Safety precautions in sheet metal workshop

Objectives: At the end of this lesson you shall be able to
- **state various hazardous while working in a SMW shop**
- **state different precautions to be taken for safe working in a SMW shop.**

Whenever a work is done in a shop the following aspects may create an injury to the workman/trainee or to others working nearby.

1 Way of handling the materials, tools and machine.

2 Cleaning of the work area/shop floor.

3 Damaged/faulty tools, machines and safety appliances.

4 Carelessness and negligence of the workman/trainee.

5 Ignorance of general safety rules.

To avoid the accident/injuries taking place, while working it is very important to follow certain safety precautions. They are:

– Do not bend your whole body while lifting heavy loads. Instead use your thigh muscles for lifting.

– Use gloves while handling thin sheets.

– Use chipping screen during chiseling operation.

– Avoid using a mushroom head chisel.

– Arrange the tools properly over the work table so that the tools are not allowed to fall from the table on your foot.

– Wear proper size safety shoes.

– Remove burrs by filing from a plate or sheet after cutting them by chisel or hacksaw.

– Do not use a hammer with a broken or damaged handle.

– Fix the hammer head with the handle securely using a wedge.

– Do not wear loose garments/dress.

– Wear plain goggles/face shield while grinding.

– Do not grind materials which are 3mm or less in thickness and non-ferrous metals.

– Adjust the gap between the work rest and the grinding wheel to 1-2mm.

– Select and use the right kind of tool for the right job.

– Keep the floor on the work area neat and clean without any cut pieces of material, oil, etc.

– Keep a separate bin/basket for throwing cotton waste, metal chips etc.

– Always keep fire fighting equipment and the First Aid Box ready for use in case of any emergency.

– After completion of work keep the tools in the tool box.

– Wear helmet if anybody is working above your work place, either to repair at the roof or on a overhead crane.

– Use tongs while handling hot objects.

– Do not try to check the sharpness of any tool with bare fingers.

– Switch off the mains of a machine while leaving the machine after completion of work.

– Do not try to rectify any electrical fault by yourself. Call an electrician for doing any electrical repair work.

– Wherever and whenever possible avoid poluting the environment.

– If any other person is affected by electric shock, immediately switch off the mains or separate the person from the electrical contact using a wooden rod or any other insulating material.

– Always fix the job at a convenient height on the vice.

– Use sufficient leverage while tightening or loosening a nut or bolt.

General Workshop Rules

– Safety glasses must be worn.

– Safety footwear must be worn when working in the workshop.

– Ask workshop instructor before using equipment.

– Visitors must remain within marked walkways.

– Long hair must be tied back.

– Clean, equipments & machines after use.

– Take care when using compressed air.

– Hearing protection should be worn when using machinery.

– Working alone after hours is not permitted.

General safety precautions

Objectives: At the end of this lesson you shall be able to
- **state what an accident is**
- **state the causes for accidents in general terms**
- **state what is safe attitude**
- **name the four basic categories of safety signs.**

What is an accident?

Nobody deliberately makes an accident; accidents occur due to the causes which are not foreseen. Sometimes nothing can be done to prevent them from happening. For example, a part of a machine fails when nobody has any reason to think there is anything wrong with it, or the driver of a vehicle collapses at the wheel. Most accidents however occur as the result of a human error, of ignorance or neglect, forgetfulness or recklessness. These accidents can be prevented. If people had acted differently at some point, the event which we call an 'accident' would not have occurred. (Fig 1)

Fig 1

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Lots of accidents still happen every year killing a lot of people. Although most people are alarmed and horrified by this state of affairs, accidents continue to happen, costing the industry millions of rupees every year. Older workers who have come to terms with the dangers, young workers who may be reckless, employers who turn a blind eye to the possibility of things going wrong - because they want to get the job done, all these factors contribute to this senseless waste. Fortunately there are many who do not take this view. They have a different attitude to wards safety - and 'attitude' is an all-important factor in the chain of events which leads to someone causing, being involved in, or becoming the victim of an 'accident'.

Causes for accidents: Normally accidents do not just happen. They are caused. (Fig 2)

Causes for accidents are many. Some of the important causes are listed below. (Fig 3)

- Unawareness of danger
- Disregard for safety
- Negligence
- Lack of understanding of proper safety procedures
- Untidy condition of workplace
- Inadequate light and ventilation
- Improper use of tools
- Unsafe conditions

Fig 2

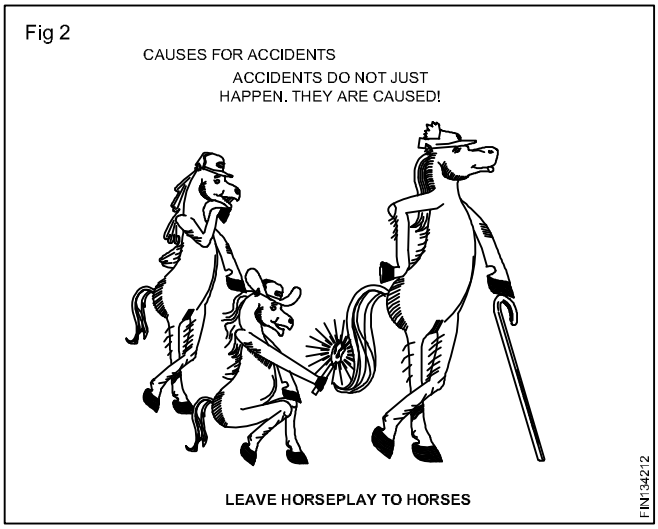

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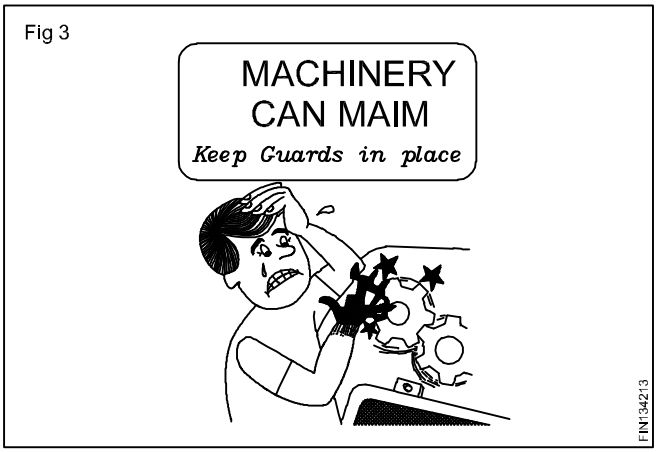
Fig 3



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Safe attitudes: People's attitudes govern what they do or fail to do. In most cases where someone is working with unsafe equipment or in an unsafe situation, somebody has allowed that state of affairs to come about by something they have done or failed to do. (Fig 4)

Fig 4

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Most accidents don't just happen; they are caused by people who (for example) damage equipment or see it is faulty but don't report it, or leave tools and equipment lying about for other people to trip over. Anybody who sees a hazard and does nothing about it is also contributing to the possibility of an accident. A worker doesn't necessarily need to do anything to bring about an accident; just going mindlessly about his work may be enough to ensure a work-mate being crippled for life. He didn't do it - but by proper and timely thinking and acting, he could have prevented it.

Responsibilities: Safety doesn't just happen - it has to be organised and achieved like the work-process of which it forms a part. The law states that the employer and his employees have the responsibility in this behalf.

Employer's responsibililties: The effort a firm puts into planning and organising work, training people, engaging skilled and competent workers, maintaining plant and equipment, and checking, inspecting and keeping records - all of this contributes to the safety in the workplace.

The employer is responsible for the equipment provided, the working conditions, what employees are asked to do, and the training given.

Employee's responsibilities: You will be responsible for the way you use the equipment, how you do your job, the use you make of your training, and your general attitude to safety.

A great deal is done by the employers and other people to make your working life safer; but always remember you are responsible for your own actions and its effect on others. You must not take that responsibility lightly.

Rules and procedures at work: What you must do, by law, is often included in the various rules and procedures laid down by your employer. They may be written down, but more often than not, are just the way a firm does things - you will learn these from other workers as you do your job. They may govern the issue and use of tools, protective clothing and equipment, reporting procedures, emergency drills, access to restricted areas, and many other matters. Such rules are essential; they contribute to the efficiency and safety of the job.

Safety signs: As you go about your work on a construction site you will see a variety of signs and notices. Some of these will be familiar to you - a 'no smoking' sign for example; other signs you may not have seen before. It is up to you to learn what they mean - and to take notice of them. They warn of the possible danger, and must not be ignored.

Safety signs fall into four separate categories. These can be recognised by their shape and colour. Sometimes they may be just symbols other signs may include letters or figures and provide extra information such as the clearance height of an obstacle or the safe working load of a crane.

The four basic categories of safety signs are as follows.

- prohibition signs
- mandatory signs
- warning signs
- information signs

Prohibition signs Fig5

Shape	Circular.
Colour	Red border and cross bar. Black symbol on white background.
Meaning	Shows it must not be done.
Example	No smoking.

Mandatory signs Fig6

Shape	Circular.
Colour	White symbol on blue background.
Meaning	Shows what must be done.
Example	Wear hand protection.

Warning signs Fig7

Shape	Triangular.
Colour	Yellow background with black border and symbol.
Meaning	Warns of hazard or danger.
Example	Caution, risk of electric shock.

Information signs Fig8

Shape	Square or oblong.
Colour	White symbols on green background.
Meaning	Indicates or gives information of safety provision.
Example	First aid point.

Prohibition signs (Fig 9)

Fig 9

Mandatory signs (Fig 10)

Fig 10

MANDATORY SIGNS

Warning signs (Fig 11)

Fig 11

WARNING SIGNS

Questions about your safety

Do you know the general safety rules that cover your place of work?

Are you familiar with the safety laws that cover your particular job?

Do you know how to do your work without causing danger to yourself, your workmates and the general public?

Are the plant, machinery and tools that you use really safe? Do you know how to use them safely and keep them in a safe condition?

Do you wear all the right protective clothing, and have you been issued with all the necessary safety equipment?

Have you been given all the necessary safety information about the materials used?

Have you been given training and instruction to enable you to do your job safely?

Do you know who is responsible for safety at your place of work?

Do you know who are the appointed `Safety Representatives'?

Importance of sheet metal work in industries

Objective : At the end of this lesson you shall be able to
- **state the scope and the importance of the trade.**

Introduction

Many engineering products are made out of sheet metal. The person who works on metal sheets is called sheet metal worker. The skilled sheet metal worker make and install various kind of sheet metal products. (Fig 1)

- roofings
- ductings
- vehicles body buildings like 3 wheelers, 4 wheelers, ships, air crafts etc.

– furnitures

– house hold articles

– railway equipment

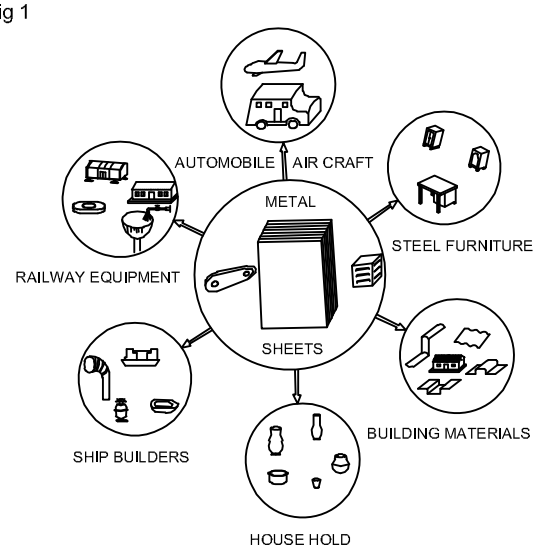
Also repairing of the above items.

To carry out these works, the sheet metal worker has to plan, layout and determine the size and the type of the sheet metal to be used.

The sheet metal worker carries out the operations such as cutting, folding, forming, fastening and assembling manually and by means of power machines.

The above requirements needs proper training and to know the basic principles of operation and process. All the advance technologies are developed from basic principles only. The advance technologies facilitates for mass production, consistance in accuracy of product and the volume of needs.

Fig 1



Technical terms in sheet metal work

Objective : At the end of this lesson you shall be able to
- **state the meaning of various terms used in sheet metal work.**

1 **Beading**: The process of raising a strip of metal around the end of a round pipe.

2 **Bench machines**: Machines clamped to a bench and operated by turning a crank. Used by the sheet metal worker to turn edges on circles and round pipes.

3 **Bench stakes**: Steel anvils of various specialized shapes that the sheet metal worker uses to form and seam sheet metal objects.

4 **Black iron**: Iron and steel sheets covered with an oxidized coating only.

5 **Braising**: The process of stretching a piece of metal by hitting it with a round head hammer, as in forming a bowl.

6 **Brake**: A machine that the sheet metal worker uses for bending and folding edges on metal.

7 **Burring**: The process of turning an edge on a circular piece of metal.

8 **Clips**: Special strips of sheet metal bent in a manner to connect two pieces of sheet metal duct.

9 **Crimping**: The process of corrugating the end of a round pipe to make it smaller so it will fit into the end of another pipe.

10 **Cut acid**: Zinc chloride, made by putting strips of zinc in hydrochloric acid.

11 **Edges**: Bends on the edges of sheet metal to eliminate sharp edges and provide stiffening.

12 **Embossing**: A stamping process that produces a shallow relief design on sheet metal.

13 **Flux**: Chemical used to clean metal and remove the oxides from the metal surface prior to soldering.

14 **Forming**: The process of rolling sheet metal into pipe or making bends to form objects.

15 **Gauge**: The system of classifying the thickness in which sheet metal is produced. Also a tool used for measuring and determining the thickness of a metal sheet.

16 **Hem**: A folded edge on a sheet metal object.

17 **Layout work**: The process of developing the pattern for a sheet metal object.

18 **Longitudinal seam**: A seam running the long length of a pipe.

19 **Miter**: The joining of two pieces at an evenly divided angle.

20 **Nibble**: Nibble to piece metal along or on its edge.

21 **Oxides of metal**: A chemical formed by a combination of the oxygen in the air with the metal. Iron rust is iron oxide.

22 **Parallel line development**: A method of pattern drafting employing parallel lines.

23 **Pattern**: The shape of an object to be made out of sheet metal as it appears when marked out on the flat sheet. Also, the exact size and shape that a piece of sheet metal must be in order to be formed into the object desired.

24 **Pickle**: To clean dirt and oxide from metal by immersing it in an acid bath.

25 **Pictorial drawings**: A drawing of an object in three dimensions as it actually appears after being formed into shape.

26 **Pierce**: To cut out interior waste stock from a metal part with a die.

27 **Planish**: To make a metal surface smooth by hammering it over a stake or block.

28 **Press brake**: A power machine used by the sheet metal worker to form sheet metal.

29 **Press forming**: Creating sheet metal products using dies to cut and shape the metal and presses to power the dies. Also called stamping.

30 **Primer**: A first coat of finish on a metal, it binds and adhers to the metal giving good base for later coats.

31 **Punching**: The process of making holes in sheet metal by the use of dies.

32 **PVC (polyviny/chloride)**: A plastic often used for hoods and tanks that require high corrosion resistance.

33 **Radial line development**: A method of pattern drafting using lines radiating from a center and using arcs.

34 **Raw acid**: Hydrochloric acid (HCI)

35 **Rivets**: Fasteners used to join two pieces of sheet metal together. The rivet is inserted in a hole and a head is formed by pounding the rivet with a hammer.

36 **Seams**: Various types of bent and hooked edges used to join two pieces of sheet metal. For lighter sheet metal, mechanical joints are used. In medium and heavy gauge metal, a riveted or welded seam is used.

37 **Seam welding**: A kind of resistance welding in which rollers are used instead of electrodes.

38 **Sheet metal**: Any type of metal sheets that are 1/8" thick or less.

39 **Sheet metal screws**: Special screws used for joining sheet metal. Also called self-tapping because the screws tap their own threads in the drilled hole.

40 **Overlapping parts**: Resistance to electricity generates heat producing the weld.

41 **Square-to-round**: The name of a common sheet metal fitting that is square or rectangular on one end and round on the other end.

42 **Stainless steel**: A special steel containing other types of metals such as chromium, nickel and molybdenum. There are many types of stainless steel sheets. All of them vary in corrosion resistance.

43 **Swage**: A special forging tool used for smoothening and finishing.

44 **Sweat soldering**: The process of soldering two pieces of metal together by making the solder “sweat” completely through the seam.

45 **Tinning**: Covering an area of metal with molten solder.

46 **Transition piece**: A sheet metal fitting that changes size or shape from one end to the other.

47 **Triangulation**: A method of pattern drafting employing the use of triangles.

48 **Wired edge**: A sheet metal edge folded around a piece of wire for added strength.

Metal sheets and their uses

Objectives: At the end of this lesson you shall be able to
- **state the types of metals used in sheet metal work**
- **state the uses of the different types of metals.**

In sheet metal work, different types of metal sheets are used. The sheets are specified by their standard gauge numbers.

It is very essential to know the different uses and applications of these metal sheets.

Black iron sheets: The cheapest sheet metal is the black iron, which is rolled to the desired thickness. The sheets are rolled in two conditions. When it is rolled in cold state, it is called cold rolled and when it is rolled in hot state, it is called hot rolled. Hot rolled sheets have a bluish black appearance, and are often referred to as uncoated sheets, since they are uncoated. They corrode rapidly.

Cold rolled sheets have plain silver whitish appearance and are uncoated. To decrease the work hardness, the cold ruled sheets are annealed in a closed atmosphere. These sheets are known as C.R.C.A (Cold roled close annealed) sheets.

The use of this metal is limited to making articles that are to be painted or enamelled such as tanks, pans, stoves, pipes etc.

Galvanised iron sheets: Zinc coated iron is known as 'galvanised iron'. This soft iron sheet is popularly known as G.I.sheet. The zinc coating resist corrosion and improves the appearance of the metal and permit it to be soldered with greater ease. Because it is coated with zinc, galvanised iron sheet withstands contact with water and exposure to weather.

Articles such as pans, buckets, furnaces, heating ducts, cabinets, gutters etc. are made mainly from G.I.sheets.

Stainless sheets: This is an alloy of steel with nickel, chromium and other metals. It has good corrosive resistance and can be welded easily. Stainless steel used in a sheet metal shop can be worked similar to galvanised iron sheets, but is tougher than G.I. sheets. The cost of stainless steel is very high.

Stainless steel is used in dairies, food processing, chemical plants, kitchenware etc.

Copper sheets: Copper sheets are available either as cold rolled or hot rolled. They have a very good resistance to corrosion and can be worked easily. They are commonly used in sheet metal shops. Copper sheet has better appearance than other metals.

Gutters, expansion joints, roof flashings, hoods, utensils and boiler plates are some of the common examples where copper sheets are used.

Aluminium sheets: Aluminium cannot be used in its pure form, but is mixed with very small amount of copper, silicon, manganese and iron. Aluminium sheets are whitish in colour and light in weight. They are highly resistant to corrosion and abrasion.

Aluminium is now widely used in the manufacture of articles such as household appliances, refrigerator trays, lighting fixtures, windows and also in the construction of airplanes and in many electrical and transport industries.

Tinned plate: Tinned plate is sheet iron coated with tin, to protect it against rust. This is used for nearly all solder work, as it is the easiest metal to join by soldering.

This metal has a very bright silvery appearance and is used in making roofs, food containers, dairy equipment, furnace fittings, cans and pans etc.

Lead sheets: Lead is very soft and heavy in weight.

Lead sheets are used for making the highly corrosive acid tanks.

When lead is coated on black iron sheets, they are called Terne sheets. They are highly anti-corrosive and commonly used in preservation of chemicals.

Indian Standard sheet sizes & strip sizes

Objectives: At the end of this lesson you shall be able to
- **specify the Indian Standard sheet sizes**
- **specify the Indian Standard strip sizes**
- **calculate the weight of the steel sheet, and the measure of the strip.**

Indian Standard sheet sizes & strip sizes

As per Indian Standard are designated as ISSH received by figures denoting length (mm) x width (mm) x thickness (mm) of the sheet as per IS 1730 : 1989.

Example

ISSH 3200 x 600 x 1.00

Where

3200 is the length of the sheet (mm)

600 is the width of the sheet (mm)

1.00 is the thickness of the sheet (mm)

Table 2 gives the weight of steel sheets of different standard sizes.

Exercise

Calculate the weight of the steel sheet given below.

ISSH 1800x1200 x 1.40mm

_____

_____

TABLE 1

Standard Nominal Dimensions and Mass of Sheet

Size mm x mm	Standard Nominal Surface Area in m²	Standard Nominal Thickness in mm												
		0.40	0.50	0.63	0.80	0.90	1.00	1.12	1.25	1.40	1.60	1.80	1.90	2.00
1800 x 600	1.08	3.39	4.24	5.34	6.78	7.65	8.47	9.50	10.6	11.9	13.6	5.3	16.1	17.0
750	1.35	4.24	5.30	6.67	8.48	9.54	10.6	11.9	13.2	14.8	17.0	19.1	20.1	21.2
900	1.62	5.09	6.35	8.01	10.2	11.4	12.7	14.2	15.9	17.8	20.3	22.9	24.2	25.4
950	1.71	5.37	6.71	8.45	10.7	12.1	13.4	15.0	16.8	18.8	21.5	24.2	25.5	26.8
1000	1.80	5.65	7.06	8.90	11.3	12.7	14.2	15.8	17.7	19.8	22.6	25.4	26.8	28.3
1100	1.98	6.22	7.77	9.79	12.4	14.0	15.6	17.4	19.4	21.8	24.9	28.0	29.5	31.1
1200	2.16	6.78	8.48	10.7	13.6	15.3	17.0	19.0	21.2	23.7	27.1	30.5	32.2	33.9
1250	2.25	7.07	8.83	11.1	14.1	15.9	17.6	19.8	22.1	24.7	28.3	31.8	33.6	35.3
1400	2.52	7.91	9.90	12.5	15.8	17.8	19.8	22.2	24.7	27.7	31.7	35.6	37.6	39.6
1500	2.70	8.48	10.6	13.4	17.0	19.1	21.2	23.8	26.5	29.7	33.9	38.2	40.2	42.4
2000 x 600	1.20	3.77	4.71	5.93	7.53	8.47	9.42	10.6	11.8	13.2	15.1	17.0	17.9	18.8
750	1.50	4.71	5.88	7.42	9.42	10.6	11.8	13.2	14.7	16.5	18.8	21.2	22.4	23.6
900	1.80	5.65	7.06	8.90	11.3	12.7	14.1	15.8	17.7	19.8	22.6	25.4	26.8	28.3
950	1.90	5.97	7.45	9.39	12.0	13.4	14.9	16.8	17.9	20.8	23.6	26.8	28.3	29.8
1000	2.00	6.28	7.85	9.89	12.6	14.1	15.7	17.6	19.6	22.0	25.1	28.3	29.8	31.4
1100	2.20	6.91	8.63	10.9	13.8	15.5	17.3	19.3	21.6	24.2	27.6	31.1	32.8	34.5
1200	2.40	7.53	9.42	11.9	15.1	17.0	18.8	21.1	23.6	26.4	30.1	33.9	35.8	37.7
1250	2.50	7.85	9.80	12.4	15.7	17.7	19.6	22.0	24.5	27.5	31.4	35.3	37.2	39.2
1400	2.80	8.79	11.0	13.8	17.6	19.8	22.0	24.6	27.5	30.8	35.2	39.6	41.8	44.0
2500	3.00	9.42	11.8	14.8	18.8	21.2	23.6	26.4	29.4	33.0	37.7	42.2	44.7	47.1
2200 x 600	1.32	4.14	5.18	6.52	8.28	9.32	10.4	11.6	13.0	14.5	16.6	18.7	19.7	20.7
750	1.65	5.18	6.47	8.16	10.4	11.7	13.0	14.5	16.2	18.1	20.7	23.3	24.6	25.9
900	1.98	6.22	7.77	9.78	12.4	14.0	15.5	17.4	19.4	21.8	24.9	28.0	29.5	31.1
950	2.09	6.56	8.20	10.3	13.1	14.8	16.4	18.4	20.5	23.0	26.2	29.5	31.2	32.8
1000	2.20	6.91	8.63	10.9	13.8	15.5	17.3	19.3	21.6	24.2	27.6	31.1	32.8	34.5
1100	2.42	7.60	9.50	12.0	15.2	17.1	19.0	21.3	23.7	26.6	30.4	34.2	36.1	38.0
1200	2.64	8.29	10.4	13.1	16.6	18.7	20.7	23.2	25.9	29.0	33.2	37.3	39.4	41.4
1250	2.75	8.63	10.8	13.6	17.3	19.4	21.6	24.2	27.9	30.2	34.5	38.9	41.0	43.2
1400	3.08	9.67	12.1	15.2	19.3	21.8	24.2	27.1	30.2	33.8	38.7	43.5	45.9	48.4
1500	3.30	10.4	13.0	16.3	20.7	23.3	25.9	29.0	32.4	36.3	41.4	46.6	49.2	51.8
2500 x 600	1.50	4.71	5.88	7.42	9.42	10.6	11.8	13.2	14.7	16.5	18.8	21.2	22.4	23.6
750	1.875	5.88	7.35	9.26	11.8	13.2	14.7	16.5	18.4	20.6	23.6	26.5	27.9	29.4
900	2.25	7.07	8.83	11.1	14.1	15.9	17.7	19.8	22.1	24.7	28.3	31.8	33.6	35.3
950	2.375	7.45	9.32	11.7	14.9	16.8	18.6	20.9	23.3	26.1	29.8	33.6	35.4	37.2
1000	2.50	7.85	9.80	12.4	15.7	17.7	19.6	22.0	24.5	27.5	31.4	35.3	37.2	39.2
1100	2.75	8.63	10.8	13.6	17.3	19.4	21.6	24.2	27.0	30.2	34.5	38.9	41.0	43.2
1200	3.00	9.42	11.8	14.8	18.8	21.2	23.6	26.4	29.4	33.0	37.7	42.4	44.7	47.1
1250	3.125	9.81	12.3	15.5	19.6	22.1	24.5	27.5	30.7	34.3	39.2	44.2	46.6	49.1
1400	3.50	11.0	13.7	17.3	22.0	24.7	27.5	30.8	34.3	38.5	44.0	49.5	52.2	55.0
1500	3.75	11.8	14.7	18.5	23.6	26.5	29.4	33.0	36.8	41.2	47.1	53.0	55.8	58.9

Based on the density of steel =7.85 g/cm2

For determining the mass of sheet above 2mm thickness
refer to IS1730:1989

Indian Standard strip sizes

Indian Standard strips are designated as ISST followed by width (mm) x thickness (mm) of the strip as per IS 1730 - 1989. (Fig.1)

Example

ISST 1050 x 3.15: Where 1050 mm is the width of the strip and 3.15mm is the thickness.

Fig 1

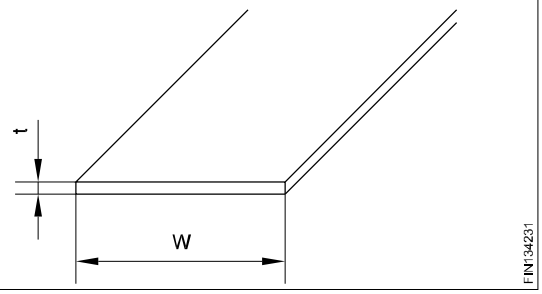


TABLE 2

Standard Nominal Dimensions and Mass of Strip

Width in mm	Thickness in mm													
	1.60	**1.80**	**2.00**	**2.24**	**2.50**	**2.80**	**3.15**	**3.55**	**4.00**	**4.50**	**5.0**	**6.0**	**8.0**	**10.0**
	Mass * kg/m													
100	1.25	1.41	1.57	1.76	1.96	2.20	2.47	2.79	3.14	3.53	3.92	4.71	6.28	7.85
125	1.57	1.77	1.96	2.20	2.45	2.74	3.08	3.48	3.92	4.41	4.90	5.88	7.85	9.81
160	2.01	2.26	2.51	2.81	3.14	3.52	3.95	4.46	5.02	5.65	6.28	7.53	10.0	12.6
200	2.51	2.82	3.14	3.52	3.92	4.39	4.94	5.58	6.28	7.06	7.84	9.42	12.6	15.7
250	3.14	3.53	3.92	4.40	4.90	5.49	6.17	6.97	7.85	8.83	9.80	11.8	15.7	16.6
320	4.02	4.52	5.02	5.62	6.28	7.05	7.90	8.92	10.0	11.3	12.5	15.1	20.0	25.1
400	5.02	5.65	6.28	7.04	7.85	8.78	9.88	11.1	12.6	14.1	15.7	18.8	25.1	31.4
500	6.28	7.05	7.85	8.79	9.51	11.0	12.4	13.9	15.7	17.7	19.6	23.6	31.4	39.2
650	8.16	9.17	10.2	11.4	12.7	14.3	16.1	18.1	20.4	23.0	25.5	30.6	40.8	51.0
800	10.0	11.3	12.6	14.1	15.7	17.6	19.8	22.3	25.1	28.3	31.4	37.7	50.2	62.8
950	-	13.4	14.9	16.7	18.6	20.8	23.5	26.5	29.8	33.6	27.3	44.7	59.7	74.6
1000	-	-	15.7	17.6	19.6	22.0	24.7	27.9	31.4	35.3	39.2	47.1	62.8	78.5
1050	-	-	16.5	18.5	20.6	23.3	26.0	29.2	33.0	37.1	41.2	49.5	65.9	82.4
1150	-	-	-	20.2	22.6	25.2	28.4	32.0	36.1	40.6	45.1	54.2	72.2	90.3
1250	-	-	-	-	24.5	27.5	30.9	34.8	39.2	44.2	49.1	58.9	78.5	98.1
1300	-	-	-	-	-	28.6	32.1	36.2	40.8	45.9	51.0	61.2	81.6	102
1450	-	-	-	-	-	-	35.8	40.4	45.5	51.2	56.9	68.3	91.1	114
1550	-	-	-	-	-	-	383	43.2	48.7	54.7	60.8	73	93.3	122

Table 2 gives the weight in kg of a particular strip per metre length.

Exercise

Calculate the weight of a ISST 500 x 4 of 2 metres

Answer

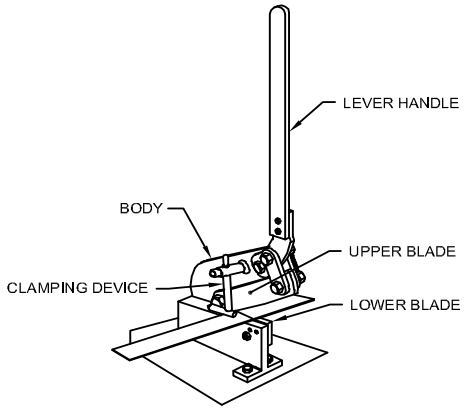
_____

Hand lever shears

Objectives: At the end of this lesson you shall be able to
- **identify the hand lever shear**
- **state the principle of working**
- **state the constructional feature parts and their functions.**

Hand lever shear is a hand operated machine used to cut sheet metal upto a thickness of 3 mm (10 SWG). When the machine is mounted on the bench, it is called a hand lever bench shear. It may also be mounted on the floor, over a small platform. It is used for cutting along straight lines and convex cutting of sheet metal. (Fig.1)

Fig 1



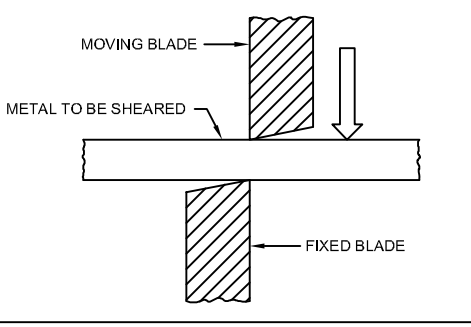
The lower blade of the hand lever shear is fixed (bottom blade) and the upper blade is pivoted at an angle.

The sheet being cut is prevented from tilting by a clamping device, which can be adjusted to the thickness of the sheet.

The knife cutting edge of the upper blade is curved so that the opening angle at the point of cut remains constant.

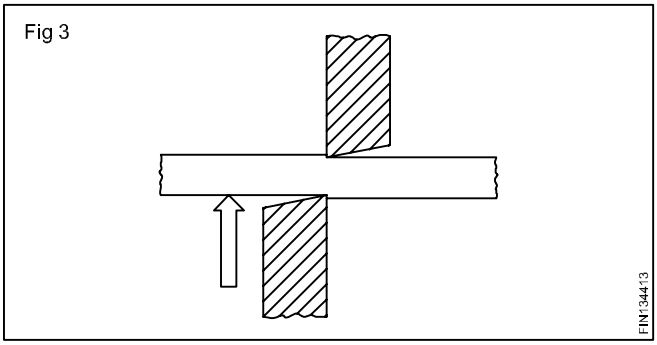
As the upper blade moves down on the sheet metal, the metal is subjected to shearing force, which causes deformation of the metal. (Fig 2 & 3) Increase in force causes plastic deformation of metal.

Fig 2



After a certain amount of plastic deformation, the cutting member begin to penetrate. The uncut metal work, harden at the edge (Fig 4).

Fig 3



Fracture begins to run into the work hardened metal from the point of contact of the cutting members. When these fractures meet, the cutting members penetrate the whole of the metal thickness. (Fig 5)

Fig 4

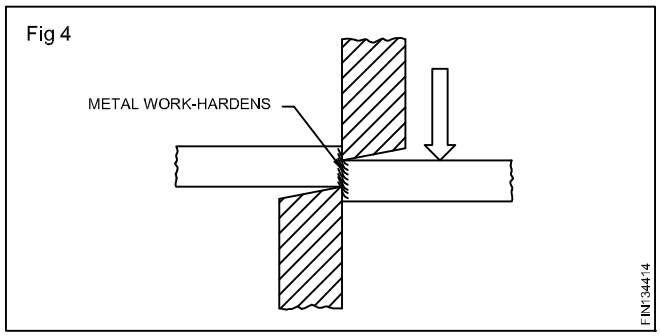
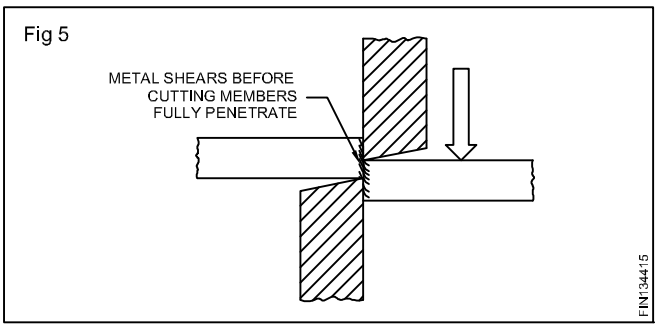


Fig 5



Blade clearance is very important and should not exceed 10 percent of the thickness to be cut and should suit the particular material.

Results of incorrect and correct setting of shear blade are as follows.

1 Excessive clearance causes a burr to form on the underside of the sheet as shown in the (Fig 6).

2 With no clearance, over strain is caused, the edge of the sheet becomes flattened on the under sides as shown in (Fig 7).

Fig 6

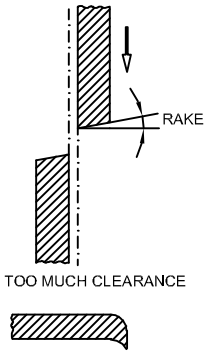
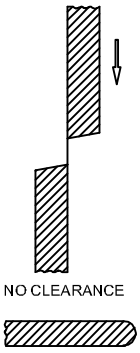
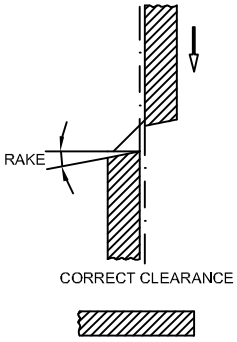


Fig 7



3 With the correct clearance, optimum shearing results are obtained as shown in (Fig 8).

Fig 8



Squaring shear

Objectives: At the end of this lesson you shall be able to
- **state the function of the squaring shear**
- **describe the adjustments on the machine to control the length of the cut**
- **state the capacity of the machine**
- **explain the safety precautions to be observed when working on squaring shears.**

Squaring shear

Cutting sheet metals is called shearing.

Squaring shears are used to cut large sheets into pieces to handle sheets easily.

Sheet metal can be cut by many simple machines.

Squaring shears, (Fig 1) operated by foot, are used to cut and trim large pieces of sheet metal. The size of the machine is specified by the length of the bed and maximum thickness of sheet it cuts. Front gauge and back gauge is provided to adjust the length of cut. A back gauge controls the length of the cut, when sheet is inserted from the front.

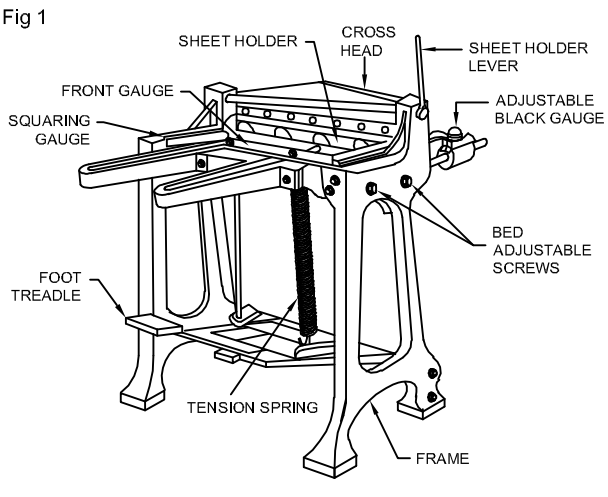
A front gauge cut the sheet which is inserted from the back.

Sheet holder is provided to hold the sheet firmly while it is being cut. It is operated by sheet holder lever.

The square gauge is adjustable and is kept at right angles to the cutting blade. 18 gauge sheets or lighter can usually be cut by squaring shear parts are as shown in Fig 1.

The clearance between the blades (Fig 2) can be adjusted by two adjusters. One adjuster shifts the table forward and other shifts the table backward. (Fig 3)

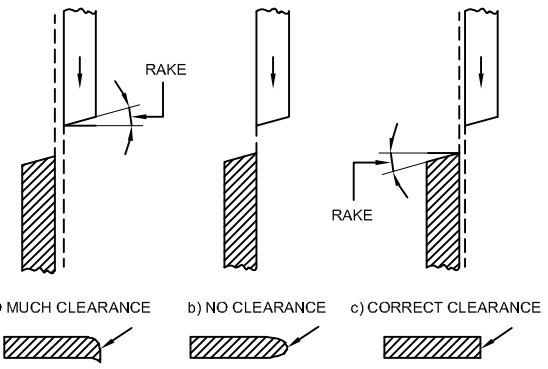
Fig 1



SQUARING SHEARS

Too much clearance causes a burr to form on the underside of the sheet (Fig 2a) with no clearance overstrain is caused, the edges of the sheet becomes flattened on the underside (Fig 2b). With the correct clearance optimum shearing results are obtained (Fig 2c).

Fig 2



RESULTS OF INCORRECT AND CORRECT SETTING OF SHEAR BLADES

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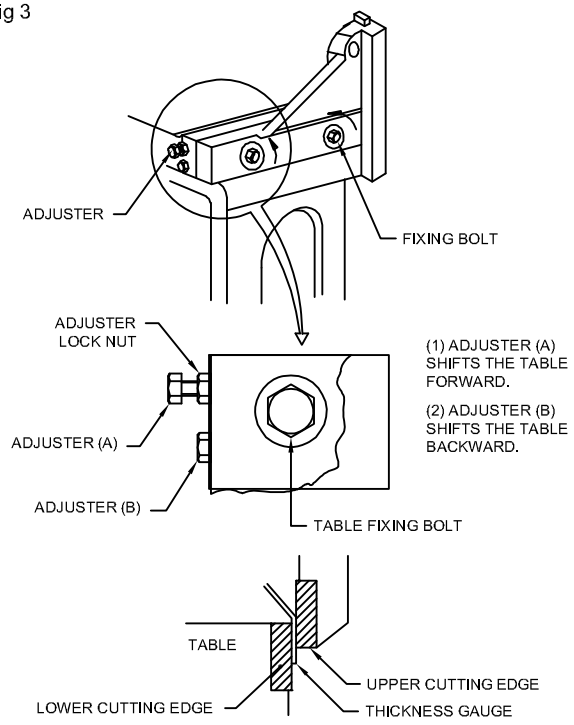
Safety

Keep your fingers away from the cutting blade at all times. Never attempt to cut bar iron, wire or any heavy metal on the squaring shears. This may nick the blade, which will then make a notch in every edge you cut. For better shearing results blade clearances and setting of blades are shown in Fig 2 & 3.

Fig 3



CLEARANCE ADJUSTMENT

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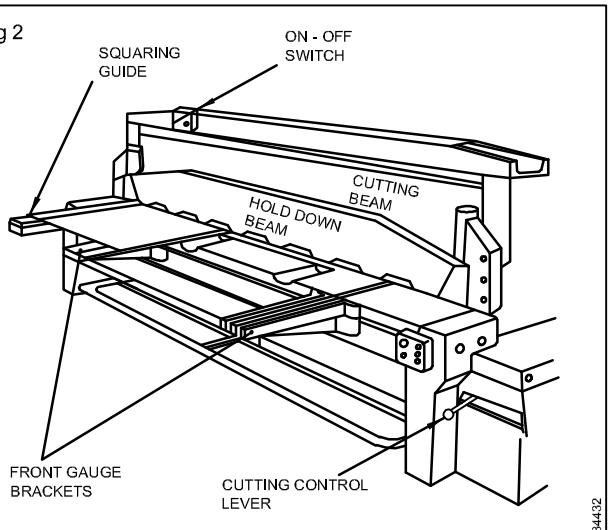
Guillotine shears

Objectives: At the end of this lesson you shall be able to

- **state the constructional features of guillotine shears**
- **explain working of guillotine shears**
- **explain setting procedures of squaring guide, front gauge and back gauge**
- **state the safety precautions to be followed while working on guillotine shears.**

Guillotine shears: On a treadle, guillotine, the bottom cutting blade is fixed to the machine bed and the top blade is operated by the treadle. The material to be cut is kept on the bed and held in position by hand. The hold down clamp comes into operation when the treadle is depressed. Figs 1&2 shows the treadle guillotine.

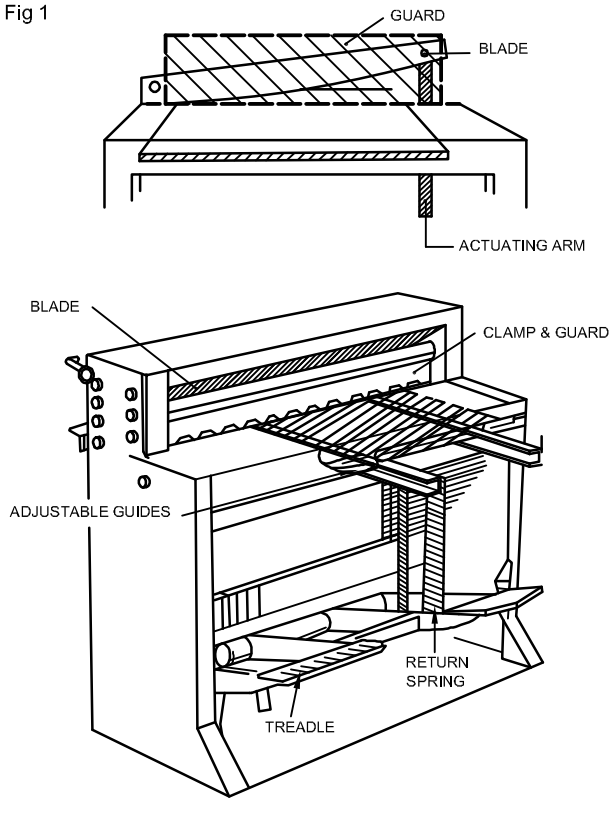
Fig 2



POWER GUILLOTINE SHEAR

FIN:34432

Fig 1



TREADLE GUILLOTINE

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On some power operated guillotines, provision is given for a single or continuous cutting action. If there is any doubt in operating cutting control, check as follows.

– Switch on guillotine

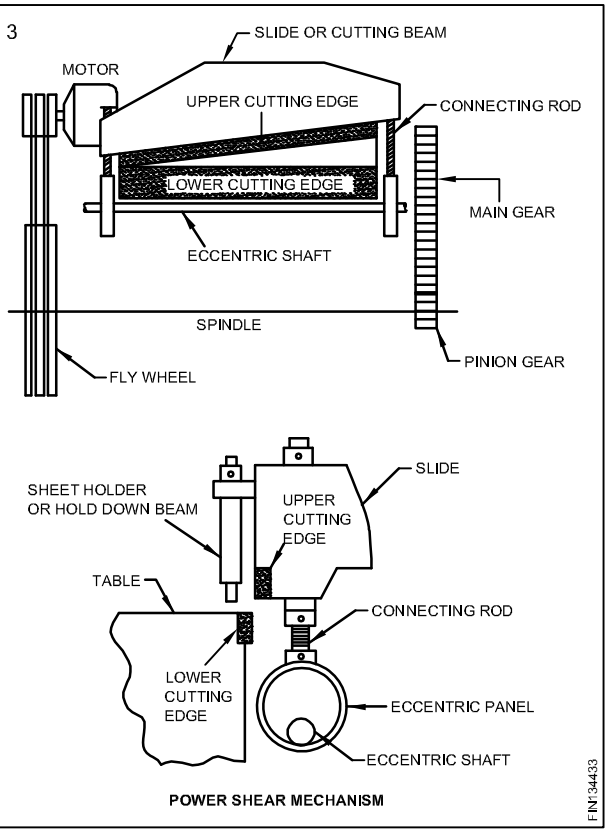
– Depress pedal

– If the control is set for single cutting the cutting beam is descent once for each depression of the pedal.

– If the controls are set for continuous cutting the beam will continue to raise and descend when pedal is depressed.

Power shear mechanism is shown in Fig 3.

Fig 3



POWER SHEAR MECHANISM

Safety

1 All guillotines are very dangerous.

2 Place the guard in position before operating.

3 Never work from the back of a guillotine.

4 Understand its safe operation fully, and the operation of emergency switches should be known perfectly.

5 Gauges, if not being used, should be clear of the material being cut.

Cutting procedure: When cutting, already marked line as shown in Fig 3.

– Switch on power guillotine

– Place the sheet on bed of machine and slide between blades

– Place the sheet on the bed of machine and slide between blades

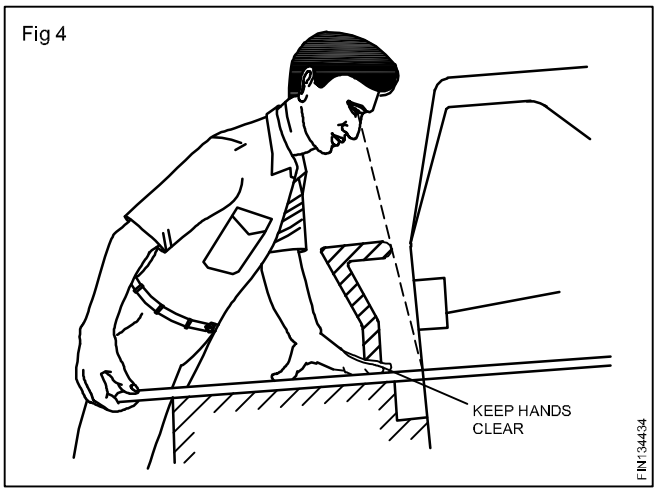
– Align cutting mark to the edge of the bottom blade

– Depress pedal, ensuring that the other foot is away from pedal bar.

Use of the squaring guide: Guillotines are commonly fitted with a guide at one end of the bed, to enable sheets to be cut without marking on the sheet.

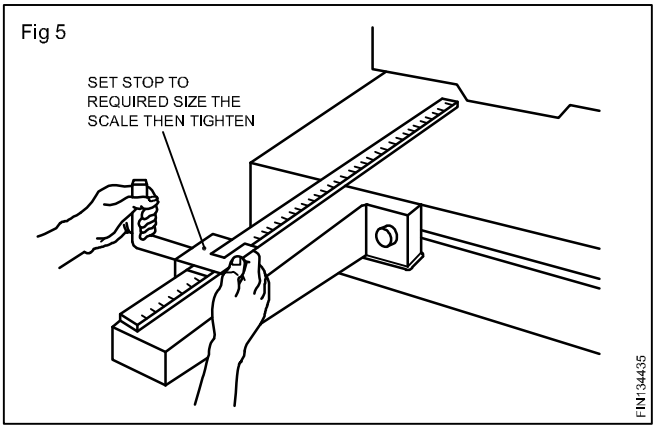
Where the guide is fitted with a scale, a stop is fitted to enable strips of a predetermined length to be cut accurately as shown in Fig 4.

Fig 4



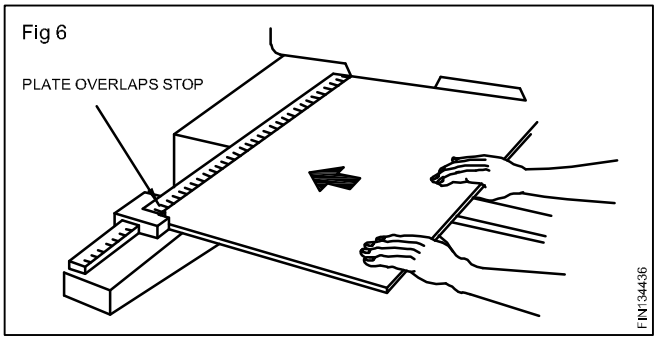
Position sheets against guide for squaring the other end over lap stops slightly as shown in Fig 5.

Fig 5



Safety: Wear protective gloves for handling sheet metal. Reverse sheet and reposition. Place same edge to guide. Pull sheet back against stop and depress pedal as shown in Fig 6.

Fig 6



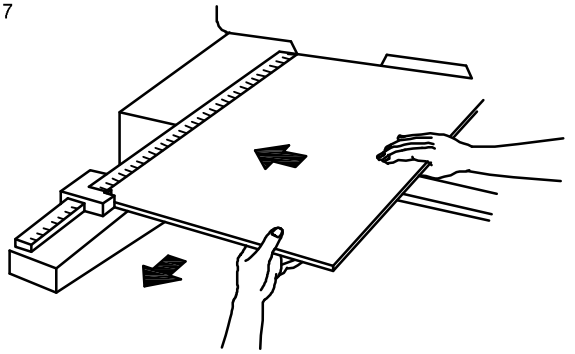
Parallel setting of front gauge: The front gauge is used when there is less overhang.

Before setting, check that the guillotine is switched off and separated. (Power machine only)

Keep wooden block under pedal as an added safe guard. Fit gauge bar by tee bolts of bar into slots in brackets.

Procedure for tape measure (Fig 7)

Fig 7

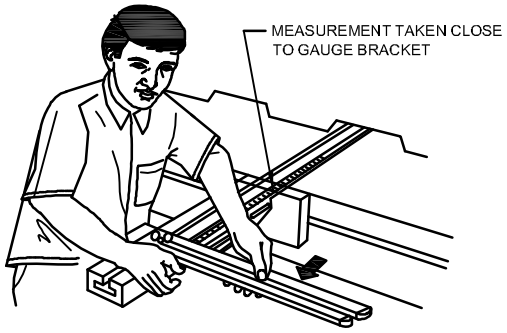


– Slide the tape end between blades
– Edge of the tape is hooked against bottom blade
– Position gauge bar, keeping the bar parallel to the blade
– Tighten securing nuts slightly
– Adjust the gauge to required position by tapping lightly by palm
– Adjust the gauge bar parallel to the blade and fully tighten the nuts.

When using a rule

– Place the rule between blades. Position required dimension on the edge of bottom blade.
– Place the gauge bar against end of the rule.
– Position the bar parallel. Slightly tighten the nut and adjust as shown in Fig 8.

Fig 8

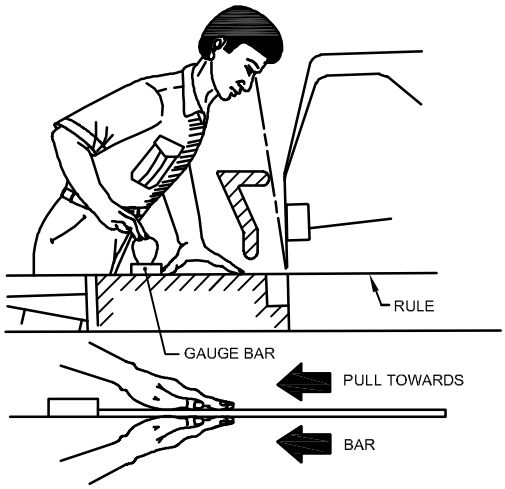


Using scale on gauge brackets: Where a machine is fitted with a graduated scale on the brackets, position gauge bar to the required dimension and fully tighten the nuts.

Keep place supported against gauge bar as shown in Fig 9.

Mark off plate to the size and shape. Set guide stop to give correct length.

Fig 9



Cut the sheet metal to the size and shape as per marking