INTER PLANT STANDARD IN STEEL INDUSTRY		
IPSS	**CODE OF PRACTICE FOR RAW MATERIAL SPILLAGE CONTROL**	**IPSS:3-02-021-18**
	Corresponding IS does not exist	Formerly : IPSS:3-02-021-07

0. FOREWORD

0.1 Interplant standardization in steel industry was initiated under the aegis of the Indian Standards Institution (ISI) and the Steel Authority of India Limited (SAIL). This IPSS was prepared by the standard committee on Operation and Maintenance, IPSS 3:2 and firstly published in 2007. Lastly, this has been revised by the standard committee in July 2018 with the active participation of the representatives from major Indian steel plants and leading consultants.

0.2 This Standard is intended to provide the guide lines to know the cause of spillages in the belt conveying system, remedial measures and practices to be followed to control spillages.

1. SCOPE

1.1. This Inter Plant Standard covers the causes of spillages normally occur at different areas of Belt Conveying System in Raw Material Handling Plant.

2. LOCATION OF SPILLAGES

2.1. Normally spillage occurs at the following locations in a Belt Conveying System:

i) At Head End, around the Discharge Chute.

ii) Under the Snub Pulley.

iii) Return side of the belt all along the length under the Return Idlers and Bend Pulleys.

iv) On the Deck Plate generally at loading point.

v) All around the Receiving Chute.

vi) At the Tail Pulley

3. CAUSES OF SPILLAGES AT VARIOUS POINTS

3.1. At Head End Pulley

i) Delivery Chute jamming and overflow of material.

ii) Excessive off-centre of belt at Head Pulley due to uneven lagging.

iii) Failure of Interlock.

iv) Absence/malfunctioning of Chute Clogging Switch/Over Filling Limit Switch.

3.2. **Under the Snub Pulley**

i) Delivery Chute jamming and overflow of material.

ii) Scrapper ineffective.

3.3. **In Return Side all along the length**

i) Return Side Scrapper not functioning

3.4. **On the Deck Plate at loading point**

i) Belt goes off-centre due to off-central loading of material from receiving chute.

ii) Damaged/jammed Idlers or Idler Stand at loading point.

iii) Malfunctioning or in-operation of Belt Sway Switch

3.5. **At Receiving Chute**

i) Damaged side Skirt Rubbers & back Skirt Rubbers.

ii) Damaged Skirt Board.

iii) Worn out chute Liner & Mother Plate Leading.

iv) Chute Inspection Window not closing properly.

3.6. **All along the Deck Plate**

i) Cuts/holes in the Belt.

ii) Off-centre running of belt due to jammed/damaged carrying Idlers & Self Trailing Idlers.

iii) Non-functioning of Belt Sway Switch

3.7. **At Tail-end Pulley Area**.

i) Material carried by Return Belt up to Tail Pulley.

ii) `V' scrapper on Return Belt ineffective.

4. ELECTRICAL & MECHANICALACCESSORIES FOR SAFETY & SPILLAGE CONTROL

4.1. Over filling switch/chute clogging switch are installed in a strategic location of the receiving chute to prevent overfilling of the material as shown in the line diagram **Fig-4.1**.

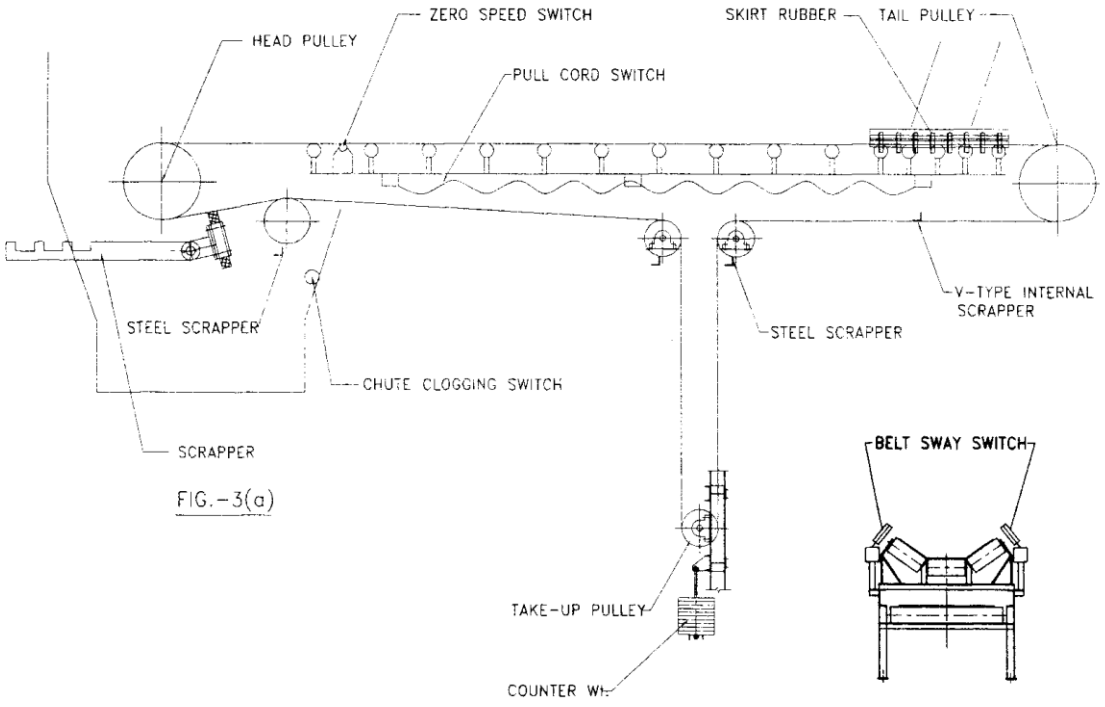


FIG. – 4.1

4.2. **Belt Sway Switches**

4.2.1. As shown in **Fig-4.2**, special limit switches with rollers on the levers are installed all along the length of conveyor at an interval of 15 metres in carrying side.

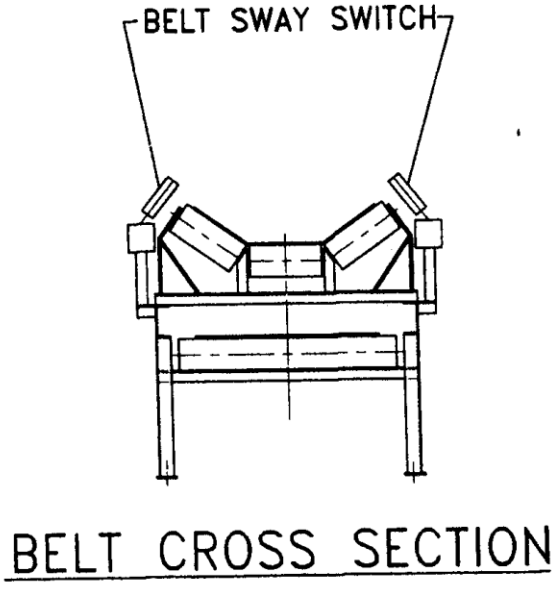


Fig-4.2

4.2.2. A use of Belt Sway Switches prevents spillages due to off-centre running of belt & also prevents damage to the edges of the belt.

4.3. **Zero speed Switches (ZSS)**

4.3.1. As shown in **Fig-4.1**, Zero Speed Switch is installed in such a way that its roller has good contact with the conveyor belt. When the belt runs, roller of the ZSS also rotates and gives signal. If due to any reason (such as belt slippage, belt snapping etc) the belt does not move physically, the ZSS gives signal to stop drive motor. Accordingly, the drive of all preceding belts also gets stopped due to interlock.

4.3.2. Zero Speed Switch is very essential to avoid belt snapping & also it prevents overflow of material from the discharge chute of preceding belt. This situation occurs during snapping of the belt or belt slippage.

4.4. **Pull Cord Switch**

4.4.1. Pull cords are provided all along the side of the belt deck and are intended for emergency use. Contact type switches are used to prevent accidental restart.

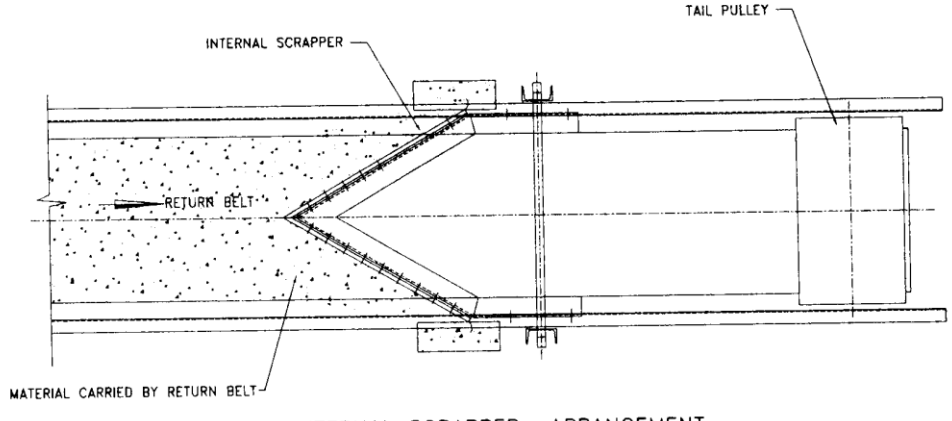
4.5. **Scrapper**

4.5.1. Scrapper is installed on the conveyor belt to clean the belt after the material is discharged in the discharge chute. If scrapper is not installed, or if it is ineffective, the material sticked on the belt is carried in return side and cause spillage and jamming of return idlers & pulleys.

4.5.2. The counter weight type of scrapper is very effective & very easy to fabricate, install and maintain. It should be installed at the location shown in the **Fig -4.1** i.e. between the Head & Snub pulley. In case, Snub pulley is not inside the chute, modification of chute is to be done so that the Snub pulley goes inside.

4.6. **Internal Scrapper "V" type**

4.6.1 Typical sketch of the Internal Scraper "V "Type is shown below in Fig – 4.6



INTERNAL SCRAPPER ARRANGEMENT

FIG 4.6

4.6.2 Many times due to overflow from chute or due to spillage at transfer point, the material is carried in the return belt. This material entraps between the belt & tail pulley and causes damage to the belt and also jamming at the tail-end pulley. To prevent this, Internal "V" scrapper is to be provided in return side just before the tail pulley.

4.7. **Skirt Rubber**

4.7.1. To prevent spillage of material at transfer point, rubber skirt is to be provided in the metallic skirt board to seal the material from the sides. Although the use of soft rubber is recommended for using as skirt rubber, but old conveyor belt is normally used for this purpose. Fixing arrangement should be simple so that it can be replaced without much loss of time. One of the simple fixing arrangements is shown in the **Fig- 4.7**.

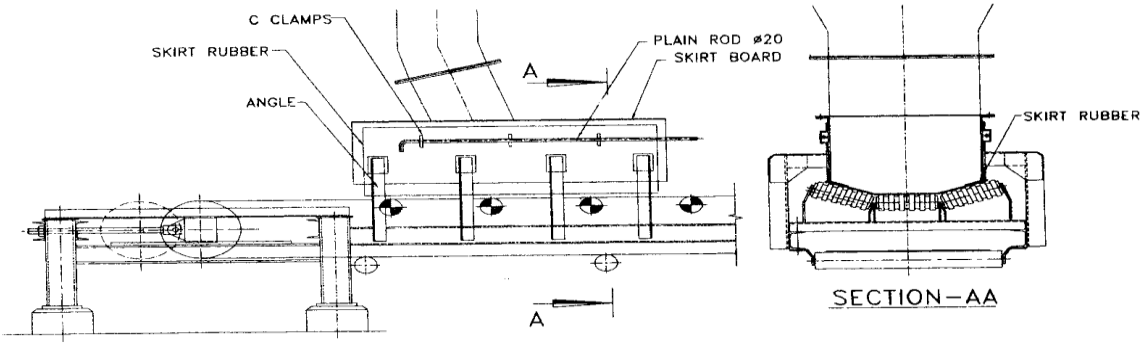
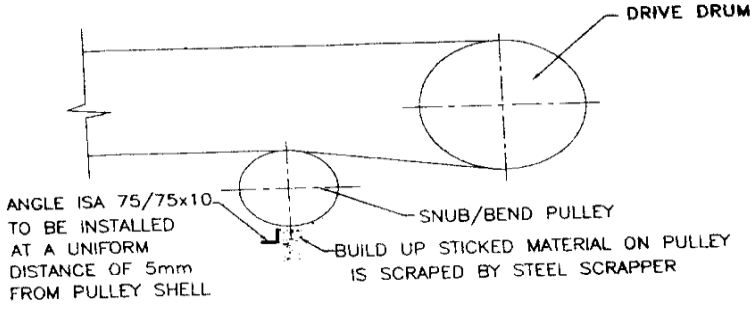


Fig -4.7

4.8. **Steel Scrapper to clean Snub Pulley & Bend Pulleys**

4.8.1. Normally, material builds up on Snub Pulley and Bend pulleys. This causes off-centre running of belt and also gradual rupture to the ply of the conveyor belt. To prevent build up of material in above pulleys, steel scrapper is to be installed as shown in **Fig.- 4.8.**



STEEL SCRAPPER TO CLEAN SNUB PULLEY & BEND PULLWY ARRANGEMENT

Fig -4.8

5. PRACTICES TO BE FOLLOWED TO CONTROL SPILLAGE

5.1. Inspection

5.1.1. Following should be inspected once in a shift and recorded properly.

i) Vulcanizing joint condition

ii) Belt Sway

iii) Belt Spillage

iv) Gearbox for noise, vibration, heating, lubricant leakage, etc.

v) General condition of spillage through out belt length

vi) Skirt condition

vii) Troughing & return idler condition

5.1.2. Any abnormality noticed which is of serious nature and required immediate attention, should be bought to the notice of concerned agency.

5.2. Belt Off-Centre Rectification

5.2.1. Rollers are to be replaced as soon as the play / noise is found in the bearing of rollers in the idler set.

5.2.2. Head End Pulley lagging shall be kept in good condition. It should be done uniformly.

5.2.3. Skew joint shall be avoided during vulcanizing.

5.2.4. Centering of the chute shall be ensured.

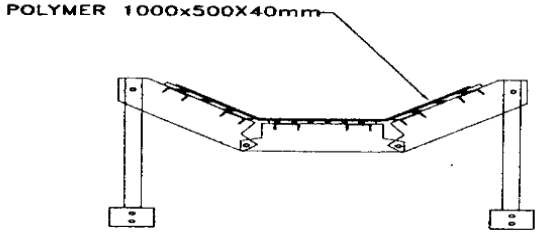
5.2.5. The level of pulley and its alignment of pulley are to be checked and corrected.

5.2.6. All pulleys, carrying & return idlers shall be in right angle alignment with reference to the direction of the belt.

5.2.7. Worn out pulleys to be replaced. Uneven worn out shell causes off-centre running of belt.

5.2.8. Material buildup on the pulleys to be cleaned. Steel scrapper is to be provided to avoid building up of material on Snub & Bend pulleys.

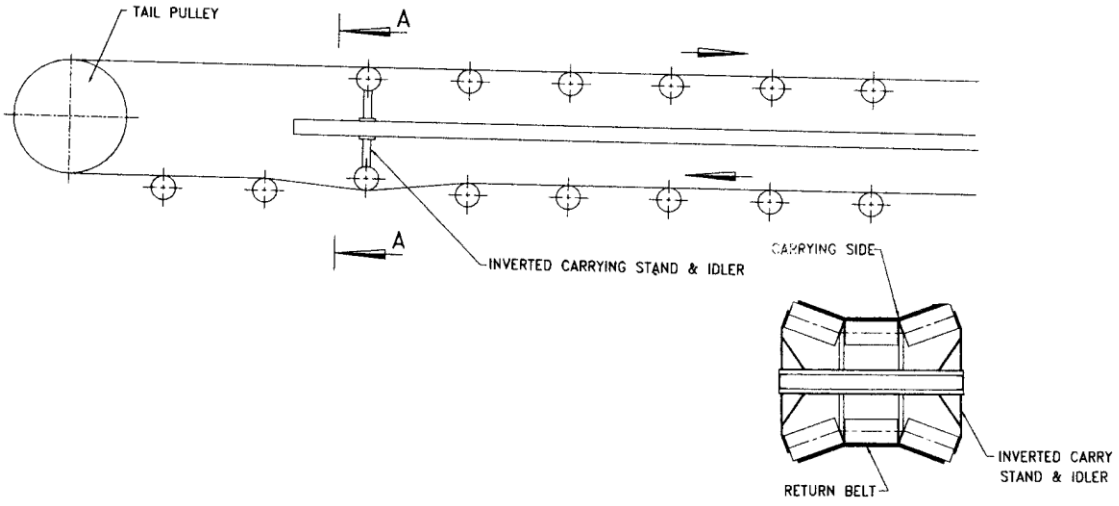
5.2.9. Impact idlers get frequently damaged. To overcome this problem, impact pad table may be installed in place of impact idlers as shown in the diagram. For 1000 mm belt, length of the impact pad should not be less than 1000 mm.



IMPACT PAD

Fig – 5.1 (i)

5.2.10. To overcome off-centre at Tail-end pulley inverted carrying idler to be installed in return side about 6 to 7 metres away from the tail end pulley as shown below:



SECTION AA

Fig – 5.1 (ii)

5.2.11. The inverted idler stand to be properly aligned or slightly skewed till the belt run centrally at the tail-end pulley & then it should be fully tightened. Rollers mounted on the inverted stand to be locked by lock plate to prevent its falling on the belt.

5.2.12. Load on the counter weight to be provided as per drawing to ensure proper tension in the belt.

5.2.13. Free movement of the counter weight in the guide to be ensured.

5.2.14. In case of Horizontal take up, free movement of trolley & counter weight to be ensured.

5.2.15. Smooth running of all the pulleys to be ensured and bearings to be checked as per schedule.

5.2.16. In case of screw take up, screw to be kept in good condition so that proper tension can be given to the belt.

5.3. **Monitoring The Condition Of Chutes, Skirt Boards & Its Timely Repair**

5.3.1. Condition of chute liners to be inspected and if any liner is bulged out, the same is to be replaced.

5.3.2. Schedule to be made for replacement of chute liners (based on the past experience of its life) and replacement to be done in time. For better flowability, slope of the chute place should not be less than 70^{o}.

5.3.3. Selection of liners in the chute to be done depending upon the materials to be passed through the chute. For lumps, rubber liners, shore hardness 72 to be used. For iron ore fines & base mix, polymer liners UHMWPE with shore

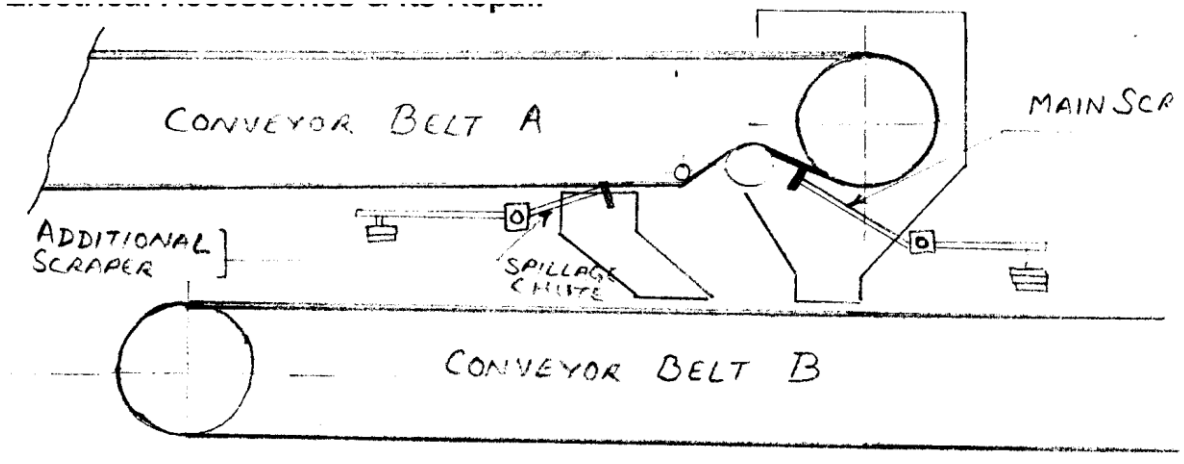
hardness of 65 to 68 to be used. Normally 40mm thick liners to be used. However, at first impact area, liner of 60 to 80 mm thickness to be used.

5.3.4. Fixing of liners to be done with proper care. The surface of mother plate to be thoroughly cleaned before fixing of new liners.

5.3.5. Plane surface to be ensured after fixing of liners to avoid chocking of chute.

5.3.6. Liners on the skirt board to be fixed out of Mn steel plate of 16mm thick with counter sunk bolts.

5.4. **Monitoring The Condition Of Scrapper / Skirt Rubber/ Belt / Mech. & Electrical Accessories & its Repair**



5.4.1. Effectiveness of scrapper to be checked & ensured every shift by adjusting the counter weight on scrapper arm.

5.4.2. Condition of the scrapper blades & skirt rubber to be checked in preventive maintenance and replaced if required.

5.4.3. Polyurethane (20mm) or rubber (30/40mm) thick to be used for scrapper blade.

5.4.4. Wherever possible, one additional scrapper is to be fixed & spillage chute is to be made as shown below.

5.4.5. Use of belt fastener should be avoided. However if it is unavoidable in view of production need, the same is to be eliminated by shortening or piece insertion at the earliest opportunity.

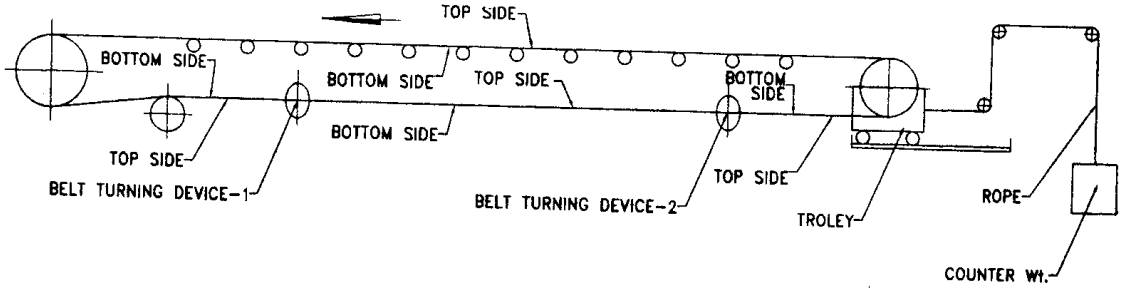
5.4.6. Good quality of vulcanizing solution and hammers to be used for vulcanizing jobs. Expired date solutions should never be used.

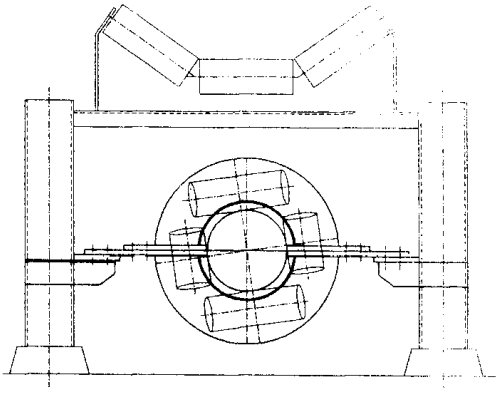
5.4.7. Condition of Mechanical & Electrical Accessories for safety and spillage control to be monitored every day and immediate rectification to be done if found defective.

5.5. Belt turning device to be installed wherever possible. This is to be installed in the return side near the head end just after the Snub pulley and at tail end

before the tail pulley. This is suitable for horizontal gravity take up in the same floor.

5.6. This device turns the belt i.e. in return side after passing through this device belt takes a turn i.e. upside down up to the another belt turning device at tail end and again turn to its normal position. By this action no spillage take place in return side as material; sticked on belt does not fall and return rollers always remain clean. Fixing locations & sketch of Turning Device is shown below:





BELT TURNING DEVICE

Fig – 5.6

5.7. Belt should never be over loaded beyond its capacity.

5.8. Adequate illumination in the conveyor gallery and junction houses to be ensured.

Good house keeping to be ensured. Inspite of above all, small amount of micro fines will be accumulated which has to be cleaned regularly and properly house keeping is to be maintained.