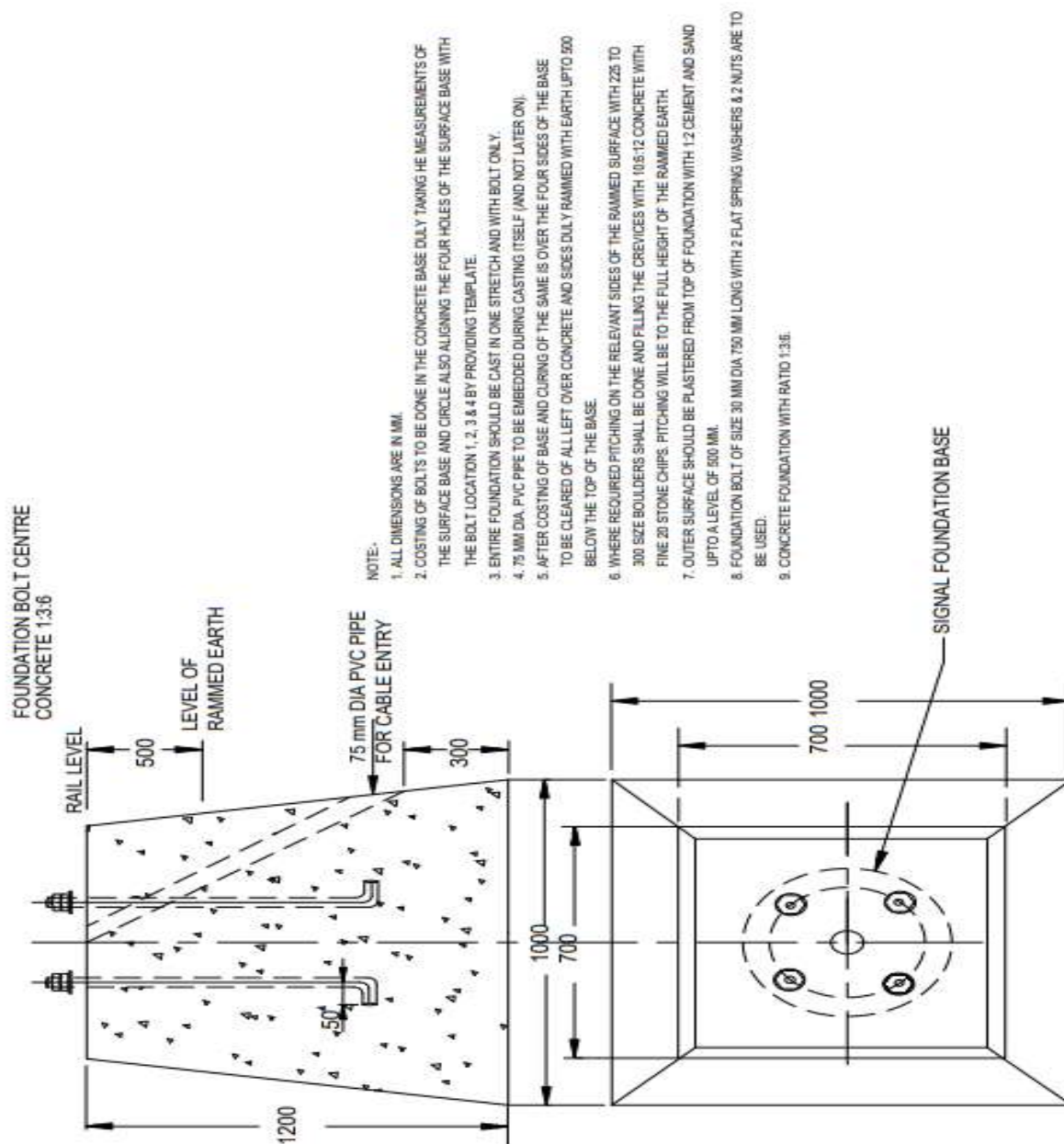
## APPARATUS CASE HALF/QUARTER SIZE FOUNDATION



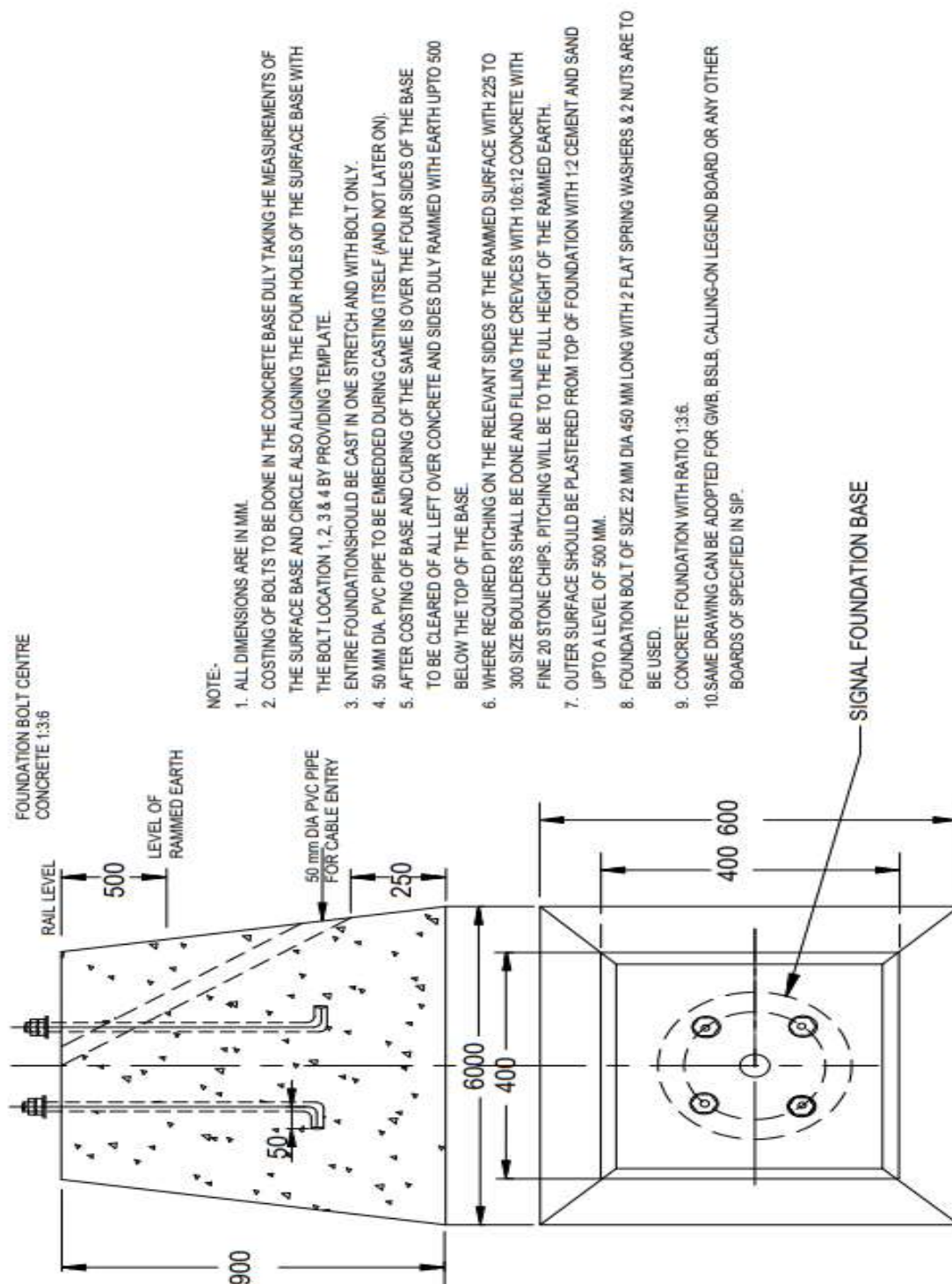
## NOTE:-

1. ALL DIMENSIONS ARE IN MM.
2. CONCRETE FOUNDATION WITH MIXTURE OF CEMENT, SAND AND JELLY CHIPS, SIZE:20, WITH RATIO 1:3:6.
3. OUTER SURFACE SHOULD BE PLASTERED WITH 1:4 CEMENT AND SAND.
4. ON ALL SIDES OF THE EARTH SHOULD BE RAMMED INTO THE LEVEL AS SHOWN IN THE SKETCH.
5. FOUNDATION BOLT OF SIZE 22 MM DIA., 450 MM LONG WITH 2 FLAT SPRING WASHERS & ONE NUT IS TO BE USED.

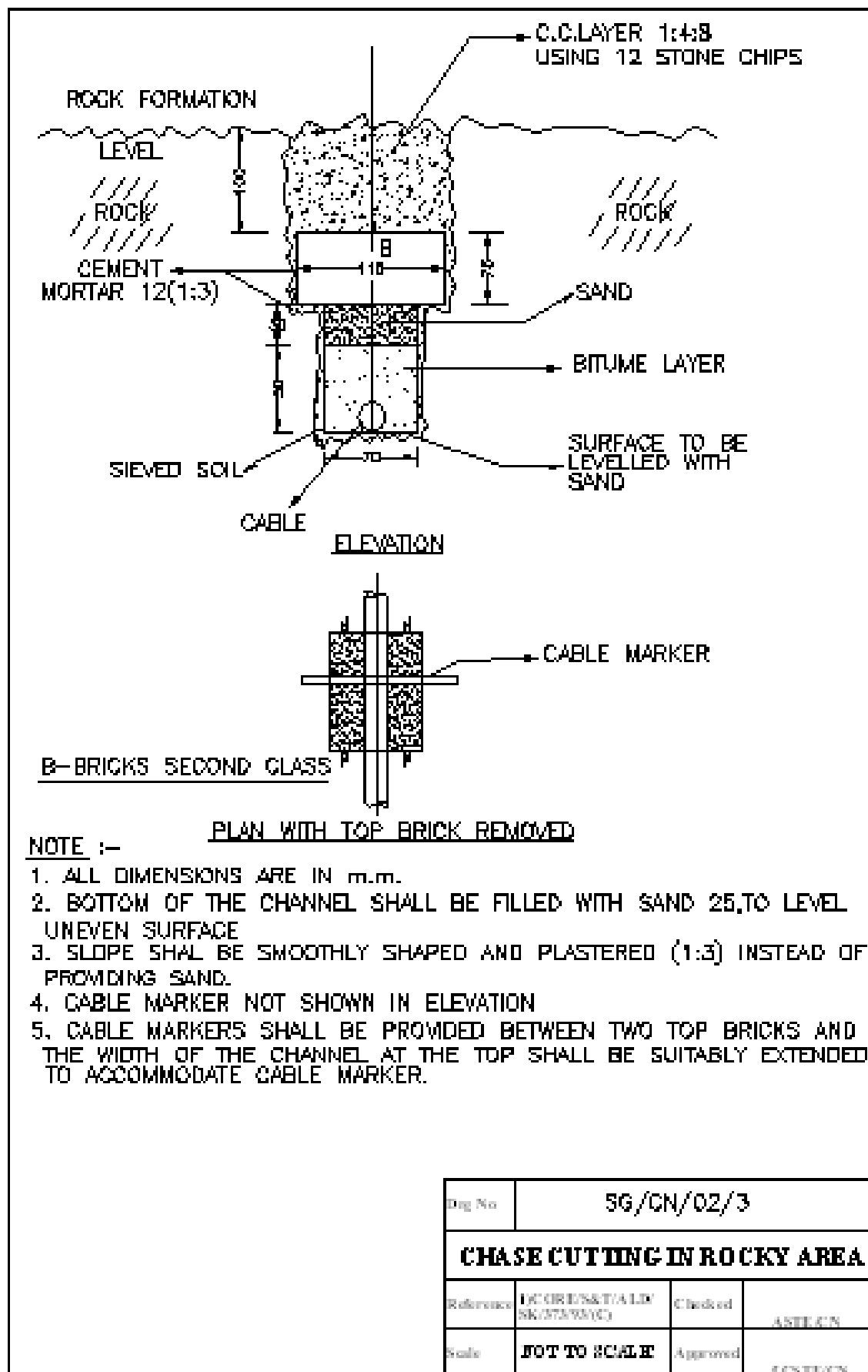
## MAIN SIGNAL POST FOUNDATION



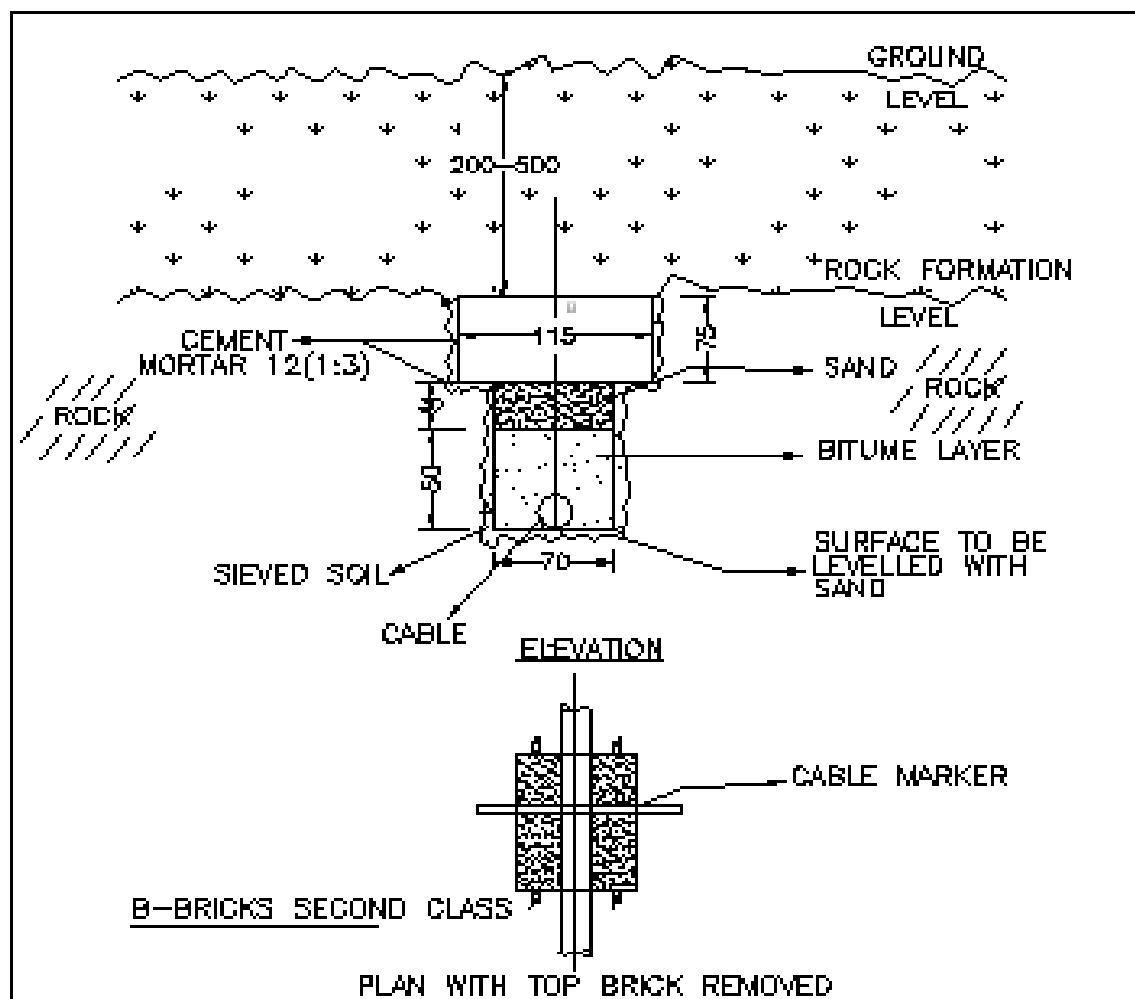
## SHUNT SIGNAL FOUNDATION



## CHASE CUTTING IN ROCKY AREA



## CHASE CUTTING IN ROCKY AREA

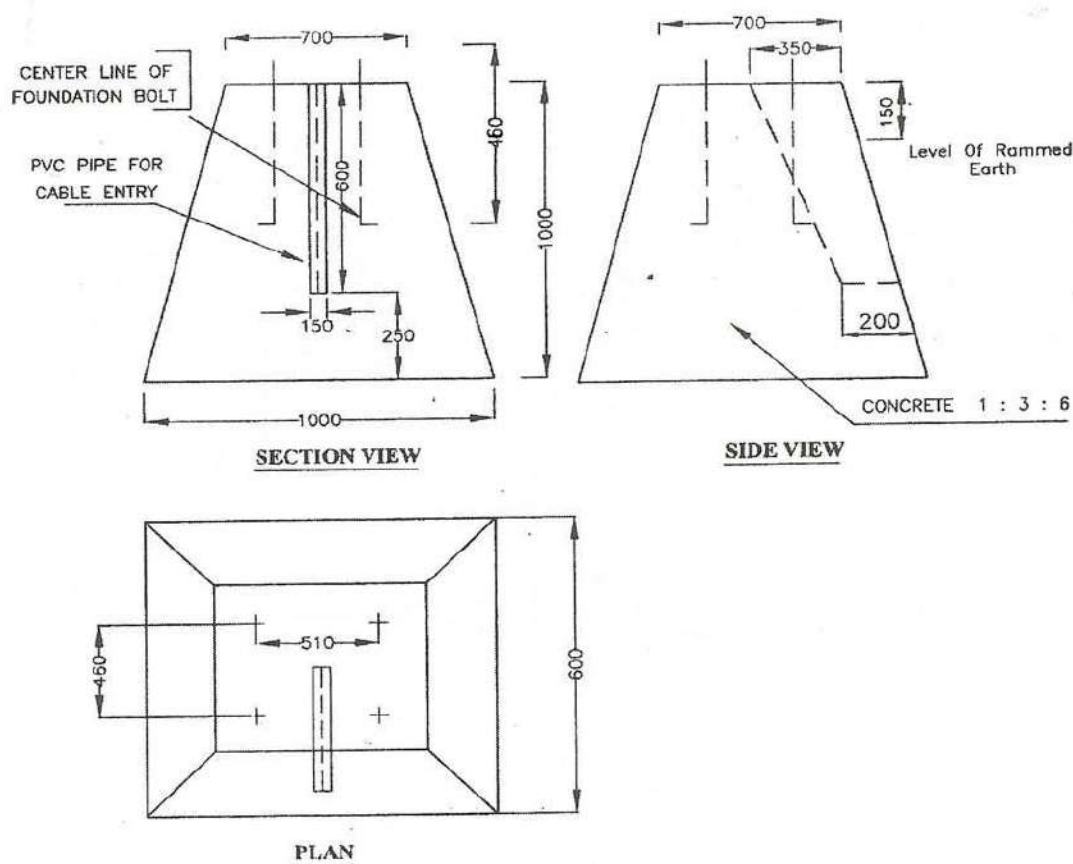
NOTE :-

1. ALL DIMENSIONS ARE IN m.m.
2. BOTTOM OF THE CHASE SHALL BE FILLED WITH SAND TO LEVEL UNEVEN SURFACE
3. SLOPE SHALL BE SMOOTHLY SHAPED AND PLASTERED (1:3) INSTEAD OF PROVIDING SAND.
4. CABLE MARKER NOT SHOWN IN ELEVATION
5. CABLE MARKERS SHALL BE SUITABLY GROUTED

Des No	SG/CN/02/4		
CHASE CUTTING IN ROCKY AREA			
Reference	1. CORE/ST/ALD/ SK/273/02(D)	Checked	AST/EN
Scale	NOT TO SCALE	Appr/rev	AST/EN

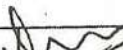
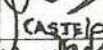


# FOUNDATION FOR APPARATUS CASE (HALF/QUARTER)



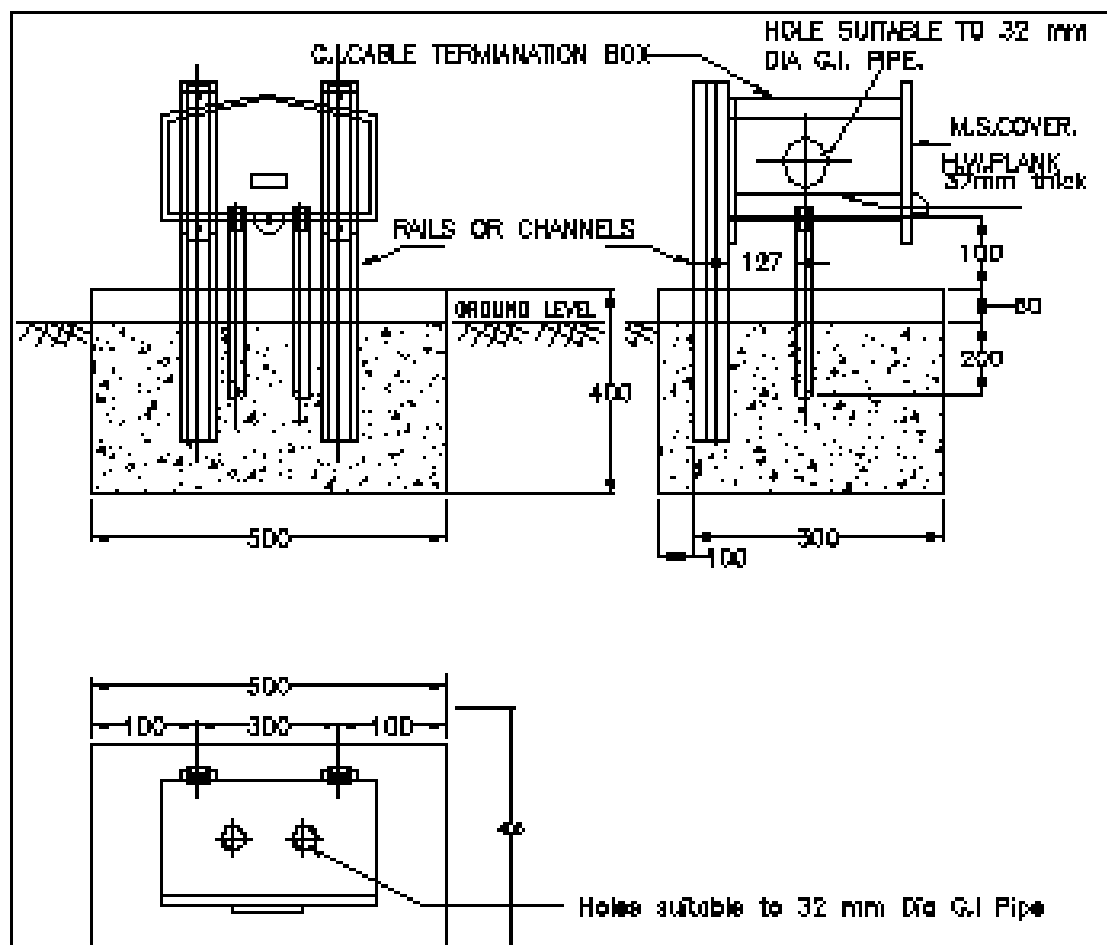
## NOTE:

1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. CONCRETE FOUNDATION WITH MIXTURE OF CEMENT, SAND AND JELLY CHIPS, SIZE : 20 WITH RATIO (1:3:6).
3. OUTER SURFACE SHOULD BE PLASTERED WITH 1:4 CEMENT AND SAND.
4. ON ALL SIDES OF THE EARTH SHOULD BE RAMMED INTO THE LEVEL AS SHOWN IN THE SKETCH.
5. FOUNDATION BOLT OF SIZE 20mm DIA, 460 mm LONG WITH 2 FLAT WASHERS & ONE NUT IS TO BE USED.

Drg No	SG/CN/02/7	
FOUNDATION FOR APPARATUS CASE (HALF/QUATER)		
Refrence	SG/CN/3	Checked  CASTLE
Scale	NOT TO SCALE	Approved  Kawale

f cste/cn

# FOUNDATION FOR CABLE TERMINATION BOX

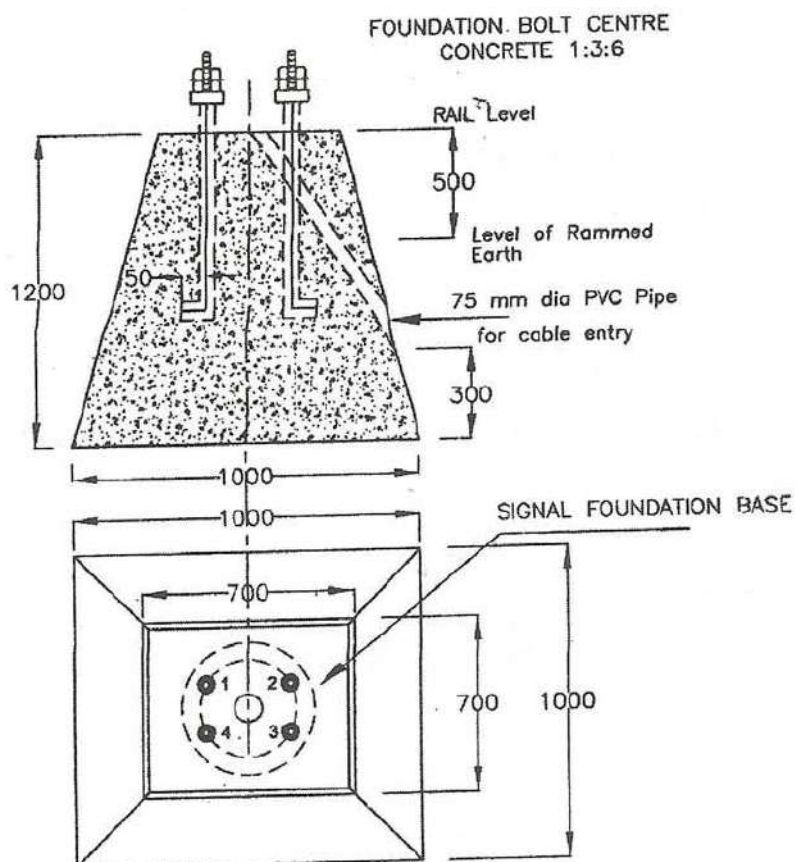


## Note:


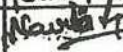
1. All dimensions are in mm.
2. Two Nos. of GI pipe of 32 mm dia and 300 mm long to be inserted for Cable troughing during casting foundation at bottom side.
3. M 20 bolts and nuts to be used.
4. Holes to be drilled on Rails to suit CTB at site.
5. Overall length of rail shall be 1.2 Metres length.
6. Foundation to be cast with concrete mix ratio of Cement, Sand and Stone Jelly of size 20/2 mm, 1:3:6.
7. GI Pipe 32 mm dia & 150 mm long to be provided at the side for point machine CT Box.
8. GI Pipe shall be fixed on CT Box with 2 clamp nuts of thickness 12 mm. one at the inner side and one at the outer side.

Dwg No	SG/CN/02/8		
FOUNDATION FOR CABLE TERMINATION BOX			
Reference	SG-10DB	Checked	ASTE/CN
Scale	NOT TO SCALE	Approved	1 CSTE/CN

## FOUNDATION FOR COLOUR LIGHT SIGNAL

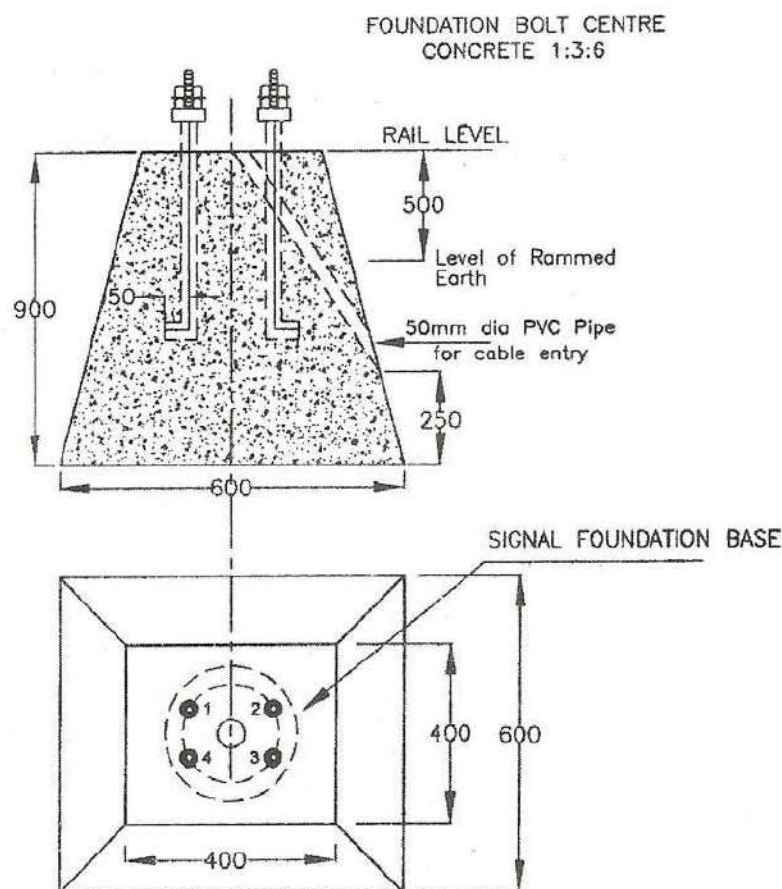
**NOTE:-**

1. All dimensions are in mm
2. Casting of bolts to be done in the concrete base duly taking the measurements of the surface base and circle also aligning the four holes of the surface base with the bolt location 1,2,3 & 4 by providing Template.
3. Entire foundation should be cast in one stretch and with bolt only.
4. 75mm dia. PVC Pipe to be embedded during casting itself and not later on.
5. After casting of base and curing of the same is over the four sides of the base to be cleared of all left over concrete and sides duly rammed with earth upto 500 below the top of the base.
6. Where required pitching on the relevant sides of the rammed surface with 225 to 300 size boulders shall be done and filling the crevices with 1:6:12 concrete with fine 20 stone chips. Pitching will be to the full height of the rammed earth.
7. Outer surface should be plastered from top of foundation with 1:2 cement sand upto a level of 50 below
8. Foundation bolt of size 24mm dia 915mm long with 2 flat washers & 2 nuts are to be used.
9. Concrete Foundation with ratio 1:3:6


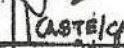
Drg No	SG/CN/02/9		
FOUNDATION FOR COLOUR LIGHT SIGNAL			
Reference	SG/CN/5	Checked	 (Caste)
Scale	NOT TO SCALE	Approved	 Nayak

PCSTE/CN

## FOUNDATION FOR SHUNT SIGNAL

**NOTE:-**

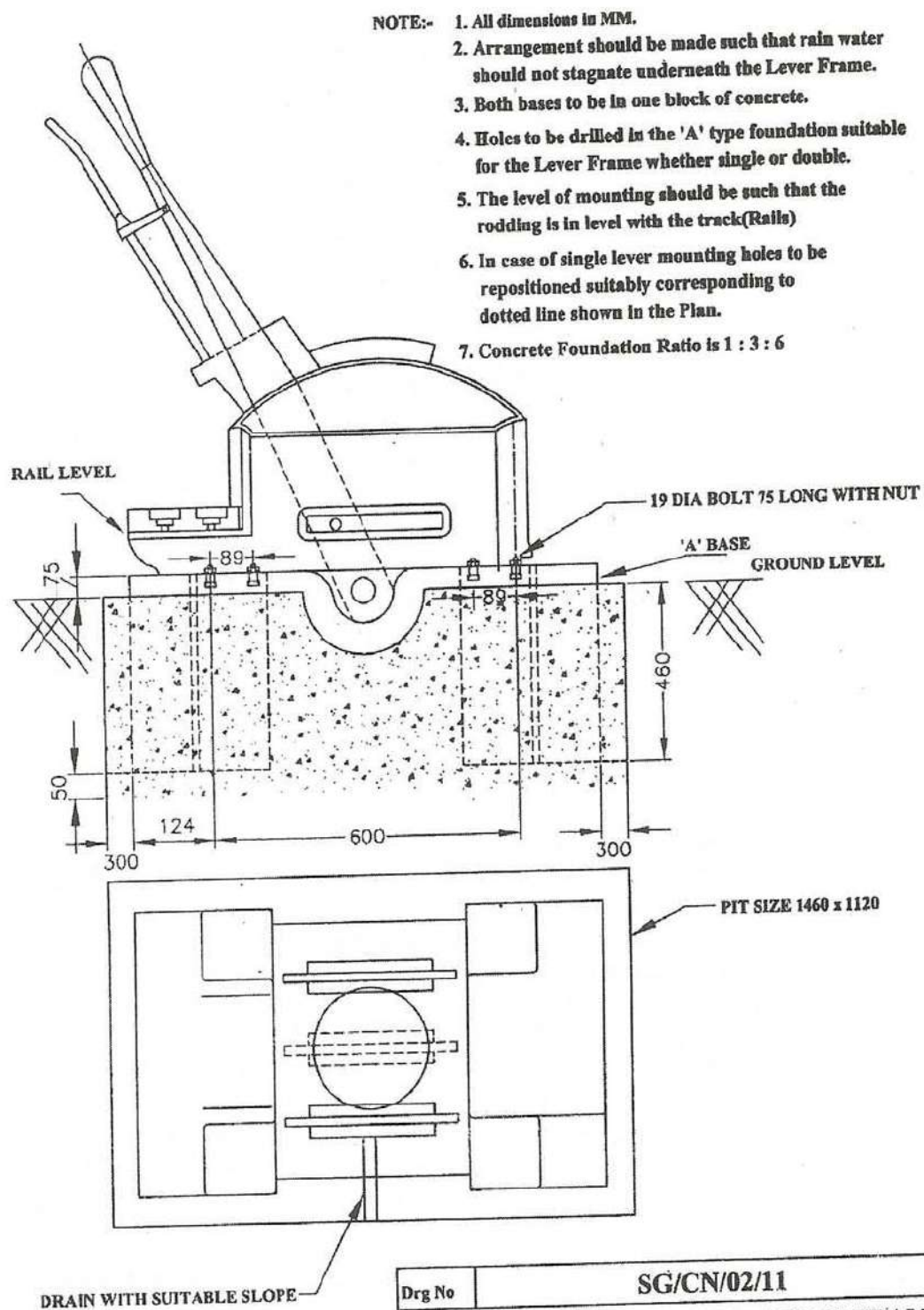
1. All dimensions are in mm
2. Casting of bolts to be done in the concrete base duly taking the measurements of the surface base and circle also aligning the four holes of the surface base with the bolt location 1,2,3 & 4 by providing Template.
3. Entire foundation should be cast in one stretch and with bolt only.
4. 50mm dia. PVC Pipe to be embedded during casting itself (and not later on)
5. After casting of base and curing of the same is over the four sides of the base to be cleared of all left over concrete and sides duly rammed with earth upto 500 below the top of the base.
6. Where required pitching on the relevant sides of the rammed surface with 225 to 300 size boulders shall be done and filling the crevices with 1:6:12 concrete with fine 20 stone chips. Pitching will be to the full height of the rammed earth.
7. Outer surface should be plastered from top of foundation with 1:2 cement sand upto a level of 50 below
8. Foundation bolt of size 22mm dia 450mm long with 2 flat washers & 2 nuts are to be used.
9. Concrete Foundation with ratio 1:3:6



Drg No	SG/CN/02/10		
FOUNDATION FOR SHUNT SIGNAL			
Refrence	SG/CN/6	Checked:	 CASTE/CN
Scale	NOT TO SCALE	Approved:	 Kaur

f CSTE/CN



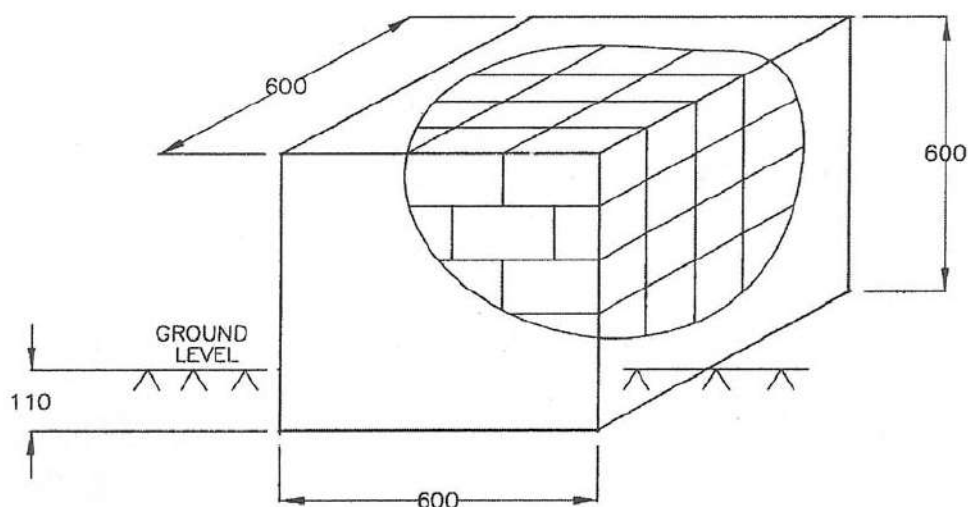
## FOUNDATION FOR GROUND LEVEL FRAME



Drg No	SG/CN/02/11		
FOUNDATION FOR GROUND LEVER FRAME			
Refrence	RE/S&T/Sig/Tender/3/85	Checked	
Scale	NOT TO SCALE	Approved	

f CSTE/CN

# MASONRY PLAT FORM FOR SIGNAL POST TELEPHONE



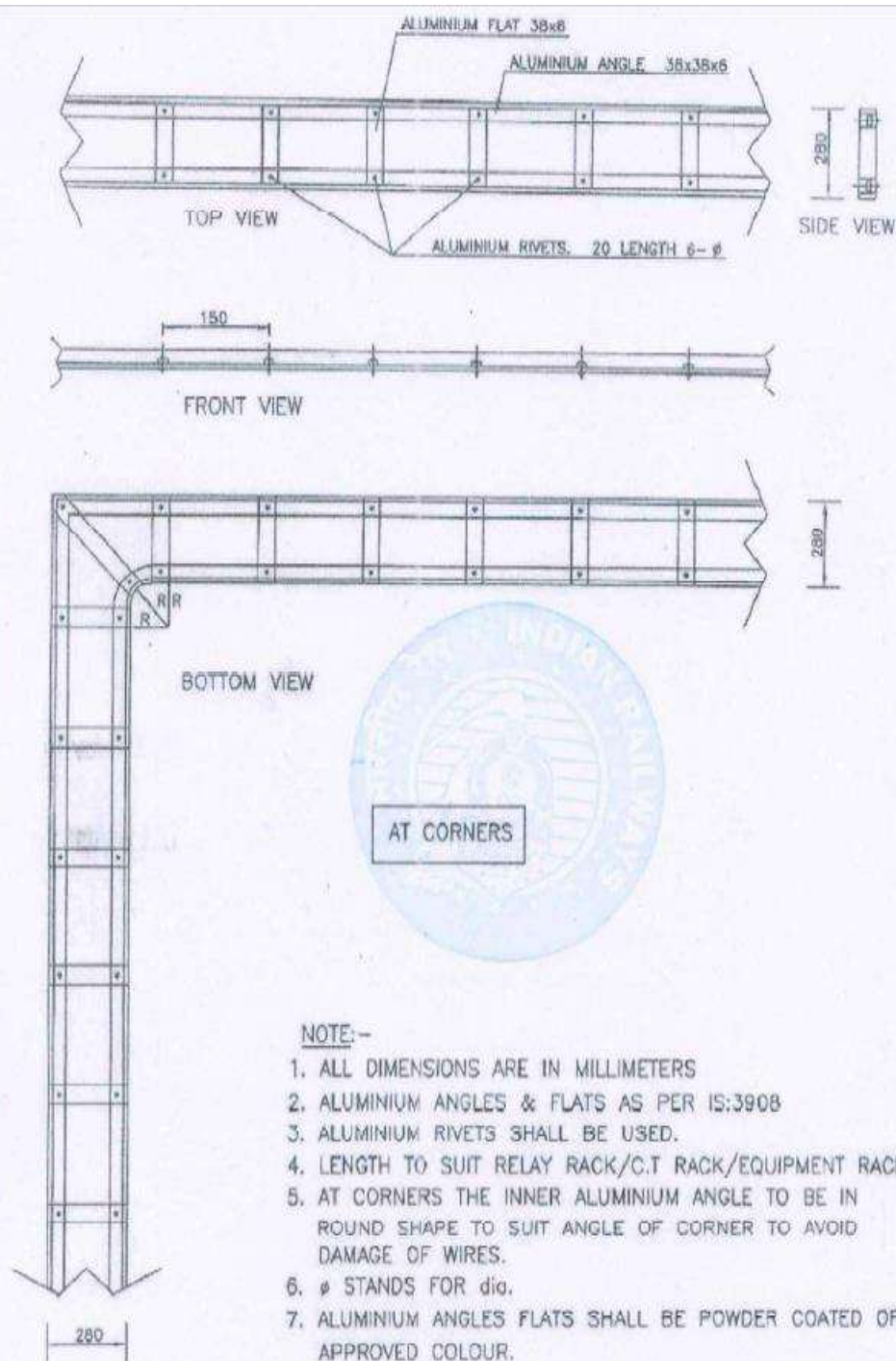
## NOTE:-

1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. GOOD QUALITY OF BRICKS OF APPROX. SIZE 220 x 100 x 60mm SHOULD BE USED
3. AFTER CONSTRUCTING THE PLAT FORM, ALL SIDES OF THE BASE SHALL BE RAMMED WITH EARTH AND CONSOLIDATED
4. PLASTERING TO BE DONE WITH CEMENT MORTAR OF RATIO OF 1:3 TO 12mm THICKNESS

Drg No	SG/CN/02/12		
MANSONARY PLAT FORM FOR SIGNAL POST TELEPHONE			
Reference	J/W/62/96	Checked	CASTE/CN
Scale	NOT TO SCALE	Approved	Naval

f cste/cu

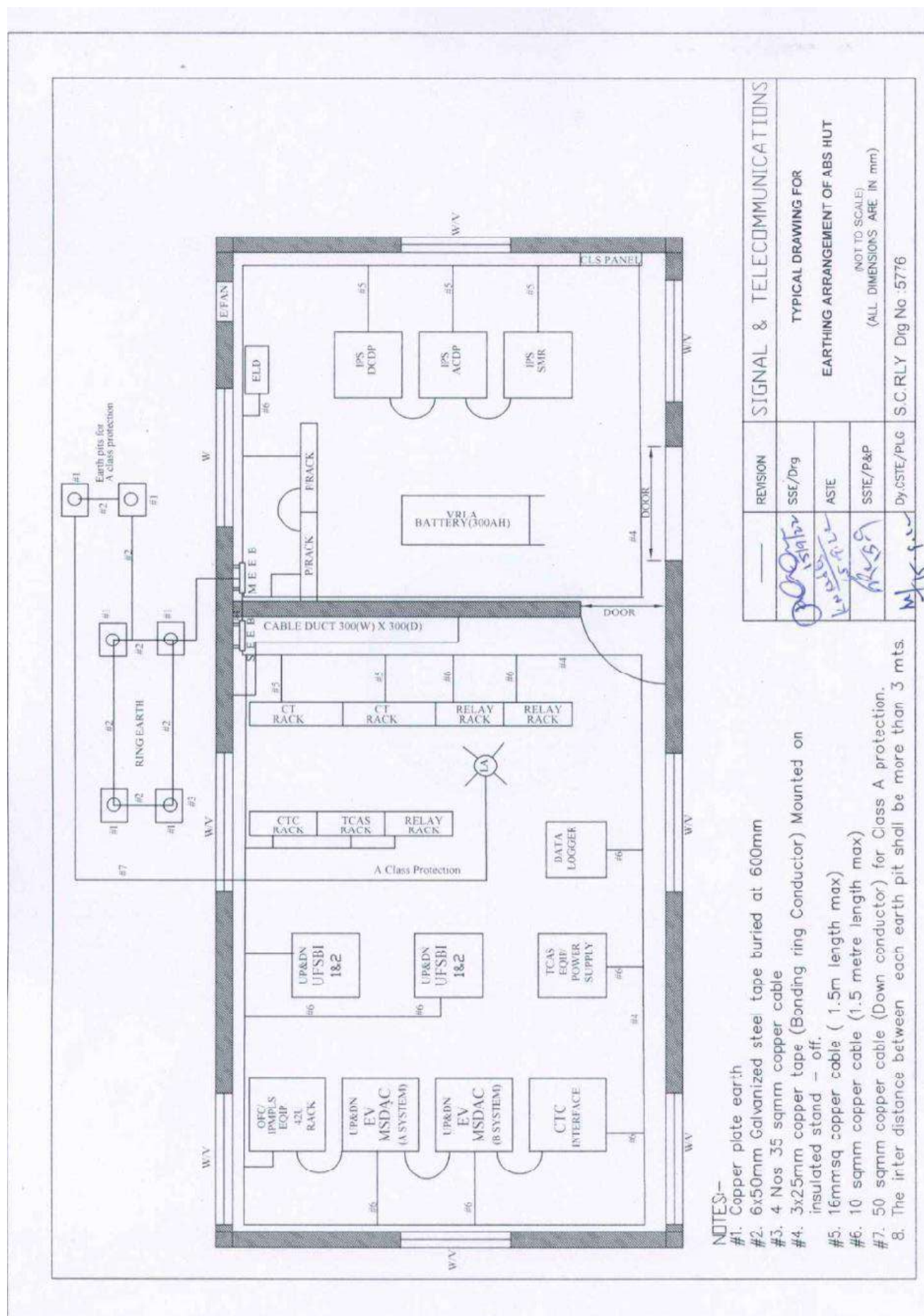
## LADDER



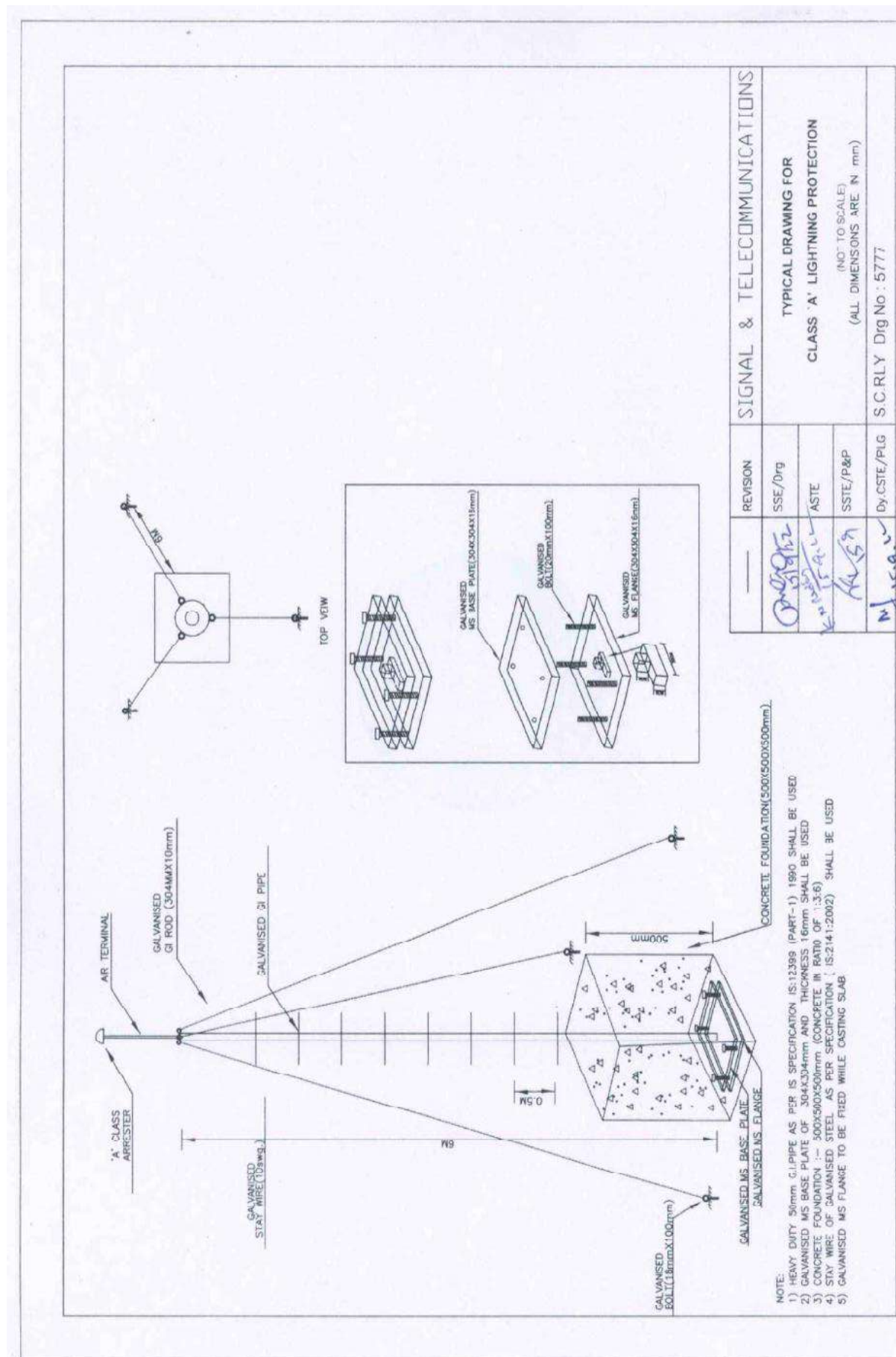
—	REVISION	SIGNAL & TELECOMMUNICATIONS
<i>Any</i>	SSE/Drg	TYPICAL DRAWING FOR LADDER (NOT TO SCALE) (ALL DIMENSIONS ARE IN mm)
<i>K. N. Singh</i>	ASTE	
<i>AR</i>	SSTE/P&P	
<i>ML - 09.11</i>	Dy.CSTE/PLG	S.C.RLY Drg No : 5769



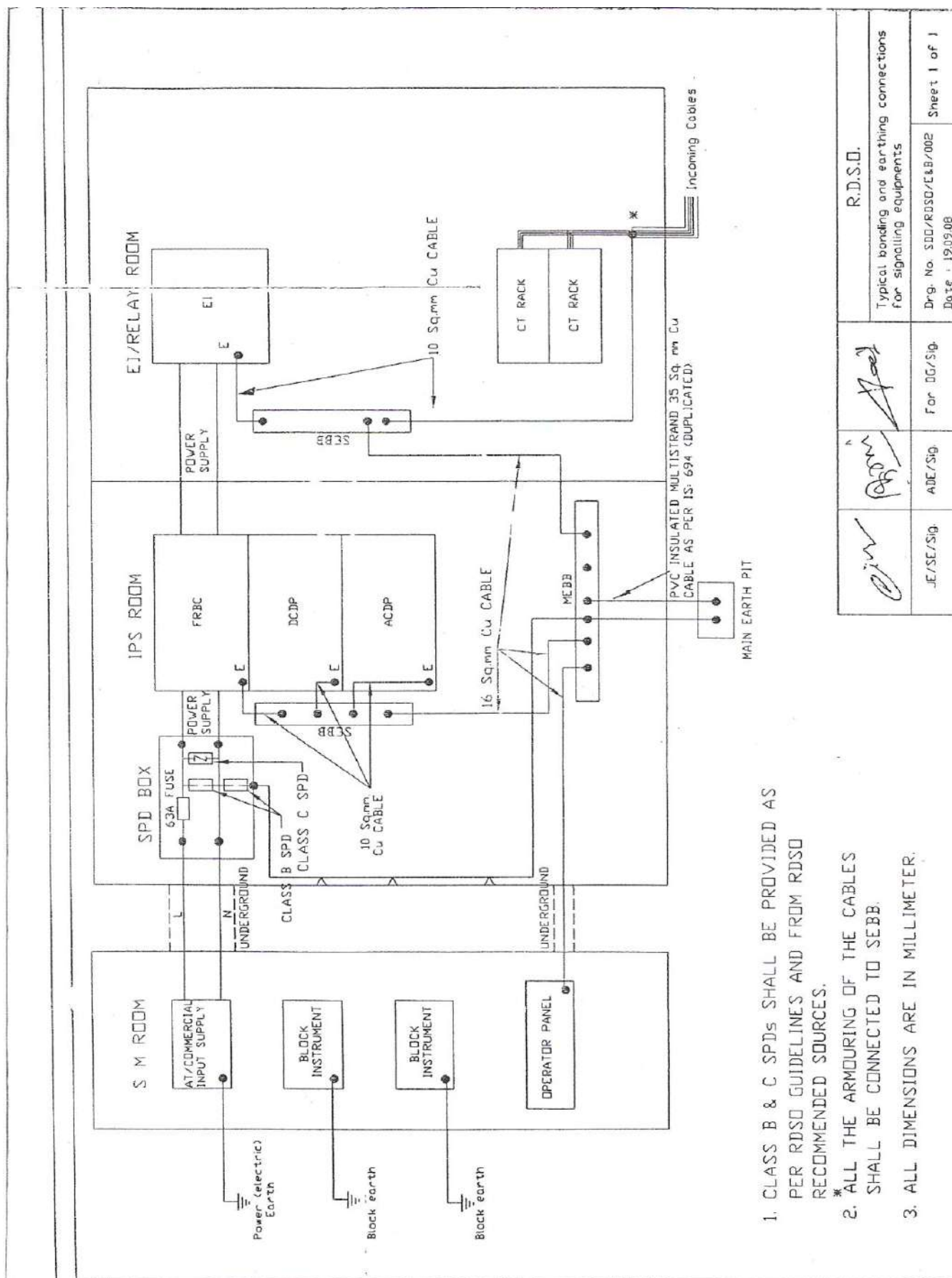
## Earthing Arrangement ABS Hut



## CLASS A LIGHTENING PROTECTION



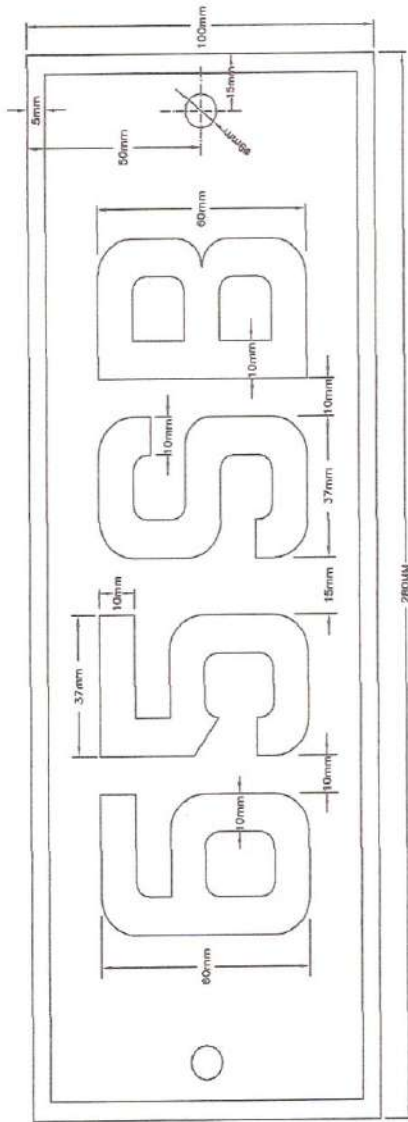
# TYPICAL BONDING AND EARTHING CONNECTIONS FOR SIGNALLING EQUIPMENTS





Enamelled Number plate

REC- FN-44 OF SG-191/P/II-VOL-4



NOTE:- 1. THE NUMBER IN THE PLATE SHOWN IS ONLY FOR EXAMPLE.

2. THE PLATE SHOULD BE MADE OF MILD STEEL.
3. THICKNESS OF THE NUMBER PLATE SHALL BE 2mm & BRACKET SHALL BE MINIMUM 3mm.
4. MINIMUM WEIGHT OF THE NUMBER PLATE SHALL BE 350gm.
5. FRONT SIDE THE NUMBER PLATE SHOULD BE ENAMELLED WHITE COLOUR WITH THE SIGNAL NUMBER ENGRAVED & ENAMELLED IN BLACK COLOUR.
6. THE REAR SIDE OF THE NUMBER PLATE SHOULD BE ENAMELLED IN BLACK COLOUR.
7. SUITABLE MILD STEEL BRACKET & FIXTURE SHOULD BE PROVIDED TO FIX THE NUMBER PLATE FIRM ON THE SIGNAL POST.
8. IN CASE ONLY TWO DIGIT OR THREE DIGIT NUMBER, IT CAN BE ADJUSTED IN THE NUMBER PLATE ACCORDINGLY WITH INTERSPACING RETAINED.

" COPY " 12/11/08  
For CSTB

SOUTHERN RAILWAY  
TYPICAL SKETCH FOR NUMBER PLATE FOR SIGNALS

DRG. NO. चुकेट नं.	TY/08/2008
DRAWN चुकेट	AM KESHORE
CHECKED चुकेट चेक	SL -
APPROVED अनुमोदित	SL -

sd - (3.11.08)  
(T.M.SRIDHAR) CSE  
for CHIEF SIGNAL AND TELECOMMUNICATION ENGINEER, CHENNAI  
சீப் சிக்னல் இன்ஜினியர் & டீ.கம். இன்ஜினியர், சென்னை