

**STANDARD SPECIFICATION NO. TM/HM/6/62 OF SCRAPER SHOVEL,  
INTERMEDIATE LINK, BOLT, ROLLER AND BUSH OF THE CUTTER CHAIN.  
FOR SHOULDER BALLAST CLEANER (PROVISIONAL) -1995.**

**1.0** This specification covers the requirements of link, base plate, bracket, cap & cotter pin which constitute the scraper shovel; intermediate link, bolt, roller and bush of the cutter chain assembly of Shoulder Ballast Cleaner for BG plain track. Normally, 43 nos. each of scraper shovels & intermediate links are connected with the help of 86 nos. bolts and 172 nos. each of rollers & bushes to complete one set of cutter chain. Two such sets of cutter chains are fitted on either side of the machine for excavating & scooping the ballast with muck from the shoulder of the track onto a set of vibrating screens. Each scraper shovel has one base plate with two brackets welded on it and fitted with excavating caps on the bracket by means of cotter pins. The plates are of two different designs where the brackets are welded in different ways; perpendicular in one type of plate and inclined in another type and these are fixed alternately in the cutter chain assembly. For dimensional details of the components covered by this specification, refer to RDSO's drawing no. TM/9422/1& TM/9422/2 (in two sheets). The specification also covers the requirements of special welding for fixing the brackets on the base plate.

**2.0** The specification may be treated as provisional subject to modification based on service performance.

**3.0 MATERIAL AND PHYSICAL PROPERTIES.**

**3.1 Scraper Shovel**

**3.1.1 Base Plate**

(a) Recommended: Fe 540 to IS: 8500-1991 (specification for weldable  
Material structural steel) for thickness of 20 mm. The component is rolled one.

(b) Hardness: Hardness of the plate shall be between 151-160 HB.

(c) Heat Treatment: Normalized

**3.1.2 Bracket**

(a) Recommended : Grade 20 Mn 5 Cr 5 to IS: 4432-1988 (specification  
Material for case hardening steels) with ruling section of 50 mm. The component is forged one.

(b) Hardness : Hardness of the bracket after heat treatment shall be between 311-320 HB.

(c) Heat Treatment : Bracket shall be hardened at 840° -870° C and Tempered at suitable temperature between 500° – 550° C.

### **3.1.3 Cap:**

- (a) Recommended Material : Grade 20 Mn 5 Cr 5 to IS: 4432 -1988 (specification for Case hardening steels). The component is forged one.
- (b) Hardness : The surface hardness of the carburised cap should be HRC 52 $\pm$ 4.
- (c) Heat Treatment : The component shall be suitably carburised at 890° - 940° C, hardened at 810° -840° C in oil / thermal bath/ polyquench bath and tempered at 170° - 200° C.

### **3.1.4 Cotter pin**

- (a) Recommended Material : Grade 60 Cr 4 V 2 to IS: 3195-1992 (specification for the manufacture of volute and helical spring). The component is rolled one
- (b) Hardness : Hardness of the cotter pin shall be between 415- 460 HB.
- (c) Heat Treatment : The cotter pin shall be hardened in between 830o - 860° C in oil and tempered in between 350° – 550° C

### **3.2 Link and Intermediate Link**

- (a) Recommended Material : Grade 40 Cr 4 Mo 3 to IS: 5517 -1978 (specification for steels for hardening and tempering) having ruling section 50 mm for both link and intermediate link. The components are forged one.
- (b)Hardness : Hardness of the link and intermediate link shall be between 270 - 300 HB.
- (c)Heat Treatment : The components shall be suitably normalized at 850° - 880° C. Afterwards they are to be hardened at 850° - 880° C in oil and then tempered at 550° to 720°C. Suitable soaking time shall be given depending on the thickness.

### **3.3 Chain Bolt**

- (a)Recommended Material : Grade 40 Cr 4 Mo 3 to IS: 5517 -1978 (specification for steels for hardening and tempering) having ruling section of 63 mm for chain bolt. The Components are forged one.
- (b) Hardness : Hardness of the chain bolt shall be between 270 - 300 HB.

- (c) Heat Treatment : The components shall be suitably normalized at 850° - 880° C. Afterwards they are to be hardened at 850° - 880° C in oil and then tempered at 550° to 720° C.

### **3.4 Roller**

- (a) Recommended : Grade 40 Cr 4 Mo 3 to IS: 5517 -1978 :(specification  
Material for steels material for hardening and tempering)  
having ruling section of 63 mm. The components are forged one.
- (b) Hardness : Hardness of the roller shall be between 270 - 300 HB.
- (c) Heat Treatment : The components shall be suitably normalized at 850° – 880° C. Afterwards they are to be hardened at 850° – 880° C in oil and then tempered at 550° to 720° C. Suitable soaking time shall be given depending on the thickness.

### **3.5 Bush**

- (a) Recommended : Grade 40 Cr 4 Mo 3 to IS: 5517 -1978 (specification  
Material for steels for hardening and tempering) having ruling section of 100 mm. The components are forged one.
- (b) Hardness : Hardness of the bush shall be between 250 - 280 HB.
- (c) Heat Treatment : The components shall be suitably normalized at 850° – 880° C. After-wards they are to be hardened at 850° – 880° C in oil and then tempered at 550° to 720° C. Suitable soaking time shall be given depending on the thickness.

## **4.0 MANUFACTURE:**

Manufacturer should have the essential infrastructure required for manufacture of the above components as appended below. Steel making facilities if not available with the manufacturer, he should furnish a certificate having obtained raw material of requisite quality from a reputed source.

### **4.1.1 Steel Making**

- (a) Type of furnace - Electric arc.  
Capacity - 5 M/T (approx).  
Argon purging desirable.  
Overhead cranes of suitable capacity.
- (b) The size of the ingot or continuous cast billet for the given size of the finished product shall be such that a minimum reduction ratio of 8:1 from the minimum cross-sectional area of the ingot or continuous cast billet to the maximum cross-sectional area of the product is ensured.

- (c) The inclusion rating level, when determined as per IS: 4163 -1982□ shall not be worse than 2.0 A B C D both for thick and thin series as per IS: 4163 -1982.

4.1.2 Rolling Mill with suitable re-heating furnace.

#### **4.1.3 Heat Treatment**

- i) Oil-fired/Electric furnace equipped with temperature indicating-cum-recording facilities.
- ii) Oil quenching tank with suitable agitation system.
- iii) Suitable carburising facilities.

#### **4.1.4 Quality Control Facilities**

- i) Chemical analysis (wet/instrumental method).
- ii) Brinell hardness testing equipment.
- iii) Rockwell hardness testing equipment (scale B & C).
- iv) Metallurgical Microscope, 100x min with photographic attachment.
- v) Macroscopic testing facilities.
- vi) Radiographic examination.

### **5.0 WELDING PROCEDURE**

#### **5.1 Preparation**

Both sides of the bracket component are to be machined or ground to have an angle of about 60° with the top surface of the base plate. The top plate surface in the area of weldment shall be cleaned to remove surface oil/grease/paints etc. The bracket shall be placed on the excavating plate in proper position and held by tack welding at few places.

#### **5.2 Welding**

Consumables Basic coated austenite stainless steel electrodes of class M1 as per IRSM-28 shall be used for welding. Electrode of 3.15 mm dia shall be used for better root fusion. Welding shall be done preferably in flat down hand position. No pre-heating shall be done since one of the components is in hardened & tempered condition. The interpass temperature should not exceed 200 °C. The heat input shall be kept as minimum as possible. The electrode shall be preheated to 150 °C for one hour before use.

#### **5.3 Testing**

After welding, the weld area shall be checked by dye penetrant test to ensure freedom from crack. The minimum fillet size shall be 8.0 mm. The weld profile should be merged with the bracket profile. There should not be any groove formation.

## **5.4 Precaution**

The following precautions are to be taken:

- i) Preferably there should not be any HAZ (Heat affected zone) in both plate and bracket, as the chances of martensite / bainite in the HAZ is possible. This makes the HAZ brittle.
- ii) Undercutting of the plate should be avoided.
- iii) Proper & complete fusion to be ensured.

## **5.5 Facilities Required For Welding**

- i) Welding transformer/rectifier set.
- ii) Gauge for measuring fillet size.
- iii) Facilities for dye penetrate test.
- iv) Portable grinder for edge preparation before welding.
- v) Electrode drying oven for preheating the electrodes.

## **6.0 TESTING AND INSPECTION**

- 6.1 The components offered by the manufacturer shall be visually inspected individually for their finish and freedom from defects viz pits, porosity, cracks, improper edges etc.
- 6.2 Each component found suitable after visual inspection shall be checked for their dimensional characteristics as per drawing no. TM/9422/1& TM/9422/2. Only those components found to be satisfactory with regard to all these dimensional characteristics shall be accepted subject to testing as per para 6.3 below. The manufacturer shall provide necessary gadget required for dimensional checks.
- 6.3 The component found to be free from defects during visual and dimensional checks shall be subjected to following tests after adequate sampling.
  - 6.3.1 Random sampling shall be done and one sample shall be taken from every heat treated lot for testing of hardness and shall conform to the particular specification for hardness as stipulated in para 3.0 for each component.
  - 6.3.2 For chemical composition the ladle analysis shall be supplied by the manufacturer and shall conform to the particular material specification as stipulated in para 3.0 for each component.
  - 6.3.3 Non-destructive tests viz Dye-penetration and Radiographic examination should be carried out to ensure freedom from cracks and defects.

## **7.0 ACCEPTANCE CRITERIA**

If the results of the product analysis do not meet the specified requirements given in para 3.0, two new samples shall be taken on different pieces from the same batch. Should both the analysis satisfy the requirements, the lot represented may be accepted. Should either of the tests fail, the material shall be taken as not complying with the standard.

## **8.0 PROTECTION**

The components shall be protected with one coat of boiled linseed oil to IS: 77-1976 'Linseed oil for paints' or any other rust preventive compound.

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