

TRADE OF
Industrial Insulation

PHASE 2

Module 1

Sheet Metal and Insulation Fundamentals

UNIT: 7

**Swaging (Basic) Male/Female
& Flange Turning**

Produced by

SOLAS

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Further Education and Training Authority**

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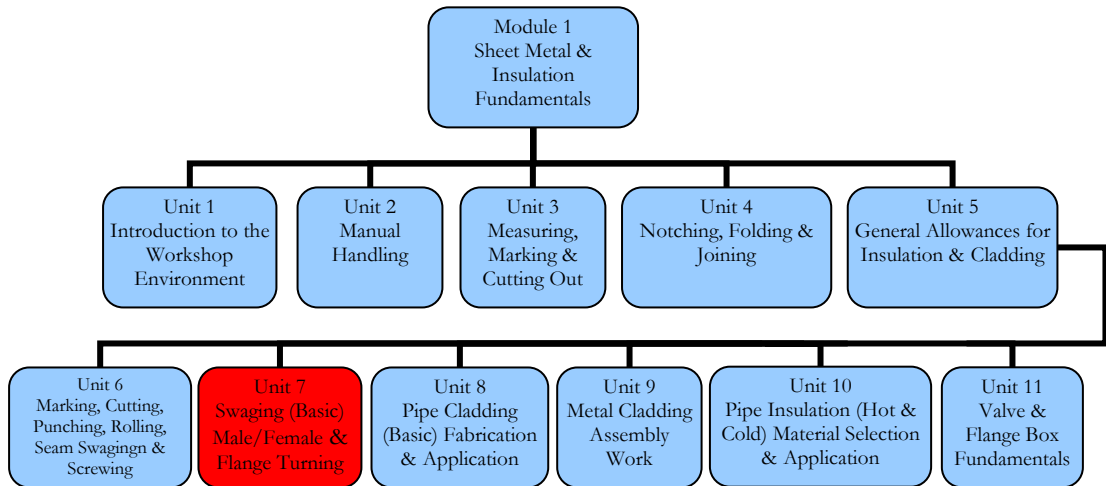
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Introduction

Swaging and flanging of pipes and discs are skills which the apprentice must develop early on in his/her apprenticeship. Swaging a cylindrical pipe has many advantages, it adds strength to the pipe, it acts as stop when one pipe is slipped into another and it adds to the appearance to the overall job. Flanging of a pipe allows it to be fixed to a flat surface, and the flanging or edge turning on a flat disc allows it to act as a blank on a pipe section.



Unit Objective

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

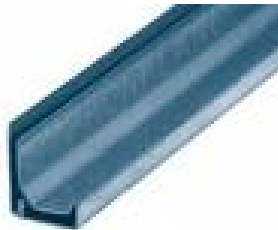
- Identify the applications of flanging.
- Set up a swaging machine.
- Identify the hazards of a swaging and flanging machine.

1.0 Flanging

Key Learning Points

- Application of flanges in pipe work and ductwork.
- Identifying the correct forming wheels/rollers for male and female swaging applications.
- Selection of flanging and forming wheels for specified operations.
- Foot pedal operation (power swager and flanger).
- Changing the forming wheels for flanging applications.
- Material properties.
- Effects of flange turning on the workpiece.

In the sheet metal shop the term flanging has a number of different applications. In cylindrical work the process of flanging a pipe section is to turn an edge out on the end of the pipe. The width of the flange that can be turned out is generally determined by the depth gauge of the swaging machine. In a ductwork application flanges are used to join two ductwork fittings using a pre-made flange section and corner pieces so the fittings can be bolted together.

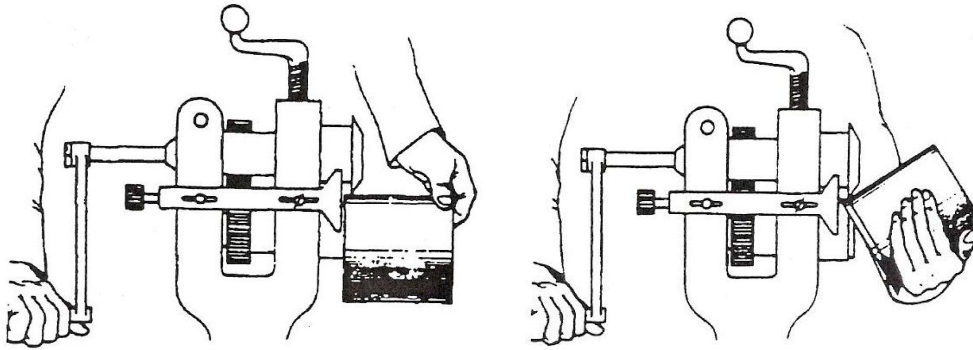


Pre-formed flanging used on ductwork.

1.1 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 the cylinder and increase the turning speed smoothly. Change position of left hand when necessary and continue applying upward pressure until flange is at required angle.

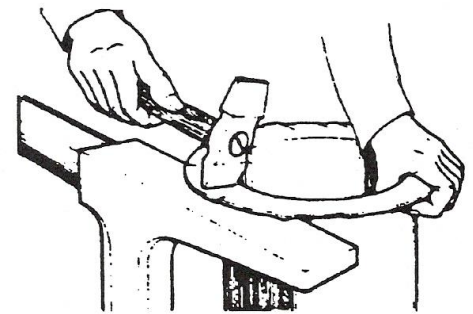


Note: When long cylinders are being flanged assistance will be necessary. Assistant will raise work to operator's instructions.

Wide flanges will need additional stretching using a stretching hammer. The work should be supported on a suitable stake.

Precaution: When using sharp edged rolls for flanging operations, do not over-tighten the top roll. If the top roll is too tight the metal will be sheared. The top roll should be adjusted so as to afford a light grip on the metal between the rolls.

The metal in the swaged bead is very highly stressed. This produces a much greater Strength/Thickness ratio than that of the sheet metal with which it is formed. In general the maximum thickness of sheet metal which may be swaged is 1.62 mm.



1.2 Flanging a Disc

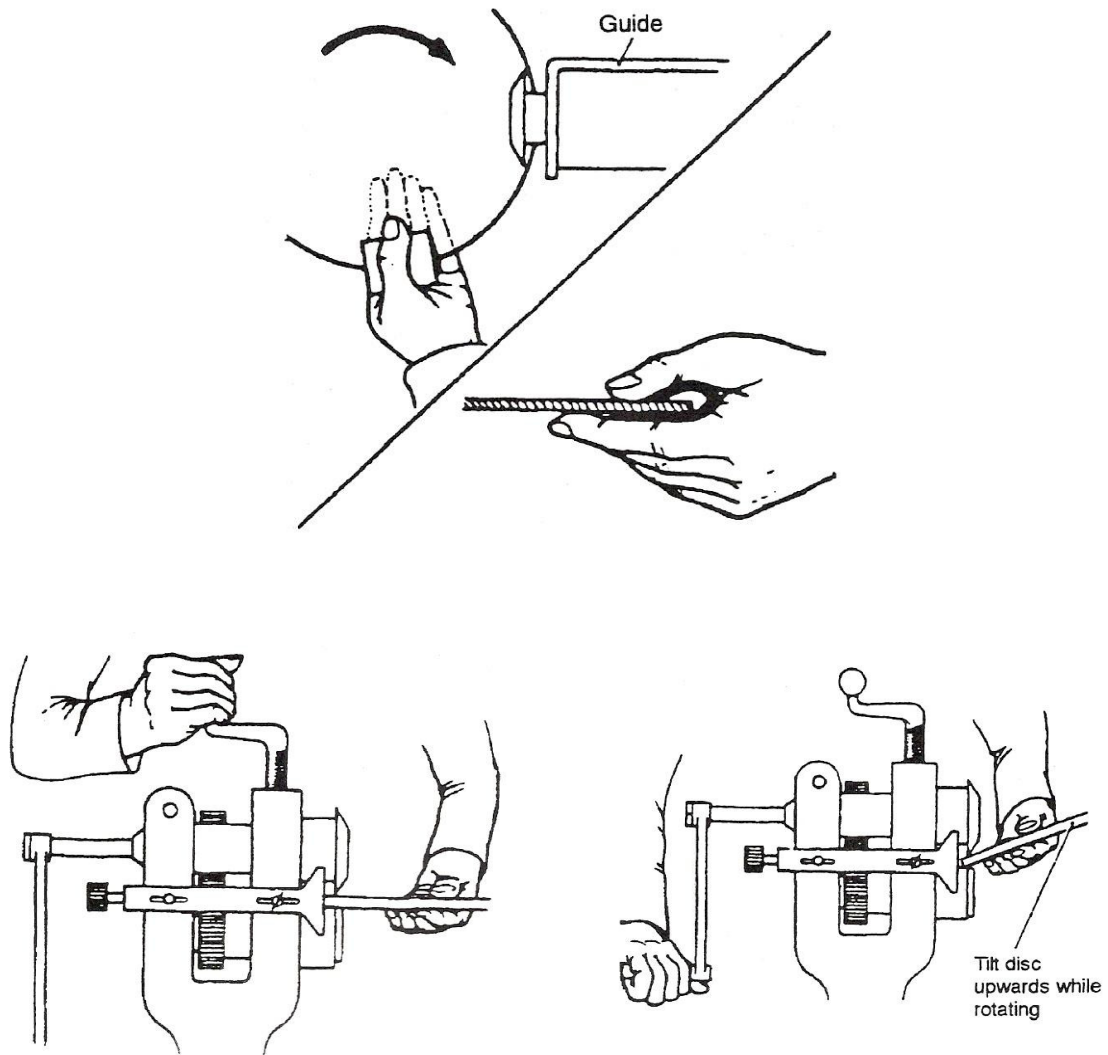
Support disc in left hand, thumb on top, fingers supporting underneath.

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

Safety: A small piece of metal folded as shown in **Error! Reference source not found.** should be used at all times to prevent injury to operator's hands. Make sure disc is deburred.

Position disc between rolls, edge against preset guide. Using top adjusting screw, lower top roll until metal is held firmly between rolls.

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.



Flanging a Disc 1

1.3 Effects of Flange Turning

Great care must be taken by the apprentice when flanging a pipe section to reduce the effects of working the metal. Some common effects of flanging are:

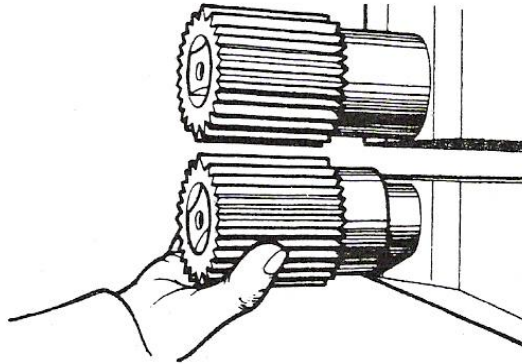
- Stretching of the metal resulting in the flange being wider than required.
- Tearing of the flange from the top roll being over tightened.
- Necking or reducing of the inside diameter of the pipe from over tightening of the wheels and raising the pipe too quickly during flanging.
- Work Hardening of the material happens when the flange is hammered over a stake resulting in the material becoming brittle.

1.4 Common Swaging Wheels

Crimping

Crimping is the process used to corrugate one end of a pipe to make it smaller so it will fit easily into the end of another pipe of the same dimension.

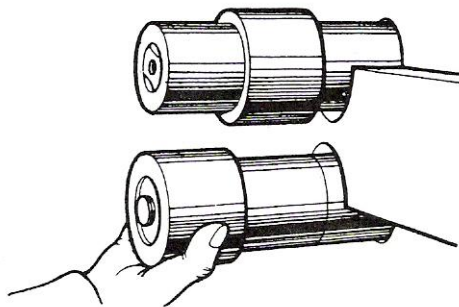
This method eliminates the need of making one end of the pattern for the pipe smaller than the other. Crimping can be used on light gauge metal only.



Jogging

Use jogging wheels to increase or decrease diameters of pipe. Fit selected wheels to machine. Wheels fitted as shown in **Error! Reference source not found.** will reduce diameter. Adjust lower roll to align wheels. Allow for material thickness between rolls.

Set gauge to size required. Position pipe against guide. Form joggle in stages, tighten rolls at each revolution.



1.5 Properties of Metals

Refer to module 1- unit 3 – section 4.6.

2.0 Swaging

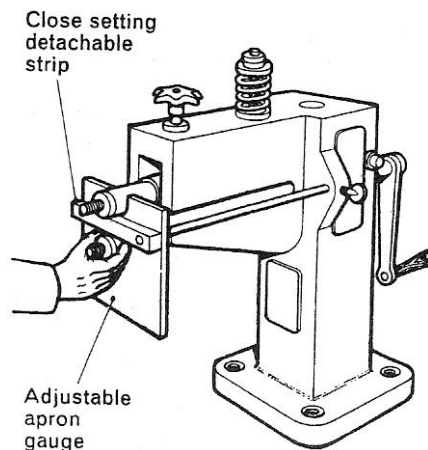
Swages are formed on cylindrical objects to serve as stiffeners, reinforcement or ornamentation. The swaging machine is a rotary machine equipped with special swaging rolls. The standard shapes of swage are the single, ogee and triple swage.

Key Learning Points

- Changing the forming wheels for male and female applications.
- Depth of swage required.
- Wheel centring.
- Guide plate adjusting.
- Fast and slow settings.
- Positioning of machine operator and workpiece.
- Removal of burrs and sharp edges.

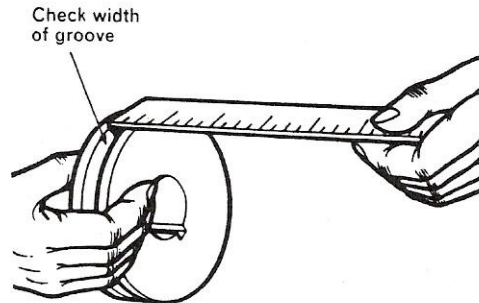
2.1 The Swaging Machine (Jenny's)

Before operating the machine, if it is powered you must familiarise yourself with the starting and stopping procedure. Use of different rolls permit the universal rotary machine to combine the functions of swaging, jennying, wiring, crimping and joggling. The machine may be either hand or power operated.



2.2 Fitting Swaging Rolls

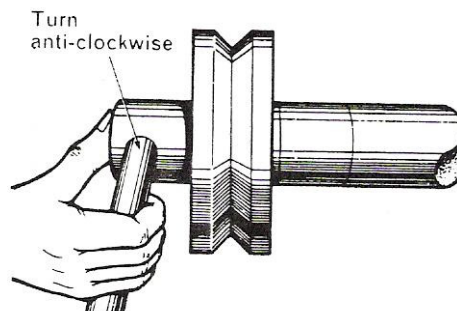
Check swage width. Select appropriate size rolls and check that they are free from damage or blemishes.



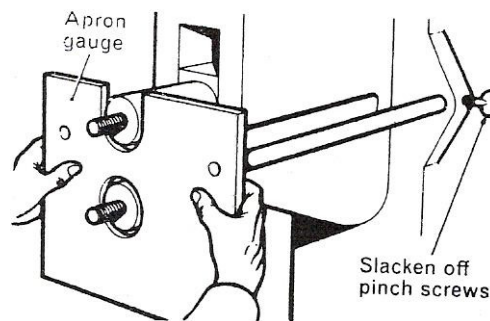
Checking Swage Width

Note: One shaft has a left hand thread, and the securing nut must be unscrewed in the appropriate direction.

Remove rolls from machine by unscrewing nut anticlockwise. Remove nut and pull rolls clear of shaft.

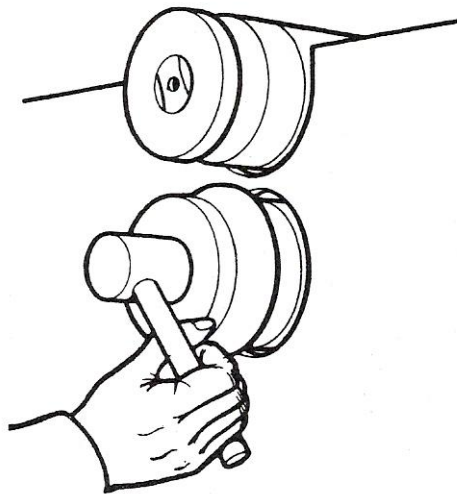


Use the apron gauge when cylindrical work is being swaged, joggled or crimped, close to edge of work. Fit gauge into locating holes on machine frame. Slide gauge clear of shaft ends.



Using the Apron Gauge

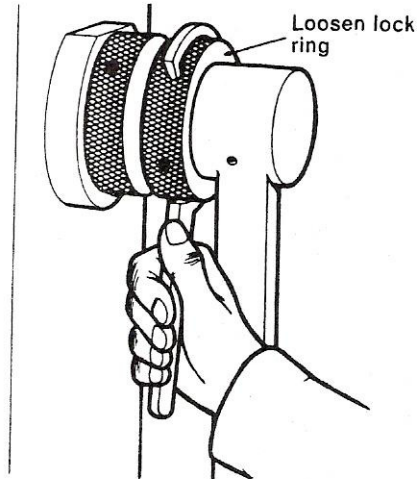
Push swaging rolls on to correct shafts, using spacing collars if necessary. Fit grooved rolls on top shaft for external swage, or a bottom for internal swage. Ensure rolls engage correctly on keys and shafts. Fit nuts noting thread type of direction, then tighten up.



Fitting Swaging Rolls

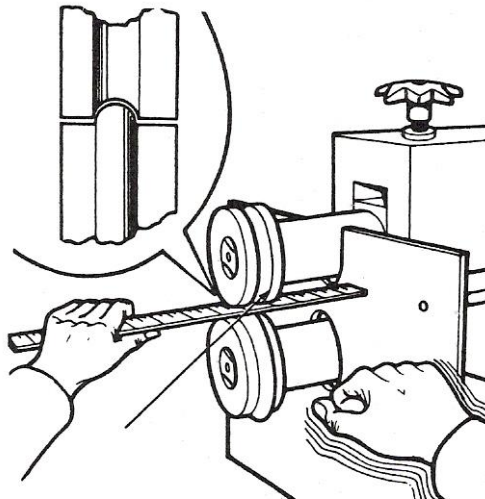
2.3 Setting Rolls in Correct Alignment

Loosen locking ring at handle end of shaft. Fit spanner to screwed bush and adjust bush by turning until alignment is approximately correct. Screw down top rolls adjusting screw until top and bottom rolls engage.



Setting Rolls in Correct Alignment 1

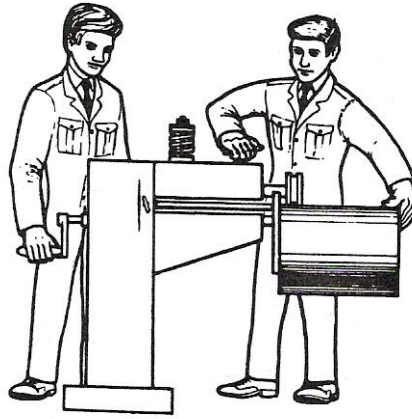
Continue adjusting screwed bush until clearance between rolls is even. Tighten nut holding bush to prevent it moving. Set gauge to dimension required, checking dimension from gauge to inside edge of groove or roll. Tighten pinch screws.



Setting Rolls in Correct Alignment

2.4 Swaging a Large Diameter Pipe

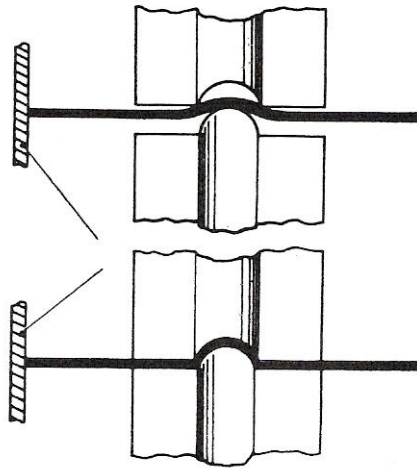
Open rolls by loosening top roll adjusting screw. Position work between rolls and set against gauge. Tighten adjusting screw until lower roll just marks material. Turn handle keeping work pressed against the gauge or apron.



Swaging

Tighten adjusting screw slightly at each revolution until satisfactory depth of swage is obtained.

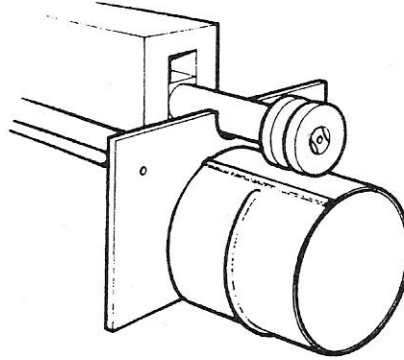
Note: Assistance may be required for large work. Assistant must keep clear of control and must obey operator's instructions.



Swaging 2

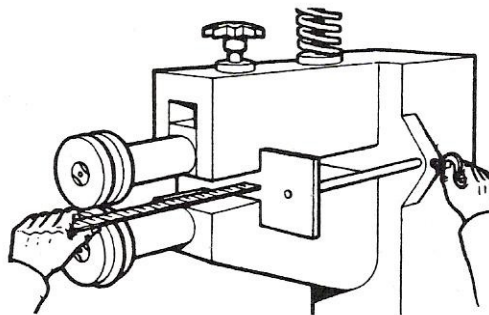
Swaging Cylindrical Work with Fully Grooved Joints

Set swage rolls and gauge position work joint close to roll and tighten adjusting screw. Turn handle, keeping work close to gauge. Stop rotation when joint is reached. Slacken off adjusting screw to allow joint to pass between rolls. Re-position work on other side of joint and continue operations until satisfactory swage is obtained.



Use of Narrow Gauge

Use narrow gauge when required line of swage is too far from edge of work to permit use of apron gauge. Fit and adjust as for apron gauge.



2.5 Male and Female Swage

The male and female swage is the method used for joining two lengths of cladding pipe together. The ends of the pipe have an internal swage or an external swage depending on the sequence of manufacturing. When the two sections of pipe are assembled together the male swage sits neatly into the female swage forming an interlocking joint. An allowance of material usually 3 to 5mm must be added to the length of the pipe to allow for each swage.

2.6 Machine settings (Power Swager and Flanger)

The power swager and the power flanger generally have two speed settings (depending on the machine type and model). The slow speed is used for the initial swage or starting the first turn up of the flange. Once a complete revolution of the part has been formed the faster speed can be used. It is important that the apprentice gives this process his/her full attention as it is very easy for the part to run off line and destroy the swage or flange.

Refer to the manufacturer's instructions regarding the machine settings.

2.7 Removal of Burrs and Sharp Edges

Refer to module 1 – unit 3 – section 5.5 - De-burring.

3.0 Health and Safety

Key Learning Points

- Dangers associated with power swaging.
- Planning and sequencing of operations.
- Awareness of hazards to others in the workshop environment.

3.1 Dangers Associated with Power Swaging

- Cuts and abrasions from sharp material.
- Fingers been caught in the machine.
- Trip hazard from the foot pedal.
- Accident due to lack of concentration.
- Back injury due to poor manual handling techniques.

3.2 Precautions to be Taken When Power Swaging

- Always wear personnel protective equipment i.e gloves, boots and overalls.
- Ensure that machine safety guards are in place and secure.
- Keep the work area tidy at all times to reduce the risk of trip hazards.
- Keep your hands and fingers away from the wheels so as to avoid getting finger caught.
- Use the proper manual handling techniques when swaging large diameter pipes and ask for help from another worker if required.
- If you require help ensure that you relay the risks associated with the machine to the other person. Always inform them of the sequence of operations so they know what to expect.
- Always switch off the machine after use.
- Leave the work area safe and tidy for the next person.

Summary

In this unit we have looked at the swaging of cylindrical pipes and the skills required to swage small and large diameter pipes. We have looked at the set up of the hand jenny's and the power swager and the tooling required for different applications. The set up of the machinery correctly is a vital part of the job. Making sure the alignment of wheels is correct will ensure a good centered swage on the pipe and will add to the overall appearance of the job.

The apprentice at an early stage must have a good understanding of the safety precautions required when using the power swager or any equipment in the workshop. Safety checks must be carried out before using any machinery, and if the swaging of a large diameter pipe requires a second person to help with the operation, it is important that this person also understands the dangers involved.

S O L A S

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