



A Division of ASPRI

LEARNER'S GUIDE

For

PERFORM FITTING WORKS IN WORKSHOP

COMPETENCY CODE: PI-PRO-105E-1

Version: 2.0

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Introduction

(a) WSQ for Process Industry

The Singapore Workforce Skills Qualifications (WSQ) System is a national continuing education and training system that will enable the workforce to obtain formal qualifications. It comprises a qualifications framework to recognise skills training, including Employability Skills, and a set of industry-specific Competency units. It also assures quality training delivery and assessment.

The Competency units for these skills were developed into modules. The individual or organisation can choose to take either one or more module/s, and/or the full (WSQ) qualification.

An individual who completes a module (known as competency unit) will get a Statement of Attainment (SOA). If an individual completes the required number of modules at the various levels, he/she will be awarded a WSQ Qualification.

(b) Competency Unit Introduction

This Competency Unit: *Perform Fitting Works in Workshop* is one of the elective units in the engineering services and environmental sectors of the Process Industry. It specifies the skills and knowledge required by people to perform fitting works in the workplace.

The competency elements covered in this competency unit are:

- Prepare for fitting work activities.
- Perform fitting works with hand tools and equipment.
- Maintain hand tools, equipment and work area.

Primarily, people who require such competencies are operators or technicians working in the workshop or engineering services environment in the process industry.

In this unit, learners can acquire the required competencies to perform fitting works with hand tools and equipment in the workshop, at the operational level in their workplace. The competencies include select appropriate hand tools, use the tools correctly and safely to produce parts to specifications and perform routine maintenance of hand tools.

Learners are assumed to:

- have received safety training related to a process plant
- have related training or work experience in a process plant
- be able to follow written and oral work instructions of lead fitter or supervisor
- be able to interpret basic technical drawings and blueprints
- be able to listen, read, speak and write English at a proficiency level equivalent to the Employability Skills System (ESS) level 2
- be able to manipulate numbers at a proficiency level equivalent to ESS level 2

(c) Competency Unit Purpose

The purpose of this competency unit is to enable learners to perform fitting works in the workplace based on a set of competency elements, which include:

- Prepare for fitting work activities.

- Perform fitting works with hand tools and equipment.
- Maintain hand tools, equipment and work area.

(d) Learning Outcomes

At the end of the programme you will be able to:

- Interpret work instructions and permit to work
- Identify workplace tools and equipment and safety devices that are safe for use
- Identify and report unsafe working conditions and hazards at the workplace
- Check and wear appropriate personal protective equipment
- Use tools and equipment safely to complete the fitting works to required specifications.
- Return tools, equipment, and materials to designated locations
- Handle waste and hazardous items from the workplace after completing fitting works

(e) Competency Unit Delivery (Guide)

Section	Topic	Training Duration Guide
-	• Administration and Introduction to fitting works	30 minutes
-	• Tea break for 3 days	1 hour 30 minutes
-	• Recap activities for Day 2 and 3	1 hour
1	• Prepare for fitting work activities.	2 hours 45 mins
2	• Perform fitting works using hand tools and equipment	13 hours
3	• Maintain hand tools, equipment and work area.	2 hours 15 mins
4	• Preparation for Assessment • Assessment Requirements	1 hours
Total Training Delivery Hours		22 hours

(f) Unit Assessment

For this competency unit it is recommended that summative assessment method be applied. Participants are encouraged to complete the recommended training hours before taking the assessment.

An overview of the instruments for the conduct of assessment in accordance with WSQ requirements is shown below:

Competency Element	Assessment Instrument
1 Prepare for fitting work activities.	WA, OQ/WQ

2	Perform fitting works using hand tools and equipment	WA, OQ/WQ
3	Maintain hand tools, equipment and work area.	WA, OQ/WQ

Note: WA: Work Assignment, OQ: Oral Questioning,
WQ: Written Questioning

Assessment Instrument	Duration
Work Assignment	2 hours
Oral/Written Questioning	10 minutes
Assessment Hour per Candidate	2 hours 10 minutes

Time /Duration	Competency Elements	Training Program Details
Day One (1)		
0830-0845 (15mins)	Administrative brief	<ul style="list-style-type: none"> ▪ Introduction of trainer ▪ House rules
0845-0900 (15 mins)	WSQ Course Introduction	<ul style="list-style-type: none"> ▪ WSQ for Training Industry ▪ Competency Unit Introduction ▪ Competency Unit Purpose ▪ Learning Outcomes ▪ Competency Unit Delivery ▪ Unit Assessment ▪ Q&A
0900-1030 (90 mins)	CE 1 Prepare for fitting work activities	<p>Lecture</p> <p>PC 1.1 Clarify fitting works to be performed with appropriate person before commencement of work activities</p> <p>PC 1.2 Use appropriate personal protective equipment for the fitting works to be performed</p> <p>PC 1.3 Prepare appropriate tools, equipment and materials according to fitting works to be performed</p> <p>PC 1.4 Check hand tools and equipment for worn out or damaged conditions before use</p> <p>PC 1.5 Check the work area for obstructions and hazards in accordance with organisational procedures</p>
1030-1045 (15 mins)	Tea Break	
1045-1215 (90 mins)	CE 2 Perform fitting works with hand tools and equipment	<p>Lecture</p> <p>PC 2.1 Interpret fitting work requirements from workshop drawings or blueprints</p>

		<p>PC 2.2 Use appropriate hand tools and equipment to complete fitting works to required specifications</p> <p>PC 2.3 Follow safe work procedures when working with hand tools and equipment</p>
1215-1315 (60 mins)	Lunch	
1315-1500 (105 mins)	Perform Basic Maintenance	<p>Lecture</p> <ul style="list-style-type: none"> Remove materials and parts as specified in the work instructions or permit-to-work Install materials and parts Test and adjust replaced materials and parts Follow safe work procedures when removing and installing materials and parts
1500-1515 (15 mins)	Tea Break	
1515-1630 (75 mins)	<p>CE3</p> <p>Maintain hand tools, equipment and work area</p>	<p>Lecture</p> <p>PC 3.1 Clean hand tools and equipment using appropriate cleaning method</p> <p>PC 3.2 Check hand tools and equipment for worn out or damaged conditions after use</p> <p>PC 3.3 Handle worn out or damaged tools and equipment in accordance with organisational procedures</p> <p>PC 3.4 Clear waste and hazardous items from the work area after competing work activities in accordance with organisational procedures</p> <p>PC 3.5 Return tools, equipment and materials to their designated locations</p>
1630-1700 (30 mins)	<p>CE 1</p> <p>Prepare for fitting work activities</p>	<p>Learning Activities #1</p> <p>PC 1.1 Clarify fitting works to be performed with appropriate person before commencement of work activities</p>
1700-1730 (30 mins)	<p>CE 1</p> <p>Prepare for fitting work activities</p>	<p>Learning Activities #2</p> <p>PC 1.2 Use appropriate personal protective equipment for the fitting works to be performed</p>

End of DAY 1

Time /Duration	Competency Elements	Training Program Details
Day Two (2)		
0830-0900 (30 mins)		Recap Day 1 Activities
0900-0915 (15 mins)	CE 1 Prepare for fitting work activities	Learning Activities #3 PC 1.3 Prepare appropriate tools, equipment and materials according to fitting works to be performed PC 1.4 Check hand tools and equipment for worn out or damaged conditions before use PC 1.5 Check the work area for obstructions and hazards in accordance with organisational procedures
9015-0930 (15 mins)	Tea Break	
0930-1130 (120 mins)	CE 2 Perform fitting works with hand tools and equipment	Learning Activities #4 PC 2.2 Use appropriate hand tools and equipment to complete fitting works to required specifications
1130-1230 (60 mins)	Lunch	
1230-1430 (120 mins)	CE 2 Perform fitting works with hand tools and equipment	Learning Activities #5 PC 2.2 Use appropriate hand tools and equipment to complete fitting works to required specifications
1430-1500 (30 mins)	CE 3 Maintain hand tools, equipment and work area	Learning Activities #6 PC 3.1 Clean hand tools and equipment using appropriate cleaning method PC 3.2 Check hand tools and equipment for worn out or damaged conditions after use PC 3.3 Handle worn out or damaged tools and equipment in accordance with organisational procedures PC 3.4 Clear waste and hazardous items from the work area after competing work activities in accordance with organisational procedures PC 3.5 Return tools, equipment and materials to their designated locations

1500-1515 (15 mins)	Tea Break	
1515-1730 (135 mins)	Perform Basic Maintenance	Demonstration and Practice <ul style="list-style-type: none"> Remove materials and parts as specified in the work instructions or permit-to-work Install materials and parts Test and adjust replaced materials and parts Follow safe work procedures when removing and installing materials and parts
End of DAY 2		

Time /Duration	Competency Elements	Training Program Details
Day Three (3)		
0830-0900 (30 mins)		Recap Day 2 Activities
0900-1030 (90 mins)	CE 2 Perform fitting works with hand tools and equipment	Pre-Assessment #1 PC 2.2 Use appropriate hand tools and equipment to complete fitting works to required specifications
1030-1045 (15 mins)	Tea Break	
1045-1215 (90 mins)	CE 2 Perform fitting works with hand tools and equipment	Pre-Assessment #2 PC 2.2 Use appropriate hand tools and equipment to complete fitting works to required specifications
1215-1305 (50 mins)	Lunch	
1305-1335 (30 mins)		Pre-Assessment #3 Mock Practise Written Test
1335-1405 (30 mins)		Assessment Expectations Briefing
1405-1415 (10 mins)		Assessment #3 Written Test

1415-1515 (60 mins)	CE 2 Perform fitting works with hand tools and equipment	Assessment #1 PC 2.2 Use appropriate hand tools and equipment to complete fitting works to required specifications
1515-1530 (15 mins)	Tea Break	
1530-1630 (60 mins)	CE 2 Perform fitting works with hand tools and equipment	Assessment #2 PC 2.2 Use appropriate hand tools and equipment to complete fitting works to required specifications
1630-1730 (60 mins)		Perform housekeeping
End of DAY 3		

Section 1: Prepare for fitting work activities

1 Learning Outcomes

At the end of Section 1, you will be able to:

- Interpret fitting work requirements from workshop drawings or blueprints.
- Clarify fitting works to be performed with appropriate persons before work commencement.
- Use appropriate personal protective equipment for the fitting works to be performed, in accordance with organisational health and safety procedures.

1.1 Introduction

The types of fitting works done in the workshop range from making a plant engineering item such as a metal bracket or support for process plant equipment.

The worker uses appropriate hand tools and equipment to complete fitting works to required specifications, which may involve:

- Layout works
- Filing operations
- Drilling operations
- Cutting operations
- Fabrication operations
- Pipe assembly

1.2 Interpreting fitting work requirements.

Work instructions in the workshop could be in the form of:

- Daily work schedule
- Technical drawings or blueprints
- Permit-to-work

Usually work instructions are in the form of technical drawings which specify the scope of work clearly so the worker can understand the tasks to be carried out and the expected quality and safety requirements.

The specifications in technical drawings or blueprints include:

- Materials or parts to be used
- Dimensional specifications
- Shape and functional requirements

If the worker thinks that the work instructions are not clear or incomplete, he must clarify with the supervisor until he understands fully the work to be done.

1.3 Using personal protective equipment

In the process industry environment, workplace safety and health are very important to the worker and the organisation.

Personal protective equipment or PPE refers to the appropriate safety clothing, aids and equipment used by a worker to protect himself from injury, diseases or work-related illness. Some examples of PPE are safety goggles, face shield, safety shoes, helmet and overalls .

All workers must be trained in the proper and safe use of personal protective equipment before starting work.



Safety goggles are worn as eye protection when using hand tools, cutting tools and machines.



A face shield is worn for full face protection against dangers such as flying objects and chemicals.

The worker must wear safety glasses or goggles under a face shield.





Helmets are worn to protect the head against possible injuries from protruding, falling and flying objects in the work area.



Safety shoes are worn to protect the feet from falling objects and punctures from below the soles of the shoes.

	<p>Industrial gloves are worn to protect the hands during work activities such as handling materials that are abrasive, sharp, corrosive or hot.</p> <p>The gloves are made of cloth, leather and rubber for different applications.</p>
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	<p>Ear plugs are inserted in the ear to block sounds and protect the ears when working in a noisy environment.</p>
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	<p>Overalls are worn over normal clothing for protection from chemicals and dust when working in a workshop or process plant.</p> <p>Most overalls are one-piece garment with full-length sleeves and legs with no gap between jacket and trousers.</p> <p>They usually have a front fastening extending the whole length of the front of the body.</p>
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1.4 Conclusion

In summary, always use the PPE prescribed by your organisation. As a safety precaution, do not wear loose clothing, long hair or dangling accessories that may become entangled with a machine or moving machine part.

All protective equipment should be maintained in a clean and sanitary condition.

Report to the person in charge if you find that the personal protective equipment is defective or cannot serve the purpose.

Section 2: Perform fitting works using hand tools and equipment

2. Learning Outcomes

At the end of Section 2, you will be able to:

- Check work area for obstructions and hazardous materials in accordance with organisational procedures.
- Check hand tools and equipment for worn out or damaged conditions before use.
- Prepare and use appropriate hand tools and equipment to complete the fitting works to required specifications.
- Follow safe work procedures when working with hand tools and equipment

2.1 Introduction

All workers must follow safe work procedures when working with hand tools and equipment in a workshop. Firstly, the worker should check the work area for obstructions and hazardous materials in accordance with organisational procedures. Then he needs to check hand tools and equipment for worn out or damaged conditions before using them. He will interpret the work instructions or technical drawings and prepare and use appropriate hand tools and equipment to complete the fitting works to required specifications in a safe manner.

2.2 Checking work area for obstructions and hazardous materials

The worker should be familiar with the organization safety procedures for checking the work area. He should interpret and seek clarification on the work instructions or the permit to work for details of environmental conditions and special conditions such as confined space, fumes, gases, dust and noise.

Before starting any practical work, the worker should be aware of the specific location of the work. He should:

- Check the work area for obstructions and hazardous materials.
- Check for temporary and permanent safety signage put up to isolate the work area if necessary.
- Check the access to and within the work area. At times this may require coordination with other workers to minimize congestion in the work area.
- Familiarise with the evacuation procedures and escape routes in the event of alarm or fire.
- Check the working environment such as ventilation, lighting and temperature. The environment should allow the work to be completed in a timely and efficient manner.

2.3 Checking hand tools and equipment for worn out or damaged conditions before use

Before using the hand tools and equipment, the worker must check them for worn out or damaged conditions. The reasons are to make sure that the tools and equipment are safe to use and in good working condition.

Here is a checklist for checking the work area, tools and equipment. The checklist should be reviewed and updated periodically to suit the requirements of your organisation.

No	What to check	Yes	No
1	The lighting of the work area is adequate.		
2	The ventilation of the work area is adequate.		
3	The floor of the work area is clear and not slippery.		
4	The work area is clearly indicated.		
5	The work area is free of obstructions.		
6	Are scribers properly sharpened?		
7	Are chisels kept sharp and ground off to a 60-degree angle?		
8	Are chisels and punches with mushroomed heads reconditioned or replaced?		
9	Are hammer faces free of chips or cracks?		
10	Do hammers have securely-wedged handles in working condition?		
11	Are the vise handles in good condition?		
12	Can the vise be tightened by hand to clamp a work piece securely?		
13	Do hacksaws have properly fitted and adjusted blades with the teeth pointing forward?		
14	Are the files cleaned and stored properly?		
15	Are the files free of broken teeth?		
16	Do the files have handles that are properly secured?		
17	Are the vernier calipers jaws in good condition?		

No	What to check	Yes	No
18	Is the try square in good condition?		
19	Are tools stored in designated locations such as toolboxes, tool racks or tool cabinets?		
20	Are drills properly sharpened?		
21	Are blunt drills reconditioned or replaced by appropriate persons?		
22	Is a machine vise available for clamping a work piece to be drilled on a drilling machine?		
23	Are clamps available for clamping the machine vise to the drilling machine table?		
24	Are the pipe wrenches in good condition?		
25	Can the pipe vise be tightened by hand to clamp a metal pipe securely?		
26	Is the pipe bender in working condition?		

Each organisation has procedures for the checking and handling of faulty or unsafe tools and equipment before use.

The hand tools and equipment that are worn out or damaged should be tagged and the supervisor or person in charge should be informed.

Workers are expected to follow the organisational procedures for:

- Tagging faulty or unsafe tools
- Reporting faulty or unsafe tools to appropriate persons
- Replacing faulty or unsafe tools

2.4 Preparing and using hand tools and equipment safely to complete fitting works to required specifications.

2.4.1 Tools for marking out, testing and measuring

Here is a range of tools commonly used for marking out, testing and measuring fitting work in the workshop.

Steel rule



A steel rule is used for marking out and measuring the dimensions of materials such as metal plates and pipes.

It is commonly supplied in lengths of 15 cm and 30 cm.

The graduations are in mm and inches and the accuracy of reading is 0.5 mm or 1/16 inch

Scriber



A scriber usually has one or 2 sharp ends that are hardened. It is used together with a try square for marking out parallel and perpendicular lines on the surface of materials.

Try square



A try square is a precision tool used for:

- Marking out lines that are at 90-degree angle or parallel;
- Checking the square ness of 2 adjoining surfaces;
- Checking the straightness and flatness of surfaces.

Handle the try square with care and always store it away from hard and sharp tools such as files.

Spring dividers



A pair of spring dividers is used for marking out lengths, arcs and circles on the surface of materials.

Accuracy of reading is based on the steel rule and is 0.5 mm.

Dot punch and centre punch



A dot punch is ground to a point angle of 60° .

It is used with a hammer to mark positions of scribed lines and centres on the work.

A centre punch is usually larger and ground to an angle of 90° .

It is used with a hammer for deepening the centre point to make it easier for a drill to start cutting a hole.

Vernier calipers



The vernier calipers is a precision measuring tool used for measuring the external dimensions, inside dimensions and depths of materials.

The accuracy of reading is 0.02 mm.

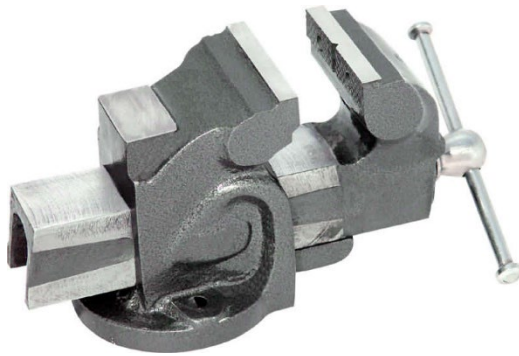
It is a good practice to check for zero-error before using the vernier calipers.

Handle vernier calipers with care and store it away from rough tools.

Tools, equipment and materials for fitting work

The following tools and equipment are commonly used for fitting work involving cutting and fabrication. A worker needs to know how to select the appropriate tools and equipment and use them safely and correctly.

Bench vise



The material should be clamped safely in the jaws of a bench vise while the cutting and fabrication operations are carried out.

Use your hands to turn the vise handle to tighten the work piece. Do not use a hammer to tighten the jaws of the vise.

Files and their uses

Hand File



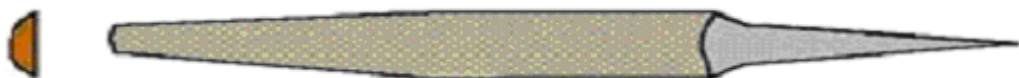
A hand file is used for roughing and finishing. It is parallel in width and has one safe edge with no teeth.

Flat File



A flat file is used for roughing and finishing. It is tapered slightly in width and thickness towards the tip.

Half-round File



The curved face of a half-round file is used for filing shapes such as radii and grooves and the flat side is used for finishing flat surfaces.

Round File



A round file is used for enlarging holes and filing internal radii.

Square File



A square file is used for filing slots or grooves.

Triangular File



A triangular file is used for filing corners or angles less than 90°

Grade of cut

The grade of cut refers to the pitch or spacing of the file teeth.

Files with a rougher grade of cut give a faster metal removal rate but a poorer surface finish.

Files with a smoother grade of cut give a better surface finish slower but a metal removal rate.

For the same grade of cut, a longer file would have a coarser pitch than a shorter one.

The 3 grades of cut of the commonly used files are:

- Bastard cut - medium teeth for general purposes, especially suitable for mild steel.
- Second cut - finer teeth for cutting harder metals.
- Smooth cut - fine teeth for getting better dimensional accuracy and surface finish.

Safety and care of files

As file teeth are brittle, files should be placed properly and not be stacked with other tools.

New files should not be used on hard materials.

The clogging of the file teeth is called pinning. Pinning should be removed by using a file card or wire brush.

It is dangerous to use files with loose or not properly fitted handles.

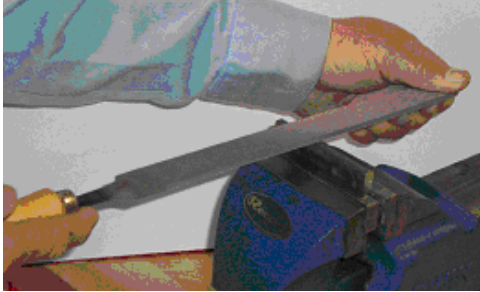
Filing techniques

The following 3 filing methods are commonly used:

- Cross filing
- Straight filing
- Draw filing

Cross filing

In cross filing the file is pushed forward and sideways to cut the whole surface. It is used for removing larger amounts of materials more quickly.



Straight filing

In straight filing the file is pushed forward and pulled backward along the file axis to get a flat narrow surface.

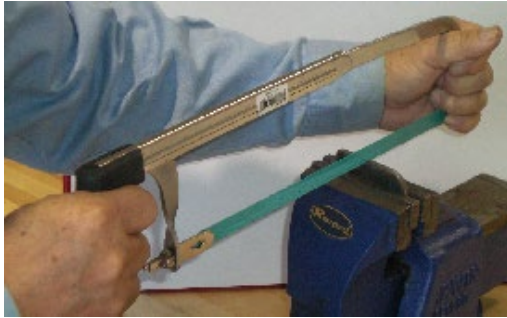


Draw filing

In draw filing the file is held as shown in the picture. The stroke is parallel to the vise jaws. It is used to produce a good surface finish on narrow surfaces.



Hacksaw



Choose the correct hacksaw and saw blade for the work based on the blade material, length and pitch.

The saw blade should be fitted to the hacksaw frame with the teeth pointing to the front.

Saw about 1 mm outside the marked line on the unwanted material.

The 1 mm allowance is for finishing by filing.

Ensure that at least 3 saw teeth are in contact with the part at all times during the forward cutting stroke.

Hammer



The most commonly used hammer is the ball peen hammer.

Choose a hammer for the work according to its weight.

Ensure the hammer head is securely fixed to the shaft by a wedge and the hammer face is not chipped.

Chisels



Flat chisel

The most common chisel used in the workshop is the flat chisel.

The other chisels which are used at times are the cross-cut chisel and groove chisel.

For safety reasons, the chisels should have a sharp cutting edge and no mushroom head.

Bench drilling machine



Drill



Here are some safe practices for drilling a hole using a bench drilling machine:

Wear safety goggles and use the drill guard as a safety precaution in case the drill breaks or the material and chips fly towards the eyes.

Set an appropriate spindle speed for the drill size and material to be drilled.

Always use a correctly sharpened drill and tighten the drill chuck to clamp the drill securely.

Adjust the height of the table so that the distance from the drill tip to the material is kept to a minimum.

Use a machine vise clamped to the drilling machine table to prevent any movement of the work while drilling.

Clear the sharp chips with a brush.

Taps



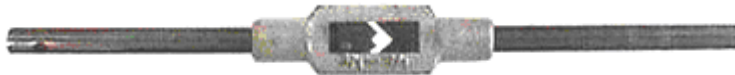
A hand tap is used to cut a screw thread inside a hole. The most common screws used have ISO Metric Threads.

A set of taps comprises the following 3 taps:

- Taper tap is used when the material is difficult to tap or the tap is of small diameter and more prone to breakage.
- Plug tap or intermediate tap is the most commonly used type of tap. It has tapered cutting edges which are used to align and start the tapping of a hole.
- Bottoming tap has a continuous cutting edge with no taper. It is used to cut threads to the bottom of a blind hole.

The correct hole diameter or tap drill size for tapping can be obtained from a [drill and tap size chart](#).

Tap wrench



A tap wrench is used to hold the tap for tapping. The adjustable handle is used to hold the tap

Tapping procedure

Tapping a through hole is done by clamping the work securely in the vise and setting a taper tap vertically to the work.

Hold the tap wrench steadily as you turn the tap with firm steady pressure and maintain squareness. When the tap is square and has gone in about 2 turns, continue with the tapping by reversing a quarter turn after each full turn. The tapping is finished when about half the tap extends below the through hole.

Tapping a blind hole is done like the tapping a through hole except that after starting a thread, change to the intermediate tap and finally the bottoming tap.

When tapping a blind hole, it is a good practice to screw a nut on the tap to act as a depth stopper.

Always use gentle pressure and clear the chips frequently so as not to break the taps.

Tools and equipment for fabricating a pipe assembly

Most pipe installations have pipes that are bent to specified angles and joined by pipe-fittings, valves and controls.

The pipes are marked out, clamped in a pipe vise and cut using a hacksaw or a pipe cutter. It is necessary to include additional length of material for the bending allowance.

A pipe threader is used to cut the threads on the ends of the pipe.

Cold bending of metal pipes is usually done with a pipe bender.

Pipe vise



Pipe cutter



Pipe threader



Pipe bender



Procedure for cutting external pipe threads

- Select the correct die head for the external thread to be cut and put the die head correctly in the ratchet socket.
- Clamp the pipe in a pipe vise with the appropriate length of pipe extended beyond the jaws.
- Place the die-stock on to the pipe and maintain the handle perpendicular to the pipe axis.
- Rotate the handle clockwise with gentle pressure towards the pipe.
- During the threading operation, apply cutting lubricant when necessary and prevent lubricant from dripping to the floor.
- When the die cuts into the pipe, continue the rotation by moving the handle up and down for one to two rounds.
- Break the metal chips by reversing the setting knob and moving the die anti-clockwise for half a round. After breaking the chips, repeat the thread cutting procedure.
- When the full length of thread is cut, reverse the setting knob and move the die anti-clockwise until you can take it off.

- Clean the threads with a wire brush and cleaning rag.
- Test the thread with an appropriate fitting such as an elbow or tee fitting.
- If adjustable dies are used, adjust the die and repeat the threading operation until the fitting can be fitted on the threaded portion.
- After the thread cutting, clean the stock and die and store them in their designated place.

Procedure for pipe bending

- Mark out the pipe length to be bent.
- Place the pipe in an appropriate pipe bender according to the marked point.
- Restrain the pipe at two external points and advance the former to form the pipe bend.
- Check the angle and length of the bend for conformance to specifications
- Continue to bend the pipe until the bend conforms to specifications
- This type of bending is suitable for bending pipes up to 50 mm diameter.
- Clean the pipe with a steel brush or a cleaning rag.

Procedure for pipe assembly

- Clamp the pipe in a pipe vise.
- Remove burrs and chips. Make sure that the pipe is clean on the outside and inside.
- Check that the threads can fit smoothly and the first few turns can be done by hand.
- Wrap sealing tape round the pipe threads in the same direction as the thread.
- Tighten the pipe fitting onto the end of the pipe by hand as far as it will go
- Use a pipe wrench to continue tightening the pipe fitting, without over-tightening.
- When assembling 2 pipes with a fitting in between, you may need to use 2 wrenches.
- Perform a hydrostatic test to check for leakage.

Pipe wrench



Hydrostatic test equipment



2.5 Follow safe work procedures when working with hand tools and equipment.

Safety is everyone's concern. A competent worker always follows safe work procedures when working with hand tools and equipment.

This means using the appropriate personal protective equipment before starting any work.

Work benches, work space, tools and equipment are kept clean and tidy to workplace standard, and a regular cleaning programme for the workplace is carried out according to company policy.

Warning notices are displayed at the site of hazards and emergency exits are kept clear of obstructions to allow people to quickly exit the workplace in an emergency.

The worker needs to select the tools and equipment needed for the work and check them to ensure they are in good condition.

When using the tools and equipment, observe safe practices and apply the correct techniques at all times.

Check the work area for hazards such as objects or liquids on the floor. Slippery or wet floors must be dried to remove the potential hazards.

Workplace housekeeping involves a wide range of routine activities which include:

- maintaining floors and surfaces;
- controlling minor spills and rectifying them quickly when they occur;
- maintaining equipment and tools;
- storing tools and equipment properly; and
- handling and disposing waste.

The benefits of following safe work procedures are important to the worker and his organization. Some examples of the benefits are as follows:

- Slips and trips accidents could be avoided if the floors are kept cleared, in good condition and free of spills.
- Fire hazards are reduced if materials are properly stored, combustible materials are not piled up, and sprinkler systems and exits are not blocked.
- Back injuries to workers are reduced or eliminated if manual lifting of materials is minimized

2.6 Conclusion

In summary before starting on the fitting works, always check the work area for obstructions and hazardous materials in accordance with organisational procedures.

Remember to check hand tools and equipment for worn out or damaged conditions before use.

The hand tools and equipment that are worn out or damaged should be tagged and reported to appropriate persons for repair or replacement.

After preparing the appropriate hand tools and equipment, use them safely to complete the fitting works to required specifications.

When carrying out fitting works, make it a habit to follow safe work procedures when working with hand tools and equipment.

Section 3: Maintain hand tools, equipment and work area

3. Learning Outcomes

At the end of Section 3, you will be able to:

- Clean hand tools and equipment
- Check hand tools and equipment for worn out or damaged conditions after use.
- Handle worn out or damaged tools and equipment
- Return tools, equipment, and materials to designated locations
- Handle waste and hazardous items from the work site after completing fitting works
- Report completed fitting work

3.1 Introduction

It is the responsibility of every worker to clean and check hand tools and equipment after using them.

The worker must follow organisational procedures for handling worn out or damaged tools and equipment and returning tools, equipment, and materials to designated locations.

Any waste and hazardous items found after completing fitting works must also be handled according to organisational procedures

Finally, the worker has to report his completed fitting works to appropriate persons.

3.2 Cleaning and checking tools and equipment

After using the tools and equipment, it is necessary to clean and check the tools and equipment to ensure they are in working condition.

Always follow organisational procedures for the care and inspection of hand tools and equipment.

For example, measuring and checking tools such as vernier calipers, try square and steel rules are cleaned with a piece of clean rag.

File teeth are cleaned with file cards or brush and the file handles are checked before storing the files individually.

Here is a checklist for checking tools and equipment after using them. The checklist is reviewed and updated periodically to suit changes in work requirements.

No	What to check	Yes	No
1	Are scribes properly sharpened?		
2	Are chisels kept sharp and ground off to a 60-degree angle?		
3	Are chisels and punches with mushroomed heads reconditioned or replaced?		

No	What to check	Yes	No
4	Are hammer faces free of chips or cracks?		
5	Do hammers have securely-wedged handles in working condition?		
6	Are the vise handles in good condition?		
7	Can the vise be tightened by hand to clamp a work piece securely?		
8	Do hacksaws have properly fitted and adjusted blades with the teeth pointing forward?		
9	Are the files cleaned and stored properly?		
10	Are the files free of broken teeth?		
11	Do the files have handles that are properly secured?		
12	Are the vernier calipers jaws in good condition?		
13	Is the try square in good condition?		
14	Are drills properly sharpened?		
15	Are blunt drills reconditioned or replaced by appropriate persons?		
16	Is a machine vise available for clamping a work piece to be drilled on a drilling machine?		
17	Are clamps available for clamping the machine vise to the drilling machine table?		
18	Are the pipe wrenches in good condition?		
19	Can the pipe vise be tightened by hand to clamp a metal pipe securely?		
20	Is the pipe bender in working condition?		

No	What to check	Yes	No
21	Is the hydrostatic test equipment in working condition?		
22	Are tools stored in designated locations such as toolboxes, tool racks or tool cabinets?		

3.3 Handling worn out or damaged tools and equipment

Each organisation has its own procedures for handling faulty or unsafe tools.

The hand tools and equipment that are worn out or damaged after being used should be tagged and the supervisor or person in charge should be informed.

The worker is expected to follow the organisational procedures for:

- Tagging faulty or unsafe tools
- Reporting faulty or unsafe tools to appropriate persons
- Replacing faulty or unsafe tools

3.4 Returning tools, equipment and materials to designated locations

All tools and equipment after being checked should be returned or stored in their designated toolboxes, tool racks, tool cabinets or work bench.

Here are some examples:

- Precision tools such as vernier calipers should be kept individually in their protective boxes or covers.
- Files should also be placed individually away from each other so as not to damage their teeth.
- Drills should be placed in their designated boxes according to respective sizes.
- Sharp tools such as scribes and spring dividers should be stored in a manner that will not cause injuries to the next user.
- Pipe threading dies should be stored away from other hardened sharp tools
- Hammers should be cleaned and stored in a clean place such as a tool box or tool panel.
- Hydrostatic test kit should be drained and stored in their designated space.
- Unused and reusable materials should be stored by type and sizes in material racks.

3.5 Handling waste and hazardous items from work site

Waste is produced while doing fitting work. At times the work may be associated with materials which, because of their chemical, physical or biological properties, are hazardous to humans or the environment.

Industrial waste and hazardous items require special handling and disposal to protect human health and the environment.

Metal fillings should be swept from the floor and emptied into bins designated for metal waste.

Solid waste materials especially metal with sharp edges should be handled by workers using appropriate gloves to protect their hands. The waste should be placed in bins designated for solid waste.

Similarly, liquid waste containing oils or chemicals should be poured into designated vessels for disposal or recycling by waste contractors.

Oily rags should be deposited into designated bins with covers to prevent accidental starting of fire.

Each of the waste containers must be clearly labeled to facilitate disposal by workers and waste contractors.

Industrial solid and liquid waste must be transferred to a scrap yard or waste store for disposal or recycling by waste contractors.

3.6 Reporting completed fitting works

After completing the required fitting works, the worker must identify the person who completes the first and final signature on the work instructions or permit to work.

The worker should be ready to clarify if necessary while the supervisor checks the completed work for conformance to specifications on the work instructions or permit to work.

The worker should also be ready to clarify while the supervisor checks the work area for proper housekeeping and waste removal.

Recording the work done in relevant sections of the work instruction or permit to work is done by the worker or his supervisor.

3.7 Conclusion

When the fitting work is done, it is important to clean hand tools and equipment and check every item for worn out or damaged conditions.

For safety reasons, tools and equipment that are worn out or damaged should be clearly tagged and reported to appropriate persons. The replacement of the tools and equipment should be initiated by the worker or his supervisor.

The worker must return tools, equipment and materials to designated locations at the work place. This will make it easier for him and his co-workers to find the tools and equipment each time they need to use them.

For health, safety and environmental reasons, industrial waste and hazardous items must be removed from the work site after completing the fitting works.

Finally, the worker has to report the completed fitting work to his supervisor or other relevant persons.

Section 4: Perform parts removal and replacement

4. Learning Outcomes:

At the end of Section, you will be able to:

- Remove materials and parts as specified in the work instructions or permit to work.
- Install materials and parts as specified in the work instructions or permit to work in accordance with technical manuals.
- Test and adjust replaced materials and parts to meet the required working condition or specifications in accordance with technical manuals.
- Follow safe work procedures when removing and installing materials and parts.

4.1 Removing materials and parts

A maintenance worker needs to know how to use the appropriate tools and equipment safely and correctly to remove materials and parts.

The tools and equipment used in maintenance work include:

- Spanners
- Hammers
- Gland packing extractors
- Scrapers
- Drifts
- Cutter
- Measuring tools such as tape measure and steel ruler
- Hydrostatic test equipment
- Chain blocks and slings

The materials and parts used in maintenance works include:

- Pipes
- Flanges
- Bolts, nuts and washers
- Gland packing
- Gaskets and seals
- Valves
- Filters
- Lubricants
- Sealing agents
- Anti-seize compound
- Cleaning agents

4.2 Lifting manually

If the work involves manual handling of heavy items, the worker should be trained in manual handling techniques. Proper manual handling techniques can significantly reduce the risk of injury.

As a safe working procedure, before moving any heavy item, always consider whether a trolley or other equipment can be used instead of manual moving.

Consider whether the item needs more than one person to lift it safely.
If the item has sharp edges, wear gloves to protect your hands.

The worker has to check whether there is enough space to move the item about. He should remove obstructions and hazards from the route.

Here are some key points on manual lifting:

- Do not let the item block your view – seek help from others if it is too large.
- Place your feet apart to make a stable base for lifting
- Stand correctly, keeping your back straight and your chin tucked in
- Place one leg forward in front of the other to improve balance and control
- Keep your shoulders level and facing the same direction as your hips
- Lift with the leg muscles, not the weaker back muscles
- Lift smoothly and avoid jerky movements
- Keep your arms close to your body to support the load
- Keep the load as close to the body as possible, with the heaviest side of the load closest to your body
- Avoid twisting your body when turning

4.3 Lifting with chain block

Items that are too heavy to be lifted manually should be lifted with the help of a chain block.

Here are some key points on the safe use of a chain block:

- Use the chain block only if you have been trained on how to use the equipment and safe slinging procedures.
- Never use defective or out-dated blocks, slings or accessories.
- Never use the block chain as a sling.
- Check the slinging arrangement to confirm that the block is safely rigged and that the chains are not twisted.
- Before starting to lift, confirm that the load is free to move and that the landing area has been prepared.
- Raise the load slightly, stop the lift to check the integrity of the block and slinging method.
- Check that the travel route is clear and that you have a clear view to avoid accidental hook engagement or collision.

- Follow site safety rules applicable to the movement of suspended loads.
- Keep fingers, toes etc clear when lowering loads.
- Follow maintenance instructions of the supplier
- Check the operation of the brake. Braking device must be kept free of oil and grease.
- Inspect the chain block regularly and report defects to supervisor for further examination.

4.4 Removing end flange from pipeline

The key steps for removing an end flange from the pipeline are listed below:

- Check whether the pipeline has been depressurised.
- If the pipeline has not been depressurized, inform the supervisor
- If the pipeline has been depressurized, wait for a few minutes for any residual fluid to be drained off.
- Select spanners of the correct type and size to suit the bolt size of the flanges.
- First loosen the bolts at bottom of the flanges to avoid injuries caused by any remaining pressure in the pipeline.
- Then loosen the remaining bolts on the flanges of the pipe in the proper sequence.
- Remove all the bolts and keep the bolts and nuts neatly in a container.
- Transfer the end flange to a safe place.

4.5 Removing pipe spool from pipeline

The key steps for removing a pipe spool from the pipeline are listed below.

- Select an appropriate sling belt for the pipe spool and check the validity and condition of the sling belt.
- Check the validity date and working condition of the chain block before using it.
- Wrap the sling belt around the pipe spool and hook the sling belt to the chain block to prevent the pipe spool from dropping when the bolts are removed.
- Loosen flange bolts to decompress the gasket seals.
- Remove flange bolting from the flanges.
- The correct spanner must be used to suit the bolt size of the flanges.
- Firstly loosen the bolts at bottom of the flanges to avoid injuries to workers from any remaining pressure in the pipeline.
- Remove all the bolts and keep the bolts and nuts neatly in a container.
- Gently move the pipe spool to a safe place.
- Move the chain block to a safe place.

4.6 Removing valve from pipeline

- Wrap the sling belt around the valve and hook the sling belt to the chain block to prevent the valve from dropping when the bolts are removed.
- Loosen flange bolts to decompress the gasket seals.

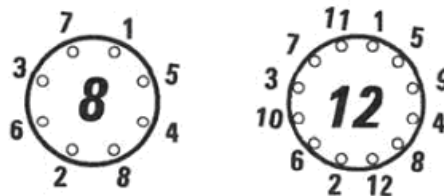
- Remove flange bolting from the flanges
- The correct spanner must be used to suit the bolt size of the flanges.
- Loosen the bolts at bottom of the flanges.
- Remove all the bolts and keep the bolts and nuts neatly in a container.
- Gently move the valve to a safe place.
- Move the chain block to a safe place.

4.7 Replacing parts and materials

4.7.1 Reinstalling a valve to the pipeline

Here is the main procedure for reinstalling a valve to the pipeline.

- Secure a sling belt on to the valve to be installed and hook the sling belt to the chain block.
- Gently move the valve to the correct position along the pipeline.
- Align the bolt holes of the valve and pipeline with the aid of a tapered drift through the two flanges.
- First insert the bottom bolts between the valve and pipeline.
- Apply anti-seize compound to the screw threads of the bolts if specified.
- Place a gasket between the flanges and hand tighten the bolt.
- Insert and hand tighten all the remaining bolts using appropriate spanner.
- The tightening sequence should be gradual and in a crisscross pattern as shown in the examples for flanges with 8 holes and 12 holes.



- Move the chain block to a safe place.

4.7.2 Reinstalling a pipe spool to the pipeline

Here is the main procedure for reinstalling a pipe spool to the pipeline.

- Secure a sling belt on the to the pipe spool to be installed and hook the sling belt to the chain block.
- Gently move the pipe spool to the correct position along the pipeline.
- Align the bolt holes of the pipe spool and valve with the aid of a tapered drift through the two flanges.
- First insert the bottom bolts between the pipe spool and valve.

- Apply anti-seize compound to the screw threads of the bolts if specified
- Place a gasket in between the flanges and hand tighten the bolt.
- Insert and hand tighten all the remaining bolts using appropriate spanner.
- The tightening sequence should gradually in a crisscross pattern as shown in the previous examples for flanges with 8 holes and 12 holes.
- Move the chain block to a safe place.

4.7.3 Reinstalling an end flange to the pipeline

Here is the main procedure for reinstalling an end flange to the pipeline.

- Align the bolt holes of the end flange and pipe spool using a tapered drift through the two flanges.
- First insert the bottom bolts between the end flange and pipe spool.
- Apply anti-seize compound to the screw threads of the bolts if required
- Place a gasket in between the flanges and hand tighten the bolt.
- Insert and hand tighten all the remaining bolts using appropriate spanner.
- The tightening sequence should gradually in a crisscross pattern as shown in the previous examples for flanges with 8 holes and 12 holes.
- Move the chain block to a safe place.

4.8 Testing and adjusting replaced materials and parts to meet the required working condition or specifications

- The main steps are listed below.
- After all the gland packing is installed, connect a hydrostatic pump and hose to the pipeline.
- Fill the drain valve with water until water overflows through the vent valve indicating that the complete system is thoroughly vented.
- Shut the vent valve and shut off the water at the pipe connection.
- Slowly increase the pressure in the pipeline system by manually operating the hydrostatic pump until the required pressure is obtained.
- Shut off the valve to the pipeline system.
- Wait a few minutes and check pressure gauge for any pressure drop.
- If there is leakage in the system, check the gasket areas and pipe joints for water leakage and tighten them accordingly.
- After testing and confirming that there is no leakage, open the drain valve to depressurize the water in the system.
- Report the completed pressure and leak test to supervisor.
- Disconnect the hydrostatic pump equipment
- Clean and store the hydrostatic pump equipment in designated location

4.9 Follow safe work procedures when removing and installing materials and parts

- Throughout the maintenance work the worker must be wearing the appropriate personal protective equipment correctly.
- Whenever the worker is not clear about the work, he must clarify with his supervisor.
- When working in a team, the team members must communicate clearly with one another and help to maintain the safety of all members.
- The worker needs to use the appropriate tools, equipment and techniques to remove and install materials and parts.
- During and after the maintenance work, the worker must always practise good housekeeping. This means that all the tools, equipment and parts should be in their designated locations and unwanted parts and materials are removed so they do not clutter up the work site and become hazards.

4.10 Conclusion

This section stresses the importance of removing and replacing materials and parts using the correct tools, equipment and techniques.

To avoid injuries to him and co-workers, the worker should use the correct method of handling heavy parts and equipment. He must work in accordance with organisational safe practices and regulations and clarify with his supervisor when in doubt.

Section 5: Preparation for Assessment

5 Preparation for Assessment

In this section, the course trainer will be preparing you for the summative assessment upon completion of this training.

You will undergo a practical review on Perform Fitting Works in Workshop conducted by the course trainer.

You will be evaluated on performance criteria and underpinning knowledge. The course trainer will feedback to you on your performance shortfall using the Performance Criteria and Underpinning Knowledge Assessment checklists.

The following pre-assessment practices are not assessment. They are meant to prepare you for the summative assessment at the end of the training.

- Pre-assessment Activity 1: Make a part to specifications using hand tools and equipment.
- Pre-assessment Activity 2: Fabricate a pipe assembly to specifications using hand tools and equipment
- Pre-assessment Activity 3: Underpinning knowledge review

5.1 Pre-assessment Activity 1: Make a part to specifications using hand tools and equipment

Refer to the drawing given by the course trainer and interpret the specifications of the items to be made using hand tools and workshop equipment.

You are required to make a work piece to specifications based on the given technical drawing.

You are expected to carry out the following within one hour:

- ✓ Interpret the technical drawing
- ✓ Use appropriate personal protective equipment
- ✓ Check and prepare the required tools, equipment and supplies provided using the list given by the course trainer.
- ✓ File datum edge
- ✓ Mark out the work piece
- ✓ Hand saw the work piece to leave an appropriate allowance for filing
- ✓ Use appropriate hand files to file the work piece to the required shape and dimensions
- ✓ Drill hole to specifications using a bench drill
- ✓ Tap hole to specifications using hand taps
- ✓ Debur the completed work piece
- ✓ Check and clean the hand tools and equipment after use
- ✓ Perform good housekeeping for the work area
- ✓ Submit the work done to Trainer/Assessor for review.

5.2 Pre-assessment Activity 2: Fabricate a pipe assembly to specifications using hand tools and equipment

Refer to the drawing given by the course trainer and interpret the specifications of the items to be made using hand tools and workshop equipment.

You are required to fabricate a pipe assembly to specifications based on the given technical drawing.

You are expected to carry out the following within one hour:

- ✓ Interpret the technical drawing.
- ✓ Check and prepare the required tools, equipment and supplies provided using the list given by the course trainer.
- ✓ Prepare and cut the pipes to required lengths
- ✓ Cut threads on the pipes
- ✓ Bend the pipes according to specifications
- ✓ Connect fittings to the pipes
- ✓ Check for leakage using hydrostatic test equipment
- ✓ Check and clean the hand tools and equipment after use
- ✓ Perform good housekeeping for the work area
- ✓ Submit the work done to the Trainer/Assessor for review.

5.3 Pre-assessment Activity 3: Underpinning knowledge review

Written/Oral Questioning Practice Session (30 minutes)

The written/oral questioning practice session is to prepare you for the assessment.

The questioning is to assess the underpinning knowledge and performance criteria that are not included in the work assignment.

You are expected to sit for the written questioning session at the end of the training or work assignment where appropriate. However oral questioning session may be used in lieu of written questioning where applicable and it will be conducted on a one-on-one basis with the Assessor.

You may clarify with the Assessor if you do not understand any of the questions. The Assessor reserves the right not to respond to your question if you ask any question that leads to the answer.

To be considered competent you must answer all the questions correctly.

Here are some questions for practice

1. *State 2 reasons for wearing appropriate safety attire and safety aids in the workshop.*
2. *State one reason why we should check safety goggles before using them.*
3. *Explain the importance of clarifying the information in the work instructions or permit-to-work.*
4. *Explain why measuring and testing tools should not be stored together with hand files.*
5. *Explain the procedure for checking hand files before using them.*
6. *Explain how to fit and adjust the saw blade in a hacksaw frame.*

7. State a safety precaution for using a chisel.
8. State a safety precaution for using a hammer.
9. Explain the procedure for drilling a hole safely using a drilling machine.
10. State a good practice for cutting an internal thread with a set of hand taps.
11. List 2 types of obstructions and hazardous materials that may be found in a workshop.
12. State a good practice for cutting an external thread on the ends of a pipe.
13. State a good practice for bending a pipe using a pipe bender.
14. Explain the importance of returning tools, equipment and materials to designated places.
15. Explain the importance of clearing waste and hazardous items from the work area.

5.4 Assessment Requirements

Upon completion of this training, you are required to take an assessment for the competency unit: Perform Fitting Works in Workshop.

This is a summative assessment consisting of:

- Assessing Performance Criteria
- Assessing Underpinning Knowledge

5.5 Assessing Performance Criteria

You will be assessed on your ability to perform fitting works in the workshop through a simulated work assignment to be done in a workshop, covering the following competency elements and respective performance criteria:

Competency Elements (CE)	Performance Criteria
CE 1 Prepare for fitting work activities.	1.1 Clarify fitting works to be performed with appropriate persons before work commencement.
	1.2 Use appropriate personal protective equipment for the fitting works to be performed.
	1.3 Prepare appropriate tools, equipment and materials according to fitting works to be performed.
	1.4 Check hand tools and equipment for worn out or damaged conditions before use.
	1.5 Check the work area for obstructions and hazardous materials in accordance with organisational procedures.

Competency Elements (CE)	Performance Criteria
CE 2 Perform fitting works using hand tools and equipment.	2.1 Interpret fitting work requirements from workshop drawings or blueprints.
	2.2 Use appropriate hand tools and equipment to complete the fitting works to required specifications.
	2.3 Follow safe work procedures when working with hand tools and equipment.
CE 3 Maintain hand tools, equipment and work area	3.1 Clean hand tools and equipment using appropriate cleaning method.
	3.2 Check hand tools and equipment for worn out or damaged conditions after use.
	3.3 Handle worn out tools and equipment in accordance with organisational procedures.
	3.4 Clear waste and hazardous items from the work area in accordance with organisational procedures.
	3.5 Return tools, equipment, and materials to their designated locations.
	3.6 Report the completed work activity to appropriate person

5.6 Assessing Underpinning Knowledge

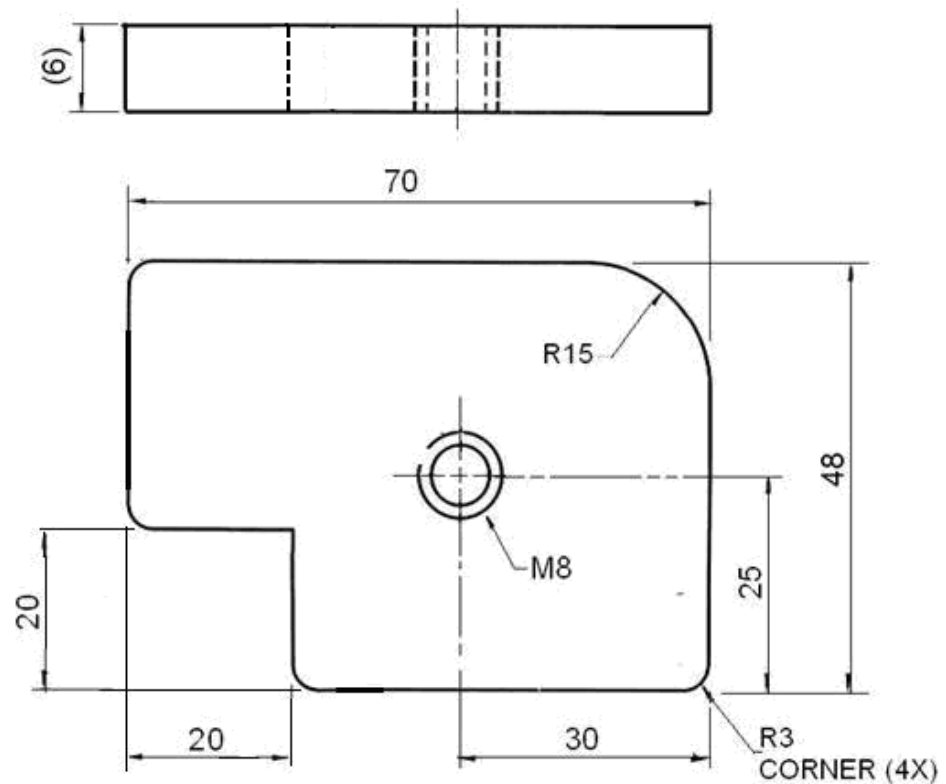
You will also be assessed on underpinning knowledge not assessed in the practical performance through questioning. The written or oral questioning covers the following topics:

- Importance of permit-to-work
- Use of personal protective equipment.
- Types of obstructions and hazardous materials
- Types of hand tools, equipment, materials and parts
- Handling of hand tools, equipment and materials.
- Procedures for cutting materials.
- Procedures for shaping materials.
- Procedures for measuring and testing materials.
- Method of cleaning tools and equipment.
- Importance of cleaning tools and equipment.
- Importance of returning tools, equipment and materials.
- Handling of worn out tools and equipment.
- Clearing of waste and hazardous items.

7 Resources

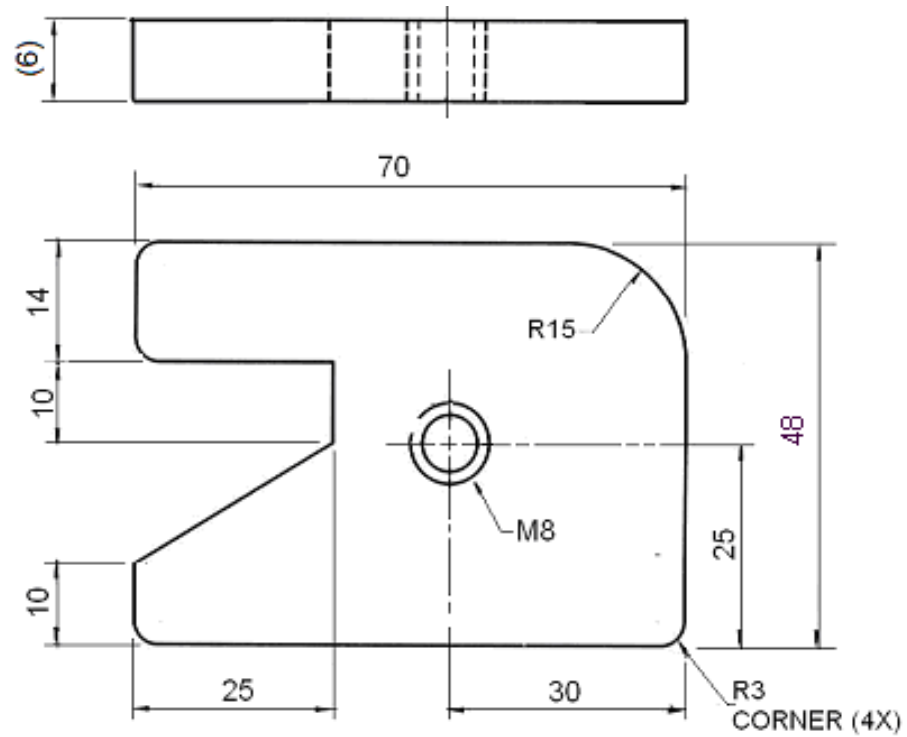
7.1 Sample Work Assignments – Make a part to specifications

Drawing to be issued by course trainer and collected from the learners after the practice.



Drawing No. FW- PAT 01A	Dimensions are in mm unless otherwise stated.	
	General tolerance unless otherwise stated:	
Material Supplied: Mild steel 72 x 50 x 6	Linear dimensions	± 1 mm
Scale: Drawing is not to scale	Angular dimensions	± 1°
Date: 1 Dec 2008	Source: ASPRI	3rd Angle Projection

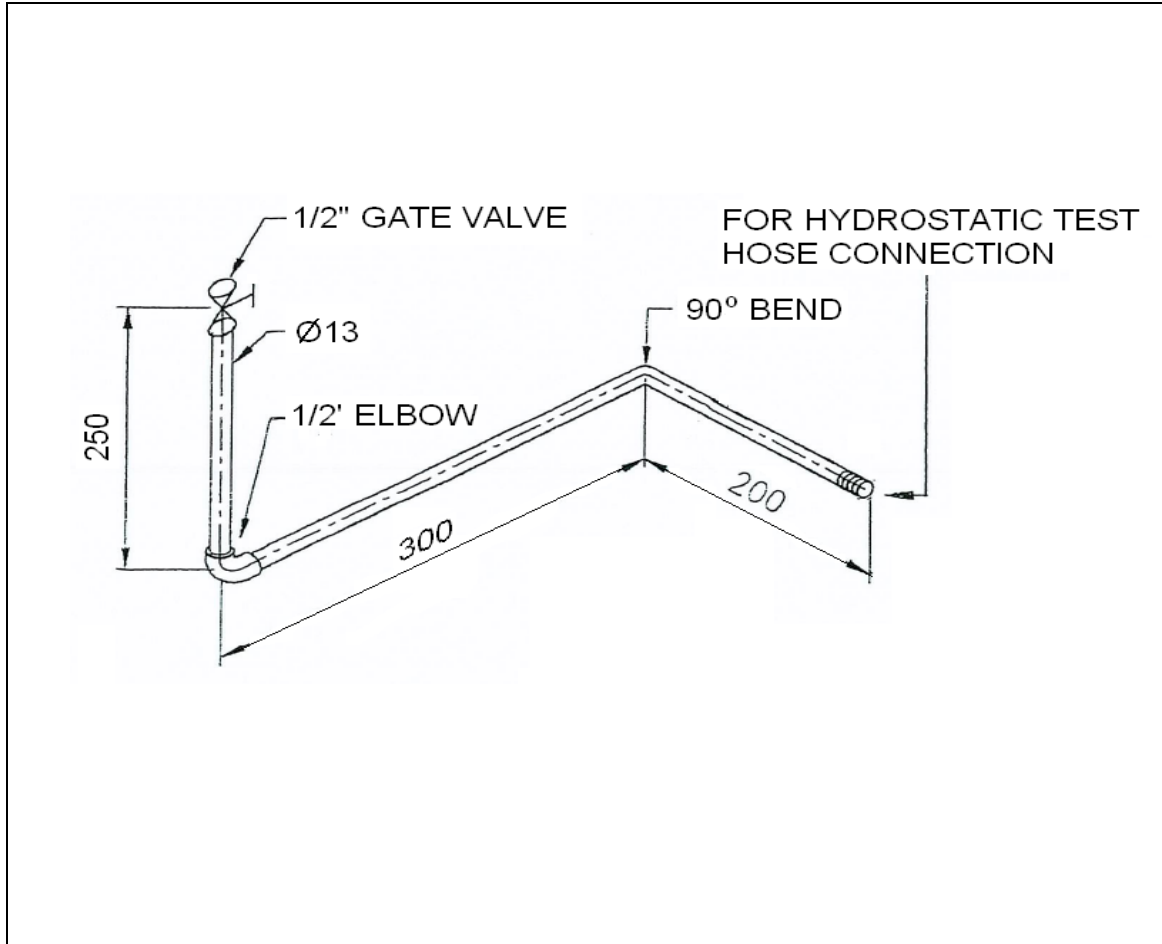
Drawing to be issued by course trainer and collected from the learners after the practice.



Drawing No. FW-PAT 01B	Dimensions are in mm unless otherwise stated.	
	General tolerance unless otherwise stated:	
Material Supplied: Mild steel 72 x 50 x 6	Linear dimensions	± 1 mm
Scale: Drawing is not to scale	Angular dimensions	± 1°
Date: 1 Dec 2008	Source: ASPRI	3rd Angle Projection

7.2 Sample Work Assignment – Fabricate a pipe assembly to specifications using hand tools and equipment

Drawing to be issued by course trainer and collected from the learners after the practice.



Drawing No. FW-WA 02		Dimensions are in mm unless otherwise stated.
Material: Mild steel pipe 1/2 " x 950 mm		General tolerance unless otherwise stated: Linear dimensions ± 3 mm
Scale: Drawing is not to scale		
Date: 8 May 2008	Source: ASPRI	Angular dimensions ± 3°

8 Sample list of tools, equipment and supplies for Work Assignment 1

Participants are to ensure that the required tools and supplies are made available to perform the stated expectations indicated in the work assignment:

- Personal protective equipment (PPE)
- Work bench equipped with bench vise
- Bench drilling machine equipped with drills and vise
- Hand tools and equipment:
 - Hand files
 - Hammers
 - Chisels
 - Wrenches
 - Hacksaw and blades
 - Hand taps and tap wrench
- Measuring and testing tools:
 - Try square
 - Dividers
 - Scriber
 - Dot punch
 - Centre punch
 - Tape measure
 - Steel ruler
 - Vernier calipers
 - Protractor
- Materials and parts
 - Lubricants
 - Cutting fluid
 - Metal plate (for work piece)
 - Marker pen/Marking chalk
- Cleaning Supplies
 - Cleaning cloth
 - Cleaning solutions/agents
 - Broom and dustpan
 - Waste bins/disposable bags
- Forms:
 - Work record sheets/log book
 - Work schedule/instruction sheet
 - Permit-to-work instruction sheet
- Office supplies:
 - Stationery (pens, markers, writing materials, etc)
 - Adhesive tapes

8.1 Sample list of tools, equipment and supplies for Work Assignment 2

Participants are to ensure that the required tools and supplies are made available to them to perform the stated expectations indicated in the work assignment:

- Personal protective equipment (PPE)
- Work bench equipped with bench vise
- Pipe vise
- Pipe cutter
- Pipe bender
- Hydrostatic test equipment
- Hand tools and equipment:
 - Hammers
 - Chisels
 - Wrenches
 - Mallets
 - Hacksaw
- Measuring and testing tools:
 - Try square
 - Tape measure
 - Steel ruler
 - Hydrostatic test equipment
- Materials and parts:
 - Pipe fittings (eg elbows)
 - Valves
 - Flanges
 - Pipes
 - Fasteners (e.g., bolts, nuts, etc)
 - Sealing (Teflon) tapes
 - Lubricants
 - Cutting fluid
- Cleaning supplies:
 - Cleaning cloth
 - Cleaning solutions/agents
 - Broom and dustpan
 - Waste bins/disposable bags
- Forms:
 - Work record sheets/log book
 - Work schedule/permit-to-work/instruction sheet
- Office supplies:
 - Stationery (pens, markers, writing materials, etc)
 - Tags and twines
 - Adhesive tapes

References

- Government Gazette, Electronic Edition (1 Mar 2006), A Guide to the Workplace Safety and Health Act. Ministry of Manpower

- Organisational procedures related to:
 - ✓ Identifying hazards at workplace
 - ✓ Workplace safety and health policy or guidelines
- General Fitter Module 1 – Workshop Practices, National Productivity Board (1995)
- Manual working of metal - Methodical course guide for instructors – Part 1 and Part 2, Published by: Institut für berufliche Entwicklung e.V. Berlin