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Module 1 – Sheetmetal Fundamentals

Unit 14 – Exhaust Pipe

Duration – 7 Hours

Learning Outcome:

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

- Develop, cut, form and assemble exhaust pipe
- Organise method of manufacture and production sequence

Key Learning Points:

<table>
<thead>
<tr>
<th>Skill Level</th>
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<tr>
<td>D Sk</td>
<td>Layout and development of exhaust pipe.</td>
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<tr>
<td>Sk</td>
<td>Cutting and deburring patterns.</td>
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<tr>
<td>Sk</td>
<td>Removing hole on end plate by drilling holes, removing waste and filing smooth.</td>
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<tr>
<td>Sk</td>
<td>Folding groove and pre-form cylinder.</td>
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<tr>
<td>Sk</td>
<td>Smooth rolling - no flats or creases.</td>
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<td>H Sk</td>
<td>Assembly/welding - close tacking, no gaps, even profile on feather-edge weld/fillet weld, good appearance.</td>
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<tr>
<td>P</td>
<td>Job planning/sequence of operations/job card.</td>
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<tr>
<td>P</td>
<td>Metal shrinking.</td>
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<tr>
<td>M</td>
<td>Calculation of circumference of pipe.</td>
</tr>
<tr>
<td>M</td>
<td>Allowance of metal thickness on end plate to slip inside main pipe.</td>
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Training Resources:

- Toolkit
- Tools/machinery and equipment
- Oxy-acetylene welding equipment
- 1.0 mild steel
- Workshop drawing 2.1.13

Exercise:

Exercise 2.1.13 – see Figure 1.

Key Learning Points Code:

M = Maths          D = Drawing          RK = Related Knowledge
P = Personal Skills Sk = Skill          H = Hazards

Sc = Science
Figure 1 - Exhaust Pipe
Assembly of Exhaust Pipe

Work out the circumference and add on groove allowance. There is no notching needed. When fabricating the end plate, metal thickness must be considered. The bend radius will also make a difference and possibly more than one attempt may be needed to get a good fit.

Gas or T.I.G. welding may be used to join the end plate to the pipe. All burrs should be removed on completion of the job.

When rolling the pipe be careful not to get kinks or flats in the job. Breaking the grain and pre-forming will help in preventing this.

Figure 2 - Exhaust Pipe
Tinman’s Jenny

This machine is used for turning edges on discs or forming fairly narrow flanges on cylindrical or conical shaped work. The machine is fitted with two rolls, a fine edged top, or pressure roll adjusted by a hand screw, and a recessed bottom or forming roll. An adjustable guide or gauge is fitted to control accurately the width of the required flange.

The jenny is normally fitted to a cast iron bench socket but may also be mounted in a vice. When mounting, ensure machine is firmly fixed or held. Position so that the handle is at operator’s right hand.

Hand operated jennies are generally limited to material lighter then 18 S.W.G..

Figure 3 - Tinman's Jenny

Setting up the Jenny

Lift the top roll slightly. Loosen the guide pinch screw. Set rule against guide and check dimension against top roll.

Adjust guide to required setting, tighten pinch screw. Check size from guide face to inside edge of top roll.

Figure 4 - Setting up the Jenny
Flanging a Disc

Support disc in left hand, thumb on top, fingers supporting underneath.

Light pressure towards centre will maintain disc in contact with guide.

![Figure 5 - Support Disc and Apply Pressure](image)

Safety

A small piece of metal folded as shown in Figure 5 should be used at all times to prevent injury to operator's hands. Make sure disc is de-burred.

Position disc between rolls, edge against pre-set guide.

Using top adjusting screw, lower top roll until metal is held firmly between rolls.

![Figure 6 - Position Disc and Place Metal between Rolls](image)
Maintain disc in contact with guide, turn handle clockwise with smooth steady action. Steadily tilt disc slowly upwards until required angle is obtained. Loosen top adjusting screw and remove disc.

Figure 7 - Turn Handle and Tilt Disc
Flanging a Cylinder

Ensure cylinder edge is smooth and burr free.
Support cylinder in machine and adjust top roll.
Turn handle slowly and smoothly maintaining cylinder edge in contact with guide.
Tilt cylinder increase turning speed smoothly.
Change position of left hand when necessary and continue applying upward pressure until flange is at required angle.

Note: When long cylinders are being flanged assistance will be necessary. Assistant will raise work to operator’s instructions.
Wide flanges will need additional stretching using a stretching hammer. The work should be supported on suitable stake.
Self Assessment

Questions on Background Notes – Module 1.Unit 14

1. What is the Neutral Line?

2. In general where is the position of the Neutral Line?

3. Name the three factors which influence the precise position of the Neutral Line.
4. What is the included angle for the tooling of a press brake when air bending and when coining.

5. What are three advantages of air bending?

6. What is the advantage of coining?
7. What are the three main steps in folding?

8. What is the minimum inside corner radius of a bend?

9. What is the standard die ratio of a press brake?
10. Name three types of punches / dies that are used on a press brake.
Answers to Questions 1-10. Module 1.Unit 14

1.

**Neutral Line:**

The Neutral Line is a imaginary curve somewhere inside the metal in the bend. Its position or length does not alter from the original flat length during bending.

2.

The Neutral Line is approximately halfway in the thickness of the sheet, i.e. \( \cdot 5 \) of the metal thickness. It varies slightly with different types and gauges of metal.

3.

- Properties of metals.
- Thickness of metals.
- Size inside radius.
4.

**Included Angle:**

Included angle for air bending is 85° and coining 90°

5.

- Less power is required
- Ability to bend heavy sheets

6.

The advantage of coining is high angular accuracy.
7.

Clamping:
The amount of lift the clamping beam has, it should be adequate to give clearance for previous folds.

Folding:
Care must be taken to see that the folding beam will clear the work, particularly when making second or third folds.

Removal of work:
Care must be taken to ensure that the work may be easily removed on completion of final bend.

8.

The inside radius of the bend is rarely less than twice the metal thickness and no more than four times the thickness of the metal.
9. Standard die ratio is normally 8:1 but may go to 10:1 or 12:1
For very thick metal i.e. 9.25mm and material with a high tensile strength.

10. • Goose Neck Punch
    • Acute angle dies
    • Interchangeable four-way dies
    • Flattening tools
    • Radius bending channel
    • Box making dies
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