## Guidelines for overhead hopper/chute/crane loading/unloading of rakes in electrified sidings

1. **OBJECTIVE** :

- To provide a solution for overhead loading at freight terminals in electrified territory.
- To minimize the rake loading time thereby improving wagon turnaround time.
- To ensure safety of personals involved in loading
- Improvement in system as a whole.
- To optimise utilization of the crew.

2. **Background**: At most of the existing overhead freight loading points (using hopper/tray for loading the wagons), no uniform way of placement of wagons, its loading & withdrawal after loading exists. In fact, it is not possible to place empty wagons for loading under hopper with the incoming rake due to non availability of OHE near the loading area. Most of the loading at such points attract multi mode systems with dependency on each other. In addition, manual system (winch) is adopted to place the wagon right under the loading point (Hopper/tray), thus it takes lot of time for entire rake loading.

With the increase in the number of sidings and electrification of yard lines in the vicinity of loading lines, it has become imperative to introduce a system by which smooth placement, safe loading & speedy withdrawal of freight rake is possible. Though, there are few systems already in use over Indian Railways, however, no standard arrangement exists, which can be straight way adopted after carrying out clearance study.

To standardise the loading arrangements in the electrified sections, guidelines for overhead hopper loading of freight trains in electrified sidings are being issued.

3. **Layout of the siding**: The placement of rake shall depend upon the layout of the yard lines in the vicinity of loading area. Generally, three types of layouts, as shown in Fig 1, 4 , drawing No. TI/DRG/OHE/SWL/RDSO/00010/08/0 have been considered and these systems call for separate methods of OHE layout for placement of empty rake in loading area & its withdrawal after loading. These are covered under Scheme-I, II, III & IV.

4. **Scheme-I**

**4.1 Issues involved**: The major issues involved in finalising the arrangement in this scenario (Fig. 1) are:

a) To maintain the statutory clearance between the contact wire and fixed structure.
b) To ensure adequate vertical electrical clearance from lowest part of the loading arrangement (hopper/tray) to the top of the contact wire of tram way type OHE.
c) To avoid direct falling of loading material on the contact wire.
d) To provide signal (audio-visual) to alert the personnel's working in the loading area, on energisation of OHE.
e) To provide electrical isolation to loading area including hopper/tray.

**4.2 Layout of siding:** Tentative layout to be adopted for such a siding shall be as shown in the drawing given in Fig 1.0 with focus on the loading area arrangement.

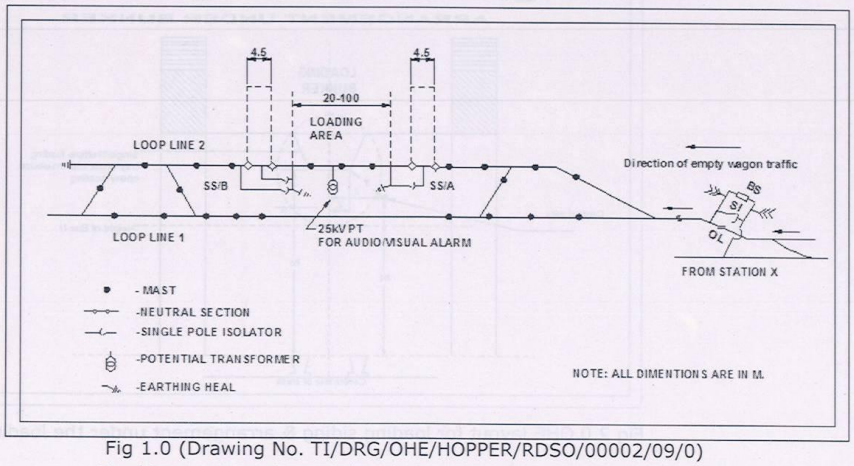



Fig 1.0 (Drawing No. TI/DRG/OHE/HOPPER/RDSO/00002/09/0)
Yard layout & location of electrical equipments in case of Scheme-I

**4.3** **Methodology:** Basic methodology for streamlining the placement of rake, its loading & withdrawal shall consist of following:

a) Tram way type OHE to be adopted.
b) 27 mts span may be adopted under the loading area with one mast erected near the loading point to minimise the effect of contact wire push up.
c) Stagger of contact wire in the loading area to be kept as 400mm to avoid obstruction of falling material to OHE.
d) Vertical electrical clearance from lowest part of the loading arrangement (hopper/tray) from the top of the contact wire of tram way type OHE to be kept as minimum 250mm.
e) To further improve the electrical clearance, Fibre Reinforce plastic (FRP) lining shall be provided on the surfaces of the hopper, which are near to contact wire. Siding owners may even be perused to use insulating material like FRP for the entire loading tray/hopper.

**4.4** **Electrical equipments:** OHE layout in loading area is shown in Fig 2.0 (Sketch No. TI/SK/OHE/CHUTE/RDSO/00002/09/0 & minute details of OHE under loading area are shown in Fig 3.0 (Sketch No. TI/SK/OHE/HOPPER/RDSO/00001/09/0).Following electrical equipments shall be used:

a) **Section insulators** for isolating the OHE under the loading area.
b) **Single pole isolator with earthing heel** shall be provided in the direction of empty traffic movement for isolating the area under the loading zone & feed the OHE between section insulators.
c) **Double pole isolator with earthing heels** to be provided on the other end of loading point to isolate the loading area & feed the OHE in loading area.
**d)** **Potential transformer** shall be connected with the OHE of the loading area & on OHE energisation, it shall provide 100V output to operate 100/230V relay, whose output shall be supplied to the audio-visual system i.e hooter & flashing lights, to warn the staff present in the loading area.
**e)** **Earth pits** shall be provided for grounding of various fixed structures.
f) Structure bond for earthing of the mast.
g) Traction mast.
h) Tram way type OHE.

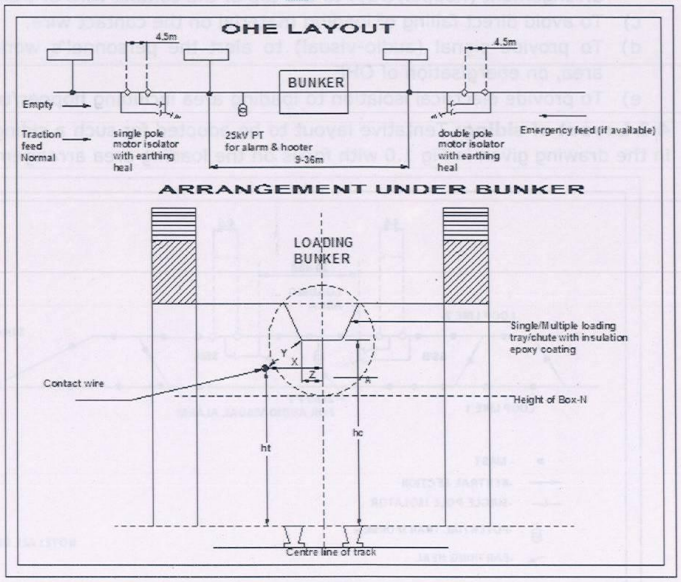



Fig 2.0 OHE layout for loading siding & arrangement under the loading area

**4.5** **Earthing :**Following shall be ensured:

a) All metallic structures shall be connected to the earth pit.
b) Both the isolators should be provided with earthling heel & each earthing heel should be connected to a separate earth pit.
c) Corresponding mast should also be connected directly to earth.
d) Track under the loading area shall be connected to separate earth pit.
e) Hoper/tray should also be connected to earth.

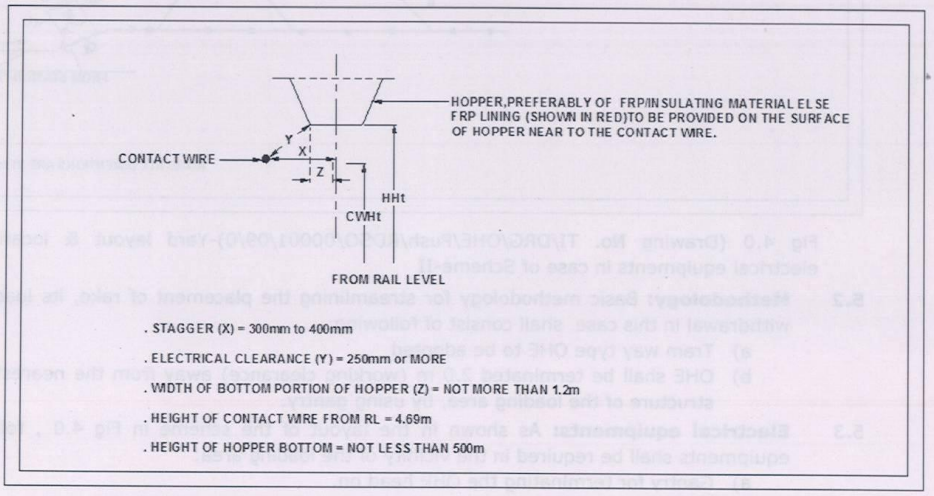



Fig 3.0 Details of critical dimensions of OHE arrangement under bunker

**4.6 Safety**:

a) For the safety of personnel's working in loading area, audio visual signal's functioning at the instant on energisation of the loading area shall be ensured.
b) Protective screen covering the loading area to be provided on both the sides to prevent falling of loading material or any other foreign material on the OHE.

**4.7 Scheme of operation**

After entering into loading line at the loading point, train must be stopped near "engine stop board" provided near isolator SS-A.

a) It must be confirmed from loading in-charge that nobody is available near loading pit for unloading the material or any other work inside the loading pit.
b) Both the isolator (First SS-A & then SS-B) shall be closed after which loading pit shall be energized by 25kV a.c.
c) As soon as loading pit is energized an audio visual signal shall indicate the energisation of loading pit.
d) The train shall be moved through loading pit with the help of electric locomotive.
e) After the engine crosses the loading area, & on entering into the loading yard, Isolator SS-B & SS-A must be opened in sequence.
f) Thereafter, permission to loading pit incharge for loading of material in empty wagon lying underneath the hopper shall be granted.
g) Once loading is complete, engine shall be detached, moved through crossover & attached on the loaded rake from the station "X" end, to proceed toward station "X".
h) SSE/OHE/of the section or his authorized representative must give training for operation of isolators to all guards, who shall be working on the loading area section.

**5.0 Scheme -II**

**5.1 Issues involved**: The major issues involved in finalising the arrangement in this scenario (Fig.4) is to maintain the minimum clearance of 2.0 mtr. between OHE & fixed structure and take safety precautions, as per site requirement.

5.2 **Layout of siding:** Tentative layout to be adopted for such a siding shall be as shown in the drawing given in Fig 4.0 below.

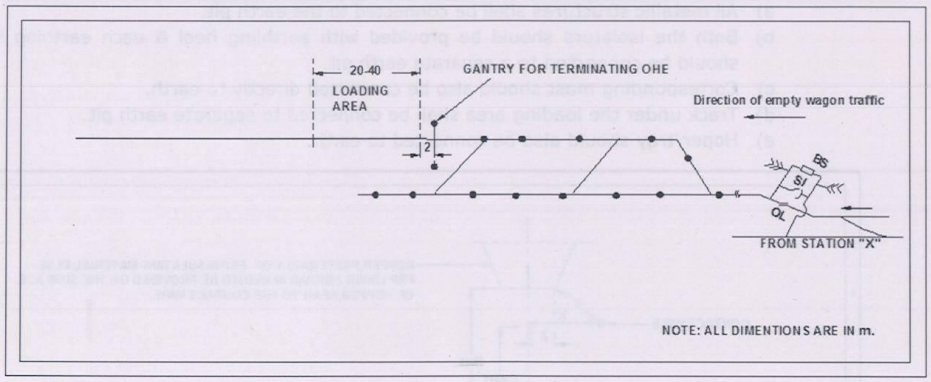



Fig 4.0 (Drawing No. TI/DRG/OHE/Push/RDSO/00001/09/0)-Yard layout & location of electrical equipments in case of Scheme-II

**5.2** **Methodology:** Basic methodology for streamlining the placement of rake, its loading & withdrawal in this case shall consist of following:

a) Tram way type OHE to be adopted
b) OHE shall be terminated 2.0 m (working clearance) away from the nearest fixed structure of the loading area, by using gantry.

5.3 **Electrical equipments:** As shown in the layout of the scheme in Fig 4.0 , following equipments shall be required in the vicinity of the loading area:

a) Gantry for terminating the OHE head on.
b) Earth pits shall be provided for grounding of the loading area.
c) Structure bond for earthing of the gantry.
d) Tram way type OHE

5.4 **Earthing :** Following shall be ensured:

a) All metallic structures shall be connected to the earth pit.
b) Both the isolators should be provided with earthling heel & each earthing heel should be connected to a separate earth pit.
c) Corresponding mast should also be connected directly to earth.
d) Track under the loading area shall be connected to separate earth pit.

**5.5** **Safety**: Protective screen covering the loading area to be provided on both the sides.

**5.6** **Scheme of operation**:

a) The empty rake with electric locomotive shall be stopped short of fouling mark of the last crossover near the loading area. Locomotive shall be detached from the empty rake & moved through the crossover. It shall thereafter be attached to the rear of the rake so that movement can be done in pushing mode.
b) Once the first empty wagon reaches just below the hopper/tray, guard shall give permission to loading pit incharge for loading of material in empty wagon lying underneath the hopper.
c) By putting locomotive in creeping mode at 3 kmph continuous loading shall be carried out so that entire rake is loaded in about 2-2.5 hours, the loading time shall however depend upon the hopper discharge rate.
d) Once the loading is complete, the train can be moved straight way toward the station "X", without wasting any more time in shunting.

**6.0 <u>Scheme-III</u>**

**6.1 Issues involved**: The major issues involved in finalizing the arrangements in this scenario **(drawing No. TI/DRG/OHE/SWL/RDSO/00010/08/0)** is to ensure the complete swings of bracket assemblies with conductors towards structures up to 70 degree parallel to the track from centre line of the structures with the help of motorizing arrangement, so that top loading with the help of cranes/lifter is possible.

6.2 **Methodology:** Basic methodology for streamlining the placement of rake, its loading & withdrawal shall consist of following:

a) Conventional OHE to be adopted between overlaps for minimizing the sag in contact wire. Tramway OHE shall be merged with conventional swiveling OHE at the either ends of loading areas.

b) 9.5 mts span may be adopted under the loading area

c) Stagger of contact wire in the loading area to be kept as maximum 300mm.

d) Vertical/horizontal electrical clearance from lowest part of the loading arrangement (crane arm) from the top of the conduit pipe bolt of OHE bracket to be kept as minimum 250mm.

**6.3 Electrical equipments:** 5HP motor as shown in drawing No. TI/DRG/OHE/SWL/RDSO/00004/ 08/0 to collapse the OHE and isolators shown in drawing No. TI/DRG/OHE/SWL/RDSO /00007/08/0 to isolate the loading area.

**6.4 Earthing:** Following shall be ensured:

e) All metallic structures shall be connected to the earth pit.

f) Both the isolators should be provided with earthling heel & each earthing heel should be connected to a separate earth pit.

g) Corresponding mast should also be connected directly to earth.

h) Track under the loading area shall be connected to separate earth pit.

**6.5 Safety**: (i) Ensure that the drum of motors is locked after swiveling the OHE.

(ii) Protective screen, covering the loading area to be provided on both the sides.

(iii) A.C. Traffic movement shall be restricted to 10kmph.

(iv) The OHE must be dead when the wind velocity is more than 75kmph.

(v) Isolator must be open before OHE is to swing, by operating the motors.

(vi) Loco with raised pantograph in the overlap zone is not allowed during operation of earthing heel isolator.

**6.6 Scheme of operation:**

(i) This swiveling OHE permits shunting with electric traction when in normal position and allow loading in wagons from the top, when pulled away from normal position. The OHE is pulled away from its normal position towards structures and brought back to its normal position with the help of motorized arrangement.

(ii) When OHE is in energized condition, loco with the entire rake shall be moved under the OHE. The Single Pole isolator with earthing heels shall be switched off after switching off DJ of locomotive and lowering of the pantograph.

(iii) The OHE is then swiveled with the help of motorized arrangement. When the switch of motorized arrangement with limit switch No. 1 is 'ON' the bracket which is connected by the steel rope is pulled causing subsequent pulling of all brackets till OHE is Swiveled at 70 degree from the normal position. At the other end, SS wire rope which is connected to bracket is released during pulling of bracket assembly as the motorized arrangement No.2, is decoupled from speed reducer.

(iv) Same way, when OHE is required to bring its normal position, motor no 2 is operated and motor No. 1 is decoupled from the speed reducer by releasing the rope and brackets are pulled back to their normal position by motorized arrangement No.2. Thus , for taking the locomotive out the swivel OHE, the swiveled bracket assemblies shall be pulled in the opposite direction with the help of motorized arrangement till they are in normal position and the isolator shall then be switched on to make the swivel OHE live at 25 kV.

(v) The scheme to be adopted for in this scenario is elaborated in the drawings listed below:

| S. N. | Description | Drawing no. |
|---|---|---|
| 01 | Special bracket for collapsible OHE | TI/DRG/OHE/COLLAP/RDSO/0001/99/0 |
| 02 | General arrangement of fixing the special bracket assembly & suspension of contact wire | TI/DRG/OHE/COLLAP/RDSO/0002/99/0 |
| 03 | General arrangement of suspension of contact wire (s) from existing bracket assembly of tram-way OHE | TI/DRG/OHE/COLLAP/RDSO/0003/99/0 |
| 04 | Motorized arrangement for collapsing the OHE | TI/DRG/OHE/SWL/RDSO/00004/08/0 |
| 05 | General arrangement for collapsing the OHE | TI/DRG/OHE/COLLAP/RDSO/0005/99/0 |
| 06 | General arrangement of fixing of conduit pipe on special bracket assembly & connection of wire rope. | TI/DRG/OHE/COLLAP/RDSO/0006/99/0 |
| 07 | General arrangement of Isolator connection to Collapsible OHE | TI/DRG/OHE/SWL/RDSO/00007/08/0 |
| 08 | Special stay arm insulator for collapsible OHE | TI/DRG/OHE/COLLAP/RDSO/0008/99/0 |
| 09 | Special Jumper Clamp | TI/DRG/OHE/COLLAP/RDSO/0009/99/0 |
| 10 | General arrangement (LAY OUT PLAN) for the | TI/DRG/OHE/SWL/RDSO/00 |

**7.0 Scheme-IV:** Scheme will be applicable for use in Railway freight/coaching terminals (Railway Board letter no. 2003/RE/161/1 Vol-III/Pt. dated 10.08.2017.

**7.1 Objective:** The requirement of top loading of wagons, without the requirement of diesel loco, can be fulfilled, by providing 'Retractable rigid OHE system' in the Railway freight/ coaching terminals.

**7.2 Issues:** The main issues in provision of 'Retractable rigid OHE system' are
**(i)** Transition of the pantograph from existing OHE to rigid OHE and
**(ii)** Swivelling of bracket assemblies with OHE conductors towards structures/support up to a minimum of 70 degree along to the track from centre line of the structure to clear the wagon top width adequately.

**7.3** This swivelling system will not have following items:
- Flexible cantilever assembly
- Tensioning device for giving tension in the conductor
- Contact & catenary wire with dropper arrangement similar to conventional or tramway OHE

**7.4** Schematic arrangement of Retractable Rigid OHE system is shown in Figure 5.

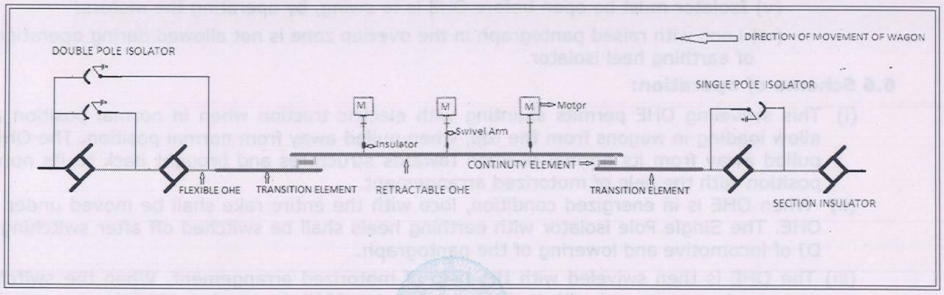



**Figure-5**

**7.5** Retractable Rigid OHE system incorporate following components:

a) **Section insulators** for the isolation purpose as shown in figure 5 above.

b) **Double pole & single pole isolators with earthing heel** for the continuity of power and for isolation & earthing as shown in figure 5 above with suitable interlock with Retractable Rigid Conductor System(RRCS)'s operating system.

c) For movement of the pantograph from flexible OHE available in the siding to Rigid OHE, a **'Transition element'** will be provided. This transition element will be rigid type and will not be swiveling.

d) **Uninsulated Overlap** between 'Transition element (as per clause (c) above) and 'retractable rigid OHE (covering the loading area)'.

e) Retractable rigid OHE will have following components:

(i) **Conductor rail** (normally of aluminum) assembly, it should be of suitable electrical and mechanical capacity equivalent to existing OHE in the siding & it should be suitable for holding Contact wire as per RDSO specification.

(ii) **Copper Contact wire** as per RDSO specification.

(iii) Swiveling type OHE **Bracket assembly** with **insulator** for supporting conductor rail assembly.

(iv) **Motor gear unit**(s), to facilitate rotation of the Swiveling type OHE Bracket assembly.

(v) **Control System** (manual or centralized control panel) to control the operation of motor, Isolator and audio-visual signals etc. It may include other controls as per the system requirement of the siding.

(vi) Other parts of Electrical continuity system: **Jumpers, small parts** etc.

(vii) **Earthing and bonding**: All metallic structures, OHE structures, Isolators with earthling heel, Earth continuity from the insulator to the Rail & Earth pit to be ensured as per Earthing & Bonding code. Track under the loading area shall be connected to earth pit. An aerial protection cable (APC) will interconnect all swing arms together in order to guarantee equi-potentiality on any point of

Retractable Rigid Conductor System (RRCS). APC will be connected on each end to the SILO main earthing points.

(viii) Swivel of the OHE Bracket assembly should be minimum 70 degree from centre of track.

(ix) Siding owner would have to provide earthing of all metallic parts of the loading equipment.

f) Design requirements: System shall have following design features:

(i) Standard height of OHE shall be 5.6m.

(ii) Electrical clearance from the live RRCS system and pantograph to the earthed structure shall be as large as possible (minimum value is specified in the IRSOD) depending upon the site condition and as decided by the EIG.

g) **Safety Features:** System shall have following safety features:

(i) For the safety of personnel's working in loading area, audio visual signal's functioning before energisation of the loading area shall be ensured.

(ii) Motor operation shall be locked after Retracting the OHE in either position.

(iii) Loco with raised pantograph in the overlap zone is not allowed during operation of isolator with earthing heel.

(iv) Isolator must be open before swinging of OHE.

(v) Suitable arrangement to prevent the falling of loading material dust on the OHE should be incorporated.

(vi) The normal position of the swivelling type rigid OHE (see coloured part of figure 5) would always be kept in position away from the track i.e. not above the track.

**7.6 Operating Sequence:**

(i) Initially, the position of the swiveling type rigid OHE will be as mentioned in 7.5 g(vi) above i.e. away from the track.

(ii) Empty rake with electric loco approaching for top loading shall be stopped before entry point of loading area which will be before single pole Isolator. At the Entry point a sensor or Indicator (engine stop board) shall be provided.

(iii) Retractable Rigid OHE shall be allowed to rotate forward over the track with the help of motorized arrangement.

(iv) Both the Isolator shall be switched-on (First Single Pole Isolator and then Double Pole Isolator) to make the OHE between the isolators live at 25 kV. Before energization of OHE an audio visual signal shall indicate the energisation of OHE under the loading area.

(v) Then, empty rake with electric loco will be moved through the loading area (i.e. through energized Retractable OHE).

(vi) The loco will stop outside of loading area and beyond the double pole isolator so that the pantograph will remain in energized OHE even after the opening of the double pole isolator and the first empty wagon is positioned below the chute for filling of wagon.

(vii) Retractable Rigid OHE will now be de-energized and earthed through Isolators (First Double Pole Isolator and then Single Pole Isolator) and discharge rod may be additionally provided.

(viii) Commencement of loading shall be synchronized with the traversing mechanism of the chute. After completion of rake loading, the traversing chute will be retracted back automatically to parking position.

(ix) The above guidelines are not exhaustive, shall be suitably examined by the EIG and suitable guidelines issued.

**7.7 Drawings:** The following drawings (an indicative list) shall be part of the documents & drawings to be provided by the manufacturers and suppliers:

| S. N. | Description |
|---|---|
| 01 | General arrangement (Layout and plan) for the Retractable Rigid OHE inside & outside the loading area with location and connection to transition element, Isolator, Jumper etc. |
| 02 | Interfacing arrangement between 'flexible OHE' to 'fixed Rigid OHE'. |
| 03 | Interfacing arrangement between 'fixed Rigid OHE" and 'Retractable Rigid OHE'. |
| 04 | Drawing of Transition Element |
| 05 | Drawing of Conductor Rail |
| 06 | Drawing of Swiveling type bracket assembly |
| 07 | Drawing of Insulator for Retractable Rigid OHE |

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|---|---|
| 08 | Motorized arrangement for Retractable Rigid OHE |
| 09 | Drawing of Isolator connection to Retractable Rigid OHE |
| 10 | Drawing of Jumper & Jumper Clamp with details |
| 11 | Earthing and Bonding arrangement under the loading area |
| 12 | Layout of loading area showing location of control room, structures, clearances, cable routing etc. |

**7.8 Documents:** Specification, Standards, drawings of complete system, Transition element, conductor Rail, Insulator, motor, Jumper etc. and test to be performed shall be provided. Maintenance, operating and safety Instruction for swiveling OHE shall be provided. This is an indicative list, Railways may decide appropriately.

**7.9** Contact wire, Isolator, Section-Insulator shall be as per RDSO Specification and procured through RDSO approved vendors.

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