TRADE OF

Industrial Insulation

PHASE 2

Module 3

Substructures, Advanced Cold Work and Cladding

UNIT: 6

Two Piece Elbow

Produced by

SOLAS

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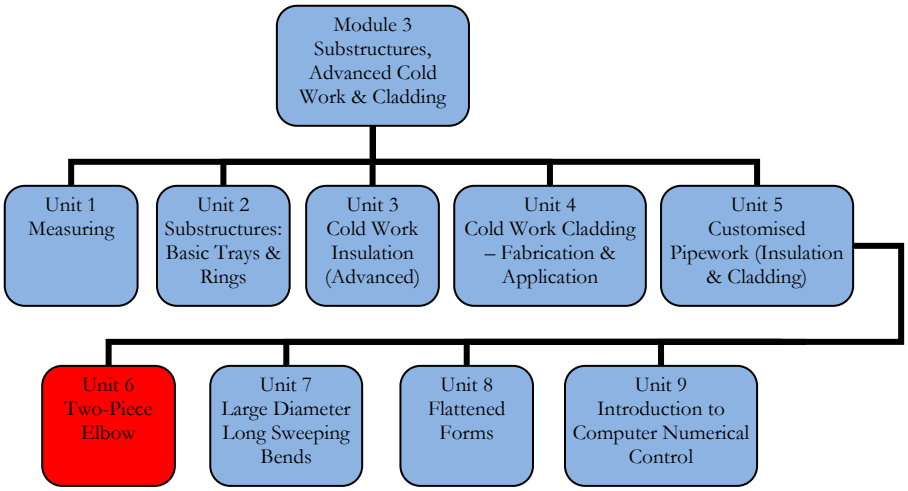
Unit Objective

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

- Sketch and measure a given pipe elbow and determine the allowances required for insulation, swaging and obstacles.
- Insulate a two piece elbow bend.
- Fabricate and fit cladding to a two piece elbow.



Introduction

A two piece elbow in pipe-work is a single angular diversion from a straight line. It is used to change the direction of a pipe system. It is important that the apprentice understands the need for accuracy when fabricating and assembling a two piece elbow, as inaccuracy can lead to a sloppy fit up of parts and a poor overall appearance to the job.

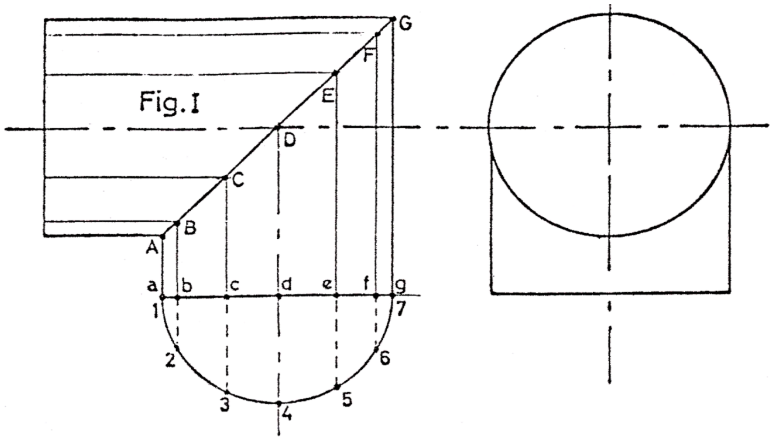
1.0 Developing a Two Piece Elbow

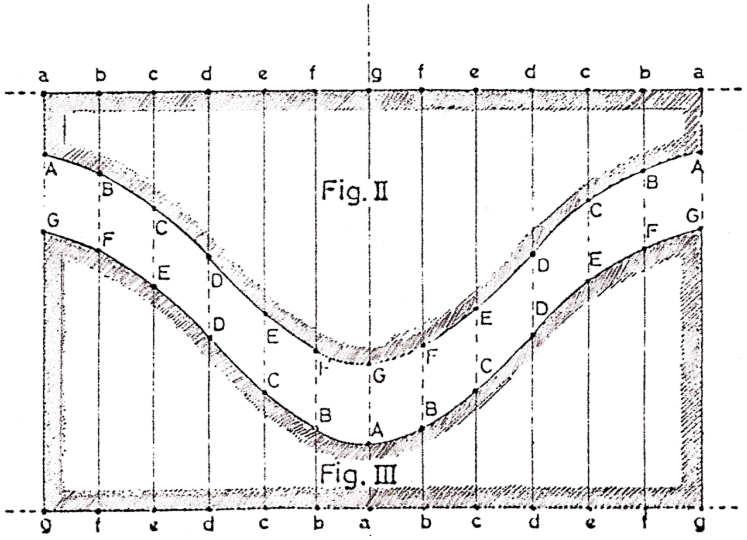
Key Learning Points

- Sketching and measurement of a given pipe elbow
- Determination of allowances for insulation, swaging and obstacles. Establishment of joint location
- Typical applications of pipe elbow and double offset pipe work
- Selection of insulation and cladding materials
- Pattern development
- Economic use of materials

1.1 Two Piece Elbow

A two piece elbow in pipe-work is a single angular diversion from a straight line. It is used to change the direction of a pipe system. The figure below shows a cylindrical pipe elbow with an angle of 90º. The position of the joint line bisects the angle of the elbow. A plain elbow cannot be formed between pipes of unequal diameter as the ellipses formed by the angular cut-off on each pipe will not fit together.





1.2 Developing a Two Piece Elbow

Figure I, shows the elevation.

Figure II, development of the lower socket, seam on the inside.

Figure III, development of the lower socket, seam on the outside.

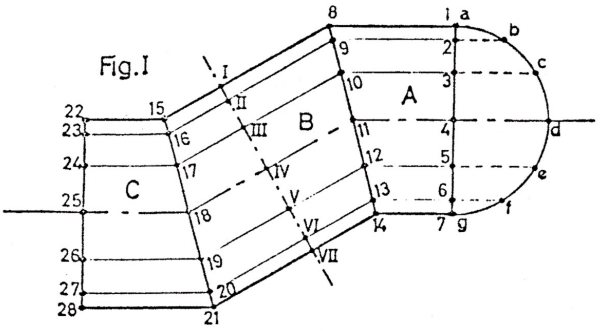
After determining the outline of the elevation of figure I, draw the semi-circle at point d, divide into six equal parts and through points 2 and 6 draw the so called generating lines parallel to the middle line. The joint line of the two pipe sockets is a straight line.

The development is obtained as described by laying off the line segment 1 to 2 (or the arc in figure1) 12 times on a base line, drawing the perpendiculars at points a to g, and on these points laying off the respective line segments aA, bB, etc. of figure I. As mentioned above, it is very important when stepping of the 12 arc lengths or divisions not to accumulate an error which would make the circumference longer or shorter than required.

Note: The pipe can also be developed by calculating it's circumference (diameter x π) and then by dividing the circumference in half, quarters, and then each quarter into three equal and accurate divisions with no accumulation or error.

1.3 Developing of an Offset

An offset is a fitting used in pipe work systems which changes the direction of a system. It is also used to connect two systems which are at different levels or planes to each other. Accurately measuring an offset requires a number of skills including sketching, measuring centre lines, use of scale drawings and working to a specification.



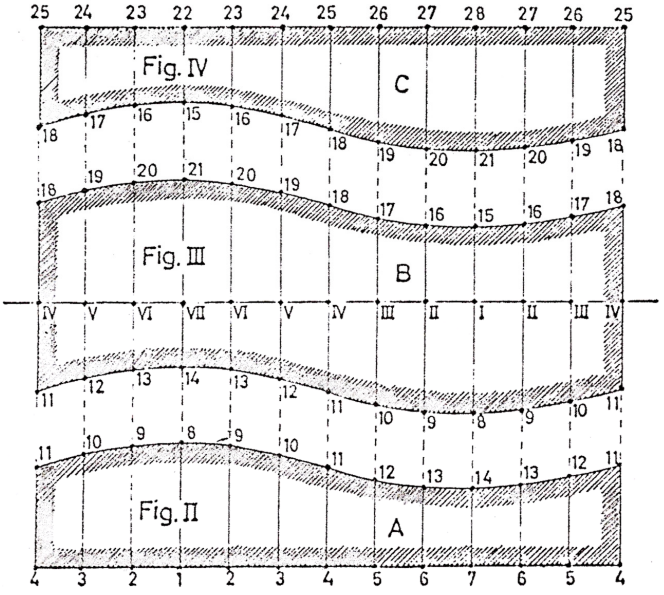


Figure I: Elevation.

Figure II: Development of socket A.

Figure III: Development of socket B.

Figure IV: Development of socket C.

First determine the outline of the elevation of the offset in figure I and take care to give the three segments or pipes the correct diameter. Then draw the semicircle with the centre at point 4, divide it into six equal parts and through points b, c, e, and f draw the so-called generating lines parallel to the middle lines of the three segments.

The development of the two sockets A and C is described in the previous development above.

For the development of the middle socket B draw the auxiliary line 1 to 7 perpendicular to the middle line in figure 1. This auxiliary line is constructed at a random point on the centreline 11 to 18. The generating line yields points 1 to 7.

For the development of figure III determine the base line with points 1 to 7 as usual. Draw the perpendiculars at these points and on these lines lay off the various lengths of the lines above and below the base line. All these lines should be the same length.

1.4 Economic Use of Materials

Nesting

When planning a job it is important to minimise the amount of scrap. A bit of thought as to how the blanks are arranged may increase the amount produced per sheet. From the developments above, we can see that the patterns of each pipe section fit into each other. This is achieved by moving the position of the joint line on each pipe. Consideration must be given however to the application of each fitting and how the joint will be affected by the conditions of the location of the system and its acceptability to water ingress into the insulation system.

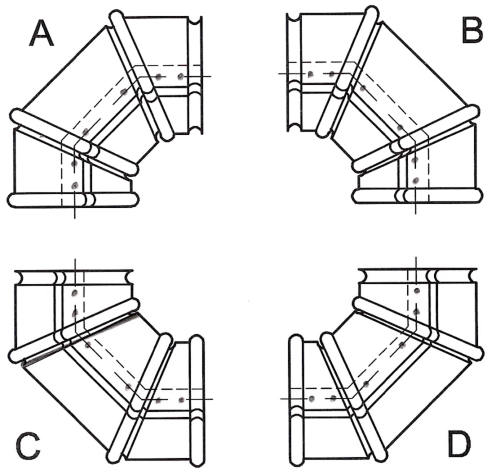
If a saving on metal means extra working time involved – one aspect must be considered against the other in the final analysis.

1.5 Determination of Allowances for Insulation and Cladding

Refer to module 1 – unit 5 – General allowances for insulation and cladding.

1.6 Position of Joints

Joints should be arranged when fitted to shed water, as water is the number one enemy of an insulation system. If water gets into a joint it can wet the insulation but over time it can cause major problems by way of corrosion to pipe-work etc under the insulation. This can be a very costly problem if it is not rectified in time.



1.7 Selection of Insulation and Cladding Materials

Selecting the correct insulation material for a particular project requires skill and knowledge. Information on all insulation products is readily available through manufacturers' catalogues, project specifications and the internet. There are a number of factors to be taken into account when selecting the correct product including temperature, location, safety, corrosion and cost of materials.

Use of Data Sheets and Manufacturers' Catalogues

Up-to date manufacturers' literature should be reviewed prior to specifying an insulation material to ensure that the material will perform as expected. Manufacturers' data sheets and catalogues generally outline the following:

- A description of the product including benefits of the product, density, thermal conductivity and overall performance.
- Structure – open cell or closed cell structure, high density.
- Temperature range – minimum and maximum temperature range.
- Thermal performance – Thermal conductivity values and performance.
- Moisture resistance – details and general information.
- Chemical resistance and compatibility – its resistance to oils, solvents, chemicals and adhesives etc.
- Fire performance – Resistance to burning and spread of flame.

Correct Selection of Material Type and Form

In selecting the correct type of material and supply form for a project, it is important to refer to the design data sheet and specification. This will indicate the pipe diameter, temperature range, insulation thickness and the method of installation i.e. multi-layers. The specification will indicate the insulation thickness for the first and second layers and the preferred method of installation.

Another method of selecting the correct material and forms of supply is to use the manufacturers' catalogues as mentioned above. These will recommend for example:

- The use of glass/rock wool rigid pre-formed process pipe sections for steam and process pipe-work.
- Rock mineral wool rigid, semi-rigid and flexible slabs for thermal, acoustic and fire insulation.
- The use of rock mineral wool lamella mat for the insulation of heating and ventilation pie-work and ductwork.
- The use of rock mineral wool wired mattress for the insulation of high temperature ducts, process pipe-work, tanks, vessels and boilers.
- The use of nitrile foamed rubber (Armaflex) for hot and cold pipe-work, ductwork and vessels.
- The use of phenolic foam insulation pipe sections bends and slabs for pipe-work, vessels and ductwork.

2.0 Fabrication and Assembly

Key Learning Points

- Cutting, punching, rolling, swaging of cladding for a two piece elbow bend
- Assembly, disassembly of cladding from the training rig
- Insulation and cladding application
- Problem solving and efficient use of work space

2.1 Fabrication

Refer to module 1 – unit 6 - Marking, Cutting, Punching, Rolling, Seam Swaging and Screwing.

2.2 Assembly, Disassembly of Cladding from the Training Rig

Refer to module 1 – unit 9 – Metal cladding assembly work.

Summary

A two piece elbow is used to change the direction of a pipe work system. The joint line in a two piece elbow will bisect the angle of the elbow in half. Care should be taken when developing and fabricating a two piece elbow to ensure that accuracy and the overall finish of the job is completed to a high standard. Nesting of patterns and the economic use of materials should also be taken into consideration to maximise materials and reduce waste.

An offset is a fitting used in pipe work systems which changes the direction of a system. It is also used to connect two systems which are at different levels or planes to each other. Accurately measuring an offset requires a number of skills including sketching, measuring centre lines, use of scale drawings and working to a specification.

In selecting the correct type of insulating and cladding material for a project, it is important to refer to the design data sheet and specification. This will indicate the pipe diameter, temperature range, insulation thickness and the method of installation that will be required for the job.

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