Signalling In Re Area

In 25 KV AC electrified section, Signalling circuits are affected by induced voltage. This induced voltage may cause hazardous effect on working of Signalling equipment’s as well as Railway staff dealing with it.

Effect of A.C. Traction

Any circuit in the vicinity of 25 KV AC electrified section is likely to be influenced by electrostatic and electromagnetic induction.

Electrostatic induction is practically eliminated by transferring a circuit into underground cables protected by a metal sheath. Electro-magnetic induction causes various current and voltage to develop in conductors parallel to the track. The value of this induced voltage depends on various factors such as:

- Length of parallelism between the cable conductors and the electrified track.
- Soil conductivity
- Screening efficiency of the cable sheath.
- Return current through the rails and the return conductor, where provided.
- Mutual inductance between catenary and the cable conductors which depends on separation between the two.
- The current carried by the catenary etc.
Precautionary Measures

As a high voltage conductor is provided, induced voltages may cause effects on the functioning of signal equipment and may be dangerous to the maintenance and operating staff, so precautionary measures are adopted for each signalling gears to minimise the effect of induced voltage as described below.

Signal Unit

- Electrical clearance required to be provided to safe guard, is specified as 2 m. from the live conductor. Under no circumstances, a signal post or any of its fittings must be allowed to infringe in this portion. When the signal have to be so located that they fall with in 2m from the electrified track, the iron screen of wire mesh should be provided between the signal post and the OHE and properly earthed to protect the staff who may have to work within the infringing portion.

- The screen shall be so fixed that its top edge is 2 meters above from the catenary and the bottom edge is 2 meters below from the contact wire.
• Signal unit shall be so fixed that the height of the centerline of the red signal shall be approx. 3.65 m. above the rails level. No part of signal w/out a route indicator shall normally be higher than 5.2 m. above rail level.
• Portal drop arms shall not normally be located in the track space where signals are located at least for a distance of 600 m. before the signal.

**Signalling And Interlocking Circuit**

• As a rule, No aerial circuit shall be retained in the RE area.
• Except block instrument circuits, No other earth return circuit shall be permitted in RE area.
• Following electrical equipment’s and circuits are not safe to withstand AC induced voltage.
  a) Separate battery set for external and internal circuits.
  b) Separate line battery for block instrument.
c) Separate battery set for local circuit of block equipment (i.e. block bell & commutator lock circuit) for both block instruments.

d) Separate battery set for each track circuit.

e) Luminous indicators, Electrical lever locks, Rotatory key transmitter etc.

**Maximum Length Of Parallelism**

- The induced voltage in the under ground unscreened cable shall be reckoned as 116V/Km on Single line and 95 V/Km on Double line.
- Relays/equipment used in circuits shall have immunity mini. 400VAC. Length of feed cable terminated on relay shall be suitably reduced depending upon the AC immunity.
- Maxi. Length of parallelism permitted on screened cable is 3.5 Km.
- Maxi. Permitted length of direct feed of signal in various configuration shall be as per tabulation below:

<table>
<thead>
<tr>
<th>Type of cable</th>
<th>110 V feed system</th>
<th>300 V feed system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screened</td>
<td>S/ track 600 m.</td>
<td>D/ track 600 m.</td>
</tr>
<tr>
<td>unscreened</td>
<td>180 m.</td>
<td>220 m.</td>
</tr>
<tr>
<td></td>
<td>500 m.</td>
<td>600 m.</td>
</tr>
</tbody>
</table>

Note: When a signal is located at a distance greater than that specified above, the signal shall be fed locally by controlling relays located at the location. Such signals may also be remotely fed from the cabin by using a corresponding relay at the location.

**Insulation Of Rod And Wires**

- Each rod or wire shall be provided with an insulator in the lead out as close to the cabin as possible.
In case there is a large number of rodding in the same alignment, the insulated joints shall be provided on each rod run between the same sets of rod roller guides. If this is not done any voltage appearing in one rod will be transmitted to another rod through the rod roller guide.

For rod running under the track, the top of the rod shall not be less than 25 mm below the bottom of the rail in order to ensure that the rails do not come in contact with the rod during the passage of the trains.

Additional insulators shall be provided on each rod at every 300 meters.

A minimum distance of 40 mm shall be maintained between the wire and nearest edge of the rail or mast.

**Track Circuit Applicable In Re Area**

Following type of track circuits are used in RE area.

- DC Single rail track circuit
- Electronic track circuit
- Audio Frequency Track Circuit
- AC Track Circuit.

**Length of DC Track Circuit**

<table>
<thead>
<tr>
<th>Type of relay</th>
<th>AC immunity level in volts</th>
<th>Maxi. Permissible length</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Single line</td>
</tr>
<tr>
<td>AC immunized shelf type</td>
<td>750 V</td>
<td>2.1 Km</td>
</tr>
<tr>
<td>QNA 1</td>
<td>1000 V</td>
<td>2.1 Km</td>
</tr>
<tr>
<td>K 50B 1</td>
<td>170 V</td>
<td>1.0 Km</td>
</tr>
<tr>
<td>K50</td>
<td>130 V</td>
<td>750 m.</td>
</tr>
</tbody>
</table>
Maintenance

- Always use tools, which are provided with insulated sleeves.
- Check caution board provided on the signal post to warn the staff. The caution board should be cleaned and varnished so that precautions are clearly readable from the foot of the signal ladder.
- Check that rod and wire insulation once in six months or as per the instructions issued by the Railway authorities.
- Check and ensure the limits of earth resistance:
  a) Earth for lightening discharger—below 10 ohm
  b) Earth for Equipment—below 10 ohm
  c) Earth for Axle counter cable—below 1 ohm

Do’s & Don’ts

Do’s
- Ensure the proper earthing of battery charger after replacing the defective charger.
- Ensure that transfer and longitudinal bonding are provided after replacement of defective glued joint on track circuited portion.
- Always arrange for power block before taking the work on hand for replacement of signal unit or any other work on the signal, which is infringing within two meter from the live parts of the OHE.
- Always use surge arrester on cable, terminated between junction box and EV of axle counter.
- Ensure that for the power cable for feeding the signals. The voltage drop is with in 5 %
♦ Ensure that a caution board is provided on signal post at the height of 3.0 meter above the rail level, if protective screen is not provided on the signal post.
♦ Ensure that earth is separated with other earth with a distance of 3 m.
♦ Insist P-way staff to inform OHE staff and S&T officials before replacing the crossing and rail to ensure continuity of RE bonds.
♦ Ensure continuity of earth bonds before opening any insulation joint.
♦ Do inform to the OHE staff immediately if any OHE bond like longitudinal bond, structural bond, and cross bond is found open or loose.
♦ Ensure continuity of armour while joints provided in the cable.
♦ Ensure the rods and wires passing under the track and are not touching the rail flange.

Don’ts
♦ Don’t remove/disconnect screen of wire mesh provided between the signal post and OHE live conductor.
♦ Don’t energize any circuit on overhead line.
♦ Don’t make through wire insulator with wire or wire rope.
♦ Don’t bypass any lightning arrester.
♦ Don’t combine earth with each other.
♦ Don’t remove any OHE bonds provided for traction bond.
♦ Do not keep the track circuit in working condition only on the battery charger.
♦ Don’t combined internal and external battery cell with each other.
♦ Don’t replace any immunized relay with non-immunized relay.
Signalling in RE Area
(Precautionary Measures)

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