INTER PLANT STANDARD – STEEL INDUSTRY		
IPSS	**SAFETY STANDARD FOR EQUIPMENT AND MACHINERY GUARDING IN STEEL INDUSTRY**	**IPSS:1-11-025-16**
	Corresponding IS does not exist	

0. **FOREWORD**

0.1 This Inter Plant standard, prepared by the Standards Committee on Safety Appliances and Procedures IPSS 1:11, with the active participation of the representatives of all member steel plants and associated organizations in the field, in presence of experts from member organizations and adopted in October, 2016.

0.2 This standard has been prepared to introduce a guideline for equipment and machinery guarding in Steel Industry to prevent Injury due to rotating equipments, components flying out due to centrifugal force, body parts like hand/ finger or clothing getting caught in the rotating component.

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1. **SCOPE**

To provide a guideline regarding safeguarding of equipments, material and construction of the guards. This standard is applicable to all the places in Steel Industry in India. Working department, Contractors, Suppliers and Consultants are responsible for implementation of this standard.

2. **Procedure:**

2.1 Types of equipments requiring safe guarding

2.1.1 Guarding of mechanical power transmission equipments

i. Belt and pulley

ii. Chain and sprocket

iii. Couplings- Input/ output shafts

iv. Flywheels/ Bull gears/ Open gears

v. Drive & Tail end of belt conveyor

vi. Brakes and clutches.

vii. Other projected parts

2.1.2 Guarding of equipments while at working site.

i. During lubrication

ii. While online cleaning.

iii. While condition monitoring and sampling.

2.1.3 Guarding of accessory equipments such as Exhaust fan, man cooler fan, pedestal fan, grinders etc.

2.2 **Guards can be classified according to the nature of the job** :

2.2.1 **Temporary Guards-**

i. Where jobs are carried out one time near the rotating or projected part of an equipment (described in section 2.1).

ii. The guards must be designed such that it can easily be refitted/ Reposition. The large guards must be made from a number of sections and provide handles and locating points.

iii. The safety guard shall be in segment of convenient size, bolted/ hooked to fix the structure for easy removal during maintenance/ condition monitoring.

2.2.2 **Permanent Guards-**

Where regular jobs are carried out near the rotating or projected part of equipment (as described in section 2.1).

2.3 **Materials generally used for construction of Guards:**

Wire mesh, Metal sheet, transparent plastic sheet etc.

2.4 **Construction of Guards**:

i. The choice of material of construction is largely a matter of local preference based upon operating conditions, types of guards already installed.

ii. Frame work / Railing of the safeguard :- Angles/ Flat, hollow structure, Pipe, rod etc can be used

iii. Filler Material: - Wire mesh, perforated or solid sheet metal, high strength plastic.

iv. If guards are located out door, painted or galvanized steel sheets to be used.

v. Guards furnished with purchased equipments are desirable if they meet the general requirements of this standard.

vi. Filler Dimensions- Wire mesh (Refer Fig 1)

'a ' is the sides of square in wire mesh - 12 to 20 mm (½ in and ¾ in).

'b' is the minimum clearance between guard and machinery - 120mm (4 ¾ in) . The wire diameter should be between 1.5mm to 3mm

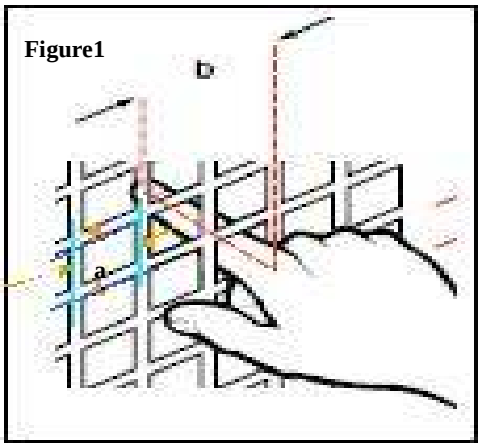


Figure – 1

Metal, transparent plastic sheet (Refer Fig 2)

Sheet thickness - 2 mm to 5 mm

Minimum clearance between safe guard and rotating machine- 120 mm

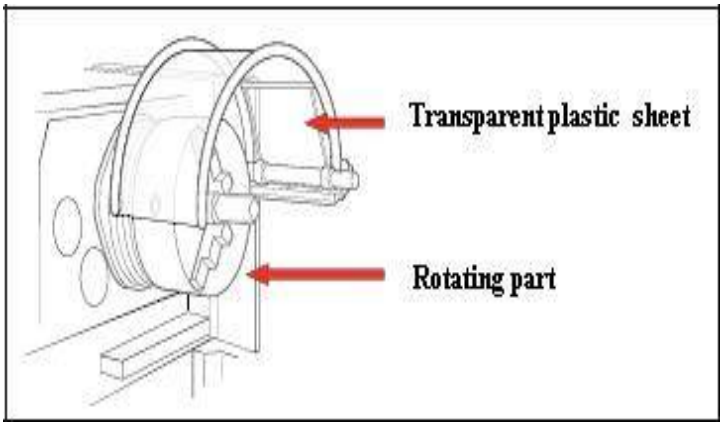


Figure 2

vii. Transparent sheet shall be used on rotating equipment from where there is a chance of oil/ coolant splashing.

viii. Framework dimension for

Square Hollow Section (SHS) – 25 X 25 X 2.5mm.

For Flat – 25 X 25 X 3.0 mm

For Angle – 25 X 25 X 3.15 to 45 X 45 X 3.15 mm.

2.5 Equipments

2.5.1 Belt and Pulley

2.5.1.1 All power transmission belts & pulleys shall be guarded fully.

2.5.1.2 All belts (Horizontal, vertical, inclined and overhead) above the floor or platform, shall be guarded for their entire length.

2.5.1.3 Metallic belt lacing or fasteners shall not be used in areas containing explosives or inflammable vapors.

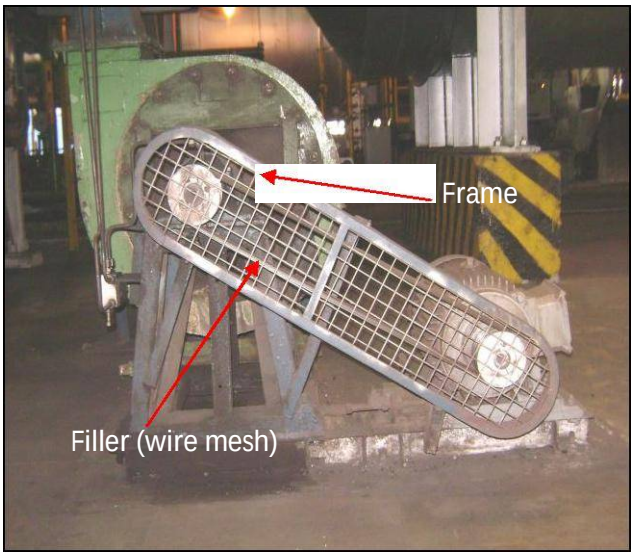


Figure :3

2.5.1.4 Unless the distance to the nearest fixed pulley, clutch, or hanger exceeds the width of the belt used, a guide shall be provided to prevent slip of the belt from the pulley on the side where insufficient clearance exists.

2.5.1.5 Where there are overhanging pulleys on line, jack, or countershafts, with no bearing between the pulley and the outer end of the shaft, a guide to prevent the belt from running off the pulley should be provided.

2.5.1.6 Where separate pulley guards are used and the belt does not require guarding, the guard should enclose the pulley so as to protect the run– in point of the belt. The guard should extend slightly above the top of the pulley.

2.5.2 Chain and sprocket: The safeguarding is similar as explained in section 2.5.1.1 to 2.5.1.3.

2.5.3 Couplings– Input/output shafts**-** Couplings mounted at input or output shaft of the machine must be guarded by a stationery guard as explained in section 2.4.

FIGURE – 4

2.5.4 Flywheels/Bull gears/ open Gears

2.5.4.1 Guards shall be provided on flywheel/ bull gear/ open gear as explained in section 2.4 .

2.5.4.2 When the upper rim of flywheel / bull gear/ open gear protrudes through a working floor it shall be enclosed entirely or surrounded by a guardrail and toe board.

2.5.4.3 When flywheel/ bull gear/ open gear extends into pit or within 12 inches of floor standard toe board shall be provided.

2.5.5 Drive & Tail end of belt conveyor

The tail end of a belt conveyor having rotating pulley must be guarded as explained in given diagram Fig. 5.

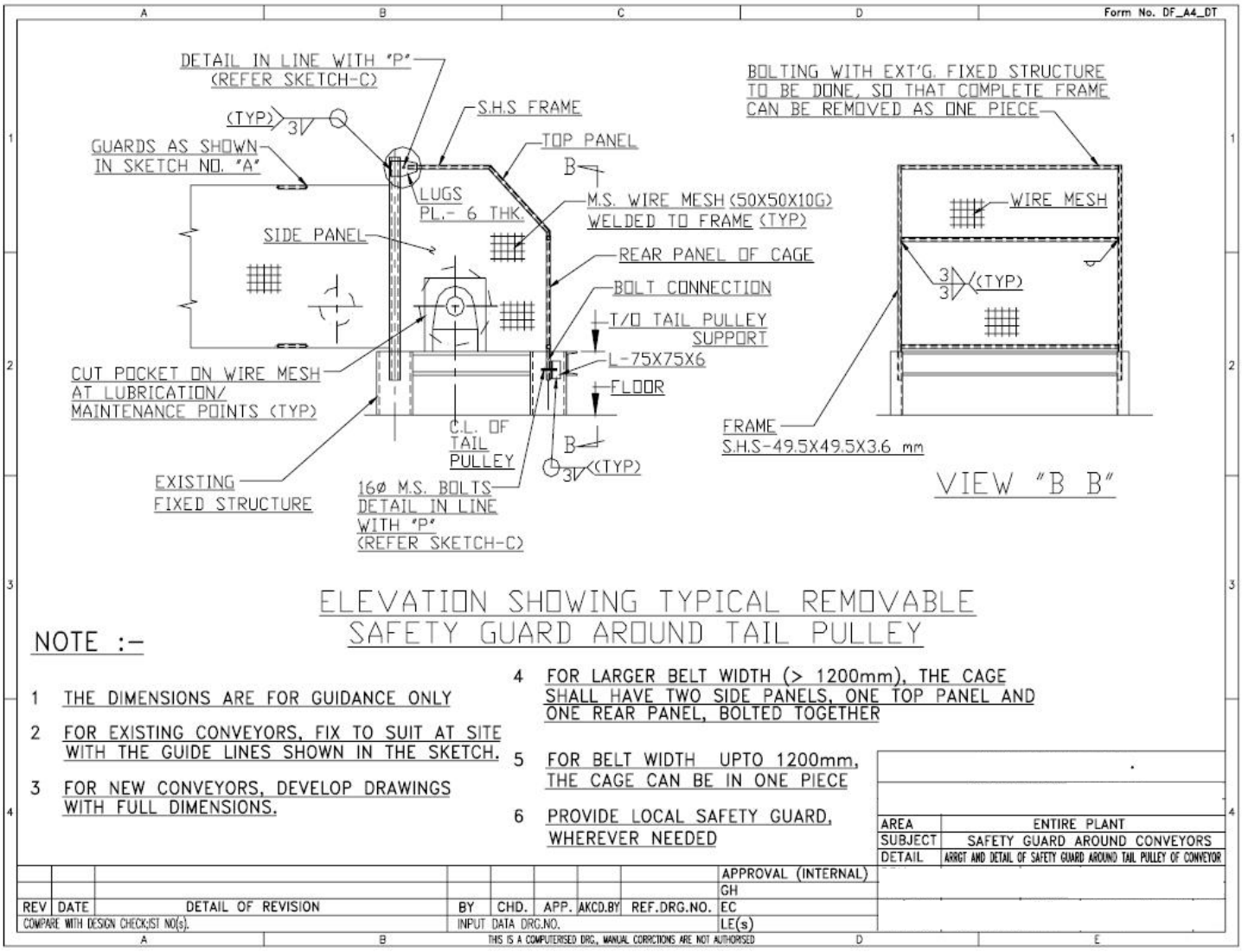


Figure5: Guarding of tail end pulley

2.5.6 Brakes and clutches:

Brakes and clutches mounted at input or output shaft of the machine must be guarded by a stationery guard as explained in section 2.4.

Figure 6

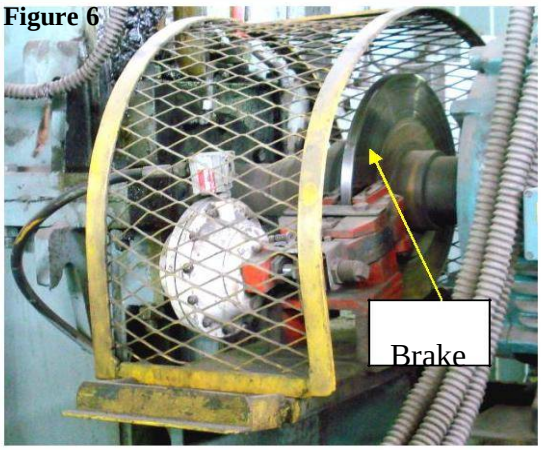


Figure 7

2.5.7 Other projected parts.

This includes (Refer Figure 7)—

i Protruded parts of stationery structures in the walkway/ nearby the working area,

ii Uncoupled shaft of gearbox / pulleys/ rolls.

The guard shall be provided as explained in section 2.4.

2.6. **At working site**

2.6.1 Lubrication

If the lubrication point is near to the rotating equipment the guard and the lubrication facility shall be given as follows:

2.6.1.1 The guards must be designed to reduce the need to remove them. For example provide access to tracking mechanisms in figure 8: (A) and greasing points (B).

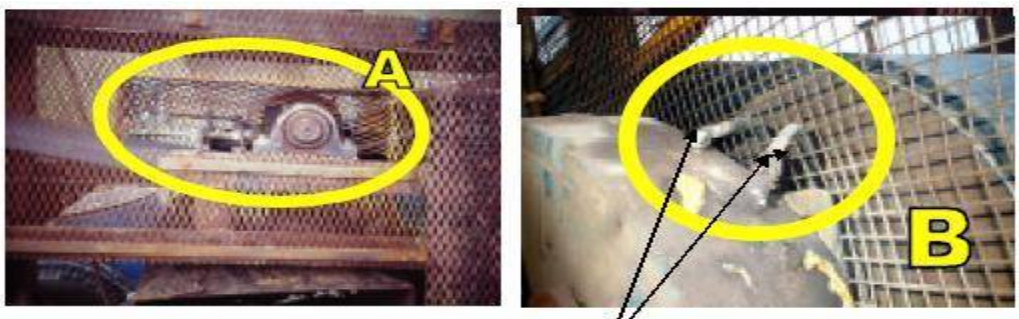
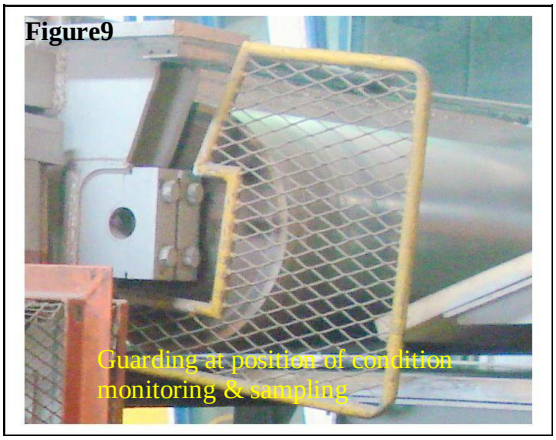


Figure: 8 Lubrication points

2.6.2 Online cleaning / Condition Monitoring/ Sampling

2.6.2.1 During online cleaning/ condition monitoring / sampling the rotating or projected part of an equipment must be guarded.

2.6.2.2 The difficulties associated with frequent removal of guards and the continual stopping for cleaning purposes may be overcome by using hinged/ detachable guards which allow access.



2.7 Accessory equipments

2.7.1 Grinders

The associated risk of bench grinders, pedestal grinders, and portable grinder is fragmentation of an abrasive wheel.

The maximum wheel exposures for guards on two types of abrasive equipment: bench and pedestal grinders (90° exposure) and hand-held angle grinders (180° exposure) is illustrated in the figure10. The protective hood of a portable grinder must cover at least 120° of the wheel periphery.

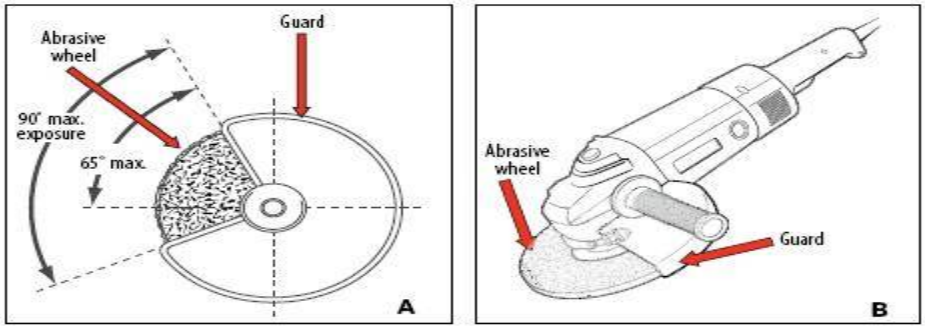


Figure 10

2.7.2 Man cooler Fan/ Exhaust Fan/ Pedestal Fan

The Fan Must be guarded by a galvanized wire mesh. The dimension of wire mesh shall be between 4 to 8 mm and minimum clearance between fan and guard shall be at least 15 mm.

2.8 **Training**

i All personnel whose job requires working in the vicinity of rotating/ moving part of equipment must be trained by an expert prior to starting of the job.

ii Safety precautions specific to the associated hazards of the equipment on/ near which the person is deployed, should be explained to him by an expert prior to starting of the job and to be displayed beside the equipment.

CHECK LIST FOR

EDUCATION AND TRAINING

1. Do operators and skilled trades workers have the necessary education and training in how to use the guards?
   Yes ☐ No ☐
2. Does the education include examples of workers in your workplace or elsewhere who might have lost their life or their limbs from lack of machine guarding?
   Yes ☐ No ☐
3. Have production workers and skilled trades workers been trained in where the guards are located, how they provide protection, and what hazards they protect against?
   Yes ☐ No ☐
4. Have production workers and skilled trades workers been trained in how and under what circumstances guards can be rem ed?
   Yes ☐ No ☐
5. Have workers been trained in the procedure to follow if they notice guards that are damaged, missing or inadequate?
   Yes ☐ No ☐
6. Do skilled trades workers have the necessary education and training in how to build the safety aspects of guards?
   Yes ☐ No ☐

Note – 'Trade' word can be removed from above format if required.

2.9 **Machine guarding Checklist**

The checklist attached below is a guideline for machine guarding

MACHINE GUARDING CHECKLIST

GUARDING REQUIREMENTS

1. Do the guards prevent workers' hands, arms, and other body parts from making contact with dangerous moving parts?
   Yes ☐ No ☐
2. Are the guards firmly secured and not easily removable?
   Yes ☐ No ☐
3. Do the guards ensure that no objects will fall into the moving parts or explode out?
   Yes ☐ No ☐
4. Do the guards permit safe, comfortable, and relatively easy operation of the machine?
   Yes ☐ No ☐
5. Can the machine be oiled or greased without removing the guard?
   Yes ☐ No ☐
6. Does the machine automatically shut down when the guard is removed?
   Yes ☐ No ☐
7. Can the existing guards be improved?
   Yes ☐ No ☐

MECHANICAL HAZARDS

The point-of-operation:

1. Is there a point-of-operation guard provided for the machine?
   Yes ☐ No ☐
2. Does it keep the operator's hands, fingers, body out of the danger area?
3. Is there evidence that the guards have been tampered with or removed?
   Yes ☐ No ☐
4. Could you suggest a more practical, effective guard?
   Yes ☐ No ☐
5. Could changes be made on the machine to eliminate the point-of-operation hazard entirely?
   Yes ☐ No ☐

Power transmission apparatus:

1. Are there any unguarded gears, sprockets, pulleys or flywheels on the apparatus?
   Yes ☐ No ☐
2. Are there any exposed belts or chain drives?
   Yes ☐ No ☐
3. Are there any exposed set screws, key ways, collars, etc.?
   Yes ☐ No ☐
4. Are starting and stopping controls within easy reach of the operator?
   Yes ☐ No ☐
5. If there is more than one operator, are separate controls provided?
   Yes ☐ No ☐

Other moving parts:

1. Are guards provided for all hazardous moving parts of the machine, including auxiliary parts?
   Yes ☐ No ☐

Annexure: -1

Item	Specification
Square Hollow Section	38X38X3.2 mm
"	25X25X3.2 mm
"	49.5X49.5X3.6 mm
Acralic Transparent Plastic sheet	130 mmX5mmX10m
Flat	MS Flat 25X3mm
Angle	MS25X25X3mm