A Quarterly Loss Prevention Digest

Sixth Edition

May 2012

IN-SIGHT

Lead Article:

Loss Prevention In Sheet Metal Operations

bharti AXA

redefining / general insurance

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CEO & MD

Bharti AXA General Insurance Company Limited

Message from CEO & MD

I am happy to inform you that Bharti AXA General Insurance Company Limited has won the **Country of the Year 2011** award the **Highest GWP Growth 2011** award for General Insurance at the **AXA Asia 2011 Awards**. Undoubtedly, this would not have been possible without your support and we thank you for this. Another of the prestigious awards that we recently won was the **AXA Asia innovation awards** in the 'Young and Families 2012' category. This is for the first of its kind personal help to our hospitalised health claimants by reaching out to them during their hour of need and helping them with their insurance queries and fulfilment of all claim and processes related requirements. This helps them to be relieved of all claims related worries and helps them to concentrate on recovery. Besides the award, this activity has endeared us to our customers resulting in a regular flow of appreciative mails and them becoming a positive advocate for our brand. I thank these customers for such positive feelings and actions and wish to convey that we respect and appreciate the efforts put in by them.

Coming to the non-life insurance scenario, there are quite a lot of changes taking place like the dismantling of motor third party pool, upward revision in rates for cat perils covered under fire, engineering and other policies, hardening of reinsurance rates and terms together with imposition of event limits and capacity restrictions. All these do pose a testing time for this sector and let's hope we are heading towards better days ahead.

Subrahmanyam B.

Senior Vice President, Health and Commercial Lines

Bharti AXA General Insurance Company Limited

From the Editor's Desk

We had in our inaugural newsletter declared that the inaugural and subsequent issues that follow would focus on the SME segment, since the majority of safety literature available today was on loss prevention issues related to large and hazardous industries. Accordingly, our loss prevention experts had brought out a series of newsletters which focussed on the SME segment. The issues covered till date are Loss Prevention in Light Engineering Industries, Loss prevention in Spray Painting Operations, Loss Prevention in Heat Treatment Operations, Loss Prevention in Metal Casting Operations, and Loss Prevention in Electroplating Operations.

In this issue, we come out with the final article in this series which is on Loss Prevention in Sheet Metal Operations. Though sheet metal working is not generally considered to involve a great risk from fire, health or injury point of view; the accident rate in this occupancy is rather high and there also happen to be issues concerning fire and health. Issues regarding the processes involved in the associated hazards and the necessary control measures are addressed in this lead article. In addition, we also have the usual safety quiz and a special feature on electrical safety.

Wishing you all a very happy and informative reading experience.

I. Lead Article: Loss Prevention in Sheet Metal Operations

1.0 Introduction

Sheet metal operations are carried out in a wide variety of manufacturing industries where goods and products manufactured have metal casings or interiors that are made of sheet metals. These include automobiles & its ancillaries; home appliances such as fridge, washing machine, vacuum cleaners; electronic goods like DVD/ CD players, radios, stereos, amplifiers, PCs and other items such as toys, steel furniture/ cabinets, aircraft wings and structural materials for roofs and wall claddings. Such operations are also carried out by sheet metal workers engaged in making, installing and maintaining heating, ventilation and air duct (HVAC) system, sign boards and buildings having metallic roofs, claddings, downspouts, etc. This article focuses on the hazards involved in sheet metal operations and loss prevention measures that can be adopted to mitigate these hazards.

Sheet metal operations involve cutting, bending and drawing of sheet metals from flat rectangular sheets and coiled strips. The thickness of sheets processed in such operations normally range between 0.25 mm and 6 mm; and steel and aluminium happen to be the most commonly used metals. Brass, copper, tin, nickel and titanium are some of the other metals used for specific applications as also silver, gold and platinum for high end decorative uses.

2.0 General Process

Sheet metal processes can be broadly classified into 3 different categories:

- Cutting
- Bending
- Drawing or Forming operations

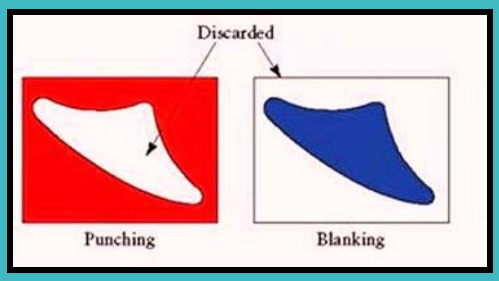
2.1 Cutting

Cutting operations carried out are shearing, punching and blanking.

- **Shearing:** This involves cutting of sheet metals by the shearing action of movable knives. Shearing processes apply shearing forces to cut, fracture or separate the sheet metal into two or more pieces.
- **Punching:** In this operation, a die and punch are used to cut the desired shape or profile on the sheet metal where the required piece is the exterior one and the unwanted portion that gets discarded is the cut interior.
- **Blanking:** A die and punch are used to obtain the desired shape from a metal sheet. In this case, the interior portion is the required piece and the exterior portion is the one that gets discarded.

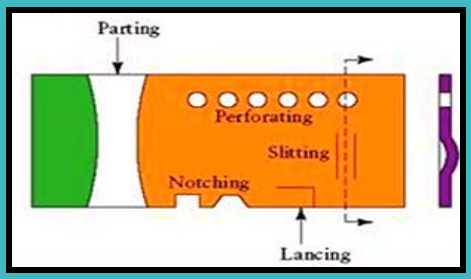
Hence in both cases, the operations are similar and the difference lies in the piece that gets selected and the portion that gets discarded. In punching, the exterior is the required piece and

the interior gets discarded. In blanking, the interior is the required piece and the exterior gets discarded, illustrated in the figure below.



Cutting Operations

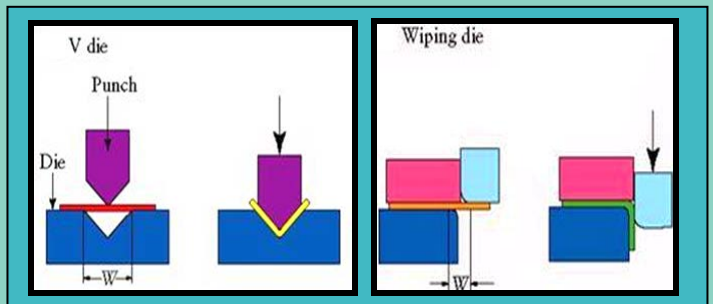
Note: Perforating & Notching are special types of punching operations. Perforating is punching of a large number of holes in a sheet and notching involves removing of undesired portions from the edges of the sheet. Illustration below:



Cutting Operations

2.2 Bending

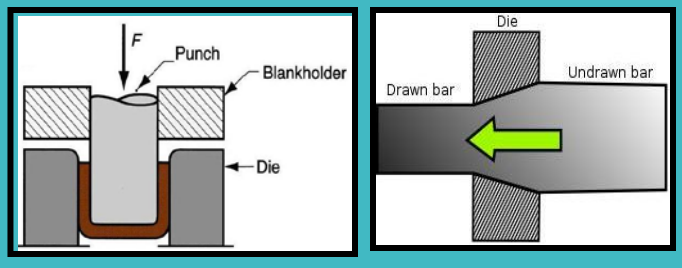
This operation involves straining of sheet metal around a straight axis so as to impart a permanent bend. These operations are carried out using dies. Commonly used dies are 'V' dies and wiping dies. 'V' dies are used for carrying out simple and inexpensive bending operations where the volume of production is generally low. Wiping dies are used for carrying out 'edge bending' operations and are generally employed when the volume of production is generally high.



Bending Operations

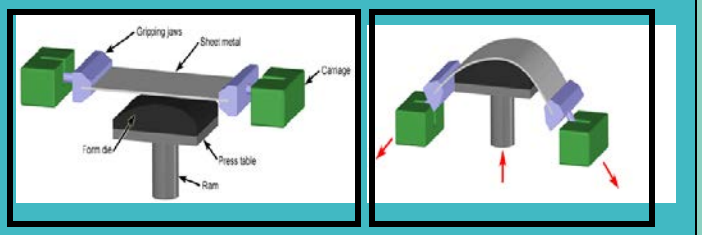
2.3 Drawing or forming operations

This operation results in forming of metal sheets into different shapes like a cube, cuboid, cylinder or other complex shapes. It involves plastic deformation of metal over a curved axis and is achieved by positioning a blank sheet metal over a die cavity through which a punch pushes the metal sheet into an opening as illustrated in the below figure. Wire, bar, tube drawing operations are different. Here, semi-finished metal rod stock is transformed into wires of smaller diameter of perfectly round cross-section by pulling them through a die(s).



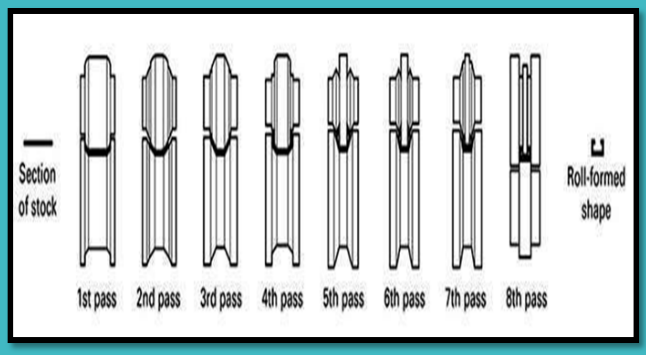
Drawing/ Forming Operations

There is another type of metal forming process called **stretching.** In this operation a piece of sheet metal is stretched and bent simultaneously over a die to form large contoured parts. This operation is performed on a stretch press, in which a piece of sheet metal is securely gripped along its edges by gripping jaws. The gripping jaws are each attached to a carriage that is pulled by pneumatic or hydraulic force to stretch the sheet. The tooling used in this process is a stretch form block, called form die, which is a solid contoured piece against which the sheet metal is pressed.



Stretch Forming Process

Roll forming is another variation of forming process wherein metal strip is progressively bent as it passes through a series of forming rolls.



Roll forming of a box channel

3.0 Fire and Explosion hazards

Since the materials being processed are not combustible in nature and processes involved are non-hazardous from fire or explosion point of view, fire hazards in such type of occupancies are generally low. Accordingly, this occupancy has been classified under 'light hazard category' by Tariff Advisory Committee (TAC) in their Fire Protection Manual. Fire hazards in such occupancies could, however, arise from the following factors:

- ❑ Use of coolants and lubricants in cutting operations
- ❑ Presence of large quantities of hydraulic oils in presses and other process machineries
- ❑ Hazards arising due to storage of supplies, such as cutting and lubricating oils, as well as combustible packaging materials
- ❑ Hazards arising from utilities such as generators and transformers
- ❑ Hot Work

3.1 Coolants/Lubricants

Coolants/ lubricants used for lubrication of cutting tools could result into fire if they get ignited due to: (1) Heat generated by the work being done (2) Friction created by the cutting tool (3) Spontaneous oxidation of waste cotton rags that get contaminated with oil or grease.

Cutting fluids are often used in metal working operations to cool and lubricate the tool and stock at the point of operation. It is also used to facilitate smoothness of the cut, increase life of the tool and remove cutting chips and fines. Cutting fluids used for such purposes would include water as well as oil-based solvents. The typical methods of application used are flood application, jet application and mist application. After the fluid has performed its function at the work point, it is collected, separated from the chips, filtered and reused. Oil based cutting fluids are combustible in nature and increase fire hazard in the premises.

In addition, mineral-oil based cutting fluids have poor biodegradability, remain in water and soil for a long time and can cause contamination of lakes, rivers, oceans and underground water. Use of environmental friendly water-based synthetic metal-cutting fluids besides reducing fire hazard would also be an environment friendly solution.

3.2 Hydraulic Oil

Hydraulic fluid becomes hazardous when heated to its flash point, sprayed or vaporized. Pressurized oil in hydraulic systems present a considerable fire hazard, particularly in processes where ignition sources are constantly present, as in die casting, automatic welding and melting and heat-treating of metals. Escaping hydraulic oil has caused many severe fires, particularly where building contents or construction were combustible and sprinkler protection was lacking. Most hydraulically operated equipment has individual oil systems located nearby, although some equipment, particularly hydraulic presses, may have very large or centralized hydraulic oil systems located in a cut-off area. Limiting the aggregate quantity of hydraulic oil to less than 2300 litres on machines that are located within 6 metres of each other is a good risk control measure as this reduces the fire load and fire spread possibilities. Rags and clothing soaked in hydraulic fluid should also be kept in closed metal containers to avoid possible fire hazard, and disposed of in a proper manner.

3.3 Fluid storages

Hydraulic and cutting/ lubricating fluids should be stored in sealed metal containers in a separate area well away from process and storage blocks. Leakages and spills if any should be immediately attended to and the area should be maintained clean and dry. The most important point is that fire risk arises in an area due to the combustible nature of goods that are stored there. Hence, it is vital to ensure that fire in this area does not spread to process and storage blocks, which can be easily achieved by adequate segregation. The required

separation distance would depend on the quantity of material being stored and the construction features of nearby occupancies.

3.4 Utilities & Electricals

Diesel generating sets, boilers and burners are heat generating sources which can initiate fire. This hazard gets accentuated when such utilities are located inside the process block or when situated adjoining to it. Fire hazards from utilities are reduced when these are located in separate blocks adequately separated from other blocks and open storages.

Electrical faults generate a lot of energy that would be sufficient enough to ignite combustible material like waste, packing material, etc. stored in close vicinity to electrical equipment and wiring. This fire can then spread to other areas in the premises. Though the products manufactured are not combustible, there is an element of fire hazard when they get packed in combustible material like carton boxes and wooden crates. Hence, it is advised that no packing material or products packed in combustible material are stored within 1 metre distance of electrical wiring and equipment.

3.5 Hot Work

Many metal workshops use cutting torches to shape and cut a variety of metal. Cutting torches use gas and oxygen to cut through metal. While gas provides heat, blown oxygen cuts the metal. Gases used with oxygen in cutting torches include flammable acetylene, LPG which has high fire and explosion hazard. Plasma cutting is also used to cut steel and other metals of different thicknesses. Using a plasma torch where plasma arcs are extremely hot and in the range of 25000°C is hazardous. All hot work should be carried out only in designated areas and such areas should always be free from any combustible material.

4.0 Injury hazards

Though sheet metal work is not a hazardous operation, it involves an element of risk and accident rates are rather high. Cuts, abrasions and bruises are the most common types of injury, mainly caused due to striking against objects or stepping on objects. Use of safety shoes, well laid out work area and following safe work practices are measures that mitigate this hazard. However, the most serious of accidents are caused on brake presses during metal forming operations and the most common type of injury is cut fingers. Proper guarding of these machines is the required risk control measure for mitigating this hazard. Also, the safety interlock devices that are designed to keep hands and body parts away from moving machinery should never be defeated.

5.0 Health Hazards

Many operations in this occupancy can generate dust, fumes and vapour, which are dangerous to health. In such areas, provision of local exhaust ventilation would be necessary to safeguard the employees' health. For welding and soldering seams and joints, use low-emission materials in a well-ventilated area. A respirator is necessary to protect the lungs from fumes and hence employees need to be educated on the use of Personal Protective Equipment (PPE). Other health hazards in such occupancies would include noise, heat, vibration and bad working conditions due to inadequate lighting, ventilation or space. All these health hazards would require periodic assessment of work environment and constant attention to good safety procedures and practices. The most serious of health hazard is 'noise induced hearing loss'. Hence, a loss control program which addresses noise measurement, noise reduction, employee protection through use of appropriate PPE such as ear plugs and ear muffs becomes a very important safety requirement.

6.0 Fire Protection

Since fire hazards mainly arise from the presence of hydraulic and lubricating oils, use of foam type hand appliances in conjunction with fire water hose reel would be the appropriate hand appliance in areas where this type of hazard exists. Recommendations with regard to fixed fire protection systems are a well designed fire hydrant system along with a pressurised hose reel system tapped from the same, installed as per TAC regulations around all major process and storage blocks.

Our ten loss prevention commandments for Sheet Metal Operations are given in the page that follows.

Wasim Khan
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Ten Loss Prevention Commandments for Sheet Metal Operations

1. **Cutting Fluids:** Use of water-based synthetic metal-cutting fluids besides reducing fire hazard would also be an environment friendly solution.
2. **Hydraulic oil:** Limiting the aggregate quantity of hydraulic oil to less than 2300 litres on machines that are located within 6 metres of each other is a good risk control measure as it reduces the fire load and fire spread possibilities.
3. **Storages**: Hydraulic fluids and cutting/ lubricating fluids should be stored in sealed metal containers in a separate area well away from process and storage blocks.
4. **Rusting and Corrosion:** Provide skids under all floor stored stocks including sheet and coiled metal to prevent rusting and pitting that could arise due to water accumulation on floor.
5. **Utilities**: Fire hazards from utilities such as boilers, DG sets and transformers are reduced when these are located in separate blocks adequately separated from other blocks and open storages.
6. **Hot Work:** It should be carried out only in designated areas and such areas should always be free from any combustible material.
7. **Injury Prevention:** The most serious accidents are caused on brake presses during metal forming operations. Proper guarding of machines is necessary for mitigation. Also, safety interlock devices that are designed to keep body away from moving machinery should never be defeated.
8. **Noise Protection:** A properly worn hearing protection can prevent this loss. Hence, training and enforcement of the proper use of hearing protection becomes very important.
9. **Housekeeping**: Work areas around machinery should be clear of clutter; metal debris should be regularly removed. Rags and clothing soaked in hydraulic fluid should be contained in closed metal containers to avoid possible fire hazard and disposed of in a safe manner.
10. **Fire Protection:** Fire hazards mainly arise from the presence of hydraulic and lubricating oils. Use of foam type hand appliances in conjunction with fire water hose reel would be appropriate where this type of hazard exists. Recommendations with regard to fixed fire protection systems are a well designed fire hydrant system along with a pressurised hose reel system tapped from the same, installed as per TAC regulations around all major process and storage blocks.

II. Safety Quiz

1. **Following is not a passive fire protection system:**
   a. Fire alarms
   b. Fire doors
   c. 6 mm thick wired glass, steel frame over window openings
   d. Fire walls

2. **Safety committee of a plant should comprise of members**
   a. Only from management staff
   b. Only from workmen
   c. Workmen & and management staff
   d. Employees of safety department, select workers from other departments

3. **Following requires 'Hot work permit'?**
   a. Welding, Cutting, Jobs generating heat and sparks
   b. Boiler lighting operations
   c. Heat treatment operations
   d. All of the above

4. **Following factors impact a dust explosion:**
   a. Particle size
   b. Chemical properties of the dust
   c. Cloud dispersion
   d. All the above

5. **Why should we "earth" the metal equipment containing flammable liquids?**
   a. Provide protection against electric shock
   b. Avoid a build-up of static electricity
   c. Prevent a discharge of static electricity
   d. Prevent corrosion

6. **Particles in respirable range are of size:**
   a. Less than 10 microns
   b. Above 10 microns
   c. Between 10 and 50 microns
   d. Above 50 microns

7. **Colour code depicting radiation hazard as per both ANSI (Z535.1-1998) and OSHA is:**
   a. Blue on White
   b. Magenta or Purple on Yellow
   c. White on Blue
   d. Yellow on Red

8. **To protect X-Rays and Gamma rays —— gloves should be used**
   a. Lead
   b. Copper
   c. Rubber
   d. Leather

9. **Which is the correct method for manual material handling?**
   a. Straight back and Bent leg
   b. Bent back and Straight leg
   c. Straight back and Straight leg
   d. Bent back and Bent leg

10. **If you are in moving vehicle when an earthquake strikes,**
   a. Speed up and drive on
   b. Pull off the road, park and stay inside the car
   c. Leave the car immediately
   d. None of the above

Answers:

1	2	3	4	5	6	7	8	9	10
a	c	a	d	b	a	b	a	a	b

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III. Electrical Safety

1.0 The need

Electrical energy happens to be the most extensively used source of energy at all places – homes, industries, commercial establishments, exhibitions, public meetings or any type of gatherings. Since there are serious hazards associated with the use of electricity, these need to be understood and mitigated, failing which the consequences could be disastrous in terms of life and property. A quick synopsis of the severity of such consequences is given below.

Deaths due to Electrocution

According to recent statistics published by the National Crime Records Bureau of India (a publication of the ministry of Home Affairs – GoI), no. of deaths due to electrocution in 2008 is **8067** (**which on an average is ~22 deaths per day**).

Electrical Fires

According to the Oil Industries Safety Directorate (India), the most significant causes for fires happen to be electricity, **accounting for 42% of fires** that take place. Experience of engineers at Bharti AXA General Insurance and insurers' world over happen to be no different.

Major fire & breakdown can result into huge financial losses due to the resulting business interruption exposures. Above all, there is also a statutory requirement that arises from Indian Electricity Rules, 1956: Rule 29, which stipulates that all electrical equipment will have to be installed and so maintained such that it does not cause harm to equipment, human being and animal.

2.0 Key elements which contribute towards electrical safety

- ❑ Selection and installation of equipment
- ❑ Systems and Procedures
- ❑ Maintenance & Testing of equipment
- ❑ Fire Detection and Prevention
- ❑ Safety Audits

Importance of the above points is brought out below through some case studies in which our engineers have had first-hand experience or information.

No.	Date	Location	Incident
1	Jan 1997	Goa	Equipment Selection - Use of ordinary electrical equipment in an area where hazardous atmosphere was likely to be present resulted in a major fire in the un-segregated storage cum manufacturing area of a Poly Urethane foam manufacturing unit using LPG as blowing agent.
2	Sept 1995	Ahmadabad, Gujarat	Systems & Procedures - Electronic Work permit issued in a thermal power plant without realizing that the 6.6 kV panel had a back feeding supply that got switched on while cleaning work was being undertaken in the panel, resulted in a heavy flashover and loss of lives when aluminium foil of a 6 inch thick paint brush made contact with the live bus bars.
3	Oct 1995	Adilabad, Andhra Pradesh	Maintenance & Testing - Earth Fault occurring at the coal mill motor of a Cement Plant not being interrupted by protective relays (due to low voltage in the DC power supply to the relays), resulted in a simultaneous fire at coal mill motor, panels of LC2 substation and booster transformer. Fault was only interrupted at the APSEB side.
4	Nov 2004	Dhenkanal, Orissa	Fire Protection - Fire that occurred in a furnace transformer of a Ferro Alloy unit spread to 5 other furnace transformers situated in the same location without fire compartmentation and to the hydraulic oil tank located in the floor above. Provincial loss estimate – INR 14 crores.

3.0 Electrical Safety Audit

Electrical Safety Audit is a proactive approach which helps improve electrical safety management in industries and commercial establishments. Qualified and competent auditors carry out a site visit; for evaluating the electrical installations in the premises through a physical inspection of plant and machinery, as well as understand systems and procedures in place for managing electrical safety through interaction with plant officials. Details regarding electrical maintenance and testing practices are collected in addition to carrying out few on-field tests and measurements. Findings of the visit in the form of observations and recommendations are made in form of a report and presented to the client. Additionally, clarifications if required are provided regarding the observations made as well as help is rendered in implementing the recommendations.

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Bharti AXA General Insurance Company Limited carries out Electrical Safety Audits for its select clients on a complimentary basis through its in-house resources. Our lead auditor has three decades of work experience in diverse fields of electrical engineering which includes: electrical maintenance, projects, design and execution of electrical safety audits for major industries such as cement, power plants, chemicals, petrochemicals, tyre manufacturing, sugar, automobiles and various other engineering industries including High Rise Buildings, POL (Petroleum Oil and Lubricants) terminals, and LPG bottling plants. Many of our major industrial clients have already benefited from such studies carried out by us. In case you have any such requirements or would like to know more about this, please do contact us.

Response Invite:

We invite your feedback on the contents and coverage we provide in our e-newsletter as also articles of interest on safety and loss prevention including fire loss case histories with loss lessons for publication over here. You may send us your feedback and articles at risk.engineering@bharti-axagi.co.in .

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