PANEL INTERLOCKING TESTING
(METAL TO CARBON)

1. Introduction

On Indian Railways, traffic is being increased day by day. For safe and punctual operation of trains, Panel Interlocking and Route Relay Interlocking (Metal to Carbon) besides of Panel Interlocking and Route Relay Interlocking (Metal to Metal) are also increasingly installed. Panel Interlocking (Metal to Carbon) signaling circuits are installed in wayside stations and Route Relay Interlocking (M to C) in big/major yard.

This Maintenance Hand book explains basic concepts of testing of Panel Interlocking and Route Relay Interlocking (Metal to Carbon) as per table of control. The Handbook includes wire test, wire count test, testing using simulation panel, Route/Back Locking testing, Approach Locking, point locking, checking of SM’s lock, Crank Handle, Locking and level crossing etc.

This book also explains ASR ckt, UCR ckt, RR, TSR, UYRs, JSLR, NJPR, HR/DR and point control circuit using point contractor unit etc.

All of these are very important to signaling installation and need a thorough study for all of us.
2. Testing of wiring

Three types of tests are conducted before taking up commissioning:

- Wire to wire test or bell test and wire count test.
- Energizing relays and testing using simulation panel.
- Circuit wise test using simulation panel and as per control table.

2.1 Wire to wire test or bell test and wire count test

Purpose of the test

Wire to wire test is done in two stages, once after the drawl of all the wires and the second time after the soldering. At the end of every day, supervisors will arrange for the departmental bell test of the wires drawn by the contractor wireman. This not only helps in assessing the knowledge and the workmanship of the contractor’s wireman but also the accumulation of faults can be avoided and the final bell test can be carried out faster.
The supervisor does the two stages bell test. Officer does the bell test after the completion of soldering.

Bell test is carried out to check

- Whether the wiring is done as per the wiring sheet and circuit diagram.
- Whether wire drawn has electrical continuity.

Arrangement for bell test

A 9V dry cell and a piezo buzzer are connected in series. Two long wires are connected, one to the buzzer and other to cell. The other ends of the two wires are held by two wiremen. The tester reads out the two ends of the wires to be tested. Both wiremen touch the leads of the test wire with the wire to be tested by going to the rack and relay position. If the wiremen reach the correct location read by the tester and the wire is drawn correctly, the buzzer sounds.

By the nature the bell test looks simple, however since the work is monotonous there is chances of making mistakes. The following are the pre-requisites of a tester and the wireman.
Tester: (Supervisor/Officer)

- He shall be systematic
- Ready to accept delay, shall not be in hurry.
- Shall have the basic knowledge of the circuit. Shall respect record keeping and log all the faults.
- Shall give break for testing to avoid monotony.
- All not believe in the earlier stage work done even it is done by him.

Wireman (ESM/Contractor wireman)

- Shall have patience.
- Shall not have over confidence.
- Communicative, he shall be able to give the information to the tester by observation even when not asked by the tester.
- Basic knowledge of wiring and contact nomination.

How to carry Bell test

- Before soldering

Wires are drawn and inserted in the relay base corresponding to the nominal contact. For testing the wires, the wires are accessed from the front side of the relay rack.

Ensuring painting of the relay name on the back and front side of the relay rack.
By this, the wireman can easily locate relay while drawing the wire and also while testing the wire.

Always start from single wire and continue testing until the wiring ends with single wire. The wireman shall give the following information to the tester after holding the wire.

• Name of the relay
• Colors of the wires
• Numbers of wires presents
• Non-availability of the wires for complementary contact.

Ex: If the wire being tested is in A1, if there is no wire in A2, it shall be reported. The tester in between shall check the movement of the wireman i.e. whether they are moving towards the right rack or not.

In case the last test ended with single wire, the tester shall always call out the complementary contact for the next testing so that only one wireman is moved for the next test.

The tester will acknowledge the buzzer sounding only after his calling out the rack, relay and contact number fully. Sometimes short in the wiring may gives false buzzer, which is required to be ignored.
Where double wires are present care shall be taken not to twist the wires while testing.

The tester shall mark a tick or slash in the circuit diagram just above the wire test.

- **After soldering**

For testing the wires, the wires are accessed from the back side of the relay rack. Hence the wireman stand on the back side of the relay rack.

Bell test after soldering is similar to the bell test before soldering. In case more than one wire is encountered the test shall be continued until the test ends with single wire.

**Wire count test**

Each Q-style relay base receptacle can accommodate only a maximum of two wires only. If more than two wires are drawn to any receptacle, while soldering itself, the mistake can be found out. If two wires are drawn in place of one wire or vice versa, it is not possible to find out the mistake while soldering. This type of fault can be identified while doing bell test. However, if Bell test is not done correctly, it is quite possible that the some of the wiring mistakes can still remain. This type of wiring mistakes can be find out while energiziing the circuit, still some
mistakes are left unattended which may cause failure after commissioning of the panel.

It is possible to avoid such mistakes by wire count test. The circuit is ready by a supervisor giving the particulars of the each end of the wire drawn. The wireman after verifying the relay base receptacle shall loudly announce.

- The relay name
- The relay location
- The number of wires and
- The colours of wires

The supervisor shall compare the circuit with the particulars given by the wireman and satisfy himself that the wires are drawn correctly.

**Mistakes to be avoided in bell test and wire count test**

Common mistakes in bell test and the aftermath are shown in table given below:

<table>
<thead>
<tr>
<th>Common Mistakes</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>No record of mistakes corrected in the wiring</td>
<td>The performance of the wireman or the person carried out the contact analysis cannot be assessed and corrected.</td>
</tr>
</tbody>
</table>
### Common Mistakes

<table>
<thead>
<tr>
<th>Common Mistakes</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joints in the testing probe (wires)</td>
<td>When shorted with relay rack give wrong buzzer</td>
</tr>
<tr>
<td>Multi test probe</td>
<td>Causes confusion, may result in delay. Un economic usage of wireman.</td>
</tr>
<tr>
<td></td>
<td>Advisable in case of big yards of more than 15 racks only.</td>
</tr>
<tr>
<td>Non finalization of field cables and panel particulars in time or Non coordination between field and relay room staff. Or non coordination between two supervisors in charge of two adjacent cabins. Or pending nomination of fuses etc.</td>
<td>Results in re-wiring of tested wiring. More chances to commit mistakes, which can go unnoticed.</td>
</tr>
</tbody>
</table>

#### 2.2 Energizing relays and testing using simulation panel

This activity consists of

- Plugging of relays as per the contact configuration decided in the contact analysis.
- Energizing relays and testing by connecting the simulation panel.

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*Panel Interlocking Testing*  
(Metal to Carbon)  
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Energizing relays by connecting the simulation panel

➢ Preliminary arrangements

For major yards, it is preferable to energize relays, circuit wise and sheet wise since it involves number of routes and parallel movements.

For way stations, it is preferable to energize the circuit, route wise.

Before taking up the above energizing, the following works shall be completed.

a. Wire to wire bell test of all sheets before soldering and after soldering.

b. Plugging of all relays as per contact configuration.

c. Power supply arrangement with batteries

d. Connection of simulation panel.

• It shall be possible to control all TPRs, NWKRs/RWKRs, CHLRs, KLCRs, LXCPRs etc. from the simulation panel by energizing all the relays.

• It is desirable to have the simulation panel adjacent to control panel so that the panel indication can be observed simultaneously while testing.

Panel Interlocking Testing
(Metal to Carbon)
3. Connecting Simulation panel

3.1 Board No. 1

It depicts the yard (painted) with points, track circuits, LC gates and slots. Switches are fixed on the board to simulate the conditions of the points, track circuits, interlocked LC gates and slots etc.

Track circuit switches are fixed on the track, point control switches are fixed nearer to the points for small yards. For major yards switches are grouped as point switches and track circuit switches.

Functions requiring ON and OFF switch (with make and break facility i.e. two wires only) with facility to pick up a relay in one position and drop the same in the other position.

Example:

Switch OFF - Track down  - TPR dropped
Switch ON   - Track pick   - TPR picked up

For controlling the following functions the above type of switches shall be used.

i) Track circuit
ii) Siding point
iii) Crank handle
iv) Slot
v) LC gate

Points require three position switches with facility to pick up conflicting relays (i.e. NWKR and RWKR) in two positions. (These switches require three wires).

Switches provided on the simulation panel shall be ensured that they are connected correctly by checking them individually before starting testing through simulation.

3.2 Board No. 2

To simulate the signals the following bulbs are used as dummy loads for the ECRs to pick up and also to observe the aspect of the signals during testing.

ON Aspect - 110V 40 W
OFF Aspect - 110V 25 W
Route Aspect - 110V 75 W
(Jn. Type route indicator)
Shunt Signal - 110V 75W
C-ON Signal - 110V 40W
‘A’ marker - 110V 75W
4. **Wiring simulation panel to the relay room side wiring at MDF**

Disconnect all the links on cable termination rack. Wires from the switches are connected to the relay room side termination. Similarly the wires from simulation panel board consisting of lamps are connected to the relay room side termination. 0.6mm Multicore cable is used for wiring the simulation board. To reduce the voltage drop, more conductors are used for supply taken to the test panel and also to the negative since common return is used.

5. **Energizing the relay**

Relays are to be energized in the following sequence:

5.1 **Relays which are normally in picked up position**

- No condition is required: Ex. TPR, TPPR, NWKR, NWKPR, CHLR, LXPR, SMR, SMPR, KLPR, CHFR, knobs relays of points
- Conditions are to be satisfied: Ex. ASR, TSR, TRSR, TLSR
5.2 Relays which are in de-energized condition

- UCR, Signal knob relay, HR, DR, ECRs, except ‘ON’ Aspect ECR, JSLR, NJPR, UYRs, NRR.

5.3 Energizing of specific relays

Signal clearance circuit

ASR

- This is a stick relay. There are 3 or 4 paths of energisation including stick path. (3 paths where dead approach lock is provided and 4 paths where approach locking is provided). Stick relay shall not be energized by the stick feed. It shall be energized by approach locking where available or cancellation path where dead approach locking is provided.
- It shall be ensured that the ASR relay is energized through all the possible paths in the back lock portion of the track circuit.
- Similar procedure shall be adopted where sectional route release is provided to pick up TRSR and TLSR.

TSR

- This is a stick relay. This relay also shall not be picked up by stick feed. If all the ASRs pertaining to TSR are in picked up condition
and the respective signal RR's are de-
energized (i.e. knob normal) TSR picks up
through TPR front contact of the controlling
track circuit. When one TSR used for more
than one signal, the circuit is designed in
such a way that the TSR does not drop when
an unconnected track circuit fails or drops.
The effectiveness of this aspect shall be
checked.

**UCR**

- This relay picks up after reversing of the
  signal knob and fulfilling certain conditions
  like, detecting of the required points,
  conflicting signals are not taken off, CHLRs
  and KLRs where required are available.
- Check all the parallel paths as per the circuit
  by setting all routes.
- Energization of UCR drops the concerned
  ASR.

**RR**

- This relay picks up through UCR front contact
  and the reverse band of the signal knob.
- This relay is required to reclear the signal
  automatically when point detection breaks
  momentarily and corresponding UCR also
drops.
**HR/DR**

- In addition to the conditions required for energizing UCR, keep all TPRs, TSRs and LXPR in pick up condition and observe that HR picks up (for diverging route, UGR picks up first, route lamps are lit on the illumination board, UECR picks up and then HR picks up). Check up whether the HG bulb is lit on the illumination board and HECR picked up. In case of indication transformer, check up whether indication is available on panel.
- Wherever more than one OFF aspect is available for a signal, all the aspects shall be energized.

Note: All panel indications shall be checked up separately from IDF.

**5.4 Cancellation Circuits**

**JSLR**

- This relay initiates time delay cancellation circuit and share the same circuit of the corresponding ASR. The same JSLR may pick up for different ASRs (from different paths).
- This relay is energized when the signal knob is normalized and all signal control relays are de-energized, all the back locks tracks are in energized condition and the concerned ASR
is in the dropped position, conflicting JSLR are dropped (i.e. JSLR sharing same time) and cancellation button is pressed.

- JSLR picking up is indicated by flashing indication on the panel.

**NJPR**

- This relay picks up after 120 seconds after the picking up of JSLR.
- JSLR and NJPR front contacts are used in the cancellation path of ASR.
- When NJPR picks up, the indication on the panel is extinguished.

### 5.5 Route Releasing

**UYRs**

- A group of conflicting signals which share the route partially or fully have the common set of UYRs. Conditionally conflicting signals however shall have different UYRs since no two signals can be taken off with in the group.
- The signal shall be cleared and the signal knob normalized. Then the train movement is simulated by dropping and picking up the track circuit sequentially. The required UYRs shall pick up. While simulating the train movement, both the light engine and long formation conditions shall be checked.
- When there is only one track circuit available to route releasing in major yard where shunting is frequently done, use of TPSLR relay is made. This also be checked. **Dropping and picking up of track circuit momentarily shall not release the route.**
- UYRs shall be energized through all the paths provided.

### 5.6 Point Control circuit

#### Siemen’s point contactor unit

- Keep all required ASRs in energized condition. Check whether free indication available near the point knob and operate knob to reverse. Check up whether WLR picks up and out going supply is available for reverse control on cable termination rack. Keep test lamp (-) ve connected to W4 and check B24 outgoing is available W1 and W3. For reverse to normal check B24 outgoing is available in W1 and W2.

#### Point Contactor unit with QBCA1 relays

- Keep all the ASRs in required condition. Check whether free indication is available near the point knob and operate the point knob to reverse. Check whether WLR picks up and outgoing supply is available for
reverse control on cable termination on W1 and W2 as shown in circuit diagram. (Negative on W1 and positive on W2) and also, supply is available on W3 and W4. (Positive on W3 and negative on W4.). In case of reverse to normal operation positive on W1 and negative on W2 shall be checked and there is no change in polarity on W3 and W4.

Note: If the point contactor unit is in relay room, check up its operation and also B110/N110 outgoing is available in the cable termination rack.

5.7 Calling on Signals

Clearance

- Keep the calling on track circuit in occupied condition. Check whether approach bell rings (COAR picks up), reverse the calling on signal knob and press the calling on clearance button COGGN (COUCR picks up and COJSLR picks up) and indication will appear indicating the progress of the circuit. Timer starts functioning and after 120 seconds NJPR picks up and COHR picks up and calling on signal is taken OFF.

Note: Calling on signal can be taken Off even if home signal route is held up. In such cases where calling on in cancellation is done, home
signal route also gets released. This operation should be checked.

Cancellation

- Separate ASR is provided for calling on signal wherever calling on signal is taken off, the route has to be cancelled every time whether train is received on calling on signal or not. Press the calling on cancellation button (COCAR picks up). Timer circuit is (240 seconds) triggered with an indication on the panel and after 240 seconds calling on ASR picks up, thus releasing the route.
- Calling on signal ASR also releases the main signal route, if it is in locked condition.

6. Circuit testing using simulation panel and as per control table

This activity consists of clearing of signals on the simulation panel and carrying out the following tests (as per table of control).

i.) Negative test
ii.) Dead/Approach locking test
iii.) Route/back locking test
iv.) Sectional Route Release test
v.) Overlap release test
vi.) Testing of conflicting signals-cross sheet testing. All other circuits viz. SM’s key, CHLR, LXPR, KLCPR are proved correctly in the respective signaling circuits.
6.1 Negative test

- The negative test is conducted on the signals. The signal is cleared with the help of simulation panel. Controls like point detection, track circuits, LC gates, siding points, crank handle and slots are withdrawn one at a time and check in each case the signal respond correctly.
- After clearing the signal when the unconnected controls (points, track circuits LC gates, etc.) are disturbed, it shall have no effect on the signal.
- In case of slotting attempt shall be made to clear the signal with wrong slot.
- Negative test shall be conducted with the conditions as controls provided in the Table of Control.
- Fouling track circuits are required to be checked in the field and even when they are not provided in the table of control, the same shall be incorporated and HQ advised.

6.2 Dead approach locking

- Dead approach locking is provided for those signals (usually home signals, shunt signals from siding) whose approach track is not track circuited. To normalize the route for such signals when a movement has not taken place, cancellation has to be applied.
• For approach locking path for picking up of ASR is TSR pick up and approach track relay pick up. For cancellation process the path for picking up ASR is JSLR pick up and NJPR pick up.

**Testing:** Clear the signal. Put back the signal by normalizing the knob. Check that the route is held. Apply cancellation. Route is released after 120 seconds and the respective counter is incremented.

6.3 Approach locking

• Approach locking is provided for those signals (usually starters and shunts signals) whose approach track circuit is track circuited or provided with axle counters. If the approach track of the signal is not occupied, the route gets released immediately after putting back the signal knob to normal. In case the approach track is occupied the route can be released only by cancellation process, which is counted.

• Approach locking is implemented by the signal in rear also.

**Example:** Main line starter is approach locked by the home signal for main line i.e. when pass through signals are taken off, normalizing the starter signal does not release the starter route, though the approach track circuit is clear.
Testing

- Clear the signal. Keep the approach track clear. Put back the signal knob to normal. The route gets released immediately.
- Clear the signal. Drop the approach track circuit. Put back the signal knob to normal. The route shall not get released. The route is released by cancellation only.
- When approach locked by signals. Testing shall be done by taking off the signal in rear. The route shall not get released when the signal (starter) knob is normalized. In case of conditional approach locking, the free condition of approach locking shall also be tested.

6.4 Route / back locking tests

For testing of back, route locking either of the following two methods may be adopted.

Method – I

- Take off the signal for each and every route. Drop the track circuit and pick up the same sequentially, so as to pick up UYRs correctly. Now drop the back lock track circuit. Put back the signal knob to normal. Route will be still in locked up condition (ASR dropped). Now all conditions are favorable for ASRs to pick up except the back lock track circuit, which is in
dropped position. Now pick up the above back lock track circuit and observe the route getting released (ASR picks up).

- This operation shall be repeated for each back lock track circuit and for each and every route of each signal. The above method is suitable for way side stations.

**Method – II**

- Take the ASR circuit (any ASR), put through UYRI, UYR2 contacts in ASR circuit and disconnect the ASR stick circuit. As per the circuit drop the back lock track circuit one by one and observe the ASR drops and picks up as and when the track circuit has picked up. This test shall be done for all the conditions.

- This test shall be done for all the ASRs, individually check up the parallel paths if any are defective in back lock circuit. The above method is most suitable for major yards. Do not forget to remove shorts for UYRI UYR2 contacts after the testing is completed.

- As part of route holding test, attempt shall be made to release the route by cancellation when back lock track circuit is in dropped condition. It shall not be possible to initiate cancellation.

**Note:** Apart from the above test the following test is also to be conducted to check the effectiveness of point locking.
• Clear the signal. Observe the points free indication and compare it with the Table of Control. Attempt shall be made to operate a locked point by operating the point operating knobs. The point indication shall remain steady.
• Do not clear any signal. The point free indication shall be available. Drop the point controlling track circuits one by one and make attempt to operate the point.
• The point indication shall remain steady. In both these cases, observe the WLR relay in the relay room.

6.5 **Sectional Route release test**

• Take off the signal for each and every route. Drop the back lock track circuits and pickup only three numbers of track circuits just ahead of the signal sequentially. So as to pick up UYR1, UYR2 relay correctly.
• Now drop any one back lock track circuit of these three track circuits and put back the signal knob to normal position. Route will be still in locked up condition (ASR dropped).
• Now pick up the above back lock track circuit, the route sections(parts of the route) within these three track circuits will get released (ASR picked up and concerned WLRs picked up). Now points in above said back lock track circuits (route sections) can be operated for next operation of train.
• Now pick up back lock track circuits ahead of these three track circuits one by one sequencely as per train movement simulation and observe that as train moves ahead and clears track circuits, route sections getting released (TRSR/TLSR picks up and concerned WLRs picks up) and points within these route sections are free for their operation.
• This test shall be repeated for each and every route of the signal.

6.6 Overlap release test

• Take off the signal for main line. ASR will drop and overlap relay OVSR will also be in dropped position. Drop and pick up the back lock track circuits and berthing track circuits sequentially to pick up UYR1 and UYR2 relays correctly as per train movement simulation for run through train. Put back the signal knob to normal position.
• Now ASR will pick up and also overlap relay (OVSR). Thus overlap will get released and overlap point is free for operation.
• Again take off the signal for main line. ASR and overlap relay OVSR will drop. Drop the back lock track circuits and berthing track circuits and pick up the same sequentially except the berthing track circuit so as to pick up UYR1 and UYR2 correctly as per train movement simulation so that train has to be stopped on main line. Put back the signal knob to normal position. Now ASR will pick up but overlap relay (OVSR) will be in dropped position.
• In this condition overlap relay (OVSR) will get picked up after two minutes through OVJSLR and NJPR relay front contacts. Thus overlap will get released after 2 minutes from when route have been released and ASR picked up.
• The emergency release of overlap by EUYN/OYN must be possible only when the whole route (all route sections) has been released and ASR picked up. The same must be tested for each (OV) overlap. Counting of each operation by EUYN and OYN counter must be checked here for each signal movement.

6.7 Testing of Conflicting signals (Cross sheet testing)

• While testing conflicting signals, it shall be ensured that all the conditions are favorable for taking off both signals under test and check that they lock each other. Conflicting signals are of two types:
  - Directly conflicting
  - Indirectly conflicting (ex. Main line and loop line starters.)
• Locking of directly conflicting signals only is given in the Table of Control
• Where conditional locking is given, the testing shall include locking condition as well as free condition i.e. when condition is broken, it shall be possible to take off the signal.
• Ensure that all possible conflicting movements are barred and all the parallel movements are available, a cross sheet should be prepared. In the cross sheet both on vertical column and horizontal row, all the signals with the permissible routes, crank handle release etc. should be recorded. Each signal column wise should be tested with the signals row wise and if cleared, P mark to be made and if not X mark to be made. This should be checked from the permissibility of the simultaneous movements.

6.8 Checking of SM's lock, crank handle, level crossing and siding points:

• Effectiveness of SM's key shall be checked for all functions (signals, points, crank handle, siding points level crossing). When SM's key is out with SM's control knob reverse, none of the above functions shall work when the knobs are operated. When SM's key is IN with SM's control knob normal, it shall be possible to operate the functions. It locks the functions in the last operated conditions.
• For checking CHLRs, KLCRs, LXPRs the converse locking has to be checked i.e. when the signal is taken off, the key can not be released. If the key is out, the signal can not be taken off. For way stations the above testing has to be done for all signals and for every route. For major yards CHFRs, LXFRs,
KLYRs shall be tested, keeping the circuit sheet and breaking the conditions one by one and observe the relay drop every time when the condition is broken. Check up all the parallel paths are effective.

6.9 Point locking circuit

- It is always preferable to test WLR circuits as per circuit sheet. Break the condition and observe WLR drops and picks up as soon as the condition is restored back. Check up whether all parallel paths are effective.
- In addition to the above, after taking off a signal the free indication of the points is to be observed and to be tallied with the Table of Control. Then all the points should be operated, the locked points should not get operated while the free points should be operated.

6.10 Testing of signals

- Check up distant signal aspects for M/L and loop line. Green for main line and double yellow for loop line shall be displayed at distant signal. Remove home signal HG bulb and observed the distant signal goes to caution aspect.
- In the same home signal green aspect may be checked by removing DG bulb of main line starter and DG bulb of advance starter
separately on the bulb panel. The home signal displays caution aspect.

- Check up main line starter green aspect is controlled by Advance starter green aspect by removing the DG bulb of the advance starter.
- Check up advance starter proceed aspect is controlled by block instrument TGT condition.
- On double line sections, effectiveness of SR1 and SR2 is to be checked up in LSS, usually LCPR picked up contact is by passed by DECR picked up contact of LSS. This is done to prevent LSS going back if the block is made to TOL before the train passes the LSS. This should be checked.
- TAR indication and block instrument release from TOL is to be checked. This is normally done at the time of reconnecting block with panel circuit.
- Check up whether main line starter is approach locked by home signal i.e. take off both home and starter and put back starter signal knob. The starter ASR shall not pick up unless home signal ASR picks up.
- Remove route lamp and observe the home signal assumes ON position.
- Individually all the signal lamps have to be removed and check, that ECR drops or NA transformer does not give sufficient voltage to lit the indication lamp on the panel.
- Check up whether all parallel movements are functioning correctly. This is very important
as the wrong contact will be known by this test.

- Panel indication for points, signals, crank handle, level crossing and routes in track picked up and track dropped conditions are to be observed carefully.
- Cancellation circuits functioning for all the ASRs to be checked. Proper cancellation indication shall appear in panel.
- By removing the signal lamp of the signal ahead, test the signal in rear does not clear for the respective line.

6.11 Random check

- Check up that indirectly conflicting signals cannot be taken off simultaneously.
- Keep one or more points in the route in unfavorable position and try to take off signal, which should not be possible.
- For taking off calling on signal, keep all the track circuits in dropped condition and check whether it could be taken off.

Special attention may be given for overlap point detection whether required or not as per circuit.
7. **Before commissioning of a station following Functional Test should be carried out.**

1. All signals of the station should display ON aspect when no signal is taken OFF and indications on the panel correspond to the ON aspect of the signals.

2. Check that home signal, First Distant and second Distant display aspects as per aspect chart of Interlocking Plan when Home signal is taken OFF for main line and indications on panel correspond to the aspect of the signals.

3. Check that Home signal display green aspect when taken off for main line with main line starter and advance starter in off position and in this position off aspect of the main line starter, advance starter, first Distant second distant should be as per Interlocking Plan and panel indications shall be corresponding to the aspect of the signals.

4. Check that home signal shows correct route indicator and aspect when taken off for loop line along with correct aspect of first and second Distant as per aspect chart of Interlocking Plan and panel indications should be conforming to the aspect of the signals. Home signal and Distant signals should not change their aspects when main line starter and advance starter are taken OFF.

5. Main line starter shall display correct aspect as per interlocking plan with advance starter not
taken off and panel indications correspond to the aspect of the signal.

6. Operate and check position of each point for Normal and Reverse at site and corresponding panel indications as per site.

7. Try to take off advance starter without receiving line clear on the block instrument from the station in advance. It should not be possible to take off the Advance starter without obtaining line clear.

8. Cascading and intra signal cascading should be checked for each signal. When signal is intended to display DG aspect and the bulb of this DG aspect is removed or fused, signal should display more restrictive aspect means HG aspect and signal in rear should display aspect as per aspect control chart of interlocking plan and circuit diagram. When signal is intended to display HG aspect and the bulb of this HG aspect is removed or fused, signal should display more restrictive aspect means RG aspect and signal/signals in rear changes and display aspect as per aspect control chart of I.P. and circuit diagram.

9. Drop each and every track circuit of the station one at a time shorted by positive and negative rails of the track circuit with a wire and check corresponding occupied indication on the panel.

10. Check that it must not be possible to open any interlocked gate after the signal has been taken off.
8. **Control Table**

For designing circuit of a yard, the table of control (also known as Selection table) is to be prepared first. The table of control provides necessary information for the preparation of circuits. It consists of the following information:

- Details of signals with aspect
- Routes governed by signal
- The method for route holding i.e. either approach locking with approach track circuits or dead approach locking with out approach track circuits. The back locking and controlling track circuits, crank handle grouping and aspect ahead of the concerned signal.
- The point in route overlap and isolation, which are detected and locked by the signals.
- The conflicting signal/route locked by the signal.
- Any other controls like interlocked level crossing, interlocked siding, lighting of route indicators, block controls etc.

It is customary to send the selection table for CRS approval along with other documents. Selection table is a user friendly data, which gives entire information about the interlocking and various conditions for setting the route, holding the route and clearing a signal. The selection table is a basic requirement for testing
various signals in a yard during commissioning and afterwards also. Each column of selection table is utilized for each circuit and for attending failures also for early rectification.

Prior to designing of circuits, the selection table will be prepared by drawing office staff. It will be checked by Chief drafts man of drawing office and ASTE/DSTE before getting approved by CSTE.

Typical selection table for the given yard is shown in next page.
**Panel Interlocking Testing**

(Metal to Carbon)

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Sig. No.</th>
<th>Leading to</th>
<th>Aspect locked by</th>
<th>Backed locked by</th>
<th>Controlled by TCs</th>
<th>Locks CH zone</th>
<th>Controlled by aspect of Sig. Ahead</th>
<th>Detects Points in Route</th>
<th>Overlap</th>
<th>Isolation</th>
<th>Signal on by TC</th>
<th>Locks signal route</th>
<th>Other controls</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>RD. 1 OR</td>
<td>YR1</td>
<td>DA (120 seconds)</td>
<td>1T, A, 2T, 2T, 101BT, 101AT</td>
<td>103 AT CH1, CH2, CH3</td>
<td>5 GECR</td>
<td>101 105</td>
<td>102 --</td>
<td>--</td>
<td>1T</td>
<td>COA 12DE 12B 11A1</td>
<td>CH1 CH2 101BT 101AT 01AT/BT</td>
<td>CH1 CH2 101BT 101AT 01AT/BT</td>
</tr>
<tr>
<td>2</td>
<td>CO1</td>
<td>Rd 1</td>
<td>OFF</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>CH1 CH2 CH3</td>
<td>101 103</td>
<td>102 --</td>
<td>--</td>
<td>1A2D 11A1 8E 12B</td>
<td>--</td>
<td>1A2D 11A1 8E 12B 12B</td>
<td>Signal can be cleared after 120 sec. of occupation of CO1T by the train. Approach can be released after 240 seconds.</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>Advance starter</td>
<td>Y/G 02 AT/BT 103BT 104BT 109F 10T or 02 AT/BT 109K, 103N 104N</td>
<td>102 BT 101 BT</td>
<td>102 BT 101 BT</td>
<td>102 BT 101 BT</td>
<td>102 BT 101 BT</td>
<td>101 102</td>
<td>-- --</td>
<td>--</td>
<td>102B 1B</td>
<td>CO1B 11B 3G 12B</td>
<td>--</td>
<td>1B CO1B 11B 3G 12B</td>
</tr>
</tbody>
</table>

**CONTROL TABLE**

The following testing shall be done periodically as per pro-forma given for each type of testing.

9.1 Approach Locking Testing

Pro-forma

TESTING OF APPROACH LOCKING
Periodicity – Quarterly
Signal No........................
Approached locked by Track Circuits....................
Approach locked Time 60/120 seconds...............  

<table>
<thead>
<tr>
<th>Sr.</th>
<th>Time</th>
<th>Date</th>
<th>Name of JE/SE/SSE</th>
<th>Signature</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

9.2 Track Locking Testing

Pro-forma

TESTING OF TRACK LOCKING
Periodicity – Quarterly
Point No........................
Track Circuit No.....................

<table>
<thead>
<tr>
<th>Sr.</th>
<th>Time Tested</th>
<th>Date Tested</th>
<th>Name of JE/SE/SSE</th>
<th>Signature</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Panel Interlocking Testing (Metal to Carbon)  
June 2008
9.3 Back Locking Testing

Pro-forma
TESTING OF BACK LOCKING
Periodicity – Quarterly
Signal No. ......................
Route ......................
Back locked by Track Circuit ......................
Released by Track circuit ......................

<table>
<thead>
<tr>
<th>Sr.</th>
<th>Time</th>
<th>Date</th>
<th>Name of JE/SE/SSE</th>
<th>Signature</th>
<th>Remarks</th>
</tr>
</thead>
</table>

Panel Interlocking Testing  
(Metal to Carbon)  
June 2008