



# Participant Handbook

Sector  
**Iron & Steel**

Sub-Sector  
**Steel, Sponge Iron, Ferro  
Alloys, Re-Rollers, Refractory**

Occupation  
**Mechanical Maintenance**

Reference ID: **ISC/Q0906, Version 1.0**  
**NSQF Level 3**



## Bearing Maintenance

## Published by

All Rights Reserved,  
First Edition, March 2016

## Copyright © 2016

Indian Iron & Steel Sector Skill Council

Sector Skill Council Contact Details:

Address: Royal Exchange, 6 N.S. Road, Kolkata - 700 001

Email: [info.iisssc@gmail.com](mailto:info.iisssc@gmail.com)

Phone: +91 9831083024

## Disclaimer

The information contained herein has been obtained from sources reliable to Indian Iron & Steel Sector Skill Council. Indian Iron & Steel Sector Skill Council disclaims all warranties to the accuracy, completeness or adequacy of such information. Indian Iron & Steel Sector Skill Council shall have no liability for errors, omissions, or inadequacies, in the information contained herein, or for interpretations thereof. Every effort has been made to trace the owners of the copyright material included in the book. The publishers would be grateful for any omissions brought to their notice for acknowledgements in future editions of the book. No entity in Indian Iron & Steel Sector Skill Council shall be responsible for any loss whatsoever, sustained by any person who relies on this material. The material in this publication is copyrighted. No parts of this publication may be reproduced, stored or distributed in any form or by any means either on paper or electronic media, unless authorized by the Indian Iron & Steel Sector Skill Council.





**Shri Narendra Modi**  
Prime Minister of India

“ Skilling is building a better India.  
If we have to move India towards  
development then Skill Development  
should be our mission. ”



## Certificate

**COMPLIANCE TO  
QUALIFICATION PACK – NATIONAL OCCUPATIONAL  
STANDARDS**

is hereby issued by the

**Indian Iron & Steel Sector Skill Council**

for

**SKILLING CONTENT : PARTICIPANT HANDBOOK**

Complying to National Occupational Standards of

Job Role/ Qualification Pack: 'Bearing Maintenance' QP No. 'ISC/Q0906 NSQF Level 3'

Date of Issuance: April 9<sup>th</sup>, 2016  
Valid up to\*: April 10<sup>th</sup>, 2018

\*Valid up to the next review date of the Qualification Pack or the  
'Valid up to' date mentioned above (whichever is earlier)

Authorised Signatory  
Indian Iron & Steel Sector Skill Council

## Table of Contents

S.No.	Modules and Units	Page No.
<b>1.</b>	<b>Introduction</b>	<b>1</b>
	Unit 1.1 – Understanding of Iron & Steel industry	3
	Unit 1.2 - Understanding various types of Iron & Steel industry	8
	Unit 1.3 – Creation of products in Iron & Steel industry	12
<b>2.</b>	<b>Occupational health and safety (OHAS) (ISC/N0008)</b>	<b>19</b>
	Unit 2.1 – Learn occupational health and safety	21
	Unit 2.2 – Hazard	24
	Unit 2.3 – Safe working practices	32
	Unit 2.4 – Working at heights and confined spaces	37
	Unit 2.5 – Fire prevention	45
	Unit 2.6 - Emergencies, rescue and first aid procedures	53
<b>3.</b>	<b>5S &amp; housekeeping (ISC/N0008)</b>	<b>59</b>
	Unit 3.1 - Identification of bottlenecks in functioning of work place	61
	Unit 3.2 - Various methods of housekeeping	64
	Unit 3.3 – Waste disposal	75
<b>4.</b>	<b>Job understanding requirements (ISC/N0929)</b>	<b>79</b>
	Unit 4.1 – Limits, Fits and Tolerances	81
	Unit 4.2 - Understanding the engineering drawings	87
	Unit 4.3 - Using of hand tools	98
	Unit 4.4 - Using of measuring instruments	115
	Unit 4.5 - Diagnosing the common defects	128
<b>5.</b>	<b>Bearings (ISC/N0929)</b>	<b>131</b>
	Unit 5.1 – Bearings	133
	Unit 5.2 – Types of bearings	136
	Unit 5.3 – Operating conditions of bearings	143
<b>6.</b>	<b>Maintenance of bearings (ISC/N0930)</b>	<b>147</b>
	Unit 6.1 – Bearing handling and storage	149
	Unit 6.2 – Bearing inspection	154
	Unit 6.3 – Troubleshooting of bearing	160



<b>7.</b>	<b>Lubrication and seals (ISC/N0930)</b>	<b>175</b>
	Unit 7.1 – Lubrication	177
	Unit 7.2 – Types of lubricant	180
	Unit 7.3 – Seals	188
<b>8.</b>	<b>Bearing installation and dismounting (ISC/N0931)</b>	<b>191</b>
	Unit 8.1 – Bearing installation	193
	Unit 8.2 – Bearing alignment	197
	Unit 8.3 – Dismounting of bearing	200
<b>9.</b>	<b>Reporting and documentation (ISC/N0008)</b>	<b>207</b>
	Unit 9.1 – Documentation for health and safety	215
	Unit 9.2 - Documentation of defects	220
<b>10.</b>	<b>Problem identification and escalation (ISC/N0008)</b>	<b>223</b>
	Unit 10.1 – Risk management	225
	Unit 10.2 – Escalation matrix	227
<b>11.</b>	<b>Work effectively with others (ISC/N0009)</b>	<b>231</b>
	Unit 11.1 - Ensure appropriate communication with others	233
	Unit 11.2 - Workplace etiquettes	236
<b>12</b>	<b>Employability &amp; Entrepreneurship Skills</b>	<b>239</b>
	Unit 12.1 – Personal Strengths & Value Systems	243
	Unit 12.2 – Digital Literacy: A Recap	262
	Unit 12.3 – Money Matters	268
	Unit 12.4 – Preparing for Employment & Self Employment	279
	Unit 12.5 – Understanding Entrepreneurship	288
	Unit 12.6 – Preparing to be an Entrepreneur	310



### 7. Reversible Ratchet Spanner

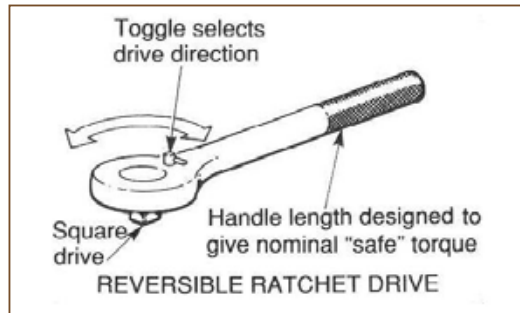


Fig 4.3.8 Reversible Ratchet Spanner

The ratchet spanner is used in conjunction with sockets and a wide range of socket accessories. It helps to speed up the turning motion when doing up and undoing nuts. It is also used in tight spots where the range of arc is small.

## 4.3.2 Mallets

A blow from a steel hammer might damage or mark the material more than what is considered acceptable. This is often the case when using soft metals like lead, copper, aluminium. In these situations mallets, sometimes called soft faced hammers are more suitable as the force of the blow is distributed over a larger area and any stretching of the metal is reduced or even eliminated.

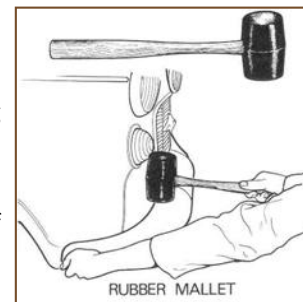


Fig 4.3.9 Rubber mallet

### Types of Mallets

#### 1. Rubber Mallets

The rubber mallet has a cylindrical head made from solid rubber moulded to a wooden handle. Correct use of this mallet will prevent damage to surfaces which may have been painted, plated or finely machined.

#### 2. Soft Faced Mallets or Hammers

There are two types of soft faced mallets:

- Plastic mallets

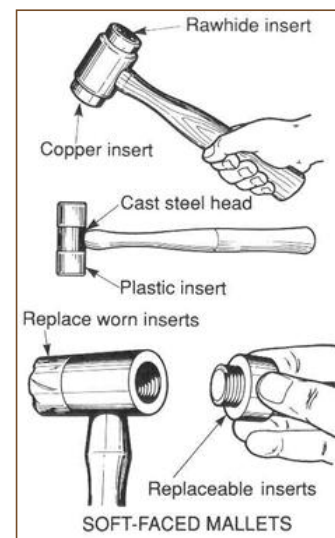


Fig 4.3.10 Soft face mallet

- Copper and rawhide faced mallets

Both types of mallets have cast steel heads where inserts can be screwed in. Inserts are made from copper or lead, rawhide and plastic, and should be replaced once they are worn or marked.

### 4.3.3 Pliers and Clamps

Pliers are gripping tools mostly used to hold small components that would otherwise be difficult to grasp and control. Pliers are also used for shaping and bending light sheet metal as well as bending, twisting and cutting small diameter wires.

#### 4.3.3.1 Types of Pliers

1. **Combination Pliers:** Standard engineers' pliers are also called combination pliers because of their versatility. The flat jaws and pipe grip are serrated for general gripping and holding. Cylindrical objects are held in the pipe gripping section of the jaws. Use the side cutting jaws only for soft wires such as copper wire.

To cut harder steel wires, use only the joint cutters. These have strong 90° shearing edges and are placed to have greater mechanical advantage than the side cutting jaws. To cut, open the pliers wide until the cutter grooves in adjacent jaws line up. Insert the wire with the short end facing away. Squeeze to cut.

**WARNING:** *Never cut wires in tension until you have made sure the ends cannot fly dangerously. Always*

*wear safety glasses. Grip small round objects at right angles to the flat jaws for greatest control.*

2. **Slip Joint Pliers:** The most common of these are multi grip pliers. When they are used as light pipe wrenches, they are known as 'gas fitters pliers'. Slip joint, multi grip pliers have a shaped pivot

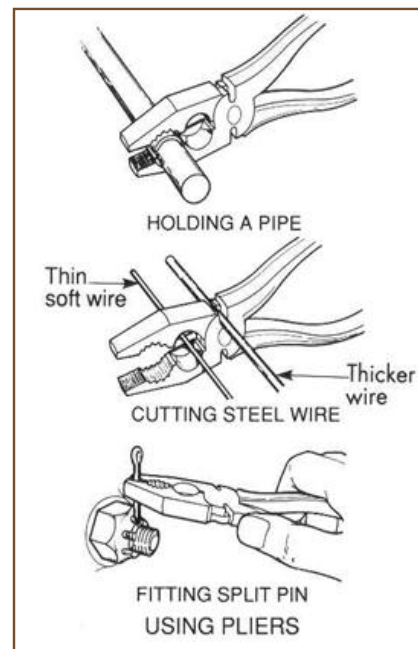


Fig 4.3.11 Pliers



### 4.3.7 Maintenance Tools

**Induction heaters:** Their method of heating does not create the smoke, fumes or oil waste caused by other heating methods and they are fast and heat can be controlled easily. Size of bore of bearing must match the yoke size of heater so that bore gets filled by heater.

Since these heaters are fast in order to avoid overheating of bearing with seals to temperatures higher than 90°C (200°F) refer manual for correct temperature and time settings. To know the time settings trial runs are necessary.



Fig 4.3.33 Induction heater

Since heater probe is easily breakable it must be handled carefully, must be placed in clean area in bore and size must be matching to the size of bore.

Before removing the work piece heating and demagnetization cycle must be completed.

#### Hydraulic nuts

Tapered bore bearings are easily and quickly installed or removed using hydraulic nuts. Bearing can be precisely positioned on the shaft by creating a smooth, controllable force due to pressure generated by the piston. Bearing internal clearance reduction is controlled and chance of damage to bearing or other components are reduced with this.



Fig 4.3.34 Hydraulic nut

#### Pullers

Pulling of bearings, bushings, gear wheels, couplings or other press-fitted work pieces can be done with a variety of hand and hydraulic pullers. More force is generated by hydraulic pulling devices

Follow the points described below while using them

- Size and capacity of puller must be selected such that it matches to the job.
- Maximum withdrawal forces which are calculated must be less than puller capacity.



Fig 4.3.35 Puller

### 5.2.2.2 Angular contact ball bearing

It contains one shoulder on the inner race, the other at the opposite side on the outer race; both of them forming a steep contact angle slanted toward the bearing's axis. These shoulders support high thrust loads combined with a moderate radial load and have high axial rigidity.

#### Benefits/advantages

- High thrust capacity
- Axial rigidity

#### Applications

- Clutch release



Fig: 5.2.2 Angular contact ball bearing

### 5.2.2.3 Double row ball bearing

Principles of the single row and angular contact bearings are combined in double row ball bearing. Position of grooves in the outer and inner races is such that the load lines through the balls from either an outwardly or inwardly converging contact angle.

Misalignment of bearing on shaft or in the housing and axial displacement is prevented by the strength of two rows of ball and also it can handle heavy loads in radial direction and thrust loads in both directions.

#### Benefits/advantages

- Thrust capacity in either direction
- High radial capacity
- Less axial displacement

#### Applications

- Air conditioner clutch



Fig: 5.2.3 Double row ball bearing

### 5.2.2.4 Ball thrust

They have high thrust capacity and used mainly for clutch release applications. But produce little axial displacement since load line runs parallel through its balls to the shaft axis. Under heavy loads flat shoulders on the shaft and housing are to be used .



Fig: 5.2.4 Ball Thrust

#### Benefits/advantages

- High thrust capacity
- Minimal axial displacement

#### Applications

- Clutch release

### 5.2.3 Roller bearings

Roller bearings are of following types:

- Tapered Rollers
- Cylindrical Rollers
- Needle Rollers

They differ in the rollers' shape and the races' curvature.



Fig: 5.2.5 Roller Bearing

#### 5.2.3.1 Tapered roller bearings

True rolling motion is achieved with the conical shape of this bearing. They can handle any combination of radial and thrust loads.

#### Benefits/advantages

- Because of conical shape designs without guidance by the cage each roller in the bearing can line up itself properly



Fig: 5.2.6 Tapered roller bearing

between the tapered faces of the cup and cone. Bearing produces maximum output by accurate alignment of each roller due to increase of contact area between the large end of the roller and the rib. This wide area of contact compels each roller to maintain accurate

alignment. With each roller perfectly aligned between the two races, the bearing works to maximum productivity.

- The second benefit – Since a radial load produces both radial and thrust reaction on a tapered bearing this can support radial and thrust loads at the same time.

#### **Applications**

Following parts of vehicles like automobiles, trucks, tractors, and various farming vehicles uses tapered roller bearings.

- Transmissions
- Transfer cases
- Rear axle shafts
- Differentials
- Front wheels
- Trailer wheels

### **5.2.3.2 Cylindrical roller bearings**

Inner race, outer race, cage and rollers are the four roller bearing parts of cylindrical type. A cage guides rotating movement of equally spaced cylinder shaped rollers on the flat surface of the two races .

#### **Benefits/advantages**

- High capacity under radial loads
- Accurate guiding of the rollers
- Limited free axial movement

#### **Applications**

- Transmissions
- Differentials
- Rear Axle Shafts



*Fig: 5.2.7 Cylindrical roller bearing*



**Skill India**  
कौशल भारत - कुशल भारत



**Address:** Royal Exchange, 6 N.S. Road, Kolkata - 700 001  
**E-mail:** info.iisscc@gmail.com  
**Web:** www.iisscc.org  
**Phone:** +91 9831083024  
**CIN No.:** U74900WB2013NPL197827

**Price: ₹**

978-1-111-22222-45-7

