

**PART - (A)**  
**TECHNICAL SPECIFICATIONS (GENERAL)**

**1. GENERAL:**

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 signalling 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.

The work shall be carried out according to the drawings approved by the Railways and shall conform to the provision of Signal Engineering Manual and schedule of dimensions. The contractor shall be solely responsible for the proper execution of the work as per specification. 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 are as follows. In case of any conflict with the description in Schedule of Work and these guidelines, the details in the Schedule of work shall prevail.

**2. CABLE LAYING:**

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, Telecomm and OFC in the station section and block section.

1. cables are laid as per the approved plan/GAD in pre-fabricated/precast ducts close to the track on both sides at suitable location. however, in block section, the duct shall be laid beyond embankment unless unavoidable.

2 The path of duct shall be kept parallel to the track alignment and any zig-zag path shall be avoided.

3. Following may be normally ensured while laying cables

a) Cables may be tied together at every 50m or so by suitable tie or GPS tape after laying and before closing of cable duct.

b) 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.

c) Partial sand filling of duct after cable laying may be considered to deter theft.

d) RFID Marker or GPS tapes shall be provided along with the cables in duct at regular interval as per requirement and at every diversion to ensure identification of the cable route.

e) GIS mapping of entire duct shall be made available to all concerned.

f) Cable route markers shall cast with foundation as per IRSEM drawings. where ever provided above the ground, shall be concreted.

g) Cable at the track crossing and road crossing shall be laid in HDPE pipe or concrete duct of specified/approved cross section and strength.

h) In station section, location box shall normally be kept on or adjacent to the duct route.

i) For extending cables for derivation at location box, signals, LC gates, SP, SSP etc. HDPE Pipe of specified diameter shall be used.

j) HDPE pipe may also be laid in duct to blow OFC in future, where ever considered necessary.

k) All entry points of cable in building must be secured through suitable measures.

4. Digital Integrated Signalling and Telecom cable route shall be prepared and made available online by Zonal Railways over Railnet.

5. 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.

i) Executing agency for works shall survey the route along with open line using cable route tracer (scanner/metal detector) to identify the existing old functional cables en-route in the section.

ii) 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.

6) Video recording of cable trench using minimum 720P and above HD camera and submit one copy in New removable hard disks (With capacity as per requirement); Two copies in DVD-R.

**7) Guidelines for protection of cables while doing work its vicinity:**

1. Cable route marking for all types of cable must be made available block section wise on Railnet.

2. Before allowing the contractor to work near the tracks, the work executing agency (like SrDSTE/SrDEN/SrDEE or DyCSTE/DyCEE/DyCE etc.) shall ensure that the permission has been granted by the division to the contractor in accordance with the local instructions / JPO to work in the vicinity of the cables. Zonal railways shall devise suitable mechanism and timelines for the obtaining/granting such permission.

3. In case of works being taken up by the State Government, National Highway Authority etc., zonal railways shall devise mechanism for shifting the cables or for proper protection of cables before granting permission to work.

4. The engineering control shall keep all the information regarding any works being done near the track. S&T and electrical control shall obtain this information from engineering control. These controls shall coordinate among themselves to ensure that no work is done in the vicinity of the track without proper permission.

5. The concerned SE/P.Way/SE/Works/SE/Sig/SE/Tele SE/Electrical (TRD or G) or RailTel supervisors supervising the work of the contractor shall ensure that the existing emergency sockets are not damaged due to their importance in providing communication during accident/emergency.

6. For all new works, cable shifting should be a mandatory part of DPR and estimate. For ongoing works, Zonal Railways may sanction works for cable shifting, if necessary, through contingency/supplementary/revised estimate where provision does not exist. However, in case zonal railways decide not to shift cables (due to any reason) then protection of cable shall be ensured by the zonal railways during execution of the work.

7. Penalty to be imposed for damages to cable shall be as under:

<b>Cable damaged</b>	<b>Penalty per location</b>
Only Quad cable or Signaling cable	Rs 1.0 Lakh
Only OFC	Rs 1.25 Lakh
Both OFC & Quad	Rs 1.5 Lakh
Electrical Cable	Rs 1.0 Lakh

8. Penalty should be levied on the contractor when they work without permission or resort to careless working without making arrangements for protecting cables and other utilities. Based upon the local conditions and practices, zonal railway shall devise its own conditions for examining and levying penalty. For each cable cut, a joint report at the level of supervisors should be prepared on the same day and it should become the basis for levying penalty and fixing responsibility. Joint note should be forwarded by SrDSTE/SrDEE to the executive in-charge of the work. The executive in-charge of the work should act and decide on the cable cut case within 15 days under information to SrDSTE/SrDEE as the case may be. There should be provision of appeal by contractors within one month of notice for levying penalty at ADRM level. Decision of ADRM shall be final and binding upon both parties.

9. Railways will not lodge FIR with RPF in cases of works being executed by authorized contractors of Railways who have been duly permitted to execute the works.

10. Zonal Railways issued JPO for protection of cables, while execution the latest JPO shall be strictly followed.

#### **FOUNDATION & ERECTION OF APPARATUS CASES:**

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

- (i). Drg. No. SG/CN/08/25 (Apparatus case full size)
- (ii). Drg. No. SG/CN/02/7 (Apparatus case Half/ Quarter size)

The location of apparatus case will be indicated by Railways.

- 3.2 Two 'E' types locks on the doors of full-size apparatus case and one 'E' type lock on the front door for half size apparatus cases shall be firmly fixed and tested with 'E' type key. Locking and unlocking shall be smooth with least force. Suitable fixing arrangements for 'E' type lock on the door of apparatus case shall be fabricated by the contractor, if such arrangements do not exist. One hard wood shelf plank 37mm thick, planed and varnished shall be firmly fixed for all types apparatus cases/ battery boxes. Also latching arrangement for the back door shall be provided, if required.
- 3.3 All the apparatus cases (Full/Half/Quarter) are to be painted with Aluminum paint on the outsides surface and the location numbers are to be painted in 'Bold' letters. Inside of location box shall be painted with white/Aluminum enamel paint.

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

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

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

The work consists of excavation of pit around the existing apparatus cases full/ half size and CT boxes, shifting of the location box along with foundation clear of infringement from the track. The pit shall be excavated with maximum care to avoid any possibility of damage to the existing cables. The location box shall then be shifted carefully along with the foundation and cable termination, 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.

**3.6 CABLE TERMINATION IN APPARATUS CASES/CTB's:**

- 3.6.1 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.
- 3.6.2 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.
- 3.6.3 Railway will indicate approximate total number of cable core, terminations to be made in the apparatus cases/cable termination boxes. The contractor shall fix Phynolic synthetic industrial 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 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.
- 3.6.4 As per site conditions, the termination of new cables may be required on the existing terminal blocks or by fixing new terminal/fuse blocks in old apparatus cases which shall be done as per approved circuit diagram wherever required. The terminal particulars are to be re-painted or corrected on the doors of apparatus cases as instructed by Railways. Suitable clamping arrangements have to be made for the new cables and also the bottom the opening of the apparatus cases shall be closed with masonry brick work and sealed with cable compound.
- 3.6.5 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 sealing compound.
- 3.6.6 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.

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

- 3.7.1 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. The MS relay frame shall be painted before fixing. Hylum 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.
- 3.7.2 The description of all relays, fixed in each apparatus case shall be painted inside apparatus case doors. PVC/ Nylon sleeves shall be provided on each wire before termination on terminal block. The name of the circuit and wire where connected shall also be painted on the sleeves.
- 3.7.3 Wire should be soldered to relay clips and suitable copper eyelets crimped with crimping tools shall be adopted before the termination. The wiring and termination shall be carried out as per the approved circuit diagram. The relays details shall be painted. PVC/Nylon sleeves shall be provided for each wire before termination and the details of circuit and where the wires connected etc., shall be painted on the sleeves. The complete wiring shall be tested.
- 3.8 **ALTERATIONS TO PAINTING PARTICULARS AT LOCATION BOXES:**  
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.
- 3.9 **FILLING OF EARTH AROUND LOCATIONS:**  
The work consists of filling of earth around the foundations of signals and apparatus cases for a width of 0.5m on all sides from 150mm below the foundation top to ground level. The earth shall be consolidated after filling.
3. **MAIN SIGNALS:**
- 4.1 **CASTING OF COLOUR LIGHT SIGNAL FOUNDATION:**
- 4.1.1 The work includes excavation of pit and casting of color light signal foundations with M.S foundation bolts as per Drg. No. SG/CN/02/9. The position of signals will be indicated by Railways.
- 4.1.2 The Signal 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 signal foundation and sufficient earth work shall be made up to the required level in the normal terrain and the cable entries shall be closed as per the instructions of Railway Representative at Site.
- 4.2 **ERECTION AND WIRING OF SIGNALS:**
- 4.2.1 Signal pole shall be securely fixed to surface base and erected on signal foundation and plumbed. The gap between the signal pole and surface base shall be filled with suitable putty to avoid tilting. Soon after installation, the pole shall be painted with two coats of Aluminum paint/ Yellow & Black strips of Enamel paint for second distant signal after a coat of primer. Signal unit shall be provided with two coats of black enamel paint.
- 4.2.2 Multi-unit color light signals up to 4 aspects shall be properly mounted on the top of signal pole where there is no route indicator. If required, LED type signal aspect shall be fixed for signals. If there is route indicator a large off set bracket shall be fixed firmly with 2 nos. of 'U' bolts 3/4" thick on the

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

- 4.2.3 Signal ladders with platform complete fittings, cast iron shoe and adequate number of support to suit signal pole 3.6/4.6m, shall be firmly fixed clear of infringement with suitable bolts and nuts and painted in black. The ladder shoes shall be concreted. This work also includes fixing of marker boards, 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.
- 4.2.4 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 signal pole for taking signal tail cable. Suitable protection shall be provided on the slotted hole to avoid damage to insulation of cable.
- 4.2.5 This work includes fixing of LED Unit along with Current Regulator. Wiring to be done according to approved circuit diagram. The unwanted aspects shall be blanked using MS sheets of 3mm thick.
- 4.2.6 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.

#### 4.3 **BLANKING ARRANGEMENTS FOR SIGNALS:**

In case of signals with a horizontal clearance between 2.21m and 2.36m (in B.G) from the nearest track centre, blanking arrangement shall be provided. If a Ladder of signal erected at a distance with in 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.

- 4.4 All signals shall be properly earthed in RE/ Non-RE area.
- 4.5 Necessary wooden cross shall be fixed on the newly erected signals before being brought into use.

#### 4.6 **ROUTE INDICATORS:**

- 4.6.1 All types of Route Indicators shall be mounted on the top of signal pole firmly. The tail cables for route indicators shall be taken through signal pole 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.

##### 4.6.2 **Universal AC/DC LED Numeric Route indicator**

- 4.6.2.1 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.
- 4.6.2.2 The unit should mount at the top of signal post safely and securely. Necessary fixing arrangements shall be supplied by Contractor.
- 4.6.2.3 The circuit should be so designed that it draws the required current to ensure the pickup of ECR whenever the digit is lit.
- 4.6.2.4 RDSO approved Route LED's should be used for left and right arms. It should work on 110V +/- 20% AC.
- 4.6.2.5 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 entire operating range Components used in numeric route indicator unit should be industrial grade.

**4.7 CALLING - ON SIGNALS/'A' MARKER LIGHTS:**

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

**4.8 REPLACING THE TAIL CABLES IN SIGNALS:**

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

**4.9 SHIFTING OF SIGNALS:**

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

**4.10 REPLACEMENT OF SIGNAL UNITS:**

The existing CLS units shall be removed from the signal post duly disconnecting the cables and new signal units (required as per signalling plan) shall be mounted on the existing signal pole. The tail cable is to be terminated and the signal aspect shall be wired by providing LED unit with Current regulator. If there are any blank aspect, the same shall be covered with round MS plate.

**4.11 SCREENING ARRANGEMENTS:**

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.

**4. SHUNT SIGNALS:**

**5.1 POSITION LIGHT GROUND TYPE SHUNT SIGNAL:**

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

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

5.1.3 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.

5.1.4 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.

5.1.5 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:**

Small off-set bracket shall be firmly fixed with 'U' bolts of suitable size on signal pole for mounting

Post type shunt signals. One 22mm through hole shall be drilled on signal pole just below the off-set bracket and a 20mm through bolt shall be provided to prevent offset bracket from sliding down. A vertical slotted hole of 50x50mm in size shall be made on signal pole for taking the signal tail cable. Suitable protection shall be provided on the slotted hole to avoid damage to insulation of cable. The cables are to be taken through the unit, skinned and terminated. The post type/Ground type shunt signals shall be wired 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.

**5. TRACK CIRCUITS:**

**6.1 INSTALLATION:**

- 6.1.1 The work includes drilling of holes, bonding of rail joints with 8 SWG GI soft solid wire. 7.2mm holes are to be drilled close to Fish Plates on the web of rail and the bond wires are to be fixed by driving channel bond pin tightly. Two bond wires are to be provided for each joint in parallel. One bond wire clip is to be provided for each joint to keep the bond wire intact. In point track circuit, parallel jumpers/ bond wires/cables shall be provided as required by the Railways with proper supporting arrangements.
- 6.1.2 Four TLD boxes, two each at track feed end relay end shall be fixed clear of infringement and the respective track circuit tail cables 2 x 2.5 sq.mm PVC copper conductor from the apparatus case shall be terminated in these boxes. In Point zones, additional TLD boxes shall be provided for series jumpers as per the bonding plan and instruction of Railway representative at site. The connection from the TLD boxes to the rail should be through 8 SWG GI soft solid wire which should be taken through PVC sleeve or signalling cable if required and fixed to the rail both at feed and relay ends. The GI Wire should be clipped on to the sleepers to prevent shorting with rails.
- 6.1.3 Wherever Glued joints are not provided, Rail Joint insulation RDSO type shall be provided with long bolts and nuts at places marked by Railways. In case of point zone track circuit, necessary insulation shall be provided for switch extension pieces/'D' brackets, throw bar lugs, gauge tie plates, crossing plates, stretcher bars, etc., as per site conditions and fixed by the contractor in the presence of Railway representative. Only non-insulated gauge tie plate/crossing plate/stretcher bar for the above work, will be supplied by Railways and insulating material shall be provided by contractor. Contractor shall use proper MS washers, bolts and nuts for insulating them. All the insulation shall be tested jointly. Wherever the Roding crosses track circuit zone, it shall be provided with rod joint insulation and tested.
- 6.1.4 Polarity bonding in each point track circuits shall be provided using 8 SWG soft wire, insulated and clipped on to sleeper. Parallel bonding shall be done wherever required. In RE area transverse bonding should be provided at both feed and relay ends by connecting 2GI 8SWG wire across the block joint as per the bonding plan.
- 6.1.5 Track circuit work includes fixing of track feed and track relay equipment in the apparatus cases as indicated by the Railway. The shelf type track relay shall be provided with suitable anti-tilting arrangement. Track relay details shall be painted on the inner side of the apparatus case door. Suitable flexible copper wire shall be used for wiring the track relay, track feed equipment, batteries, chokes, etc. and finally terminated at the terminal block. For each track circuit, secondary cell 80 AH shall be charged and installed in the apparatus case. The no. of cells and chokes to be used for each track circuit will be as instructed by the Engineer in charge.
- 6.1.6 The secondary cells shall be charged by the contractor through reputed agencies. The charging of secondary cells shall be done as indicated in following paras below.
- 6.1.7 All the TLD boxes shall be painted and Track Circuit numbers along with feed end or relay end particulars shall be neatly painted as required by Railways.



**6.2 ALTERATIONS TO TRACK CIRCUIT:**

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

**6. POINT MACHINES:**

**7.1 INSTALLATION OF POINT MACHINES**

- 7.1.1 Electrically operated point machines shall be fitted in level to all facing points as per standard drawing on long sleepers on extended gauge-tie plate, clear of infringement.
- 7.1.2 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.
- 7.1.3 The point machines shall be fixed with proper size of bolts and nuts and flat/spring washers with correct size of holes on special sleepers to avoid lateral play.
- 7.1.4 All point connecting rods shall be connected to point machines as per standard layout/drawings without any strain and with minimum offset. All connecting rods shall be in level and correct size of pins shall be used to avoid longitudinal play. Any changes in the connecting 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 roddings shall be supported suitably.
- 7.1.5 Suitable eyelet shall be used for termination of power cables using Crimping tool. The jumper wires from the point machines to the CT boxes shall be taken through flexible conduit PVC pipes and securely fixed with suitable clips. The wiring inside the point machine for motor and detector circuit shall be tested for insulation and earth and the connections tightened. 7/1.4mm 3/0.75mm PVC copper wire shall be used for wiring point machines. PVC/Nylon sleeves shall be used for identification of cable cores/jumper wires and marked with paint. Necessary grooves/wards shall be cut on the point machine at the place of insertion of crank handle, for crank handle interlocking purpose.

**7.2 ADJUSTMENT AND TESTING OF POINT MACHINES:**

- 7.2.1 The point machines shall be worked by hand crank and the housing of switch rail with the stock rail shall be checked. All the electrical wiring shall be carried out neatly.
- 7.2.2 The point machines shall be worked both ways with proper feed. It should work without undue friction and working current shall be recorded.
- 7.2.3 The point stretcher bar and lock connections should be adjusted in such a way that with a 5mm thick obstruction piece placed between the switch and stock rail at 150mm from the toe of switch,
  - (a) The point does not get locked.
  - (b) The point detection circuit is not completed
  - (c) The friction clutch disengages.
  - (d) The tripping current does not exceed 200% of normal working current.
- 7.2.4 The point machine shall be provided with EWS locks/pipe locks.
- 7.2.5 Necessary notches shall be cut on the pinion of point machine to suit crank handle configuration in the case of 5E only.

**7. CABLE TERMINATION RACK:**

- 8.1 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.
- 8.2 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.

**8.3 TERMINATION OF CABLES:**

- 8.3.1 The PBT terminal and fuse blocks shall be fixed firmly on the cable termination racks and serially numbered with paint for easy identification. Tags shall be provided for each terminals 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.
- 8.3.2 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 10mm 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.

**9 RELAY ROOM:**

**9.1 ERECTION OF RELAY RACK:**

- 9.1.1 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.
- 9.1.2 Relay rack, (to accommodate '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 wall and the other end fixed to the relay rack as tie.
- 9.1.3 The relay rack shall be painted including Relay nomenclature as per relay disposition chart soon after the installation and before plugging of relays.

**9.2 WIRING OF RELAYS(NEW/ ADDITIONAL/ ALTERATION):**

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

- 9.2.3 The wiring shall be carried out as per approved circuit diagram. The wiring shall be done on connectors and terminated on terminal clips by soldering process neatly, using high grade solder 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 Railway Representative. Any addition/alteration to wiring in the course of testing shall be carried out free of cost by the contractor. Different colours of wire shall be used for identify the power supply circuit wiring. In case of alteration, a different colour of wire from the existing one shall be used for easy identification.
- 9.2.4 Before plugging, the relays shall be checked visually and defective ones noticed shall be replaced duly reporting the same to the railways.
- 9.2.5 The printed Relay Index and pasted on Perpex sheet of thickness 10mm 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.
- 9.2.6 The new relay room shall be provided with Double Key Door Lock arrangement.
- 9.2.7 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.
- 9.3 **FUSE BLOWN OUT INDICATION:** (Applicable for Relay Interlocking)
- 9.3.1 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 switch shall be provided for each circuits. This arrangement shall be made near FTOT inside the relay room.
- 10 INTERCONNECTIONS:** (Applicable for Relay Interlocking)  
Interconnection arrangements between the cable termination rack, relay rack, control panel, power and battery room shall be carried out as follows:-
- 10.1 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-armoured, unsheathed 1100v grade cable.
- 10.2 Relay rack to relay rack wiring shall be done with 16/0.2mm PVC copper conductor by soldering process.
- 10.3 The inter-connection between the relay rack and power room, power room and FTOT, Block Instruments and FTOT shall be carried out with underground, armoured, sheathed, power/ signalling cables of adequate length. The termination shall be carried out using suitable size of copper eyelets/sockets. Inter-connection between power rack and battery room, shall be carried out by using suitable underground cables.
- 10.4 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.

- 10.5 The inter connection arrangement includes laying of signalling cables in ducts, wherever necessary as indicated by Railways. Wherever cables are taken through cable ducts inside relay room/ battery room etc., the ducts shall be filled with River/ M-Sand sand up to the floor level and covered with RCC slabs covered with suitable tiles.
- 10.6 All connections/ terminations shall be tested by the contractor and after satisfying himself jointly with Railway Representative. Any alterations required shall be carried out by the contractor free of cost.
- 10.7 Cable details, functions allotted to each core and terminal numbers shall be prepared in standard size tracing film and handed over to Railways.

## **11 POWER SUPPLY ARRANGEMENT:**

### **11.1 INSTALLATION IN POWER ROOM:**

Transformers, battery chargers, transformer rectifiers, voltage stabilizers, inverter, etc., as detailed in the schedule shall be installed and wired as per approved power diagram in power room.

- 11.2 The contractor shall manufacture a power supply panel using 1200x1200mm Hylum sheet not less than 10mm thick for mounting meters, switches/fuses, etc. as required by Railways. It shall be installed on a frame made of MS angles of size 25x25x6mm, MS flat of size 50x6mm and grouted to the wall after leaving sufficient space from the wall for testing and replacement. The cable shall be fixed on TW base plank of size 25x150mm using TW cable clamps of size 50x50mm and terminated on PBT Terminal blocks.
- 11.3 The power supply arrangements wiring shall be carried out using 7/1.4 mm PVC Copper wire as per the approved circuit diagram.
- 11.4 Ammeter and Stabilizer by-pass arrangements shall be provided on the panel to prevent ammeter being always in the circuit. After wiring, the power rack shall be tested jointly. The power rack shall be energised to its rated capacity and kept in that condition for not less than a week before commencement and any defect notice shall be rectified by the contractor. The Guarantee Certificates and Technical Pamphlets for the power supply equipments shall be handed over to Railways. Any addition/alteration to power supply arrangement shall be carried out during Testing and Commissioning.
- 11.5 The power rack and power supply equipments shall be painted suitably and uniformly before installation as required by Railways. Schematic diagram of power supply arrangement and distribution details shall be printed and pasted on 10mm thick perspex sheet as per instructions of site in-charge and fixed in the power room. As made power diagram shall be submitted in tracing film duly indicating the power supply details and position of the equipments.
- 11.6 The power panel and power rack should be suitably earthed.

### **11.7 INTEGRATED POWER SUPPLY ARRANGEMENT**

This work involves erection of Integrated Power Supply (IPS) units conforming to RDSO Specification No. RDSO/SPN/ 165/2023 (Ver. 4.0) with latest amendment as required by Railways and wired.

### **11.8 PROVISION OF POWER EQUIPMENTS AT LOCATIONS:**

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

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

**12 INSTALLATION OF SECONDARY CELLS AT BATTERY ROOM/ LOCATION:**

- 12.1 This work includes initial charging and installation of the track circuit or any other purpose cells as specified in the schedule. Secondary cells shall be initially charged by reputed firms only and shall undergo not less than 3 cycles of charges and discharges as detailed by Railway representative.
- 12.2 IPS batteries shall be charged as per the conditions of the agreement.
- 12.3 Battery links (copper/lead) with copper lugs crimped and suitable bolts and nuts shall be used for connecting cells. The charged Cells shall be fixed leaving sufficient working space for taking specific gravity reading and distilled water topping. Cells are to be connected with suitable copper lead links sufficient to carry the full load. Immediately after connection, petroleum jelly shall be applied on battery terminals.
- 12.4 In the Battery room/ Cable Hut wiring of the batteries shall be carried out using PVC 7/1.40mm copper wire with colour codes through PVC Pipes properly clamped and terminated on the Hylum sheet in the battery room.
- 12.5 The details of batteries like capacity, circuit, date of installation, etc., shall be Computer printed and displayed on a Perplex sheet of 10mm thickness and mounted on the wall with suitable screws.
- 12.6 The specific gravity and voltage reading shall be recorded for each cell in a separate register along with the Guarantee Certificate of the supplier and handed over to the Railway duly signed.
- 12.7 One Hydro Meter on suitable Stand shall be kept in the battery room.
- 12.8 In case of installation of secondary cells at location boxes, anticorrosive black paint to be coated inside the apparatus case. Additional ventilation arrangements shall be made. The date of installation, capacity serial No. and circuit particulars shall be painted on each cell and inner side of the door.
- 12.9 All connections/ termination shall be tested by the contractor and after satisfying himself then to be tested jointly with Railway Representative. Any alterations required shall be carried out by the contractor during testing and commissioning of installation.

**13 BLOCK INSTRUMENTS:**

- 13.1 Double line block instrument UFSBI as per RDSO spec No IRS:S-105/2012 or latest is to be installed as per the instruction of Railway engineer.
- 13.2 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 block panel and terminated. The cables required for interconnection between UFSBI system and Block operation/control panel should be provided as part of the installation.
- 13.3 The UFSBI system to be installed on teak wood frame/Tripod base as indicated by Railways.
- 13.4 The required surge protection device for power supply line/ communication line etc. should be provided.
- 13.5 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 Railway representative at site.
- 13.6 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.

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

**14 INSTALLATION OF WAY STATION EQUIPMENTS:**

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

**15 INSTALLATION OF DISTILLED WATER/ DEIONISOR PLANT:**

- 15.1 The work involves Supply and installation of De-ionizer plant, which shall be installed at Distilled Water Plant Room on suitable stand.
- 15.2 For water supply, a fiber tank similar to 'SINTEX' make – 200 liters capacity shall be installed on cut rails, grouted to wall at suitable place indicated by Railway Representative.
- 15.3 The water supply connection from water tap towards fiber tank and Distilled Water tank shall be made using good quality of GI pipes, bends, taps and valves of 25mm dia wherever required.
- 15.4 The water pipe lines shall be clamped at required places using proper size of clamps. One separate power socket with fuse indication shall be provided and wired for distilled water plant.
- 15.5 The Distilled water plant shall be tested for its satisfactory working jointly with Railways.

**16 INTERLOCKING OF LEVEL CROSSING GATES WITH LIFTING BARRIERS:**

- 16.1 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.
- 16.2 Making rod connection from the Ground lever frame to the boom locking mechanism through cranks, adjusting and testing the boom locking from ground lever frame. The rod run shall be at rail level and gap of not less than 40mm shall be maintained while crossing the track. All the joints of rod connecting cranks and levers shall be smithy welded. The rod run between the track shall be insulated while crossing the track circuited portion. The Lengthy roddings shall be run on roller stands fixed on trestle located not more than 2.2 Meters between adjacent supports.
- 16.3 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.
- 16.4 The lifting Barrier will be painted with two coats of enamel paint of approved quality as given below:  
(A) Stands: Black  
(B) Boom with fringes: Black and Yellow- Retro-Reflective stripe 300 mm wide alternatively  
(C) Stop Disc on the boom: Red- Retro-Reflective
- 16.5 Florescent paper strips should be pasted on both the lifting barrier boom.
- 16.6 For EOLB installation **Casting concrete foundation** of size 900mmX 900mmX900mm for **pedestal**, 400mmX400mmX 600mm for **meeting post**, fixing of lifting barrier boom, contact makers, termination of cables, wiring and painting as per the instructions of Railway representative at site shall be carried out.

Installation, wiring, testing and commissioning of **electrical/mechanical lifting barrier shall** be done as per approved circuits.

**16.7 INSTALLATION OF ELECTRONIC GATE WARNING EQUIPMENT:**

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

- 16.8 In RE area wire rope and Roding shall be insulated with proper insulating material and all metallic parts shall be connected to earth. Insulation required for wire rope and Roding insulation shall be supplied by the contractor.

**17 INSTALLATION OF STAND BY DIESEL GENERATOR SET:**

- 17.1 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.
- 17.2 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 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.
- 17.3 The Auto Change-Over CLS Control Panel as per the Item Description in the tender schedule need to supplied and installed as instructed by Railway representative at site in Panel Room.
- 17.4 The Standby generating plant and control panel shall be earthed.
- 17.5 Secondary cell of required capacity shall be installed and connected for self- starting facility.
- 17.6 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 expired warranty period, the defect rectification shall be arranged by the contractor.

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

- 18.1 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.

**18.2 INSTALLATION OF EMERGENCY KEY PROVING CONTACT:**

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.

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.

**NOTE:** In case of Crank Handle Interlocking using Key-Lock Checking Relays, Provision for KLCR/Crank Handle Box, Termination of Cables on Wago Terminals and Installation to be carried out as per the Item Description in the Tender Schedule and Drawing enclosed here.

**19 INTERLOCKING OF SIDING POINTS/ TRAP POINTS:**

- 19.1 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.

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

## **20 FIXING OF ELECTRICAL DETECTOR:**

- 20.1 The electrical detector shall be fixed on the extended gauge tie plate firmly. The switch extension piece shall be fixed on the switches and the point is to be connected with electrical detector by using ground connections. If any smithy work is involved, the same shall be carried out on the ground connection rods.
- 20.2 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.
- 20.3 The electrical detector shall be painted with Aluminum paint and the point ground connections, CT box with black paint. The working of electrical detector shall be tested in presence of Railway representative to conform to obstruction test.

## **21 TELEPHONES:**

### **21.1 DESK TYPE PHONES AT STATION HOUSE/APPARATUS CASES/LCs:**

Desk Type magneto telephone shall be supplied and fixed at station house/ apparatus case/ LCs/ apparatus cases near top points/siding points and securely fixed on shelf planks. It shall be ensured that no other gadgets is kept in that apparatus case and separate door lock arrangement made to protect the Telephone battery.

Nickel-Cadmium power pack 4V - 2.2AH, with battery charger 110V AC/4V DC shall be supplied and provided for telephone.

### **21.2 INSTALLATION OF ANNUNCIATOR**

Fixing of Annunciator in the Station Master room on a suitable HW stand fixed to the table/ wall by MS angles, wiring the same using wire PVC 16/0.2mm copper and painting. The hard wood plank shall be pasted with coloured Decolum sheets on all sides. The work also includes supply and wiring of magneto telephone - 1 No. and Ni-cad power pack 4V DC – 2.2AH with battery charger 110V AC/4V DC and painting of various circuit particulars on the Annunciator as instructed by Railway representative.

## **22 PROVISION OF TEAK WOOD KEY BOX & TOOL BOX:**

- 22.1 This work involves manufacture, supply and installation of Glass fronted Teakwood Key box of size 300mmx600mmx75mm with built in lock arrangement. Plastic tags duly engraved giving the particulars of various keys are to be provided along with the keys.
- 22.2 A teak wood tool box of size 1000mm x750mm x100mm (inner dimensions) made of 25mm thick teak wood, perplex sheet fronted 6mm (Color-less) shall be manufactured and fixed on the wall at a convenient location as instructed by Railway representative at site. The box should have provision of padlock for locking arrangements.

## **23 ERECTION OF BOARDS WITH LEGENDS/ GOODS WARNING BOARDS:**



- 23.1 Retro reflective Boards with Calling on Legends/ Goods Warning boards shall be fitted on to the Rails/L-Angles, erected with suitable foundation at location as indicated by Railway representative and as per approved signaling plan, clear of infringements.
- 23.2 Necessary legends such as "DRAW CLOSE IF SIGNAL IS AT ON" shall be computer printed on retro reflective sheet as per standard practice of this Railways and as per Signal Engineering Manual.
- 23.3 Rail posts and other fittings shall be painted as prescribed in Signal Engineering Manual and as directed by Railways Engineer.

## **24 EARTHING:**

- 24.1 All apparatus cases, battery boxes, 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. 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. The earth resistance shall not be more than 10 Ohms.
- 24.2 **GI PIPE EARTHING SYSTEM** shall be provided as per the drawing of GI Pipe Earthing system available at the office of CSTE/CN/BNC and as directed by Railways Engineer.
- 24.3 **COPPER PLATE EARTHING SYSTEM** shall be provided as per the drawing of Copper Plate Earthing system available at the office of CSTE/CN/BNC and as directed by Railways Engineer.

## **25 PROVISION OF LOCKS:**

Universal locks (EWS Locks)/ GI locks/Navtal Locks shall be provided for CLS units, Route Indicators, point machines, apparatus cases, battery boxes and C.T. boxes, wherever necessary. Two Navtal locks (Godrej make) 75mm with 2 keys shall be provided for Relay Rooms at all stations.

## **26 PAINTING:**

- 26.1 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.
- 26.2 While painting, initially one coat of primer and afterwards 2 coats of enamel/aluminium paint shall be applied.
- 26.3 The details of paints to be used on the signaling gears are shown below.

<b>S. No.</b>	<b>Signalling Gadgets</b>	<b>Colour to be painted (outside)</b>
I	Signal (Colour Light Signal) & Shunt Signal: (i) Surface base (ii) Post (iii) Aspect unit complete	Black Aluminium (except for Distant Signal in Double Distant Territory) Black <b>Note:</b> Post of Distant Signal in Double Distant Territory to be painted in black & yellow stripes at 300 mm interval.
II	All types of apparatus cases and cable termination box	Aluminium

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

## 27 NON-INTERLOCKED SIGNALLING ARRANGEMENT:

- 27.1 Non-Interlocked Signalling 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 Railway representative. No extra payment will be made on this account.
- 27.2 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.
- 27.3 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.

## 28 INSTALLATION OF DATA LOGGER:

The installation and commissioning of Data Logger includes wiring between Data logger equipment and relay rack/ power equipment room. The potential free contacts of DC-DC Converters of EI, TJs, IPS Modules, Block Instruments, Automatic fire alarm and detection system, and ELD to be monitored shall also be wired to the data logger.

## 29 RELEASING OF S & T GEARS:

- 29.1 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.

- 29.2 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.
- 29.3 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.
- 29.4 All the unserviceable released materials shall be guarded by the contractor till they are returned back to stores/ depot as directed by railway representatives.

### **30 TRANSPORTATION OF SERVICEABLE MATERIALS:**

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

### **31 PROCUREMENT OF CEMENT:**

- 31.1 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.
- 31.2 Cement bags packing should bear the following information in legible marking:
- i. Manufacturer's name
  - ii. Registered Trade Mark of manufacturer, if any
  - iii. Type of cement
  - iv. Weight of each bag in kgs. or No. of bags/ton.
  - v. Date of manufacturer, generally marked as week of the year/year of manufacturer, e.g., 30/93 which means of 30th week of 1993.
- 31.3 To ensure quality control, test certificates from the manufacturer should be produced by the contractors, which should confirm to the relevant specifications [latest may be incorporated].
- 31.4 Railways may also take samples during the course of the work and get the cement tested to ascertain their conformity to specifications.
- 31.5 When such sampling is done, it shall be as per IS Specifications.
- 31.6 Test on the cement as per IS:4301 shall be carried out in the field level. Some of the tests which may be carried out are:
- (i) Compressive strength
  - (ii) Initial and final setting time
  - (iii) Consistency
  - (iv) Soundness

### **32 WIRES TO BE USED IN S&T INSTALLATION:**

The size of various wires/ cables to be used for the wiring of signalling and telecommunication gadget is indicated below:

SN	Size of wire	Circuits/ Equipments
1	16/0.2 mm Copper	Relay rack wiring Panel wiring Plug-in type relay wiring at location

2	7/1.4mm Copper	Power equipment's
3	3/0.75mm Copper	Power equipment's in locations Relays other than plug-in type Block instrument Rotary key transmitter All Signals Electrical detector SM's control instrument Point machine Loop wire at locations

### 33 TESTING & COMMISSIONING INCLUDING AS MADE:

33.1 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.

33.2 In order to ensure that equipment's 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, Datalogger are installed, tested and commissioned by RDSO approved manufacturer and a certificate is issued to Railways.

#### 33.3 "AS MADE" DETAILS:

After joint testing of the installation with the railways engineers and incorporating all alterations suggested in the approved plan and design, the contractor shall update all the records, plans and design. Required copies of final 'As Made' details as hereunder shall have to be supplied duly incorporating all particulars for the station before commissioning of the entire installation. All 'As made' shall be prepared by the contractor in AutoCAD 2000 or latest and submitted in compact discs in duplicate. All 'As Made' documents/ plans shall be made by the contractor on Polyester Films to RAILWAY STANDARD only as laid down in the Special Condition of Contract and shall be handed over to the Railways, duly signed.

- i. 'As made' Circuit Diagram
- ii. 'As made' Cable Core Plan
- iii. 'As made' Cable Route Plan
- iv. 'As made' Track Bonding Plans
- v. 'As made' Power Supply Layout Diagram
- vi. 'As made' Contact Analysis Chart
- vii. 'As made' Relay Disposition Chart
- viii. 'As made' Termination Particulars of Locations & FTOT.

Contractor shall hand over along with the negatives, required copies of plans and designs in the

neatly bound booklet marked as 'FINAL As Made'. Two sets of these documents shall be kept in thick plastic cover (2 sheets back to back in one plastic cover) duly filled in plastic folder and handed over to Railways.

The contractor is required to supply the following bound registers in 100 pages printed on good quality papers. (75 GSM)

- i. Cable Meggering Register,
- ii. Relay Register,
- iii. Relay Room Key Register,
- iv. Route Cancellation Register
- v. Earth Resistance Register.
- vi. Track Circuit Register
- vii. Points Machine Parameter Register
- viii. IPS Parameter Register
- ix. Battery Register,
- x. Axle Counter/ BPAC Parameter Register and any other Registers/Bounded Books as indicated by the Railway Representative.

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

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

#### **35 PROCUREMENT OF STORES:**

- 35.1 For the execution of the works, the contractor shall procure items of materials inclusive of miscellaneous and consumable items of Stores.
- 35.2 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's 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.

35.3 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. Materials covered under RDSO's approved list of items should be procured from those firms approved by RDSO only.

35.4 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.

**36 USE OF TECHNICAL TERMS AND CONDITIONS, DRAWINGS AND SPECIFICATIONS:**

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.

**37 SPARES:**

The Tenderer shall supply the essential spares as per the quantities indicated in respective Schedule of works.

**38 DISCREPANCIES IN DRAWINGS AND OTHER DOCUMENTS:**

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.

**39 ISSUE OF MATERIALS:**

39.1 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 Railway's specified depot to the site of work. The contractor should also undertake necessary repairs to crates drums etc. in respect of unused materials required to be returned to the purchaser. No extra payment will be made on this account.

39.2 Extra care should be taken in the transportation of sophisticated Electrical and Electronic equipments like relays, power equipments, etc. to prevent from damage during transit. Further, these equipments 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

39.3 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.

- 39.4 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.
- 39.5 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.
- 39.6 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 Railway Engineer in the first week of every month without fail.
- 39.7 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.

#### **40 RETURN OF SURPLUS/ RELEASED MATERIALS:**

- 40.1 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
- 40.2 The contractor shall take proper written acknowledgement from the Engineers Representative for all the materials returned by him.
- 40.3 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.

#### **41 RECEIPT OF MATERIALS FROM CONTRACTOR:**

- 41.1 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.
- 41.2 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.

- 41.3 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.

## **42 INSPECTION OF WORKS:**

- 42.1 The Engineer or his representative shall inspect and test the various portions of the work at all stages and shall have full power to reject all or any portion of the work that he may consider to be defective or inferior in quality of materials workmanship or design in comparison to what is called for in the specification. In the event of rejection of any work already executed and not in accordance with specification as in this tender and/or as determined by the Engineer or which the Contractor has been apprised, the contractor shall carry out alterations/ replacements to such works to the satisfaction of the Engineer for which no additional expenses will be borne by the Railway.
- 42.2 The contractor shall submit detailed test procedure for each equipment, sub-system and system as a whole to the Railways. The Railways shall discuss with the contractor and modify the test procedure as may be required to ensure that the requirement of tender specifications are complied. The finalized test procedure shall, only, act as a broad guideline and Railway shall be free to carry out any other tests that may be considered essential. The test procedure shall give details of all equipment, test and measuring instruments required to perform the tests which shall be provided by the contractor free of cost.

## **43 ATTENDING TO DEFECTS:**

The contractor shall rectify defects that may arise in the work executed during Maintenance period after completion of work, such defects being due to bad workmanship on the part of the contractor or otherwise. Should any dispute arise so as to correctness of the defect pointed out, the Engineer's decision in this regard is final and binding.

## **44 INSPECTION OF MATERIALS:**

- 44.1 Materials to be supplied by Contractor shall be of best quality and shall conform to the relevant specifications, Designs and Drawings. The materials shall be procured by the Contractor/s from manufacturers of repute or their authorized dealers as approved by the Engineer-in-Charge.
- 44.2 The contractor should procure signaling/telecom items which appear in the RDSO approved list of suppliers. The contractor shall take prior approval of the Railways before placing orders on the firms.
- 44.3 The items which are included in the list of RDSO approved suppliers (Electrical Signaling items) shall be inspected by RDSO and Mechanical Signaling items shall be inspected by RITES except petty items which shall be inspected by representative of the Engineer-in-Charge. The RCC products, GI Pipes, FRP type TLD Boxes, Apparatus Case, HDPE Pipe and Earth Electrodes, shall be inspected by RITES. In case the value of Electrical signaling items is less than Rs. One Lakh, the inspection shall be carried out by RITES. In exceptional cases, the consignee inspection shall be carried out by an Officer nominated for the purpose. Even in these cases, the materials shall be procured from RDSO approved sources.
- 44.4 The following items will continue to be inspected by RDSO irrespective of its value:
- (a) All Types of Signalling Relays
  - (b) Block Instruments
  - (c) Axle Counter Equipments



- (d) All Power Supply Equipments
  - (e) Electric Key Transmitter
  - (f) Terminal Blocks (PBT type)
  - (g) Electric Point and Lock Detector
  - (h) Electronic Interlocking system.
  - (h) Data Loggers
  - (i) LED Signals
  - (j) PVC Wire Copper for signalling
  - (k) Maintenance Free Earth.
- 44.5 All materials that are not covered under specification, designs and drawings of RDSO, Railway Board, etc., will be procured by the Contractor from the manufacturers of repute/their authorized dealers, after the approval of the Contract Signing Authority
- 44.6 Materials to be supplied by the contractor shall be put up for inspection of Engineer or his representative for checking its quality/ suitability before they are finally used/ installed by the Contractor and necessary inspection certificate to be obtained. The Contractor shall therefore arrange to get the material inspected in advance, preferably in bulk and not in piece-meal. The Contractor shall give the Railway 10 (Ten) days' notice, when the materials are ready for inspection.
- 44.7 The inspection charges levied by RDSO/ RITES will be on Railway's account.
- 44.8 All materials to be supplied by contractor should be offered by him/them for RDSO's/RITES inspection, well in time, so as not to delay the progress of work at any stage at any of the stations in any way on this account.
- 44.9 If required, the Contractor shall provide at point of production, apparatus and labour for making required tests under the supervision of the Railway. Tests may be made either at point of production, on samples submitted or at the destination.
- 45 FACILITIES FOR TEST & EXAMINATION:**
- The contractor shall provide, without any extra charges, all materials, equipments, tools and labour of every kind which the RDSO/RITES or their nominee may consider necessary for any tests and examinations which they or their nominee shall require to be made on the contractor's premises and shall pay all cost attendant there upon. The contractor shall also provide and deliver free of charge at such places as the RDSO/RITES or their nominee may nominate such materials as they or their nominee may require for the independent testing organization. The cost of any such tests will be defrayed by the Railways unless it is stated in the specification that it is to be paid by the Contractor.
- 46 CERTIFICATE OF INSPECTION AND APPROVAL:**
- 46.1 No stores will be considered ready for delivery until RDSO/RITES/Railway inspecting officer nominated by them have certified in writing that the material has been inspected and approved by them for dispatch.
- 46.2 Facilities must be provided by the contractor to the Railway or their nominee for inspection of the stores, equipments and structures at all stages of their assembly, manufacture and fabrication.
- 47 INSURANCE:**
- 47.1 The contractor shall take out and keep in force a policy or policies of insurance against all liabilities of the Contractor or the Railway at common law or under any statute in respect of accidents to persons who shall be employed by the Contractor in or about the site or the Contractor's Office for the purpose of carrying out the contract works on the site. The contractor shall take about and keep in force a policy or policies of Insurance against all recognized risks to their office

accommodation and storage for which he is liable. Such insurance shall in all respects be subject to the approval of the Railway.

47.2 The Contractor shall take out and keep in force a policy or policies or insurance for all materials handed over to him irrespective of whether used up in the portion of work already done or kept for use for the balance portion of the work until such works are handed over to the Railway.

47.3 For this purpose, the works are deemed to have been handed over when final acceptance certificate is issued by the Engineer after the completion of the entire acceptance test to be conducted on the works. The contractor shall not be liable for losses/damages to the materials either used up in the portion of work done or the materials kept for use at site, in consequence of mutiny or other similar causes over which the contractor has no control and which cannot be insured. Such losses or damages shall be the liability of the Railway.

47.4 The Contractor should, however, insure the stores brought to site, against risks in consequence of war and invasion, as required under the Emergency Risk (Good) Insurance Act in force.

47.5 The Contractor shall take out all insurance covers in connection with this contract with the General Insurance Corporation of India.

**48 AVOIDING INFRINGEMENT OF INDIAN RAILWAY ACT:**

48.1 The works must be carried out most carefully without any infringement of the Indian Railway Act or the General and subsidiary rules in force on the Railway, in such a way that they do not hinder Railway operation nor affect the proper functioning of or damage any Railway equipment, structure or rolling stock except as agreed to by the Railway, provided that all damage and disfiguration caused by the contractor to any Railway or Public property must be made good by the contractor at his own expenses failing which cost of such repairs shall be recovered from the contractor.

48.2 No work on the points, track circuits, equipment's involving working signaling gears, internal wiring, cable termination, etc., should be done unless and until contractor's technical supervisors are present at site.

**49 CONTRACTOR'S DRAWINGS:**

49.1 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.

49.2 The tenderer shall be responsible for the correctness of the drawings furnished by him. The contractor shall carryout 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.

49.3 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.

49.4 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.

49.5 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.

- 49.6 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.

**PART- (B)**  
**TECHNICAL REQUIREMENTS OF ELECTRONIC INTERLOCKING**

1. Electronic Interlocking (EI) system including sub systems to be offered should be as per RDSO Specification No. [RDSO/SPN/192/2019 Ver.2.0 or latest amendments](#) for all the stations mentioned in the Scope of Work of SCC with Hot standby feature as per RDSO TAN No: STS/E/TAN/3004 or latest and have RDSO approval on the date of closing of tender.
2. Approved Signal Interlocking Plan of the proposed stations shall be issued as per the Milestone Activities and TDC specified in SCC and during the Kick off/ review meetings. However, Draft/ Tentative plans of the yards may be seen in the office of Chief Signal & Telecommunication Engineer (Construction), Bangalore on any working day.
3. Before Commissioning of Electronic Interlocking, Technical System Application approval as specified in RDSO TAN No: STS/E/TAN/3012 Ver. 2 or latest shall be obtained from the Competent Authority RDSO/ CSTE 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.
4. Information required as per RDSO specification is as under:

Sl. No.	Description of Information	Details of Information
a)	Approved Interlocking Plan, Selection Table and Panel diagram of the station	1. 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. 2. VDU Panel diagram shall be designed by the Contractor as per the Approved Interlocking Plan and submitted for approval by the Railways.
b)	Whether CCIP (Domino type) or VDU terminal or both required	Dual VDU
c)	System O/P required to drive field gears. Relay interface or object controllers	Relay Interface
d)	110V AC or DC usage for signal lamp lighting	110V AC with ECRs
e)	Size of VDU monitor screen	Maintenance VDU – 55” LED ,4k resolution Operator VDU – 55” LED, 4k resolution
f)	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 110V AC (pure sine wave) and 24V DC with redundant arrangement.

5. Other features of the proposed signaling system shall be as under:
- 5.1 EI system to be installed at all stations is working in Centralized Architecture. However, scheme may be changed during the course of execution.

- 5.2 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.
- 5.3 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.
- 5.4 For better reliability, all vital sub systems like Processor unit, 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.
- 5.5 The EI system should be designed to suit QN1 and QNA1 24V DC relays.
- 5.6 The scope for Provision of EI system includes designing of EI Software (Application Logic, Interface Circuits etc.) including Operator and Maintenance VDU software as per approved signaling plan & 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.
- 5.7 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.
- 5.8 Operation and Maintenance terminal of the EI system shall be as per RDSO TAN No. STS/E/TAN/3007 Ver.1 or latest
- 5.9 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.
- 5.10 Installation, testing and commissioning of Datalogger 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.
- 5.11 Track repeater relays /slot relays /Gate controls relays/ siding control relays/repeater relays shall be of approved type and shall work on 24V DC.
- 5.12 The point operation is working on 110 V DC with independent detection.
6. The signaling system should meet the requirements of 25 KV Railway Electrified section.
7. 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 (pen drives) and Hard Copy (R.P. Film) in duplicate. Blue prints of the same shall be supplied in desired number as per the schedule.
8. ESSENTIAL SPARES:
- 8.1 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.
- 8.2 The scale of Essential spares shall be 10% and 15% of the quantities of Normal Cards and Vital Cards used in the working system respectively subject to a minimum of one.

9. **Specification for Tool Kit related to EI**

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.

1. Crimping tool set
2. Crimp insert set
3. Extract tool set
4. Insertion tool set
5. Location tool set
6. Screw driver adjustable
7. Spanner double ended 33mm
8. Spanner double ended 3/8x1/2"
9. Spanner double ended 5/8 x 3/4"
10. Spanner double ended 7/8x1"
11. Adjustable screw spanner 12"
12. Insulated cutting plier
13. Insulated nose plier
14. Hammer 1 1/2" LBS ball pane
15. Hacksaw frame
16. Electronic soldering iron 230V/60W
17. Digital multimeter (Fluke)
18. AC/DC clamp meter of Suitable range to cover the measurements of all kind of Used Voltages and currents (Fluke or equivalent)
19. Cabinet to store tools

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

10.1. 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:

- (a). 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.
- (b). 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 Datalogger 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

- (c). 2 Nos. of 55" size Operator VDUs and 1 No. of 55" 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 4K resolution for 55" monitor with commercial grade suitable for 24/7 operation.
- (d). 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, 50V DC 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.

**10.2. Installation, Testing and Commissioning of Electronic Interlocking System Complete**

Design, Installation, Wiring, Testing and Commissioning of EI Equipment as per RDSO Specification No. [RDSO/SPN/192/2019 Ver.2.0 or latest amendments](#), including installation of Relay racks and fixing & 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 (RDSO approved) used for interface wiring of EI shall be made of twisted pair.

This work also includes:

- (a). 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.
- (b). 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.
- (c). 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.
- (d). Supply and Installation of Panel Operator Console in SM Room with arrangements to fix 2 No. 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 needs to be carried out as per the tentative drawing available at the office of Dy. CSTE/CN/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 No.s).
- (e). Synchronization of EI clock and Data logger clock through CMU.

- (f). Provision of Communication between Operator VDU, Maintenance VDU and CIU/Main EI Equipment.
- (g). 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.)
- (h). Supply and provision of Earthing & bonding, Surge Protection and System integration as per RDSO specification No. RDSO/SPN/197/2016 VER 1.0 or latest, RDSO TAN No. STS/E/TAN/3012 VER 4.0 dated 23.07.2025, RDSO TAN No. STS/E/TAN/3006 Version 3.1 dated 25.06.2025 and/or latest and guidelines issued by RDSO/Railway board for achieving earth value less than One Ohm, using minimum of EIGHT Maintenance Free Earth Pits.
- (i). Supply, Installation and commissioning of Class 'A' protection with Lightning Event Counter as per RDSO spec No. RDSO/SPN/197/2008 and as per details given in technical specification in following sections, with three years warranty.
- (j). 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.
- (k). 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, 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.

**10.3. Submission of "As Made" documents for EI:**

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.

The As-made shall include the following:

- (a). Wiring diagrams (Interface circuits)
- (b). Application program listing (Application logic in ladder form)
- (c). Relay/Cable termination particulars
- (d). Input/Output assignment details
- (e). Relay layout and contact analysis chart
- (f). Equipment disposition layout
- (g). Details of power supply arrangement
- (h). 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

(i). Any other drawing as required by the Railway as per the practice

(j). All other documentation as per clause No.10 of RDSO specification RDSO/SPN/192/2005 or latest with latest amendment shall be supplied.

11. 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



12. 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 Schedule E 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.
13. 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.

#### 1. PART-(C)

##### TECHNICAL REQUIREMENTS OF EARTHING ARRANGEMENT

Earthing arrangement for ELECTRONIC INTERLOCKING / END GOOMTIES shall be as per RDSO Guidelines STS/E/TAN/3006 VERSION 3.1 DTD 25.06.2025 or latest and further guidelines issued by Railway board/ RDSO for achieving earth value less than One Ohm based on RDSO specification RDSO/SPN/197 Ver 1.0., RDSO/SPN/144/2006 Rev 2.

#### PART- (D)

##### TECHNICAL REQUIREMENTS OF DATA LOGGER

1. The Data Loggers shall confirm to RDSO Specification No. IRS S. 99/2006 with latest amendment equipped with cards for 512 digital input or as specified in the Schedule of work , to monitor the internal relays and to 32 analog inputs and digital data from SSIs including Networking Modem and shall be procured from RDSO approved firm with RDSO inspection.
2. Information required as per Para. 11 of RDSO specifications No. IRS S. 99/2006 is as under:

S. No.	Description of Information	Details of Information
11.1	Total number of Digital and Analog inputs to be monitored	
11.1.1	Number of Digital inputs	512
11.1.2	Number of Analog inputs	32
11.1.3	Whether RTU is required for monitoring of equipments at distant place	Required in Case of IBS./LC GATE Digital Input: 64 Analog Input: 16 Approx. distance from Data logger: Approx. 10 Km
11.2	Additional Exception Reports (Other than those mentioned in Annex-C to be generated)	Yes. As per the present practice followed over SWR.
11.3	List of functions to be monitored (if any other than Annexure "B")	Digital inputs from EI and Internal Relays
11.4(a)	Central Monitoring Unit (CMU) Required?	Required if mentioned in Tender Schedule
11.4(b)	FEP Required?	Required if mentioned in Tender Schedule

S. No.	Description of Information	Details of Information
11.5	Printer Required?	Yes
11.6	Computer Table	Yes

3. Other features of the proposed Data logger system shall be as under:

- 3.1. The data loggers proposed are to be networked to the existing Datalogger network of respective division and enabled for centralized monitoring. All required additional hardware and software has to be provided by the contractor.
- 3.2. 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 datalogger.
- 3.3. 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.
- 3.4. Power extension board with O/V, U/V, fuse and spike protection shall be supplied along with each Data logger.
- 3.5. The PC to be provided with Datalogger 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.

## **PART-(E)**

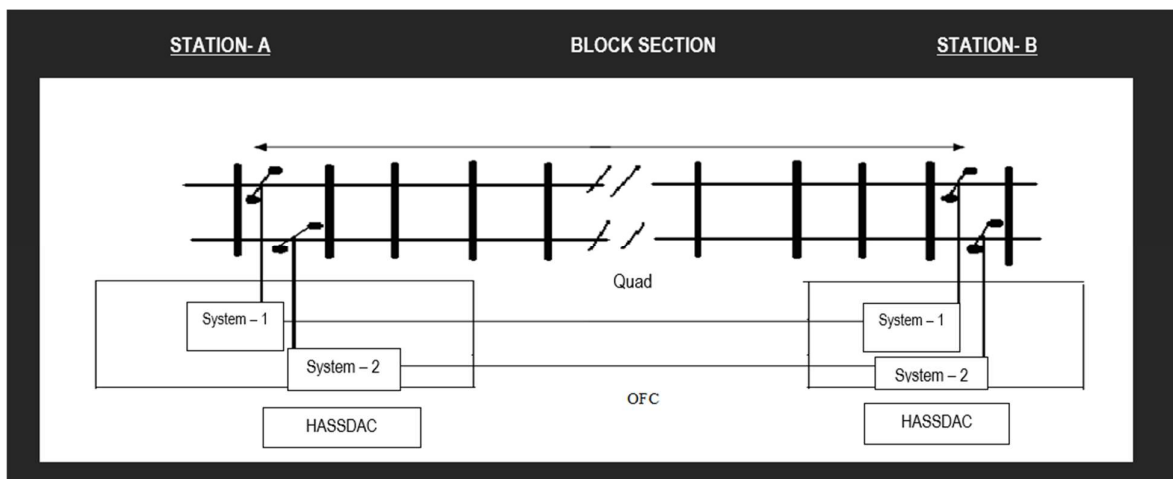
### **TECHNICAL REQUIREMENTS OF SSBPAC(D) BLOCK WORKING**

1. The system must meet the requirements of RDSO Specification RDSO/SPN/175/2005 Ver.1 or Latest for SSBPAC(D) complete for Single Line.
2. Block Proving System will require the following sub systems for its working
  - i) Block Panel
  - ii) Microprocessor based SSBPAC(D) Block Interface.
  - iii) High Availability Single Section Digital Axle Counter
  - iv) Block Telephone.
  - v) Telecom cable/ voice/ data channels provided over optic fiber subsystem using proper multiplexer.
  - vi) Battery Set and Battery Charger/ IPS module.
  - vii) Relay racks and pre-inspected Relays.
3. Except Communication media and 24 V DC supply from IPS module; all other equipments and materials required for commissioning of Block proving system by SSBPAC(D) with block panel shall be supplied by the contractor.
4. Railway will provide 24V DC supply from IPS module; all other voltages required for Block proving system working shall supplied and arranged by the contractors as per RDSO specifications.
5. Contractor should supply maintenance tool kit for maintaining the devices and equipment along with the products and equipment's.
6. Contractor should arrange three sets of printed and soft copies of Installation, maintenance, trouble shooting and user manuals along with product.
7. 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.
8. Media change over between OFC and Quad should be automatic as per Railway requirement.
9. OEM Engineer shall demonstrate the parameters and fill up the pre-commissioning check list which shall be jointly signed with Railway Representative after detailed quality check of the installation.
10. OEM shall verify the installation and commissioning and issue the OEM certificate as per RDSO guidelines for Electronics based system.
11. Requirements as per RDSO Specification:
  - i. Medium of working : OFC and Quad Cable with Auto Changeover
  - ii. Type of Block Instrument : SSBPAC(D) Double Line with Block Panel
  - iii. Communication : Voice/ Data

## **PART-(F)**

### **TECHNICAL REQUIREMENTS OF HIGH AVAILABILITY SINGLE SECTION DIGITAL AXLE COUNTER**

1. The High Availability Single Section Digital Axle Counter (HASSDAC) must be confirming to RDSO Specification no. RDSO/SPN/177/2012 (Ver. 3) or latest and shall be provided with High Availability Dual track sensor.
2. Wiring Discipline should be as per RDSO TAN No. STS/E/TAN/6001, dtd. 04.10.2011.
3. 19" rack Mountable Multi service multiplexer chassis consisting of 4 E1 Interface uplink and 3 module slots, one slot populated with 2W/4W E & M supporting up to eight interfaces, balance two empty, unit should support both AC/DC power supply (MRO TEK make MAPLE 4C PCM 1U or similar specifications) shall be provided for auto changeover of the transmission media.
4. Requirements as per Para 18 of RDSO specification no. RDSO/SPN/177/2012 (Ver. 3)
  - i. Configuration : 2 DP 1 Section
  - ii. Length of cable : 15/25 Meter
  - iii. Supply option :
    - a) High Availability SSDAC
    - b) Dual track sensor device



**Note:**

1. Two sensors shall be put on two different rails with 1.25m longitudinal spacing along the track. This will ensure 2m diagonal distance between two sensors.
2. HASSDAC having system – 1 & system – 2 shall be preferably using diverse media (Quad/OFC).
3. When one of the SSDAC is clear whereas other is showing occupied for more than 10 seconds, the clear SSDAC will automatically reset the failed one.
4. All resetting will only be of preparatory reset type.
5. Use of dual track sensors on different all with high availability system is based on MTBF requirements.

**Wiring and Installation and Commissioning details:**

1. Fixing of HASSDAC system in the location box.
2. Wiring of HASSDAC system in the location box. (The different cables for signalling & Communication cable will be laid and terminated in the location box).
3. Supply, fixing and wiring of suitable Lightning Dischargers, fuse terminals and fuses.
4. 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.
5. 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.
7. Connecting of HASSDAC system at location box and reset box at SM's room to earth bus bar
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.
9. 19" rack Mountable Multi service multiplexer chassis and interface equipment's required for Mountable Multi service multiplexer chassis should be installed and configured as per requirements of Railway site Engineer.

### **Specification of Portable Data Analyser:**

Supply of Data Analyzer similar to HP /IBM/Dell or better specifications of following configuration. Necessary software tools required for data analysis should be pre-installed in the system.

- a. CPU : 12th Generation Intel® Core™ i7-1250U (12MB Cache, up to 4.7 GHz, 10 cores)  
or latest version
- b. RAM : 32 GB: LPDDR5, 5200 MT/s (onboard), dual-channel
- c. Hard Disk : 1 TB, PCIe x2 NVMe, SSD integrated
- d. Port : USB 3.0 Ports-2, HDMI Ports-1 & LAN Port-1
- e. Monitor : 13.4", FHD+ 1920x1200, 60Hz, Non-Touch, Anti-Glare, 500nit, Infinity Edge
- f. Operating system : Windows 11 or higher
- g. Power back up : Internal Battery Pack with min. Two hours backup or higher.
- h. Carrying Case : Superior quality leather bag with hand and Shoulder strips.

### **Multi Section Digital Axle Counter (MSDAC)**

Supply, Design, installation, testing, and commissioning of Multi Section Digital Axle Counter (MSDAC) complete system as per RDSO Specification No. RDSO/SPN/176/2013 version.3 with latest amendments STR No. SIQ 0001 Ver.2.0 or latest. Inspection: RDSO. DPs may be considered as per tender schedule quantity and track sections as per SIP along with BPAC configuration, in which dual DP should be used for BPAC purpose and **DP should be clamp mounted hole less over rail**. Reset should be as per latest SWR policy / RDSO guidelines. This schedule includes all related equipment's including hardware and software along with diagnostic modules and its networking. The diagnostic module should be remote accessible through rail net and related FIELD earthing (if required) should be part this supply and installation.

Tenderer shall design the scheme for provision of required number of Evaluators, trackside junction boxes, detection points, and track clearance relays etc submit along with the offer. MSDAC should have facility to reset track section with both automatic and manual modes. System shall be with cooperative type design. This includes supply of all trackside junction boxes, required number of evaluators, detection points, reset panels, last vehicle/cooperation boxes, communication/interface equipment for connecting evaluators, reset panels and last vehicle/cooperation boxes, all other accessories including Multiplexers, Modems, Cards, Modules etc., and any other miscellaneous materials required for the work shall be supplied as part of scope this Tender. Total cost breakup shall be given against the work. **MSDAC to be procured only from RDSO Approved Vendors.**

#### **Special Conditions:**

"Before placing the call letter to the OEM for RDSO inspection, the detailed scheme shall be submitted by the supplier/OEM to the Office of Dy.CSTE/CN/UBL for approval"

#### **I. Scope of Work**

1. Any other materials not quoted in the breakup and/or any increase in quantities listed in the breakup but found necessary while commissioning should be supplied free of cost as part of scope this work. Track clearance and occupied indications and Reset indications of each Track section & Supervisory Track section shall be provided at station. Two sets of MSDAC manuals, Trouble Shooting guidelines and related documents to be supplied for this work.

2. MSDAC System shall conform to RDSO Specification No. RDSO/SPN/176/2013 version.3 with latest amendments or latest and from RDSO Approved Vendors.
3. The MSDAC system comprises of Axle Detector, Trackside Electronics/Digital Axle Counter field units, Central evaluator, Reset Unit, Relay Unit, Event logger, diagnostic terminals, and line verification boxes (wherever required) are to be supplied for overall systems of dual detection MSDAC supplied under this work. The diagnostic terminal shall be suitable both in hardware and software installed for configuration of MSDAC system (online/off line).
4. OEM supplied/certified pre-fabricated Rack with power supply arrangement for Evaluator (inspection by RDSO) which is to be supplied along with the system (Para 5.1.1) of RDSO Specification No. RDSO/SPN/176/2013 version.3 with latest amendments or latest.
5. Each Station/Station Goomty shall consist of evaluator and shall cater the maximum number of detection points of maximum capacity as per RDSO specification.
6. OEM Supplied/certified Mushroom cover/apparatus case(s) (if required for installation) for track-side equipment/each detection point housing (inspection by RDSO for OEM supplied/certified Mushroom cover; Consignee for apparatus cases). Quantity of Mushroom cover/apparatus case shall be same as that of detection point. However, if RDSO declines, will be inspected by authorized representative of Railways.
7. All the MSDAC equipment to be provided with efficient lightning and surge protections which also to be supplied along with the system (for all sub systems as suggested by OEM).
8. 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, suspended chains, Electrical Inductors in Locomotives, air-conditioning equipment and other electrical/electronic equipment in train/engine.
9. One set of Axle detector shall not influence another set of detectors mounted  $\geq 2$  Meters away. The length of in-built cable with Axle detector shall be up to 25 Mtrs. which shall be supplied as part of scope of this work.
10. The MSDAC system shall be of Single detection type and Tenderer shall submit the design regarding the Evaluators housed at each Goomties/central cabin before placing call letters for RDSO inspection. In future system should be ready to make Dual DPs. BPAC configurations of MSDAC must be with dual detection only.
11. The Modems supplied shall be capable of automatic changeover/Hot standby communication. In case of single OFC/Quad cut between Goomty/Stations both System I and system II functionality shall not be affected.
12. Instruction manuals, installation manual & maintenance manuals including Dos & Don'ts, mechanical drawing for each subsystem, schematic block diagram showing mounting arrangement of various components & details of each type of assembled PCB, troubleshooting manual, pre-commissioning check list and other technical information regarding MSDAC supplied (as per item no. 1g of RDSO Specification No. RDSO/SPN/176/2013 version.3 with latest amendments or latest).
13. 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 of Indoor and outdoor equipment.
14. Power Supply to be extended to the Evaluators/Detection Points (wherever necessary even power cables if required) by the tenderer himself from the IPS available at Goomties or Stations.

## **II.Scope of Installation:**

1. Transportation, Installation, Testing & Commissioning of Multi Section Digital Axle Counter (MSDAC) as per the approved yard layout with Reset counter unit, Relay unit, Evaluator(s), line verification boxes, power supply, event loggers, diagnostic terminals, programming etc with the supply of all necessary cable, connectors, fixture, clamps.
2. Transportation of materials from stores to site and site to stores shall be done by tenderer/supplier.

3. The Evaluators shall be placed in Station.
4. Detection Points shall be provided in respective station yards and shall cover the entire yard.
5. In case of mounting of the Mushroom box/Trackside Electronics equipment in outdoor is required, it shall be done only inside the Apparatus case Full box and shall be supplied as per drawing and erected under the scope of this work. Also any trenching required between location boxes to DP/Mushroom Box, which will be done under the scope of this work.
6. 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/197/2008 or latest. It shall be done as unit Maintenance free earth. Supply and installation shall be covered as part of scope this work and for which separate payment will not be made.
7. 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 stations as part of scope this work.
8. Configuration of MSDAC at site by OEM or authorized OEM representative.
9. All empty slots in the card-file shall have dummy cards fitted to prevent entry of lizards/rodents etc.
10. Tenderer shall submit the scheme of resetting the MSDAC along with the offer.
11. Wherever various indoor and outdoor agencies work are involved, the supplier shall closely coordinate with agencies and installation will be intimated by the office of Dy. CSTE/CN/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.
12. Reset feature:

The following procedure for resetting of Digital Axle Counters (SSDAC/HASSDAC/ MSDAC) provided in Station/Yard shall be adopted by SM/ASM:

1. Resetting of straight portion of Digital Axle Counters of Main Line and Loop Line within the Station /Yard.
  - a. Preparatory mode of resetting shall be used by SM/ASM on-duty.
  - b. SM/ASM on duty will apply preparatory reset after physical verification of the affected track portion of Digital Axle Counter.
  - c. LV Box is not required.
  - d. First train shall be piloted or calling-on signal to be taken off for the movement duly observing all procedures.
2. Resetting of Point Zone Digital Axle Counter (MSDAC).
  - a. Co-operative resetting shall be done by SM/ASM using LV Box at site. Physical verification at site shall be done by SM/ASM/Switchman/ESM/SM on-duty ensuring S that affected portion is free from any vehicles before resetting is applied.
  - b. No preparatory mode shall be used.
  - c. Direct resetting shall be provided.
  - d. Proper signaling movement shall be possible after resetting.
3. SM reset for MSDAC shall be provided "through reset box or VDU panel provided by MSDAC manufacturer".
4. All resets must be recorded by physical counter per track section / block section.

### **III. Railway shall supply the following:**

1. Necessary underground cables for this purpose will be provided by Railways.
2. Station/goomties will be constructed by Railways for accommodating of MSDAC Evaluators.
3. The Communication media between Evaluators to Evaluators shall be through OFC Cable and Communication media between MSDAC Evaluator to DPs is through armoured 6-Quad cable (0.9 Sq mm). Necessary 6 Quad cables and OFC Cable will be supplied by Railways. OFC cable to be laid if Railway requires a separate Interconnectivity between MSDAC DP and Evaluators as redundant cable for communication along with Quad



cable. 4 Fibers are terminated in FMS/FDMS in Relay Room of Goomty/Station will be made available for installation/commissioning of MSDAC. All the necessary OFC patch chords, wiring materials, ladder arrangements and other miscellaneous materials as per site conditions shall be supplied as part of scope of this work.

4. Necessary 24V/110V DC from IPS/ battery bank of IPS will be arranged by Railways

**IV. Delivery Schedule:**

The Concerned Engineer-in-charge of the work will fix appropriate milestones and monitor the progress from time to time.

**V. Payment Terms: Please refer payment conditions clause under SPECIAL CONDITIONS OF CONTRACT**

**VI. Variation:**

OEM shall supply the additional DPs if required as per the site conditions at the time of the installation and variation of DPs will be paid as per the special conditions of contract.

**VII. Spares:**

The scope of this work shall include supply of 10% of spares (minimum one number w.r.t overall quantity) subject to a fractional quantity to be rounded off to next higher digit for all indoor and outdoor equipment of MSDAC hardware (excluding maintenance terminals, location boxes (if any) and earthing materials). Detailed cost and quantity wise break up of all spares should be given.

**VIII. Warranty:**

The MSDAC equipment and its subsystems shall be under warranty for a period of ONE year from the date of completion of the work, i.e., date of issue of the Provisional Acceptance Certificate.

**IX. Break up of equipment:**

OEM certifies the breakup of all modules shall be clearly mentioned while quoting the rates.

**X.Detailed Guidelines**

The original manufacturer shall,

1. Offer technical support for supply, installation and commissioning of the equipment. Undertake verification and certification of pre- commissioning checklist as per RDSO guidelines.
2. Sign on the Application for Technical System approval by RDSO to ensure that the installation is as per the RDSO stipulations.
3. Guarantee to supply spares for a minimum period of 7 years after the expiry of the warranty period.
4. Support Railways for entering into AMC/ARC if any on later date after the expiry of warranty period.
5. All the designs shall be signed by IRSTELO license holders in the respective category.
6. Design the Interface circuits as per approved SIP. Interface circuits shall be approved by Railways.

**XI.Inspection Clause**

S.No	Description	Inspection Agency
1	Supply MSDAC system with hardware, cards with suitable configuration as per RDSO specification RDSO/SPN/176/2013 version.3 or with latest amendments or latest	RDSO
2	Supply of WAGO Terminals, fixing and wiring as per requirement	Consignee
3	Supply of Wire coils different sizes as per RDSO specification IRS: S 76/89 that are required for installation.	RDSO
4	Supply of surge protection class B&C pluggable and testable type surge protection device as per RDSO/SPN/ 165/2012 or latest.	RDSO

5	Supply of all types of relays as per RDSO specification BRS 930 & 931 or latest.	RDSO
<b>The Following items shall be supplied wherever required as detailed in special conditions</b>		
1	Supply Full GRS box as per drawing	RITES
2	Supply of unit maintenance free earth as per RDSO/SPN/197/2008 or latest.	RDSO
3	Power supply equipment's like DC-DC converters as per RDSO specification No. RDSO/SPN/165/2012 Ver.3 with latest amendments or latest.	RDSO

## **XII. Training:**

Training on Installations, maintenance & trouble shooting shall be imparted to Railway Personal at site (10 man-days for 20 DPs or part thereof).

- Training shall be organized for open line and executing staff & officers through the OEM/agency before commissioning and proper record shall be maintained.
- During programming, testing and commissioning one more round of training shall be organized for the staff to have better understanding of the product going to be commissioned.
- During the training each of the attendee shall be given the copy of the training manual and copies of the approved document without any exception.

## **XIII. Tenderer/Supplier shall invariably submit the following documents before installation for approval and As-Made documents after installing, testing & commissioning:**

- Evaluator summary, DP summary and evaluator communication summary.
- MSDAC DP Plan.
- Rack wise evaluator allotment Plan.
- Wiring Diagram.
- MSDAC DP connection between 2 CTRs.
- Reset Box disposition & resetting arrangement.
- Cable Core Plan.
- Quad allocation plan.
- For each track section, relay drive evaluator, direct DP and indirect DP connected to be shown in a tabular format.
- Pre-Commissioning Check List (PCCL) and other technical information regarding MSDAC supplied (one copy for each evaluator) shall be submitted by the tenderer/supplier.
- All drawings Hard copy and soft copy (in PDF format) shall be submitted by the tenderer/supplier.

**XIV.** Axle Counter operation must be independent of type of sleepers in the section such as wooden, RCC, or steel etc. and shall work on all types of rail profiles and construction such as welded or non-welded rails of 52 kg / 60 kg / 90R/71 kg etc. Axle counter shall operate up to the vertical limit for worn out rail as given below:

Sl. No	Rail section	Vertical wear in mm
1.	60 Kg / meter	13.00
2.	52 Kg / meter	8.00
3.	90 R	5.00

## **MSDAC POLICY:**

As per PCSTE/SWR Policy letter No. SG/SWR/Signal Policy/Vol.V dated 26.05.2020 -“Provision of MSDAC in station yards and dual detection from Home replacement track Section” the following directives being issued:

1. All new works of EI/PI/RRI shall be provided with MSDAC for track detection. No dual detection is required for the entire yard.
2. To improve reliability and enhance operating mobility, Home replacement track section shall be provided with dual detection by MSDAC to enable lowering off calling-on signals.
3. Dual detection for Home replacement track section shall be adopted in all new works of EI/PI/RRI and also existing installations of EI/PI/RRI.
4. Provision of dual detection for Home replacement phased manner on priority for existing installations.

#### **TECHNICAL REQUIREMENTS OF MULTI SECTION DIGITAL AXLE COUNTER**

Multi Section Digital Axle Counter must be confirming to RDSO Specification No. RDSO/SPN/176/2013 ver-3 or latest...

The MSDAC system comprises of Axle Detectors, Track side electronics/DAC field units, Central Evaluator, Reset unit. Relay unit, Event Logger and diagnostic terminal. MSDAC should be scalable and support detection points & generate vital relay outputs for requisite track sections as per user's requirement.

This specification is issued under the fixed serial No. RDSO/SPN/176/2013 followed by the year of original adoption as standard or in case of revision, the year of latest revision.

#### **1.0 Objective and Scope**

- 1.1** This document sets forth general, operational, technical, performance & type tests requirements of Multi Section Digital Axle counter.
- 1.2** This specification does not cover the specification of external cable and protective devices to be used in conjunction with Multi Section Digital Axle Counter for its installation.
- 1.3** Axle Counter shall use amplitude/phase change techniques or any other fail-safe techniques for safe and reliable wheel detection functions

#### **2.0 Terminology**

- 2.0.1** The terminology referred to in the specification is covered by the definitions given in IRS Specification no. S-23, IS Specification No. 9000 and as given below.
- 2.0.2 Axle detector:** The track device comprising of the coils fixed in cover mounted on the rail. It will detect the wheel (rolling stock axle) passing over the device.
- 2.0.3 Counting device/Digital Axle Counter field unit (track side):** Counting device/digital axle counter field unit is the track side electronic assembly that energise the axle detectors for detecting the passing wheels determining the direction of movement and keeping the count of wheels. It transmits the count and health information to the Central Evaluator at regular intervals.
- 2.0.4 Detection Point:** Detection point comprises of one axle detector and the field unit connected to it.
- 2.0.5 Track Section:** The portion of track confined by associated axle detectors & field units. The axle counter is checking the occupancy of this section.
- 2.0.6 Section Balancing:** Axle counter determines whether the track section in question is clear / occupied, based on the information on detected (in counts and out counts) numbers of axles, which is received from the axle detectors confining the section in question.
- 2.0.7 Resetting:** Resetting commands the setting to zero the records of counted axles.
- 2.0.8 Preparatory Reset:** After resetting, axle counter shall continue to show occupied until one train movement in the section carries out correct balancing

of track section.

**2.0.9 Conditional Hard Reset:** The reset is activated after physical verification of a condition from different location like the clearance of the track section from site using line verification box. The axle counter

will show clear after the conditional reset.

**2.0.10 Event Logger:** Logs the events occurring in axle counter system with date and time stamping.

**2.0.11 Central Evaluator (Indoor):** The Central Evaluator receives count and health information from Digital Axle Counter Field units. It evaluates the counts received from the digital axle counter field units to generate relay- driving signals for individual track-sections.

3.0	Applicable documents/drawings:
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**3.1** Wherever in this specification, any of the specification is referred; the latest issue of the same is implied.

**4.0** System Requirements:

The MSDAC system comprises of Axle Detectors, Track side electronics/DAC field units, Central Evaluator, Reset unit, Relay unit, Event Logger and diagnostic terminal. MSDAC system should be scalable and support detection points & generate vital relay outputs for requisite track sections as per user's requirement. The Central Evaluator shall be connected to Track side electronics/ DAC field units in star configuration through 2 wire or if track side electronics are to be reduced then 4 wire arrangements can be used to transmit information from field unit to central unit. Each track section can be reset independently from the Reset Box/Reset Module of Reset Panel/Visual Display Unit (VDU). The Event Logger shall record all the events occurring in the multiple sections of axle counter.

**5.0** General Requirements:

5.0.1 Multi section digital Axle counter consists of axle detectors & field units scalable upto user's requirement shall be configured for desired track sections as per user's requirement/site specific conditions. It is capable of counting axles, count comparison, finding direction of axle movement, supervision, relay drive and transmission of counts and health of axle detectors & field units. The field units are connected to the Central Evaluator by a transmission medium where transmission is in VF range or Central Evaluator may be connected to detection point through track side electronics on 2 wire arrangements or 4 wire arrangements may be used to reduce the track side electronics considerably

5.0.2 Track clear indication shall only be given when IN count and OUT count are equal and equipment is functioning all right. This implies that until all axles that enter a section are completely counted out, the section concerned shall not show as clear.

5.0.3 Axle counter shall show occupied the moment any of the axle counter sub-assemblies belonging to the section is damaged, missing or has become faulty.

5.0.4 The axle counter shall use Amplitude/ Phase change techniques or any other fail-safe techniques for safe & reliable wheel detection function

5.0.5 Axle counter shall have arrangement so that wheels of push trolleys, dip lorry, rail dollies etc. are not counted by it. Trolley protection track circuit shall not be required with phase detection.

5.0.6 Axle counter operation shall be independent of wear & tear of wheels as permitted vide Indian Railway's Schedule of Dimension, lateral displacement of wheels on rails etc. The manufacturer shall specify the minimum diameter of the wheels, condition of wheels etc., to which the performance of equipment shall not be affected.

5.0.7 Axle Counter operation must be independent of type of sleepers in the section

such as wooden, RCC, or steel etc. and shall work on all types of rail profiles and construction such as welded or non-welded rails of 52 kg / 60 kg / 90R/71 kg etc. Axle counter shall operate up to the vertical limit for worn out rail as given below:

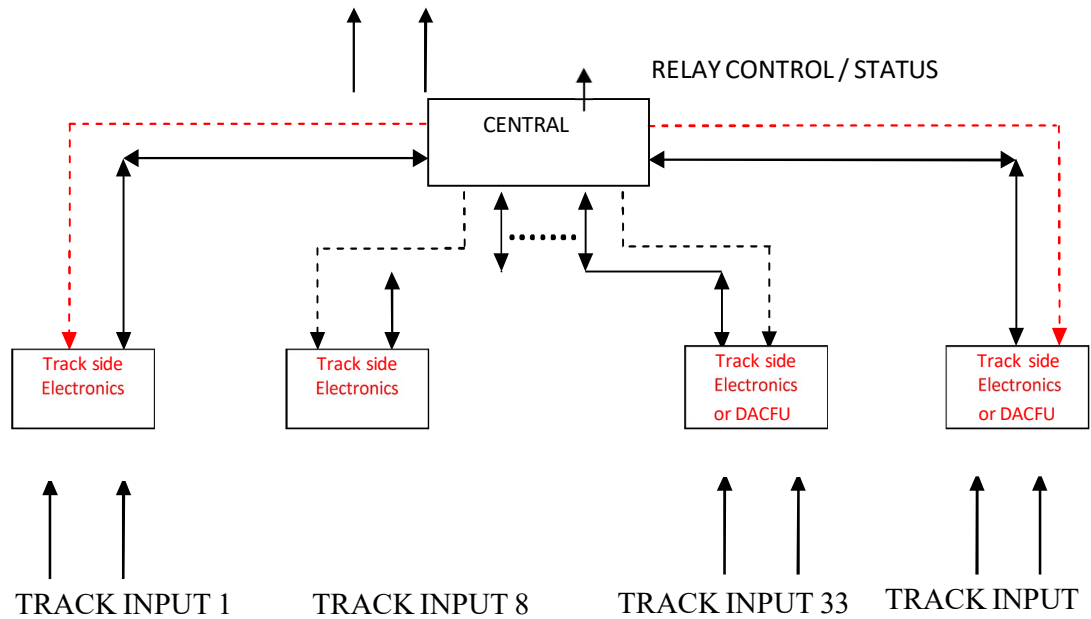
Sl. No.	Rail section	Vertical wear in mm.
1.	60 Kg / meter	13.00
2.	52 Kg / meter	8.00
3.	90 R	5.00

- 5.0.8 Axle counter shall be suitable for train speed from 0 to 250 Km/h.
- 5.0.9 Axle counter system shall be designed for ease of maintainability and testability.
- 5.0.10 The equipment shall be robust in construction and shall work on the permanently energized principle. Any defect occurring in the equipment shall not result in a condition that will lead to unsafe situation.
- 5.0.11 The equipment (central evaluator & field unit) shall be of continuously self-checking type and shall have separate indication to show conditions of track clear and track occupied (including fault). Any disturbance or failure in the equipment including power supply failure shall result in withdrawal of clear indication and occupied indication shall be lit. Disturbance /failure related to a track section shall not influence the normal working of other track sections.
- 5.0.12 Card wise failure indication shall be provided in Central Evaluator & Field Unit. It is desirable to give suitable indication of the nature of failure. Also, total system failure and O.K. indications shall be provided.
- 5.0.13 Axle detector & field unit shall have no moving parts and shall require little maintenance.
- 5.0.14 The equipment (central evaluator & field unit) shall be so constructed as to prevent unauthorized/irregular access to sub-assemblies of the system. Authorized persons should, however, have access to these sub- assemblies for the purpose of installation and maintenance by unlocking the outer cover/breaking of seal provided on the outer cover.
- 5.0.15 The central evaluator & field units shall be provided with testing, measuring and adjusting facilities for indicating proper functioning of equipment and for facility of maintenance.
- 5.0.16 The equipment shall be fully solid-state using carefully chosen industrial grade components.
- 5.0.17 The system shall provide for continuous supervision of field units including cables connecting the field units with central evaluator and detectors with field units. Any defect in these shall be immediately detected, error code displayed and the system / section should go to error mode.
- 5.0.18 The maximum axle count, each track section can handle, should be  $\geq 1024$ .
- 5.0.19 Response time of train occupancy for any track section shall be less than 1.0 second.
- 5.0.20 Clearance time of any track section after train leaves the section shall be less than 2.5 sec.
- 5.0.21 Axle counter system design shall take into consideration system growth capability and architecture of digital axle counter shall be such that it is fit to be used on all the sections of Indian Railways including suburban sections.
- 5.0.22 Environmentally slight moisture condensation shall not lead to malfunction or failure of equipment.
- 5.0.23 The design of axle counter shall take into account switching transients that may occur either inside or outside the system and of any magnitude upto and including interruption of full short circuit current.
- 5.0.24 Axle counter shall withstand the effect of lightning & surges incorporating lightning and surge protection as per RDSO/SPN/144.
- 5.0.25 The equipment shall conform to the Safety Integrity Level 4 as per CENELEC

Standard and as per Clause 3 of this specification i.e., Applicable Documents/drawings.

- 5.0.26 The axle counter should not affect the operation of other wayside signalling equipments.
- 5.0.27 The axle counter shall neither affect nor be affected by presence in vicinity of other trackside signalling equipments like AFTC, TPWS, AWS, DC track circuit, 50Hz and 83-1/3 AC track circuit etc. and Telecommunication equipments.
- 5.0.28 Error rate should not be more than 2 errors per 1 million correctly counted axles, and if there is error, it should not result in unsafe condition.
- 5.0.29 The equipment shall be capable of simultaneously counting in and / or counting out from the ends of any track section.
- 5.0.30 Response of rocking of wheels on Axle Detector: If any sensor is influenced two or more times consecutively without a proper count pulse, the system should go to error. If both sensors are influenced four or more times consecutively without a proper count pulse, the system should go to error.
- 5.0.31 Axle counter should tolerate induced voltage of at least 400V AC, 50Hz on the quad cable.
- 5.0.32 It shall fulfil fail safety requirement as per RDSO/SPN/144.
- 5.0.33 It shall fulfil the requirement of Signal Engineering Manual as per RDSO/SPN/144.
- 5.0.34 The software shall fulfil the software requirements as per RDSO/SPN/144.
- 5.0.35 Axle counter system shall adopt a structured design process including but not limited to the System architecture, Software requirements specification, software architecture, flow charts, Man machine Interface for prototypes, verification and test approach.
- 5.0.36 Detection point at the junction of two consecutive sections shall be capable of giving feed to both the monitoring sections.
- 5.0.37 Both hardware and software functions will be partitioned to ensure that integrity of certified design will not be compromised though routine software and hardware upgrades.
- 5.0.38 Design of the axle counter will maximize the use of vendor independent implementations.
- 5.0.39 Digital axle counter interconnection diagram is shown in figure 1.

n



-----> Power Line      ———> Communication Line or Power and Data  
 Line when no separate Power Line

System (Scalable) with Track side Electronics Interconnection (Network Mode)

- 5.0.40 Digital Axle Counter system will be provided with suitable spare application data as per the site-specific requirement and shall be suitably marked.

5.1 Configuration:

Multi section axle counter shall be easily configurable as per yard layout in different track sections as given below:

- 5.1.1 One detection point Single section: In terminal lines / siding.
- 5.1.2 Two detection points Single section: In straight line.
- 5.1.3 Three detection points Single section: In point zone.
- 5.1.4 Four detection points Single section: In point zone.
- 5.1.5 Multiple detection points single section: In ladder.
- 5.1.6 Consecutive single section in a straight line.

5.2 Vital Relay Drive & Relay Unit

- 5.2.1 Free and occupied indication of an axle counter section (track section) shall be available in the form of vital relay pick up and drop contact respectively. Vital relay/s will be driven by central evaluator.
- 5.2.2 The vital relay shall be 24V DC, 1000-ohm plug-in type. In section clear condition, the relay driver output shall be more than 20V DC and in occupied condition, it should be less than 2.0V DC.
- 5.2.3 The design should incorporate fail safety feature such that when the vital relay is in dropped condition as per status of the track section, if any external voltage appears across the vital relay coil which can pick up the vital relay, then the system should detect it and the concerned axle counter section/track section will go to error state.
- 5.2.4 The relay unit shall provide housing for all vital relays.
- 5.2.5 The relay unit shall have enough space for mounting vital relays (upto 39) for max. no. of track sections supported by MSDAC.

5.3 Axle detector:

- 5.3.1 It comprises of two sets of TX/RX coils / sensors.
- 5.3.2 The TX/RX coils shall operate at frequencies above 20 KHz.
- 5.3.3 Different frequencies shall be used for each set of TX/RX coils.
- 5.3.4 These shall be capable of withstanding environmental conditions given and specified later. The inductance of axle detectors shall not vary more than  $\pm 6\%$  within the specified temperature range.
- 5.3.5 The transmitter/receiver coils in the track shall be of web mounted type. The fasteners should be tightened at specified torque using torque wrench.
- 5.3.6 Axle counter performance shall not be affected by the flooding of track.
- 5.3.7 The axle detector shall be actuated only by wheel flanges and not by other parts of trains e.g., rail brakes, toilet pipes, suspended chains, electrical inductors in locomotives, air-conditioning equipment and other electrical /electronic equipment in train /engine.
- 5.3.8 One set of axle detector shall not influence another set of detectors mounted  $\geq 2$  meters away.
- 5.3.9 The axle detector should not infringe with the Schedule of Dimensions of Indian Railways.
- 5.3.10 The length of inbuilt cable with Axle Detector shall be 5 / 10 / 15 mtr. only.

5.4 Resetting:

- 5.4.1 User input track section wise reset shall be possible.
- 5.4.2 Whenever any yard is provided with MSDAC, reset boxes/Visual Display Unit (VDU) shall be incorporated in a panel depicting yard layout so that respective reset boxes are easily co-related with the track section they pertain to. Refer drawing No. RDSO/S/20001 for details.
- 5.4.3 Track section wise resetting shall be easily configurable as preparatory reset or conditional hard reset.



- 5.4.4 Resetting of a track-section shall not disturb other track-sections in any way.
- 5.4.5 The resetting of the track section shall be recorded in the event logger.
- 5.4.6 A voltage sensitive feature shall ensure that without the operation of re- setting key, the system will not come back to initial or original condition for the following cases:
  - 5.4.6.1 Power fails and restores back in field unit and/or central evaluator.
  - 5.4.6.2 Voltage fluctuation beyond upper and lower limits in field unit and/or central evaluator.
  - 5.4.6.3 Removal of printed circuit cards from the system (field unit and/or central evaluator.)
  - 5.4.6.4 In case OUT count has been registered before any IN count.
- 5.4.7 It shall be possible to reset each track section from reset box/reset module of reset panel only.
- 5.4.8 Provision shall be made for recording every operation of resetting by means of non-resettable counter. For one reset operation, the counter should not increment by more than one.
- 5.4.9 For track section on a straight line confined by two detection points, when reset is applied, the axle counter section shall go to “preparatory reset mode”. The preparatory reset LED in reset box/reset module of reset panel shall glow and reset counter shall increment. The axle counter section will be still in occupied state. The axle counter section will become clear only after more than one in count from one end and same number of outcount from the other end have taken place.
- 5.4.10 For track section on a terminating line/siding line, point zone and ladder, the reset command from reset box/reset module of reset panel will be transmitted only after verifying that verification switch have been pressed & turned in the line verification box at site as a proof of the axle counter section being clear physically. On availability of reset command, the section will reset and show clear and counter shall increment.
- 5.4.11 The reset box / reset module of reset panel should work from 24V DC supply. The following should be provided in the reset box/reset module of reset panel (as per Reset Box drawing no. RDSO/S/20001).
  - 5.4.11.1 A six-digit (min.) non-resettable type counter.
  - 5.4.11.2 Reset switch with key.
  - 5.4.11.3 Reset push button – Red.
  - 5.4.11.4 Axle counter section clear indication (LED-10mm) –Green
  - 5.4.11.5 Axle counter section occupied indication (LED-10mm)-Red
  - 5.4.11.6 Power OK indication (LED-3mm)-Yellow
  - 5.4.11.7 Preparatory reset indication (LED-3mm) –Green or
  - 5.4.11.8 Line verification indication (LED-3mm)-Yellow
- 5.4.12 The possibility of reset will be as per table below:

S. No.	Conditions	Whether reset permitted (Yes/No)
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1.	No in count, No out count, section clear & healthy.	No
2.	No in count, No out count, Error has occurred.	Yes
3.	Only in count, No out count, System healthy	No
4.	Only in count, No out count, Error has occurred.	Yes
5.	In count & out count, registered System healthy	Yes
6.	In count & Out count started, Error has occurred	Yes
7.	No in count, but only out counts, system goes to error.	Yes
8.	System in preparatory mode	No

5.4.13 There shall be provision of sealing in the reset box.

5.4.14 The line verification box shall be as per RDSO Drg. No. RDSO/S/20002.

### 5.5 Central Evaluator

5.5.1 The Central Evaluator Unit shall be housed in a pre-fabricated rack to be supplied along with the system.

5.5.2 The Central Evaluator shall be based on 2 out of 3 logic.

5.5.3 Central Evaluator based on 2 out of 2 logic may be considered through cross acceptance/ approval.

5.5.4 The Central Evaluator shall be able to connect up to 40 detection points.

5.5.5 The Central Evaluator shall connect to Digital Axle Counter field units in star configuration.

5.5.6 The Central Evaluator shall communicate with the Digital Axle Counter field units at minimum 1200 Baud.

5.5.7 The Central Evaluator will provide one vital relay output for each track section.

5.5.8 The Central Evaluator shall be able to generate relay outputs for up to 39 track sections.

5.5.9 The Evaluator should be configurable as per site specific requirements to handle the associated DPs for a track section.

5.5.10 The Central Evaluator shall be able to receive the reset command generated from Reset unit for section wise resetting of track section(s).

5.5.11 The Central Evaluator shall provide input to the Event Logger for registration and recording of events occurring in the multiple section digital axle counter.

5.5.12 The Central Evaluator will have an RS-232 port to interface with Electronic Interlocking (EI) system as per RDSO/SPN/192.

5.5.13 The Central Evaluator will have a separate port to connect to the station data logger for monitoring the section wise clear/occupied information. Standard Data Logger protocol as specified in RDSO/SPN/99 shall be used for this purpose.

5.5.13.1 The following information shall be sent to station data logger:

5.5.13.1.1 Track section nomenclature as per signalling plan.

5.5.13.1.2 Status of track section i.e., clear, occupied, failed or preparatory reset.

5.5.13.1.3 Application of reset command track section wise

5.5.14 Provision should be there for lightning & surge protection in the central evaluator power supply input and communication line input/output.

5.5.15 The field units should be able to communicate with central evaluator for transmission loss up to 20dB.

5.5.16 Suitable arrangements shall be made for providing electrical isolation

Between external relay circuits and internal circuits.

#### 5.6 Digital Axle Counter Field Unit

- 5.6.1 It shall have 2 out of 2 architectures.
- 5.6.2 It shall detect and count axles passing over the axle detector.
- 5.6.3 It shall determine the direction of passing of axles.
- 5.6.4 Provision should be there for lightning & surge protection in the field unit powersupply input and communication line input/output.
- 5.6.5 The field units should be able to communicate with central evaluator for transmission loss upto 20dB.
- 5.6.6 It shall identify and communicate in the following conditions to the Central Evaluator:
  - 5.6.6.1 Power fails and restores back
  - 5.6.6.2 Voltage fluctuation beyond upper and lower limits
  - 5.6.6.3 Removal of printed circuit card(s) from the unit
  - 5.6.6.4 In case out count has been registered before any in count.
- 5.6.7 It shall transmit axle counts and health status to Central Evaluator at regular intervals
- 5.6.8 It shall have provision for setting unique address of each field unit. The address shall be minimum 8 bit.

#### 5.7 Communication:

- 5.7.1 It shall be possible to use copper cable or voice channel in optical fiber communication for transmission of data between field units and central evaluator. The copper cable will be quad cable as per IRS: TC: 30-97 (0.9 mm dia) or PIJF Telecom Cable as per IRS: TC 41/97 (0.9 mm dia.) No separate external interface should be required for using any of these two transmission mediums.
- 5.7.2 Impedance matching between communication channel and modem shall be provided.
- 5.7.3 It shall be capable of transmission of axle counts, health status and other information between field units & central evaluator on a transmission link. The transmission link, in case of copper cable, shall be  $\frac{1}{2}$  quad telecom cable or 1 pair in PIJF cable or use 2 pairs of cable to reduce the trackside electronics or one 2- wire voice channel in case of OFC. The rate of transmission should be minimum 1200 baud.
- 5.7.4 Fault tolerant telegrams shall be used for transmission of axle counts and other information between field units and central evaluator. CRC to be used for error detection and the hamming distance of the message protocol shall be at least 5. The code transmission should be safety validated. Communication should be as per CCITT standard.
- 5.7.5 Minimum 2 (two) consecutive telegrams will be required to verify the integrity of the status of direction and counts transmitted. However, for the information that in count has started, action may be taken after receiving first telegram itself to take the axle counter section to occupied state (a safe state). The manufacturer shall specify the minimum length of the axle counter section for which the axle counter section shall work properly for train running at maximum speed as specified.

#### 5.8 Earthing:

- 5.8.1 Provision of earthing should be there in the central evaluator, field unit and reset box. The earth terminal shall be suitable for taking upto 4mm dia. copper wire with lug.

#### 5.9 Event Logger

- 5.9.1 The Event Logger shall be inbuilt in the Central Evaluator.
- 5.9.2 The event logger should work automatically without any other input

required to be given by staff.

- 5.9.3 Digital Axle Counter failures shall not affect in any way the correctness of the information recorded in the Event Logger. Neither shall it cause its loss or change.
- 5.9.4 The data registered in the event logger must be secured against erasing by unauthorized persons.
- 5.9.5 It should be possible to download logged events to a commercial computer/Pen Drive through standard port.
- 5.9.6 The process of event logging and downloading of logged events should not hamper the normal working of axle counter in any manner.
- 5.9.7 The event logger shall record following events at the minimum:
  - 5.9.7.1 Resetting of a track-section, field unit or central evaluator.
  - 5.9.7.2 Failures/errors in field units or central evaluator.
  - 5.9.7.3 Breakdown of communication link (s).
  - 5.9.7.4 Change in relay status for section occupied / clear.
  - 5.9.7.5 Changes in 5 V output of DC-DC converter beyond limits.
  - 5.9.7.6 Change in date / time.
- 5.9.8 Provision should be there to log minimum 40,000 events. In case of its memory becoming full, the event logging should be on first in first out principle.
- 5.9.9 All data will be recorded in a user-friendly form with date & time stamp in English Language.
- 5.9.10 It shall be possible to download the data for a user-selected period.

## 6. Diagnostics

- 6.1 Diagnostic system of the axle counter shall provide-
  - 6.1.1 Local and remote diagnostics and testing of system through a serial connection.
  - 6.1.2 Self-detection of errors and display through error codes and brief description in diagnostic terminal. The same display should normally show in count / out count detection point wise and section wise and software version no. when the system is switched on initially.
- 6.2 Diagnostic information should not be considered vital.
- 6.3 Diagnostic functions shall be carried out on a permanent basis without disturbing normal operation of the equipment.
- 6.4 Information on the state of the equipment in failure situations and on operations performed by the staff shall be registered with time stamping.

## 7. Traction and supply

- 7.1 Axle Counter system shall be capable of working in all sections including non-electrified, 25 kV 50 Hz AC, 1500 VDC & 750V DC electrified areas.
- 7.2 The axle counter should operate correctly under traction return currents of up to following magnitudes
  - 7.2.1** 25 kV / 50Hz 1000 A
  - 7.2.2** 1.5kV/dc 6000 A
  - 7.2.3** 750V/ dc 3000 A
- 7.3 The currents or their harmonics flowing in the rolling stock & rails shall not affect the digital axle counter.
- 7.4 The equipment shall be insensitive to extraneous magnetic or electric fields such as due to traction return currents on electrified sections, traction motor failures, vehicle magnetism or due to any other source.
- 7.5 The electromagnetic brakes in both on and off states should not affect the axle counter.

## 8. DC Input Power Supply

- 8.1 The field unit shall work with power supply of 24V DC fed from a remote location. The input voltage range is +24V DC (+20% to -30%) & will have a maximum ripple as per Para 5.4.23 of RDSO/SPN/165 or Para 5.4.2 of IRS: S 86/2000.

- 8.2 The Central Evaluator shall work with same type of power supply as mentioned in Para 8.1 but range will be 24V+ 20%, -10%.
- 8.3 The power consumption in the equipment shall be low. It should be less than 0.75A for field unit at 24VDC (nominal).
- 8.4 There should be protection of over voltage, under voltage and polarity reversal.
- 9.0 Purchaser should specify:
  - 9.1 Number of detection points and track sections required.
  - 9.2 The length of cable required with each track device (Refer Cl. 5.3.10).
  - 9.3 Specialized tools and measuring instruments required.
- 10.0 Tools for maintenance:
  - 10.1 The manufacturer shall indicate special maintenance instruments and tools that may be necessary for safe and reliable adjustment and maintenance of equipment and supply these, if so, required by the purchaser.

## **PART-(G)**

### **TECHNICAL REQUIREMENTS OF UFSBI FOR IB APPLICATION**

1. The Universal Failsafe Block Interface (UFSBI) must be confirming to RDSO Specification no. IRS/S-104/2012 (Ver. 0) or latest for IB Signalling Application
2. Requirements as per Para 18 of RDSO specification no. RDSO/SPN/177/2012 (Ver. 3)
 

(a). Medium of working	:	OFC and Quad Cable with Auto Changeover
(b). Type of Block Instrument:	:	SSBPAC(D) Double Line with Block Panel
(c). Communication	:	Voice/ Data
(d). Relay Rack Wiring	:	To Suit IB Signalling Application

**PART- (H)**  
**TECHNICAL REQUIREMENTS OF DESIGN AND DRAWINGS**

**1.0 General:**

- 1.1 Design of signalling circuits should meet the requirements of Signal Engineering Manual, Recommendations of Working Group on Signalling 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 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.
- 1.3 System shall be designed for use with Dual Video Display Unit (VDU).

**2.0 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.CSTE/CN/D&D/BNC.
- 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.

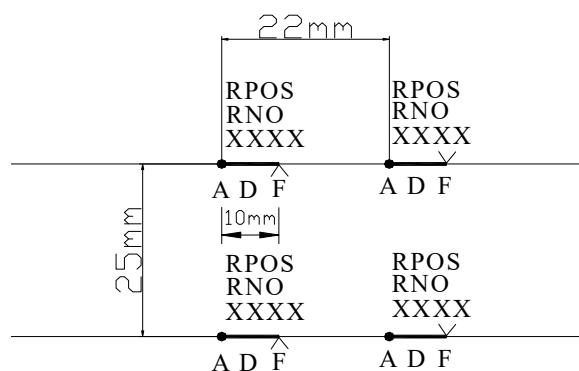
**3.0 Design:**

- 3.1 The interface circuits must be designed as per the final phase of the Signalling 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 As per latest policy Point FCOR logic NDKR/RDKR shall be implemented.

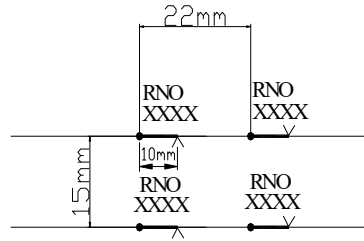
- 3.9 In UCR logics, conflicting ASR/ TRSR/ TLSR shall be proved but for Calling ON signals, only UCR back contact of the main signal above it shall be proved.
- 3.10 In yards with sectional route release, railway shall indicate the track circuits to be used in the ASR logics in the Table of Control (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.

#### 4.0 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 left hand side an extra margin of 30mm should be allowed for binding.
- 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 – Auto CAD.
- 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 be 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:
- (i) Arm to contact: 10 mm
  - (ii) Arm to Arm: 22 mm
  - (iii) Line to Line: 25 mm



- 4.6 Minimum space in the design elements in Application Logic circuits shall be maintained as follows:
- (i) Arm to Contact: 10 mm
  - (ii) Arm to Arm: 22 mm
  - (iii) Line to Line: 15 mm



- 4.7 Height of Title signature column) should be 30mm from inner borderline.
- 4.8 Sheet Nos. should be serially marked in X of Y format without omitting any numbers in between sheets.
- 4.9 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.
- 4.10 Outdoor location termination and wiring details shall be incorporated in the As Made Interface circuit diagrams.
- 4.11 Circuits shall be grouped in the sequence of signal initiation to route release, panel indication, Block and Miscellaneous circuits as follows:
- KNOB/ BUTTON LOGIC
  - NLR/ RLR
  - LR/ UR
  - NR/ RR
  - ZNR/ ZRR
  - ASR
  - LOHR/ ROHR
  - ROUTE CANCELLATION/ EMERGENCY CANCELLATION
  - TRSR/ TLSR/ TLZR (STATION WITH SECTIONAL ROUTE RELEASE)
  - POINT OPERATION
  - PCR
  - NWKSR/ RWKSR
  - ZWLKR
  - UCR
  - CRANK HANDLE
  - TSR
  - HZR



- HR/DR/UGR
- INDICATION
- BLOCK/UFSBI, BPAC
- GFXR/ UNCR BUZZER/ POWER FAILURE/ TJ FAILURE/ DC-DC FAILURE LOGICS
- FCOR
- REDIRECTIONAL
- DATA LOGGER
- MISCELLANEOUS

- 4.12 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.
- 4.13 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.

## **PART-(I)**

### **TECHNICAL REQUIREMENTS OF AS MADE DIAGRAMS**

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 Blue Prints of the following design and documents shall be handed over to the Railway.
  - (a) Equipment Layout diagram
  - (b) Application Logic and associated Circuit diagrams
  - (c) Interface circuits
  - (d) Wiring diagram of All EI equipment's including Object Controllers
  - (e) Panel Termination particulars
  - (f) Relay Contact particulars
  - (g) Terminal Analysis diagram
  - (h) Fuse Particulars
  - (i) Inspectors Completion Certificate
  - (j) Relay Index and disposition particulars
  - (k) Power distribution diagram etc
2. The sizes of different signaling documents are standardized as follows. However, contractor shall take the confirmation about the sizes and media etc before undertaking preparation of As Made drawings and designs.
  - (a) Circuit diagram: A3 Size.
  - (b) Panel termination particulars, FTOT particulars, location particulars: A3 Size.
  - (c) Font name: Times New Roman – Auto CAD.
  - (d) Font size: 10- 2.5 mm
- (e). The above drawings to be made as per SEM/ CSTE Circular (copy may be collected from Dy.CSTE/CN/UBL's office).
- (f). 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.
- (g). After completion of each phase work, the Application logic and Interface circuits has to be updated as per bell test copy / SAT copy and submit 2 sets of corrected Application logic and Interface circuits in plain paper.
- (h). After preliminary approval, required 2 number 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/ blue prints kept in standard plastic covers back-to-back and bounded neatly shall be handed over to the office of Dy. CSTE/Con.
- (i). One set of the above drawings shall be submitted in Reproduction Tracing Film with 2 sets of soft copy in CD's/Pen Drive.

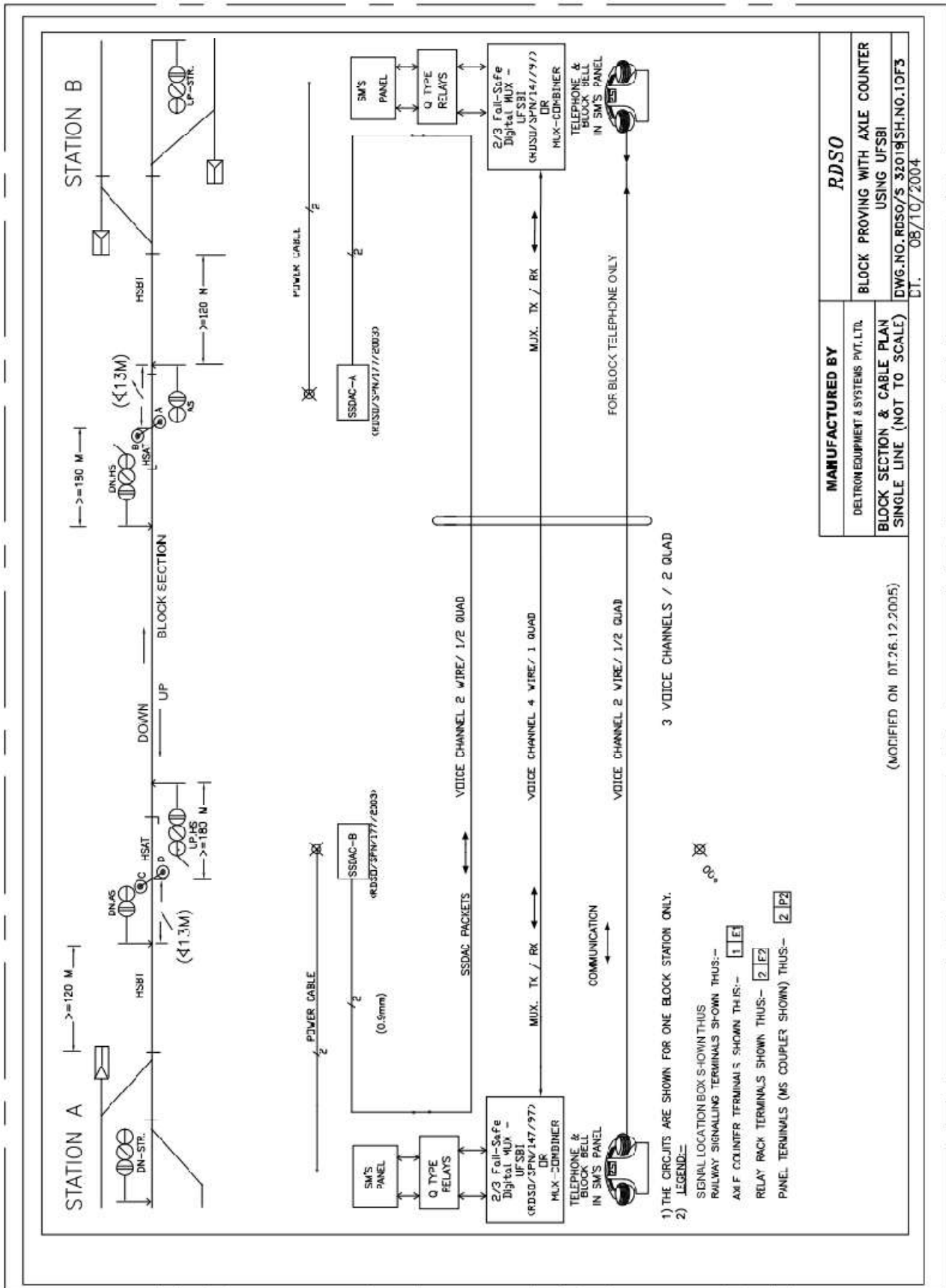
## **PART- (J)**

### **TECHNICAL REQUIREMENTS FOR FIRE DETECTION AND ALARM AND SUPPRESSION SYSTEM**

- 1 Fire Detection Alarm System must be confirming to RDSO Specification No. RDSO/SPN/217/2018 ver-2 or latest...
  - 1.1 The detectors shall be suitable for installation in electrical cabinets, transformers, invertors, cable trays, electronic equipment's, power equipment rooms, relay rooms, or any other enclosed areas.
  - 1.2 It shall be possible to extend the alarm to remote location.
  - 1.3 The working of the equipment shall not cause interference to other electrical/electronic circuits/systems.
  - 1.4 In case of low battery, the system shall give alarm and indication.
  - 1.5 The system shall not degrade the performance of relays, power equipment's, wiring, cables etc. when subjected to Fire Detection & Alarm process.
  - 1.6 It shall Indicate or display the location of fire, status of detectors with all stages of alarms.
  - 1.7 It shall be possible to expand the system by minimum 20% in future in terms of various types of sensors subject to minimum of two sensors in each category.
  - 1.8 Detection, actuation and control system shall have provision for automatic as well as manual operation.
  - 1.9 The Control Panel shall be the central processing unit of the system, receiving and analyzing signals from Probe type bimetallic heat detectors, UV/IR flame detectors, Heat and Smoke multi sensors, LHS Interface, Aspirating Smoke Detectors and manual releasing devices, providing audible and visual information to the user.
  - 1.10 Manual call points shall be provided at each entrance/exit point of the area under protection.
- 2 Fire Suppression System:
  - 2.1 Gas based Fire suppression system should be as per the NFPA guidelines so that the gas is released within 10 sec in the hazard area to maintain respective 4.7% concentration, required to extinguish the fire.
  - 2.2 The suppressant must be Environment friendly, clean, safe and suitable for Data center, Computer rooms, telecommunication facilities and Power supply equipment rooms.
  - 2.3 Details of the component used in the system should be attached along with the offer for evaluation of the suitability of the system offered.
  - 2.4 Air-conditioned relay rooms shall be provided with aspiration-type smoke detector. Highly sensitive smoke aspiration system for monitoring of rooms and equipment for earliest possible fire detection For Relay rooms as per RDSO spec No. RDSO/SPN/217/2025 ver3.1or latest.
  - 2.5 Aspiration type smoke detector with respect to RDSO specification with necessary CPVC pipe and related equipment's shall be installed.

**PART-(K)**  
**TECHNICAL REQUIREMENTS OF UNIVERSAL FAIL SAFE BLOCK INTERFACE**  
**(UFSBI) BASED BLOCK WORKING**

1. The system must meet the requirements of RDSO Specification IRS S 105/2012 Ver 0.0 or Latest for Block Proving by Axle Counter using Universal Fail Safe Block Interface (UFSBI) and should be confirming to RDSO/ SPN/ 147/ 2005 Rev. 1 or latest for Universal Fail Safe Block Interface (UFSBI)
2. Block Proving System will require the following sub systems for its working as per the scheme depicted in RDSO Drg. No. RDSO/S/32019 Sheet No. 1 of 3 for single line working.
  - i) Block Panel
  - ii) Universal Fail Safe Block Interface.
  - iii) High Availability Single Section Digital Axle Counter
  - iv) Block Telephone.
  - v) Telecom cable/ voice/ data channels provided over optic fiber subsystem using proper multiplexer.
  - vi) Battery Set.
  - vii) Battery Charger/ IPS module.
  - viii) Relay racks and pre-inspected Relays.
3. Except Communication media and 24 V DC supply from IPS module; all other equipment's and materials required for commissioning of Block proving system by UFSBI with block panel shall be supplied by the contractor.
4. Railway will provide 24V DC supply from IPS module; all other voltages required for Block proving system working shall supplied and arranged by the contractors as per RDSO specifications.
5. Block panel at all stations shall be integrated with the Station Master Control panel in an extended chamber/ cabinet as per approved drawing issued by Railway.
6. Prior to manufacturing of the SM control panel, contractor should submit the Panel Face Plate Diagram including the Block panel in scale for approval of Railway. Fabrication shall be done as per the approved diagram.
7. Contractor should supply maintenance tool kit for maintaining the devices and equipment along with the products and equipments.
8. Contractor should arrange three sets of printed and soft copies of Installation, maintenance, trouble shooting and user manuals along with product.
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.
10. Media change over between OFC and Quad should be automatic as per Railway requirement.
11. OEM Engineer shall demonstrate the parameters and fill up the pre-commissioning check list which shall be jointly signed with Railway Representative after detailed quality check of the installation.
12. OEM shall verify the installation and commissioning and issue the OEM certificate as per RDSO guidelines for Electronics based system.
13. Requirements as per Paras -- & 15 of RDSO Specification:
  - i. Medium of working : OFC and Quad Cable with Auto Changeover
  - ii. Type of Block Instrument : Block Panel
  - iii. Communication : Voice/ Data.



**Schedule-B VSS Technical Specifications** (RDSO Specification of IP Based Video Surveillance System Specification no. RDSO/SPN/TC/65/2021 Revision 6.0 with Amendment No. 1, 2 and 3 or latest with all amendments)

Item No.	Item	Description
<b>AMC Station</b>		
B4	Full HD (Pan /Tilt / Zoom) PTZ IP colour Camera	As per Clause No. 7.0 of RDSO Specification of IP Based Video Surveillance System Specification no. RDSO/SPN/TC/65/2021 Revision 6.0 with Amendment No. 1, 2 and 3 or latest with all amendments
B5	Full HD Fixed Bullet type IP	As per Clause No. 5.4 of RDSO Specification IP Based Video Surveillance System, Specification No. RDSO/SPN/TC/65/2021 Revision 6.0 with Amendment No. 1, 2 and 3 or latest with all amendments.
B6	Full HD Fixed Dome type IP	As per Clause No. 6.0 of RDSO Specification IP Based Video Surveillance System, Specification No. RDSO/SPN/TC/65/2021 Revision 6.0 with Amendment No. 1, 2 and 3 or latest with all amendments.
B7	Video Management and recording Software	<p>As per Clause no. 18.1 &amp; 18.2 of RDSO Specification of IP Based Video Surveillance System Specification No. RDSO/SPN/TC/65/2021 Revision 6.0 with Amendment No. 3 or latest.</p> <p><b>VMS Software shall support minimum required cameras as mentioned in the schedule or higher per division on multiple servers (per camera basis Per camera Licence means Video Management (Viewing) and (recording) at multiple locations such as Station, RPF Post &amp; DC Server room, Security control by same license, Zonal HQs, etc.,). Existing Integrated VMS server in Data Centre of each division shall manage, monitor, control and configure all the VMS servers provided at various locations over respective divisions in a federated architecture and multi-tenant model. The newly installed VMS at Thanas/any other locations as directed by railway engineer should be integrated with the existing VMS in the data centre. There is no provision for a separate failover or an independent integrated VMS. Necessary configuration modifications and hardware requirements shall be taken care of by the bidder.</b></p> <p>Video Management Software with federated cloud architecture to be provided for scalability and flexibility to support large-sized VMS installations Scalability: Federated cloud architecture greatly should help in designing and implementing large-sized Video management software to support an unlimited number of cameras, management servers, and big data.</p> <p>Centralized Video Surveillance: Centralized video surveillance should improve the security of the connected organizational branches/sites, provides transparency and helps in enhancing the business operations. Since operations of any connected sites can be monitored from the corporate/main office, management of the enterprise can have a complete hold on the organizational activities. Independent Site Monitoring: Federated cloud VMS system also allows individual sites to have complete control of their site. For incidents triggered via video analytics to be quickly responded and resolved from the local site itself, federated VMS system provides independent control of the VMS at the local sites Support for Multi-tenant VMS architecture: Multi-tenancy and cloud federation should go hand in hand for Cloud based Video management Software. While Multi-tenant Video management Software allows VMS infrastructure to be</p>

		shared with multiple clients/sites simultaneously, federation helps in retaining the independent management of the individual sites. Multi tenancy supports shared infrastructure and monitoring costs, easy upgrades and customization, whereas federation facilitates authorized access to complete VMS System from a single location. Fault Tolerance: Federated cloud architecture should provide fault tolerance to the large-sized VMS system. It enables the VMS systems of the independent sites to work efficiently even in the case of network failure. Even though the central site may not be able to access the independent sites, VMS systems of these sites can record videos and secure their premises with assigned video analytics. On resuming connection with the federated architecture, data of the local sites can be transferred to the main site for analysis. As per Clause no. 18.5 of RDSO Specification of IP Based Video Surveillance System Specification no. RDSO/SPN/TC/65/2021 Revision 6.0 with Amendment No. 3 or latest.
B8	VAS SOFTWARE	<p>As per schedule description (Per camera License means Video analytic at multiple locations such as Station, RPF Post, Security control, Data center and zonal HQ by same license) as per clause No.18.4 RDSO Specification No RDSO/SPN/TC/65/2021 Revision 6.0 with Amendment No.3 or latest. Details of additional, optional features of Video Analytics Software (in addition to RDSO specification) are as under.</p> <ol style="list-style-type: none"> <li>1. AI based video analytics should be able to detect Smoke and Fire in a defined area. (Optional)</li> <li>2. Auto tracking of person whereabouts while movement in Railway Premises through Video analytics in Fixed cameras. (Optional)</li> <li>3. People counting. (Optional)</li> </ol> <p><b>Note: Where ever required the optional features shall be configured and made available as directed by railway representative.</b></p>
B9	Layer 2 Switch, Minimum 8+2 Port Manageable	As per Clause No. 14.0 (iii) field switches of RDSO Specification of IP Based Video Surveillance System Specification no. RDSO/SPN/TC/65/2021 Revision 6.0 with Amendment No. 1, 2 and 3 or latest with all amendments
B10	12F FDMS	<p>The FMS should be confirming to RDSO specification No. RDSO/SPN/TC/37/2020 or latest. However, the FMS should have the following:</p> <p>It should be mountable in standard 19" rack and of slider type. There should be an arrangement of termination of 48/24/12/6 No of fibers. It should be supplied with 48/24/12/6 Nos. of pigtails of respective type of connector of minimum 1.5 meters length. Colour coded pigtails (µn tight jacket) shall be provided for easy identification.</p> <p>The FMS should be supplied with arrangement of required Nos. of adapters.</p> <p>The adaptors shall be fixed in such a way that these shall be easily accessible protecting the eye from direct exposure to laser.</p> <p>There should be a nos. of trays or as per site requirement for the provision of termination of the fibres &amp; sufficient space for routing of the fibres in the trays.</p> <p>Trays shall be numbered bottom to top (tray no. 1 is lower most).</p> <p>Pigtails shall follow tray numbering.</p>

		<p>Pigtails shall be labelled through colour coding/ferruling.</p> <p>Adaptors shall be numbered Bottom to Top or Left to Right in ascending order.</p> <p>All adaptors shall be provided with dust protection caps.</p> <p>Important Do's and Don'ts about the operation of the FMS shall be clearly indicated at a convenient place on the FMS.</p> <p>Insertion Loss: <math>\leq 0.3</math> dB or less</p> <p>Return Loss: <math>\leq 45</math> dB or less</p> <p>The FMS shall be manufactured as per latest state of art technology.</p> <p>The FMS shall be protected against the entry of dust and insects, rodents etc.</p> <p>Body should be of MS steel; powder coating painting (min.70 micrometres thickness) shall be provided with rust resistance paint.</p> <p>Marking: The marking on the system shall be indelible and following minimum information shall be provided by way of engraving or Laser printing method:</p> <p>"SWR" should be written on each FMS to be visible from front.</p> <p>Manufacturer's name &amp; date/ year of production.</p> <p>Model No./Batch No./ Serial No.</p> <p>Capacity i.e. No. of cables and the fibres.</p> <p>Identification details/ cables/ Fiber/ labelling facility.</p> <p>Preferred type of connector is SC/APC for all connectors.</p>
B11	Supply and fixing of GI pipe for fixing cameras in open area.	
B12	6U Cabinet	Supply and fixing of outdoor 6U cabinet (IP65 or better) with locking facility, suitable for housing one 8-port switch, fdms, 150 AH tubular battery, solar charging controller, NVR, DC-DC converters with adequate free space for air flow. The cabinet should be fixed in the outdoor pole. Necessary power adapter and all accessories required for this work shall be supplied by the contractor.
B13	Splicing	Splicing/ Drooping/ Termination of each fiber/ Pigtail in the LIU/FDMS/IO Box/Termination Joints through fusion Splicing of the termination of OFC Cables. The Fiber termination shall be tested and the test Report (Soft Copy) in CDs or any USB Storage shall be submitted to the site Engineer for records. Each fiber shall be properly marked with necessary ferrules/tags.
B14	Blowing & Drawing ofc	Blowing & drawing of OFC 24F/12F/6F, Switchboard telecom cable, CAT-6 and Power Cable (including crimping and termination of copper cables) through PVC Conduit/GI/DWC/HDPE Pipe. OFC should normally be blown through the ducts by blowing through machines; drawing may be adopted in short lengths as decided by the site engineer.



B15	30 days storage	As per RDSO Specification No. RDSO/SPN/TC/65/2021 Revision 6.0 with Amendment No.3 or latest. Reputed Brand: IBM/Dell/HP or Equivalent. (Per camera License means Video recording at multiple locations such as Station, RPF Post & Security control, CCC and DC by same license). Necessary storage hardware required for all the cameras shall be provided.
B16	Wireless Transmitter and Receiver	As per Clause No. 15.0 of RDSO Specification of IP Based Video Surveillance System Specification no. RDSO/SPN/TC/65/2021 Revision 6.0 with Amendment No. 1, 2 and 3 or latest with all amendments
B17	PC Work Station	As per Clause No. 11 of RDSO Specification No. RDSO/SPN/TC/65/2021 of IP Based Video Surveillance System Revision 6.0 with Amendment No.3 or latest. including 24-inch 4K UHD LED Monitors with all accessories, all required Licensed software, (like Win OS, MS Office, Antivirus-total 3 years security), <b>RAM 64GB,1TB SSD</b> along with cable of Reputed make, Spike buster (minimum 5 Nos. 6A points with fuse), 600VA UPS, Make: Samsung/Dell/HP or similar or better.
B18	8TB Hard disk	The Storage Capacity of External Storage Device shall be as specified in Clause no. 2.8 and 12.0 of RDSO Specification of IP Based Video Surveillance System Specification no. RDSO/SPN/TC/65/2021 Revision 6.0 with Amendment No. 1, 2 and 3 or latest with all amendments
B19	3 KVA UPS	3 KVA Online UPS with 2 Hrs SMF Battery Backup. This also includes supply of one set MF battery of suitable AH capacity Rack and one set compatible MCBs complete with cover & fixing materials, one earth leakage circuit breaker arrangement. Make:Exide/Amaron/Tata green or better
SWR Sor 2025 Chapter 21 Item No.43	Portable Maintenance Terminal	As per Clause 8.7 & 8.9 of RDSO Specification of VoIP Based Train Control Communication System Specification No. RDSO/ SPN/ TC/ 99/ 2012 Rev.2 or latest. The specs includes i7 Processor, 16GB RAM, 1TB SSD, MS Office with latest license version, Windows OS with latest version & Anti-Virus with Three Year licences, USB to Serial cable, Monitor size 14/15.6 inch or better. Shall be of reputed brand with all client software loaded.
SWR Sor 2025 Chapter 21 Item No.23	CAT-6 Patch Cord 5 mtrs	UTP CAT6 Cable, Cable jacket lowSmokezerohalogen(LSZH), conductor dia 23AWG, confirming to ANSI/TIA/EIA-568-C.2 or latest. Make.D-Link or equivalent.
SWR Sor 2025 Chapter 21 Item No.20	24F FDMS 19" Rack Mount with Telescopic type	a. It should be mountable in standard 19" rack and of slider type. b. There should be an arrangement of termination of 48/24/12/6 Nos. of fibers (as per SOR). c. It should be supplied with 48/24/12/6 Nos. of pigtailed of respective type of connector of minimum 3 meter length. d. Colour coded pigtailed (µn tight jacket) shall be provided for easy identification. e. The FMS should be supplied with arrangement of required Nos. of adapters (as per SOR). f. The adaptors shall be fixed in such a way that these shall be easily accessible protecting the eye from direct exposure to laser. g. There should be a nos. of trays or as per site requirement for the provision of termination of the fibers & sufficient space for routing of the fibers in the trays. h. Trays shall be numbered bottom to top (tray no. 1 is lower most). i. Pigtailed shall follow tray numbering. j. Pigtailed shall be labeled through colour coding/ferruling. k. Adaptors shall be numbered Bottom to Top or Left to Right in ascending order. m. All adaptors shall be provided with dust protection caps. n. Important Do's and Don'ts about the operation of the FMS shall be clearly indicated at a convenient place on the FMS. o. Insertion Loss: ≤ 0.3 dB or less p. Return Loss: ≤ 45 dB or less q. The

		FMS shall be manufactured as per latest state of art technology. The FMS shall be protected against the entry of dust and insects, rodent's etc. s. Body should be of MS steel; powder coating painting (min. 70 micro meter thickness) shall be provided with rust resistance paint.
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**Note:** To ensure security of VSS (Camera & Software) from vulnerabilities & breaches and discourage false undertaking from OEMs, security auditing and testing of equipment including source code of camera and software shall be carried out from STQC (Ministry of Electronics & Information Technology) or any other Government Agency from the list of CERT-In empanelled Information Security Auditing Organization. In order to ensure security of network and other IT equipment of VSS system, before bulk supply and installation, purchaser should ensure that security auditing and testing at the time of POC (Proof of Concept) as well as at the time of completion of project are conducted or as specified by the purchaser. In case any security breach is found in the system at any stage including at POC level, immediate strict penal action is to be initiated by the purchaser. (As per Clause No. 3.0 of RDSO Specification of IP Based Video Surveillance System Specification no. RDSO/SPN/TC/65/2021 Revision 6.0 with Amendment No. 1, 2 and 3 or latest with all amendments)