

## Technical Specification

### Item no. 1. Supply of SFP Optical/Electrical 1 Gbps or 100/1000 Mbps Electrical as required.

The contractor shall do the supply of small form-factor Pluggable (SFP) as per IEEE standard: IEEE 802.3 z, Connector type : LC type, Wavelength(nm) :1310 nm, Fiber type: Single mode , Max cable distance: upto 20 Km. Inspection: Consignee

#### Inspection- Consignee

### Item no. 2. Supply of STP (Shielded twisted pair) CAT-6 Cable as per EIA/TIA-568-B Specification or latest.

The contractor shall do the Supply of STP (Shielded twisted pair) CAT-6 Cable as per EIA/TIA-568-B Specification or latest. As per below specification.

STP CAT 6 Cable	
Shielding Type	Shielded
Cable Type	Twisted Pair
Cable Length	305m
Cable Size	23 AWG
Type Of Cable	PVC
Insulation Material	PVC
Wire Type	Twisted

#### Inspection- Consignee

### Item no. 2. Excavation of cable trench of 1.20 mtr depth and 30 cm width in all kind of soil.

#### 1. INSTRUCTIONS FOR EXCAVATION & BACK FILLING OF TRENCHES

2. The representative of Engineer in charge of the work will mark the route of the cable in white chalk or lime as per the tapping and route plan and the instructions given to him by the Engineer, not withstanding the cable route shown in the tapping and route plan to meet the requirement of local conditions at site, if any and as required shall be taken by the contractor to be final. The contractor shall be present at the time of marking and he shall furnish to the engineer's representative required quantities of lime, rope labour etc. for carrying out this work. The marking will be given on the track side of the trench at a distance approx. one meter away from the center line of the trench. In the difficult terrains such as water logged areas, the position of the cable route will be specified by off sets from the center line of the nearest track.

3. Trenches for telecommunication cable shall normally be done. Digging to a depth of 1 2 0 cm as specified in schedule of work. The width of the trench shall be 30 cm as per schedule of work. In places where underground pipes, electric main etc. come in the way, trenches shall be dug as necessary and HDPE pipes shall be placed to protect the telecom cables.

4. Metalled, macadamized, concrete and stone paved roads shall also be cut to a depth of at least 1.2 meter. The cable shall be laid through HDPE pipe or through trenchless method at a depth of 1.200 Mtr, as per direction of site engineer. The road surface shall be restored to original.

5. The bottom of the trench where the cable is to be laid shall be thoroughly prepared and shall be free from any stones. The bottom of the trench shall be horizontal and shall in no case be undulating. When

the cable bed changes from solid to soft surface or from the bridge to soft soil, tamped fill at the transition point shall be provided so that cable is not pressed against the edge of a hard surface.

6. The back filling of trenches shall be done by tamping and consolidating the excavated soil in layers of 15-20 cm at time. All the soil that is excavated shall be put back to the trench and care shall be taken in consolidation to ensure that the back filling does not suffer any sinkage in monsoon. The left out earth if any within station limit has to be thrown out from Railway premises by the contractor at his own cost.

7. Wherever the Engineer's representative considers it necessary to adopt shoring, the contractor will be required to adopt shoring for which the contractor shall have sufficient quantities of shoring material on hand. Where the direction of trench has to change, it should be done in a gentle curve of not less than one meter radius and not at sharp angles.

8. Places where back filling is not done properly are likely to get water logged with the first rains after completion of the work, the contractor and engineer's representative will inspect the entire section soon after the first monsoon and the contractor will arrange to set right such areas.

9. TRACK / BUSY ROAD CROSSING Cables, crossings across railway tracks/busy roads etc. shall be done in G.I. pipes, taking the cable through these pipes. The contractor shall cross the railway track / busy road by excavating trenchless method at a depth mentioned in schedule, where ever necessary on the direction of site engineer. Two G.I. wire of 10 SWG size shall be threaded through G.I. pipe, one to pull the cable one for future use.

#### 10. ROAD CROSSING

11. When crossing road ways it is necessary to lay the cables in such a manner as to avoid the necessity of handling the cable sharply and minimize the excavation of road surface as far as possible. Where cable is laid in surfaced trunking, the trunking alignment should be curved down to the pipes and proper bricks or concrete joint should be made between trunking and pipe.

12. The crossing of main roads often involves difficulties especially if traffic is heavy, precautions to avoid accidents to workmen, pedestrians and vehicles should be taken. on minor roads which can be temporarily closed to traffic it is possible to open up and cross the entire width of the road. Pipes should be installed quickly in the cutting which is then filled in there by reducing to a minimum time for which the road is closed.

13. Track crossing and crossing at busy roads should be done through trenchless method according to schedule of work.

14. HDPE pipe trunking under metal roads but depth should be as per schedule of work & as per direction of site engineer.

#### 15. CABLES OVER STEEL GIRDER BRIDGES

16. Cable may be laid through G.I. pipe / HDPE pipe on steel girder bridges or by way of Horizontal Direction drilling ( HDD) trenchless technology method using HDPE pipe as per direction of site engineer.

17. Where the cable has to cross the steel girder bridges, the cable shall be protected with G.I. pipe/HDPE pipe fitted on the steel girder bridges with suitable galvanized clamps without drilling holes in the girders. Arrangements for laying the cable over girder bridges shall be similar to one by way of Horizontal

Direction drilling ( HDD)trenchless technology method using HDPE pipe as per direction of site engineer.

18. When laying cable on long bridges, the question of longitudinal expansion caused by temperature differences should be taken into consideration and suitable cable loops should be provided at the pillars of the bridge.

19. The laying of the cable on the bridge is to be done with much care and planning. it is necessary that the cable drum to be laid on the bridge is inspected and tested thoroughly so that damaged cable is not installed.

20. As the laying involves movement of large number of staff over the bridge the line should be blocked and flagman posted on either side. On a double line near which the cable is being laid should be blocked but care should be taken to see that staffs are aware of this and measures taken to prevent staff from staying on to the unblocked line.

#### 21. TO CROSS THE CULVERTS & BRIDGES

22. Where feasible the cable shall be laid under the bed of the culvert, using Horizontal Direction drilling ( HDD) trench less technology method using HDPE pipe as per tender schedule as well as per direction of site engineer. up to a length of approximately 100 meters.

23. In case of wet culverts or unfriendly terrains where it is not feasible to lay cable under the bed of the culvert through trench less method using HDD system, the cable may be laid over the culvert in HDPE pipe

24. The protection of cable on Arc Bridges & approach to culvert & bridges .

25. CABLES IN MARSHY AREAS In marshy area where it is not possible to divert the cable route the cable shall be suitably laid and protected as per decision of site engineer depending on site condition, like laying cable in HDPE pipe / RCC pipe supported on masonry pillars/iron channels etc.

#### 26. LAYING OF MAIN / DERIVATION CABLE IN MASONRY BUILDINGS & CABINS:

27. When Cable will have to be laid inside any masonry building such as cable hut, ASM's room at a depth of 0.75 M by cutting the masonry structure of the wall After the cable has been led inside the masonry wall the floor inside shall be duly repaired and plastered.

28. When a cable has to be taken and terminated on the Ist. floor cabin it shall be first led inside the ground floor of the cabin by cutting the masonry structure of the wall of the cabin and then it will be taken through a HDPE pipe fixed vertically on the inside of the cabin wall by suitably clamps to be embodied on the wall as per arrangement .

#### 29. LAYING OF CABLE IN SPECIAL CASES

30. NEAR POWER CABLE: When the contractor comes across any other cable already laid, he shall first report the fact to the engineer .& cable should be identified by the Engineer as a power cable (LT or HT). The trench shall be dug as far away from the route of the power cable as practicable.

#### 31. CROSSING OF TELECOMMUNICATION CABLE WITH ANOTHER CABLE: Crossing of the

telecommunication cable with another cable shall be avoided wherever possible. Where however, this is not possible, the telecommunication cable shall be laid in cement or asbestos cement pipes. The length of pipe of to be provided on either side of the crossing shall be at least one meter.

### 32. LAYING OF OTHER THAN TELECOM. CABLE IN THE SAME TRENCH

33. No other cable shall be laid in the trench for the telecommunication cable. Where, however, exceptional circumstance exists, the telecommunication cable may be laid along with another cable in the same trench provided a specific permission of each such case is obtained in writing from Engineer. When telecommunication cable and L.T power cable/ Signalling cable have to be laid in the same trench they shall be separated by placing a layer of brick between them vertically (approx. 16 bricks/ meter) or laid in HDPE pipe.

### 34. LAYING OF CABLE THROUGH PIPES.

35. The cable shall be laid through G.I./HDPE pipes at the locations marked on the tapping and route plan and as advised by the Engineer or his representative. 36. Laying the cable through pipes galvanized steel wires of a cross section not less than 10 SWG shall be used as a lead wire. Two such lengths of wires shall be laid through the pipes, so that after the cable is threaded through the pipe, one lead wire is permanently left in the pipe with a suitable overlay at two ends, to enable the cable to be pulled out at a later stage if required to do so.

37. On arch bridges and culverts bridges the cables will be threaded through GI/HDPE pipes etc. while threading the cable through these pipes the contractor shall do the trenching to the required depth wherever necessary for which no extra charge will be paid.

38. LAYING NEAR OILY SURFACE. If during the excavation of trenches for laying cables the contractor or his representative notices the presence of oil or oily substance or any other chemical which is likely to cause the deterioration of the cable protective material he shall bring the matter to the notice of the engineer or his representative and on the latter's decision he shall choose an alternative cable route or he shall protect the cable in such places in such a manner as advised in writing by the engineer or his representative. No additional charges are payable.

39. SPECIAL SOIL CONDITION.: Cable should not be run through abnormally high acidic or alkaline soil or through sewages. If this is unavoidable special measures should be taken against corrosion as advised by the engineer in charge.

40. PROTECTION AGAINST DAMAGE DUE TO SHARP EDGES. When cable are laid in trunking care should be taken to see that no ballast or stones have been dropped inside the trunking, should be cleared of all ballast and stones before the cover is secured. When the ends of covers are joined together with cement plaster a piece of paper or wood should be placed under the joint to prevent the cement plaster from falling on the cables.

41. Laying of cables in the vicinity of traction sub-stations, OHE switching stations and their associated earthing system shall be governed by the following principles:

- In the vicinity of traction sub-stations, the cable shall be laid at least one meter away from any metallic body of the sub-stations, which is fixed in the ground, and at least one meter away from the sub station earthing. The cables shall, further, be laid in concrete pipes or enclosed brick channels for a length of 300 m. on either side of the sub-station. As far as possible, the cable should be laid on the side of the track opposite the substation side.
- In the vicinity of the OHE switching stations (feeding posts, sectioning and sub-stationing posts), the cable shall be laid at least one meter away from any metallic body of the station which is fixed in the ground and at least 5 m. Away from station earthing. The distance of 5 meter from station earthing can be reduced to one meter, provided the cables are laid in concrete piles

- Where an independent earth is provided for an OHE structure, the cables shall be laid at least one meter away from such earthing

#### 42. HANDLING OF CABLE DRUMS & LAYING OF CABLES:

43. The drums shall be unloaded by the side of the Railway Track from either a crane or any other suitable means very carefully so as not to cause any damage to the cable. The drums at site shall be protected until they are laid.

44. On each drum there are two ends, A&B. The 'B' end of one cable length shall meet 'A' end of the next cable at a joint. The 'A' end shall be normally on the top unless indicated otherwise on a drum.

45. The drums shall always be kept upright i.e. axle in parallel position to the base. The drums shall not be set by jerks but shall be handled slowly and with care. The walls of the drums should not be damaged while moving the drums if required for unrolling.

46. The drums shall normally be unrolled at the same place and the cable carried by workmen near the trench. The drums shall not be dragged in any case, but where drums of cable have to be moved would always be rolled in the direction of the arrow, otherwise the coils tend to unwind and the cable may get battered. In case no direction arrow is marked on the drum remove several battens and determine the direction in which the cable is coiled. The arrow should then be painted on the drum pointing in the opposite direction in which the upper cable end is coiled so that future handling of the cable drum is facilitated and then replace the battens carefully.

47. The drum should be properly mounted on jacks (or on a cable wheel) making sure that the spindle is strong enough to carry the weight without bending and that it is laying horizontally in the bearings so as to prevent the drum creeping to one side or the other while it is rotating. Before attempting to pull off the cable, remove the end protection box attached to the flange of the drum and cut the security ropes so as to leave the cable and free to move.

48. If a portion of the cable only is taken out from the cable drum, the battens should be Immediately replaced to prevent damages to the balance of the cable. This is important.

49. With armoured cables having Hessian serving it is possible under extreme conditions for the bitumen to soften and cause adjacent turns of the cable on the drum to stick to each other. In such cases, particular care must be taken to pull the cable of these drums very slowly and to free the cables carefully from the adjacent turns on the drums. Snatching of the cable to cause it to break away may result in kinks and damage, small size cable require care in this respect.

50. The use of steel bars between the bolt heads to 'jump' or turn the drum around is dangerous to staff and likely to damage the drums. A better method is to use two steel plates with grease between them by standing the drum on these greased plates, it can be easily turned round to the desired position.

51. All care should be taken in handling cable drums with a view to ensure safety not of the cables but also of the working party handling them. The man should not be allowed to brake the cable drum by standing in front but only from side.

#### **Inspection-Consignee**

**Item no. 4. Supply of networking Gigabit switch 24 port POE+ having 4 Uplink fiber ports Min. Switching capacity 128 Gbps.**

### Architecture & Performance

Switch with at least 24 X 10/100/1000 Mbps PoE Ports and 4 SFP or SFP+ Ports.
Switching capacity should be 128Gbps or higher or non-blocking architecture.
Switch packet forwarding rate should be 95.24 Mpps or higher or non-blocking architecture.
Switch Should Support IEEE 802.3af & at compliance (for PoE ports) and 370W Power Budget.
Switch MAC table should be at least 16K or higher.
Switch should be standard 19 inch 1U rack mountable.
Support for the Energy Efficient Ethernet (IEEE 802.3az) standard.
Power input should be 100 to 240 VAC, 50/60 Hz, internal power supply.
Operating temperature should be -5 degree celsius to +50 degree celsius.
Certification: CE, FCC, BSMI, RoHS and cUL.
<b>Switch Software Specification</b>
Should support Head of Line blocking prevention for lower latency and better performance.
Support Jumbo Frame up to 12K Bytes or higher.
Should support IGMP Snooping, Able to create 250 or more IGMP groups and require support for IGMP Snooping Fast Leave,IGMP Snooping Querier
Should support MLD Snooping, Able to create 250 or more MLD groups, Per VLAN MLD Snooping and require support for MLD Snooping Fast Leave.
Should have 802.1D STP, 802.1w RSTP and 802.1s MSTP Spanning Tree Protocol.
Should support Spanning tree Root restriction
Should support Loopback detection (LBD) to detect the loop created by a specific port.
Should support Multicast Filtering to filters or forward all unregistered groups.
Switch should support IEEE 802.1Q VLAN tagging for Ethernet frames.
Different type of VLAN like Port based, Auto Surveillance, Auto Voice, Asymmetric Vlan etc. should be available for configuration.
Switch should support QoS (quality of service) IEEE 802.1P for traffic prioritization. It should support 8 queues per port.
Different type of QoS priority like Strict Priority Queue and Weighted Round Robin.
Port based ingress / egress rate limit function should be available with limit in increments as low as 16 Kbps
Switch should support Neighbor Discovery (ND) protocol for IPv6.
Switch should support to create atleast 4 IP interface
Should support default routing and static routing with minimum 100 IPv4 static route entries and minimum 50 IPv6 static route entries.
Support at least 700 rules shared by IPv4, MAC, and IPv6 & Each rule can only be associated with a single port.
Should support port security to secures the access port based on MAC address.
should have broadcast, multicast, and unicast storm control to prevents faulty end stations from degrading overall systems performance.
Support Traffic Segmentation to restricted traffic flow from a single or group of ports, to a another group of ports.
Should have SSH and SSL for IPv4 and IPv6.
Require prevention of DoS attacks, which include Land, Blat, TCP Null Scan, TCP Xmas Scan and TCP SYNFIN.
Should support 802.1X port based authentication.

Should support ARP spoofing prevention.
Should support DHCP snooping and DHCP server screening.
Switch should be able to create a binding table for IP + MAC + Port to prevent a malicious user from spoofing or to restrict the unauthorized users.
Should support 802.1X RADIUS and local server database authentication.
Should have option to check the status of copper cables using the cable-diagnostics time domain reflectometer (TDR).
Able to manage through Web-GUI, CLI, Telnet & SNMP
Should support SNMP v1, v2c, v3 and SNMP Traps and Remote Monitoring (RMON).
Should have dual Image support to reduce down time for the switches.
Switch should support dynamic host configuration protocol (DHCP) auto configuration of multiple switches through a boot server to ease switch deployment.
Should have SNTP/NTP protocol for time synchronization.
Switch should be IPv6 Ready Compliance.
Should support Link Layer Discovery Protocol (LLDP) and LLDP-MED.
<b>Note</b>
Switch should be supplied with all necessary components like Power cord, Rack-mount bracket, Installation Guide, etc. and necessary software image file to fulfil all above mentioned feature set from day 1.

#### **Inspection- Consignee**

##### **Item no 5:- Supply & Installation of OFC Joint Closure**

The contractor shall supply and install the OFC joint closure (TEC specification No. TEC/GR/ TX /OJC-002/03/APR 2010. & RDSO Spec- RDSO/SPN/ TC/68/ 2014 Revision 1.0)) along with latest amendment & making straight through joint for 24 fibre cable & end testing. This includes splicing & making pits etc. The Joint pit should be of size 1mx1mx0.6m, using bricks, sand and cement in the ratio 1:3. The thickness of the wall shall be 120 mm. The top cover shall be of concrete of thickness 75 mm with two iron handles on top of it. The pit shall be covered with sand after putting the joint enclosure. All construction material to be supplied by contractor.

Splicing of 24 core optic fiber cable and making the splicing joint with contractor's own machine and tools. Joint should be prepared in such a way that the top of the enclosure should be at a depth of minimum 1.2 mtr and the enclosure should be covered with soft soil and bricks. Splice loss of each fibre should be less than 0.05dB.

#### **Inspection- Consignee.**

##### **Item no. 6. Supply and installation of FDMS and termination of IN and OUT 24 fibre OFC cables as per GR No G/FDM-01/02 April-2007 of TEC or latest.**

The contractor shall do the Supply and installation of FDMS/LIU and termination of IN and OUT 24 fibre OFC cables as per GR No G/FDM-01/02 April-2007 of TEC or latest.

The FDMS/LIU should be as per below specification:-

The FDMS/LIU should be fully loaded with 24 SC adpater 4x6 fully loaded SC-SM Fiber LIU/FMS Box Single mode.

- Have sufficient slots to accommodate Simplex/duplex SC/LC/FC adapters individually.

