HANDBOOK ON
INSTALLATION AND MAINTENANCE OF
ELECTRIC POINT MACHINE
(ROTARY LOCKING TYPE)
CAMTECH/S&T/S/2010/HB/EPM/1.0
MARCH 2010

MAHARAJPUR, GWALIOR – 474 005
FOREWORD

Electric Point Machine is a vital device for Railway Signalling for quick operation and locking of point switches and plays an important role in safe running of trains. Failure of these machines affects the train movement severely and deficiencies at the time of installation can result into unsafe conditions.

Keeping above in view, CAMTECH has developed this handbook to help maintenance personnel in enhancing their knowledge regarding installation and maintenance of Electric Point Machines.

I hope that this handbook will prove useful in efficiently maintaining electric point machines and related systems.

CAMTECH Gwalior
Date: 30.03.2010

S.C.SINGHAL
Executive Director
PREFACE

Continuing its efforts in documentation and up-gradation of information on maintenance practices, CAMTECH has prepared this handbook to help field staff in the maintenance of 143 mm throw Electric Point Machine with internal locking. Apart from working and maintenance practices this handbook also covers installation procedure, troubleshooting, standard RDSO drawings and guidelines for prevention of unsafe failures. For better understanding of concepts, IRS and Siemens Electric Point Machines rotary locking type conforming to IRS:S 24 –2002 have been taken as base.

It is clarified that this handbook does not supersede any existing provisions laid down in the Signal Engineering Manual, Railway Board publications and prevalent Zonal Railways instructions. The instructions given in it are for the purpose of guidance only.

We are sincerely thankful to Shri R.K.Jain, Director/Signal/RDSO, Shri R.N.Meena, Sr.D.S.T.E./Agra Cantt./N.C.Rly., M/s Signal Workshop/N.E.Rly./Gorakhpur, M/s Siemens and field maintenance staff who helped us in preparing this handbook.

CAMTECH Gwalior
Date: 30.03.2010

JAGMOHAN RAM
Director (S&T)
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Where "XX" is the serial number of the concerned correction slip (starting from 01 onwards).

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SECTION – I

ELECTRIC POINT MACHINE

1.1 Introduction
An electric point machine is a device, which can perform the function of unlocking and operating the point switches in the desired position and lock them and detect their correct setting with the aid of an electric motor, similar to that performed by an operator through a lever in a mechanical lever frame. Non-trailable Electric Point Machines 143 mm throw and 220 mm throw with internal locking on Indian Railways conform to specification No. IRS:S 24 –2002.

1.2 General requirements
Following are the general requirements as per IRS:S 24 – 2002.

1.2.1 Construction
The machine shall be of robust construction, securely fixed and protected from unauthorized interference.

1.2.2 Mid Stroke Reversal facility
The machine shall be so designed that it can be stopped, reversed or obstructed at any point during operation without any damage to bring back the point to its original position if wrongly thrown over or inoperative due to obstruction or any other reason.

1.2.3 Mounting
The machine shall be suitable for either right-hand or left-hand mounting, and shall be so constructed that it can readily be converted at site from right-hand to left-hand mounting and vice-versa.

1.2.4 Locking
The locking of the points shall be achieved by means of a locking segment engaging in the locking slot of the lock slide.

1.2.5 Machine case
The machine shall be enclosed in a strong metallic weather-proof lockable machine case, designed for mounting on two sleepers. Suitable hole with removable vent plug shall be provided at the base for draining off the accumulated oil or water.

1.2.6 Manual operation with crank handle
During the failure of motor, point etc. due to power supply or for maintenance work, facility must be provided for locally operating the points manually. For this purpose crank handles are provided. The crank handle is inserted in the point machine and by rotating the handle drive is imparted to the point. For ensuring safety to the persons using the crank handle against a sudden operation by electric power, the crank handle whenever
inserted isolates the power supply to the point machine through a contact known as crank handle contact. 

The crank handle and the key for uncovering the flap (which is required to be uncovered for inserting the crank handle) are kept under the custody of SM in a box which is kept and pad locked by SM or kept electrically locked through slotting from panel.

1.3 Crank handle interlocking

Normally the key used for uncovering the flap for inserting the crank handle in the point machine is common (i.e. Master Key). In this, there is a possibility of crank handling a wrong point. To avoid this, an interlocking is provided as explained below:

The points in the yard are divided into groups and each group is provided with an independent key. The wards of keys of each group are different. The keys are kept locked in separate key locked relays housed in a glass fronted wooden box in the panel room/location box. The key locked relay box is kept pad locked by operating staff.

The crank handle key can be extracted from the relay only after getting the slot from panel, and once the control on crank handle key has been released from the panel, the corresponding routes and signals cannot be initiated.

The crank handle key obtained can be used only for uncovering the flap of the point machine pertaining to the relevant group of point and thus crank handling of wrong point is avoided. After the completion of work, the key is put back into the key interlocked relay and control is resumed back to the panel. Once the control is returned to the panel, the signals and routes can be initiated.

1.4 Internal wiring

The internal wiring of the machine conforms to IRS:S:23. The conductors for the internal wiring are insulated and of tinned copper, stranded having a cross-sectional area of not less than 2 sq. mm. and not less than 3 strands.

1.5 Operating characteristics

The friction clutch of the machine is factory adjusted to slip at not exceeding 580 Kg. load on throw bar for 143 mm. throw point machine and not exceeding 700 Kg. load for 220 mm. throw point machine.

\[ \text{Note: The Electric point machine have a min. AC immunity level of 160 V (r.m.s), 50 Hz.} \]

Operating Data

<table>
<thead>
<tr>
<th>Throw of point machine</th>
<th>Time of operation (Max.)</th>
<th>Current consumption</th>
<th>Test voltage</th>
<th>Test load on throw bar</th>
<th>Slipping load</th>
<th>Stalling load (Min.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>143 mm.+ 2</td>
<td>4.0 sec.</td>
<td>(&lt; 4.5 \text{ Amp.})</td>
<td>110 V DC</td>
<td>450 Kg.</td>
<td>(&lt; 580 \text{ Kg.})</td>
<td>1000 Kg.</td>
</tr>
<tr>
<td>220 mm.+4/-1</td>
<td>5.0 sec.</td>
<td>(&lt; 5.5 \text{ Amp.})</td>
<td>110 V DC</td>
<td>450 Kg.</td>
<td>(&lt; 580 \text{ Kg.})</td>
<td>1000 Kg.</td>
</tr>
</tbody>
</table>
1.6 **Power Supply**
Power for operation of point machine is extended from the nearest location box through PVC insulated Aluminium conductor cable of 3 core X 10 sq. mm. or equivalent copper cable (for 110 V DC operation of point machine) and PVC insulated Aluminium conductor cable of 19 core X 1.5 sq. mm (for detection circuit) directly or through adjacent junction box.

1.7 **Superimposed detection**
Normally separate sets of wires are used for point control and point indication circuits i.e. 3 conductors for point operation and 4 conductors for point indication are used. In order to provide economy on total number of line wires used and greater protection against the external feeds, the idle point control and the return wires are used for indication. Such an arrangement is known as ‘Super-imposed detection’. Both point control and indication supplies are DC. The indication circuit voltage is kept low, so that the motor operation cannot take place while the indication is being given. In this arrangement only 4 conductors are used for both point operation and detection circuits.

1.8 **Sequence of operation**
The Electric Point Machine operates in the following sequence

i. Open the detection contacts
ii. Unlock the points
iii. Move the points
iv. Lock the points
v. Close the detection contacts

1.9 **RDSO approved firms**
For information on RDSO approved firms for manufacture and supply of Electric Point Machine for Indian Railways, Vendor list issued by Quality Assurance (S&T) Directorate, RDSO, Manak Nagar, Lucknow - 226011 should be referred. The status of approved firms is revised every six months.

1.10 **Scope**
This handbook covers installation procedure, adjustment, testing and maintenance instructions, for Non - trailable. Electric Point Machine 143 mm throw with internal locking (rotary) only. This also includes main parts, accessories and technical data of rotary locking type Electric Point Machines manufactured by M/s Signal Workshop NER Gorakhpur, M/s Siemens.

For Installation and maintenance instructions for interlocking arrangement for 60 Kg turnout with Thick Web Switches (TWS) on PSC sleepers using 220 mm throw IRS type point and clamp lock CAMTECH’s Maintenance handbook on “IRS point machine for Thick Web Switch (December 2002)” may be referred.
SECTION – II

ELECTRIC POINT MACHINE
143 MM THROW WITH ROTARY LOCKING

2.1 Introduction
143 mm throw Electric Point Machine is normally used with 90R, 52 kg and 60 Kg conventional switches. Brief description of main parts is as under:

2.1.1 Motor
The motor drives the point mechanism through friction clutch, reduction gears and throw bar when electric power is supplied. The motor is an integral part of the machine, which is removable. It complies with the requirements of IRS:S37.

2.1.2 Gear wheel transmission assembly
The transmission assembly consists of following components:
- Main Gear Rim
- Spring loaded friction clutch
- Transmission shaft
- Pinion
- Rotary type locking segment
- Drive disc
- Lift out disc
- Control disc

The rotary motion of the motor is converted into a rectilinear movement of the toothed driving bar with the aid of this assembly. Various parts of transmission assembly are shown in fig.2.1 below:

![Transmission assembly](image)

Fig. 2.1.1 : Transmission assembly

Functions of various components are as given on following pages:
**Main Gear Rim**

It is engaged with the motor pinion and gets rotary motion from the motor which is restricted to 270 degrees. Gear rim transmits the rotary motion to its centre shaft through spring loaded friction clutch which in turn imparts 143 mm linear motion to the throw bar (gear rack). (Fig. 2.1.2).

**Control disc**

It is used to lock the detector and control contact actuating roller ‘A’ in a cam arrangement provided in its periphery. (Fig. 2.1.3).

**Lift out disc**

It is placed in between gear rim and control disc. The detection contact actuating pin roller ‘A’ is allowed to drop in a smooth cam provided in its periphery, when point is fully locked in Normal or Reverse position. Lift out disc pushes the roller ‘A’ upwards at the start of unlocking stroke. (Fig. 2.1.4).

**Slip ring**

It is supported by a compression spring with two numbers of expansion shoe levers (levers L.H. & R.H.) and a bracket (Retaining strip). (Fig. 2.1.5).

**Locking segment**

The locking and unlocking of the switches is achieved by means of locking segment, which moves with rotary motion clockwise and anti-clockwise and engages in the locking curve provided over respective locking bar and driving bar at the end of each operation.
Pinion
Pinion having teeth is allowed to engage with the throw bar during operation after unlocking, for transmitting linear stroke of 143 mm to move the point. (Fig. 2.1.7)

Drive disc
It is keyed to a driving centre shaft. On the same shaft, driving pinion and locking segment are also keyed. (Fig. 2.1.8)

Bearing pedestals
There are two numbers of bearing pedestals through which driving shaft is fitted with machine housing. These pedestals are made up of cast iron and act like mechanical fuse in case of trail throw of point thereby reducing the damage to the point machine. (Fig. 2.1.9)

Friction Clutch
The friction clutch is a part of transmission assembly and it is fitted between the motor and the mechanism to absorb shock at the end of the operation or in case the machine is obstructed from completing the movement due to an obstruction between switch and the stock rail. The compression spring assembly is inserted in the slip ring. The complete assembly is fitted inside the main gear rim and held in position by means of spring locking plate LH and RH. The spring load on the slip ring can be increased or decreased by tightening or loosening a hexagonal adjustable bolt provided in its assembly. This increases and decreases the friction load on main gear rim. Since it is pre-adjusted in the manufacturing place it self, there is no need to adjust at site.

2.1.3 Driving Bar
Driving bar or throw bar imparts stroke required for the operation of the switches via attached point operating rod. Throw bar consists of one hole each of 24mm dia. at its ends and a rack in the middle. The rack pinion engages with the rack after unlocking and gets a maximum stroke of 143mm for driving the point switch rail from N to R and vice versa. Two circular lock notches are also provided for locking the throw bar at the end of the point operation one each for point normal and reverse.
2.1.4 **Lock slides**

The lock slides are independent for each switch and move along with the switch rails. In Siemens Point Machine there is only one common lock slide. These slides are having one short and one wide circular notch to receive the locking segment for locking the point in Normal or Reverse position. A threaded rod is riveted and welded to one end of the lock slide in which ground connection rod is connected by using a lug for easy adjustment of notch position according to the requirement. The slides position can be changed only by removing the same from the machine when the position of the point machine is to be changed from right to left or vice versa. A brass strip is riveted to its sides so that, the possibility of moving together due to rust or friction is eliminated during breakage of lock rod.

![Fig.2.1.11: Locking Slides](image)

2.1.5 **Detector slides**

The detector slides are moved via attached rods by the point tongues and check whether the point tongues have followed the movement of the point machine and have reached the end position.

![Fig.2.1.12 (a): Detector slide L.H.](image)

![Fig.2.1.12 (b): Detector slide R.H.](image)

2.1.6 **Detection and control contact assembly**

Four sets of heavy duty self wiping contacts are provided for (2 sets for control and 2 sets for detection) electrically detecting the Normal and Reverse position of the point and to control motor feed. The entire assembly along with its mechanism is named as switch and contact pedestal.
Control contacts
The control contacts (outer ones) are named as Normal control contacts and Reverse control contacts. When point is set and locked in Normal position, the Normal control contacts open. Similarly when point is set and locked in Reverse position, the Reverse control contacts open. The position of these contacts depends upon the type of turnout i.e. LH or RH.

Detection contacts
The inner contacts are named as Normal and detection contacts. These contacts are allowed to make only when point is fully set and locked in the respective position.

Only one set of contacts (i.e. ND and RC or RD and NC) are allowed to make at a time, provided that rotation of transmission assembly is complete and both detection slides have completed its predetermined linear motion of 100 mm in MG and 115 mm in BG. To achieve the above condition, notches on detection slides should align with the position of the roller ‘B’ in the pedestal assembly and cams in control and lift out discs should come below roller ‘A’. All these contacts are actuated only by lift out disc at the beginning of operation and held in position by control disc at the end of operation.

<table>
<thead>
<tr>
<th>Type of layout</th>
<th>Condition of point</th>
<th>Contacts make</th>
</tr>
</thead>
<tbody>
<tr>
<td>RH</td>
<td>Normal and locked</td>
<td>2/2a, 3/3a, 6/6a and 7/7a</td>
</tr>
<tr>
<td></td>
<td>Reverse and locked</td>
<td>1/1a, 4/4a, 5/5a and 8/8a</td>
</tr>
<tr>
<td>LH</td>
<td>Normal and locked</td>
<td>1/1a, 4/4a, 5/5a and 8/8a</td>
</tr>
<tr>
<td></td>
<td>Reverse and locked</td>
<td>2/2a, 3/3a, 6/6a and 7/7a</td>
</tr>
</tbody>
</table>
**Sequential operation of detection and control contacts of switch pedestal in the machine:**

In case of DC machine, when the motor starts operation, its detection contacts break first and then the control contacts make. Similarly at the end of operation the control contacts break after which the corresponding detection contacts make. Thus the detection contacts and the corresponding control contacts (ND and NC or RD and RC) cannot make simultaneously at any instant.

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Position/Setting of point</th>
<th>Position of Control/Detection contacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Point is Normal (N) and locked</td>
<td>ND Make RC Make</td>
</tr>
<tr>
<td>2</td>
<td>While starting the operation from N to R</td>
<td>NC Make after ND Break</td>
</tr>
<tr>
<td>3</td>
<td>During operation from N to R</td>
<td>RC Make NC Make</td>
</tr>
<tr>
<td>4</td>
<td>At the end of N to R operation</td>
<td>RD Make after RC Break</td>
</tr>
<tr>
<td>5</td>
<td>Point is Reverse (R) and locked</td>
<td>RD Make NC Make</td>
</tr>
<tr>
<td>6</td>
<td>While starting the operation from R to N</td>
<td>RC Make after RD Break</td>
</tr>
<tr>
<td>7</td>
<td>During operation from R to N</td>
<td>ND Make RC Make</td>
</tr>
<tr>
<td>8</td>
<td>At the end of R to N operation</td>
<td>ND Make after NC Make</td>
</tr>
</tbody>
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**2.2 Electric Point Machines complying to RDSO specification**

Normally all point machines comply RDSO specification and RDSO drawings except Siemens Electric Point Machine, which has certain deviations. The main variations in design of Siemens point machine from that manufactured as per RDSO drawings are as under:

- Siemens Point Machine is of manufacture’s own design. The machine complies IRS:S-24 and is evaluated as per this specification.
- Siemens point machine has common lock rod for locking both the switch rails.
- Fixing arrangement of point motor in Siemens point machine is different i.e point motor is fixed on 2 bolts in Siemens point machine against 4 bolts in RDSO design.
- Shaft of the point motor is also not held through bracket in Siemens point machine.
- Gear ratio of Motor pinion and main gear of Siemens point machine is 16:88 against 12:92 in RDSO design.

For comparative study an overview of IRS point machine and Siemens Point machine along with vital parameters is given in clause 2.2.1 and 2.2.2:
2.2.1 IRS Point machine

IRS Type of Electric Point Machine (Rotary Type) is manufactured as per IRS specification S-24/2002 and RDSO Drawing No.10800. These machines can be used for single point, single switch, double switch and trap points, for all types of switch fittings and weight of rails.

Main Parts

The main parts of IRS point machine are as shown in Fig.2.2.1.

Salient features

- Independent locking of each switch with rotary type locking arrangement.
- The lock notches are different for Normal and Reverse position of switch, hence Normal lock slide can not be used for Reverse position and vice versa.
- Self adjustable friction clutch which takes care of stopping the motor smoothly at the end of each operation by mechanical braking. No need of electrical snubbing.
- Detection and controlling contacts are of heavy duty and self wiping type.
- The possibility of both slides (lock and detection) moving together due to rust/friction in case one slide connecting rod breaks is prevented by the provision of brass strips between them.
**Ground connections**

These provide rigid movable connection between the Throw bar, detection and lock slides in the point machine and each of the switches. The ground connections consist of the following:

i. Switch extension brackets (P brackets) – 2 Nos.

![Switch extension bracket front and top view](image)

**Fig.2.2.2: Switch extension bracket front and top view**

ii. Operating or throw rod. - 1 No.

![Throw rod (Top view)](image)

**Fig.2.2.3: Throw rod (Top view)**

iii. Lock rod long (far end) – 1 No.

![Lock rod far end (Top view)](image)

**Fig.2.2.4: Lock rod far end (Top view)**

iv. Lock rod short (near end) – 1 No.

![Lock rod near end (Side view)](image)

**Fig.2.2.5: Lock rod near end (Side view)**
v. Detector rod long (far end) - 1 No.

Fig.2.2.6: Detector rod far end (Side view)

vi. Detector rod short (near end) - 1 No.

Fig.2.2.7: Detector rod near end (Side view)

vii. Drive lug – 1 No. viii. Sleeve arrangement

Fig.2.2.8: Drive Lug Fig.2.2.9: Sleeve

The method of connection of ground connections is given in Section III – Installation.

Technical data
- Motor – DC series split field motor
- Rated voltage 110 V DC capable of working at +/-25% of rated voltage.
- RPM 1700+/-15%
- Rated current 5.3A and maximum 8.5A.
- Operating time 4 to 5 seconds.
- Power 440 Watts.
- Gear oil SAE 30.
2.2.2 Siemens Electric Point Machine

Siemens Electric Point Machine type BSG-ANTR-91 (non-trailable) with internal locking serves to operate the point tongue rails and lock them in their respective end positions. Provision is available for the detection of both the switch rails, mid stroke reversal operation and setting of points with the help of crank handle.

Main Parts

The main parts are as shown in Fig.2.2.10.

![Exploded view of Siemens Electric Point machine.](image)

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
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<tbody>
<tr>
<td>2.</td>
<td>Housing cover assembly.</td>
</tr>
<tr>
<td>4.</td>
<td>Switch Pedestal with contact device.</td>
</tr>
<tr>
<td>5a.</td>
<td>Cover assembly for Gear rack.</td>
</tr>
<tr>
<td>5b.</td>
<td>Cover assembly for detection slide.</td>
</tr>
<tr>
<td>6.</td>
<td>Transmission assembly (including friction clutch)</td>
</tr>
<tr>
<td>7a.</td>
<td>Gear rack (Throw rod)</td>
</tr>
<tr>
<td>7b.</td>
<td>Locking slide (Main &amp; Auxiliary)</td>
</tr>
<tr>
<td>8.</td>
<td>Detector Slide Left hand &amp; Detector Slide Right hand.</td>
</tr>
<tr>
<td>9.</td>
<td>Lubricating cover assembly.</td>
</tr>
<tr>
<td>10.</td>
<td>Voltage cutout switch</td>
</tr>
</tbody>
</table>

The above parts and their functions are similar to that of IRS point machine except for locking slide which is explained on next page.
Locking Slide
It is made up of two parts, main and auxiliary consisting of serrated (toothed) faces and circular locking notches. These are joined by two bolt screws with their serrated portions facing each other. The locking slide is moved via attached rod by the point tongues and is locked in the same way as that of Gear rack.

Fig. 2.2.11: Locking slide

Ground connections
The ground connections consist of the following parts:
(i). Switch extension brackets (P brackets) – 2 Nos.
(ii). Operating or throw rod. - 1 No.
(iii). Lock rod with stretcher – 1 No.
(iv). Detector rod long (far end) - 1 No.
(v). Detector rod short (near end) - 1 No.
(vi). Drive lug – 1 No.
(vii). Sleeve arrangement

Salient features
- Minimum operating voltage is 60 V DC hence range of operation more.
- Self adjustable type friction clutch. No electrical snubbing required.
- Up to the second stage of reduction the gears are enclosed in a sealed oil chamber.
- Lock stretcher bars and throw bar get cleaned and lubricated by felt pad provided over them.
- Superimposed detection facility, hence can work on less number of conductors.
- Self-wiping type heavy duty control and detection contacts.
- Brass strips between two point detection slides which avoid moving of slides together due to jamming in case of breakage of any one of detection rods.
- The threaded portions of the point detection slides are welded by the slides; hence the slides cannot be interchanged, thus preventing the unsafe condition.

Technical data
- Type of motor ......................... 110 V Split field, series wound motor.
- Minimum operating voltage ............. 60 V DC
- Normal operating current .................. 2.5 to 3.0 Amps
- Operating current during obstruction ... 3.6 to 3.8 Amps.
- R.P.M ........................................... 1700
- Output of the motor ....................... 0.44 KW.
- Minimum throw of the machine ........... 94 mm
- Maximum throw of the machine ........... 143 mm
- Type of machine .......................... Combined
- Operating time ................................ 3 to 4 Secs
SECTION – III
INSTALLATION

3.1. P. Way requirements before interlocking of points
Before any newly laid point is connected to a point machine and interlocked, it shall be ensured that the JE/SE/SSE (P.Way) has taken necessary steps as detailed in Annexure 5 Para 12.40 of SEM Part II which are reproduced below:

- Brought the track to correct level and alignment.
- Fully ballasted and packed all points which are to be interlocked and taken adequate measures to prevent lateral and longitudinal movement of points.
- Provided creep and level pillars.
- Arranged the sleepers on adjacent tracks in alignment, where rods and wires have to cross.
- Seen that the gauge is correct.
- Provided and fixed special timbers as required.
- Provided means to prevent creep in the vicinity of points.
- Fitted gauge tie plates correctly (under toe of the switch and crossing for wooden sleepers and under toe of switch for PRC sleepers).
- Made the stretchers of such a length so that the throw of the switches is as per approved drawings.
- Adjusted Loose heel switches so that
  i. They can be thrown both ways with ease and can be housed against the stock rail by hand and remain there when the pressure is removed.
  ii. The planed surface of the switch rail fully houses against the stock rail for a sufficient length.

- Adjusted Fixed heel switches so that
  i. They normally lie in the mid position and flex equally in the normal and reverse directions.
  ii. The planed surface of the switch rail fully houses against the stock rails.

- Fitted flexible stretchers so that they flex equally in the normal and reverse positions.
- Provided a stop for the open position of a single switch layout.

3.2. Additional P. Way requirements for installation of point machine
- Initial opening of the switch rail at the toe shall be ensured within limits of 115 mm±3mm on BG and 100±3 mm on MG.
- As per standard layout two long sleepers, either wooden or PSC shall be provided for point machine mounting.
- Both long sleepers are to be fixed on equal horizontal level and are to be spaced to suit point machine fixing without any off-set in ground connections.
• Extended gauge tie plate duly insulated shall be fixed on the first long sleeper i.e. on the toe sleeper.
• Leading stretcher bar shall be provided connecting both switch rails at the proper position for the requisite opening of switch rail for both Normal and reverse setting of points leaving 1.5 mm. to 1.75 mm. gap below the bottom of the rail.
• Following stretcher bars shall also be provided as per P.W. drawing to meet provisions of P. Way standards.
• Points shall be checked for proper housing of switch rail with stock rail for not less than 5 sleepers on both Normal and Reverse settings.
• Adequate ballast shall be provided and well packed for proper working of point machine, especially under/surrounding the long sleepers.
• All the wooden sleepers on which the point machines are installed shall be strapped on both sides with 50mm X 20mm MS strap. Necessary holes 21.5 mm dia. shall be drilled on the strap and 20 mm dia bolts and nuts shall be used for fixing to the sleepers.
• Thinner half headed stud bolts only to be used over planed length of tongue rail which butts against the stock rail.

3.3. Some useful guidelines for installation of Electric Point machine
• In the switch pedestal the inner contacts are ‘Detection contacts’ and outer contacts are ‘Control contacts’.
• The internal wiring of point machine depends upon the type of turn-out and not the position of the machine with respect to the track/point.
• The internal wiring of point machine installed at the left side of point is similar to that fitted at right side.
• LH & RH turnout: it should be understood that LH and RH do not refer to the fixing of the point machine on the left hand side or right hand side of the point but to the point layout.
• An RH layout is one which the right hand tongue rail is set with its stock rail in the normal position. A left hand layout is one which the left hand tongue rail is normally set with the stock rail.
• The position of detector rods (short & long) depends upon the position of the point machine. If the machine is at R.H. side of the track the first detection slide while facing the point should be connected to the long detection rod and the other one to short detection rod. If the point machine is at the L.H. side of the point, the connection should be vice-versa.

3.4. Installation as per standard drawing
Electric Point Machine has to be installed as per standard RDSO drawing. Although separate RDSO drawings are issued for different type of point machines, (Refer Annexure) the procedure for installation is almost same. The procedure for installation of Rotary locking type point machine is given in the following paragraphs. If there is variation at a certain stage for a particular type of point machine, the same is explained separately.
There are various standard drawings issued by RDSO for installation of point machine on different types of layouts. Some of them are listed below:

SA 8800-01 - Layout facing point B.G. fitted with Siemens electric point machine. (52 Kg & 90R, Wooden sleepers, 1 in 8.5).
SA 9151-52 - Layout facing point 1 in 12 turnout - B.G. on pre-stressed concrete sleepers fitted with Siemens Electric point machine. (60 Kg UIC rail & 52 Kg).
RDSO/S 3262-63 - Layout facing point B.G. fitted with IRS Electric point machine. (52 Kg & 90R, Wooden sleepers).
RDSO/S 3361-62 - Layout facing point 1 in 12 turnout - B.G. on pre-stressed concrete sleepers fitted with IRS Electric point machine. (143 mm throw). (60 Kg UIC rail & 52 Kg).

3.4.1 Sleepers
- Longer or PSC sleepers are to be laid by Engineering department for installation of point machine.
- The point machine is installed on sleeper No. 3 & 4 of the point layout.
- Sleeper No. 2, 3 & 4 are 3750 mm long while other sleepers are 2750 mm long.
- Extended gauge tie plate is provided on sleeper No. 3 and MS plate is provided on sleeper No. 4.
- The spacing between sleepers to be kept as under:
  - Sleeper No. 1 & 2 – 457 mm.
  - Sleeper No. 2 & 3 – 505 mm.
  - Sleeper no. 3 & 4 – 685 mm.
  - Sleeper No. 4 & 5 – 547 mm.
- Toe of the switch should be 27 mm in advance of the centre line of the sleeper no.3.

3.4.2 Leading Stretcher bar
Leading stretcher bar (insulated) is to be located at a distance of 470 mm from the toe for BG & MG layouts. Fasten leading stretcher bar and ensure toe opening of 115 mm for BG layout and 100 mm for MG layout.

3.4.3 Drive lug
Fasten the L-shaped drive lug to the stretcher bar holes as shown in the layout drawing with insulation plate, washers and sleeves.
Check that the special bolt head is positioned at the 'L' bent side of 'the drive lug. Following stretcher bar need not be disturbed and is fixed as per the Track Manual layouts.

3.4.4 Switch extension bracket or D brackets
- Drill the holes at appropriate places on the both the switches as per layout drawing (Fig. below).
- Assemble the switch extension bracket to RH and LH switch rails with proper insulation.
- Fix the D brackets on each of the switch.
- Push the RH switch rail to closed position and clamp the point.
3.4.5 Point machine
- The distance between the machine centre and the inner gauge face should be 1050 mm.
- Hence, for fixing the point machine four holes of 20 mm dia are to be drilled on two long sleepers accordingly in case of wooden sleepers (i.e. two holes on each sleeper) and extended gauge tie plate. PSC sleepers for point machine fixing come with pre-fabricated holes.
- Place the point machine on the sleepers.
- Align the sleeper holes and the point machine holes for fixing
- Tie the point machine to the sleepers securely with suitable size mounting bolts to avoid shake and vibration while operation.

Note: For flood prone areas the point machine may be fixed at raised level as per standard policy prevailing on the railway.

3.4.6 Connection of throw rod
- Hand crank the machine to operate the drive bar to the centre position.
- Keep the switch rails also in centre position.
- Connect the jaw end of throw rod to the gear rack/throw bar of the point machine.
- Guide the threaded end of the throw rod through sleeve and the drive lug provided on the leading William stretcher bar. Provide nuts and lock nuts on both sides of the sleeve.

![Fig. 3.4.1: Section showing throw rod connection (Top view)](image)

3.4.7 Connection of lock rod

(i) For point machine with independent locking rods for Normal and Reverse positions (IRS Point Machine)
- Operate the drive bar, lock bars and detector bars of the point machine to the centre position and align the wide and short notch of RH and LH lock bars respectively to fall in line with locking pawl for locking the point in LH position.
- Insert the lock rod into the welded stud of lock bar and adjust the short notch to come in line with the radial movement of the locking pawl for locking the point in LH position and secure it with nuts and washers.
- Connect the other end to the respective connecting hole of the switch extension bracket at near end and hold the lock rod by inserting a pin through it and switch extension bracket.
- Connect the lock rod far end also in the same way and adjust the nuts in the lock bar to hold lock rods in.

![Diagram](image1.png)

Fig. 3.4.2: Section showing near and far end lock rod connections (Top view)

(ii) **For point machine with common lock rod (Siemens point machine)**
- Connect the common lock stretcher rod with the switch rails at appropriate holes on D brackets.
- Connect one end of the lock rod with locking bar of point machine.
- Position the threaded end of lock rod at the lug of the common stretcher rod when the point is in fully normal position.
- Align the circular locking notch of the locking bar in line with locking pawl.
- Tighten the nuts to secure its position.
- Repeat the same procedure as above for full reverse position of points.

3.4.8. **Connection of detector rods**
- Connect the one end of Normal detection rod with the Normal point switch through D bracket.
- Position the lug of the other end on the threaded portion of the corresponding detector slide of point machine.
- Connect the short detector rod from close switch to the detector bar which aligns its short notch to the roller.
- Connect the long detector rod from open switch and align its wide notch with the short notch of short detector.
3.4.9. Requirement of insulation material

Following insulation material is required to track circuit the layout:

- D bracket bush – 4 Nos. per set.
- D bracket washer – 2 Nos. per set.
- D bracket side plate L.H. – 1 No. per set.
- D bracket side plate R.H. – 1 No. per set.
- Splice plate for insulated stretchers – 1 No. per set.
- Bush for insulated stretchers – 2 Nos. per set.
- L bracket insulating plate – 1 No. per set.
- Bush insulating for stretcher bar – 2 Nos. per set.
- Gauge tie plate insulating plate – 1 No. per set.
- Gauge tie plate insulating bush – 3 Nos. per set
- Gauge tie plate insulating washer – 6 Nos.
- Stretcher bar insulating washer – 4 Nos.

3.4.10 Power connection to point machine

Connect the external wiring to the terminal blocks in accordance with the wiring diagram, applying for the particular location.
SECTION – IV

ADJUSTMENT AND TESTING

4.1 Initial adjustments

4.1.1 Initial adjustment of Driving Rod (Ref: SEM Part II Para 19.35)
After installation of the point machine as per standard layout:

- Insert the crank handle. This should disconnect the power supply to the machine.
- Operate the machine by crank handle to move the points to RH position at the end of the stroke, positioning the locking bar(s) so as to allow the appropriate locking dog to pass through notch/notches.
- Adjust the closed switch by tightening/loosening the throw rod nuts provided on both sides of drive lug sleeve such that it is just in contact with the stock rail.
- Tighten the connections further by 2 mm to 3.5 mm to impart a springing action to the tongue rail.
- Hand crank the machine to the opposite end (LH) of the stroke.
- Repeat the setting for LH position.

![Section showing throw rod connections](image)

Fig. 4.1.1: Section showing throw rod connections

Note: Unless any special instruction are issued by the Railway, adjustment for driving rod and lock rod shall be done for the close switch nearest to the point machine first.

4.1.2 Initial adjustment of lock slides

(i) For point machine with independent locking rods for Normal and Reverse positions
Operate the point machine to the RH position by hand cranking. If the switch rail is housed with stock rail but locking pawl could not enter into the lock bar notch, loosen the lock rod connecting nuts and adjust the lock bar alone to align its close notch to enable the locking pawl enter into the notch and lock
the point in that position. Tighten the Hexagonal nuts of the Lock rod to hold securely with Lock bar. Operate the point machine to LH side by hand cranking and set the lock rod in the same manner as illustrated for RH side. Once again move point to the previous position and ensure the locking of the point takes place.

(ii) **For point machine with common lock rod (Siemens point machine)**

Operate the point machine to the RH position by hand cranking. Shorten/lengthen the locking bar to align the corresponding circular locking notch to enable the locking pawl enter into the notch and lock the point in that position.

To shorten/lengthen the locking bar, first loosen the screw studs on the joint. Slide the serrated end of auxiliary locking bar on that of the main locking bar to the required extent. Re-fix it by tightening the screw studs.
4.1.3 Initial adjustment of Detector contacts  
(Ref: SEM Part II Para 19.36)
- Hand crank the machine to the end of the stroke to close the tongue rail.
- Insert 1.6 mm test piece between stock rail and open tongue rail at 150 mm from toe of the switch.
- Operate the point.
- Ensure detector contacts just make. Bring back the point to original position.
- Now insert a test gauge of 3.25 mm between the same switch rail and stock rail at a distance of 150 mm from the toe of the switch and operate the point.
- Adjust the detector connection of the closed switch till the appropriate detector contacts are just broken.
- Repeat the same procedure at the other end of the stroke.

![Fig 4.1.6: Adjustment of detector contacts through detection slides](image)

Note: Where lock slide is provided in the machine, during switch detector adjustment the test shall first be done with fictitious (false) locking. After completing the above test, same test be repeated with machine properly locked.

4.2 Final adjustment
After initial adjustment, final adjustment is to be performed as under:

4.2.1 Adjustment of free stroke for RH switch rail
- Operate the machine a couple of times by power.
- Operate it to RH position
- If the travel of the drive rod is correct, the tongue will close well against stock rail at the end of operation
- If the travel of drive rod is not correct, either the tongue will not close against stock rail or the point machine cannot be operated to end position i.e., the clutch slips continuously.
- Adjust the setting of switch rail to RH position by tightening or loosening the nuts of drive rod to ensure correct point setting.

4.2.2 Adjustment of free stroke for LH switch rail
- Operate the machine to the LH position and repeat the procedure as given for RH switch rail.
- Check the spring of points in both positions. It should be equal on either side or make it equal by adjusting nuts near the sleeve.
- Tightening the nut towards lug increases the spring. Loosening the nut from lug decreases the spring.
4.2.3 **Adjustment of locking slides**
Operate the point with power and ensure that the locking pawl can enter the circular locking notches of the lock slides and the driving slide only when the point is correctly set. If not then adjust the lock slides with the help of nuts on their threaded portion.

4.2.4 **Adjustment of detection slides**
Adjust the detector slides with the help of nut on the threaded portion such that the roller ‘A’ falls inside the groove of the control disc only when the point is fully set and the control disc completes its rotation (i.e. point is fully locked). Repeat the procedure for Reverse detection rod.

Note: The detector rollers ‘B’ should fall in short notch of detector slide connected to close switch and long notch of detector slide connected to open switch.

4.3 **Adjustment of Friction Clutch (Ref: SEM Part II Para 19.37)**
Friction clutch should be so adjusted that slipping current is between one and half times to twice the normal operating current or as specified by the manufacturer. When difference between normal operating current and operating current under obstruction is less than 0.5 Amp., the clutch requires adjustment. Such machine should be replaced.

For adjustment, first dismantle the transmission assembly, and then tighten the hexagonal bolt as shown in the fig 4.2.1. Friction clutch becomes stronger and obstruction current increases. Loosen the hexagonal bolt, friction clutch becomes weaker and obstruction current decreases. Now re-assemble friction clutch, contact unit and motor and test.

Note: For rotary type point machines no attempt should be made to adjust friction clutch at site. Friction clutch should be adjusted only in authorized workshop.

![Adjust this hexagonal bolt](image)

*Fig.4.2.1: Friction clutch*
4.4 Testing

4.4.1 General testing after adjustment

- Operate the machine several times to see that the locking segment goes smoothly inside the circular locking notches of the lock slides and the driving slide.
- Operate the machine several times by hand cranking and ensure that one of the two lock detection rollers drop into the respective notch of the control disc and detection contacts make only at the end of locking operation.
- The control contacts make with the beginning of the unlocking stroke.
- Check the correspondence between the switches and the point operating lever/group and with the point indication.

4.4.2 Testing of Friction Clutch

- Place an obstruction test piece between closed switch and stock rail at 150 mm from toe of the switch.
- Connect an ammeter in series with the motor feed.
- Shunt operating windings of the overload relay, if provided.
- Operate the points against the obstruction.
- Read the motor current as the clutch slips.
- Remove the shunt of the overload relay after the test.
- Remove the ammeter from the motor feed.

4.4.3 Obstruction Test (Ref: SEM Part II Para 19.38)

The point driving rod and the lock connections of the machine must be so adjusted that with 5 mm thick test piece obstruction placed between the switch and the stock rail at 150 mm from the toe of the switch:

- The point cannot be locked.
- The point detector contacts should not assume the position indicating point closure and
- Friction clutch should slip.

Fig.4.4.1: Test piece being placed between switch and stock rail

- The point cannot be locked.
- The point detector contacts should not assume the position indicating point closure and
- Friction clutch should slip.
4.4.4 Measurement of working voltage and Current

Operate the machine electrically and measure working current and voltage for both Normal and Reverse operations with and without obstruction. Ensure that the friction clutch declutches during operation with obstruction.

(i) Current measurement

Method 1
- Disconnect the tail cable conductor on common motor terminal.
- Connect the ammeter in series with this conductor and common motor terminal as shown in Fig. 4.4.2.
- Operate the machine electrically from Normal to Reverse.
- Note the working current.
- Current reading should be less than 3 amps. This may vary according to site condition.
- Repeat the above for Reverse to Normal operation.
- Measure the current with obstruction in point for Normal to Reverse operation and vice-versa.

Method 2
- Insert the crank handle key and turn to break crank handle cut-out contacts.
- Connect the ammeter in series between CH1 and CH2 terminals.
- Operate the machine electrically.
- Measure the working current as above.

(ii) Voltage measurement

Measure the voltage for normal and reverse operation by connecting voltmeter probes directly to the motor terminals (1 & 2 for Reverse operation, 2 & 3 for Normal operation).

Fig. 4.4.2.: Measurement of working current by method 1

Fig.4.4.3: Measurement of working current by method 2

Installation and Maintenance of Electric Point Machine (Rotary locking type) March 2010
Section IV- Adjustment and Testing
The above parameters of current and voltage measurement should be taken every 3 months and recorded as given in following table:

<table>
<thead>
<tr>
<th>Point No.</th>
<th>Without obstruction</th>
<th>With obstruction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Voltage</td>
<td>Current</td>
</tr>
<tr>
<td>N to R</td>
<td>R to N</td>
<td>N to R</td>
</tr>
</tbody>
</table>

4.4.5 Crank handle cut out contact testing
Check the wire connections to the terminals of voltage cut-out switch and ensure their intactness. Open the voltage cut-out switch and ensure that the contact is not giving break in circuit and making with sufficient pressure.

4.4.6 Detection contact testing
To check the individual integrity of point detection contacts,
- Open the transparent cover of switch pedestal.
- Break each detection contact one by one manually.
- Check that the corresponding detection relay in the relay room drops each time the detection contact is broken.
- Operate the machine by power and check that the contacts are making with sufficient pressure.

4.4.7 Electrical and Insulation Testing
- Operating values of point machine, point motor insulation and switch bracket insulation should be tested once in three months.
- Tail cable testing with 500 V megger and pot box wiring should be performed once in six months.

4.4.8 Correspondence testing
Correspondence testing of point at site with respect to point group/relay and panel indication must be done after cable meggering and each time the point is reconnected after disconnection for maintenance/repair.

4.4.9 Track locking testing
Shunt any one of the track circuit on point portion with proper track shunt and ensure that the point track indication on the lever frame/panel is showing occupied. Operate the point from the cabin/panel. Ensure that the point does not operate in this condition. Remove the shunt and ensure that the point gets operated. This test shall be done both for normal to reverse and reverse to normal operation. Track locking should be tested once in three months.
SECTION – V

MAINTENANCE AND OVERHAULING

5.1 Maintenance
For maintenance of Electric point machine, Maintenance schedules as laid down in SEM part II must be followed strictly.

5.1.1 General
- Ensure cleaning and lubricating of moving parts.
- Ensure that all bolts and nuts including point machine mounting bolts are tight and split pins are opened properly, during every maintenance visit.
- Check that electrical wire connections inside the cable termination box and inside the machine are tight and the wiring is laced properly.
- Check the rodding connections for tightness and friction free movement.
- Lubricate the slide chair plates frequently for smooth working of points.
- Ensure that the rodent entry points in the point machine and CTB etc. if any are properly plugged.
- Lubricate all moving parts with lubricating oil/grease as per manufacture’s specifications (refer Para 5.4).

5.1.2 Contact pedestal
Inside the contact assembly, check that the spring contacts press against the fixed contacts with sufficient pressure.

5.1.3 Carbon brush
Check that the carbon brushes are exerting sufficient pressure on the commutator. Once in three months check the carbon brushes and commutator, clean the commutator with chamois leather until carbon deposits are disappeared.

5.2 Overhauling
As per IRS:S24 -2002, the life cycle of Electric Point Machine is one million operations. The schedule for overhauling of point machine with one million operations should be as given below (ref.: Recommendations of 7th MSG meeting approved by Rly. Board vide letter No. No. 2000/SIG/M/4 dated 08.02.2001)

- Sub-urban and Trunk routes – 10 years.
- Other than Sub-urban and trunk routes – 15 years.
  OR
- 5 lakh operations whichever is earlier.

Overhauling of point machine should be done only at an authorized centralized depot of the division or S & T workshop.
5.3 Painting
Check the point machine for rusting. Remove the rust and apply red oxide and paint to repair it.
The point machine shall be painted black, as stipulated in Annexure – 29 of para 19.106, SEM Part – II.
Arrows showing the direction rotation of crank handle for manual operation of point (N and R) should be painted on the cover beside the socket in which the crank handle is inserted.

5.4 Oiling and lubrication
Lubricate all moving parts with lubricating oil/grease as under:

5.4.1 Oiling

Motor transmission
Pour 100 cc lubricating oil SAE 30 or Shell 100X through oil inlet (1) (provided on the reduction gear box) into the oil reservoir as shown below. Allow some time for soaking of oil and pour oil in intervals and in quantities of approx-10 ccm at a time until oil emerges out of overflow tube (2). This way excessive overflow of oil is avoided.

Fig.5.4.1: Oiling of gear box (1) Oil inlet (2) overflow outlet

Fig.5.4.2: The inside view of gear train for oiling
The periodicity for oiling of motor transmission is as under:

At the time of installation and after 10,000 operations or at 6 month’s interval for less frequently operated point machines or as per manufacture’s specifications/Zonal Railway instructions. The period may be reduced as and when required according to local climatic conditions.

**Throw bar, lock and detection slides**

Pour 10 cc lubricating oil SAE 30 or Shell100X in inlets provided on the cover with felt pad for throw bar, lock and detection slides.

**Contact assembly**

Apply 10 drops of spindle oil on the helical spring guides of contact assembly.

**Miscellaneous**

Apply medium grade lubricating oil on all pin connections, detection slides, chair plates, lug and sleeve assembly on drive rod etc.

**Drainage of excessive oil**

To drain out excessive lubricating oil or water accumulated at the bottom of the point machine casting, unscrew the spring loaded drain outlet and close it afterwards.

5.4.2 **Greasing**

Apply non-corrosive all temperature grease through all the grease nipples by a grease gun, once in 6 months or as local conditions need to the following:

- Bearings of the gear rack.
- Locking bars.
- Detection slides
- External gears of the transmission assembly.
- Contact assembly of lever bearing.

After approximately 100,000 operations or with less frequently used points, once annually, wipe off all superfluous grease from nipples to prevent clogging and lubricate thoroughly all internal and external lubricating points.
SECTION - VI

DO’S & DON’TS

6.1 DO’s

- Tighten all fixing bolts and other associate fittings.
- Lubricate all moving parts either with oil / grease and clean excessive oil / grease.
- Clear the ballast from ground connection rods.
- Watch for any unusual noise while working if so, take remedial measures.
- Issue Disconnection Notice whenever required & Do not Disconnect without giving notice.
- Watch for any iron burrs in the stock rail if so clear the same.
- Watch for excessive creep (15 mm. is permitted.) if so take assistance from Engineering staff.
- Check for excessive opening if so, take remedial measures. (Engineering).
- Ensure proper packing of sleepers.
- Check for proper making and breaking of Detection Contacts & other electrical contacts including Cut Out contact.
- Clean the Motor armature and ensure it is free from Carbon Deposits.
- Test the working of point with & without 5mm. Test Gauge and ensure correct working. Correct it if required.
- Use only Hand Crank for operating the Point Machine for Manual working.
- Test for effective Track Locking.
- Use proper tools while carrying out Maintenance, Testing and adjustments.
- Drain out Water if collected in side the Machine & close the drain out hole.

6.2 DON’TS

- Operate the Machine locally with out hand crank.
- Adjust lock & detection slides straightaway without checking switch opening (only + 3mm. is allowed from initial opening)
- Use oil in Transmission Gear Rim.
- Allow water to get stagnated in side the Machine.
- Short any electrical contacts manually under any circumstances.
- Disturb the pre-setting of the detection contacts at site.
SECTION - VII

TOOLS AND SPARES

7.1 Tools and measuring instruments
Following tools and measuring instruments should be kept in the duty room for installation and maintenance of Electric point machine:
- Spanner set
- 32 mm (1 1/4”) single end spanner
- Adjustable pipe wrench
- Screw driver
- Hammer
- Tommy bar
- Measuring tape
- Test gauge
- Cutting pliers
- Wire cutter
- Insulation peeler
- DC Ammeter with centre ‘0’ incase of Analog (0-30 Amp)
- DC Voltmeter (0-250V)
- Track shunt resistance.

7.2 Spares and Consumables
Following spares and consumables are necessary for maintenance and inspection.
- SAE 30/SHELL 100 oil
- Grease IS 507/508
- Chamois leather
- Cotton waste grade A
- Carbon brush
- Contact assembly
- MS-pins and split pins
- D-bracket and stretcher bar insulation material sets

7.3 Tools and accessories to be supplied with new point machines
The following set of tools shall be supplied along with every set of eight point machines or less:
- M6/M8/M18/M20/M22 Box spanners.
- M10/M12 Spanners.
- Adjustable Wrench.
- Screw Driver 300 mm long.

Junction box and two numbers of telescopic pipes of approved type shall be supplied as an integral part of the point machine.
8.1 Common failures of Electric Point Machine and their causes
Most commonly observed failures of Electric Point Machine and their probable causes are given in the following table. On observing the failure, the maintainer should ascertain the exact cause from various possible causes given in the table before proceeding for rectification. These are applicable to all types of point machines.

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Nature of failure</th>
<th>Probable fault</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Point motor does not start.</td>
<td>(a) Feed not coming out from relay room. (b) Cable fault (c) Neither detection nor control contacts of the machine are making (d) The 1&lt;sup&gt;st&lt;/sup&gt; machine do not start if the detection of the 2&lt;sup&gt;nd&lt;/sup&gt; machine not available.</td>
</tr>
<tr>
<td>2.</td>
<td>Point is showing gap and motor rotates continuously.</td>
<td>(a) Obstruction between stock and tongue rails or at stretcher bar. (b) Friction due to improper cleaning and oiling of the points. (c) Wrong adjustments of point driving rod. (d) Defect with P-way fittings. (e) Friction Clutch is defective.</td>
</tr>
<tr>
<td>3.</td>
<td>Point is properly set, but motor is continuously rotating.</td>
<td>(a) Detection rod out of adjustment if machine is locked. (b) Lock rod/Lock plunger out of adjustment if machine is not locked.</td>
</tr>
<tr>
<td>4.</td>
<td>First point is correctly set, locked and detection made, but the motor do not stop and feed not extended to the 2&lt;sup&gt;nd&lt;/sup&gt; machine.</td>
<td>(a) Feed not coming to 2&lt;sup&gt;nd&lt;/sup&gt; machine due to cable between machines defective. (b) Crank handle contact of 2&lt;sup&gt;nd&lt;/sup&gt; machine not making. (c) Any other fault in 2&lt;sup&gt;nd&lt;/sup&gt; machine.</td>
</tr>
<tr>
<td>5.</td>
<td>First point is correctly set, locked and detection made, but the motor do not stop even after the starting of 2&lt;sup&gt;nd&lt;/sup&gt; machine</td>
<td>Short circuit fault in the terminals of point machine.</td>
</tr>
<tr>
<td>6.</td>
<td>Point machine is correctly set and locked and detection available but point motor do not operate to other side.</td>
<td>(a) Feed not coming out from Relay room. (b) Cable fault (low insulation of cable). Due to low insulation 110 Volts DC voltage is not available on point machine terminals.</td>
</tr>
<tr>
<td>7.</td>
<td>While operating the points the motor rotates in just reverse</td>
<td>(a) Conductors of NW &amp; RW interchanged. (b) In point junction box cable interchanged.</td>
</tr>
<tr>
<td>Sr. No.</td>
<td>Nature of failure</td>
<td>Probable fault</td>
</tr>
<tr>
<td>---------</td>
<td>-------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>8.</td>
<td>Out of correspondence between point and relay group.</td>
<td>(a) Cable interchanged in point junction box (b) Wiring interchanged in crank handle box terminal.</td>
</tr>
<tr>
<td>9.</td>
<td>Point indication flashing under movement of train wheel.</td>
<td>(a) Loose packing of points. (b) Improper housing of switch rail against the stock rail for sufficient length. (c) Wear and tear of the heel block and gauge tie plate. (d) Loose fitting of point machine. (e) Loose fixing of switching unit. (f) Improper adjustment of detection slides. (g) Improper spring between switch and stock rail. (h) Improper tension of detection contact spring. (i) Detection contacts not properly cleaned.</td>
</tr>
<tr>
<td>10.</td>
<td>Flashing indication of point appears suddenly on the panel.</td>
<td>(a) WKR2 picks up due to earth fault (for Siemens Point machine) (b) Wire breakage at lugs or terminals of NX switch. (c) Defective carbon brush. (d) Critical adjustment of points. (e) Transformer/Rectifier fuse blown off. (f) Group/Relay contact defect. (g) Motor gone defective due to water logging.</td>
</tr>
</tbody>
</table>
ANNEXURE A

PREVENTION OF UNSAFE FAILURES

A1. Unsafe failure of point machine due to cable fault

An unsafe failure of point on account of multiple faults in the cable and inadequate protection arrangements for short/open circuit faults had taken place at Virar station on Western Railway. For prevention of such failures recommendations given by RDSO are reproduced below:

1. In all future works, independent operation and detection feature should be provided in point control and detection circuit. No super-imposed detection should be provided.
2. M/s Siemens and M/s Bombardier should develop new point groups for independent operation and detection of point machine.
3. All existing installations, where super-imposed point and detection is being used, should be provided with independent operation and detection in a gradual manner.
4. Diodes, where provided, in existing point machines should be removed.
5. To eliminate the possibility of damage of cable in a station yard, it is suggested that all cables should be protected by laying in buried RCC duct/DWC/HDPE pipe.
6. Point tail cables should invariably be laid in DWC pipe.
7. Earth leakage detectors should be provided at all installations.

In addition to the recommendations of RDSO, Railway Board vide letter No. 2004/Sig./A/WR/1 dated 05.01.2005 have issued following guidelines in order to avoid unsafe failure of point:

1. Investigation and analysis of each and every point failure should be done in detail and with utmost care at a higher level i.e. SSE/Signal or ASTE of the section, for taking corrective action.
2. Point cable testing (Main cable and Tail cable) should be done once a year just after first monsoon. Other cables should be tested as recommended and approved after the 8th MSG Meeting.
3. At existing motor points, a separate second tail cable should be provided. This cable should be laid between the two motor points of a crossover.
A2. **Independent operation and detection circuit for motor operated points**

In this connection C.S.T.E./WR’s technical circular No. 136/2005 vide letter No. SG.126/0 Vol III dated 17.03.2005 is reproduced below.

The following scheme for operation and detection circuit of motor points shall be adopted in all future installations:

A2.1. **New installations**

1.1 All the new installation shall only be commissioned with independent operation and detection circuit involving operation of point through point machine.

1.2 In case use of Point Group is inevitable in a bigger yard provided with RRI/PI, independent detection with Point Group operation circuit shall be used as per typical circuit No.CSTE-6106 (Refer fig. No.A.1).

A2.2 **Cabling Scheme**

1.3 The detection supply in both the types of arrangements shall originate from the bus bar at locations. A separate Signalling/Power cable shall be catered for providing bus bar in ring formation of the power supply depending upon the type of detection relay used.

1.4 In case operation and detection supply originates from the same place, the detection circuit shall be separated from the operation circuit by taking it in separate cable.

1.5 Two tail cables shall be laid from main cable location to both the point machines of a crossover, irrespective of the type of operation and the detection circuit used.

1.6 Machine-to-machine connections shall be done in main cable location. Use of JBs for terminating tail cable near the point machine should be avoided as far as possible. Wherever JBs are used near point machine, two tail cables shall be laid upto the point machine terminals.

1.7 The conductor allocation in the two tail cables shall be as follows:

   (a) Independent operation and detection circuit:

      Operation and detection circuit shall be separated in the two tail cables. Electrical connections from CT Box/JBs wherever used, to the machine shall also be done using separate cable for operation and detection.

   (b) The conductor allocation in two tail cables for the points provided with independent detection with Point Group operation shall be as per typical drawing CSTE/6080 (Refer Fig. No.A.2) and as follows:

      (i) W3 conductor (L-3 & L-4) to be kept in one tail cable.

      (ii) W1, W2 & W4 (L-1, L-2 & L-4) conductors should be kept in 2nd tail cable.

      (iii) W4 conductor [L-4(a), L-4(b)] shall be paralleled in the 2nd tail cable to enhance probability of detecting cable fault.
Fig.A.1: Wiring diagram for independent detection and operation circuit using Siemens Point Machines ((RH – RH crossover points) (Ref.: W.Rly. Typical drawing No.CSTE-6106)

~ AC immunised relays to be used in RE area.
Fig. A.2: Core plan for coupled group operated points (Ref.: W.Rly. Typical drawing No.CSTE-6080)
A2.3 Cable laying practice
In suburban section throughout and between outermost point-to-point in non-suburban section, cable shall be laid in RCC duct made in-situ in the trench. The point tail cable should be invariably taken in DWC pipe throughout in its length, so that there is no exposed portion. The DWC pipe should be of highest standards as per IS, so that the pipes laid are effective for protecting the cable.

A2.4 Existing installations
Existing installations provided with Point Group operation circuit shall be upgraded by adopting following scheme in the order of priority:
In existing installations, two tail cables shall be laid as per the above scheme. Whenever cabling is from Main location to 1st machine and then 1st machine to 2nd machine, two-tail cables
ANNEXURE B

RDSO DRAWINGS

Fig.B.1(i): Drawing No.RDSO/S 3262-63 – General description and references
Fig. B.1(ii): Drawing No. RDSO/S 3262-63 – Throw rod, Lock and detection connections for IRS Electric Point Machine
Fig. B.1(iii): Drawing No. RDSO/S 3262-63 – Layout Facing Point B.G. fitted with IRS Electric Point Machine

Installation and Maintenance of Electric Point Machine (Rotary locking type) March 2010

ANNEXURE – B: RDSO Drawing

Click for Contents
### R. D. S. O.

**LAYOUT-FACING POINT 1 IN 12 TURNOUT-B.G. ON PRESTRESSED CONCRETE SLEEPERS FITTED WITH SIEMEN'S ELECT. POINT MACHINE**

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<th>PART No.</th>
<th>DESCRIPTION</th>
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<th>SA 9152</th>
<th>REQD</th>
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<td>B</td>
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<tr>
<td>A</td>
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<td>DRIVE ROD</td>
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8. SHIFTING OF LEADING STRETCHER BAR AND SLEEPERS SHALL BE ARRANGED THROUGH ENGS. DEPARTMENT.
9. INSULATED JOINT OF LEADING STRETCHER BAR BE SHIFTED AWAY SUITABLY AT SITE TO FACILITATE THE ADJUSTMENT OF LOCK ROD.

Fig.B.2(i): Drawing No. SA9151-52 – General description and references
Fig.B.2(ii): Drawing No. SA9151-52 – Throw rod, Lock and detection connections for Siemens Electric Point Machine
Fig. B.2(iii): Drawing No. SA 9151-52 – Layout Facing Point 1 in 12 turnout B.G. on Pre-stressed Concrete Sleepers fitted with Siemens Electric Point Machine
REFERENCES

- Installation and Maintenance handbook –IRS type of Electric Point Machine (Rotary Type) 143 mm & 220 mm stroke – M/s Signal Workshop, N.E. Railway, Gorakhpur Cantt. (U.P).
- Literature on Siemens Power operated point machine Bsg.antr.9i –M/s Siemens Ltd.
- CAMTECH’s handbook on Siemens Point Machine – October 1999.
- Railway Board vide letter No. 2004/Sig./A/WR/1 dated 05.01.2005.
- C.S.T.E./WR’s technical circular No. 136/2005 vide letter No. SG.126/0 Vol III dated 17.03.2005