Reconditioning of Points & Crossing

CAMTECH/C/2007/RECONDITIONING/1.0

DECEMBER - 2007

Centre for Advanced Maintenance TECHNOLOGY

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Reconditioning of Points & Crossing
Foreword

Indian Railways have a vast network of Railway track in which more than one lakh turnouts are in service. In high traffic density routes, the points & crossings wear out within a very short period, which require replacement or reconditioning of points & crossing.

Civil engineering branch of CAMTECH has made effort to bring out the booklet on Reconditioning of Points & Crossing. This booklet mainly focuses on equipments, welding electrodes, staff, selection of worn-out points and crossing, process of reconditioning, inspection & records, precautions & defects in reconditioning.

I hope, this booklet will prove to be a valuable source of technical knowledge for civil engineering supervisors & field staff in Railways.

CAMTECH/Gwalior
Date : 11.12.2007

Pramod Kumar
Executive Director
Preface

The turnouts are the weakest links in the track and wornout very early, which requires replacement of the same. The cost of these components is comparatively much higher than other track materials, therefore to enhance the service life of these components reconditioning of wornout areas of these turnouts by a combination of metal arc welding technique and consumables is carried out.

The objective of this booklet is to provide basic information and technical details regarding reconditioning of Points & Crossing i.e. equipments, welding electrodes, staff, selection of worn-out points and crossing, process of reconditioning, inspection and records, precautions & defects in reconditioning. This booklet does not supersede any existing instructions from Railway Board, RDSO & Zonal Railways and the provisions of IRPWM. This booklet is not statutory and contents are for the purpose of guidance only.

We welcome any suggestion for addition and improvements from our readers.

CAMTECH/Gwalior
Date : 28.11.2007

A.K.Dadarya
Director/Civil
<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Description</th>
<th>Page Nos.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Foreword</td>
<td>i</td>
</tr>
<tr>
<td></td>
<td>Preface</td>
<td>ii</td>
</tr>
<tr>
<td></td>
<td>Content</td>
<td>iii</td>
</tr>
<tr>
<td></td>
<td>Correction Slip</td>
<td>iv</td>
</tr>
<tr>
<td>1.0</td>
<td>Introduction</td>
<td>01</td>
</tr>
<tr>
<td>2.0</td>
<td>Equipments</td>
<td>03</td>
</tr>
<tr>
<td>3.0</td>
<td>Welding Electrodes</td>
<td>06</td>
</tr>
<tr>
<td>4.0</td>
<td>Staff</td>
<td>08</td>
</tr>
<tr>
<td>5.0</td>
<td>Selection of worn-out Points and Crossing</td>
<td>09</td>
</tr>
<tr>
<td>6.0</td>
<td>Process of reconditioning</td>
<td>12</td>
</tr>
<tr>
<td>7.0</td>
<td>Inspection &amp; Records of Reconditioning</td>
<td>24</td>
</tr>
<tr>
<td>8.0</td>
<td>Precautions for Reconditioning</td>
<td>29</td>
</tr>
<tr>
<td>9.0</td>
<td>Defects in Reconditioning</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td>Notes</td>
<td>41</td>
</tr>
</tbody>
</table>

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ISSUE OF CORRECTION SLIPS

The correction slips to be issued in future for this booklet will be numbered as follows:

CAMTECH/2007/C/RECONDITIONING/1.0/CS.#
XX date __________

Where “XX” is the serial number of the concerned correction slip (starting from 01 onwards).

**CORRECTION SLIPS ISSUED**

<table>
<thead>
<tr>
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<th>Date of issue</th>
<th>Page No. and Item No. modified</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
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CHAPTER – 1

Introduction

The turnouts are one of the weakest links in the track, which requires continuous attention and maintenance for ensuring their proper geometry, service performance and above all for safety consideration. The cost of these components is comparatively much higher than any other P.Way material, therefore to enhance the service life of these components reconditioning of worn-out area by a combination of metal arc welding technique and consumables is carried out. Reconditioning of points and crossing may be done either at site or in depot as per feasibility. Two types of resurfacing techniques are used on Indian Railways.

Single Electrode System: In this system of welding, only one type of electrode is used to make up for the entire worn out portion of the crossing. The worn out points & crossing can
be resurfaced manually by this method by gradually depositing number of layers as per requirement with 4mm dia. Electrode.

**Flux cored continuous wire welding Process :** In this technique, the filler wire (flux cored) is continuously fed into the molten metal pool. It runs by attaching with DC power source i.e. rectifier or a generator.

***
CHAPTER – 2

Equipments

2.0 Equipments for 72/ 90 UTS Points & Crossings

Equipment for (flux shielded) metal arc welding:

(i) A Portable welding generator DC set or AC set with 800CV or more.
(ii) Welding cables.
(iii) Electrode holder.
(iv) Ground clamp.
(v) Welding electrodes.
(vi) Pre-heating oven for electrodes.
(vii) Pre-heating arrangement for crossing body (torch).
(viii) Gauging equipment.
(ix) Chipping hammer, wire brush etc.
(x) Protective clothing including hand gloves, apron, shoes etc.
(xi) Welding hand shield.
(xii) Magnaflux kit.
Dye Penetration Testing kit.

(xiv) Tong tester.

(xv) Thermo chalks.

(xvi) Grinders/Hand grinding Machine (preferably electric angle grinder or straight grinder).

(xvii) Templates for finishing switches, crossings.

(xviii) Hammer ball pin (1/2Kg. weight).

2.1 Equipments for CMS Crossings

All equipment mentioned above except pre-heating arrangement for crossing body at S. No. vii and water tank made of either masonry or steel plate walls of suitable size, which can accommodate a crossing.

2.2 Guidelines for use of portable DC Electric Welding Generator:

<table>
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<tr>
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<th>Range of welding current</th>
<th>60 to 200 Amp.</th>
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<tr>
<td>1.</td>
<td>Minimum hand welding current</td>
<td>60 Amp. at 100% duty cycle.</td>
</tr>
<tr>
<td>2.</td>
<td>Maximum hand welding current</td>
<td>200 Amp. at 60% duty cycle.</td>
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</tbody>
</table>
4. Open circuit voltage 66V - 85V.
5. Welding load voltage 20V - 30V.
6. Insulation glass F.
7. Auxiliary Voltage 200V AC
8. AC out put 4.0 KVA AT 50Hz
9. 4 Stroke Twin Cylinder 15 HP
10. Rated Speed 3000 R.P.M.
11. Fuel Consumption 3 Litres/Hour (Approx.)
12. Running Hours (Welding) 4 Hours. (Approx.)
13. Weight 135 Kg (Approx.)

The equipment capable of giving 200 Amp. current at 60% duty cycle is ideally suited for reconditioning of points & crossing by using 4.00 mm electrode size of H3, H3A class.

***
CHAPTER – 3

Welding Electrodes

3.0 Welding electrodes for resurfacing of points & crossing

Electrodes approved under Class H3 series, (as per IRS M-28) of the approved list issued by RDSO of 4.0 mm dia. shall only be used for resurfacing of points and crossing and CMS crossings. All electrodes used for welding purposes fall under H3 series, and have been further classified into H3, H3A & H3B classes based upon their traffic carrying capacity as under:

- **H3 Class**: To achieve minimum service life of 15 GMT.

- **H3A Class**: To achieve minimum service life of 25 GMT.

- **H3B Class**: To achieve minimum service life of 35 GMT.
3.1 Precautions for using electrode

- Electrodes shall be dried at $130^0\text{C}$ to $170^0\text{C}$ for at least one hour immediately before use. In case, the packing of electrodes is absolutely intact and all the electrodes are consumed within six hours after of opening of the packing, then pre-heating of electrodes may be dispensed with.

- During use of electrodes, arc is to be taken to use shortest possible arc and minimum weaving. Current polarity, angle of electrode and welding technique as recommended by the manufacture of the electrode shall be used.

- Electrodes having cracked and damaged flux covering shall be discarded.

- The electrode shall be stored in a dry storeroom.

- Welding should be done using 4 mm dia electrodes only.

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CHAPTER – 4

Staff

4.0 Welder

- The welder should be qualified and certified by the competent authority.

- Competency of the welder should be checked and certified by Chemist and Metallurgist (CMT) of the Railway or by any other officer nominated by CE in case of departmental welders and by RDSO in case of private welders.

- The validity of competency certificate will be for a period of five years from the date of issue. Thereafter, competency certificate will be renewed again from CMT of the Railway/RDSO/any other nominated officer.

***
CHAPTER – 5

Selection of worn-out Points and Crossing

5.0 Selection of worn-out Points and Crossing for reconditioning

- **Condition**: Points and crossings to be reconditioned by welding should be in good condition and certified by the Sectional PWI for their suitability for reconditioning and should normally not have exceeded specified limit of wear. Points and Crossings containing cracks on the worn-out portion having depth more than 3 mm beyond the condemning size shall not be selected for further reconditioning and ultrasonic testing should be carried out. Points & Crossing having internal defects should not be reconditioned.
- Wear limits: Maximum vertical wear limit on wing rails and nose of crossing is 10 mm. However, on Rajdhani/Shatabdi routes, as a good maintenance practice, crossings and the wing rails should be planned for reconditioning before reaching the following wear limits:

  Built up Crossings: 6 mm  
  CMS Crossings: 8 mm

5.1 History of the crossing and Wear pattern

Before start of welding, the history of the crossing shall be collected and recorded on a card or register. The details to be recorded shall be as given in para 7.3. The wear pattern shall be recorded along with depth of wear at ten different locations as indicated in figure below.
Figure - 1

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CHAPTER – 6

Process of Reconditioning

6.0 Medium manganese steel or 90 UTS Points and Crossings (in depot)

(i) History of the crossing and wear pattern

Before start of welding, the history of the crossing and wear pattern shall be collected and recorded on a card or register.

(ii) Surface preparation

The locations to be reconditioned shall be ground by pneumatic or electrical grinder to remove adherent scales, deformed and work hardened metal and surface cracks. After grinding, the locations to be welded shall be tested by Magnaflux or dye-penetrant methods to ensure freedom from cracks.
(iii) **Pre-heating**

The points and crossings shall be pre-heated by oxyacetylene flames to a temperature between 250°C to 300°C before welding. This temperature shall be maintained throughout the welding operation. If welding is to be interrupted for some reason, then the portions to be reclaimed subsequently shall be pre-heated again to the above temperature range before welding is continued.

(iv) **Welding sequence**

To avoid distortion, weld metal shall be deposited following a proper sequence so as to achieve uniform welding as well as low heat input. The runs shall be deposited in turn on the right wing rail, nose and left wing rail.

**For Crossings**: In case **skip welding** is started from right wing rail, the sequence will be in the order as under:

Set A- Right wing rail (RWR)-I, Nose-II and Left wing rail (LWR)-III
Set B - RWR-I, Nose-II, and LWR-III

Set C - RWR-I, Nose-II and LWR-III & so on

Similarly, if skip welding is started from left wing rail, the sequence will be as follows:

Set A - Left wing rail-III, Nose-II & Right wing rail-I

Set B - LWR-III, Nose-II & RWR-I

Set C - LWR-III, Nose-II & RWR-I & so on.

For Switches:

Stock rail should be reconditioned before the tongue rail. A worn out tongue rail shall be reconditioned in the closed position i.e. resting against the stock rail. In case of a broken toe, however, the tongue rail is to be built-up initially and hammer forged in the open position and thereafter the tongue rail shall be closed with the stock rail to attain the final profile.
(v) **Welding**

Welding shall be carried out in the flat position following the welding sequence as mentioned above. The arc shall be struck on the points/crossing and then electrodes shall be progressively advanced by maintaining the arc using uniform movement. Care shall be taken to fill the crater to the full weld size before breaking the arc to avoid formation of crater cracks. During restart of the welding operation, the arc shall be struck ahead of the crater and then drawn back. Slag shall be removed thoroughly in between runs. Depending on the depth of wear, the number of layers to be deposited shall be assessed and sufficient weld metal shall be deposited to provide an excess of weld metal by about 3 mm which shall finally be finished by grinding. An interpose temperature of 250°C to 300°C shall be maintained throughout during the welding operation.
(vi) Grindling

After completion of welding, reconditioned area shall be ground off in accordance with the original contour of the rail. A straight edge along with a proper template may be used to check the profile after finish grinding. During grinding, the grinding wheel shall be moved back and forth over the area and not stopped at one spot to avoid formation of grinding cracks.

The grinding wheel shall be kept properly dressed to have a clean cutting surface, as a smoothened and loaded face will increase frictional heat and proneness to grinding cracks.

6.1 Medium manganese steel or 90 UTS Points and Crossings (in-situ)

(i) History of the crossing and Wear pattern

Before start of welding, the history of the crossing and wear pattern shall be collected and recorded on a card or register.
(ii) Surface preparation

The work hardened, fatigued and loose metal if any, shall be removed by minimum grinding. Cracks if any, shall be completely/removed by grinding and then the surface shall be tested by magnetic particles or by dye-penetrant test. In case, deep cracks are present, the same may be removed first by special cutting electrodes followed by grinding.

(iii) Pre-heating

The tongue rail or nose and wing rails of MM/90 UTS steel shall be preheated on the surface by to and fro movement of Oxy-acetylene torch so that rail temperature of approx. 250°C is maintained when depositing the weld metal. Once welding continues, blowpipe can be withdrawn and the welding process itself sustain the interpass temperature of 250°C.
(iv) **Welding**

The crossing shall be welded following proper weld sequence for ensuring uniform and minimum heat input. For this Purpose, weld metal shall be deposited alternatively on left wing rail, nose and then right wing rail. Lower side of the recommended current range shall be used with shortest arc possible. Weaving may carried out but it should be minimum. Slag inclusion shall be removed by hardwire brush having three rows of bristles on 25mm width and chipping hammer having pointed and flat ends. In case, DC welding is recommended by the supplier of electrodes, the electrode should be connected to the recommended polarity. After completion of welding, reclaimed area shall be carefully checked for presence of sufficient metal at each point and presence of any weld defects. Undercut, groove or any other defect, if noticed, shall be removed immediately by electrode cutting followed by re-welding when the crossing still remains hot.

*Reconditioning of Points & Crossing*  
Dec.– 2007
(v) **Passage of train**

Trains can be passed at normal speed over the weld metal crossing even before completion of the hard facing operation. After passage of the train, welding can be started again. However, the weld metal should be allowed to cool for a period of 2 to 3 minutes before allowing the passage of train.

(vi) **Grinding**

After completion of welding, reconditioned area shall be ground off in accordance with the original contour of the rail.

6.2 **Austenitic Manganese Steel Crossing (CMS Crossing)**

(i) **Surface preparation**

The portions to be reconditioned shall be ground by pneumatic or electrical grinder to remove all work hardened metal, spelled edges, cracks, adherent scales etc. After grinding, the locations to be welded shall be
tested by dye penetrant method to ensure freedom from cracks.

(ii) Pre-heating

Due to its low thermal conductivity and possibility of brittle structure formation, it is not advisable to pre-heat the crossings before welding. Interpass temperature shall always be maintained below $150^\circ C$ by keeping adequate intervals in between the runs and cooling the weld deposit and heat affected zone by means of compressed air jet or water quenching immediately after welding. Alternatively, the crossings may be kept submerged in a water bath (water tank made of either masonry or steel plate wall) so that only top 1 cm of the crossing remains un-submerged and temperature is monitored/measured either by contact type pyrometer or tempil stick. No post-heat treatment is required after welding.

(iii) Welding sequence

Rectification of defects by welding of CMS Crossings requires great care in reducing the
heat input. The cycle shall be short i.e. not more than two minutes at a time and on no occasion more than one run shall be deposited. It is advisable to follow skip welding sequence or to weld different portions of the crossings by rotation keeping the intervals adequate to ensure that the temperature of the adjoining areas remain below 150\(^0\)C. The runs may preferably be deposited in turn on the right wing rail, nose and left wing rail in case of crossings following a skip sequence as recommended in Medium Manganese steel/90 UTS points and crossings (in depot).

(iv) **Welding**

Welding shall be carried out in the flat position following the sequence as recommended in Medium Manganese steel/90 UTS points and crossings (in depot) except that at no stage the temperature of crossing shall be allowed to go beyond 150\(^0\)C. The arc shall be struck on the crossing and then the electrode shall be progressively advanced by maintaining the arc with
uniform movement. At a time, a run of about 7 to 8 cm length only shall be deposited by using weaving technique with the electrode held at $45^0$ angle to the direction of welding. The width of the weld shall be twice the diameter of the electrodes and the arc length approximately equal to the electrode diameter. Care shall be taken to fill the crater to the full layer size before breaking the arc so as to avoid crater cracks. During re-start of welding, the arc shall be struck ahead of crater and then drawn back. Slag shall be removed thoroughly in between the runs. Depending on the depth of wear, the number of layers to be deposited shall be assessed and sufficient weld metal shall be deposited to provide an excess of the weld deposit of about 3.0 mm which shall finally be finished by grinding.

(v) **Grinding**

After completion of welding, the reconditioned areas shall be finished by grinding to obtain a smooth surface. A straight edge along with a proper gauge may
be used to check the profile after finish grinding. During grinding, water shall be sprayed frequently and the grinding wheel shall be moved back and forth over the whole area and not stopped at one spot so as to avoid grinding cracks.

(vi) **Welding site**

CMS crossing requires special welding procedure and precautions for obtaining crack free weld deposit on them. The process needs cooling of the weld deposit intermittently by water or compressed air to maintain the temperature below 150°C thereby requiring longer time for welding. In view of this, it will be advisable to weld such crossings **in a depot**.

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CHAPTER – 7

Inspection & Records of Reconditioning

7.0 Inspection

- The resurfaced points and crossings after cooling and finish grinding shall be subjected to a visual inspection, dimensional measurement.

- The points and crossings found to be free from any defect during visual examination shall be subjected to magna-flux or dye-penetrant test to ensure freedom from the presence of any surface crack, which may not be detected during visual examination.

7.1 Rectification of Defects after Inspection

If during visual inspection and magnaflux and/or dye-penetrant tests, cracks or other
weld defects are found, the portion containing the defects shall be gauged either by pneumatic gauging or grinding and the remaining portion shall be re-examined by dye-penetrant tests for ascertaining freedom from any crack defect before undertaking further repairs. In the absence of any crack, the portion shall be re-welded, ground and inspected again as mentioned above.

7.2 Periodical Inspection

After laying in track, the resurfaced points and crossing shall be inspected quarterly in order to record the amount of wear on the nose, left wing and right wing rail as well as stock and tongue rail and also for the structural soundness, presence of disintegration or any other defects. Wear shall be recorded in crossing at ten different locations marked (A1, A3, B1, B3, C1, C2, C3, D1, D2 & D3) in figure 1 at para 5.1 and in tongue rails at seven different locations starting from one at toe to places each 100 mm away towards heel side and up to 600 mm from the toe.
7.3 Records of Reconditioning

For each crossing, records shall be maintained at PWI's office showing station, point no., Up/Down line, facing/trailing direction, traffic density, angle, UTS (72/90), date of last resurfacing, traffic carried since then, date of present resurfacing; wear readings at nominated locations (depth in mm) on left wing rail, nose, right-wing rail, brand and size of electrode used, quantity of electrode consumed (in Nos. or Kg.), grinding time, welding time, total time taken, no. of trains passed during welding and name of welders.

Proforma for recording details regarding reconditioning of built-up/CMS crossings

Railway___________ Division
________________ PWI
Section_____________

(i)       Station
(ii)      Sr. No. of crossing

Reconditioning of Points & Crossing Dec.– 2007
(iii) Make
(iv) Angle/Gauge/Section/ Sleeper type
(v) Laying date and traffic carried

**Particulars (GMT)**

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<td>d) Date of laying</td>
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<td>e)* Date of removal</td>
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<td>i) Traffic carried since last reconditioned (GMT)</td>
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<td>j) Cumulative Traffic carried (GMT)</td>
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(vi) Wear and welding particulars

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<td>b) Wear on nose after surface preparation (100 mm away from ANC)</td>
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<td>c) Date of reconditioning</td>
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<tr>
<td>d) Technique of welding</td>
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<td>ii) Whether single electrode or continuous wire process</td>
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<td>e) Brands of electrodes used</td>
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<td>g) Remarks</td>
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**Signature of PWI**

*Note: In case of reconditioning being done in-situ, the col. 5(d) & (e) will be replaced by date of reconditioning.

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CHAPTER – 8

Precautions for Reconditioning

8.0 The following precautions will be observed during reconditioning work:

- The crossing shall be inspected and it shall be ensured that it is repairable. In case crack is through and through across the complete section either through nose or through wing rails it should not be taken up for repairs. Bolt-holes, if elongated, shall be re-deposited by welding followed by drilling.
- Worn-out area should be thoroughly cleaned to ensure freedom from dust, rust, grease or any foreign material.
- DC generator/rectifier with rating of 65-80 OCV (Open circuit voltage) should be used. It should preferably be with reversed polarity in case of CMS crossings.
• The cables should be free from any damage. The cables should not be too long to avoid current loss.
• The power source and job to be welded should be properly earthed.
• Arc length shall be short.
• Job to be welded shall be in flat position.
• Skip welding sequence should be adopted in the order LWR, NOSE & RWR or vice-versa.
• Welding cycle shall not be more than 2 minutes.
• Electrode angle should be maintained at 45° with the direction of welding.
• In case of single electrode system, it shall be ensured that after grinding, the depth of worn-out area shall not be less than 3 mm at any location.
• Only those electrodes, which are approved by RDSO, shall be used.
• Electrodes should be connected to correct polarity using recommended current. Tong testers shall be used to determine actual current flow.
- During welding, straight edge should be used continuously for correct build-up. After completion of welding, built-up area should be carefully examined and any under-welded spot shall be deposited again while the crossing/ still remains hot.

- MMS/90 UTS switches/crossings before welding, preheated to a temperature of about 250\(^0\)C to 300\(^0\)C, by to and fro movement of the oxyacetylene torch. The blowpipe shall not be held at one spot.

- Preheating should not be done for CMS crossings.

- Welding shall be commenced immediately after pre-heating.

- Preheating of electrodes shall be done at 130\(^0\)C to 170\(^0\)C for atleast one hour immediately before use. In case, the packing of electrodes is absolutely intact and all the electrodes are consumed within six hours after opening of the packing, then preheating of electrodes is not required.

- Complete removal of slag shall be ensured during welding with the help of
hardened chipping hammer having flat and pointed ends and hardened wire brush having three rows of bristles on a width of 25 mm.

- Electrodes with damaged and cracked coating shall not be used.
- In case the crack in switch/crossing is deep, instead of grinding, suitable cutting or gouging electrodes shall be utilised to remove such cracks easily.
- Temperature of the switches & crossings shall be checked during welding. It shall not exceed 300°C for MMS/90 UTS switches & crossings and 150°C for CMS crossings.
- In case of CMS crossings, it shall be ensured that the crossing is submerged by in a water tank with only the head portion projecting out of water by 1 cm. Lower current of the recommended range shall be employed with stringer bead of shorter length, say 7 cm, deposited at a time. In case of CMS crossings, electrodes should be connected to positive polarity to reduce heat input.
- Grinding for surface preparation/finalising to be done avoiding localised heating.
- It shall be ensured that all records regarding history of the switches & crossings like number of times reconditioned, worn-out area reclaimed, electrode used, laying particulars, service life in terms of GMT etc are recorded in a card or register. Preferably, card shall be maintained separately for each switch & crossing.

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CHAPTER – 9

Defects in Reconditioning

9.0 Defects in Reconditioning by Metal Arc Welding

(i) Lack of fusion

Lack of fusion that determines the discontinuity in a weld between weld metal and parent metal or between two adjacent layers of metal and which affects the considerable reduction in static strength and stress raiser under fatigue loading.

Causes

- Dirty surface.
- Improper joint preparation.
- Current too low.
- Excessive welding speed.
- Wrong electrode angle.
- Too large electrode dia.
(ii) Incomplete penetration

A gap left by failure of the weld metal to fill the root of joint or incomplete fusion with the root faces of the parent plate/surface, which may lead to development of cracks from root due to slag.

Causes

- Improper joint design/preparation.
- High welding speed.
- Current too low.
- Too large electrode dia.
- Exclusively long arc length.
- Incorrect electrode angle.
- Incorrect polarity when welding with DC.
(iii) **Undercut**
A groove or channel in the parent metal along the sides of weld bead, which may lead to serious stress concentration under fatigue loading.

**Causes**

- Too fast welding speed.
- Too large electrode dia.
- Too high welding current.
- Wrong electrode manipulation.
- Too long arc length.
- Rusty and scaly job surface.

(iv) **Overlap**

An imperfection at the toe of weld caused by overflow of weld metal on to the parent surface without proper fusion, which may lead to stress concentration under fatigue loading in fillet areas.


**Causes**

- Lower arc current.
- Too low welding speed.
- Incorrect electrode dia.
- Incorrect electrode angle.

(v) **Slag Inclusion**

Slag of any other foreign matter entrapped in weld, which may lead to reduction in static strength and development of cracks at weld junction along side inclusions.

**Causes**

- Incomplete slag removal between runs/passes.
- Faulty welding speed.
- Too large electrode dia.
- Longer arc.
- Too high or too low arc current.
- Improper joint design.
• Damp or cracked electrode coating.

(vi) Porosity

A group of gas pores in the weld causing elongated or tubular cavity due to entrapped gas called piping or a large isolated cavity called blowhole, which affects reduction in static strength and stress raiser under fatigue loading.

Causes
• Welding speed too high.
• Too low or too high welding current.
• Dirty surface.
• Damp or damaged coating of Electrode.
• Higher Sulphur content in parent metal.
• Arc length too short or long.
(vii) **Cracks**

A discontinuity produced either by tearing of metal in plastic condition (hot crack) or by fracture when old (cold crack). Cracks may be confined at the surface only or may be internal both in longitudinal or transverse direction. A crack affects serious reduction in strength & complete failure.

**Causes**

- Welding speed too high.
- Poor ductility of base metal.
- High S% and C% in base metal.
- Rapid cooling or high restraint.
- Improper joint design/preparation.
- Electrodes with high Hydrogen content.
- Base metal having oil, grease, rust or moisture.
(viii) Spatter

Spatters are the small metal particles which are thrown out during welding and get deposited on the base metal around the weld bead along its length. Spatter creates burnt structure on parent metal which acts as raiser and reduces fatigue strength.

Causes

- Arc current too high.
- Longer arc.
- Damp electrodes coated with improper ingredients.
- Electrodes coated with improper ingredients.
- Arc below making the arc uncontrollable.

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| 9. |   |
|10. |   |
|11. |   |
|12. |   |
|13. |   |
|14. |   |
|15. |   |

Go to index
**OUR OBJECTIVE**

To upgrade Maintenance Technologies and Methodologies and achieve improvement in productivity and performance of all Railway assets and manpower which inter-alia would cover Reliability, Availability, and Utilisation.

The contents of this booklet are for guidance only & are **not statutory**. It also does not supersede any existing instructions from Railway Board, RDSO and zonal Railways & the provisions of IRPWM, Manual for reconditioning of Points & Crossing etc on the subject.

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