

TRADE OF  
**Industrial Insulation**

PHASE 2

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**Module 1**

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**Sheet Metal and Insulation Fundamentals**

UNIT: 11

**Valve & Flange Box  
Fundamentals**

*Produced by*

**SOLAS**

**An tSeirbhís Oideachais Leanúnaigh agus Scileanna  
Further Education and Training Authority**

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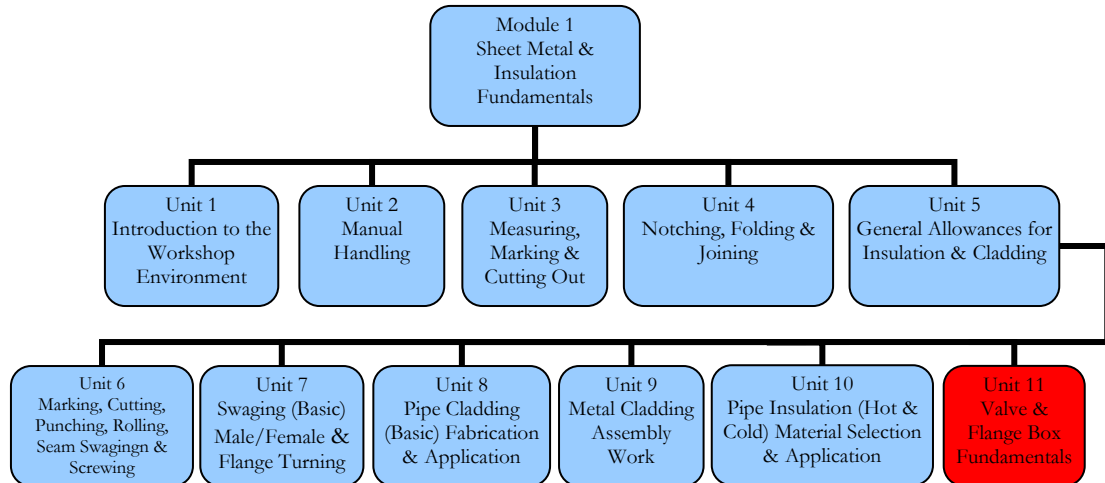
## Table of Contents

Unit Objective .....	1
Introduction.....	2
1.0 Basic Requirements for Flange and Valve Boxes .....	3
1.1 Typical Design of a Flange and Valve Box .....	3
1.2 Measuring a Flange and Valve Box.....	6
2.0 The Flange Box.....	8
2.1 Fabricating a Flange Box .....	8
2.2 Sequence of Works .....	9
2.3 Fabrication .....	9
3.0 The Valve Box .....	11
3.1 Fabricating a Valve Box.....	11
4.0 The Lock Forming Machine.....	12
4.1 Safe Operation of a Lock Forming Machine.....	13
4.2 Lock Forming a Metal Blank.....	13
5.0 Rotary Shears .....	15
5.1 Setup of a Rotary Shears.....	15
Summary.....	16

## Unit Objective

By the end of this unit **each apprentice** will be able to:

- Describe the fundamental requirements of basic valve and flange boxes.
- Identify and measure various valves and flanges.
- Identify obstacles and record details.
- Fabricate and install a basic valve and flange box.



## Introduction

Flange and valve boxes are manufactured and installed for many reasons. They are used for the protection of personnel against the temperature of the pipe work system, to maintain the thermal insulation integrity of the system, for acoustic insulation, to protect the valves and electrical connections from damage and they add to the overall appearance of the pipe work system.

# 1.0 Basic Requirements for Flange and Valve Boxes

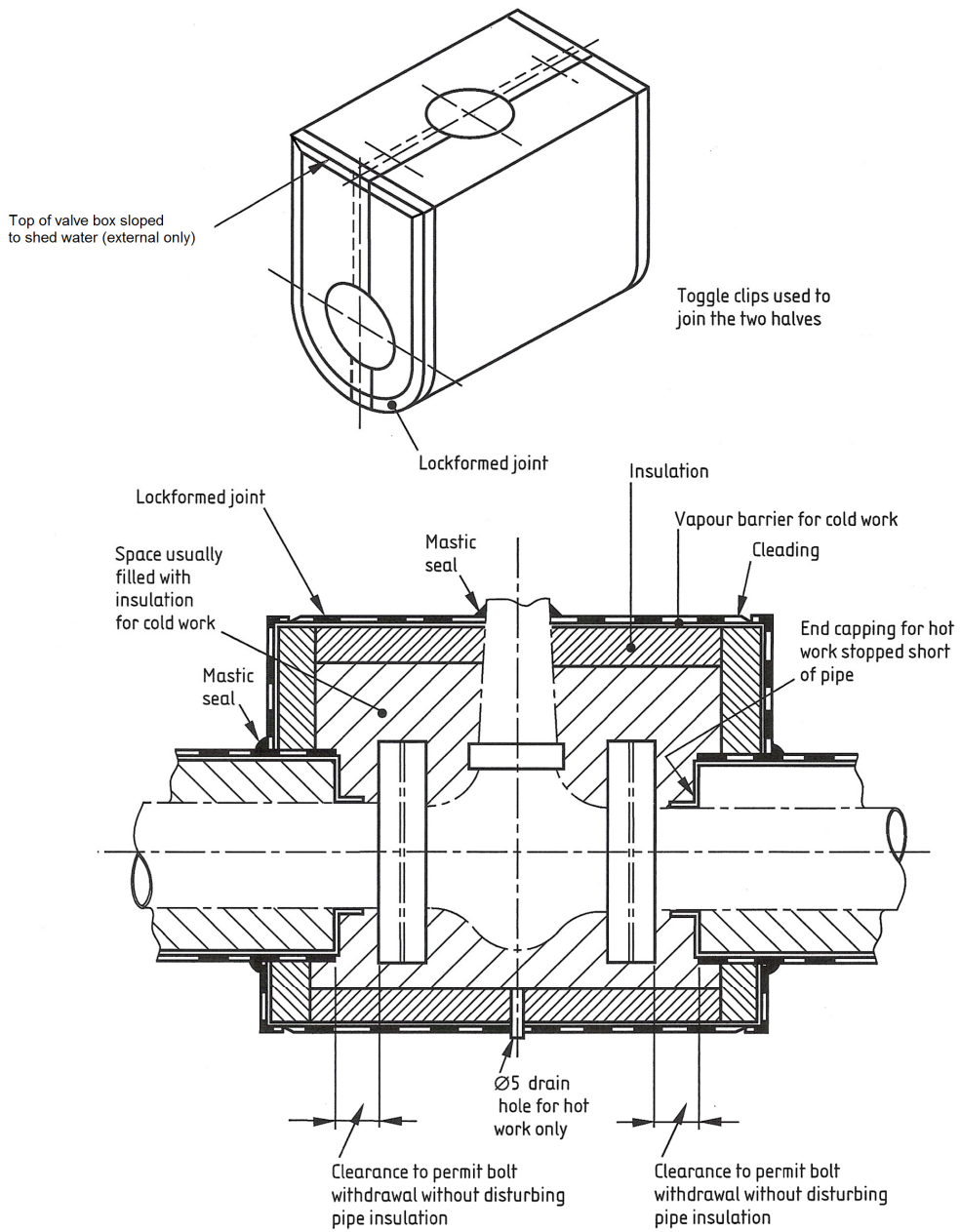
## Key Learning Points

- Free hand sketching, measuring of valves and flanges on the training rig.
- Identification of valves and flange types.
- Requirements for basic valve and flange boxes.
- Identification of obstacles and joint location.

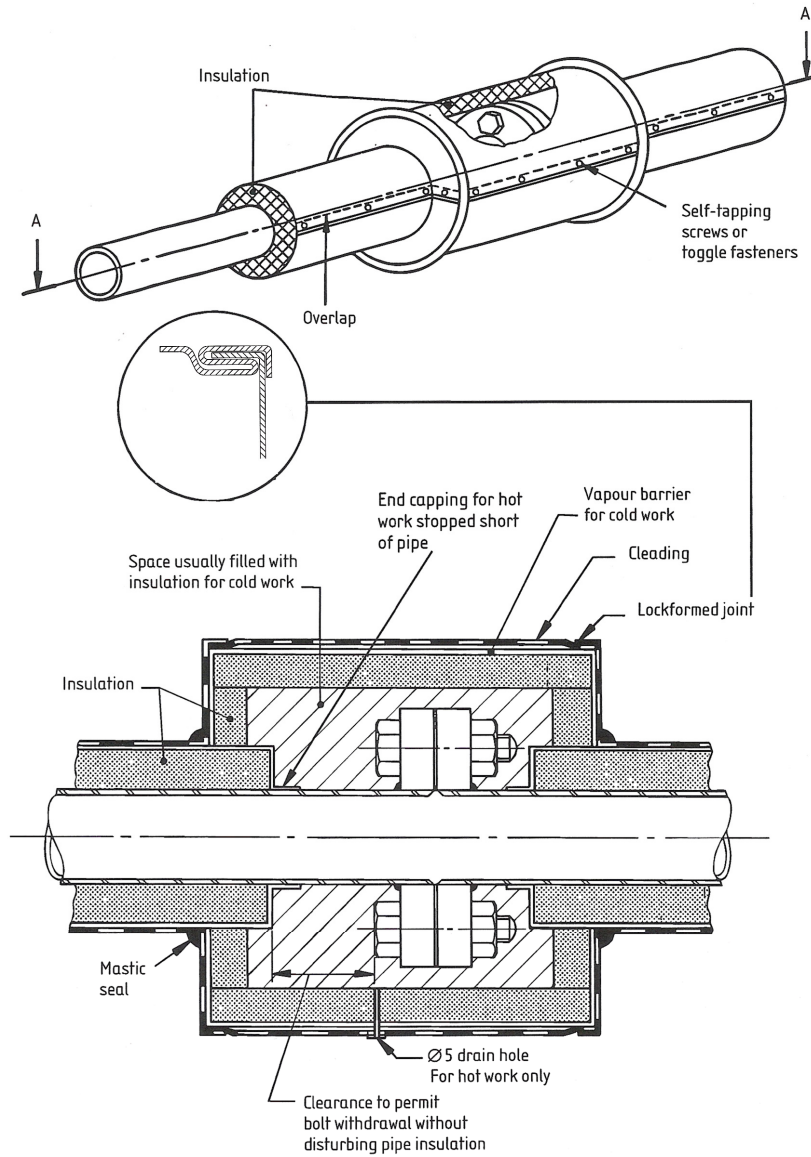
## 1.1 Typical Design of a Flange and Valve Box

All flange and valves boxes differ in size and shape, however the basic fundamentals of such boxes should always be the same.

1. It is preferable that valves and flanges should be insulated, but where hidden flange leakage can cause a possible fire or other hazard, e.g. with oil lines, or where repeated access will make it uneconomical, insulation can be omitted.
2. Flange and valve boxes are usually constructed from galvanised sheet, aluminium or stainless steel.
3. The need to dismantle flange and valve boxes for inspection and maintenance should be anticipated in their construction with the use of toggle clamps to hold the various parts together.
4. The flange or valve box should be lined with pre-formed or flexible insulating material which is mechanically secured to the box so as to maintain the integrity of the insulation during inspection and maintenance.
5. The insulation system within the box should be vapour sealed for cold work to ensure that the flange or valve insulation can be removed without damage to the vapour barrier on the adjacent pipe work.

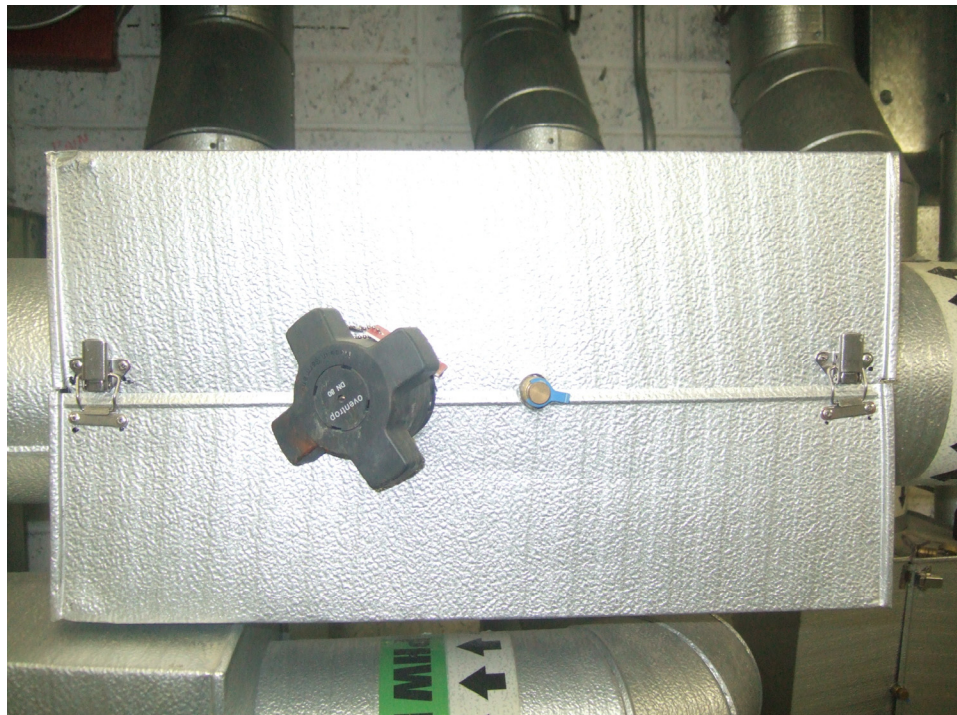
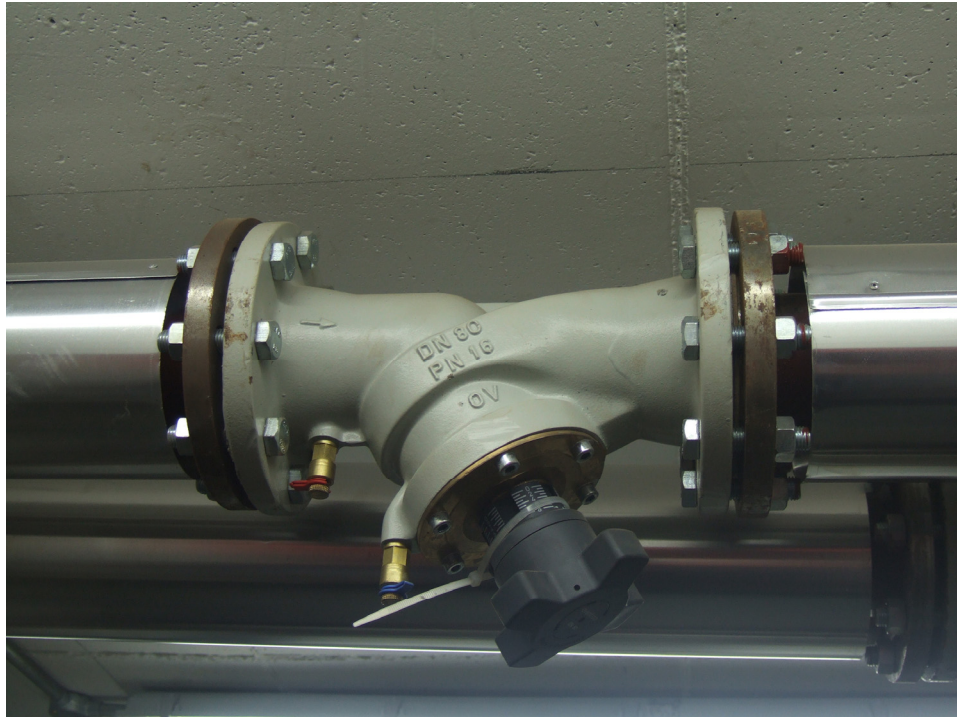


Typical Valve or "D" Box.



*Typical Flange Box.*





## 1.2 Measuring a Flange and Valve Box

As mentioned earlier flanges and valves come in many different shapes and sizes, so it is important that when measuring such items, the apprentice should include as much information as possible on the drawing/sketch so as to ensure the flange or valve box is manufactured correctly. A proper sequence of

measuring the fitting is vital as this will eliminate the possibility of incorrect and missed measurements. The sequence of measuring could be as follows:

1. Sketch the flange or valve from a number of different angles. Show any obstacles which may cause problems for manufacture or installation.
2. Measure the diameter of the pipe work leading into and out of the fitting using a measuring tape or rule. If the pipe work is already insulated note the thickness and type of insulation used.
3. Measure the overall length, height and width of the valve for the valve box and the diameter and total width of the flange for the flange box. Allow clearance for bolt removal and insulation thickness to arrive at the final measurements for boxes.
4. Decide on the position of the joint and the availability of access to install and remove the box if required for maintenance.
5. Note any cut-outs that may be required for drains, valve spindles etc and evaluate how they fit in to the overall assembly of the box. Designs of valves vary so exercise caution with cut-outs.
6. Check the works specification for the type of material to be used and any other item that may be required in the box.
7. Double check all measurements for accuracy and make notes on your sketch to clarify details that might not be clear.

## 2.0 The Flange Box

### Key Learning Points

- Planning of the sequence of operations for the manufacture of a basic valve and flange box.
- Marking out and cutting various plates from 0.7 mm galvanised mild steel.
- Turning up of a 5mm lip on all plates using the flanging machine and power swager.
- Lip turning using the flanging machine and power swager.

### 2.1 Fabricating a Flange Box



Typical Flange Box

Sometimes it is necessary to insulate and enclose or cover the flanges which form part of the pipe work system. Some flanges can be insulated and cladded to form a permanent fixture, however more than often the insulation and cladding needs to be removable in order to allow for maintenance and changing of the pipe work. The flange box should be manufactured in two sections with quick release clamps for easy dismantling. It is important for the apprentice to set out a sequence of works and to plan the job correctly before manufacture.

## 2.2 Sequence of Works

As with any job or task you do, if you fail to plan, you plan to fail.

1. Make a sketch of the flanges as set out above taking note of any obstacles that may impede on the installation of the flange box.
2. Decide on the location of the joints and the positioning of the quick release clamps.
3. Check the works specification for insulation thickness to be used and fixing arrangements for the flange box.
4. Gather the materials required to manufacture the flange box ensuring that the metal to be used is free from marks and scratches.
5. Make sure the work area is clean and tidy and that all tools required to do the job are to hand.
6. Wear appropriate personal protective equipment.

## 2.3 Fabrication

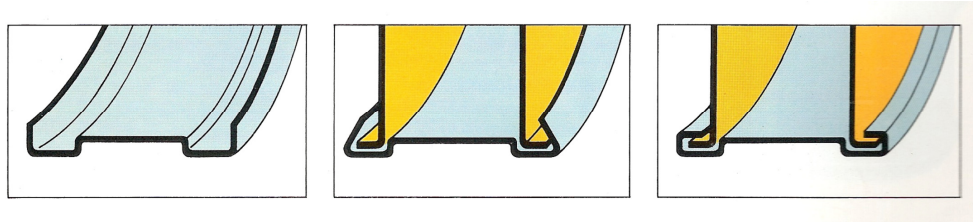
1. Mark out the semi-circular blank ends of the flange box using a dividers and steel rule. The ends of the flange box are manufactured in two halves, one half must have an allowance for a lap seam while the other half is left plain. This arrangement applies to both ends of the box. An allowance must also be added onto the radius of each semi-circular blank to fit into the lock form joint of the wrapper.(the size of the allowance should suit the size of the lock form joint being used).
2. Cut out each blank using the rotary shears ensuring that all safety precautions are been taken.
3. Turn the single edge up 90° on each of the semi-circular blanks using the flanging machine.
4. Joggle or set the 20mm lap joint on the folding machine to strengthen the lap and to improve the overall appearance of the joint.
5. Once the blank ends have been formed measure the circumference of the ends using a small and narrow measuring tape. Make a note of these measurements and double check the circumferences again for accuracy.
6. Mark out the wrappers for the flange box on a piece of material using a measuring tape or rule. The wrappers are to be manufactured in two halves to allow for ease of installation and removal.
  - (1) Add the allowances to the top and bottom of the wrapper for the lock form joint (this allowance should be checked against the model of machine used in the work shop). Check all measurements for accuracy. An alternative to the lock form joint is the valve box swaged joint shown in the figure below.
7. Cut out the blanks using the power guillotine and notch the pattern to suit.
8. Lock form the top and bottom of the pattern as set out below in **section 4.2**.
9. Insert a strip of metal into the lock form joint before rolling as this will stop the lock form joint from been closed completely during the rolling process. Roll the pattern to suit the curvature of the ends using the rolling machine.

***Refer to Module 1 – Unit 6 – Section 3.0***

10. Swage the longitudinal joints of the pattern for strength and appearance.

***Refer to Module 1 – Unit 7 – Section 2***

11. Assemble each section of the flange box; care should be taken when closing down the lock form joint, so as to avoid hammer marks.
12. Drill and fix the toggle clamps onto the box ensuring they are equally spaced, paying particular attention to the alignment of the clamps.
13. Assemble both halves of the flange box together and check the overall fit-up of the parts.



**Valve Box Swaged Joint.**

## 3.0 The Valve Box

### Key Learning Points

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### 3.1 Fabricating a Valve Box

*Refer to section 2.1 – Sequence of Works*

*Refer to section 2.2 – Fabrication*



**Valve and Flange Box Arrangement.**

The manufacturing process of the valve box follows the same procedure as that of the flange box with particular attention been given to the assembly of the box and the fixing of the toggle clamps so as to give a good overall appearance to the job.

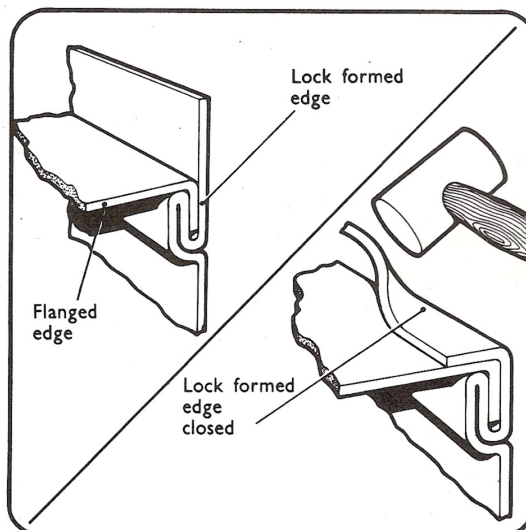
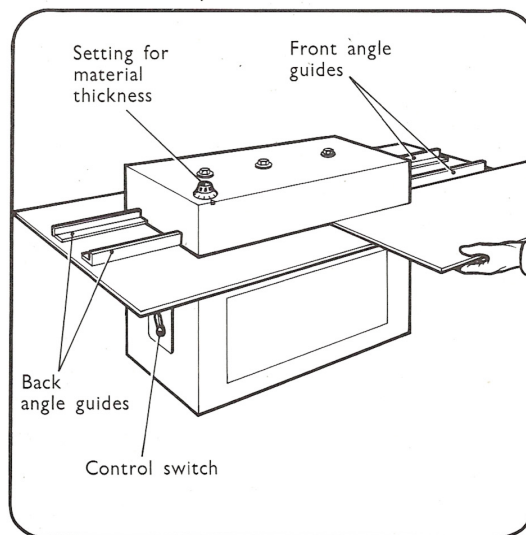
## 4.0 The Lock Forming Machine

### Key Learning Points

- Effective communication and safety. Safe work practices.

Lock forming machines are commonly used to prepare joints for the assembly of ducts or articles of box form. The metal passing through the machine is shaped by a series of forming wheels to produce the required type of joint. On many of these machines provision is made to change the forming wheels, enabling a wide variety of shapes to be produced.

The lock formed joint illustrated, often termed a “Pittsburg Lock”, is a common method of making joints in ductwork and cladding. Allowances for this joint depend on the type of machine in use and should be checked if necessary, using a trial strip of metal.



## 4.1 Safe Operation of a Lock Forming Machine

Extreme caution should be used when operating machinery in the workshop and the lock forming machine is no exception. Some of the basic safety procedures are as follows:

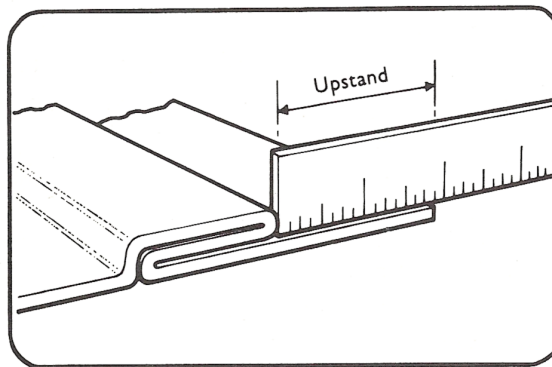
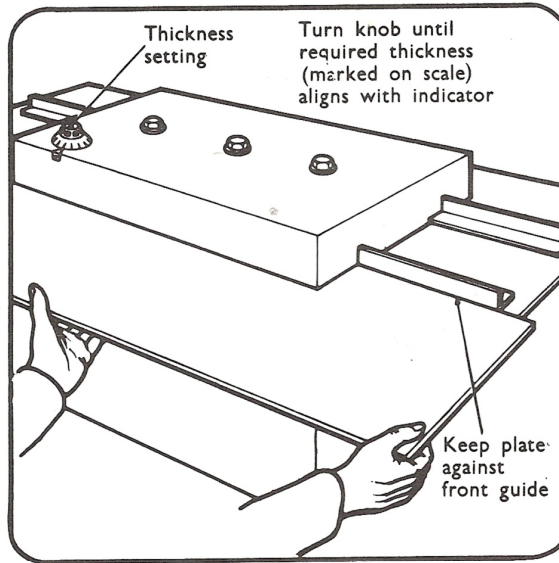
1. Ensure that all machine safety guards are fixed securely in place.
2. The work area around the machine should be tidy and free from any trip hazards.
3. Wear appropriate personal protective equipment – overalls, boots and gloves.
4. Check that all power leads are secure and free from breaks.

## 4.2 Lock Forming a Metal Blank

The following steps should be observed when lock forming a piece of metal:

1. Adjust the thickness setting of the machine by turning the knob to the appropriate position to suit the thickness of material to be lock formed.
2. Switch on the machine.
3. Position the work piece against the front guide and push the metal forward to engage the rolls of the machine which are positioned under the safety guard.
4. Allow the machine to feed the work piece through the forming rolls.
5. Check that the size of the up stand is correct as this is the amount of material available to knock over to close the joint.





## 5.0 Rotary Shears

### Key Learning Points

- Power shears and rotary shears set-up and operation.
- Cutting out of 0.7mm galvanised plates using a power shears and rotary shears.

The manually operated circular shears distinguish themselves by their easy operability. Interior and exterior contours are cut cleanly. It is driven by a hand crank on the top shaft. The round blank diameter is set according to the dimension scale. The blade is advanced by means of a hand wheel and spindle. The cut gap can be adjusted quickly and easily by means of a setting ring with scale. The blade shafts are held in place by maintenance-free bearings.



### 5.1 Setup of a Rotary Shears

1. Before setting up the machine, ensure that the work area is clean and tidy.
2. Locate centers of square or rectangular blanks by drawing lines from opposite corners.
3. Scribe the required circle on the blank with a dividers or use the graduated dimension scale on the machine.
4. Locate the metal blank on the machine, clamp, adjust cutters and cut out work piece by rotating the handle.
5. Remove waste material and place in the scrap recycling bin.

## Summary

Flange and valve boxes are manufactured and installed to maintain thermal insulation integrity, to protect the valves and electrical connections from damage and to protect personnel against temperature burns. Flange and valve boxes are manufactured to suit individual installations and it is important that the apprentice has a good understanding of different measuring procedures. Flange and valve boxes when manufactured correctly can enhance the overall appearance of a cladding system.

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