Government of Western Australia
North Metropolitan TAFE

CERTIFICATE III in ELECTRICAL FITTING

UEE 33011

Shut Down and Isolate Machines / Equipment

Student Guide

Student name: _____

Class: _____

Electrical

Midland Campus

ISOLATION, TESTING AND TAGGING PROCEDURES

Any electrical circuit must consist of at least five basic parts:

1 **A voltage source** - this can be either AC. or DC.

2 **A load**, which will convert the electrical energy to another form of energy such as lighting or heating.

3 **Conductors** to provide a return to the source of supply.

4 Functional switch

5 Circuit protection – fuse or circuit breaker

An individual circuit originates at the fuse or circuit breaker protecting it and every sub-main or final sub-circuit is required to be individually protected at the switchboard from which it originates (see AS/NZS 3000 Clause 2.4.1).

Switchboards and the equipment mounted thereon are required to be legibly and indelibly marked (see AS/NZS 3000 Clause 2.9.4.1).

Figure 1 is a block diagram of a typical simple arrangement is shown below:

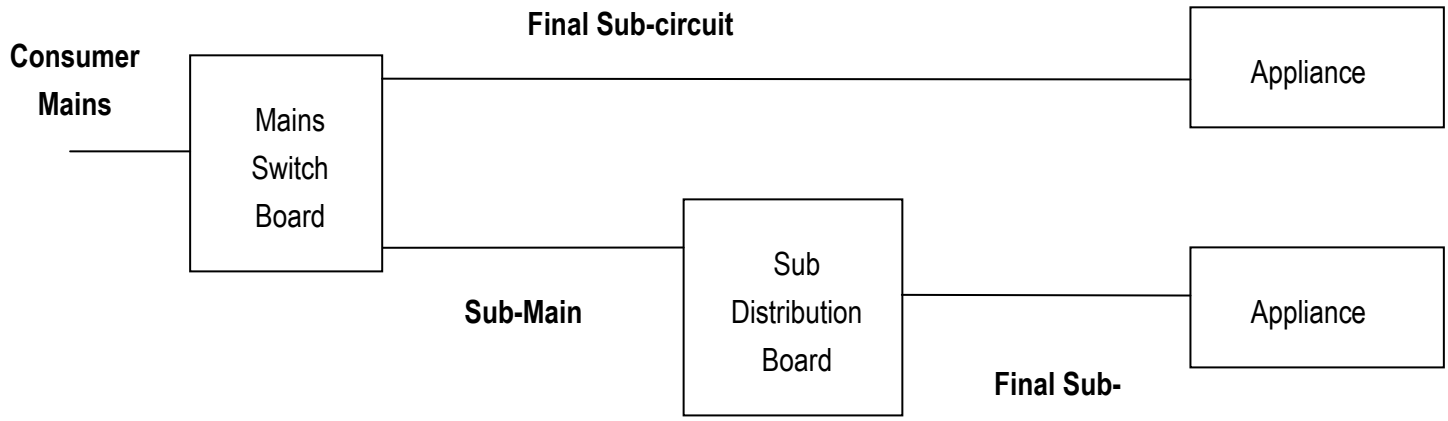
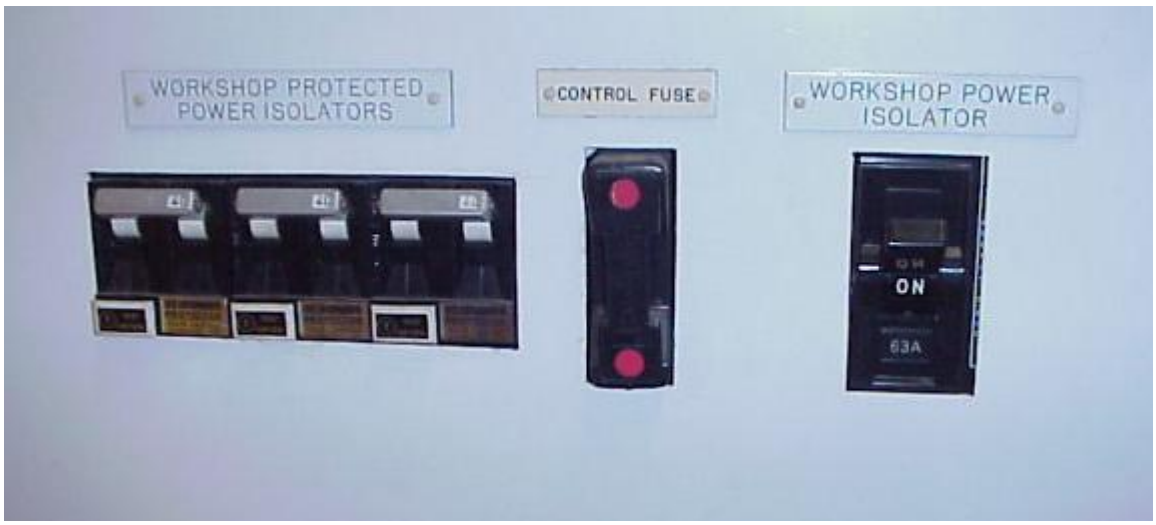


Figure 1

An isolator or isolating switch is a manually operated switch which enables the supply to a particular circuit or device to be disconnected.

The Wiring Rules require that every installation be controlled by a main switch (Clause 2.8.3.3.1), and, in general, every electric motor is required to be provided with an isolating switch (Clause 2.8.3.5).

It is vitally important that you be able to identify a main switch or any other isolator so that you can disconnect the supply before beginning work on any switchboard.



DANGER TAGS AND ISOLATION PROCEDURES

A fundamental responsibility of all electrical workers is to ensure their own safety, the safety of other workers in their vicinity, and the safety of the public.

In the electrical industry there are two basic tagging systems which must be used to warn others that it is unsafe to operate a particular machine or device. These are:

THE DANGER TAG.

A danger tag is mainly RED and contains the words "DANGER – DO NOT OPERATE THIS EQUIPMENT/SWITCH/VALVE", as shown in Figure 4. **Danger Tags**

If you have a job to do and you think there is a possibility that you can be injured if someone turns on the electricity (or the faulty machine or a flow of steam, gas or liquid) then YOU must fasten a red DANGER TAG to the main isolating switch, valve or equipment.

Each tag you put on must clearly show your name, your department and the date.

Nobody must operate the danger tagged switch or control until the job is finished and the danger tags have been removed.

Only the person who put on the danger tag is allowed to remove it.

Should that person be unavailable for any reason your organisation's safety policy details the procedure to be followed to have the tag removed.

A typical safety policy could state that if the person who fitted the danger tag is definitely unavailable, his foreman or supervisor may do so only if he has personally investigated the situation, and is satisfied that it is safe to remove it.

It is important that you are full aware of the tagging policy of the company you work for.

THE OUT OF SERVICE TAG.

An Out of service tag is mainly. YELLOW and BLACK and contains the words "OUT OF SERVICE - NOT TO BE OPERATED", as shown in Figure 5.

OUT OF SERVICE TAGS

- The yellow and black **OUT OF SERVICE** tags show equipment or machinery which is out of action for repairs or alterations, to prevent damage to plant if someone happened to use the switch/equipment/valve etc.

- Equipment which has Out-of-Service tag fitted must not be operated except with the direct permission of the person in charge.

- If machinery or equipment is faulty or damaged, and you can see that using it would cause more damage, or could injure someone, you must fasten an Out-of-Service tag to it and inform your supervisor immediately.

- Make sure that you are familiar with your company's tagging procedure.

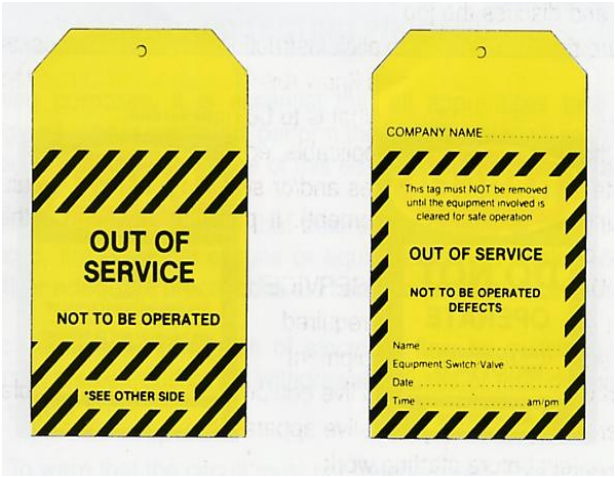


Figure 5.

POINTS TO WATCH

- Make absolutely sure that the switch, valve, control or equipment is the correct one to tag. If you have any doubts, ask your supervisor.

- Make sure that you leave the switch or control in the correct safe position.

- Some switches are not positive isolating switches. Switches such as the simple push - button type, emergency stop buttons, master control and control switches are not, and cannot be used as, isolating switches.

- Fasten the danger tag securely.

- When two or more people are working on the same job, each person must fasten their own danger tag to the main isolating switch or control.

- The supervisor or person in charge must investigate the work area and fasten his own danger tag to any point which, if operated, would be dangerous. The supervisor is then responsible for seeing that all personnel under his control have removed their danger tags and the job is safe before his own tag is removed.

- **If you go on a job and find a switch or control already Danger tagged, you must still attach your own Danger tag.**

- Before you isolate a circuit, make sure you notify the owner or manager.

- If you come to the end of your shift and the equipment or machine is still unsafe, remove your danger tag and fit a yellow OUT OF SERVICE tag in its place.

ISOLATING PLUG-IN APPLIANCES

The procedure for isolating a single, two or three phase appliance which is designed to operate via a plug top inserted into an appropriate socket-outlet or de-contactor is as follows:

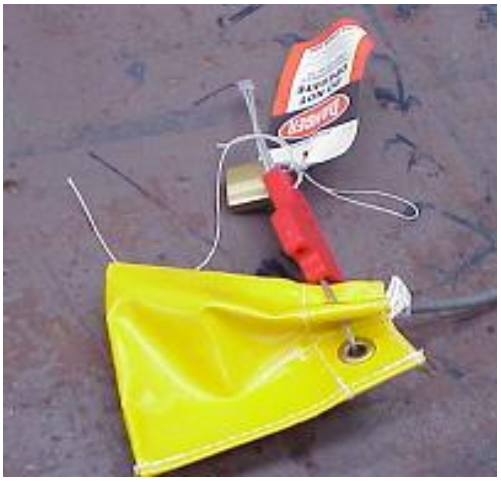
Make sure that the appliance is switched off.

Switch the switch off at the socket-outlet.

Remove the plug from the socket-outlet or de-contactor.

Place plug top into lockout bag.

Attach lock and personal danger tag.



If the equipment is not suitable for being returned to service then you must attach an out of service tag prior to the removal of your danger tag.

ISOLATING DIRECT CONNECTED APPLIANCES

Direct connected appliances are those which are permanently connected to the fixed wiring in an installation.

- Direct connected appliances are supplied from a switchboard which will have one or more fuses or air circuit breakers (ACB's), depending on whether the appliance is one, two or three phase.

- In the case of two or three phase appliances controlled from a circuit breaker, the circuit breaker will be double or triple pole, with one operating lever or toggle.

- Before attempting to isolate the appliance is it necessary to establish whether it is one, two or three phase, so that the appropriate number of fuses can be located. The appliance name plate is the usual source of the relevant information.

- Having established the number of phases the circuit can be traced back to the switchboard. The fuses or circuit breakers on the switchboard should be examined in conjunction with the switchboard legend to accurately locate those associated with the circuit to be isolated.

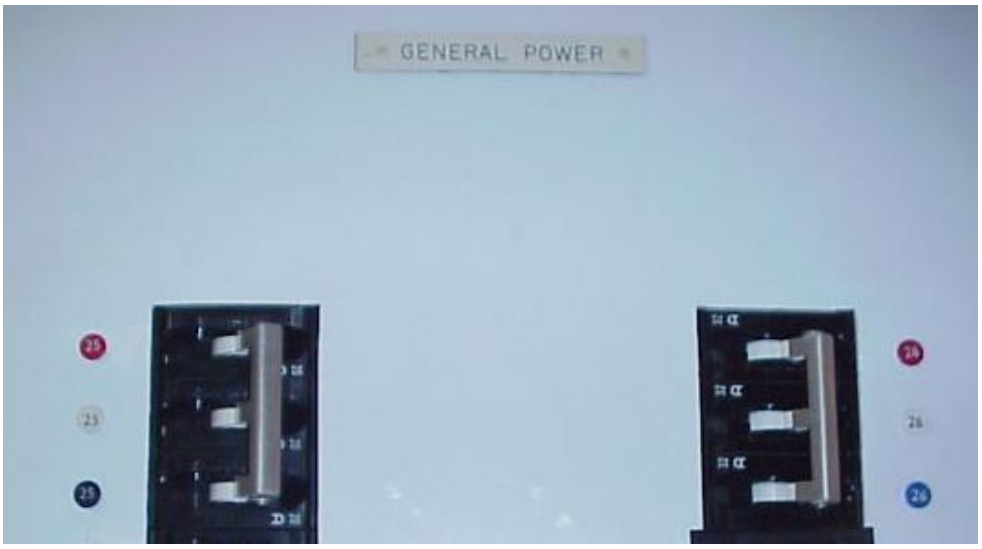
- Accurate identification of the required fuses or circuit breaker is essential. If, for example, you attempted to withdraw the wrong fuses you could:

a. Cut the supply to another important machine.

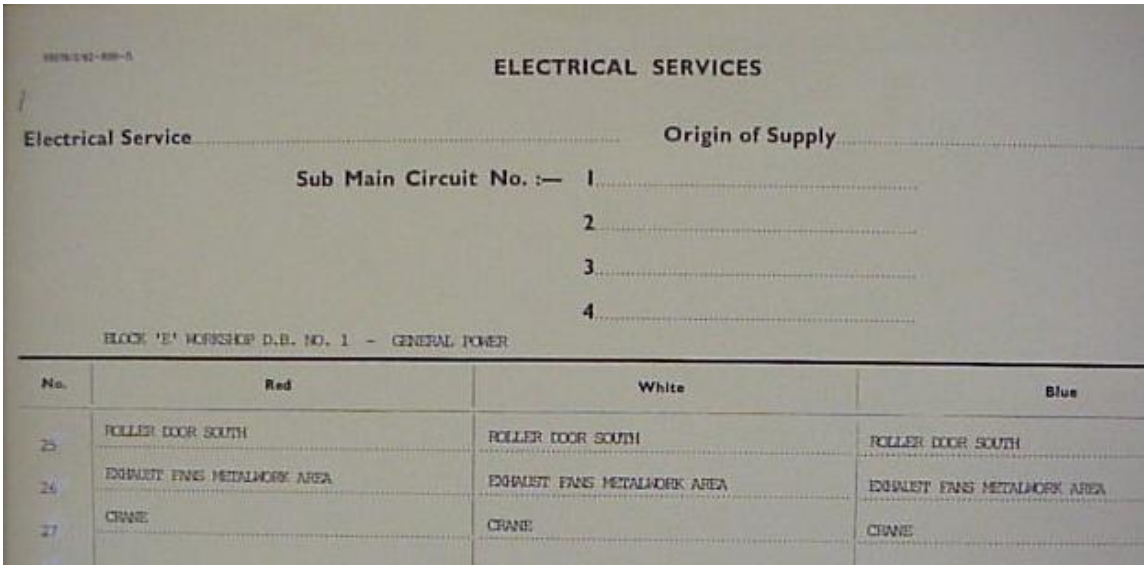
b. Draw an arc and burn yourself or suffer eye injury.

c. Leave the appliance you intend to work on alive, thus creating a dangerous electrical hazard.

- If the circuit is protected by a circuit breaker it should be carefully examined to determine the off position. Most circuit breakers are the opposite to normal switch mechanisms — the OFF position is DOWN; a label should be visible on the circuit breaker indicating whether it is off or on.



Identification of the correct circuit is made by referencing the electrical services schedule in the door of the switchboard to the labeled circuit breakers. Here we can see that circuit 25 red, white and blue phases are for the electric roller door on the south wall of the building.



ELECTRICAL SERVICES

Electrical Service ..... Origin of Supply .....

Sub Main Circuit No. :— 1 .....

2 .....

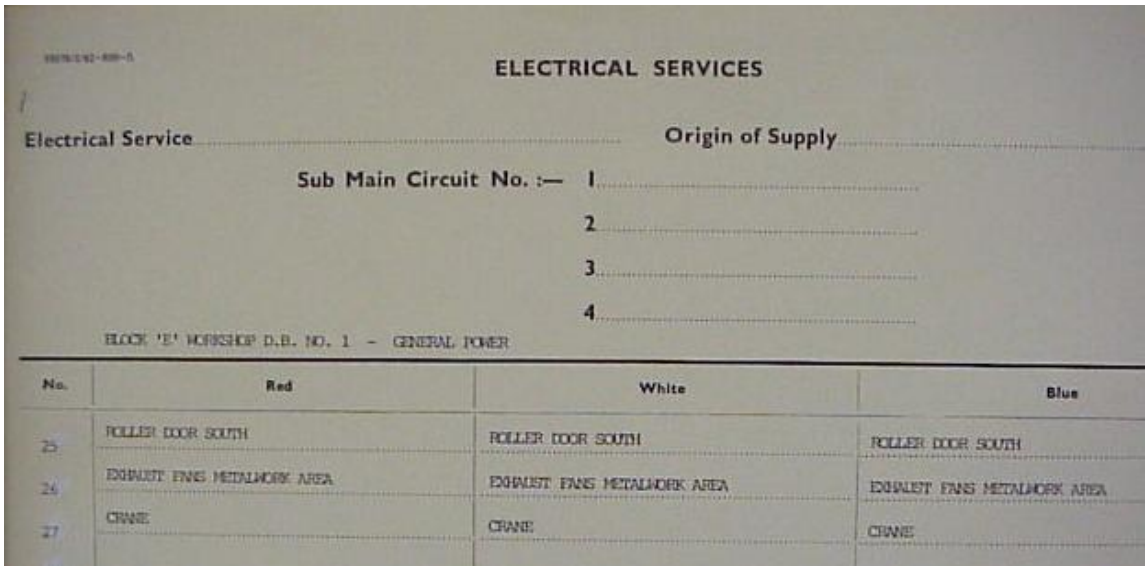
3 .....

4 .....

BLOCK 'E' WORKSHOP D.B. NO. 1 - GENERAL POWER

No.	Red	White	Blue
25	ROLLER DOOR SOUTH	ROLLER DOOR SOUTH	ROLLER DOOR SOUTH
26	EXHAUST FANS METALWORK AREA	EXHAUST FANS METALWORK AREA	EXHAUST FANS METALWORK AREA
27	CRANE	CRANE	CRANE

This lockable isolator switch is labeled accordingly for identification.



ELECTRICAL SERVICES

Electrical Service ..... Origin of Supply .....

Sub Main Circuit No. :— 1 .....

2 .....

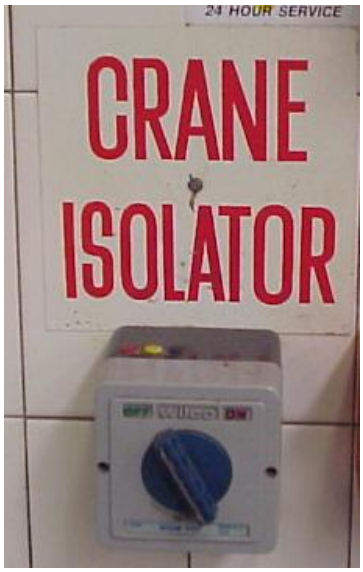
3 .....

4 .....

BLOCK 'E' WORKSHOP D.B. NO. 1 - GENERAL POWER

No.	Red	White	Blue
25	ROLLER DOOR SOUTH	ROLLER DOOR SOUTH	ROLLER DOOR SOUTH
26	EXHAUST FANS METALWORK AREA	EXHAUST FANS METALWORK AREA	EXHAUST FANS METALWORK AREA
27	CRANE	CRANE	CRANE

We can also see that the workshop crane circuit is identified as 27 red, white and blue phase.



ISOLATION PROCEDURE

The procedure for isolating an appliance or machine consists of several basic operations

a. Advise the owner or manager that you intend to isolate the circuit.

b. Switch the appliance or machine off. **Lock it off with a padlock if possible**.

c. Isolate the supply by withdrawing the fuses or switching the circuit breaker to the off position. Lock it in the OFF position.

d. Attach your danger tag to the fuses or circuit breaker to warn others that the circuit must not be re-energised.

e. Check your test instrument (usually a multimeter) to see that it is working properly.

f. Test for zero volts at the point at which you are to begin work. Test between all actives, from all actives to neutral, and from all actives to earth.

g. Re-check your test instrument to see that it is still working properly.

h. Double check all conductors using a phase pencil.

PROBLEMS IN ISOLATION

If the appliance is found to be alive after you have isolated the supply it means that something is wrong. Possible faults could be:

a. The wrong isolating switch has been switched off.

b. The wrong fuses have been removed or the wrong circuit

c. The wiring is faulty, damaged or incorrectly installed.

d. The circuit is being fed from more than one source.

e. Any of the combination of the faults listed above.

- If it is necessary to leave conductors disconnected, tape them up and make them safe so that if the circuit is inadvertently re-energised they do not cause an injury or a fault.

- Two of the basic safety procedures you must use at all times are:

TEST BEFORE YOU TOUCH

CHECK THE CHECKER

SINGLE LINE DIAGRAMS

These are a simplified form of wiring diagrams which show only essential details.

Characteristics:

- Simplified circuit diagram showing how power and lighting circuits are to be connected.
- Show numeric coding of circuits and protection equipment

Applications:

- Quoting for and wiring of installations

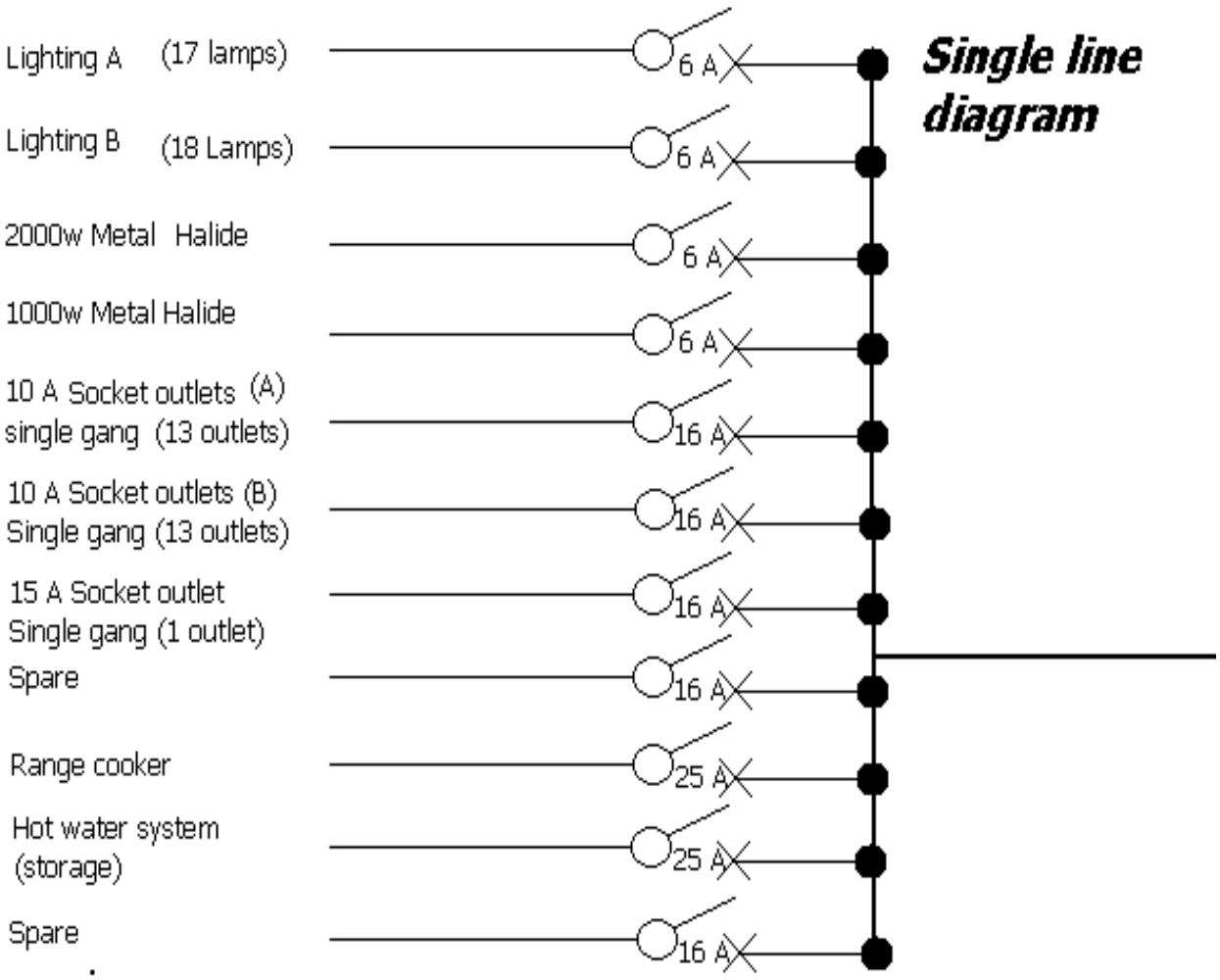


Figure 21

SINGLE-LINE DIAGRAM OF ADDITIONS TO A DISTRIBUTION BOARD

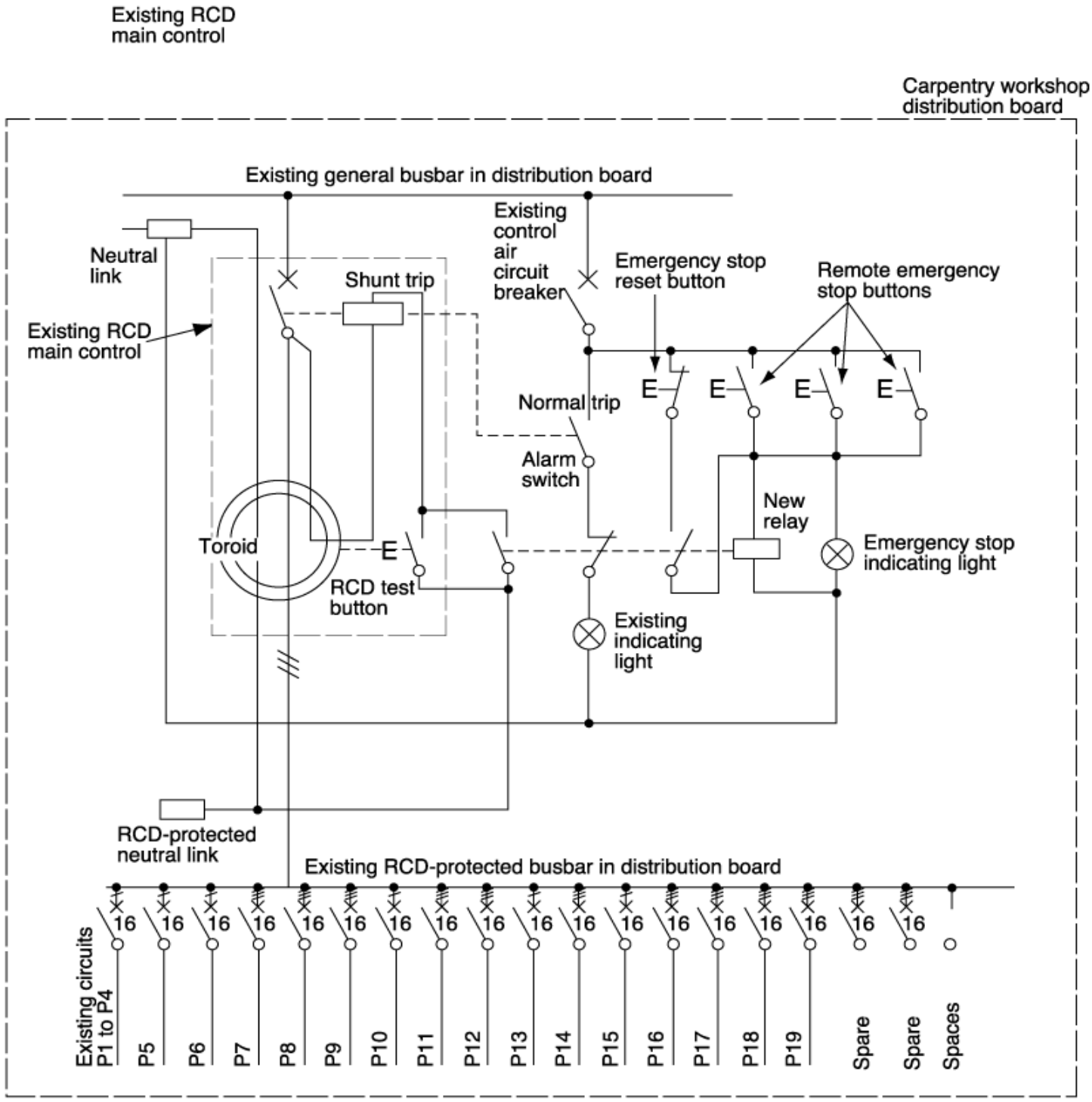
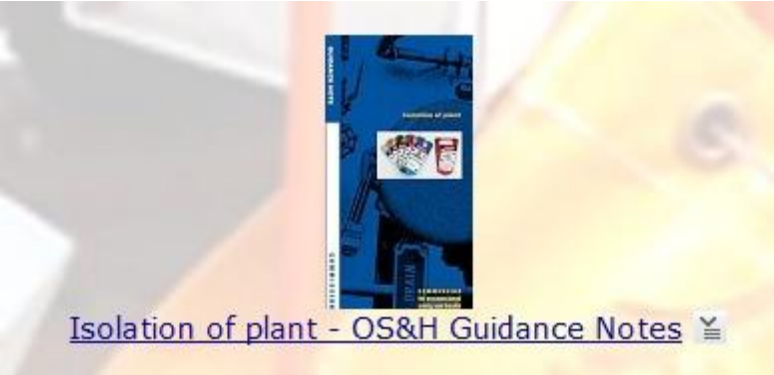


Figure 22

ELECTRICAL ISOLATION PROCEDURE.

STEP No:	SEQUENCE FOR *ELECTRICAL ISOLATION.*
1.	IMFORM APPROPRIATE PERSONS
2.	TEST YOUR "TEST INSTRUMENT"
3.	LOCATE THE ISOLATION POINT FOR THE CIRCUIT TO BE ISOLATED.
4.	TEST STATUS OF CIRCUIT
5.	ISOLATE CIRCUIT (VIA USE OFCIRCUIT C/B OR FUSE[S])
6.	PLACE TAG & LOCK TO ISOLATION POINT.
7.	RETEST: CIRCUIT CONDITION.
8.	RETEST: 'TEST INSTRUMENT'
9.	***ISOLATION COMPLETE*!**

Read 'Isolation of Plant Guidance notes' on CE6 under Isolations in S2B1 Fault find and Isolate electrical machines.



What is an isolation procedure?

Fill in the missing words.

The basic principle is comprised of three separate steps:

1. Lock.

2. Tag.

3. _____

Identifying energy sources and other hazards

All _____ sources and other hazards likely to place people doing the work at risk must be identified. This is especially important when employing contractors who may not be familiar
with the complexities of processes associated with the plant and the lack of reliable "as-built" diagrams of plant installations at many workplaces.

Identify all the energy sources for this equipment:

Conveyor

• 63 m long fabricated truss / stringer conveyor
• 0.7 m / sec belt speed for product sizes minus 0.1mm
• 5.5 kW shaft mounted motor drive with holdback
• Fenner H20 gearbox with 22 rpm speed
• 750 mm wide rubber belt with 6mm top cover, 2 mm bottom cover
• PN 200 4 ply Grade M cover
• head pulley scraper and tail belt plough for cleaning
• lanyard protection with underspeed switches and beltdrift
• Prok series 15 idlers
• 420 mm diameter drive, tripper head, tripper bend and tail pulleys – rubber lagged and crowned
• 400 mm gravity takeup – plain crowned – cold vulcanised splice
• tripper chute
• fabricated steel support frame structure
• walkway at one side with platform at head for drive maintenance
• gravity takeup tower

Air Cannon

An air cannon converts potential energy into usable energy.

It releases a volume of compressed air travelling at speeds in excess of the speed of sound (Mach 1).

This sudden release of energy is directed through a transition pipe into compacted or frozen material in a bin, silo or stockpile, to dislodge that material and restore flow.

Identify all the energy sources for this equipment:

Isolation Procedure Example:

The following piece of equipment is to be decommissioned.

It is to be isolated from Distribution board 1 in the E block workshop.

The machine is in the Metal Work area that is currently being refurbished on the south side of the building.

The circuit is to be disconnected on the load side of the isolator.

The isolator is to remain in place so that a replacement machine will be reconnected at a later date.

- **Contact building technician and identify the correct machine that is required to be isolated: - Drill press in metal work area on south side of building.**
- **Identify the circuit to be isolated by reading the circuit identification labels on the machine isolator – Circuit number 10 Red, White and Blue**
- **Switch isolator to the off position.**
- **Locate the switchboard – E block Distribution board 1**
- **Identify the circuit breaker labeled number 10 Red. White and Blue. Use the Electrical services schedule to verify that this circuit is the correct machine to be isolated.**
- **Switch circuit breaker to the off position and use locking mechanism.**
- **Place personal danger tag and lock on circuit breaker.**
- **Check your meter for safe operation. With leads connected to correct jacks and meter set to highest ac voltage range, check meter on know source. (Socket outlet)**
- **Remove machine isolator cover and test for zero volts.**
- **Retest the meter on known source.**
- **Remove the load side conductors on the isolator and disconnect the flexible conduit.**
- **Place blue point connectors on all active conductors and tape together.**
- **Place plug fitting on isolator where the conduit was removed to maintain IP rating.**
- **Replace the isolator cover and ensure the circuit is left in a safe manner.**
- **Remove personal lock and tag from circuit breaker in switchboard.**
- **Place Out of service tag to circuit breaker indicating that the equipment has been removed from isolator.**
- **Report to building technician that isolation has been completed.**

Writing the isolation procedure:

Identify each step in the safe activity on the equipment

Look at the task at hand and list out all the practical steps that are required to complete the job.

What needs to be isolated?
There may be more than just the equipment you are directly working on. You may have a conveyor isolated so that it will not move but have you considered isolating the water sprays that are used for dust control?

Accurately describe each step.
This is to make sure that you have covered all aspects of the job and have preempted any problems.

Fulfill the requirements of AS/NZS4836
With all the steps listed carry out an analysis to fulfill the requirements of AS/NZS4836.

- Identifying the hazards
- Assessing and prioritizing the risks
- Applying control measures to the identified risks

This is commonly achieved by completing a Job Safe Analysis JSA, Job Hazard Analysis JHA or a Job and Environmental Hazard Analysis.

These a number of common names for the same type of document in various industries.

Make sure that you have included all the requirements for PPE and personal safety.
(See the attached requirements and example for JSAs)

The requirements for the correct use of power tools, ladders, EWPs, safety harnesses and the use of safety observers where required needs to be considered.

Also ensure that your meter is suitable for the application category it is being used in and where possible check your voltmeter against a known source especially when you are confirming zero voltage present.

Use correct terminology

Make sure that your procedure is written in clear and concise language using the correct terminology for the trade.

This is to ensure that another tradesperson could pick up your isolation procedure and effectively carry out the task.

Isolation Procedure Exercises

ONLY COMPLETE WHEN PRACTICAL ASSESSMENT (TASK1) COMPLETED

Write a step by step isolation and job procedure for replacing a Orange Single Phase GPO in the tower situated on the workbench (in front of the store) in the Electrical Workshop.

- Make sure that you include all steps and correctly identify and reference the circuit to be isolated.
- Your task is to find out where to isolate them and how to complete the task.
- The storeperson / technician is the person responsible for the workshop

Isolation Procedure Exercises

ONLY COMPLETE WHEN PRACTICAL ASSESSMENT (TASK2) COMPLETED

Write a step by step isolation and job procedure for replacing a motor on a “ROMAC”, Cylindtical Grinder in the Fitters Workshop.

- Make sure that you include all steps and correctly identify and reference the circuit to be isolated.
- Your task is to find out where to isolate them and how to complete the task.
- The storeperson / technician is the person responsible for the workshop

Now that you have written your isolation procedures you will need to consider JSA's for the task of carrying out maintenance on the GPO and Motor replacement on the two jobs

Use the following JSA Example as a guide and then use the blank JSA to write your own job procedure.

Job Safety Analysis Example

Date: _____

Description of task:
Laboratory test - Measuring the line and excitation current on a synchronous motor to observe the characteristic V curve

Team Members:		**PPE required:**
Joe Worker		Steel cap boots
		Protective cotton work clothing
		Safety glasses
		Ear plugs

Tools and equipment required:

- Synchronous motor
- Extra low voltage power supply
- Ammeter
- Test leads

Task	Identified Hazards	Hazard elimination or control
Set up motor on test bench	Damaged leads and equipment posing an electric shock risk	Carry out visual inspection of equipment prior to use. If item is not suitably tagged then carry out electrical testing as per standard procedure
	Back injuries from lifting	Use correct lifting techniques.
Run motor and record results	Rotating equipment	Ensure that limbs to not come into contact with rotating parts. Ensure that people working nearby are aware of the risk prior to enrgising.
Return equipment to storage	Back injuries from lifting	Use correct lifting techniques. Ensure that storage area is clear prior to picking up equipment.
	Trip hazards from material left lying around	General housekeeping

Compiled by: _____ **Print name:** _____ **Signed**_____

POLYTECHNIC WEST
The Polytechnic of Western Australia

Job Safety Analysis

Date: _____

Description of task: GPO IN ELECTRICAL WORKSHOP (TASK 1)

Team Members:		**PPE required:**

Tools and equipment required:

Task	Identified Hazards	Hazard elimination or control

Compiled by: Print name: _____ Signed_____

Authorised: Print name: _____ Signed_____

Job Safety Analysis

Date: _____

Description of task: MOTOR ON THE "ROMAC" SURFACE GRINDER (TASK 2)

Team Members:		PPE required:

Tools and equipment required:

Task	Identified Hazards	Hazard elimination or control

Compiled by: Print name: _____ Signed_____

Authorised: Print name: _____ Signed_____