



MAINTENANCE FITTER - MECHANICAL

(Facilitator's Guide)

REFERENCE ID: CSC/Q 0901

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Introduction to the Facilitator Guide

1. Preface and Purpose of the Guide

This guide is designed to help you (the facilitator) to plan and conduct the course.

2. What will I find in the guide?

This facilitator's guide is a comprehensive package that contains:

- Presentation scripts and key points to cover
- Key points at a glance
- Facilitation tips
- Sampling of potential questions
- Checklist of necessary materials and equipment

3. Program Preparation

Programs require a significant amount of preparation. It is crucial that program facilitators familiarize themselves with the material they designed or are expected to deliver and have adequate time to adapt the content to the specific audience.

4. The Role of the Facilitator

Who is a facilitator?

A facilitator is someone who is present to assist a group in reaching its objectives; the group, not the facilitator, may determine the objectives.

The facilitator's role:

When adopting the role of a facilitator, the facilitator needs to:

- Ensure the more verbose do not take over and encourage contributions, particularly from those who may be less confident
- Devise non-aggressive, friendly ways to deal with difficult participants
- Control conflict by stepping in if necessary to help participants learn to deal with conflict positively
- From time to time get the participants to summarize what has been discussed
- Assist 'weaker' participants by rephrasing their arguments for them so that these do not get lost just because they are not forcefully put across
- Provide feedback to the group as a whole as to its performance
- Provide the information and resources for the group to function effectively

Session Preparation:

A. Questions

What

- What is the subject I have been asked to present on/lead/arrange

Why

- Why have they asked me to do it?



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- What is the purpose of the session or the training course?
- To communicate information and knowledge.
- To make a proposition.
- To test existing knowledge.
- To practice skills.
- To inspire and motivate.
- The first thing to get clear in your mind is the objectives of the entire course or one session.

When

- What time of day will my session(s) take place? After lunch is known as the graveyard slot; you should therefore consider making it more active than, say, a morning session.
- How long have I got?

How

- How am I going to present my subject?
- Straight talk
- Talk with overheads
- Talk with PowerPoint presentation
- Talk with video
- Give the participants a period in which to discuss aspects of the subject, e.g. by using a case study.
- Combination of any of these.
- Am I going to allow questions during the session?
- Always leave time at the end for questions and discussion.

Where









- Where is the presentation due to take place?
- How do the windows open/air conditioning work? If using PowerPoint or video, how do we darken the room?
- What equipment have they got, e.g. video, computer, projector, overhead projector, etc.?
- Decide on seating arrangements
- Are there likely to be any distractions, e.g. loud air-conditioning; things happening outside the window, etc.
- Can I be heard at the back of the room?

Who

- Who are they? How senior/junior are they?
- How many will be present?
- What is the extent of their existing knowledge of the subject I am going to present?
- What will be of interest to them?
- What will their attitudes, preconceptions or expectations?
- Is there a gender balance within the group?
- Could you foresee or expect any kind of dynamics or potential resistant due to group composition?
- What can you glean overall from the participants list and profile without making too many assumptions?





Icons Used In This Guide

Icon	Description/guidelines
	Trainer Led Discussion
	Show a slide < Used to denote the slide to be shown>. Even better paste the image of the slide being discussed.
	Show a video <mention video/clip name>
	Evaluate - administer assessment <mention name and guidelines for assessment>
	Narrate/Share astory or valid examples
	Share insights or ask participants to share insights about current topic
	Distribute Hand-outs
	Transition from one subject/topic/objective/story, etc to another (also could indicate flow)



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	Derive objective/key point
	Materials required
	Ask following Questions
	Group Discussion <mention guidelines (number in each group, whether team leader is required in each group, etc.) and duration>
	Play music < mention file names and duration>
	Capture on flipchart and put up in the class to be reference at a later point during the class or to summarize the learning of the session
	Summarize the session/day
	Activity - describe activity
	Debrief to bring out relevant learning



TOPIC WISE CONTENTS

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2	Fundamental Concepts of Mechanical Engineering	30 - 42
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Unit - 2	Fundamental Concepts of Mechanical Engineering <ul style="list-style-type: none"> • Introduction • Interchangeability • Limits • Tolerance • Allowance • Fit • Fit - Hole Basis & Shaft Basis System 	30 Hrs
Unit - 3	Engineering Drawings Basics <ul style="list-style-type: none"> • Introduction to Customer Service • The Importance of Good Customer Service • How to Improve your Customer Service Skills • Following Customer-Centric Approach • Building Strong Customer Relationships • Dealing with a Range of Customers and Understand their Needs and Issues • Identify Customer Needs • Reverting to Customer Queries/Complaints • Interacting with Customer Prior to Visit 	40 Hrs



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	<ul style="list-style-type: none"> • Interacting with Customer at their Premises • Suggesting Possible Solutions to Customer • Achieving Productivity and Quality Standards • Importance of Maintaining Clean Surface/Work Area • 	
Unit - 4	Fault Diagnostic Techniques & Equipment <ul style="list-style-type: none"> • Introduction • Spanners • Pliers • Screw Driver • Fault Diagnostic Techniques & Equipments • Algorithm & Flowcharts • Test Equipment 	30 Hrs
Unit - 5	Performing Mechanical Maintenance Operations <ul style="list-style-type: none"> • Maintenance of Gear Box • Service & Maintenance of Lifting Equipment • Maintenance of Work Holding Devices • Reassemble the Components • Mechanical Assembly - Methods • Service & Maintenance Techniques • Maintenance & its Types • Purpose of Maintenance • Types of Maintenance • Maintenance Schedule • Repair Cycle • Preparation of Schedule • Maintaining Records • Lubrication • Purpose of Lubrication • Lubricants • Types of Lubricant • Properties of Lubricant • Lubricating Devices • Coolant (Cutting Fluid) • Properties of a Good Coolant • Types of Coolants (Cutting Fluid) 	128 Hrs



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	<ul style="list-style-type: none"> • Overall Equipment Effectiveness (OEE) • Regulatory Compliance • Visual Management • 5'S' • Benefits of 5'S' • Spirit Level • Overhauling of Machines • Alignment of Machines 	
Unit - 6	Emergencies, Rescue and First-aid Procedures <ul style="list-style-type: none"> • Employee Health and Safety • Monitoring Safety Practices • Workplace Safety Tips • Safeguards for Personnel Protection • Personal Protective Equipment (PPE) • Personal Protective Kit • Protective Clothing & Protective (Safety) Gear • Maintenance of PPE • Electrical Testing of Electrical Protective Equipment • Training Required for PPE • How to Determine What PPE must be worn? • Overcoming Staff Reluctance • Consider using the 'Four E's • Personal Safety • Safety with Hand Tools • Safety with the Machine • Safety in Workshop • Safety with Drilling Machines • Safety with Grinding • Safety with Lathes • Safety with Lifting Loads • First Aid • First Aid Kit • Types of Injury and their Prevention • First-aid Procedures • First Aid Management • How to Apply Different Types of Bandages • Basics of Bandaging 	62 Hrs



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	<ul style="list-style-type: none"> • Bandaging of Minor Wound • Bandaging Serious Wounds • Applying a Strip Bandage • Applying a Wrap/Elastic Bandage • Staging & Housekeeping • Benefits of Good Housekeeping • Preventing Electrical Hazards • Using Electrical Equipment Safely • Preventing Electric Shock on the Job • First Aid for Electric Shock • Safety Measures while Working at Height • Dos and Don'ts of Working at Height • How to Minimise the Consequences of a fall • Identification of Fragile Surfaces • Types of Fires • Prevention of Fire • Extinguishment of Fire • Common Causes of Workplace Fires • How to prevent hot work incidents? • How to prevent flammable liquid and gas incidents? • How to prevent electrical fire incidents? • What to Do in the Event of a Fire - and How to Avoid One • Fire Extinguisher • Types of Fire Extinguishers • Care & Maintenance of Fire Extinguisher • Fire Sprinkler System • Smoke Detectors • Sounders and Strobes • Alerting Techniques • Safety Signs 	
<p>Unit - 7</p>	<p>Work effectively with others</p> <ul style="list-style-type: none"> • Working with Colleagues • Be Polite and Cooperative with Others • Take Opportunities to Enhance the Level of Support Offered to Colleagues • Address all Requests and Issues within a given 	<p>80 Hrs</p>



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	<p>Timeframe</p> <ul style="list-style-type: none">• Delivering Quality Work on Time• Seek Assistance when Difficulties Arise• Ask Questions to Clarify on Given Instructions or to Understand Responsibilities• Have a Unbiased Attitude with all Contacts, Customers and other Staff Members• Respect your Colleagues• Communicating about Potential Hazards at Workplace• Handing over the Work and Receiving Feedback• Communication Skills and Etiquettes• What is Communication?• Etiquettes for Face-to-Face Conversation:• Etiquettes for Telephonic Conversation• Non-verbal Communication• Writing Skills• Basic E-Mail Etiquettes• Tips to Write Effective Official and Business Letters• Active Listening• Professional Appearance• Workplace Ethics• Assertiveness• Tips for Effective Verbal and Non-verbal Communication• Disciplined Behaviors	
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Unit 1

Occupational Health & Safety in Engineering Workshops



The Session in Perspective



Unit 1: Occupational Health & Safety in Engineering Workshops

Module Learning Goals

This module covers the overview of occupational health and safety in engineering workshops.

Enabling objectives:

Upon completion of this module, the participant will be able to:

- Understand and learn about the role of a fitter
- Understand and learn about safety guidelines for fitting work
- Identify different types of hazards at workplace
- Understand and learn about precautionary measures to be taken to prevent from hazards

Methodology

Trainer Led Discussion, Skill Practice, Individual Reflection, Assessment



Instructions to the Trainees: The students should participate while the trainer discusses about each topic to make the class more interesting.

Equipment /Tools Required:

Computer, Projector, White Board, Participants Manual, Markers, Flipcharts, Notes, Handout & PPT



Duration: 30 Hours



Introduction

2 Hrs

The process of Fitting is widely applied to engineering technology which involves machining, maintenance & assembly operations. The process of fitting involves making /producing the components as per the client requirements or as per the manufacturing, engineering environment.

Fitting is the process of removing unwanted material with the help of hand tools, from a given stock for making a component or fitting one in the other to form a mating or fitting pair.

Presently in most of the industries, the work is done using automatic machines which produces the jobs with good accuracy. But, for certain jobs still there is a need to perform the work by using hand operations, which is known as fitting. The person who performs the fitting work is known as fitter.

Fitting & Bench working are just like two faces of the coin. The bench working involves the use of hand tools like hacksaw, chisel, file, scraper, taps, dies and a variety of making and measuring instruments for performing various bench working processes like cutting, chipping, scraping, threading, etc. on metal pieces.

A fitter is supposed to have a well versed knowledge pertaining to use of tools & instruments. The bench working processes are mostly carried out on a job held in a vice fitted on the fitter's working table. But sometimes the use of these processes and hand tools for site works proves quite effective and useful because of the flexibility and ease they provide in tackling difficult situations, particularly where power-operated machines may not be used.

Job of a Fitter

The job of a fitter mainly involves preparing, fitting and assembling metal parts. A fitter needs to be well-versed and skilled in selection, use and operation of hand tools, measuring instruments and quality requirements of finished products.

Laying out the jobs as per product drawings provided, cutting, sawing, filing, scraping, drilling, reaming, threading welding, soldering, heat treating are examples of operations that a skilled fitter should be able to carry out with high degree of perfection.





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Knowledge of various kinds of working materials (e.g. metals) their properties and behaviour is called for. Acquiring proper safety practices forms an essential part of the skill training programme.

Employment Opportunities

On successful completion of training, the candidates are likely to have employment opportunities in following industries:

- 1) Production & Manufacturing industries
- 2) Structural fabrication like bridges, roof structures, building & construction
- 3) Automobile and allied industries
- 4) Service industries like road transportation and railways
- 5) Ship building and repair
- 6) Infrastructure and defense organizations
- 7) In public sector industries like BHEL, BEML, NTPC, and private industries in India & abroad
- 8) Self-employment



Show Video: A day in the life of a fitter

2 Hrs

www.youtube.com/watch?v=Zk9NZsbxpPY



Instructions for the facilitator

- Ask students to watch the mentioned video and gain knowledge about a day in the life of a fitter.
- Resolve their queries if any.



Show Video: A Fitter On The Job 02:00 Hrs

www.youtube.com/watch?v=Tz4aQBnWagA



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Instructions for the facilitator

- Ask students to watch the mentioned video and gain knowledge about a fitter on the job.
- Resolve their queries if any.

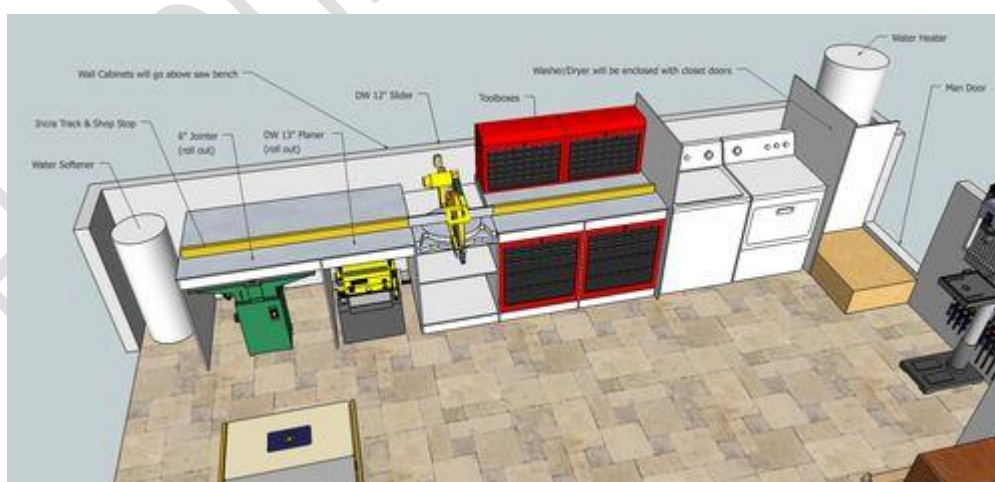


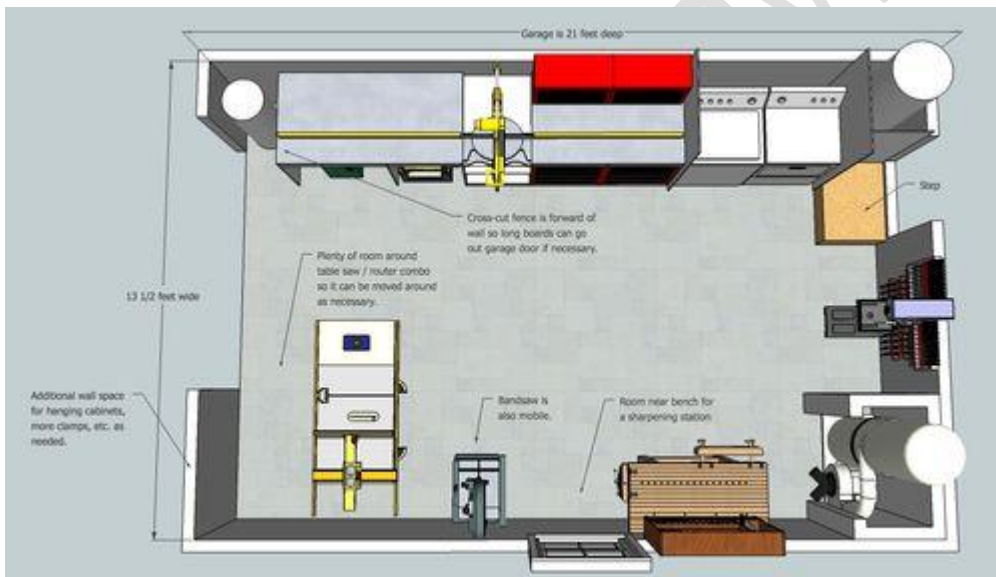
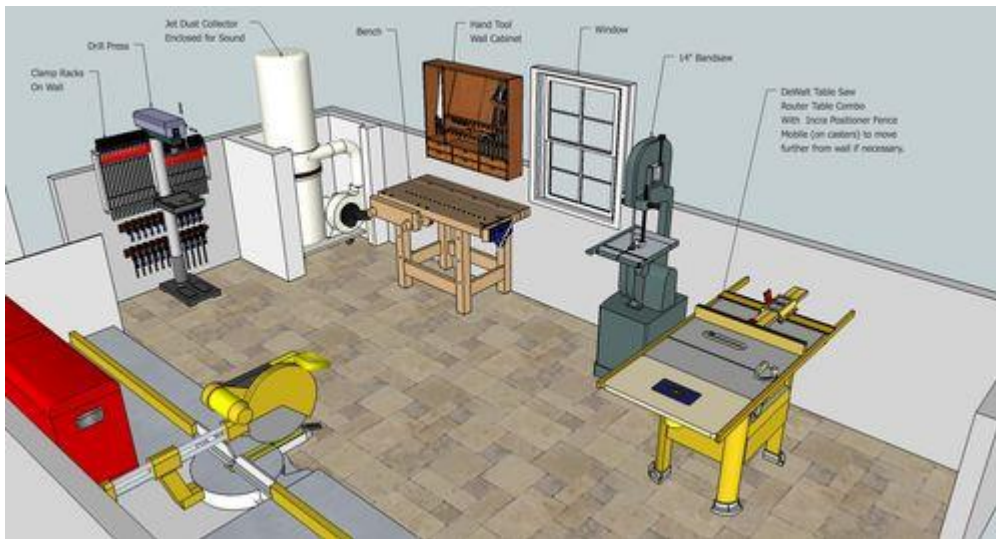
Layout of the Shop Floor

2 Hrs

A few examples of shop floor layout are given here. It consists of the following set of tools and equipments:

- Tool Boxes
- Clamp racks
- Drill press
- Jet dust collector
- Bench
- Hand tool wall cabinet
- 14” band saw
- Table saw (Mobile on casters)
- Sharpening station







Show Video: Shop Floor Layout

02:00 Hrs

www.youtube.com/watch?v=Vc7gofWMgnw



Instructions for the facilitator

- Ask students to watch the mentioned video and gain knowledge about the shop floor layout.
- Resolve their queries if any.



Show Video: Shop Floor Layout Optimization

02:00 Hrs

www.youtube.com/watch?v=aZRtIXIbyNO



Instructions for the facilitator

- Ask students to watch the mentioned video and gain knowledge about shop floor optimization.
- Resolve their queries if any.



Occupational Health & Safety

06:00 Hrs

An accident is an unplanned and non-controlled event in which the action or reaction of an object, substance or person results in personal injury.

Results of Accidents: Accidents result in the following -

- Complete loss of equipment and building
- Partial loss of equipment or building
- Loss of production
- Loss of lives of employees
- Permanent Disability of the persons due to loss of limbs, eye sight, hearing etc
- Temporary disablement due to injuries

Causes of Workshop Accidents

Human Causes: Carelessness and overconfidence

Hand Tools: Use of faulty or improper tools to perform the job

Working Conditions: Slippery floors, poor ventilation, poor lighting and inadequate space

Machines: Unguarded machinery, poor maintenance, improper adjustments, etc

Materials: Storage of inflammable materials in unsecured places, sharp and pointed tools and jobs

An Improper Position or Posture or an uncomfortable dress can also cause accidents at workplace

Safety Precautions at Shop Floor

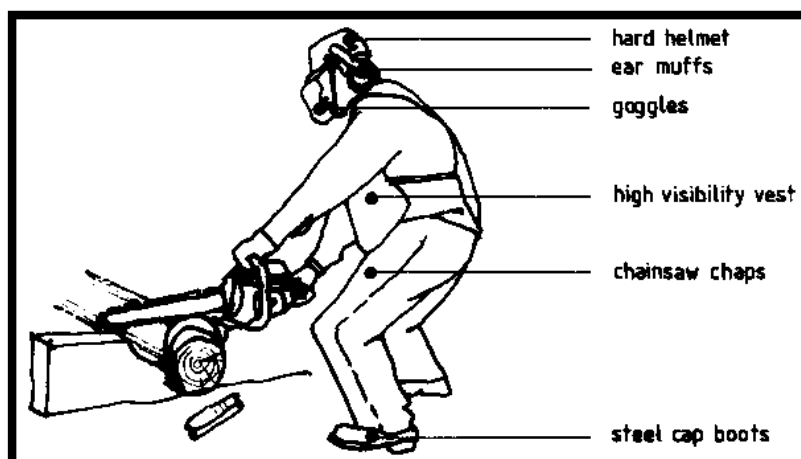
The following safety precautions should be taken care of while using hand tools and equipments. These safety precautions are most important for prevention of accidents:

1. Maintain a discipline at shop floor
2. Ensure the teeth of hacksaw are sharp and along the forward position
3. While handling a chisel, keep its directions away from other persons working on the shop floor
4. Check the measuring instruments such as Vernier calipers & micrometer for errors, before it is used for length measurements



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5. When files are under forward cut, apply force along the forward stroke rather than backward & vice versa
6. Do not wear any neck tie, jewelry, rings, and watches while working in the shop floor
7. Clean the spills caused by oil & grease on the floor to prevent from slipping
8. Ensure that the hack saw blade is fitted to the pins properly
9. Always use appropriate Personal Protective Equipment (PPE)



Safety Guidelines for Fitting Work

Safety is very important while carrying out fitting work. It is imperative that safe working practices are observed at all times. Failure to observe safety rules will result in that individual losing the privilege to work in fitting shop.

All tools are dangerous if used improperly or carelessly. Working safely is the first thing the fitter should learn because the safe way is the only correct way. A person learning to operate machine tools must first learn the safety regulations and precautions for each tool or machine. Most accidents are caused by not following prescribed procedures.

1. Eye Protection

Using eye protection in the machine shop is the most important safety rule for all. Metal chips and shavings can fly at great speeds and distances and cause serious eye injury.

Safety glasses must be worn when working with hand cutting tools, since most hand cutting tools are made of hardened steel and can break or shatter when used improperly.





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There are many different types of safety glasses available in the supply system; however, the ones that offer the best protection are the safety glasses with side shields. Safety goggles should be worn over prescription glasses as well.

2. Foot Protection

The floor in a machine shop is often covered with razor-sharp metal chips, and heavy stock may be dropped on the feet. Therefore, safety shoes or a solid leather shoe must be worn at all times. Safety shoes have a steel plate located over the toe and are designed to resist impact. Some safety shoes also have an in-step guard.

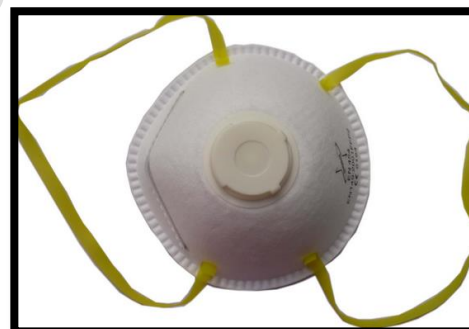


3. Grinding Dust and Hazardous Fumes

Grinding dust from abrasive wheels is made up of extremely fine particles of the metal and the wheel. Some grinding machines are equipped with a vacuum dust collector.

When operating a grinder without a vacuum, wear an approved respirator to avoid inhaling the dust.

Whenever possible, use coolant when grinding. This will aid in dust control. Grinding dust can be very dangerous to your health, especially beryllium or parts used in nuclear systems. These materials require careful control of grinding dust.



4. Electrical safety

The machine operator is mostly concerned with the on/off switch on the machine. However, if adjustments or repairs have to be made, the power source should be disconnected. If the machine tool is wired permanently, the circuit breaker should be switched off and tagged with an appropriate warning statement.

Most often the power source will not be disconnected for routine adjustment such as changing machine speeds. However, if a speed change involves a belt change, make sure that no other



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person is likely to turn on the machine while the operator's hands are in contact with belts and pulleys.

Hazards & Type of PPE

PPE	Protection	Hazard	Prevention	Area of Protection
	Eye Protection	Chemical or metal splash, dust, projectiles, gas and vapour, radiation	Wear safety glasses	Near welding machine
	Hearing Protection	Noise	Wear ear plugs	In noisy area
	Head Protection	Risk of Head bumping, Falling or flying objects	Wear industrial safety helmets	Material handling and storage area



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	Hand Protection	Abrasion, temperature extremes, cuts and punctures, impact, chemicals, electric shock, radiation, vibration, and prolonged immersion in water	Wear safety gloves	Near cleaning station and assembling area, as well as during welding operation
	Respiratory protection	Oxygen-deficient atmospheres, dusts, gases and vapours	Wear suitable respirators approved as per IS specifications; shall be worn wherever necessary	Near welding machine
	Whole body protection	Heat, chemical or metal splash, spray from pressure leaks or spray guns, contaminated dust, impact or penetration, excessive wear or entanglement of own clothing	Wear aprons	Welding area
	Foot Protection	Chemical splash, work in wet areas	Wear safety shoes	Near cleaning and welding area



Workplace Hazards

Hazards are the conditions that cause threat to life of human beings and animals in the surroundings. Hazards may cause serious threats such as nuclear fallout, release of poisonous gases to atmosphere, spills of oils or grease that leads to slip & falls or fire accidents. Hazards may lead to serious health issues.

There are mainly three types of hazards:

- 1) Chemical hazard
- 2) Physical hazard
- 3) Ergonomic hazard

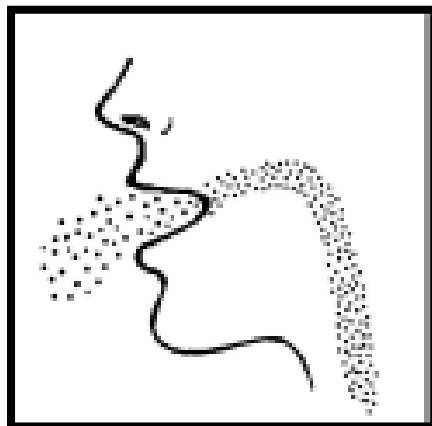
Chemical Hazards

The Entry of foreign bodies into a human body is termed as chemical hazards. The chemicals enter into human body in the following ways:

- **Inhalation** - This is the most common way through which chemicals enter into human body. When a person respire, the chemicals enter the worker's body through the process of respiration.

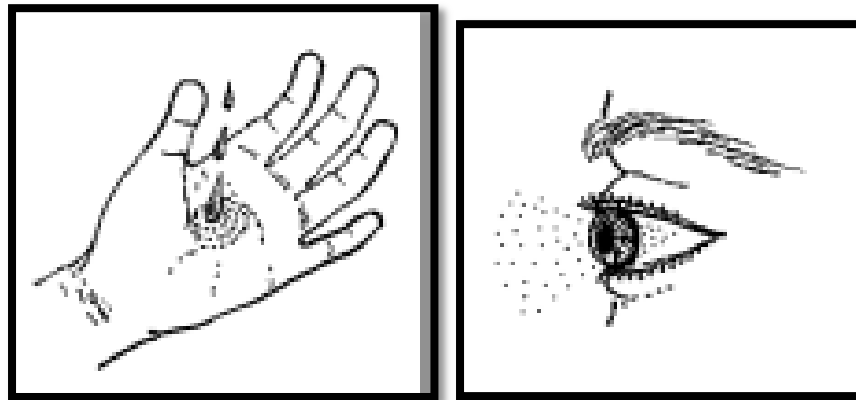


- **Ingestion** - It is a process in which chemicals are swallowed through eating, drinking etc.





- **Absorption** - It is a process in which chemicals enters into the body through skin & eyes.



Physical Hazards

There are of different types of physical hazards that are hazardous to workers:

- Noise
- Vibration
- Temperature Extremes

Noise: When working on machine, if workers are exposed to dangerous noise levels, it can cause a temporary loss of hearing. The some of the factors which majorly affect the workers are listed out here:

- When two or more machines producing high sound are operated simultaneously
- Enclosed or partially enclosed spaces
- If a machine is not properly maintained or malfunctioned and produces high noise levels, when operated

Vibration: While working with large equipments such as drillers, air mallets, pile drivers, tractors, bulldozers, earth-moving equipment etc., hand-arm vibration usually occurs such as while using power tools, like pneumatic drills, grinders, etc.

Temperature Extremes - A transformation in body temperature due to risky work environmental conditions could incorporate stress or illness from heat or cold. If not treated in time, both heat and cold stress/illness can develop into life-threatening situations.

Heat illnesses causes and injuries: Substantial amount of work in very high temperatures could lead to muscle cramps, dehydration and unconsciousness. A few symptoms of heat illnesses are as follows:



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- Heat rash
- Fainting
- Heat cramps
- Heat exhaustion
- Heat stroke
- Wearing resistant protective clothing when doing heavy work.

Cold illnesses causes and injuries: A cold temperature majorly causes tiredness, breathing difficulties and lack of consciousness (hypothermia). A few symptoms of heat illnesses are as follows:

- Frost nip
- Immersion injury (trench foot)
- Frost bite
- Hypothermia

Ergonomic Hazards

These hazards lead to aching & disabling injuries mainly in muscles and joints. These injuries are due to following factors:

- Repeating chores more than twice
- Wrong way of holding a tool, wrong body language (gestures or movements) while working
- Lifting heavy weight tools, regular lifting, or wrong method of lifting
- Using unnecessary force
- Using improperly maintained tools
- Using wrong tools for the job
- Hand-intensive work

The Ergonomic hazards also lead to musculoskeletal disorders (MSDs) and injuries.

Following are the correct lifting procedures that must be followed at work to avoid Ergonomic hazards:

- Chin tucked in
- Comfortably straight back
- Leaning slightly forward
- Arms close to body
- Secure grip
- Bent knees
- Proper foot position



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Common hazards that can lead to an accident:

- Slip & fall at the work place due to spill of liquids, oils, water at the floors. To prevent this, non-slip floor surfaces & fatigue mats must be provided at the shop floor.



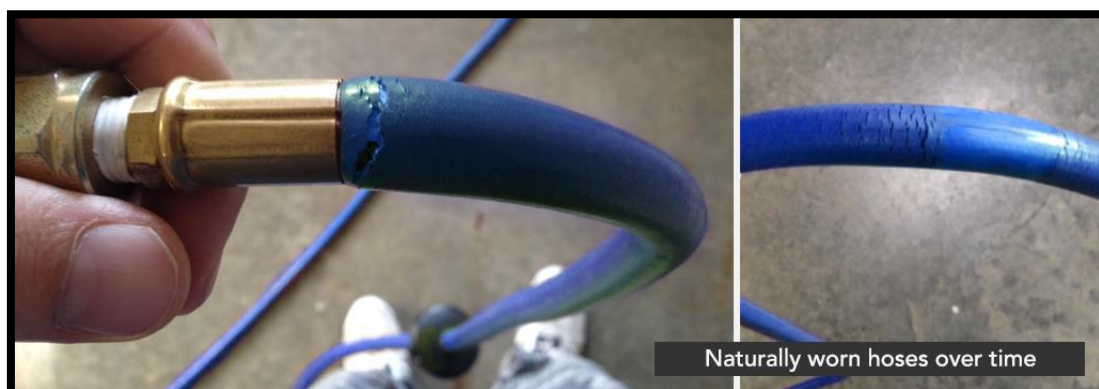
Spills of Chemicals

- Use of faulty, defective & improperly maintained equipment to perform some operations leads to accidents. A proper maintenance of equipments is recommended.
- Lifting heavy objects manually leads to muscle tension & spinal injuries.
- Improper store of chemicals & some dangerous substances leads to fire hazards & in few cases it leads to explosions also. This can be prevented by make use of fire extinguisher.



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- Worn out hoses:



- Damaged power tools:



Precautionary Measures to Prevent from Workplace Hazards

- Wear an appropriate PPE.
- Ensure that all tools, equipment's, extension leads are in safe and usable conditions.
- Ensure the machine and its tools are secured at all times. Also, check the work area is kept free from any hazards.
- Carry out regular maintenance of tools & equipments.





Show Video: Shop Floor Safety

2 Hrs

www.youtube.com/watch?v=5LD5-r3rCtY



Instructions for the facilitator

- Ask students to watch the mentioned video and gain knowledge about shop floor safety.
- Resolve their queries if any.



Show Video: 10 Commandments of Workplace Safety

2 Hrs

www.youtube.com/watch?v=3C6js5JtClQ



Instructions for the facilitator

- Ask students to watch the mentioned video and gain knowledge about 10 commandments of workplace safety.
- Resolve their queries if any.



Showcase the various safety tools and explain their usage.

4 Hrs



Practice Session: 2 Hrs



Class Assignment: Ask the participants to answer the following questions. 2 Hrs

- Describe role and responsibilities of a fitter.
- What are the causes of workshop accidents?
- What are the safety precautions to ensure health & safety for workers in fitting work?
- What are the types of workplace hazards?
- Describe the precautionary measures to be taken to prevent from various workplace hazards.



Discuss in class - What is the learning from this module/unit?



Summarize the Lesson



Ask Questions/Solve the Exercise