TRADE OF

Pipefitting

PHASE 2

Module 1

Introduction to Pipefitting

UNIT: 3

Health and Safety

Produced by

SOLAS

An tSeirbhís Oideachais Leanúnaigh agus Scileanna
Further Education and Training Authority

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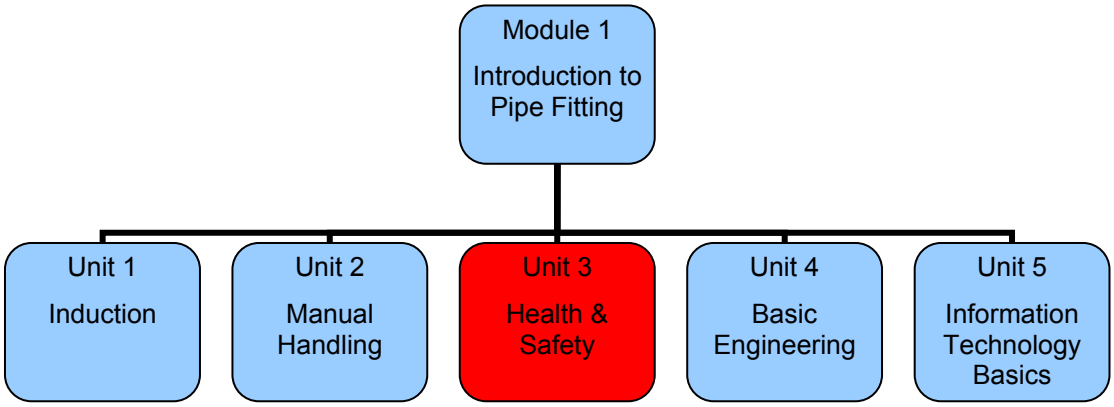
Unit Objective

There are five Units in Module 1. Unit 1 focuses on Induction, Fire Drill and Behaviour Guidelines, Unit 2; Manual handling, Unit 3; Health and Safety, Unit 4; Basic Engineering and Unit 5; Information Technology basics.

In this unit you will receive instruction on induction, health and safety behaviour guidelines for the training centre.



Learning Outcome

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

- Describe the health, safety, responsibilities of all personnel, that apply to the Training Centre/premises while working with pipes.
- Identify the safe practices required while working at heights
- Identify the safe practices and precautions required while working with piping systems that may contain hazardous substances.
- Identify the need for PPE and when is the correct time to wear it.
- Describe the correct procedure for handling, storing and moving gas cylinders
- Outline the requirements for work permits and hot-work permits and identify why they are required.

1.0 Health, Safety and Behaviour Guidelines While Working with Pipes

Key Learning Points

- Health and Safety; Fire alarm sound, emergency exit route, designated safe area, the location and function of Safety statements, responsibilities of all personnel i.e. identification of hazards, their removal, reduction, drawn to the attention of others etc. and personal safety recommendations applicable to the pipefitting workshop/equipment, chemicals, fuels, oils etc., e.g. voltage outlets -110V/220V/380V, pipe cutting equipment, welders - eye wash – first aid station, compressed gases etc.
- Course participant guidelines; Training Centre rules on: time, attendance, expected learning outcomes, personal behaviour on premises e.g. the driving or movement of vehicles or training units inside workshop or training areas, computer user policy, racism, sexual harassment, drugs, alcohol, smoking, environmental materials, recycling etc. and disciplinary procedures
- Fire drill, location and use of fire alarm, emergency exit procedure, location, selection and use of correct fire extinguisher for electrical, chemical and carbonaceous fires, location and use of fire blanket
- Correct methods for handling pipe in a workshop environment paying particular attention to handling long pipes and how this may affect other people and equipment in the workshop.

1.1 Health, Safety and Behaviour Guidelines

Please refer to your instructor for information, which is available from the training centre induction pack. Please refer to the key learning points within this unit.

1.2 Correct Procedures for Handling Pipes

When handling pipes which may be heavy and up to 6m in length it is important to be aware of the environment that you are operating in and be conscious of other personnel and equipment. Key points to be considered:

- Observe all safe working practices and wear the correct PPE
- Keep work area tidy
- Get assistance for heavy or long lengths of pipe
- Make sure pipe is stored correctly in racks, not stacked in pyramids which may become unstable
- Never work on a pipe system with out the correct authorization and work permits in place

2.0 Working at Heights

Key Learning Points

- Be able to identify where working at heights criteria apply
- Correct use of safety harness and lanyards for fall protection
- Basic ladder safety
- Working with MEWPs
- Working on scaffold
- Protection of others when working at heights

2.1 Identify Situations that are Classified as Working at Heights

It is important that apprentices be aware of the surrounding work environment and know when to observe working at heights safety procedures:

- Working from a ladder
- Working on trestles or scaffold
- Working at ground level adjacent to an excavation;
- Working on formwork within an excavation
- Working on a pipe bridge or a flat roof
- Working on buildings where the building envelope has not been completed. (e.g. outside walls, stair opes, lift shafts etc.)
- Working near or adjacent to fragile materials

2.2 Correct Use of Safety Harness for Fall Protection

When working above 2m it is mandatory to wear fall protection equipment. Before using a safety harness and lanyard the following checks must be performed:

- Be inspected prior to use
- Ensure that there are no cuts or abrasions on the harness or lanyard
- The lanyard should be the appropriate length (max 2 M)
- Be attached to a secure anchor point and not just clipped to itself
- Sufficient clearance must be available underneath work area
- Never tie knots in lanyards
- All fall arrest equipment should be destroyed and disposed of after a fall incident, they are not re-usable. There is no price on safety!

Fig 1 Full arrest body Harness

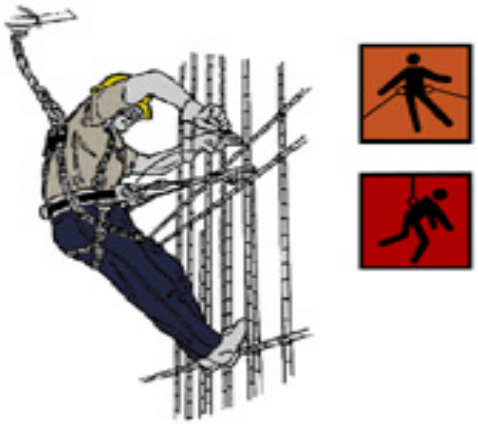


Fig 2 Harness attached to secure anchor point

2.3 Ladders and Step Ladders

While the use of ladders and step ladders has not been banned, their use is discouraged or recommended only for light work that is low risk and of short time duration. See Table 1 for Do's and Don't while using ladders and step ladders:

Do:	Don't:
Always have 3 points of contact on the ladder	Over reach from a ladder
use a ladder 'Stopper'	Use the top two rungs
Tie off top of ladder if possible	Move a ladder while on it
Get down and re-position the ladder when required	Climb a ladder while carrying work material
Get a taller ladder if required	Share a ladder
Use a tool belt	Set up near live cables
Cordon off the area around a ladder to ensure safety for others	
Extend the ladder 1m above the landing place	

2.4 Working with MEWPs

Mobile Elevated Working Platforms (MEWPs) are preferred to ladders where suitable access is available. When using MEWPs the following procedures should be observed:

- MEWP and accompanying documentation and test certification should be inspected prior to use

- Never operate a MEWP without having certified training.
- Ensure the MEWP is suitable for the environment where it is being used. I.e. use electric powered indoors, diesel powered units outside.
- Ensure relevant PPE and safety harnesses are used.
- Operator to be aware of overhead structures and power lines
- Be aware of prevailing weather conditions, high winds etc.
- Never exceed the safe working load.

2.4 Working on Fixed or Mobile Scaffolds

When working on fixed or mobile scaffolding the following safety measures should be observed:

- Scaffold should only be erected, altered and dismantled by competent, qualified scaffolders
- WH1 duly completed and signed off before any one uses the scaffold
- Check for overhead obstructions, power cables, ground holes and floor obstructions when moving a scaffold tower
- Ensure the working platform has close fitting boards, and has evenly supported kick boards, handrails and proper secure ladder access
- Operator is wearing relevant PPE and fall arrest system in place
- Swivelling castors with brakes should be secured to the uprights (keep brakes on when in use).
- Secure to a building if so required or use secure outstays

2.5 Protection of Others

When working at heights the pipefitter has a responsibility for the safety of others which may be in the area:

- The area under the working area should be cordoned off to restrict access and ensure no one can be hurt from objects falling accidentally.
- Suitable signage should be erected on all approach points to warn others of the hazards above.
- Suitable signage and fencing should be erected around excavations and manholes to prevent people entering the work area accidentally.
- All work equipment and materials should be secured at all times and any excess material be removed.

3.0 Hazardous Substances in Pipes

Key Learning Points

- Identify hazardous chemicals that can be contained in piping systems
- Identify hazardous services that can be contained in piping systems
- Describe suitable precautions to be observed when dealing with hazardous chemicals or services in piping systems

3.1 Hazardous Chemicals and Services Contained in Piping Systems

When installing new piping systems or maintaining existing piping systems it is crucial that the pipefitter be aware what is being transported in the pipe. Table 2 identifies some of the more common services distributed in piping systems.

4333	Service	Design Press Bar	Design Temp °C	Line Class	Description
ACY	Acetylene	10	60	SS1	316LSSpipe
AR	Argon	10	60	SS1	316LSSpipe
CA	Clean Air	7	125	SS7	316LSS Tubing
CA	Compressed Air	10	70	CS1	Carbon Steel
CHWR	Chilled Water Return	7	-5/65	CS1	Carbon Steel
				CU1	Copper Tubing
CHWS	Chilled Water Supply	7	-5/65	CS1	Carbon Steel
				CU1	Copper Tubing
CIPR	CIP Return	7	125	SS1	316LSSpipe
				SS7	316LSS Tubing
CIPS	CIP Supply	7	125	SS1	316LSSpipe
				SS7	316LSS Tubing
CTWR	Cooling Tower Water Return	10	0/70	CS1	Carbon Steel
CTWS	Cooling Tower Water Supply	10	0/70	CS1	Carbon Steel
DF	Drain - Foul - In	Atm	60 •	PVC	PVC-DWV

	B1de/UG				
DP	Drain - Floor- In Bldg,	2	100	FRP1	FRP
	Drain - Floor- Underground	Atm	100	FRP2	FRP Double Contained
HE	Helium	10	60	SS1	3I6LSSpipe
HPC	Condensate {High Pressure)	12	250	CS3	Carbon Steel
HPS	Steam (High Pressure)	12	250	CS3	Carbon Steel
HHWR	Heating Hot Water Return	8	90	CS1	Carbon Steel
				CU1	Copper Tubing
HHWS	Heating Hot Water Supply	8	90	CS1	Carbon Steel
				CU1	Copper Tubing
IS	Instrument Air	10	70	SS1	316LSSpipe
				SS7	3 16LSS Tubing, 25M1
LPC	Condensate (Low Pressure)	1	150	CSS	Carbon Steel
LPS	Steam (Low Pressure)	1	150	CSS	Carbon Steel
MFC	Condensate (Medium Pressure)	5	180	CSS	Carbon Steel
MPS	Steam (Medium Pressure)	5	180	CSS	Carbon Steel
NO	Natural Gas	6	Amb	CS6	Carbon Steel
N2	Nitrogen	10	60	SS1	316LSSpipe
PA	Plant Air	10	70	SS1	316LSS pipe
				SS7	316LSS Tubing, 25M1
P	Process	7	135	SS7	316LSSTubing,25 MI
PW	Potable Water	10	60	SS8	316LSSpipe
				CU1	Copper Tubing
PWA	Process Waste Aqueous	7	100	FRP1	FRP

PW1	Process Water- 55 degC	10	100	SS1	316LSSpipe
PW2	Process Water - 80 deg C	10	100	SS1	316LSSpipe
SD	Storm Drain	Atm	60	PVC	PVC-DWV
SW	Softened Water	6	70	CS4	Carbon Steel Galvanized
USP	USP Purified Water	10	135	SS7	316LSS Tubing
V	Ventilation	3	70	PP(M) SS7	Polypropylene 316LSS Tubing
VAC	Vacuum	75-90 mm Hg	20	SSI(M)	316LSSpipe

Table 2: Piping material specification and Line classification

Hazards to the pipefitter can be present for different reasons

- Chemical substances, such as acids or strong alkalis
- Explosive gases such as methane
- High temperatures such as steam and condensate lines
- Cold temperatures such as chilled water.
- High pressure lines such as compressed air.

3.2 Precautions to be Taken with Hazardous Chemicals or Services

Before working on any piping system it is a pipefitter's responsibility to ensure that he/she is happy that all necessary safety precautions and procedures are implemented. This is dealt with in more detail in section 6 of this document under permit to work. The following are basic precautions to be observed when dealing with piping systems that have hazardous chemicals or services. (Please note that this is not an exhaustive list and consultation with the Plant owner is critical before work should commence):

- For new systems it is important that the correct records of installation are maintained and the correct materials are used. (e.g. For compressed oxygen systems all tube and fittings must be degreased as high pressure oxygen can ignite oils or greases)
- System isolated and all pumps and valves isolated, locked out and tagged.
- System de-pressurised and drained out
- System flushed of any hazardous chemicals and rinse water verified as safe.
- Gas systems thoroughly purged and all high points vented and gas monitoring performed to ensure atmospheric conditions

- Steam and condensate systems isolated and left to cool for an adequate period of time.
- Correct PPE equipment is available, this will usually involve additional equipment such as respirators, acid suits, gloves etc. depending on the piping system.

4.0 Personal Protection Equipment (PPE)

Key Learning Points

- Personal Safety measures
- Safety in the Workshop
- Occupational hazard of noise
- This is not an exhaustive list and is meant only to high light the importance of personal safety and the hazards involved in the trade of Pipefitting.

4.1 Personal Safety Measures

Whenever you perform a task in the workshop you must use personal protective clothing and equipment that is appropriate for the task and which conforms to your local safety regulations and policies. Please note that this is not meant to be an exhaustive list and the apprentice should consult with the instructor / supervisor before attempting any task which requires PPE.

- Work clothing - such as overalls, high viz vests and steel-capped footwear
- Head protection – such as hard hats. (Note welding helmets are not hard hats and therefore sufficient precautions must be taken by a welder if he/she removes their hard hat to wear a welding helmet)
- Eye protection - such as safety glasses and face masks
- Ear protection - such as earmuffs and earplugs
- Hand protection – such as rubber gloves and barrier cream
- Respiratory equipment – such as face masks

If you are not certain what are appropriate or required, ask your instructor.

4.2 Protective Clothing and Equipment

When using oxy-acetylene cutting or welding equipment a pipefitter's body and clothing must be protected from radiation and burns caused by flying globules of molten metal. It may be necessary for a welder to wear an apron, usually of thick leather, to protect his trunk and thighs whilst seated at a bench welding. An apron should also be worn if the welder's clothing is made of flammable material.

When deep gouging or cutting is carried out using metal-arc processes, the amount of 'spatter' is considerably greater than that experienced with normal arc welding, and therefore it is necessary to protect the feet and legs in the same way as the hands and forearms. Suitable leather leggings and spats are available and should be used to prevent burns to the legs, feet, and ankles.

Figure 3, Figure 4 and Figure 5 illustrate examples of the use of protective clothing and equipment.

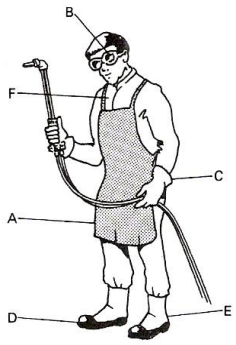


Figure 3 - Protective Clothing

Name	Main use
A. Flame-resistant apron	Prevents burning of clothes.
B. Gas welding/cutting goggles	Protects eyes from sparks.
C. Gauntlets	Prevents skin burn.
D. Safety boots (steel toecap)	Prevents crushing of toes.
E. Spats	No molten metal down boots.
F. Boilersuit	Protects neck and chest.

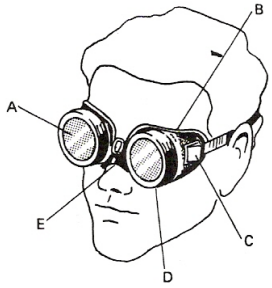


Figure 4 - Protective Eyewear

Name	*Use*
A. (i) Clear glass	Protects tinted lens.
A (ii) Tinted lens	Limits glare.
B. Goggle body	Stops sparks.
C. Air vent	Prevents misting up.
D. Lens holder	To change broken lens.
E. Strap adjustor	Adjust for size

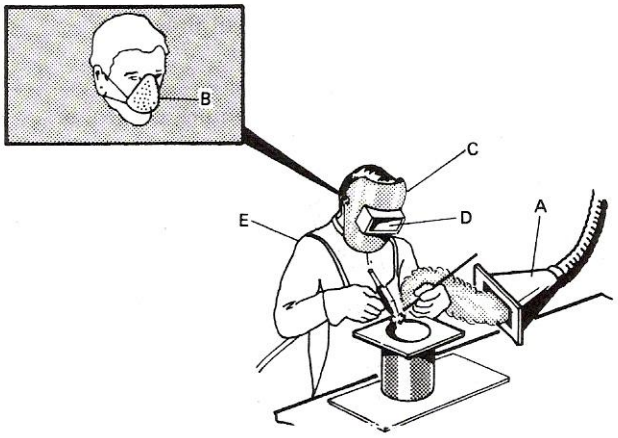


Figure 5 - Protective Equipment

Name	*Use*
A. Extractor fan	Takes away fumes.
B. Filter mask	Dust and fumes.
C. Head shield	Prevents skin burn.
D. (i) Renewable clear glass	Takes spatter etc.
D. (ii) Renewable tinted	Prevents arc eye.
E. Leather cape with sleeves	For overhead work.

The filter mask (Figure 5B) is no protection from dangerous gases such as phosgene (which is formed from degreasing agents such as trichloroethylene) or nitrous fumes (caused when large areas of plate are heated) or any other poisonous gases. See safety precautions for TAGS and MAGS.

5.0 Safe Handling of Compressed Gas Bottles

Key Learning Points

- Gas characteristics
- Safety in cylinder handling
- Safe transport of gas cylinders
- Gas Cylinders
- Safe storage of Gas Cylinders
- Industrial Cylinder Identification Chart

5.1 Gas Characteristics

All operators and users of gases in cylinders must fully understand the potential hazards and properties of the gases they are using and are stored on site.

Each gas has its own characteristics, which affect its behaviour. Gases also change characteristics when subjected to external pressures.

An important characteristic of a gas is its density relative to air because this will determine whether it rises or falls if it leaks. The table below gives the densities of some common gases.

Most gases are colourless and odourless in their natural state so there is little or no warning of a leak. Most fuel gases have or are given a "smell" to aid leak detection.

All suppliers have a complete range of material safety data sheets which detail the chemical and physical properties of the gases as well as their characteristics. In addition suppliers can provide advice on safe handling, storage, transport and use of the product.

Important:

Know ALL the properties of the gases you deal with!

This publication outlines the basic properties and characteristics of commonly used industrial gases. We strongly advise you to supplement this information with appropriate material safety data sheets.

Gas density compared to air (approximately)

Hydrogen	0.06
Helium	0.1
Nitrogen	0.9
Acetylene	0.9
Air	1
Oxygen	1.1

Argon	1.4
Carbon dioxide	1.5
Propane	1.5

Industrial gases are categorised as follows:

Oxidants	These do not themselves burn but support combustion. By increasing the amount and type of oxidant many things will burn that are not normally flammable. Examples: Air and oxygen
Inerts	These do not generally react with other materials, they do not support combustion nor do they support life. Inert gases should be regarded as asphyxiants because if they leak they displace air and hence the oxygen in the atmosphere. Examples: Nitrogen, Argoshield and helium based mixtures
Flammables	These gases when mixed with an oxidant and provided with the right ignition source will burn. An increase in the temperature of the fuel/oxidant mix can also cause ignition. Examples: Acetylene, hydrogen and propane
Toxics	These have the potential to cause injury or threaten life, even in small concentrations. Examples: Carbon monoxide, chlorine and ammonia
Corrosives	These react chemically with other materials causing reactions and deterioration. Toxic gases may be given off. Examples: Chlorine and sulphur dioxide
Pyrophorics	Will ignite spontaneously in contact with air. Examples: Silane and phosphine

5.2 Safety in Cylinder Handling

A typical gas cylinder is about 1.6m (5 ft.) tall, 200mm (8 inch) diameter base and weighs over 69kg (150 lbs). If it falls, anyone in its way will get hurt.

The dimensions of cylinders vary according to their contents. Free-standing cylinders should be regarded as unstable!

The correct way to move cylinders is with the cylinder:

- upright
- secure
- valves uppermost

Remember! Never attempt to catch a falling cylinder - get out of the way!

Anyone moving cylinders should always wear protective footwear, clean gloves and eye protection.

It is obviously better to move cylinders using mechanical aids, for example a trolley or on a cylinder pallet with a forklift truck. The Manual Handling

Operations Regulations 1992 require that wherever possible operations are mechanised or handling aids provided.

Where this is not reasonably practicable then assess the handling task, including:

- can the task involved be mechanically aided, does it need more than one person?
- the weight, height and nature of the loads to be moved
- the environment; for example lighting, flooring, temperature access
- the individual's ability to move and maintain control of the load

Remember:

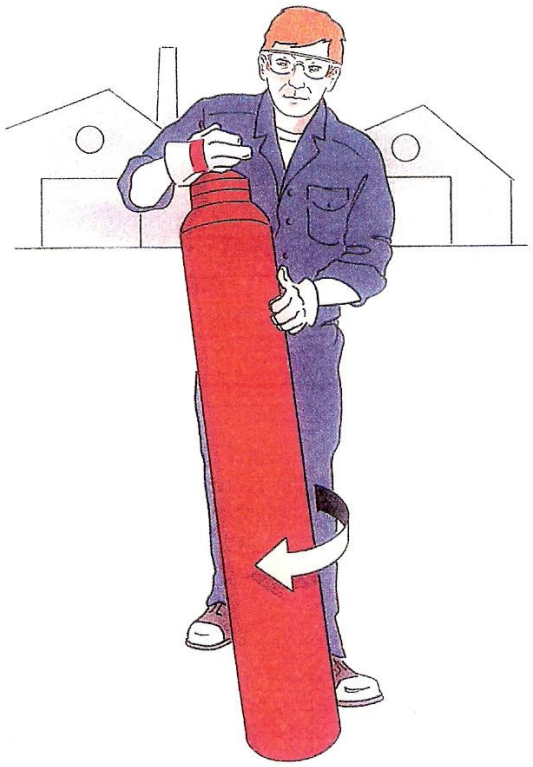
Always treat a cylinder as if it is never empty!

The correct way to move cylinders over long distances or uneven ground is with the aid of a purpose designed trolley complete with some means of retaining the cylinders.

Cylinders must never be left free standing, they must always be secured or under somebody's direct control. Be aware of the hazards of manually lifting cylinders from horizontal to vertical. Make sure all personnel have attended a specific manual handling course.

Cylinders must never be rolled along the ground as damage may occur to the identification of the cylinder and to the cylinder valve. It can be extremely dangerous to roll steel cylinders full of gas across concrete.

Never transport cylinders with the pressure regulator and equipment attached. Cylinders must not be moved with the valve open.



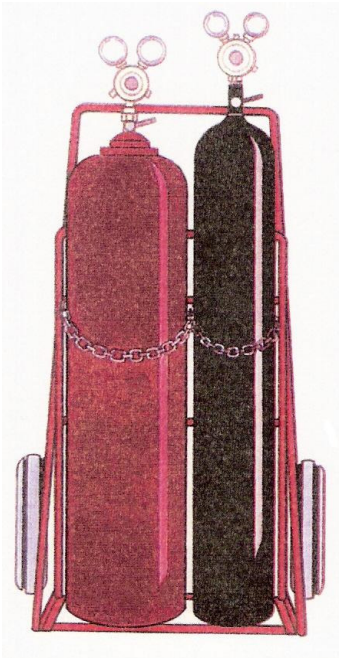
The correct method to position a cylinder

5.3 Safe Transport of Cylinders

1. If possible carry cylinders in open vehicles or open trailers.
2. If cylinders must be carried in closed vans or cars, ensure good ventilation.
3. All cylinders are checked by BOC Gases after filling for leak tightness. However after loading the cylinder into your vehicle check again that there is no leakage of gas.
4. Secure cylinders properly and ensure they do not project beyond the sides or end of the vehicle.
5. Unload the cylinders as soon as possible and move them to a secure and well ventilated storage area.
6. Do not smoke while carrying cylinders containing oxygen or flammable gases (e.g. acetylene, hydrogen, propane) inside vans or cars.
7. If at any time a cylinder is leaking, park your vehicle in a safe place and contact BOC Gases for advice.
8. If you are involved in a road accident advise the emergency services that gas cylinders are being carried.
9. If in doubt on any point ask for guidance before leaving the BOC Gases site.

5.4 Gas Cylinders

When faced with an industrial gas cylinder full of gas and asked, "What makes the cylinder potentially hazardous?" the average person is likely to mention:



- the size and weight of the cylinder
- they can fall over
- the gas inside the cylinder

Most people would not think to add:

- the pressure of the gas in the cylinder

But the pressure of the gas in the cylinder is potentially the greatest hazard of those listed above (with the exception of some special gases).

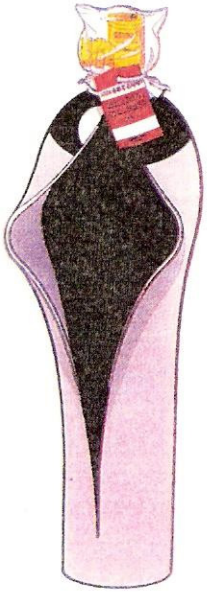
Many gases are considered harmless at normal atmospheric pressure and temperature. However, if they are subjected to high pressure or temperature changes they are potentially hazardous. A good example is air; it is perfectly safe until pressurised, when its stored energy can make it hazardous. Cylinders used for storing gases under pressure are designed and built to a high specification and are subjected to regular pressure tests. The supplier of the gas in the cylinder has a legal duty under the ***Pressure Systems and Transportable Gas Containers Regulations 1989*** to inspect and test the cylinder regularly.

How often the cylinder needs to be tested will depend on:

- the gas contained in the cylinder
  - fuel gas cylinders are tested more frequently than compressed air cylinders for example.
- the working pressure the cylinder is subjected to
  - different gases are stored at different pressures.

Always ensure cylinders are upright and secure.

The supplier can establish when the cylinder is due for test from stampings on the neck of the cylinder and by using shaped and coloured "test rings" fitted around the neck of the cylinder. Each colour and shape of test ring will determine in which year the test is to be carried out. This test ring is for the suppliers use and need not concern the user of the cylinder.



Cylinders are filled to different pressures dependent on the characteristics of the gas and the capability of the cylinder. They are made of steel or aluminium alloys. All cylinders are manufactured to meet European and British Standards and/or Home Office Specifications.

Although some cylinders are welded most are solid drawn from a single steel billet. This gives them strength and

robustness. In addition some cylinders have a bursting disc to vent the gas quickly and reduce pressure should the cylinder be subjected to heat for example.

Most cylinders do not have a bursting disc. If the pressure increases abnormally, the cylinder normally splits or peels open to release its contents rather than fragmenting. However, it does depend on circumstances and the reasons for failure.

5.5 Safe storage of Gas Cylinders

There are various British Compressed Gases Association (BCGA) Codes of Practice and Health and Safety Executive (HSE) guidelines for the storage of different gases. For industrial gases refer to BCGA Guidance Note GN2 which provides guidance on the hazards of storing gas cylinders and good practice for the controlling of risks.

Every storage situation should be considered on its merits therefore risk assessments should be carried out for each storage location. The following notes may be used as a basic guide; however special circumstances may necessitate variations on these recommendations.

In the event of an incident the fire brigade will arrive on site and expect to receive information from the site fire marshal (safety officer etc.) on the type and number of cylinders as well as their location. If this information is not available no-one may enter the premises.

You must set emergency procedures for each storage location. For large storage areas, consult the emergency services.

There are a number of issues to be considered when storing cylinders:

- the nature of the gases stored
- the effects and hazards should a leak occur
- access for delivery and removal of the cylinders
- good 'house' keeping
- general site conditions, security and vandalism

Personnel must be trained in the safe handling and storage of gases and satisfy their employer that they have understood the training and are capable of taking the appropriate action in the event of an emergency.

This should include:

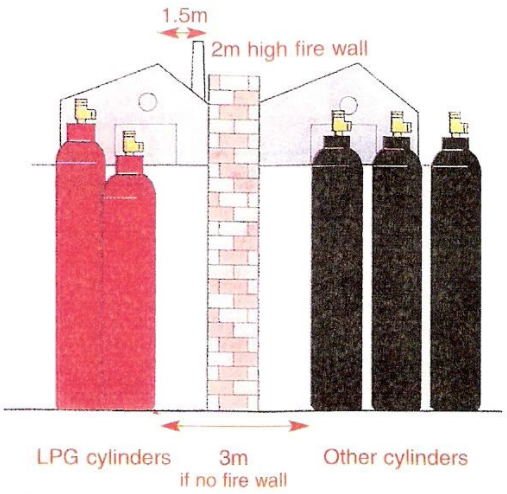
- the potential hazards of the gases stored
- cylinder identification
- supplier information
  i.e. the use of material safety data sheets
- site safety and emergency procedures
- selection and use of fire fighting equipment
- safe handling of cylinders

Training should be formalised and recorded with refresher courses as appropriate.

Ensure ease of access into and around the storage facility. The provision of aisles of at least 0.6m wide is important to avoid the 'domino' effect. In addition:

- cylinders should be stored in an upright and secure position on a well drained and level surface
- store cylinders in a designated no smoking area away from the risk of fire, heat and sources of ignition
- ensure the store has adequate warning signs
- provide fire fighting equipment where necessary.

The best storage facility available is of little use if the store person does not control what goes where. Good housekeeping is essential:



- Store nothing else in the cylinder store as other materials may represent additional fuel sources if a fire starts.
  This is especially applicable to oils, paints, thinners and other flammable or corrosive liquids.
- Segregate full cylinders from empty cylinders.
- Segregate cylinders according to potential hazards and type of gas i.e. oxygen, propane and very toxic.
- Oxygen cylinders may be stored with cylinders containing inert gases.
- LPG cylinders must be stored 3m minimum away from any other gas cylinder type. For detailed information see the LP Gas Association Code of Practice 7:1998
- Pyrophoric and very toxic gases should be stored separately in locked, suitably ventilated storage areas with restricted access.

Remember:

Know ALL the properties of the gases you deal with!

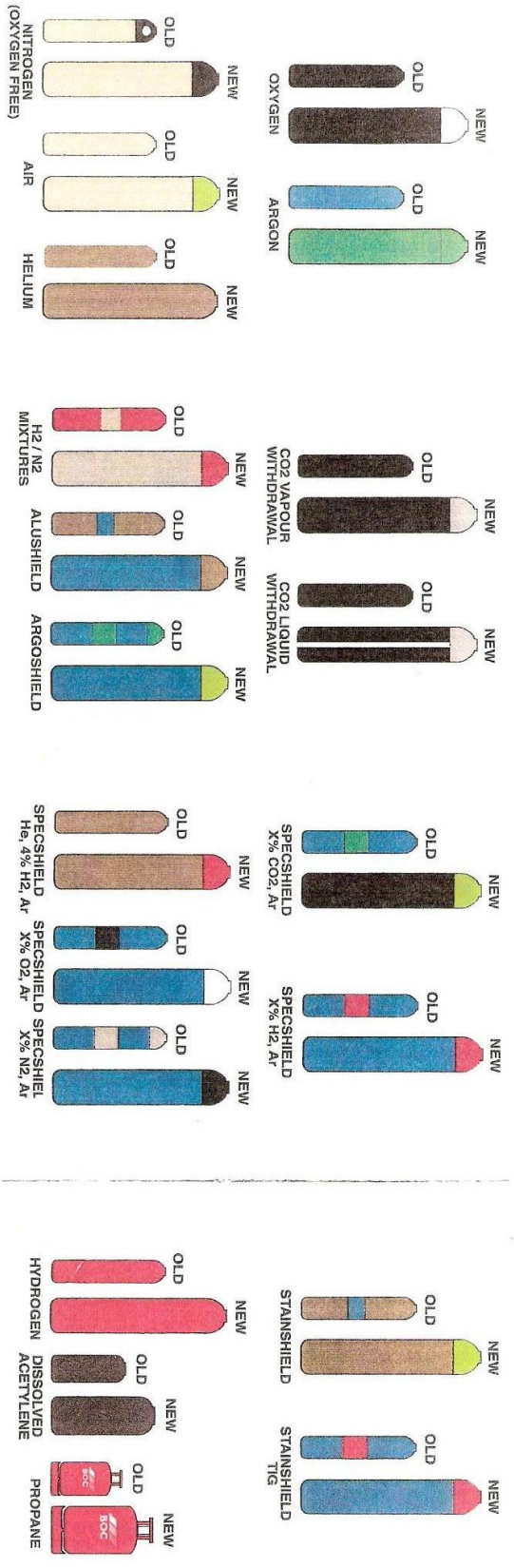
The location of the store is vital:

- The storage area should be preferably in open air, in a well ventilated place away from boundary fences.

- Consideration must be given to segregation and location of storage areas with regard to the potential hazards of the gases stored. For example, heavier than air gases could seep into drains, ducts, and ventilation systems etc. Lighter than air gases could also enter buildings for example through air intakes.
- Consideration must be given to access for delivery, manual handling and the emergency services - emergency services will want to 'shower' cylinders with water rather than direct a lot of water at them as the cylinder could be disturbed or even pushed over.
- Ensure the storage area is away from potential sources of ignition and sources of heat.
- Other products should not be stored in the gas storage area, particularly oil or corrosive liquids.
- Cylinders must be stored upright and secure on a clean, well drained level base.
- Storage should be away from other processes and activities that may affect the cylinders.
- Adequate lighting should be provided, potential ignition from artificial lighting should be a consideration.
- Warning signs should include the types of gas stored, full and empty cylinders, no smoking, restricted access etc.
- Acetylene and propane must never be stacked horizontally in storage or in use.
- Your storage arrangement should ensure adequate turnaround of stock.
- Security from vandalism, tampering and theft should be considered. Where necessary the use of 1.8m high industrial fencing may be necessary.
- Gates, if locked for security, should not be fitted with self locking mechanisms and must open outwards. All emergency exits should be fitted with panic bars, be suitably identified and remain clear at all times.
- In addition to the above reference should be made to BCGA Guidance Note GN2.

Remember: A cylinder is never empty.

5.6 Industrial Cylinder Identification Chart



6.0 Permit to Work System

Key Learning Points

- Identify what a "permit to work" system is
- Identify when a "permit to work" system should be used
- Identify who has responsibilities for what in a Permit to work system
- Provide the information required to complete a permit to work form

6.1 What is a Permit to Work System

A Permit To Work (P.T.W) system is a formal written system used to control types of work which are identified as potentially hazardous. It is also a means of communication between site / installation management, plant supervisors and operators and those who carry out the work. Essential features of P.T.W system are:

- clear identification of who may authorise particular jobs (and any limits to their authority) and whois responsible for specifying the necessary precautions
- training and instruction in the issue and use of permits
- monitoring and auditing to ensure that the system works as intended.

A permit to work system aims to ensure that proper planning and consideration is given to the risks of a particular job. The permit is a written document which authorises certain people to carry out specific work, at a certain time and place, and which sets out the main precautions needed to complete the job safely.

The objectives and functions of such a system can be summarised:

- ensuring the proper authorisation of designated work. This may be work of certain types, or work of any type within certain designated areas, other than normal operations
- making clear to people carrying out the work the exact identity, nature and extent of the job and the hazards involved, and any limitations on the extent of the work and the time during which the job may be carried out
- specifying the precautions to be taken including safe isolation from potential risks such as hazardous substances and energy sources
- ensuring that the person in charge of a unit, plant or installation is aware of all the work being done there
- providing not only a system of continuous control but also a record showing that the nature of the work and the precautions needed have been checked by an appropriate person or people
- providing for the suitable display of permits

- providing a procedure for times when work has to be suspended, ie stopped for a period before it is complete
- providing for the procedures or arrangements for work activities that may interact with or affect any of these activities
- providing a formal hand-over procedure for use when a permit is issued for a period longer than one shift or when permit signatories change
- providing a formal hand-back procedure to ensure that any part of the plant affected by the work is in a safe condition and ready for reinstatement.

6.2 When should a Permit to Work System Operate

Permits to Work should be considered whenever it is intended to carry out any work which may adversely affect the safety of personnel, the environment or the plant.

They are normally considered to be more appropriate to non-routine activities which may require some form of Job Safety Analysis prior to work commencing.

There will, however, be activities closely related to plant operations where P.T.W systems will be required. Maintenance work carried out by plant operators, for instance, should be subject to P.T.W procedures.

It is also advisable to use a P.T.W system when two or more individuals or groups or people, perhaps from different trades or different contractors, need to co-ordinate their activities to ensure that their work is completed safely. This will apply equally when there is a transfer of work and responsibilities from one group to another.

It is suggested that companies assess the risk of their activities and list specific operations and types of work which should be subject to P.T.W systems.

It is not intended that P.T.W procedures be applied to all activities as experience has shown that their overall effectiveness may be weakened.

It is very important for clear understanding by personnel moving from site to site, (especially contractors), that P.T.W systems are, as far as possible, harmonised between the different locations of the same Company. It is in any event essential that anybody starting work is familiar with the local instructions detailing when and how P.T.W systems are to be applied at a particular location.

6.3 Responsibilities for a Permit to Work System

Several individuals/organisations will have specific duties which should be defined in the P.T.W. procedures. Principal responsibilities are identified below.

Installation owners should ensure:

- an appropriate P.T.W system is introduced
- training programmes and competence standards are established and maintained
- monitoring/auditing/reviewing of the P.T.W. system is established and maintained.

The Installation Manager should ensure that:

- all personnel who operate and use the P.T.W. system are competent; to do so
- the planning, issue and return of permits is properly co-ordinated
- a secure method of electrical and process/mechanical isolations is implemented
- adequate time is allowed during shift changes to ensure effective transfer of information on outstanding permits
- the system is regularly monitored to ensure that the P.T.W system is implemented effectively.

Contractor's management should ensure that:

- they are informed of and understand the broad principles of the P.T.W system for the locations where their employees are to work
- their employees have been given the appropriate training and understand the operation of the P.T.W system and their specific responsibilities within it
- they monitor the training of their employees.

The person who issues a permit should ensure that:

- the nature of the work is fully understood
- all the hazards associated with the job are identified
- all the necessary precautions are implemented, including isolations, before work begins
- all people who may be affected by the work are informed before the work begins, when the work is suspended and when the work is complete
- permits for tasks that may interact are cross-referenced

- that effective arrangements are made for the work site to be examined before work begins, on completion of work and as appropriate when work is suspended
- sufficient time is spent on shift handover to discuss all ongoing or suspended permits with the oncoming permit issuer.

Supervisors (or person in charge of the work) should ensure that:

- they have received training in the P.T.W system as applied in that particular location
- the people working for them have received adequate instruction in the system they discuss the job fully with the person issuing the permit
- the permit is posted at the work site
- the work party is briefed on the details of the permit including any potential hazards, and on all the precautions taken or to be taken
- the precautions are maintained throughout the work activity
- the worker understands that if circumstances change -work must be stopped and advice sought
- the work group stays within the limitations set on the permit (physical boundaries, type of work and validity time)
- on completion or suspension of the work the site is left in a safe condition and the permit issuer is informed.

Individuals working within the P.T.Wsystem should ensure that:

- they have received instruction and have a good understanding of the P.T.W. system at the installation where they work
- they do not start any work requiring a permit, until it has been properly authorised and issued
- they receive a briefing from the supervisor on the particular task and they understand the hazards and the precautions taken or to be taken
- they follow the instructions specified in the permit
- when they stop work, the site and any equipment they are using is left in a safe condition
- if in any doubt or if circumstances change, they must stop work and consult with their supervisor.

6.4 Information Required to Complete a Permit to Work Form

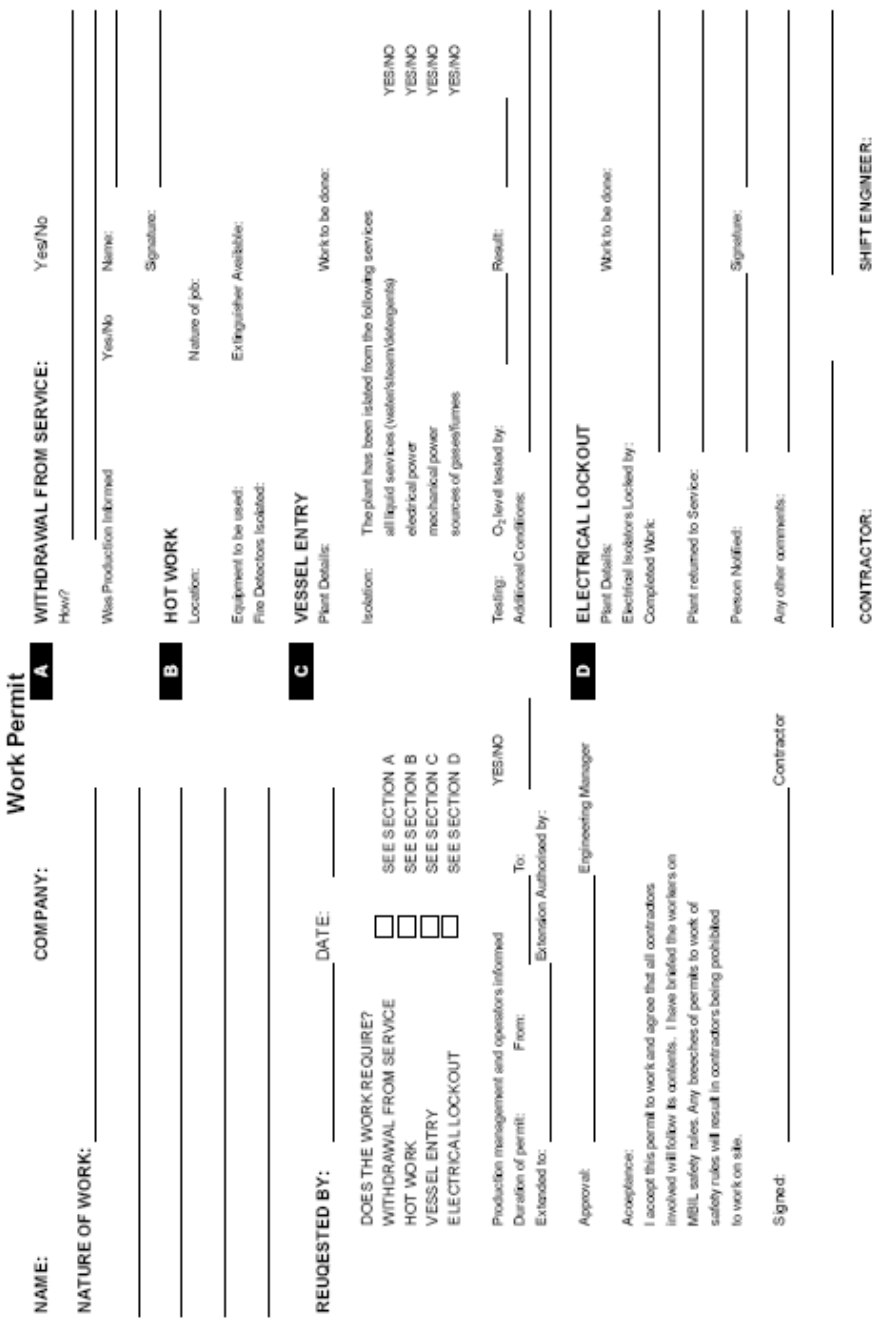
The core of the P.T.W system is the form itself. Many different types of forms are used by installation owners. Some companies use a simple form to cover all activities. Others use different forms for different types of hazards. The two most common categories of forms are for hot work and cold work.

When a large number of active permits are in force, then administration of the permit system and control of work may be enhanced by using colour combinations, to distinguish between the permits issued for the work of differing type and degree of potential hazard.

It is recommended that the method of differentiation selected should be consistent within a company and/or geographic areas.

Every effort should be made to keep the form simple and user friendly. Universal pictograms and multi-language formats should be used where appropriate.

A sample "Permit to Work" form is provided please consult with the course instructor for the filling out of this form.



Work Permit

NAME: COMPANY:

NATURE OF WORK: _____

REUQESTED BY: _____ DATE: _____

DOES THE WORK REQUIRE? SEE SECTION

WITHDRAWAL FROM SERVICE ☐ A

HOT WORK ☐ B

VESSEL ENTRY ☐ C

ELECTRICAL LOCKOUT ☐ D

Production management and operators informed YES/NO

Duration of permit: From: _____ To: _____

Extended to: _____ Extension Authorised by: _____

Approval: _____ Engineering Manager

Acceptance:

I accept this permit to work and agree that all contractors involved will follow its contents. I have briefed the workers on MBIL safety rules. Any breaches of permits to work of safety rules will result in contractors being prohibited to work on site.

Signed: _____ Contractor

A WITHDRAWAL FROM SERVICE: Yes/No

How? _____

Was Production Informed Yes/No Name: _____

Signature: _____

B HOT WORK

Location: Nature of job:

Equipment to be used: Extinguisher Available:

Fire Detectors Isolated:

C VESSEL ENTRY

Plant Details: Work to be done:

Isolation: The plant has been isolated from the following services

all liquid services (water/steam/defoegents) YES/NO

electrical power YES/NO

mechanical power YES/NO

sources of gases/fumes YES/NO

Testing: O_2 level tested by: _____ Result: _____

Additional Conditions: _____

D ELECTRICAL LOCKOUT

Plant Details: Work to be done:

Electrical Isolators Locked by:

Completed Work: _____

Plant returned to Service: _____

Person Notified: _____ Signature: _____

Any other comments: _____

_____ _____

CONTRACTOR: SHIFT ENGINEER:

Suggested Exercises

1. Demonstrate the correct method of wearing a full arrest body harness
2. Under supervision, demonstrate the correct procedure to roll a gas cylinder into a storage position and securing it for use.
3. Complete a permit to work form for a sample task to be completed on site

Self Assessment

Q1: The correct procedure for handling long lengths of pipe is:

- ❑ 1. Get an assistant to hold the other end
- ❑ 2. Have a long workshop
- ❑ 3. Cut the pipe into shorter lengths
- ❑ 4. Use a crane to support the

Q2: Why are gas bottles coloured coded?

- ❑ 1. To identify what gas is in the cylinder
- ❑ 2. To identify what pressure the cylinder is rated for.
- ❑ 3. To identify what temperature the cylinder is rated for.
- ❑ 4. To identify full cylinders from empty cylinders.

Q3: What type of tasks should ladders be used for?

- ❑ 1. Ladders should be used for light work that is low risk and of short time duration.
- ❑ 2. Ladders should be used for hard to reach areas narrow access areas.
- ❑ 3. Ladders should be used in confined spaces such as vessels to access hard to reach areas.
- ❑ 4. .?

Q4: Why should you use a tool belt when working from a ladder?

- ❑ 1. It ensures that the operator can maintain 3 points of contact on the ladder at all times.
- ❑ 2. It can be used as an anchor point for a fall arrest lanyard.
- ❑ 3. Tool belts are a good method of holding a mobile phone .
- ❑ 4. It can be fitted with a winch to hoist up work materials.

Q5: Why should Scaffolds be fitted with toe boards ?

- ❑ 1. To prevent tools or work materials being accidentally knocked down on unsuspecting workers underneath
- ❑ 2.

❑ 3.

❑ 4.

Q6: Why should you use a tool belt when working from a ladder?

❑ 1.

❑ 2.

❑ 3.

❑ 4.

Additional Resources

I will expand the reading list as I progress the other units. Please feel free to suggest typical reference books that are available in FAS centres

Title	Author	Ref. Code
FAS Induction Book, *"Code of Behaviour & Health & Safety Guidelines"*	FAS	
Basic Welding and Fabrication	W Kenyon	ISBN 0-582-00536-L
Fundamentals of Fabrication and Welding Engineering	FJM Smith	ISBN 0-582-09799-1

Videos:

- Understanding welding fumes
- Welder on Site…Be Aware (Vocam)
- Powered hand tool safety (Vocam)
- Industrial Ergonomics (Vocam)

Available from:

Vocam Ireland

Circle Organisation Ltd

Friar Street, Thurles, Co Tipperary, Ireland

Tel: +353 504 24666

SOLAS

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Further Education and Training Authority

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