



SOUTH WESTERN RAILWAY

TECHNICAL SPECIFICATION FOR SIGNALING WORKS

Revision: 0.0

OFFICE OF CHIEF PROJECT MANAGER

GATI SHAKTI UNIT (HUBBALLI)

HUBBALLI DIVISION

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Chapter-01

General

1. The detailed Specifications for the work which is to be carried out by the contractor are as stipulated here. Notwithstanding 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.
2. Current RDSO specifications are mentioned here. However, while procuring only the latest RDSO specification will prevail and material to be inspected as per latest RDSO specifications.
3. Materials shall be procured from the RDSO approved vendor list, prior approval of Railways shall be obtained before placing the order with vendors under Development orders.
4. Drawing number mentioned here are current and may be updated. Latest drawings is required to be followed while execution of work.
5. The quantities of sub items against each item are to be calculated/assessed and approval of Engineer to be taken before consolidated procurement of such items and for arranging inspection by RDSO/RITES.
6. Materials not covered in RDSO's approved list of items and to be supplied by the contractor shall be of the best quality and from manufacturers of reputed establishments. The contractor shall produce Quality test, Warranty certificates from the manufacturers and the pamphlets in four copies to the Railways.
7. The Outdoor works include supply and execution of items as well as work in the relay/equipment room and in the field. It will be the responsibility of the Tenderer to commission the complete interlocking with outside gears i.e., points, signals and other field signaling equipment, installation, testing and commissioning of system including transportation of all the equipment to site of installation. Testing and commissioning will be done in association with Railway Engineer and staff.
8. For the execution of the works, the contractor shall procure items of materials inclusive of miscellaneous and consumable items of Stores.
9. The specification for each material to be procured and used by the tenderer shall be as indicated against each item of material. All the materials and equipment to be supplied and used for execution of work shall be to IRS specification wherever available, or to IS, if IRS is not available. In case of materials for which neither IRS nor IS specification is available, detailed specifications with drawing have to be supplied by the contractor for approval of the Railway.

10. Materials required for installation at the station shall be made available to the contractor at the Railway's depot, and the contractor shall take delivery of such materials at this depot and make his own arrangements for the transport of the materials at the works spot at his own cost. The contractor shall be responsible for checking before taking delivery that all the materials given to them are in good condition. The contractor shall be responsible for undertaking repairs, if any, to crates, cable drums packing cases, etc. for safe transport of materials from the Railway's specified depot to the site of work. The contractor should also undertake necessary repairs to create drums etc. in respect of unused materials required to be returned to the purchaser. No extra payment will be made on this account.
11. Extra care should be taken in the transportation of sophisticated Electrical and Electronic equipment like relays, power equipment, etc. to prevent damage during transit. Further, these equipment should be stored in a covered place to protect from heat, dust, water, etc. These equipments should be installed and brought in use before the expiry of the shelf life.
12. The materials that shall be handed over to the Contractor at any time for execution of the work shall depend upon the particular item of work in the Schedule to be done at a particular time and also the progress of work. The contractor shall furnish an indemnity bond for a sum equal to the cost of materials proposed to be taken by him. The quantity of materials that shall be given by the Railway at a time shall not exceed the value of the indemnity bond that is furnished by the contractor.
13. The materials issued by the Railways shall be used solely and economically for the purpose of the works covered under this contract only. The materials shall be used in such quantities and manner as indicated in the relevant specifications or drawings or as approved by the Engineer whose decision thereon shall be final. Waste or damage to such materials in any manner shall not be caused by the Contractor.
14. The contractor will be liable to render full accountable for all the materials issued by the Railway. If any quantity of Railway materials is consumed in excess or wasted or damaged or lost or otherwise not satisfactorily accounted for, recovery shall be made from the contractor at the book rate or last purchase rate or the prevailing market rate whichever is higher plus 5% on account of initial freight, 2% on account of incidental charges together with supervision charges at 12.5% on the total cost inclusive of materials, freight and incidental charges. Freight between the Railway sources of supply and the site of work shall be to the contractor's account.
15. Material at Site statement shall be prepared and submitted as per the provisions contained in GCC by the Railway Engineer. The contractor must promptly submit the monthly return of the issued stores to the Railway Engineer in the first week of every month without fail.
16. If at any time, any material which the contractor would normally have to arrange

for himself for executing the works, is supplied by the Railways, either at the contractor's request or suo-moto in order to prevent possible delay in the execution of the work due to contractor's inability to make adequate arrangements for the supply thereof or otherwise such materials will be made available to the contractor in the Railways Stores. All handling thereof will be the contractor's responsibility. Recovery of the cost of such supply materials will be made from the contractor's bills as per extant rules of the Railway.

17. The contractor has to return any cut pieces of cables, wires, etc., that may be left out and surplus materials from the drums and other packing materials that might have been handed over to him. No extra payment will be made for this and the unit price quoted against the various items should include this work also. The surplus materials have to be handed over to the Stores of the Engineer- in-Charge of the work.
18. The contractor shall take proper written acknowledgement from the Engineers Representative for all the materials returned by him.
19. All tools that are required by the contractor for the purpose of transportation of the materials, digging, concreting and erection, wiring and painting works shall be brought by the contractor himself. This shall include spare parts, fuel and consumable and miscellaneous stores. The rates quoted by the contractor shall be deemed to be inclusive of all charges for such items and inclusive of labour required to ensure efficient and methodical execution of work.
20. As soon as the materials are accepted by the Railway from the contractor, DMTR entries are to be made immediately. While taking materials from the contractor, delivery challan issued by the firm, who has sold the materials to the contractor/trader and inspection certificate shall be insisted upon.
21. Fabricated items which are to be supplied by the contractor are to be checked thoroughly with the drawings regarding quality of the materials, gauge dimensions, etc. as per the schedule. Wherever any material is received from field/contractor, the detailed nomenclature shall be entered in the DMTR. In case of equipment, the details of manufacturer's name, year of manufacture, RDSO Test Certificate No., Serial No., Contractor's name and Agreement No. and place of installation shall be mentioned both in the DMTR and the ledgers.
22. Materials are normally to be delivered at designated Stores by the contractor. If they are delivered at site due to logistics/exigencies, the supervisor/officer receiving such materials (after verification of due inspection) shall arrange for necessary entries in the Site Inspection Register and ensure the entry in designated Stores' DMTR within a week.
23. The following items will continue to be inspected by RDSO irrespective of its value:
 - i. All Types of Signaling Relays
 - ii. Block Instruments
 - iii. Axle Counter Equipments
 - iv. All Power Supply Equipments

- v. Electric Key Transmitter
 - vi. Terminal Blocks (PBT type)
 - vii. Electric Point and Lock Detector
 - viii. Electronic Interlocking system.
 - ix. Data Loggers
 - x. LED Signals
 - xi. PVC Wire Copper for signaling
 - xii. Maintenance Free Earth.
24. The contractor will however have to procure all the tools and plants required for executing the labour portion of the work and before the actual commencement of the work, the contractor will satisfy the Railway engineer that he has procured all the necessary tools and plant required of good quality. The contractor shall engage his own labour and supervisor for the execution for work covered in the contract.
25. The work shall be carried out by the contractor according to the drawings approved by the Railways and shall conform to the provision of codes, Signal Engineering Manual, Telecom Manual, RDSO specifications, Railway Board guidelines, RE Manual, Block manual and schedule of dimensions are deemed to be a part of the Contract Agreement and solely responsible for the proper execution of the work. Description of Outdoor work is given in the respective item of Schedule of work, however, Broad guidelines for various activities in connection with outdoor works shall be followed. In case of any conflict with the description in the Schedule of Work and these guidelines, the details in the Schedule of work shall prevail.

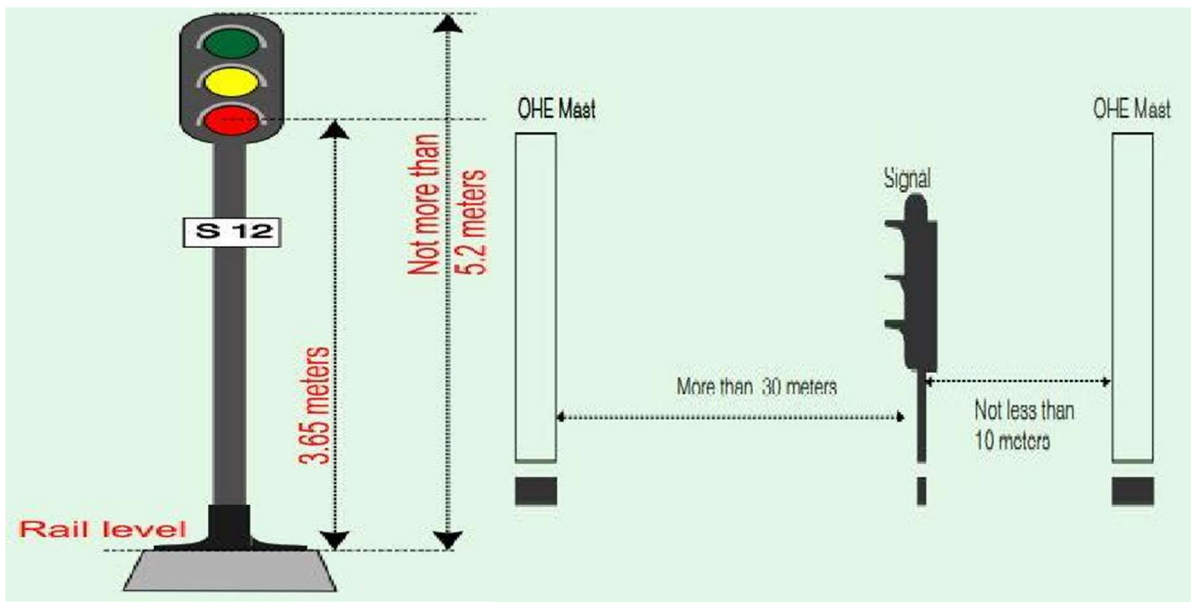
Chapter-02

Signal and Accessories

1. General:

- 1.1. Main LED Signal shall be conforming to RDSO Specification No. RDSO/SPN/199/2010 Rev. 1.1 or latest and Subsidiary LED Signal shall be conforming to RDSO Specification No. RDSO/SPN/153/2011 Rev 5.0 or latest.
- 1.2. The work includes excavation of pits and casting of signal foundations as per relevant schedule item and standard drawings.
- 1.3. Signal pole shall be securely fixed to the surface base and erected on the signal foundation and plumbed. The gap between the signal pole and surface base shall be filled up with lead wool or any other approved substance to avoid tilting.
- 1.4. Multi-unit color light signal up to 2/3/4 aspect shall be properly mounted on signal post with or without route indicator. Soon after installation, the pole shall be painted with Aluminum enamel after giving a coat of primer and the signal unit shall also be painted as per the standard practice.
- 1.5. All the signal aspects have to be focused properly. LED signal units may be employed where supplied by Railways.
- 1.6. Signal unit door shall be locked using universal locks. Universal locks are covered by a separate item of schedule or Railway supplied.
- 1.7. The cables are to be taken through the pole to the unit without damaging the insulation and armor then skinned and terminated.
- 1.8. All the signal units are to be wired as per approved practice by the Railway. The wiring is to be tested jointly.
- 1.9. Jumper selection shall be such that ON aspects shall be "Non blanking" and "OFF" aspects shall be "blanking".
- 1.10. The signal post shall be properly plumbed and fitted with a ladder having a platform and guarding on the top.
- 1.11. Necessary ladder with concreted supports as required shall be provided.
- 1.12. All the signal posts and signals shall be installed clear of infringements. i.e., 2.36 meters Non RE and 2.844 meters for RE area (new installation) from the center line of the nearest track.
- 1.13. Signal ladder erected at a distance of less than 2.36 meters from the center of the adjacent track should be blanked off to a height of 300mm between 2.06 meters and 2.36 meters above rail level.
- 1.14. Markers and number plates shall be fixed wherever necessary as per signaling plan using suitable clamps. Signal number has to be painted on the

- "Number plate". All fittings are to be tightened properly. Signal unit shall be locked properly.
- 1.15. Protective mesh shall be provided for all signal units and part of execution of work without any additional payments.
 - 1.16. Necessary earthwork shall be made around each signal if required by Railways. The earth work and pitching shall be paid separately under a different item of schedule.
 - 1.17. Supply of signal accessories, post, CLS unit, LED aspect, Ladders etc. are covered by separate items of schedule or supplied by Railways.
 - 1.18. FRP type signal units may be preferred against conventional CI units.
 - 1.19. For existing signals erected on the Right-Hand Side, illuminated arrow markers lit on the signal may be provided on such signal posts after it is standardized by RDSO. In case of new signal approval of GM would be required for not locating the signal on the Left Hand Side.
 - 1.20. For better visibility, it is preferable to erect the signals on the opposite side of the OHE masts but if this is not possible then
 - 1.21. The distance between the signal and the mast in front of it must not be less than 30meters.
 - 1.22. At the same time, the signal should not be located closer than 10 meters from the mast behind it. However, this distance may be reduced to 3 meter provided:
 - 1.23. The mast is not anchored and It is ensured that the contact wire is staggered awayfrom the signal.
 - 1.24. Signal with or without Route Indicators between Tracks:
 - i. If it is not possible to cater for extra implantation due to restricted trackseparation, no masts shall be provided for at least 3 spans in front of the signal.
 - ii. Portal drop arms also should not normally be located in the track space wheresignals are located.
 - iii. In case portal drop arms should not be avoided, off-setting the signal and theportal drop arm may be done.
 - 1.25. The height of the centerline of the red signal should be 3.65 meter above rail level.
 - 1.26. Post height for Signal without Route Indicator is 3.5 meter.
 - 1.27. Post height for signal with route Indicator (Main unit on Offset bracket) is 4.5 meter.
 - 1.28. No part of a signal without route indicator shall normally be higher than 5.2 meterabove rail level.
 - 1.29. The minimum visibility of signals as per the SEM shall be as follows.
 - i. For Distant Signal – 400 meters.
 - ii. For Stop Signal – 200 meters.



2. Erection and wiring of color light main signals:

- 2.1. Signal pole shall be securely fixed to the surface base and erected on the 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 Aluminum paint/ Yellow & Black strips of Enamel paint for the second distant signal after a coat of primer. Signal unit shall be provided with two coats of black enamel paint.
- 2.2. Multi-unit color light signals up to 4 aspects shall be properly mounted on the top of the signal pole where there is no route indicator. If required, LED type signal aspect shall be fixed for signals. If there is a route indicator a large offset bracket shall be fixed firmly with 2 nos. of 'U' bolts 3/4" thick on the signal pole for mounting multi-unit color light signals. One 22mm through hole shall be drilled on the signal pole just below the off-set bracket and a 20mm through bolt shall be provided to prevent the offset bracket from sliding down. Signal ladders with platform complete fittings, cast iron shoe and adequate number of supports 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, enameled 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.
- 2.3. Signal tail cable shall be taken through the signal pole without damaging insulation and armor, 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 the signal pole for taking signal tail cable. Suitable protection shall be provided on the slotted hole to avoid damage to insulation of cable.

- 2.4. This work includes fixing of LED Unit along with Current Regulator. Wiring to be done according to the approved circuit diagram. The unwanted aspects shall be blanked using MS sheets of 3mm thick.
- 2.5. All the multi-unit color 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.
- 2.6. 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. If a Ladder of signal erected at a distance within 2360 mm from C/L of adjacent track then it should be blanked off (strap around by a sheet around ladder) to a height of 300mm between 2060mm and 2360mm above rail level using MS plate not less than 8mm thick. 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.
- 2.7. All signals shall be properly earthed in the RE/ Non-RE area.
- 2.8. Necessary wooden cross shall be fixed on the newly erected signals before being brought into use.

3. Route Indicators:

- 3.1. All types of Route Indicators shall be mounted on the top of the signal pole firmly. The tail cables for route indicators shall be taken through signal poles without any damage to the insulation and armor, 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 indicators shall be painted as required by Railways.
- 3.2. Universal AC/DC LED Numeric Route indicator should be capable of displaying 1 to 19 route with right & left arms with optical sensing and complete housing for use with LED ECR.
- 3.3. The unit should mount at the top of the signal post safely and securely. Necessary fixing arrangements shall be supplied by the Contractor.
- 3.4. The circuit should be so designed that it draws the required current to ensure the pickup of ECR whenever the digit is lit.
- 3.5. RDSO approved Route LED's should be used for left and right arms. It should work on 110V +/- 20% AC.
- 3.6. Color of LED's of white color of reputed make should be used for Numeric

Route indicator seven segment display. Fusing of an LED should neither blank the whole segment nor deteriorate the visibility of indication. Uniform intensity over the entire operating range Components used in the numeric route indicator unit should be industrial grade.

4. Calling - On Signals/'A' Marker Lights:

- 4.1. 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 Railways.

5. Shunt Signals:

5.1. Position Light Ground Type Shunt Signal:

- i. The position light shunt signal shall be properly mounted and plumbed.
- ii. The cables are to be taken through the unit, skinned and terminated. The post type/Ground type shunt signals shall be wired and terminated and the wiring shall be tested jointly.
- iii. This work includes fixing of number plates and direction Arrow plates. The post shall be painted with Aluminum while the signal unit and surface base with black enamel paint.
- iv. The CLS units, Route Indicators, Calling-on signals, position light shunt signals, post type and ground type shall be provided with EWS locks.

5.2. Post Type Shunt Signal:

- i. Small off-set bracket shall be firmly fixed with 'U' bolts of suitable size on the signal pole for mounting Post type shunt signals. One 22mm through hole shall be drilled on the signal pole just below the off-set bracket and a 20mm through bolt shall be provided to prevent the offset bracket from sliding down. A vertical slotted hole of 50x50mm in size shall be made on the 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 and terminated and the wiring shall be

tested jointly. This work includes fixing of number plates and direction Arrow plates. The post and signal unit shall be painted with Aluminium and enamel black respectively. One EWS lock shall be provided for the signal.

6. Provision of locks:

- 6.1. 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. Two Navtal locks (Godrej make) 75mm with 2 keys shall be provided for Relay Rooms at all stations.
- 6.2. Block instruments, Block counters, control panel, EKT's and all signaling gears installed shall be painted in accordance with the standard practice of South Western Railway and as per Signal Engineering Manual.
- 6.3. While painting, initially one coat of primer and afterwards 2 coats of Enamel/Aluminium paint shall be applied.

7. Screening arrangements:

- 7.1. For the Colour Light signals in RE area which are coming in the infringing zone, screening arrangement as per standard RE drawing 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.

8. Warning Board:

- 8.1. The Warning Board shall be as per Drg. No.SG/SWR/0050.
- 8.2. Warning boards fitted on the Rails/angle/channel/ shall be erected and concreted at locations as indicated by Railway representative and as per approved Signaling plan and shall be clear of all infringement.
- 8.3. If necessary, existing warning/stop boards shall be shifted and re-erected on the place required by Railways.
- 8.4. The rail post and other fittings shall be painted as required by Railways.

9. Shifting Of Signals:

- 9.1. 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
- 9.2. Wherever required the existing Colour Light Signals shall be shifted to clear any infringement from the tracks as instructed by the 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.

- 9.3. 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 an LED unit with Current regulator. If there are any blank aspects, the same shall be covered with a round MS plate.

Chapter-03

Location Boxes and Accessories

1. Location Boxes

- 1.1. All apparatus cases/battery boxes shall be erected on concrete foundation and plumbed. It should be clear of infringement when the doors are kept open perpendicular to the track.
- 1.2. All foundations shall be plastered on all sides and earthwork shall be made up to the required level. All the apparatus/battery boxes used shall be painted on the inner side with white paint before fixing the shelf planks and terminal board after a primary coating with red oxide and with Aluminum paint on the outer side after installation at site.
- 1.3. All the apparatus cases used as battery boxes shall be provided with hard wooden planks planned to smooth the surface.
- 1.4. Branded (IEL brand Bakelite sheets or better) full size hylam Sheet of 10mm thickness and wood screws of proper size shall be used for fixing ARA terminal/fuse block and hylam Sheet of 12 mm thickness or one hard wood 37mm thick shall be used for shelf planks.
- 1.5. Minimum Two holes on either side of the terminal/fuse block shall be made if required for carrying out wiring termination. Shelf plank be securely fixed in level on suitable M.S. angle brackets. Supporting MSZ angle to be provided for shelf plank.
- 1.6. The hylam sheet shall be drilled holes carefully with sufficient wood supports at bottom of it to avoid damage, if damaged the contractor shall replace the entire sheet and no extra payment may be done for it.
- 1.7. The bolts and nuts of appropriate size to be used for fixing of these hylam sheets.
- 1.8. The underground signaling cable shall be taken into the apparatus case/battery boxes and properly secured by wooden clamps/cable gland plates.
- 1.9. Additional dummy entry plugs/duct pipes shall be provided for future cable entries, which are to be provided for future cable entries, which are to be provided with caps.
- 1.10. The cables shall be neatly skinned, bunched and terminated. All cores of cable shall be terminated on the terminal board at locations and in relay rack at the required places in the order as approved by Inspector in charge. All the power cables (Aluminum) shall be crimped with Aluminum lugs using a crimping tool.
- 1.11. All apparatus cases shall be provided with 'E' type lock arrangements on one or both the doors as per instructions at site. Contractor shall procure material and fabricate for fixing of 'E' type lock if such provision did not exist

- on the apparatus case. Location box supplied by Railways.
- 1.12. The armors of all the cables and apparatus case shall be earthed as directed by Site Engineer.
- 1.13. Track relays, line relays, overload relays, transformers, track feed chargers, rectifiers, charged secondary cells, track feed resistance, EKT, telephone plugs etc., shall be fixed neatly in the apparatus case as required by Railways. The wiring shall be carried out in a neat manner. Wires to be bunched neatly and tested and shall be ensured all relay Q connectors are intact. The relays wherever fixed shall be fixed in such a manner that they cannot be easily removed or tilted. Details of cable terminations and wiring particulars shall be painted inside the apparatus case door in addition to documentation (in a laminated sheet placed inside the pocket available on the door). Relay fixing arrangements shall be firm and rigid to avoid any chance of vibration due to train movements.
- 1.14. All electrical equipment wherever provided shall be earthed as directed by site Engineer. Description of equipment, relays etc., shall be neatly painted inside the apparatus case door. All the internal wiring shall be tested from point to point in full, jointly by contractors authorized Engineer and Railways supervisor.
- 1.15. Track circuit accessories, chargers etc. shall be mounted on a hylam Sheet of 12 mm thickness Size. Batteries shall be mounted on a hylam Sheet of 12 mm thickness Size.
- 1.16. Stone pitching may be provided in slope area, water logging area and soil erosion anticipated areas to protect the Apparatus Cases/cables and signals.
- 1.17. Fencing may be provided around the cluster of Apparatus Cases wherever required to avoid miscreant activities.
- 1.18. For all signals, the implantation distance from the centerline of nearest track along with an arrow indicating towards nearest track may be painted on signal post in following colors:
- 1.19. Black on white background for normal implantation
- 1.20. Red on white background for implantation distance less than 2.36mtrs
- 1.21. Ref: Para No. 19.106 chapter XIX of SEM part-II correction slips No.1)
- 1.22. All the signal and location foundations shall be painted uniformly with standard quality paint primer for better protection of foundation materials & aesthetics.
- 1.23. The location of the apparatus case will be indicated by Railways.
- 1.24. Two 'E' type locks on the doors of full size apparatus cases and one 'E' type lock on the front door for half size apparatus cases shall be firmly fixed and tested with 'E' type keys. 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 do not exist. One hard wood shelf plank 37mm thick, planed and varnished shall be firmly fixed for all types of apparatus cases/ battery boxes. Also latching arrangements for the back door

shall be provided, if required.

- 1.25. All the apparatus cases (Full/Half/Quarter) are to be painted with Aluminum paint on the outside surface and the location numbers are to be painted in 'Bold' letters. Inside the location box shall be painted with white/Aluminum enamel paint.

2. Cable Termination in Apparatus Cases/CTB's:

- 2.1. At each apparatus case/CTB, the work consists of fixing all cables, fixing of Phynolic synthetic industrial fiber base fine weave cotton fiber sheet - 6mm thick to IS specification 2036 - 1995 - Type board along with terminal blocks and termination of cables/cores (conductors) using PVC/ Nylon sleeves as per details of termination in approved location diagrams. 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.
- 2.2. The underground signaling 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 aluminum power cables of size 10 Sq.mm and above shall be provided with Aluminum lugs using crimping tools of appropriate size.
- 2.3. Railway will indicate the approximate total number of cable core terminations to be made in the apparatus cases/cable termination boxes. The contractor shall fix Phynolic synthetic industrial fiber base fine weave cotton fiber 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 the terminal block and fuse block for bringing cable for termination. 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.
- 2.4. 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 repainted 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.

- 2.5. After fixing all the signaling 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 a sealing compound.
- 2.6. All the underground cables shall be provided with punched name plates showing total no. of cores, cross section of each core, Aluminum or copper conductor and from and to details etc. and also painted inside each apparatus case.

3. Wiring Of Signals/ LC Gate Control/ Track Circuit/ Point Control Relays in Location Boxes:

- 3.1. Relays, 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.
- 3.2. MS relay frame shall be painted before fixing. A hylam sheet of 25mm thick of requisite size shall be fixed inside 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 and temperature controlled soldering irons shall be used. The complete wiring shall be tested jointly and linked to tail cable.
- 3.3. 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 the terminal block. The name of the circuit and wire where connected shall also be painted on the sleeves.
- 3.4. 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 relay 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.

4. Alterations to Painting Particulars at Location Boxes:

- 4.1. Consequent to introduction of new circuits or alterations to existing circuits in apparatus cases/ CTB's, 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's.

Chapter-04

Point Machines and Accessories

1. The Non Trailable electric point machine shall be as per RDSO Specification No.IRS:S24-2002 or latest.

2. Installation of Point Machines:

- 2.1. 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.
- 2.2. The point machine shall be installed after cleaning the machine (both inside and outside) and greasing/oiling of 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.
- 2.3. 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.
- 2.4. 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 Roding 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 rodings shall be supported suitably.
- 2.5. Suitable eyelets shall be used for termination of power cables using Crimping tools. 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 the 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.

3. Adjustment and Testing of Point Machines:

- 3.1. 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.
- 3.2. The point machines shall be worked both ways with proper feed. It should

work without undue friction and working current shall be recorded.

- 3.3. 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,
- 3.4. The point does not get locked.
- 3.5. The point detection circuit is not completed
- 3.6. The friction clutch disengages.
- 3.7. The tripping current does not exceed 200% of normal working current.
- 3.8. The point machine shall be provided with EWS locks/pipe locks.
- 3.9. Necessary notches shall be cut on the pinion of the point machine to suit crank handle configuration in the case of 5E only.

4. Cable Termination Box for Cable Thoroughing, Point Machine:

- 4.1. The cables from location box to CTB shall be taken through 2 Nos. of G.I. Pipes of suitable size 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.
- 4.2. Jumper wires from Point machine to CTB to be taken through suitable hose pipes, both ends of the pipe shall be clamped with suitable stainless steel adjustable Hose Pipe Clamps. The CTB shall be provided with an EWS lock.

5. Shifting of Apparatus Cases/ CT Boxes:

- 5.1. The work consists of excavation of a 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, equipment 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/M-sand sand shall be filled up to the floor of the location and the bottom shall be sealed with sealing compound.

6. Interlocking of Siding Points/ Trap Points:

- 6.1. 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.

- 6.2. It shall be ensured that, it is not possible to lock the points with an obstruction of 5 mm test piece placed between switch and stock rail at 150mm from the toe of the switch.
- 6.3. 'E' type lock shall be fitted to the hand plunger locks with proper bolts and nuts.
- 6.4. After ensuring the free as well as the full movement of the plunger, marking shall be done and notches cut on the plunger.
- 6.5. Proper lubrication shall be done for the smooth operation of points, HP locks and 'E' type locks.

7. Fixing of Electrical Detector:

- 7.1. 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 an electrical detector by using ground connections. If any smithy work is involved, the same shall be carried out on the ground connection rods.
- 7.2. A CT box shall be fixed near the electrical detector and the cable is terminated inside the CT 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 CT box.
- 7.3. The electrical detector shall be painted with Aluminum paint and the point ground connections, CT box with black paint. The working of electrical detectors shall be tested in presence of a Railway representative to conform to obstruction tests.

Chapter-05

Track Circuits and Accessories

1. General

- 1.1. Reference Drawing no.: SG/SWR/066.
- 1.2. Track circuits shall be provided to confirm to para 8 of IRS specification S.36/87.

2. Installation:

- 2.1. Track circuit work includes fixing of track feed and track relay equipment in the apparatus cases as indicated by the Railway. 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 of 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 instructed by the Engineer in charge.
- 2.2. 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.

3. Alterations to Track Circuit:

- 3.1. Alterations to the existing track circuits involve shifting the Feed end equipment/ Relay end equipment/block joints and installing them at different locations and re- wiring them.
- 3.2. After completing the installation/alteration of track circuit, it shall be energized, tested, adjusted and readings recorded in track test record.

Chapter-06

Relays

1. Nomination of relays:

- 1.1. Relays shall be nominated as per the approved circuit diagram and contact analysis. All the works / circuit diagrams shall comply with RE standards.

2. Types of Relays:

- 2.1. Generally, the following types of relays are used in the relay room and in location as per site requirement. Code pin configuration/holes on the relay bases should not be tampered.
- 2.2. NON-AC Immunized Relays, Plug-In-Type, style QN1, 8F/8B Contacts, DC Neutral line Relay, Working voltage 24V DC, metal to carbon, with plug board, retaining clip and connectors as per RDSO Specification No BRS:930,IRS: S: 34 & IRS: S: 23, STR: SIQ 0420 Ver.1 or latest,. The Interlocking code for this relay shall be ABCDF.
- 2.3. AC Immunized Relays, Plug-In-Type style QNA1, 8F/8B Contact, DC Neutral line Relay, Working voltage 24V DC, metal to carbon with plug board, retaining clip and connectors as per RDSO Specification No BRS:931A, IRS: S:60, IRS:S:34 & IRS:S:23, STR: SIQ 0420 Ver.1 or latest. The Interlocking code for this relay shall be ABDGH.
- 2.4. Relay, Plug-in Type, QL1, 11F.4B contacts, Magnetically latched, neutral line Relay, working voltage 24V DC, Metal to Carbon with Plug board, retaining clips and connectors as per RDSO Specification No. BRS 935/A, IRS S-34, IRS S23 as applicable. The interlocking code for this unit shall be ABDEG.
- 2.5. Track Relays, Plug in type, Style QTA2 - 9 Ohm, 2F-1B Contacts, metal to carbon with plug boards, connectors and retaining clips as per RDSO specification No. BRS: 939A & 966 (Appx F2) & IRS:S-23,S34 & 60, STR: SIQ 0420 Ver.1 or latest. The interlocking code for this relay shall be FGHKX.
- 2.6. AC immunized Relays, Plug-in-type, style QBAT -9 Ohms, DC based track Relay, 2F/2B - contacts, Metal to carbon complete with plug board, retaining clip & connectors as per RDSO Specification No. RDSO/SPN/84-88, IRS:S:34 & IRS:S:23. The interlocking code for this unit shall be ABEJX.
- 2.7. AC immunized Relays plug in type style QBCA-1, 2HF/4B contacts, DC Biased contractor Relay, Tractive armature, working voltage 24V DC with Heavy duty front contact, metal to carbon complete with plug board, retaining clips and connectors as per RDSO specification No. BRS 943,

IRS. S.34,IRS.S.23

- 2.8. AC immunized Relays, plug in type, style QNA1K, 6F/6B contacts. DC neutral line Relay, working voltage 24V DC 1000 ohms, metal to carbon with plug board, retaining clip and connectors as per RDSO Specification No. BRS: 931A & STs/E/Relays/UEA/PI dated 30.05.97 Annex II & IRS:S-23,34&60, STR: SIQ 0420 Ver.1 or latest. The interlocking code for this relay shall be CDEKY.
- 2.9. AC Immunized Relays, Plug in type style "QSPA1" 8F/4B contacts ,DC Neutral line Relay, slow to pick up, Working voltage 24V DC, metal to carbon, complete with plug board, retaining clip and connectors as per RDSO Specification No. BRS:933A, IRS:S:34, IRS:S:23;IRS S 60-78, STR: SIQ 0420 Ver.1 or latest. The interlocking code for this relay shall be ABDEJ.
- 2.10. AC Lamp Proving Relays, Plug in type, Style QECX , 4F-4B Contacts, working voltage 110 V AC, metal to carbon for LED aspects with plug boards, connectors and retaining clips as per RDSO specification No : BRS:941A,STS/E/RELAYS/AC LIT LED SIGNAL/09-2002 Amdt1, IRS S-23 & 34, STR: SIQ 0420 Ver.1 or latest. The interlocking code for this relay shall be ABDHK.
- 2.11. Track Relays, Plug in type, Style QT2 - 9 Ohm, 2F-2B Contacts, metal to carbon with plug boards, connectors and retaining clips as per RDSO specification No. BRS: 938A; IRS S 34; IRS S 23, STR: SIQ 0420 Ver.1 or latest. The interlocking code for this relay shall be DEFJX.
- 2.12. Electronic Flasher unit operating on 230V/110V AC, 110V DC, able to drive 2 No. of flasher lights.
- 2.13. Electronic Time Delay Units (120/60 seconds), Working Voltage 24V DC with plug boards, connectors and retaining clips as per RDSO specification No.IRS:S- 61/2000 , STR: SIQ 422 Ver1.0 or latest.
- 2.14. Key Lock Checking Relay (KLCR) working on24V DC, AC Immunized with different ward combinations and contact configuration 4F/4Bwith 2 extra ward plates and with case, RDSO spec no. RDSO/SPN/219/2016 Ver. 1.0 with amendment or latest, confirming to IRS S-23, S-34 & S@45<44@ IRS S:46

Chapter-07

Relay Room and Accessories

1. Relay Racks:

- 1.1. Relay rack frame 1 way, fabricated out of 2 Nos. vertical supporting L angles of 65mm x 65mm x 6mm of 2103mm height and 1220mm width.
- 1.2. For inter rack cables/wiring ladder to be used instead of duct in the relay room.
- 1.3. For inter room cables/wiring, the entry made in the walls shall be sealed with foam so as to avoid entry of rodents inside the relay room/IPS room/battery room after completion of wiring.
- 1.4. Important points to be kept in mind while numbering the circuit diagram.
 - i. Maintain uniformity.
 - ii. Maintain the same contact for the stick path in the stick circuit. (A1/A2 in case of QN1 relays).
 - iii. The principle of similar relays at one location shall be normally adhered to.
 - iv. For inter rack cables/wiring ladder to be used instead of duct in the relay room.
 - v. As far as possible, allot the same contact for vital circuits.
- 1.5. For example:
 - i. RR front contact used in UCR, HR circuit shall be the same.
 - ii. UCR front contact used in the HR circuit shall be the same.
 - iii. HR front contact shall be the same for lighting circuits.
 - iv. ASR/ASPR back contact proved in the HR circuit shall be the same.
 - v. UCR, RR back contact used in ASR circuit shall be the same.
- 1.6. The cross protection contact used in UCR, HR circuit shall be the same i.e., RR back contact in UCR circuit, UCR back contact in the HR circuit.

2. Erection of Relay Rack (Podanur/ Siemens):

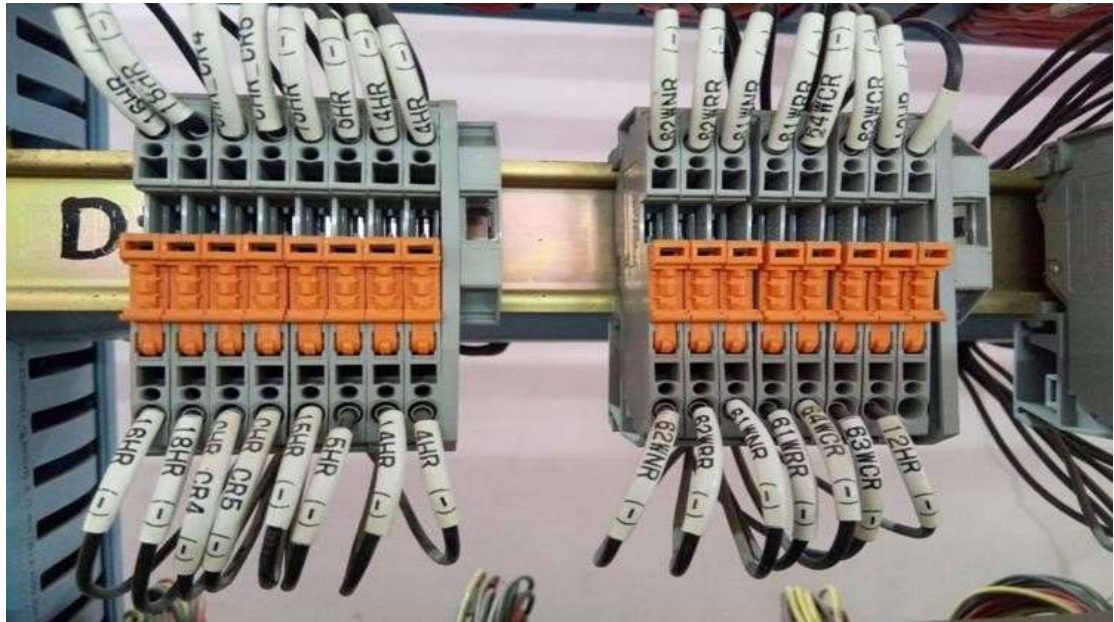
- 2.1. Podanur type Relay racks shall be mounted on T.W. base frame of size 50x150mm as required by Railways in the relay room with suitable foundation bolts and cement concrete.
- 2.2. Siemens's relay rack, (to accommodate 56 Nos. of 'Q' series relays) shall be anchored using 'J' type foundation bolts and nuts (12mmx100mm) with washers. In places where 'J' type bolts cannot 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 the wall and the other end fixed to the relay rack as tie.

- 2.3. The relay rack shall be painted including Relay nomenclature as per relay disposition chart soon after the installation and before plugging of relays.

3. Wiring of Relays (New/ Additional/ Alteration):

- 3.1. Based on the circuit diagram, the 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 the 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 the front side of the relays in the relay frame shall be painted.
- 3.2. 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 the relay rack to accommodate the complete bunch, wherever the new wiring is carried out.
- 3.3. 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 and Temperature controlled soldering iron. 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 using distinct colour wire. 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 the 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 to 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.
- 3.4. Before plugging, the relays shall be checked visually and defective ones noticed shall be replaced duly reporting the same to the railways.
- 3.5. The printed Relay Index and pasted on Perplex sheet of thickness 10 mm as per instructions of site in-charge shall be fixed in the relay room 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 incharge.
- 3.6. The new relay room shall be provided with Double Key Door Lock arrangement.
- 3.7. 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.

- 3.8. Standard colors codes i.e. Red for +ve, Black for –ve, (for all the circuits) and green for earthing shall be used.
- 3.9. The following types of wires shall be used.
 - i. 16/0.2 for internal relay wiring.
 - ii. 3/20 for Track battery chargers, batteries, signal unit & point machine wiring.
 - iii. 1 or 0.9 sqmm for data logger wiring.
 - iv. 0.5 sqmm from Telecom CTB to B/I for line circuit.
 - v. 7/20 ,16 sqmm multi strand copper cables for power supply wiring.
 - vi. 10 strands, 16 strand, & 35 sqmm multi strand copper cable for earthing. Eyelets must be used whenever multi strand wires are used.
- 3.10. The provisions of 21.15/ 21.16 of SEM Part-II shall be broadly followed in relay erection and wiring.
- 3.11. Each wire shall be given distinctive ferrules for easy identification as shown in picture.



- 3.12. The equipment is to be wired in the relay room, SMs office, power room, Location box, CT box, battery box and in other locations as per the approved circuit diagrams.
- 3.13. Contact numbering for the relays shall be made as per the approved circuit diagram issued by the Railway and type of relay proposed to be used on the installation.
- 3.14. Relays pertaining to a signal route may be wired on one rack as far as possible, to reduce the MTTR during failures.
- 3.15. Relay rack wiring housing plug in type relays confirming to BRS-930 and BRS-931 shall be done with "PVC insulated unsheathed flame retarding type single core flexible wire 1100 V grade having 16/0.2mm annealed

copper conductor. Wiring of these relays shall be terminated on eyelets/lugs of standard design.

3.16. The sequence of wiring and testing is as follows:

- i. Erection of relay racks
- ii. Fixing of relay bases as per disposition chart prepared and ensured for propertightness.
- iii. Fixing of fuses and terminals and ensure proper tightness.
- iv. Drawing of wires from contact to contact.
- v. Wire to wire testing including wire count w.r.t. wiring diagram by supervisor(JE/ SSE)
- vi. Soldering after due corrections and testing.
- vii. Wire to wire testing including wire count w.r.t. wiring diagram by supervisor(JE/SSE) of soldered wires.
- viii. Testing of wire to wire by officer (ADSTE/ DSTE).
- ix. Plug in Relays in their base duly matching them. Code pins must not betampered.
- x. Ensuring the proper locking of all the relay clips.
- xi. Visual inspection, testing of individual relays for its contact resistance withproper operation.
- xii. Plugging of relays after confirming as per nomination.
- xiii. Connection of simulation panel, operating panel and block instruments.
- xiv. Simulation testing and square sheets check by in-charge supervisor as per approved TOC.
- xv. Simulation testing and square sheets check by the in-charge Officer as per approved TOC.
- xvi. Functional testing including correspondence with field gears by in-charge supervisor and officer. (Done during Non-interlocking for working stations).
- xvii. After testing, the loose wires on the cable ladder shall be neatly bunched andlaced with twine black. A suitable color code for wiring shall be adopted as required by Railways.

3.17. Various supplies associated with signaling viz., 110V AC, 110V DC, 24V DC and 12/24V DC are to be brought out from the IPS distribution panel. Necessary measuring instruments are to be mounted on the Hylam sheet on the distribution panel.

3.18. The incoming cables to the relay room are to be neatly arranged and fixed to the cable supporting and guiding rack and all holes to be plugged to avoid rodent entry.

3.19. After the complete testing by the Railways supervisor and officer and before commissioning the installation proper sealing arrangements to be done for relevant gears.

- 3.20. The nomenclature of each relay shall be painted both in front and rear side of each relay with contact configuration. The CT rack, fuse chart and relay index plan duly printed (in black) with relevant details on white flex sheet affixed over plywood sheet of 6mm thickness of standard size in the relay room. All the relays to be plugged shall be checked visually and defect if any, noticed shall be replaced duly reporting the same to the Railways. As made relay rack wiring and contact chart of all relays shall be prepared in linen/polyester sheets, duly signed and handed over to Railways for preparation of handing over documents to maintenance organization.
- 3.21. Suitable fixing arrangements shall be made in the relay rack for fixing condenser and resistance units wherever required. Letter painting shall be made against each unit to identify the circuit to which it is used.
- 3.22. All circuits shall be carefully protected by individual fuses in the relay room and locations grouped preferably to facilitate easy fault location. Fuses shall be so arranged that they can easily be placed without causing interference to other circuits. Fuses for all signaling circuits shall be of the non-deteriorating type as per RDSO specification. For all circuits in the relay room, indicative type of fuses shall be provided, which are normally blank and when fuse is blown off concerned RED LED of 5mm indication shall be lit at respective racks. Push button switch for confirming the healthiness of all LEDs shall be provided in respective racks.
- 3.23. Fixing of EKT with micro switches 2 NO/2NC at gate lodge, S.M's office on Teakwood board, providing telephone at site/gate lodge/SM's office, carrying out wiring of EKT, telephone using 16/0.2mm wire and testing as per approved circuit diagram and commissioning the same wiring has to be neatly clipped wherever necessary.
- 3.24. The contractor shall make such tests as may be necessary to demonstrate to the satisfaction of the Railway that the apparatus and the system as installed are in accordance with the specification and contract. The contractor shall provide such instruments and apparatus as may be necessary for conducting the following tests:
- 3.25. Test to determine that all circuits confirm the approved circuit, plan by individually, electrically checking each contact selection.
- 3.26. Test of all electrically operated devices to determine that electrically operating characteristics are in accordance with specification designated by the Railway.
- 3.27. The insulation resistance shall not be less than values specified in the signal engineering manual.
- 3.28. The responsibility of fault localization in the defective or inoperative installation during the execution and testing and restoration thereof shall be that of the contractor.
- 3.29. The contractor shall cooperate in conducting tests and trials and wherever the special conditions of the contract, contained herein shall prevail.
- 3.30. IPS cabinets, invertors, transformers, spare modules/cards and accessories are to be protected.
- 3.31. Pre-commissioning joint check list of mini-IPS, RTU shall be adhered as per RDSO standard formats.
- 3.32. The gears shall be tested and ensured for its satisfactory working before

declaring work ready and the readings shall be recorded and submitted to the controlling officer before applying for NI.

4. Non-deteriorating type Fuse holders 20 Amps, voltage 240 AC/DC and Fuse Links of 20Amps, 16Amps, 10Amps, 6Amps, 2 Amps:

- 4.1. Non-deteriorating type Fuse holders 20 Amps, voltage 240 AC/DC and Fuse Links of 20Amps, 16Amps, 10Amps, 6Amps, 2Amps shall be conforming to RDSO Specification No. IRS S.78/92 or latest.

5. Rubber Mat:

- 5.1. Thickness - 6mm or more
- 5.2. Color - Black
- 5.3. Usage/Application - Industrial
- 5.4. Shape - Square/Rectangle

6. Provision of Teak Wood Key Box & Tool Box:

- 6.1. Glass fronted teakwood key box of size 300mmx600mmx75mm with built in lock arrangement.
- 6.2. Teak wood tool box of size 1000mm x750mm x100mm made of 25mm thick teak wood, perplex sheet fronted 6mm (Color-less). The box should have provision of padlock for locking arrangements.
- 6.3. Shall be fixed on the wall at a convenient location as instructed by Railway representative at site.

7. Fuse Blown Out Indication: (Applicable for Relay Interlocking)

- 7.1. Fuse blown out indication shall be provided using hylum sheet 5mm thick and 50mm width and fixing of 5mm LEDs and resistance in case independent Fuse Alarm system is not provided. The hylum sheet shall be fixed by the side of the corresponding Fuse Blocks. Separate switches shall be provided for each circuit. This arrangement shall be made near FTOT inside the relay room.

8. Interconnections: (Applicable for Relay Interlocking)

- 8.1. Interconnection arrangements between the cable termination rack, relay rack, control panel, power and battery room shall be carried out as follows:-
- 8.2. Interconnection between relay rack and FTOT, and 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, un-armored, unsheathed 1100v grade cable.
- 8.3. Relay rack to relay rack wiring shall be done with 16/0.2mm PVC copper conductor by soldering process.
- 8.4. The inter-connection between the relay rack and power room, power room

and FTOT, block Instruments and FTOT shall be carried out with underground, armored, sheathed, power/ signaling cables of adequate length. The termination shall be carried out using a suitable size of copper eyelets/sockets. Inter-connection between power rack and battery room, shall be carried out by using suitable underground cables.

- 8.5. All the interconnecting wires shall be supported by means of Aluminium ladder. Ladder of suitable capacity shall be manufactured using Aluminium angles of size 50mmx50mmx6mm 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 inter-connection 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.
- 8.6. The inter connection arrangement includes laying of signaling cables in ducts, wherever necessary as indicated by Railways. Wherever cables are taken through cable ducts inside the relay room/ battery room etc., the ducts shall be filled with River/ M-Sand sand up to the floor level and covered with RCC slabs covered with suitable tiles.
- 8.7. All connections/ terminations shall be tested by the contractor and after satisfying himself jointly with the Railway Representative. Any alterations required shall be carried out by the contractor free of cost.
- 8.8. Cable details, functions allotted to each core and terminal numbers shall be prepared in standard size tracing film and handed over to Railways.

9. Cable Termination Rack:

- 9.1. Cable termination racks shall be erected in the relay room at the required location as per the approved Relay room floor plan and shown by the railway with suitable foundation bolts and cement concreted. The cable termination racks shall be painted soon after installation but before cable termination work is taken up. Suitable cable ducts wherever required shall be provided to bring all outside cables to the termination rack.
- 9.2. All the cables are to be neatly skinned, fixed on the cable bracket and terminate in order. Bending of cables to less than 120 degree shall be avoided. The cable armors and the rack should be earthed. Internal wiring and termination particulars are to be written with paint. 6 way/1 way terminal blocks are to be fixed on hylum sheet and held rigidly by mechanical screws.
- 9.3. 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 grommet 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.
- 9.4. All the cables shall be identified by a punched label, tied on to each cable. Printed cable termination index and pasted on Perplex sheet of thickness

10 mm as per instructions of site in charge 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 tracing Film duly signed and handed over to the Railway at the time of commissioning.

10. Electrical Key Transmitter (EKT):

- 10.1. Where EKT with /without crank handle fixed on the key is installed firmly on the suitable angle support and teak wood board made with 25 mm thick in the place indicated by railways with economizer push switch and wired.
- 10.2. The cable shall be terminated on a terminal box made with 25 mm T.W planks and locking facilities. The cable shall be taken through GI/PVC pipe 50mm to the terminal box. The wiring shall not be exposed.
- 10.3. The EKT shall be painted and particulars and ward no. to be printed in bold letters.
- 10.4. Wherever EKT's are fixed in the apparatus case for operating use like siding control, the EKT shall be fixed on the teak wood board made 25 mm thick with economizer push switch and wired.
- 10.5. Locking facility shall be made and one padlocks with duplicate keys to be provided for the apparatus case externally. The cable shall be terminated on phenolic synthetic industrial fiber base fine weave cotton fiber board 6mm thick (hylum sheet) duly fixing the terminal blocks.
- 10.6. No other circuit/relays shall be provided in that apparatus case.
- 10.7. Emergency Key proving contact Box:
- 10.8. "E" type lock having long plunger and key contact or EKT without lock and coil shall be assembled and fixed in a glass fronted box made with 25 mm teakwood planks and wired as per the approved circuit.
- 10.9. The box shall have been locking and sealing facilities using 50mm navtal lock with duplicate keys.
- 10.10. The contacts shall be made when the key is 'IN' and contacts shall break when the key is disturbed or taken 'OUT'. Using this contact one relay shall be energized at Apparatus' case.

11. Electric Key Transmitter at Station House:

- 11.1. Electric key transmitter with/ without crank handle fixed to the key shall be installed firmly on suitable angle supports and hylum sheet boards in the place indicated by Railways, with economizer push switch and wired. The cables shall be terminated on a terminal box made using 25mm thick T.W. planks 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 powder coated MS box of suitable size. Interlock the EKT key with crank handle by nickel coated dog chain/ welded. The EKT should be

painted and the circuit particulars and ward nos. are to be painted in bold letters.

12. Non-Interlocked Signaling Arrangement:

- 12.1. Non-Interlocked signaling arrangement as explained below shall be made by the contractor at his own cost during all the phases of commissioning of stations as per the directions of the Railway representative. No extra payment will be made on this account.
- 12.2. Erection and wiring of temporary relay rack, SM's slide instrument, wiring alteration in the FTOT, apparatus cases, signals, control panel etc. as per the instructions of Railway representative at site for operating signals and points during non- interlocked working. The work also includes provision of magneto telephone communication between top points/ location goomties and SM's room.
- 12.3. The SM's control instrument shall be wired as required by Railways and as per the circuit diagram prepared in connection with NI working. Necessary wooden crosses shall be fixed for the signals put out of use as indicated by railways. Special warning boards/stop/speed boards may be fixed temporarily as per the NI plan.

13. Releasing of S & T Gears:

- 13.1. 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.
- 13.2. 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.
- 13.3. 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.
- 13.4. All the unserviceable released materials shall be guarded by the contractor till they are returned back to stores/ depot as directed by railway representatives.

14. Testing & Commissioning including As Made:

- 14.1. The entire installation shall be tested by the contractor as per the approved plan and design according to the provisions in Signal Engineering Manual (SEM), OEM guidelines and established practice of the railways and after satisfying himself, the railway shall jointly test along with the contractor. Any alteration during testing shall be carried out at free of cost as required by Railways before commissioning. Each installation shall be tested in the presence of the supervisory officials deputed by the Railways as soon as

the particular installation/ equipment is installed and unless the working of the equipment is actually ensured, it will not mean that the work has been completed to the satisfaction of the railway. This work involves testing and commissioning of the entire installation. Two copies of the approved plans and designs incorporating all construction details and stamped as "TESTING COPY" shall be submitted to railways before taking up the joint testing with Railways.

- 14.2. In order to ensure that equipments are properly installed and commissioned by adhering to pre-commissioning check list and procedure as defined by OEM in its installation manual, it is necessary that Electronic Signaling systems i.e. EI, SSDAC, IPS, data logger are installed, tested and commissioned by RDSO approved manufacturers and a certificate is issued to Railways.

Chapter-08

Cables and Wires

1. **PVC Insulated, Underground, Unscreened Cable:** PVC Insulated, Underground, Unscreened shall be conforming to RDSO Specification. No. IRS: S-63/2014 Rev.4.0 or latest.
2. **24 Fiber Armored Optic fiber cable:** 24 Fiber Armored Optic fiber cable shall be conforming to RDSO specification IRS: TC 55-2006 Amdt. 3 or latest.
3. **Underground Railway Jelly Filled Telecom Quad Cables:** 6 Quad 0.9 mm conductor underground jelly filled Quad cable shall be conforming to RDSO specification No.IRS.TC30-2005 Amdt. 5 or latest.
4. **Armored PIJF underground telephone Cable copper conductor of 0.5mm Diameter:** Armored PIJF underground telephone Cable copper conductor of 0.5mm dia shall be conforming to RDSO Specification No. IRS/TC-41-97 with amendment No. 2 or latest.
5. **PVC Insulated Cables & Wires copper conductor:** PVC insulated Cables and wires copper conductor shall be conforming to RDSO spec No. IRS.S 76/89 or latest.
6. **PVC Insulated twisted pair Switch Board Cables & Wires annealed tinned copper conductor**
 - i. No. of pairs: 1 pair to 50 pair
 - ii. Wire diameter: 0.5mm annealed tinned copper conductor
 - iii. Insulation material: PVC sheath with Nylon rip
 - iv. Protection type: Un-Shielded
7. **12 Core armored Fiber Optic Cable**
 - i. Number of cores : 12 core
 - ii. Jacket material : Nylon
 - iii. Armoring: Co-polymer laminated steel tape
 - iv. Sheath: Polyethylene (UV Stabilized)
 - v. Inner Sheath : Polyethylene
8. **4/6/12 Core unarmored Fiber Optic Cable**
 - i. Number of Cores : 4/6/12 core
 - ii. Jacket Material : Nylon

- iii. Armoring: Unarmored
- iv. Sheath: Polyethylene (UV Stabilized)
- v. Inner Sheath : Polyethylene

9. STP CAT 6 cable:

- i. Cable conductor: Single Wire
- ii. Conductor Size: AWG20 (0.50sq)
- iii. No. of Pairs: 4 Pair (4P)
- iv. Cable Outer Diameter(mm): 6.0 to 6.9
- v. Length: 305 meters box

10. Twin Core Multi Strands Screened Cable suitable for speakers:

- i. Number of Core: 2 Core
- ii. Usage/Application: Speakers, HI-FI Amplifier, Home Theaters
- iii. Conductor Type: Stranded
- iv. Product Type: Valuecon 16 AWG Copper Speaker Cable
- v. Resistance: Conductor Max. 13.7
- vi. Conductor Construction: 16 AWG 2core Copper
- vii. Shielding: Aluminium
- viii. Wire Material: Copper
- ix. Jacketing: LSZH
- x. Material: Copper

Chapter-09

Trenching and Cable Laying

1. Cable Trenching:

- 1.1. For laying of signaling cables in the station yards from Home to Home signal manual trenching shall be done.
- 1.2. From Home to distant signal and beyond into block/automatic section – mechanized trenching shall be done.
- 1.3. The representative of engineer in charge of the work will mark the route of the cable in white chalk or lime as per the tapping and route plan and instructions given to him by the Engineer, notwithstanding the cable route shown in the tapping and route plan to meet the requirement of local conditions at site, if any and as required shall be taken by the Contractor to be final. The Contractor shall be present at the time of marking and he shall furnish to the Engineer's representative required quantities of lime, rope, labor, etc., for carrying out the work. The marking will be given on the track side of the trench in the difficult terrains such as water logged areas; the positions of the cable route will be specified by offsets from the centerline of the nearest track.
- 1.4. Excavation of cable trench shall be made in all kinds of soils including clearing roots of trees, rocks etc. to a depth of 1 meter and to a width of 0.30 to 0.50 meters as required, providing proper protection as required by Railways while crossing power cables, pipe lines etc. The bottom of the trench shall be leveled and got rid of any sharp materials. Trenches shall be straight as far as possible and steep angles shall be avoided. Railways will decide alignment of the main cable route as well as track/road crossings, after deciding route with other departments.
- 1.5. Through Signaling / Power cables within station limits shall be laid as close to the railway boundary as possible. The cable track separation distance generally is about 6 Meters, wherever feasible. In the block section they shall be laid within 1m from the Railway land boundary as far as possible. Cables shall be laid only after obtaining the approval of cable route plan and cable core plan as applicable.
- 1.6. Whenever the cable route is very near or over the embankment due to non-availability of space, the route marking shall be given in consultation with Railway Civil Engineering Officials. In these stretches the contractor shall complete the work in minimum possible time.
- 1.7. The progress of trenching, availability of cable, pipes etc., shall be closely coordinated to ensure that the trenches remain open for minimum possible time.

- 1.8. Whenever the track crossing is to be done or trenching in proximity of track, the same shall be done at least possible time in the presence of Railway Civil Engineering Representative.
- 1.9. 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, cable laid and refilling done on the same day.
- 1.10. In all such cases of lower depth, the Railway supervisor shall record the reasons for such low depth in the site register. No payment shall be made for any extra excavation carried out of additional depth or width of the trench other than schedule item.
- 1.11. The following criteria of cable laying shall be adopted as per the site condition in conjunction with the relevant item of SOR :

2. Types of trenches:

Depth of Trench	Protection arrangement	Drawing No.
Full Rock and no trench at the ground level	GI Pipe with 300 mm X 300mm Concrete block at every 2 meter.	SG/SWR/ 065.
Rock faced at about 400 mm depth	HDPE with continuous concrete of 300 mm X 300mm	SG/SWR/063.
Rock faced at about 600 mm depth	HDPE with 300x300 mm concrete block interval of every 2 meter	SG/SWR/ 064.
Trench of full depth – 1000 mm: Between Gate hut to Gate Home signal (180 meters)	Half cut RCC pipe	SG/SWR/062

- 2.1. During excavation of the trenches, earth should be preferably thrown away from the track and care shall be taken that the same should not fall on the track ballast. Complete excavated earth shall be backfilled in the trench after laying the cable and rammed well.

3. Track/Road Crossings:

- 3.1. Whenever signaling/power cable has to cross the track/road, it shall be done preferably with a horizontal boring method.
- 3.2. In case horizontal boring is not feasible, manual track/road crossing shall be done as per RDSO DRG No: SDO/cable laying/009 using RCC pipe/DWC/HDPE pipes of appropriate sizes to avoid more pipes. In case of RCC pipes, each of 2M long with collars shall be provided. In case of DWC/HDPE pipe, suitable couplers shall be used to avoid gaps.
- 3.3. The cable crosses the track/road at right angles.
- 3.4. The cable normally does not cross in between or inside points and

crossings.

- 3.5. The track/road crossings to be carried out as per the drawings.
- 3.6. The work includes removal of ballast, cutting of trench across track/road at the places indicated by the Railways and covering the trenches after placing RCC/DWC/HDPE pipes in position.

4. Cable Laying:

- 4.1. Guidelines on the Cable Laying (Document No. RDSO/SI/G/2010, Version 1.1 or latest) issued by RDSO, which is part of the tender document shall be followed while laying the signaling, power, Telecom and OFC in the station section and block section.
- 4.2. Cables are laid as per the approved plan/GAD in prefabricated/precast ducts close to the track on both sides at suitable locations. However, in the block section, the duct shall be laid beyond embankment unless unavoidable.
- 4.3. The path of the duct shall be kept parallel to the track alignment and any zig-zag path shall be avoided.
- 4.4. Following may be normally ensured while laying cables
- 4.5. Cables may be tied together at every 50m or so by suitable tie or GPS tape after laying and before closing of cable duct.
- 4.6. Entry and exit of cable in chamber shall be properly sealed to avoid theft and entry of rodents. Sealing through Bitumen/suitable compound can be done at entry and exit of cable chamber to arrest cable theft.
- 4.7. Cable route markers wherever provided above the ground, shall be concrete.
- 4.8. Cable at the track crossing and road crossing shall be laid in HDPE pipe or concrete duct of specified/approved cross section and strength.
- 4.9. In the station section, the location box shall normally be kept on or adjacent to the duct route.
- 4.10. All entry points of cable in the building must be secured through suitable measures.
- 4.11. Digital Integrated Signaling and Telecom cable route shall be prepared and made available online by Zonal Railways over Railnet.
- 4.12. Existing cables shall be protected as per latest directions/policies/JPO issued by railway board in addition following precautions shall be taken in new projects.
- 4.13. Executing agency for works shall survey the route along with the open line using cable route tracer (scanner/metal detector) to identify the existing old functional cables en-route in the section.
- 4.14. Cable route/zone identified through scanner or as per approved plans for existing cable shall be marked (white chalk/Lime) on site by executing agency, in presence of open line staff before the start of excavation or

digging work.

- 4.15. Provisions of Para 15.10 of Part-II SEM shall be broadly followed.
- 4.16. Before the cables are laid, a visual inspection of cable shall be made and it shall be tested for insulation and continuity of cores. The insulation resistance (Dry) of each core shall not be less than 10.0 MΩ per kilometer and insulation resistance (Wet) shall not be less than 7.5 MΩ per kilometer for cable conductor sizes up to 2.5 sq.mm. For cable conductor sizes more than 2.5 sq. mm, the insulation resistance (Dry and wet) shall be 5 MΩ / Km as per RDSO SPN: IRS S 63/2014(Rev.4). As per SEM-II Para no. 15.23.1 Annexure 12. The insulation resistance so measured should not be less than 5MΩ per KM at buried temperature.
- 4.17. If there is wide disparity between insulation of different conductors, the conditions of the cable should be thoroughly checked before permitting its use. Bedding and armoring shall be inspected to see that there has been no damage during transit or in storage.
- 4.18. Cable wheels shall be used normally to mount the drums before rolling them. In case where the Cable wheels not available or the area is not convenient for rolling the Wheel Drums along the route, the drum shall be mounted on the axle at one end of trench and cable un- wound using adequate number of men ensuring that the insulation of the cable is not damaged and no kink/twist is formed.
- 4.19. Before laying of cable in the trench, a visual inspection shall be adequate for any damage or defect throughout its length. The depth of the trench shall be measured at an interval of every 15m.
- 4.20. Normally, cable laying should be commenced only after the construction of ducts in relay room and Location boxes on the route and the cable should be fully terminated at the relay room/ Location boxes immediately after the cables are laid. However, if for any reason the cables are to be laid in advance, special care should be taken to ensure that the coiled cable near the relay room/ Location boxes is fully protected before and during final termination. The coiled cable should be fully covered suitably and necessary protection arrangements shall be done by the contractor to avoid damages and thefts. On no occasion the ends of the cable should be left unprotected.
- 4.21. Cable laying shall commence only after ensuring the depth and width of the trench, quality of protective arrangements meets as per standards with joint inspection by the Railway engineer's representative and contractor's representative.
- 4.22. Cables shall never be taken over the running tracks at the time of cable laying by the contractor as this is likely to cause unsafe incidents and damage to cables. In case where the cable is required to be transported across the tracks, the same shall be done in the presence of Railway Supervisory staff after safety precautions have been taken to post flagmen

on all the sides as may be required to stop any train approaching the site of the fouled line.

- 4.23. At each end of the main cable/tail cable/power cables an extra coil length of 6 to 8 meters should be kept.
- 4.24. At the time of commissioning of the cables, the insulation values of the cable should again be checked and the value obtained shall not be below 5 MΩ per km. If there is wide disparity between insulation of different conductors, the conditions of the cable should be thoroughly checked before permitting its use. The readings shall be recorded in the register for all cables.
- 4.25. The contractor and supervisor in-charge shall jointly record actual cable core plan and cable route plan showing the distance of cables from the nearest track center at every 20 meters interval, diversion, track/road crossings and location of apparatus cases.
- 4.26. Refilling of the cable trenches with the earth and placing and concreting of cable markers at an interval of 20m within station limit and 50m in the block section, throughout the cable route and also on either side of track crossings along the cable route shall be done. RCC cable markers to be preferred. The cable marker shall be concreted to a depth of 0.60 M in case of concrete marker. The grouting of concrete markers shall be for 30 Cm to avoid theft and shall be provided with cement.
- 4.27. The detailed procedure for undertaking digging work in the vicinity of signaling, electrical and telecommunication cable is issued as JPO vide RB It no 2003/Tele/RCIL/1Pt IX dated 24.06.13 or latest. Should be followed.

5. On Bridges:

- 5.1. On bridges, the cables are to be laid through GI pipe of appropriate size and either ends of GI pipes suitably buried on both sides of the bridges for a sufficient depth so as to meet the bottom of the cable trench.
- 5.2. Then fixing the pipe in concrete of size 0.5m x 0.5m in both abutments, length may be decided as per site condition so that bend should not exceed 30 degrees.
- 5.3. Separate pipes/troughs shall be used for power/signaling cables. Suitable supporting clamps shall be manufactured as required by Railways at the rate of 1 clamp/meter depending upon the type of girder.
- 5.4. Before fixing GI pipes, perforated holes of 5mm dia shall be drilled at an interval of 0.3 m to avoid theft of GI pipes.
- 5.5. All the above works shall be carried out in presence of Railway representatives only.
- 5.6. The work shall be executed as per RDSO DRG No: SDO/cable laying/013 for girder Bridges and on RCC bridges cable shall be laid through GI pipe with 300mm x 300mm size concrete blocks at an interval of 2 meters with

sufficient layer of concrete protection on either ends or through RCC channel trough made along with the bridge length.

6. Cable Laying on Platform:

- 6.1. The work includes removing/breaking of existing RCC slab/concrete on the passenger platform, trenching to a required depth and laying cables and covering the trench, replacing the removed slabs or re-plastering with cement, mortar and restoring to the original condition as per the railway representative at site.

7. Optical Fiber Cable (OFC) laying:

- 7.1. Optical fiber cable (OFC) shall be laid / blown through Permanently Lubricated High Density Polyethylene Duct (PLB-HDPE).
- 7.2. Permanently Lubricated High Density Polyethylene Duct (PLB-HDPE) of Dia 40/33mm shall be conforming to RDSO Specification No. RDSO/SPN/TC/45/2013 Rev. 2.0 or latest.
- 7.3. RCC Joint chamber for OFC joint coil specification
 - i. Grade : M30
 - ii. Diameter: 1200 mm (Outer)
 - iii. Height: 1000mm
 - iv. Wall thickness: 75mm
 - v. Cover thickness: 100mm
 - vi. Shape: Round
 - vii. Material: RCC reinforcement

8. Cable Plan:

- 8.1. Cable plan with distribution chart for each cable shall be prepared jointly by contractor and Railway for each station and block section leaving adequate spare conductors overall as laid down in SEM Part-II Para No.15.3.2/ Indian Railway Standard Specification SI no: S36/87 i.e., adequate spare conductors to a minimum of 20% of total conductors used shall be provided in each main cable up to the farthest main point zone and beyond this there should be a minimum of 10% of spare conductors of total conductors used. No spare conductors are required if the total no. of conductors used is 3 or less. Typical cable plan for LC Gate shall be as per Drg. No. SG/SWR/ 089, or as per the instructions of the site in-charge.

9. RCC Cable Marker:

- 9.1. Reference Drawing DRG No. SG/SWR/067.

- 9.2. Cable markers wherever provided should be placed as per the requirement of Railways. Placing and concreting of cable markers at an interval of 20m within station limit and 50m in the block section, throughout the cable route and also on either side of track crossings along the cable route shall be done. RCC cable markers to be preferred.
- 9.3. Cable markers shall be painted in BLACK color cement paint for Signaling cables as per SEM Part-II, Annexure-29, and Para 19.106 Item No. 5.2. For Quad, cable markers shall be painted with GREEN when placed at joint location and painted with RED for normal indication as per IRISSET Note TC-1, Para. 6.11.8. The engraved letters shall be painted in WHITE color cement paint as per SEM Part-II, Annexure-29, Para 19.106, Item No. 5.3.
- 9.4. The cable marker shall be erected by digging the pit to a depth of 800mm X 300mmX300mm followed by casting the concrete foundation of size 300mm x 300mm x 300mm and refilling the pit and consolidating it by ramming (the proportion for cement, sand & jelly shall be 1:2:4 with 6mm to 10mm granite metal).
- 9.5. Concrete Cable markers are projected above the surface level at least 300mm. As the concrete cable markers are visible from a long distance. Sketch showing cable marker is as furnished below

10. Trunking and Capping of RCC Duct:

- 10.1. Trunking and Capping of RCC Duct shall be conforming to Drg.No.SDO/Cable laying/ 007.

Chapter-10

Power Supply and Accessories

1. **SMPS based Integrated Power Supply (IPS):** The SMPS based integrated power supply (IPS) shall conforming to RDSO Specification No. RDSO/SPN/165/2012 (Ver. 3.0) with latest amendment as required by Railways and wired.
2. **Installation & commissioning:** Installation shall be done by OEM if specified by the purchaser. However, commissioning of IPS shall be done by the OEM only. OEM shall issue a certificate of fitness of installation before commissioning. For this, Zonal Railways and OEM shall ensure the compliance to Pre-commissioning checklist issued by RDSO.
3. **Battery Chargers:** Battery chargers shall be conforming to RDSO Specification No. IRS:S 86-2000 with Amdt. 4 or latest.
4. **Step Down Transformer:** Step Down Transformer shall be conforming to RDSO Specification No. RDSO Spec No IRS:S 72-88 Ver. 1.0 or latest.
5. **Automatic Voltage Stabilizer:** Automatic Voltage Stabilizer shall be conforming to RDSO Specification No. RDSO Spec No. IRS:S 74/89 with Amdt. 6 or latest.
6. **CLS Panel:** Control and Distribution Panel for color light signaling supply in 25 Kv ac. traction system shall be conforming to RDSO Draft Specification No. TI/SPC//PSI/CLS/0021 or latest.
7. **Power Distribution Panel:**
 - 7.1. Power Distribution Panel for IPS using Hylum sheet 10 mm and erecting it using MS angle clamp 65mm X 65mm X 8mm, bolt and nuts and fitted with Mains control switch, ammeter by-pass switch and voltmeter.
 - 7.2. Termination of power cables using teakwood clamp of size 25mm X 60mm X 150mm on a base plank of 25mm thick 150mm width.
8. **Low Maintenance Lead Acid Stationary Secondary Cells:** Low Maintenance Lead Acid Stationary Secondary Cells shall be conforming to RDSO Specification No. RDSO Spec No. IRS: S 88/2004 Version 1.0 or latest.
9. **Charging and installation of Lead acid cells:**
 - 9.1. Cells shall be charged at railway premises at Hubballi or any other place or reputed firms place as specified by Railway.

- 9.2. Power shall be arranged by Railways if charged at Railway premises.
- 9.3. All materials shall be supplied by the contractor including the charger of required capacity.
- 9.4. Acid shall comply with the specification IS 266 and distilled water to IS 1069.
- 9.5. Cycles of charging and discharging shall be done as mentioned below.

9.5.1. 1st Cycle:

- i. 1st charge of cycle @4A for 80Ah, 6A for 120Ah and 10A for 200Ah for 80 to 100hrs.
- ii. Every 12 Hrs the Sp. Gravity and voltage to be recorded.
- iii. At the end of first cycle and after cooling for one hour the specific gravity and voltage should be – 1220 / 2.10V
- iv. Keep idle for 12 Hrs – 1220 / 2.10V
- v. 1st discharge cycle @ 8A for 80Ah, 12A for 120Ah and 20A for 200Ah for 9 Hour still 1190 / 1.98V.
- vi. Every three hours Sp. Gravity and voltage to be recorded.
- vii. Keep idle for 2 hrs at the end of 1st discharge.

9.5.2. 2nd Cycle:

- i. 2nd charge of cycle @ 8A for 80Ah, 12A for 120Ah and 20A for 200Ah for about 6 hours.
- ii. Every 3 hrs the Sp. Gravity and voltage to be recorded.
- iii. At the end of second cycle and after cooling for one hour the specific gravity and voltage should be – 1220 / 2.02V
- iv. Now reduce the charging to half of above and charge for 10 hrs. At the end of second cycle charging the specific gravity and voltage should be 1220 / 2.16V.
- v. Keep idle for 12 hrs.
- vi. 2nd discharge cycle @ 8A for 80Ah, 12A for 120Ah and 20A for 200Ah for 10 hrs. at the end of second discharge the specific gravity and voltage should be 1170/1.90V (Cells may be defective if lower sp. Gravity).
- vii. Every 2 hrs Sp. Gravity and voltage to be recorded.
- viii. Keep idle for 2 hrs.

9.5.3. 3rd Cycle:

- i. 3rd charge of cycle @ 8A for 80Ah, 12A for 120Ah and 20A for 200Ah for one hour per day, till the cells are dispatched to maintain continuity of charge.
- ii. Before loading, close the caps to avoid spill over during transport.
- iii. The specific gravity should be recorded in below mentioned format.

Bank no: No. of cells: Capacity of cells:

Filling of Electrolyte Date: Time:

1st Cycle - Charging: Date: Time:

Check Sp. Gravity and Voltage of individual cell at every 12 Hrs intervals.

Sl. No	Sp. Gravity/Voltage	After 12 hrs	After 24 hrs	After 36hrs	After 48 hrs	After 60 hrs	After 72 hrs	After 84 hrs	After 96 hrs
.									
1									
2									
...									
...									
60									

1st Cycle - Discharge: Date: Time:

Check Sp. Gravity and Voltage of individual cells at every 3 Hr intervals.

Sl. No.	Sp. Gravity /Voltage	After 3 hrs	After 6 hrs	After 9 hrs
2				
...				
...				
60				

2nd Cycle - Charging: Date: Time:

Check Sp. Gravity and Voltage of individual cell at every 3 Hrs. intervals.

Sl. No	Sp. Gravity /Voltage	After 3 hrs	After 6 hrs	After 9 hrs	After 12 hrs	After 15 hrs	After 18 hrs
1							
2							
...							
...							

2nd Cycle - Discharge: Date: Time:

Check Sp. Gravity and Voltage of individual cells at every 2 Hrs interval.

Sl. No	Sp. Gravity /Voltage	After 2 hrs	After 4 hrs	After 6 hrs	After 8 hrs	After 10 hrs
1						
2						
...						
...						
60						

3rd Cycle - Charging: Date: Time:

Check Sp. Gravity and Voltage of individual cells at every 3 Hrs. intervals.

Sl. No	Sp. Gravity /Voltage	After 3 hrs	After 6 hrs	After 9 hrs	After 12 hrs	After 15 hrs	After 18 hrs	After 21 hrs	After 24 hrs
1									
2									
...									
...									
60									

9.5.4. Equalizing charging: After initial charging, batteries are not connected to load (not put in use) for 15 days then equalizing charge must be given.

10. Installation of Batteries

- 10.1. The charged batteries shall be provided in the battery room/ locations with suitable links sufficient to carry full load, as per instructions. The cells shall be arranged neatly with sufficient working space for maintenance along with floats and vent plugs.
- 10.2. Apply a coating of petroleum jelly or non-oxidizing grease on the battery connections to avoid corrosion. Close all the Vent caps and ensure that float indicators, indicating the electrolyte level, are in proper position.
- 10.3. One Hydro Meter on suitable Stand shall be kept in the battery room.

11. Installation of Power Supply Equipment In Power Room:

- 11.1. Transformers, battery chargers, transformer rectifiers, voltage stabilizers, inverters, etc., as detailed in the schedule shall be installed and wired as per approved power diagram in the power room.
- 11.2. The power panel and power rack should be suitably earthed.

12. Provision of Power Equipment at Locations/ LC Gate:

- 12.1. The power equipment 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 equipment 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 equipment 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 equipment 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.

13. Installation of Distilled Water/ Deionizer Plant:

- 13.1. The work involves Supply and installation of Deionizer plant, which shall be installed at Distilled Water Plant Room on suitable stand.
- 13.2. The Distilled water plant shall be tested for its satisfactory working jointly with Railways.

14. Installation of Standby Diesel Generator Set:

- 14.1. The Standby diesel generator plant with control panel shall be installed on the concrete platform as per standard practice adopted by the Railways using anti- vibration packing to minimize the vibration. Required number of anti-vibration mounting (cushy foot) shall be provided by the contractor.
- 14.2. Necessary asbestos rope should be wrapped around the exhaust pipe, when required. The control panel of the Diesel Generating set should be properly mounted. The wiring of the generator and the control panel shall be carried out using PVC 7/1.40mm copper wire, through PVC Pipes, PVC bends and terminated. An Hour meter shall be provided as required by Railways.
- 14.3. The Auto Change-Over CLS Control Panel as per the Item Description in the tenderschedule needs to be supplied and installed as instructed by Railway representative at site in Panel Room.
- 14.4. The Standby generating plant and control panel shall be earthed.
- 14.5. Secondary cells of required capacity shall be installed and connected for self- starting facility.
- 14.6. After installation, for initial commissioning, the procedure given in the firm's manual should be strictly followed. Each diesel generating set should be tested on full load continuously as per the rating of the generator, defects noticed if any, shall be rectified by the contractor as per the warranty

conditions. In case of an expired warranty period, the defect rectification shall be arranged by the contractor.

15. Technical Specification for 1 KVA online UPS

- i. Generic Rating (KVA): 1.0 KVA
- ii. Technology: IGBT-PWM with Inbuilt Isolation Transformer
- iii. Input Power: Single Phase 160V-260V Sine wave, 50Hz
- iv. Output Power: Single Phase 230V+/-1% Sine wave 50 Hz
- v. Backup Time (Minutes): 120
- vi. Minimum VAH (VAH): 1512
- vii. Warranty for UPS (Years): 2
- viii. Movable Trolley for Batteries: With Rack
- ix. Warranty For Battery: 2
- x. Degree of Protection: IP20
- xi. Cabling 5 Meters for Input and Output: With
- xii. Paralleling Kit for Synchronizing: Without
- xiii. Installation and Commissioning: Yes

16. Technical Specification for 2 KVA online UPS

- i. Generic Rating in KVA(KVA): 2.0 KVA
- ii. Technology: IGBT-PWM with inbuilt isolation transformer
- iii. Input power: Single phase 160V-260V sine wave, 50Hz
- iv. Output power: Single phase 230V+/-1% sine wave 50 Hz
- v. Backup time(minutes): 120
- vi. Minimum VAH(VAH): 4608
- vii. Warranty for UPS(years: 2
- viii. Movable trolley for batteries: with rack
- ix. Warranty for battery: 2
- x. Degree of protection: IP20
- xi. Cabling 5 meters for input and output: With
- xii. Paralleling kit for synchronizing: Without
- xiii. Installation and Commissioning: Yes

17. Technical Specifications for On-Line UPS of capacities 5.0 KVA 230V

- i. Generic Rating (KVA) : 5.0 KVA
- ii. Technology: IGBT-PWM with inbuilt isolation transformer
- iii. Input power: Single phase 160V-260V sinewave, 50Hz
- iv. Output power: Single phase 230V+/-1% sinewave 50 Hz

- v. Backup time(minutes): 120
- vi. Minimum VAH(VAH): 8064
- vii. Warranty for UPS(years): 2
- viii. Movable trolley for batteries: with rack
- ix. Warranty for battery: 2
- x. Degree of protection: IP20
- xi. Cabling 5 meters for input and output: With
- xii. Paralleling kit for synchronizing : Without
- xiii. Installation and Commissioning : Yes

18. Technical Specification for 10 KVA online UPS

- i. Generic Rating (KVA): 10.0 KVA
- ii. Technology: IGBT-PWM with inbuilt isolation transformer
- iii. Input power: Single phase 160V-260V sine wave, 50Hz
- iv. Output power: Single phase 230V+/-1% sine wave 50 Hz
- v. Backup time(minutes): 120
- vi. Minimum VAH(VAH): 10000
- vii. Warranty for UPS(years): 2
- viii. Movable trolley for batteries: with rack
- ix. Warranty for battery: 2
- x. Degree of protection: IP20
- xi. Cabling 5 meters for input and output: With
- xii. Paralleling kit for synchronizing: Without
- xiii. Installation and Commissioning: Yes

19. Inverter -48V DC to 230 AC 50Hz

- i. Input: -48V DC
- ii. Output: 230V AC 50 Hz
- iii. Phase: Single
- iv. Capacity: 1KVA
- v. Voltage Range: 230V +or- 20%
- vi. Frequency Range: 50Hz +or-.

Chapter-11

Data Logger and Remote Terminal Unit

1. TECHNICAL REQUIREMENTS OF DATA LOGGER

- 1.1. The Data Loggers shall be confirming to RDSO Specification No. IRS S. 99/2006 or latest equipped with cards for 512/1024 digital input and 32 analog inputs or as specified in the Schedule of work, to monitor the internal relays and digital data from SSIs including Networking Modem.
- 1.2. Information required as per Para. 11 of RDSO specifications No. IRS S. 99/2006 will be given by Railways before supply of Data logger.
- 1.3. Other features of the proposed Data logger system shall be as under:
- 1.4. The data loggers proposed are to be networked to the existing Data logger network of respective division and enabled for centralized monitoring. All required additional hardware and software has to be provided by the contractor.
- 1.5. 2 MBPS E1 Converter – E1 to Serial Port suitable for data logger monitoring scheme issued by RDSO vide letter No. STS/E/Data logger/Vol. XX, dtd.12.09.2011 is to be supplied in place of 64 KBPS Modems which is part of standard configuration of data logger.
- 1.6. Guidelines issued by RDSO/ Railway Board to supplement the RDSO specification of the data logger until the date of closing of the tender must be complied and implemented.
- 1.7. Power extension board with O/V, U/V, fuse and spike protection shall be supplied along with each Data logger.
- 1.8. The PC to be provided with Data logger shall be Commercially available HP/DELL/IBM desktop PC based with Intel Core i7-860 2.8GHz, 8MB cache or latest processor, Compatible RAM and minimum 500 GB HDD, Suitable Communication ports, accessories, 22" monitor, Window Operating system, Antivirus software as specified in the RDSO Guideline issued vide letter no. STS/E/Data logger/vol. XX, dtd 12.09.2011 or better.

Chapter-12

Block Instruments and Accessories

1. **Block Proving Axle Counter Using UFSBI:** Block Proving Axle Counter Using UFSBI complete and Block panel shall be conforming to RDSO specification. No. IRS:S- 105/2012Ver.0 or latest.
2. **Solid State Block Proving By Axle Counter (Digital) [SSBPAC (D)]:** Solid State Block Proving By Axle Counter (Digital) [SSBPAC (D)] complete and Block panel shall be conforming to RDSO specification. No RDSO/SPN/175/2005 Ver.1 or latest.
3. **Installation of Block Proving Axle Counter and Solid State Block Proving by Axle Counter:**
 - 3.1. Necessary Terminal Blocks and Fuse Blocks shall be fixed inside the Block Panel for termination of jumper wires and cables etc. Cable shall be fixed properly inside the block panel and terminated.
 - 3.2. Panel should be provided as part of the installation.
 - 3.3. Prior to manufacturing of the SM control panel, the contractor should submit the Panel Face Plate Diagram including the Block panel in scale for approval of the Railway. Fabrication shall be done as per the approved diagram.
 - 3.4. The UFSBI/SSBPAC system to be installed on teak wood frame/Tripod base as indicated by Railways.
 - 3.5. The required surge protection device for power supply line/ communication line etc. should be provided.
 - 3.6. The work involves termination of cables in the block panel and block instrument, block wiring. Interconnection between block panel and block instrument by underground signaling cable and painting the instrument as per the instructions of the Railway representative at site.
 - 3.7. Phynolic sheet (6mm) for 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.
 - 3.8. The block counter shall be provided with a suitable lock with 2 keys.
 - 3.9. Contractor should arrange training at site or factory premises for Railway officials, supervisors and staff in installation, maintenance and troubleshooting of the Block proving system.
 - 3.10. Media change over between OFC and Quad should be automatic as per Railway requirement.
 - 3.11. OEM Engineer shall demonstrate the parameters and fill up the pre-commissioning check list which shall be jointly signed with the Railway Representative after detailed quality check of the installation.

- 3.12. OEM shall verify the installation and commissioning and issue the OEM certificate as per RDSO guidelines for Electronics based system.

4. Releasing of Installations:

- 4.1. All the unserviceable released materials shall be guarded by the contractor till they are returned back to stores/ depot as directed by railway representatives.

Chapter-13

Earth Leakage Detector (ELD), Earthing and Accessories

1. Earthing with GI pipe electrode:

- 1.1. Reference Drawing DRG No.SG/SWR/057
- 1.2. Earth Electrode: GI Pipe of size 50mm x 2000mm x 3.0mm thick with 12mm dia. holes on the sides at intervals of 300mm.
- 1.3. Earth enhancing material: mixture of 30Kg of charcoal, 30Kg of common salt and earth.
- 1.4. Reinforcement details for concrete chamber: The concrete chamber with outer measurement of 450mm x 450mm x 300mm and inner measurement of 300mm x 300mm x 300mm made up with vertical MS rods of 8mm dia. 250mm height of 8 Nos and horizontal MS rings of 350 x 350 mm of 8mm dia. 2 Nos and cover with handle with a concreting in the ratio of 1:3:6 by using suitable stone jelly.
- 1.5. Earth resistance shall be less than 10 ohms.

2. Copper Plate Earthing System:

- 2.1. Reference Drawing DRG No.SG/SWR/058.
- 2.2. Copper plate 300mm X 300mm X 3 mm at the bottom of earth electrode.
- 2.3. Copper strip of 25mm x 3mm connected from copper plate to copper bus bar of size 25mm x 3mm x 300mm at location Box.
- 2.4. Earth Electrode: GI Pipe of size 4.5 feet length 40mm dia, 3.0mm thick and Water funnel on Perforated GI pipe of length 4.5 ft with earth enhancing material: Earth Pit 6 ft depth filled up with charcoal 10 kg & salt 25 kg in alternate layers up to 2 ft from bottom.
- 2.5. Reinforcement details for concrete chamber: The concrete chamber with outer measurement of 450mm x 450mm x 300mm and inner measurement of 300mm x 300mm x 300mm made up with vertical MS rods of 8mm dia. 250mm height of 8 Nos and horizontal MS rings of 350 x 350mm of 8mm dia. 2 Nos with Cast Iron top plate with a concreting in the ratio of 1:3:6 by using suitable stone jelly.
- 2.6. Earth resistance shall be less than 1 ohm.

3. Basic material to construct Unit maintenance free earth:

- 3.1. Basic material to construct Unit maintenance free earth shall be conforming to RDSO Specification No. RDSO/SPN/197 Ver.1.0 or latest.
- 3.2. Earth resistance shall be less than 1 ohm.

4. Installation of Unit maintenance free single earth and Ring earth:

- 4.1. Installation of Unit maintenance free single earth and Ring earth shall be conforming to para 8.4 and 8.5 of RDSO Specification No. RDSO/SPN/197 Ver. 1.0 or latest.

5. Earthing of Equipments:

- 5.1. All apparatus cases, battery boxes, signal posts, CT boxes, armors of cables, battery chargers, transformers, power panels, Control panel, Block Instruments/Control test panel/Cable Termination Rack/Relay Racks, etc., shall be earthed.
- 5.2. If number of apparatus cases are grouped at a place, one earth shall be provided up to 2 Full Locations and 1 Half Location. Over and above this, additional earth to be provided at the other end and both the earth need to be connected to all the locations in ring path. Otherwise, separate earth is to be provided for each apparatus case.
- 5.3. Equipment to be earthed shall be connected to the earth pipe by using MS flat of 35mm X 6mm or 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 (Supply of 19C cable is not covered in the scope of this schedule).
- 5.4. MS flat for earthing 35mm X 6mm, cement, GI earth electrodes, common salt, charcoal, country bricks, river sand, soldering materials and all other miscellaneous materials required for the work shall be supplied by the Contractor.

6. Earthing arrangement for Electronic Interlocking:

- 6.1. Earthing arrangement for Electronic Interlocking and End goomties shall be as per RDSO Guidelines STS/E/TAN/3006 or latest and further guidelines issued by Railway board/ RDSO for achieving earth value less than One Ohm. At locations, where it may not be possible to form a perimetric ring earth around the EI room, Power supply room and station room, in such stations parallel earthing arrangement consisting of interconnected multiple earth electrode may be made at the free space near the station building such that following requirements are made
- 6.2. Single point entry of Main earth bond with all other cables to the EI room shall be adhered.
- 6.3. The earth connections to the perimetric ring earthing for all the items shall be made using shortest possible path.
- 6.4. All earth electrodes must be interconnected with buried conductor however visible and provided with RCC enclosure/ skirting.

7. Conventional Lightning Protection System:

- 7.1. The lightning protection system shall be installed shall be conforming to RDSO Specification No.RDSO/SPN/197 Ver. 1.0 or latest and additional requirements of local authority. The system shall consist of air terminations, down conductors, joints & bends, testing joints, earth terminations & earth electrodes. Advanced lightning protection system shall include components as follows: Air terminations, mechanical supports, low impedance insulated down conductor, performance recording equipment, and a low impedance grounding earthing system.

- 7.2. Advanced Controlled Streamer Emission based Lightning Protection System is suitable for protection of Buildings and Towers against Direct lightning Strike complete with Controlled Streamer Emission (CSE) lightning conductor air Terminal. The round shaped Air terminal should be based on the latest lightning research and technology, which has an enhanced area of protection. Placement of the Air terminals is determined using the 'Collection Volume Design Method'. Unlike conventional design theories, this method provides an imperial and quantitative method based on design parameters such as the structure height, field intensification of structural projections.
- 7.3. The Controlled Steamer Emission Air Terminal shall be working on the principle of field intensification and responds dynamically to the appearance of a lightning down leader by creating free electrons and photo-ionization between a semispherical surface and an earthed control finial and chart have a shape of semi-spherical with outer diameter of 260mm and height from the base of 115mm. and approximate weight of terminal being 2.8 Kg, to significantly reduce the build-up of sharp point corona discharge under static field thunderstorm conditions.
- 7.4. The supporting accessories and mast system are comprising of the insulated FRP pipe of min. 2m length, high grade Aluminium mast of min. 2 Mtr., the U Bolts so as to withstand maximum recorded wind velocities of 100 Kmph and the Event Counter with triggering impulse of 1500 Amps. For 8/20 micro second without any external power supply and complete as required as per the specifications. The Air Terminal should be UL listed as per the UL96. "Lighting Protection Components" (Standard for Safety). The round shape of the Air Terminal is designed to reduce the build-up of Corona space charge which inhibits the formation of upward streamers. Standard Franklin rods and ESE terminals which are pointed, create a lot of Corona which is a main reason for conventional lightning protection system failures. The geometry of the air terminal is a significant factor in its performance. The round Air Terminal launches a streamer before other competing structures of the structure can launch their streamers giving it a time advantage, which allows its streamer to become the preferred attachment point for the approaching down leader.
- 7.5. The protective zone provided by the air termination shall be such that it becomes the preferred strike point for all discharges exceeding a peak amplitude return strike current of XkA, according to the statistical level Y per IEC 61024. The design shall take account of upward leader competing projections on the structure.

Strike Current (X)	Level of protection (Y)	Excedance Probability
2.9 kA	Protection Level-I Very High	99%
5.4 kA	Protection Level-II High	97%
10.1 kA	Protection Level-III Medium	91%
15.7 kA	Protection Level-IV	84%
	Standard	

- 7.6. The Down conductor should be in form of multi layered cable consisting of plastic filler, multi stranded copper conductor with the cross-sectional area of 55 Sq.mm. inner insulation, outer copper conductor, conductive sheath, all concentrically arranged with outer diameter of 36mm. characteristic impedance of Ohms, inductance of 22nH/m and voltage withstand capability of 250kV, i.e. core to screen 250kV based on 1/50us wave shape as defined under ANSI C62.41, with factory done upper termination and the kit for lower termination and all fixings and accessories as per specifications. The multilayered cable is the Shielded conductor which reduces the risk of side flashing to the building/structure, thereby eliminating the possibility of damage of equipment and injury to people. The conventional GI or Copper strips can cause side flashing.
- 7.7. The down conductor shall have a capacitance equal to 1100 or greater than 1100 pF/m and the resistance should be equal to or less than 0.5m.ohm/m.
- 7.8. The main copper conductor of down conductor cable shall be capable of direct connection to the base of the air termination by use of a compression coupling or CADWELD.
- 7.9. Each Protection system shall be provided with a Lightning Event Counter. The lightning event counter shall have a register that activates one count for every discharge where the peak current exceeds 1500A. The test wave shape shall be the 8/20us standard as defined by A SI C62.41.
- 7.10. The lightning event counter shall be robust, easy to install & housed in a IP67 rated enclosure. The counter shall operate from the energy of the lightning discharge and not depend on external or battery power to operate.
- 7.11. The lightning event counter shall be installed to the manufacturer's instructions in a readily accessible manner so that readings can be taken at regular intervals. It shall be so positioned such that its operating temperature is within the range -10 deg. C to +50 deg. C

8. Bonding Connections:

- 8.1. To minimize the effect of circulating earth loops and to provide equipotential bonding, "star type" bonding connection is required.
- 8.2. Each of the SEEBs installed in the rooms shall be directly connected to MEEB using bonding conductors. Also, equipment/racks in the room shall be directly connected to its SEEB.
- 8.3. The bonding conductors shall be bonded to their respective lugs by exothermic welding.
- 8.4. All connections i.e. routing of bonding conductors from equipment to SEEB and from SEEBs to MEEB shall be as short and as direct as possible with minimum bends and separated from other wiring. However, connection from SPD to MEEB shall be as short as possible and preferably without any bend.

9. Earth Leakage detector:

- 9.1. Earth Leakage detector shall be conforming to RDSO Specification No. RDSO/SPN/256/2002 or latest.

Chapter-14

Automatic Fire Detection and Alarm System

1. Automatic Fire Detection and Alarm System:

- 1.1. Automatic Fire Detection & Alarm System for Signaling & Telecom Installations shall be conforming to RDSO Specification No. RDSO/SPN/217/2021 Ver. 3.0 or latest.
- 1.2. Installation and wiring of Heat and smoke multi sensors, fault isolators, fire alarm control panel, GSM module, manual call point etc., shall be carried out by drawing various type of cables on PVC pipe / capping casing, or cable trays, ladder, shelter etc as instructed by Railway engineer at site. (Indoor cables to be drawn through pipe, outdoor cables if required to be clamped on wall /floor etc.

Chapter-15

Axle Counter and Accessories

1. Technical Requirements Of High Availability Single Section Digital Axle Counter:

1.1. The High Availability Single Section Digital Axle Counter (HASSDAC) shall be confirming to RDSO Specification no. RDSO/SPN/177/2012 Ver. 3 or latest and shall be provided with High Availability Dual track sensor.

1.2. Wiring and Installation and Commissioning details:

- 1.2.1. Wiring Discipline should be as per RDSO TAN No. STS/E/TAN/6001, dated 04.10.2011.
- 1.2.2. Fixing of HASSDAC system in the location box.
- 1.2.3. Wiring of HASSDAC system in the location box. (The different cables for signaling & Communication cable will be laid and terminated in the location box).
- 1.2.4. Supply, fixing and wiring of suitable Lightning Dischargers, fuse terminals and fuses.
- 1.2.5. Marking and drilling of holes in Rail, fitting of track device and laying of underground cable from the HASSDAC system to track device using 40mm dia HDPE pipe. Trans and receive cables has to be taken in separate HDPE Pipe. This includes required trenching from location box to track device. All the materials including HDPE & Cable from system to track device to be supplied by the contractor.
- 1.2.6. Fixing, wiring and installation of Reset box in the SM's room. This includes the supply & fixing of 25mm PVC casing & capping and drawl of required cable from reset box to Cable Termination Box. All the materials like cable, PVC casing & capping to be supplied by the contractor.
- 1.2.7. Connecting of HASSDAC system at location box and reset box at SM's room to earth busbar
- 1.2.8. HASSDAC will be installed, wired, tested & commissioned by OEM's engineer as per guidelines issued by RDSO. The pre-commissioning check list issued by RDSO for SSDAC will be prepared by OEM's Engineer and signed jointly with Railway site Engineer. Before commissioning of SSDAC, OEM will submit site installation certificate to Railways by mentioning that SSDAC has been installed, wired, tested and commissioned by OEM.
- 1.2.9. 19" rack Mountable Multi service multiplexer chassis and interface equipments required for Mountable Multi service multiplexer chassis should be installed and configured as per requirements of Railway site Engineer.

2. Multi Section Digital Axle Counter (MSDAC):

- 2.1.** Multi Section Digital Axle Counter System (MSDAC) shall be conforming to RDSO Specification No. RDSO/SPN/176/2013 ver.3 or latest.

2.2. Scope of work:

- 2.2.1. MSDAC Reset procedure shall be as per SWR MSDAC Reset policy.
- 2.2.2. Remote Diagnostic System shall be provided at Station.
- 2.2.3. This schedule also includes supply of 10% all types of cards, LV Boxes, Wheel sensors and other essential modules as specified in RDSO Spec, it shall be rounded to nearest integer subjected minimum of one item.
- 2.2.4. One set of Specialized Tool and measuring equipment's as per RDSO specifications shall be supplied.
- 2.2.5. This includes supply of all track side junction boxes, required number of evaluators, detection points, reset panels, last vehicle/co-operation boxes, communication/ interface equipment's for connecting evaluators, all other accessories including Modems, Cards, Modules etc., and any other miscellaneous materials required for the work shall be supplied and installed as part of scope this work.
- 2.2.6. Any other materials not mentioned in schedule or any increase in quantities listed in the schedule but found necessary while commissioning should be supplied free of cost as part of scope this work. Track section and Supervisory Track section Reset Box shall be provided at station and Cooperation LV box at suitable location in the outdoor/yard. Track clearance and occupied indications and Reset indications of each Track section & Supervisory Track section shall be provided at stations. Two sets of MSDAC manuals, Trouble Shooting guidelines and related documents to be supplied.
- 2.2.7. The MSDAC system comprises of Axle Detector, Trackside Electronics/Digital Axle Counter field units, Central evaluator, Reset Unit, Relay Unit, Event logger and diagnostic terminal is to be supplied one for station and one at test room. The diagnostic terminal shall be suitable both in hardware and software installed for configuration of MSDAC system (online/offline).
- 2.2.8. All the MSDAC equipment shall be provided with efficient lightning and surge protections which are also to be supplied along with the system as suggested by OEM.
- 2.2.9. MSDAC performance shall not be affected by the flooding of track. The axle detectors supplied shall be actuated only by wheel flanges and not by other parts of trains, for example Rail Brakes, Toilet pipes, and suspended chains, electrical inductors in Locomotives, air-conditioning equipment and

other electrical/electronic equipment intrain/engine.

- 2.2.10. The length of in-built cable with Axle detector shall be up to 15 Mtrs as per the site requirement which shall be supplied as part of scope of this work.
- 2.2.11. Supply of tool kit for installation and maintenance of MSDAC as per OEM requirement. It shall include the exhaustive list of tools used for the installation and maintenance of Indoor and outdoor equipment's.
- 2.2.12. Supply of DC-DC converters or any other power supply modules/cards required in outdoor for commissioning of MSDAC system shall be supplied as per RDSO specification No RDSO/SPN/165/2012 Ver.3 with latest amendments.

2.3. Scope of Installation:

- 2.3.1. The Evaluators shall be placed in the relay room and Detection Points shall be provided in entire station yard.
- 2.3.2. In case the MSDAC system requires Earthing at outdoor for line side electronic/ mushroom boxes, it shall be supplied and installed as complete Maintenance free Earthing material as per RDSO Specification No. RDSO/SPN/197 Ver. 1. It shall be done as unit Maintenance free earth. Supply and installation shall be covered as part of scope this schedule.
- 2.3.3. Diagnostic terminal shall be supplied and installed with necessary connectivity with test room along with necessary application software to facilitate the remote diagnosis of all indoor and outdoor equipment, installed in the station yard as part of scope this work. One diagnostic terminal at station and one diagnostic terminal at test room shall be supplied each and installed as part of scope of this work.
- 2.3.4. Configuration of MSDAC at site by OEM or authorized OEM representative.
- 2.3.5. Wherever various indoor and outdoor agencies works are involved, the supplier shall closely coordinate with agencies and installation will be intimated by the office of Dy.CPM/S&T/GS/UBL from time to time and shall ensure that the installation shall be done as per the instruction of Engineer concerned. Co-ordination with other S&T ongoing works in the section.
- 2.3.6. On-duty SM shall reset the entire MSDAC system duly physical verifying yard by on duty points man and by pressing line verification box button. Requirement of Reset Boxes and line verification Boxes to be supplied as per SIP and SWR Policy.
- 2.3.7. Common Reset Box will be provided at stations and all track indications including Supervisory indications to be displayed at stations.
- 2.3.8. Individual Track section resetting feature shall be provided at stations which will be operated by Technician in case of failure of Supervisory and Reset Box at Stations.

Chapter-16

Design Documents

1. General:

- 1.1. Design of signaling circuits should meet the requirements of Signal Engineering Manual, Recommendations of Working Group on signaling Practices and Interlocking Principles (SP & IP) accepted and circulated vide Ministry of Railway letter no. 2010/Sig/WG/Interlocking Principle, dated 22.05.2012, typical circuits issued by RDSO and Table of Control (TOC) approved and issued by railway. The railways shall issue hard and soft copies of the Signal Interlocking Plan (SIP) and TOC to the contractor.
- 1.2. Definition of technical terms and symbols used in circuits shall be as per Indian Standard Specifications and where such specifications are not available, they should be of British Standard Specification.
- 1.3. Circuits shall be designed to RE standards unless specified otherwise. All interface circuits shall be designed with indirect feeding of signals for non-RE area also.
- 1.4. The tenderer shall carry out at his expense any alteration of the work due to any discrepancies, errors or omissions in the drawings or other particulars submitted by him. Any approval given by the Railway for this purpose shall in no way absolve the contractor from any or all responsibilities for the correct function of the equipment. In this regard, the sole responsibility rests with the contractor in all respect. Any fittings or accessories which may not be specifically mentioned in the specification of tender documents or the letter of acceptance of the tender or the agreement executed thereof but which are usual or necessary as per normal Signal Engineering practice are to be provided by the contractor without extra charge so that the plant is complete in all respects.
- 1.5. Any work done by the contractor prior to the approval of the contractor's drawings will be done at the risk of the contractor unless previously authorized in writing by the Railway.
- 1.6. The tenderer shall be responsible for the correctness of the drawings furnished by him. The contractor shall carry out any alterations of the works due to any discrepancies, errors or omissions in the drawings or other particulars, submitted by him. Any approval given by the Railway for this purpose shall in no way absolve the tenderer from full responsibility for the execution of the contract in all respects.
- 1.7. After the contract is awarded, the contractor shall furnish to the Railways required, prints of contractor's drawings that form an essential part thereof. No change shall be made in any approved drawings without the written consent of the Railways.

- 1.8. After completion of the execution of the contracts, the contractor shall submit to the Railway all corrected tracing film/cloth tracings of drawings furnished by him and prescribed sets of copies of final drawings.
- 1.9. Notwithstanding the fact the Railway might have approved or the contractor's design, drawings and specifications the contractor is responsible for the correctness of the entire scheme as a whole and its satisfactory performance to the specifications as laid down by the Railway. The Railway's responsibility is only for the correctness of the signaling plans.
- 1.10. In the event of any breach of the aforesaid conditions, the contractor shall in addition to throwing himself open to action for contravention of terms of the agreement and or for original breach of trust, be liable to account to Government for all moneys, advances or profits resulting or which in the usual course would have resulted by reason of such breach.

2. Version Control:

- 2.1. Strict Version control shall be exercised. The Check Sum/ CRC details shall be furnished with the initial application logic and changed Check Sum/ CRC along with details of changes in Application Logics subsequently. No change in the Application Logic shall be made without the approval of Dy.CPM/S&T/GS/UBL.
- 2.2. After making any change in application logic, a comparison statement shall be submitted duly indicating the checksum prior and after the change.
- 2.3. In case of no change in Application Logic during Factory Acceptance Test (FAT) and System Acceptance Test (SAT), the checksum of the initial submission and that of the service version shall be the same.

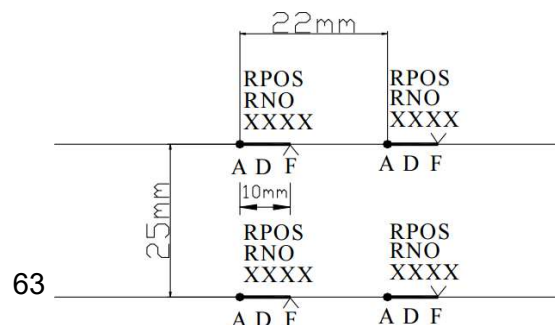
3. Design:

- 3.1. The interface circuits must be designed as per the final phase of the signaling plan so that alterations in the existing interface wiring of initial phases is limited to removal of wires and minimum re-use of bits so as to minimize the interface wiring alterations during non-interlocked working period in subsequent phases. Additional functions/ alterations shall be catered in new terminations to the extent possible.
- 3.2. Terminations shall be grouped function wise.
- 3.3. In ASR logics, read back contact of HR/ DR/ UGR shall not be proved. It shall be ensured that all ASRs are dropped before booting the system.
- 3.4. Crank handle logics shall be designed with NLR and RLR up contacts instead of back contact of HR and UCR.
- 3.5. CHRZR shall be slow to release for 30 sec for extracting the Crank Handles comfortably.

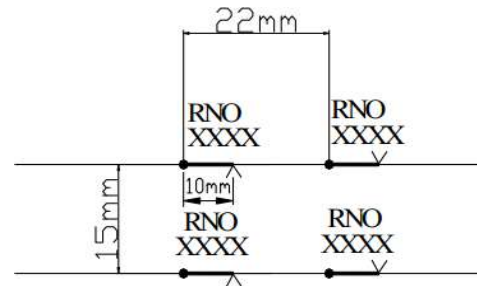
- 3.6. In LR Logics, parallel movements with conditional points shall not be proved. However, these shall be ensured in UCR and HR logics.
- 3.7. In Point operation circuit, XR shall be initially dropped before picking up WJR.
- 3.8. ZWLKRs shall not be split and there shall be only one ZWLKR for a point with different conditional movements.
- 3.9. In UCR logics, conflicting ASR/ TRSR/ TLSR shall be proved but for Calling ON signals, only UCR back contact of the main signal above it shall be proved.
- 3.10. In yards with sectional route release, railway shall indicate the track circuits to be used in the ASR logics in the Table of Control (TOC) and all other back lock track circuits shall have sectional route release.
- 3.11. In HR logics, drop contact of all the sectional route release bits (TRSR/TLSR) of the same direction in the route and up contacts of the conflicting direction shall be proved. For overlap, the conflicting ZR, ZR-C, SHZR up contacts shall be proved.
- 3.12. In ELUYR/ERUYR logics, TSR & TSSLR down contact shall be proved in parallel to track circuits down contacts.

4. Documentation:

- 4.1. As per SEM, part-I, Para No.8.3.4, the circuit diagrams shall be in A3 size sheet (297mm x 420mm) with 10MM border and on the left-hand side an extra margin of 30mm should be allowed for bidding.
- 4.2. Plotting shall be done with minimum border setting in AutoCAD on the A3 size sheet.
- 4.3. Relay/ Contact font size should be 2.5 mm and style Times New Roman – AutoCAD.
- 4.4. Negative shall be tracing film for approval of As Made and after approval and signature thereon, RTF shall be submitted. As made, negative print must not fade and spread when subjected to any kind of liquid/ water drops.
- 4.5. Minimum space in the design elements in Interface or Relay circuits shall be maintained as follows:
- 4.6. Arm to contact: 10 mm
- 4.7. Arm to Arm: 22 mm
- 4.8. Line to Line: 25 mm



- 4.9. Minimum space in the design elements in Application Logic circuits shall be maintained as follows:
- 4.10. Arm to Contact: 10 mm
- 4.11. Arm to Arm: 22 mm
- 4.12. Line to Line: 15 mm



- 4.13. Height of Title signature column) should be 30mm from inner borderline.
- 4.14. Sheet Nos. should be serially marked in X of Y format without omitting any numbers in between sheets.
- 4.15. Each booklet of Interface Circuit and Application logic shall be limited to 200 sheets for the convenience of handling. Index shall clearly indicate the specific description of circuit on each sheet.
- 4.16. Outdoor location termination and wiring details shall be incorporated in the As Made Interface circuit diagrams.
- 4.17. Circuits shall be grouped in the sequence of signal initiation to route release, panel indication, Block and Miscellaneous circuits as follows:
 - i. KNOB/ BUTTON LOGIC
 - ii. NLR/ RLR
 - iii. LR/ UR
 - iv. NR/ RR
 - v. ZNR/ ZRR
 - vi. ASR
 - vii. LOHR/ ROHR
 - viii. ROUTE CANCELLATION/ EMERGENCY CANCELLATION
 - ix. TRSR/ TLSR/ TLZR (STATION WITH SECTIONAL ROUTE RELEASE)
 - x. POINT OPERATION
 - xi. PCR
 - xii. NWKSR/ RWKSR
 - xiii. ZWLKR
 - xiv. UCR
 - xv. CRANK HANDLE
 - xvi. TSR
 - xvii. HZR

- xviii. HR/DR/UGR
- xix. INDICATION
- xx. BLOCK/UFSBI, BPAC
- xxi. GFXR/ UNCR BUZZER/ POWER FAILURE/ TJ FAILURE/ DC-DC FAILURELOGICS
- xxii. FCOR
- xxiii. REDIRECTIONAL
- xxiv. DATA LOGGER
- xxv. MISCELLANEOUS

- 4.18. After each group of circuits, Spare blank sheets shall be provided duly indicating in the index sheet while submitting for initial approval. These spare blank sheets shall be utilized for incorporation of any additional logic during subsequent stages of design, checking and testing without disturbing the sheet numbering.
- 4.19. Approved design sheet template shall be adopted for design of the Border, Title, Version and Signature block. Contractor must ensure the verification and collection of the same from the office of the Chief Signal & Telecommunication Engineer (Construction), South Western Railway before start of the design.

5. Technical Requirements of As Made Diagrams

- 5.1. The following as made Design and documents shall be prepared by the contractor after completion of the work and submit the same for approval by Railways. After receiving the approval, soft copy in two sets and Hard copy One set on tracing film and 6 Sets of the bounded Blueprints of the following design and documents shall be handed over to the Railway.
 - i. Equipment Layout diagram
 - ii. Application Logic and associated Circuit diagrams
 - iii. Interface circuits
 - iv. Cable Core Plan
 - v. Cable Route Plan
 - vi. Track Bonding Plans
 - vii. Wiring diagram of All EI equipment's including Object Controllers
 - viii. Panel Termination particulars
 - ix. Relay Contact particulars
 - x. Terminal Analysis diagram
 - xi. Fuse Particulars
 - xii. Inspectors Completion Certificate
 - xiii. Relay Index and disposition particulars
 - xiv. Power distribution diagram etc
- 5.2. The sizes of different signaling documents are standardized as follows. However, the contractor shall take the confirmation about the sizes and

media etc before undertaking preparation of As Made drawings and designs.

- i. Circuit diagram: A3 size.
 - ii. Panel termination particulars, FTOT particulars, location particulars: A3 Size.
 - iii. Font name: Times New Roman – AutoCAD.
 - iv. Font size: 10- 2.5 mm
- 5.3. The above drawings are to be made as per SEM/ CSTE Circular (copy may be collected from Dy.CPM/S&T/GSU/UBL's office).
- 5.4. Two draft copies of above drawings to be submitted for approval. One copy will be returned either duly approved for making a fair copy or for resubmission for approval after incorporating the changes as required by Railways.
- 5.5. After completion of each phase work, the Application logic and Interface circuits have to be updated as per bell test copy / SAT copy and submit 2 sets of corrected Application logic and Interface circuits in plain paper.
- 5.6. After preliminary approval, required 2 numbers of prints are to be submitted for administrative approval. After the Administrative approval negatives of the above drawings have to be made in tracing films for signature in token of approval. After signature on the tracings, 6 sets of these drawings in ammonia/ blueprints kept in standard plastic covers back-to-back and bound neatly shall be handed over to the office of Dy. CPM/S&T/GS/UBL. One set of the above drawings shall be submitted in Reproduction

6. Registers:

- 6.1. The contractor is required to supply the registers in 100 pages printed on good quality papers (75 GSM) as per schedule.
- 6.2. The contents and format required for printing the registers shall be collected from office of Dy.CPM/S&T/GS/UBL.

CHAPTER-17

LC Gates & Accessories

1. General:

- 1.1. Boom shall be so installed that its bottom is about 800mm to 1000mm from Road level.
- 1.2. The distance from the center of the nearest track to boom between 3.5 metersto 5 meters.
- 1.3. In double line sections, the booms shall be so installed that the end of theboom point is in the direction of Normal train movements.
- 1.4. The top level of the foundation shall be in level with the existing rail level.

2. Electrical Lifting Barrier:

- 2.1. Electric Lifting Barrier shall be conforming to RDSO Specification No. RDSO/SPN/208/2012 Ver. 2.0 or latest.
- 2.2. Electric Lifting barrier boom shall be conforming to RDSO drawing No. RDSO/S 11600.

3. Installation and wiring of Electric Lifting Barrier and Control panel:

- 3.1. Fixing of lifting barrier boom, contact makers, termination of cables, wiring andpainting as per the instructions of Railway representative at site.
- 3.2. Each pedestal and meeting post shall be fixed on foundation using 4 Nos. of 'L' type bolts and nuts ('L' type bolt of size 3/4 inch dia and 20 inch length withone bend up to 3 inch length and other end threading up to 3 inch of thread pitch of 2.5 mm with suitable nut to suit thread with plain washer and spring washer of 3/4 inch in size).
- 3.3. Fixing of stop boards at the center of each boom.
- 3.4. Balancing the boom with a sufficient number of cylindrical and flat weights byfixing them on to the booms.
- 3.5. Fixing of the control panel stands on a suitable cement platform with requiredsize of bolts and nuts.
- 3.6. Fixing of boom locking mechanisms and wiring, adjusting and testing the boomlocking from gate control panel as per signaling plan.
- 3.7. Pedestal, meeting post and control panel wiring should be carried out by usingwire PVC 3/0.75mm copper.

4. Emergency sliding Boom:

- 4.1. Reference Drawing: E.Rly/Signal Workshop /HWH's DRG No. BSA/29/730, BSA/29/731, BSA/29/737 with of 5 Nos 'E' type Lock with Key

as per IRS Spec.No. IRS:S-30/64 Rev.0 or latest and as per Drg. No. SA-3376/M.

- 4.2. The length of the sliding boom is approximately 11 to 12 meters. It consists of a GI pipe of two numbers of 6 meter length each, with 3 mm thickness and 75mm dia.



Emergency Sliding Booms

Notch for locking of emergency sliding boom in locking box by key lock plunger

Stop Board

Emergency Sliding Boom



Lock hold for inserting the key attached with emergency sliding boom

Key released after locking the emergency sliding boom in locking box

Locking box fitted at for end of the gate hut for locking emergency sliding Boom

Hole for inserting the forward portion of ESB

Locking Post at far end of LC Gate hut



5. Installation of sliding gate:

- 5.1. 5 Nos of foundations are to be casted for boom base and 1 Nos of foundation is to be casted for locking post on either sides.
- 5.2. Each boom base and locking post shall be fixed on foundation using 4 Nos. of 'L' type bolts and nuts ('L' type bolt of size 3/4 inch dia and 20 inch length with one bend up to 3 inch length and other end threading up to 3 inch of thread pitch of 2.5 mm with suitable nut to suit thread with plain washer and spring washer of 3/4 inch in size).
- 5.3. Fixing of stop boards at the center of each boom.
- 5.4. Rollers shall be provided at regular intervals for smooth movement of the sliding boom.
- 5.5. Fixing of E type locks on locking post for boom locking mechanism and testing the boom locking from gate control panel as per signaling plan.
- 5.6. Including all accessories with complete set E Type locks (different wards suitable with site conditions), Stop Boards, meeting post, painting and related to requirement for gate commission as per standard etc.,
- 5.7. All set and keys to be arranged by contractor with instruction of Railway.

6. Interlocking of Level Crossing Gates with Lifting Barriers:

- 6.1. Excavation of pit, concrete 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.
- 6.2. Making rod connection from the Ground lever frame to the boom locking mechanism through cranks, adjusting and testing the boom locking from the 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 tracks shall be insulated while crossing the track circuit.

- portion The Lengthy roddings shall be run on roller stands fixed on trestle located not more than 2.2 Meters between adjacent supports.
- 6.3. The gate interlocking arrangement shall be carried out as per the standard practice of S.W. Rly and as per the instructions of the Railway representative at site.
 - 6.4. The lifting Barrier will be painted with two coats of enamel paint of approved quality as given below:
 - 6.5. Stands: Black
 - 6.6. Boom with fringes: Black and Yellow- Retro-Reflective stripe 300 mm wide alternatively
 - 6.7. Stop Disc on the boom: Red- Retro-Reflective
 - 6.8. Fluorescent paper strips should be pasted on both the lifting barrier boom.

7. LC Gate EKT Interlocking:

- 7.1. Electric key transmitter with key shall be installed on Acrylic Sheet/Glass fronted T.W. box firmly on suitably angle supports, in LC Gate Hut as indicated by Railways.
- 7.2. The wiring shall not be exposed, EKT when fixed, shall be ensured that proper supports have been given to avoid undue strain to the mechanism of the EKT.
- 7.3. The box shall be pasted with a laminated sheet of the same color of panel on the sides and providing a suitable partition with 12mm teak wood. A push button with 2 NO/2 NC contacts of reputed make viz., L&T/Crompton make. 3 Nos. of LEDs Red, yellow and green shall be provided inside the box to give EKT Key "Out", EKT Key "IN", EKT Key "FREE" indications.
- 7.4. Providing nickel coated welded chain handle and key, locking and sealing arrangements.
- 7.5. 37mm brass locks of good quality should be provided.
- 7.6. Carrying out wiring as per approved circuit diagram as instructed at site by SSE/JE.
- 7.7. This includes necessary mounting of the box to the wall using TW plugs and cement mortar, except wires, all materials to be arranged by contractor.

8. Installation of Electronic Gate Warning Equipment:

- 8.1. 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 in apparatus case and hooter at Road warning signal post, wiring as per approved circuit diagram and painting.
- 8.2. In the RE area wire rope and Roding shall be insulated with proper insulating material and all metallic parts shall be connected to earth with 35mm x 6mm MS flat. Insulation required for wire rope and Roding insulation shall be supplied by the contractor.

9. Installation of Emergency Key Proving Contact:

- 9.1. EKT shall be kept in a glass fronted wooden box and wired. The box shall have the locking and sealing facility using 6 levers Navtal lock with duplicate keys.
- 9.2. 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.

Chapter-18

Electronic Interlocking

1. Technical Requirements of Electronic Interlocking

- 1.1. Electronic Interlocking (EI) system including sub systems to be offered shall be conforming to RDSO specifications no. RDSO/SPN/192/2019 Ver.2.0 or latest with hot standby feature as per RDSO TAN No: STS/E/TAN/3004 or latest and have RDSO approval on the date of opening of tender.
- 1.2. Approved Signal Interlocking Plan of the proposed stations shall be issued along with the letter of Acceptance after finalization of tender. However, approved plans of the yards may be seen in the office of Dy.CPM/S&T/GS/UBL on any working day.
- 1.3. Before Commissioning of Electronic Interlocking, Technical System Application approval as specified in RDSO TAN No: STS/E/TAN/3012 or latest shall be obtained from the Competent Authority RDSO/PCSTE by the Railways. Contractor shall ensure the preparation and submission of the required documents at least two months in advance of the first phase commissioning schedule.
- 1.4. Information required as per RDSO specification is as under:

Sl. No.	Description of Information	Details of Information
1	Approved Interlocking Plan, Selection Table and Panel diagram of the station	Approved Interlocking Plan and Selection Table shall be provided by Railways as per the Milestone of Activities and TDC specified in Special Conditions of Contract and during the Kick off/ review meetings. Design to be provided by contractor. VDU Panel diagram shall be designed by the contractor as per the Approved Interlocking Plan and submitted for approval by the Railways.
2	Whether CCIP (Domino type) or VDU terminal or both required	Dual VDU
3	System O/P required to drive field gears. Relay interface or object controllers	Relay Interface
4	110V AC or DC usage for signal lamp lighting	110V AC with ECRs
5	Size of VDU monitor screen	Maintenance VDU – 42” LED Operator VDU - 55” LED

6	Inverters for VDU's	Individual Inverter of reputed make to be provided for each Operator VDU & Maintenance VDU (Input voltage 24V DC nominal from DC-DC converter or 110V DC and output 230V AC pure sine wave) with redundant arrangement
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2. Other features of the proposed signaling system shall be as under:

- 2.1. EI system to be installed shall be working in Distributed architecture or Centralized Architecture as per the architecture mentioned in the Tender Schedule. However, scheme may be changed during execution.
- 2.2. In the Distributed architecture, the distribution of Object Controllers shall be made Line/ Zone-wise so as to result in minimum repercussion to traffic in case of failure of any Object Control Module or the power supply or its OFC connectivity to electronic interlocking. The end goomties shall be provided by railways in addition to central EI room for housing the distributed version of EI.
- 2.3. The typical EI Distributed architecture with power supply and redundant communication topology as specified in the RDSO TAN No. STS/E/TAN/3008 or latest shall be followed.
- 2.4. For better reliability, all vital sub systems like Processor unit and Object controllers shall have separate 110-24 Volt DC-DC converters. DC-DC converters provided for EI shall be segregated for 'A' & 'B' systems along with segregation of cabling and termination for power supply up to DC-DC converters, for all the converters and in N+1 configuration. The typical EI power supply schemes issued by RDSO vide TAN No. STS/E/TAN/3008 or latest shall be followed.
- 2.5. The EI system should be designed to suit QN1 and QNA1 relays.
- 2.6. The scope for provision of EI system includes designing of EI software equipment layout (Application Logic, Interface Circuits etc.) including operator and maintenance VDU software as per approved signaling plan and table of control provided by Railways. The Railways will check and make necessary corrections and hand it over to the contractor for final preparation of circuit diagram and submission for approval before installation.
- 2.7. Design charges for phase works as per Phase signaling plan will be paid as per schedule of work, in case the work is commissioned in multiple phases.
- 2.8. Operation and Maintenance terminal of the EI system shall be as per RDSO TAN No. STS/E/TAN/3007 Version 1 or latest

- 2.9. Industrial grade fan less PCs shall be used for EI installation for VDU/Maintenance/Diagnostic terminals like MOXA Series V2406, Kontron MPCX 28R, MEN BC50M or similar as specified in the RDSO specification and Technical Advisory Notes with compact flash drive suitable for use in Non AC & normal environment.
- 2.10. Installation, testing and commissioning of Data logger system/ RTUs at End Goomties as well as central EI room suitably interfaced to EI system with networking up to divisional S&T control room to facilitate monitoring of digital and analog inputs.
- 2.11. Track repeater relays /slot relays /Gate controls relays/ siding control relays/repeater relays shall be of approved type and shall work on 24V DC.
- 2.12. The point operation is working on 110 V DC with independent detection.
- 2.13. The signaling system should meet the requirements of 25 KV Railway Electrified section.
- 2.14. After testing and commissioning of the entire installation, "As Made" Design & Documents and Installation details shall have to be supplied as per specification, duly incorporating all particulars for the station. All "As Made" Design and Documents' shall be prepared by the contractor in AutoCAD 2000 or latest and submitted in Soft Copy (compact discs) and Hard Copy (R.P. Film) in duplicate. Blueprints of the same shall be supplied in desired number as per the schedule.

3. Essential Spares :

- 3.1. All lowest level field replacement module/ assembly/ device units, which shall include all circuit packs/ boards, Cards, modules, terminals, fuses, power supply ancillary equipment, interconnecting couplers/ connectors/cable of each type.
- 3.2. The scale of Essential spares shall be 10% of the quantities used in the working system subject to a minimum of one.
- 3.3. Specification for Tool Kit related to EI
- 3.4. The indicative list of measuring instruments and tools is as follows, which is not exhaustive. Tenderer should include the contents of the Tool Kit along with their offer including any other tool specifically required for handling the equipment's supplied in this contract.
 - i. Crimping tool set
 - ii. Crimp insert set
 - iii. Extract tool set
 - iv. Insertion tool set
 - v. Location tool set
 - vi. Screw driver adjustable

- vii. Spanner double ended 33mm
- viii. Spanner double ended 3/8x1/2"
- ix. Spanner double ended 5/8 x 3/4"
- x. Spanner double ended 7/8x1"
- xi. Adjustable screw spanner 12"
- xii. Insulated cutting plier
- xiii. Insulated nose plier
- xiv. Hammer 1 1/2" LBS ball pane
- xv. Hacksaw frame
- xvi. Electronic soldering iron 230V/60W
- xvii. Digital multi meter (Fluke)
- xviii. AC clamp meter of Suitable range to cover the measurements of all kind of Used Voltages and currents (Fluke or equivalent)
- xix. Cabinet to store tools

4. Scope of Work under Items related to Electronic Interlocking System Complete is as below.

4.1. Supply Portion of Electronic Interlocking System Complete:

Manufacture and Supply of Microprocessor based Electronic Interlocking (EI) system complete as per RDSO Specification No. RDSO/SPN/192/2019 Ver.2.0 or latest amendments, as per Special Conditions of Contract and Technical Specification enclosed, including all fixtures, interconnection cables and jumper wires, mounting arrangement and accessories to make the EI System functional at stations mentioned in the Scope of Work of SCC. This EI system shall be of Hot Standby with Centralized Architecture. This system should have either relay interface or object controllers to drive field gears. If object controllers are used, it shall be installed at relay room of station. The system shall be designed with Dual Operator VDU of size 55" with industrial grade Embedded Fan-less PC as per RDSO TAN No. STS/E/TAN/3007 Version 1.0 or latest. The Signal lamps are to be lit with 110V AC in case of direct-fed signals. The supply includes:

- i. DC-DC converters shall be supplied separately for A & B Systems along with segregation of cabling and termination & shall be in N+1 configuration as per RDSO TAN No. STS/E/TAN/3012 dated 10.08.2016 ver.2.0 or latest.
- ii. Data logger with 32 Analog inputs and 512 External Digital inputs along with Protocol converter for Interfacing the EI system and Fault diagnostic software shall be as per RDSO Specification No. IRS-S-

99/2006 or latest and as detailed in technical requirements for Data logger in next section. Data logging facilities shall conform to 5.1.5 of RDSO Specification No. RDSO/SPN/192/2005 or latest. The tenderer shall take the responsibility to supply Data loggers which are not only interfaced with EI system but also interface seamlessly with the existing Data logger network

- iii. 2 Nos. of 55" size Operator VDUs and 1 No. of 42" Maintenance VDU with Industrial grade Embedded Fanless PC as per RDSO TAN No. STS/E/TAN/3007 Ver. 1.0 or latest with adequate storage memory to work in Hot-standby mode. The VDUs shall have minimum 4K resolution for 55" monitor and 42" monitor with commercial grade suitable for 24/7 operation.
- iv. Only OFC based communication equipment should be provided for communication between EI equipment and Operator VDU. OFC/UTP cable switches, protocol converters etc. and any special cards and cables /wires required for OFC based communication system should be supplied for under this schedule item. Only Armoured OFC cable as per railway specification will be provided by the railways.

NOTE:

- 1. Vital I/O Bits are calculated as per the EI Functional Table enclosed below.
- 2. Hardware Configuration mentioned below is inclusive of additional 15% of I/O Bits either in the form of Unused bits in installed cards or unused I/O slots, any other Vital I/O, Non- vital I/O and Read Back Inputs as required to make EI system functional with Dual VDU system as per OEM requirements.
- 3. In case of Siemens Westarce Make, the Quote Should be inclusive of QN1, 50VDC Interface relays, if required.
- 4. Any other materials other than the above mentioned materials, required for making the Electronic Interlocking functional to be supplied as part of this schedule item.

4.2. Installation, Testing and Commissioning of Electronic Interlocking System Complete: Design, installation, wiring, testing and commissioning of EI equipment's as per RDSO specification No. RDSO/SPN/192/2019 Ver. 2.0 or latest amendments, including installation of relay racks fixing and wiring of all types of interface relays, termination of interface wires on the CT rack (FTOT) and printing sleeve particulars. The input and output cables/wires used for interface wiring of EI shall be twisted pair and RDSO approved. This work also includes:

- i. Supply of 2 sets of hard copies of design documents (application logic and interface circuits) for approval and supply of 2 sets of final approved copy.
- ii. Supply and installation of EI racks, relay racks, fixtures, mounting arrangements, interconnecting cables and jumper wires etc. Relay racks, which are being supplied as a part of this item shall have 15% spare capacity for future use.
- iii. Supply and installation of powder coated SM key cum counter box made of MS sheet of approved type as per approved drawing of counter box.
- iv. Supply and installation of panel operator console in SM room with arrangements to fix 2 Nos VDUs, SM key cum counter box, axle counter reset boxes, etc. The basic frame structure of the console to be made of teak wood and water proof plywood sheet of 19mm thickness of reputed make to be used for fabrication of table duly consisting of required partitions/compartments for accommodating associated necessary equipment/ terminations. Interior and exterior to be covered using laminated sheet of reputed make and approved colors. All the materials required for the fabrication and fixing of console shall be supplied by contractor including lead, lift and man-power. Work need to be carried out as per the tentative drawing available at the office of Dy.CPM/GS/UBL and the instruction of site engineer. This item also includes supply of Godrej C13 or better make/model computer table (1 No.) for installation of maintenance VDU and Godrej office executive chair or better make (2 Nos).
- v. Synchronization of EI clock and data logger clock through CMU.
- vi. Provision of communication between operator VDU, maintenance VDU and CIU/main EI equipment.
- vii. Installation, wiring, testing and commissioning of data logger including wiring the external relay contacts. (All the internal variables of EI should be monitored by the data logger.)
- viii. Supply and provision of earthing and bonding, surge protection and system integration as per RDSO specification No. RDSO/SPN/197/2008 Ver. 1.0 or latest, RDSO TAN No.STS/E/TAN/3012, dated 10.08.2016 ver. 2.0, RDSO TAN No.STS/E/TAN/3006 Ver. 1.0 dated 02.11.2012 and/or latest and guidelines issued by RDSO/Railway board for achieving earth value less than one ohm, using minimum of six maintenance free earth pits.
- ix. Supply, installation and commissioning of class 'A' protection with lightening event counter shall be conforming to RDSO specification No.RDSO/SPN/197/2008 Ver. 1.0 or latest and as

per details given in technical specification in following sections, with three years warranty.

- x. Supply and provision of necessary class B, C and D protection as per RDSO guidelines. Provision of DC-DC converters in N+1 configuration separately for A & B systems along with segregation of cabling and termination.
- xi. The tenderer shall submit the OEM certificate for the installation as per RDSO prescribed format before commissioning of EI. (OEM certificate is mandatory for making payment.)

NOTE:

- 1. During the stage of execution, if there is any alteration in the approved TOC, up to 20% positive variation in number of routes, need to be catered within the scope of this item. No additional cost will be given by Railways.
- 2. Fuses, LED indicators for fuses, indoor cable and wire coils, etc. required to wire the various relays and all other miscellaneous materials required for the work shall be supplied by the contractor. Any other materials other than EI modules/card, relays and DC-DC converters required for the commissioning of EI shall be supplied by the contractor.

5. Submission of "As Made" documents for EI:

- 5.1. The contractor has to supply six sets of documents as mentioned below along with system details, site installation details/drawings, maintenance manual, and operation procedure in a bounded book as per practice of SW Railway. 'As made' shall be prepared by the contractor in AUTOCAD 2000 or latest in A3 size. All indoor work details shall be prepared by contractor and submitted to Railways before testing the circuits. On execution of the work, one copy of the 'As made' check print along with soft copy of the drawings shall be submitted for checking. The final negatives shall be made in tracing sheet and submitted to Railways for approval. On approval, the contractor shall submit along with the negatives, six sets of documents duly making neatly bounded booklets. Out of 6 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.

5.2. The As-made shall include the following:

- i. Wiring diagrams (Interface circuits)
- ii. Application program listing (Application logic in ladder form)
- iii. Relay/cable termination particulars

- iv. Input/output assignment details
- v. Relay layout and contact analysis chart
- vi. Equipment disposition layout
- vii. Details of power supply arrangement
- viii. Actual Boolean equations (note pad/word file), VDU software for the station, VDU application data for the station, various compilers of the data etc. as per RDSO TAN No. STS/L/SSI/General dt.10.3.2017
- ix. Any other drawing as required by the Railway as per the practice
- x. All other documentation as per clause No.10 of RDSO specification RDSO/SPN/192/2019 Ver. 2.0 or latest with latest amendment shall be supplied.

6. Function Table for I/O Bit Calculation:

FUNCTION TABLE FOR EI I/O BIT CALCULATION					
SN	FUNCTION	VITAL OUTPUT		VITAL INPUT	
		NAME	BITS	NAME	BITS
1	Signal 4A	HR, HHR, DR	3	RECR, HECR, HHECR, DECR	4
2	Signal 3A	HR, DR	2	RECR, HECR, DECR	3
3	Signal 2A	HR	1	RECR, HECR	2
4	Route Indicator - 1	UGR1	1	UECR	1
5	Route Indicator - 2	UGR1, UGR2	2	UECR	1
6	Route Indicator - 3	UGR1, UGR2, UGR3	3	UECR	1
7	Route Indicator - 4	UGR1, UGR2, UGR3, UGR4	4	UECR	1
8	Calling-On Signal	Co-HR	1	Co-HECR	1
9	Shunt - Ground Type	HR	1	HECR, RECR	2
10	Shunt - Post Type	HR	1	HECR	1
11	Point	WCR, WNR, WRR	3	NWKR, RWKR	2
12	Track Circuits			TPR	1
13	Crank Handle	CHZR	1	CHR	1
14	LC Gate	LCAR, LCYR	2	LCPR, EKPR	2
15	Axle Counter	Reset	1	VPR	2
16	UFSBI (DL/SL)	LSS-SR, LSS-NR, FSS-RR, FSS-NR	4	ASCR	1
17	FM (Diado)	1R, 2R	2	ASCR	1
18	SLBI (TLBI)	SNR, TAR	2	ASCR, SHZR	2
19	SMR			SMR	1
20	Relay Room Door			RR.DOOR	1
21	TJ Failure			Up TJ, Down TJ	2
22	DC-DC Converter Fail			DC-DC Fail	1

23	Emergency Crank Handle	ECHR-Key	1	EMR.CHR.CR	1
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7. Quantum of hardware cards, components and sub-systems and spares to be supplied by the contractor as per the requirement for all RDSO approved OEMs (as on the date of tender uploading) for all four types of system configuration are as below.

7.1. Hardware Cards, Components, Sub-systems and Spares for Medha Make

SN	Description	Unit	Sys. Config. 1 Qty	Sys. Config. Qty.	Sys. Config. 3 Qty.
Hardware Components/ Cards					
a. Central Interlocking Unit					
1	Vital Interlocking Computer Card	Nos	2	2	2
2	Communication Processor Card	Nos	2	2	2
3	Communication Interface Card	Nos	2	2	2
4	CIU Voltage and Health Monitoring Card	Nos	2	2	2
5	Power Supply Card Type B	Nos	4	4	4
6	Front Panel Display	Nos	2	2	2
7	RS232-OFC Converter	Nos	8	8	8
8	Single Mode RS485-OFC Bi-Dir. Convert	Nos	8	8	8
9	RS485 Distribution Card	Nos	2	2	2
10	24V EMI Filter	Nos	12	12	12
11	CIU Card files, Enclosure	Set	1	1	1
b. Object Controller					
1	IOCOM CPU Card	Nos	6	8	10
2	IOCOM Voltage and health monitoring C	Nos	6	8	10
3	Input WFM CPU Card	Nos	12	16	19
4	Output WFM CPU Card	Nos	8	10	13
5	WFM Relay Driver Card	Nos	8	10	13
6	OCM Vital Cut off Card	Nos	3	4	5
7	Power Supply Card Type B	Nos	6	8	10
8	Power Supply Card Type C	Nos	6	8	10
9	Single Mode RS485-OFC Bi-Dir. Convert	Nos	6	8	10
10	24V EMI Filter	Nos	15	20	25
11	OC Card files enclosure	Set	3	4	5
c. Counter Box					
1	Single Mode RS485-OFC Bi-Dir. Convert	Nos	1	1	1
2	Panel Processor CPU Card	Nos	1	1	1

3	Panel Processor Output Card	Nos	1	1	1
4	Power Supply Card Type B	Nos	2	2	2
5	24V EMI Filter	Nos	2	2	2
6	CB Card files enclosure	Set	1	1	1
d. Power Supply Equipment's					
1	DC-DC Converters(Rating: 110V-24V/5A Make: Medha	Nos	34	36	40
e. Supply of Essential Spares			Spare Set1	Spare S 2	Spare S 3
1	Vital Interlocking Computer Card	Nos	1	1	1
2	Communication Processor Card	Nos	1	1	1
3	Communication Interface Card	Nos	1	1	1
4	CIU Voltage and Health Monitoring Card	Nos	1	1	1
5	Power Supply Card Type B(CIU)	Nos	1	1	1
6	RS232-OFC Converter	Nos	1	1	1
7	Single Mode RS485-OFC Bi-Dir. Convert	Nos	1	1	1
8	IOCOM CPU Card	Nos	1	2	2
9	IOCOM Voltage and health monitoringCa	Nos	1	2	2
10	Input WFM CPU Card	Nos	2	2	2
11	Output WFM CPU Card	Nos	1	1	2
12	WFM Relay Driver Card	Nos	1	1	2
13	OCM Vital Cut off Card	Nos	1	1	1
14	Power Supply Card Type B(OC)	Nos	1	2	2
15	Power Supply Card Type C	Nos	1	2	2
16	24V EMI Filter	Nos	3	3	4

7.2. Hardware Cards, Components, Sub-systems and Spares for Kyosan Make

SN	Description	Unit	Sys. Config. 1	Sys. Config. 2	Sys. Config. .
			Qty	Qty	Qty
a.	Hardware Components/ Cards				
1	L-K7C SUBRACK with Mother Board	Nos	1	1	1
2	CPU CARD, F486-4I	Nos	2	2	2
3	IF CARD, FSIO	Nos	2	2	2
4	IF CARD, FSIO-EX	Nos	2	2	2
5	I/O CARD, FIO7-[P]	Nos	2	2	2
6	I/O CARD, EXTFIO7-[P]	Nos	2	2	2
7	I/O CARD, DID.	Nos	2	2	2
8	POWER CARD, IPU6C	Nos	2	2	2
9	E-P5 SUBRACK	Nos	1	1	2

10	IF CARD, LINE2B	Nos	2	2	4
11	I/O CARD, ET-PIO2	Nos	4	5	7
12	PCINIO CARD FOR OPC	Nos	2	2	2
13	PCINIO CARD FOR MTC	Nos	2	2	2
14	SM480 RELAY	Nos	4	4	4
15	TCF-142M Card (Media Converter)	Nos	4	4	4
b. Power Supply Equipment's					
1	DC-DC Converters for EI Internal Power Supply (Gallant Make: DD2410 or better)	Nos	16	16	18
c. Supply of Essential Spares					
			Spare Set 1	Spare S 2	Spare 3
1	CPU CARD, F486-4I	Nos	1	1	1
2	IF CARD, FSIO	Nos	1	1	1
3	IF CARD, FSIO-EX	Nos	1	1	1
4	I/O CARD, FIO7-[P]	Nos	1	1	1
5	I/O CARD, EXTFIO7-[P]	Nos	1	1	1
6	I/O CARD, DID.	Nos	1	1	1
7	POWER CARD, IPU6C	Nos	1	1	1
8	IF CARD, LINE2B	Nos	1	1	1
9	I/O CARD, ET-PIO2	Nos	1	1	1

7.3. Hardware Cards, Components, Sub-systems and Spares for Ansaldo Make

SN	Description	Unit	Sys. Config. 1	Sys. Config.	Sys. Config. .3
			Qty	Qty.	Qty.
a.	Hardware Components/ Cards				
1	MLK_II Card file	Nos	2	2	4
2	CPU_PCB	Nos	2	2	4
3	PS_PCB	Nos	2	2	4
4	MLK_II Vital Input	Nos	12	16	20
5	MLK_II Vital Output	Nos	8	10	14
6	MLK_II Non-Vital I/O	Nos	2	2	4
7	SYNC_PCB (MDSC)	Nos	2	2	4
8	COMM_PCB	Nos	2	2	4
9	Relay VCOR	Nos	2	2	4
10	Relay Base VCOR	Nos	2	2	4
11	Address select PCB-48 pin	Nos	24	30	42
12	Address select PCB-96 pin	Nos	2	2	4
13	CPU EEPROM PCB	Nos	2	2	4
14	48-Pin Connector Housing Assembly	Nos	28	34	50

15	48-Pin Connector Guide Element	Nos	28	34	50
16	96-Pin Connector Housing Assembly	Nos	2	2	4
17	96-Pin Connector Guide Element	Nos	2	2	4
18	48-Pin Female Connector	Nos	28	34	50
19	48-Pin Female Crimp Contact	Nos	750	1150	1300
20	96-Pin Female Connector	Nos	2	2	4
21	96-Pin Female Crimp Contact	Nos	140	140	280
22	1-Wide Blank Front Panel Assembly	Nos	6	0	18
23	PCB Keyin Plug	Nos	180	216	324
b.	Power Supply Equipments				
1	DC-DC Converters 12V	Nos	4	4	4
2	DC-DC Convertres 24V	Nos	8	8	8
c.	Supply of Essential Spares		Spare Set 1	Spare Set 2	Spare Set 3
1	CPU_PCB	Nos	1	1	1
2	PS_PCB	Nos	1	1	1
3	MLK_II Vital Input	Nos	1	1	1
4	MLK_II Vital Output	Nos	2	2	2
5	MLK_II Non-Vital I/O	Nos	1	1	2
6	SYNC_PCB (MDSC)	Nos	1	1	1
7	COMM_PCB	Nos	1	1	1

7.4. Hardware Cards, Components, Sub-systems and Spares for Siemens Westarce Mk-II Make

SN	Description	Unit	Sys. Config. 1	Sys. Config . 2	Sys. Config. 3
			Qty	Qty.	Qty.
a.	Hardware Components/ Cards				
1	Processor Module	Nos.	2	2	2
2	Processor Module Backplane	Nos.	2	2	2
3	Parallel Input Module (50V)	Nos.	10	13	16
4	Relay Output Module (50V)	Nos.	9	11	14
5	Westarce MkII housing for one full backplane	Nos.	3	3	4
6	Full backplane with shield and Screws	Nos.	3	3	4
7	SMB Termination Dongle (plug)	Nos.	10	10	12
8	I/O back plate connector - Crimp - PIM	Nos.	10	13	16
9	I/O back plate connector - Crimp - ROM	Nos.	9	11	14
10	Front filler panel-8hp	Nos.	9	4	8
11	Rear Filler panel- 8hp	Nos.	9	4	8
b.	Power Supply Equipment's				

1	DC DC Converter,110V/24V,10 Amps	Nos.	8	8	8
2	DC DC Converter,110V/50V,5 Amps	Nos.	6	6	6
c.	Supply of Essential Spares		Spare Set 1	Spare Set 2	Spare Set 3
1	Processor Module	Nos.	1	1	1
2	Processor Module Backplane	Nos.	1	1	1
3	Parallel Input Module (50V)	Nos.	1	2	2
4	Relay Output Module (50V)	Nos.	1	2	2
5	I/O back plate connector - Crimp - PIM	Nos.	1	2	2
6	I/O back plate connector - Crimp - ROM	Nos.	1	2	2

8. In case of RDSO approved OEMs as mentioned above, detailed cost-wise and quantity-wise break-up for items related to Electronic Interlocking system-supply, installation, testing and commissioning and spares for these items are not required to be submitted by the contractor. Supply and execution of the items related to Electronic Interlocking should be carried out strictly as per the schedule of works and quantum of hardware cards, components and sub-systems and spares are to be supplied by the contractor as mentioned in previous para.
9. In case of any OEMs getting RDSO approval after the date of tender uploading and before tender closing, detailed cost-wise and quantity-wise break-up for items related to Electronic Interlocking system- supply, installation, testing and commissioning and spares for these items need to be uploaded by the contractor along with his e-offer. In this case, as per the requirement for each type of system configuration, quantity will be deduced by the Railways before finalization of tender and contractor need to supply the material as per the quantity deduced by the railways only.
10. During the stage of execution, 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 the maximum available input/output functions/hardware cards of that particular system configuration. However, if hardware augmentation is involved for such changes in scope beyond above mentioned limit of input/output functions, then cost of supply of requisite hardware will be considered for payment as a new/additional item. Re-designing and installation will be paid as under relevant schedule item.

Chapter-19

Foundations

1. Casting of foundations for signaling installations:

Sl. No.	Type of foundation	Drawing Nos/dimensions
1	Signal (main CLS)	SG/SWR/052
2	Road warning signal CLS type	SG/SWR/054
3	Ground Type Shunt Signal	SG/CN/02/10
4	Apparatus Case Full	SG/SWR/055
5	Apparatus Case Half/ Quarter	SG/SWR/056
6	Cable Termination box for cable throughing, Point Machine	SG/CN/02/08
7	Electrical Lifting Barrier (Pedestal)	900mm x 900mm x 900mm
8	Electrical Lifting Barrier (Meeting Post)	400mm x 400mm x 600mm
9	Sliding Boom Base	1000mm x 500mm x 500mm
10	Sliding Boom Locking Post	1000mm x 500mm x 500mm

- 1.1. The work includes excavation of the pit and casting of foundations with M.S foundation bolts. Foundation shall be casted with cement concrete in the ratio 1:3:6 using stone jelly of size 20/25mm. Casted foundation shall be cured for a period not less than 7 days. The position of foundations for S&T gears will be indicated by Railways.
- 1.2. The foundations should be casted using hylum sheet/ waterproof plywood/ MS sheet form work to ensure smooth exterior finish and avoid the additional plastering. Necessary earth work shall be made around the 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 the Railway representative at Site.
- 1.3. Apparatus case foundations are to be laid in such a way that the doors are parallel to track in open condition. The boxes shall be installed in rear of the signals covered by them such that the signal aspect can be watched while taking readings etc. The open door shall be farther than 2.36 meters from the center of the nearest track.
- 1.4. The sand and ballast must be clean and free from soil, clay, shells, soft or flaky materials or any vegetable. Ballast must be washed when necessary to ensure cleanliness.
- 1.5. Sand used must be tidal river sand or M-sand and must be free from any salts. Water used for mixing must be clean and free from any oil, alkali and acid. Materials for concrete must be carefully and accurately measured for every batch.

- 1.6. Mixing must be done in a mixing trough or a M.S. Sheet, which should not be more than half filled at the time of mixing. Two men shall use square ended shovels and not powrahs. Water must be added by pouring continuously until all materials and water are thoroughly mixed and uniformly combined.
- 1.7. When the batch is fully mixed, it must be used without any delay. The aggregate shall be deposited in a uniform layer not exceeding 15 cm. Tamping and spreading of each layer to be done as to cause it to settle thoroughly in the form and produce a dense mass.
- 1.8. Forms must be drenched with water before the concrete is placed against them and must not be removed in less than 36 hours afterwards.
- 1.9. A template for each foundation should be prepared suiting the holes in the base of the location box or signal post (for which foundation is cast) in order to hold the anchor bolts in position till the foundation is cured. The template shall be removed before the top of the foundation is given fine finishing.
- 1.10. Fine aggregate must consist of sand, stone ballast not exceeding 40mm x 40mm size and cement. The sand and ballast must be clean and free from soil, clay shells, soft or flaky materials or any vegetation. Ballast must be washed when necessary to ensure cleanliness.
- 1.11. The top level of the foundation shall be in level with the existing rail level as far as possible.
- 1.12. After all the signaling cables are taken inside the apparatus case/battery boxes, signal posts the side opening shall be closed with masonry work and plastered. The inner side is then filled with sand and finally the bottom is sealed with a sealing compound.
- 1.13. Earth work and pitching shall be done in all cases of location box erection after completing all works of termination and testing up to such a height and width around the box such that the technician can easily reach the contents inside.
- 1.14. Earth work and stone pitching shall be done where the boxes/signals are laid on edges of embankments or the height of the location box heights are unreachable to maintainers. This item shall be paid separately.
- 1.15. Earth work and pitching is covered under a separate item of schedule.
- 1.16. No payment shall be made for any extra excavation carried out in the slope and width of the pit, including for foundations where soil is loose and the pit is to be dug for more depth.

2. Procurement of Cement:

- 2.1. Cement for use in the works shall be procured by the contractor from the main producers/their authorized dealers/ authorized stock yards which shall conform to BIS specifications.

- 2.2. Cement bags packing should bear the following information in legible marking:
 - i. Manufacturer's name
 - ii. Registered trademark of manufacturer, if any
 - iii. Type of cement
 - iv. Weight of each bag in Kg or no. of bags/ton.
 - v. Date of manufacture, generally marked as week of the year/year of manufacture, e.g. 30/93 which means the 30th week of 1993.
- 2.3. To ensure quality control, test certificates from the manufacturer should be produced by the contractors, which should confirm the relevant specifications [latest may be incorporated].
- 2.4. Railways may also take samples during the course of the work and get the cement tested to ascertain their conformity to specifications.
- 2.5. When such sampling is done, it shall be as per IS Specifications.
- 2.6. Tests 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

Chapter-20

Painting of Signaling and Telecommunication Gears

1. Painting

- 1.1. All the signaling equipment shall be painted in accordance with chapter XIX of signal engineering manual part-II. The coloring scheme shall be as per annexure '29 para 19.106 of SEM part-II.

2. Indoor Painting:

- 2.1. Painting of complete relay rack/cable termination rack and ladder and its fixtures and other equipment installed in the relay room as per the instructions of site engineer and writing all cable termination numbering particulars in rack and also on flex board, relay numbering, nomenclature and other details both on relays and racks, rack numbering, particulars of condensers, and fuses, resistances both at fixing boards as well as in the particulars board, cable numbering as cables.
- 2.2. Painting of power distribution panel with all relevant details.
- 2.3. Battery bank particulars to be displayed on flex prints affixed over 6mm plywood in battery room.
- 2.4. Painting of numbering in sequence on secondary cells with yellow circle background with black color number.
- 2.5. Key transmitters shall be painted in "Black".

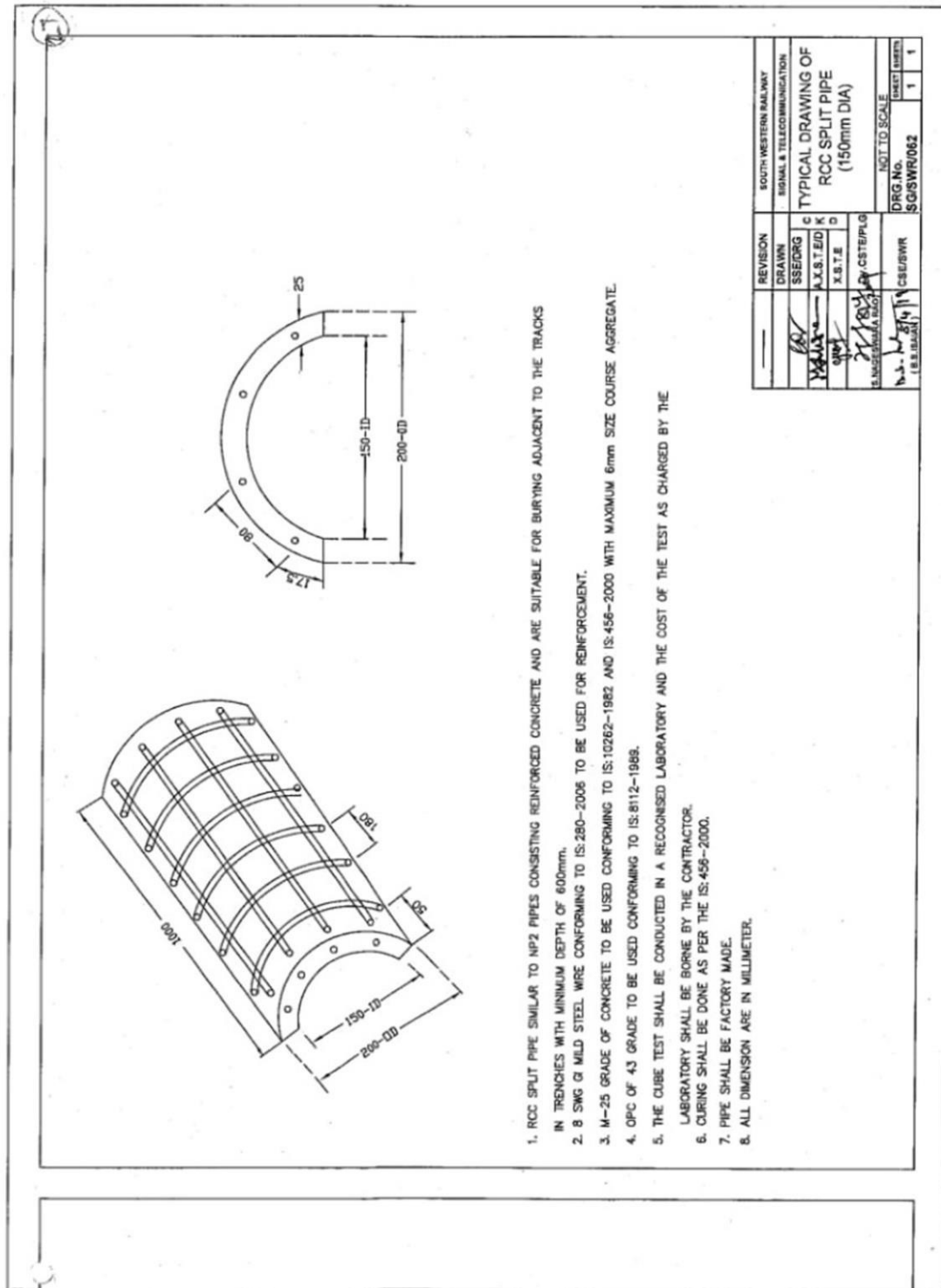
3. Outdoor Painting:

- 3.1. All gears like signal post, signal units, signal base, location box inside and outside, LC gate booms and other installations shall be painted with one coat of red oxide and two coats of aluminium paint.
- 3.2. Painting shall be done with Asian make or better quality of enamel paint and painting the following equipment in two coats duly scrapping the rust as directed by site engineer at site. Color scheme shall be as per Annexure '29 para 19.106 of SEM part-II.
- 3.3. Color light signal post, unit, hood complete with route indicators, ladders, calling on signals are to be painted both inside and outside including numbering of signals, cable termination details as per standard practice.
- 3.4. Apparatus cases both inside and outside with station code, location number, particulars of cable termination and other equipment kept inside the location.
- 3.5. Track circuits: painting of feed/relay end details on rails, TLJBs, details of feed equipment with track circuit numbers and battery with track circuit

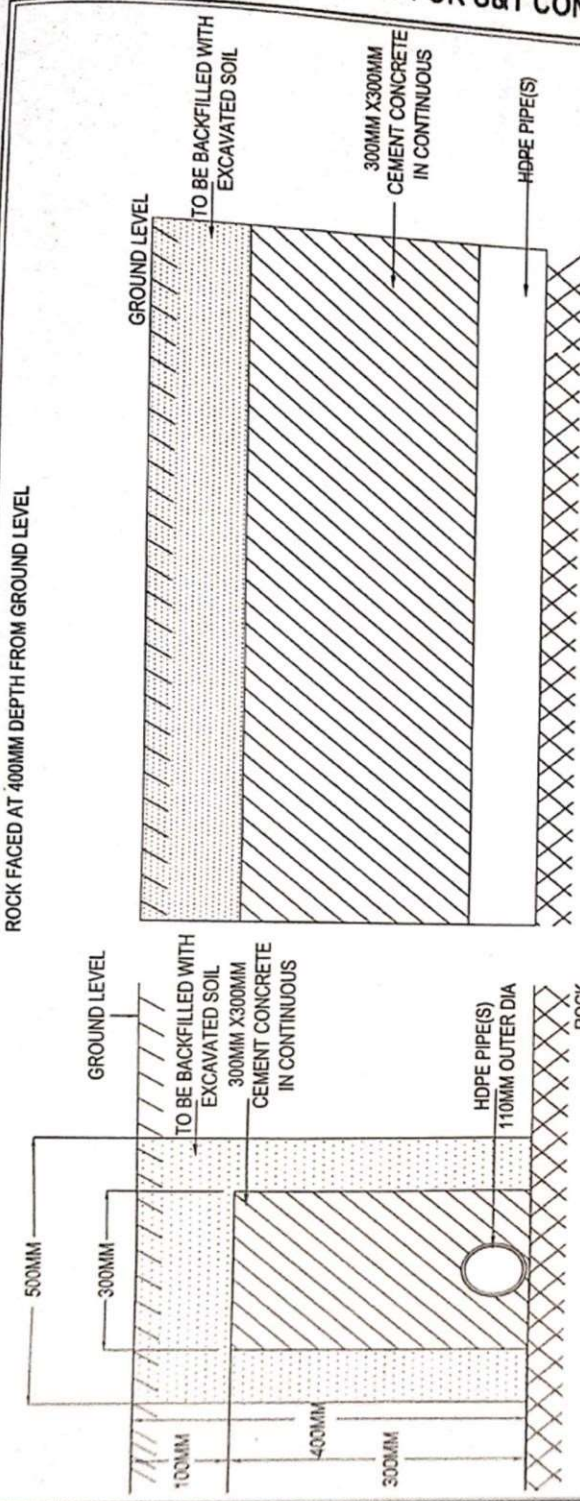
- number and date of installation.
- 3.6. TLJB shall be painted in "Black".
- 3.7. For all signal posts, white aluminium paint should be used.
- 3.8. Fittings (signal aspect unit, hood and ladder) shall be painted in "Black", and the rear of the signal aspect unit may be painted in "Black" with diagonal cross of aluminum.

4. Colours to be used for Painting the Signaling Gears are shown below.

Sl. No.	Signaling Gadgets	Colours to be painted (outside)
I	Signal: colour light signal & shunt signal: Surface base post aspect unit complete	Aluminium (except for distant signal in double distant territory) black Note: Post of distant signal in double distant territory to be painted in yellow stripes at 300 mm interval.
II	All types of apparatus cases and cable termination box	Aluminium
III	Track lead junction box	Black
IV	SM's control frame instrument	Green enamel
V	Point machines	Black
VI	Electrical detectors	Black
VII	Electrical lever locks and circuit controller	Black
VIII	Key transmitters	Red or black
IX	(i)Double line SGE block instrument (ii)Single line token instrument (iii)Single line token less instrument	Green enamel Grey enamel Grey enamel
X	Interlocking frame supports, quadrants, lever below quadrants, locking trough, catch handle connection & Indication plates Down rods between lever tail and crank All types of cranks, compensators, facing point locks, lock bars and detectors. Roddings and 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
XIII	Lifting barrier: Stands upright and others boom Stop board on the boom	Black Black and yellow stripes 300mm wide alternatively Red

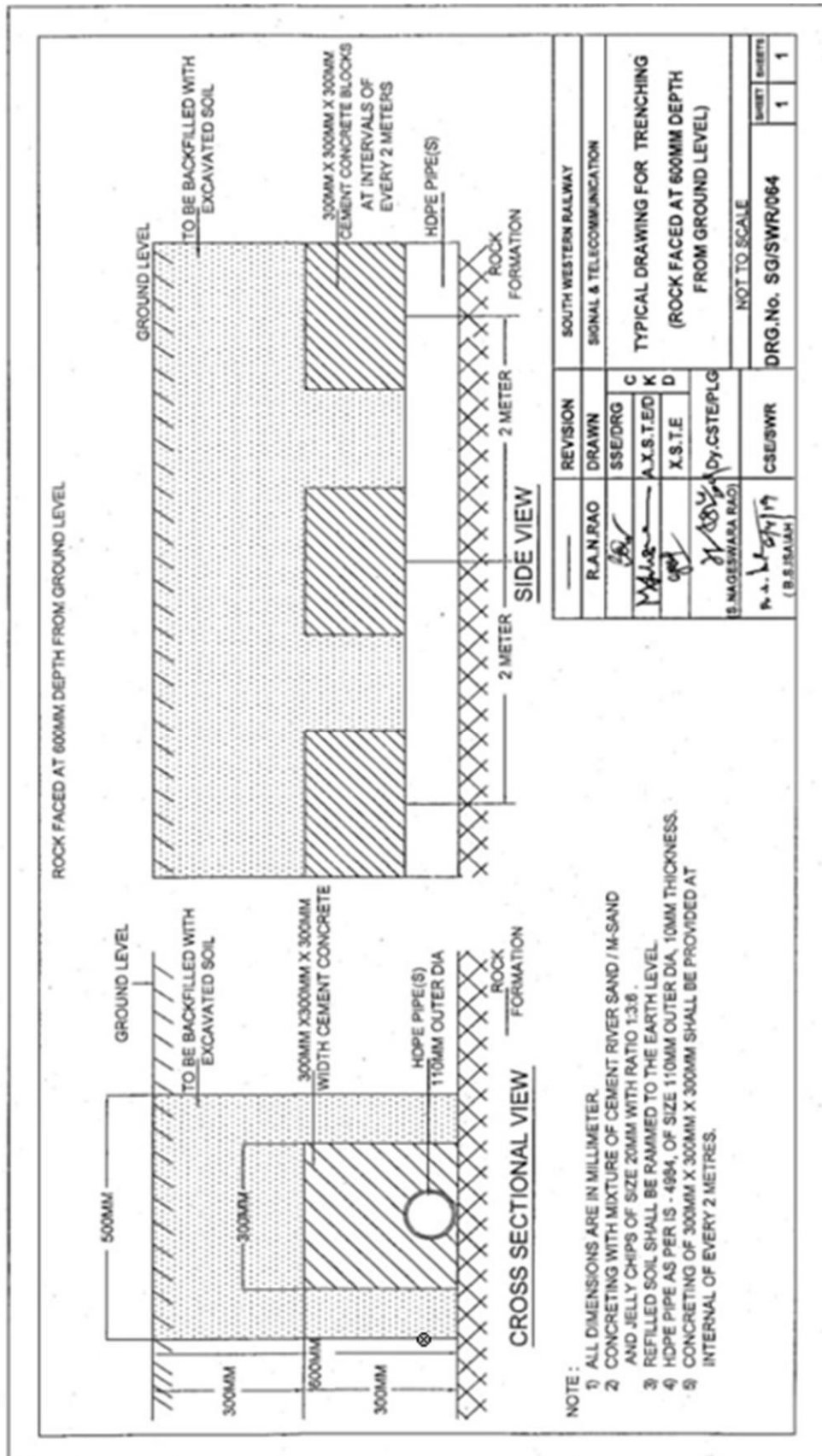


TECHNICAL GUIDELINES FOR S&T CONTRACTUAL WORKS (MAY-2019)

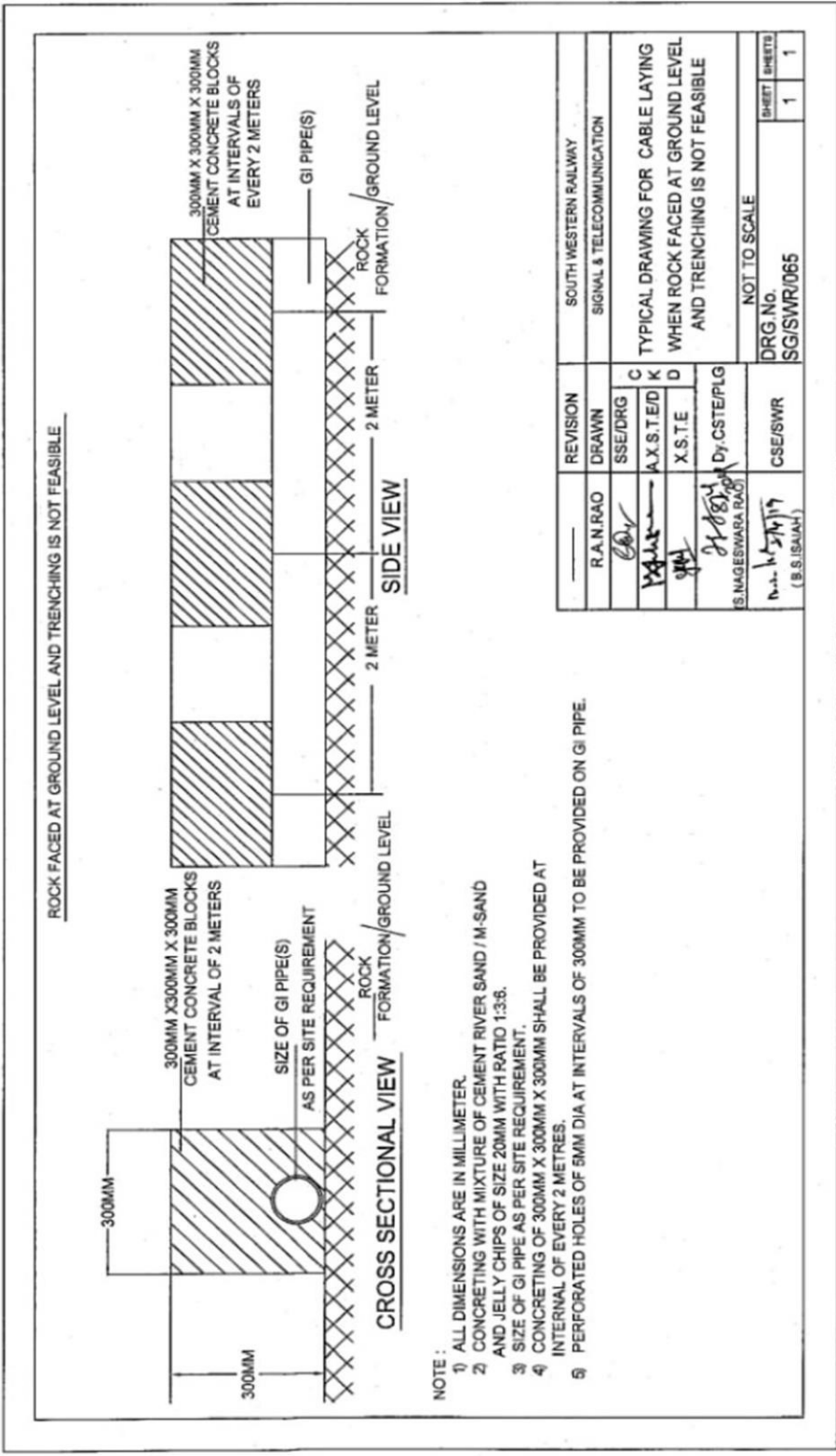


REVISION	SOUTH WESTERN RAILWAY
DRAWN	SIGNAL & TELECOMMUNICATION
SSE/DRG	TYPICAL DRAWING FOR TRENCHING
A.X.S.T.E/D K	(ROCK FACED AT 400MM DEPTH
X.S.T.E	FROM GROUND LEVEL)
Dy.CSTE/PLG	NOT TO SCALE
S.NAGESWARA-RAO	DRG.No.
S.NAGESWARA-RAO	SG/ISWR/063
(B.S.ISA/H)	SHEET SHEETS
	1 1

- NOTE :
- 1) ALL DIMENSIONS ARE IN MILLIMETER.
 - 2) CONCRETING WITH MIXTURE OF CEMENT RIVER SAND / M-SAND AND JELLY CHIPS OF SIZE 20MM WITH RATIO 1:3:6.
 - 3) REFILLED SOIL SHALL BE RAMMED TO THE EARTH LEVEL.
 - 4) HDPE PIPE AS PER IS - 4984, OF SIZE 110MM OUTER DIA, 10MM THICKNESS.
 - 5) CONCRETING OF 300MM X 300MM SHALL BE PROVIDED IN CONTINUOUS



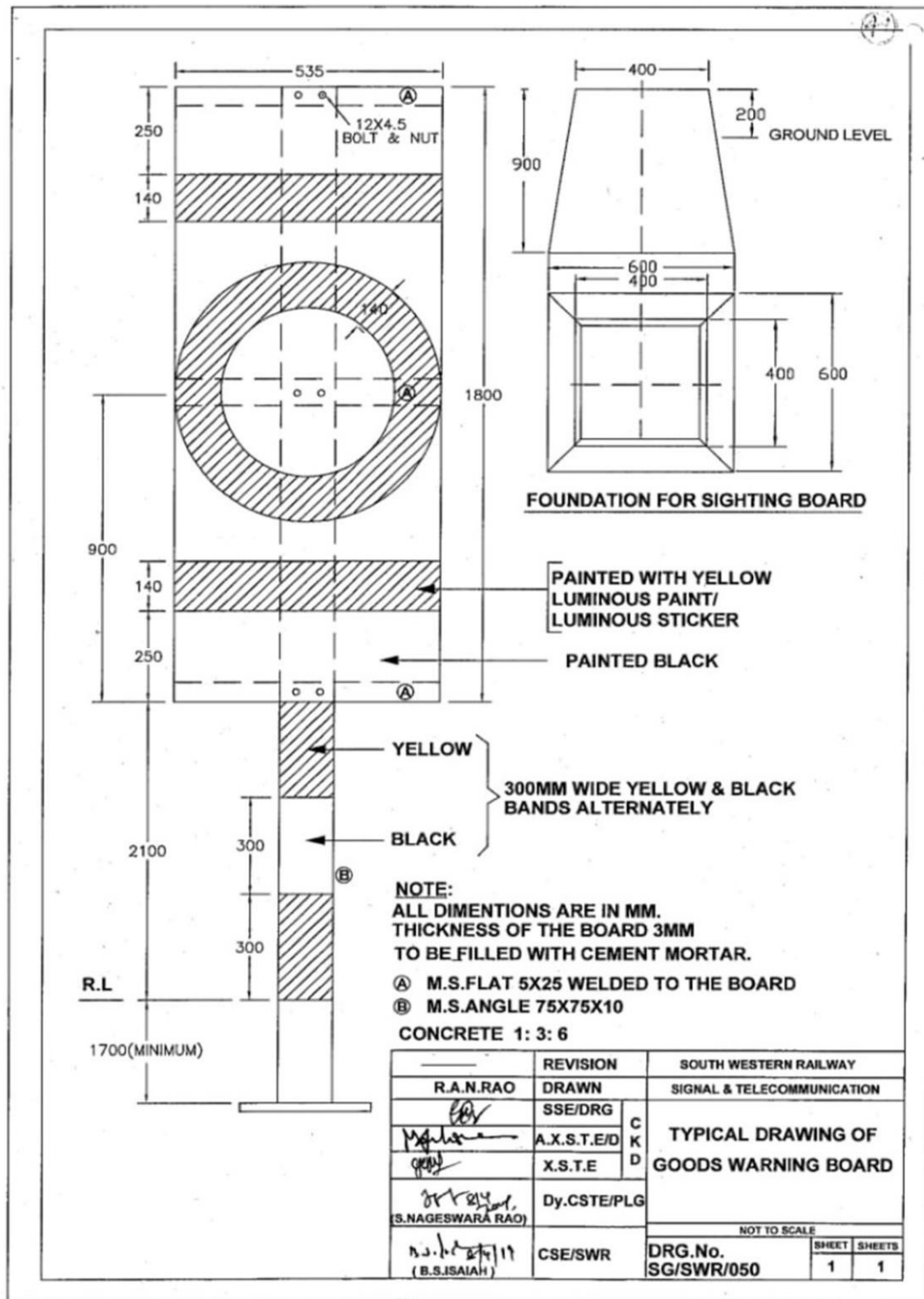
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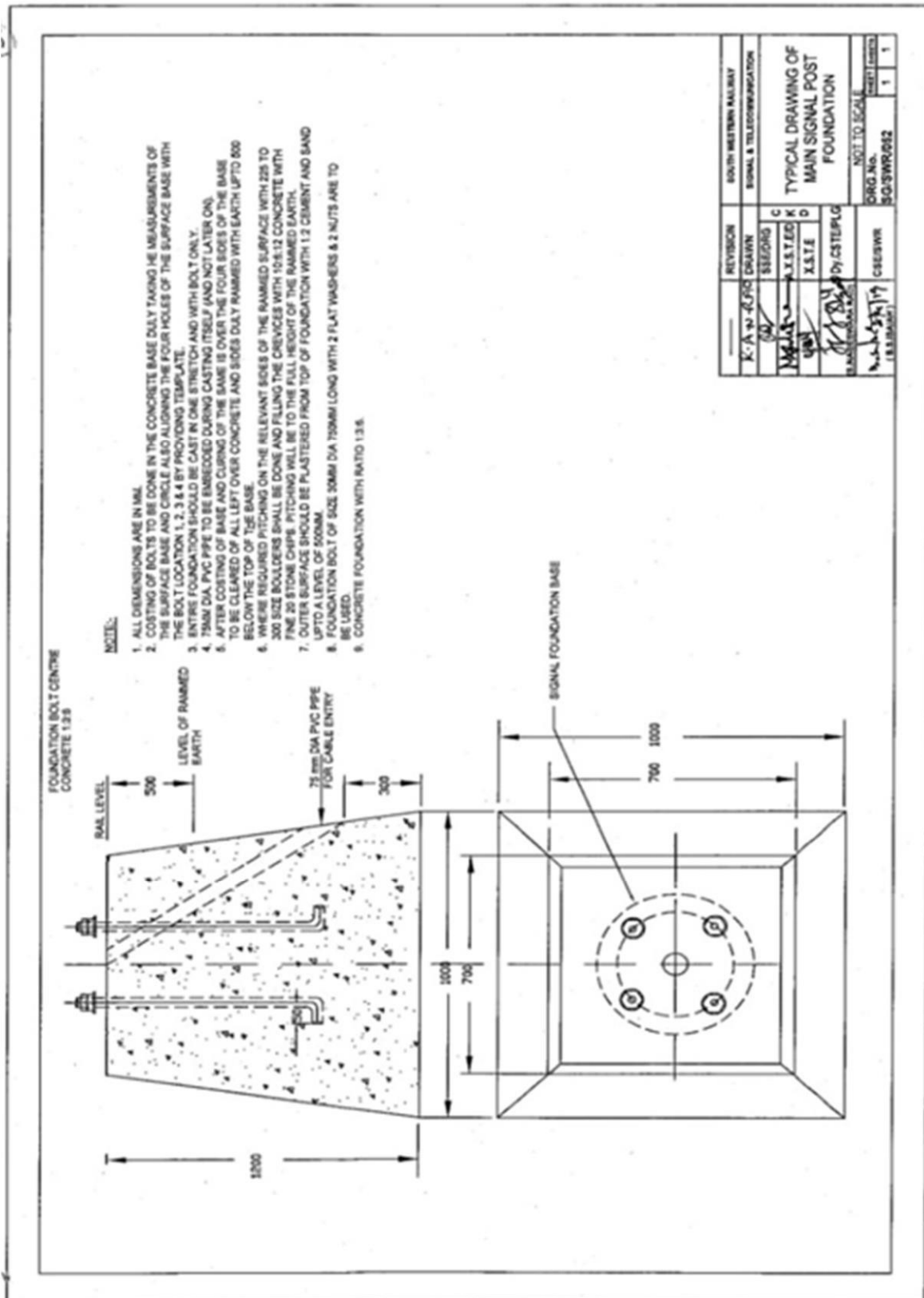




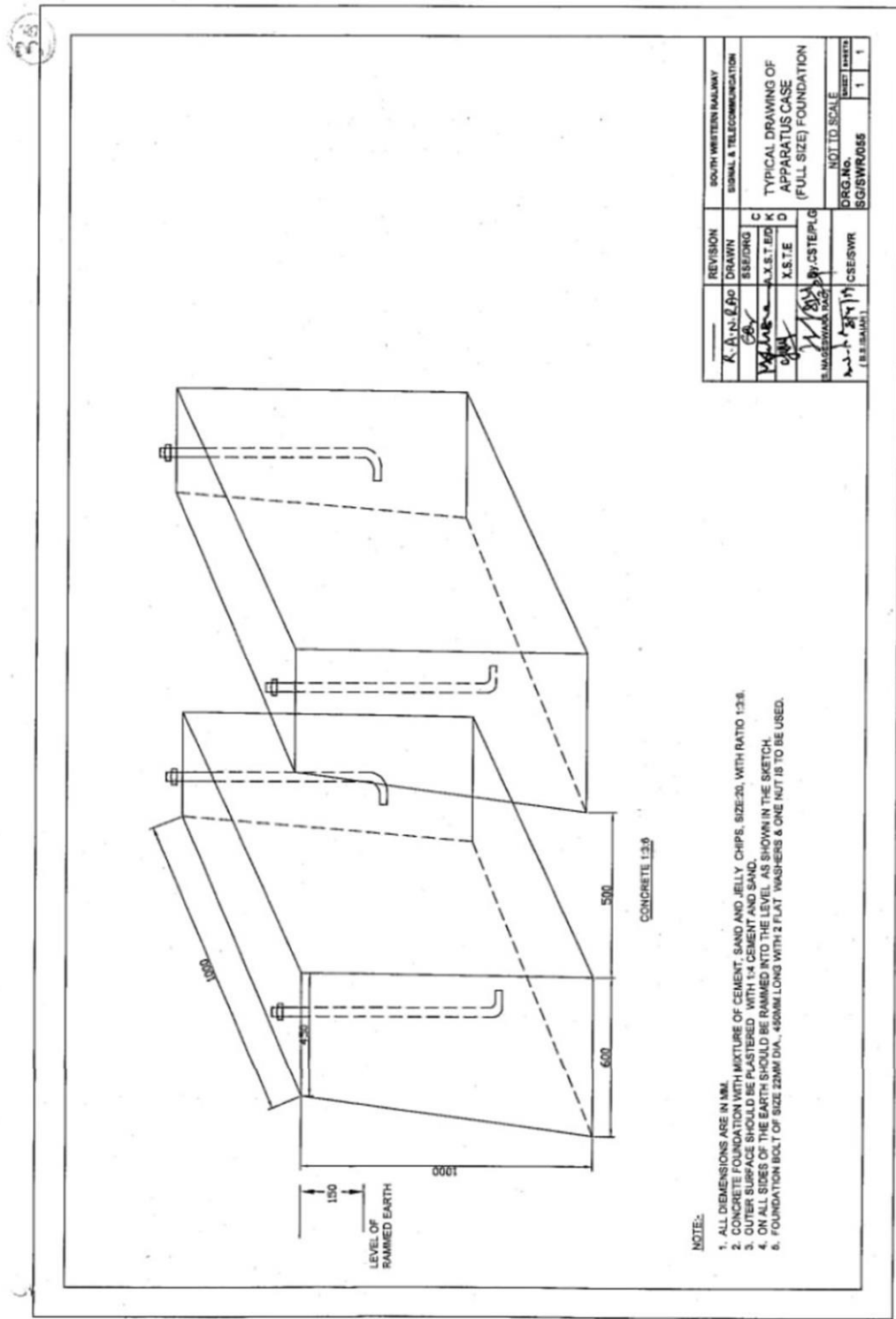
1. ALL DIMENSIONS ARE IN MM.
2. TRACK LEAD CABLE SHALL BE LAID AT A DEPTH OF 1M² FROM THE GROUND LEVEL.
3. CONNECTORS FROM TLJB TO TRACK SHALL BE MADE FIRMLY THROUGH 202.5 SQ MM CABLE ALONG WITH ARMOUR AT BOTH ENDS.

NOT TO SCALE



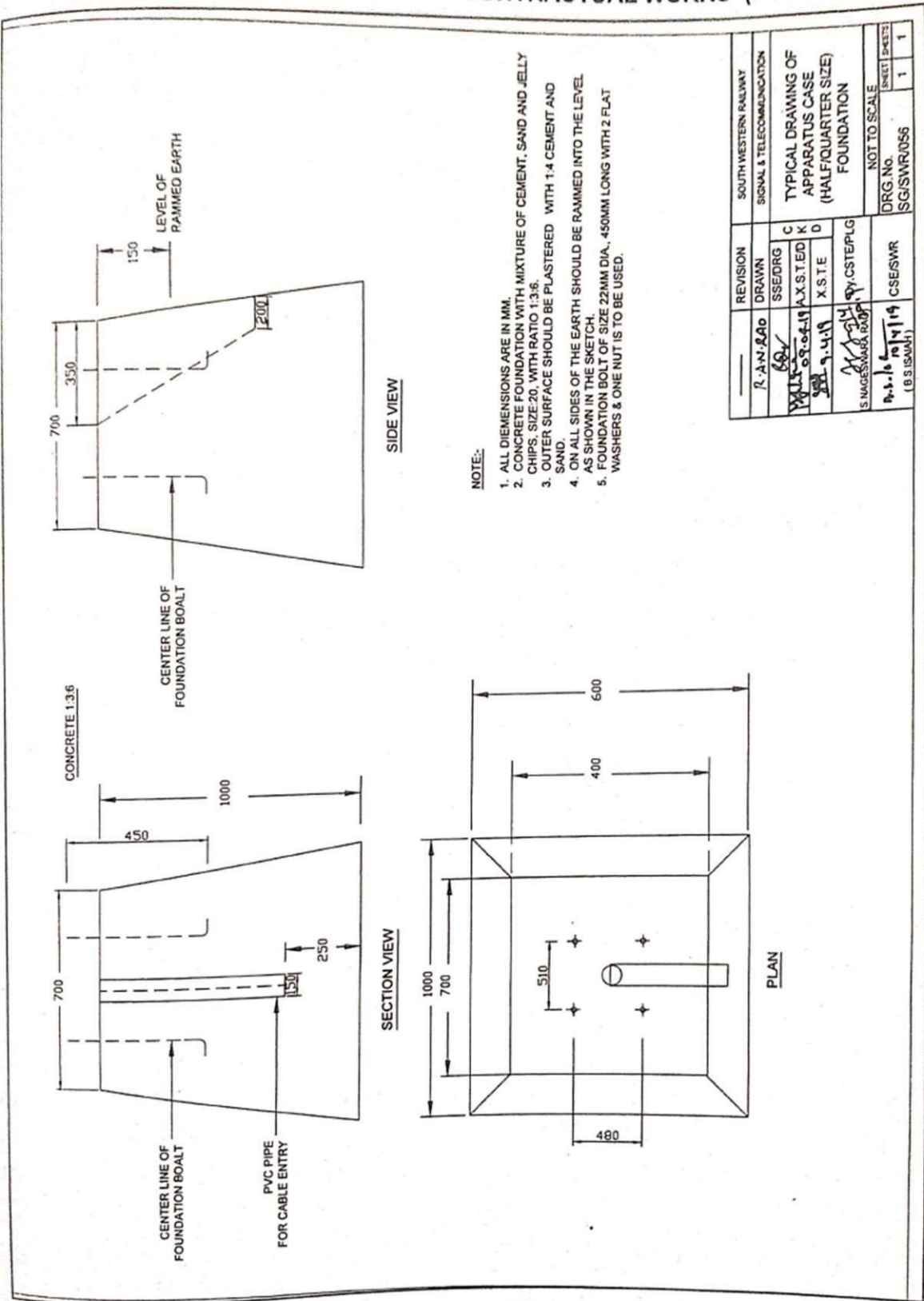


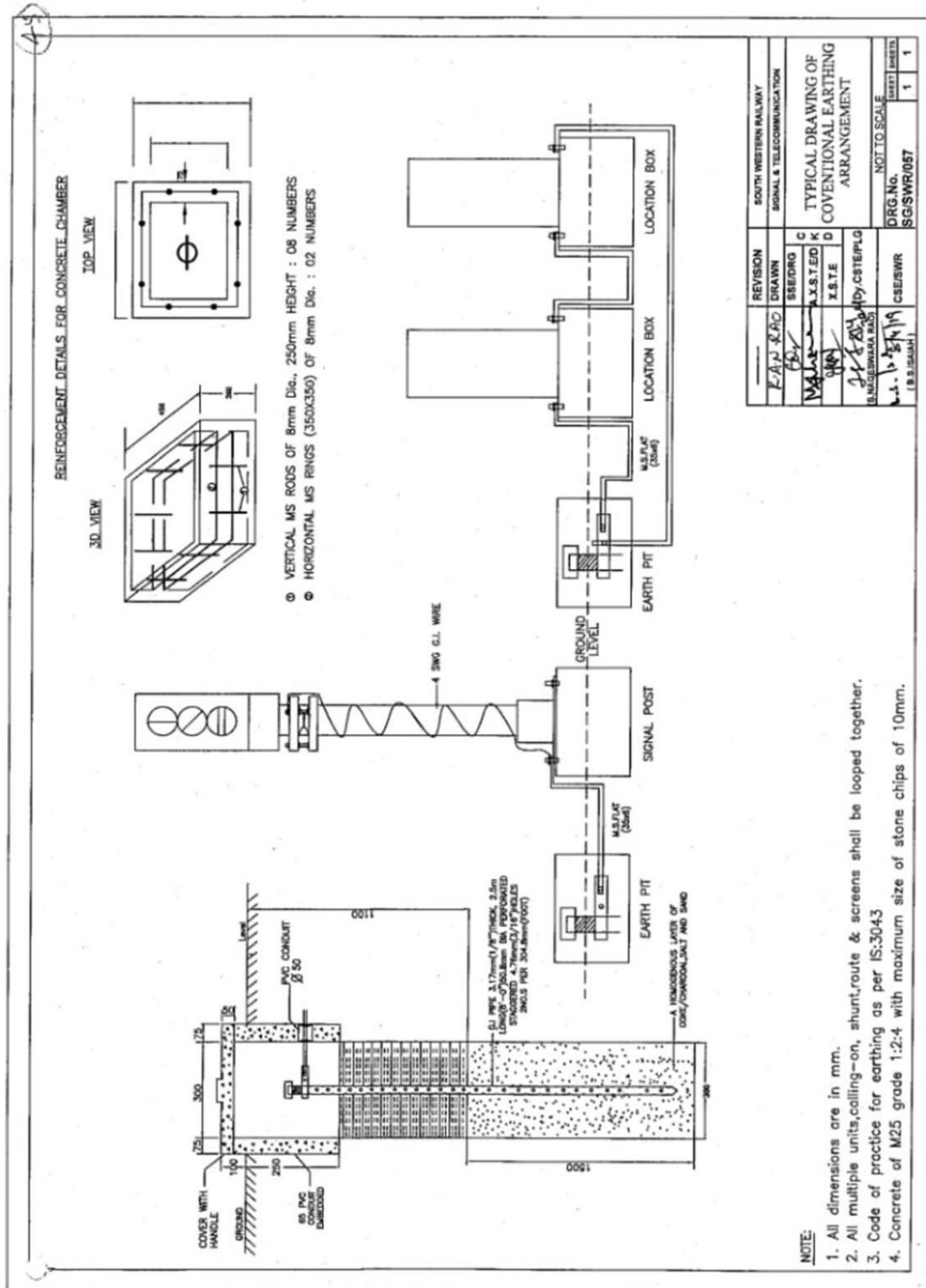


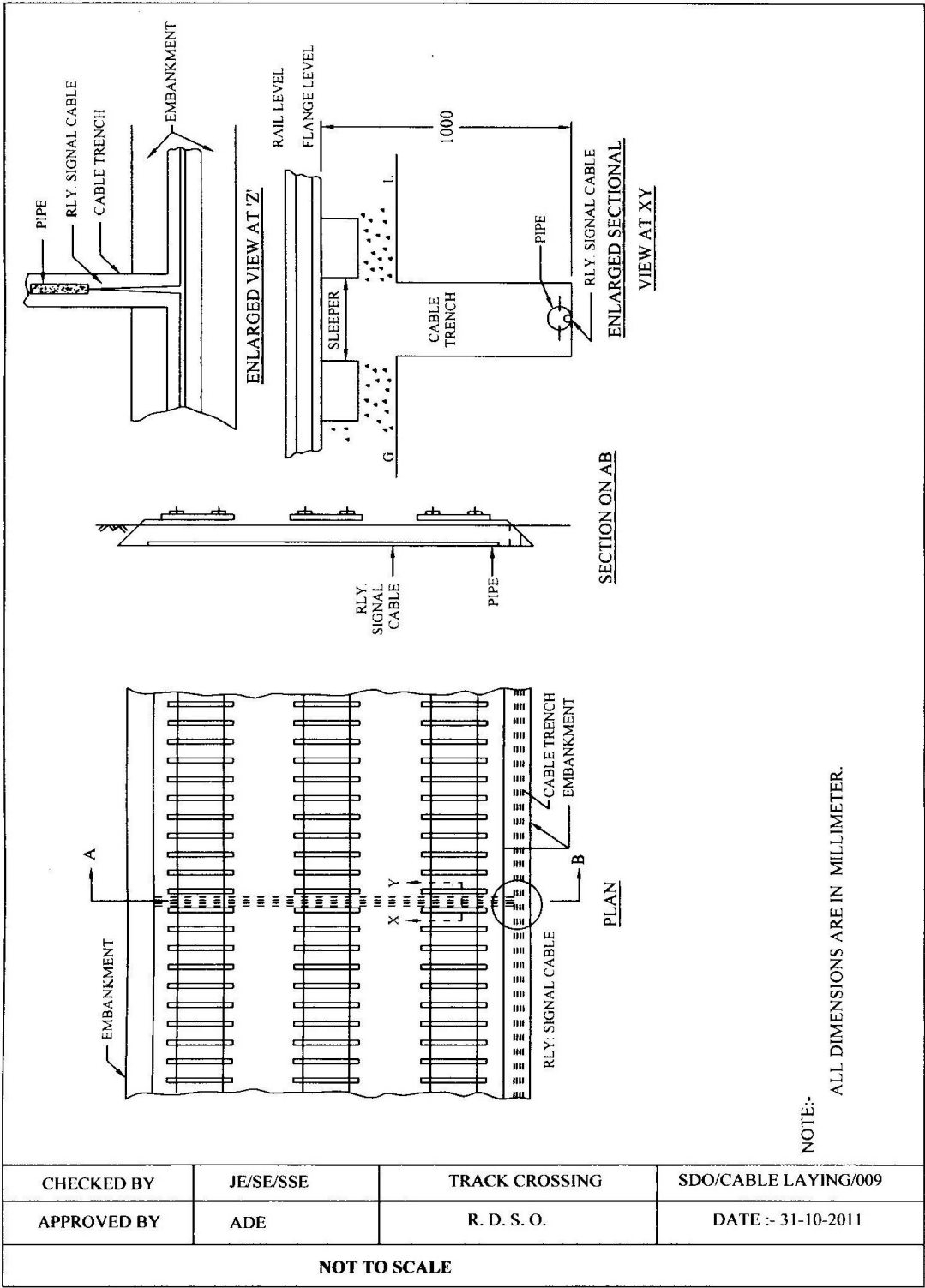


- NOTE:
1. ALL DIMENSIONS ARE IN MM.
 2. CONCRETE FOUNDATION WITH MIXTURE OF CEMENT, SAND AND JELLY CHIPS, SIZE 20, WITH RATIO 1:3:6.
 3. OUTER SURFACE SHOULD BE PLASTERED WITH 1:4 CEMENT AND SAND.
 4. ON ALL SIDES OF THE EARTH SHOULD BE RAMMED INTO THE LEVEL AS SHOWN IN THE SKETCH.
 5. FOUNDATION BOLT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

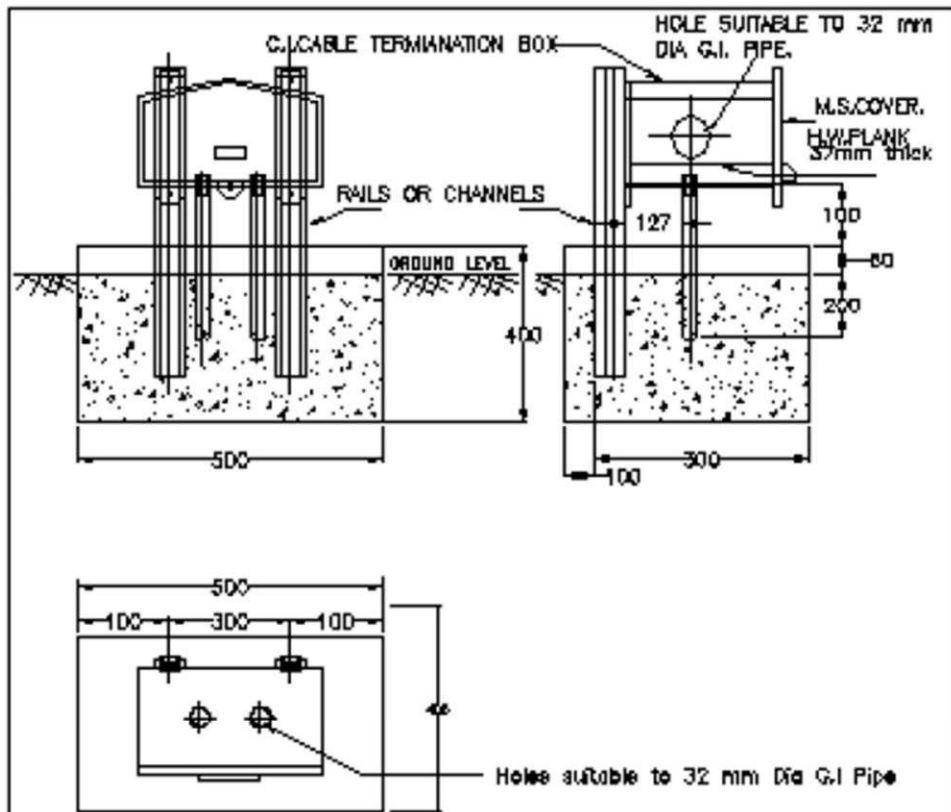
TECHNICAL GUIDELINES FOR S&T CONTRACTUAL WORKS (MAY-2019)







FOUNDATION FOR CABLE TERMINATION BOX

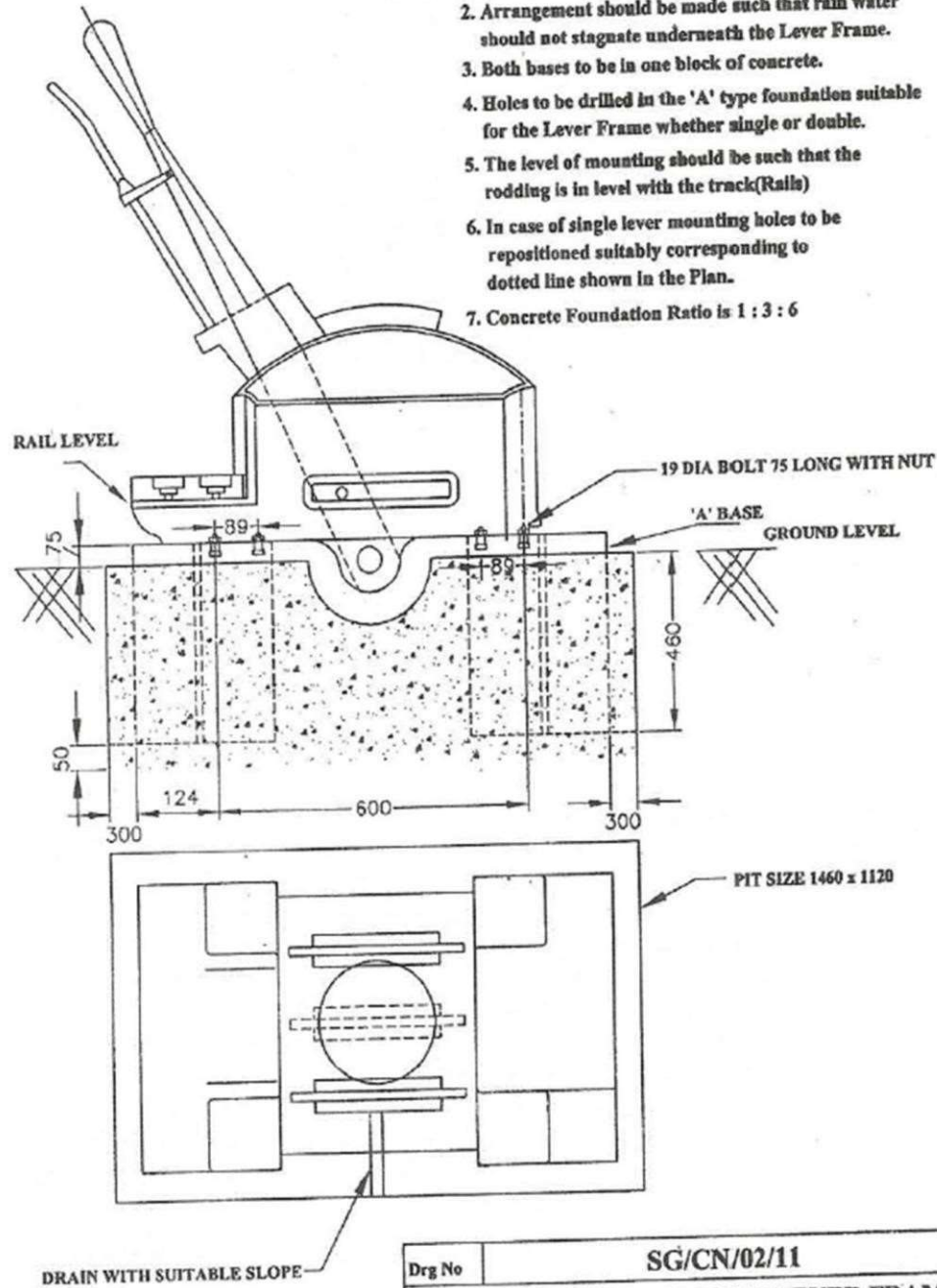


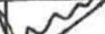

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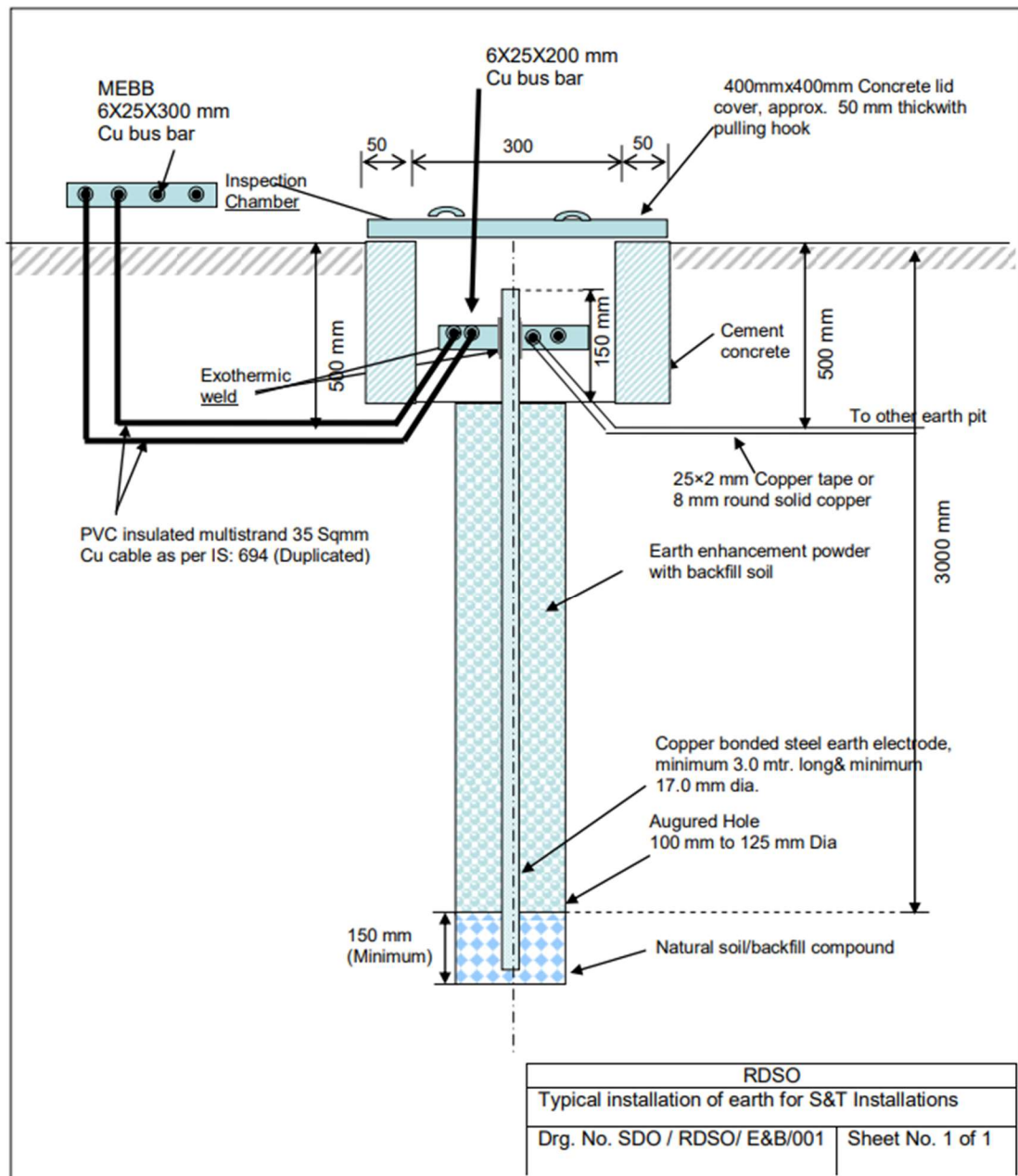
1. All dimensions are in mm.
2. Two Nos. of G.I pipe of 32 mm dia and 300 mm long to be inserted for Cable troughing during casting foundation at bottom side.
3. M 20 bolts and nuts to be used.
4. Holes to be drilled on Rails to suit CTB at site.
5. Overall length of rail shall be 1.2 Metres length.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

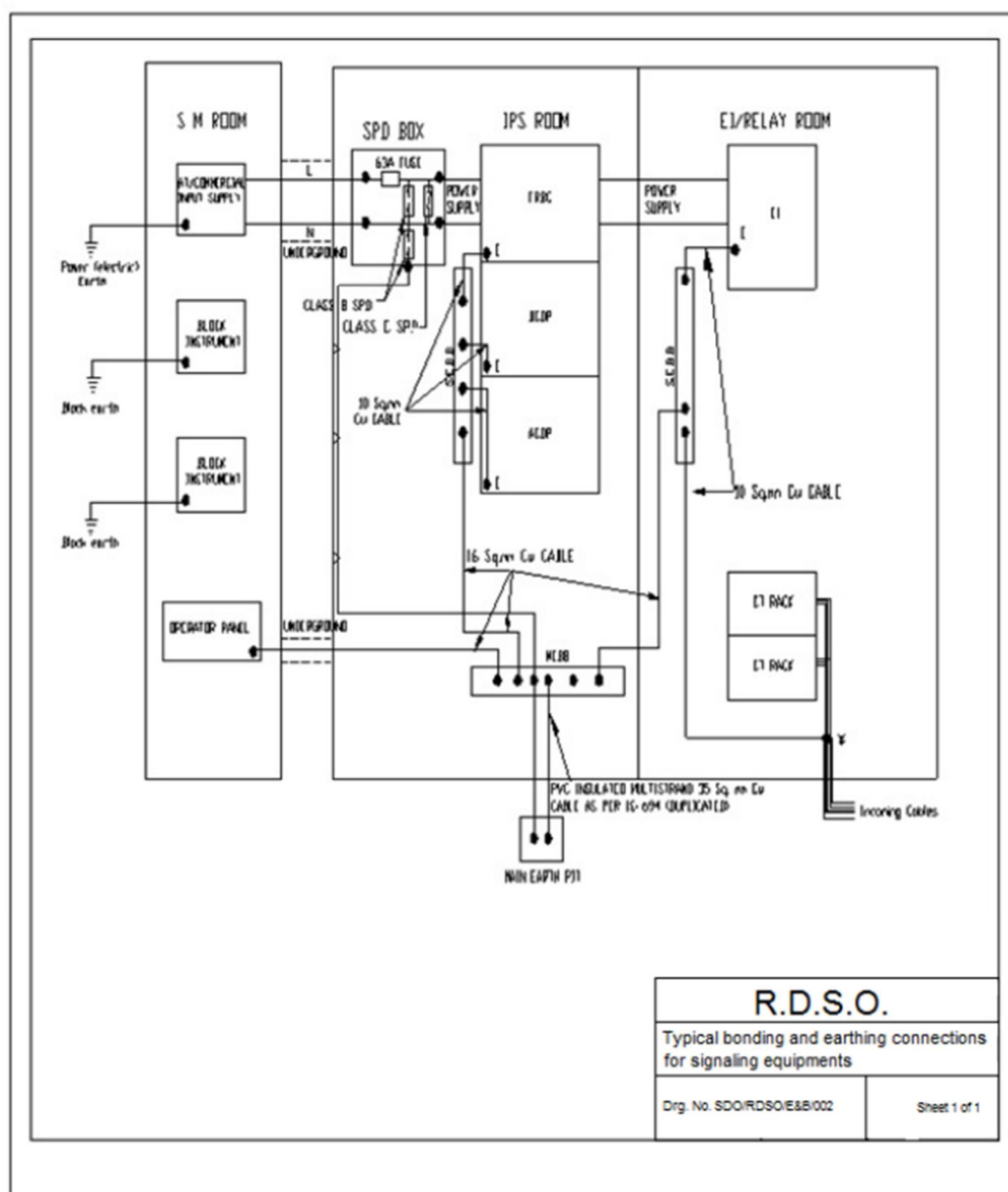
Org No	SG/CN/02/8		
FOUNDATION FOR CABLE TERMINATION BOX			
Reference	SG-100B	Checked	ASTE/CN
Scale	NOT TO SCALE	Approved	1 GSTE/CN

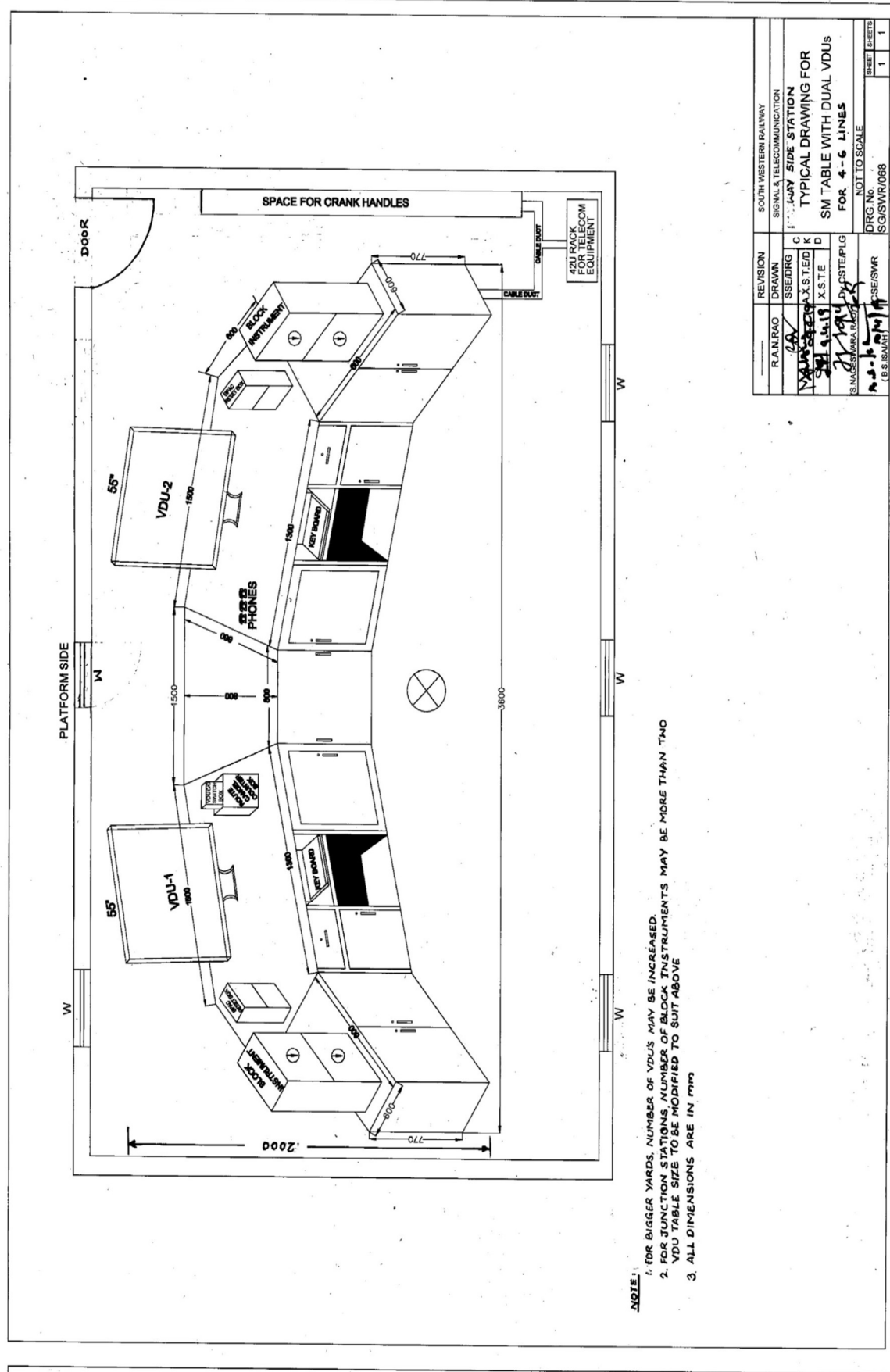
- NOTE:-
1. All dimensions in MM.
 2. Arrangement should be made such that rain water should not stagnate underneath the Lever Frame.
 3. Both bases to be in one block of concrete.
 4. Holes to be drilled in the 'A' type foundation suitable for the Lever Frame whether single or double.
 5. The level of mounting should be such that the rodding is in level with the track(Rails)
 6. In case of single lever mounting holes to be repositioned suitably corresponding to dotted line shown in the Plan.
 7. Concrete Foundation Ratio is 1 : 3 : 6



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

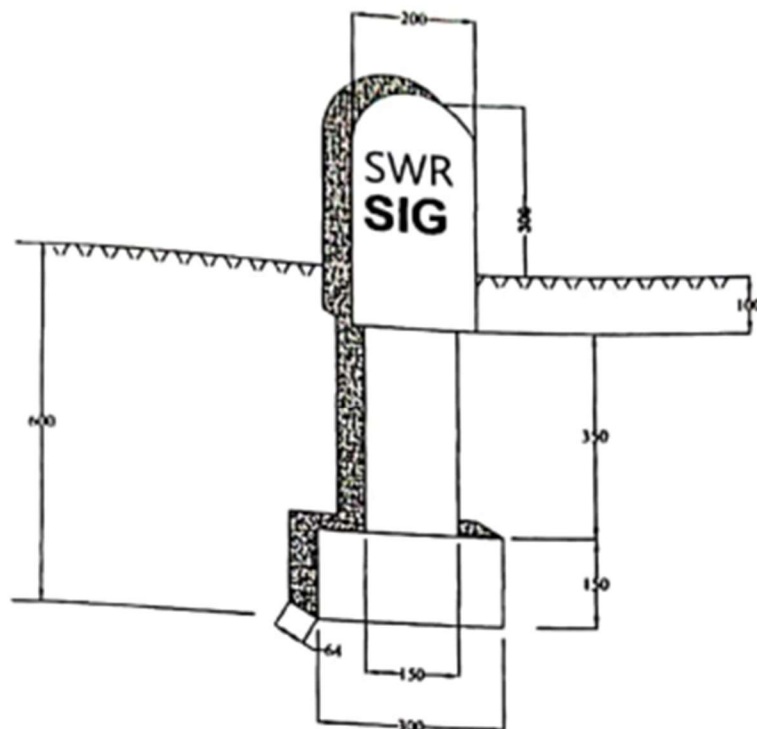






REVISION	RAJ.RAO	SS/DRG	C	SOUTH WESTERN RAILWAY
DRAWN	SS/DRG	SS/DRG	C	SIGNAL & TELECOMMUNICATION
DESIGNED	SS/DRG	SS/DRG	C	1. WAY SIDE STATION
CHECKED	SS/DRG	SS/DRG	C	TYPICAL DRAWING FOR
APPROVED	SS/DRG	SS/DRG	C	SM TABLE WITH DUAL VDUS
DATE	21.04.19	21.04.19	21.04.19	FOR 4-6 LINES
BY	SS/DRG	SS/DRG	SS/DRG	NOT TO SCALE
FOR	SS/DRG	SS/DRG	SS/DRG	ORG. NO.
SS/DRG	SS/DRG	SS/DRG	SS/DRG	SG/SWR/068
SS/DRG	SS/DRG	SS/DRG	SS/DRG	SHEET
SS/DRG	SS/DRG	SS/DRG	SS/DRG	1
SS/DRG	SS/DRG	SS/DRG	SS/DRG	1

TECHNICAL GUIDELINES FOR S&T CONTRACTUAL WORKS (MAY-2019)



NOTE:-

1. ALL DIMENTIONS ARE IN MILLIMETER
2. PAINTED WHITE LETTERS ON RED BACKGROUND.
3. FOUNDATION CONCRETE OF 300 mm FROM THE BASE OF THE MARKER SHALL BE DONE AT SITE AT ALL PLACES WITH MIX 1:3:5.
4. COMPONENT CONCRETE SHALL BE OF M25 MIX AND WIRE MESH OF 1.5MM THICKNESS SHALL BE USED.
5. THE ENGRAVING OF "RLY" & "SIG" SHALL BE DONE ON BOTH SIDES OF THE MARKER.

CHECKED BY	JE/SE/SSE	CONCRETE CABLE MARKER	SDO/CABLE LAYING/020
APPROVED BY	ADE	R.D.S.O.	DATE :- 31-10-2011
NOT TO SCALE			

