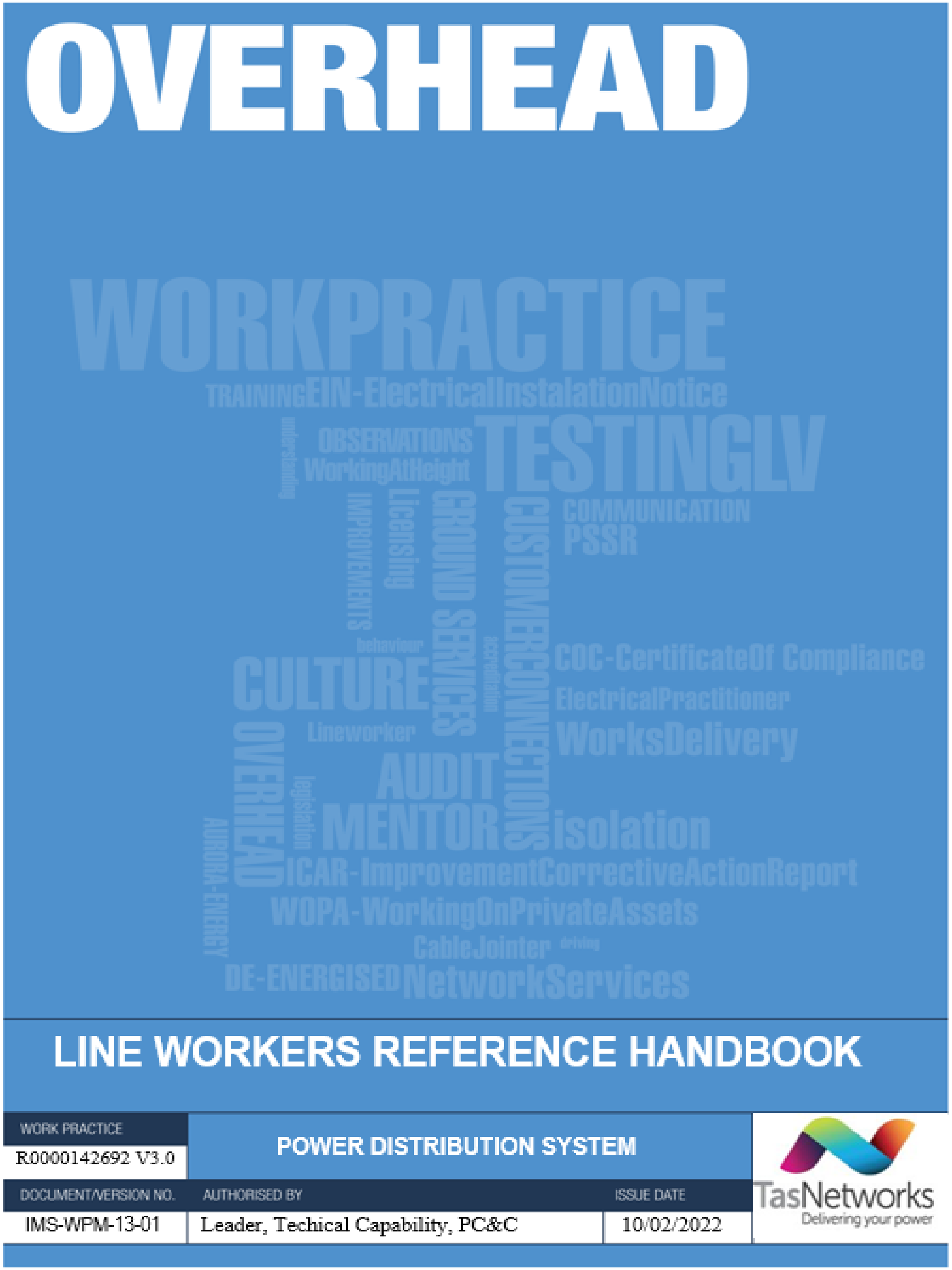
DISTRIBUTION LINE WORKERS REFERENCE HANDBOOK



FOREWARD

Welcome to the Line Workers Handbook covering electrical and construction work in the Tasmanian Power Distribution System for voltages up 22,000 Volts (22KV). Inside, you will find requirements and guidelines for, safety, plant, tools, equipment and work practices relevant to distribution line work.

This Handbook is uncontrolled when printed and, with evolving changes in new technology and work practices, the Handbook will be subject to continual review and updating.

Therefore, it is the responsibility of users to ensure they have the latest copy and version number by periodically:

Contacting the Tasmanian Power Supply Authority, Work Standards Officer and/or;

1) Accessing the Power Supply Authority, **#External Work Practice Web Site**, and obtaining the latest approved version and any relevant additional updated information that may be provided.

1) **# Note** : Access to the "External Work Practice Web Site" is restricted such that users need to contact the Power Supply Authority, Work Standards Officer to **obtain a Username and Password** to be able to access the web site.

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1•0 ALTERATIONS AND ADDITIONS TO HANDBOOK

Page Number(s)	Section Number and Description	Date LWRHB Modified
Entire Document	Issue of Completely New Document.	Dec, 2004
2	FOREWARD altered to indicate Handbook now an uncontrolled document and users need to ensure they obtain latest copy via the WPWS or BSO or Work Standards Officer.	11-04-2013
3-7	Section 3.7 Definitions – "Pole Strap" removed as no longer used except for pole top rescue. Section removed and left blank.	11-04-2013
5-21	Section 5.4.2.6 (c) Polarity Tester – this model not used now. Section removed and left blank. Refer to WPWS for approved list of test instruments.	11-04-2013
5-21	Section 5.4.2.6 (c) Phase Sequence Tester – this model not used now. Section removed and left blank. Refer to WPWS for approved list of test instruments.	11-04-2013
5-25 to 5-26	Section 5.4.2.9 Traffic Control Signage - removed as not compliant to latest edition of the traffic standard AS1742.3. Refer WPWS for new Traffic Management Plans (TMPs).	11-04-2013
5-39	Section 5.6.8.2 Line Workers Body Belt – not used now - Section removed and left blank.	11-04-2013
5-39	Section 5.6.8.3 Line Workers Pole Strap – not used now except for rescue - Section removed and left blank.	11-04-2013
5-42	Section 5.6.12 Height Safety Equipment Register – Pole Strap & Body Belt removed – left blank.	11-04-2013
10-1 to 10-7	Section 10 Traffic – whole section removed from Handbook as no longer compliant with AS1742.3. Refer WPWS for new Traffic Management Plans (TMPs).	11-04-2013
11-57	Section 11.5 Work On Live Low Voltage – all references to tapping conductors with back of hand to check if live removed as this practice not permitted. Instead must test for live parts.	11-04-2013
11-88	Section 11.10.2 Testing – Section removed and left blank. Refer to WPWS for TE-WP-001 Testing Low Voltage Standard	11-04-2013
11-99 to 11-101	Section 11.10.3.3 – Diagrams of Overhead Clearances - removed as clearances listed no longer correct – refer to drawing nos. listed in the DS-D-OH-1 Overhead Design Construction Manual.	11-04-2013
11-106 to 11-109	Section 11.10.5 Service Installation&/or Reconnection removed and left blank as superseded by work practices on WPWS.	11-04-2013
11-125	Section 11.12 Testing Electrical Installations – section left blank as superseded by TE-WP-001 Testing Low Voltage Standard.	11-04-2013

12-5 to 12-7	Section 12.2.5 Testing Transformers removed and left blank as superseded by work practice OH-WP-016 Transformers – Pole Mounted – Installation/Replacement/Testing.	11-04-2013
14-1 to 14-5	Section 14 Metering completely removed as not relevant to the work performed by Line Workers.	11-04-2013
	Whole LWRHB re-structured and brought up to date to current standard with the following main additions :- 1) Hyperlinks to, associated relevant work practices, construction manuals and, internet web sites. Whenever these work practices get updated the same hyperlink will open up the latest version. 2) Manual made for generic use by Service Providers in addition to TasNetworks employees. 3) Manual re-structured to be in logical order i.e. pre-requisites, construction work, pre-commissioning, commissioning, work on existing assets and, fault response work. 4) To assist employees easily find information, added in, sub table of contents in each major section, bookmarks, index and, hyperlinking to open up a document to the exact page of the topic e.g. in the overhead construction manual. 5) Added in more technical content where possible to make manual more relevant for field work.	10-10-2016
Section 5.3.2	This section added in to cover changes to permitted scope of work for each class of electrical licence held, as per the Occupational Licensing (Electrical Work Licence Classes) Determination 2016.	23/03/2017
Section 9.8.4.2	Corrrect Backfilling And Ramming Method – updated to strengthen requirements for poles to be properly backfilled and, rammed solidly in 150-200mm layers to ensure poles do not lean or fall over. Changes shown in grey background colour.	07/09/2017
Section 12.2.3.1.4	Added in details on requirements for handling and installation of the new fibreglass MK1 cross arm and where it is to be used.	14/09/2017
Section 6.19.2.3	Added in this section for covering off new work procedure **Implement Safety Drop Zone**.	21/02/2018
Section 12.2.3.6.2	Added in this section to cover of description of different categories of switchgear.	21/02/2018
Section 12.2.10	Titled “Stringing Conductors Under Live Conditions” added in to cover off newly developed **Decision Flow Chart** on what steps to take to perform safe stringing of overhead conductors after a fatality occurred in NSW when a person was holding a conductor that touched live HV apparatus.	05/03/2018

Section 9.3.1	Updated to enforce requirement not to move pole pegs and install pole in new location until agreed to by Job Designer and a Locations Officer scans the site to ensure no underground services will be damaged.	05/03/2018
Section 12.2.1.4	Updated with hyperlink to instructions on proper inspection of LV Gloves to ensure they are in sound condition prior to use when workrng on live LV.	05/03/2018
Section 7.7.4	This section on hitching and securing trailers updated and strengthened with information from two alerts issued on this subject.	05/03/2018
Section 9.14.1	Updated to include requirements, contained in **Amber Alert – Live Line Clamp**, on ensuring strain gear used to ensure conductor will not fall when installing/replacing line clamps on aged conductors.	05/03/2018
Section 13.3.2	Updated to cover off requirement to ensure fire extinguishers are regularly checked and in serviceable order.	05/03/2018
Section 6.19.1	Added in reinforcement that fall arrest harness must be fitted properly prior to use.	06/03/2018
Section 8.11.2	Added in to be aware there may be some boric acid fuse units installed with an earthing point on the top side as well as the bottom of the EDO unit, with risk of inadvertently earthing on the live top side.	06/03/2018
Section 9.3	This Section added in to cover requirement to ensure:- • Redundant equipment is removed after completion of construction work to remove hazard to plant, machinery and the public. • Pole top structures are inspected to ensure no loose items can fall and be a hazard to the public.	07/03/2018
Section 13.8.4.4	Updated to require the use of a Bushfire Response Kit to protect health when dealing with CCA treated poles in the aftermath of a bushfire.	07/03/2018
Section 9.15.7.4.9	Updated to incorporate details from **blue lesson on Ampact Fittings**.	08/03/2018
Section 9.14.9.3	Added in details on new pole top bracket designed to provide more support strength for AKS type air Break Switch, as per **Blue Lesson** on this.	08/03/2018
Section 12.2.1.4.1	Step 5) was updated to require adequate insulation be used to cover all conductors and other conductive parts within reach to prevent a flashover.	08/03/2018
Section 9.14.3.2	Added in details on increase in use of Load Break Switches to replace Air Break Switches, from the **Blue Lesson** issued out.	08/03/2018
Section 9.14.12.6.1	Added in details of faulty TFR hanging bracket and new replacement bracket to use.	08/03/2018

Section 9.4.1	Updated with details on referencing underground markers provided by Locations Officer to ensure the original markers can be re-established after excavation work is done.	20/03/2018
Section 12.2.1.6.2	Maintenance details included on suspect live line split bolts failing.	20/03/2018
Section 9.15.2.5	Updated to require Section 12.2.10 to be complied with on Decision Flow Chart to determine if safe to perform conductor stringing under live conductors. Also, added in details from Blue Alert on ensuring roller is secured properly to avoid conductor slipping out and striking employee.	20/03/2018
Section 13.8.4.2	Fallen conductors strengthened to cover cutting live conductors in light of arc flash incident.	20/03/2018
Sections 13.8.4.2 and 12.2.3.10.3	Updated to cover introduction of earthing stirrup now supplied with NGK Stanger type EDO units to increase SAD to 700mm minimum.	20/03/2018
Section 9.15.7.4.5	Added in details on requirement to use two PG Clamps on pre-formed conductor lead connections	20/03/2018
Section 9.14.12.3	Added in detail on transition from Tyree to Willson transformers and the issue with mounting brackets until Wilson hanging brackets available.	20/03/2018
Section 9.16.1.1	Added in details covering need to ensure overhead services are installed properly to avoid degradation from UV radiation.	20/03/2018
Section 9.6.1	Green alert added in to strengthen need to ensure adequate eye protection is worn where applicable.	20/03/2018
Section 7.6.1.2	Green alert added in to provide added details on High Risk Licensing obligations for operating plant and machinery.	20/03/2018
Section 9.12	Green alert added in to emphasise need not to damage pole ID tags.	20/03/2018
Section 6.19.9	Green alert added in to emphasise safe use of EWP when “mobiling” between poles and street light columns.	20/03/2018
Section 7.3	Added in need to tag operational earths sharing common Access Authorities.	20/03/2018
Section 11.2.1.9	Red Lesson added in to emphasise need to properly identify conductors and connections and test before and after completion of work.	20/03/2018
Section 5.3.3.1	Updated with Green Alert that covers changed requirements for dealing with staking of privately owned power poles.	21/03/2018
Section 6.12.6	This new section added in under Safety to cover off radiation from anntennas on Telstra small cell units installed on TasNetworks poles.	21/03/2018
Section 12.2.1.2.2	Added new section on aerial inspection to cover off use of helicopters to inspect and carry out aerial maintenance work.	21/03/2018

Section 13.9.11	This new section added in to cover off new requirements from Green Lesson on new process to follow to ensure CEC received from Contractor after fault repair before TasNetworks will re-connect supply.	21/03/2018
Section 12.2.1.6.6	Updated to cover off on operating restrictions to AK Power Air Break Switch.	21/03/2018
Section 9.15.7.4.2	Updated to emphasise the critical need to ensure correct compression die is used on conductor joints.	21/03/2018
Section 6.12.9	Updated to emphasise the need to be careful of backfeed voltage from customer source, from Red Lesson on backfeed from a generator.	21/03/2018
Section 9.16.3.2	Added this in to cover proper method for using IPC connectors on overhead service work.	21/03/2018
Section 6.19.2.3	Added in Red Lesson to emphasise need to ensure a safety drop zone is put in place where applicable.	21/03/2018
Section 6.19.9	Updated to emphasise need with soft road edges to ensure EWPs are set up properly on site to avoid roll over.	21/03/2018
Section 12.2.2.3.2	Added in ruling & WP requirements on dealing with a pole marked to be staked when next to a pole being replaced (e.g. condemned pole).	12/11/2018
Section 5.10.1	Added in, Section covering driving vehicles and, special requirement from amber alert to properly **check fire extinguisher** in vehicle is in sound operational condition prior to departure.	12/11/2018
Section 9.15.7.4.10	Updated section on IPCs to cover off special tips on using new type IPC introduced during 2018.	12/11/2018
Section 9.15.2.1.2	Updated details on the use of copper push pulls, and added in latest **blue alert** that covers moving away from push pulls to crimped connections.	01/02/2019
Section 6.19.9	Section on EWPs updated with **red alert** covering requirement to keep EWP engine going when working on or close to live LV apparatus to ensure EWP controls work if a rescue is required.	01/02/2019
Section 12.2.2.3.2	Replaced previous wording on replacing a pole where the adjacent pole is marked as “impaired” but has not been staked to restore pole strength. Changes shown in greyed background colour.	02/07/2019
Section 12.2.2.1.5	Additional wording added to strengthen requirements for when working on or adjacent to a condemned pole. Changes shown in greyed background colour.	02/07/2019
Section 12.2.2.1.1	Section on Pole Top Forces strengthened with additional requirements and guidelines added in detailing how changed in forces (e.g. conductor movement) can affect pole top forces. Changes shown in greyed background colour.	02/07/2019

Section 12.2.2.4	New section "Functional Pole Failure" added in to cover re-defnition of failed poles to eliminate poles that still need attention but not to be classified as condemned poles and instead, are defined as functional pole failures.	02/07/2019
Section 12.2.2.5	New section on "Unassisted Pole Failures" added in.	03/07/2019
Section 5.9.1.3	New section "Customer Notification Of Life Support Change" added in.	03/07/2019
Section 6.14.9	Blue Alert On PPE After Fire Response added in.	04/07/2019
Section 13.8.2	New section "Replacement Of Known Defective Equipment" add in.	04/07/2019
Section 13.9.6 & Section 13.9.7	Updated to cover off latest requirements for reporting electrical non compliances no complying with AZ/NZS 3000 Wiring Rules etc.	04/07/2019
Section 9.9.3.1	More detail added in on the use of "Shear Legs".	04/07/2019
Section 9.16.5	Added detail in to emphasise single insulated cables to be kept clear of metal surface on steel service poles to avoid wearing away insulation.	07/07/2021
Section 13.8.5.11.3	New WP Hazardous Materials - Transportation Spill Management For Oils And Fuels.	21/02/2022
Section 13.8.5.4	New WP Hazardous Materials - Transportation Spill Management For Copper Chrome Arsenic Ash	21/02/2022
Section 6.14.1	New WP Hazardous Materials - Transportation Spill Management For Asbestos.	21/02/2022
Section 12.2.4	New Live Low Voltage Work Manual added in.	21/02/2022
Section 5.9.1.1	New National Energy Retail Rule Disconnections added in.	21/02/2022
Section 9.15.7.4.12	New WP **Installation Of Spiral Vibration Dampers** added in.	05/04/2022

2•0 INTRODUCTION

2•1 Purpose

The purpose of this handbook is to specify, safe working requirements, work practices, technical information and, minimum standards and compliance requirements for carrying out overhead line work activities associated with the Power Distribution System within Tasmania.

This handbook has been compiled in logical order covering the life cycle of distribution supply assets, starting with pre-requisities and then commencing with new construction work, pre-commissioning, commissioning, work on existing assets and finally, fault response work.

In addition to being used for field work, this handbook will be used as a training reference document to assist all electrical practitioners and other relevant persons who have a vested interest in Power Distribution System line work and maintenance of these assets within Tasmania.

2•2 Scope and Application

2•2•1 Scope

The information in this document applies to all persons working for or on behalf of TasNetworks Pty Ltd in Tasmania associated with working on or in close proximity to Tasmanian Power Distribution System assets covering from High Voltage output (up to and including 22,000 volts) from Zone Substations to 415/240 voltage supply assets (including privately owned where applicable) to the line side of customer Tariff main switches.

2•2•2 Exclusions

The following are areas of work not covered by this handbook.

2•2•2•1 Distribution HV Live Line Work

Electrical Practitioners are not permitted to perform HV live line work (i.e. glove and barrier and/or stick work) unless properly trained, and authorised by TasNetworks.

Distribution HV live line work shall comply with the TasNetworks **Live Line Handbook Distribution** and;

The only exception to this are limited HV live line work tasks done at a safe distance using insulated sticks detailed in work instructions in this handbook.

2•2•2•2 Transmission Work

This covers, live or de-energised line work and, construction work on any HV supply assets up to the connection point where 22KV supply or 11KV distribution voltage is fed from.

Transmission work shall comply with the TasNetworks **Transmission Manual**.

2•2•2•3 NBN Fibre Optic Work On Distribution Network

All National Broadband Network fibre optic cable construction work performed on or near the Power Distribution Network shall comply with the TasNetworks:

- **Fibre Optic Installation Work Standard**.
- **Telecommunications Design & Construction Standard**

The only fibre optic work covered in this handbook is for maintenance work where there is a need for Line Workers to remove damaged or broken fibre optic cable to a safe location at ground level for a Contractor to make repairs.

2•2•2•4 Privately Owned Overhead HV Supply Networks

This covers privately owned, HV lines and, HV apparatus at customer sites.

Other than fault/replacement work and replacing like for like, TasNetworks employees or Service Providers performing this type of construction work would need to comply to :

- **AS 2067 High Voltage Installations Exceeding 1 KV** and;
- Occupational Licensing (Private High Voltage Electrical Work - Certification and Energisation) Notice 2013.

2•2•2•5 Switching And Operating

Operating Distribution System switchgear and training and authorisation of Field Operators is covered under TasNetworks separate requirements for this detailed on the **Operating & Standards Group Web Site.**

HV operating sticks must be properly used in accordance with Sections :-

- **6.16.2.5 Care And Use Of HV Operating Sticks**.
- **12.2.5 Insulated Hot Sticks.**

2•2•2•6 Metering Work

As metering work is beyond the Point Of Supply a Line Worker is not permitted under Legislation to perform metering work unless, trained and accredited under an Electrical Safety Management Scheme (ESMS) or, also holds and Electrical Practitioner License, Electrician and has been trained and accredited to perform metering work.

2•2•2•7 Ground Services Work

Ground services work, as implied, covers work done at ground level covering the installation, commissioning and maintenance of underground cables and associated street furniture (e.g. padmount transformers, turrets, cabinets etc.).

This work is covered by :-

1) Separate scope of work for Service Providers.
2) TasNetworks, Underground Construction Manual and;
3) Specific work practices for doing this type of work.

2•2•2•8 Other

1. Vegetation management.

Other than trimming vegetation or cutting away limbs from power lines during fault response work mentioned in this handbook, full blown vegetation management near power lines is performed by Service Providers in accordance with TasNetworks **Work Practice/Technical Specification Vegetation Scope Of Work**.

2. Imbedded generation connection

Other than a work practice for installation and connection of metering equipment to record the amount of energy flowing into the power grid, the installation and wiring of imbedded generator equipment (photo voltaic panels, generators and wind turbines) is excluded from this handbook.

3. Design Work, Policies & Technical Specifications On Distribution Power Supply Infrastructure

This information is contained in documentation on TasNetworks Web Site the **Overhead Line Design And Construction Standard** and associated documents. These documents are referenced where applicable in this handbook.

4. Protection & Control Work

This is covered in other work practices and compliance with an Electrical Safety Management Scheme for TasNetworks employees not holding an Electrical Practitioners License.

5. Telecommunications Work

This covers telecommunications work, including SCADA, done for or on behalf of TasNetworks, and this work is covered by separate work practices outside the scope of this handbook.

2•2•3 Application

All Electrical Practitioners and other personnel performing work on the Power Distribution System in Tasmania shall be familiar with and comply with the safe working requirements, work practices and minimum standards contained in this Handbook unless they conflict with any of the following that may over rule the information in this handbook. :

1) A “Policy”, “Work Instruction”, “Work Procedure” or “Work Standard” issued by TasNetworks.

2) Tasmanian State Government Legislation or Code Of Practice.

3) Federal Legislation or Code Of Practice.

4) Energy Networks Australia (ENA) Policy or Guideline.

5) Australian Standards.

Compliance with the requirements and guidelines in this handbook is necessary to ensure :

1) The safety of employees, visitors and the general public.

2) Compliance under Tasmanian Government Legislation covering electrical work for :-

- Quality of work to comply with relevant Construction Standards.
- Certification of electrical work.

3) Continuity of power supply.

4) Security of TasNetworks assets and plant.

Under NO circumstance is safety to be compromised.

2•2•4 Document Control

The production and issue of this handbook is for electronic PDF format only and, there is no formal control over issue and maintenance of hard copies.

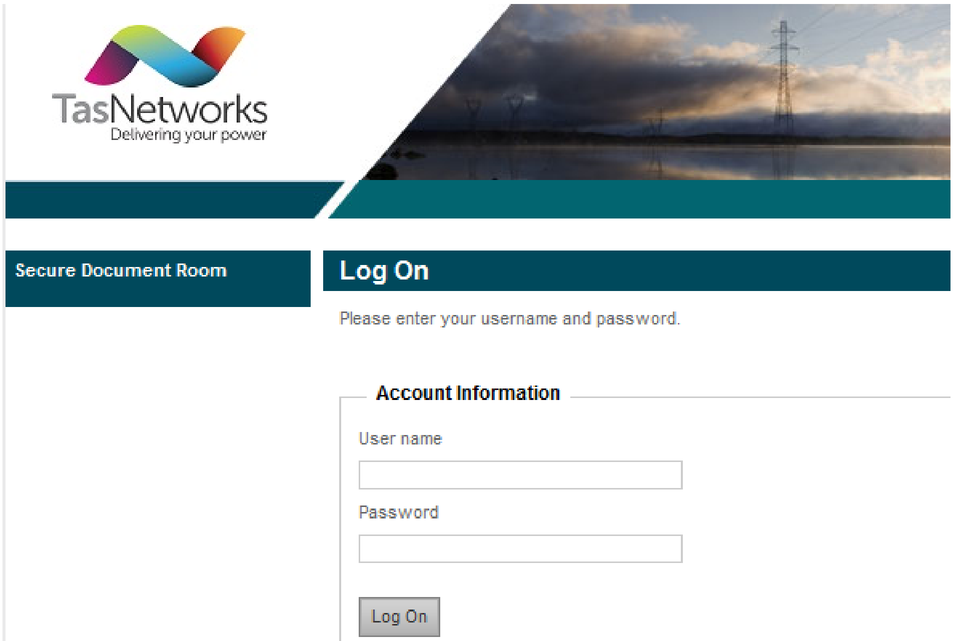
TasNetworks will endeavour to inform users of this handbook of any revisions and updates but, notwithstanding that, it is the responsibility of users to ensure they have the latest updated electronic version via :-

1. For TasNetworks employees – accessing the **Internal Work Practice Web Site** on the **ZONE intranet or via the ODI app** 

on Field Tough Pads.

Example - Display page after accessing Intranet Web site.

2. For Service Providers – accessing the **External Work Practice Web Site** on the Internet. **Note**: This requires the Service Provider to contact TasNetworks for approval to obtain a Username and Password to gain access into the external web site.



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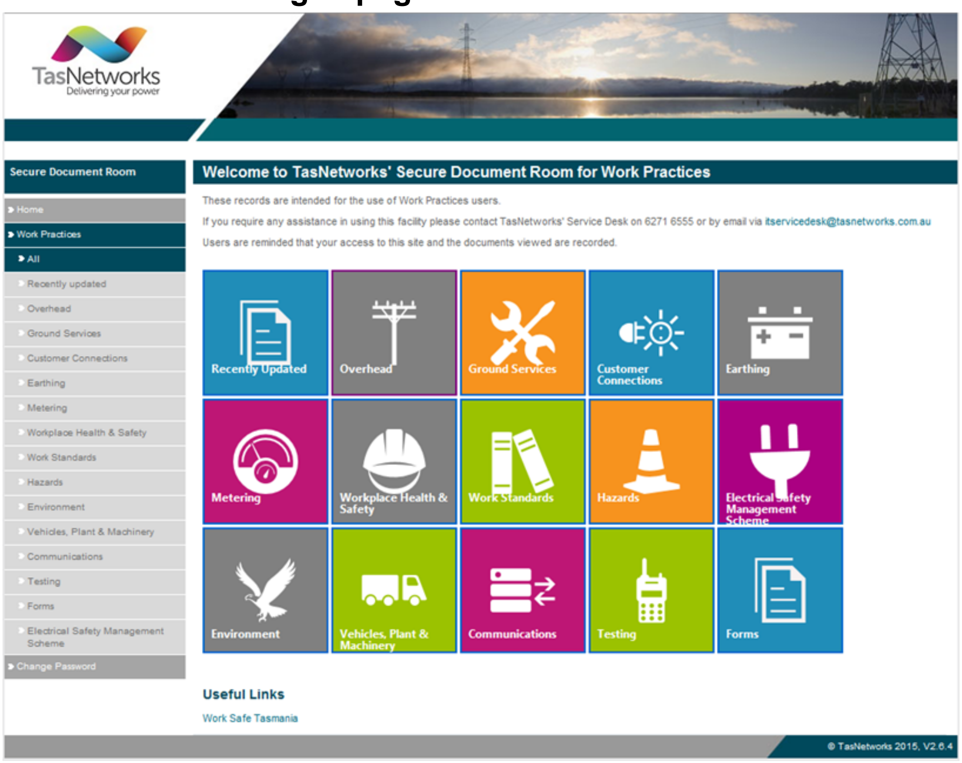
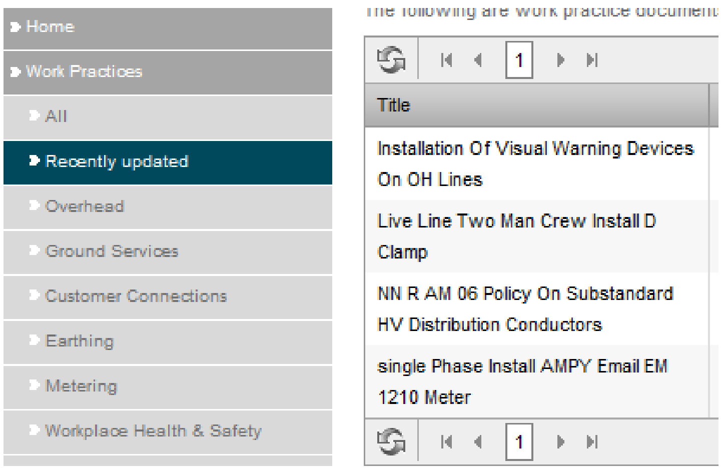


External Web Site Display Page After Access Granted



To ensure you have the latest documentation, click on the **Recently Updated** option to view the latest updates.

Version control of the handbook is via the following process :-

1. Where a major change to the handbook is made where formal approval is required, the issue date will change and, the version number will change to the next whole number e.g. old version was Version 2.0 and will now change to Version 3.0 with a new issue date and so on with each major change made and;

2. Details of major changes made will be recorded in Section 1.0 Alterations And Additions To Handbook. Details of minor editorial changes that do not require a major version change will be recorded here as well.

3. Associated documents that are hyperlinked from this handbook will have their own document version control process. The only exception is when opening up technical support documents (e.g. parts description from a supplier) that TasNetworks has no control over.

2•2•5 Disclaimer

The material contained within this publication has been developed for the use and guidance of Electrical Practitioners and other personnel working on or in close proximity to Tasmanian Power Distribution Supply assets.

No person should act on the basis of any matter contained in this publication without first considering, and if necessary, taking appropriate professional advice upon his / her own particular circumstances.

TasNetworks Pty Ltd disclaims all and any liability to any person or company, whether a purchaser of this publication or not, in respect of anything and of the consequences of anything done, or omitted to be done, by any such person, or persons, in respect wholly or in part to the information contained within this publication.

2•2•6 Copyright

3•0 REFERENCES

3•1 Referenced Documents

This Handbook makes reference to the following key relevant documents :-

- Handbook for Linesmen 1985.
- Distribution Overhead Line Design & Construction Standard.
- Load Restraint Guide – Safe Carriage of Loads on Road Vehicles
- Australian Standards.
- Energy Networks Association (ENA) of Australia Codes and Guidelines.
- Federal and State Government Legislation and Codes Of Practice.
- Worksafe Australia – National Occupational Health & Safety Commission Standards, Codes and Guidelines.
- Workplace Standards Tasmania documentation.

3•2 Other Related Documents

The documents listed below have a direct bearing on the Line Worker in his/her role but they sit independently and have not been duplicated in this Handbook but have been made accessible via hyperlinks in this handbook.

TasNetworks :-

- Safety Procedures and Safe Work Method Statements.
- Specific, Work Practices, Procedures, Guidelines and Technical support documents.
- Distribution Construction Manuals.
- Street Lighting Manual.
- Service And Installation Rules.

4•0 DEFINITIONS

Access Authority.

Means any form of authorisation, which allows access to work on or near, or for the testing of, apparatus.

Access, egress and transfer.

Vertical or horizontal movement of a person

Accident.

An incident which causes personal injury or loss / damage to TasNetworks Assets

Aloft.

At or above the minimum height specified by jurisdictional requirements at which fall prevention measures are to be applied.

Anchorage.

A secure attachment on a structure to which a fall arrest device, or lanyard assembly or restraint line may be attached.

Apparatus.

Means electrical apparatus and mechanical apparatus.

Approved.

Means having appropriate organisation endorsement in writing for a specific function.

Attached.

Continuously connected to a structure or platform.

Attached Climbing.

Continuously connected to a structure or platform while accessing, egressing from, working upon or transferring between.

Authorised Person.

Means a person with technical knowledge or sufficient experience who has been approved, or has the delegated authority to act on behalf of the Organisation, to perform the duty concerned.

Bare.

Means, in relation to a conductor, not insulated.

Barrier.

Means a rope, tape, barricade or alternative erected in accordance with approved procedures.

Bond.

The connection of conductive objects together in such a manner as to ensure that they are at the same electrical potential.

Brush Contact.

Inadvertent momentary contact with an insulating barrier covering energised conductors or equipment.

Cable.

Means an insulated conductor, or two or more such conductors, laid together, whether with or without fillings, reinforcements or protective coverings. Cable for the purpose of this document also means Aerial Bundled Cables (ABC).

Certificate.

A document issued by a Registered Authority, as confirmation that an individual has been assessed and deemed competent to perform specific tasks.

Certificated.

A person who has satisfactorily completed training and been assessed as competent to the standards for which a certificate is issued.

Competent.

Having the skills, knowledge and attributes a person needs to complete a task safely and to required standards.

Competency.

Acquisition through training, qualification or experience or a combination of those things, of the knowledge, skills and attitudes required to undertake the assigned task competently.

Conductor.

Means a wire, cable or form of metal designed for carrying electric current.

Confined Space.

Means confined space as defined in Australian Standard, "AS/NZS 2865 Safe Working in a Confined Space".

An enclosed or partially enclosed space that is at atmospheric pressure during occupancy and is not intended or designated primarily as a place of work, and

(a) is liable at any time to :

- (i) have an atmosphere which contains potentially harmful levels of contaminant.
- (ii) have an oxygen deficiency or excess.
- (iii) cause engulfment.

(b) could have restricted means for entry and exit.

Control Measures.

Means policies, standards, procedures or actions to eliminate, avoid or minimise risks.

Covered.

Shielded, surrounded or covered with an approved insulating material such as rubber or PVC insulating mats and hose or PVC covered conductor.

Current Rating.

The maximum current permitted to flow (under defined conditions) through items of equipment that form part of a power system.

Current Transformer (CT).

A transformer used with meters and/or protection devices in which the current in the secondary winding is, within prescribed limits, proportional to the current in the primary winding.

Dead.

Apparatus which is isolated and at earth potential, but may be subject to induced voltages.

De-Energised.

Disconnected from all sources of supply but not necessarily isolated, **tested** and **earthed**.

Do Not Operate Tag.

Means an approved tag, used in accordance with approved procedures, warning of a particular hazard or hazardous condition that is likely to be life threatening.

Earthed.

Electrically connected to the general mass of earth by means of an approved earthing device to ensure and maintain effective discharge of electrical energy.

Electrical Apparatus.

Electrical equipment including overhead lines and underground cables, the conductors of which are alive or can be made alive.

Electrical Connection.

A jointing of two or more conductive materials by clamping, bolting, compression, welding or other method for the purpose of allowing electricity to flow through them.

Electrical Operator.

A person authorised to carry out operating work on electrical apparatus in accordance with the TasNetworks Power System Safety Rules.

Electricity Network.

Means transmission and distribution systems consisting of electrical apparatus which are used to convey or control the conveyance of electricity between generator's points of connection and customer's points of connection.

Elevating Work Platform or EWP.

Means a vehicle on which a boom type mechanism, either articulating or telescoping, is installed. The mechanism is designed and used for the positioning of personnel at work sites or for positioning both personnel and equipment at work sites.

Emergency.

A situation where danger exists to human life, equipment or property.

Employee.

An employee of TasNetworks Pty Ltd, whether under a contract of employment or training, and includes a Contractor, and a person employed by a Contractor or Service Provider, who carries out work for TasNetworks Pty Ltd.

Employer.

Means TasNetworks Pty Ltd or Authorised Service Provider, as the case may be who engages a person to perform work.

Energised.

Means connected to any source of energy.

Exposed Conductor.

Means an electrical conductor, approach to which is not prevented by a barrier of rigid material or by insulation which is adequate under a relevant Australian Standard specification for the voltage concerned.

Fall Arrest System.

An assembly of interconnected components comprising a harness connected to an anchorage or anchorage system, either directly or by means of a lanyard or lanyard assembly, for the purpose of arresting a fall.

Fall Arrest Harness.

An assembly of interconnected shoulder and leg straps, with or without a body belt, designed for attachment to a lanyard or other type fall arrest device as specified in AS/NZS 1891.3 and used where there is a likelihood of free fall or restrained fall.

Footed.

Means physically supporting a portable ladder at the base, to prevent unintentional movement.

Hazard.

A source of potential harm or a situation with potential for harm.

High Voltage.

Voltages exceeding 1000 volts.

Incident.

An unplanned event, which may or may not have resulted in harm to people damage to property or the environment or loss to process.

Insulated.

Means separated from adjoining conducting material by a non-conducting substance which provides resistance to the passage of current, or to disruptive discharges through or over the surface of the substance at the operating voltage, to mitigate the danger of shock or injurious leakage of current.

Insulating Barrier (also called cover up equipment).

A barrier of insulating material specifically designed, approved and tested for use as a cover for lines, insulators, cross arms, terminations or similar equipment. **Insulating barriers** are intended to prevent personnel making accidental **brush contact** with **live** components or equipment at a different potential. (Used by Live Line Workers on live high voltage work).

Insulated Elevating Work Platform.

An approved and tested insulated telescopic device or articulating device or any combination thereof used to position personnel, equipment and material at work locations, and to provide a working area for persons elevated by and working from the platform.

Insulating Cover.

A pipe or tube drape, blanket or wrapping of insulating, non-hygroscopic material applied on or around conducting mains, apparatus, surfaces and pipes so as to prevent inadvertent contact and provide an electrically safe barrier for personnel or equipment working in the vicinity. (Used by Line Workers on live low voltage work).

Insulating Gloves and Sleeves.

Gloves and sleeves specifically designed, approved and tested to a rated voltage. (Used by Live Line Workers on live high voltage work).

Insulating Mat.

A mat of insulating and non-hygroscopic material intended to effectively provide an electrically safe barrier on which the user can stand, kneel or be otherwise supported. (Used on the ground for live low voltage work).

Isolated.

Disconnected from all sources of supply by breaks of a length (distance appropriate to the voltage and insulating medium and rendered incapable of being made alive without premeditated and deliberate manual operation).

Issuing Officer.

A person authorised by the Operating Authority to issue a Permit to Work.

Lanyard Assembly.

An assembly of a lanyard and a personal energy absorber.

Limits of Approach

(see Minimum Approach Distance below).

Line Work.

Is work carried out on any part of a power line, including underground cables, that is part of a power system network.

Line Worker.

A person who holds an Electrical Practitioner – Line Worker electrical licence in Tasmania and is trained and authorised to perform line work.

Live (or alive).

Connected to a source of electrical supply.

Live Line Equipment.

Approved tools, rope, insulating equipment and other gear used for **Live Line work**.

Live Line Glove and Barrier Method.

A method of performing line work on live circuits up to and including 33 000 volts using approved insulating gloves and sleeves, insulating platform and/ or insulated elevating work platform and insulating barriers.

Live Line Permit.

A permit or authorisation issued by the Distribution Operating Authority, to verify to a **Live Line work** party the control measure in place on the circuit being worked on, and to authorise work.

Live Line Rope.

Commercial grade synthetic, polypropylene, rope which is known to have good insulating properties. **Note**. *Live Line rope is not Insulating Rope*.

Live Line Stick (*also called Hot Stick*).

A length of insulating material specifically designed approved and **tested** for use to physically bridge the distance between the **energised** apparatus and earth or between adjacent phases; and to enable physical loads to be taken or tools to be applied to the stick.

Live Line Stick Method.

A method of performing line work live using tools and equipment attached to Live Line sticks with the line worker maintaining the minimum safe approach distance from energised apparatus.

Live Line Work.

Work performed on apparatus capable of being energised without implementing the full protective practice of isolating, proving de-energised and earthing at the work-site.

Low Voltage.

A voltage not exceeding 1000 volts ac. or 1500 volts dc. as defined in AS/NZ 3000.

Manual Re-close.

Means an action taken, under the direction of or by the Distribution Operating Authority, involving manually re-energising an electrical circuit in an attempt to restore supply or locate a faulty system.

Minimum Approach Distance.

The minimum air gap that shall be maintained between a worker and any other component at different potential during line work, in order to prevent flashover and provide for worker safety.

Minimum Tool Insulation Distance (*also called effective length*).

The distance that insulating material (stick or rope) is subjected to contacting energised conductors. This distance shall be measured between the metal end fitting at the conductor end of the insulating material and the metal end fitting or hand mark, where provided, at the opposite end of the insulating material.

When Live Line sticks consist of sections joined with metal couplings, the insulation distance shall be the total of each of the lengths of insulating material which have not been bridged out by the metal couplings.

Mobile Plant.

Any mobile equipment capable of raising or lowering a load. When in travelling mode - it is considered a vehicle and Limits or Minimum Approach distances for vehicles apply.

Must.

The word “must” is similar to “shall” and refers to mandatory requirements.

Near.

Working at distances up to the specified Minimum Approach or Limits of Approach distances.

Operating Work.

The operation of switches, opening and closing of links, removal or replacement of other connections intended for isolation, removal or replacement of fuses, proving that electrical apparatus is de-energised and the earthing and short-circuiting of electrical apparatus. The issue and cancellation of Access Permits is included.

Operator.

See definition for Electrical Operator.

Operating Authority.

The Network Service provider responsible for supervision and operation of the power system.

Ordinary Person.

Means a person without sufficient training or experience to enable them to avoid the dangers which electrical apparatus may create.

Other Cable Systems.

Means telecommunications cables, control cables, aerial earthed cables or electrolysis drainage cables.

Overhead Line.

Means any aerial conductor or conductors with associated supports, insulators and other apparatus erected, or in the course of erection, for the purpose of the conveyance of electrical energy.

Person in Charge.

The person in charge of a facility or work-site or a person designated to exercise control over a specific work function.

Personal Protective Equipment (PPE).

Means clothing, equipment and / or substances, which when worn or correctly used, protect parts or all of the body from foreseeable risk of injury or disease at work or in the workplace.

Portable Ladder.

A ladder designed, constructed and used in an inclined standing mode, in accordance with AS / NZS 1892 series.

Qualified.

Deemed competent, on the basis of appropriate training and authorised assessment, to carry out the work to which the qualification pertains.

Rated Voltage.

The manufacturer's recommended maximum voltage that shall be applied to specified equipment.

Readily Accessible.

A position where something is placed to ensure it is visible and easily accessed in an emergency.

Recipient in Charge.

An authorised recipient to whom an Access Authority, Vicinity or Test Permit has been issued and who is in charge of the work-site to which the Permit applies.

Recloser.

A form of circuit breaker, usually suitable for pole mounting, designed for a multi-shot operating sequence and with built in devices for fault sensing and reclosing.

Risk.

The chance of something happening that has the potential to cause injury or harm the health of a person. It is measured in terms of consequences and likelihood.

Risk Management.

Means the management of risk in accordance with Australian Standard AS 4360, Risk Management.

Safe.

Means not posing an unacceptable risk to life, health or property.

Safe Approach Distance (SAD)

Same as **Minimum Approach Distance**

Safe Working Load (SWL).

The maximum load (in kilograms [kgs]) which shall be applied to the specified equipment, apparatus or hardware.

Safety Observer.

Note. A Safety Observer may also be called a "Watcher or Spotter".

Has the definition and requirements given to it in the:-

1) PSSR when working under the PSSR rules in the field.

2) Live Low Voltage Work Manual when these rules apply in the field..

Sectionaliser.

An isolating switch, usually suitable for pole mounting, which is arranged to open automatically during a pre-selected dead time interval in the operating sequence of a controlling circuit breaker or recloser, on the occurrence of a sustained fault beyond the sectionaliser.

Secure.

Free from or not exposed to danger. Safe and not liable to fall or become displaced.

Secured.

Lashing, clamping or otherwise fixing of the ladder to the structure against which the ladder has been placed or to some other "medium" close by such as : trees, fence posts or stakes driven into the ground.

Service Line.

The terminating span of an electric line ordinarily used for the supply of electricity at Low Voltage and through which electricity is, or is intended to be, supplied by a Network Service Provider to a Customer's point of supply.

Shall.

The word "shall" refers to MANDATORY requirements.

Should.

The word "should" is used in a discretionary / advisory sense.

Special Effort.

Means to deliberately shift position or overreach. Beyond what could be reached by normal movement of one or both arms.

Test Permit.

A documented form of authorisation that allows access to High Voltage apparatus for testing.

Tested.

Apparatus which has been tested in accordance with the relevant Standard or work practice.

Test Voltage.

The voltage which shall be applied to specified equipment for the purpose of periodic electrical testing.

Transformer.

A plant or device that reduces or increases the voltage of alternating current.

Vicinity.

Working in the vicinity of live electrical apparatus at distances up to the Vicinity Minimum Approach or Limits of Approach distances.

Vicinity Authority.

A form of authorisation, to be used when applicable, to allow work in the vicinity of live electrical apparatus.

Voltage.

The electronic force or electric potential between two points that give rise to the flow of electricity.

Voltage Transformer (VT).

A transformer for use with meters and / or protection devices in which the voltage across the secondary terminals is, within prescribed error limits, proportional to the voltage across the primary terminals.

Watcher.

An appropriately trained and competent employee assigned the duty of observing the work activity and warning against approach to live electrical apparatus.

Note. A Watcher would generally be referred to as a "Safety Observer".

Work Area.

The area within normal body reach of the line workers working position.

Working on.

Touching conducting parts or working closer than at normal or special Minimum Approach or Limit of Approach distances.

5•0 ELECTRICAL AND WORK COMPLIANCE

Click on page No. to go to topic.

5•1 Building Standards & Occupational Licensing

The Tasmanian Government Department, Building Standards & Occupational Licensing (BSOL) administers the Tasmanian Electrical Legislation and associated Licensing Regulations and Codes Of Practice related to electrical work through :-

1) The BSOL, Electrical Standards & Safety (ESS) Group that oversees compliance of work performed by TasNetworks employees and associated Authorised Service Providers and;

2) An external Service Provider for inspection of electrical work performed on privately owned electricity assets.

5•2 Authorised Service Provider (ASP) Scheme

To be permitted to perform work for TasNetworks within the Power Distribution System, Service Providers must be accredited under the TasNetworks, **Authorised Service Provider Scheme** and then comply with, the ASP Work Practice/Technical Specification For Overhead Work and, any additional requirements contained in this handbook.

5•3 Legislation

The following are the key parts of Tasmanian Government Legislation that persons performing electrical and line work must comply with :

5•3•1 Occupational Licensing Act (OLA)

The OLA covers requirements for persons to hold a practitioners license to perform work defined as electrical work.

5•3•2 Electrical Licences - Permitted Scopes Of Work

In Tasmania it is possible for persons to hold any or all of the following licenses.

The permitted scope of work for the type of licence held is in accordance with the Occupational Licensing (Electrical Work Classes) Determination 2016 and described as follows :-

5•3•2•1 Electrical Practitioner License - Line Worker

5•3•2•1•1 Licensing Requirements

The following is an extract from the Licensing Determination.

"A practitioner who holds a line worker licence may carry out electrical work to install, repair, alter or remove overhead electricity lines cables and wires, and supporting or protective structures, including street lighting and control lines, cables and wires, for;

The construction, erecting, installing, stringing, augmenting, testing, energising, servicing, maintaining, fault finding, altering, removing, repairing or replacing:

(i) overhead electrical cabling/network systems, hardware, apparatus and equipment, excluding electricity consumption metering and cable jointing work; and

(ii) the aboveground portion of underground cables associated with overhead electricity network systems."

From the Licensing Determination TasNetworks has obtained a clarification from BSOL that Line Workers can perform work on and test private spans of overhead supply conductors and this also applies where privates spans are beyond the POS

5•3•2•1•2 TasNetworks Requirements

As the above Licensing Determination only allows Line Workers to perform work on overhead line this means that Line Workers are not permitted to perform electrical work and testing :-

(a) On consumer mains.

(b) On electricity metering equipment.

(c) At customer switchboards.

(d) On underground supply cables except for the overhead portion.

The only exception to the above is if a Line Worker :-

- Also holds a current Electrical Practitioner License Electrical to operate as a dual trader or;
- Is authorised to perform a limited scope of work at the customer metering/switchboard subject to enrolling and completing a training course under the TasNetworks Electrical Safety Management Scheme (ESMS) in compliance with the following :-

(a) ESMS Management Plan Metering Work At Customer Switchboard.

(b) ESMS Metering Work At Customer Switchboard Work Practice Technical Specification.

NOTE : Line Workers have a responsibility to test, inspect, verify and certify electrical work they have done is, to proper construction standard and, electrically compliant prior to and after energisation of supply.

5•3•3 Exemptions Order

In accordance with the relevant Legislation, an Exemptions Order allows work defined under the Order (as electrical work) to be performed by persons not holding an Electrical Practitioners license subject to being accredited under an approved course of training.

TasNetworks employees, under the **Occupational Licensing (Electrical Infrastructure and Installation Exemptions) Order** can perform the work of **inspecting, erecting and staking poles and associated structures** without holding a practitioners license due to an having approved course of training for pole staking.

Note: Service Providers working for TasNetworks performing similar work must ensure only licensed employees can perform this work unless the Service Provider has an approved course of training under the relevant Exemptions Order.

5•3•3•1 Performing Pole Staking Work

Under the Exemptions Order, TasNetworks employees must perform pole staking work in accordance with the following requirements :-

- Pole Staking Work Standard

This standard covers all aspects of pole staking work and is used for compliance, training and reference.

- **Pole Staking Field Guideline**

This is a single page double sided quick short cut guideline for use out in the field by employees once they have been trained and accredited.

- **Staking Private Poles**

Shall comply with equirements contained in **Green Alert** on staking private poles.

5•3•4 Electrical Safety Management Scheme (ESMS)

Where an Exemptions Order is not applicable, **Part 8 of the Electricity Industry Safety And Adminsitration Act 1997** allows for specified electrical work to be performed by persons not holding a practitioners license, subject to an Electrical Safety Management Scheme (ESMS) being developed, validated and, submitted to BSOL for approval and, after approval, gazetted under Tasmanian Legislation.

TasNetworks has an ESMS approved that permits employees holding just a Line Worker practitioners license to perform restricted electrical work defined under the ESMS beyond the POS subject to being trained and accredited under the ESMS.

Note: Service Providers working for TasNetworks must ensure only employees licensed as Electricians can perform electrical work beyond the POS unless the Service Provider has an ESMS approved by BSOL.

5•3•4•1 Line Workers Working Beyond The Point Of Supply (POS)

Only TasNetworks trained and accredited Line Workers who do not hold an Electrical Practitioner – Electrician License, in accordance with the following ESMS Management Plan, are permitted to perform limited work at customer switchboards beyond the POS :-

- **ESMS Management Plan For Work At Customer Switchboards**

Note: The type of electrical work allowed to be performed is restricted to what is prescribed in the following work practice :-

- **ESMS Work Practice For Work At Customer Switchboards**

5•3•5 Contractor's License And Nominated Manager

It is a requirement under Tasmanian Licensing Legislation that a :-

- **Contractor's license** is required if you enter into a contract to carry out any electrical work; or employ another person to carry out any electrical work; or have the management or control of any other person carrying out any electrical work**.**

- **Nominated Manager** is required as the person in an electrical contractor's business who is responsible for certifying that the work complies with relevant electrical standards.

Note: Service Providers must hold a Contractor's license and have a Nominated Manager appointed to be engaged to perform electrical work for TasNetworks.

5•3•6 Certification Of Completed Work

Tasmanian Legislation requires that all completed electrical work must be "certified" as being correct in regard to :

- All relevant electrical tests have been conducted to confirm all electrical circuits and associated apparatus is electrically compliant and free of any fault prior to livening up and commissioning.

- All relevant electrical tests have been conducted during live commissioning to confirm all electrical circuits and associated apparatus is electrically compliant and this infrastructure is made safe for public use i.e. polarity, phase sequence, earth protection etc. is correct.

- The quality of electrical infrastructure construction and maintenance work is completed to the standard required, as contained in relevant Australian Standards (e.g. the AS/NZS AS3000 Wiring Rules) and TasNetworks Construction Standards, Work Practices and Work Guidelines.

- All relevant paper work (e.g. electrical test forms, works orders, sign off inspection sheets etc.) are properly filled out and dated and signed off by a licensed Electrical Practitioner and;

- This information is properly filed away for as completed records for future reference and retrieval when required.

5•3•7 Certification Of Electrical And Infrastructure Work

Employees and Service Providers working for TasNetworks must comply with the requirements of the following ESMS Management Plan and, Work Practice for certification of electrical work :-

- **ESMS Management Plan For Certification Of Electrical Work**
- **ESMS Work Practice For Certification OF Electrical Work**

In addition, all electrical work and associated infrastructure construction and maintenance work performed on the Power Distribution System (e.g. install or replace power poles, cross arms and fittings etc.) must be certified as being done to a satisfactory standard in accordance with the construction standards used and issued by TasNetworks via;

- TasNetworks employees filling out and signing the relevant sections covering electrical and infrastructure work in the **Electrical Work Certification (EWC) Form** and attaching this to "as built" paperwork for input into the asset management record keeping system.
- Service Provider employees filling out a similar form provided by the Service Provider, such as a Certificate of Electrical Compliance (CEC).

Note: A copy of this certification form must be attached to "as built" paperwork and forwarded to TasNetworks for input into the asset management record keeping system.

5•4 Competency

5•4•1 Minimum Qualifications Required

In addition to the minimum qualifications listed in this handbook, there may be additional pre-requisites listed in specific work practices in this Handbook that both Service Provider and TasNetworks employees must comply with and, this may require additional training.

5•4•2 Recognition Of Interstate Qualifications

- Persons from Interstate or outside Australia must apply to BSOL to have their electrical practitioners license checked and endorsed and;

- Must provide this evidence to TasNetworks, Training School at Mornington, Hobart for confirmation and;
- There may be a requirement for the person(s) involved to attend specific training to cover off any additional requirements and accreditations required by TasNetworks to be permitted to work within the Tasmanian Power Distribution System.

5•4•3 Training and Refreshers

It is the responsibility of Line Managers, Team Leaders and employees of TasNetworks and Service Providers to ensure minimum accreditations and authorisations required to perform line work are attained and are current through training and refresher training in accordance with :-

The general requirements of this Handbook.

- Any specific additional training required as detailed in associated linked Work Practices and Work Practice Procedures in this handbook.
- Any specific training detailed in the **ASP Work Practice/Technical Specification For Overhead Work** for Service Providers.
- A significant amount of lead time is required where TasNetworks provides training. Therefore, Service Providers must book in training for employees as early as possible in consultation with the TasNetworks Training Centre.
- **Note**: All details of qualifications and completed training and refresher training must be recorded and stamped in the ESI passport and this must be available on site to be produced as evidence if an audit is conducted.

5•5 Apprentices

TasNetworks, Managers and Team Leaders etc. must ensure electrical apprentices comply with and do not breach the **Apprentice Supervision Standard**.

Service Providers will need to ensure they have their own apprentice supervision guidelines and manage apprentices to the guideline.

5•6 Australian Standards And Construction Standards

Persons performing work on Power System Supply infrastructure must ensure design, construction and quality of work complies with requirements of the following main documents :

1. This handbook, the Line Work Handbook, for work practice requirements.

2. TasNetworks:

    - Legacy Overhead Design Construction Manual
    - New Distribution Overhead Construction Manual
    - High Voltage ABC Conductor Manual
    - Low Voltage ABC Conductor Manual

3. AS/NZS 7000 Overhead Line Design Standard.

4. **AS/NZS 3000 Wiring Rules and associated Standards** (for work performed on privately owned LV supply infrastructure assets).

5. AS 2067 High Voltage Installations Exceeding 1 KV (for work performed on privately owned HV supply infrastructure assets).

5•7 Service & Installation Rules

TasNetworks Service & Installation Rules contains all the following requirements that Service Providers, Authorised Metering Installers (AMIs), Designers, Consultants and the like must comply with in regard to :

1. Connecting to the Power Distribution System.
2. Covers the low voltage electricity supply.
3. Servicing arrangements.
4. Metering.

5•8 Environmental

5•8•1 General Requirements

Comply with TasNetworks Environmental Handbook.

Associated work practices can be found in the Environmental Section on the internal or external Work Practice Web site.

5•8•2 Vegetation Management

Only Authorised Service Providers are permitted to carry out full scale vegetation management near overhead power lines and, shall comply with the follow work practice and ENA Guideline.

Work Practice/Technical Specification Vegetation Management

ENA Guidelines For Safe Vegetation Management Near Live OH Powerlines

5•9 Access To Perform Work

5•9•1 N.E.C.F. Requirements

5•9•1•1 General

The **National Electricity Customer Framework (NECF)** is a Federal Government body set up to administer a set of new energy regulations that protects the interests of customers connected to the Power Distribution System.

As TasNetworks has signed up with NECF, TasNetworks must comply with a number of NECF obligations on customer connection notifications as per the National Energy Retail Rule (NERR) Disconnections rules and;

If obligations have been breached TasNetworks can be sanctioned and/or fined.

Therefore, it is very important that all persons working for or on behalf of TasNetworks make sure they understand and comply with the NECF obligations and make sure these are not breached.

5•9•1•2 Customer Notification Of Life Support Change

If a customer advises a TasNetworks team member or contractor that:

1. They or somone residing at the premises are a life support customer or alternatively,
2. They are no longer a life support customer, the following steps must be followed :-
   - Call the fault centre crew line on 1800 638 449 - To allow Fault Centre team

members to record customer details including customers name, contact number, address and NMI.

(FAULT CENTRE CREW LINE - INTERNAL NUMBER DO NOT GIVE TO CUSTOMERS).

- Advise the fault centre of the customers details and if they require life support to be applied to or removed from the NMI.

This is a requirement under the National Energy Retailer Rules.

If the customer would like to speak further with TasNetworks about this, or any other issue, please direct them to the Customer Service Centre: 1300 137 008

5•9•1•3 Process For Customer Notification

The general process to follow regardless if the customer or TasNetworks initiates the work is via the **Customer Connections Process**.

Where work has been initiated by TasNetworks and this requires the electricity supply to be disconnected, unless it is a safety issue or an emergency (e.g. power outage caused by a storm), the NECF obligations for customer notification must be complied with (e.g. sufficient advance notification given to customers on life support) via :-

- Issue of a **Customer Interruption Acceptance Form.**

5•9•2 Rights To Enter Private Property

In accordance with section 58 of the ESI Act 1995, persons are required to have an Electricity Officer ID card to enable lawful entry onto private property to perform electricity supply/customer connections work.

5•9•2•1 TasNetworks Employees

Persons performing work that requires access onto private property *shall* be issued with an Electricity Officer Card via the following process :

Fill out an **Application Form** to apply for a card.
Email the filled out Application Form via **EO.Cards@tasnetworks.com.au** for processing.

1. After processing is completed the applicant will be issued with an **"Instrument Of Appointment"** in writing and *must* comply with the conditions imposed in regard to powers of entry granted to access private property to carry out work and;

2. An Electricity Officer ID card will be issued, and *must* be carried at all times to be produced if access onto private property if challenged by the customer.

5•9•2•2 Service Provider Employees

Service Provider employees are also required to have an Employee ID card when accessing private property when working for or on behalf of TasNetworks.

Contact TasNetworks, Training Centre to obtain an ID card and, you will need to supply, a good electronic picture i.e. head shot of each employee from the shoulders up, their employee number and, details of the work they will be doing.

5•9•3 Public Access & Clearances To Supply Infrastructure

Unless authorised otherwise by TasNetworks, public access and clearances to energised power supply infrastructure shall be in accordance with the following :

- **Guidelines When Working Near TasNetworks Assets**

  The above guideline contain requirements for customers to contact TasNetworks and provide sufficient notice when needing access to work near energised power supply infrastructure.

- **A Guide For The Public Working Safely Near Overhead Power Lines**

- The relevant sections in the PSSR for clearance (i.e. SADs) for private vehicles and plant.

5•9•4 Work On Council Owned Infrastructure

For public safety, TasNetworks employees and Service Providers must comply with the following guideline to ensure Council owned infrastructure, such as footpaths, is restored and reinstated to a proper standard to avoid creating a public hazard (e.g. a trip hazard if hole not properly back filled after pole removal).

- **Guideline For Working On Council Owned Infrastructure**

5•9•5 Access Near UG Services

Where overhead infrastructure, such as power poles, will be installed near existing underground services, such as where gas pipes are likely to be buried nearby, the DIAL BEFORE YOU DIG 1100 process must be used before any excavation can occur and;

It may be necessary to engage a TasNetworks or Private underground **Cable Locations Officer** to locate, in accordance with work practice Locate Underground Services and warn of, underground cables and other services within the vicinity of the work zone to avoid when excavating.

When it is okay to excavate, if an underground cable or other service is close by, careful hand digging (also known as pot holing) must be used to carefully locate where the cable or other underground services are before proceeding with major excavation e.g. using a pole hole borer erector unit.

5•10 Driving Vehicles & Traffic Management

5•10•1 Driving Vehicles

- Special requirement to Check Fire Extinguishers.
- Driving Light Vehicles On Public Roads.
- Driving Off Road And In Remote Areas.
- Driving At Night And In Adverse Conditions.
- **Guide –** Transporting High Loads Near OH Power Lines

5•10•2 Traffic Management

In general, employees and Service Providers shall comply with the Australian Traffic Standard AS 1742.3.

Employees must have “Implement Traffic Plan” accreditation to be able to implement a Traffic Management Plan (TMP).

Where ever possible employees shall implement the non-complex TMPs provided by TasNetworks, by selecting an appropriate TMP from the **Traffic Mgt. Selection Matrix**. A Traffic Mgt. Contractor should only be called in where a complex TMP is required e.g. at a major intersection, round about or, on a built up section of a highway.

5•11 Responsibility

TasNetworks and Service Provider employees at all levels (includes Line Managers, Project Managers, Team Leaders etc. in charge of field employees) must ensure they comply with the requirements contained in this Handbook to ensure distribution line work is carried out in a safe and professional manner.

5•12 Auditing

TasNetworks reserves the right to conduct unannounced field site audits to check that all employees and Service Providers comply with the requirements of this handbook and any other associated compliance requirements.

5•13 Consequences Of Non Compliance

For Service Providers, if a non-compliance is found it will be managed under either or both of the following :-

1. The Authorised Service Provider Scheme and may result in :-

   The person involved being stood down from being permitted to continue working on site (may be immediate if enforced by the Field Auditor for a major non-compliance) until the problem is rectified and;

If the non-compliance found is severe enough (e.g. a major safety breach), it may result in all the Service Provider work force being stood down until the issue is rectified to the satisfaction of TasNetworks Pty Ltd.

For TasNetworks employees, non-compliance will be dealt with in accordance with relevant TasNetworks policies and procedures and, if the non-compliance is severe enough, disciplinary action may apply.

2. Breach of Contract Conditions - handled by TasNetworks, Contracts Section.

6•0 SAFETY

Click on page No. to go to topic.

6•1 Power System Safety Rules (PSSR)

The Power System Safety Rules (PSSR) applies across the Power Supply Distribution Network for all levels of voltage down to the Point Of Supply (POS) connection.

Nothing overrides the requirements of the PSSR and all employees and Service Providers, where applicable, must comply with the following requirements contained in the PSSR.

Unless specified otherwise in this handbook, the minimum Safe Approach Distances (SADs) detailed in the **Power System Safety Rules (PSSR)** shall be complied with by persons and/or machinery and plant working on or near energised power system supply infrastructure.

6•2 PSSR Safe Approach Distances (SADs)

6•2•1 Ordinary Person

An "Ordinary Person" is a person without any formal training and knowledge of the dangers and risks associated with working on or near the Power Supply Distribution Network and is at the most risk when working near energised apparatus and therefore the SADs for Ordinary Persons are greater than for trained persons.

Ordinary Persons shall comply with the SADs listed in **Section 5.3 of the PSSR.**

6•2•2 Instructed Person

An **Instructed Person (IP)** is a person trained to understand the dangers and risks associated with working on or near energised apparatus.

It is a general requirement that persons have been trained and accredited with IP status as a minimum to be permitted to work within close proximity to energised Power Supply apparatus.

Persons with IP accreditation are permitted to work to the SADs in **Section 5.4 of the PSSR**.

6•2•3 Authorised Person

An "Authorised Person" is a level above an IP and could be a person trained and formally authorised under the PSSR as a Person In Charge (PIC) or an Authorised Issuing Officer (IO).

SADs for Authorised Persons shall comply with **Section 5.4 of the PSSR**.

6•2•4 Mobile Plant

SADs for mobile plant (Prolines, EWPs, and Cranes etc.) shall comply with the following requirements :

1. Operated By An Ordinary Person.

   Section 5.5 of the PSSR

2. Operated By An IP Or Authorised Person.

   Section 5.6 of the PSSR

6•2•5 Vehicles

1. Operated by An Ordinary Person.

   Section 5.7 Table 5 of the PSSR

2. Operated By An IP Or Authorised Person.

   Section 5.8 Table 6 of the PSSR

6•2•6 Safety Observer

A Safety Observer is used where, the PSSR applies or, required when working under the rules of the Live Low Voltage Work Manual.

A full definition of a Safety Observer and the allowable extent of work duties is described in the PSSR under **Section 3.6**.

A full definition of a Safety Observer and the allowable extent of work duties is described in **Section 6.12 Safety Observer** in the Live Low Voltage Work Manual.

In essence, a Safety Observer is restricted to the sole task of observing that SADs will not be breached by persons or mobile plant when work is performed in close proximity to energised electricity supply apparatus.

Note: Unless holding an Electrical Practitioners license, a Safety Observer is not permitted to perform a rescue of any person in contact with live apparatus or within the SADs to live LV apparatus, as this would breach the OLA rules for performing electrical work.

6•2•7 Person In Charge

In accordance with the PSSR where an Access Authority has been issued by an Authorised Person (e.g. to de-energise and isolate a section of power lines to be worked on) there must be at least one person on site with Person In Charge (PIC) accreditation to be able to :

- Receive the Access Authority and;
- Manage work is being carried out safely in accordance with the restrictions, safety requirements and, any other requirements listed on the Access Authority.

6•3 Safe Work Method Statements

Under Federal Legislation there is a requirement that Safe Work Method Statements (SWMS) are developed and adhered to for high risk tasks and, working in the electricity supply industry involves high risk tasks.

Therefore, all persons working for or on behalf of TasNetworks shall perform work in a safe manner under the controlling framework of a SWMS where applicable.

Service Providers working for or on behalf of TasNetworks shall have their own developed SWMS and ensure employees work to these SWMS. As a guide to determining when a SWMS is required, the following is an extract from the **National Code Of Practice For Construction Work** :-

When a SWMS is required

The following is a list of SWMS are for use by TasNetworks employees :-

TasNetworks List Of SWMS

6•4 Job Risk Analysis (JRA)

A Job Risk Analysis (JRA) is used at each work site to identify the hazards and mitigation control measures (based on the "hierarchy of controls" under the Work Place Health & Safety Act) to be implemented to allow work to be performed in a safe manner.

Where a SWMS is available and covers off all the known risks at a work site then a JRA is not necessarily required unless there are some safety risks not covered by the SWMS or there is a need to write all the work steps where work is of a technical or complex nature.

Service Providers working for or on behalf of TasNetworks are required to use their own JRAs in the field.

6•5 Safety Alerts

Safety Alerts are issued out by the Power Supply Authority, Safety Group, under any of the following scenarios :

1. Safety incident that has occurred involving a TasNetworks employee or a Service Provider working for TasNetworks.

2. A Safety Alert issued out via other means, such as by another TasNetworks or Work Standards Tasmania etc.

The Safety alert may contain general safety awareness information or require immediate attention and compliance from employees or Service Providers until a follow up safety instruction or work practice is developed and rolled out.

The following is the current list of TasNetworks Safety Alerts:-

List Of Safety Alerts

6•6 Work Practice

A Work Practice (WP) is written for a single task that is technical or complex in nature and covers the important steps for the task (e.g. Operating Chainsaws). The WP is usually no more than two pages in length and contains a WP identifying number and is dated and signed with a version control number.

All current approved WPs for TasNetworks employees are available on the **internal Work Practice Web Site** and as linked documents in this handbook and, the WPs can easily be opened up on field lap top computers.

Unless there are any specific WPs mentioned in this handbook that Service Provider employees must comply with;

TasNetworks requires Service Providers to have their own WPs developed and used out in the field and;

These WPs must be equivalent or better than the WPs TasNetworks has listed on the External Work Practice Web as reference, which Service Providers can access with a Username and Password. This also applies to the following Work Practice Procedures and Safety Policies/Procedures.

6•7 Work Practice Procedure

A Work Practice Procedure (WPP) is written to cover a number of tasks involved in a work function i.e. a collection of individual WPs in the one procedure. An example of this is the WPP for Installing And Commissioning A pole Mounted Transformer. A WPP is more than two pages in length and normally has a front cover page and also a document control page.

6•8 Work Place Health & Safety Policies/Procedures

This is a safety policy or procedure written by TasNetworks, Safety Group, under the auspices of Federal and/or State, Safety Legislation and Codes Of Practice or, internal safety requirements etc. Service Providers should have their own Safety Policies/ Procedures to comply to.

A safety procedure or policy is generally written to cover off the overarching general safety principles to be adhered to (e.g. safety procedure on **Manual Handling**) and, may refer to specific WPs or safety instructions that provide more detailed steps to be adhered to e.g. as detailed on the **Manual Handling** web site.

Note: Where no specific WP or safety instruction exists, the general principles of the safety procedure must be complied with.

6•9 Eye Protection

6•9•1 General

Appropriate eye protection must always be worn where there is a danger of injury to the eyes. This **Green Lesson** is a real example of what can happen if proper eye protection is not worn.

The eyes are susceptible to short-term, prolonged or permanent damage from a variety of hazards ranging from contact with flying objects to exposure to radiation.

In some cases, damage can be severe, resulting in loss of sight. In other situations the effect may be a gradual deterioration of sight over time. Either way it can reduce or otherwise impair the victim's ability to work.
Note: Metal-framed glasses shall NOT be worn when working in an electrical environment.

6•9•2 Prescription Safety Glasses

Employees who normally wear prescription glasses and are required to wear safety glasses because of the work they carry out, should be issued with plastic framed prescription safety glasses.

An employee required to wear prescription safety glasses may consult their own Optometrist or TasNetworks Pty Ltd's nominated supplier for fitting and supply.

Prescription safety glasses must :

- Have plastic frames fitted with side shields.
- Have tinted or clear single vision lenses.
- Meet Australian Standard AS/NZS 1337, Eye Protectors for Industrial Applications, requirements.

For TasNetworks employees, information on how to obtain prescription safety glasses is contained in the document **Prescription Safety Glasses**.

Note: Approval must be given by the appropriate Line Manager BEFORE prescription safety glasses can be ordered or purchased.

6•10 High Voltage (HV)

- All persons shall comply with the Safe Approach Distances (SADs) they are authorised to work to in accordance with the PSSR.
- Unless trained and accredited to work as a Live Line Worker, no person shall have any part of their body within the SADs for energised HV or work directly on energised HV apparatus.
- There are a number of limited Live Line work practices detailed in this handbook that allow persons to work outside the SADs using an insulated work stick, such as a shot-gun stick, to affix apparatus to energised overhead HV lines (e.g. bird flappers or a D clamp), subject to training and accreditation.
- Comply with requirements for PPE in TasNetworks **Personal Protective Equipment Procedure** to protect against arc flash and accidental contact with energised apparatus.

6•11 Low Voltage (LV)

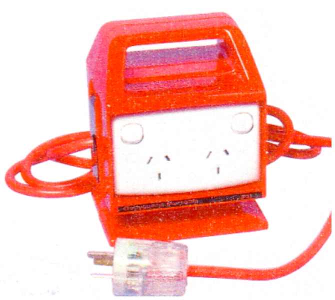
6•11•1 Work On/Near Live Low Voltage

Shall comply with the **Live Low Voltage Work Manual** which includes requirements for :-

- Isolation of supply.
- When supply can only be de-energised but not isolated.
- Tasks that can be performed live.
- Tasks that cannot be performed live.

6•11•2 Residual Current Device (RCD)

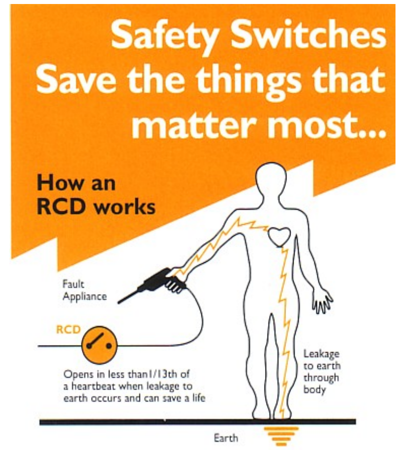
6•11•2•1 RCD Protected Socket Outlets



Sample Only

AS/NZS 3000 requires RCD protection on all socket outlets not exceeding 20 amps where there is an increased risk of electric shock.

The photograph above shows a portable “socket outlet” fitted with an RCD.



RCD's offer a high level of protection from electrical shock and electrocution by immediately switching off the electricity when it flows to earth, through a person for instance. See Diagram below.

Only correctly installed RCD's will provide personal protection from electric shock from faulty leads, power tools, etc.

When employees use socket outlets, extension leads and portable electric tools they should be "protected" with an RCD device. The RCD causes immediate interruption to the power supply and prevents the possibility of electric shock to the user in the event of failure of the electric appliance.

Note: RCD's are NOT a substitute for good maintenance of leads and appliances.

6•11•2•2 Testing of RCD's.

RCD's must be kept in good working order. A competent person must regularly inspect and test the RCD's to ensure their continued effective operation.

The testing and inspection intervals shall be in accordance with Table 4, of Australian Standard AS/NZS 3760, In-service Safety Inspection & Testing of Electrical Equipment.

There should be a Record kept of all tests carried out. The "Record" should list the following information : -

- Date tests were carried out.
- Location of RCD.
- Type of RCD.
- Condition of RCD.
- Action required and person carrying out the test / inspection.

6•12 Other Safety Considerations

This Section covers the most likely safety issues that need to be considered prior to departure to the work site and dealt with on site to ensure work is performed in a safe manner.

6•12•1 Earth Potential Rise

As an example of Earth Potential Rise (EPR), if 1000 amps flows to earth from a fault and the earth resistance is 1 ohm then the possible EPR = Current times Resistance = 1000 x 1 = 1000 Volts which could produce a harmful electric shock.

As a large fault current would be required to produce EPR the possibility of this occurring is low but may need consideration in a JRA when :-

- Working within close proximity to large sources of electrical energy, such as a switch yard or a substation and particularly if;
- These assets are old and may be prone to failure that could cause large fault current to flow.
- Bad weather is present e.g. lightning that could strike the asset and cause a fault.

6•12•2 Capacitive Charge

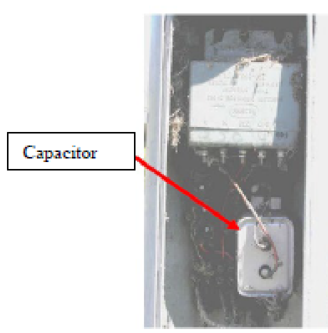
There are Capacitor Banks installed in the Power Supply Distribution System with large capacitors that will hold a residual capacitive charge and voltage after the supply is isolated.

Typical Capacitor Bank

If required to work on any capacitor bank, ensure you engage a Field Operator to properly isolate and discharge the capacitor bank before you touch the assets.

Some light fittings, such as street light columns may also contain capacitors.

Although these are small they can still retain a voltage and charge after the supply is isolated that can give a nasty shock if the terminals are touched and, need to be handled with care and should be shorted out across the capacitor terminals/leads to discharge the voltage before being handled.



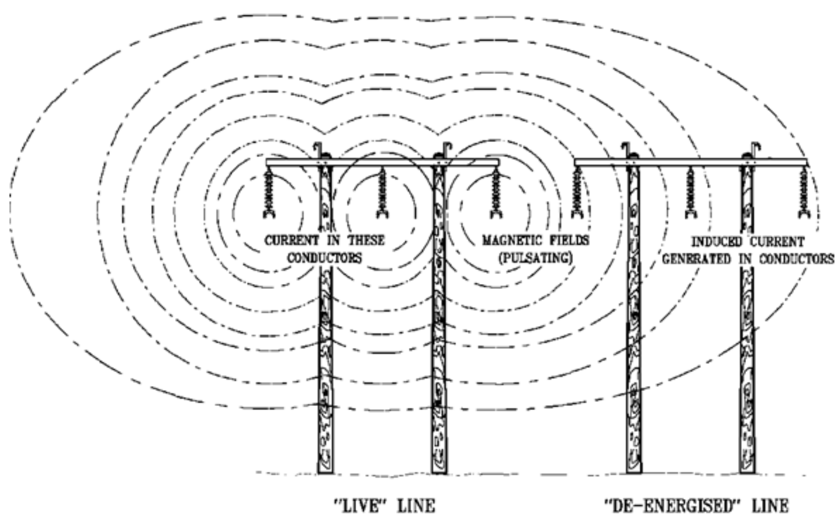
Street Light Access Cover Open

Also, it's possible that a reasonable length of HV overhead conductor or HV or LV de-energised underground cable could have built up a capacitive charge.

Therefore, if there is any doubt, test to check for any residual voltage across conductors and discharge any voltage found via shorting out across the conductors before touching bare conductors or cable ends.

6•12•3 Induction

Induction is the voltage induced into a conductor, even though it may have been de-energised, from the magnetic fields of adjacent energised conductors cutting across the energised conductor, as shown in the following diagram. The harmful effects of induction are only relevant under HV conditions.



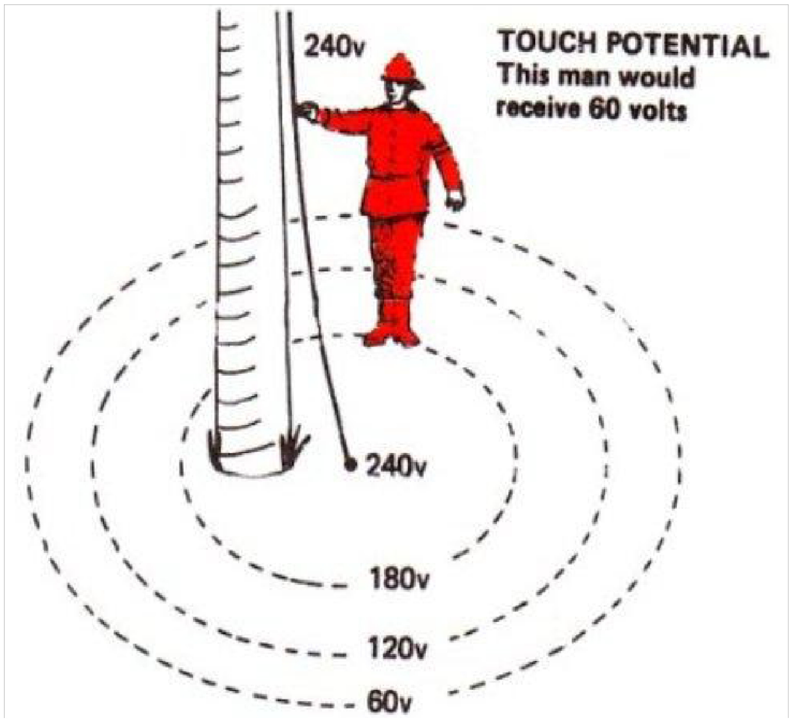
Therefore, the possibility of induction must be considered if working on de-energised lines that are adjacent to and in parallel to energised HV conductors.

To counter against the effects of induction the overhead line to be worked on must be properly earthed before touching or working on any assets.

6•12•4 Touch Potential

As shown in the following diagram, where a fault has occurred and a stay wire has become alive to earth with LV on it, the voltage value drops off as the distance increases form the source of the voltage.

Therefore, in this example, the person's hand touching the conductor is at 240V potential but the feet being further away are at 180V potential, giving 240V – 180V = 60V difference which is the voltage felt by the person.



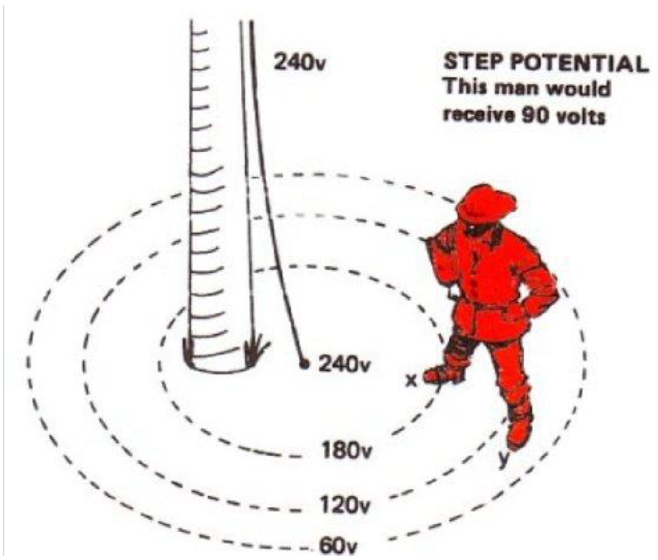
To mitigate against the above :-

- Always test assets for stray voltage before touching, using a suitable proximity voltage tester in the first instance and;
- If stray voltage is detected, follow up and confirm using a contact voltage tester, such as a multimeter and take appropriate action to make safe and report/fix the problem.
- Carefully inspect energised LV or HV overhead assets to check for any situation (e.g. broken loop of cracked insulator etc.) that may lead to wooden poles or stay wires becoming energised with stray voltage from a HV or LV leak.

6•12•5 Step Potential

As shown in the following diagram step potential is similar to touch potential in that there is a difference in potential across a fault area as the voltage value reduces as the distance increases from origin of the fault.

In this example the person would receive 90 volts shock as his “Y” foot is halfway between 120V and 60V making it 90V and his “X” foot is right on the 180V value giving a difference of 90V potential.



Similar to Touch Potential, test and inspect before touching assets and, if you happen to be in the above situation keep both legs together to keep the step potential to a minimum and the hop away clear of the fault area.

6•12•6 Radiation From Telstra Small Cells On Poles

Telstra small cell units with antennas are being installed on TasNetworks power poles to improve mobile phone communications in known black spots and;

You must comply with work practice **Telstra Small Cell On TasNetworks Pole** to ensure you are protected from electro-magnetic radiation form the antenna.

6•12•7 Alternative Supply

This is where an alternative supply is provided via switching options to keep supply fed to customers while fault repairs or maintenance work is being done.

In this situation care must be taken to be aware of what section of line is energised and, in the case of a pole mounted transformer keep in mind the load side of the LV fuses or links may be energised.

6•12•8 Control Circuits

Particular care should be taken when work is being performed near overhead control circuit wiring (e.g. switching street lighting circuits) as this wiring could suddenly become energised from another supply some distance away via activation through a time switch or photo electric cell.

While working in or near any street lighting control circuits, they must be treated as ALIVE at all times and appropriate live Low Voltage work procedures adopted where applicable to minimise the risk of electric shock from work carried out remotely that could cause control circuit components to become live.

Alternatively the work crew should isolate the switch wire and or control circuits, and lock and tag control points as appropriate to ensure there is no possibility of the circuit becoming or made alive.

6•12•9 From Customers

It is possible for voltage to inadvertently appear on LV overhead conductors due to, customer activated generators and, solar panels feeding some of the electricity generated back into the power grid. The following Red Alert is a real example of voltage backfeed from a 30 KVA customer generator after the overhead line had been de-energised and isolated from the electricity supply.

In this situation where there is any doubt that the overhead conductors could be inadvertently energised, isolation or live LV work practice methods will need to be used to mitigate against this risk.

6•12•10 Live Structures

There is always the risk of old apparatus, such as insulator pins, deteriorating over time with insulation breakdown (e.g. fine cracks occurring) causing stray voltage to appear (e.g. where least expected down a wooden power pole).

Therefore where the supply has not been isolated, to be fail safe, always test for stray voltage using a proximity tester prior to touching and working on a pole and associated assets.

If stray voltage is found employees can perform follow up testing as per work practice **Testing Stray Voltages On Poles** to confirm if the voltage is real or just a ghost voltage only.

If a genuine problem is found (e.g. faulty insulator pin causing voltage tracking) immediately fix the problem if you can else, make the site safe if necessary (barrier it off, danger sign etc. and you may even need to stay on site) and report to TasNetworks, Fault Centre for urgent follow up and repair.

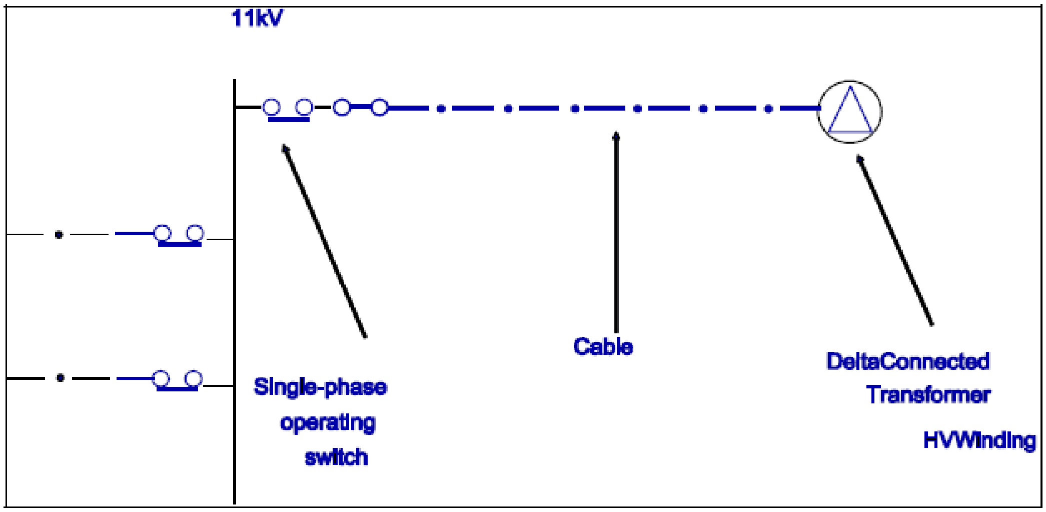
6•12•11 Ferroresonance

The phenomenon of ferroresonance results in high voltages that may occur when a modest size capacitance is either in series or in parallel, with non-linear inductance, such as an iron cored transformer.

In power systems, the most common place to find ferroresonance is with a three-phase distribution transformer energised through an underground cable of moderate length. Under no load, or very light load conditions, the capacitance of the cable is sufficient to precipitate ferroresonant behaviour under single-phase switching conditions (e.g. the operation of an HV fuse or asynchronous operation of single-phase 11 kV switches such as a drop out fuse unit or plastic switchgear).

The simplest form of occurrence of a ferroresonant circuit in a URD distribution system is when the single-phase operating switchgear or switch fuses are located some distance away from the transformer itself, with a length of cable joining the switchgear and transformer.

A circuit of this sort could occur, for example, where a substation is "satellited" from a switching station, with the switchgear at the switching station being single-phase operated, as shown in the following example diagram.



Although the possibility of ferroresonace occurring is low it nevertheless needs to be taken into consideration when switching loads under no load, or very light load conditions where the above factors apply.

6•12•12 Reclosing Onto Fault Or Large Load

When attending a fault response care must be taken to avoid reclosing onto a fault or a large load, especially where you are nearby e.g. re-inserting a fuse, as the fault or large load current could be significant and cause damage, as shown by the following picture of a damaged fuse holder.

There is also the risk of personal injury unless adequate PPE is used.

Example of damage caused reclosing onto a fault or large load

6•12•13 Broken Or Stolen Earths

For safety, in the event of a fault occurring, the purpose of a standard earth is to operate the protection device(s) to isolate the supply. This will not happen if part of the earth circuit is found broken or stolen.

In a Single Wire Earth Return (SWER) system, as there is no neutral return conductor, the earth carries the load current and, a dangerous voltage can appear at ground level if a SWER earth is found broken or stolen.

CAUTION :

1. In case there is a broken or stolen earth, prior to working in close proximity to an energised SWER system employees must perform a **Safe To Approach SWER Test** to confirm there is no harmful voltage present at ground level.

2. Employees and Service Providers are not permitted to work on or near energised LV or HV apparatus (e.g. SWER, transformer or voltage regulator.) where any LV or HV earth has been found broken or stolen, unless the supply has first been de-energised and isolated and;

   - You must report a broken or stolen earth to TasNetworks, Fault Centre for immediate follow up and repair and :

   - The supply will need to be de-energised and isolated prior to repairing a broken or stolen earth that is connected to apparatus such as a transformer or voltage regulator but;

   - If the broken or stolen earth is not connected to any apparatus, such as an intermediate pole being earthed to the overhead neutral, then you can repair the earth with the supply still energised in accordance with work practice **Maintain And Repair Distribution Earths** and;

   - An earth resistance test must be performed in accordance with **Standard Earth Tests In The Distribution System** and the earth resistance value obtained from the test must be within the allowed limits (e.g. max. of 30 ohms for HV pole earth) to ensure the circuit protection will operate under a fault condition.

   - To reduce the possibility of stolen earths all new earths installed on poles must have a protective cover guard installed in accordance with work practice **Install Cover Guard Over Pole Earths**.

6•12•14 Working In Adverse Conditions

6•12•14•1 Major Events

Examples of major events are full scale, bush fires, floods, wind storms and snow storms etc.

Floods **Bush Fire**

Snow Storm **Wind Storm**

When a major event occurs or prior to it occurring, if it is severe enough, TasNetworks will operate in accordance with a **Crisis And Emergency Management Plan** to handle the emergency as best as possible and;

- Employees and Service Providers will need to work in accordance with :

- Instructions given by, the **local Regional Co-ordinator** appointed to manage the response effort and, TasNetworks, Fault Centre.

- Any work practices, safety requirements and guidelines listed below relevant to the type of adverse working conditions to be encountered.

- The requirement to comply with the Fatigue Management Procedure and in particular, not to exceed the maximum continuous hours allowed to work before a rest break is required.

6•12•14•2 Electrical Storms

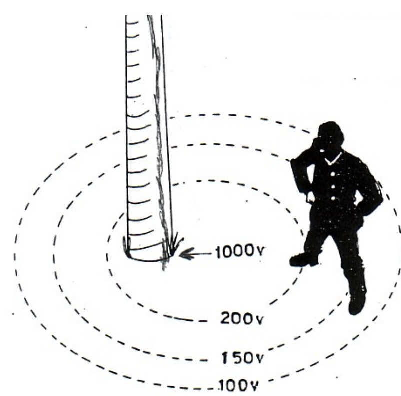
6•12•14•2•1 General

Work activities during electrical storms or lightning activity warrants additional safety precautions. Electrical storms can affect equipment and components associated with the distribution of electricity. Working on electrical equipment during storm activity increases personal risk and has the potential to cause serious harm.

This can occur as a result of lightning striking equipment and travelling to earth via electrical infrastructure when employees are :

Working on overhead conductors or structures.
Operating pole mounted switchgear.
Operating ground mounted switchgear.

The incidence of power poles or lines actually being struck by lightning whilst line workers are working on them is very low. However, there is a somewhat greater risk should an employee be in contact with part of the power system when there is a nearby lightning strike.



Not only is there the direct effect, possibly causing a flashover on the system, but steel, concrete and wood poles may also conduct fault current to the ground.

This can result in a voltage gradient extending outwards from the pole and anyone standing astride this gradient could be injured due to electric shock.

Effects of a Lightning Strike

6•12•14•2•2 Action To Be Taken During Electrical Storm

1. **Work on overhead conductors or structures** :

- **Work on High Voltage Conductors.**

  Whenever there is visible lightning or a thundercloud, judged to be **within 20km** of the place of work, work is to cease immediately and all members of the working party are to seek shelter at ground level.

- **Work on Low Voltage Conductors.**

  Whenever there is visible lightning or a thundercloud, judged to be **within 5km** of the work area, work is to cease immediately and all members of the working party are to seek shelter at ground level.

- **Seeking Shelter.**

  When seeking shelter in a building or a vehicle the building or vehicle should be **at least 20 metres** clear of all conductors.

2. **Operation of Pole Mounted Switchgear and Replacement of Fuses**.

   Switching operations, which includes replacement of fuses, shall cease when visible lightning or a thundercloud is judged to be **within 5km** of the location of the switch or fuse. When seeking shelter the same principle shall apply as above.

3. **Operation of Ground Mounted Switchgear**.

   Modern Type Substations : Modern ground mounted substations have fault rated operating equipment installed and earth mats provided in the operating area. Hence there are **no restrictions** to operating these substations during lightning storms.

   Note: Operators should use their own discretion regarding their personal safety, as to whether or not to continue performing operating or other work when lightning storm activity exists in the vicinity of the work area.

   Older Type Substations. Older ground mounted substations that have pole mounted fuses, air break switches or links do not have the same fault rating and rely on the integral earth mat to dissipate fault currents. Where the integrity of the earth system is suspect - operations are not to be carried out when visible lightning or a thunder cloud is considered to be **within 5km** of the location of the substation.

4. **Safety Concerns**.

   If any reasonable doubt exists as to the proximity of an electrical storm or personal safety, an individual employee or work party may cease work and seek shelter.

6•12•14•3 High Fire Danger

On a total fire ban day or when likely to be working during a high fire risk day comply with the requirements of the following work practice.

[Total Fire Ban Day Response Plan]

6•12•14•4 Snow And Ice

Increased risk here is from severe cold weather conditions or possibly working in remote areas and alone patrolling overhead line sections at night in hilly or remote areas.

There is also the risk of getting the vehicle bogged in the snow or sharp ice slivers falling down from trees and overhead lines.

Therefore, ensure you have the appropriate vehicle for the terrain and you have the best communication possible in case you need to make an emergency call.

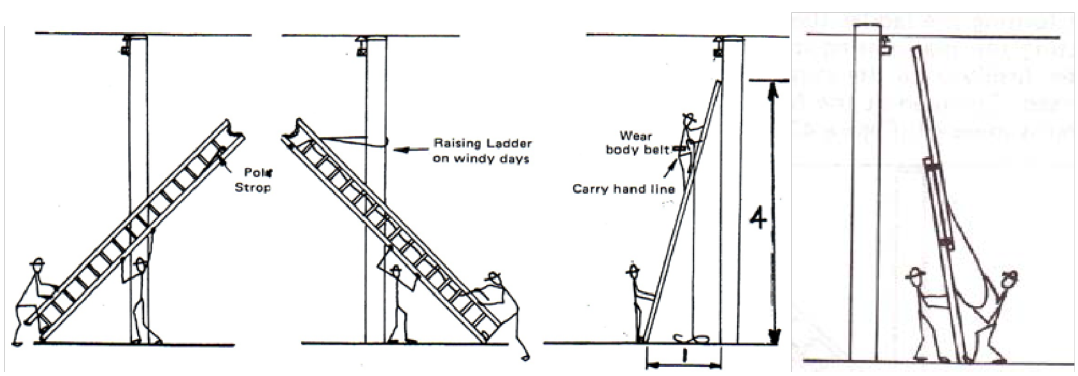
Also, ensure you comply with the requirements of the work instruction **Working In Remote Areas Or Working Alone**.

6•12•14•5 High Winds

6•12•14•5•1 Using Ladders

Get assistance when carrying a ladder in windy weather. When erecting an extension ladder against a pole in windy weather – tie a handline to the top of the ladder, pass it around the pole and back through the top rungs of the ladder – hold the tail of the rope as the ladder is pushed up against the pole. This will hold the ladder captive against the pole and prevent the wind blowing it off.

An extension ladder over 5 metres in length (closed up length) shall be carried, erected and lowered by at least two persons, as shown in the following diagrams.



Erecting Ladder In Windy Weather **Climbing** **Erecting Ladder**

6•12•14•5•2 Operating Mobile Plant

Care needs to be taken not exceed the maximum wind speed rating (should be marked on the mobile plant) when operating mobile plant, such as EWPs and Prolines etc., especially where booms are extended when working near energised apparatus.

6•12•14•5•3 Other

Other factors need to be considered when working on windy days such as, nearby vegetation that could contact energised conductors in the work area or, loose items that could blow into the work area or when trying to operate extension sticks near energised conductors.

6•13 Protect Against Arc Flash

If working on or in close proximity to energised electrical apparatus a risk assessment needs to consider the correct level of protection against the likelihood of arc flash.

The **ENA NENS 09 National Guideline for the Selection, Use And Maintenance Of Personal Protective Equipment Electrical Arc Hazards** sets the minimum requirements for protection against arc flash.

However, TasNetworks has a requirement over and above the NENS 09 Guideline that persons working for or on behalf of TasNetworks must comply with:-

If working in a substation or switchyard the following arc flash protection is required :-

- **Arc Flash Hazard Risk Management Procedure For Distribution Substations**
- **Work Practice: Arc Flash Risk Management For Distribution Substations**
- **Arc Flash Controls Look-Up Table** (to determine what level of PPE is to be worn).
- Any additional PPE requirements and insulating materials and barriers, etc. detailed in any specific work practice written for a task to be performed within a distribution substation.

For all other tasks outside switchyards and substations minimum PPE to be in accordance with TasNetworks **Personal Protective Equipment (PPE) Procedure**.

6•14 Relevant Safety Procedures And Plans

The following are overarching safety procedures and plans that shall be complied with at all times and;

There may be Work Practices or Safe Work Method Statements linked to these safety procedures and plans covering specific tasks or;

Special Alerts or Compliance Communications, usually written after the outcomes of a safety incident, that reinforce safety requirements.

Note: In the absence of any specific Work Practice, Safe Work Method Statement, Special Alert or Compliance Communication, the principles of the relevant Safety Procedure or Plan shall be complied with.

6•14•1 Asbestos Management Plan

The Asbestos Management Plan covers the overarching requirements for safe management of asbestos. Under the management plan sits the following specific work practices that must be complied with by employees :-

- Asbestos In Streetlights
- Asbestos Management Testing Federal Meter Boards
- Asbestos Management Naturally Occurring Asbestos
- Asbestos Management Replacing Meter Panels
- Asbestos Management Removing Arc Shields
- Asbestos Management Handling & Disposing Of Fuses
- Asbestos Management Replacing Boards In Streetlights Turrets & Substations
- Hazardous Materials - Transportation Spill Management For Asbestos.

6•14•2 Confined Space

- Confined Space Procedure
- Confined Space Standard AS 2865

6•14•3 Fatigue Management

- Fatigue Management Procedure

Employees must ensure they comply with the requirements in the Fatigue Management Procedure to ensure they do not work or drive excessive hours that could lead to a risk of a safety incident occurring.

6•14•4 First Aid

- First Aid Procedure

Note: In addition to general compliance with the First Aid Procedure, employees need to ensure they are up to date and current with refresher training for first aid.

6•14•5 Isolation Lock Out And Tag Out

The Isolate Lockout Tag Out Procedure is the overarching procedure that must be applied, where no specific work practice exists, in situations where there is a risk of supply being accidently re-energised by other employees or the public.

In addition to the Lockout Tag Out Procedure are the following specialised work practices for isolation of supply :-

- Affix Hazardous Caution Tag

The **hazardous caution tag** is used mainly in the customer connections area when there is a need to isolate and tag where an unsafe condition exists. The tag is handy where no facility exists to apply an isolation lock.

- Isolation Of LV Supply

This work practice covers the methods to isolate LV supply and make safe to ensure supply cannot be re-energised to a customer installation until the unsafe problem (e.g. broken neutral) has been fixed.

6•14•6 Hazardous Substance Management

The **Hazardous Substance Management Procedure** covers the management, handling, protection against and disposal of hazardous substances.

In addition, there is the **Chem Watch Web Site** where employees can find out health details on every type of hazardous substance.

6•14•7 Managing Plant

The **Managing Plant Procedure** is the overarching procedure for management of plant that employees must comply with.

Under that sits work practices covering the specific use of plant (e.g. use of excavators, cranes etc.), and these can be found on the **external Work Practice Web Site** for Service Providers or, TasNetworks, Intranet Work Practice Web Site, under the sub heading **Vehicles, Plant & Machinery**.

6•14•8 Manual Tasks

To minimise the risk of injury from manual handling, refer to and comply with the following :-

1. The overarching **Manual Tasks Procedure** contains details on identifying hazardous manual tasks and controlling the risks.

2. TasNetworks web site for **Manual Handling** that contains useful guidelines and risk assessments and videos for different types of work tasks being performed.

3. The **Manual Handling Guidelines – Line Worker**.

4. The **Risk Assessment – Line Worker**.

6•14•9 Personal Protective Equipment (PPE)

The **Personal Protective Equipment Procedure** contains all the minimum PPE requirements for employees and must be complied with at all times.

Also comply with **Amber Alert PPE For After Fire Response**.

Note: Special requirements apply for arc flash protection when working in switchyards and substations - refer **Section 6.13 Arc Flash Protection.**

6•14•10 Hearing Protection

Employees shall in general comply with the Noise Management Procedure and in particular :-

1. Types of Protectors

There are various types of hearing protectors from the simple "Earplug" to the more selective "Hearing-protective helmet".

Each particular type has its benefits but in most situations within our Organisation – the "Earmuff" is the type most commonly used. The Earmuff can be worn on its own or in conjunction with a safety helmet or cap. Earmuffs are generally superior to earplugs because they are simple to put on and wear.

2. Noise Levels of Various Equipment.

Item	dB(A)		Item	dB(A)
Compressor.	101 – 123		Mining Drill.	108 – 113
Abrasive Cutter.	100 – 115		Diesel Generator.	107 – 111
Metal Saw.	105 – 108		Petrol Generator.	70
Revving Truck.	100 – 102		Impact Wrench.	104 – 107
Router.	98 – 100		Grinder.	83 – 110
Back Hoe.	82 – 94		Band Saw.	94 – 95
Chainsaw.	105 – 110		Belt Sander.	82 – 92
Crane Vehicles.	84 – 88		Kanga Hammer.	55 – 65*
Pole Stake Driver	106 – 108		Erect. Borer Vehicle	85 – 92

* Depends upon type of tool & material being cut.

Note. In majority of cases – hearing protection devices will NOT affect the wearer's ability to listen to machinery or to hear warning signals, but, will lessen or prevent the impact of loud noise levels upon the wearer.

REMEMBER. **Any noise above "85" dB(A) may be hazardous to your hearing, even if it lasts for only a short while**.

6•15 Sharps

Employees shall comply with the work practice Handling Sharps.

6•16 Insulating Material

6•16•1 General Requirements

There are various types of insulating mats and covers used in live electrical environments in different applications but for the same reason - to provide an electrically safe barrier from equipment or personnel working in the vicinity of live LV apparatus.

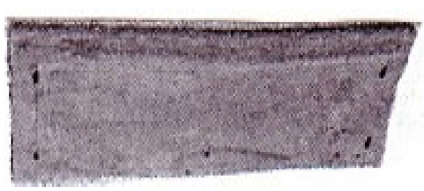
LV insulating mats and covers shall comply in general with the Australian and International Standards listed in section 3.11 of the **ENA National Guideline For Tools & Equipment Used In The Electricity Supply Industry**.

6•16•2 Line Work And Other Electrical Work

There are various types of insulating mats and covers used in live electrical environments in different applications but the same reason. This is to provide an electrically safe barrier from equipment or personnel working in the vicinity.

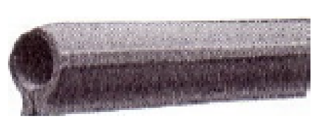
6•16•2•1 Insulating Covers And Pipes

Insulating covers and pipes (hoses) are used on overhead low voltage conductors and apparatus. As these covers and pipes are NOT required to undergo any electrical testing it is important for the safety of the Line Worker that they be in a sound condition. For further information refer to Australian Standard AS 4202.



Rubber Insulated Cover & Hose

New PVC Insulated Cover



6•16•2•2 Insulating Mats

Insulating mats are used for covering low voltage electrical apparatus in substations, covering underground cables, wrapping around poles or laying on the ground at the base of a switchboard, meter panel, underground turret, streetlight, etc. For further information refer to Australian Standard AS/NZS 2978.

NOTE. These "mats" MUST be electrically tested at intervals not exceeding six (6) months.

6•16•2•3 Insulating Barriers

Insulating barriers (rigid and flexible covers) are used by Live Line workers on live high voltage overhead conductors and apparatus. The rigid covers are made from polyethylene of ABS plastic and the flexible covers are made from natural or synthetic rubber. For further information refer to ESAA Standard, HB ESAA LLM 03 and TasNetworks, Live Line Handbook.

NOTE. These "barriers" MUST be electrically tested at intervals not exceeding twelve (12) months.

6•16•2•4 Care And Use Of Gloves And Sleeves

As insulating gloves and sleeves provide the last line of protection against receiving an electrical shock, it is important they are properly taken care of and inspected for sound condition before use in accordance with Field Guideline **Care and Use Of Insulating Gloves And Sleeves**.

6•16•2•5 Care And Use Of HV Operating Sticks

Prior to using HV operating sticks :-

- A pre-use inspection must be done to look for signs of wear and tear and damage such as, cracks, surface damage or mechanical defects and;

  If any of this type of damage is found immediately stop using the operating stick and mark as defective and contact your Compliance Inspection Officer to replace with a new stick.

- A check must be made to ensure the sticks are effectively insulated by wiping them clean with a de-greasing cloth and application of silicon grease.

- As a minimum, a Compliance Inspection Officer must ensure HV operating sticks are maintained in good working order in accordance with the **ENA National Guideline For Management Of Tools And Equipment Used In The Electricity Supply Industry** and in particular, **Section 3.9 High Voltage Insulated Sticks**.

6•17 Life Jackets

Where there is a need to use a boat to run wires across large storage dams or water-ways the occupants of the boat are required to wear approved “life jackets”. In open boats, dinghies and similar craft, the life jackets shall be worn at all times and not removed until the person is safely ashore.

6•18 Working Remotely Or Alone

If employees are likely to be working in a remote location, particularly if working alone, a risk assessment needs to be done on the need for a Remote Work Plan to ensure employee safety as per the following field guideline **Working In Remote Areas And/Or Working Alone**.

6•19 Working At Heights

6•19•1 General

References :-

- Section 3.2 “Height safety Equipment” of the **ENA National Guideline For Tools & Equipment Used In The Electricity Supply Industry** for selection and use of fall arrest equipment.

- **National Code Of Practice For The Prevention Of Falls In General Construction.**

- TasNetworks **Preventing Falls And Falling Objects Procedure**.

Working at heights applies when the work is above 2 metres, measured from bottom of a person's foot to the ground or nearest platform below.

Employees *shall* ensure when working at height :

- Correct fall arrest *equipment* is used, and fall arrest harness is fitted properly prior to use.
- A Nominated Rescuer, trained in height rescue, is nearby in case a rescue is required.
- A rescue kit is available close by ready to be used.

6•19•2 Risk Assessment

When working at height the following factors should be included in the risk assessment :

6•19•2•1 Identify The Work Method

- The nature and duration of the task.
- Requirements associated with the task.
- Alternative methods of access such as climbing, work platforms, scaffolding or some other method.
- The risks associated with each method of access.
- The method of access chosen.
- An appropriate rescue procedure.

Consideration of "access" also takes into account "egress" requirements

6•19•2•2 Identify The Fall Protection Method(s) Required

- The fall protection equipment to be used.
- Anchorage security and strength.
- Control over movement of the connection along the anchorage (where installed).
- Possible abrasion or damage to fall protection components.
- Possible effect of welding, cutting, heating or water cleaning equipment on components.
- Effect of chemicals on the components.
- Electrical hazards.
- Other associated hazards.
- Additional personnel required.

6•19•2•3 Identify Need For A Safety Drop Zone

Comply with Work Procedure **Implement Safety Drop Zone.**

The following **Red Lesson** is a real example of what can go wrong if a person enters a safety drop zone when work above is being performed.

6•19•3 Training

Employees required to climb and work aloft must be appropriately trained and competent in the particular type of "climbing" required.

Training shall include but not be limited to :-

- Safe work practices and procedures to prevent a fall.
- Principles and methods of fall protection for access to, egress from and transfer between work positions and working aloft.
- Correct selection, fitting, use, care, maintenance and storage of fall arrest systems and devices.

- Hazard identification associated with fall arrest situations.
- Work Practice procedures for rescue aloft – specific to location, type of work and fall protection methods used.
- Fitness for the task.
- Initial training and periodic training refreshers conducted by a RTO to assess and maintain competency. **Note**: Service Providers must also comply with this requirement.

6•19•4 Principles of Fall Arrest

Persons required to access, egress from or transfer between work positions or work aloft on poles, lattice structures, substation equipment and related structures, shall maintain attachment at all times **except when gaining access by and climbing a portable ladder**, OR **where particular task requirements permit or require alternative means of managing the prevention of falls**.

Fall protection principles are based on a hierarchy of control. The selection of appropriate fall protection equipment shall be based on identification of the hazards associated with access to, or egress from or transfer between work positions or working aloft and assessment of the risk of :

- **Restrained fall.**

The arrest of a fall, where the person suffering the fall, is partially restrained by the actions of a restraining device such as a safety lanyard, normally used under tension.

- **Limited free fall.**

The arrest of a fall occurring under the conditions described for a free fall except that under reasonable foreseeable circumstances the fall distance will not exceed 600 mm.

- **Free fall.**

The arrest of a fall where the fall distance before the fall arrest system begins to take loading, is in excess of 600 mm either vertically or on a slope which is not possible to walk without the assistance of a handrail or hand line. The fall distance shall not exceed 2000 mm.

6•19•5 Restrained and Free Fall Situations with Requirements

Fall Arrest Category	System Description	Safety Equipment Required	Anchorage Requirement	Typical Application
Restrained Fall Arrest	Combination of anchorage placement & restraint line or lanyard length which will permit only a restrained fall at the work position.	Line worker's lanyard or work positioning harness. Fixed length restraint line.	**6 kN** minimum strength without breakage. (**600 kg.** Approximately)	Access to, egress from and transfer between work positions and working aloft – where no free fall is possible. (Working on a pole or roof with slope greater than 150 but with secure footing & no risk of falling).
Limited Free Fall Arrest.	Combination of anchorage placement & lanyard length that will permit only limited free fall of less than or equal to 600 mm.	Work positioning harness with fixed lanyard.	**12 kN** minimum strength without breakage or equivalent static line, cable or rail. (1200 kg. Approximately)	Any situation where use of short lanyard or fall arrest device (or both) will limit any free fall to less than or equal to 600 mm.
Free Fall Arrest.	A suitable fall-arrest system which permits a free fall of between 600 mm – 2000 mm.	Fall arrest harness & lanyard assembly or fall arrest device which will limit free fall to 2000 mm	**15 kN** minimum strength without breakage or equivalent static line, cable or rail. (1500 kg. Approximately)	Any situation in which a free fall of between 600 mm and 2000 mm is possible.

6•19•6 Anchorages

Certain structures may not be capable of providing anchorages of adequate strength for fall arrest purposes. In such cases, alternative methods of protecting persons at height, based on an appropriate risk assessment, shall be required.

Anchorages shall have the following minimum strength without breakage in the direction of loading for :-

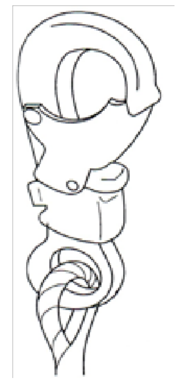
- A restrained fall arrest= **6** kN
- A limited free fall arrest= **12** kN
- A free fall arrest= **15** kN

6•19•7 Restraint Line

A restraint line comprises a rope or webbing line of appropriate strength and length for use with a harness or restraint belt.

6•19•7•1 Attachment Hardware

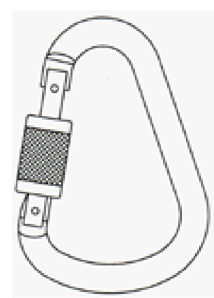
6•19•7•1•1 Snap Hooks



These comprise a hook-shaped body and gate similar to the one at right. The gate can be opened to receive a suitable and compatible attachment point such as a ring on a harness, anchorage point in an EWP bucket or the eye of a lanyard or sling.

The snap hook is required to be of the self-closing and self-locking type which has a locking gate overriding the latch that remains closed until the hook is intentionally unlocked and opened by means of “two” separate manual actions.

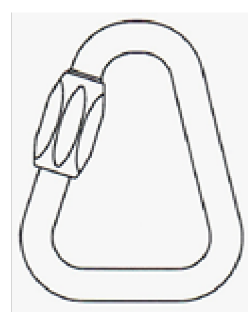
6•19•7•1•2 Karabiners



These comprise a connector with a spring loaded locking gate. The gate opens to receive a mating connection and when released – automatically closes to retain the connection.

Karabiners are required to be self-closing and have a locking device so that the karabiner is only capable of being unlocked and opened by “two” separate manual actions.

6•19•7•1•3 Tube Nut Connectors



These comprise an open loop, the sides of the opening terminating in a pair of aligned screw threads arranged so that a single tubular nut can close the
“loop” by simultaneously engaging both threads.

Tube nut connectors require a succession of screwing actions to open them and are not prone to “roll” out as are other connectors that rely on spring mechanisms for security.

Tube nut connectors are suitable at the "harness" end of a lanyard assembly but NOT at the "anchorage" end of the lanyard because the locking mechanism is SLOW to operate. A tube nut connector is NOT required to be self-closing or self-locking.

Note. The attachment hardware mentioned above is for use in association with the various fall arrest equipment already mentioned. Equipment such as : restraint lines, anchorages, harnesses and lanyard assemblies.

6•19•7•2 Main Use Of Fall Arrest Equipment

Safety Device	Main Uses	Permitted for Fall-arrest		
		Free Fall	Limited Free Fall	Restrained Fall
Restraint Line	Part of horizontal restraint system	NO	NO	Yes
Fall Arrest Harness	Any situation with risk of free fall.	Yes	Yes	Yes
Lanyard assembly	Part of fall arrest system	Yes	Yes	Yes

6•19•7•3 Correct Use Of Safety Harness

These safety pointers apply to every employee who will use a safety harness of any type where there will be an attachment of a snap hook via a lanyard or other safety device :

- Always carry out pre-use inspections on harness / belt and attachments.
- Always ensure that "D's" are properly engaged in snap hooks and that the "gate" is closed.
- Always test the integrity of attachments prior to relying on the assembly to support your weight.
- Where possible, maintain "tension" on the pole strap during use and movement around work positions on a pole or structure.
- Reinspect attachments after periods of slackness of pole straps and lanyards.

- Regularly confirm attachment during work activity where your body is in contact with anything that is capable of accidentally releasing the locking tongue of the snap hook.
- Have any harness / lanyard or component replaced when identifying any defect and then tag the equipment as defective so that it cannot be reused until repaired or replaced.
- **CRITICAL** – double check you are secured before leaning back.

6•19•8 Transfer Between Work Positions

Persons required to transfer between structures and work platforms, where this is permitted, shall use limited fall arrest or free fall arrest, depending upon which type best achieves fall protection for the circumstances. Persons must remain "attached" at all times during the move from one position to the next.

Consideration shall be given to minimising the time persons are attached at two points, the relative movement of the work platform, the condition and suitability of the structure and an appropriate rescue procedure.

6•19•9 Elevating Work Platforms (EWP's)

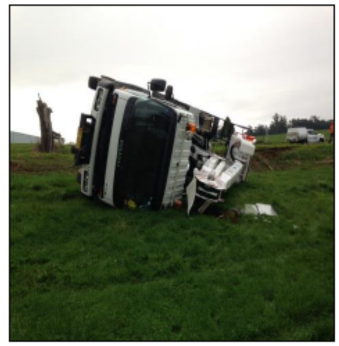
Elevating Work Platforms shall be safely used in accordance with the **Work Procedure Using EWPs** and, the rescue procedure **EWP And Controlled Descent Device (CDD) Rescue.**

If you will be operating a model of EWP you are not used to, ensure you familiarise yourself with how the controls work (do a dummy run) before usng the EWP to perform work.

The following **Green Lesson** emphasises the need for safety when "mobiling" which is travelling in the bucket of an EWP at slow speed for short distances between power and light poles where it is safe to do so.

Note: Where unstable ground or soft edges are encountered, check that stabilisers are in sound position and if not, if there is need to use dunnage to help support the stabilisers and to ensure the EWP is sitting level and not at an angle that might cause a roll over.





Example – soft road edge causing roll over from poor set up of EWP

Note: As per the Red Alert on this, to ensure the EWP is fully functional to be used in an emergency to perform a rescue, you must not turn the motor of the EWP off when working on or in closeproximity to live low voltage conductors and assets.

6•19•10 Steel Lattice and Tower Structures

Persons climbing or working on these structures shall :

- Comply with the work practice **Work At Height On Towers.**
- Be familiar with and competent in the appropriate rescue procedure **Carry Out Tower Rescue.**
- Wear an approved harness with suitable lanyard when climbing or working on the structure at a height where a free fall is greater than 2 metres or if the work position is lower than 2 metres, and the use of a harness would improve safe working.
- Ensure that if the "structure" is in a switchyard environment – the ground assistant also wears a safety harness and is proficient in **Carry Out Switchyard Rescue Procedure**.

- Remain "attached" to the structure, at all times, when climbing or working on it. This can be achieved by the use of a double-legged lanyard or specially installed fall arrest and restraint device as shown in Diagrams on below. The only exception to remaining "attached" - is when climbing a portable ladder placed against the structure to gain access to the structure.

Rope Grab Restraint Device & Double Legged Lanyard

- A portable ladder placed against a structure shall be secure* before climbing it and then tied off, at the top of the ladder, to the structure.
- ***Secure** means to be "free from or not exposed to danger / safe / not liable to fall or become displaced".*
- Wear conductive soled footwear on transmission line towers when the conductors are "live". This will prevent electric shocks due to induction.
- **Note.** Employees at the work position shall use : *restrained fall arrest, limited free fall arrest or free fall arrest* depending upon which type best achieves fall protection for that situation.

6•19•11 Working At Height On Poles

6•19•11•1 General Requirements

With the exception of condemned poles that must not be climbed and special requirements for private poles and pine poles, as per Section 12.2.25 Private Poles,

TasNetworks owned poles, including staked poles and untreated wood poles are considered SAFE to climb **subject to rigorously testing the sturdiness of each pole via an inspection and following push test** before affixing a ladder to the pole and ascending to perform work.

6•19•11•2 Check Stability Of Pole

6•19•11•2•1 General

Test the pole by :-

- "Sounding" with a hammer, or the back of an axe, all around the pole from ground level up to a height of approximately 2.0 metres.

- Poking the pole surface near the ground line with a screwdriver and closely examining for signs of serious decay or deterioration. This is what happened when an employee failed to do this check !

Employee fell down with pole narrowly missing a sharp stake

- Especially with service poles, always check how tight the overhead service cable is either side of the pole. If the service cable is very tight this might be a clue that this all that is holding the pole up and, the pole could fall if the service cable is disconnected or cut away. This is what happened in the above example under point 2.

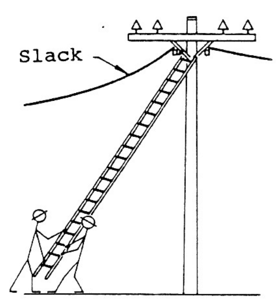
- Using the "ladder push test" when the previous two (2) "tests" leave cause for additional testing. See Diagrams on next page for information on the "ladder push test".

Note. Poles that have been staked or re-instated by other approved methods should be inspected as above. An additional examination of the steel section for obvious defects should also be made where any doubt may exist.

Should either of the first two (2) TESTS disclose any reason for doubt, then the pole must either be tested by application of the "ladder push test", as described below, or treated as condemned. Where pole collapse will not damage property, a suspect pole can be subjected to a powerful side push with a ladder applied at the pole top.

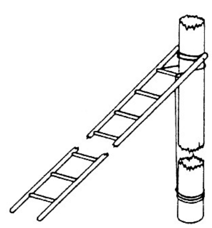
6•19•11•2•2 Ladder Push Test

This can be applied as follows:-



- Position a ladder against the crossarm brace at the pole top at right angles to the conductors.
- Lift the bottom of the ladder off the ground, to about hip height, and push against the pole as hard as you can **across the line of conductors**. *Even a light person can exert 900 newtons in this way*.

Note. If the ladder is not long enough to reach the pole top, or there is NO crossarm on the pole - lash ladder to the pole as shown in diagram at right.



Besides being simple, this is by far the most effective way of testing whether a pole is safe to climb.

REMEMBER :

- Pushing **along the line of conductors is USELESS** because the conductors act as stays.

- Jumping on the ladder on your way up the pole is unsafe.

- Immediately cease testing a pole that shows signs of failure - and don't climb it until it is made safe.

For natural wood poles where a ladder push test can not be done safely - dig down 300 mm and thoroughly inspect above and below ground.

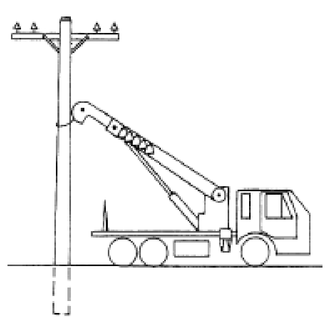
With impregnated wood poles - sound test immediately above ground level and if the sound is hollow or doubtful, hold the pole with a crane or support it as described below.

Note. If, after the above test, there is still doubt as to the stability of the pole then it should be treated as a condemned pole ("**X**").

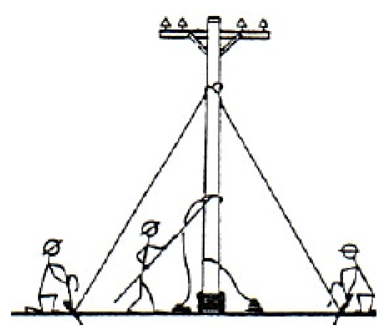
Work should not be carried out on a pole marked with an "X" without the pole being made safe, either by permanently staking, temporarily bracing, staying or holding with a crane vehicle.

6•19•11•2•3 Supporting A Pole

Attach temporary rope stays and secure them to suitable anchorage points, stake it, OR hold it secure with a crane.



Supported by Crane



Supported by Temporary Stays

Note. Further information on temporarily supporting a pole can be found in **Section 12.2.2.1 Securing Poles Prior to Work**.

6•19•11•2•4 Monitoring Pole Condition

After proving the pole “sound” and climbing it, remember that the load conditions at the top will continue to change due to worker and conductor movement This may affect its stability.

Continually check for any changes in stability and take appropriate remedial action as and when required.

6•19•11•2•5 If Okay To Climb Pole

- Position and secure* an approved extension ladder against the pole.
- Ensure the ladder can’t slip. Tie the ladder or, if this is not practically possible, have the “assistant” hold and foot the ladder before climbing. Tie ladder off at the top on the first ascent. Do the “reverse” when descending. When a ladder is positioned against a pole – the top of the ladder must be tied off to the pole.
- * Secure means to be “free from or not exposed to danger / safe / not liable to fall or become displaced”.
- Employees required to perform work on poles shall use “restrained fall arrest” which is achieved through the use of a Line Worker’s safety harness, with an approved lanyard fitted around the pole or ladder as the case may be.
- Where obstructions or other factors prevent the use of restrained fall arrest, then limited free fall arrest or full free fall arrest shall be used until such time as restrained fall arrest can be resumed.
- Wear an approved safety harness or line worker’s body belt and lanyard.
- Position the lanyard around the pole or structure when in the working position. The lanyard can be fastened around the ladder – provided the ladder is correctly positioned and secured to the pole.
- Maintain “attachment” at all times except where gaining access via a portable ladder. Face the ladder when climbing and grasp the stiles with “both” hands.

- Always use the right ladder for the job and in the correct manner. Never overreach above or to the sides of the ladder as you can overbalance and fall.

6•19•11•3 Standing On Cross Arm

- Although preference is to work out of an EWP bucket or from a ladder, a person can perform work standing on a cross arm or other structure provided it has been properly inspected and assessed as being sound enough to stand on (not brittle, badly rusted or rotten) and perform work and;
- A safety lanyard has been attached to an anchorage point or around the pole and;
- Transfer to that position will not cause a safety issue (i.e. remain attached with safety lanyard during the transfer).

6•19•11•4 Standing On Pole Chair

Although preference is to work out of an EWP bucket or from a ladder, a person can perform work standing on a pole chair provided that the person complies with the work practice **Care and Use Of Pole Chairs and Platforms**.

6•19•12 Pole Operating Platforms

TasNetworks has deemed that no employee or Service Provider employee shall stand on a pole operating platform as those in service are old and structurally not up to standard.

There is a program of work to remove all old pole operating platforms as per the work practice **Remove Pole Operating Platforms**.

6•19•13 Substation Equipment

6•19•13•1 General

Persons climbing or working on this type of equipment shall :

Be competent in **Power Transformer Rescue**.

- **Wear an approved harness with suitable lanyard when climbing or working on the structure at a height where a free fall is greater than 2 metres or if the work position is lower than 2 metres, but where the use of a harness would improve safe working.**

- Employees at the work position on a substation or related equipment, required to work "attached", shall use restrained fall restraint where practicable. Where this is impracticable, limited free fall arrest shall be used, depending upon which type best achieves fall protection.

- Remain "attached" to the equipment whilst working on it. The only exception to being "attached" is when climbing a portable ladder to gain access to the equipment.

Remain Securely Anchored

- Ensure that when the "structure" is in a switchyard environment – the ground assistant also wears a suitable safety harness and is proficient in switchyard rescue procedures.

- **Note:** Consideration must be given to the use of other means of fall protection where the above methods cannot be practicably deployed.

6•19•13•2 Scaffolding

- Scaffolding shall NOT be erected by untrained or uncertified persons.

- Scaffolds are the preferred means of providing a stable, temporary work platform to perform work at heights exceeding 2.0 metres.

- Platforms on scaffolds MUST have handrails, kickboards, mid-rails (where required) and provide clear access across them. They must be provided with access that complies with the requirements for ladders, and should be kept free of unnecessary obstructions and tripping risks.

- The height of the scaffolding must not exceed three times the least base measurement.

- Scaffolds must only be used on a solid, level surface.

- There shall be NO platform(s) installed between two (2) separate items of mobile scaffolding. Scaffolding could move and allow platform(s) to drop.

- Care shall be exercised when erecting metal scaffolding in switchyards because of the proximity of LIVE equipment. Proximity of metal scaffolding to exposed live equipment must also comply with Australian Standard AS/NZS 1576.1, “Scaffolding – General Requirements”.

- A trailing earth shall be securely connected to the scaffolding and an appropriate earth point within the switchyard, to ensure that all exposed metal parts of the scaffolding are maintained at earth potential. This will provide protection against induced voltages likely to be encountered within this environment.

- Employees who transfer between a ladder and a scaffold shall use limited fall arrest or free fall arrest, depending upon which type best achieves fall protection for the circumstances. Consideration shall be given to minimising the time persons are attached at two (2) points, the relevant movement of the scaffold, and an appropriate rescue path.

- A risk assessment shall be done to assess the risk relative to the height of the scaffold, and other factors that could influence the risk of accessing, working on, or egressing the scaffold.

6•19•14 Using Work Cage Attached To Crane

- Using Work Cage Attached To A Crane Work Practice.

6•19•15 Ladders

6•19•15•1 General

“Portable ladders” can include trestle, single, step and extension ladders of the type that can be physically picked up and moved from one place to another manually.

All ladders shall comply with the relevant requirements of the standards, and shall be free from structural defects that would render the ladder hazardous to the user.

6•19•15•2 Trestle Type Ladders

A trestle ladder must be set up on a firm level surface in the fully opened position. The ladder must be checked to ensure the legs are correctly spread, the ladder is secure, and it is safe to climb.

Working platforms positioned between two trestle ladders - must not be less than 450 mm wide (2 planks). They must also extend far enough onto each trestle ladder so they are secure*.

***Secure** *means to be free from or not exposed to danger, to be safe, not liable to fall or become displaced*.

Where the height of the working platform exceeds two (2) metres edge protection must be provided by installing guardrails up to one (1) metre high. The guardrail must include a mid-rail.

6•19•15•3 Step Ladders

A step ladder must be set up on a firm level surface in the fully opened position. The ladder must be fitted with a suitable restraining device to prevent the opposite sides spreading too far apart.

When working on a higher step ladder, there may be a need to secure* the ladder while a person is climbing or working aloft.

***Secure** *means to be free from or not exposed to danger, to be safe, not liable to fall or become displaced*.

6•19•15•4 Single And Extension Type Ladders

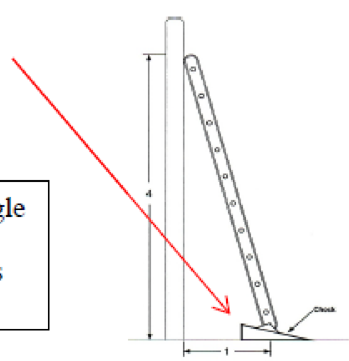
When working in the field employees must comply with work practice [Work At Height From Ladders](#).

Additional requirements are :-

1. Ladders may be carried in a live switchyard – but only in a horizontal position and they must be carried so that no part is at any time above waist height.

2. Correct use of Ladder Chock.

Preferred ladder angle is 4 metres up for every 1 metre out as shown



3. Get assistance with ladder where any of the following conditions apply :-

   3.1. An extension ladder over 5 metres in length (closed up length) shall be carried, erected and lowered by at least two persons.

   3.2. Using shorter ladders in difficult situations or hazardous terrain.

   3.3. Using or moving ladders in LIVE switchyard or substation environments when two people are required to ENSURE it can be done safely.

   3.4. Using ladders heavier than YOU can safely handle on your own.

   3.5. When ladders are to be erected outdoors in windy weather.

   3.6. During ascent / descent when ladder is not secure*.

   3.7. *Secure means to be free from or not exposed to danger, to be safe, not liable to fall or become displaced.

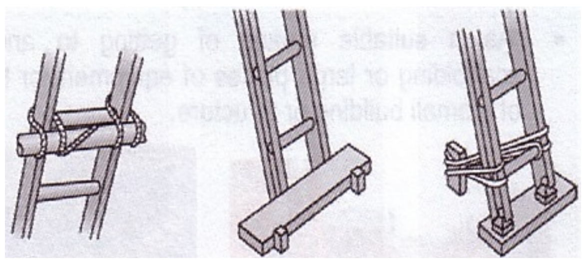
4. All ladders in “continuous” use should be thoroughly checked at least once a month.

5. Position ladders against landings or roofs, with a minimum of 1 metre extending above the landing or roof.

6. Secure* bottom of ladders if there is any likelihood of them slipping or moving. That is, foot, hold or tie off to a suitable anchorage point(s).

   Note. Suitable anchorage points can be : a pole, tree, stake driven into the ground, house footings, pipes or anything a rope can be attached to that will not move and would be strong enough to hold the ladder secure.

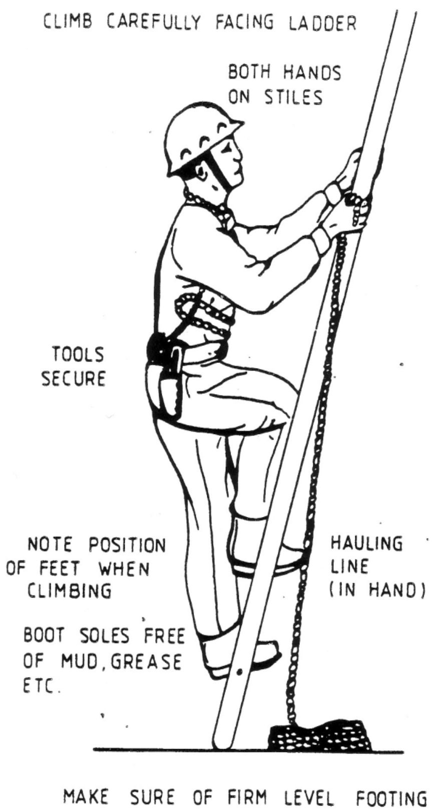
   Diagram at right shows some ways a ladder can be secured.

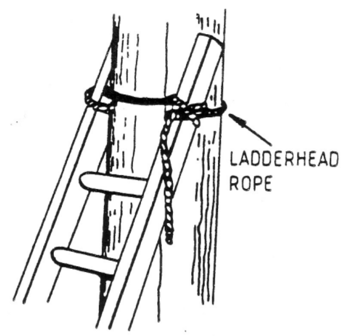


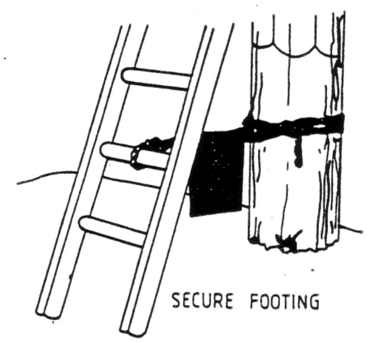
7. Secure* top of ladders where they rest against structures / buildings. Tie off with a head rope where practicable. A ladder that cannot be tied off (e.g., leaning against a building) shall be “secured” by some other means, while an employee is aloft.

   This may mean a person or persons will need to foot and hold the ladder while it is elevated and being used.

8. Always face the ladder when ascending or descending and use both hands to climb.



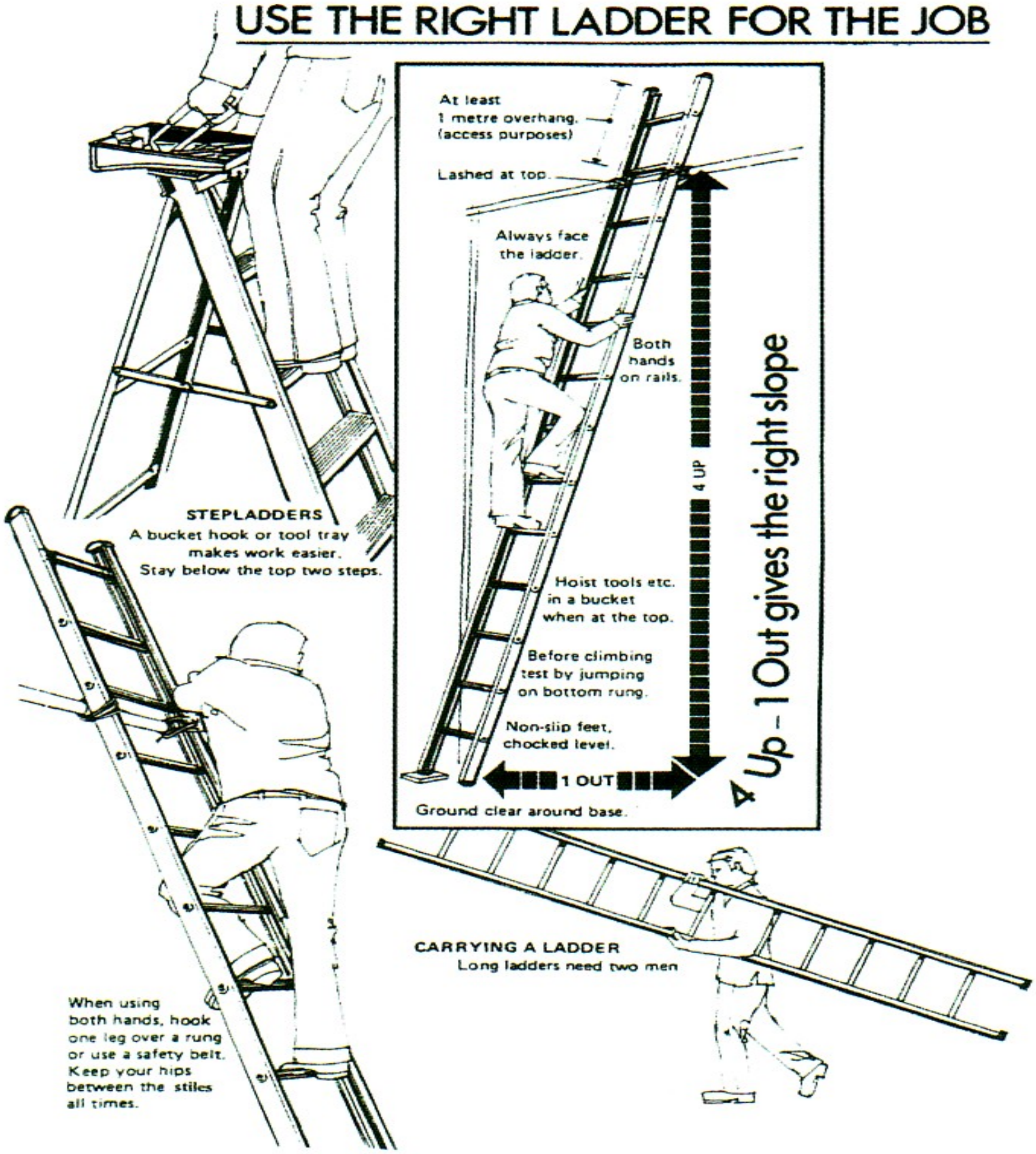




9. Position suitable barrier(s) around ladder(s) to maintain a safe work site if this is required.

10. Only have one person on the ladder at any one time except in an emergency situation.

11. Erect the ladder as close to the work as possible. A person on a ladder should never over reach, but instead should descend and relocate the ladder to a better working position.



Examples of Different Ladder Use

12. Remove mud, grease, etc. from footwear before climbing a ladder. Likewise keep ladder rungs and / or treads clean.

13. Don't stand on the "top" of ladders. A person's feet must be at least "3" rungs from the top on single or extension ladders and at least "2" steps or treads from the top of step ladders.

14. No one shall remove a ladder from a pole or structure while someone else is still aloft.

15. When a ladder is required to be placed against framing or brittle material such as asbestos sheet or rough casting – a board should be fixed across the top of the ladder stiles to distribute the load evenly on the wall. A single stile can penetrate brittle material or be unstable against framing material.

16. When a ladder is required to be used near a doorway, the door should be blocked open or locked closed or else a Safety Observer posted to guard the ladder.

17. Ladders placed in areas exposed to traffic (vehicular / pedestrian) must be protected against anything or anyone striking them, and should be conspicuously marked or barricaded off. If necessary, an employee should direct the traffic.

6•19•15•5 Hanging Ladders

Where a “hanging ladder” is used as a work position, the ladder shall be fixed in a secure manner and the person shall use limited free fall arrest or free fall arrest safety equipment, depending upon which type best achieves fall protection for the situation.

Where a person is working on a gondola ladder they shall be attached via a retractable inertia fall arrestor from the dorsal “D” ring of the harness to a tower steel member. For additional security the Line worker should use their work lanyard attached to the ladder. At no time is the work lanyard attached to the ladder to be the SOLE means of security.

Note : Where a ladder or gondola ladder has been placed in the horizontal position, maximum weight (including tools/equipment) not to exceed 150 kgs on horizontal ladder unless ladder type specifies otherwise and this is clearly indicated on the ladder.

6•19•15•6 Building Roofs Or Awnings

1. Where personnel are required to access a building or roof to gain access to a Point of Attachment (POA), they shall determine what is required to ensure it can be done safely. This may mean the use of :-

   1.1. A suitable ladder appropriately positioned and correctly secured*.
   Secured *means to be "free from or not exposed to danger / safe/ not liable to fall or become displaced".*

   1.2. Suitable Elevating Work Platform (EWP).

   1.3. Suitably erected scaffolding.

   1.4. An appropriate safety harness and fall arrest equipment, safety lines, etc.

   1.5. Suitable planking placed across the roof surface.

   1.6. Perimeter fall protection or barriers, essential for : two storey buildings, tiled roofs exceeding 300, metal and glazed tile roofs exceeding 260 and where a fall could land a person on a spear picket fence or similar.

   1.7. The assistance of other specialist people to WORK on the roof.

2. Ensure any ladder used is correctly secured* when placed against the roof in an appropriate position.

3. The ladder must extend at least one (1) metre ABOVE the roof. It must have non-slip feet and be placed on a level surface or otherwise levelled at the base.

4. **CAUTION**: For safety, electrically test the roof has not been inadvertently energised before touching and stepping onto it.

5. Ensure movement on the roof is carried out slowly and with extreme care.

6. Use appropriate fall arrest equipment and a suitable anchorage point. This may be :

    6.1. The service bracket at the POA.
    6.2. The ladder – if in a secure mode.
    6.3. An appropriate safety line rigged for the occasion.
    6.4. In the bucket of an EWP.
    6.5. A secure point on the building or structure.

7. Remain OFF the roof if the roof surface is slippery or not able to be accessed safely.

8. **Note** : Under no condition shall an employee step onto a roof constructed of fragile material such as asbestos, PVC, glass or other brittle substance.

9. Where work on awnings (roofs) involves the risk of a free fall – restrained fall arrest, limited free fall arrest or free fall arrest shall be used as appropriate to achieve the best fall protection for the circumstances and;

10. Consideration MUST be given to :-

    10.1. The use of other means of fall protection such as, Elevating Work Platforms or temporary work platforms.

    10.2. The use of approved insulated mats.

    10.3. Other specialised persons accessing the roof and doing the work.

6•19•15•7 Inspection And Maintenance

Shall comply with work practice Care And Use Of Ladders.

6•20 Rescue

6•20•1 Overhead

Employees must be trained in the appropriate method of rescue for the type of work being performed as per the following list of rescue work practices related to performing line work :-

- Elevating Work Platform and Controlled Descent Device Rescue
- Pole Top Rescue
- Tower Rescue
- Switchyard Rescue

Other rescue procedures are listed on TasNetworks, Work Practice Web Site under Work Function – **Rescue**.

Prior to performing work, a rescue kit must be on site and placed where it can be quickly obtained and used.

All employees must ensure they have currency in annual rescue refresher training.

6•20•2 Ground Mounted Apparatus

When working at ground level comply with the following rescue work practices as applicable.

Suitable Anchor Point

- Power Transformer Rescue

- Substation Rescue & LV Switchboard Panel Rescue

6•21 Gases & Fluids

6•21•1 LPG Gas

All gas cylinders in use or storage must be either caged, chained or otherwise secured in a vertical position in a way that will prevent them being dislodged and knocked over. This also applies during transportation.

LPG and Acetylene must be stored separately from Oxygen and other inert gases. Gas cylinders must be transported in a secure (upright) manner external to the cabin of the vehicle. An exception to this is small Liquid Petroleum Gas (LPG) cylinders.

6•21•1•1 Transportation Of LPG Cylinders

Only LPG cylinders, other than small camping cylinders, that are **NO bigger than 2.5 litres** (approx. 2.5 kg.) **can be carried in the passenger compartment of a vehicle**. [1 litre = 1 kg. approximately]. ***In order to avoid a serious accident or explosion caused by a gas leak from a "cylinder" in a vehicle – the following should be observed :-***

- Never transport / store cylinders in an unventilated vehicle. If the cylinder is transported regularly, keep the cylinder in a purpose built compartment with adequate drainage and ventilation.
- Never attach the cylinder to the external body of a vehicle UNLESS in a purpose built restraint, because of the potential risk of damage in a collision.
- Regularly check the cylinder for "leaks".

While transporting small gas cylinders is exempt from the provisions of the "Dangerous Goods (Road and Rail) Regulations", general duty of care provisions apply to all motorists when transporting these cylinders in their vehicles.

Bottles bigger than 2.5 kg. MUST be carried outside the cabin of the vehicle.

Open panel vans, four-wheel drive and other similar type vehicles that are NOT fitted with an external facility for carrying gas cylinders MUST NOT transport cylinders larger than 2.5 litres.

- Always ensure adequate cross flow ventilation.
- Keep unwanted ignition sources away from the cylinder.
- Secure cylinders and keep them upright.
- Unload the cylinder from the vehicle upon reaching your destination IF it is NOT in a purpose built compartment.

6•21•2 Working Adjacent To Gas Mains

Ensure you obtain accurate information about the location of buried gas pipelines BEFORE you do any work to significantly reduce these risks, especially when digging down to install poles and stays.

Dial Before You Dig (DBYD) is a free referral service for information on underground pipes (including gas)
To lodge an enquiry with Dial Before You Dig:
Phone: 1100
Online: www.1100.com.au

It is essential that you report any accidental damage to gas pipelines immediately.

This applies even in cases where only the pipeline coating or surface appears to be scratched. Superficial damage can weaken the pipeline and has the potential of future failure.

If you notice any signs of a leak near a gas pipeline immediately :-

- Remove and/or switch of all ignition sources except diesel fuelled plant and equipment.
- Extinguish cigarettes and naked flames, turn off petrol and electrical motors, remove mobile phones and battery operated equipment.
- Evacuate the immediate area.
- Call Emergency Services (Fire) 000.

Severe penalties can and will be imposed on individuals or companies who endanger the safe operation of a gas pipeline. Risking the lives or property of others by interfering with or damaging a pipeline or facility is breaking the law.

In the interest of everyone's safety, look out for gas pipeline markers and contact the Dial Before You Dig service before starting any excavation, drilling, boring or blasting activities.

Pipeline marker posts or curb markers serve to indicate that there is a buried gas pipeline nearby. Markers are only indicative and do not provide precise location details.

Contacts for urgent or emergency situations :-

- For distribution networks - Tas Gas Networks (TGN) on 180 2111
- For transmission pipelines - Tasmanian Gas Pipeline (TGP) on 1800 195 666

6•21•3 Hydraulic Fluids

6•21•3•1 General

Hydraulic fluid is dangerous. Fluid can escape when adjusting or removing equipment.

Fluid can be trapped in the hydraulic system even when the engine and hydraulic pump are stopped. Trapped fluid can be pressurized in excess of 2,000 psi.
Pressurized fluid can penetrate the skin, requiring prompt surgical removal. If not properly cared for, gangrene may result. Penetration injuries may not appear serious, but the injected body part is usually lost if medical attention in not promptly sought.

Do NOT attempt to service or repair Hydraulic Powered or Controlled Equipment. Contact an authorised person to have the servicing and/or repair work done.

When working with hydraulic lines and equipment comply with the following :-

- Stay away from pinholes and nozzles which eject fluid under pressure.

- Relieve pressure before disconnecting a hydraulic line.
- Promptly seek medical attention if fluid is injected into the skin.
- Review the Following Points
- Adjusting and removing equipment when hydraulic fluid is under pressure can be hazardous.
- Always relieve hydraulic pressure before loosening hydraulic fittings. Injury can result from the hot, high pressure spray of the hydraulic fluid.

- Do not cross hydraulic lines. If the lines are not coupled correctly, the implement will not rise and drop as expected. Tape or colour code lines to prevent an accident.
- Keep all body parts away from pinholes and nozzles which eject fluid under pressure.
- Never cross hydraulic lines on equipment.
- Follow all instructions in the operator's manual.
- Pre operational safety checks should be done before using hydraulic tools, checking for oil leaks, inspection of safety guards, damage to hose connections or couplings and damage or abrasions to hydraulic hoses. This is important to guard against a leak that could spray near energised apparatus.
- Tighten all connectors before applying pressure. Keep hands and body away from pinholes and nozzles that eject fluid under high pressure. Use a piece of cardboard or paper to search for leaks.
- Damage to tools or potential safety issues must be reported as soon as possible, and the tool taken out of service and repaired or replaced. While operating hydraulic tools, the operator must be appropriately dressed with approved personal protective clothing and equipment.
- The following is an amber lesson where incorrect work practice caused an incident with the use of hydraulic tools - Amber Lesson Hydraulic Tools.

6•21•3•2 Hydraulic Impact Wrench And Drill Holster

Special Requirements For Installation and Use

The "holster" shall :-

- Be a fully insulated full-length type similar to the Hastings one shown in the photo at right.
- Have a suitable "drain" hole, or holes, drilled in the bottom.
- Be permanently attached to the bucket when it is installed on the outside of the bucket as with the Live Line EWP's.
- Have all attachment fittings shall of an insulated material or covered by an insulating medium.
- Not have a facility on the outside for holding drill bits when it is mounted externally on an EWP bucket. Any "facility" supplied with a holster shall be removed BEFORE the holster is installed.

Note :

- For installation on EWP buckets other than those used for high voltage Live Line work –the "holster" may be fitted inside or outside the bucket. If fitted on the outside, it must be permanently attached as described above.

- Installation to be done by the vehicle fleet service provider.

6•21•4 Compressed Air

The protect yourself and others when using compressed air, you should be aware of the following safety guidelines :-

- Never point an air hose at anyone, including yourself, in fun or to remove dirt from clothing or the body.

- Never use compressed air for cleaning without adequate eye protection. Use safety glasses with side shields or goggles.

- If it is essential to use compressed air to clean dirt and chips from your work, use a proper nozzle on the end of the air hose to maintain air pressure at 30 pounds per square inch or less. Place a screen around the work area, or check to see that other workers are safely out of the range of flying particles.

- Whenever possible, substitute brushes or vacuum systems for compressed air in cleaning operations.

- Before using compressed air, check the air hose for damage or signs of failure. Make sure connections and couplings are tight.

- Before attempting to disconnect a hose from an air line, the air should be cut off, and the remaining air bled from the line.

- Keep air hoses off the floor where they become tripping hazards and are subject to damage by vehicles, doors, and dropped tools. If possible, suspend air hoses from overhead.

- Never use compressed air to transfer flammable liquids.

6•21•5 SF6 Gases

SF6 Gas is colourless and normally odourless and can be harmful to health if a significant amount is breathed in. Therefore SF6 must be carefully dealt with in accordance with the following practices.

- Work Practice Handling Sulphur Hexa-Fluoride (SF6) Gas
- Procedure For Disposal Of SF6 Equipment

6•21•6 Oils And PCBs

- WP Control And Clean Up Oil Spills
- WP Handling Polychlorinated Biphenyls (PCBs)

6•22 Explosives

6•22•1 General

This information is supplied to assist where employees are involved with Service Providers using explosives to carry out work for the Power Supply Authority.

The handbook "**Notes for the Tasmanian Shot-Firer**" produced by and available from the Tasmanian Regulatory Authority is the reference document for the use of explosives, and a copy must be available for any employee involved in the use of explosives.

The Australian Standard, AS 2187.2 "Explosives – Storage, transport and use Part 2: Use of Explosives", is also a handy reference source of information.

Only competent persons over the age of 21 years who hold a current Shot Firers Permit issued by the State Government Issuing Authority are permitted to handle explosives.

Shot-Firers Permits are issued subject to the successful completion of a recognised course in the use of explosives.

Transport of explosives falls within two relevant categories :

- Below 5 kg and including 125 detonators.
- Between 5 kg to 250 kg including 125 to 5000 detonators.

The storage of explosives has two categories :-

- Non-Licensed storage [up to 5 kg of explosives and 125 detonators].
- **Licensed storage to specified quantities.**

A register of all explosives must be kept where explosives are used and stored.

The register must contain the following information :-

- The quantities of explosives and detonators kept on the premises.
- The quantities of explosives taken in and out of the storage magazine.
- The dates and times at which those explosives are taken in and out of the magazine.
- The name of the person to whom the explosives are delivered.
- Qualifications of Shot-Firers.

All misfires and accidents must be reported through normal channels and an accident report must be completed following any incident.

The theft or attempted theft of any explosives MUST be reported immediately to the Police.

6•22•2 Blasting

Warning notices must be displayed on all approach roads to the blasting site and, when necessary, traffic must be stopped prior to firing.

It is also necessary that any persons likely to be affected by the noise or vibration from the blast be warned that blasting is intended and be advised of the audible warning signals to be used prior to every firing. It is essential that those persons likely to be affected by the blast can hear the warning signals.

Before charging, all tools and equipment not required by the shot-firer shall be removed before charging operations begin.

All explosives removed from the magazine must be carried to the site in covered containers, each holding not more than 25 kg. and until the site is ready for charging those explosives must be kept at least 15 metres away from the blast site.

6•22•3 Control of Fly Rock

In any blasting operation there is a possibility of damage being caused or danger from flying rock or other material projected from a blast. The Person in Charge shall use blasting mats or other suitable cover necessary to prevent such damage or danger.

Methods of controlling fly rock include :-

- Direction of Blasting Face.
- Depth of Hole.
- Charging.
- Burden
- Stemming.
- Delay Firing.
- Effective Cover(s).
- Blasting Mats.

6•22•4 Notification Of All In Proximity

Before starting a blasting operation within the limits of any city, town or built-up area, it is necessary to notify the clerk of the Local Authority at least 24 hours in advance. They will then issue official approval and will advise of any requirements or restrictions placed on the use of explosives within the area under their control.

A Shire, Council or Town Clerk may issue a Permit as approval for blasting subject to certain conditions specified by the Council and, if the shot-firer fails to observe any of the conditions, it should be clearly understood that the Council has authority to withdraw and cancel the Permit.

6•23 Site Incident Management

If a safety incident occurs it shall be handled in accordance with the correct process for **Reporting** and **Handling Incidents**.

7•0 TOOLS, PLANT AND EQUIPMENT

Click on page No. to go to topic.

7•1 General

The effectiveness of tools, plant and equipment used for work activities will only be as effective as the way in which they are serviced and maintained.

Tools, plant and equipment not maintained correctly will gradually become harder to use and can ultimately lead to accidents.

It is important to ensure that ALL tools, plant and equipment is regularly inspected each time prior to use for signs of wear and tear and, serviced and maintained in proper working order and cared for as stipulated by the manufacturer's specifications.

A management system must be in place, similar to the ENA Guideline For Inspection & Maintenance Of Tools & Equipment to properly manage inspection and maintenance of tools and equipment, and that requires;

Plant and equipment, to be regularly inspected/maintained and/or tested, and this must be done at stipulated time intervals specified in the management system or as per the manufacturer's instructions and to the appropriate "Standards".

7•2 Introduction Of New Equipment

All new tools, plant and equipment needs to go through a thorough assessment process to ensure it is adequate for the task and safe to use before being introduced into service for working on or near energised electrical apparatus.

Some factors to consider are :-

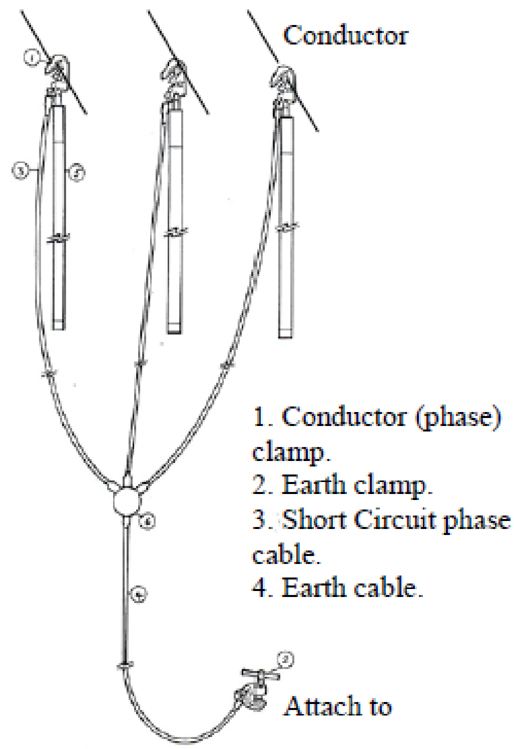
- Electrical test equipment – does it have the correct category rating for the electrical environment it will be used for ?.
- Does the equipment or plant have the appropriate level of insulation protection for the voltage(s) to be encountered ?.
- Does the plant or equipment need to comply with an Australian Standard e.g. for Elevating Work Platforms ?.
- Is there a requirement to have the equipment marked/labelled for periodic testing or servicing ?.
- Does a Work Practice need to be written ?.
- Will training be required ?.

Service Providers will need to ensure they go through a proper recorded process for introduction of new equipment and be able to supply this information should a safety incident occur later on.

TasNetworks employees shall go through the [Introduction Of New Technology Process Form](#) when introducing new equipment.

7•3 Portable Work Earths

The **earthing and short circuiting device** is a device permitting conductors to be earthed as well as short circuited. It comprises an earthing device and a short circuiting device.



The **earthing** part is for connecting the earthing system, or earth mass, to the short circuiting device and electrical installation equipment to be earthed.

The **short circuiting** part is for interconnecting conductors for short circuiting purposes.

The **applicator stick** is a hand-held insulating pole for bringing the connecting conductor clamps of portable work earths to parts of electrical installations for earthing and short circuiting purposes.

Operating personnel shall keep their hands BELOW the indicator point on the applicator stick to ensure they maintain the safe approach distance from potentially live apparatus.

As per the following [Green Lesson](#), operational earths shall be tagged to provide sound identification when common to multiple Access Authorities.

The earth clamp of the portable work earth may be connected to :-

•A known recognised earthing system.
•A metal ground rod of an installed ground stay.

- An approved metal earthing rod driven, where practicable, one (1) metre into the ground, "clear" of underground cables, water pipes, etc.

Note. Temporary earth connections should NOT be made to Air Break Switch handles or shafts.

Portable Work Earths must be periodically tested, inspected, tagged and disposed of if damaged as per the work guideline **Care And Use Of Portable Work Earths**.
CAUTION : When climbing a ladder to apply a portable work to an earthing near energised apparatus (particularly the earth point on an old EDO without an earthing stirrup which is only 300mm away from live HV) care must be taken to keep the work earth from being in contact with the body to avoid the risk of receiving an electric shock.

NOTE : All new NGK Stanger EDO units are now purchased with earthing stirrups that will increase Safe Approach Distance (SAD) to greater than 700mm which is the required minimum. Refer to the **Blue Lesson** for full compliance and technical details on the earthing stirrup.

7•4 Use Of Powered Tools

7•4•1 General

Powered tools may be driven electrically, hydraulically, by petrol engines, or by rechargeable battery. It is important not to overload the portable tool or to use it for purposes other than that for which the tool was designed.

Always inspect the tool before each use, and ensure that it is in a safe condition. Checks should include inspection of portable electric tool's flex, bolts securing blades, and security of chucks.

7•4•2 Hydraulic Powered Tools

Hydraulically driven tools can include drills, chainsaws, crimpers, etc.

Pre operational safety checks should be done before using hydraulic tools, checking for oil leaks, inspection of safety guards, damage to hose connections or couplings and damage or abrasions to hydraulic hoses.

Damage to tools or potential safety issues must be reported as soon as possible, and the tool taken out of service and repaired or replaced. While operating hydraulic tools, the operators must be appropriately dressed with approved personal protective clothing and equipment.

7•4•3 Petrol Driven Tools

Tools powered by petrol engines can include drills, chainsaws, brush cutters, concrete cutting equipment, generators, etc.

Pre operational safety checks should be done before the use of any petrol driven tool. Inspection of safety guards, potential fuel leaks and other signs of damage or abnormal wear should be checked.

Damage to tools or potential safety issues must be reported as soon as possible and the tool taken out of service and repaired.

A certified service agent for that specific tool should do all servicing, repairs or maintenance to the tool(s).

When using petrol driven tools, operators must be appropriately dressed with approved ear and eye protection, where required, safety helmet, safety boots, work gloves and appropriate clothing.

7•4•4 Electric Powered Tools

Electrical powered tools can include drills, bench and angle grinders, power saws, etc.

All electric tools must be tested annually and re tagged to ensure they are in a safe working condition.

Flexible cords of electric power tools should be inspected prior to each use in case they are damaged and make the appliance dangerous to use.

The Tag on electrical appliances at any given time should indicate less than one year since the last test date.

Defective or damaged tools and cords must NOT be used.

7•4•5 Electric Extension Leads

Extension leads must be :-

- Maintained in good condition.
- Inspected and tagged annually.
- Visually checked before each use.
- Protected from mechanical damage when in use.

Where long extension leads are to be used, a core balance earth leakage protection device [Residual Current Device (RCD)] should be used.

These are available fitted with a plug and socket to install “in line” in extension leads.

If cable reels for extension leads are used, the lead should be fully unwound prior to use.

Coiled flexes may overheat in use, resulting in permanent damage and possible fire.

The Table below shows the testing intervals for electrical equipment.

Type of environment where used	Interval between inspection and tests				
	Class of Equipment	Testing for portable RCD's			
	Class1 Protectively earthed	**Class 2** Double Insulated	**Test for Operation Push-button Test** [by user]	**Cord Extension sets and EPODs**	
1 Factories, workshops, places of work and repair	6 months	12 Months	Daily, or before every use, whichever is the longer	12 months	6 months
2 Laboratories, health care and educational	12 Months	12 Months	3 months, or before every use, whichever is the longer	2 Years	12 Months
3 Office Environment where equipment is not subject to constant flexing of the supply cord	5 Years	5 Years	3 months	2 Years	5 Years
4 Hire Equipment	Inspect before each hire. Test monthly	Inspect before each hire Test monthly	Inspect before each hire Test monthly	Inspect before each hire Test monthly	Inspect before each hire Test monthly
5 New equipment and repaired / serviced equipment	Prior to initial introduction to use, and after servicing	Prior to initial introduction to use, and after servicing	Prior to initial introduction to use, and after servicing	Prior to initial introduction to use, and after servicing	Prior to initial introduction to use, and after servicing
6 Construction and demolition sites	3 Months	3 Months	Immediately after connection into a socket outlet, and every day in use	3 Months	3 Months

7•4•6 Battery Powered Tools

These can include drills, crimpers, torches, etc.

Where no 240V power supply is available these tools can be extremely useful. For speed of use, battery drills have established themselves in the workplace as a fast reliable alternative.

For drilling, driving tech screws and multiple other uses, battery operated drills come in a range of sizes, chuck types, and adjustable torque settings to meet the many and varied needs.
Batteries are available with large capacity and quick recharge capability to minimise down time.

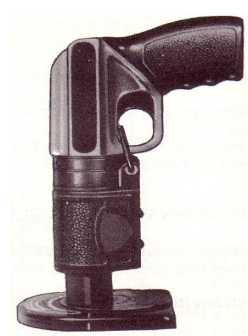
Note: Care needs to be exercised to prevent batteries shorting out, as they can become hot and possibly explode.

All battery operated tools are designed to serve a specific purpose and should only be used for that purpose.

Faulty tools should be returned for repair and or replacement.

7•4•7 Explosive Powered Tools

7•4•7•1 General Rules



No employee shall be allowed to use an Explosive Powered Tool (EPT) unless they hold a current Certificate of Accreditation.

No person shall issue a Certificate of Accreditation unless satisfied that the recipient has :

- Been trained in the safe use, inspection, dismantling, cleaning and re-assembly of the tool by a person authorised by the manufacturer to give such training.

- Passed a colour perception test to the satisfaction of a Medical Practitioner.

Approved eye and hearing protection must be worn by users and other persons in the vicinity of where an EPT is being used.

A logbook is to accompany each EPT and be kept in the same container as the EPT. The following information is to be recorded in the log book :

- The date and approximate duration a tool is used.
- The date of all inspections and services by the operator.
- The date and details of all inspections and repairs by the Manufacturer or authorised agent.

No EPT shall be used unless :

- A current logbook for that particular EPT is with the tool.
- The logbook is up to date as regards service overhaul and repair.

WARNING

An Explosive Powered Tool is a most useful piece of equipment - IT CAN ALSO BE A DANGEROUS WEAPON used incorrectly.

You are required, in most instances, to have a Qualified Operator's Certificate to : load, unload, or discharge an Explosive Powered Tool

7•4•7•2 Maintenance

Repairs to EPT's will only be made by persons authorised to do so by the manufacturer.

All repairs or defects noted by the operator are to be remedied before the tool can be used again.

Regular maintenance inspections are to be carried out and recorded as per the manufacturer's instructions when dismantling or cleaning the tool.

The tool is to be returned to the agents for a complete overhaul by an authorised person at least once every 12 months.
Check the tool after each firing and remove any particles of explosive or other foreign material before reloading.

Explosive charges are an ignition source, so don't use an EPT in the presence of, explosive or flammable gases, vapours, dust or, compressed air.

7•4•7•3 Storage of Explosive Charges

Containers in which EPT's or explosive charges are stored are to be kept securely locked at all times they are not in use. The person responsible for the EPT is to ensure only those people with a demonstrated need have access to the containers and keys.

The explosive container is to be clearly marked "**EXPLOSIVE CHARGES**".

Explosive charges are colour coded to indicate their explosive power. Users are to ensure that the explosive charges they use are the correct ones for the particular tool, and are of an explosive power appropriate to the task being undertaken.

If a misfire occurs, hold the tool in the firing position for at least 10 seconds after the attempted firing. If the charge has still not exploded, unload immediately. If repeated misfires occur, or misfires are frequent, regard the tool as defective and withdraw it from use. Have it repaired.

Every EPT must have the following notice permanently engraved or embossed on it:- **"DO NOT REMOVE FROM WORK SURFACE FOR AT LEAST 10 SECONDS IF TOOL FAILS TO FIRE."**

7•4•7•4 Precautions During Use

A warning sign must be prominently displayed in a position where it can be clearly seen by persons at or near the vicinity of where an EPT is being used. The minimum allowable size of the sign is 750 mm wide by 450 mm high.

Be aware of stance and assume a position that will maintain balance. Avoid tilting the tool during firing. Make sure the charge and fastener are suitable for the task and do not use the tool on materials that are likely to shatter.

When fastening into concrete special care should be exercised to avoid reinforcement or other known materials that could deflect the fastener.

EPT's are capable of causing serious injury to the user or other people in the vicinity if not used correctly. Treat them with respect and care and don't point them towards yourself or other people.

On any roof or other elevated surface where there is a possibility of the fastener penetrating through, check that an area of at least 6 metres in every direction from the point of use below the work point is clear of other personnel.

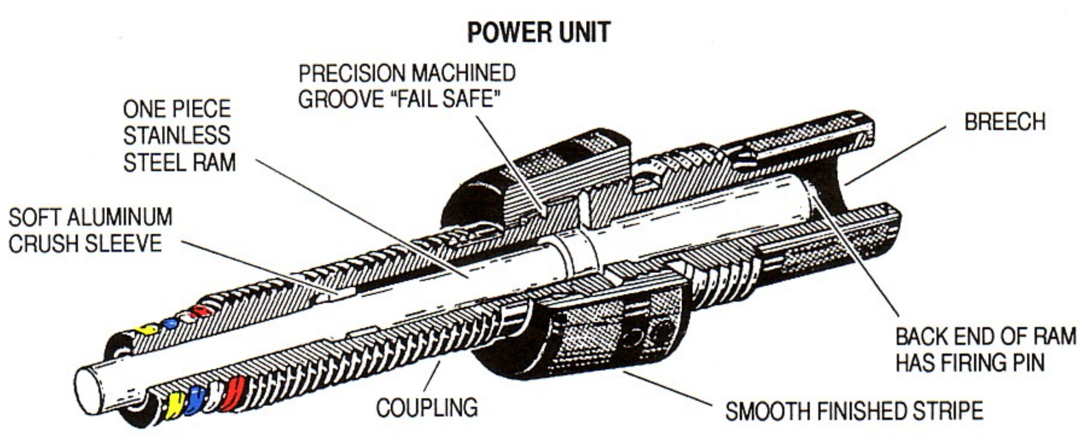
Keep well clear of the edges of concrete or other material that might crack or break away, and at least 15mm clear of the edge of any exposed steel.

7•4•8 Ampact Tools

Whilst the Ampact tool uses an "explosive" charge", it does NOT fall into the same category as the Explosive Powered Tools mentioned above.

The Ampact Tool is a precision-designed, powder-actuated tool. The Manufacturer provides a manual that contains information relevant to the use and care of the tool and the application of the taps and stirrups.

The Ampact Tool power unit has incorporated into its design a "Fail Safe" which will deliberately fail before any other part of the "Tool". The "Fail Safe" is designed to make the Ampact Tool inoperable when it is broken by allowing the coupling nut to turn so that the power unit cannot be screwed onto or within the tool head. See Diagram below.



Note.

- Disassembly of the "power unit" is NOT permitted, other than maintenance procedures listed in the Manufacturer's manual.
- An Ampact Tool should NEVER be operated with a broken "Fail Safe".
- Refer to Section 9.15.7 Making Connections for more details on the application and use of Ampact Tools.

7•5 Communication Equipment

7•5•1 Mobile Phones

The use of mobile phones while engaged in any work activity can distract a person's attention from what they need to focus on.

Mobile phones must be switched OFF and NOT used by personnel while they are physically engaged in work at the pole top, whether it is from a ladder, platform or EWP. Safety Observers who are directly responsible for assisting and monitoring Line Workers working at the pole top or Plant Operators shifting loads – shall NOT transmit or receive messages from a mobile phone whilst engaged in this activity.

Employees shall NOT use mobile phones while they are actually operating any machinery.

Employees who are directly involved in work on live electrical apparatus - shall NOT transmit or receive messages from a mobile phone while they are performing this work.

Employees shall NOT use mobile phones when driving vehicles UNLESS they are a "hands free" type and it is SAFE to do so.

A hands-free device can reduce the physical effort to make and receive calls.

However, drivers should also avoid making calls in heavy traffic or adverse weather conditions and should not engage in complex or emotional conversations while driving.

If a call is unnecessary or you consider it unsafe to answer at the time, don't answer the call and let it divert to voicemail or an answering service.

If the mobile phone is not connected to a hands free system then the only option is to let the incoming call divert to voicemail or pull over to a safe location on the side of the road and stop the car to take the call.

7•5•2 Trunk Mobile Radio (TMR)

Two-way FM radio systems must be operated in accordance with the rules and regulations of the Federal Communications Commission (FCC). Operators of these “radio systems” must do so in accordance with the RULES that apply to the particular type of radio operation. TasNetworks Pty Ltd is currently using a Trunk Mobile Radio (TMR) system.

Following the RULES will help eliminate confusion, assure efficient use of existing channels and result in a smoothly functioning radio network.

7•5•2•1 RULES for Operating the TMR System

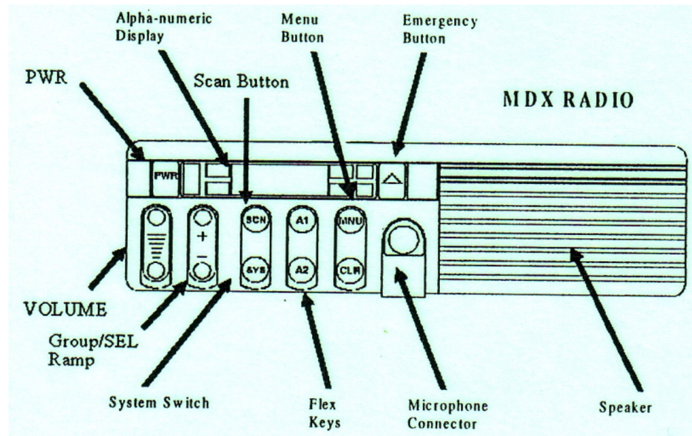
- Do NOT interrupt any **distress** or **emergency** message. It is a violation of FCC Rules. ***These calls have priority over all other messages***.
- Stay OFF the air - if another person is sending an emergency message.
- Listen to ensure the line is clear - before sending your message.
- Do NOT use profane or obscene language on air. It is a Federal offence.
- Do NOT send false calls or false emergency messages. It is unlawful.
- Keep conversations BRIEF and confined to business.
- Do NOT send personal messages. It is a violation of FCC Rules.
- Do NOT repeat or make known information overheard on the radio. It is a Federal offence. Conversations between “others” sharing a channel must be regarded as confidential.
- Do NOT make unauthorised changes or adjustments to the radio equipment.

- Turn the radio OFF when fuelling the vehicle (where there may be a possibility of igniting fuel vapours).

- Turn the radio OFF when approaching “Turn Off Two Way Radio” signs posted near blasting sites.

- Turn the radio OFF whenever blasting “caps” are being put into or removed from that vehicle.

- Use the radio ONLY when the vehicle is stopped, wherever practicable, or allow a “passenger” to operate it.



Example Drawing Of Trunk Mobile Radio

7•5•2•2 TMR Emergency Procedure

In an emergency i.e., accident involving injury, exposure to actual danger or potential danger the following procedure shall be used :-

1. **PRESS the Emergency Button.** On unit above, it is white with red triangle.

   All other users will be BLOCKED from using the talk group the emergency was declared on and allow communication between the monitoring agent and person declaring the emergency. The emergency button will ONLY activate a signal when PRESSED for LONGER than ONE SECOND.

   Note. ***The “emergency” button should NOT be confused with the green “PWR” button on these MDX radios***.

2. **CHECK your radio DISPLAY for ‘EMERGENCY’ to ensure it has worked.**

   The people monitoring the network system will attempt to contact YOU via the radio system within a few seconds of the emergency being declared.

   Note. Other radios on your same talk group will show E*XXXX where the XXXX is the identification of your radio that made the emergency call.

3. **Respond to the CALL** and :-

- **State your name.**
- **Company.**
- **Exact location.**
- **Reason for declaring the emergency.**

Note. The radio system is MONITORED **24 hours a day 7 days a** week and WHEN the emergency is declared – your radio number is displayed to the people monitoring the system.

If you UNINTENTIONALLY declare an emergency, DO NOT SWITCH OFF THE RADIO.

Reply to the person responding to your emergency signal and explain that it was a false alarm. If you do not reply, the emergency will be assumed to be real and escalated to your line manager.

If you change your CONTACT information, vehicle or radio ID number ensure you advise the Operations Section or your Fleet manager.
This information is essential for TRACKING when an emergency is declared.

Note It is important :-

- **To use the words "OVER" or "OUT" after the message to ensure the person on the other end KNOWS that the message and / or the call is "finished" - so they can respond at the appropriate time and in the appropriate place.**

- **That other radio users on hearing the emergency call – immediately cease their communication and free up the airway.**

7•6 Plant

7•6•1 Managing Plant

7•6•1•1 General

The following are general overarching requirements for managing plant.

- Managing Plant Procedure

The following link on the Work Practice Web site contains all the specific work practice requirements for vehicles, plant and machinery.

- VEHICLES, PLANT AND MACHINERY

The following sections contain the more relevant WPs and associated requirements for vehicles, plant and machinery relative to line work.

7•6•1•2 Licenses To Operate Plant

All persons working for or on behalf of TasNetworks must ensure they have the appropriate license, where required, which is current for the vehicle, plant or machinery being used in accordance with :

- **Where detailed in any specific work procedures or instructions listed throughout this hand book and;**
- **The** Guide For High Risk Licensing **in Tasmania.**
- **The following** Green Lesson **which covers more detailed requirements for High Risk Licensing Obligations.**

7•6•1•3 Introduction Of New Plant

Where any new plant is being introduced to perform work on/near the Power Distribution System, it must first be checked and vetted by TasNetworks, Work Practice and Safety Team for suitability and compliance and if there is any need for, a work practice to be written and, training.

7•6•2 Elevating Work Platforms

- Elevating Work Platform Procedure

7•6•3 Cranes

- Use Of Cranes Procedure

7•6•4 Pole Hole Borer Erector

- Use Of Pole Hole Bore Erector (PHBE) Procedure

7•6•5 Fork Lift Trucks

- Operating Fork Lift Truck.

7•6•6 Loadalls

- Operating Loadall.

7•6•7 Mobile Generators

TasNetworks has a number of mobile generators covering :

- 100KVA up to 550KVA at LV output.
- 1250KVA at HV output.

Persons must be authorised in accordance with the following work practice Mobile Generators Site Set Up Requirements to be permitted to connect up and operate any of the mobile generator model types listed in that WP that are permitted to be connected to the Network.

Note: The 1250KVA mobile generator operates the same as the mobile 550KVA generator, so use the 550KVA generator work practices. The only differences are that the LV output KVA is higher and, the generator is connected to a portable substation that steps the LV up to HV for connection to the HV network.

Persons holding a Line Worker qualification only can perform some limited fault response or site checks tasks in accordance with requirements listed on the Operating Standards Web Site.

7•6•8 Excavators

Where and Excavator is used by an Authorised Service Provider working for TasNetworks, the safe work principles and relevant work method in the following SWMS must be complied with.

- **SWMS Install, Remove, Straighten, Power Pole With Excavator**.

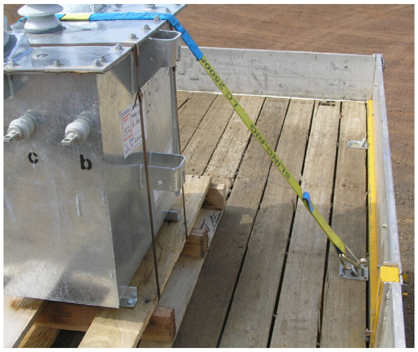
7•7 Moveable Objects

7•7•1 General Principles

- People directly involved in lifting, lowering or moving objects shall be appropriately trained and competent in what they are required to do. Refer to the **Manual Tasks Procedure**.
- People operating plant to lift, lower or move objects shall be competent, authorised and hold a current OH&S Certificate where applicable.
- People shall remain clear of objects while they are being moved, lifted or lowered.
- People and vehicles NOT involved in the work shall be kept well clear of the work area. If it is necessary to erect barriers to achieve this, then it shall be done.
- High visibility vests shall be worn when working near operational plant and on or near roads or areas accessible to vehicles.
- A **Traffic Management Plan** shall be implemented where applicable.
- Safe approach distances, in accordance with the PSSR shall be adhered to when working in close proximity of energised apparatus.
- A Safety Observer shall be used when one is required.
- Lifting gear shall be carefully selected, used correctly and, maintained in a serviceable condition, as per guideline **Care And Use Of Lifting Gear.**

7•7•2 Load Restraint On Vehicles

Also refer **Section 9.6.3 Carting Poles.**



Example Of Good Restraint **Example Of Poor Restraint**

For safety, it is important to ensure all equipment transported is restrained properly to avoid slipping, moving and falling off the vehicle.

The above example shows good restraint where a transformer is correctly mounted and strapped onto a loading pallet. The pallet and transformer is then correctly secured inside the vehicle sideboard using a ratchet strap.

In contrast, the other example shows poor restraint where the tie down strap is secured over the side board where the sharp angle of the sideboard would cut into and weaken the strap over time. In addition, road safety signage is sitting above the height of the side board where it could easily be blown out over the side of the vehicle.

Ensure you properly load, restrain, transport and unload equipment on vehicles comply with the following :-

- Placing And Securing Loads On Vehicles And Trailers.

- Load Restraint Guide.

  The Load Restraint Guide, developed by the National Transport Commission, is a useful reference tool covering the correct principles for load restraint. The guide also covers :-

  - General principles of load restraint.
  - Arranging loads on vehicles.
  - Driving laden vehicles.
  - Load on vehicles.

7•7•3 Transporting Loads

- Comply in general to National Transport Commission Load Restraint Guide.

- Guide For Transporting High Loads Near Overhead Powerlines.

  Work Practices/Guidelines :-

  - Transporting Loads.

  - Placing & Securing Loads On Vehicles And Trailers.

- Also refer to Sections, 9.5.2 Handling Poles **and** 9.6.3 Carting Poles.

7•7•4 Hitching And Securing Trailers

- This can be a major issue, as shown in the following picture, if trailers are not properly hitched and disconnect and cause a lot of damage and possible injury to the public.

Don't Let This Happen To You !

- Stores SWMS Handling Cable Drum Trailer. (although this SWMS was designed for use at Depot Stores, Line Workers etc. shall apply the same safety principles when working with Cable Drum Trailers out in the field).

- Therefore, prior to departure, a double check must be made to ensure the tow ball coupling is locked into position, and the safety pin and safety chain are properly secured – **don't let this happen to you**.

- Check the trailer lights and brakes work properly and, you are not driving with the trailer brakes still on.

- Check the load, weight does not exceed the maximum SWL of the trailer and the tow ball and, is evenly balanced across the trailer and properly secured.

- Refer to the blue alert on **Trailer Safety** for all the other things that need to be checked off to ensure trailers are used in a safe manner.

7•7•5 Lifting, Lowering or Shifting Objects

In all cases, when lifting, lowering or shifting objects, whether doing it manually with chain pull, rope blocks, block & tackle, etc. or by mechanical means with crane, fork lift truck, etc. the following safety rules shall apply : -

- Assess job and "object" to be lifted.
- Only select and use appropriate lifting equipment that is on sound conditions and has a tagged test date that has not expired. This **Red Lesson** illustrates this requirement.
- Select appropriate safety equipment.
- Examine equipment before use.
- Do not use incorrect or faulty equipment.
- Assemble and prepare equipment in the correct manner.
- Check Safe Working Load (SWL) and do not exceed.
- Attach object / load securely.
- Attach tag lines / ropes to load when required to control swing / movement.
- Ensure any "Assistant" is competent, informed and appropriately positioned.
- Take up and move load smoothly without jerking or erratic moves.
- Maintain a clear line of vision with load and assistant.
- Maintain a safe distance from adjacent buildings / structures.
- Keep everyone clear of load when moving or about to move it.
- **Note**:

  1. *Only trained / competent persons* shall direct Operator in movement of a load*.
  2. *Never stand under suspended loads or swing a suspended load over any person*.

- A **Dogman** (with dogging certificate) will be required to *sling and direct the crane or hoist Operator in the movement of the load when :-

  - Slinging techniques** are required to sling and lift the load.
  - The load passes out of view of the Operator.

* ***Slinging Techniques*** *is the exercising of judgement in relation to the suitability and condition of lifting gear and the method of slinging, by consideration of the nature of the load, its mass and its centre of gravity.*

7•7•6 Working Above Walkways Or Access / Exit Points

- There are times when there is a need to work above walkways or places where pedestrians could pass.

- In these situations - ensure **people are NOT permitted to walk directly beneath the pole / ladder / working position whilst someone is working aloft**. **There is also the risk of tools and equipment falling down onto employees or the public below.**

- Precautions may need to be implemented such as : -

  - Defining a safety drop zone area and;
  - Erecting safety nets over the walkway to prevent objects falling onto people.
  - Installing ropes or barriers to restrict pedestrians from entering work site or drop zone areas and guide them to using specific pathways.
  - Having an Assistant guide pedestrians through / around the work area.
  - Attaching tools, etc., via short lanyards to suitable anchorage points.
  - Stopping work until persons below have moved out of the way.

7•7•7 Working On Slopes

- When carrying out work on sloping ground there is a need for greater awareness and attention to detail.

- This is particularly important when round objects like poles, cable drums and the like are to be moved about or positioned on the ground. In this type of situation it will be necessary to : -

  - Avoid working / positioning yourself on the downhill side of moveable objects.
  - Use tag lines on objects to help eliminate unwanted / unsafe movement.
  - Handle objects with care and get assistance where required.
  - Maintain CONTROL over ALL MOVEMENT.
  - Ensure objects on the ground are securely chocked or firmly held.

7•7•8 Moving Materials And Equipment In Vicinity Of Electrical Apparatus

Where mobile plant is used in the vicinity of electrical apparatus – the following additional precautions shall be observed. For mobile cranes and vehicles transporting high loads :-

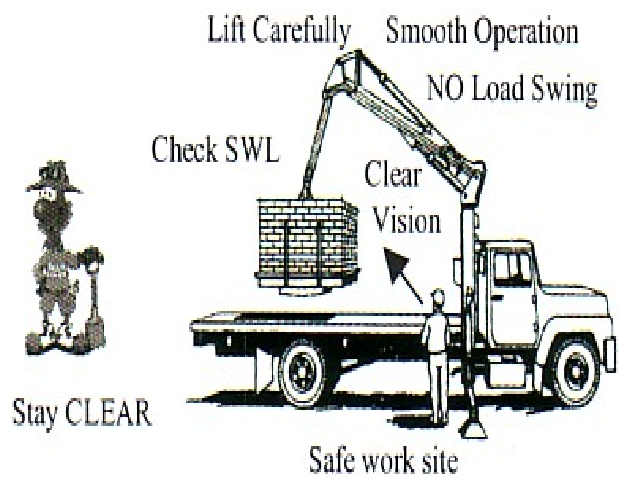
- Assess the access route and operational area to ensure required clearances can be maintained near electrical apparatus.
- Appoint a Safety Observer to observe the movement of the crane or transporting vehicle and to warn the Operator concerning their limits of approach.
- Use approved rope(s) on any suspended load to control its movement.
- Use clear and concise signals, hand and / or audible, when directing the Operator.
- Use standard hand signals and bell / whistle codes for signalling crane operators.
- NEVER infringe the SAFE APPROACH DISTANCE (SAD) and comply with the SADS for mobile plant within the **Power System Safety Rules.**

7•8 Mechanical Lifting

7•8•1 Safe Work Principles For Lifting Operations

- Wear the approved protective clothing appropriate for the job:-
  - Outer clothing to protect against cuts, abrasions etc.
  - Safety helmet.
  - Work gloves for hand protection and firmer grip capabilities.
  - Safety footwear for foot protection and stable footing.
  - Hearing protection and eye protection as designated. **Note**. Items such as earmuffs, safety glasses, etc. may be required with specific types of equipment or work activity and are covered by specific instructions and Manufacturer's handbooks.

- Comply with relevant rules and regulations.
- Hold the appropriate Licence, Permit or Certification
- Observe safe approach distance(s), particularly around live apparatus and;
- Use a Safety Observer where needed.
- Implement safe working procedures.
- Lifting equipment is used by trained and competent Operators.
- Lifting equipment is appropriate for the job.
- The weight of the load to be lifted does not exceed the Safe Working Limit (SWL) of the lifting equipment or plant used.
- Ensure a competent assistant/dogman is available to assist, when required.



- Assess the job and the weight to be lifted.
- Examine the lifting equipment before use.
- Assemble and prepare the lifting equipment carefully.
- Check on the Safe Working Load (SWL) and do NOT exceed it.
- Attach the load securely.
- Take up the load smoothly, without jerking.
- Do not stand under any suspended loads and keep a safe distance away.

7•8•2 Slings

- Slings of various sizes, varied safe working loads and material types are frequently used throughout the organisation to move loads. However, in distribution line work, the polyester round sling (also commonly referred to as a strop) is the type most commonly used.

- **When using slings of any type, the following points apply** :-

  - Slings must not be overloaded. They must be clearly branded with the Safe Working Load (SWL) and must not be used above that load.
  - All slings must be carefully inspected before use. Defective slings must be destroyed. [With round terylene slings – **if the outer case is damaged in any way, the sling must be taken out of service immediately and destroyed**].
  - Kinks must be removed before loading slings.
  - All employees required to use lifting equipment must familiarise themselves with the use of slings and spreader bars with respect to size and safe loads for various angles.
  - All employees required to use lifting equipment must familiarise themselves with the

use of slings and spreader bars with respect to size and safe loads for various angles.

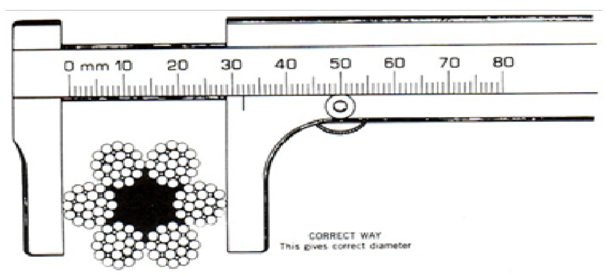
- The load must be distributed evenly over all legs with multiple slings lifting the **same** load
- Slings must not be placed around sharp edges of loads unless adequate padding is placed to avoid damage.

7•8•3 Wire Rope Slings

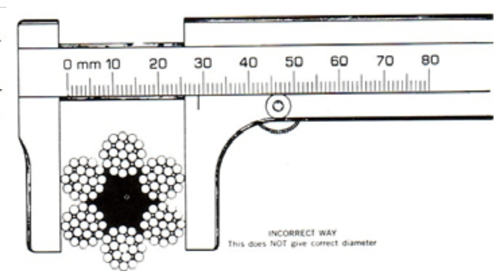
- **Note** : Due to the potential of wire ropes and slings to cause injury from whip lash from broken wires cutting through hands etc., wire ropes and slings are gradually being phased out and replaced with chain or webbing type slings.

- The use of steel wire rope slings for lifting materials provides several advantages over other materials. Greater strength and a minimum of weight are combined with greater flexibility.

- The composition of a rope is six individual wires arranged around a central core to make a wire rope. Ropes are referred to by a diameter size. The **CORRECT** way to measure wire rope is shown in the Diagram below.



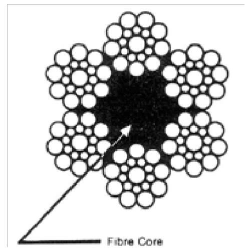
RIGHT way



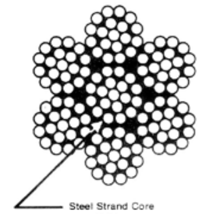
WRONG way

- In general, a large number of small size wires and strands produce a flexible rope with good resistance to bending fatigue. The rope construction is also important for tensile loading, abrasive wear, crushing, corrosion and rotation. A number of core types are available and each gives specific properties to the wire rope.

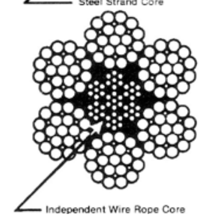
- **A fibre core** – generally sisal, provides a resilient foundation for the strands in the rope structure. Fibre cores are used for ropes that are not subjected to heavy loading, prolonged outdoor exposure, crushing on small drums and sheaves or where flexibility in handling is required. This rope is used on some winch trucks where the winch is under the vehicle cabin.



- **Steel Strand Core** – These cores are used chiefly for standing ropes in guys and rigging, and offer higher tensile strength, owing to the larger wires in the core with greater resistance to corrosion failure.



- **Wire Rope Core -** are preferred for operating ropes in applications of high tensile stress, high compression loads on small drums / sheaves and high operating temperatures as on most cranes used.



- **Safe Handling**:-
  - Wire ropes must not be overloaded or be used above their rated SWL load. They must be clearly branded with the SWL.
  - Avoid short radius bends around loads and small hooks.
  - Defects such as corroded or pitted surface of the wire and excessive wear or mechanical abuse such as pinched or partially cut strands shall be considered enough reason for removing wire rope from service.
  - Avoid exposing wire rope to corrosive fumes or liquids.
  - Every precaution must be taken to keep people clear of winches and winch ropes when they are under load.
  - Gloves must be worn at all times when handling wire rope.
  - Dragging wire rope from under loads or over obstacles should be avoided.
  - Incorrect handling of rope from reels and coils can result in the springing of wires or strands and possible kinking of the rope. This can greatly reduce the service life of the rope.

  - **DEFECTIVE WIRE ROPE MUST NOT BE USED**.

7•8•4 Chain Slings

- Chain slings are mainly used in those areas where the primary requirements are ruggedness, abrasion resistance and high temperature resistance.

- Chain slings must have a durable metal tag firmly attached depicting the Safe Working Limit and the mode of application. The diameter of the chain must not be less than 10 mm.

- **Inspection of chain slings** :-

    - If necessary, clean the sling before inspection. Check every chain link for : -
        - Signs of wear.
        - Signs of cracking.
        - Twisting or stretching.
        - Nicks or gouging.
        - Seizing or corrosion.

    - Check oblong links and / or hooks for signs of wear at their load bearing points and for any sign of distortion (e.g. widening of hook throat opening).

    - Check hammerlock coupling for :
        - Signs of wear at their load bearing points.
        - Excessive play of the pin within the body halves.
        - Impaired rotation of the body halves around the pin.

- **Chain links or fittings which have defects, should be clearly marked defective and the chain sling withdrawn from service until it is repaired.**

- **All visible signs of wear in any lifting gear or equipment should be reported to your equipment inspection Compliance Officer.**

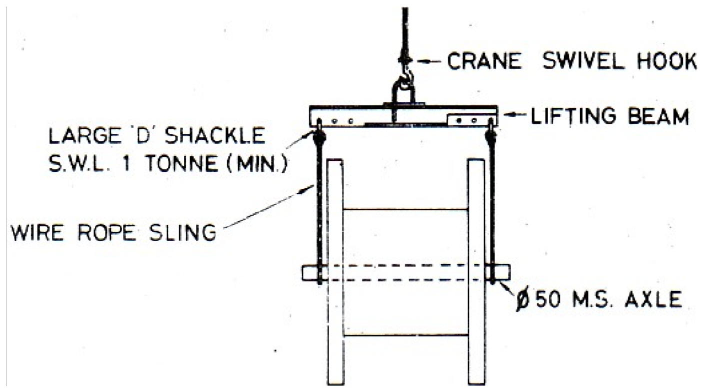
7•8•5 Round Slings and Webbing Slings

- These slings are made from 100% polyester and each sling is clearly labelled with the Safe Working Load (SWL).
- All slings are colour coded for increased safety and are usually flexible so they tend to mould themselves to the shape of the load.
- **Safe Use of These Slings :-**
  - Do not use sling if the ID tag is missing.
  - Do not use a damaged sling. Inspect before use.
  - Do not tie knots in sling(s) to shorten them or join two together.
  - Position sling(s) correctly. Sling(s) must not be placed over sharp edges without some form of protection or allowed to slide over corners or along edges.
  - Do not drag the sling(s) along the ground or over areas which can damage them or allow abrasive material or grit to penetrate the fibres.
  - Position the sling, and load, so as to allow easy removal of sling after use.
  - Avoid placing more than one sling on the same hook. Use appropriate 'D' Shackle).
  - Keep slings away from corrosive substances.
- **Inspection of Round Slings and Webbing Slings :-**
  - Lay sling on a flat surface in a well-lit area and examine both sides of the sling over its whole length and around the eyes.
  - Check for general wear and tear, particularly, cut or torn strands in the webbing sling, damaged seams or stitching in the outer sleeve and inner strands of the round sling.
  - Check for defects such as : abrasion, excessive wear, corrosion, discolouration or contamination.
  - Check that identification (ID) tag is still attached.
  - Check for the presence of grit, abrasive materials or other physically harmful matter.
  - If a sling is found to be damaged remove it from service and :-
    - ➢ Affix a **Hazardous Caution Tag** and write on it;
    - ➢ What was found wrong with the sling.
    - ➢ Your name and contact details.
    - ➢ Then send the defective sling to your local equipment inspection Compliance Officer to repair or dispose of.

7•8•6 Lifting Methods

7•8•6•1 Multi-legged Lifting Beams

- These lifting beams are a combination of steel spreader bars with lifting slings attached via 'D' s hackles.

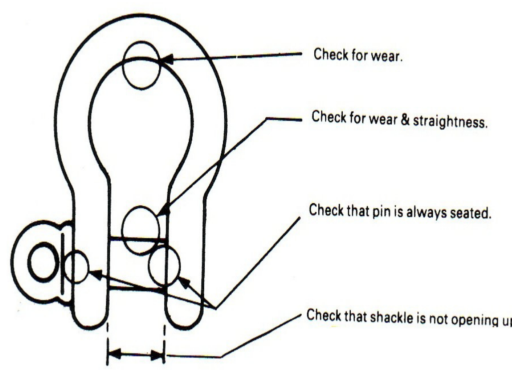


Sample "Lifting Beam" used for Lifting Cable Drums

- Lifting beams are normally used on wider / longer loads where it is required to distribute the lift evenly across the load. They also assist in keeping the load level whilst lifting.

- All lifting beams must have the **Safe Working Load (SWL)** and identification **Serial Number** "attached" in a prominent position. It must be fixed so that it cannot be easily removed or defaced. The SWL takes into account all the lifting components that make up the lifting device.

- The various lifting components (Dee shackles, slings, etc.) must not be replaced with components of a lesser SWL limit unless the SWL of the lifting beam is down rated accordingly.



- Slings must be placed within the bight of the hook. Gates or safety latches must be closed.
- Only approved eyebolts are to be used and they must be screwed down so that the flange is home. Side loads on eyebolts must be avoided and slings must not be passed from one eyebolt to another.

- Only approved shackles and pins are to be used for lifting. They must be clearly branded with the Safe Working Load (SWL). The correct size and type of shackle must be selected and used for each particular application. Threaded pins must be fully screwed home.

- **Inspection of Beam, Hooks, Eyebolts and Shackles** :-
    - All components of the Lifting Beam such as hooks, eyebolts, shackles, chains or slings, etc. must be regularly inspected for cracking, bruising or deformation.
    - **Faulty equipment must be replaced.**
    - Parts of a D shackle likely to wear are those shown by the circles in the diagram above. **These are the critical areas that MUST be inspected.**

7•8•6•2 General Purpose Jib

- A General Purpose Jib is a "lifting beam" that slips onto the tines of a Fork-lift Truck and is "secured" via a safety chain and hooking device.
- The type of "Jib" used on a Fork Lift Truck used by TasNetworks is an FJS 2.5 as shown below fitted on the tines. This is a general purpose lifting device with four (4) separate lifting points attached to a fixed and manually extendable boom.
- The Jib is primarily used when lifting and moving poles and, correct use of the Jib shall be in accordance with the work practice for **Operating A Fork Lift Truck**.

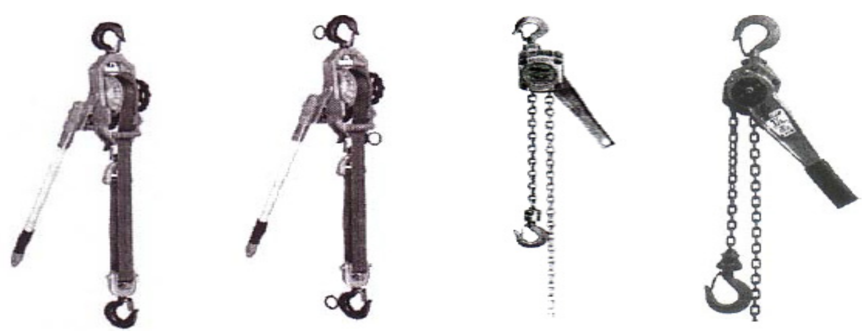
7•8•6•3 Jacks and Stands

- Only jacks and stands, which are in good working condition, shall be used.
- The rated lifting capacity of a jack should be stamped on the body of the jack and this capacity must not be exceeded.
- Jacks and stands must be set on an adequate base to prevent sinking, tipping, or slipping.
- The load must be fully supported by chocks or stands before employee's work underneath.
- The load must be raised and lowered in a steady manner, rushing can lead to mishaps.

- **Note**: You must avoid using excessive force with the slew mechanism of a Pole Hole Borer Erector (PHBE) when removing poles out of the ground. Instead, the PHBE shall be used in conjunction with a pole jack so the pole jack does the heavy work of removing the pole out of the ground to avoid damaging the slew mechanism of the PHBE. The following safety alert illustrates the damage that can be done to the slew mechanism – **Blue Alert Crane Borer Slew Mechanism Failure**.

7•8•6•4 Roto-lifts, Chain-pulls and Similar Equipment

- This type of equipment is used regularly for dead and Live Line work.
- **The following points should always be adhered to** :-
  - Be aware of the equipment's rated lifting / pulling capacity and never exceed it.
  - Ensure that other equipment (slings, Dee shackles, etc.) used in conjunction with these pullers have a rated lifting capacity at least equal to the puller.
  - When installing the puller, hang the body section first and then hang the chain hook. Ensure the body section ALWAYS hangs from the anchorage point such as cross arm, pole, etc. and NOT the other way around. Check the safety latches on the hooks are working correctly.
  - When removing the puller, unhook the chain end first and then unhook the body section.
  - Never fit pipe or such like over the handle of a puller to give greater purchasing power as this can damage the equipment and possibly cause it to fail.
  - Ensure that an equipment inspection Compliance Officer services the lifting equipment at regular intervals, not exceeding twelve (12) months.



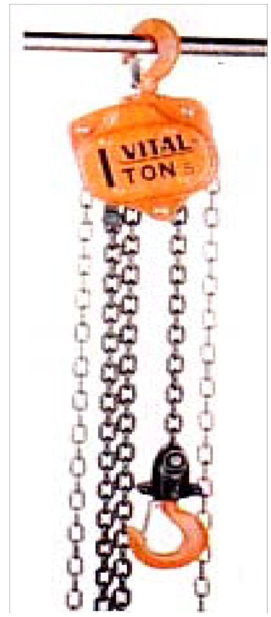
Samples Of Different Types Of Pullers

- Chain pullers are available in a range of styles, types and lifting capacities.
- Some variations are:-
  - Ductile aluminium alloy or steel housing.
  - Hardened steel alloy chain, wire or webbing strap.
  - Lifting capacity 1/2 tonne to in excess of 5 tonne.
  - Single line or double line pull configuration.

7•8•6•5 Rope and Chain Blocks

- Rope and Chain Blocks are used for raising, lowering or moving heavy loads. For example; lifting apparatus on / off poles, straining conductors and lifting equipment on and off vehicles.
- They can also be used to haul equipment in awkward situations, eliminating the need for heavy physical effort and manual work by personnel.
- **Rope Blocks** have one or more pulley blocks reeved with rope, and it is important that the rope and the sheaves are matched.
- The correct size rope to fit the sheave must be used. The minimum size rope used by TasNetworks = 12 mm diameter.

Sample set of Rope Blocks.
(Used by Live Line personnel)



- **Chain Blocks** are suitable for many operations on which a block and tackle is used and they are stronger, more dependable and more durable. They are capable of lifting much heavier loads and are easier to control.

Sample set of Chain Blocks.
(General purpose use)

- Every rope block or chain block must have a Safe Working Load (SWL) marked on it.

- **If the "blocks" are NOT marked with their respective SWL they should NOT BE USED until they are "marked".**

- If the SWL is exceeded at any stage, the lifting equipment may be damaged and the load dropped.

- Chain blocks come in all shapes and sizes and can be quite heavy to lift or to move from one place to another. Care is needed to handle them safely.

- Like other lifting gear, chain blocks and rope blocks should be regularly inspected and shall be thoroughly examined every twelve (12) months by a competent person, such as an equipment inspection Compliance Officer.

- Irrespective of the 12 monthly inspection, out at the work site, employees must check the condition of chain and rope blocks before each use by inspecting for the following :-

  - **Inspection of Rope Blocks** :-
    - Check the rope over its entire length, both inside and out.
    - Check the outside for broken fibres, cuts, nicks, signs of abrasion, burns, unlaying, or reduction in diameter.
    - Check the inside - by untwisting the strands, looking for broken yarns, soiling, discolouration or an accumulation of powder-like dust, which indicates excessive wear between the strands.
    - Check the sheaves, hooks and associated attachments for rusting, cracks, distortion, deterioration, bending or jagged pieces. This is critical in any area where the rope can make contact as the rope can be CUT and fail.
    - Loose pins or clips.
    - Faulty or missing safety clips on the hooks.
    - Should any of the above be found, remove the "blocks" from service and have them repaired or replaced.

- **Inspection of Chain Blocks :-**

  - Check the chain or chains over their entire length.
  - Check the condition of every individual chain link for signs of wear, twisting, stretching, cracks, nicks or gouging.
  - Check the sheaves, hooks and associated attachments for rusting, cracks, distortion, deterioration, bending or excessive wear.
  - Loose pins or clips.
  - Faulty or missing safety clip on the hooks.
  - Check operation of the unit, particularly for smooth operation and "locking off" where this is a function of the blocks.
  - Should any of the above be found, remove the "blocks" from service and have them repaired or replaced.

- **Safe Use of Rope / Chain Blocks**

  - Select lifting gear with the correct rated SWL and check the weight of the load.
  - Check the condition and operation of the lifting gear before attempting to use it.
  - Ensure the lifting gear is **correctly rigged*** and there are sufficient people to safely lift and control the load.

    Correctly rigged* : If this requires slinging techniques where the person involved must exercise judgement in relation to the suitability and condition of lifting, and the method of slinging, by consideration of the nature of the load, its mass, and its centre of gravity, the person rigging the load MUST hold a current Dogging Certificate.

  - Apply a steady even pressure on the pull line (rope or chain depending on type being used). Lower the same way.
  - Do not allow the pull line to run through your hands as it can burn and you may lose control of it.
  - Do not leave a load suspended from the lifting tackle any longer than necessary and do not allow anyone to walk or stand under a suspended load.
  - Post a Safety Observer, where required, to observe and warn when the blocks are getting close. This will prevent them locking together and causing over-stressing of the rope or chain, which may cause it to break and drop the load.

7•8•6•6 Power Operated Loadalls & Similar Vehicles

Where applicable, persons shall be properly trained and have a license to operate such vehicles, and the following work practices shall be complied with for vehicles used by TasNetworks employees :

- Operating A Fork Lift Truck.
- Operating A Loadall.

7•8•6•7 Vehicle Mounted Winches

- Operating Vehicle Mounted Winches.
- Lifting Or Lowering Loads With Vehicle Winches.

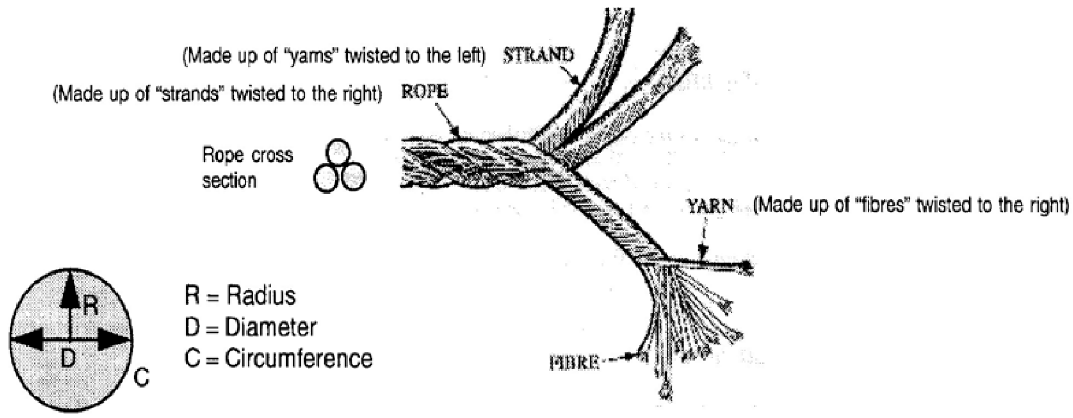
7•8•6•8 Portable Winches

- Work Practice Operating Portable Winches (e.g. Capstan Winch).

7•8•6•9 Natural and Synthetic Fibre Ropes

- Ropes are generally constructed of natural or synthetic fibre being twisted together to make a yarn.
- Natural fibres come from plants, which include manilla, sisal and hemp.
- Synthetic fibres include nylon, polypropylene and various polyesters.
- These yarns are further twisted to make a strand. Strands are then twisted in a right hand lay to make a rope.

- **Rope Construction**



These ropes are commonly used for : hand lines, in block and tackle sets or through snatch blocks to give a mechanical advantage when lifting or pulling loads.

- **Handling and Care of Fibre Ropes** :-
  - Only approved fibre ropes shall be used and the correct type and size of rope must be selected to perform the job safely.
  - Defective or damaged ropes must be removed from service.
  - Ropes must not be overloaded.
  - Ropes must be carefully inspected before using, for defects such as cuts, broken strands, wear or abrasion.
  - Ropes must not be exposed to acids or acid fumes during use or storage.
  - Sharp bending and kinking of ropes should be avoided. Square-edged objects must be padded.
  - Knots must be used with caution because they can reduce the load carrying capacity of a rope by as much as 50%.
  - Regularly inspect all rope and ensure it is free of grit infestation and any defects prior to use.
  - **Ensure ropes are dry before storing away.**

- **Inspection of Natural Fibre Ropes** :-

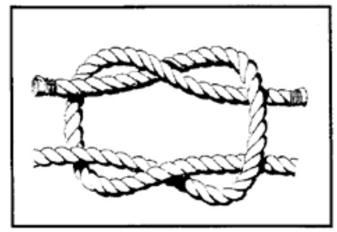
  In addition to the general rules above, the following rules apply to these ropes :

  - Because synthetic fibre is a thermo-plastic material which melts at relatively low temperatures, care must be taken to avoid exposure to high temperatures in either storage or use.
  - Synthetic fibre ropes must not be used in applications where friction could cause rope to melt or fuse.
  - Extra care must be taken when knotting these ropes because of their somewhat slippery surface, particularly when new.
  - When using these ropes, remember that they stretch more than manilla rope.

7•9 Knots and Their Application in Line Work

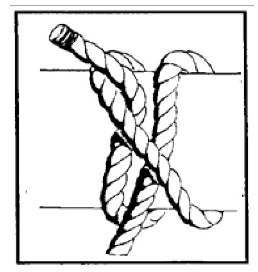
- The distinction between knots, bends and hitches is generally accepted as : -
  - A “ knot “ is the intertwining of the end of a rope within a portion of the rope.
  - A “ bend “ is the intertwining of the ends of two ropes or the same rope to make one continuous rope or endless rope.
  - A “ hitch “ is the attachment of a rope to a post, pole, ring, hook or other object.
- A good knot, bend or hitch is one that can be tied with speed and ease and which, when tied, will hold.
- A large percentage of overhead line work involves hauling of conductors, raising and lowering tools, equipment etc. The correct use of ropes and knots is essential.
- A suitable knot for any application must be safe, simple, convenient, reliable, will not damage the rope or equipment and be easy to undo when the task is completed.

7•9•1 Reef Knot



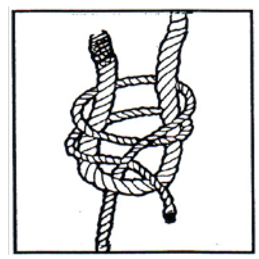
- **Used in First Aid Applications -** Can be used to join ropes of equal or close to equal diameter.
- **Method -** Pass left end over and under right end, reverse and pass right end over and under left end, then pull tight.

7•9•2 Clove Hitch



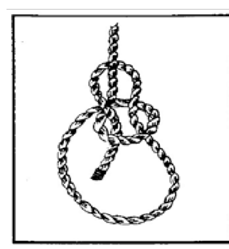
- **Used for tying ladders, strop or handline to pole.** Can be used to tie a handline to a pole, bar or similar round object.
- **Method -** Make a turn round the object, lead the rope up over itself & around a second turn, then bring the end of the rope under the cross-ing and pull tight.

7•9•3 Double Sheet Bend



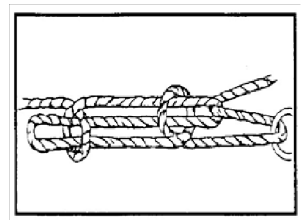
- **Used for running/ pulling through conductors.** Can be used for joining two ropes together.
- **Method -** Form a bight in one rope or conductor, pass other rope through and around bight twice, then back out underneath the loop and pull tight.

7•9•4 Bowline



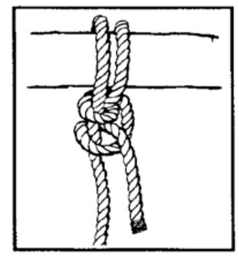
- **Used for hauling conductors to the pole top.** Can also be used to make a temporary loop in end of rope.
- **Method -** Make an overhand loop in the rope. Bring the rope end up through this loop. Pass the end behind standing part, down through the same loop. Pull the end and loop tight.

7•9•5 Sheep Shank



- **Used for temporary stays, tying down loads and for shortening up long ropes.** Can be used to temporary eliminate a weak spot in the rope.
- **Method -** Gather loops of rope in length to be shortened. Make a half hitch with the standing part at each end and place over the loops and pull tight.

7•9•6 Fisherman's Bend

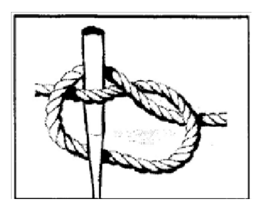


- **Used for lowering large limbs from trees.** Can also be used for tying ropes to rings, handles of buckets etc.
- **Method -** Wrap rope twice around object. Pass tail around rope and through loops. Finish with half hitch on rope and pull tight.

7•9•7 Becket or Buntline Hitch

- **Used for lowering small limbs from trees.** Can also be used to secure ends of tackles to beckets.
- **Method -** Pass rope around object, over & around itself, then back over the loop. Pass tail around the rope & back through the loop and pull tight.

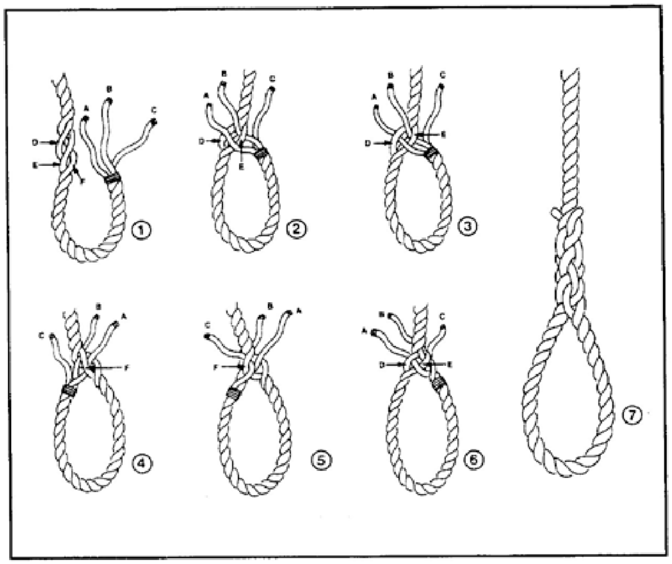
7•9•8 Lever or Marlinspike Hitch



- **Used for sending most equipment aloft on a handline.**
- **Method -** Grasp rope with hand. Lift and twist forming a loop with tail under on top of rope. Pass object or tool through loop arrangement and pull tight.

7•9•9 Splicing and Whipping Used in Line Work

1. **EYE SPLICE**

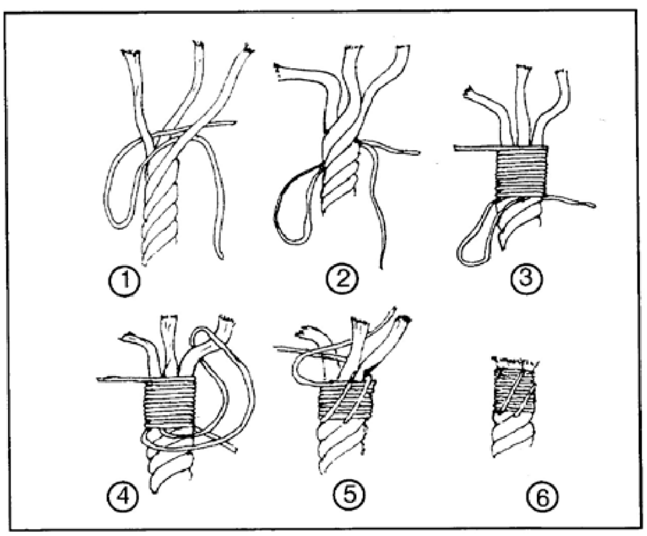


Used to form an eye in the end of rope for easy attachment.

Method :

1. Unlay strands A, B & C & tape/whip each end. Twist rope slightly to open up strands DEF of standing part of the rope.
2. Tuck end of middle strand B under the middle strand E of standing part of rope. Pull through.
3. Pass strand A over strand E & under strand D of standing part of rope.
4. Turn rope over to get at strand F.
5. Pass strand C over & under strand F as shown. Pull all three strands (A, B & C) in tight. (First round of tucks completed).
6. Pass strand B over strand D & under next strand to the left. Continue with A & C passing over one strand & under the next strand to the left.
7. Finish the splice by tucking each strand (A, B & C) once more through the rope.

2. **SAIL MAKER'S WHIP**



Used to lay hold of rope ends.

Method :

1. Unlay rope for approx. 50 mm with the centre strand away from you. Loop twine (as shown) with short tail 50 mm long and loop hanging down rope about 50 mm.
2. Relay three strands to original position.
3. Start wrapping long tail of twine around rope (from loop to top of rope) tightly & in opposite direction to lay of rope. Finish the whipping approx. 10 mm from rope end.
4. Following lay of rope, place loop over strand it was originally made around. Pull short tail of twine to tighten loop around the whipping.
5. Take short tail of twine up over whipping (following lay of rope) & tie both the tails together (reef knot) in middle of rope out of sight.
6. Cut off excessive tails of twine & fluff up the end of the rope.

8•0 LINE WORK – WORK SITE SET UP

Click on page No. to go to topic.

8•1 Management And Control Of Work Site

8•1•1 Overall Control Of Work Site

At any work site where work will be carried out on or near Power Supply apparatus it is the responsibility of every employee to perform work in a safe and professional manner and, work is controlled and managed accordingly by the person appointed to be in charge of the work site.

In the absence of anyone being appointed in charge of the work site responsibility will fall to the most senior person in terms of qualifications and experience to control and manage work is being performed in a safe manner.

Where TasNetworks employees are running a work site, all persons come under the control and direction of **the** TasNetworks person in charge of the work site and this includes any Service Provider**, Contractor, Sub Contractor**, or Traffic Control or other persons on site.

Where a Service Provider is performing work at a site in the absence of any TasNetworks employee(s) present, the Service Provider shall manage and control the work site in accordance with the above requirements.

Prior to performing any work on site it is very important to ensure the work site is set up as safe as possible with the person in charge of the work site and all employees considering all of the following functions and implementing them where applicable.

8•1•2 Where An Access Authority Is Issued

An Access Authority is issued by a Field Operator when switching/isolation is required to allow employees to work on the Power Distribution System.

To be able to receive an Access Authority, at least one person at the work site must have Person In Charge (PIC) accreditation, in accordance with the Power System Safety Rules.

The PIC is responsible to ensure that all employees on site work to the safety requirements and any restrictions imposed by the Access Authority. For this reason, it is best that the person managing the work site has PIC accreditation and;

All other persons at the work site must have Instructed Person accreditation.

8•1•3 The Use Of Work Permits

The use of Work Permits is confined to specialised tasks that involve a significant amount of risk if not managed properly.

As an example, if TasNetworks employees have to work in close proximity to a Tasmanian Gas Pipeline (TGP) – a **TGP Operation Work Permit** is required.

Another example is where a **Hot Work Permit** may be required to allow welding where it is necessary implement special safety control measures to avoid welding sparks igniting flammable material.

Where a Work Permit is issued ensure you comply with all the safety and control measures listed. You may also have to sign on and off the Permit.

8•2 Safe Work Method Statement (SWMS)

Under new Federal Work Place Safety Legislation it is now a requirement to perform work in accordance with a Safe Work Method Statement (SWMS) where the work is defined as high risk.

The following are SWMS used by TasNetworks that are applicable for line work being undertaken :-

- **SWMS Overhead General – Supply Isolated.**
- **SWMS Overhead General – Supply Energised.**

Service Providers and Sub Contractors etc. working for or on behalf of TasNetworks must also comply with the requirement to work in accordance with a SWMS for high risk work.

8•3 Job Risk Assessment (JRA)

All persons at the work site must be involved in performing a job risk assessment (JRA) taking into consideration all relevant risks covered under **Section 6.0 Safety** and;

The person in charge of the work site must finalise and document the risk assessment and any control measures on the JRA form and ensure this information is available on site if required and filed away later on for future reference.

8•3•1 Safety Control Measures

Safety control measures to be implemented :-

- Shall be based on implementing the hierarchy of controls as detailed in the WHS Safety Regulations i.e. priority is to eliminate, engineer, substitute or barricade out the risk if practical to do so before relying on PPE and administrative control measures.
- Must be able to reduce the risk down to an acceptable level otherwise work must not commence until this has been achieved.
- Must be discussed with, agreed and understood by all employees on site.
- Must be in place and, tested before hand if necessary, before any work commences.
- Re-assessment and effectiveness of safety control measures when circumstances of the job change.

8•4 Employee Consultation

All employees, including service Providers, Sub Contractors, Labour Hire and Traffic Management personnel etc., must be consulted on the intended, job plan, restricted work area, safety considerations and safety control measures via a toolbox meeting prior to commencement of work.

8•5 Follow Work Practice Steps

Properly following work practice steps each time will virtually eliminate the chances of a safety incident occurring and in addition will improve efficiency and eliminate costly rework.

Work practices are hyperlinked in blue colour this handbook. Any other relevant work practices can found on TasNetworks internal Intranet **Work Practice Web Site** or the **External Work Practice Site** for Service Providers (requires a Username and Password to gain access).

If a relevant work practice is available (e.g. for proper installation and commissioning a pole mounted transformer) the person in charge of the work site must make sure employees follow the work practice step by step to ensure work is done safely and to proper construction standard.

If no work practice is available and the work is reasonably complex, then the work steps should be written down in logical order and all employees made aware of the requirements. For high risk work, the written steps need to be attached to a SWMS (or written into or attached to a JRA in the absence of a SWMS) and attached to the paper work returned for the job for filing away for future reference.

In addition to this, if the work practice steps are considered important a formal work practice should be drafted up and approved by either the Service Provider or TasNetworks and rolled out as copies to employees in a formal manner.

8•6 Rescue And First Aid Set Up

Where applicable (e.g. working at height) the relevant rescue and first aid kits must be made available and be ready to use on site if needed and;

- A pre-use inspection must be made to ensure all the equipment required is there and in sound working condition.
- A person with currency of rescue training for the type of work being undertaken must be nominated to perform a rescue.

8•7 Qualifications On Site

All employees, including those of Service Providers and Sub Contractors, at the work site must carry proof of current qualifications and accreditations and licenses etc. and be able to produce these when required.

The person in charge of the work site must not allow anyone to commence work unless it can be confirmed the person(s) involved have the appropriate competency, qualifications, accreditation and licenses required for the type of work to be carried out.

8•8 Traffic Management

Persons must be trained and have "**Implement Traffic**" accreditation to be permitted to implement Traffic Management Plans (TMPs).

TasNetworks employees shall comply in general with the **Traffic Management Procedure.**

For simple traffic management, TasNetworks and Service Provider employees should select and implement an appropriate TMP from the **Traffic Selection Matrix**.

Where a Traffic Management Contractor is called in (usually to set up a traffic management plan for a complex set up), close consultation is required with the person in charge of the work site to ensure traffic management is adequate and;

The person in charge of the work site must ensure, and in particular at a “rolling work site” where work is on the move (e.g. replacing a number of power poles along a road), that :

- The correct traffic plan has been implemented, particularly if it is a plan provided by TasNetworks.

- The traffic management keeps up with a moving site as work progresses (e.g. from pole to pole) and;

- Work vehicles and mobile plant do not inadvertently move outside the area covered by the traffic management plan and;

- Visitors to the work site (e.g. Line Manager, Field Auditors, and Consultants etc.) are made to comply with the traffic management plan requirements.

8•9 Isolation Of Supply – General Requirements

When it is considered that work on low voltage lines or apparatus is too dangerous to be carried out energised – then it shall be de-energised and, isolated where practical to do so.

If a Field Operator has de-energised and isolated supply and issued an Access Authority the PIC must ensure :-

- All persons at the work site sign onto the Access Authority.
- Conduct a toolbox meeting to spell out, the requirements listed on the Access Authority and, the boundary of the de-energised and isolated work zone that employees must work within.
- Despite the work site being de-energised and isolated spell out the need for employees to be fail safe and always test to confirmed de-energised if absent from the work site for some time, before resuming work.

If a Field Operator is not involved then to de-energise and make safe for work :-

- Identify the neutral, by inspection, and mark accordingly.
- Prove its identity with the line alive by testing between conductors with an approved “Tester” which is “known” to be working correctly.
- Isolate all “active” conductors and the neutral if required. Neutral may remain connected if not required to be replaced.
- Prove dead by “testing” all conductors using “Identification” test.
- Fit “warning notices” at places where the low voltage could be livened up.

Caution:

(1) If a conductor has to be removed from the pole always lower it with a handline or suitable device and take precautions to ensure it does not come into contact with any other live conductor(s).

(2) If an LV service has not been isolated at the POS and the isolation has occurred further back in the power system you need to take into consideration the possibility of the overhead conductors becoming energised from another source as per **Section 6.12 Other Safety Considerations** and;

Where there is any doubt at all about the overhead conductors and any other apparatus becoming inadvertently energised at any time them energised work methods must be used.

8•10 Isolation Of LV Supply

8•10•1 General

This section covers the proper isolation of LV supply to make the work site safe by isolating the "primary" side and, where necessary, the "secondary" side as well.

Where proper isolation cannot be achieved then live LV work methods must be used in accordance with **Section 12.2.1.4 Working On Or Near Live Low Voltage**.

8•10•2 Isolation Of Primary Supply

Primary isolation covers isolating all sources of primary supply from the distribution supply side from the location where the work will be performed and;

Where possible isolate by opening an Air Break Switch, Isolating Links or Fuses (e.g. LV output side of pole transformer). Where this is not possible or practical to do so then you may need to disconnect conductors from the primary supply - ***to de-energise and make safe for work :***

- Identify the neutral, by inspection, and mark accordingly.

- Prove its identity with the line alive by testing between conductors with an approved "Tester" which is "known" to be working correctly.

- Isolate all "active" conductors and the neutral if required. Neutral may remain connected if not required to be replaced.

- Prove dead by "testing" all conductors using "Identification" test.

- Fit "warning notices" at places where the low voltage could be livened up and also consider the need to lock and tag to ensure inadvertant livening up cannot occur.

- **Note.** If a conductor has to be removed from the pole always lower it with a handline or suitable device and take precautions to ensure it does not come into contact with any other live conductor(s).

8•10•3 Isolation Of Secondary Supply

8•10•3•1 General

CAUTION : Only isolating just the **primary side** may not provide total isolation to make the work site safe as there could be the possibility of the work site becoming alive from the **secondary side** that is;

The distribution mains, through to customer installations via the service and service fuses, becoming alive from alternative sources of supply (e.g. from solar inverters, portable generators or overhead street light circuit operated by PE cell or switching circuit on a timer).

Therefore, where possible to do so, isolate the secondary side by removing customer service fuses and;

Where fuses could be within easy reach of persons and inadvertently re-inserted comply with work practice Isolation Of LV Services to ensure this cannot happen.

8•10•3•2 Isolation For Long Term Or For Safety

Where a service fuse needs to be removed for a lengthy period or there is an issue with safety comply with the following work practices :-

- Isolation Of LV Services and/or;

- Affix Hazardous Caution Tag and;

If a Hazardous Caution Tag has been fitted the overhead service must not be re-energised until it has been confirmed the condition listed on the Tag has been addressed.

8•11 Isolation Of HV Supply

CAUTION : All High Voltage electrical apparatus shall be regarded as ALIVE until isolated, proven DEAD (de-energised), earthed and short circuited in the approved manner.

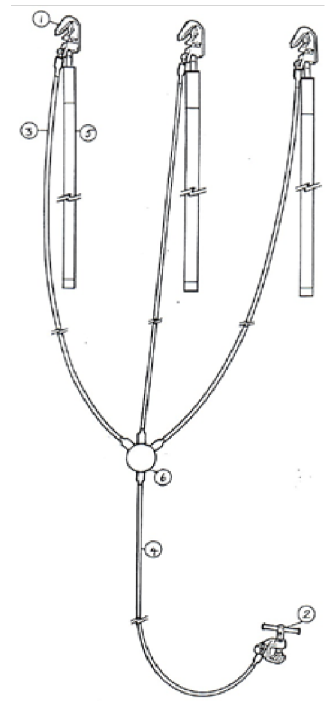
Isolation of HV supply shall be done by a Field Operator (an Authorised Person) in accordance with Switching Procedures and the PSSR.

In general, before carrying out work on or near exposed high voltage electrical apparatus connected to or capable of being connected to the network by operating or the making of loops - except where approved Live Line techniques are applied – the Field Operator will :

1. **ISOLATE** the associated electrical apparatus from ALL possible sources of supply.
2. **SECURE the ISOLATION** to prevent it becoming energised – by applying approved “Tags” and “Locking Devices”.
3. **PROVE DEAD** - the associated electrical apparatus - by using approved testing devices and procedures.
4. **EARTH & SHORT CIRCUIT** - the associated electrical apparatus - immediately after proving dead, by means of approved earthing devices and procedures.
5. **CLEARLY IDENTIFY the SAFE WORK AREA** - by using approved means. This may require the installation of “barriers” if considered necessary to keep unauthorised persons out.
6. **ISSUE an ACCESS AUTHORITY** and **ADVISE PERSONNEL** of :
   - The extent of the work area.
   - Any conditions to which the Access Authority is subject.
   - Any electrical hazards in the vicinity of the work area.

   CAUTION : Where a work crew is absent from a work site for some time, to be fail safe, test to prove de-energised before touching and working on supply apparatus.

8•11•1 Portable Work Earths



The **earthing and short circuiting device** is a device permitting conductors to be earthed as well as short circuited. It comprises an earthing device and a short circuiting device.

The **earthing** part is for connecting the earthing system, or earth mass, to the short circuiting device and electrical installation equipment to be earthed.

The **short circuiting** part is for interconnecting conductors for short circuiting purposes.
The **applicator stick** is a hand-held insulating pole for bringing the connecting conductor clamps of portable work earths to parts of electrical installations for earthing and short circuiting purposes.

Operating personnel shall keep their hands BELOW the indicator point on the applicator stick to ensure they maintain the safe approach distance from potentially live apparatus.

The earth clamp of the portable work earth may be connected to :

- A known recognised earthing system.
- A metal ground rod of an installed ground stay.
- An approved metal earthing rod driven, where practicable, one (1) metre into the ground, “clear” of underground cables, water pipes, etc.

Note: Temporary earth connections should NOT be made to Air Break Switch handles or shafts.

CAUTION : Under no condition shall the separate multiple earthed neutral (MEN) of the Low Voltage system be used for earthing of HV conductors.

Once conductors and electrical apparatus have been isolated and proven de-energised, it is the Operator's responsibility to apply approved earths either at the work location or between the work location and all points of ISOLATION. The preferred choice is to install earths to a recognised earthing system at or near the work location.

A recognised earthing system is a permanent earthing point provided for the purpose of earthing, such as an operational earth permanently installed on a pole.

Note: Operational earths must NOT be applied to LV MEN earthing points.

If temporary earths cannot be applied to a recognised earthing system or if none exists in that location, then earthing connections can be made to a temporarily installed approved earth stake driven into the ground within sight of the work location. The earth stake should be driven approximately 1.0 metre into the ground.

A ground "stay rod" is a recognised earth point.

If operational earths are not visible from the work location additional local earths (work earths) must be applied on-site by the "working party".

Earths must only be connected to overhead conductors after the conductors have been proved de-energised.

Earthing and short circuiting apparatus must be left attached to the conductors or apparatus until all work is completed and all persons are clear of the conductors or apparatus.

8•11•2 Temporary Work Earths

8•11•2•1 General

When working on de-energised equipment, lines or apparatus, it is a safety requirement that temporary work earths shall be installed to maintain the equipment equipotential to a **known** earth, thus ensuring the safety of persons working on the equipment.

Earths also protect against dangerous voltages becoming induced in equipment under repair.

REMEMBER: Temporary work earths shall only be attached to electrical conductors AFTER they have been proven to be de-energised and isolated.

8•11•2•2 Earthing Arrangements And Attachments

When overhead conductors are earthed to a **recognised earthing system** the earth connection, clamp, shall be clamped to a permanent earthing attachment provided for the purpose, or to an earth wire by means of a suitable clamp or fitting.

Recognised earthing attachments are :-

- A permanent HV earth provided for earthing purposes.
- A ganged isolator HV earth.
- Earthing point on the bottom side of an EDO.

  CAUTION : Where boric acid fuses have been installed in EDOs these came with an earthing point on the top as well as the bottom. And, even though there is a program in place to remove the top earthing point there may still be some units in service with the top earthing point with the risk of an operator after PROVING DEAD may became confused or blind sighted looking for an earthing bolt, and may apply their EARTH to the LIVE SIDE top of fuse. Refer to **Amber Lesson** on this.
- A transformer HV earth.
- A pole stake if the earth fitting will connect securely.
- The steel rod of a ground stay.
- An approved metal earthing rod (1375 mm long) driven 1000 mm into the ground.
- A trailing earth may be used an option on moveable objects, such as a scaffold being used within a switchyard, to ensure the scaffold frame is earthed at all times to protect against induced voltages.

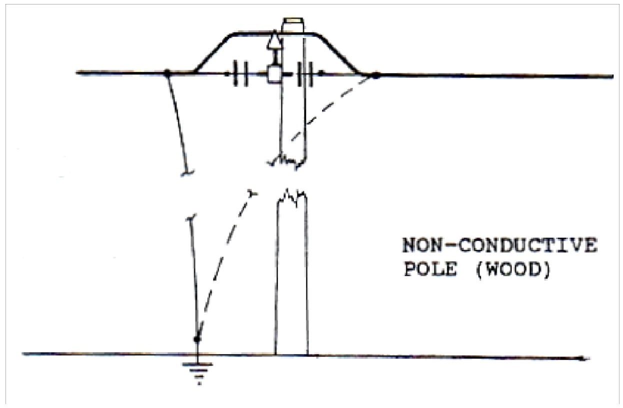
Note. Earths shall NOT be attached to MEN earthing points.

A low voltage neutral earth system shall NOT be used as a temporary high voltage earth.

Earthing and short circuiting shall be installed at or within **sight of the work location**, except that when the nature of the work renders this impracticable, the earth connection(s) shall be placed as near as practicable to the work location. Either way - **they must be placed between the work location and all points of ISOLATION**.

When a HV system to be worked on is divided, or it has to be divided, the conductors on BOTH sides of the divided section shall be earthed and short circuited.

BOTH earthing "clamps" of the two sets of work earths shall be **connected to the ONE earth point**. See following diagram .



Note. In the case of a conductive, steel or concrete, pole – connect BOTH earths to the same point on the pole. Use an earth lug bolted to the pole in an approved manner.

Without using the second earth – a dangerous potential voltage, may otherwise exist between the earthed and unearthed conductors as a result of INDUCTION.

REMEMBER. The source of induction could be a considerable distance away and NOT evident at the work site.

The same earthing and short circuit equipment may be used on copper or aluminium conductors provided the clamp connector used is at least 25mm long and has a plain, not ridged, surface.

Wherever possible, apply the earths to a bridge, loop, in preference to a tensioned conductor. Do not over-tighten the clamp or the conductor may be damaged. It is better to have a loop burn through than a conductor that would drop to the ground.

Do NOT apply earth "clamps" to helical terminations or conductor ties.

8•11•3 Applying HV Earths Through LV Conductors

8•11•3•1 From A Ladder

1) Set the ladder and work site up according to standard instructions.
2) Prove HV conductors dead using approved method.
3) Fit rubber sleeves to LV conductors where the "earth" lead will pass between.
4) Hang bottom part of earth and clamp over rung of ladder clear of the ground.
5) Pull earth set up between LV conductors and hang up pole.

6) Attach bottom part of earth and clamp to recognised earth point.
7) Attach each of the earth / short circuit clamps to HV conductors in turn using approved method.

8•11•3•2 From an EWP

1) Set the EWP and work site up according to standard instructions.
2) Prove HV conductors dead using approved method.
3) Take complete earth / short circuit set up in bucket of EWP.
4) Fit rubber sleeves to LV conductors where the "earth" lead will pass between.
5) Carefully lower bottom part of earth and clamp down between the LV conductors.
6) Keep each of the earth / short circuit clamps clear of all live conductors.
7) Have ground assistant "attach" bottom part of earth clamp to a recognised earth point.
8) Attach each of the earth / short circuit clamps to HV conductors in turn using approved method.

Note. Removal of earthing set(s) is the reverse of installation.

8•11•4 Final Checks Prior To Working On Isolated HV

CAUTION : **All High Voltage electrical apparatus shall be regarded as ALIVE until isolated, proved DEAD, earthed and short circuited in the approved manner.**

There is a great deal of information contained in the **Power System Safety Rules** about "working on or near High Voltage exposed electrical apparatus". Reference should be made to this document for clarification.

In general, before carrying out work on or near exposed high voltage electrical apparatus connected to or capable of being connected to the network by operating or the making of loops - except where approved Live Line techniques are applied - an authorised person shall :

1) **ISOLATE** the associated electrical apparatus from ALL possible sources of supply.
2) **SECURE the ISOLATION** to prevent it becoming energised – by applying approved "Tags" and "Locking Devices".
3) **PROVE DEAD** - the associated electrical apparatus - by using approved testing devices and procedures.

4) **EARTH & SHORT CIRCUIT** - the associated electrical apparatus - immediately after proving dead, by means of approved earthing devices and procedures.

5) **CLEARLY IDENTIFY the SAFE WORK AREA** - by using approved means. This may require the installation of "barriers" if considered necessary to keep unauthorised persons out.

6) **ISSUE an ACCESS AUTHORITY** and **ADVISE PERSONNEL** of :

- The extent of the work area.
- Any conditions to which the Access Authority is subject.
- Any electrical hazards in the vicinity of the work area.

8•12 Locking And Tagging

Locking and tagging of HV and LV supply shall comply with **the Isolation, Lockout And Tag Procedure**.

CAUTION : Where work will be done where access to the isolation point is readily available to third parties, such as the public, the lockout/tag out process must be used to avoid the supply becoming inadvertently re-energised.

8•13 Need For Safety Observer

In a high risk situation, such as operating machinery and plant near energised overhead lines, there may be a need to have a Safety Observer to observer to make sure SADs will not be breached.

The following is an extract from Section 3.6. of the Power System Safety Rules on the requirements and duties of a Safety Observer :

- The *Person In Charge* of the *Access Authority* shall not perform the role of *Safety Observer*.

- The *Safety Observer* shall be a *Competent* person responsible for :-

  1) Understanding the extent of the *Apparatus / Work Site* covered by the *Access Authority*.

  2) Understanding the specific *Hazards / Danger Points* associated with the *Apparatus / Work Site*.

  3) Signing on and off the *Access Authority* as a *Safety Observer*.

4) Performing the role of a *Safety Observer* exclusively and not performing any other task.

5) Being positioned at a suitable location to effectively observe and be able to immediately communicate with workers performing the work.

6) Warning against unsafe approach to Energised Apparatus.

7) Stopping work processes to prevent unsafe situations arising.

9•0 LINE WORK – CONSTRUCTION TASKS

Click on page No. to go to topic.

9•1 Introduction

Section 9.0 covers construction and installation work of the following assets prior to the next logical stages of the work, Section 10 LINE WORK – PRIOR TO COMMISSIONING and, Section 11 LINE WORK – COMMISSIONING :-

1) New Distribution supply infrastructure – commonly known as a “Greenfield Site” or;

2) New addition to existing supply infrastructure e.g. extension of an overhead line commonly known as “augmentation”.

Compared to **Section 12 LINE WORK – ON EXISTING ASSETS** or **Section 13 LINE WORK – FAULT RESPONSE** where working on or near live apparatus and aged assets may be encountered, new construction and installation work is done with new assets installed to current construction standard and, with the electricity supply always isolated therefore;

Work practices may differ when working on new infrastructure as compared to working on existing assets or in a fault response situation.

9•2 Quality Of Construction Work

The quality of construction work done will have a bearing on the service life of newly installed assets therefore;

Line Workers, Service Providers and other personnel performing construction work must ensure the quality of work done complies with the technical requirements laid down in TasNetworks Overhead Line Design & Construction Manual and all other relevant Construction Manuals, Standards and requirements detailed in this Handbook.

In addition, it is a Legislative requirement for Occupational Licensing that Electrical Practitioners must sign off to “certify” they have done the work in accordance with current construction standards.

TasNetworks reserves the right to conduct field audits without prior notice to check quality of work is to current construction standard and where a non-compliance is found this may be dealt with in accordance with Section 5.0 ELECTRICAL AND WORK COMPLIANCE of this Handbook.

9•3 Remove Redundant Equipment From Site

Regardless of the type of construction work being done upon completion of work :

- Redundant equipment (e.g. left over conductor cut offs, old pole butt etc.) must not be left on site, and this includes dropping items into old pole holes and covering over, as over time grass will grow and cover over items sticking out presenting a hazard to plant, machinery and the public. Refer to the **Amber Lesson** on the hazard and costly damage this can cause.

- Site inspection must be done to ensure no loose items that could fall from pole top structures andcause a safety issue to the public. **Refer Amber Lesson** on this.

9•4 Excavation

9•4•1 Check For UG Services Prior To Excavation

Location of excavated holes, pole and stay, in built up areas are usually governed by the position of footpaths, gutters, fences, roads, underground services, etc.

Before any excavation, pole and stay can be dug, local Councils and Service Providers should be consulted to determine the location of water mains, sewerage lines, electrical cables, communication cables, gas pipes and other underground equipment and;

Where there is the risk and likelihood of hitting underground services but it cannot be confirmed beforehand what is below ground level, the **Dial Before Dig Process** must be used and;

It may be necessary to excavate carefully (i.e. pot hole) and have a Safety Observer keep watch to ensure no underground service will be hit by excavation equipment.

CAUTIONS:

1) To avoid a **costly incident to damaged underground services**, where a pole has been marked to be installed (e.g .via use of pole pegs) that location must not be moved unless :

   - There is agreement from the job designer and;
   - After a Service Locations Officer has scanned the site to ensure no underground services will be damaged.

2) If the location markers provided by the Locations Officer will be removed (e.g. paint line marking when excavating) then;

   Reference markers must be established before the Locations markings are removed so the the Locations markers can be re-established to ensure other underground services will not be inadvertently damaged. Ref: **Amber Lesson**.

9•4•2 Confirm Correct Hole Diameter And Depth

9•4•2•1 General Factors To Consider

Typical Pole Hole Dug Out.

It is important to ensure pole holes dug are :-

1) To the correct depth (adequate stability to avoid the pole falling over).

2) Of the correct diameter to leave sufficient gap around the pole to be installed to allow proper backfilling and compacting of the pole.

Factors to consider that may affect the depth and diameter of a pole hole are :-

1) The type of soil.

   Poor soil type may not provide sufficient compacting strength, thus requiring a deeper hole to compensate to provide the stability required.

2) The diameter and height of the pole to be installed, as this will affect the depth of the hole.

3) The equipment to be installed on the pole.

For example, a large 500KVA transformer to be mounted on the pole may require a larger size taller pole and deeper hole depth to provide more stability to counter the weight of the transformer pulling the pole over on a lean.

4) Strain forces on the pole.

   For example, if the main conductors will be at an angle to the pole at considerable strain then a larger taller pole may be needed to withstand this force in addition to a side stay being used.

5) If the pole will be an end pole.

   If so, this may require are a larger diameter hole, and possibly deeper than normal, if a breast log needs to be installed.

6) The composition of the pole.

   For example, if the pole is a concrete pole this may need a different hole depth than for a wood pole.

7) Ground clearances on the existing pole.

8) Measure mid span and where crossing roads or driveways. If the pole change over is like for like, will the new pole with a deeper sinking depth maintain conductor clearance heights as per **WP Dealing With Low & Substandard Services** and other relevant clearances (e.g. from other structures and conductors).

9•4•2•2 Distribution Mains Poles Correct Hole Diameter And Depth

Where planned work is being done, details on correct pole type and depth of hole to be dug should be provided in the work details provided. If so, comply with what is provided.

Where no details are provided on correct pole hole diameter and depth you can :-

1) Use the **Guideline Table For Pole Hole Depth** as a rule of thumb guide, in conjunction with the above general factors to consider, for selection of hole depth and diameter based on soil type and pole type else if unsure;

2) Contact Design Section to clarify what is required if there is still any major doubt.

9•4•2•3 Servicing Poles Depth And Footing Details

Shall be in accordance with drawing D-OH1-1.6/8 in the Legacy OH Construction Manual.

S/2kN SHS GI Steel Service Poles:

- All steel service poles shall be backfilled to full depth with wet pre mixed Rapid Set Cement, full batch to be prepared prior to pouring.

- Support pole until cement sets before attaching service.

9•4•3 Hole Preparation

When sinking any type of hole, whether for a pole or a ground stay, it is important that the hole be dug :

- In the correct location.
- The correct shape.
- The correct depth.

The pole position is generally indicated by a wooden peg hammered in the ground or a painted mark on the footpath or kerb.

Although the proposed location for a pole should have been checked, care must be taken when sinking holes as there could be misplaced or undisclosed pipe or cable in the vicinity.

The width of the hole must be slightly larger than the size of the pole to allow for backfill and ramming. It must fit the size and shape of the pole.
Holes that are correctly dug - will make the installation of poles and stays much easier and ensure their long term stability.

Reduced hole depth will affect the strength and stability of a pole. A 20% reduction in hole depth can reduce the pole stability by 49%.

If a pole is not to be erected within a reasonable time of the hole being sunk, a cover board should be placed over the hole, and, in some instances, secured by pegging down or placing soil on top of it.

9•4•4 Using Pole Hole Borer Erector (PHBE)

Where possible, preference is to use a PHBE (also known as a Proline) to bore pole holes.

Comply with the WP Using PHBE when excavating pole holes.

9•4•5 Using Excavator

Where a PHBE cannot be used (e.g. in rough terrain) and an Excavator is used by an Authorised Service Provider working for TasNetworks, the safe work principles and relevant work method in the following SWMS must be complied with.

- SWMS Install, Remove, Straighten, Power Pole With Excavator.

9•4•6 Using Post Hole Digger

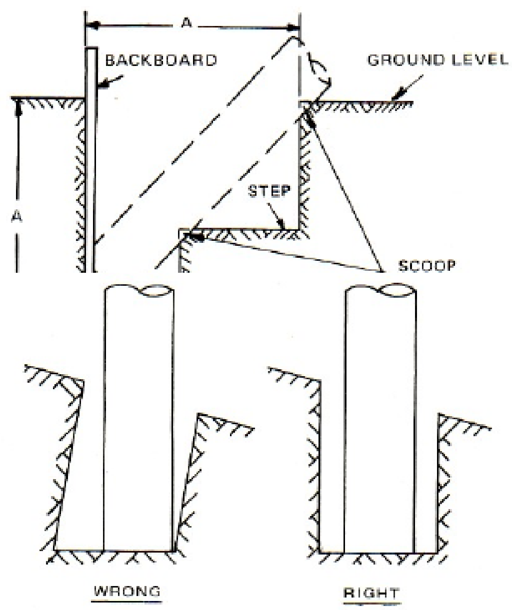
A portable post hole digger as per work instruction Using Portable Post Hole Digger can be used in locations where it may not be easy or practical to get PHBE into position to bore out a hole to install a power pole.

9•4•7 Digging By Hand

9•4•7•1 General

In some locations it is not possible to dig holes using the PHBE unit.

Inadequate access, underground cables or pipes in close proximity or probable damage to customer's property necessitates hand digging of the hole using a bar and shovel, jackhammer, etc.



The length of the hole should be the same as the depth, particularly in situations where the pole is to be erected using shear legs. If the pole hole is in solid rock, then the hole depth may be reduced by 150 mm. The deepest portion of the hole is known as the pot and the stepped portion the step. In some cases it may be necessary to dig more than one step to allow easier access to the bottom of the hole or to allow smoother erection of a pole when using shear legs.

The hole is dug so as to be only slightly wider than the diameter of the pole to be erected. The sides of the hole then give some support to the pole as it is being erected, particularly with shear legs, and only a minimum of spoil is removed from the hole.

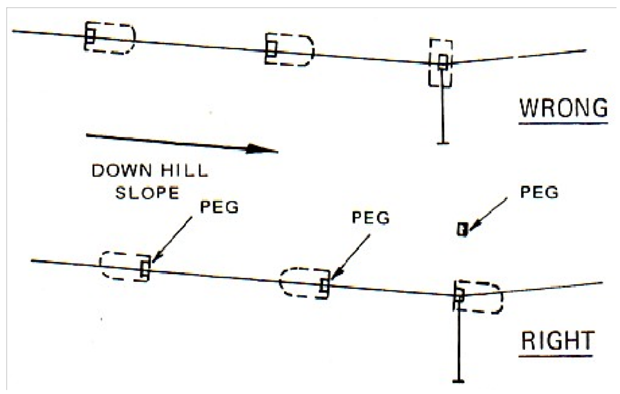
An excessively wide hole will allow the pole to move about and make it more difficult to control during erection.

The hole must also be vertical to ensure the pole can be correctly installed. A sloping hole may not allow the pole to be sufficiently plumbed to enable it to stand upright.

This must be taken into account when digging on sloping ground where there is a tendency to dig at right angles to the surface, instead of straight up and down.

To check, stand over the centre of the “pot” and drop a crowbar into the hole. It should fall from the centre of the pole position at the ground line into the centre of the pot at the bottom of the hole.

When sinking a hole at “pegged” position, it should be remembered that the “peg” marks the centre of the pole.



Before the peg is dug out, it should be decided in which direction the step will be dug and some action taken to “mark” the position where the pole will stand. This can be done by : chalking a mark on the kerb, if present, or placing reference pegs. Keep side reference pegs clear of spoil or blast area.

The step position should always be chosen so that the pole, when erected, will bear against undisturbed ground. When it is necessary to stay a pole, this is particularly important as the stay will be installed before the conductors are run and the pole will be raked against the pull.

The hole for an angle pull, pole without a stay, should be undercut on the pull side, as most poles have large butts and this enables the pole to be erected hard up against the undisturbed ground.

REMEMBER!

- It is difficult to see errors in pole alignment until after the poles are erected and if erected out of line they look unsightly.
- If a hole has been sunk too deep it should be backfilled to the required depth with crushed metal, never clay or dirt.

Another form of hole sinking by hand is called the “drop” hole method. In this case the hole is sunk straight down without a step using a drop hole set.

A drop hole set is a long handled shovel, with the spade bent at right angles to the handle, and a curved spade, known as a slice.

The shovel is placed in the hole and the slice, or a crowbar, is used to “slice” the spoil away from the sides and bottom of the hole and heap it onto the shovel which is then used to haul it out of the hole.

This method is used for enlarging or cleaning out the hole when changing over poles by lift-out method and the PHBE cannot be used to clean out the hole. “Lift-out method” = pull out old pole and erect new pole in same hole.

9•4•7•2 Procedure For digging By Hand

1. Check that underground services, if present, have been marked :-
   - Check with electronic cable locater.
   - Dig carefully until uncovered.
2. Position vehicle and equipment :-
   - Convenient and safe location.
   - Place “warning signs” for motorists and pedestrians.
   - Appoint traffic controller(s) if required and avoid blocking thoroughfares wherever possible.
3. Use approved safety clothing and equipment.
4. Locate the peg and mark out the hole:-
   - Centre the pothole on the peg, if for pole hole.
   - Ensure correct position and line.
   - Ensure correct length and width.
   - Allow sufficient width for comfortable working.
   - Install reference pegs as required to ensure hole centre.
5. Refer to Overhead Line Design & Construction Standard for :-
   - Correct hole depths and footings.
   - Other requirements e.g. pole clearance to other structures.

6. Dig the hole :-

(a) **Pole Hole**.

- Use pick and shovel at shallow depth then exchange pick for crowbar or jackhammer, if available.
- Ensure tools are in good condition and use correctly.
- Use explosives, as required, in accordance with the “Notes for the Tasmanian Shot-firer”, 2nd Edition.
- Keep spoil clear of hole.
- Dig step(s) as you sink the hole, unless using “drop set”.
- Check that sides of hole are vertical. Sloping ground gives false sense of direction.
- Ensure “pot” at bottom of hole is correct size and depth.

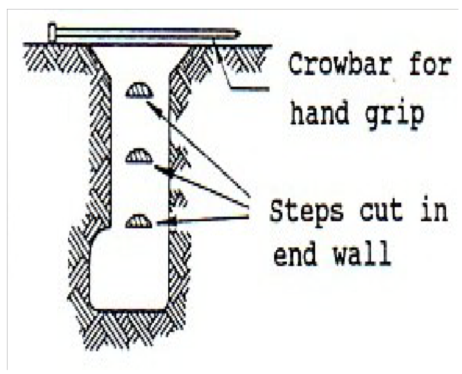
Note: If the hole is for a steel and concrete pole which is to be installed in a socket then ensure the hole is the correct size and depth to suit the appropriate steel mould and the concrete to be poured around it. The steel mould is removed from the ground after the concrete has set and before the pole is erected.

(b) **Stay Hole** :-

- As for pole hole above.
- Prepare the undercut to take the anchor block.
- Prepare the groove or channel for the stay rod by digging out with a crowbar.
- Use the stay rod to site line of channel to pole eyebolt position.
- This will prevent slackening of conductors due to an incorrectly set stay rod pulling into line after rain, or under load.

Note. Refer to Section 9.10 Staying Of Poles, for additional information on the installation of ground stays, particularly the process for determining the line of the stay and the stay hole position.

For ease of climbing in and out of the hole, use a short ladder OR cut steps in the side and use a crowbar as shown in diagram at right.



9•4•8 Trenches

9•4•8•1 General Requirements

Care must be taken when creating and/or working in trenches in regard to the following safety issues :-

1. Where the depth exceeds 1.5 metres the working area may be defined as "confined space" as per the **Confined Space Standard AS2865** and;

2. If the trench is narrow there is a risk the side walls may crumble in and engulf a person working in the trench.

3. There is a risk of plant/equipment situated too close to the edge of the trench toppling over.

Don't let this

Turn into this !

9•4•8•2 Risk Assessment

A risk assessment must be undertaken prior to working in or near trenches / excavations with consideration given to the following :-

- Control of traffic near the excavation / trench.
- Weather conditions and ground conditions.
- Work tasks in / near the excavation / trench.
- Safe access and egress must be provided in a trench or excavation (e.g. Ladder).
- Persons working in a trench must wear an approved safety helmet.
- Trenches and excavations when left unattended must have barricades erected to pre-

vent persons entering the area of the trench or excavation.

- A daily inspection to check on ground conditions, soil type and shoring must be made of any trench or excavation by a competent person, before employees enter.
- Any shoring used, must be of an approved design.

- **Daily checks must be made for** :-

  - Development of new fissures or cracks in wall of trench/excavation.
  - Sudden separation of soil from bank(s), e.g. sand beginning to trickle down into the trench, even small amounts.
  - Movement at the bottom of the trench, usually associated with subsidence alongside the trench.
  - Drumminess (hollow sound) – when the material forming the sides of an excavation, especially rock, is struck with an iron bar. This could indicate loose material.
  - Stability of plant/vehicles positioned close to trench.
  - Spoil being kept clear of the trench.
  - Shoring/battering is adequate and added as required if trench is extended.
  - Water seeping in and soft unstable walls from bad weather (i.e. after a lot of rain has fallen).
  - The risk of asphyxiation from gases that have collected in the bottom of the excavation or trench (if any gas is suspected use a gas detector to check and confirm).
  - Persons working too close together.
  - Persons not being provided with or not using proper tools for the job.
  - The striking of services such as : electricity cables, communication cables, gas pipes, etc.
  - Lack of training or technical knowledge.
  - Physical or psychological conditions of personnel.
  - Use of adequate personal protective equipment.
  - Adequate trench rescue equipment being available.
  - At the end of each working day, adequate steps are taken to prevent public access by ensuring exposed trenches are covered over or barriers are used (e.g. lockable cyclone fence).
  - The need to consider using night time lighting/flashing indicators to warn the public and vehicles of the trench.

- Should any of the daily checks shows a problem that is causing a safety issue all persons must LEAVE THE TRENCH / EXCAVATION IMMEDIATELY and;

- Necessary steps must be taken to ensure safety before re-entering.

9•4•8•3 Implement Key Risk Controls

1. Where there is risk of trench collapse ensure, adequate rescue equipment is close by and persons are trained in trench rescue or, a procedure is in place to call for emergency assistance if needed.

2. Place all spoil removed sufficiently clear of the sides of the excavation.

3. Avoid, where practicable, positioning vehicles / plant in close proximity to open trenches, particularly where a trench is not shored or battered and;

   If needing to position plant near a trench, check the bearing surface of the ground to ensure it will support the weight of the plant e.g. EWP or PHBE and;.

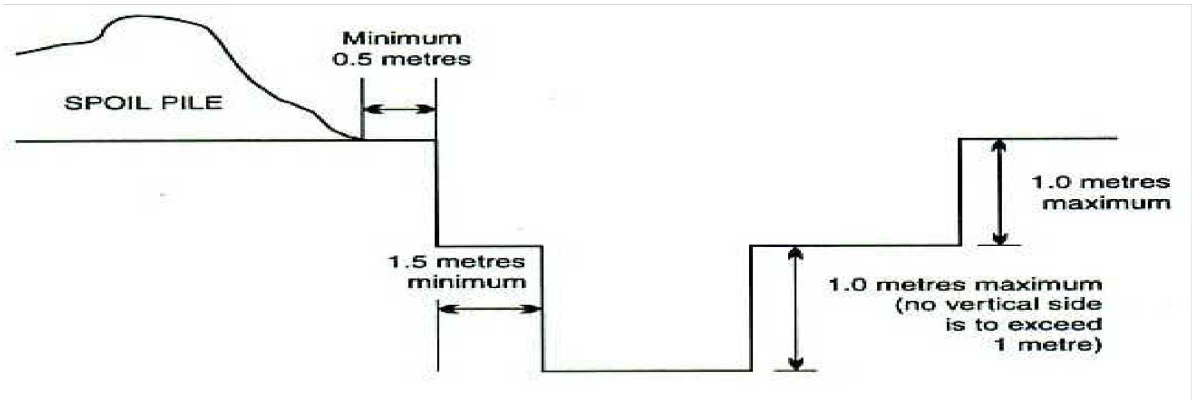
   Position the “unit”, including stabiliser legs, sufficient distance away from the edge of the excavation to prevent any collapse of the wall(s) and overturning of the unit. A guide is to STAY the same distance away from the excavation as the depth of the excavation. That is 1 metre out for each metre of depth.

4. Trench walls should be “shored” (e.g. with timber framing) when the strata type (i.e., sand, shale, floaters, etc.) dictates a risk that trench walls could become unstable resulting in collapse of the trench.

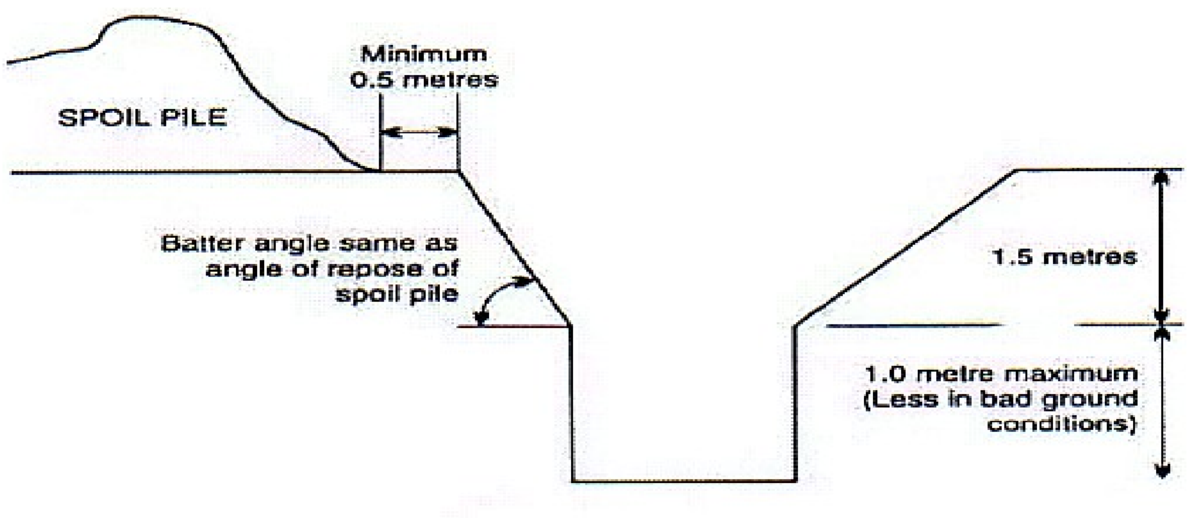
5. Where the risk of wall collapse exists, suitable safety control measures shall be put in place to ensure the safety of those erecting the shoring or entering the excavation.

6. Shoring may include any suitable system of temporary supports and sheeting material to maintain the stability of the sides of the excavation. Removal of shoring should only be done from outside the excavation.

7. Another option is to widen the trench and reduce the height of the deepest trench wall to 1.5 metres or less as shown in the following examples.



Steep battering vertical sided trenches
Example 2.0 metres deep in stiff clay



Battering the sides of trenches
Example 2.5 metres deep in stiff clay

9•4•9 Blasting

Refer to Section 6.22 Explosives.

9•4•10 Pre-dug Hole Left For Pole Installation Later On

An option that can be used is to have a hole pre-dug and then left covered over ready for the pole to be installed later on. This option is handy, particularly at green field sites, where it is not possible for the pole to be installed on the same day the hole has been dug.

The following shows, after the hole has been dug, a steel tube that is cut in halves and inserted with a cover plate. This prevents the hole collapsing and public access to the hole. Then, after the pole is installed, the two halves are pulled out.


Cover removed – while pole held steady.


Removing one half of the steel tube.


Typical steel tube inserted

Another allowable option is the use of an old 44 gallon steel drum provided that:

1. The base is fully removed creating a tube such that retaining water against the CCA TN wood pole butt when installed /backfilled is minimised; and

2. The top of the tube is sufficiently below the natural ground level once backfilled such that no trip hazards are created and surface water drains away rather than travel down the pole.

9•5 Pole Types For Installation

Poles in various forms and sizes, and described in the following sections, are used to support overhead conductors, transformers, street lighting and associated equipment.

Sections 4.3 (design) and 4.15 (Services) of the Distribution Overhead Line Design and Construction Manual lists information about poles (type, size, strength, depth in ground, design data and so on). Section 5.1 list information about stays.

Types of poles used by TasNetworks are :

- Wood poles (treated & natural).
- Steel poles (various shapes & sizes).
- Steel and concrete poles.
- Spun concrete poles.

9•5•1 Wood Poles (natural)

Natural wood poles are the cheapest of all. They offer the greatest insulation to earth, but maintenance is high and life expectancy is short. They have an average useful life of 10 - 12 years and often as short as 5 years. They are NO longer installed.

NOTE: Care must be taken when working with natural wood poles to avoid using a ladder to ascend them as, they may have become brittle over the years and could easily fracture or break.

9•5•2 Servicing Poles

9•5•2•1 General

These poles carry overhead service conductors that terminate at the POS at customer installations and, can be steel or wooden poles.

Steel poles are round or square tubular poles used to support services. The round poles are no longer used because they failed to provide adequate ground clearance, particularly across a roadway.

When using servicing poles, care must be taken to ensure that :-

1. They are of adequate size and KN strength to support conductors in accordance with drawing D-OH1-1.6/7 of the Legacy OH Line Design & Construction Manual.

2. They will be high enough to give the required ground clearance.

3. They are installed in accordance with :-

   (a) Section 1.0 Services In The Overhead Line Design and Construction Manual.

   (b) The Service & Installation Rules.

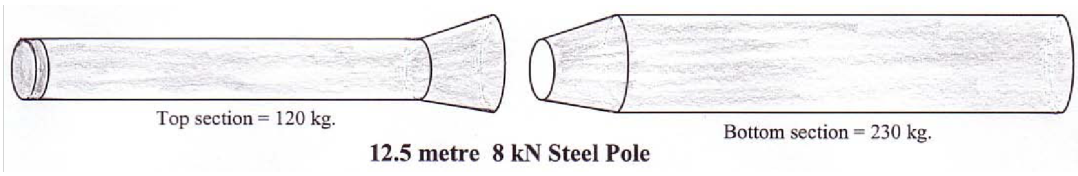
9•5•3 Steel Distribution Line Poles (two piece tubular)

These steel poles were introduced into Tasmania in 2003 / 2004 and inclined to be used in areas of difficult access. They come in two pieces and can be erected in two ways :-

1. Bottom section installed first and then the top section slipped on after.
2. Both sections joined together and erected as a complete pole.

The poles used in distribution lines are 12.5 metres in length with a strength rating of 8 kN. These poles are conductive.

Bottom section of pole weighs = 230 kg. } See below.
Top section of pole weighs = 120 kg. }



Sample Drawing Only

9•5•4 Steel And Concrete Poles (Stobies)

Steel and concrete poles have been used throughout the state for strength and to reduce maintenance and in situations where it has been difficult to renew poles or provide staying arrangements.

The poles are usually installed in pre-poured concrete sockets but in some cases have been simply concreted in the ground.

These poles are no longer made and the only ones used now would be second hand ones. These poles can be conductive.

Typical Stobie Pole

9•5•5 Spun Concrete Poles

These poles have only been used in recent years and by 2004 there would have only been around sixty (60) poles in the Distribution system. They are circular in shape and taper from a wide base to a narrow top. These poles can be conductive.

Typical Spun Pole

9•5•6 Busck Concrete Poles

These are a recent new addition, and are used in critical areas to resist damage from bush fires and keep the main supply feeder connected. These poles can be conductive.

Busck poles shall be installed in accordance with the **WP For Installation Of Busck Poles**.

9•5•7 Titan Poles

These poles will be used in selected areas, such as bush fire prone areas, to provide longer service life and better reliability of supply.

Titan poles shall be transported and installed in accordance with the work practice **Installation And Maintenance Of Titan Poles.**

9•6 Transporting And Handling Poles

9•6•1 General

Also refer to Section 7.7.2 Load Restraint On Vehicles and; Section 7.7.3 Transporting Loads.

Employees are frequently required to handle poles and at times, and cart them to and from the work site.

- Prior to the delivery of any pole to the work site, it is important to check and ensure that the pole is the correct height (e.g. taller pole needed to install a transformer on) and KN rating and can be safely transported.
- It is free of any major defects (i.e., excessive cracks, decay, incorrectly fitted pole cap, rust, etc.). Rotten poles can BREAK during transport.
- The site where it is to be dropped off is accessible.
- If it is to be left lying on the ground at the work site - it is not left in such a way that it becomes a hazard for vehicles, pedestrians, or animals.

9•6•2 Handling Poles

When handling poles, it is important to ensure that :-

- The correct protective clothing is worn.
- The correct equipment is used.
- The poles are stacked correctly and all poles are prevented from rolling.
- The lifting sling is fitted on the pole near the point of balance so the pole can easily be controlled when lifting and moving it about.

  Slipping a short length of rope around the head of the pole as a tag line can also assist in controlling the pole movement while it is suspended from a crane.

- **When loading or unloading poles make sure** :-
  - You have sufficient working space to do the job safely.
  - Nobody stands in any position where they can be struck by the pole or other poles that may be dislodged.

9•6•3 Carting Poles

When carting poles, it is important to ensure that :-

- The correct poles are selected for the job in hand.
- They are loaded in a way that allows them to be unloaded singly and in correct order at the job site.
- Pole length and load limitations are in accordance with the appropriate Transport Department Permit and vehicle limitations.
- The poles are properly secured to the respective truck or trailer so that they do not move during transit. Use a minimum of "two" tie downs.

Note: Using pieces of rubber "friction" matting between the "bolsters" and pole(s) and between poles WILL help prevent the poles from moving.

Loads being transported on vehicles MUST NOT be allowed to MOVE or FALL OFF the vehicle at any time.

The picture at right shows what can happen when a "LOAD" does come off.

A trailer, if used, is correctly attached to the towing vehicle and all lights and brakes are working correctly.

The required Driving Licence and Operator's Certificate or Authorisation is held by the driver / operator and they are current.

The vehicle is driven safely, courteously and within the requirements of the Law.

When carting condemned poles - always ensure they are safe to transport. **BEFORE LOADING THEM - CHECK THEIR CONDITION**. If a pole butt is likely to break during transport, cut it off and cart it separately.

9•6•4 Transport Of Busck Concrete Poles

Due to the special shape and weight of busck concrete poles, they need to be transported and stored in accordance with the WP For Transport And Storage Of Busck Poles.

9•7 Preparation Of Pole Prior To Installation

9•7•1 General

The overhead line worker is often involved in the erection and removal of poles of various types and sizes. The uncontrolled movement of poles can create hazardous situations and possible injury to persons in the vicinity, so a high degree of care and skill is required for this operation.

Under NO circumstance shall the erection or removal of poles be undertaken without proper planning and due care and consideration being given to the safety and welfare of all persons, equipment and property.

The successful erection of poles is dependent on proper preparation. The following points can be helpful for persons involved with this activity :

9•7•2 Dressing Pole

9•7•2•1 General

In many cases the opportunity is there to make life easier and save time by dressing poles at ground level prior to erection provided that :

- The poles can be erected safely without fouling the crane, trees, structures or overhead wires.
- Nothing can fall from them while they are being lifted into position.

E.g. pole being dressed at ground level while still on pole trailer.

9•7•2•2 Affix Cross Arm

When dressing a pole keep in mind the maximum weight of assets to be mounted on poles and in particular, transformers as per the following guidelines as to the maximum weight limit a new cross arm can handle :-

- Bolt Fixed without mounting plate 750 kg.
- Bolt Fixed with mounting plates 1750 kg.
- **Cross arm Hung 2150 kg.**
- Platform Mounted 2700 kg.

The standard type support structure for a pole mounted substation is a single pressure impregnated wood pole, which will support transformers of :-

- **2.15 tonnes – when cross arm hung.**
- 2.70 tonnes – when mounted on a platform.

CAUTION : If the cross arm will be affixed after the pole has been stood, you must ensure the total weight of yourself (and second person if used), tools and equipment plus the cross arm (e.g. a MK 7 weighs 28.5 kg) if raised by an EWP bucket, does not exceed the SWL of the EWP bucket as per the Table on the next page.

If the SWL will be exceeded you would need to use another method for safely lifting the cross arm (e.g. crane, or on a ladder or block and tackle on the pole).

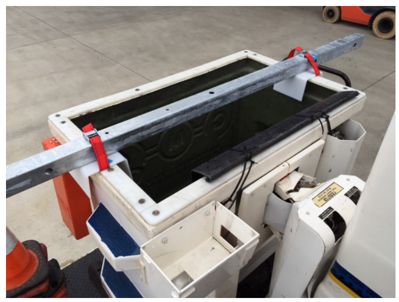
EWP's with a SWL ≤ 250kg	• In all instances the load shall not exceed the SWL of the EWP. • No loads shall be carried on the basket rim. • All load items shall be carried within the basket.
EWP's with a SWL >250kg	• In all instances the load shall not exceed the SWL of the EWP. • No load > 60kg can be carr[illegible] the basket rim • Where a load is carried upon the basket rim refer to controls below.
Redmond Gary's with basket rotation	• In all instances the load shall not exceed a 250kg SWL of the EWP. • No loads shall be carried on the basket rim. • All load items shall be carried within the basket. • Small, lighter cross arms can be carried within the basket with one person.

Controls :-

EWP's with a rated capacity of 250kg or less are not considered appropriate to carry cross arms as the rated capacity can be readily exceeded. One person could carry a smaller, lighter cross arm contained inside the basket (not on the basket rim) so long as it can be safely handled.

EWP's with a SWL greater than 250kg can be used to carry cross arms/loads on the basket rim up to 60kg so long as the basket SWL is not exceeded.
The risk of the cross arm/load falling is to be controlled by employing the following method;

1. Always employing two persons when carrying cross arms on the basket rim - one as an observer.
2. Where necessary, tethering the cross arm to the basket in a similar fashion as shown.



3. Maintaining clearances from external structures and wires if the cross arm is secured to the basket.

4. Ensuring that the cross arm is released - in particular by permitting vertical movement.

5. Maintaining a drop zone at all times during the operation.

Refer to drawing D-OH1-1.8/22 in the Overhead Line Design & Construction Manual to determine the weights of all the steel and wooden cross arms that are used.

Generally wooden cross arms are used for affixing LV apparatus to and steel cross arms are used for affixing HV apparatus to.

It is essential that cross arms are :-

- **Installed at the correct height** as detailed in the Overhead Line Design Construction Manual to ensure correct clearances are maintained, particularly where LV conductors will be strung below HV conductors.

Where there is any issue in doing this don't affix the cross arm where you think it should go. Instead, stop the work until you properly resolve the issue by consulting with someone in Design Section.

- **Installed as square and straight as possible to the line of conductors**, to keep even tension across the cross arm and to prevent it from bending or warping.

9•7•3 Pole Size, KN Rating, Height & Weight

The full technical details on poles is far too comprehensive to include here.

Refer to :-

- TasNetworks, Construction Manual :-
  - **KN Loading Details**, to ensure you have the latest details on maximum loading tensions and KN ratings etc.
  - **Component Mass Table.**
- **Section 9.3.2 Confirm Correct Pole Diameter And Depth**, as this will have a bearing on the height of pole required and then the diameter and mass.

The key requirement is to ensure the combined weight of the pole with all the affixed assets does not exceed the SWL of the crane and/or becomes too top heavy to handle in a safe manner. The following Tables are a guide for general use only.

Impregnated Wood Poles : **Table - 3**

Used for General Purpose Line work		
Pole Length & Strength	**Depth in Ground**	**Dry Mass of Pole**
8.0 metre – 6 kN.	**1.50** metres (line pole)	390 kg.
8.0 metre – 6 kN.	**1.80** metres (stay pole)	390 kg.
8.0 metre – 8 kN.	**1.80** metres	470 kg.
8.0 metre – 10 kN.	**1.80** metres	560 kg.
9.0 metre -- 4 kN.	**1.50** metres	400 kg.
9.0 metre – 6 kN.	**1.65** metres	540 kg.
9.0 metre – 8 kN.	**1.80** metres	665 kg.
10.5 metre – 4 kN.	**1.65** metres	525 kg.
10.5 metre – 6 kN.	**1.80** metres	705 kg.
10.5 metre – 8 kN.	**1.80** metres	850 kg.
12.0 metre – 4 kN.	**1.80** metres	665 kg.
12.0 metre – 6 kN.	**1.80** metres	875 kg.
12.0 metre – 8 kN.	**1.80** metres	1050 kg.
13.5 metre – 4 kN.	**2.00** metres	850 kg.
13.5 metre – 6 kN.	**2.00** metres	1090 kg.
13.5 metre – 8 kN.	**2.00** metres	1300 kg.
15.0 metre – 6 kN.	**2.10** metres	1175 kg.
15.0 metre – 8 kN.	**2.10** metres	1485 kg.
15.0 metre – 10 kN.	**2.10** metres	1720 kg.

Two Piece Tubular Steel Poles : **Table - 4**

Used for General Purpose Line work		
Pole Length & Strength	**Depth in Ground**	**Dry Mass of Pole**
12.5 metre -- 8 kN. Round	**1.80** metres	350 kg.

Steel and Concrete Poles : **Table - 5**

Used for General Purpose Line work		
Pole Length & Size	**Depth in Ground**	**Dry Mass of Pole**
9.0 metre x 102 x 51 mm	**1.50** metres	830 kg.
9.0 metre x 127 x 64 mm	**1.50** metres	1100 kg.
10.5 metre x 127 x 64 mm	**1.65** metres	1375 kg.
10.5 metre x 152 x 76 mm	**1.65** metres	1635 kg.
12.0 metre x 152 x 76 mm	**1.80** metres	1850 kg.
13.0 metre x 152 x 76 mm	**1.90** metres	1960 kg.

Spun Concrete Poles : **Table - 6**

Used for General Purpose Line work		
Pole Length & Strength	**Depth in Ground**	**Dry Mass of Pole**
12.0 metre -- 5 kN.	**1.80** metres	1650 kg.
12.0 metre -- 8 kN.	**1.80** metres	1820 kg.
12.0 metre -- 10 kN.	**1.00** metres	2040 kg.
13.5 metre -- 8 kN.	**2.00** metres	2130 kg.

9•7•4 Lifting Poles

When lifting a pole, the lifting sling should be fitted :

- Near the "point of balance" but just above that for manoeuvring into position.
- Closer to the head for actual erection.
- The pole should be placed in the best position for direct lifting, with the point of slinging close to the hole.

Other options for lifting poles are detailed in **Section 9.9.2 Plant/Machinery**.

9•8 Pole Locations

9•8•1 Distribution Mains Poles

9•8•1•1 General

This section covers HV and LV poles that carry distribution mains supply conductors (e.g. along roads, and streets) prior to connection of the mains conductors to the service conductors and service poles for connection to customer installations.

It is important that poles are installed in proper locations that have the correct clearances otherwise there is the risk of electrical or mechanical damage.

The following example is an incident that occurred because the pole was incorrectly installed too close (within 400mm) to an existing overhead line and, the overhead conductor swung in the wind and touched the top of the pole and burnt off falling live to the ground.


Pole too close to Overhead HV **Result – arcing and broken conductor**

Therefore, it is important to comply with the design details issued out and, if there is a problem in complying with the design or the details in the Overhead Line Design Construction Manual – STOP – and escalate the issue to get the problem fixed.

9•8•1•2 In Rural Areas

Refer to Pole Location drawing in the OH Line Design & Construction Manual.

9•8•1•3 In Built Up Areas

In built up areas, such as Cities, Towns and Suburbs, often the only place to install HV and LV poles is on the side of roads and footpaths, often nearby buildings and mechanical structures. Due to this sort of complexity there are no hard and fast rules in the Overhead Construction Manual that can be generally applied to determine best locations to install poles.

Careful planning is required when situating poles. The location of a pole will have a direct bearing on the forces acting on it, the amount of ground clearance and the vulnerability to outside damage.

1. For planned work issued out comply with the location already determined, unless you believe there is something wrong with the location (e.g. clearances don't seem right). If so, raise a query to resolve the problem.

2. If installing a pole is not the result of planned work or if planned work does not specify the exact pole locations then consider the following factors to help determine the best location :-

   2.1 The line and poles shall be positioned on the correct side of the street to avoid existing vegetation and obstacles. Visual impact will need to be considered.

   2.2 Consideration should also be given to future ongoing costs such as vegetation clearing and pole maintenance, (type of soil, access, and proximity to salt water and exposure to wind.)

   2.3 The pole should be situated so that there is minimal or no uplift on conductors and to take advantage of the undulations of terrain, (i.e. placing poles on rises to maximise ground clearance), reduction in the number of expensive pole top constructions and to maximise the length of span for the situation.

   2.4 Install poles in the road reserve back far enough from the road to be clear of high vehicles but not encroaching onto or over private property, especially the affixed apparatus e.g. on cross arms that could overhang and;

   2.5 With footpaths, install pole as far away as possible from the road edge without encroaching private property.

   2.6 Assess that the pole will not be installed where it would be too close and interfere with other public infrastructure such as, bus stops, traffic lights etc. and Council owned assets such as trees and seats.

   2.7 Consider underground services that could affect where a pole hole can be dug and hence where the pole can be installed. Use a **Cable Locations Officer** to check underground services or use **Dial Before Dig Process** to confirm.

   2.8 Consider minimum height clearances required, after assets are affixed to the pole (e.g. large transformer), above moving traffic and mechanical structures and, to building structures taking into account;

   2.9 Depending on the type of pole and its size and height, the depth the pole will be sunk to as this may affect height clearance. Refer Section 9.1.2 Confirm Correct Hole Diameter And Depth and;

2.10 Minimum safe clearances specified in Section 9.14.6 Conductor Clearances and also in the Overhead Construction Manual and;

2.11 Appendix B Minimum Clearances in the Service & Installation Rules.

2. If, despite taking all the above factors into consideration, you still cannot determine the best location to install a pole, err on the side of caution and seek resolution with a Field Engineer or someone in Design Section.

9•8•2 LV Servicing Poles

9•8•2•1 General

LV servicing poles are installed (also includes cross over poles) to maintain clearances of LV service conductors across roads and streets prior to connection to the Point Of Supply (POS) at the customer's installation (e.g. at the mains box on the fascia board at residential premises).

Section 4.0 of the SIR shows typical allowed installation layout configurations for servicing poles.

9•8•2•2 What Is Installed By TasNetworks

As per Section 2.5.6 of the Service Installation Rules (SIR).

9•8•2•3 What Is Installed By Electrical Contractor

As per Section 2.5.3 of the Service Installation Rules (SIR).

9•9 Pole Installation

9•9•1 General

This covers the installation of poles where the overhead is de-energised.

1. **Team work**.

   Pole installation work requires a mix of personnel and plant/machinery working together. In addition, traffic management and use of Contractors may also be involved. Therefore, good team work and co-ordination is essential to ensure the installation of a pole goes smoothly and therefore;

   The Job Manager must be recognised as the controller of the on - site operation and a complete understanding of instructions, including standard signalling, is essential.

2. **Standard signalling**.

   The use of correct signalling is important because the crane operator must know exactly what the party leader wants done.
   Any misunderstanding of "signals", while erecting poles, could possibly lead to accidents occurring.

9•9•2 Plant/Machinery

9•9•2•1 Pole Hole Borer Erector (PHBE)

Using a PHBE (also known as a Proline) is the preferred method for installing a pole into place as per work practice **Using a Pole Hole Borer Erector.**

9•9•2•2 Other Cranes

An allowable option is to use a vehicle mounted crane, such as a Unic Crane used by TasNetworks or other suitable type crane in compliance with TasNetworks, Procedure **Operating Cranes.**

9•9•2•3 Excavator

Where a PHBE cannot be used (e.g. in rough terrain) and an Excavator is used by an Authorised Service Provider working for TasNetworks, the safe work principles and relevant work method in the following SWMS must be complied with.

SWMS Install, Remove, Straighten, Power Pole With Excavator.

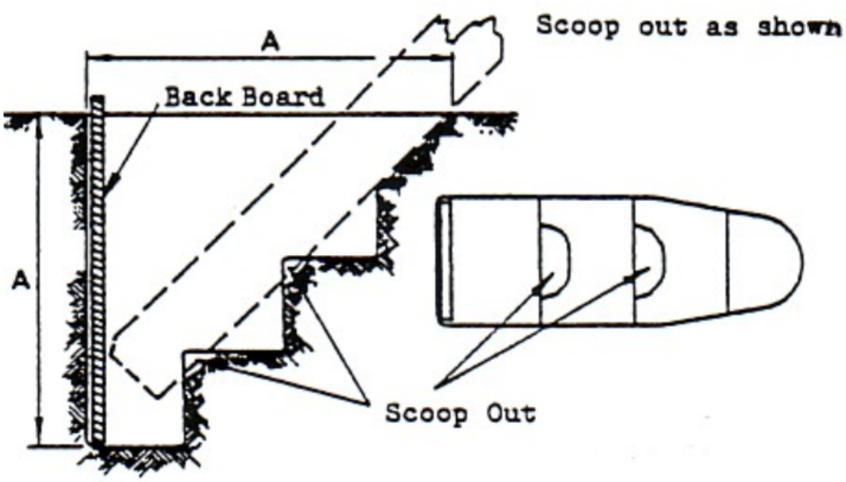
Push Method Using Supporting Jig

Lift Method Using Pole Grab

9•9•3 Other Methods

9•9•3•1 Shear Legs And Winch

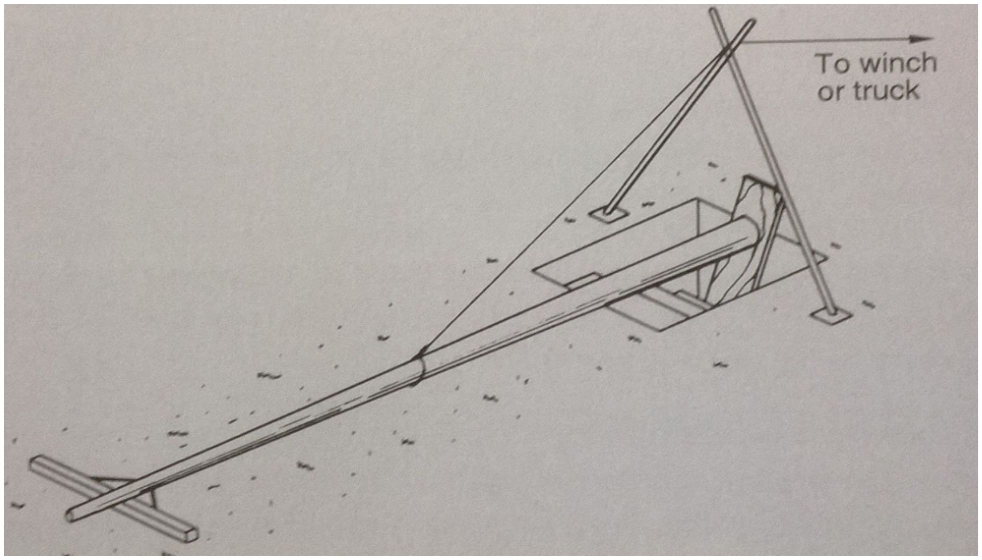
Where it is not practicable to erect the pole with a crane or excavator, a vehicle-mounted winch or portable hand winch, such as a Forest Devil or similar, can be used in conjunction with a "set" of shear legs and "backboard" as shown to lift and position the pole in the hole.



Note This method of pole erection requires a specially prepared hole, as shown in Diagram above, to allow the pole to slide smoothly into the bottom of the hole. If this is NOT done then the pole can catch up and have difficulty slipping down into the hole.

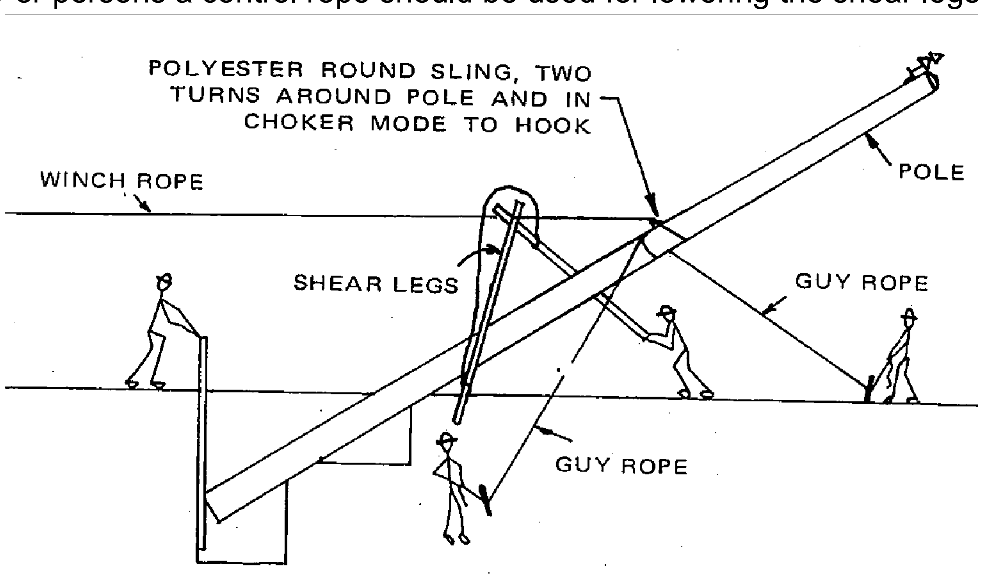
Note: Details on the following "Shear Legs" can be found in our Equipment Manual in Drawing No's.

- A2 – 4529. Steel. [38 x 38 x 2.6 RHS x 3800 mm with 1.25 Tonne SWL].
- A2 – 4530. Laminated Timber. [75 x 75 x 3800 mm with 1.25 Tonne SWL]
- A2 – 6027. Laminated Timber. [80 x 80 x 4300 mm with 1 Tonne SWL].



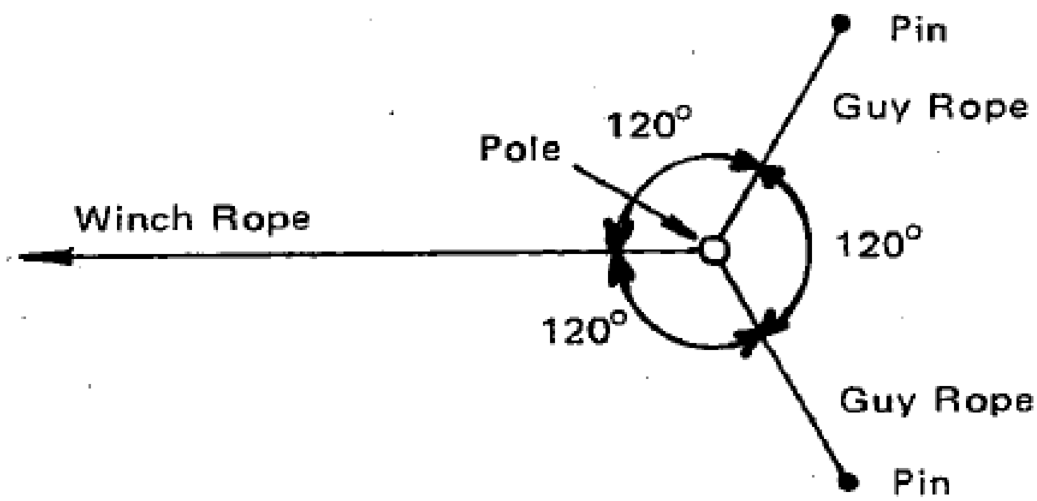
As shown in the above diagram, lay the pole over the hole with the butt end about 50 mm clear from the backboard. Attach the winch wire to the pole in such a position that the majority of the weight is between the wire and the butt of the pole and such that when the pole is erected the wire is beneath the conductors. The shear legs are laid across the pole with the legs towards the butt and the wire over the legs as shown.

The shear legs will become erect and as the pole becomes upright, the legs will lean towards the butt of the pole until the weight comes off them and the legs tip over (as per diagram below). Care must be taken that the falling legs do not injure anybody or cause damage. The pole is then erected, plumbed and rammed. Where there is a risk of damage to property or persons a control rope should be used for lowering the shear legs.



When using shear legs care should be taken to ensure the following :-

1) They are long enough for the pole to be lifted, the normal length being 4 m to 4.5 m.
2) The feet are dug in and level to prevent slipping or twisting about the winch rope. This is important on uneven ground so that undue weight is not imposed on either leg.
3) When setting the legs over the pole avoid opening the legs too much as more spread imposes more weight into each leg.
4) The guy rope pins are located so that when the pole is vertical it will be supported by the winch rope and two guy ropes spaced at approx. 120° from each other as shown in following diagram.



Should there be a need to erect a pole using this method and there is ANY uncertainty about HOW to do it – advice can be sought from the Training Officers at TasNetworks Training Centre, Mornington.

9•9•3•2 Erecting Pole Using A Gin Pole

Where it was necessary to erect a new pole adjacent to an existing safe pole, this pole could be used as a Gin Pole. That is, a supporting pole on which to fit a snatch block and winch rope to pull up the new pole.

This method, although it was not used very often, precluded the use of shear legs and was suitable for both hand and power driven winches on vehicles.

Should there be a need to erect a pole using this method – advice can be sought from the Training Officers at TasNetworks Training Centre, Mornington.

9•9•4 Back Filling & Ramming

9•9•4•1 Correct Clearances Prior To Backfilling & Ramming

Prior to back filling and ramming confirm the following is correct :-

1) Correct Hole Diameter And Depth. Refer Section 9.3.2 Confirm Correct Hole Diameter And Depth.

2) After sinking the pole confirm there is sufficient height remaining to provide minimum clearances for conductors and apparatus to be fixed to the poles. Refer Section 9.14.6 Conductor Clearances.

3) Sufficient gap around the pole to allow for back fill and, room for properly ramming and tamping down (with appropriate tamping tool) the soil to ensure pole is solidly in the ground.

Check clearances before backfilling

Solid ramming and tamping

9•9•4•2 Correct Backfilling And Ramming Method

1) With any pole erection – it is MOST IMPORTANT to backfill and "ram" the spoil in the hole correctly - so that it packs tightly around the pole. Failure to do this can allow "water" to soak in and LOOSEN up the backfill - thus allowing the pole to become loose

in the hole and LEAN to one side. Rated pole strengths can ONLY be depended upon when the POLE FOOTING STRENGTH is adequate.

2) Pole holes shall only be backfilled with the spoil removed from the hole if of good quality e.g. gravel or dry clay. If the backfill is not good quality then fine crushed rock (FCR) or equivalent (e.g. gravel) will need to be used.

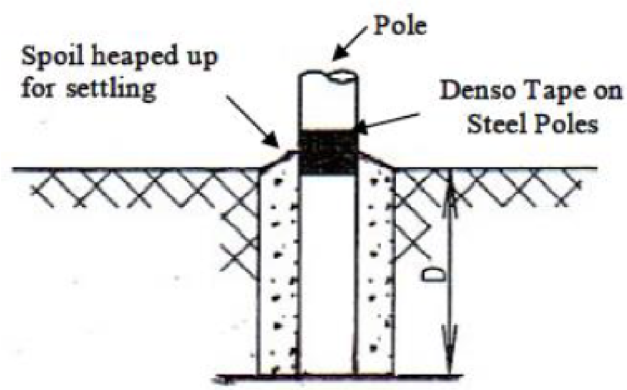
3) The top 300 mm of the hole is to filled with fine crushed rock (FCR). Both the spoil and the fine crushed rock are to be well compacted to prevent pole movement during and after conductor stringing".

4) **REMEMBER** :-

(a) Return the earth, where applicable, to the hole in such a way that the material which came out last goes back in first. This will ensure that the foundation material is adequate. It is of no use having the top-soil around the butt of the pole because it will not consolidate and the pole WILL move.

(b) Ram the pocket after the first 150 mm of the back-fill has been returned and keep on ramming in 150-200mm layers until the hole is filled. It consolidates easier and ensures a solid installation with very little subsidence.

5) Form a mound of topsoil, about 150 mm above ground level, around the pole to allow for any sinking especially on footpaths and nature strips.



6) **NOTE** :

(a) The hole must be rammed evenly all around the pole as ramming only on one side has a tendency to turn the pole. This looks bad as the crossarms would be facing in the wrong direction. If the pole tends to turn, it should be held with a wooden handled Cant Hook during the early ramming.

(b) In many urban locations, crushed blue metal dust or Fine Crushed Rock (FCR) is used to back fill holes. This is a little more expensive but is easier to use, consolidates very well and holds the poles securely.

(c) Always spread out or cart away excess spoil, depending upon location, as mounds of dirt / gravel left lying around can look unsightly, create a safety hazard and poor public relations.

9•10 Install Possum Guard

Ensure possum guards are correctly installed, as per the following drawing D-OHC-G031-SD-001, to ensure sufficient air gap to let air pass through to minimise risk of pole rot.

9•11 Staying Of Poles

9•11•1 General

Some power poles may be end poles or have conductors attached at an angle on them. The resulting pole top forces on these poles may pull the pole over on a lean or onto the ground, unless a counter strain is applied. The purpose of using stays is to provide the counter strain required therefore it is important that the stays are installed correctly so that :-

1) The stay is properly anchored in the ground to provide the counter strain required to keep the pole in a vertical position and;
2) For safety :-
   (a) Excess stay wire is cut and terminated properly and not left protruding with sharp burred ends that could cut persons or animals.
   (b) The stay wire cable is clamped securely so it will not pull undone
   (c) There is no risk the stay anchor will suddenly pull out of the ground under tension.

9•11•2 Check For UG Services

As stays are installed on an angle the anchor point in the ground can be some distance away from the pole therefore, where there is any doubt, especially when installing a stay at an existing location;

Check for any underground services (e.g. cables, gas, water) using a **Cable Locations Officer** who then may use the **Dial Before Dig** process where necessary, prior to excavating or drilling in stay anchors.

9•11•3 Stays Used On Poles Carrying HV

For safety, stays installed on poles carrying overhead HV must have an insulating disk fitted to guard against HV tracking down the pole onto the stay wire.

Note: There may be some existing stays installed under HV without an insulating disk fitted. Therefore, even though there is a very low chance of stray voltage on the stay wire, to be fail safe, always check and test for any stray voltage before touching any of these stays.

9•11•4 Installing Stays

9•11•4•1 General

Stays are used to provide support for a pole, which, by itself is not capable of holding the line conductor tension or wind loading, particularly on dead end poles or angle poles.

A stay wire is a stranded cable, usually of corrosion - resistant steel, attached to the pole as near as possible to the centre of conductor loading and anchored at the other end to a supporting device or ground anchor.

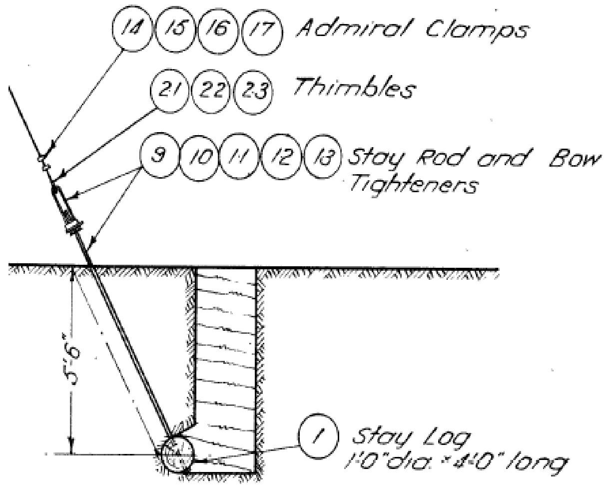
The two main types of stays used are :-

- Termination stay, sometimes called a dead end or back stay.
- Angle stay, sometimes called a side stay or bisect stay.

They could be : an overhead (aerial) stay or a ground stay, or a combination of the two.

Refer, stay arrangements, in the OH construction manual for full technical and installation requirements.

9•11•4•2 Bow Stays



Early installations of Bow Type Ground Anchors were secured via a rod attached to a buried timber log. In some areas these logs, the associated rod and the integrity of the installation have been adversely affected by ground conditions and therefore prone to failure.

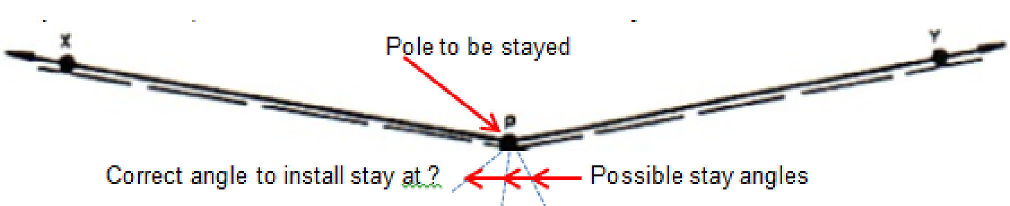
Therefore, for safety, all persons performing work on a pole with a ground stay attached, secured to the ground anchor via a Bow Type stay attachment, must employ pre-climbing test via;

Physical inspection and application of physical force e.g. pushing and pulling stay to check soundness.

If there is any doubt about integrity, the pole must be secured by other suitable means prior to climbing and working on the pole.

9•11•4•3 Ground Stays

Where a stay is to be installed and there is a deviation in the angle of the overhead conductors to the pole, and it is important to get the angle of the stay to the pole correct, refer to **Section 9.11.4.9 Bisect Stays**.

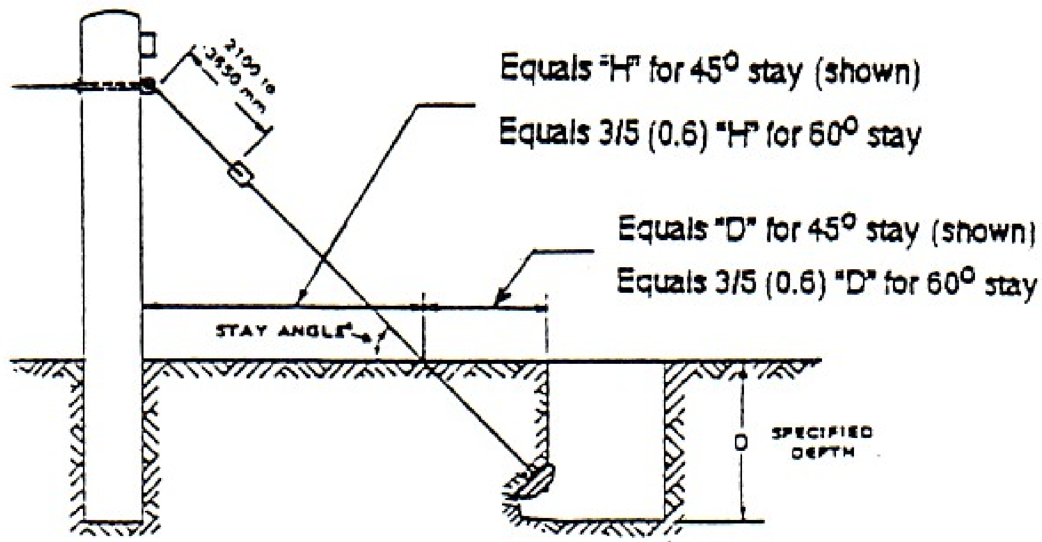


Pole to be stayed

The angle of a ground stay, 45° or 60°, will determine the position of the hole for the "ground anchor".

The "anchor" or stay rod will emerge from the ground at a distance from the pole equal to the height of the pole fixing for a 45° stay, and 3/5 or 0.6 times this distance for a 60° stay as shown in the following Diagram for an anchor block stay.

9•11•4•4 Anchor Block Ground Stay



Anchor Block Ground Stay

The actual spot for digging the hole is an additional distance beyond the point where the stay rod comes out of the ground as shown in the above Diagram.

The stay angles are measured from the horizontal plane to the stay line.

The measurements mentioned above are for a level site and would need to be adjusted to suit sloping ground. The measurements will vary according to the length "H" (Height) of the pole.

The use of the 45° stay provides a more suitable footing and imposes less vertical load on the pole.

It is, therefore, preferable to use a 45° stay wherever there is room for it. It is particularly suitable for the termination of heavy conductors where soil conditions are doubtful.

The 60° stay does not extend as far from the pole and is used more frequently in built up areas where space behind the pole is limited.

INCORRECT

Anchor stays must not be installed vertically as this means the anchor block will not bite into the side wall and could easily be pulled out of the ground.

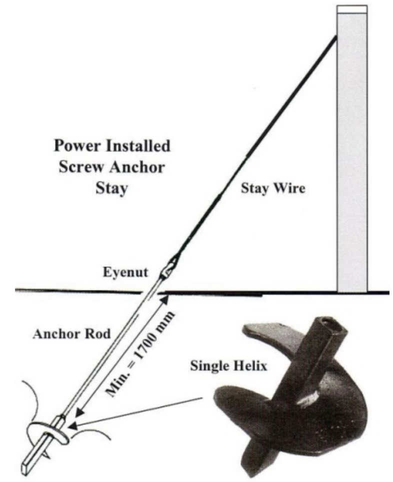
CORRECT

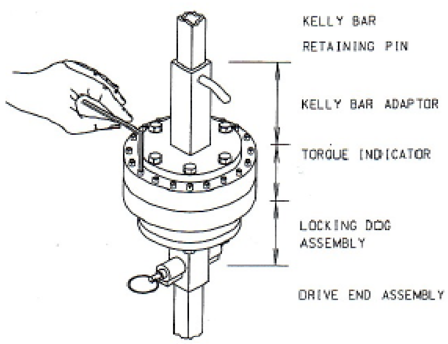
The correct method is to dig a groove into the hole at an angle so the stay rod will pull the anchor block at an angle allowing it to bite into the side wall as shown.

9•11•4•5 Screw In Anchor – Using PHBE

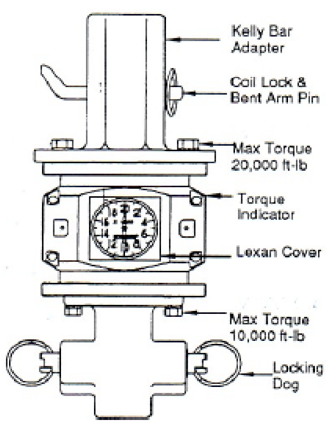
A screw anchor stay is as the name implies-SCREWED directly into the ground without having to dig a hole first.

The anchor is screwed in by a power screw anchor assembly fitted to a Pole Hole Borer Erector (PHBE).

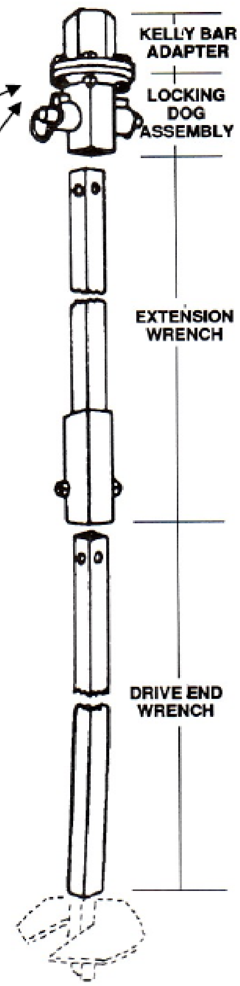




Shear Pin Torque Indicator.



Readout Dial Torque Indicator



Power Screw Anchor Assembly and Components

Either of the "Torque Indicators" shown above may be installed in the Power Screw Anchor Assembly. The "Indicator" bolts between the Kelly bar adaptor and the Locking dog assembly as shown in the Diagrams above.

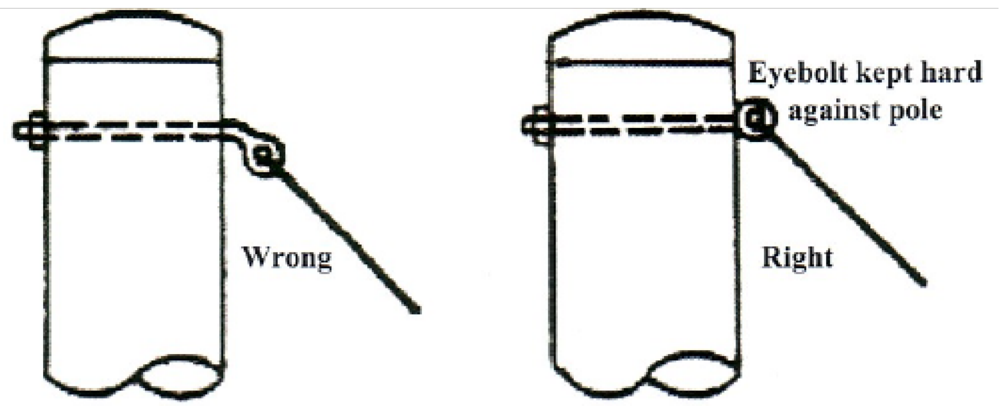
Refer to Power Installed Screw Anchor of the Distribution Overhead Line Design and Construction Standard for detailed information on the screw anchors and the process for installing them.

Special Notes : Always be careful when straining up a ground stay to a "screw anchor" as they have been known to fail in the ground.

When an eyebolt is used for fixing the stay to the pole, it is generally fitted as close below the conductors as possible. The position, however, varies according to circumstances but must be fitted into the pole as shown in the Diagram following.

If the eyebolt is left projecting from the pole, it will bend under strain and allow the stay to slacken off.

This will cause the pole to lean into the line and the conductors to drop, possibly BELOW their required ground clearance.



Method of Fitting Stay Eyebolt into Pole

1) When installing an anchor block stay - REMEMBER the following :-
2) Only one person to lower "block" into ground - holding the end of rod.
3) Sight stay rod with pole eyebolt and pull anchor block hard up against the undercut portion of the hole.
4) Backfill hole and ram well.
5) Always ensure that :-

- The ground rod is in a direct line with the stay eyebolt in the pole top.
- Loose spoil is not left between anchor block and the undisturbed ground.
- If this is not adhered to, the loose spoil can be dislodged causing the stay to become slack. This will allow the pole to LEAN and the conductors to DROP.

9•11•4•6 Screw In Anchor – Using Excavator

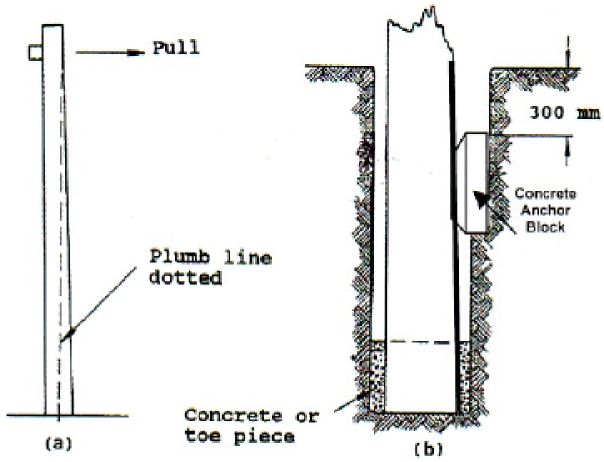
Another option for screwing in an anchor stay is to use an excavator.

Note: Where an Excavator is used by an Authorised Service Provider working for TasNetworks, the safe work principles and relevant work method in the following SWMS must be complied with.

- SWMS Install, Remove, Straighten, Power Pole With Excavator.

9•11•4•7 Breast Logs And Toe Pieces

Breast logs and toe pieces are used to reinforce pole foundations of poles with minimal strain tension on the pole top, such as slack spans or very light conductors.



Drawing (a) shows pole pulled ½ pole back to allow for conductor tension.	Drawing (b) shows bottom section of pole in ground fitted with concrete toe piece and breast log.

Reinforcing the pole foundations by the method shown in Diagram (b) will not prevent bending of the pole towards the load (conductor tension) nor will it provide adequate support for heavy or tightly strung conductors.

Note. The other associated risk in installing poles WITHOUT a back stay is when the pole deteriorates to the stage where the pole top forces are greater than the remaining strength in the pole – the pole can break off and fall over.

When the weight is applied to the pole top, the pole is securely wedged between the toe piece in the bottom of the hole and the breast plate. This method is not as good as “staying” but is effective for small line angles and lighter loads.

Installation method :-

1) Set the pole 1/2 its pole top diameter away from the direction the conductors will pull. See Diagram (a) above.

2) Fit toe piece or concrete in hole against pole footing. The toe piece can be concrete or suitable rock(s).

3) Position breast plate (concrete anchor block), on ground, against pole directly below the conductors and with the flat side outwards. Mark around it. Mark accurately - a tight fit is ESSENTIAL.

4) Move the breast plate and dig out to a depth of the plate plus 300 mm. Keep the face straight and vertical.

5) Fit breast plate in hole against pole. Top of breast plate to be 300 mm below ground level.

6) Back fill hole and ram earth well.

7) Tidy up site.

9•11•4•8 Rock Bolt Stay

These types of stays are installed in situations where there is a large amount of rock in the area and it is not possible to install a screw anchor or sink a hole for an anchor block.

Rock bolt stays shall comply with Drawing D-OHC-L003-SD-001 in the Overhead Line Design Construction Manual.

An old method of creating a rock bolt stay, but not really done now, is to drill a hole through a large rock and a “rock bolt” is inserted as shown.

9•11•4•9 Bisect Stays

When there is a deviation in a line and a bisect stay has to be installed, its correct installation position can be determined by one of the following methods.

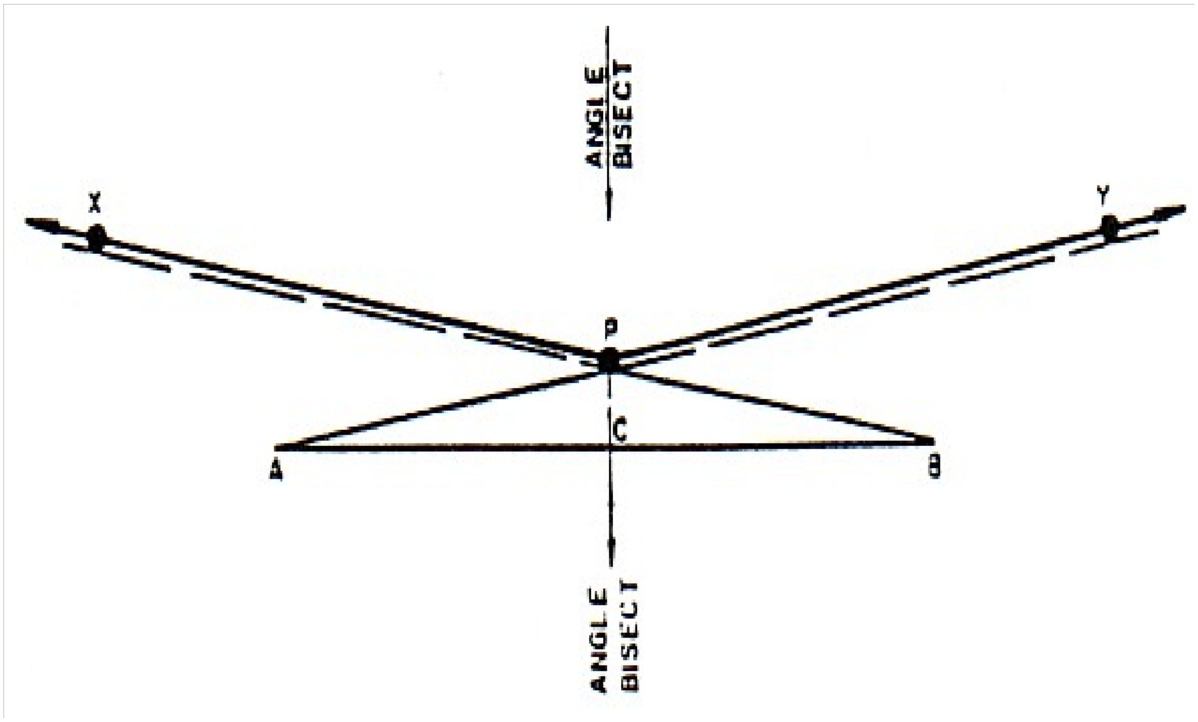
9•11•4•9•1 Method 1 Determine Position Of Bisect Stay

1) Sight along the side of poles Y and P and place a peg (A) in line at a distance, say, 10 metres from P. Similarly, place another peg at point B the same distance, 10 metres, from P and in line with the sides of poles X and P. See following Diagram.

2) Measure the distance between pegs A and B and mark the mid – point between them (C).

3) The bisecting stay will lay along the line through the centre of the pole (P) and point C.

4) Measure the required distance out along this bisect line for the particular stay to be installed. (That is, 45° or 60° stay).



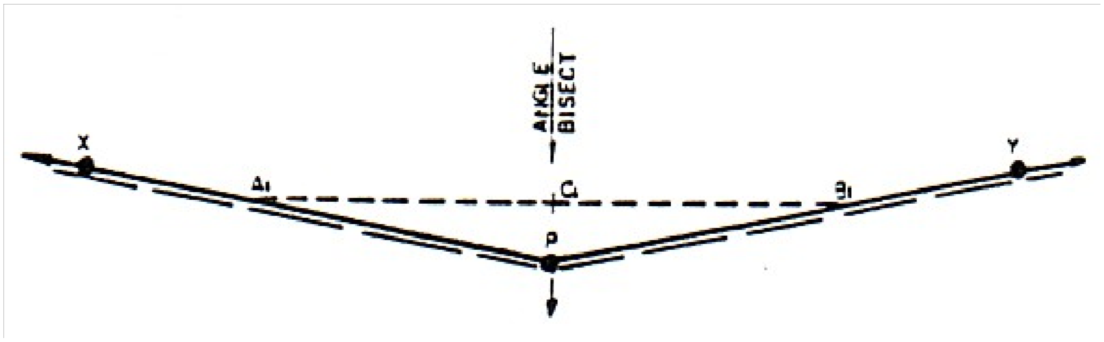
9•11•4•9•2 Method 2 Determine Position Of Bisect Stay

1) Place sighting sticks (or pegs) A1 and B1 in line with poles P and X, and P and Y, an equal distance from pole P. See Diagram below.

2) Stretch a tape between points A1 and B1 and mark the mid-point C1. A line through the pole (P) and C1 is the line through which the combined forces of the conductors will act on the pole. To counteract this pull, the stay must be installed on the same line in the opposite direction.

3) Project a line from point C1 through pole (P) as indicated by arrow.

4) Measure out along this line the required distance for the stay to be installed.



9•11•4•9•3 Method 3 Determine Position Of Bisect Stay

1) Stand erect with your back against the pole and your arms outstretched along the line as shown in the following Diagram. Ensure you are in the best position to sight the line along both arms.

2) With your head erect and looking straight ahead - you are looking in the direction of the bisecting line.

3) Swing your arms in a horizontal motion to the front as shown in Diagram below.

4) Place a marker in the ground along this line. Project a line from this marker, back through the pole as indicated by the arrow.

5) Measure from pole, out along this line for ground stay.

Note: Method 3 is not as accurate as methods 1 and 2 but in some situations can be quite acceptable.

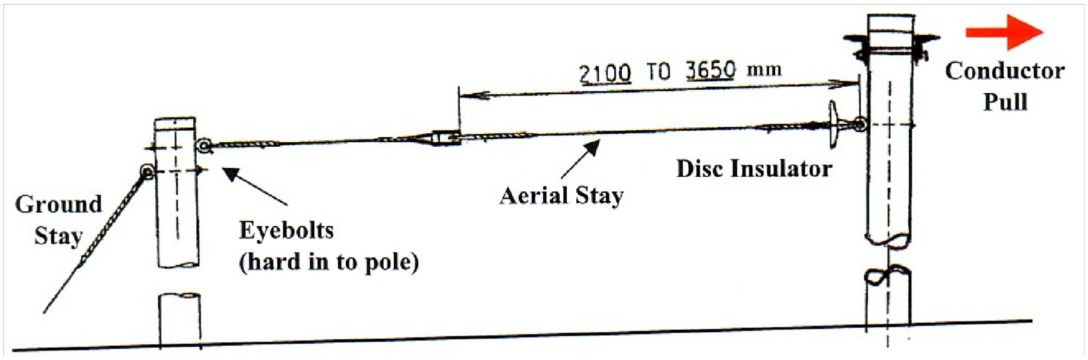
Bisect stays are not only ground stays. They can be aerial stays or a combination of aerial and ground stay.

9•11•4•10 Aerial Stays

In places where a back stay is impractical because of the need to cross a road or driveway or some other obstacle, an overhead (aerial) stay is used.

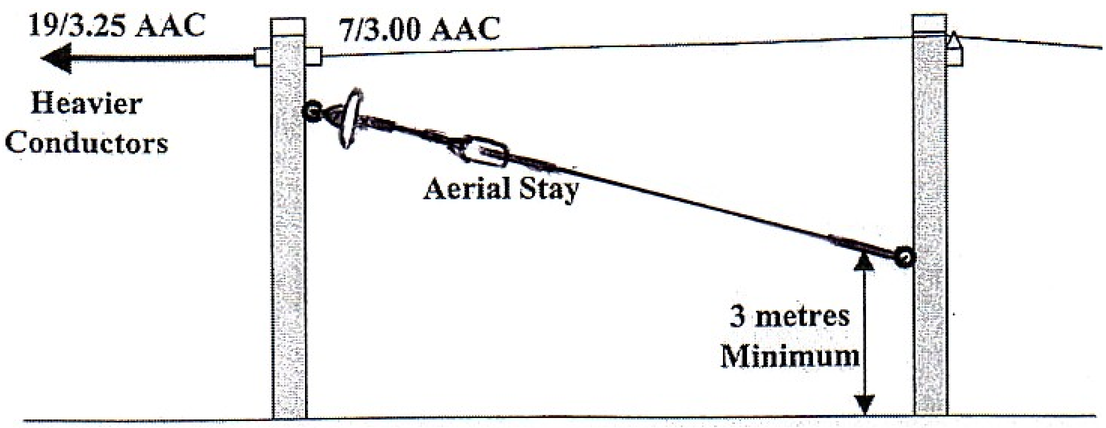
In this form of staying, a stay wire extends from near the top of the pole, to be stayed, to the top of another pole across the street at approximately the same height.

An aerial stay merely transfers some of the strain (tension) from one pole to another pole nearby, as shown in the following diagram.



In ALL instances, a ground stay has to be used in conjunction with an aerial stay because the pull of the conductors can exceed the footing strength of both the supporting pole and the aerial stay pole.

<u>Note</u>: In some situations where conductors of different sizes terminate on a "straight through" pole - an aerial stay has to be used to counteract the pull of the heavier conductors as shown in the following Diagram.



In such cases, an aerial stay from the top of the pole to be stayed – installed back to the next pole in line, will hold the pole quite satisfactorily.

The stay must be fixed a minimum distance of three (3) metres up from the ground.

This measurement of 3 metres may need to be increased in order to give the required ground clearance over a drive or laneway, but must not ever be less than three (3) metres above the ground.

9•11•4•11 Stay Guards or Sighters

With the installation of ground stays, the safety and welfare of the public is of primary concern. Therefore, in all areas where ground stays are installed, they must be fitted with a white PVC guard or sighter.

These serve a dual purpose. They make the stay wire more VISIBLE so as to prevent people, or animals, tripping over them and should they walk into the wire there is less chance of them being cut by it. The stay guard also protects the stay wire against damage from vehicles or vandals.

All stay "guards" MUST be secured to the stay wire by "clamping" or "tying" to PREVENT them being pulled off or pushed up the stay wire.

9•11•5 Clearances For Stays

Standards have been established regarding ground clearances for stays, just as for conductors.

Minimum ground clearance of aerial stay wires :

- Over roads or highways = 5.8 metres.
- Over private driveways = 4.6 metres.
- Over all other areas = 3.0 metres.

Minimum clearance in any direction between stay wires and conductors :

- Low voltage conductors = 230 mm (To Active conductor) = 150 mm (To Neutral conductor).
- High voltage conductors = 460 mm (To 11 kV or 22 kV).

9•11•6 General Work Principles For Stays

9•11•6•1 Key Work Steps

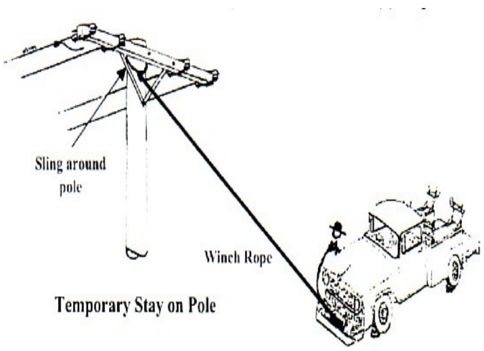
1) Check and expose underground services as required and, use **Dial Before Dig** process where necessary.

2) Determine traffic management requirements.

3) Do a risk assessment and implement control measures and;

(a) **CAUTION** : If replacing an existing stay check the pole top forces and determine if it may be necessary to temporarily strain and support the pole prior to releasing and replacing the old stay.

(b) Electrically test to check for stray voltage before touching stays.



4) Don't install or tension stay wires on poles with live "substandard" high voltage conductors of 7/.044 to 7/.064 copper or #8 steel.

5) Be aware of spring effect when working with hard drawn wire as movement is highly unpredictable and uncontrolled movement can take out an eye or pierce the body – wear safety glasses & gloves.

6) Attach stay(s) to pole / structure in correct position and angle.

7) The pole is raked half a pole back against the pull prior to the conductors being attached.

8) The correct size wire and stay wire components are used.

9) The wire is correctly measured, wrapped with PVC tape and cut through cleanly. The tape should be firmly applied in 2 or 3 layers over a length of 50 to 75 mm. The cut should be made through the centre of the taped bit.

10) The correct stay insulator is used and inserted the right way up. That is, the glazed end faces upwards and the unglazed end faces downwards.

11) The stay insulator is fitted the correct distance (2100 - 3650 mm) from the TOP of the stay. This is referred to as the "bridle".

12) The preformed wrapons (wire grips) are correctly fitted through the stay insulator so that even if the insulator is broken, the wrapons will remain linked together.

13) The wrapons are started at the correct crossover mark and wrapped fully onto the wire. The wire end should NOT protrude outside the wrapon.

14) The wrapons are correctly fitted around the thimbles, where these are used.

15) No stray strands or wire tails should be left protruding from the wrapons. This is particularly important with ground stays as it could cause an injury to animals or people passing by.

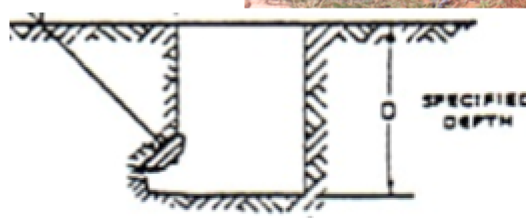
16) The ground rod is in a direct line with the eyebolt in the pole.

17) The stay is correctly tensioned and made off.

18) Fit a white plastic marker (sighter) tube on stay wire over termination and secure it to the wire so it remains close to the ground as a warning device.

19) Don't install stays on poles supporting HV wires without fitting a disc insulator in stay wire.

20) **IMPORTANT** : If using an anchor block or rock bolt you must ensure the hole is excavated so there is a back angle cut at the bottom of the hole as shown, so the anchor block or rock bolt will properly bite into the side wall of the hole and cannot be pulled out of the hole.



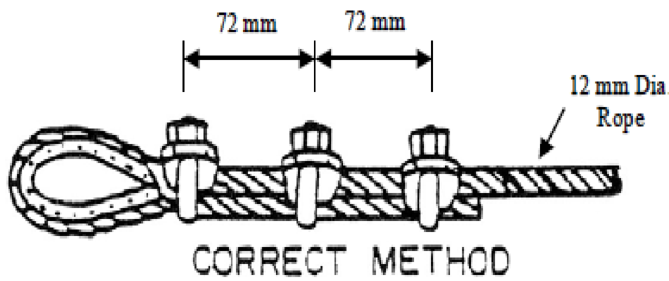
21) To remove old stay, install a tensioning device to stay wire and stay rod / eyebolt and apply tension.

22) **Note** : A normal aerial stay has one (1) insulator UNLESS it runs between live conductors and there is a need for an additional insulator, or it runs across Telecom wires or onto a Telecom pole. In this case, two (2) insulators MUST be fitted the same distance, as above, from each end of the aerial section of the pole being stayed and the pole to which the stay is anchored.

These insulators must always be fitted into the stay wire before the stay is installed. The correct size insulator must be used to ensure the appropriate amount of insulation and tension is provided in each case.

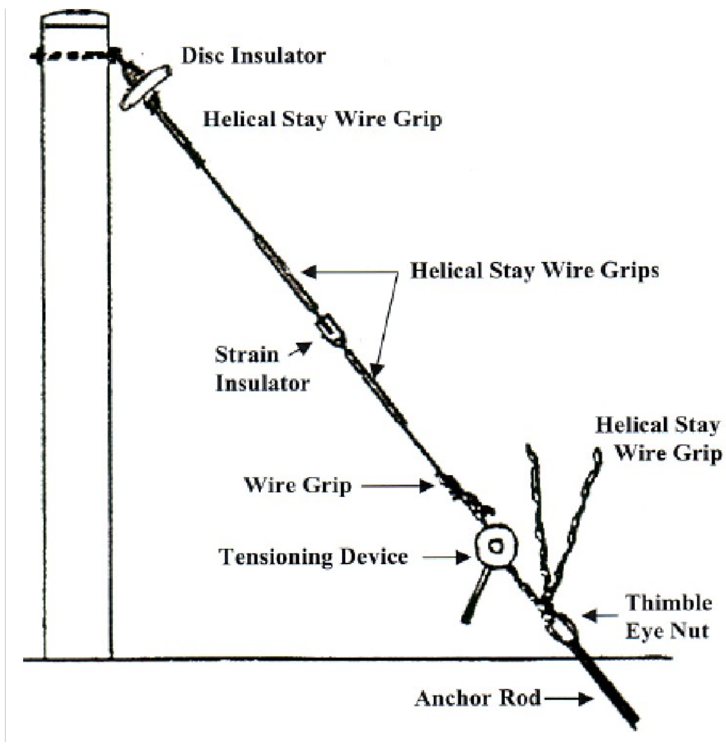
9•11•6•2 Terminations

Stay wires are now terminated by fitting preformed helical wrapons of the appropriate size directly to the wire.



In the past, a stay wire "joint" was made, or Admiral clamps (bulldog grips) were fitted over the wire. Neither of these methods is now used. However, if an existing stay has these clamps fitted, then they must be fitted as shown in the Diagram above.

There must be a minimum of three clamps fitted and spaced approximately six (6) times the rope diameter apart. For example, 12 mm diameter rope – the clamps are fitted 72 mm apart as shown in Diagram below.



With new work, stays must be installed before the conductors are erected.

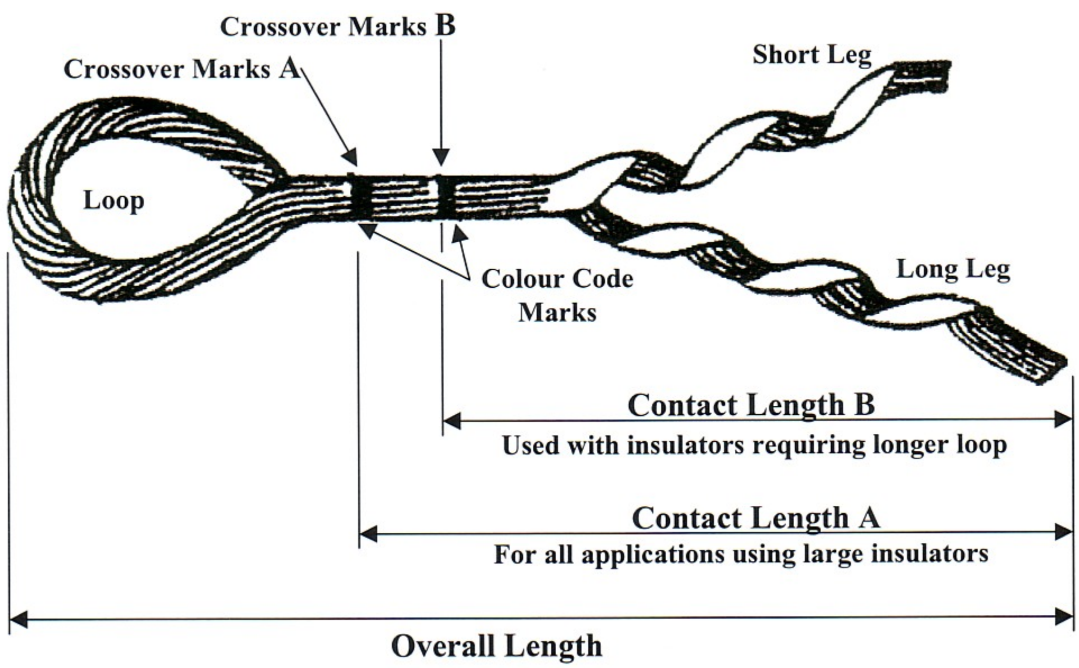
With reconstruction work, stays must be installed, or upgraded, before changes are made to the conductors. When installing stays, care must be taken not to place any excessive strain on the pole or the existing conductors.

Care must also be taken to prevent stays from contacting live conductors.

Special Note : **In possum prone areas there may be a need to install two (2) white stay " sighters" on ground stays. One " sighter" at the bottom near the ground and the second one at the top on the " bridle"**.

9•11•6•3 Application of Preformed Helical Wrapons

Preformed helical wrapons may be applied on the ground or up in the air as required. All wrapons have at least one painted crossover mark on each leg of the grip. Some have two painted marks as shown in the following diagram.



The provision of two crossover marks, "A" and "B" as shown in Diagram above, is to provide a longer loop when using on large insulators.

The "crossover marks" are colour coded to provide :-

1) Visual identification of size and materials.

2) A starting point for installation of wrapon.

9•11•6•4 Controlled Slip of a Stay Wire Wrapon

1) If a stay wire is too tight, it may be slackened off by “controlled slipping”. This is loosening the wrapon SLOWLY and allowing wire to slip back through it.
2) This controlled slipping, as described below, should only be carried out with a straining device attached to the stay wire but slackened off.
3) Carefully lever both ends of wrapon legs away from stay wire.
4) Commence unwrapping both legs of the wrapon simultaneously. This must be done carefully so as to control the slipping. This usually begins when the wrapon is undone to the point indicated by crossover mark “B” shown in previous Diagram.
5) Immediately re-apply both legs of the wrapon to the wire when enough slack has occurred or you wish to stop for some reason. This will stop any further slipping of the wire.
6) Complete re-application of the wrapon, remove the straining device and refix the stay sighter.

9•12 Management Of Pole ID Tags

Identification of power poles is important to enable easy location of poles (e.g. during fault work) and, pole tags with identification numbers on them are affixed to the poles as per the following work guideline.

Management Of Pole Identification Tags

Note: As per the following Green Lesson, “DO NOT OPERATE TAGS” or similar have been fixed to pole ID tags and then ripped off causing the pole ID to be ripped off as well or badly damaged. Ensure you use a pair of side cutters to avoid damaging the pole ID tag.

9•13 Earthing Systems

9•13•1 General

Earthing is important as the earth circuit :-

1) Provides additional protection to minimise the chance of persons receiving an electric shock if an electrical fault occurs.

2) When connected as an earth mat arrangement (e.g. in a switchyard) provides protection against step and touch potential by keeping voltage differential between conductive surfaces down as close as possible to zero.

The earth wire is connected to the mass of earth via connection to an earth rod (or via bonding to a steel pole or as an earth mat) buried into the ground to provide a low resistance path for current to flow through when an electrical fault occurs.

The fault current through the earth circuit then operates protection devices (e.g. fuses or circuit breakers) to open the main circuit (active back through neutral) to stop the current flow and protect persons and property.

In general, earthing and the use of earthing to protect against induced voltages shall comply with the following :

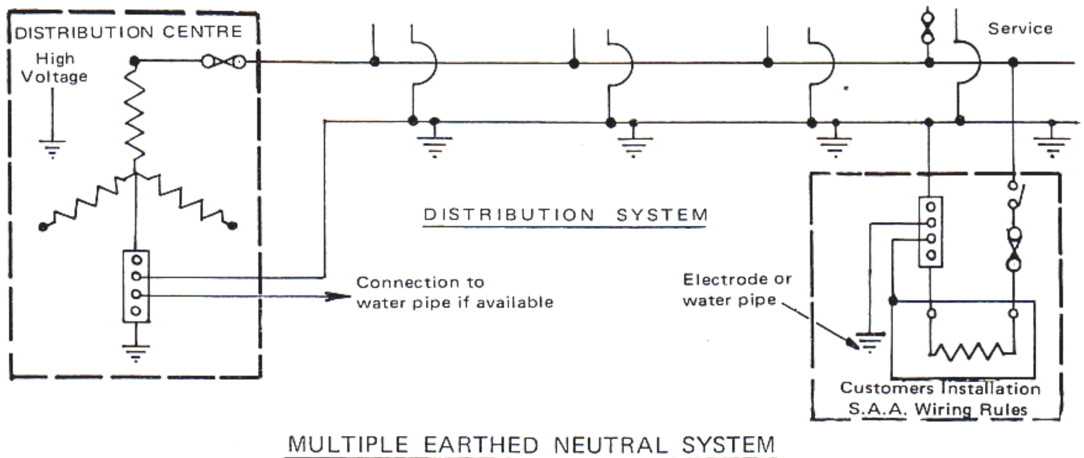
- **ENA Guideline For Earthing Of Mobile Plant.**
- **EC23 Guide To Induced And Transferred Voltages**
- Work Practice requirements for earthing listed under the section **Earthing** on the Work Practice Web Site.

9•13•2 Multiple Earthed Neutral (MEN) System

Multiple Earthed Neutral (MEN) means a system of earthing in which the parts of an installation required to be earthed are connected to the general mass of earth and in addition are connected within the installation to the neutral conductor of the supply system.

The M.E.N. is the main system of earthing used in electrical circuits in the Power Distribution System and also in customer installations.

In the M.E.N. system, the fault current returns through the neutral conductor as shown in the Diagram below. The neutral conductor is connected to earth at various pole positions [typically every third or fourth span] in order to maintain the neutral at earth potential. Intermediate earths are connected to the LV neutral conductor, but HV and LV earths are electrically separated at the transformer.

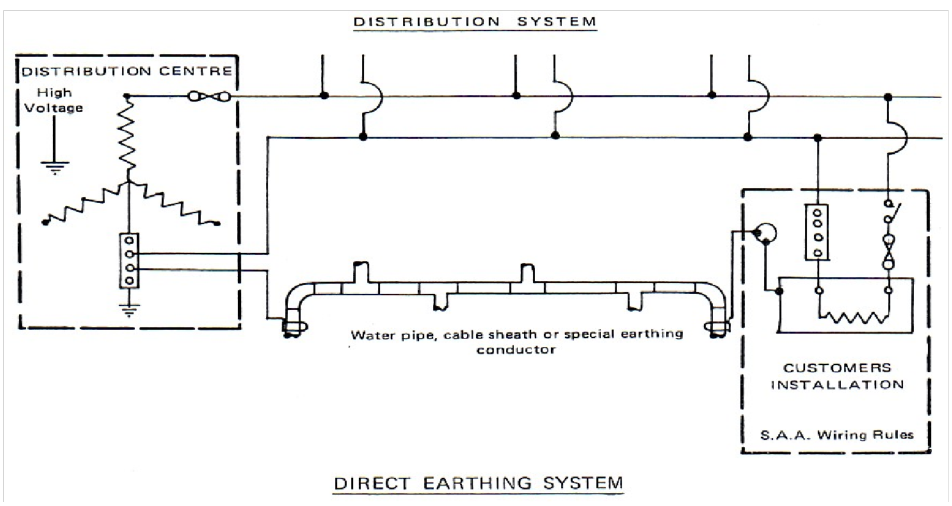


Sample For Information Only

Note: In the M.E.N. system, the earth and neutral are connected together at the Customer's switchboard.

9•13•3 Direct Earthing System

Direct Earthing means a system of earthing in which the parts of the installation are earthed but not connected within the installation to the neutral conductor of the supply system, or to earth through the trip coil of an earth leakage circuit breaker.



Sample For Information Only

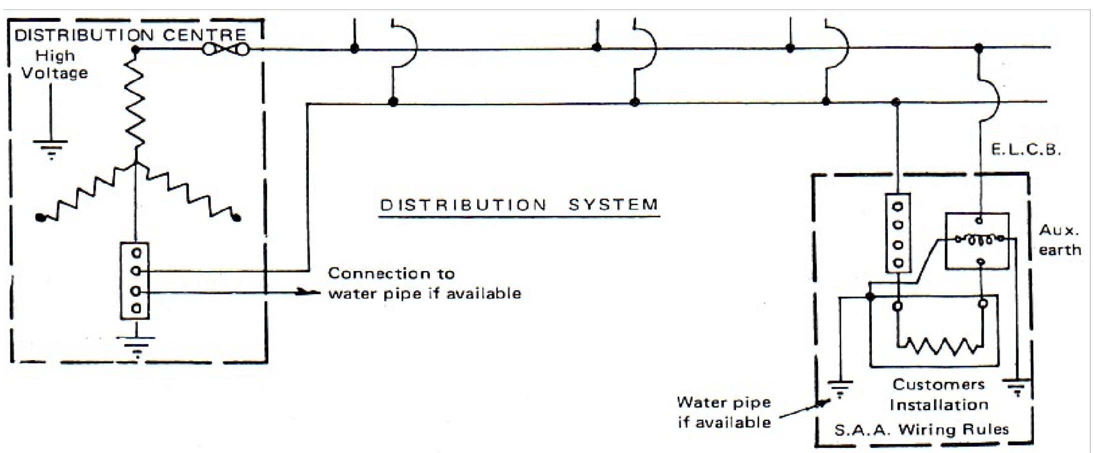
In the direct earthing system the fault current returns via the earth, the independent earth stake at the customer's installation, or the metallic water mains system where metallic water mains are still in use. A direct earthing system may only exist in remote areas.

9•13•4 Earth Leakage Circuit Breaker (ELCB) System

Earth Leakage Circuit Breaker is a means of protection in which the parts of an installation are earthed through a earth leakage circuit breakers or relay. In low voltage wiring installations an ELCB is also known as a Residual Current Device (RCD)

The system is used in the distribution system where the Circuit Breaker operation is initiated from a dedicated relay coupled to current transformers. In low voltage installations and low voltage wiring systems the RCD device is now a requirement. In circuits protected by earth leakage circuit breakers both the "active' and "neutral" conductors pass through a "core balance "toroid current transformer built into the "ELCB".

When load currents are normal, the current flowing in the active and the neutral conductor are equal, and cancel each other out. Should a person receive an electric shock, or should any situation arise where current leakage occurs to earth, the current flowing from the active conductor to earth reduces the return current flowing in the neutral conductor. This "out of balance" variation causes the circuit breaker to trip.



EARTH LEAKAGE CIRCUIT–BREAKER SYSTEM

Sample For Information Only

The subject of Earthing is a comprehensive and complex one. The information above briefly describes "3" types of conventional earthing systems. It is not intended to be a complete reference for earthing design or requirements.

9•13•5 SWER Earthing System

A SWER supply involves the installation of a single conductor and the earth is used as the return circuit. This means material cost is much less for a SWER system than for conventional systems, fewer conductors, insulators, fittings and no cross arms. In remote areas, where the number of customers is very small and the “load” required is low, it has been cost effective to install a SWER system.

A SWER system has a 12,700 volt single high voltage conductor running from an “Isolating” transformer out to individual single phase Distribution transformers situated close to the Customer’s installation. The low voltage supply to the Customer could be via a split phase transformer and associated metering as shown in Diagram A, or normal single phase transformer as shown in Diagram B below.

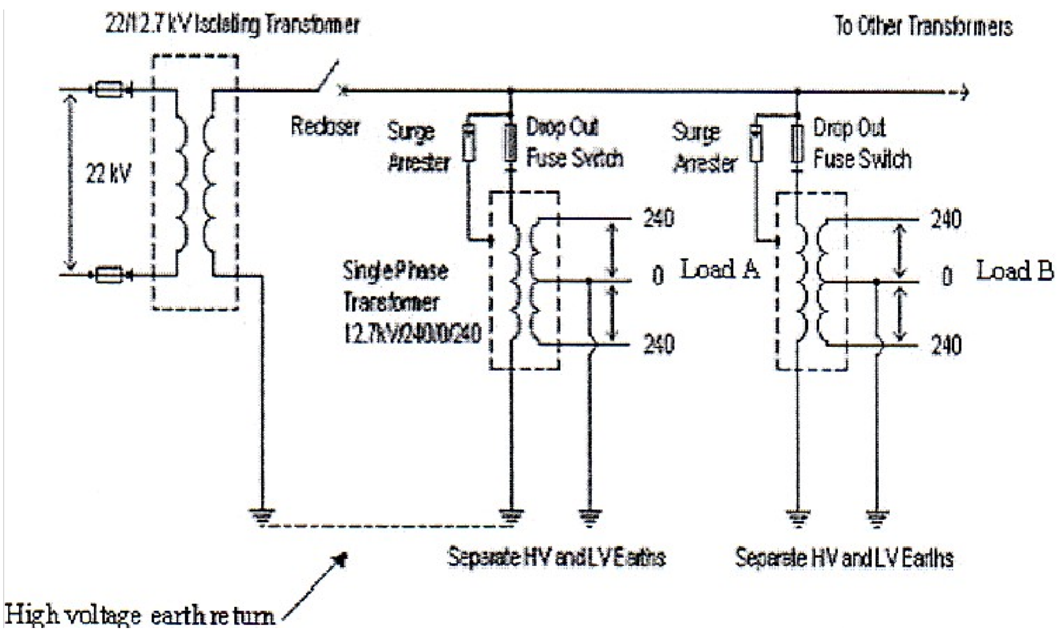


Diagram A. SWER Supply to Single Phase Split Transformer Loads.

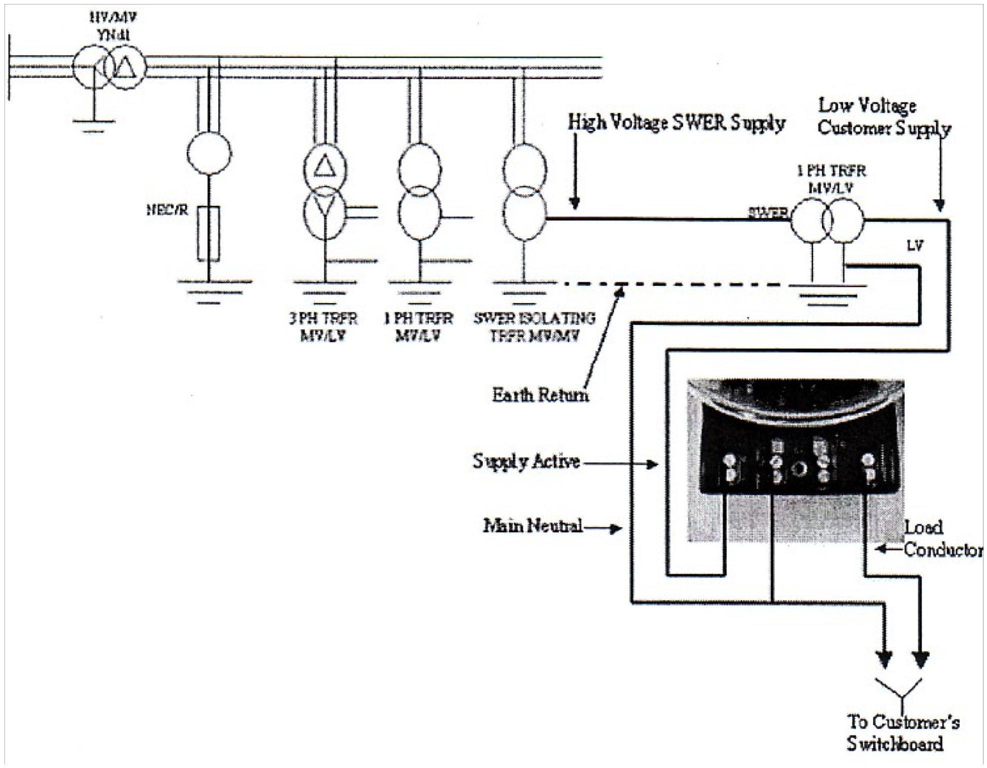


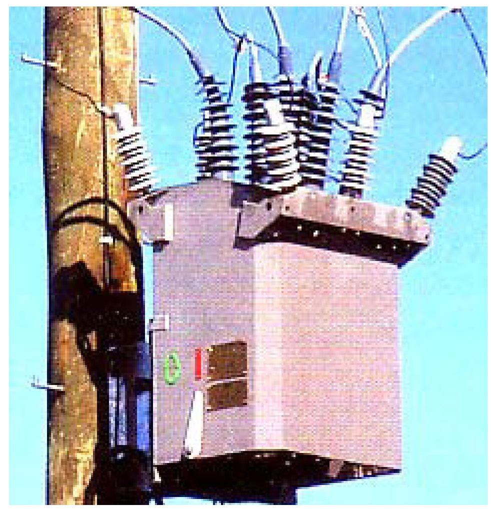
Diagram B. SWER Supply to Normal Single Phase Transformer & Associated Metering

Note: Regardless of the SWER supply, the metering wiring at the customers' installation is no different from a normal single phase metering arrangement. However, it is critical to ensure a good earth main connection is made into the ground and tested to ensure a low earth value is achieved, as there is no return neutral path back to the supply transformer.

9•14 Affix And Connect Assets

9•14•1 Reclosers

9•14•1•1 General

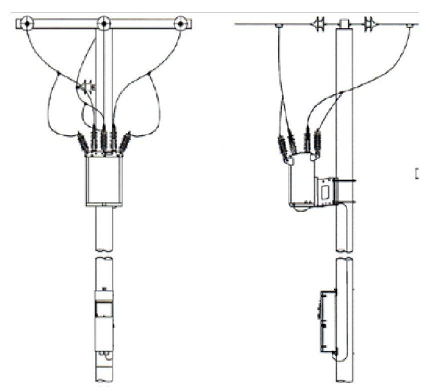


A recloser is a pole mounted circuit breaker, which operates automatically, switching off and on under fault conditions, restoring supply after each trip until the fault clears, or "lock out" occurs.

The use of reclosers results in fast restoration of supply after transient faults, reduces the number of customers affected by a fault and minimises interruption times by dividing long feeders into smaller sections.

A recloser can also be operated manually. When set to "one trip to lock-out " this prevents the recloser from reclosing after a protection operation.

The Nulec Automatic Circuit Recloser (ACR), shown above, is an electronically controlled pole mounted, GAS insulated, three (3) phase switch that is set up for REMOTE CONTROL operation. It can also be operated MANUALLY on-site if required.



Vacuum interrupters, insulated by SF6 gas, enclosed in a sealed-for life stainless steel tank ensures a long, low maintenance service life.

An Operator control panel is provided with the ACR for an Operator to operate the unit on-site.

The Nulec ACR is mounted on a single pole similar to the diagram shown at right. The control panel, mentioned above, is fitted on the same pole at 5 metres above the ground.

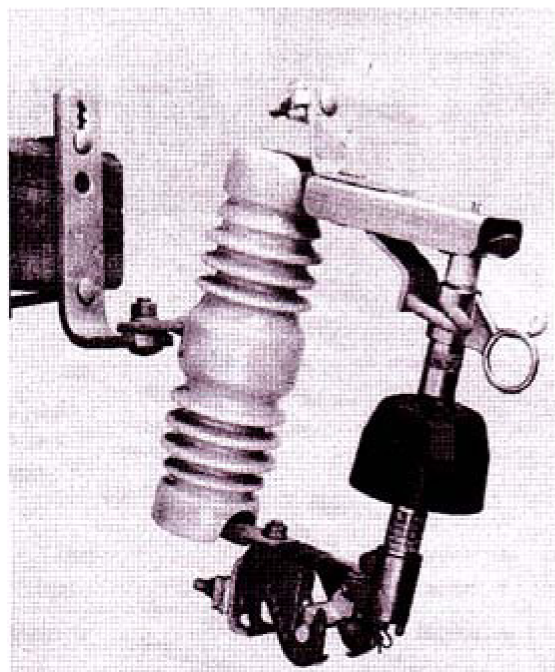
9•14•1•2 Installation

Reclosers shall be installed as per the following requirements :-

1) Work Procedure **Automatic Reclosers Load Break Switches And Sectionalisers**.
2) **Section 5.6 Reclosers** in the Overhead Line Design And Construction Manual.

9•14•2 Sectionalisers

9•14•2•1 General



Pole mounted Sectionalisers are devices designed to work in conjunction with an automatic Recloser. They are specifically designed for the protection of spur lines.

A Sectionaliser installed at the beginning of a spur line in place of an Expulsion Dropout Fuse unit, greatly enhances system coordination by reducing nuisance fuse operations.

These devices normally operate during the Recloser dead time and should not be used to make or break load current.

Sample Only

Sectionalisers are similar to an Expulsion Drop Out fuse, where the melting of the fuse element releases a fuse carrier from its mount.

However, in a Sectionaliser, a chemical actuator releases the Sectionaliser link after it is activated by a small current from a logic circuit. This converts chemical energy into mechanical movement that releases the Sectionaliser link tube from its mount.

The electronic logic is contained on a printed circuit board within the link tube and is powered by a current transformer fitted around the tube.

This ”logic” opens off the Sectionaliser during the “dead” time of an UPSTREAM Recloser after it has tripped and closed a number of times.

These “times” are PRESET by the Organisation. When the Logic unit “counts” the SET number of PRESET TRIPS of the “Recloser” it will automatically trip out.

After a predetermined number of operations the Sectionaliser isolates the line while the upstream Recloser is in the open position. The Recloser then restores supply to the un-faulted section of the system.

If the fault is temporary and is cleared before the Sectionaliser count reaches the predetermined number of operations, the Sectionaliser remains closed and resets to its original state after a set time.

One type of Sectionaliser has an actuator, shown at right, which is used to measure current changes and to initiate the operation of the Sectionaliser which opens off all phases.

9•14•2•2 Installation

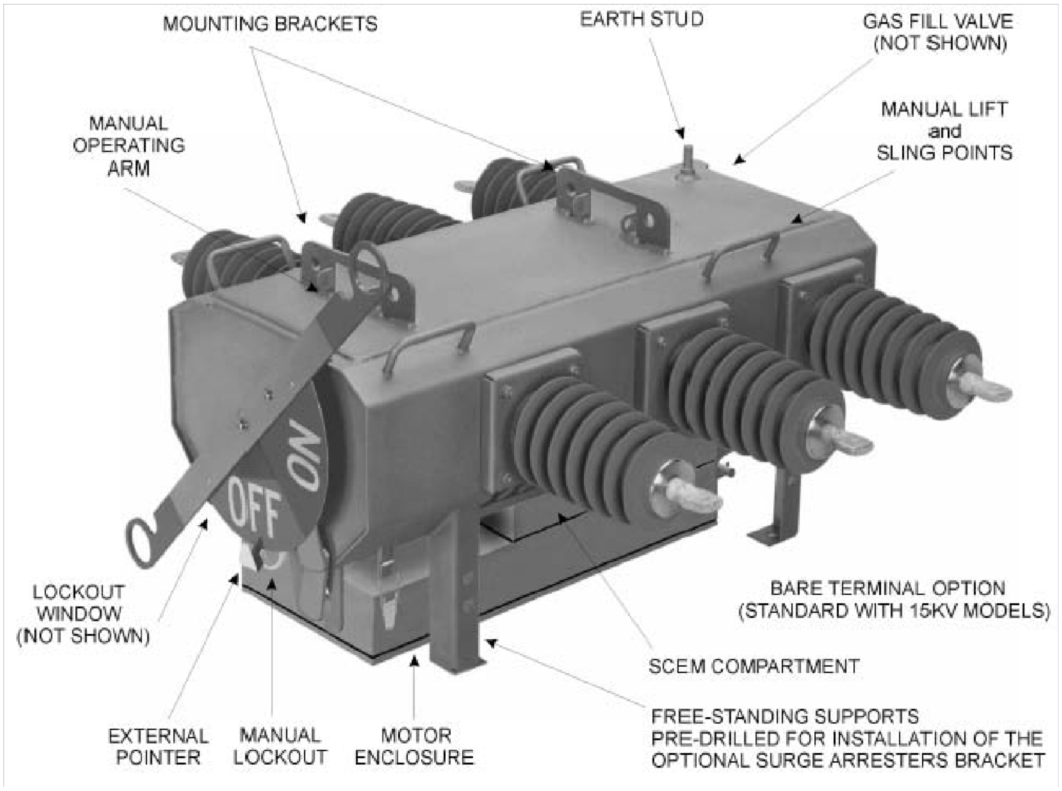
Sectionalisers shall be installed as per the following requirements :-

1) Work Procedure **Automatic Reclosers Load Break Switches And Sectionalisers.**
2) **Section 5.7 Sectionalisers** in the Overhead Construction Manual.

9•14•3 Load Break Switches

9•14•3•1 General

The Load Break Switch (LBS) is a pole mounted, GAS insulated, three (3) phase switch that is set up for REMOTE CONTROL operation. It can also be operated MANUALLY on-site if required.

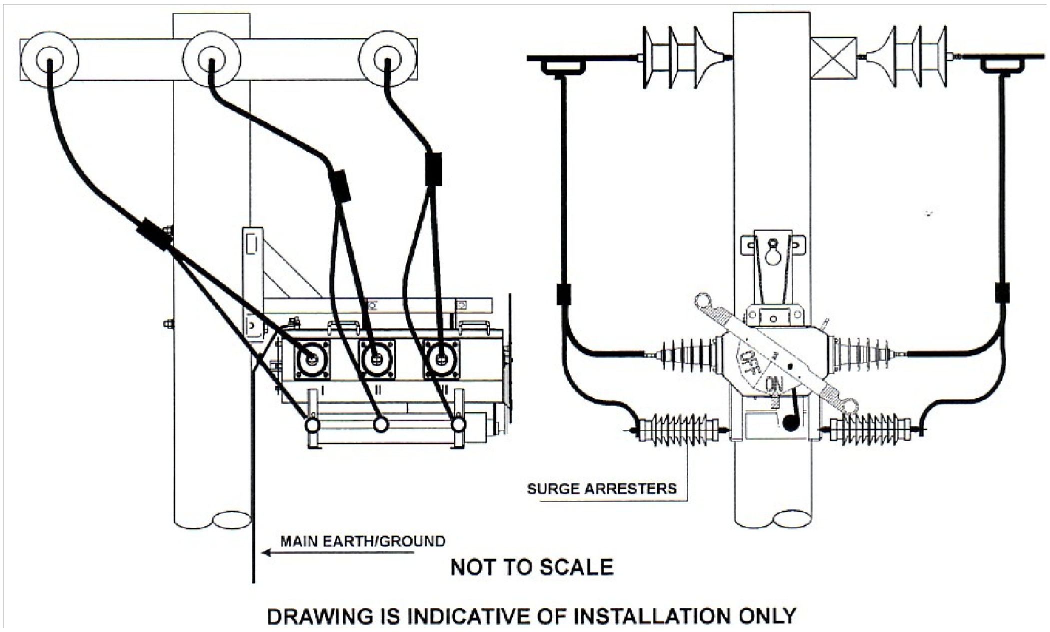


A puffer interruption system insulated by SF6 gas, enclosed in a sealed-for life stainless steel tank ensures a long, low maintenance service life.

An Operator control panel is provided with the LBS to allow an Operator to operate the unit on-site.

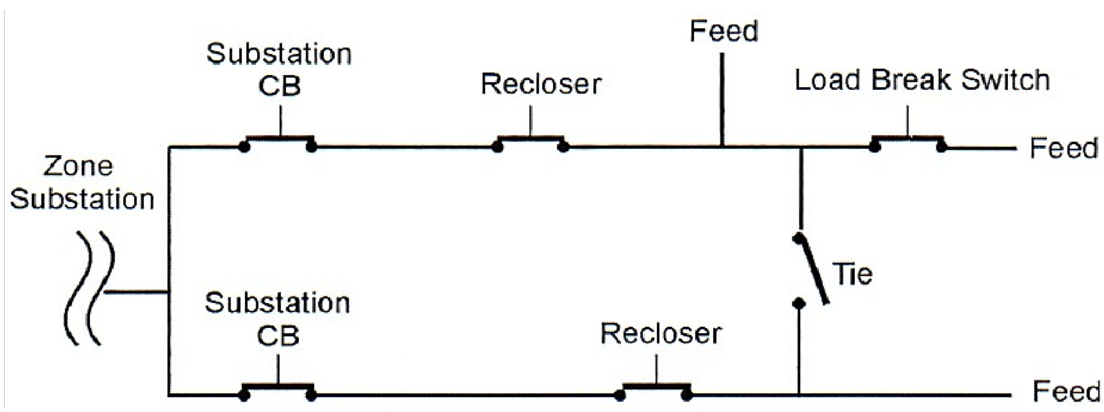
The LBS is mounted on a single pole similar to the diagram shown below.

The control panel is fitted on the same pole at 5 metres above the ground.



When the LBS “counts” the SET number of PRESET TRIPS of the “Recloser” it will then automatically trip out. This isolates the DOWNSTREAM “fault” from the network system and allows the UPSTREAM Recloser to restore supply to Feeder(s) upstream of the LBS.

The diagram below, of a simple network, shows the relative positioning of an LBS “downstream” of a Recloser.



From the diagram above, it can be seen how a fault condition BELOW the“LBS” can be isolated and supply restored by the Recloser to Feeder(s) upstream of it.

The “fault condition” MUST be rectified BEFORE the LBS closes back on to restore supply downstream.

9•14•3•2 Installation

Load break switches shall be installed as per the following requirements :

1) Work Procedure **Automatic Reclosers Load Break Switches And Sectionalisers**.

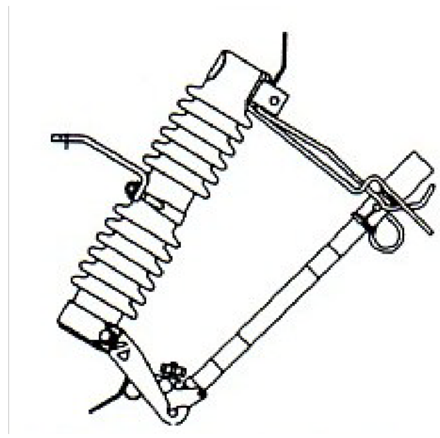
2) **Section 5.8 Load Break Switches** in the Overhead Construction Manual.

Note: Due to load break switches having the advantages of, less maintenance, lower lifetime cost and higher reliability, they will be used more often on new installations and to replace aged air break switches. Refer to the engineering **Blue Lesson** on the full details on use of load break switches.

Line Wokers can conduct on site testing and checks of a Load Break Switch as per the **Schneider Load Break Switch On Site Test Form** (also available on the ODI).

9•14•4 Expulsion Drop Out (EDO) Fuses

9•14•4•1 General



High Voltage EDO fuses are single phase devices, installed for protection of Distribution transformers and spur lines.

The fuse switch drops open, under fault conditions, to isolate the faulty apparatus or section of line, whilst at the same time providing a clear
indication of the fuse operation.

The most commonly used are the Expulsion Drop Out (EDO) fuse fitting similar to that shown.

The EDO fuse consists of a fuse element installed within a fibre reinforced carrier. The fuse carrier is fitted into a mounting assembly with a spring loaded hinged contact at the lower end and a pulling eye and contact arrangement at the top end. When the element melts and separates due to a fault, the spring operates causing the fuse carrier to drop out.

9•14•4•2 Installation

The installation of EDOs would be issued out as a job from Design Section which should specify the details required for installation and also the correct fuse type and size to be installed in accordance with the following section in the **Overhead Line Design Construction Manual** :-

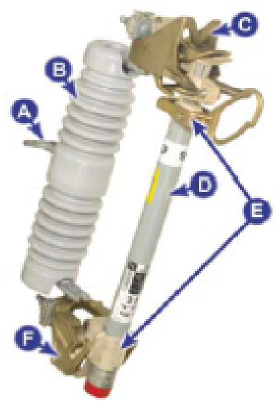
- **Section 5.3 HV EDO Fuses.**
- **Note :** All newly purchased NGK Stanger type EDOs are now supplied with an earthing stirrup to extend the Safe Approach Distance out to the minimum industry standard 700mm. Refer to the **Blue Alert** for compliance and details of the earthing stirrup.

9•14•5 Boric Acid Fuses

9•14•5•1 General

Complete Unit

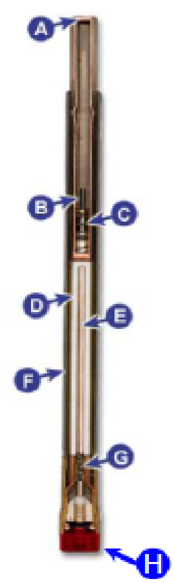
A. Rugged mounting bracket
B. Porcelain insulator
C. Latch-and-upper-contact assembly with compression-loaded silver clad contacts
D. Fuse Unit
E. Reusable upper and lower end fittings
F. Hinge-and-lower-contact assembly with compression-loaded silver clad contacts



Example of Complete Boric Acid SMU/20 Fuse Unit

SMU 20 Fuse

A. Upper seal
B. Latch-actuating pin
C. Stainless-steel drive spring — provides stored energy to drive arcing rod upward through arc-extinguishing medium.
D. Solid material arc-extinguishing medium (Boric Acid)
E. Silver-clad copper arcing rod
F. Filament-wound glass-epoxy tube
G. Fusible element — helically-coiled silver or pretensioned nickel-chrome — provide precise melting characteristics and nondamageable performance
H. Vent cover



Example Of Full Fuse Details

This type of fuse is installed, usually as packaged program of work, in :-

1) **Bush fire prone areas** as part of a fire risk mitigation strategy as, this type of fuse is less likely to create a spark due to the boric acid being an arc extinguisher.

2) **High Fault Current Areas** – Generally this type of fuse is capable of interrupting larger amounts of fault current.

The fuse is designed to be able to replace the standard fuse in an EDO unit.

9•14•5•2 Installation

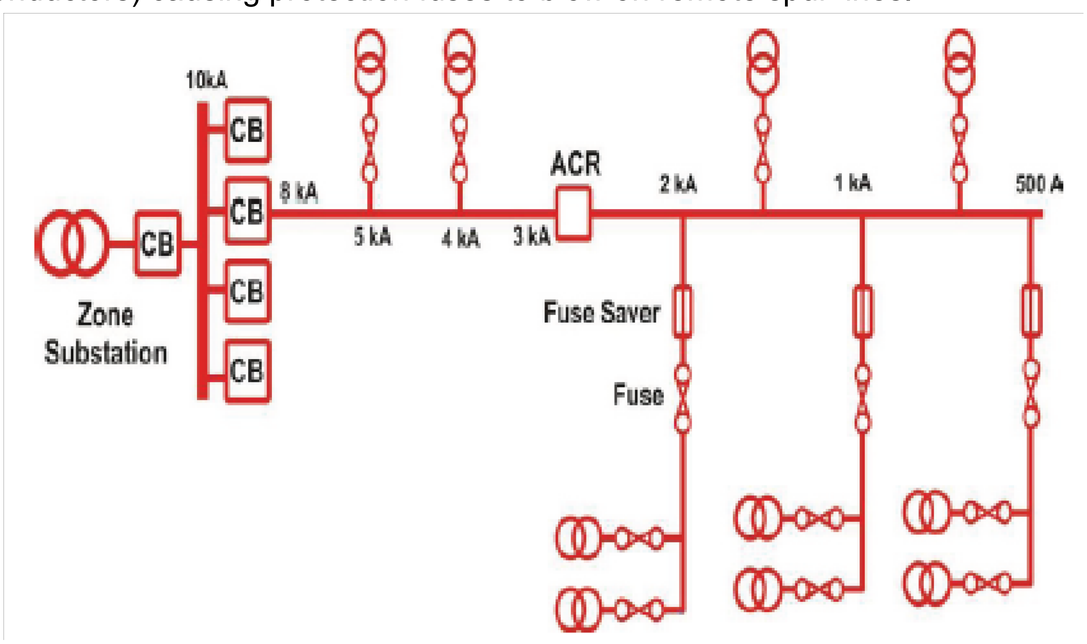
As per the work practice **Boric Acid Fuse Installation And Maintenance.**

For full details refer to the **Technical And Training Support Document**.

9•14•6 Kaon Fuse Savers

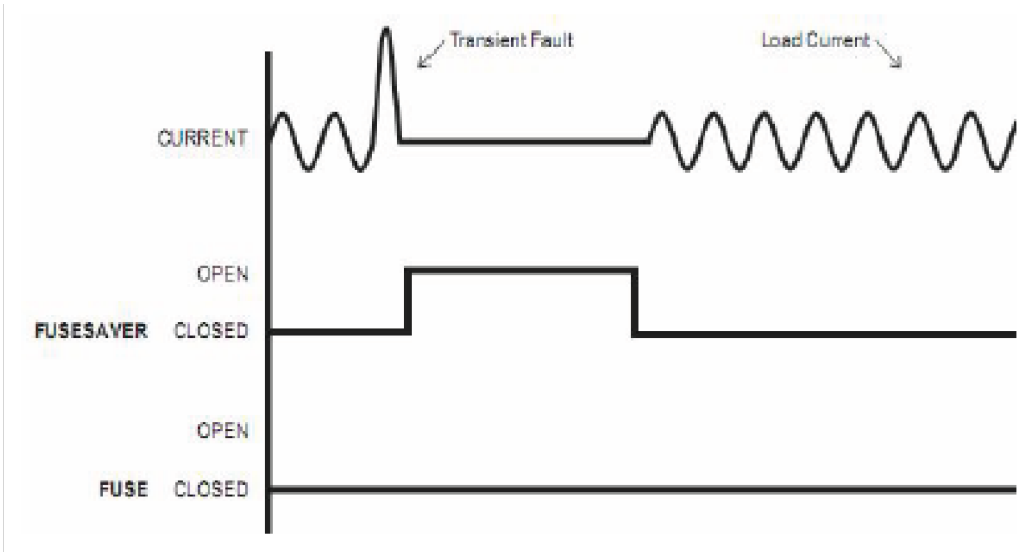
9•14•6•1 General

The objective of the Kaon Fuse Saver is to help improve reliability of supply in outlying areas by preventing outages from transient faults (e.g. branch brushing across overhead conductors) causing protection fuses to blow on remote spur lines.



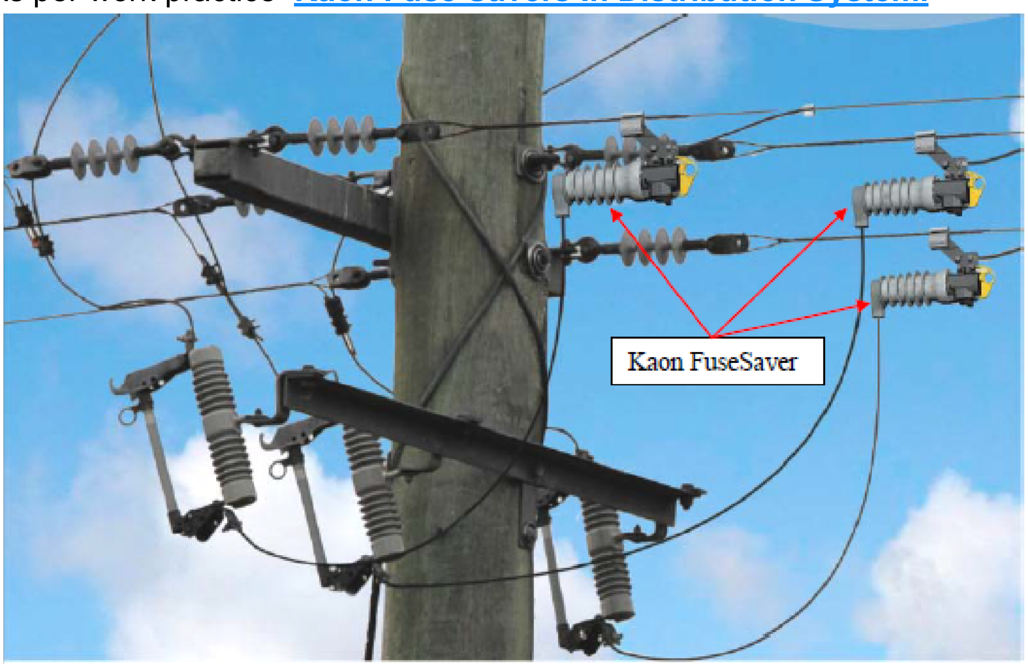
Example Diagram - Kaon Fuses Savers Installed In Spur Lines

As shown in the diagram below, the Kaon Fuse Saver momentarily interrupts the fault current. After 20 seconds the Fuse Saver closes back in again and, if the transient fault current is still there (i.e. a genuine fault exists) the Fuse Saver will allow the protection fuses to blow.



9•14•6•2 Installation

As per work practice [Kaon Fuse Savers In Distribution System.]

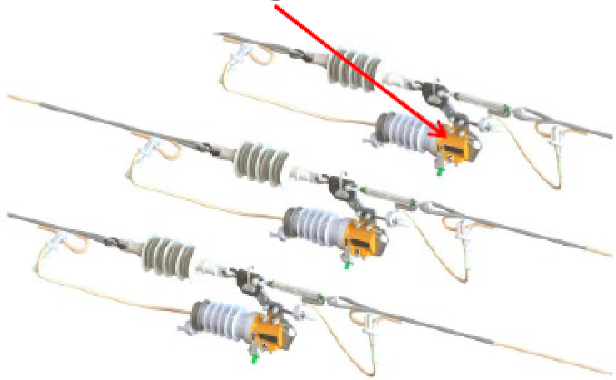


Typical Set Of Kaon Fuse Savers Installed In Series With An EDO

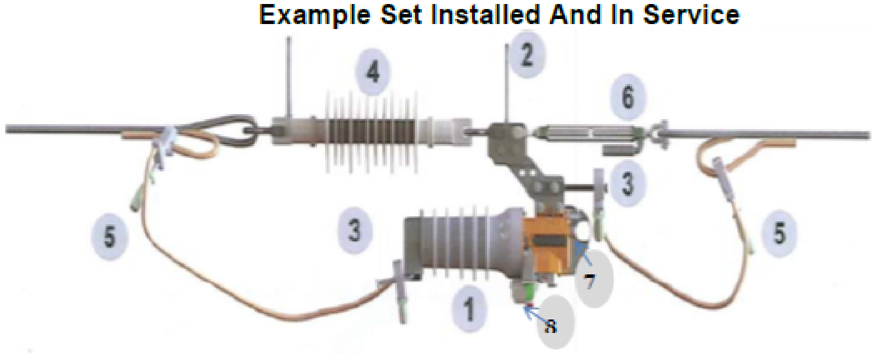
9•14•7 Siemens Temporary Isolating Switches

9•14•7•1 General

The temporary isolation switch is really a cut down version of the old Kaon Fuse Saver with the fault current sensing circuit removed so the unit operates for switching only. These are now Siemens owned switches and are called Siemens 3AD8 Temporary Switches and marked with orange colour as shown.



Example Set Installed And In Service



Item No.	Description	Item No.	Description
1	Switch unit based on old Kaon Fusesaver circuit breaker design with communications module.	5	Temporary Bridge
2	Tension hanging bracket with hook	6	Ratchet Turnbuckle
3	Parking bars	7	Protection lever
4	Isolating tension insulator	8	Battery pack and Red and Green actuating levers

NOTE: The temporary isolating switches are rated to : -

- Carry up to 400 A load.
- Break load up to 2000 A.

Take fault current up to 4000 A for 1 second.

The Temporary Isolation Switch comes as a set of three and, can be manually operated via a HV operating stick such that operating just one switch will simultaneously operate the other two ganged switches.

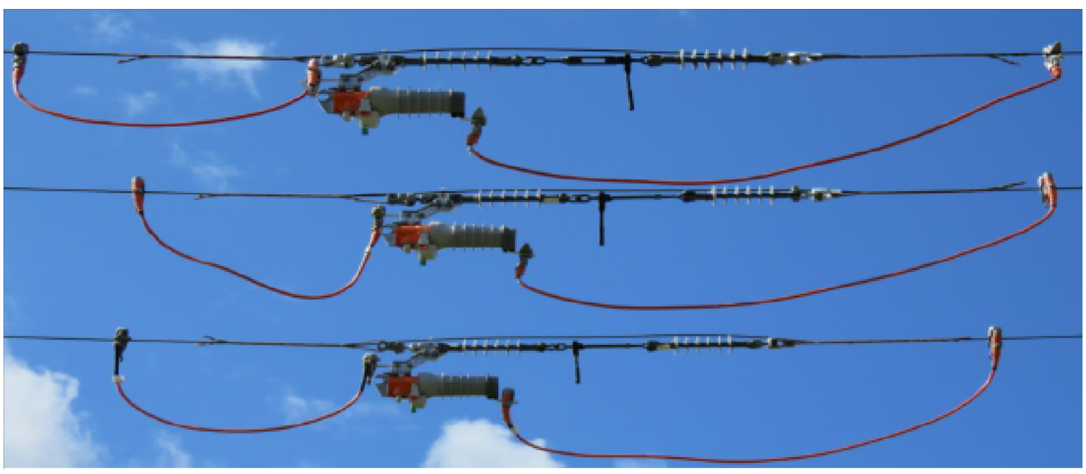
Alternatively, the Temporary Isolation Switches can be operated from ground level via radio communication from software on a laptop computer, if you are set up to use this mode.

The Temporary Isolation Switches are a handy lightweight alternative, as against installing a temporary ABS or cutting in temporary isolating links, for providing a temporary isolation break in an overhead HV line where it is not practical or there is no requirement to open an ABS or Recloser etc.

Although the Temporary Isolation Switches would most likely be installed by a Live Line Crew it is also possible that they could be installed with the overhead line isolated. Therefore, it is handy for all Line Workers to know about these switches and how they operate.

9•14•7•2 Installation

As per work practice **Live Line Portable Temporary Isolation Switch**.



Switches with bridging leads closed before opening switches.

9•14•8 Distribution Mains Fuses

9•14•8•1 General

Low Voltage fuses are connected into low voltage mains and services, to protect them from fault current. The type of fuse most commonly used is the “HRC“ or High Rupture Capacity type fuse.

Low voltage fuses are installed on transformers to protect against :-

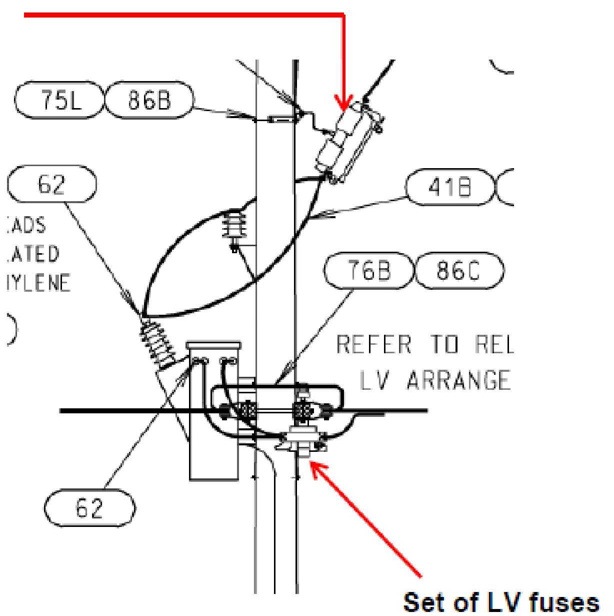
- Thermal damage to the transformer.
- Thermal damage to the cable insulation.
- Annealing of the conductor.
- Mechanical damage to the cable.
- Risk of electric shock to personnel and the public.

Where a single customer is supplied directly from a pole top transformer, the transformer fuse may replace the service fuse or in fact be one and the same.

9•14•8•2 Installation

Only when the HV supply has been transformed down to LV, as through a transformer shown above is there a need for LV fuses to be installed.

Most of the mains distribution fuses are HV fuses as installed with HV switchgear e.g. EDO fuse installed to protect pole mounted transformer as shown.



Example Taken From OH Construction Manual

Fuses shall be installed in accordance with :-

1) The locations shown on the relevant **Installation Drawing** in the Overhead Line Design & Construction Manual e.g. as shown above.

2) The type and size of fuse fitting and base as detailed on the **Material List** in the Overhead Line Design & Construction Manual that aligns to the relevant **Installation Drawing,** as shown by the following example for the above pole mounted transformer for 11KV supply.

Unit_Assembly	Store Type	Item Ref	Stock Item	Description	Quantity
SSB/11/3	S	75C	032275	Bolt Hex M16 X 140	3
SSB/11/3	S	75M	032287	Bolt Hex M16 X 325	2
SSB/11/3	S	76B	032338	Bolt Hex M20 X 350	2
SSB/11/3	S	78A	033780	Bolt Tower M16 X 35	3
SSB/11/3	S	85B	050250	Coach Screw M12 X 100	2
SSB/11/3	S	86B	065158	Washer Els 16	4
SSB/11/3	S	88B	066413	Washer Tower 16	3
SSB/11/3	S	62E	144617	Bushing Cover 11kv	3
SSB/11/3	S	41B	157877	Sleeving 6 ID 2 Wall	6
SSB/11/3	S	64A	236243	Switch Fuse 660V 630A	3
SSB/11/3	S	63M	236323	Switch Fuse EDO 24KV - single phase	3
SSB/11/3	S	60E	320531	Insulator,Pin 22/450	1
SSB/11/3	S	59A	322721	Pin,Insulator 22kv	1
SSB/11/3	S	1D	323304	Crossarm Mk4	1
SSB/11/3	S	2A	323314	Crossarm Strap Mk14	2
SSB/11/3	S	6A	323315	Insulator Bracket Mk15	1
SSB/11/3	S	2B	323317	Crossarm Strap Mk17	1

HV fuses
LV fuses

9•14•8•3 Selection Of Fuse Size
9•14•8•3•1 For 22KV Transformer HV And LV Protection

TABLE 1
TRANSFORMER DATA AND FUSE SIZES

22kV TRANSFORMERS

kVA	FULL LOAD CURRENT (Amps)			HRC FUSE RATING (Amps)	DROP-OUT FUSE RATING (Amps)	LV FUSE RATING (Amps)	
	PRIMARY	SECONDARY 1x250V	SECONDARY 2x250V			1x250V	2x250V
10,1 PH	0.45	40	20		6/20	63	63
15,1 PH	0.66	60	30		6/20	100	63
25,1 PH	1.14	100	50		6/20	160	100
50,1 PH	2.27	200	100		6/20	315	160
10,3 PH	0.26	13			6/20	40	
15,3 PH	0.39	20			6/20	40	
25,3 PH	0.66	33			6/20	63	
50,3 PH	1.31	67		5	6/20	100	
63,3 PH	1.7	84		5	6/20	125	
100,3 PH	2.62	133		10	6/20	200	
200,3 PH	5.25	267		16	16	2 x 200 or 1 x 315	
300,3 PH	7.88	400		20	25	2 x 315 or 1 x 450	
315,3 PH	8.3	420		20	25	2 x 315 or 1 x 450	
500,3 PH	13.41	667		40	25	LVCB or 2 X 450	

Notes:
1. Minimum fuse size used is 6/20 surge-proof fuses. All fuses are sparkless type.
2. When replacing existing HV fuses, LV fuses must be installed to provide overload protection on the LV side. If it is not possible to install LV fuses when HV fuses are replaced, LV fuses must be programmed to be installed ASAP.
3. Two LV Fuses are preferred for 200kVA, 300kVA and 315kVA Transformers
4. No special fusing is to be made for Motor Start. Motor start can be made upto 80% of Transformer kVA Rating. Refer to Development Group for other options.

9•14•8•3•2 For 11KV Transformer HV And LV Protection

TABLE 2
TRANSFORMER DATA AND FUSE SIZES

11kV TRANSFORMERS

kVA	FULL LOAD CURRENT (Amps)			HRC FUSE RATING (Amps)	DROP-OUT FUSE RATING (Amps)	LV FUSE RATING (Amps)	
	PRIMARY	SECONDARY				1x250V	2x250V
		1x250V	2x250V				
10,1 PH	0.91	40	20		6/20	63	63
15,1 PH	1.36	60	30		6/20	100	63
25,1 PH	2.27	100	50		6/20	160	100
50,1 PH	4.55	200	100		16	315	160
10,3 PH	0.53	13			6/20	40	
15,3 PH	0.79	20			6/20	40	
25,3 PH	1.31	33			6/20	63	
50,3 PH	2.62	67		10	6/20	100	
63,3 PH	3.3	84		10	6/20	125	
100,3 PH	5.25	133		16	16	200	
200,3 PH	10.5	267		31.5	40	2 x 200 or 1 x 315	
300,3 PH	15.72	400		40	50	2 x 315 or 1 x 450	
315,3 PH	16.5	420		40	50	2 x 315 or 1 x 450	
500,3 PH	26.3	667		50	50	LVCB or 2 X 450	

Notes: 1. Minimum fuse size used is 6/20 surge-proof fuses. All fuses are sparkless type.

2. When replacing existing HV fuses, LV fuses must be installed to provide overload protection on the LV side. If it is not possible to install LV fuses when HV fuses are replaced, LV fuses must be programmed to be installed ASAP.

3.Two LV Fuses are preferred for 200kVA, 300kVA and 315kVA Transformers

4.No special fusing is to be made for Motor Start. Motor start can be made upto 80% of Transformer kVA Rating. Refer to Development Group for other options.

9•14•8•3•3 For 6.6KV Transformer HV and LV Protection

TABLE 3
TRANSFORMER DATA AND FUSE SIZES

6.6 kV TRANSFORMERS

kVA	FULL LOAD CURRENT (Amps)			HRC FUSE RATING (Amps)	DROP-OUT FUSE RATING (Amps)	LV FUSE RATING (Amps)	
	PRIMARY	SECONDARY				1x250V	2x250V
		1x250V	2x250V				
100,3 PH	8.75	133		0	25	133	

Notes: 1. Minimum fuse size used is 6/20 surge-proof fuses. All fuses are sparkless type.

2. When replacing existing HV fuses, LV fuses must be installed to provide overload protection on the LV side. If it is not possible to install LV fuses when HV fuses are replaced, LV fuses must be programmed to be installed ASAP.

3.Two LV Fuses are preferred for 200kVA, 300kVA and 315kVA Transformers

4.No special fusing is to be made for Motor Start. Motor start can be made upto 80% of Transformer kVA Rating. Refer to Development Group for other options.

9•14•8•3•4 For SWER Transformers

1) **Distribution Transformer**

TABLE 4

TRANSFORMER DATA AND FUSE SIZES

12.7 kV TRANSFORMERS

KvA	FULL LOAD CURRENT (Amps)			HRC FUSE RATING (Amps)		DROP-OUT FUSE RATING (Amps)	LV FUSE RATING (Amps)	
	PRIMARY	SECONDARY					1x250V	2x250V
		1x250V	2x250V					
10,1 PH	0.79	40	20			6/20	63	63
15,1 PH	1.18	60	30			6/20	100	63
25,1 PH	1.97	100	50			6/20	160	100

Notes: 1. Minimum fuse size used is 6/20 surge-proof fuses. All fuses are sparkless type.

2. When replacing existing HV fuses, LV fuses must be installed to provide overload protection on the LV side. If it is not possible to install LV fuses when HV fuses are replaced, LV fuses must be programmed to be installed ASAP.

3.Two LV Fuses are preferred for 200kVA, 300kVA and 315kVA Transformers

4.No special fusing is to be made for Motor Start. Motor start can be made upto 80% of Transformer kVA Rating. Refer to Development Group for other options.

2) **Isolating Transformer**

TABLE 5
ISOLATING TRANSFORMERS

kVA	kV	FULL LOAD CURRENT (Amp) PRIMARY	RECOMMENDED DROP-OUT FUSE RATING (Amps)
25	22/12.7	1.14	6/20
50	22/12.7	2.27	6/20
100	22/12.7	4.55	16
25	11/12.7	2.27	6/20
50	11/12.7	4.55	16
100	11/12.7	9.09	16

9•14•8•3•5 Spur Line Fuses

TABLE 6
SPUR LINE FUSE SIZES

TOTAL CONNECTED kVA				RECOMMENDED DROP-OUT FUSE RATING (Amps)
11Kv		22kV		
1 PHASE	3 PHASE	1 PHASE	3 PHASE	
50	80	100	160	16
100	170	200	340	25
200	350	400	700	25
300	500	600	1 000	50
500	850	1 000	1 700	63

Notes:
1. Minimum fuse size used is 6/20 surge-proof fuses. All fuses are sparkless type.
2. When replacing existing HV fuses, LV fuses must be installed to provide overload protection on the LV side. If it is not possible to install LV fuses when HV fuses are replaced, LV fuses must be programmed to be installed ASAP.
3. Two LV Fuses are preferred for 200kVA, 300kVA and 315kVA Transformers
4. No special fusing is to be made for Motor Start. Motor start can be made upto 80% of Transformer kVA Rating. Refer to Development Group for other options.

9•14•9 Air Break Switches (ABS)

9•14•9•1 General

There is no specific work practice for installing an Air Break Switch (ABS) as this is standard line work that Line Workers are trained to do.

All ABS must be installed in accordance with TasNetworks Overhead Construction Manual and in particular, in accordance with Section 5.5 Air Break Switches.

In addition, check for correct mechanical operation (no loose bolts and nuts etc.) and that the ABS makes and breaks contact properly when opening and closing prior to energisation and commissioning.

9•14•9•2 AK Power Silicon Type ABS

The new type of ABS installed now is the AK POWER silicon type i.e. the ABS uses insulators made of silicon material (feels like soft plastic).

Other than the silicon insulators, this new ABS is similar in structure to previous types of ABS installed and comes in a total package ready to install.

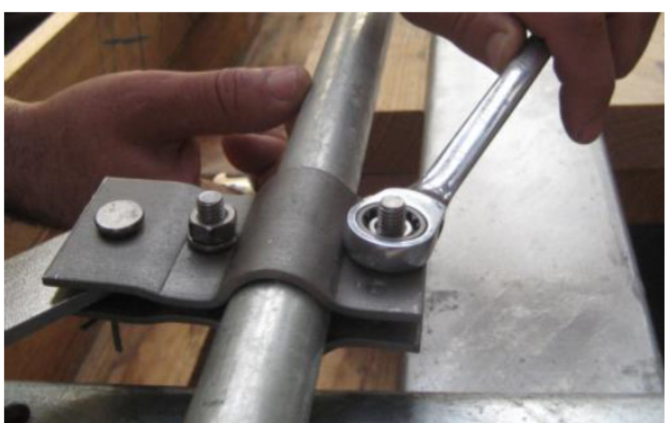
9•14•9•3 Special Checks For AK Power ABS

All AK Power SBS air break switches have had an operational restriction placed upon them as;

They must receive corrective maintenance prior to operation due to a flash over safety risk. Network Operations is managing the 'Restricted Operation List' to ensure safe switching in the network.

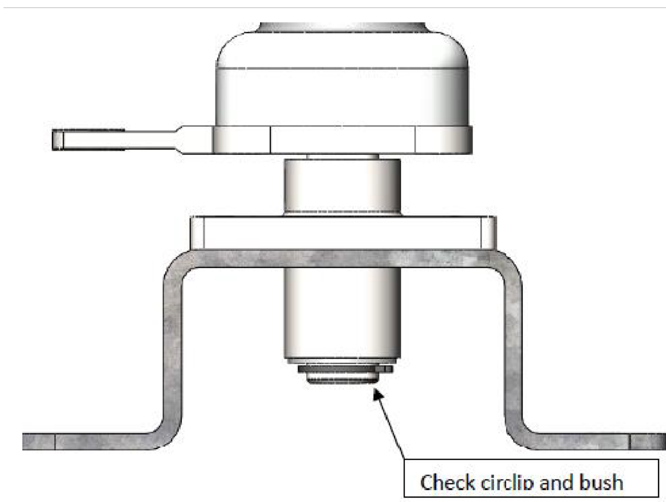
All new installations of AK Power air break switches must be checked and have :-

1) The interphase clamp bolts tightened as follows.



2) The circlips and bushes check and fixed.

The circlips and bushes sit under the swivelling insulators, as shown.



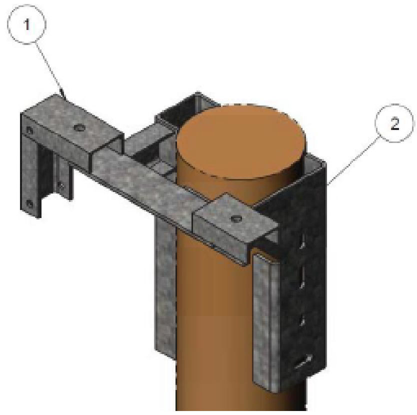
The circlip prevents the insulator from moving vertically upwards and the bushes ensure the insulator remains aligned.

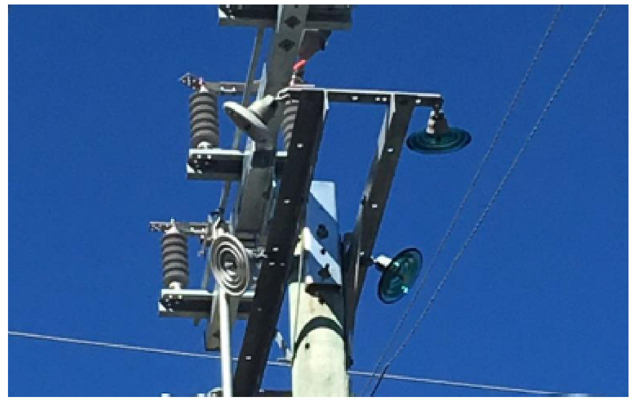
Operating an AK Power SBS Air Break Switch with missing circlips or bushes may result in malfunction of the switch and possible flashover.

Therefore, always check all circlips and bushes during installation of all AK Power SBS Air Break Switch units, and check correct operation prior to energising and commissioning.

NOTE: The pole top mounting bracket has been redesigned to better suit TasNetworks requirements. The updated design utilises a support bracket on the opposite side of the pole to give the assembly much greater rigidity and support for operating. A dedicated earthing point with a captive nut has now been incorporated into the bracket.

The design change was initiated due to feedback from field personnel as well as some previous incident investigations.





Refer to the **Blue Lesson** issued for full details on the new pole top bracket.

9•14•10 Voltage Regulators

9•14•10•1 General

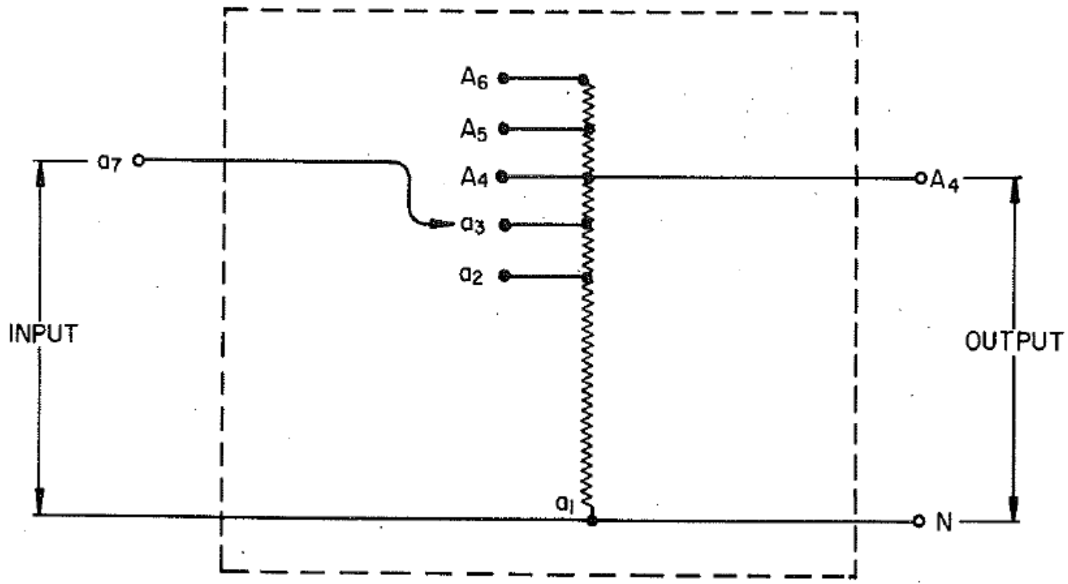
A regulator is a special type of transformer used to maintain a pre-determined “voltage” over long Feeder lines that could otherwise have significant voltage drop.

When the load on a Feeder is high, there is high current flow in the line and a considerable drop in voltage can occur at the receiving end.

The two principal methods of preventing this voltage “drop” are either to increase the conductor size or install an automatic voltage regulator.

In rural areas where long Feeders occur it is uneconomical to increase the conductor size to compensate for voltage drop which only occurs at peak load periods. In these cases Automatic Voltage Regulators are installed and their function is to maintain constant voltage in the Feeder regardless of variations in load.

A most common type of voltage regulator is the auto-transformer with tapping coils on the incoming side of the windings, as shown in the following diagram.



Example diagram showing operating principles of voltage regulator

Leads from these coils are connected to contacts in a tap-change tank fixed to the side of the main transformer tank. This tap-change tank also includes a drum with contacts attached. As this drum revolves the contacts bridge out the different coils of the transformer thus altering the turns ratio and output voltage.

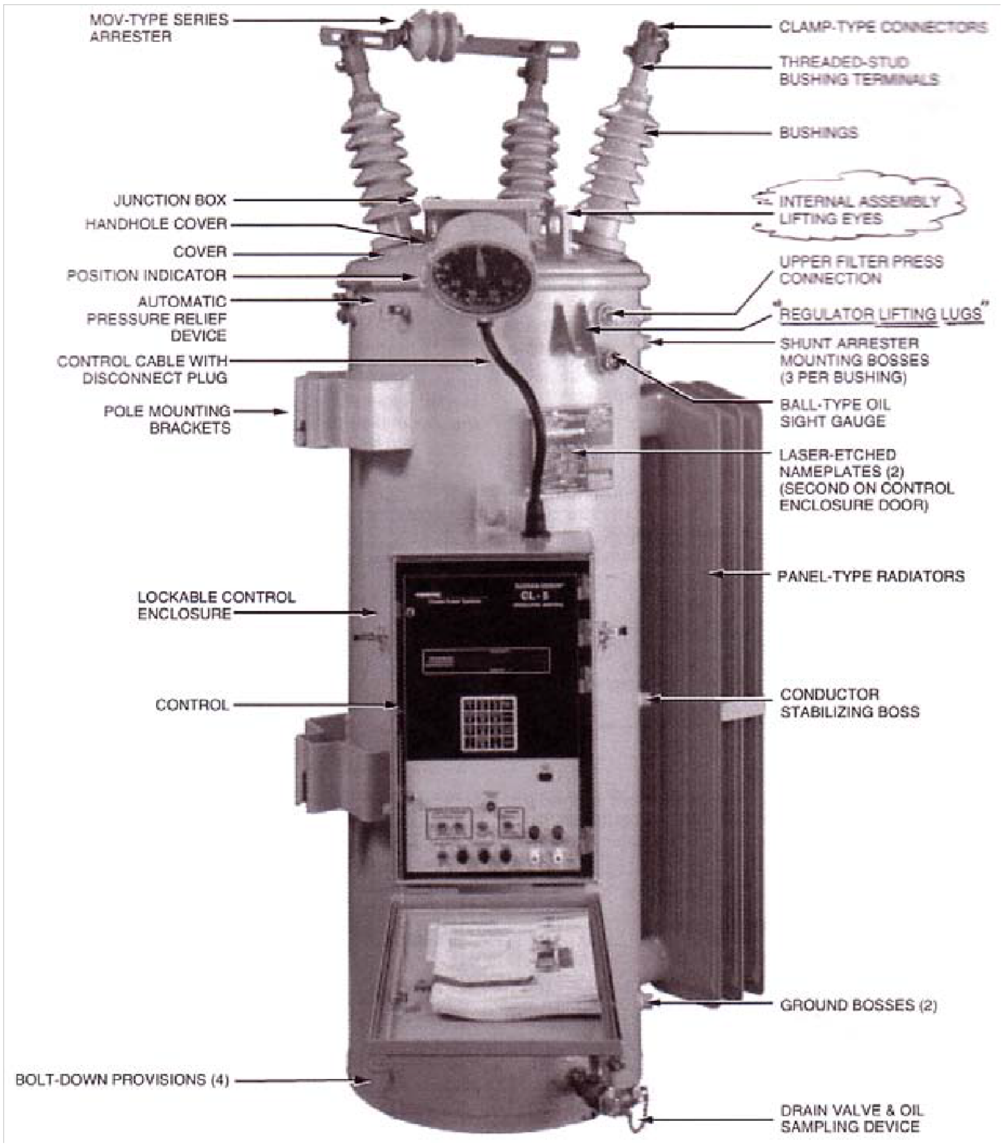
When switched to automatic operation, the tap position is governed by a voltage regulating relay, which is contained with other control apparatus in a cubicle attached to the main tank or close by. This “relay” has the ability to sense a drop or rise in voltage in the line and through a series of contactors causes the drum to revolve and thus step-up or step-down the Regulator to adjust the output voltage to the pre-set level.

Regulators are also supplied with a control for on-site manual operation, but this cannot be engaged unless the control switch is switched from automatic to manual. During commissioning the control box usually requires an experienced Electrician to check and ensure the regulator operates correctly.

Voltage regulators can be mounted, above ground level on a platform between power poles or, at ground level within an enclosure/switchyard.

9•14•10•2 McGraw-Edison, COOPER, Voltage Regulator

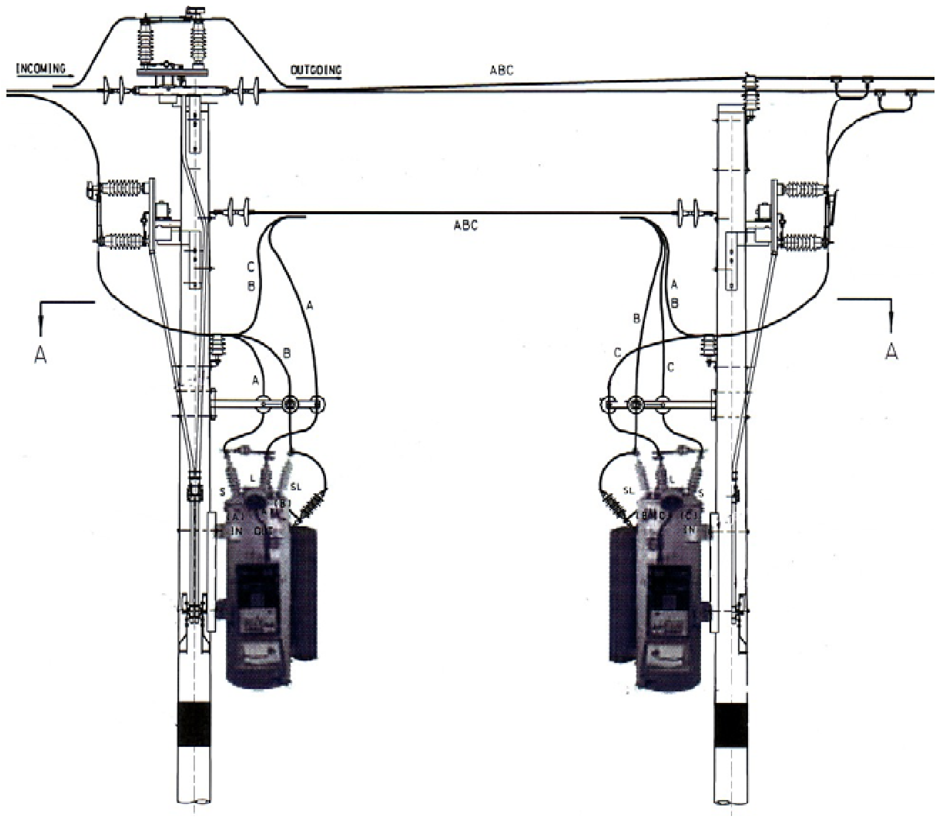
Voltage regulators installed in the Power Distribution System are of the Coopers automatic type, such as the McGraw-Edison, COOPER, Voltage Regulator.



The Coopers Automatic Voltage Regulator is a pole mounted single phase Regulator. The Regulators are a regulating auto-transformer and are normally installed to regulate two (2) phases only. They regulate voltage on a Feeder line from 10% RAISE (boost) to 10% LOWER (buck) in a “range” of STEPS.

9•14•10•3 Cooper Regulators installed On Poles

For more detailed information on Regulators refer to Section 7 Other Pole Mounted Plant & Attachments **in the Distribution Overhead Line Design & Construction Standard**.



9•14•10•4 Installation

Regulators MUST be lifted by means of a sling and spreader bar using the TANK-MOUNTED lifting lugs.

Do NOT lift the entire unit with the “lifting eyes” on the top cover. The top cover may FRACTURE if lifted this way.

9•14•10•5 Pre-energising Checks

1. Check the oil sight gauge. Look for visible signs of oil leakage.

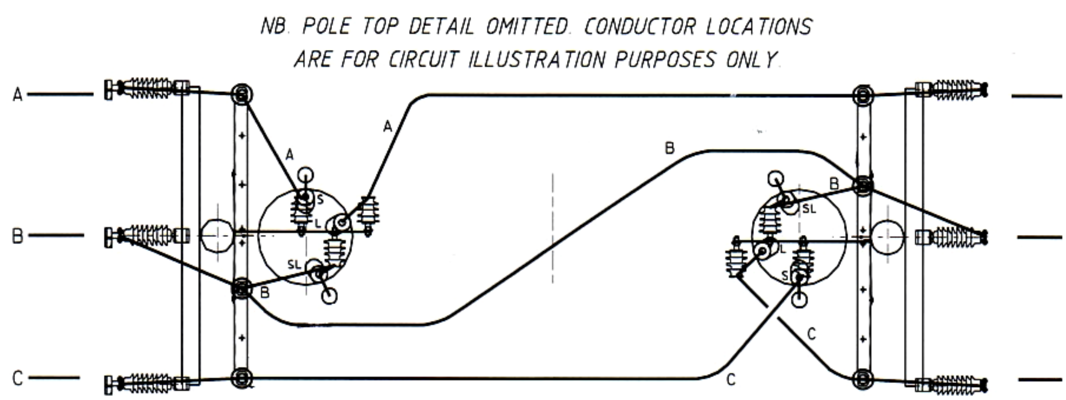
2. Examine the series arrester for damage. If damaged, renew it.

3. Inspect the porcelain bushings for damage or leaking oil seals. If there is a suspicion that moisture has entered the unit, the “hand hole” cover (see diagram next page) should be removed and a CHECK made for evidence of moisture such as rust or water tracks in the oil.

4. If moisture HAS entered that tank, the Regulator and oil must be filtered and moisture extracted BEFORE the Regulator is placed into service. Refer to Manufacturer’s Instructions for guidance on this.

5. Check the position indicator for damage.

6. Check all connections for tightness and check wiring connections are correct as per the Diagram below.



Incoming Supply (Source) Outgoing Supply (Load) “S” bushing = Source. “L” bushing = Load. “SL” bushing = Centre Phase.

7. Check that “earth” wire is properly connected to the Control Box and Regulator Tanks.

Note :-

1. If Regulator has been stored for some time, test the dielectric strength of the oil in accordance with Manufacturer’s Instructions.

2. After the above has been done, the Regulator may be energised at the rated voltage and operational checks carried out.

3. A high potential test should be done to ensure there are adequate electrical clearances to ground.

9•14•11 Capacitor Banks

9•14•11•1 General

Capacitor banks are installed (usually in long HV lines) where there is a need to reduce KVARs and improve power factor and minimise fluctuation of voltage levels.

Typical Capacitor Bank Installed – Ready To Connect To OH Supply

Capacitor banks shall be installed in accordance with :-

1. Work Practice **Capacitor Banks In The Distribution System**.
2. **Section 7.5 ABB Pole Mounted Capacitor Bank** in TasNetworks Overhead Construction Manual.

9•14•12 Pole Mounted Transformers

9•14•12•1 General

Typical Standard Three Phase Pole Mounted Transformer

Transformers and associated control and protection apparatus mounted on poles greatly reduces substation costs and provides a simple means of creating voltages for domestic and light commercial or industrial customers.

The standard type support structure for a pole mounted substation is a single pressure impregnated wood pole, which will support transformers of :

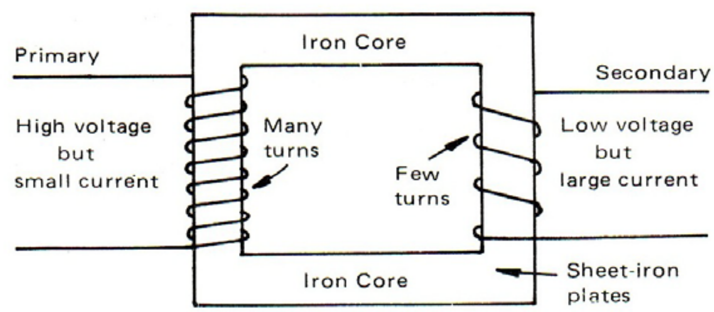
- 2.15 tonnes – when cross arm hung.
- 2.70 tonnes – when mounted on a platform.

Transformers are also mounted on stobie poles and spun concrete poles.

Transformers purchased in recent years have a reduced weight per kVA ratio. It is now possible to mount larger capacity transformers on single pole structures.

9•14•12•2 Principle Of Operation

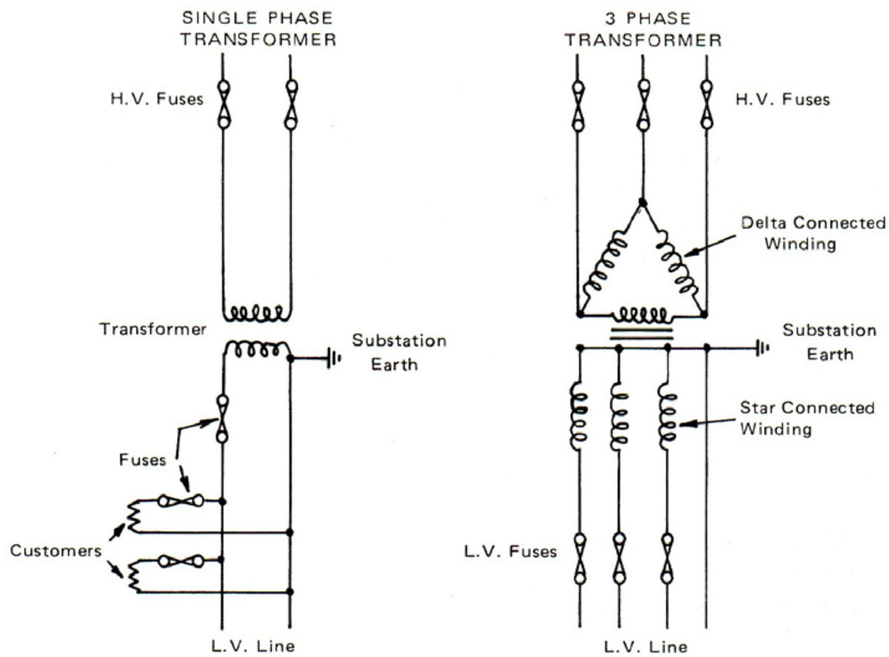
A transformer consists of two or more electric circuits in the form of windings magnetically interlinked by a common magnetic circuit.



An alternating voltage applied to one of the windings produces electro-magnetic induction and a corresponding electro-motive force in the other windings, energy is transferred from the primary circuit to the other secondary circuit by means of the common magnetic flux.

A transformer has three principal parts :

- An iron core that provides a continuous magnetic circuit.
- A primary winding that draws current from the supply circuit. This is always considered to be the winding supplied by the voltage to be changed.
- A secondary winding that receives energy by induction from the primary winding and delivers current to the secondary circuit. The secondary circuit is the one supplying the load.



Circuit Diagrams for a Single and Three Phase Substation

9•14•12•3 Mounting Transformers

There are three ways of mounting transformers on poles. These are :-

- Bolting them directly to the pole.
- Mounting them on a cross arm and associated hanger bracket.

  Note: Whilst transitioning from Tyree to Wilson transformers we are reliant on using Tyree cross arm hanging brackets if Wilson hanging brackets are not available. Only the Wilson bracket will allow the 63 kVA transformers to be cross arm hung. Refer to the **Blue Lesson** for the technical and installation details.

- Mounting them on a supporting platform.

Maximum mass of transformers to be mounted on poles :-

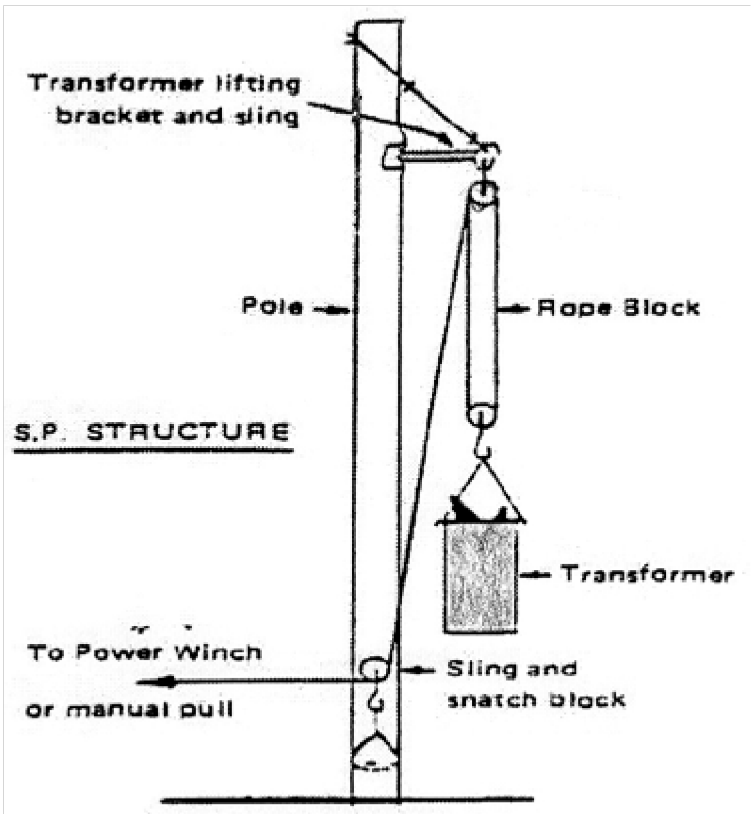
- Bolt Fixed without mounting plate 750 kg.
- Bolt Fixed with mounting plates 1750 kg.
- Cross arm Hung 2150 kg.
- Platform Mounted 2700 kg.

9•14•12•4 Lifting Methods

Transformers are installed on poles using a range of different lifting methods such as : -

Rope Blocks to pull them up.

This can be by hand or vehicle.

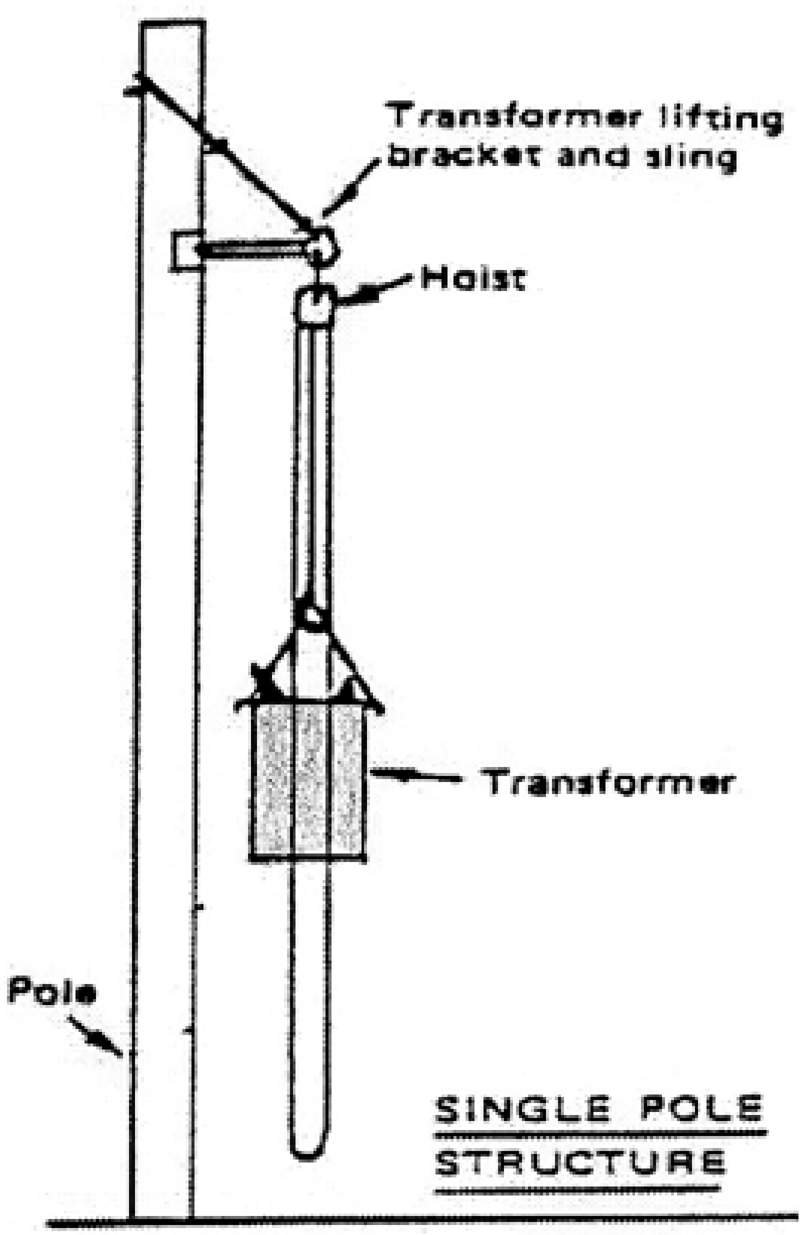


Manual Hoist - Rope Blocks

Normally suitable for lifting of chain hoist and slings. transformers up to 50 kVA capacity depending on rating of rope blocks.

Chain Blocks / Hoist to pull them up.

This can only be done by hand.

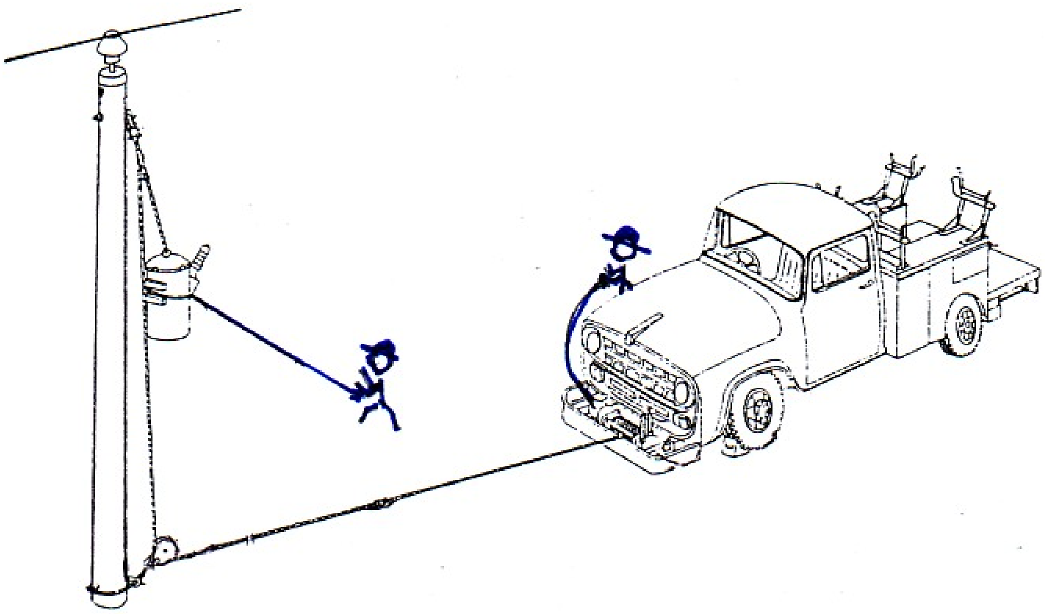


Manual Hoist - Endless Chain.

Lifting capacity dictated by rating Normally suitable for lifting of chain hoist and slings.

Winch Rope to pull them up.

This is done using a vehicle mounted winch and winch rope as shown.



Winch Rope to lift them up.

This is done using a crane or vehicle mounted crane.

A crane mounted on a vehicle is used to lift and position the transformer on the pole as shown above. This is now the most commonly used method for erecting and removing transformers.

9•14•12•5 Test Prior To Installation

Spare pole mounted transformers can sit in a Depot yard out in the weather for many months being subject to the ingress of moisture that could affect the integrity of the transformer and, some transformers have been found faulty prior to installation.

Therefore, distribution transformers (including SWER) must be tested prior to installation as per :

- The work instruction Using Tilt Transformer Tester for Line Workers and Electricians or;
- Electricians can test the transformer as per section **7.3 Testing Transformers If Not Using Tilt Tester** in the work practice Pole Mounted Transformer Installation Replacement And Testing.

9•14•12•6 Installation

9•14•12•6•1 General

Standard three phase and single phase transformers must be installed and tested in accordance with :

- Any requirements listed on design plans and Works Orders issued for the job.
- Requirements in the **Overhead Construction Manual** as per Section 6 - Pole Substations/Transformers.

Note: The S.I. 32.34.58 transformer hanging brackets were previously supplied with the overhang sharply bent, and this weakened the strength of the bracket. The brackets have now been remade with the overhang bent with a larger bending radius.

The newly made brackets can be identified as they have an 18mm inside bending radius as seen in Fig 1 below and can be freely used in the network, the previous version of the bracket has been quarantined and shall not be installed on new installations.

Fig 1 – Newly manufactured 32.34.58 cross arm hung transformer bracket – Larger bending radius

Fig 2 – Previous 32.34.58 bracket with tighter bending radius.

Prior to conducting work, confirm that the bracket being used is the new version with the larger bending radius on the overhang

If working on sites currently utilising the previous version of bracket, check for cracking or signs of corrosion under the metal overhang. If cracks are found make safe by implementing a **safety drop zone** and replace the hanging bracket.

Where if there is a need to install a surge diverter (also known as a lightning arrestor).

During installation and commissioning, comply with work practice **Pole Mounted Transformer Installation Replacement And Testing**.

9•14•12•6•2 Final Checks Prior To Conductor Connections

Before making conductor connections to a pole mounted Transformer, check the following : -

1) The transformer voltage ratios are appropriate for the installation.
2) The vector group (3 phase installation) is appropriate for the application.
3) All the bushings are in good condition.
4) The breather cap, where fitted and tagged, has been removed.
5) The oil level is correct and there are no leaks.
6) The tank is correctly connected to the High Voltage (HV) earth.
7) The transformer has the correct height clearances and clearances from other structures.
8) Where applicable, surge diverter(s) have been fitted.
9) Correct type and size of LV output fuses have been fitted and the fuse cartridge size is of the correct rating to provide protection of the transformer.

9•14•12•7 Three Phase Transformers

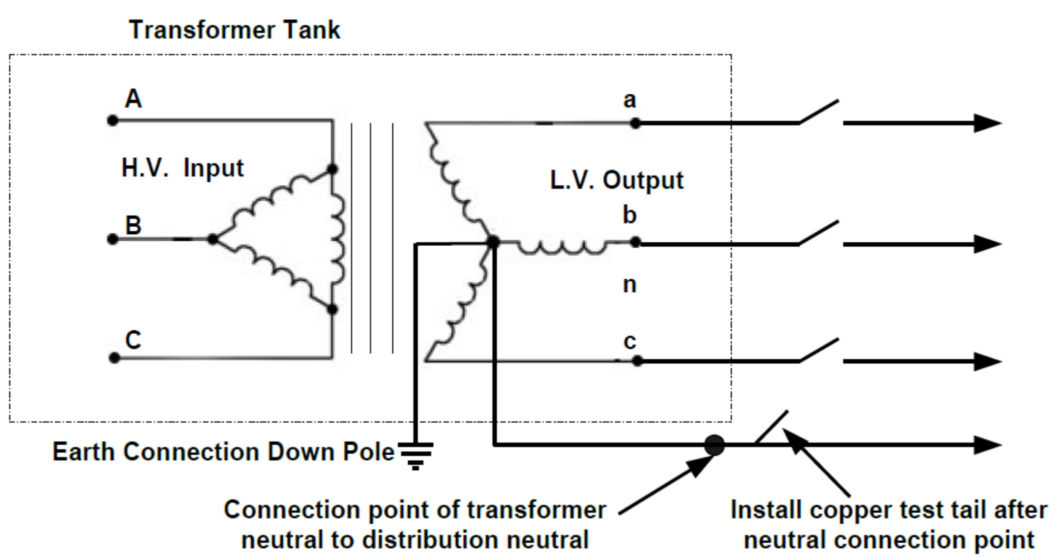
Three phase transformers are used to transform the Power Distribution System High Voltage of either 22KV or 11KV down to 415V/240V Low Voltage (LV) for direct connection to a number of customer installations in urban areas and townships fed from the transformer(s).

These transformers are available in different sizes ranging from 50KVA up to 500KVA output to match different customer total loads.

Where the total customer load is less than 50KVA, this is likely to occur in outlying areas where the number of customers are low and spread out and, single phase transformers are normally used to supply these loads.

Where the total customer load exceeds 500KVA ground mounted substations are installed to supply the load.

9•14•12•7•1 Standard Wiring Configuration



Although it is possible to have other configurations (e.g. Star to Star) the standard wiring configuration for pole mounted transformers is Delta to Star as shown in the above diagram.

Transformer to be installed in accordance with work practice **Pole Mounted Transformer Installation Replacement Testing**.

Also refer to Sections :-

- 12.2.5 Paralleling Circuits.
- 13.8.5.11 Faulty Transformers.

9•14•12•8 Standard Single Phase Transformers

Single phase transformers are normally installed where there are no LV overhead distribution mains conductors, only HV conductors but, there is a need to supply LV to one or two customers. This usually occurs in outlying rural areas.

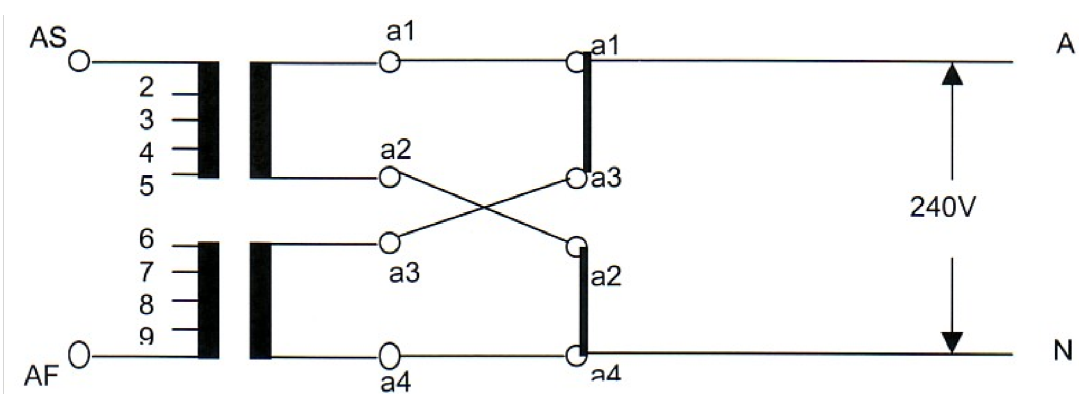
The main precaution to be taken with these transformers is to ensure that the neutral or earthed terminal of the low voltage winding is connected to the neutral conductor.

Single phase Distribution transformers used on the Distribution System have four (4) low voltage bushings marked, a1, a2, a3 and a4. These can be configured to supply a two (2) wire or three (3) wire system.

9•14•12•8•1 Standard 240V Configuration

This is the normal standard configuration and has bushings **a1** and **a3** bridged out and **a2** and **a4** also bridged out with a copper busbar. This configuration allows for a two wire 240 volt LV system taking advantage of the full rating of the transformer.

By convention, the **a1-a3** connection is the nominated Active connection and the **a2-a4** is the nominated Neutral connection. This arrangement delivers a nominal voltage of 240 volts. See wiring following Diagram.

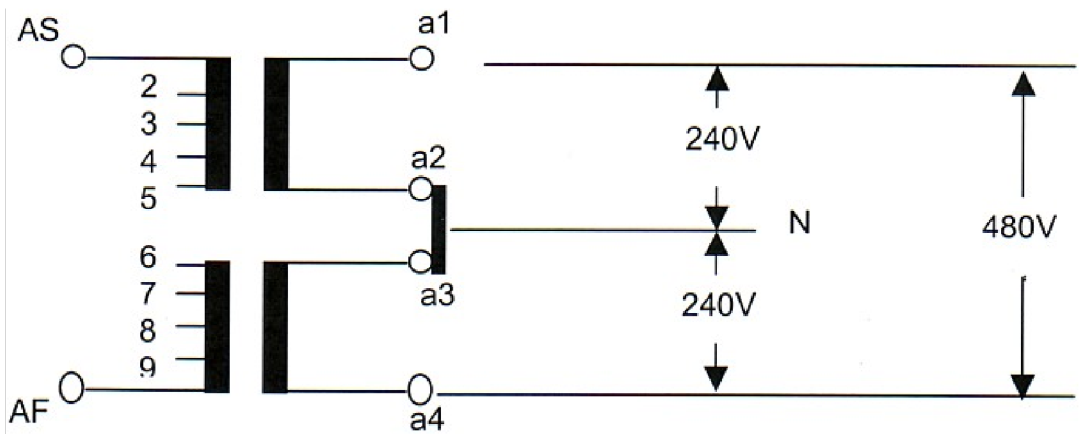


Two Wire System – Standard 240 volt Arrangement

9•14•12•8•2 Split Phase 480 V Configuration

In this arrangement, only half the capacity of the transformer is utilised. Remove the busbars between **a1 and a3** as well as between **a2 and a4.**

Connect a busbar between **a2 and a3**. By convention, for a 240 volt supply, we have **a1** as the Active and **a2-a3** as the Neutral for one phase and **a4** as the Active with **a2-a3** as the Neutral for the other. A 480 volt supply can be supplied from **a1 and a4**. See following wiring Diagram.



Three Wire System – Split Phase Supplying 2 x 240 volt Supplies and 1 x 480 volt Supply

The three wire system is handy for supplying two customers from the same transformer provided neither customer total exceeds half the rated KVA output from the transformer.

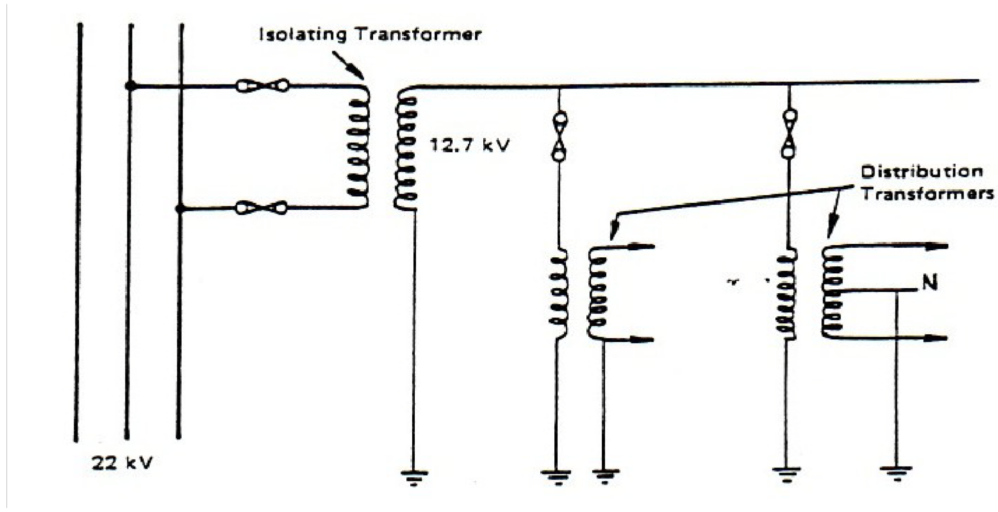
In addition, care must be taken to ensure 480V is not inadvertently supplied as this would damage customer appliances.

9•14•12•9 SWER Transformers

In rural areas when distances between customers are large and the load small, a traditional method of supply has been a system known as Single Wire Earth Return (SWER). As its name implies, this system uses only one HV conductor and utilises the "ground" as a return conductor. It is less costly than conventional construction but its use is limited to areas of light load.

A 22KV to 12.7KV output isolating SWER transformer is used to transport the HV supply to a SWER 12.7KV step down to 415/240V distribution transformer at the customer's installation, as shown in the wiring configuration.

9•14•12•9•1 Wiring Configuration

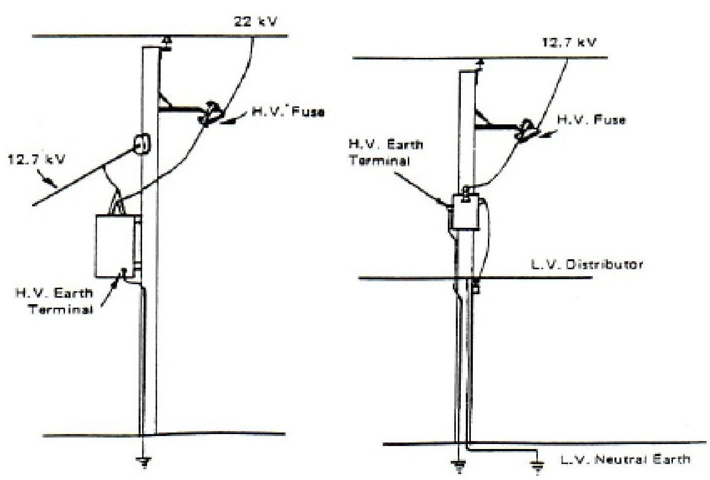


"EARTH / GROUND"

The installation of a SWER system is governed by regulations laid down by the Telecommunications Authority and details of each installation must be submitted to them for approval before any work is carried out.

The Telecommunications Authority "Regulations" are aimed at protecting their telecommunication system from interference caused by the Earth Return currents.

The following two (2) Diagrams show diagrammatic examples of the two different SWER substation structures.



S.W.E.R. ISOLATING SUBSTATION

S.W.E.R. DISTRIBUTING SUBSTATION

9•14•12•9•2 Installation

SWER transformers must be installed and tested in accordance with :-

1) Any requirements listed on design plans and Works Orders issued for the job.

2) Requirements for SWER in the **Overhead Construction Manual** as per Section 3 - 11/22kV & SWER Constructions.

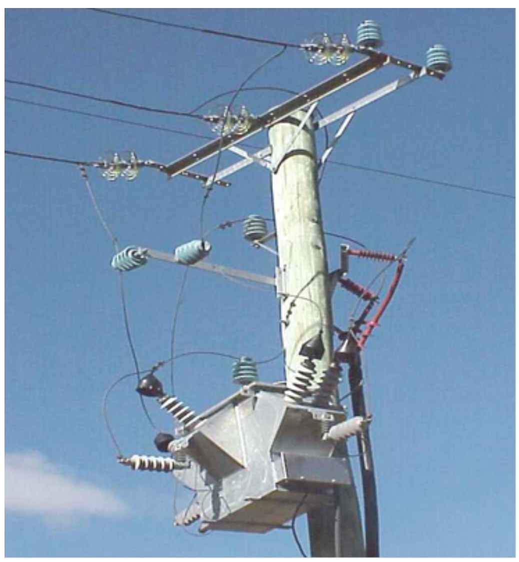
Note. As a high resistance earth or broken earth can cause high voltage to appear at ground level, it is important that earthing is installed correctly and properly tested to ensure a low earth resistance.

The work practices :-

- Install, Test Or Repair SWER Earthing.
- SWER Earth Testing Procedure.

9•14•12•10 HV Metering

9•14•12•10•1 General



Typical Pole Mounted HV Metering Unit

A HV metering transformer is installed at large commercial sites where HV supply is directly fed to the site and the load is large enough to warrant HV metering and, is usually installed as a pole mounted unit.

However, for very large customer sites the HV metering units are installed at ground level within a substation. But, as work inside substations is outside the scope of work for Line Workers, only the pole mounted metering transformer would require Line Workers to help with its installation.

The HV metering unit is used to record a ratioed amount of the actual energy used via :-

- The HV being transformed down e.g. from 22KV to 110V for connection to the terminals of a HV meter that records the electricity consumption. In this example 22,000 divided by 110 = a voltage multiplier of 200 and;
- The current is also ratioed down via appropriate connection tappings on the transformer and can be typically 50:1 or 80:1 etc. therefore;
- The electricity recorded in the meter must be multiplied up by the voltage ratio X the current ratio and e.g. in this example 200 X 80 = 16,000 as the multiplier therefore;
- It is very important to ensure the metering transformer is installed correctly and the wiring circuits are connected correctly as any minor error will be magnified many times and the resultant revenue loss could be substantial.

9•14•12•10•2 Installation

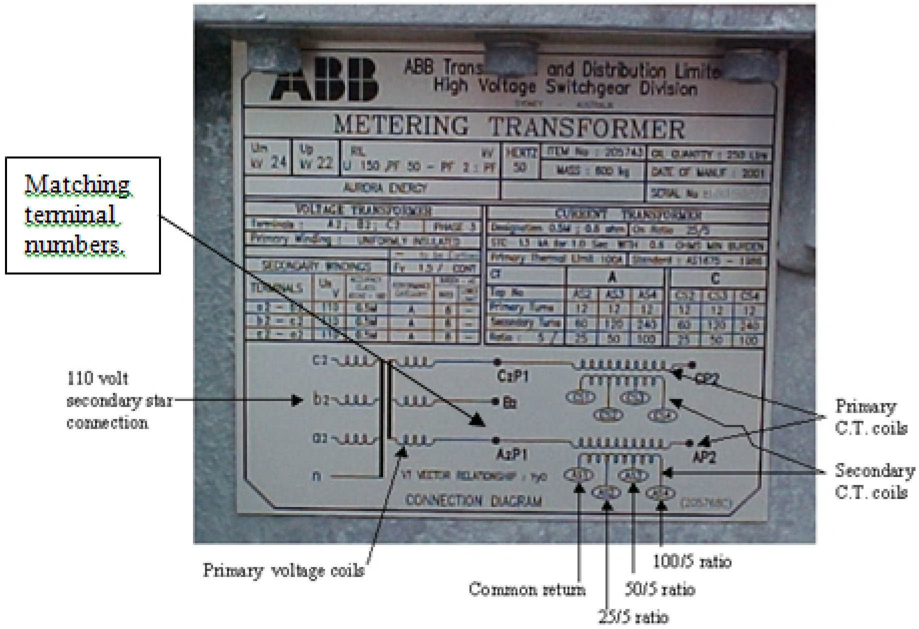
When installing a HV metering transformer Line Workers must always do this in conjunction with the Complex Metering Officer in the local area, who will check the metering unit over prior to and after installation to ensure all the work has been done correctly.

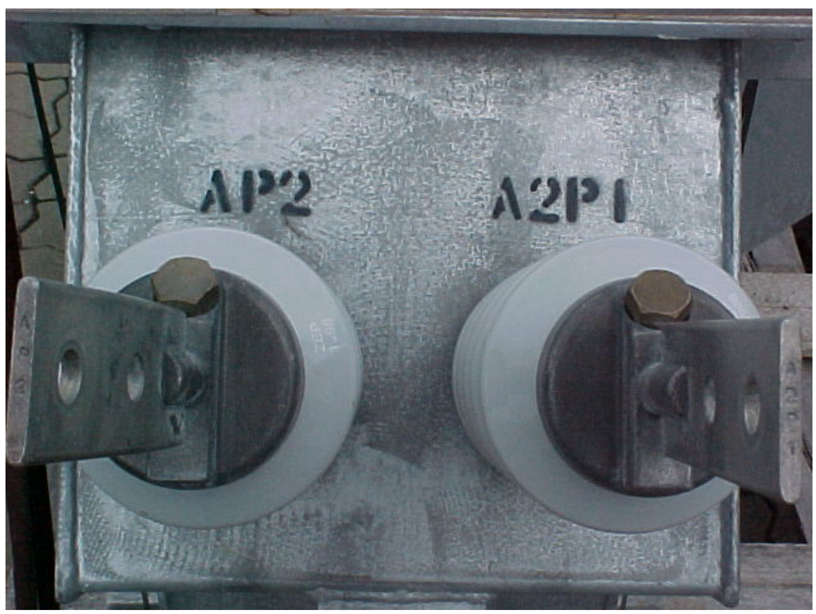
The HV metering unit must be installed in accordance with the **Overhead Line Design & Construction Manual** as per drawings in Section 7.8 HV Metering Unit.

Special Notes:-

- The meter box on the pole must also be earthed.
- The following name plate drawing shows three voltage coils and two current coils but, HV metering units can also be supplied using, only two voltage coils and two current coils or, three voltage coils and three current coils.

  Therefore you need to double check the wiring layout detailed on the unit to be installed, as shown in the following example, and confirm this with the Electrician performing the metering work.





You can then look at the actual terminals of the HV metering unit and see how they line up with the wiring layout given.

In this example you can see that the AP2 connection is the primary current coil connection to the incoming high voltage A phase conductor and;

The A2P1 connection is the connection of the current coil to the outgoing high voltage A phase conductor . This means the current coil is connected in series with the high voltage A phase conductor. The other current coil is then connected in series with the high voltage C phase conductor.

You must ensure a conductor for every current coil tapping is brought down to the meter box, just in case later on if the current ratio tap connection needs to be changed. If so, this means the HV supply does not need to be isolated to bring a tapping conductor down.

In addition to the earthing of the metering transformer, the meter box must also be earthed and, earth tests must be conducted as per the work practice **Standard Earth Tests In The Power Distribution System** to confirm the earth values are within the allowed limits prior to energisation and commissioning.

After completion of the installation work and commissioning you must :-

- Fill out the section for HV Metering Transformer on the Pole Transformer Checklist Form and;
- The completion of infrastructure work in the relevant section on the **EWC Checklist Form** to certify you have done the construction work in accordance with the Overhead Line Design & Construction Manual and;
- These completed forms must be attached to all other paperwork for the job and filed away in TasNetworks, Records Management System.

9•14•13 Ground Mounted Substations

Ground mounted substations are usually installed where the total customer load will exceed the 500KVA output of a pole mounted transformer.

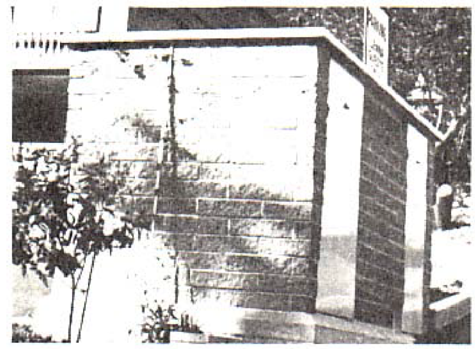
Ground mounted substations include: substations in buildings, kiosk type, fenced type and padmount type.

Line Workers may get involved with the construction phase when a ground mounted substation is installed so it is handy to know the general details.

9•14•13•1 Kiosk Substation

The sub-station apparatus is an indoor type, enclosed in a common weather proof housing in which there is little or no working space. The building is generally made of brick with a concrete roof.

Provision may be made for individual items to be changed for others of a different rating or design.

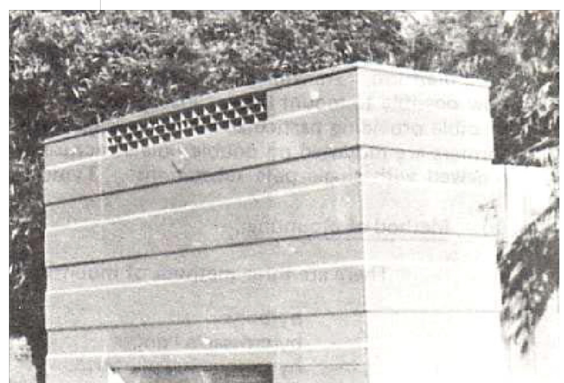


TYPICAL KIOSK TYPE SUBSTATION

9•14•13•2 Padmount Substation

The substation apparatus and its control equipment is in the form of a single complete unit delivered by the supplier which is installed or replaced as a unit on a concrete foundation called a plinth. The outer structure is generally made of fibreglass or steel.

Due to the ease of installation, padmounts are the most common ground mounted substations installed, particularly at new underground subdivisions and at medium size commercial installations.



TYPICAL PADMOUNTED TYPE SUBSTATION

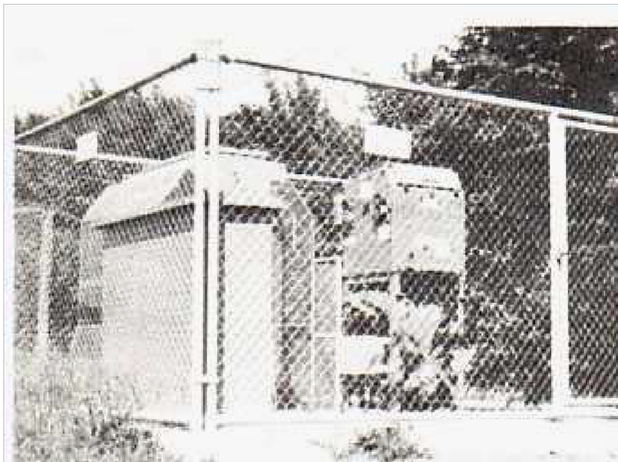
9•14•13•3 Fenced Substation

Before kiosk and padmount substations were introduced fence type substations were installed.

Although new fence type substations would probably not be installed now there are still quite a few in service.

This substation apparatus is of an outdoor type, with no additional weatherproof housing.

It sits on a concrete base and is surrounded by a cyclone wire fence.



TYPICAL FENCE TYPE SUBSTATION

The term, fence type substation, refers to its enclosure. Later versions may include indoor switchgear housed in a small brick enclosure within the main enclosure.

9•14•13•4 Building Substation

For large loads that exceed the capacity of kiosk and padmounts, a larger building type substation is used.

This type of substation is usually located, as a separate building on common ground or, at a commercial location or, inside a Government or commerical building either underground or at street level. Access may be by means of, a main door, ramp from the footpath or, a courtyard or a gatic steel / concrete hatch cover installed in the footpath.

9•14•14 Public Lighting

9•14•14•1 General

TasNetworks designs, installs and maintains a public lighting system through an arrangement with public authorities.

Public lighting schemes are designed to comply with the relevant part of the Australian Standard Public Lighting Code AS 1158.

The final responsibility for nominating the lighting to be used rests with the public authority concerned.

It is preferable that the minimum standard be maintained at intersections, roundabouts, and other areas where high traffic density exists.

In general installation of lighting apparatus and circuits shall comply with TasNetworks Lighting Design and Construction Standard.

9•14•14•2 Ground Mounted Lighting

9•14•14•2•1 General

Ground mounted lighting is installed on street lighting **columns.** These columns come in a range of styles, types and sizes to suit particular requirements of street lighting. They can vary in length from 6.0 metres to 18.0 metres. They can be circular or octagonal, wide base or narrow base.



Examples of Street Lighting Poles

9•14•14•2•2 Installation

Some poles are direct buried in the ground. Others are bolted onto a concrete foundation. Further information can be found in TasNetworks :-

1) Lighting Design And Construction Standard.

2) OH Construction Manual for equipment details.

3) Work Practices and Technical Support Documents :-

- Steel Pole Identification Guide.
- Install And Replace Street Light Lamps And Fittings LED Type.
- Install And Replace Street Light Lamps And Fittings LED Type – Shading Options.
- Replace Asbestos Boards In Wide Based Streetlights.
- Public Lighting Fact Sheet For PE Cell.
- Public Lighting Change Fact Sheet PL 0002 Minor Streetlight Requirements.

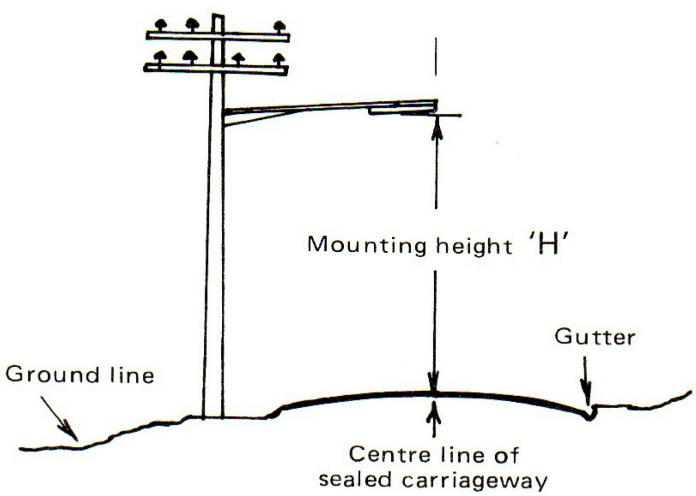
9•14•14•3 Overhead Mounted Lighting

9•14•14•3•1 General

As the following picture and diagram below diagram illustrates, this covers the installation of a lighting spigot and luminaire on a power pole.

Typical Overhead Street Light

In this situation TasNetworks generally owns and installs the light fittings.



Ensure light fitting meets minimum height clearance above ground level.

9•14•14•3•2 Installation – LV Overhead Conductors Only

1) Any requirements listed on design plans and Works Orders issued for the job.

2) Requirements in the Lighting Manual as per :-

- The **Guidelines For Electrical Installation** covering :-
  - Earthing.
  - Circuit Protection.
  - Cabling.

- Drawing **D-SL1-1.6/1** details the internal circuitry for the following most commonly used lighting luminaires :

Note:: All the above luminaires are now replaced with the new LED 18Watt Luminaire, to be installed as per the following work instructions and technical support fact sheet and guidelines :-

- **Install And Replace Lamps And Fittings - Street LED.**

- **Install and Replace Lamps And Fittings LED Shading Options**

- **Public Lighting Change Fact Sheet.**

- Unless specified otherwise, light to be controlled via a Photo Electric Cell as per the type shown in the **Change Factsheet PL-00001**.

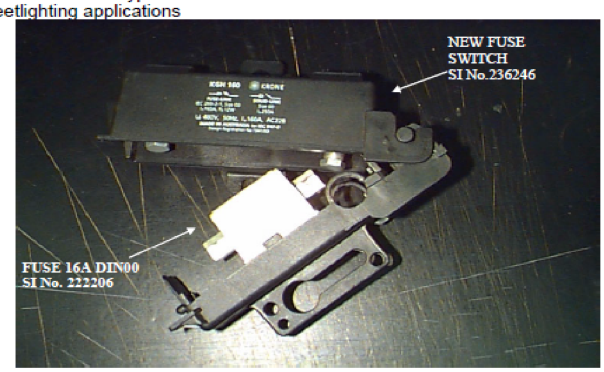
- Drawing D-SL1-7.1.1 for Luminaire on wood pole.

- **Note**: Although D-SL1-7.1.1 shows a Stanger fuse fitting all new overhead light fittings must use the new type of fuse fitting as per the following details below.

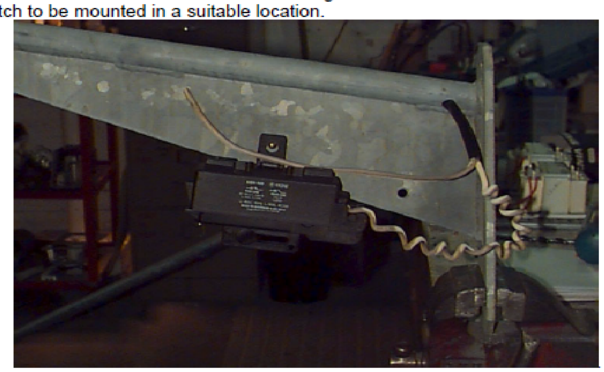
Fuse fitting for streetlights which require an external fuse fitted to the pole or out reach arm.

Currently 55amp Stanger fuse fittings are used with a variety of fuse ratings. Because stocks of these Stanger units are running out the fuse switch unit and fuse shown below are to be used as a replacement. We will now standardises on using 16 amp rated fuses, regardless of the wattage of the light, with the new fuse switch unit.

Shown below is a typical fuse switch unit and associated fuse element for streetlighting applications



Shown below is the typical fuse switch unit mounted on an outreach arm. Note that the arm needs to have a mounting hole drilled to enable the fuse switch to be mounted in a suitable location.



9•14•14•3•3 Installation With HV Overhead

Where a light fitting will be installed on a conductive pole (e.g. Stobie pole) that has HV conductors above there is the risk if a HV fault occurs of damaging stray voltage passing into the LV MEN network and damaging customer appliances (and it has happened).

Therefore, to protect against this all light fittings mounted on conductive power poles with HV above must be installed with an insulated spigot arm in accordance with the work practice **Road Lighting Insulated Spigot And Luminaire**.

9•14•15 Visual Warning Devices

9•14•15•1 Ball Sighters

Refer Section 12.2.7.4 Install Sighter Ball.

9•14•15•2 Bird Diverters

Install Bird Diverters In The Distribution System.

9•14•15•3 Tiger Tails

Shall comply TasNetworks Installation Standard For Visual Warning Devices.

9•14•15•4 Safety Tags And Locks

The purpose of safety tags and locks is to ensure the supply is isolated and warn against and prevent persons from inadvertently switching the supply on again.

The use of tags and locks shall comply with the procedure for Locking And Tagging.

9•15 Installing And Connecting Distribution Conductors

9•15•1 Caution - Working Near Apparatus Under Tension

When doing construction work and running and stringing conductors or working near conductors under tension care must be taken (do a JRA and include/implement safety control measures) to avoid the consequences from :

1) Too much strain suddenly breaking and releasing a conductor.

   The resulting whiplash could result in a conductor striking someone or damaging apparatus.

2) A person being on the wrong side of a conductor and being pinned by it if holding apparatus (e.g. tie pin or stay wire) suddenly gives way.

3) Pole or equipment affixed to it suddenly shaking and possibly causing and issue if equipment breaks and falls down or if a person is working off a ladder resting against the pole.

Work Likely to Introduce Sudden Significant Strain to Conductors.

The following type of construction work could produce a sudden significant strain and must be considered in a JRA :

- Straining of HV or LV conductors.
- Tensioning of stay wires.
- Straightening of a pole.
- Mounting and removal of pole type transformers, reclosers, etc.
- Fitting of or replacing live line clamps to conductors. **CAUTION** : With aged conductors there is the risk of the conductor suddenly breaking and falling down when doing this work causing an incident, especially if this work is done live. Therefore, do a thorough inspection before hand and comply with the requirements in the **Amber Alert - Live Line Clamp** i.e., apply strain gear either side of the clamp to ensure conductor will not fall.
- Use of cranes etc. near overhead conductors.

9•15•2 Install And Tension Hard Drawn HV Or LV Conductors

9•15•2•1 Safety Considerations

9•15•2•1•1 General

It is important to remember that when working with hard drawn conductors it is essential to :

- Be aware that these conductors can recoil quickly, if they break away, and trap an unwary worker with the conductor actually wrapping itself around them or penetrating some part of their body. This is particularly so with 3/2.75 steel wire.
- Be aware that the ends of these conductors can flick UP, if not held firmly, and hit you in the face or some other part of your body.
- Wear appropriate protective clothing when working with this type of conductor. Such things as :-
  - Safety glasses (to protect your eyes).
  - Safety helmet (to protect your head).

- Good quality work gloves (to protect your hands).
- Good quality work clothing (to protect your limbs).

- Properly clean the outer surface of aluminium conductor so it is FREE of aluminium oxide - PRIOR to making any electrical connection.

- Properly clean the outer surface of copper conductor to clear away the scaly surface (black oxide coating or verdigris) - PRIOR to making any electrical connection.

9•15•2•1•2 Copper Push Pulls

Cable pulled out of copper push pull

Copper push pulls have been used in the past and, there have been incidents where the conductor has pulled out of the fitting as shown above.

Because of this, in accordance with the Blue Alert **Overhead Copper Compression Sleeves,** copper compression sleeves shall be used instead of copper push pulls.

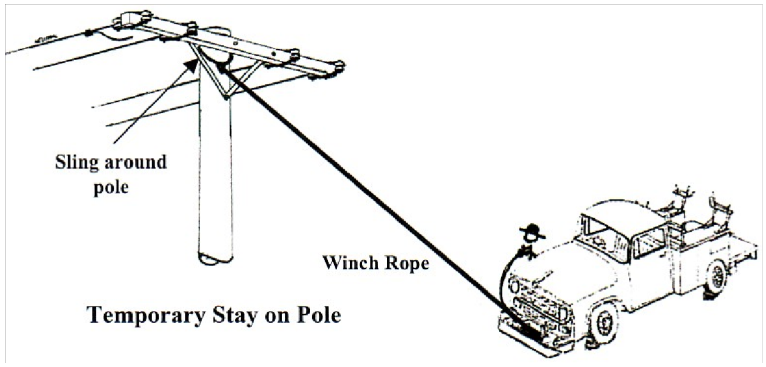
Working with existing copper push pulls shall comply with :

- Blue Alert **Copper Push-Pull Update**.

- Safety Alert **Conductor Push-Pulls** that covers, where conductors have more than four joints in any span they are to be replaced and, risk assessment requirements when work over roadways will occur.

9•15•2•2 Assess Need To Use Support Stay

Before installing, stringing and tensioning conductors it may be necessary to install either a permanent stay (e.g. a back end stay) or a temporary stay (e.g. to counter the strain of conductors pulling at an angle to the pole).



9•15•2•3 Set Up For Stringing Conductors

1) Where applicable, set up a safety drop zone to ensure persons cannot be struck by any conductor breaking under tension and falling to theground.

2) Conductors and cables must NOT be dragged across the ground or any other rough surface as this can damage the conductor strands.

3) Cable stringing rollers must be used to avoid damage to conductors and cables.

   Note:-
   - Where there are poles with double pinner insulators special consideration may be needed on how best to set up rollers to enable the conductors to be rolled through.
   - You must ensure the gate on each roller used is securely closed because if not, this would allow a conductor to be pulled out under tension with the potetnia to strike and employee nearby

4) Rollers that have previously been used for copper conductors must be cleaned prior to running aluminium conductors to avoid any copper contamination of the aluminium conductors.

5) Personnel must endeavour to make the most efficient use of conductor and cable in order to keep the number of joints to a minimum.

6) The conductor stringing “sag” or “tension” shall be MEASURED and shall be in accordance with the stringing charts in the Distribution Overhead Line Design & Construction Standard (Section 3).

7) Conductor terminations, ties and connections shall be as specified in the Distribution Overhead Line Design & Construction Standard.

8) Termination dead ends shall be of the “preformed helical” type and single pin ties shall be of the preformed type.

9) Armour rods and vibration dampers may be required to be installed at positions nominated.

9•15•2•4 Conductor Details And Current Ratings

The conductor details and current ratings listed here in this section will only cover those conductors that are now being installed in the distribution system.

There are many other sizes and types of conductors still within our "system" but are not listed here. Details on these conductors can be found in **Section 9.1 Conductor and Cable Data** in the OH Construction Manual covering metric and imperial sizes for, Bare Mains, LV ABC Mains, HV ABC Mains and, Communications and Other Cables.

9•15•2•5 String Conductors

9•15•2•5•1 Laying Out Along the Ground

This method should only be used when no damage to the cable can occur. It can ONLY be used where it is possible to drive a vehicle along the entire line route beside every pole.

1) Anchor the cable to the pole at one end of the cable run.

2) With the cable drum set up on a vehicle tray or wire trailer – slowly drive the vehicle along the cable route and "lay" the wire out on the ground.

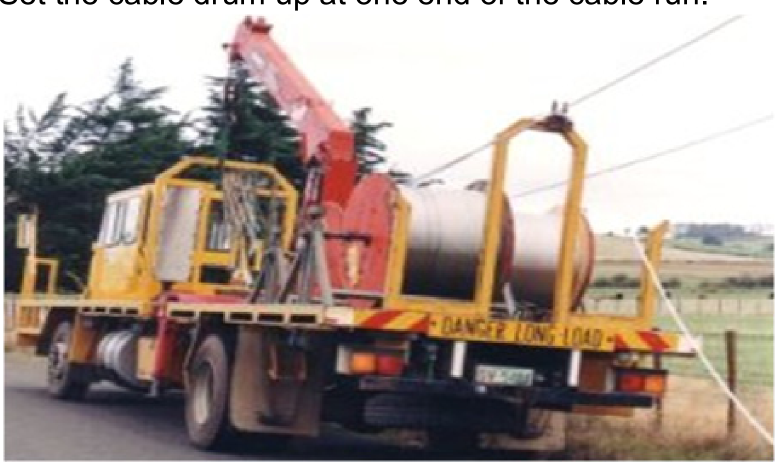
3) Lift the conductor up at each pole and place it in the stringing roller on the pole - prior to tensioning up and making it off.

Note: When using rollers you must ensure the gate is securely closed and wing nut is tightly done up to avoid injury that could occur, as per the **Blue Safety Alert,** if the gate is not secured properly and the conductor slips out and strikes an employee.

9•15•2•5•2 Pulling Out Along the Ground

This method should only be used when no damage to the cable can occur.

1) Set the cable drum up at one end of the cable run.



2) Attach pulling rope to the conductor end and slowly pull it out using manpower OR mechanical means.

3) Stop at each pole and string the conductor over the stringing rollers on each pole prior to moving onto the next pole.

9•15•2•5•3 Pulling Out Under Tension Over the Poles

1) Set up the cable drums on the appropriate trailer.
2) Set up the rope pulling drums on the recovery vehicle.
3) Run out and string the pulling rope(s) through the rollers on every pole.
4) Attach end of the pulling rope(s) to end(s) of conductor(s).
5) Rewind the rope(s) and pull the conductor(s) through with it.

Note. Some of the recovery vehicles and associated trailers are equipped to pull up to four (4) conductors through at one time.

9•15•2•5•4 Stringing Near / Below Live HV Or LV Conductors

Note: All the safety requirements in **Section 12.2.10 Stringing Conductors Under Live Conditions** must be complied with to determine if it is allowable to string conductors underneath live conductors and to do this work safely.

When pulling conductors through in the vicinity of existing LIVE conductors it will be necessary to :-

1) Ensure all persons involved on the job are made aware of the location of ALL live conductors.
2) Instruct all persons on the safe work methods to be adopted.
3) Check the condition of existing conductors, especially if their condition is “suspect”, and determine whether the job can be done with the conductors alive.
4) Post Safety Observers at likely hazardous positions along the cable run.
5) Use a dry, good quality insulated pull rope to pull out the new conductor.
6) Have everyone pull on the rope and NOT the conductor (if pulling it through by hand).
7) Arrange with the Distribution Operating Authority for the HV Feeder Protection to be identified and SET in accordance with their requirements.
8) Ensure the cable drum attendant is insulated from ground.
9) **Note**: Have an earthing device in contact with each conductor as it is pulled through.
10) Place a dry, good quality handline over the “pulled” conductor in the centre of each span and ensure a competent person holds each rope to control “up and down” movement of the conductor.
11) Ensure each conductor is pulled through in a STEADY and CONTROLLED manner.

9•15•2•5•5 Stringing Conductors Above Energised Conductors

This covers the installation of “Hurdles” to facilitate the crossing of Distribution Lines during conductor stringing and removal activities

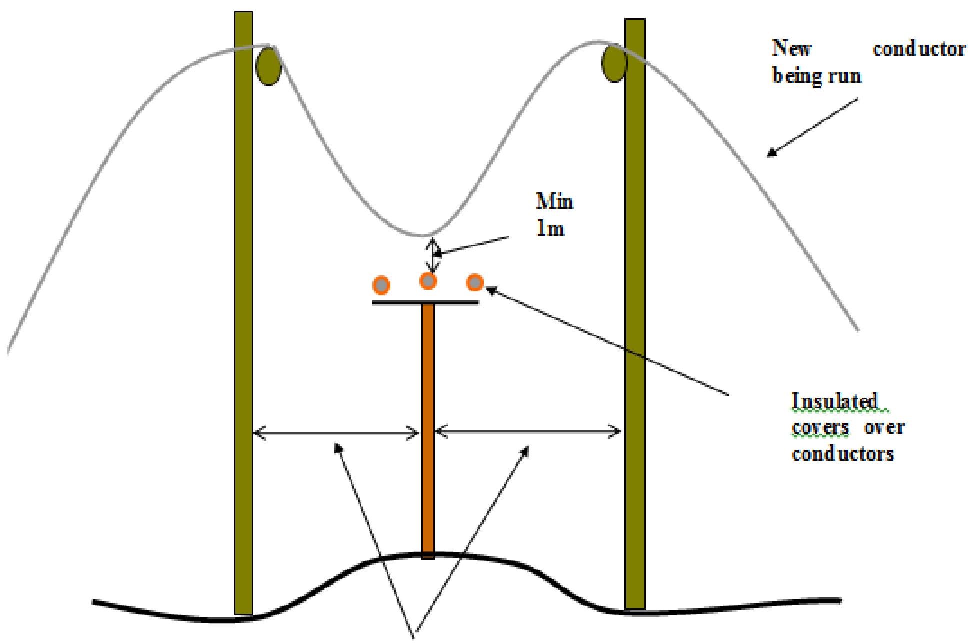
1) **Key Controls** :-

1.1 Feeder to be taken out of service whilst insulated line covers are being installed unless live line procedures are utilised.

1.2 Running earths to be used at pulling and cable drum ends

1.3 Feeder conductors are to be covered with insulated line covers for the full width of the hurdles

1.4 Hurdles are to be installed as close to feeder as possible without encroaching safe limits of approach.(Conductor swing must be added to electrical clearances. For further detail on clearances, refer Section 14 - Clearances in the Overhead Construction Manual.



As close as safely possible to the 3m limits of approach whilst making allowances for conductor swing in the wind

1.5 Hurdles are to be installed on both sides of the feeder, where applicable.

1.6 Hurdles must be high enough to maintain a 1m clearance from the feeder conductors when only draped over.

1.7 Hurdles must be wide enough to cradle all conductors being pulled, plus an allowance for conductor swing in the prevailing wind conditions. As tensions will vary this must be monitored during the operation.

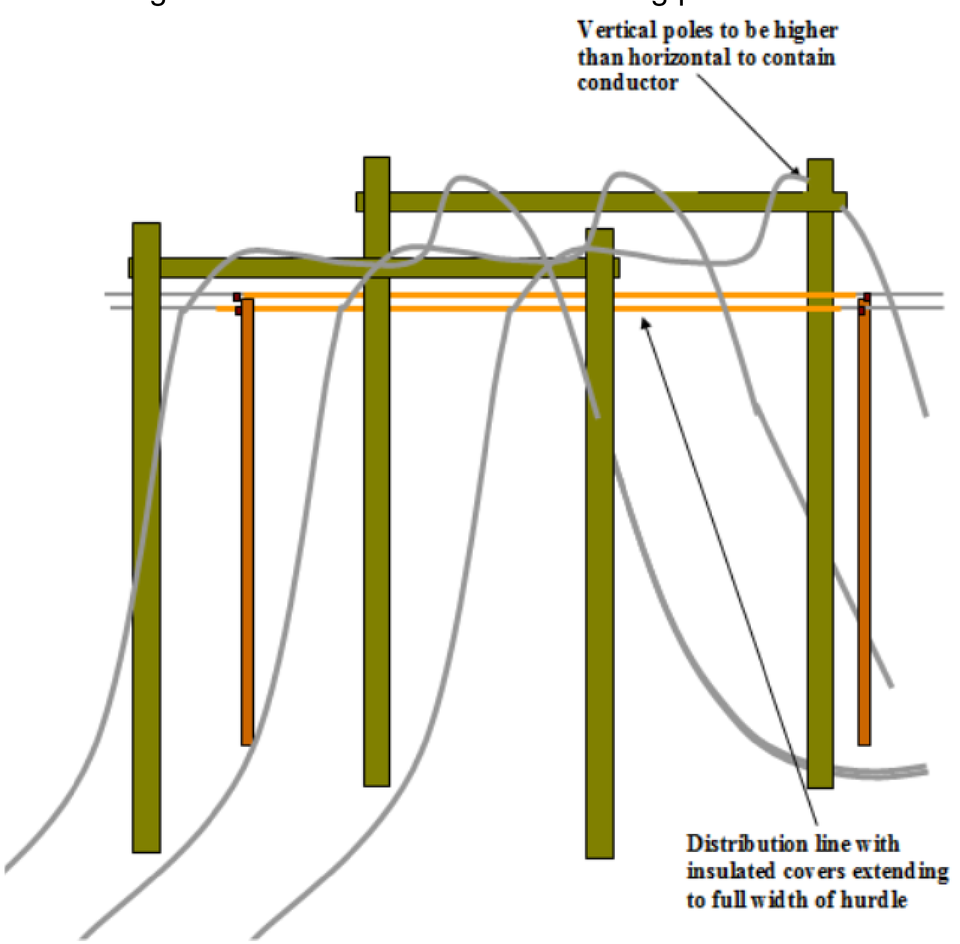
1.8 Hurdle poles upright support poles must be high enough to extend past the horizontal poles to prevent conductors being pulled from slipping over the sides of the hurdle.

1.9 Use approved polypropylene rope as a hand line to pull conductor or pilot wires over hurdles.

2) **Installation** :-

2.1 Measure width of conductor set being pulled and determine point at which they will cross the distribution line.

2.2 Measure height of distribution line at the crossing point.



2.3 Determine height and position of the hurdles for both sides of the distribution line ensuring they are as close safely possible to the 3m limits of approach whilst making allowances for conductor swing in the wind.

2.4 Determine pole strength and installation requirements (A guide to pole strength and installation depth etc. is available in **Section 10 - Poles** in the Overhead Construction Manual.

2.5 Mark out site.

2.6 Determine installation methodology i.e. live line, outage etc.

2.7 Negotiate/determine outage requirements / protection settings Install hurdles and insulated line covers

2.8 Run draw wires as required.

2.9 Return distribution line to service if safe to do so

2.10 Undertake conductor stringing whilst monitoring swing in the conductors being strung, to ensure they remain within the catching ability of hurdles.

3) **Removal :-**

3.1 Determine outage requirements and organise requirements for hurdle removal.

3.2 Remove hurdles.

3.3 Remove insulated conductor covers.

3.4 Pack up and restore site to acceptable condition.

9•15•2•6 Set Up Ready To Strain Conductors

9•15•2•6•1 Signals For Use While Straining Conductors

When two way radios or phone systems are NOT available for pulling out and tensioning up conductors, it may be necessary to use approved “manual” signalling.

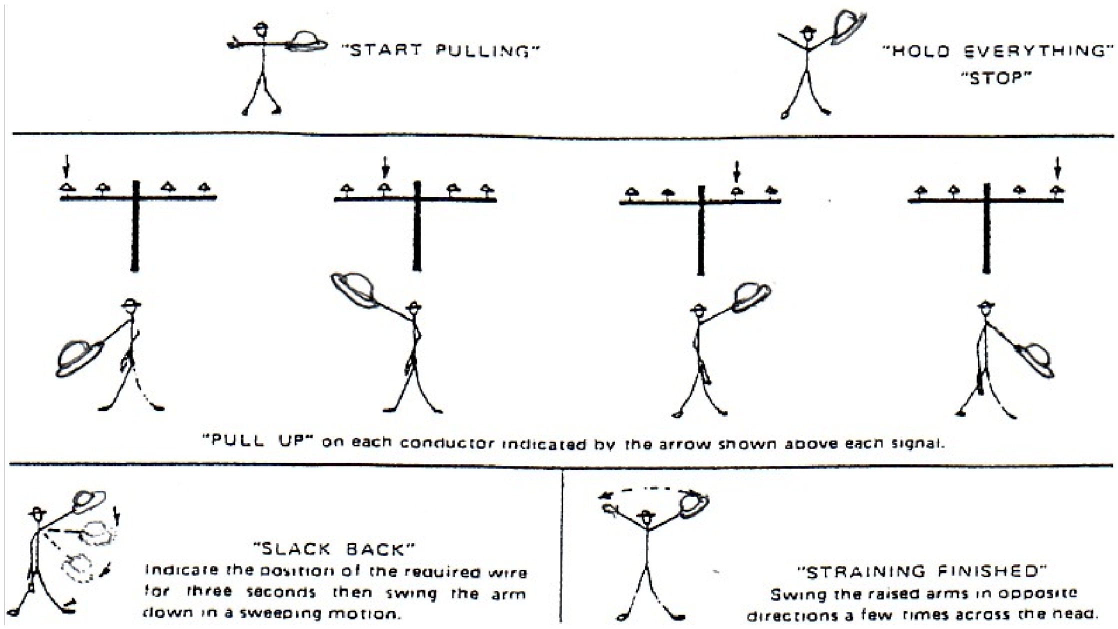
If this is the case - it is essential that a uniform system of signals be used, as there could be danger in the case of different signalling methods.

For example, if 'slack off' by one man was read as 'pull up' by another, it would be possible to lift a low voltage conductor into live high voltage conductors above it.

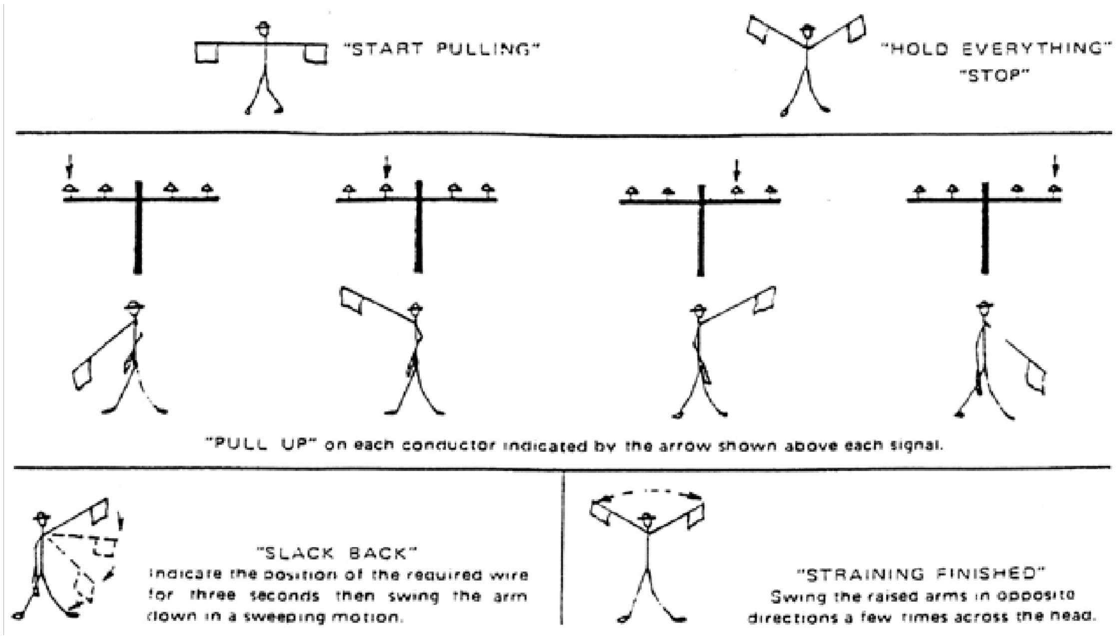
REMEMBER. Always be positive when making signals and avoid sending any confusing messages (signals).

Make your signals with the hand corresponding to the position of the conductors on the pole. If you want the right hand conductor (seen from your position) to be altered, use your right hand, and so on.

In most cases, employees indicate by holding their helmet in their hand and waving it.



Another method that has been used successfully is the waving of a red flag or flags as shown in the diagram below.



Note. When more than one high voltage circuit is carried on a pole, care should be taken to correctly identify the right circuit, and signal accordingly.
REMEMBER.

1) When signalling from a pole top keep the signalling arm(s) as close to the body as possible and do not raise the signalling arm(s) above head level.

2) One hand may be used to signal 'Stop' or 'All Clear' if it is necessary to hold on with the other, otherwise when signalling with one arm, keep the other arm close to side of body.

3) When signalling in an area subject to vehicle traffic, stand in a position clear of the traffic. It can be difficult to watch conductor movement AND moving traffic at the same time.

4) The signals shown in the previous "sample Diagrams" are for a typical application of sagging low voltage conductors. The same signals can be applied to sagging high voltage conductors on single and double circuit construction.

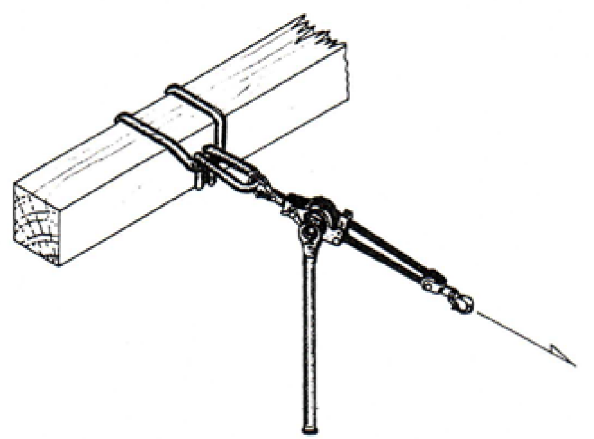
9•15•2•7 Straining/Sagging Conductors

CAUTION: **Dead end poles or poles having heavy line angles must be stayed before the straining operation begins**.

For slack spans, or spans of small size conductor, it is possible to strain the conductor by hand using a hand line.

For larger size conductors or conductors requiring a higher tension, it is necessary to use a mechanical straining device.

It is necessary to provide an anchor for straining and some means of gripping the conductor without causing damage to it.



A terylene strop (round sling) is used on steel or timber cross arms to provide an eye for the hook of the tensioning device. The safe method is to pass the strop around the cross arm and thread one eye of the strop through the other and hook the lever hoist, in the eye that protrudes, as shown in the Diagram to the right.

Another method commonly used when straining high voltage conductors is to attach a straining device* to the ball socket clevis on the disc insulator. The tensioning device is then "hooked" into this straining device.

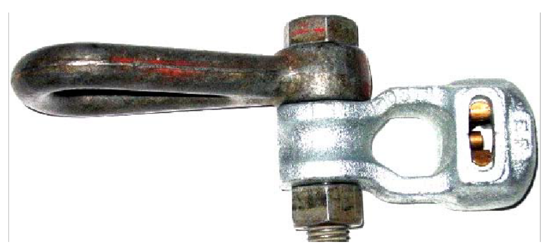
*A straining device (shown at right) which has been used for some time has fondly been called a "Pigtail" Straining Device This "straining device" was originally supplied as a component part of the Jefferson Disc (JD) insulator.

However, the "Pigtail" Straining Device **MUST NOT BE USED ANYMORE** as it does not meet proper engineering standards to be approved as a straining device.

The approved straining devices for use are the following types :

Cast Iron Straining Device.
Safe Working Load = 10 kN

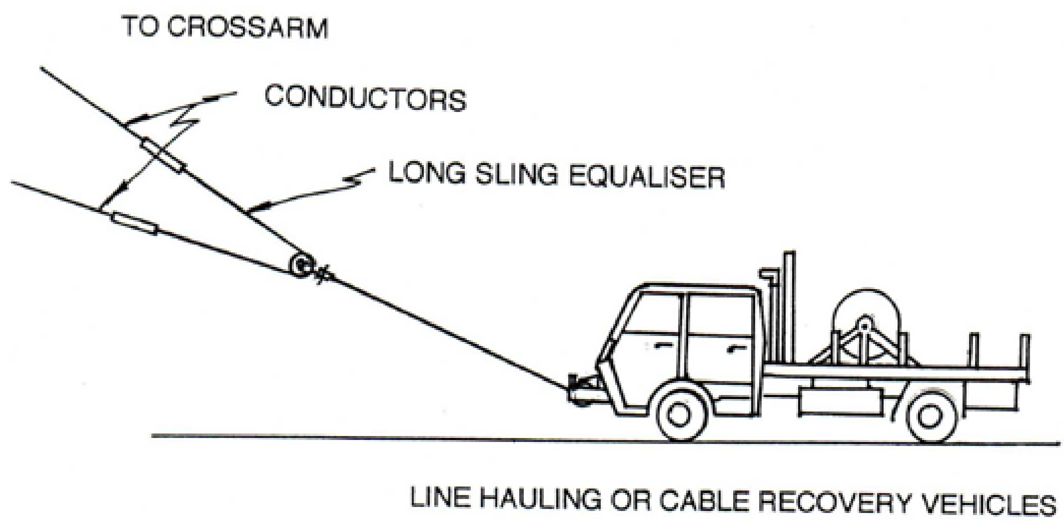
An M16 x 75 mm bolt shall be used to bolt this "device" to the ball socket clevis as shown at right.



Uni-Directional Ring Bolt Device.
Safe Working Load = 14.8 kN or **= 1.5 tonne**

An M16 x 100 mm bolt shall be used to bolt this "device" to the ball socket clevis as shown at right.

A method of straining two conductors in tandem is shown in the following diagram.



This method uses a winch rope hooked to a snatch block fitted on a wire rope (long sling equaliser) connected to the ends of both conductors. The wire rope acts as an equaliser and pulls both conductors at the same time and evens out the tension between the conductors.

NOTE : **Aluminium conductors must be protected from damage when straining up by using aluminium grips** (comealongs) **which have smooth jaws**.

If an aluminium grip is not available a wrapping of armour tape around the conductor will protect the conductor. Preformed wrapons may also be used.

9•15•2•8 Confirm Correct Sag & KN Tension

The correct sag and tension will depend primarily on, the type of conductor (e.g. AL, or CU), conductor size and, the length of the span.

In addition, you must ensure sufficient ground clearance will be maintained in the worst conditions (e.g. when ambient temperature is 40 degrees plus).

Therefore, comply with the relevant stringing and sagging requirements for the type and size of conductor being worked on in accordance with [Section 5 - Conductor Stringing] in of the Overhead Design Manual.

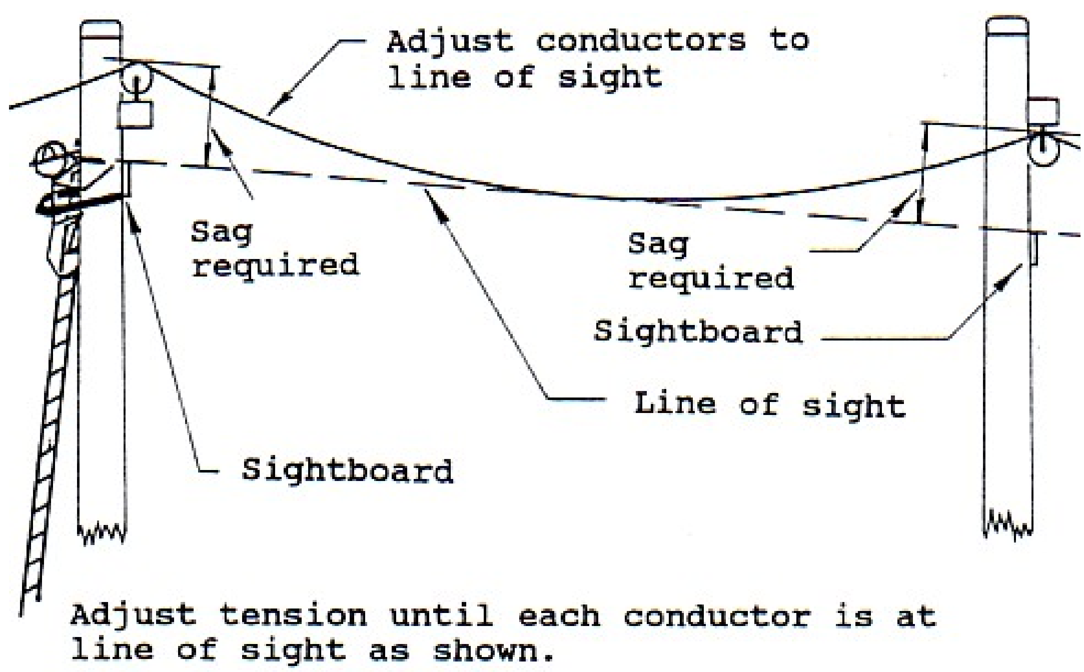
9•15•2•8•1 Using A Sight Board

Sagging "by sight" is an acceptable alternative to sagging conductors using a dynamometer.

This is where a "SIGHT" board is attached on two different poles at the required distance below where the conductors will eventually rest.

An employee "SIGHTS" between the two boards and has the conductor(s) raised or lowered until the lowest point in the conductor is LEVEL with the sight boards.

Note. Sagging by sight when using a sag chart should never be attempted on very windy days because the tension in the conductors will be increased by the wind action and consequently wrong results will be obtained.



9•15•2•8•2 Using A Dynamometer

When conductors are required to be strained to “X” kilo newtons tension, a dynamometer is used.

A dynamometer indicates on the dial the tension in the conductor when it is connected in line between the conductor being sagged and the tensioning equipment (see Diagram at left).

When tensioning up each conductor, **allow about 0.5 kN** extra to allow for any lost tension when making off.

The dynamometer method of sagging conductors is the most effective way of ensuring that conductors are CORRECTLY tensioned for the pole top forces allowed for in line design and existing pole strengths.

9•15•2•8•3 Straining & Sagging Insulated Conductors

1) Damage to the outer insulation can occur when straining or terminating the conductor IF the correct “CLAMPS” are NOT used and fitted correctly.

2) Damage can also occur to the insulated cable when straining – IF it is “OVERTENSIONED” and NOT sagged correctly.

Other care to be taken when working with insulated conductors is to :-

1) Ensure that the outer insulation covering on the conductor(s) is NOT damaged in any way as this can allow the **ingress of water**. This will then lead to deterioration of the internal conductor or a direct “short” between phases or phase and neutral.

2) Ensure the “ends” of each conductor core is “sealed” correctly with heat shrink caps to prevent the ingress of water and consequent damage to the cable.

3) Ensure the correct “connectors” are selected for the appropriate cable and fitted correctly - to prevent the ingress of water and consequent damage to the inner conductor.

9•15•3 Install And Tension HV ABC Conductors

HV ABC conductors shall be installed and have appropriate clearances and sag tension in accordance with TasNetworks, HV ABC Manual and in particular, the following Sections for correct tensioning of the conductors :-

- Section 6.3 Stringing Charts.
- Section 6.4 Stringing Charts.

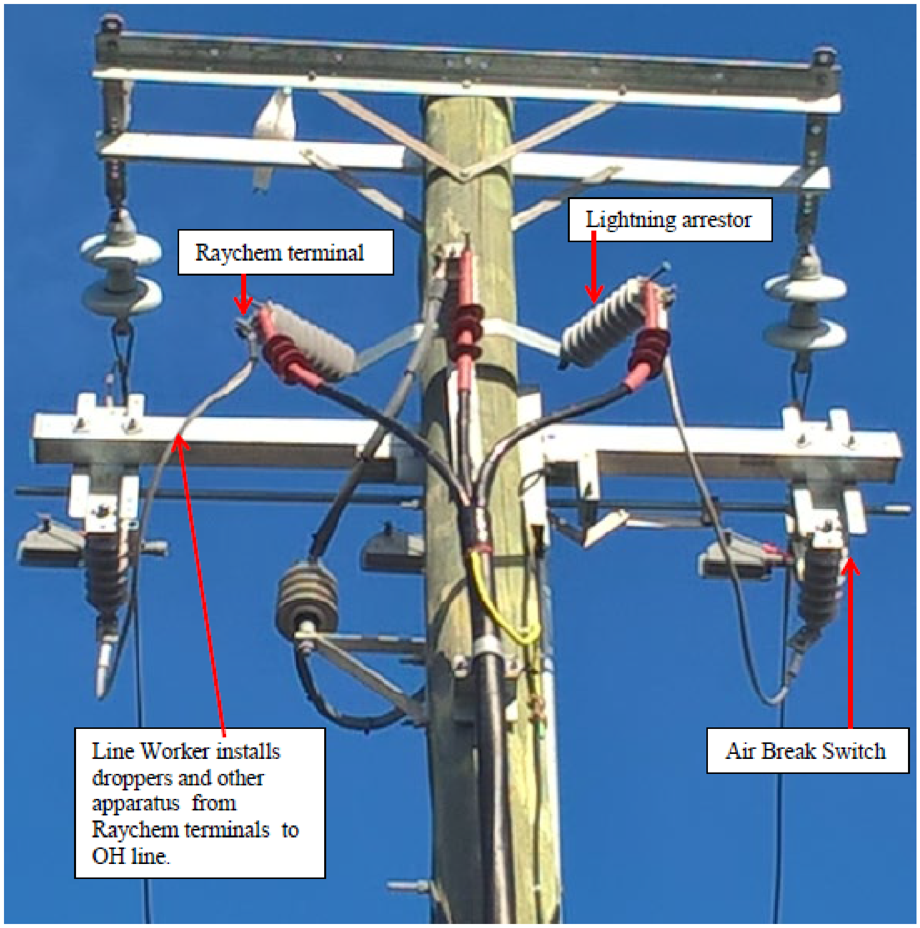
9•15•4 Install And Tension LV ABC Conductors

LV ABC conductors shall be installed and have appropriate clearances and sag tension in accordance with TasNetworks **LV ABC Manual** and in particular, the following Sections for correct tensioning of the conductors :-

- **Section 7.0 String Equipment**.
- **Section 8.0 Stringing Charts.**

9•15•5 Install Underground Cable On Pole

9•15•5•1 HV Cable



Example Of Standard Underground HV Cable Termination On Pole

A Cable Jointer is involved with installation and termination of a HV cable up to the terminal connection on a Raychem bracket on the pole.

Line Workers then connect droppers from the Raychem bracket to the overhead HV mains via connection to the bottom of an Air Break Switch that is normally installed at the same time as part of the job.

Installation of HV cable and associated pole top arrangements shall comply with Section 7A - Underground (UG) Cable Terminations On Poles in the **Overhead Line Design Construction Manual**.

9•15•5•2 LV Underground Supply Cable

Example Standard LV Underground Cable Termination On Pole

As the above picture illustrates there is not a lot of complexity with installing and connecting an underground LV cable onto the overhead distribution mains.

Line workers would get involved if a new pole top hardware had to be installed (e.g. cross arm and isolating fuse links show above) otherwise, the Cable Jointer would do all the work with installation and cable termination.

Installation of underground LV Cables on poles shall comply with the details in Section 7A - Underground (UG) Cable Terminations On Poles in the **Overhead Line Design Construction Manual**.

9•15•5•3 LV Underground Service Cable

- Section 1.4 Underground Services From Poles **in the OH Construction Manual.**
- The Service & Installation Rules refer :-

  (a) **Section 6.2 Underground (UG) Connection.**

  (b) Section 4 Supply Arrangement Considerations.

9•15•6 Conductor Clearances

9•15•6•1 Overhead Services

As per **Section 6.3.6 Clearances in the Service & Installation Rules**.

For TasNetworks owned overhead services, Work Practice **Dealing With Low And Sub Standard LV Services And Fittings.**

For clearances of privately owned overhead lines and services shall comply with **AS/NZS 3000 Wirings Rules** as per Section 3.1.2 Clearances (page 169 onwards) and associated :-

- **Table 3.8 Minimum Aerial Clearances**.
- **Table 3.9 Aerial Conductor Maximum Spans**.

9•15•6•2 Distribution Mains Conductors

- As per **Section 14 Clearances** in the OH Construction Manual.
- Refer to **Section 11.0 For Stays** in OH Construction Manual.

9•15•7 Making Connections

9•15•7•1 General

Electrical connections are made between conductors in many situations.

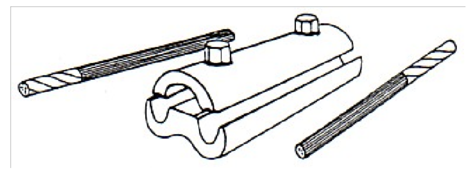
The “connection” must be suitable for the particular application, and must ensure high conductivity / low resistance between the respective conductors.

The "connection" also needs to ensure stability under the range of temperature and weather conditions, have the necessary strength to withstand mechanical and electrical loads, and provide a reliable stable connection over a long period of time.

Connectors should be easy to install and may require disconnection and reconnection from time to time without any adverse effect on the "connection" or conductor.

Factors which have to be considered when selecting connectors for electrical connections include :-

1. Effects of the thermal expansion cycle on the connection.
2. Creep and stress of the various metals.
3. Relaxation of the various metals.
4. Ingress of moisture.
5. Connection of dissimilar metals.
6. Oxidation and corrosion.



A requirement common to all connections is that they must provide a low resistance reliable joint capable of withstanding the variables listed above.

Whilst only some of the above factors may affect a particular connection, the impact of such factors will depend on the type of electrical connection being used, the magnitude of normal currents flowing in the conductors, and the environment in which it is located.

Note. **Wherever connectors are used to joint copper and aluminium conductors together – the copper MUST always be installed BELOW the aluminium**. This is to prevent copper contaminated water running onto the aluminium and causing a corroding effect on the aluminium.

When making an electrical connection it is important to :-

- **Select** the **correct connector** for the SIZE & TYPE of conductor.
- **Correctly prepare** the **conductor surfaces** to be jointed.
- **Correctly assemble** the **connection**.

It is vital to ensure that the conductors to be joined are thoroughly "cleaned" with a wire brush.

Inhibitor grease MUST only be applied to "clean" conductor immediately after the conductor has been cleaned.

The INHIBITOR GREASE or jointing compound is designed to prevent air and water reforming "oxides" and to provide continuing protection against corrosion of the electrical connection.

The “grease”, when deposited around the contact surfaces prevents the penetration of oxygen and the forming of oxide.

9•15•7•2 Select Correct Connector

The type of “connector” selected will depend upon the size and type of conductors being joined. For example, whether it is copper or aluminium, bare or insulated, how many strands and what the size of each strand is.

The type of connection used will also depend upon whether the conductor(s) being connected are exposed to the weather, or are under tension.

If there is ANY DOUBT about a particular “connector” and whether it is the “correct one” refer, to the data supplied with it or, **Section 9 - Conductors, Cables, Connectors & Associated Fittings** in the **OH Construction Manual**.

9•15•7•3 Correctly Prepare Conductor Surfaces

Conductor surfaces could be covered by a thin layer of oxide that is electrically NON-conducting. This is especially so with BARE conductors.

This “oxide coating” MUST be removed from the conductor BEFORE the conductor can be joined / connected. This oxide coating will return quite quickly after it has been cleaned off the conductor and because of this it is necessary to apply inhibitor grease and / or make the connection IMMEDIATELY after the conductor has been cleaned.

- **COPPER** - very resistant to corrosion but DOES form a black oxide coating which is relatively thin and slow forming. The shale formed on badly corroded copper PRE-VENTS good electrical contact.

- **ALUMINIUM** – a very reactive metal that starts to oxidise immediately on contact with air. The coat of transparent oxide increases in thickness which then protects the metal from further oxidation.

Aluminium MUST have an INHIBITOR GREASE evenly “applied” to the CLEANED SURFACE immediately after it has been cleaned to prevent the oxide reforming, which it does very quickly.

- **STEEL** – an alloy of iron that easily rusts. Where the galvanising has been damaged the conductor will rust and this will prevent a good electrical connection. Don’t dam-age the galvanising when cleaning it.

9•15•7•4 Connection Types And Assembly

9•15•7•4•1 General

Refer to TasNetworks **Overhead Construction Manual,** Section 9 - Conductors, Cables, Connectors & Associated Fittings, for details on all connection types, methods and assemblies used for connecting HV and LV Power Distribution Conductors.

The following are the main types of connection types and assemblies used.

9•15•7•4•2 Compression Connections

NOTE: With all compression connections, to avoid joints coming apart, it is critically important to ensure you use the correct size compression die to suit the conductor size and compression sleeve to be used. Refer to the Red Lesson for full details on an incorrect die being used and the correct die that should have been used.

Hydraulically operated crimping equipment is used for compressing the "connectors" installed on aluminium cables and aerial conductors. This "equipment" comes in a wide range of types and sizes suitable for a range of activities.

Those commonly used can be :-

- VC6 Crimpers fitted with permanent compression jaws. These have a limited use due to their lower compression range.
- Alcan, Utile or similar, compression tools that can be fitted with a range of different size compression dies. These have a compression range from around five (5) tonne upwards. We mainly use twelve (12) tonne.

VC6 Crimpers

These "crimpers" have the ability to crimp sleeves on the full range of aluminium conductors up to 19/3.25 AAC as well as 7/1.60 ACSR.

Compression is by a number of indent crimps along the body of the sleeve.

Note. The body and handles of the VC6 tool are Neoprene covered for "mechanical" protection. It is NOT intended to provide any "electrical" protection for the operator when used in live line work.

It is important, when using these VC6 Compression Tools, to :-

- Keep them clean and regularly serviced.

- Not drop them or leave them lying on the ground.
- Keep them in their “case” when not in use.
- Not allow the joint compound to build up on the crimping “dies”. This compound is highly abrasive and will work into the hydraulic system if not wiped off after each crimping session.
- Regularly check the hydraulic pressure using the “GO, NO GO” gauge and crimping slugs provided.
- Store them with the crimping nibs in the fully OPEN position.
- NOT screw up the quick advance handle while pumping the tool as this will damage the hydraulic system.

Alcan, Utile or Similar, Compression Tools

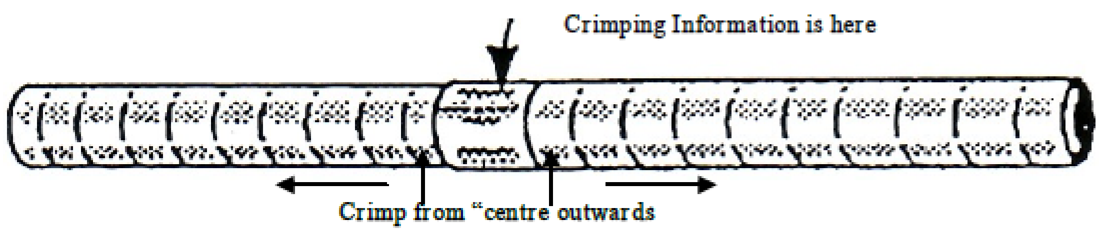
These particular type tools can be fitted with a range of different size “dies” to compress sleeves onto a variety of different size and shape conductors.
Compression can be in the range of 12 tonne or more, to create a solid low resistance joint. Sleeves are available for non-tension and full tension situations to suit the variety of requirements. Hydraulic compression can be done with a hand operated lever type pump, electrically operated hydraulic pump or battery operated unit as shown below.

Samples of Different Types of Compression Tools & Dies.

It is vital at the commencement of any crimping operation, to ensure the conductors to be joined are thoroughly cleaned with a wire brush before inserting into the sleeve.

Conductors must be fully inserted into the sleeve.

Crimping should commence at or near the centre of the sleeve, and successive crimps should be made alternately working outwards towards the ends of the sleeve.
This allows the conductors to expand freely inside the sleeve until the joint is completed. Many crimps are numbered indicating the correct order in which crimps are to be made.



It is important, when using these Compression Tools, to :-

- Keep the operating heads clean, dry and regularly serviced.
- Keep the dies clean and free from rust.
- Not drop them or leave them lying on the ground.
- Keep them in their "case" when not in use.
- Not allow the joint compound to build up on the crimping "dies". This compound is highly abrasive and will work into the hydraulic system if
- not wiped off after each crimping session.
- Avoid damage to oil lines where used.
- Keep oil line connections clean and fitted correctly.
- Store them with the crimping jaws in the fully OPEN position.

Non-tension Compression Sleeves are suitable for overhead and underground low tension joints in industrial and commercial installations.

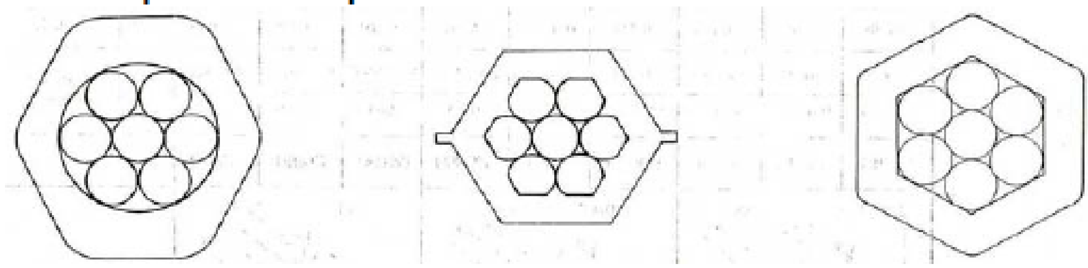
They are suitable for aluminium conductors and in some cases galvanised steel conductors.

Full Tension Compression Sleeves are suitable for full tension joints in overhead distribution lines.

They are suitable for all aluminium alloy and aluminium cored steel reinforced conductors.

Refer to Section 9.3 Compression Sleeves/Splices in the **Distribution Overhead Line Design & Construction Standard** for further details on sleeves.

Samples of Compressed Connections – Different Dies Used.



Die Too Large | Die Too Small | Die Correct

In summary when making compression connections :-

- Insert conductors into the correct depth and hold firmly.
- Select correct "tool" and correct "die" (matched to compression sleeve).
- Position in correct place on "sleeve" to commence compressions. This is starting from either right or left of centre of the sleeve and then working outwards to the end.
- Compress to correct depth.
- Reposition and continue correct number of compressions in correct positions.
- **Note**. The principles applied here are similar with "Crimped" connectors.

9•15•7•4•3 Bi-metal Crimp Lugs

Electrical connections used on an air break switch, with either copper, aluminium or steel conductors need to be made off and capable of withstanding wide variations of weather and load conditions.

This is done using bi-metal crimp lugs and stainless steel bolts and washers, tightened to the required tension.

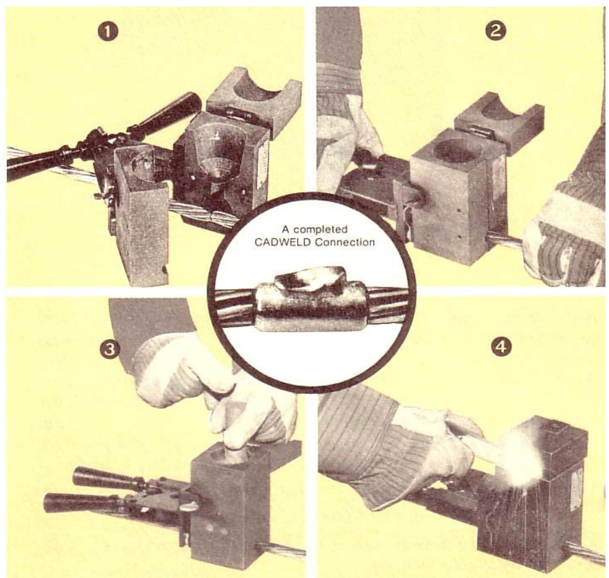
Conductors must be thoroughly cleaned and for aluminium conductors, "inhibitor" grease must be applied to the conductor prior to insertion into the crimping lug.

Refer to Section 9.8 Compression (Crimp) Lugs, for more details on crimp lugs, in the **Distribution Overhead Line Design & Construction Standard** for details on connectors.

Refer to Distribution Overhead Line Design & Construction Standard –HV ABC for details on connectors for HV ABC.

9•15•7•4•4 Cadweld Connections

Cadwelding is a process that has been used on Distribution overhead lines in Tasmania in the past but is most likely only used now in ground type substations for bonding earth mats together.



The Cadweld process is a method of making electrical connections of copper to copper or copper to steel in which no outside source of heat or power is required. Powdered metals, copper oxide and aluminium, are dumped from a container into a graphite crucible and ignited by means of a flint igniter.

The ignition of the two powdered metals produces a very high temperature during the fusion process.

The reduction of copper oxide by the aluminium (exothermic reaction) produces molten copper and aluminium oxide slag. The molten copper flows over the conductors in the graphite mould, melting them and welding them together.

A Cadweld welded connection produces a joint or connection superior in performance to any known mechanical or pressure type surface-to surface contact connector. By virtue of its molecular bond, a Cadweld connection will not loosen or corrode, with the resultant increase in resistance, over the lifetime of the installation. This is, of course, so long as it has been installed correctly.

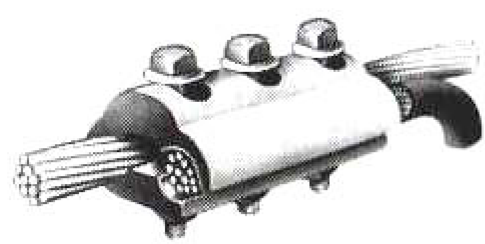
Cadweld connections can NOT be disconnected once they have been made.

Note. Refer to Manufacturer's Instructions BEFORE attempting to make a Cadweld joint.

9•15•7•4•5 Bolted Connections

Parallel Groove Clamps supplied for use with aluminium conductors come with an "inhibitor" grease compound lining the conductor grooves.

The inhibitor ensures optimal contact between the clamp and the conductors to minimise joint resistance, and where dissimilar metals are being connected, reduces the possibility of cable / joint deterioration due to the effects of electrolysis.



- **Ensure conductors are correctly cleaned or prepared with a wire brush**.
- Ensure inhibitor grease is applied where required.
- Position both conductors in connector correctly.
- Tighten all bolts evenly and uniformly over the "connector". Five (5) cycles are required to reach a uniform contact pressure.
- **The centre bolt, on this clamp, should be tensioned first, then remaining outer bolts, increasing tension uniformly across the clamp.**

Refer to Drawing D-OH1-1.4/8 of the **Distribution Overhead Line Design & Construction Standard** for details on size and types.

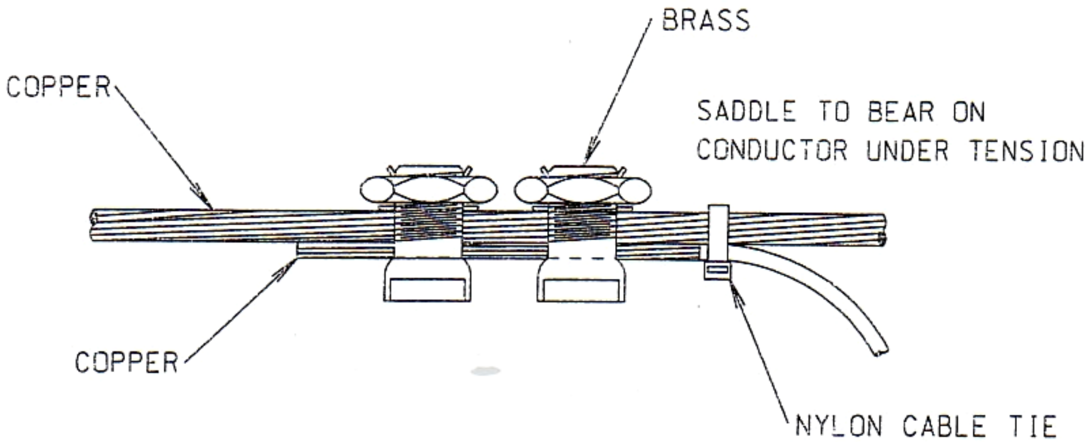
Note: Two parallel groove (PG) clamps will be used instead of one parallel groove clamp for connections of preformed leads on tensioned conductors. Refer to the **Blue Lesson** for full compliance and installation details.

9•15•7•4•6 Brass Split Bolt Clamps (Line Taps)

These are another type of bolted cable jointing connection. Line taps are manufactured from hard rolled brass or aluminium.

Two (2) spanners are required to effectively tighten the "line tap". One (1) spanner is required to hold the BODY of the "clamp" to stop it trying to twist on the conductor and the second spanner is required to tighten up the nut.

If it is NOT tightened in this manner – it may not be an EFFECTIVE connection as it will NOT be tight enough.

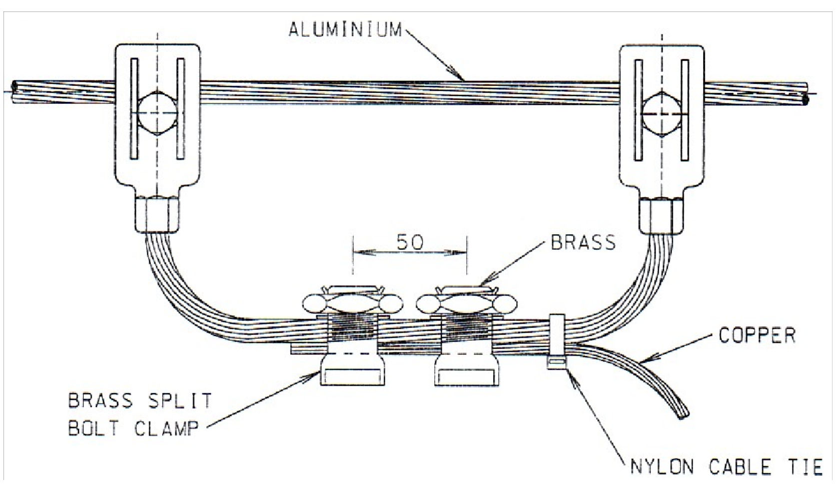


Note. The SMALLER conductor always fits in the "V" section of the body as shown in diagram above.

Refer to Section 9.6 Split Bolt Clamp Connectors in the **Distribution Overhead Line Design & Construction Standard** for details on use of these "clamps".

9•15•7•4•7 Copper to Aluminium Dee Clamps

Wherever possible, bolted connectors should not be attached to conductors under tension. The copper tail must **always** be positioned **below** the aluminium to prevent copper contaminated water draining on to the aluminium and causing corrosion.



Inhibitor grease must be applied to the aluminium conductor immediately after it has been thoroughly cleaned.

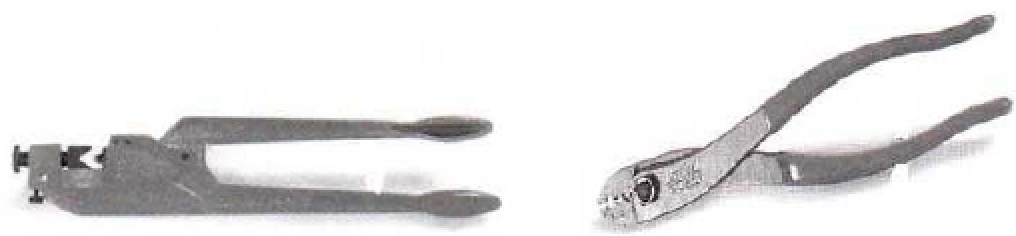
9•15•7•4•8 Crimped Connections

Crimped connections include the use of crimp lugs, and crimp links.

For use with copper conductors, specifically on smaller sized conductors, the crimp lugs or links are normally manufactured from annealed copper and tinned to reduce corrosion.

Crimp connections are made using hand operated crimping tools on smaller conductors, or hydraulically operated crimpers on larger cables.

The lug or link needs to accommodate the cable with a good fit prior to crimping. Joints on smaller conductors are crimped with hand-operated crimpers similar to those shown below.



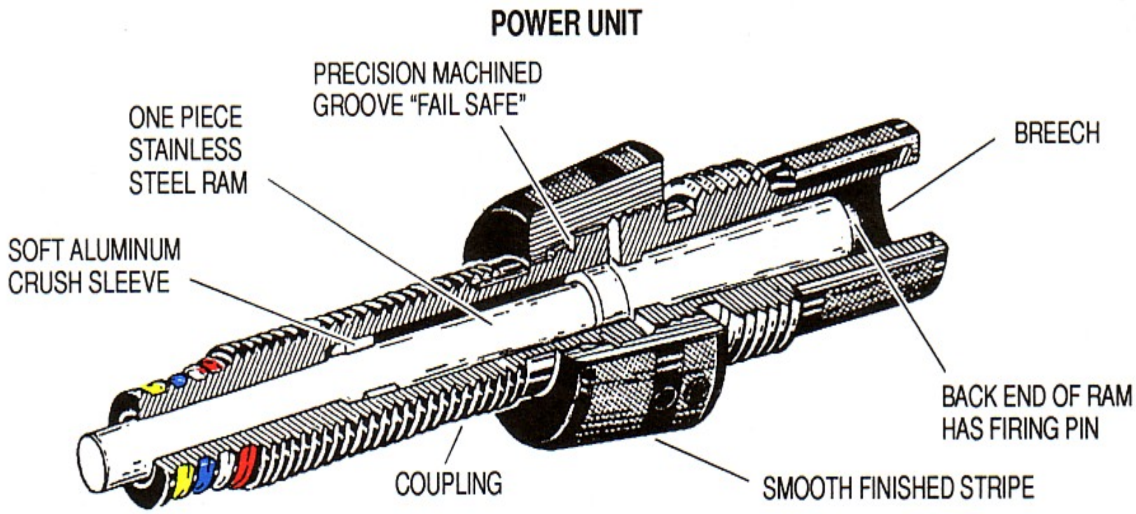
Crimpers

9•15•7•4•9 Ampact Connections And Tools

Whilst the Ampact tool uses an "explosive" charge", it does NOT fall into the same category as the Explosive Powered Tools mentioned in **Section 7.4.7. Explosive Powered Tools**.

The Ampact Tool is a precision-designed, powder-actuated tool. The Manufacturer provides a manual that contains information relevant to the use and care of the tool and the application of the taps and stirrups.

The Ampact Tool power unit has incorporated into its design a "Fail Safe" which will deliberately fail before any other part of the "Tool". The "Fail Safe" is designed to make the Ampact Tool inoperable when it is broken by allowing the coupling nut to turn so that the power unit cannot be screwed onto or within the tool head. See Diagram below.



Note:

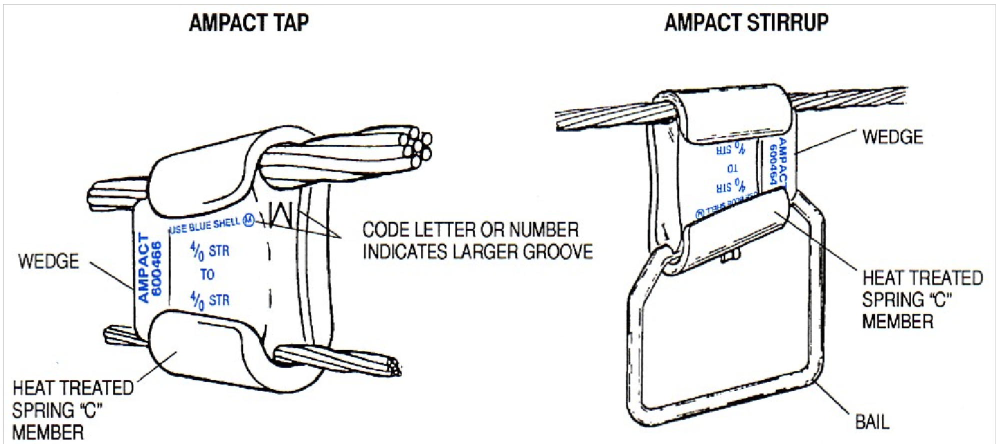
- Disassembly of the "power unit" is NOT permitted, other than maintenance procedures listed in the Manufacturer's manual.
- An Ampact Tool should NEVER be operated with a broken "Fail Safe".

Ampact tap and stirrup connectors are suitable for connecting solid or stranded conductors. They can be used to connect aluminium to aluminium, aluminium to copper, or copper to copper.

The AMPACT "**tap**" consists of two parts : a heat-treated spring "C" member and a wedge with grooves on the tapered sides. See Diagram below.

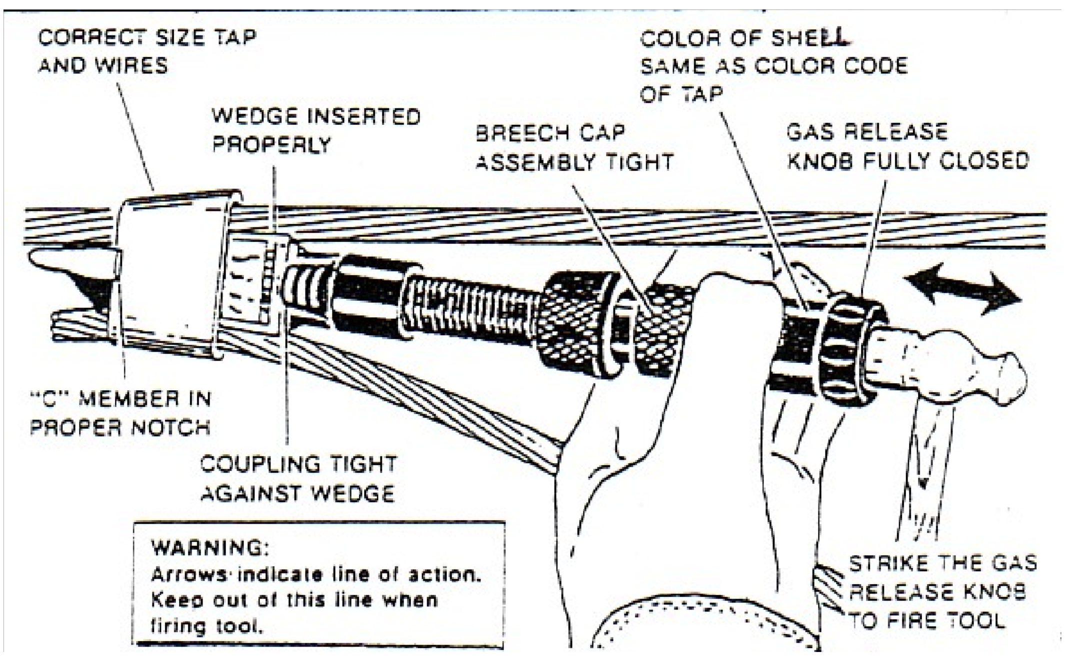
The AMPACT "**stirrup**" consists of three parts : a heat treated spring "C" member with a bail made of tin-plated copper wire permanently attached to its side, and a wedge with grooves on the tapered sides. See Diagram below.

Note. *Inhibitor grease* is applied, by the Manufacturer, to the "grooves" of all the wedges and to the "C" members where the conductor fits. This is done at the factory before they are issued.



The spring "C" member (clamp) exerts continuous pressure on the conductors when the "wedge" is driven in and locked between them, as shown in Diagram. The assembly can be driven apart, when required, without damaging the conductors.

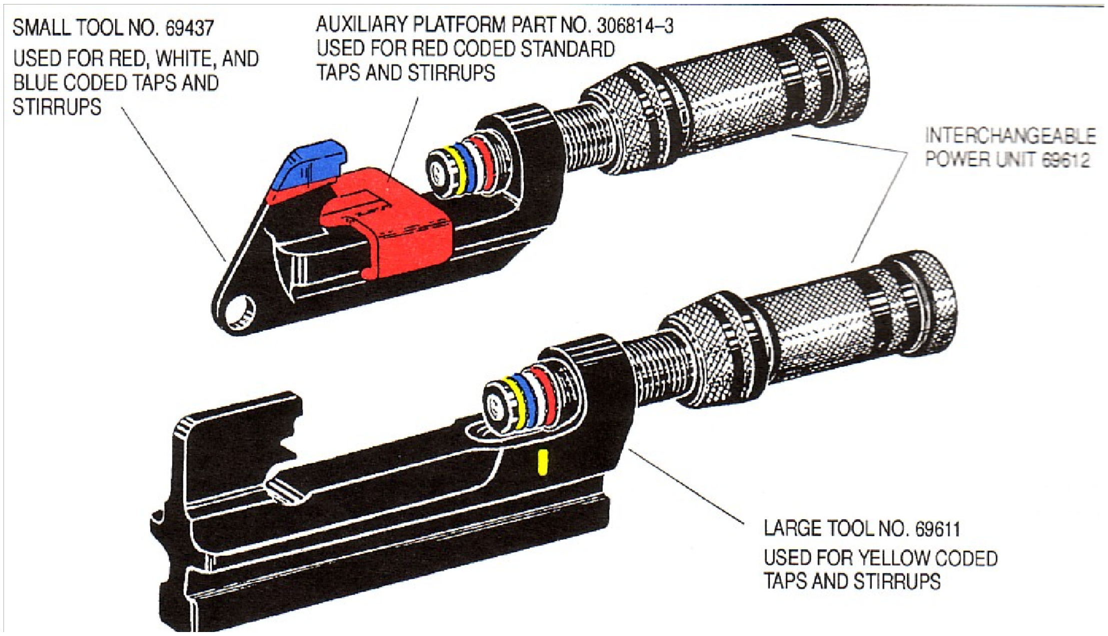
<u>Note</u>. It is important to **select the "correct" tap or stirrup** for the type and size conductor being used. Refer to [Section 9.4 Wedge Connectors - AMPACT Connectors] in the **Distribution Overhead Line Design & Construction Standard** for further details.



Method of Connecting Conductors with "C" Clamp and Wedge

Ampact Tools

There are two (2) different size Ampact "tools", as shown below, and they have specific uses.



"SMALL" TOOL.

This 2.5 kg. Ampact tool includes the SMALL head and interchangeable power unit. It is used for the following specific applications :

To install **red-coded** standard taps and stirrups **with auxiliary platform** and **red shell**.

To install **white-coded** taps & stirrups with NO platform & **white shell**.

To install **blue-coded** taps & stirrups with NO platform & **white shell**.

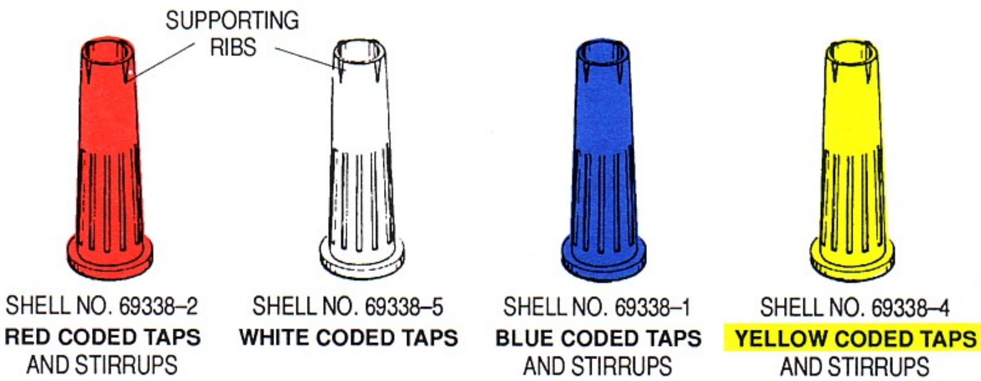
"LARGE" TOOL.

This 3.6 kg. Ampact tool includes the LARGE head and interchangeable power unit. It is used ONLY to install **yellow-coded** taps and stirrups with **yellow shells**.

Colour Coded Shells

The Ampact "shells" are colour coded (red, white, yellow and blue) for specific applications. The cartridges are moulded of weatherproof polyethylene and packed with propellant and primer.

Colour codes indicate the "strength" of the powder charge and correspond to the colour code of "TAP" sizes with which they are used for installation. See shells below.



The Colour Coded Shells

Note. NEVER use the "**yellow**" shell to REMOVE a tap. **The yellow shell is TOO powerful for tap removal**.

Special Notes :-

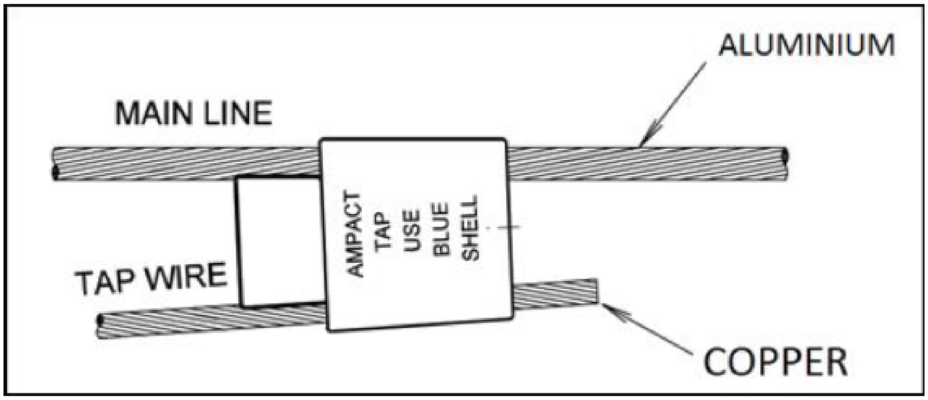
- Refer to Section 1.4 and Section 9.4 Wedge Connectors - AMPACT Connectors in TasNetworks **Overhead Construction Manual** for the conductors sizes (aluminium and/or copper) each colour coded shell can handle.

- NEVER use this equipment WITHOUT receiving appropriate training and authorisation.
- Always wear approved safety glasses when making Ampact joints.
- The wearing of "earmuffs" is NOT required and is discouraged from use with Live Line work because it could affect "communication" between personnel.

In summary, when making Ampact connections :-

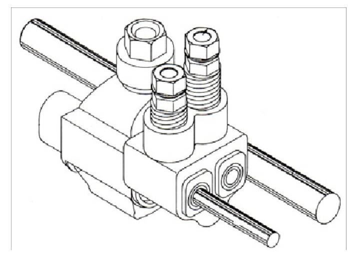
- Ensure conductors are correctly cleaned or prepared.
- Ensure inhibitor grease is applied where required.
- Select correct "tap and wedge" for conductor(s).
- Position both conductors in connector correctly.

  NOTE: When connecting Aluminium to Copper ensure that the Aluminium is always on top of the connection (see picture below).



- Fit correct “tool” with correct “charge” to connector.
- Strike gas release knob and attach connector.
- Remove tool.

9•15•7•4•10 Insulated Piercing (IPC) Connections



Cable Piercing connections are used on Aerial Bundled Conductors (ABC). The cable end with the insulation still intact is inserted into the terminal of the aerial connector, and the top nut of the terminal screw is tightened with a ratchet type socket spanner specially designed for this task

The terminal screws have “teeth” on the end that pierce the cable insulation when they are tensioned up. They must be tightened up until the top nut shears off.

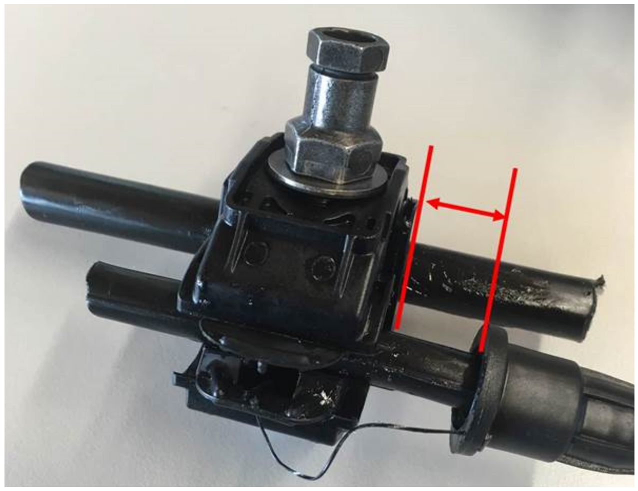
This ensures that the terminal screw is tensioned sufficiently to make a reliable contact with the conductor. A second nut below the shear nut provides the capability to subsequently release the connection and remove the conductor should the need arise.

Note. It is important to use the “correct” size and type connector for the particular type of insulated conductor.

Refer to Section 9.10 IPC (Insulation Piercing Connectors) in the Distribution Overhead Line Design & Construction Standard for more details on IPC Connectors.

- Strip correct length of insulation from conductor where required.
- Position conductor(s) into correct IPC.
- Tighten up bolts to correct torque and shear off.

Tips for using the latest type of IPC introduced during year 2018:



- For these new IPCs, the end cap does not have to be flush up against the body of the IPC as shown in the photo attached. If the cap is flush it may interfere with the connector properly piercing the conductor.
- The inside of the caps are stepped to meet each size of LVABC so need to be pushed on firmly. This should be done prior to tightening the shear bolts on the connector to ensure there's enough 'tail' on the end of the tapped conductor for the cap to grip to.

9•15•7•4•11 D Clamp Connection

The D clamp is used to connect onto a HV mains conductor and a supply conductor (commonly known as a "dropper") is then connected to the bottom of the D to the electrical equipment (e.g. to the HV terminals of a pole mounted transformer).

The D clamp provides flexibility by allowing the dropper to be disconnected and reconnected using a shotgun stick without any wear and tear of the mains conductor.

Refer to **Section 9.9 Live Line Clamps** in the TasNetworks **Overhead Construction Manual** on further connection details for the D Clamp.

9•15•7•4•12 Installation Of Spiral Dampers

To dampen down excessive conductor movement and minimise risk of damage from conductor breakage or clash, especially on windy days.

As per WP **Installation Of Spiral Vibration Dampers.**

9•15•8 Installing And Connecting Earthing

9•15•8•1 General

The purpose of a sound earth circuit is to provide a low resistance path to the general mass of earth so that in a fault situation :-

Sufficient current will flow through this path to earth and operate the circuit protection device (e.g. a HRC Fuse) to open the circuit and;

Protect against the risk of electric shock to the public and/or damage to electrical apparatus from exposure to large fault current.

Therefore, to provide protection for the public, it is important to ensure earthing circuits and equipment are correctly installed in accordance with the following requirements.

9•15•8•2 Pole Mounted Transformers – M.E.N. System

Pole mounted transformers have an HV earth and LV earth connection and;

It is important to keep the HV earth in the ground separated from the LV earth by at least 2 metres minimum to ensure HV, under a fault condition, does not track into the LV earth back through the LV neutral and damage LV equipment.

Therefore, ensure installation of earthing for pole mounted transformers complies with the relevant drawing as per Section 12.0 Earthing in TasNetworks Overhead Construction Manual.

9•15•8•3 Earthing Of Other Poles

9•15•8•3•1 Bonding Steel Poles

- Section 1.3.4 Steel Pole Intermediate Neutral Bonding in Overhead Line Design Construction Manual.
- Section 9.1.6.5 Bond Steel Poles.

9•15•8•3•2 Wooden Poles Carrying HV

A road lighting luminaire mounted on a wooden power pole :-

- The Luminaire metal work must not be bonded to the supply neutral inside the luminaire where the fitting is mounted on a wooden pole carrying HV.
- No requirement for bonding luminaire metal work for M.E.N. earthing.

9•15•8•3•3 Steel/Concrete Poles Carrying HV

- The Luminaire metal work must not be bonded to the supply neutral inside the luminaire.
- Pole steel work to be earthed (max. 10 ohms value allowed).
- Neutral connection between mains and luminaire fitting to be double insulated.
- Wiring inside luminaire to be double insulated.

9•15•8•3•4 Steel/Concrete Poles

- This includes all ground mounted street lighting columns.
- LV Neutral of luminaire to be bonded to pole steelwork for M.E.N. earthing.

9•16 Installing Customer Service Apparatus

9•16•1 Overhead Services

9•16•1•1 General

The installation of new overhead customer services shall comply with :-

1. The Work Practice **Low Voltage Overhead Service Installation And Connection**.
2. The minimum requirements in the **Service and Installation Rules** in regard to a whole host of requirements for servicing work.
3. **Section 9.15.6 Conductors Clearances** of this Handbook.
4. **Section 12.3.1 LV Services** of this Handbook covering replacement and/or upgrading of existing services.

6. The requirements of **Section 1.0 Services** in the Overhead Line Design & Construction Manual.
7. The requirements, as per the **Green Lesson**, to ensure conductor double insulation is maintained to avoid UV degradation and if the inner insulation (not UV rated) is exposed then UV rated heat shrink must be applied.

9•16•1•2 Equipment For Straining Service Conductors

Typical cable strain grip and comealong on ABC service

Currently there are three (3) different types of grips for use by employees when straining Aerial Bundle Service Cable:-

- Small grip for use on 50mm LV ABC & multi core 25mm ABC
- Medium size grip for use on 95mm LV ABC & multi core 50mm ABC
- Large size grip for use on 150mm HV ABC

Selection of strain grips for use on bare and insulated service cable

The standard methods used are :-

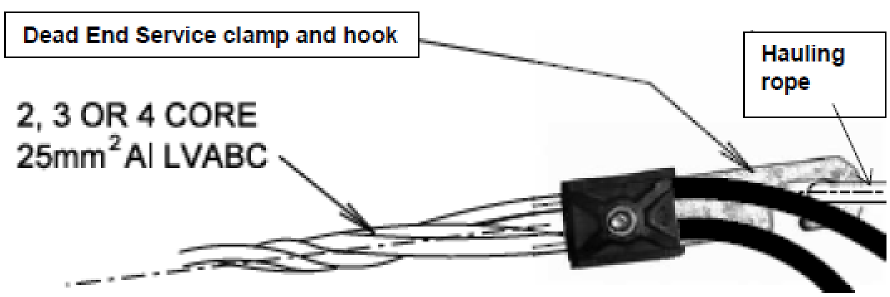
- hauling line — Used for shorter cables and shorter spans.
- comealong
- ratchet puller

(comealong and ratchet puller:) Used for heavier cables/longer spans.

The following is an example of a hauling line being used – otherwise known as a Rope Snotter.

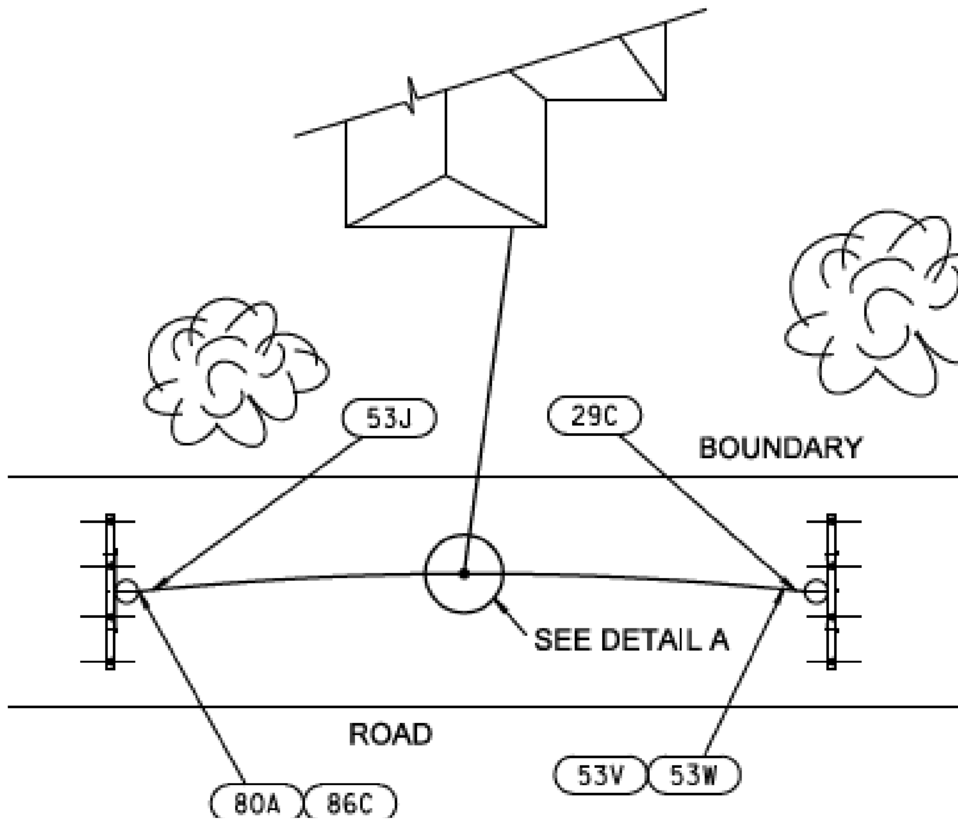
Rope Snotter To Haul Up Service

Another approved method is to use an appropriate Dead End clamp suitable for the service wire to act as a grip to strain.



Also, there are other lighter grips in weight and possibly more user friendly, that could be used, such as at the following web site – **new strain grips**.

9•16•1•3 Mid Span Take Off Service



Where the only option is to connect a service "mid span" between two power poles, this shall be done in accordance with :-

- Section 1.1.7 Midspan Service in TasNetworks Overhead Line Design & Construction Manual.
- If the customer's property is on the same side of the street as the distribution system.
- If the distance between the line pole and POA does not exceed 45m.
- If the take-off service line is at 90° to the mains and does not exceed 20m.

9•16•1•4 Standard Service Cable Sizes

The service conductor details and current ratings listed here will only cover those conductors that are now being installed in our distribution system.

For further details can be found in Section 9.1 Conductor and Cable Data in the Distribution Overhead Line Design & Construction Manual.

Cable CSA (mm^2)	Conductor material	Cable Cores	Service rating (Amp)	Common Use
25	Aluminium	2 core or 4 core	100	Domestic
50	Aluminium	1 x 4 core	170	Commercial, Agricultural sites
95	Aluminium	1 x 4 core	300	Commercial, Distribution

9•16•1•5 Maximum Span Lengths

The maximum span (length) of an overhead service from the distribution street pole to a customer's POA (fascia) is:

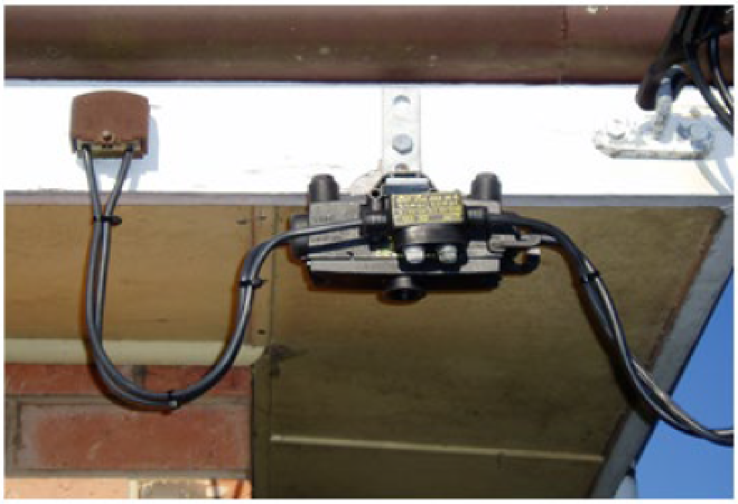
$25mm^2$ – 1phase	46m
$25mm^2$ - multi phase	33m

Length of span from pole to pole can be greater. This is determined by required clearances, size and type of pole, size of conductor, insulation type, type of service clamp and environmental considerations

9•16•2 Overhead Service Fuses

9•16•2•1 General

"A good installation"



Adequate drip loops and, use of cable ties to secure conductors

A poor installation"

No drip loops and, no cable ties used.

Service fuses are installed at the point where the Power Authorities responsibilities end on low voltage service lines, that is at the POS (junction of the service mains with the customers consumer mains), which is normally at the Point of Attachment (POA) on customer's premises or on the first private pole of a private service line or within a turret or service cabinet if supply is underground.

Note: Although at times a service fuse may provide protection on the consumer's mains from overload and short circuit, the primary purpose of the service protective device is to prevent detrimental effects on the distribution system.

In the past at multi customer installations (e.g. a block of flats) a set of three phase fuses may have been installed to cover all the customers. This had the problem that a blown fuse would affect a lot of customers and, it was difficult to isolate supply to perform metering work for a single customer but;

These days the general rule is that each customer has an isolation fuse or at least an isolating switch.

9•16•2•2 Installation

The installation of service fuses shall comply with :-

1. Minimum requirements in the Service and Installation Rules(SIR).

2. The following main requirements contained in Section 1 - Services in the Overhead Line Design & Construction Manual :-

    - Service fuses.
    - Strain clamps.
    - AL XLPE Connectors.
    - XLPE service cable.
    - Comparison between single core Cu and Al Cable.
    - Raiser brackets.
    - Bare Mains – clearance requirements.
    - Intermediate Steel Pole Bonding Detail.
    - OH Services steel cross over pole.

9•16•3 Conductor Connections

9•16•3•1 General

When connecting overhead services to Customer's premises employees MUST ensure :-

Where possible the primary service conductor is connected hard into the mains connection box and service fuse(s) without any intermediate joints or connections as shown in Diagram below.

No “uninsulated” section of conductor is exposed.

Where any intermediate connection is unavoidable, an “insulated” fitting should be used.

If no other alternative exists a “line tap” (split bolt clamp) may be used but must be :-

- Insulated with heat shrink material.
- As a last resort, covered with at least seven (7) layers of insulation tape.

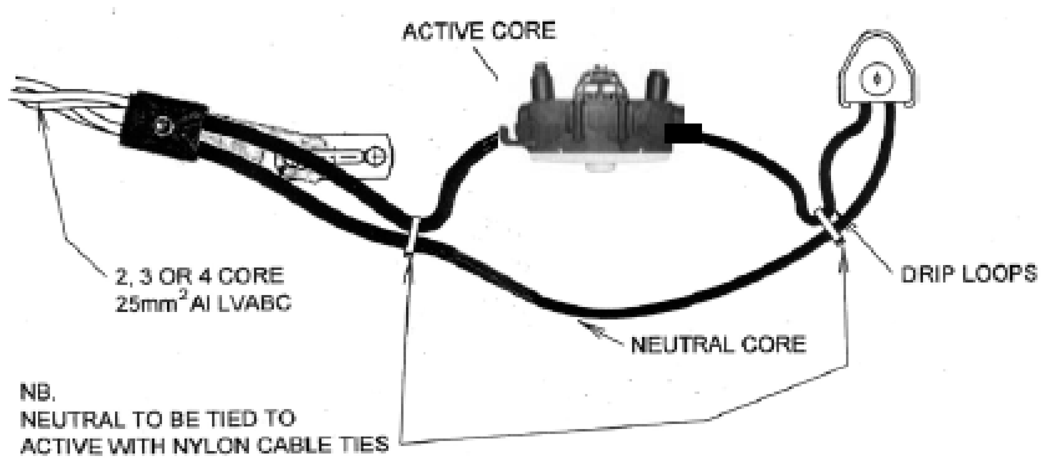
The Diagram below shows the service “tails” connected hard into the fuse and mains connection box.

To reduce conductor / cable movement due to wind and reduce the incidence of broken connections, the neutral core is to be fastened to the active conductor on either side of the service fuse with black, UV resistant cable ties.

Drip loops must be made sufficiently lower in height than any of the fittings to stop rain water running into the fittings.

IMPORTANT : To avoid issues from fault occurring due to, poor connection or wear and tear (e.g. cable insulation wearing away from rubbing on metal surface), overheating of connection, or possible electric shock to customer if neutral is opened circuit) you must ensure :-

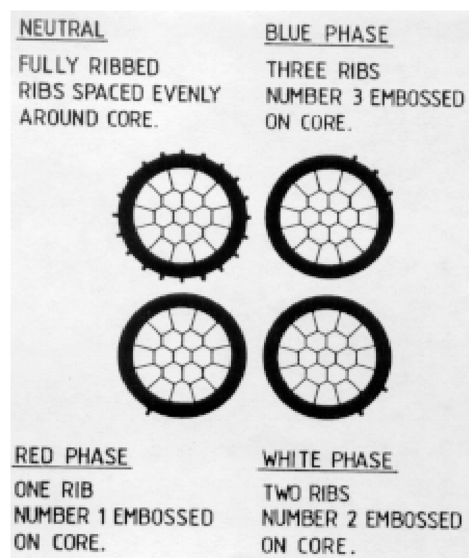
- All single insulated cables (including neutral) are kept clear of metal surfaces, especially on metal service poles as per Section 9.16.5.
- Adequate drip loops are provided, as shown in picture below, to avoid rain water running, into service fitting connection terminals and/or, down inside steel service poles or, conduits and sleeves.
- Sufficient exposed of the conductor is stripped back so the screw through the fuse fitting is clamping down on the bare conductor and **NOT the insulation**.
- Care is taken to apply proper technique when terminating conductors into the fuse fitting to avoid the screw heads from prematurely shearing off and leaving a connection that is not as tight as it should be and over time could cause overheating or a broken connection.

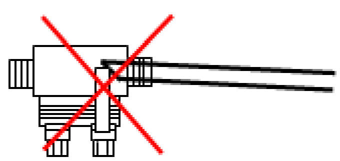


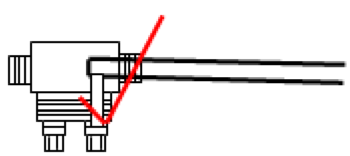
The neutral conductor of overhead open wire mains should be established by testing or tracing from a known source.

The phase(s) in Aerial Bundled Cable (ABC) are identified by a number of longitudinal, continuous raised ribs aligning with the phase identification number indicated on the core. (e.g., Phase 1 has one rib plus the number "1" applied. Phase 2 has 2 ribs plus "2" applied and so on). See the Diagram above.

The Neutral is identified by a series of longitudinal continuous raised ribs.







Neutral connector should be positioned horizontal so that no water can build up around the cable entry points. The neutral connector can be positioned on its side or with the shear heads facing down. The ends of the cable should be square otherwise if cut at an angle, an unacceptable joint may result.(i.e. the clamping screw is likely to only clamp down on a couple of strands.)

NOTE : In accordance with the LV Testing Procedure, electrical testing is required whenever new connections are made or existing connections are broken.

Therefore, Line Workers must ensure they perform the mandatory electrical tests in the **LV Testing Procedure** to confirm correct electrical compliance of the service mains (including pole bonds) and termination connections and "certifying" this work has been done correctly by filling out an EWC form (CEC form for Service Providers) before passing over to an Electrician to complete work beyond the POS and liven up the installation.

9•16•3•2 IPC Connections

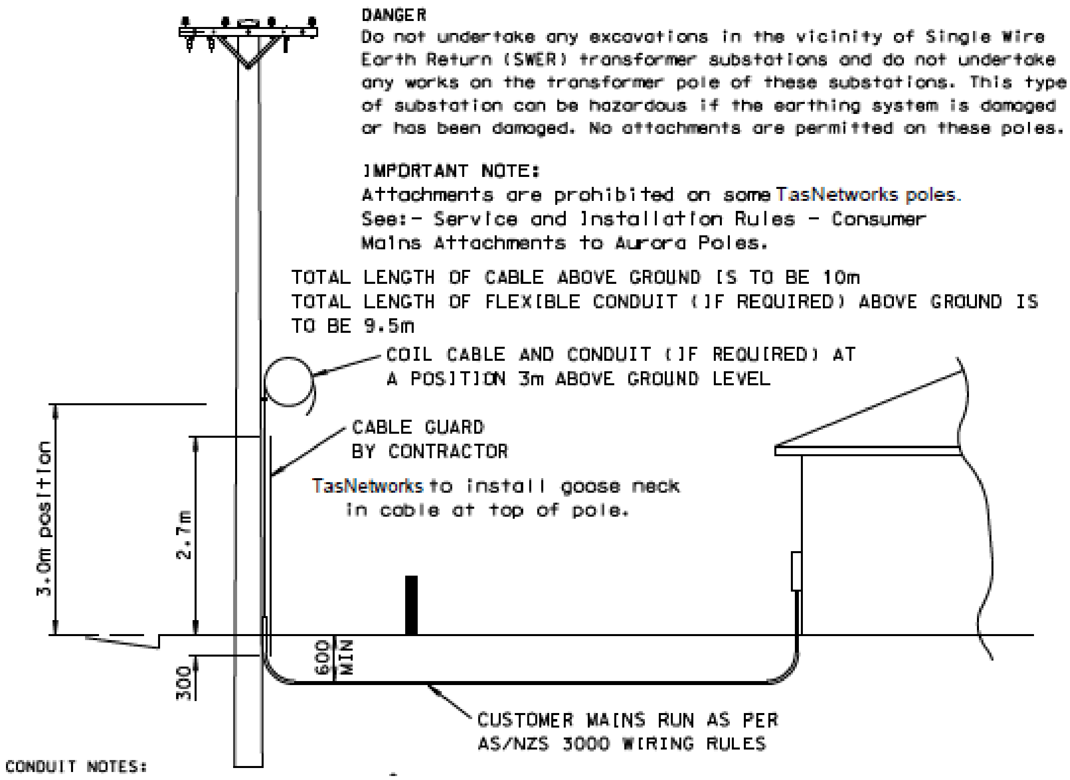
When installing IPC's connectors the shear bolts are designed to break off at a certain KN force applied using the correct tightening tool. Using an incorrect tool can cause the head to shear off prematurely result in an unsound joint.

Therefore, with shear bolts only use an approved spanner (ABC Spanner) for tightening the bolts and :-

- Adjustable spanners are not to be used as these tend to damage the plastic shear head.
- Do not exert a bending force on the shear head, because the shear head may break prematurely.
- Ensure spanner is in such a position that a sudden release cannot cause any bodily harm. The connector should be held firmly when tightening the bolt.

- Tighten the bolt of the connector until shear head releases. This ensures that the correct torque has been applied and that proper contact is achieved.
- Do a solid tug test to confirm the shear bolt has pierced into the conductor and made a sound connection.

9•16•4 Underground Service From Pole



- **Section taken from Drawing D-OH1-1.6/36**

Underground services must comply with TasNetworks :-

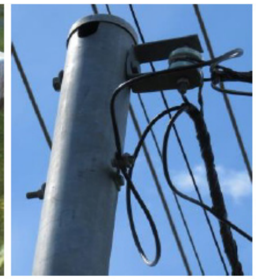
- Overhead Line Design & Construction Manual as per Section 1.4 Underground Services From Poles.
- Service & Installation Rules, Section 6 Underground (UG), Overhead Or Multiple Tenancy Connection Types.

Example of UG Cable Being Tensioned Up Ready For Connection

Example of Three Phase UG Cable Termination On Pole

9•16•5 Neutral Bond On Steel Poles

The following three (3) examples are **INCORRECT** ways of bonding the main neutral to a steel service pole.



The **CORRECT** way to bond a steel service pole is via the following method shown, which complies with **Section 1.3.4 Steel Pole Intermediate Neutral Bonding** in the Overhead Line Design Construction Manual.

The main neutral is connected straight through and, a tail is taken from the main neutral and bonded to the pole.

That way, if the bonded tail should ever come loose or break off, there will be no issue with floating voltage appearing on the steel pole to harm the public, as the main neutral is still solidly connected and is not part of the pole bond.

CORRECT - Method tail taken from main neutral to bond to the pole.

NOTE : To avoid wearing away insulation and leading to a fault over time, other than the neutral tail bond, all other single insulated cables (including the neutral) must be kept clear from the steel work and, must not be cable tied to the steel work.

The following shows a series of pictures where cables have either been cable tied to a metal surface or left hard up against a metal surface. In either situation, over time, these cables are likely to suffer abrasion from movement under windy conditions and possibly cause a fault (active to metal surface) if the insulation is worn away exposing the conductor.

Photo 1

Photo 2

Photo 3

Photo 4

Examples Of Improper Service Work That Could Cause A Fault To Occur

To avoid the above issues occurring ensure :-

- Phase conductor loops are clear of the pole steelwork and if necessary sleeve the loops to provide additional insulation.
- All steel, service poles, cross over poles and intermediate poles in the customer run have the neutral bonded to the pole except on poles used to support a meter box.
- However, If unsure of meter box being installed or meter box is for temporary building supply and will be removed later on, for safety bond the pole.

10•0 LINE WORK – PRIOR TO COMMISSIONING

Click on page No. to go to topic.

10•1 Introduction

Section 10.0 covers the next logical step after completion of construction/installation work of new Distribution Supply assets i.e. carry out all relevant electrical tests, inspections and sign offs to confirm all newly installed assets are free of fault prior to live commissioning.

10•2 Compliance To Job Requirements

This relates to work issued out via various means such as from, Design Section, Job Scheduler, Contracts Section Scope Of Work etc. in a written format.

Prior to commissioning you must check to ensure you have completed all the tasks in accordance with the planned work issued out.

10•3 Compliance To Construction Standards

All construction and electrical work must be done to requirements detailed in the relevant Standard(s) applicable.

For Line Workers, the main Standards for compliance with are :-

1. TasNetworks covering work done up to the POS as per :-
   - Overhead Construction Manual.
   - High Voltage ABC Manual.
   - Low Voltage ABC Manual.
   - Public Lighting Manual.
   - Service And Installation Rules.

2. The AS/NZS 3000 Wiring Rules and associated Standards, covering electrical work done on privately owned electrical assets beyond the POS.

10•4 Visual Inspection And Electrical Tests

To avoid the risk of electrical shock and major damage to assets, as an Electrical Practitioner you must ensure, via careful inspection (check for loose parts etc.) and, electrical tests where applicable, that all electrical apparatus you have worked on is electrically compliant and free of fault prior to energisation and commissioning.

Electrical testing shall in general comply with TasNetworks **LV Testing Procedure**,

The following are the key electrical tests that must be done where applicable.

10•4•1 Continuity Test

This test is very important to ensure that the main neutral circuit is not broken from the transformer output to the end termination, as a broken neutral could cause issues e.g. a floating neutral on a polyphase supply could cause a voltage higher than 240V that could damage customer appliances.

10•4•2 Standard Insulation Test

This test is relevant for being done on electrical apparatus and conductors (e.g. HV and LV ABC conductors) to ensure low resistance (a potential fault condition) is not found between, phases and, each phase to neutral and to earth.

10•4•3 Special Tilt Test Pole Mounted Transformers

A special Tilt Test must be conducted on pole mounted transformers as a rudimentary test to check the windings and resistance values are okay to ensure the transformer is not faulty prior to connection and energisation.

If you do not have a Tilt Tester or equivalent you can apply the resistance test in **Section 7.3 TESTING TRANSFORMERS IF NOT USING TILT TESTER** of the work practice **Pole Mounted Transformers Installation Replacement & Testing** using a standard insulation resistance tester.

10•4•4 HV And LV Earth Tests

To ensure public safety and minimise risk of damage to electrical apparatus, the correct resistance values of earths is critical to ensure protection equipment will operate and operate quickly should a fault to earth occur.

Where a HV and/or LV earth wire has been installed, it must have an earth resistance test done in accordance with the work practice **Standard Earth Tests In The Distribution System.**

10•5 Completion And Certification Of Work

10•5•1 Service Providers

NOTE : Under Contract conditions, Service Providers performing work for TasNetworks may be liable to pay for damages that have occurred after TasNetworks assets, that the Service Provider has worked on, have failed after energising and commissioning where;

It has been found that the Service Provider has not properly carried out all the relevant tests and checks required beforehand to confirm the electrical apparatus was electrically compliant and free of fault prior to hand over to TasNetworks.

Therefore it is important that Service Providers must ensure all work has been “certified” as being, electrically compliant, done to construction standard and, free of fault, prior to energisation and commissioning by filling out an Electrical Work Certification (EWC) check list (if provided or obtained from TasNetworks) or a Certificate Of Electrical Compliance (CEC) form and;

This paperwork must be provided to TasNetworks prior to any TasNetworks employees taking over responsibility to energise and commission the apparatus installed by the Service Provider.

10•5•2 TasNetworks Employees

Line Workers must fill out the relevant sections on testing and also the section covering Infrastructure Work on the Electrical Work Certification (EWC) check list and date and sign the EWC to “certify” the work is compliant and apparatus is free of fault prior to energising and commissioning.

11•0 LINEWORK - COMMISSIONING

11•1 Preparation Prior To Commissioning

11•1•1 Handover By Service Provider

IMPORTANT : To avoid possible damage to apparatus from an electrical fault, TasNetworks employees **SHALL NOT** under any circumstance connect, energise and commission electrical apparatus worked on by a Service Provider until "certification" paperwork and accompanying electrical test details have been received from the Service Provider beforehand and checked as being properly dated and signed off as being valid.

11•1•2 RADs And Operations Section Notification

Before commencing commissioning apparatus, commissioning personnel must ensure where applicable :-

1) A Request to Alter Distribution System (RADS) has been submitted through to TasNetworks, Operations Section at least 10 to 15 days prior to the intended commissioning date.

2) On the day of commissioning, the apparatus has been correctly identified and, where there is a requirement, the appropriate "Access Authority" has been issued.

11•2 Commission And Test Apparatus

11•2•1 Commissioning In Stages

The safest way to commission apparatus is to do it in stages by starting with all output circuits open. That way, should a problem or fault occur, any damage that may occur is limited to the stage being commissioned.

E.g. commissioning a pole mounted three phase transformer should be done by :-

1) Opening the HV Air Break Switch (ABS) and the LV output fuses/links and, where applicable opening all customer circuits (e.g. remove overhead service fuses).

2) Then ensure all temporary earths are removed and close on the HV supply and close the HV ABS.

3) If no fault occurs then the transformer should produce LV supply (415V phase to phase and 240V phase to neutral) to the line side of the of the LV fuses/links.

4) Then perform all relevant electrical tests and checks as per the LV Testing Procedure, and the work practice Pole Mounted Transformer Installation Replacement And Testing.

5) If the transformer is operating correctly, is on the correct voltage tapping, and the out LV values are within the correct range then;

6) The LV output fuses/links can be closed to connect through to the customer circuits but again re-check the LV output voltages are correct.

7) Finally conduct electrical testing at customer installations to the **LV Testing Procedure** and ensure;

8) Phase sequence is correct.

Apply the above principles to all other apparatus being commissioned.

The following sections contain additional commissioning requirements to the above, depending on circuit arrangement or the type of apparatus being installed.

11•2•1•1 Phasing Out

Occasionally during commissioning HV and/or LV phasing out may be required across two supplies of different origins and if so, phasing out must be done in accordance with the following work practice steps.

11•2•1•1•1 HV Phasing Out

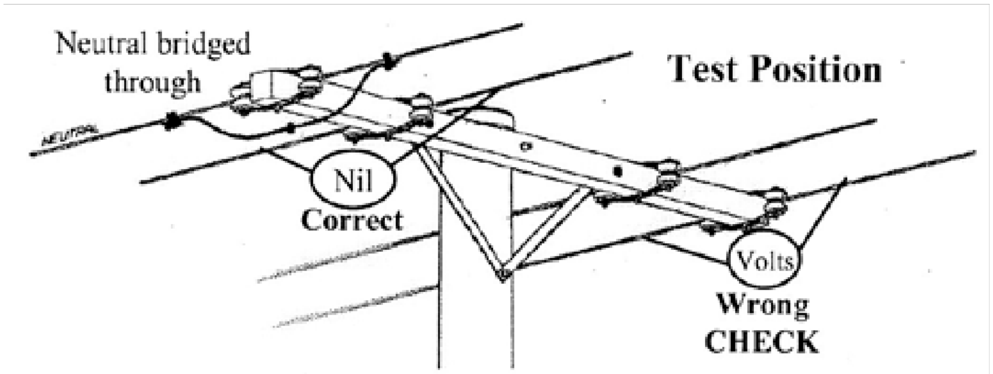
Work Practice Phasing Out Using Fameca Tester.

11•2•1•1•2 LV Phasing Out

There are times when two separate low voltage circuits need to be connected in parallel to keep supply on as a result of a faulty transformer or when a transformer may need to be replaced or upgraded.

This can be done by :-

1. Closing a set of low voltage isolators / links where circuits are already phased out.
2. Phasing out across an open point and fitting jumpers or loops across the two circuits to be paralleled.To do this :-



2.1 Identify the neutral conductor in both circuits, if not continuous.

2.2 Prove that all other conductors are alive using approved tester and Retest Tester after a zero reading.

2.3 Bridge the neutral conductors together if not already connected.

2.4 Test across phases in opposite circuits and find two corresponding phases that give a zero voltage reading.

2.5 Retest tester and if O/K connect these two phases together.

2.6 Repeat this process with remaining phases.

Special Notes:-

1. A 415 volt reading between phases of opposite circuits indicates the phases are "out of phase" and cannot be connected together.

2. A zero reading indicates they are "in phase" and can be connected together.

3. A 240 volt reading between phases of opposite circuits indicate that one phase is alive and one phase is dead.

4. It is possible, when phasing out, to get a 415 volt reading on one phase and two readings of 240 volts on the other two phases, in which case the circuits can NOT be paralleled as the transformers are "out of phase".

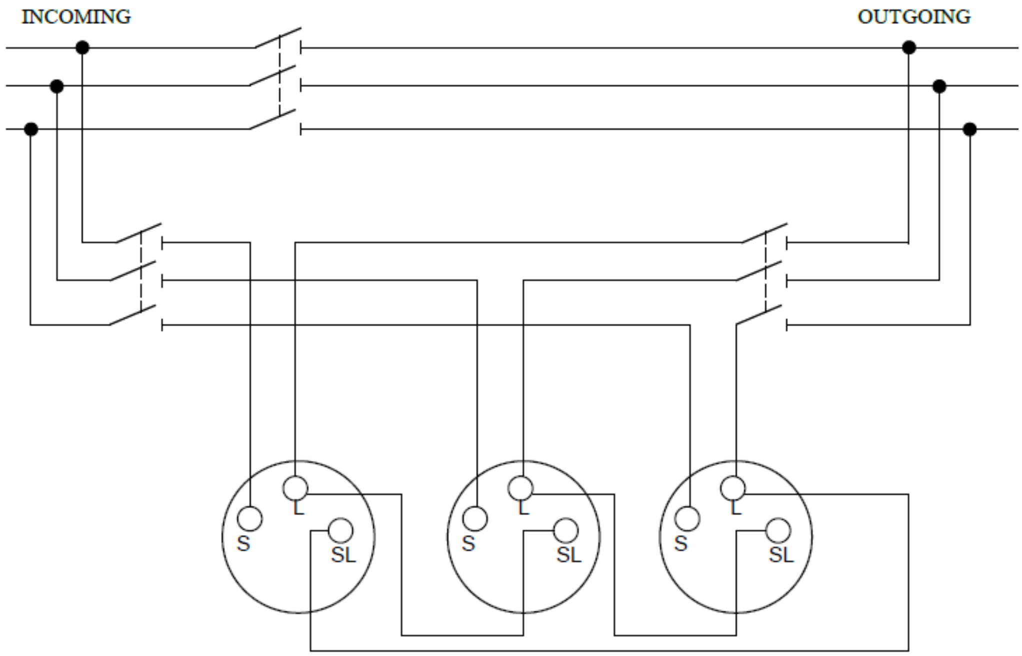
5. Do NOT assume that because "links" are fitted at "open points" that the low voltage circuits WILL phase out. ALWAYS test first, using approved testing method, to ENSURE the "phases" are correct and will parallel.

11•2•1•2 Voltage Regulators

Voltage regulators are commissioned in accordance with the following work practice procedures depending on whether the regulator is configured in closed or open delta mode.

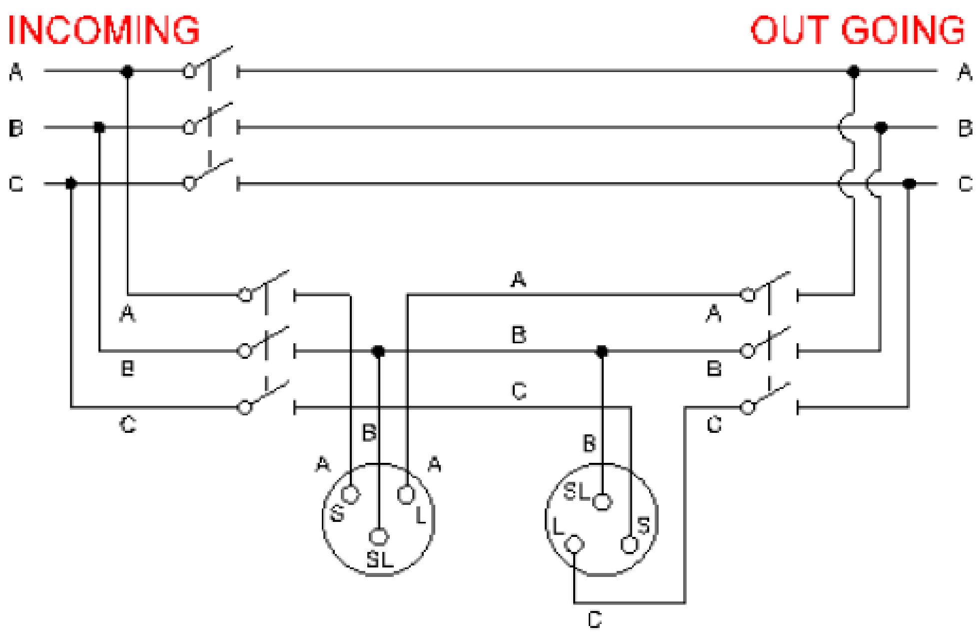
An experienced Electrical Practitioner – Electrician does the live commissioning of voltage regulators, and Line Workers are not generally required to be in attendance.

- **Commissioning Cooper Regulator In Closed Delta Mode.**



Closed Delta Mode

- **Commissioning Cooper Regulator In Open Delta Mode.**



Open Delta Mode

11•2•1•3 Reclosers, Load Break Switches & Sectionalisers

Reclosers, Load Break Switches and Sectionalisers are commissioned in accordance with the following work practice procedure :-

- Automatic Reclosers Load Break Switches And Sectionalisers.

An experienced Electrical Practitioner – Electrician does the live commissioning and, Line Workers are not generally required to be in attendance.

11•2•1•4 EDOs And Air Break Switches

Typical EDO Fuse Switch

Typical Air Break Switch

As EDOs and Air Break Switches (ABS) are mechanical devices only, there is no real complication for commissioning other than to double check, contacts are making and breaking properly, there are no loose parts and that the operating handle of the ABS travels freely without difficulty.

11•2•1•5 Test For Stray Voltage On Assets

To ensure public safety, before leaving the site, it is a good idea after completion of commissioning to do a simple test for any stray voltage that may appear on assets (e.g. voltage on steel pole neutral bond or voltage tracking through an insulator) using a LV and/or HV proximity tester.

If any stray voltage is found then trace out and fix the problem if you are able to else, make the site safe from the public (isolate or barricade) until assistance arrives to fix the problem.

11•2•1•6 Pole Earths

IMPORTANT : that distribution earths are properly installed and maintained with resistance values within approved limits so that :-

- Sufficient current will be generated under a fault condition to operate protection devices; and
- Earth faults will not cause harmful touch or step voltages that could affect public safety.

Therefore, all Electrical Practitioners must ensure electrical testing is done for all HV and LV distribution earths prior to or during commissioning in accordance with the following work practice :-

- **Standard Earth Tests In The Distribution System**

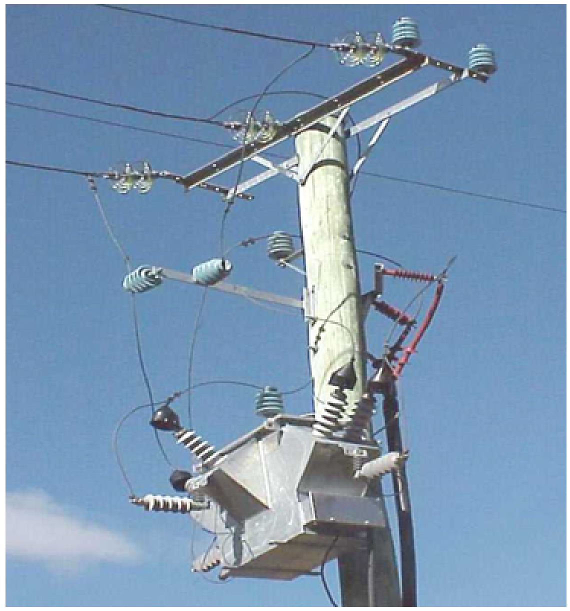
  Note : Prior to leaving the site check to ensure all earths running down a pole have a protection guard installed in accordance with work practice **Install Cover Guard Over Pole Earths**.

11•2•1•7 Transformers

Live commissioning, of pole mounted standard single and three phase transformers, split phase transformers and, SWER transformers, must be done in accordance with work practice :-

- **Pole Mounted Transformer Installation Replacement And Testing**.

11•2•1•8 Metering Transformers



Typical Pole Mounted HV Metering Unit

Due to requirements for accreditation to perform metering work and, also the potential for significant loss of revenue if metering transformers are not installed correctly, only a TasNetworks, Complex Metering Officer is permitted to perform commissioning of these transformers.

However, Line Workers may need to be present during commissioning in case there is a need to make alterations to the overhead wiring configuration if a problem is found.

11•2•1•9 Commission Customer Installations

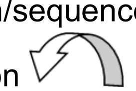
Where, a section of overhead LV distribution mains has been altered or installed as new and/or, customer services have been upgraded or installed as new, Line Workers must ensure they perform all relevant electrical tests required up to the POS (normally at the point of attachment to the consumers mains) in accordance with the LV Testing Procedure and;

Special Notes : It is the Line Workers responsibility to ensure :-

1. All electrical apparatus prior to the POS has been properly tested and is electrically compliant and free of fault prior to Handing over to Electrical Practitioner – Electricians to complete the commissioning and testing of installations from the POS onwards.

2. All steel service and cross over poles are properly bonded and electrically tested as being correct.

   NOTE: The following **Red Lesson,** covering a bonded phase conductor livening a GI steel service pole, emphasises the need to properly identifiy conductors and connections and test for live parts before and after completion of work as part of the commissioning process.

3. Phase sequence/rotation is standard for all new three phases services installed i.e. clock wise arrow shown on phase rotation/sequence tester is standard rotation , Anti-clockwise is non-standard rotation 

11•3 Certification Of Completed Work

Refer **Section 5.0 ELECTRICAL AND WORK COMPLIANCE** for full details.

After completion of commissioning, all electrical work and associated infrastructure construction and maintenance work performed on the Power Distribution System must be certified as being done to a satisfactory standard in accordance with the construction standards used and issued by TasNetworks via :-

1. TasNetworks employees filling out and signing the relevant sections covering electrical and infrastructure work in the **Electrical Work Certification (EWC) Form** and attaching this to “as built” paperwork for input into the asset management record keeping system.

2. Service Provider employees filling out a similar form provided by the Service Provider, such as a Certificate of Electrical Compliance (CEC).

   Note: A copy of this certification form must be attached to “as built” paperwork and forwarded to TasNetworks for input into the asset management record keeping system.

12•0 LINE WORK - ON EXISTING ASSETS

Click on page No. to go to topic.

12•1 Introduction

Section 12.0 covers working on existing assets which is different to working on newly installed assets for the following main reasons :-

1) Existing assets can vary in age and condition from being fairly new to aged assets where care must be taken when working on them and, there may be a need to upgrade aged assets where encountered to current standard.

2) Different minimum safety requirements may apply prior to working on existing assets, especially in regard to substandard assets such as aged conductors.

3) Compared to new installation/construction work which is done without supply being energised, there may be a need to perform work on or near live energised existing apparatus or;

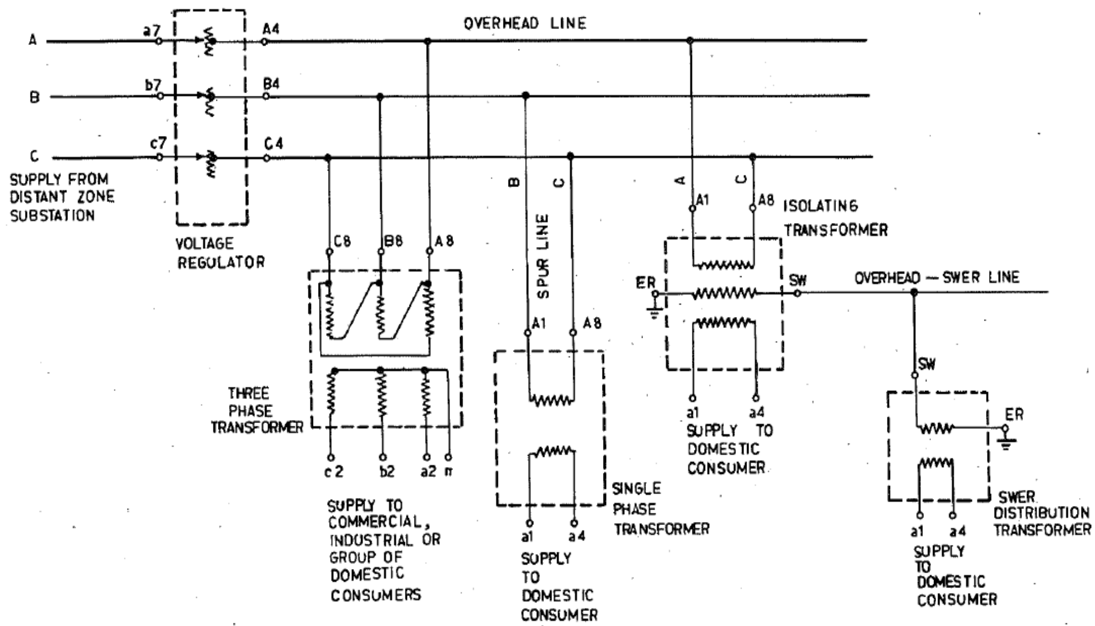
4) Special requirements must be taken to ensure the work site is properly isolated and made safe prior to commencement of work.

5) Work practice may differ when working on existing assets due to the above and also because in years gone by different fittings were used that are not used now and also, less stringent construction standards may have applied.

12•2 Power Distribution Apparatus

12•2•1 Typical Distribution Electrical Layout

The following diagram shows the typical electrical circuits and transformer apparatus that may appear in a section of existing main line in the overhead Power Distribution system.



12•2•2 Inspection Of Assets

12•2•2•1 General

Whilst it is not possible to cover off every possible maintenance or fault condition that could occur, the **Defect List Maintenance Guideline** is a handy general guide on what to look out for in regard to :-

- Being used in a risk assessment to determine if work can be done in a safe manner.
- Deterioration of assets where maintenance/repair may be required.
- Tracing out likely causes when responding to faults.

12•2•2•2 Aerial Inspection

Unless indicated otherwise, this involves inspection and also possible maintenance work at the same time via the use of helicopters as per the work practice Helicopter Elevated Line Maintenance (HELMs).

12•2•3 Working Under Or Near Live High Voltage

12•2•3•1 General Safety Requirements

CAUTION : This applies to all of the following sub sections under 12.2.1.3 :-

1) Where there is any risk that SADs to energised HV could be breached or supply apparatus suddenly failing causing a safety issue (e.g. old conductors breaking) or, you feel unsafe in performing the work;

   You must arrange through TasNetworks, Operations Section, to have the HV supply isolated and earthed prior to performing the work.

2) If a JRA, thorough inspection and implementation of safety control measures deems it safe to perform the work, as a precautionary measure, contact Operations Section to implement feeder suppression to one trip to lockout prior to commencing work.

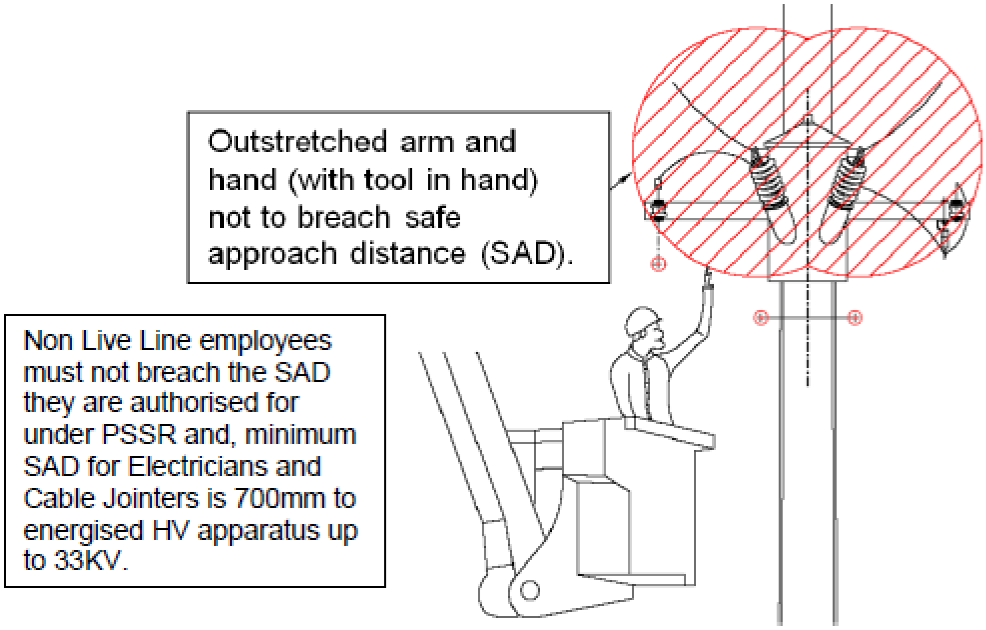
When working near to live overhead HV apparatus (includes privately owned HV apparatus) the following must be taken into account :-

1) Workers must first conduct a JRA and from that, if safe to work under live HV;

2) Must ensure the SADs they are authorised to work to will not be breached when working with tools in hand (refer following diagram) and;

3) This may require a Safety Observer to be appointed to ensure the SADs will not be breached.

4) A safety rescue kit must be opened nearby and ready to use.

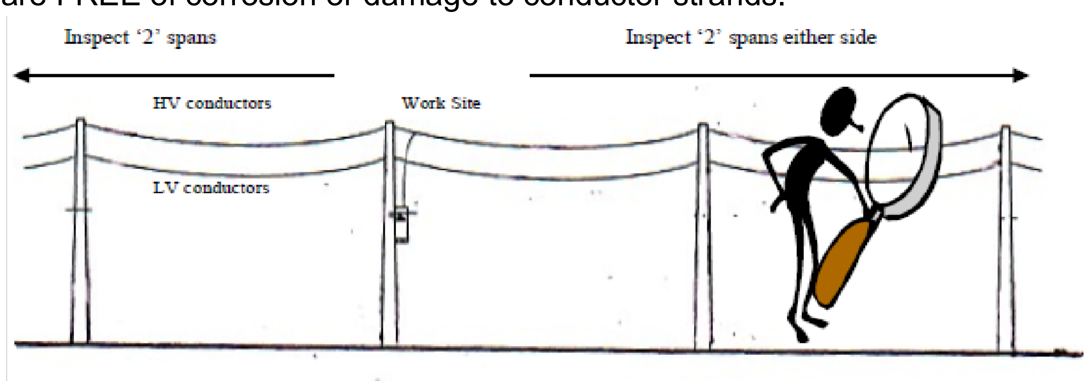


Safe Approach Distance (SAD) To Energised HV

12•2•3•2 Suspect Or Substandard HV Conductors

When required to carry out work on poles supporting older type high voltage conductors as detailed below – the conductors must be treated as "suspect" to failure if a sudden significant strain is placed on them.

To ensure these conductors are SAFE to work under – a thorough visible inspection of each conductor – up to TWO SPANS either side of the proposed work - shall be done to check they are FREE of corrosion or damage to conductor strands.



Working with suspect or substandard HV conductors shall comply with the following policy.

- **Policy On Aged Overhead Conductors**

1) **Suspect Conductors**

7/.064 Copper. 7/.093 All Aluminium. 6/1/2.50 ASCR

The “suspect” conductors shown above are NOT listed by the Network owner as “substandard” conductors. However, whilst not being “substandard” there is sufficient reason to “suspect” they could fail due to deterioration.

2) **Substandard Conductors**

No. 8 Gauge Steel. 7/.044 Copper. 7/.048 Copper.

The erection of poles through or near energised HV substandard or suspect conductors is NOT permitted

Staking of poles supporting energised No. 8 GI Steel is NOT permitted.

Work is NOT permitted at a pole position under energised HV substandard or suspect conductors where the work is likely to introduce a sudden significant increase in strain.

12•2•3•3 Likely Strain To HV Conductors

The following type of work could produce a sudden significant strain :-

- Straining of low voltage conductors.
- Tensioning of stay wires.
- Straightening of the pole.
- Mounting and removal of pole type transformers, reclosers, etc.
- Fitting of live line clamps to conductors.

The inspection of the HV conductors must be done using magnifying mirrors (or other suitable means e.g. Go Pro Camera) fitted to insulated sticks or preferably from the bucket of an Elevating Work Platform.

The conductors must be “closely” inspected along their length and especially at :-

- Tie positions on insulators.
- Conductor joint positions.
- Places where connectors are fitted.
- Near the pole where the work is to take place.

12•2•3•4 Multi Circuit HV Overhead Lines

Line workers are required from time to time to work on poles that can support multiple Feeders. In situations where these Feeders are mounted in vertical configurations on either side of the pole, it can be more hazardous to carry out work on a Feeder on one side of the pole if the Feeder on the opposite side remains ALIVE.

If the work can be performed from OUTSIDE the line from the bucket of an Elevating Work Platform (EWP) it may be safe enough to work on that Feeder under “Access” conditions with the other Feeder still alive, PROVIDING minimum approach distances to the LIVE Feeder can be maintained.

In situations where a pole cannot be accessed from an EWP and it will be necessary to CLIMB the pole, BOTH Feeders will need to be isolated and earthed with access to the Feeder to be worked on done under Access Authority conditions. For additional information refer to TasNetworks, Power System Safety Rules.

The alternative is for the work to be done by Live Line personnel working under Live Line conditions. For additional information refer to the Live Line Handbook for Distribution Network.

12•2•3•5 Install Pole Through/Near Live HV Conductors

Poles may be erected through, or in close proximity to, live high voltage conductors but only with a Pole Hole Borer Erector unit and in accordance with Work Practice Instruction, **Erecting Poles Through Or Near Live High Voltage Conductors** which :-

- Addresses the process and equipment to be used.
- Lists the specific requirements for Distribution Line Workers as distinct from Live Line Workers and the variations applicable to both.

A MINIMUM of four (4) competent persons are required to install a pole through live HV conductors at all times regardless of the method used.

CAUTION :-

- Poles other than wood poles shall not be erected close to live high voltage conductors EXCEPT by Live Line personnel using live line techniques.
- The erection of poles through live high voltage conductors shall not be attempted in wet or foggy weather or gusty wind conditions.
- The work site and equipment shall be adequately prepared in accordance with the relevant “Instructions”.

- Every precaution must be taken to ensure that no person comes into direct contact with the pole or crane, during erection, other than the Operator once the pole head has reached the proximity of the live conductors.

- In addition to the above mentioned safety precautions, the following more general directions must be adhered to :-

    - Clear warning must be given to all personnel that the HV conductors are alive.

    - The pole hole should be so prepared as to allow the pole butt to move into the hole smoothly without obstruction.

    - A Safety Observer shall be nominated to oversee the job. This person shall watch the movements of pole, vehicle, etc. and will direct the crane operator and guy rope attendants as the pole is erected.

    - The Safety Observer must not be diverted to other work whilst acting in this capacity.

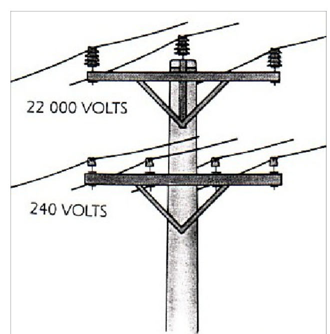
    - No person shall touch either the pole or crane while the pole is being erected until such time as the pole is vertical and stationary, clear of H.V conductors and held secure. The only way to turn the pole, to align the cross arm, is by a wooden handled cant hook. The cant hook operator is to wear H.V operating gloves.

    - **<u>Note</u>**. When a pole is to be installed by a Live Line crew using Live Line techniques the Live Line personnel shall control the pole erection and the Safety Observer shall be a Live Line Worker.

12•2•3•6 LV Under HV Overhead Lines

When working with LV voltage conductors under live High Voltage conductors the following operational requirements shall be carried out :

- Prior to commencing work, the leader of the work party running the LV conductors shall liaise with the Distribution Operating Authority and arrange for the "protection devices" on the HV Feeder, where the LV conductors are to be run, to be "SET" for that type of work.



22 000 and 240 volt distribution lines.

- **CAUTION** : Care, via suitable control measures being implemented, must be taken to ensure conductors or being, installed, released or removed do not whip up anywhere along the overhead circuit and inadvertently contact energised overhead HV. Refer to the Section on **Cutting Away & Releasing Conductors** for guidance on this.

- After the LV conductors have been run and the work is finished, the leader of the work party shall again liaise with TasNetworks, Operating Section and arrange for the "protection devices" to be "RESET" to normal.

- **Note**: The leader of the work party running the LV conductors must immediately notify the Distribution Operating Authority of any incident, such as contact with the live HV, which may cause the feeder to be accidentally tripped, interrupting the power supply.

- Any low voltage / high voltage "contact" MUST be reported and then thoroughly investigated.

12•2•4 Working On Or Near Live Low Voltage

12•2•4•1 General

Work on or near live Low Voltage (LV) apparatus shall comply with the safety principles in the **Live Low Voltage Work Manual** and, in this regard :-

1) For safety, first preference is to work on or near LV apparatus with supply de-energised and/or isolated but;

2) Where it may be difficult and/or impractical to de-energise and/or isolate LV supply then the work can be done under live LV conditions as a last resort provided that :-

   (a) **The Live LV Decision Making Process** has been complied with and from that;

   (b) The work can be done under live LV conditions as a permitted task under **Section 4.3.3 Live Task List** in the Live Low Voltage Manual and subject to;

   (c) To full compliance to a work practice. if listed for the task in Section 4.3.3.

3) Where the Live LV Work Manual does not allow a task to be done under live LV conditions, the supply must be de-energised and/or isolated from all possible sources, as per section **8.10 Isolation Of LV Supply** before the work can be done.

   Note: If satisfactory de-energisation and/or isolation is not achievable to avoid supply becoming inadvertantly energised then live LV work methods must be used to provide adequated protection.

The only exception to 3) above is if an exemption is approved after seeking approval under Section 5.0 Live LV Exemption Process in the **Live Low Voltage Work Manual**.

Only persons who have been appropriately trained for the work to be carried out and are qualified in accordance with TasNetworks, **Live Low Voltage Work Manual** are permitted to work on or in close proximity to LIVE Low Voltage exposed conductors and apparatus.

They shall be correctly dressed in approved clothing with sleeves to wrist length and trousers to ankle length. They shall wear, an approved safety helmet, safety footwear and, low voltage insulated gloves inspected and **sound condition** prior to use.

Safety glasses shall be worn when making / breaking electrical connections or working with hard drawn conductors.

When assessing and mitigating the risk persons shall comply with the following :-

1) The safety principles contained in TasNetworks, **Live Low Voltage Work Manual**.

3) TasNetworks **PPE Procedure**.

4) TasNetworks **Apprentice Supervision Standard**.

5) Adequate insulating barriers, such as line mats, must be used to cover all conductors and conductive material within reach and;

   This could include stay wires, street light brackets and other steel components, especially on steel and stobie poles. This **Blue Lesson** shows how a live insulator tie wire contacted the steel side of a stobie pole because inadequate insulating material was used to prevent contact.

6) Conduct a sound JRA and implement safety control measures and;

7) Ensure a Safety Observer or Assistant is nearby to check SADs will not be breached by plant/machinery and persons and;

8) The relevant rescue kit is close by open and ready to use e.g. for **Pole Top Rescue**.

12•2•4•2 Work On Live LV Using A Ladder

"8" Important Activities for Work on Live L.V. Using a Ladder	
(1) **Make a Safety Assessment.**	• Ensure job can be done safely alive. • Identify hazards & control strategies. • Ensure all necessary equipment is available. • Test each pole for "soundness". • Check condition of safety belt, ladder, etc.
(2) **Arrange for Assistant with Pole Top Rescue Kit.**	• Ensure assistant is current in P/T rescue procedures. • Position Rescue Kit at base of ladder.
(3) **Wear Approved LV Gloves.**	• Ensure gloves are in **sound condition**, and put on before leaving the ground and worn correctly.
(4) **Fasten Safety Belt.**	• Do this immediately upon reaching top of ladder. • Ensure safety belt lanyard is fastened correctly.
(5) **Tie the Ladder.**	• Have assistant foot ladder until it is tied off.
(6) **Tie the Handline.**	• Position handline in readily accessible position.
(7) **Cover all Conductors within Reach.**	• Use insulated mats or sleeves as required. • Position & re-position as required.
(8) **Prove there is NO 2nd Point of Contact.**	• Make visual check first. • Conduct test for live parts (e.g. use volt stick)

ALL crew members should know WHAT is to be done and HOW it will be done.

Employees shall ensure there are adequate insulated covers (mats and / or sleeves) for the job and they are in good condition. Covers may need to be secured so they cannot be dislodged or blow off conductors.

Poles shall be checked for "soundness" prior to climbing or working on them.

If in **any doubt** the pole shall be supported **before** commencing work.

A pole top rescue kit shall be positioned at the base of the ladder.

Ladders, when used, shall be positioned to provide the safest and most suitable working position. Ladders shall be held secure or firmly tied off to prevent them falling or moving, causing an employee to lose their balance or possibly fall.

When Working From a Ladder :-

- Climb the ladder, stop just below the bare low voltage conductors and secure safety belt / harness. Remain BELOW the low voltage conductors until you have applied the mats or sleeves to the wires you must pass between.

- Tie ladder, secure handline and then pull up the required rubber mats and sleeves.

  Note. If your ladder passes between the live conductors, cover the conductors BEFORE you pass between them to tie the ladder.

- Position mats and / or sleeves on all conductors within REACH "except" the one to be worked on.

- Move into a safe comfortable working position for the work to be done and re-attach safety belt / harness. A good position when working on low voltage conductors is about waist height level with conductors. This will depend on the type of work to be performed.

- Cover all remaining conductors and conductive material within reach – except the one to be worked on. This could include stay wires, street light brackets and other steel components, especially on steel poles.

  Conductors within reach are those you can touch without special effort.

- Move any mats from the conductor you are to work on and place in a convenient position.

- Check for any inadvertent "contact" with some part of an earthed pole or some other conducting material by testing for live parts (e.g. use volt stick). Keep clear of all conductive material.

12•2•4•3 Work On Live LV Using EWP

- Perform all safety checks and set the EWP up in accordance with standing instructions.

- Inspect safety harness, put it on and adjust it correctly. Attach safety lanyard to harness and anchorage point in EWP bucket.

- Manoeuvre bucket into position avoiding contact between live LV and any non-insulated part of the EWP.

- Maintain Safe Approach Distances (SAD) and Safe Work Loads (SWL).

- Cover all conductors and conductive material within reach – except the one to be worked on. This could include stay wires, street light brackets and other steel components, especially on steel poles.

- *Conductors within reach are those you can touch without special effort*.

- Move any mats from the conductor you are to work on and place in a convenient position.

- Check for any inadvertent "contact" with some part of an earthed pole or some other conducting material by testing for live parts (e.g. use volt stick).

When working on LIVE LV conductors – remember the following :-

- Think about "where" you are.
- Never wave your arms about.
- Never make sudden unexpected moves.
- It's Alive.
- Alter mats if you change position or work on different conductor.
- Never reach over a conductor before "covering" it with an insulated mat.
- Always check for 2nd. points of contact BEFORE grabbing live wire(s).
- Never hold onto a live wire while passing something to someone else.
- Never hold onto a live wire while putting hand into tool bag, etc.
- Always use insulated jumper when making / breaking loops on live LV.
- Always "disconnect" phase(s) first and then neutral last.
- Always "connect" neutral first and then phase(s) next.
- Steel or steel and concrete poles are "conductive" and should be "covered" within reach. Keep toes back clear of metal poles.
- Don't allow bare live conductor to "contact" metal components on pole.
- Don't use metal measuring tapes.

<u>Note</u> :-

- If there is a need for the ground assistant to temporarily leave the site, descend to a position BELOW and clear of the low voltage conductors.

- Only re-ascend once the "assistant" has returned to the site and can safely observe you working.
- When work is finished – leave rubber mats in place, descend to a work position below conductors, then remove mats and lower to the ground.

12•2•4•4 Install Pole Through Live LV Conductors

By taking adequate precautions, poles may be erected quite safely in the vicinity of live low voltage conductors.

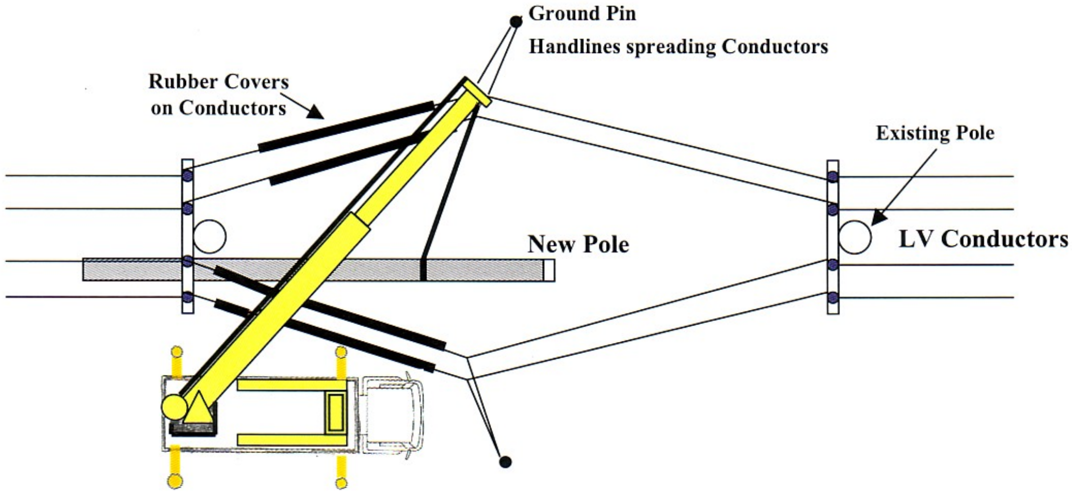
Contact with live conductors, during lifting, should be avoided by :-

- Proper planning of the erection process.
- Spreading of the conductors by pulling and holding with dry ropes.
- Covering the conductors or pole with protective insulating covers.

WARNING. If the metal work or wire rope of the crane makes contact with a live wire, the whole vehicle may become "energised". AVOID TOUCHING THE CRANE VEHICLE, WHILE STANDING ON THE GROUND, DURING POLE ERECTION

In all cases where the crane jib or wire rope could approach within 600mm of live uninsulated conductors or 200mm where they are insulated - there must be a Safety Observer continuously on the alert to ensure that NO part of the crane or winch rope approaches closer than 300mm (or 100mm respectively) to the live Low Voltage conductors.

REMEMBER. The crane jib can rise, once the pole touches the bottom of the hole and the weight comes off the winch rope.



Crane Erecting New Pole Through Low Voltage Conductors

The Diagram above shows how the conductors are spread to allow for the erection of the pole.

If erecting steel or steel and concrete poles, additional insulating covers would be required on the conductors and maybe in some cases on the pole to provide adequate protection against live “contact”.

By the correct use of protective covers and handlines spreading conductors, it is quite safe to erect poles through live low voltage conductors even with cross arm assemblies, etc. attached to the pole.
Note. Attachments to the pole, such as : cross arms, pole steps, etc. must be decided in each case according to local on-site conditions.

REMEMBER :

Position the crane and the pole as shown in Diagram on previous page.

Note. Crane jib (boom) may go under or over LV conductors depending on size of crane, size and position of pole, location of conductors, etc.

Place sufficient approved insulating covers over the conductors, as required.

Use a separate good quality, dry rope for spreading each conductor.

Always spread the outside conductors first and anchor securely, then;

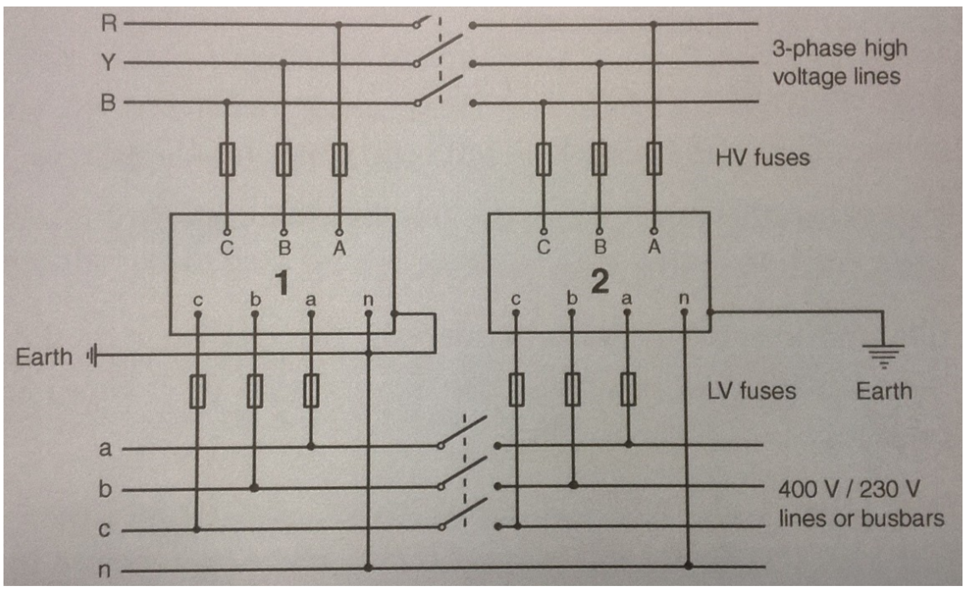
Spread the inside conductors last and secure them. Ensure they do not make contact with any other conductors, or crane, while doing this.

Keep the pole under observation during erection when spreading or releasing conductors and;

ALWAYS do it slowly and with care to prevent them swinging and making subsequent contact. Inadvertent contact will cause clashing – with molten metal particles and possibly live conductors falling to the ground.

12•2•5 Paralleling Circuits

12•2•5•1 Connecting Two Transformers In Parallel



Example diagram showing two transformers connected in parallel

Although the power distribution system when operating normally is designed to only have a single transformer feeding supply to customers, in some situations, such as providing alternative supply due to a fault in a feeder or transformer the above configuration allows for :-

1) Two transformers to be connected in parallel to be able to supply the total load.

2) Line Workers to understand how, where the option is available, alternative switching can be put in place to temporarily supply load to customers affected by a faulty transformer from another operating transformer (providing it can cater for the additional load) whilst the faulty transformer gets replaced.

3) As an example, in the above diagram if Transformer 1 on the left was faulty you would remove it's LV fuses, ensure the HV supply is isolated as shown and then close the LV tie switch connecting output from Transformer 2 through to the customer load.

12•2•5•2 Paralleling HV Feeders

Paralleling of Distribution feeders fall into three categories :-

1. Paralleling sections of the same feeder.
2. Paralleling feeders originating at the same substation busbar(s).
3. Paralleling of feeders originating at different substations or different supply transformers.

Feeders are usually paralleled for the purpose of transferring or sharing load.

Earth fault protection systems may see current imbalance between phases as an earth fault while feeder parallels are being made or broken, or while feeders are connected in parallel, and hence cause a Circuit Breaker or line Recloser to operate.

The earth fault relay may need to be switched "out of service" during the parallel process.

When feeders originate from different sources, or from separate supply transformers, high circulating currents could occur. To minimise these currents the feeder voltages at the two substations or transformers should be adjusted to the same value and the tap changers at both substations or transformers are to be switched to manual control for the duration of the parallel.

One or more voltage regulating transformers may be installed along the route of a HV feeder. During the parallel of such feeders the voltage regulators should be switched to manual control.

Auto-reclose facilities shall be switched off during paralleling operations.

This is achieved by setting reclosers to "one trip to lock-out" or switching the protection "OFF".

Care must also be exercised when paralleling feeders, to ensure that phasing is correct. Making or breaking the parallel with a single phase switching device may cause tripping and should be avoided when possible.

General precautions to be taken when paralleling two feeders where a Recloser or Regulator is installed are as follows :-

(i) At the Recloser :-

1. By-Pass the recloser
2. Switch off the recloser protection to prevent tripping due to imbalance.
3. Through load should be limited to prevent tripping on overload.
   Tripping current = 2 x coil rating.

(ii) At the Regulator :-

1. Set to “manual” operation.
2. If the supply direction is reversed set tap changer to the neutral tap.

Note. After restoring the feeder to normal, protection devices must bereturned to their original settings.

12•2•6 Aged Assets

The following are key items to cover off when working on or near aged distribution assets. Outside this, comply with any special requirements that may apply for each asset item detailed in Section 12.0.

Note : Aged LV servicing apparatus and conductors is covered under **Section 12.3 Apparatus Beyond Distribution Supply Mains**.

12•2•6•1 General Asset Inspection

Any major defects with aged assets should have been picked up via the Asset Inspector during routine inspections. However, in case anything has been missed you should do a general inspection when on site to check for any defects and report these to, the Fault Centre if an obvious safety or urgent situation or, to your Regional Asset Manager or Team Leader for follow up for less important defects that should be fixed.

Use the following documents that contain example pictures of defects to look out for and what level of severity the defects are rated at as a guide on what needs to be done to fix the problem found.

- **Overhead Defect Photo Manual.**
- **Distribution Asset Inspection Manual (Reportable Defects Section).**
- For LV Servicing apparatus **Non-Compliant Installations**.

12•2•6•2 HV Conductors

Prior to working on or near old HV conductors care must be taken to thoroughly inspect for any signs of wear and tear, such as broken or damaged strands and corrosion etc., that that might cause a safety issue and;

The **NN R AM 06 Policy On Substandard HV Distribtuion Conductors** must be complied with when working with aged HV conductors, especially if they are still energised, as excessive strain could cause a conductor to suddenly break and fall down.

Note :-

There has been a failure of the split bolts used on the Live Line clamps. These have been either stripping or jumping threads before a sufficient connection could be made onto the tap conductor. Therefore, comply with the Blue Lesson on this and replace with the Cabac split bolt shown – S.I. 14-53-04.

12•2•6•3 LV Distribution Mains Conductors

Prior to working on or near aged LV distribution mains conductors, especially if they are still energised, care must be taken to perform a thorough inspections for such things as, corrosion, damaged or broken strands, suspect joints and, signs of arcing marks from conductor clash on long spans that may :-

1) Be potential safety risk (e.g. high chance conductor might break) where controls need to be put in place to mitigate against this.
2) Be a potential fire hazard risk (.e.g. conductors clashing).
3) Not be an immediate risk now (e.g. worn conductor) but may be a longer term risk.

Where old distribution mains conductor needs to be replaced then the new LV should be LV ABC but;

If LV ABC is not suitable then the standard LV conductor choice is AAC 7/4.50 and to a lesser extent AAC 7/3.75.

There may be small pockets of old copper mains conductor installed such as, 7/0.44 (8mm equivalent), 7/0.48 (10mm equivalent) and 7/0.64). After doing a thorough inspection of these conductors and no obvious defects are found and the conductor is in good condition, then it is okay to put back up.

12•2•6•4 LV ABC Distribution Mains

If you you notice a low span of LV ABC distribution mains the cause may be a faulty suspension clamp failure so check this out and replace with the current approved clamp.

Older style clamp Older style clamp with failure Current clamp with reinforce

12•2•6•5 Uninsulated Stays Under HV Conductors

A shown in Fig. (a) and Fig. (b) below you may encounter some HV stays correctly fitted an insulating disc and some that have not.

However, regardless of an insulating disc being fitted or not, to be on the safe side to guard against the possibility of HV tracking down the pole (e.g. from a cracked insulator pin); onto the stay;

Always test the stay to check for stray voltage using a suitable proximity tester (e.g. modiewark) prior to touching and;

If stray voltage is found ensure you make safe and fix the problem if you can else report this to the Fault centre for immediate follow up.

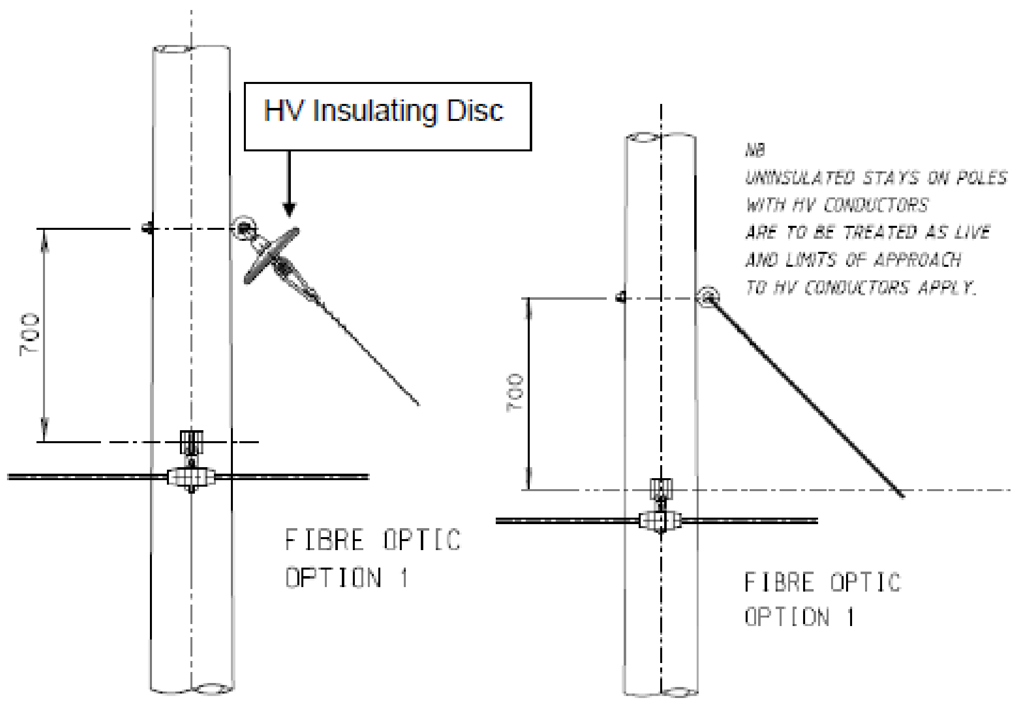


Fig. (a) Insulated Stay   Fig. (b) Uninsulated Stay

12•2•6•6 Air Break Switches

The following shown below are Air Breaks Switches where the HV porcelain insulators have deteriorated with age from ingress of moisture causing possible cracks which, if bad enough, could cause any of the following problems :-

1) The conductor can fall causing a phase to phase short, or phase to earth.

2) The conductor can drop and come in contact with an uninsulated body part of a line worker.

3) Porcelain fragments from the insulator can fall from the ABS into the work area below causing a risk to anyone working on the pole/ drop zone.

Therefore, no Live Line work shall be performed on or near ABB, S Series or Stanger, USB air break switches (see below) including but not necessarily limited to the following activities:-

1) The replacement of the ABS unit;
2) Transformer replacements; and
3) Staking of poles on which the ABS is mounted.

ABB, S Series air break switch

Stanger, USB air break switch

Live line work may be performed on older type and Morlynn/Stanger units (see below), provided a detailed visual inspection is performed prior to live line work.

Older type air break switch

Morlynn/Stanger air break switch

With respect to the operation of an air break switch, all air break switches must be operated in accordance with the flow chart on the next page, and work practice **Safe Operation Of Suspect Air Break Switches**.

All switches must have a detailed visual inspection performed prior to operation. If no cracks are found in this detailed inspection, ABB, S Series or Stanger, USB air break switches must be operated using one of the approved methods described in the safe work practice.

"Older type" and Morlynn/Stanger units may be operated from a ladder using the mid pole handle.

If cracks are identified in an air break switch as a part of planned work, do not proceed with the work and contact Operations and your Team Leader immediately.
Note: All AK Power SBS airbreak switches have had an operational restriction placed upon them; they must receive corrective maintenance prior to operation due to a flash over safety risk. Network Operations is managing the 'Restricted Operation List' to ensure safe switching in the network.

Corrective maintenance involves the tightening of the interphase clamp bolts and checking that the circlip under the swiveling insulator is seated correctly.

Figure 1: Typical AK Power air break switch

Refer to the Red Alert for full details.

12•2•7 Poles

First option, where practical to do so, shall be to work from an EWP bucket when working on poles.

12•2•7•1 Securing Of Poles Prior To Work

The need to secure poles when renewing conductors can vary almost with every job and the method required could vary from pole to pole depending whether remaining conductors were under tension or not.

Each pole would, therefore, need to be considered on its own merits and a decision made as to the actual method applied at the time.

12•2•7•1•1 Pole Top Forces

When a conductor is being moved and the tensions are increasing or decreasing this is a dynamic load. Dynamic loads can impart larger or unexpected loads and because of this less predictable loading the pole must be secured when undertaking these activities.

When a conductor is being lifted into a temporary line fixture vertically the load is unknown and so the pole needs to be secured. Once the conductor is secured in the fixture the load is no longer dynamic and it is static. When the load is static the pole/ system can be treated as predictable and controlled and back within the intended design limits therefore the securing method, for example a proline can be disengaged from the pole, whilst the replacement pole is stood/positioned.

The change in loads from the original conductor position to the new position in the fixture must not materially increase or decrease conductor tensions, otherwise a tip load calculation will be required by a designer:

- For instance lifting conductors vertically will not materially increase the loads on the pole.
- Slight horizontal movements will not materially affect the loads for an intermediate pole.
- When moving angle pole conductors onto fixtures, the tension should remain the same as original tensions that is;
- if tensions will increase put some slack into the conductor and vice versa.

A risk assessment should be conducted prior to removing the securing method to stand the replacement pole, depending on site specific circumstances. If work become unsafe then stop work and assess the situation. The pole may require securing.

An example of how the above would work practically:

1) Condemned pole.
2) Secure the condemned pole with a proline.
3) Move conductors into temporary fixtures to make room for standing the replacement pole.
4) Once conductors are in temporary fixtures the loads are static.
5) Disengage proline.
6) Stand replacement pole.
7) Secure the condemned pole to the replacement pole.
8) Transfer conductors to the new pole.
9) Remove condemned pole.

Also, when replacing poles, care must be taken to consider the age and structural integrity of the pole (e.g. condemned or impaired pole) and pole top forces (e.g. sudden release of conductors) that could cause a pole to break or fall over or cross arms under tension to suddenly break off. Therefore, the following shall be adhered to :-

- **Compliance Communication - Management Of PoleTop Forces.**
- **Safe Access To Pole Tops Decision Flow Chart**
- Section 12.2.2.1.5 Condemned Poles

In additon, no one shall apply excessive force or lean anything against the pole (e.g. a ladder) or use the pole as a support (e.g. climb on cross arm or use a pole chair) until a thorough job risk assessment is carried out in accordance with the above compliance documents that includes testing the structural integrity of the pole.

12•2•7•1•2 Use Crane

Refer **Section 7.6.3 Cranes**.

12•2•7•1•3 Temporary Staying

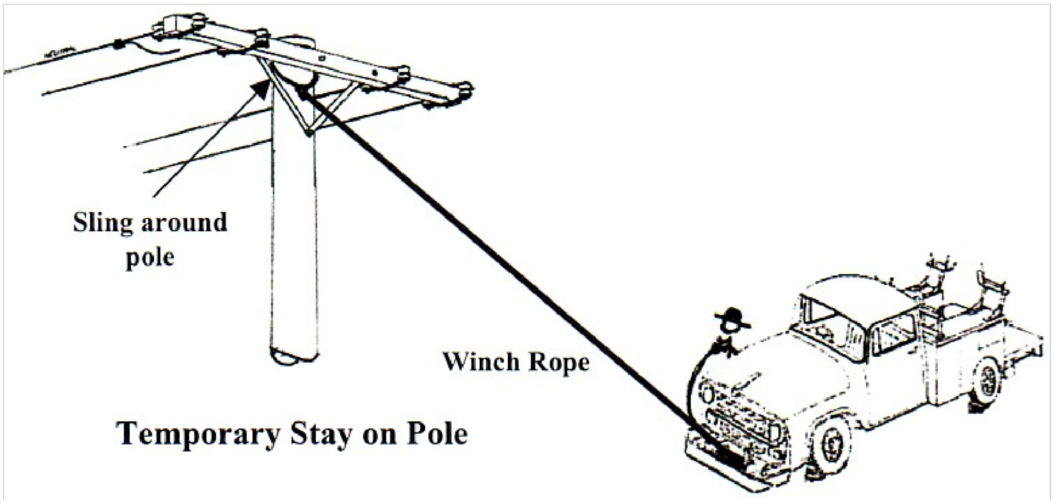
- **9.11 Staying Of Poles**.
- **9.11.6 General Work Principles For Stays**.

There are times when a pole needs to be stayed temporarily, due to :-

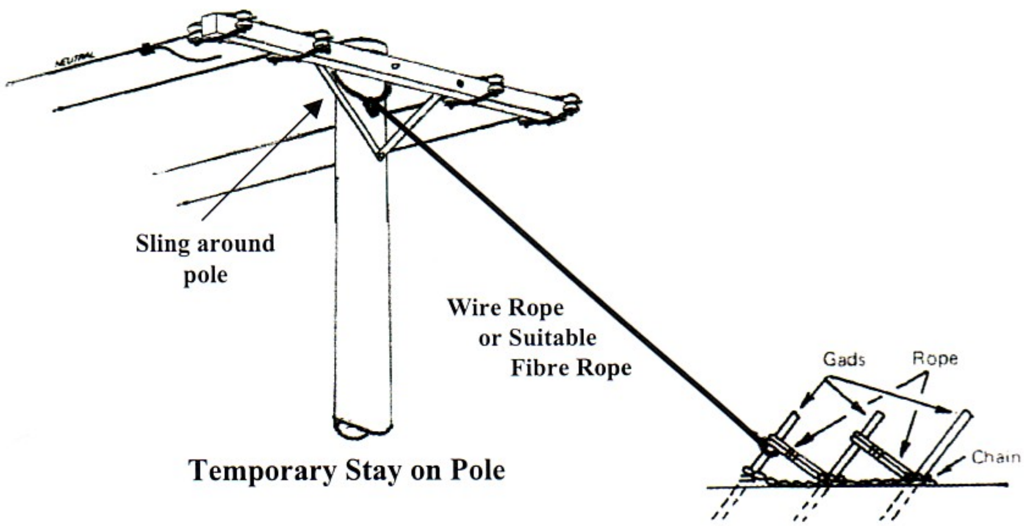
- The need to “secure” a pole prior to climbing it.
- Releasing or temporarily removing conductors from one (1) side.
- Renewing conductors.
- Supporting a condemned pole with new pole prior to changing it over.

1) **Releasing or temporarily removing conductors from one side**.

   A temporary stay must be attached to the pole BEFORE conductors are released / removed from one side of pole. See the next two (2) Diagrams.



In the situation on the previous page, a terylene "sling" is placed around the pole and attached to the winch rope or temporary stay via a Dee shackle.



The temporary stay can be :-

- A winch rope from a vehicle mounted winch as shown above.
- A wire rope fitted with an "eye" both ends and attached to a vehicle or temporary ground anchor consisting of gads roped together as shown above.
- A suitable fibre rope attached as above.

CAUTION : All poles where overhead conductors (in tension) are to be temporarily removed from one side of the pole – SHALL have a temporary stay installed that is capable of fully supporting the remaining conductor tension on the opposite side of the pole.

1) **Renewing Conductors**

The need to support poles when renewing conductors can vary almost with every job and the method required could vary from pole to pole depending whether remaining conductors were under tension or not.

Each pole would, therefore, need to be considered on its own merits and a decision made as to the actual method applied at the time.

Supporting a condemned pole with a new pole prior to changing it over.

Existing poles often need to be replaced with new poles. Where the old pole is “suspect” or condemned and CAN’T be replaced immediately, a new pole is installed beside it and the old pole made secure by supporting it with the new pole.

12•2•7•1•4 Steel Rail Poles

Steel rail poles have been installed in the past as service poles and for private low voltage lines. This steel rail is no longer approved for use as poles - but it could be some time before existing poles of this nature disappear completely from the system and, therefore, must be treated with consideration and care.

Whilst a check is made by an Asset Inspector for rust, corrosion or obvious defects, there is no portable method of checking for metal fatigue.

Therefore, the following precautions are to be taken with these poles :

- Hold them secure with a crane vehicle, when required to work on them.
- If crane is not available, position an EWP near the pole and work from the bucket of the EWP.
- If not possible to use an EWP – de-energise conductors and drop them down off adjacent pole / building and completely remove steel rail pole.
- **Note**. These same precautions are essential for after hours work as well as during normal working hours.
- **CAUTION : Do NOT climb old steel rail poles – they could break off and fall.**

12•2•7•1•5 Condemned Poles

Condemned poles have very poor structural integrity and are marked with a cross (X) ready to be removed from service.

Condemned pole marked with X

Existing poles often need to be replaced with new poles. Where the old pole is "suspect" or condemned and CAN'T be replaced immediately, a new pole is installed beside it and the old pole made secure by supporting it with the new pole.

Any activity that increases or decreases the conductor tension will change the pole top forces. Therefore, when working on a condemned pole it must be secured whilst pole top forces are being changed.

If working adjacent to a condemned pole (not on the condemned pole itself) the following is still permitted without supporting the adjacent pole:-

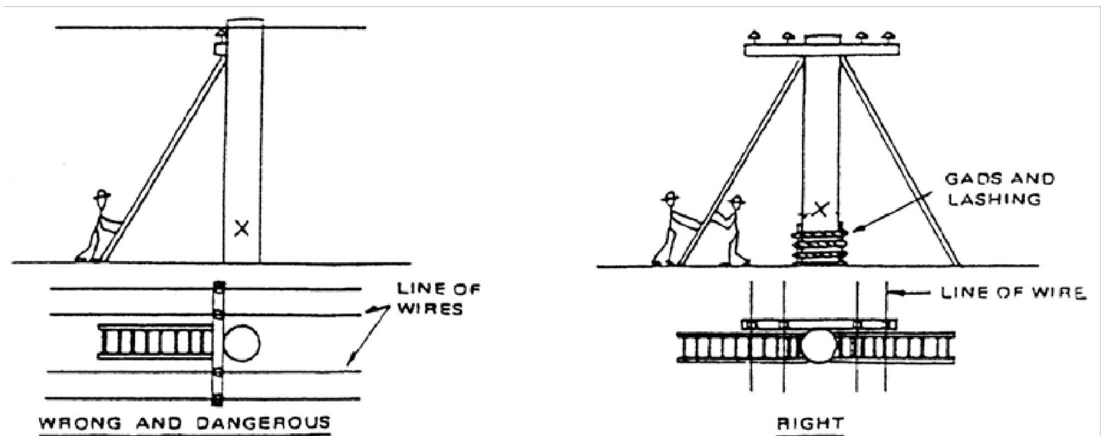
- Vertical conductor lifts onto temporary raiser live line instruments (approx. 0.5m).
- Horizontal conductor movement to maximum of 0.3m for intermediate poles. E.g. moving a conductor onto a temporary pin to replace an insulator.

Allowed options for supporting and replacing a condemned pole are contained in the field work guideline **Replace Condemned Poles.**

12•2•7•1•6 Use Steel Gads And Ladders

A pole can be made secure by :-

- Firstly driving three steel gads into the ground equally spaced around and against the bottom of the pole, then firmly lashing the pole and gads together using a good hand line as shown in diagram below.
- Then you extend a ladder up against the pole, underneath the cross arm on the opposite side of the pole to the side you intend placing your climbing ladder. This will act as a brace against the weight of the person climbing.
- Then position your climbing ladder up under the cross arm. The pole should now be braced in four directions - by the two erected ladders and the existing overhead conductors which can act as stays.



Carefully climb the ladder and tie three, or four, guy ropes around the top of the pole and use them to guy the pole in three, or four, different directions.

Note: The above diagram shows the wrong and right way of climbing a condemned pole. The correct way is with the ladders extended up the pole on each side at right angles to the conductors.

Tie the ladders at the pole top.

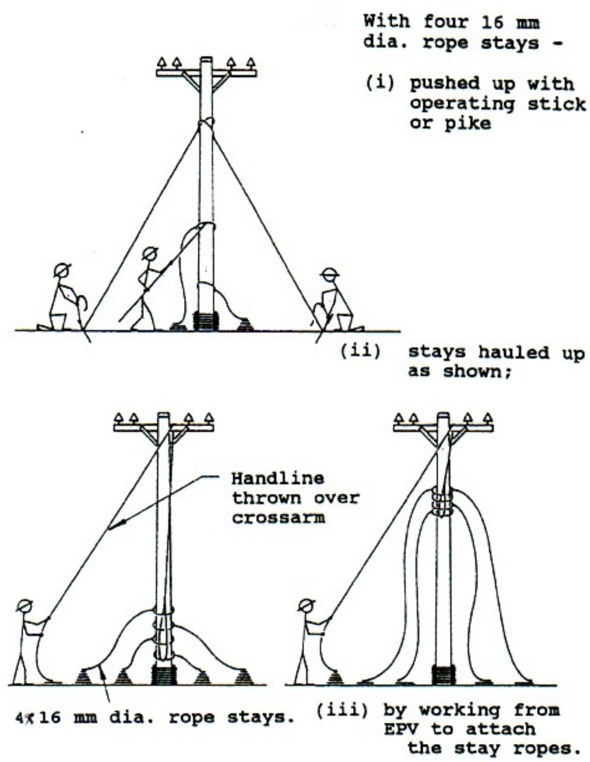
Care should be taken when placing the ladders to avoid the cross arm straps, particularly on a pole with only one cross arm.
Always use ladders that are long enough to reach right up under the cross arm(s), otherwise they may not be effective in fully bracing the pole.

12•2•7•1•7 Other Methods To Secure Pole

Another way to secure a pole top, after the bottom has been secured in the usual way, is to tie three or four guy ropes around the pole, at a convenient height above ground, and push them up the pole using an operating stick or pole pike as shown in Diagram below.

Alternatively, throw a handline over the cross arm and pull the guy ropes up the pole OR use an EWP to fix the guy ropes to the pole top.

Tie the guy ropes to ground pins driven into the ground (120 degrees apart for three guys or 90 degrees apart for four guys). Take up the weight simultaneously on all guy ropes and tie them off securely.



A simpler, preferred method would be to use a crane vehicle, if available, to hold the suspect pole using the winch rope. A sling or chain is placed around the pole connected to the winch rope, pushed up the pole and then held while the weight is taken on the winch. The winch rope must be above the centre of gravity of the pole in case it breaks off.

Should the new pole be erected close to the condemned pole, it would not be necessary to climb the old pole until it had been securely lashed to the new pole. It would be better to work off the new pole and NOT climb the old pole.

When lashing a condemned pole to a new pole, always work from the new pole and NOT from the old pole. Avoid climbing a condemned pole wherever possible.

Note. Always support a condemned, or suspect, pole with a crane wherever practicable.

12•2•7•2 Checklist For Pole Replacement

1) What is the size and strength of the existing pole?.
   - Size - check disk, measure height.
   - Strength rating - check disk.
2) What circuits are attached?
   - HV, LV & services
3) What are the ground clearances of the circuits on the existing pole?.
   - Measure mid span and where crossing roads or driveways.
4) If the pole change over is like for like, will the new pole with a deeper sinking depth maintain conductor clearance heights?. In this regard;
5) Refer to Section 9.3.2 Confirm Correct Hole Diameter And Depth as a guide on soil conditions and to what depth the type of pole to be used must be sunk down to and if still undecided;
6) Contact a Distribution Designer or, Regional Asset Manager for the region if you foresee clearance problems with the pole replacement.
7) You must ensure all redundant left over equipment and metal scraps and wire cut offs etc. are removed from site – to avoid any trip injury to the public and costly damage to machinery e.g. vegetation slasher contacting left over scrap wire buried in grass.

12•2•7•3 Impaired poles

12•2•7•3•1 General

These are poles marked with a single slash, as shown below, to be staked to extend service life as per work standard Staking Poles.

Poles marked for staking are those that are found to be structurally weak at the base but, are marked with a single red slash as suitable for staking to extend their service life.

Pole marked with red slash

Staked Pole

12•2•7•3•2 Impaired Pole Next To Pole To Be Replaced

Where an impaired pole, not yet staked, is next to another pole marked for replacement (e.g a condemned pole) the impaired pole must not be replaced. Instead, the impaired pole can either be staked before the condemned pole is replaced or it can be secured using an approved method.

12•2•7•4 Functional Failure Pole

These are poles that are not marked as “Condemned with an X” or “Impaired with a slash /” (unless still failing despite staking) but have failed inspection from an Asset Inspector for any of the following reasons, and require remedial action which may require replacement of the pole.

List of functional failures:-

1) **<u>Leaning Poles</u>** :-

- High ID disc indicating pole had not been installed deep enough in the first place.
- If already staked but failing in some way.
- If lean greater than the Asset Inspection limit allowed.

Note: When working on or adjacent to a leaning pole a sound risk assessment, taking in the following considerations, must be done beforehand to determine if the pole needs to be supported.

- Height of ID disc.
- Soil condition.
- Signs of erosion.
- Has pole footing been undermined e.g. soil removed because of road widening ?.
- Is the pole supported?
- Is the pole overloaded?
- Check stay footings.
- Angle and tension of conductors and what effect this may have on pole top forces.

2) **Split Pole Heads** :-

- Excluding 7 day or less defects
- **Note**: prior to working on the pole the split must be 'secured' by the use of a ratchet strap to stop the split propagating.

When dealing with split pole heads consider the following :-

- Are the bolts pulling through?
- If the bolt pulled through what would happen?
- Will securing with a ratchet strap materially secure the bolt? Or is it too far gone?
- Ratchet strap the pole head but also look at securing the crossarms or/and stays temporarily if in doubt. Take pressure off bolts in doubt.

3) **Poles With Barrel Checks** :-

These are poles found with splits/cracks in the body of the pole as shown by the following example.

Barrel check

12•2•7•5 Unassisted Pole Failures

The definition of an 'Unassisted Pole Failure' is :-

- The failure of a utility pole that cannot be attributed to third party cause.

E.g. Unassisted Pole Failure

An unassisted pole failure is therefore not a failure caused by a vehicle impact, a change of pole top forces (conductor failure) or fire damaged.

Unassisted pole failures are of high importance as findings from the investigation (such as the root cause of the failure) may elude to unknown safety risks in the Power Network that may need urgent attention.

<u>'Unassisted Pole Failure' Process</u> - Comply with WP **<u>Dealing With Unassisted Pole Failure</u>** and in particular :-

1. Pole failure is reported to Fault Centre whom dispatch a Fault Crew to site.
2. Fault Crew identify that it is an 'Unassisted Pole Failure' and report back to the SBO and/or Team Leader and Fault Centre.
3. SBO and/or Team Leader engages Senior Asset Inspector (when appropriate) to undertake a Pole Failed in Service report on the failed pole.
4. Fault Crew recover the failed pole (including the pole butt if possible) and : -
   a. Deliver the pole to designated depot and provide easy access for Asset Inspector.
   b. Clearly tag the pole with a 'UF' (Unassisted Failure)
5. Senior Asset Inspector then completes a Pole Failed In Service report (when appropriate) and forwards onto Field Engineering Inbox (field.engineering@tasnetworks.com.au).

12•2•7•6 Steel Poles

The Steel Pole Identification Document can be used as a guide to identify the different types of steel poles used.

12•2•7•7 Private Poles

Private power poles may not be maintained as well as TasNetworks owned power poles and therefore structural integrity may not be sound, particularly pine poles. Therefore, in addition to performing a risk assessment, the following compliance communication must be adhered in regard to access to pine poles.

Compliance Communication - Access To Electrical Equipment Attached To Pole Top.

12•2•7•8 Impregnated Poles

Impregnated poles are treated with Copper Chrome Arsenate (CCA) preservative. The preservative chemicals are locked into the timber in an insoluble form and can only be released if the timber is burned.

The fumes released from burning CCA treated timber should NOT be inhaled.

Should these fumes be inhaled in such volume to cause nausea or a feeling of sickness – contact the Poisons Information Centre and get prompt medical advice.

CCA treated timber should not be burned in barbecues, stoves or fire places, nor should it be left / used where children would play and could pick up splinters as this may allow an injection of arsenic.

When CCA treated poles have been removed from the distribution system - DO NOT LEAVE THEM LYING ABOUT INDEFINITELY – as they could be cut up for use by persons unaware of the hazards involved in burning the CCA treated timber.

ALL SECOND HAND CCA TREATED POLES and POLE PIECES SHALL BE RETURNED TO THE NOMINATED DEPOT(S) FOR PICK UP AND RECYCLING BY AN APPROVED CONTRACTOR.

The Contractor shall dispose of them in an agreed manner. The person or persons obtaining these pole sections shall sign an approved Indemnity Form, see Sample on next page, which stipulates what they can and can't do with the timber pole sections.

Sample Only.

Indemnity Form for Disposal of Second Hand Poles

I/We…………………………………………………………………………………
…………………………………………………………………………………………
…………………………………………………………………………………………
…………………………………………………………………………………………

IN CONSIDERATION of TasNetworks Pty Ltd agreeing to sell and /or donate surplus poles no longer fit for services in the electricity supply industry, and being aware that the use of such poles shall not include structural purposes or for use as a combustible material e.g., firewood.

THIS IS THEREFORE to release, discharge and Indemnify TasNetworks Pty Ltd, its employees and agents against all and any liability arising out of, or consequential to, damage or injury arising from the collection, transport, unloading or use of such items.

Name (please print)……………………………………………………………
Address………………………………………………………………..…………..
Signature…………………………………………………………………………

12•2•7•9 Straightening Poles

Poles are considered to be leaning too far and need straightening if the pole leans by more than four top widths from the vertical.

Poles to be straightened are usually those that Asset Inspectors have reported as needing straightening.

Poles must be straightened in accordance with the work practice **Pole Maintenance (Straightening)**

12•2•7•10 Removing/Replacing Poles

12•2•7•10•1 General

There are various reasons why poles are removed; these include :-

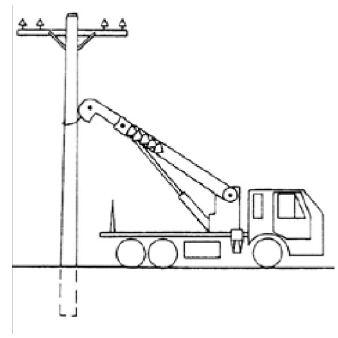
- Replacement due to deterioration.
- Replacement by a larger pole.
- Replacement due to redesign of roadways, etc.
- Pole no longer required.

In the first case, more care is required than in the last three, because the strength of a deteriorating pole is always suspect.

When removing a pole - it must be lowered, under full control, until it reaches the ground or is stowed on the transporting vehicle. An uncontrolled, falling pole can cause serious injury to persons, damage to property, etc., particularly in populated areas.

Note : A pole shall NOT be lowered using only the “jaws” on the boom of the Pole Hole Borer Erector unit.

Poles shall be lowered via the crane hook attached to a sling, or chain, around the pole.



There are three ways in which poles can be removed :-

- Removal of complete pole, including the butt.
- Removal of pole leaving butt in the ground.
- Removal of pole in sections.

It is preferable to remove the complete pole - as a butt left in the ground can limit the space available for future pole replacements, be an obstruction for cabling or pipework and in some situations look unsightly.

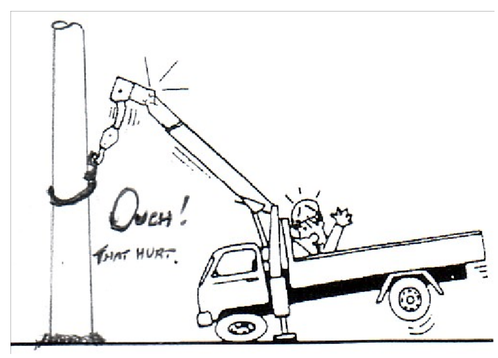
12•2•7•10•2 Safe Use Of Crane And Pole Jack

Poles shall be extracted by a Crane in conjunction with a Pole Jack.

The crane manufacturer states that, “when a crane is to be used for extracting a pole from its hole in the ground the operation must always be done in conjunction with an approved pole extraction jack.

The “force” necessary to BREAK a pole FREE of the ground can extend to many Tonnes and is not readily known.

Therefore every care must be exercised when attempting to pull poles out of the ground and, where there is any resistance a pole jack must be used in preference to trying to loosen a pole using a crane as;



Pushing backwards and forwards with a crane boom and slew mechanism can and most likely will cause expensive damage to the crane and perhaps also to other apparatus as shown in the following safety incident that occurred during 2016.

"*While removing a condemned pole that had been replaced using live line practices, the slew gear failed on borer erecter unit allowing pole and boom to slew left uncontrollably contacting live low voltage conductor which caused the live High voltage conductor above to clash mid span causing a loss of power to approx. 500 customers including the Eastland's Shopping Centre for 20 minutes.*

The transformer controlling the LV was isolated and power was restored to the main feeder whilst the 33 customers off the transformer remained isolated until boom and pole could be safely removed by another proline. The final customer was re -energised 1hr after the incident."

The purpose of the crane is only to support the pole and take its freely suspended weight.

The above incident emphasises the point that the purpose of the jack is to provide all the force necessary to break the pole free of the hole and;

As shown in the above incident, failure to use the jack will damage the crane and could necessitate expensive repairs.

12•2•7•10•3 Using PHBE And Jack

Removal of a pole is basically the reverse of erection, but there are the additional constraints as follows :-

1) The operator must be careful not to exceed the lifting capacity of the Pole Hole Borer Erector (PHBE) crane.

   In this regard the maximum force available from a typical PHBE unit is about 5.0 tonne after allowing for the weight of the pole.

   The safe working load of a typical winch rope on these vehicles is around 3.5 to 4.0 tonne. These values are easily exceeded even when pulling out a non-concreted in pole.

2) The Safe Working Load (SWL) of a PHBE unit fully extended can be as low as 0.5 tonne. It would be safer to break up the ground or dig out around the pole before attempting to lift the pole.

3) Resistance to lifting, caused by friction of the pole foundation, WILL be well in excess of the weight of the pole.

4) With hydraulic equipment, by-pass valves are usually set to prevent overload, but this limiting device is not available on mechanically driven equipment.

5) The pole's point of balance cannot be accurately determined until the pole is out of the ground. Therefore, the winch rope should be attached to the pole as high as practicable for initial lift.

6) If the pole has deteriorated, there is always the risk of it breaking off.

To remove a complete pole :-

1) Support the pole with a crane.

2) Ensure the lifting sling is above the balance point of the pole but low enough to allow the butt to clear the ground.

3) Use a mechanical or hydraulic pole jack with a chain bound around the pole.

4) Jack the butt out of the ground while the crane supports the pole.

5) The jack makes the initial movement of the pole and the crane completes the pull.

12•2•7•10•4 Using An Excavator

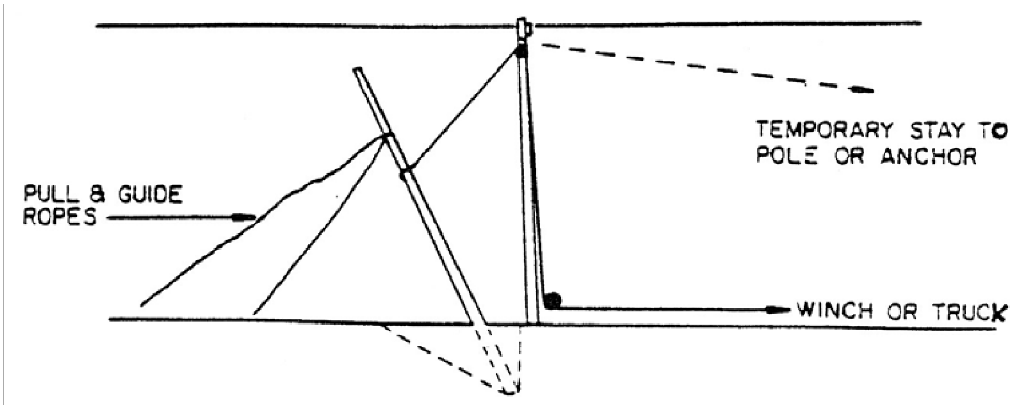
Where a PHBE cannot be used (e.g. in rough terrain), and an Excavator is used by an Authorised Service Provider working for TasNetworks, the safe work principles and relevant work method in the following SWMS must be complied with.

SWMS Install, Remove, Straighten, Power Pole With Excavator.

12•2•7•10•5 Using Manual Method

Another method, if a crane is NOT available or access is NOT possible even for an excavator, is to remove the old pole manually, by digging out one side of the pole, similar to digging a hole for manual erection, and lowering it down with ropes. See diagram below.

Whilst this particular method may rarely ever be used it is an option when all else fails, especially when the entire pole needs to be recovered.



The various ropes are used to :-

- Pull on the pole.
- Control sideways movement of the pole.
- Lower the pole and prevent it from FREE falling.

Snatch blocks are attached top and bottom of existing “sound” pole with suitable wire rope running through them as shown in diagram above.

Note. New pole, snatch blocks and rope must be of adequate strength to lift and then lower the old pole.

Other ropes are attached to pull and guide the pole down safely. Everyone should stay well clear of the pole when lowering.

At no time shall any person be within falling distance of the pole being lowered.

12•2•7•10•6 Leave Butt In Ground

The procedure is similar to that for removing the complete pole except that the point of balance will be higher up the pole because the weight of the butt will be REMOVED. Hence the lifting sling must be positioned accordingly.

As the butt will be left in the ground :-

- Dig out sufficient earth from around the pole to allow it to be cut off below ground level.

- Scrape the soil off the side of the pole to prevent damage to the cutting tool.

- Ensure the pole is held securely by the crane and cut the pole off.
- Carefully lower pole to ground.
- Backfill the hole and tamp down.

12•2•7•10•7 Removal Of Pole In Sections

There are times when it is necessary, or convenient, to remove a pole in sections.

There are also occasions when it is necessary to remove the top of a pole, sometimes referred to as "heading" a pole, in order to clear overhead conductors so they can be re-energised.

In this situation - the pole is sawn off in successive short lengths from the top of the pole, down to the height required, and lowered, not dropped, to the ground.

The preferred and easiest method is for an Operator, working from an EWP bucket, to cut the pole off in SMALL manageable size sections and bring, or lower, them to the ground.

Refer to work practice **Operating Chainsaws** for full details on cutting and removing a pole.

The 'heading' or 'topping' of poles can be carried out provided :-

- The pole to be removed is not through or near live H.V conductors.
- Any live L.V conductors in the vicinity are 'rubbered' up.
- The operator has an EWP platform that is secure and of adequate size.
- The chainsaw and all other equipment can be handled easily and safely at the pole top.
- All equipment and pole sections can be raised or lowered safely.
- There is a competent person available to render assistance.
- The operator has been properly trained for the work.
- Any chainsaw to be used for pole topping must be :-
  - Lightweight, small and easily managed at the pole top.
  - Easy to start, handle, and stop at the pole top.
  - Fitted with a cutting bar that is longer than the diameter of the pole section to be cut.
  - Fitted with a drive mechanism that stops the cutting chain immediately the throttle is released or the chain brake is applied.

CAUTION :-

- It is important that pole sections only be cut off in manageable size pieces so as to prevent personal injury or loss of control.
- Never overload the EWP bucket with pole sections as this can cause structural failures to occur which may result in personal injury.

12•2•7•10•8 Disposing Of Poles

All poles removed from service should be disposed of thoughtfully and in accordance with your local Responsibility Centre requirements.

Poles must not be left lying about where people and animals can trip over them or vehicles run into them. They should be picked up and returned to the Depot for proper disposal.

Pressure impregnated poles must never be burned and should be disposed of in accordance with **Section 12.2.7.8 Impregnated Poles**.

12•2•7•10•9 Re-use Of Second Hand Recovered Poles

Poles that have been in use and have been recovered must not be re-used until such time as they have been properly inspected or tested and proven to be in a good, sound condition. Even then, there are strict requirements for reuse of the pole in our network system.

All recovered poles should have the original ground line clearly marked and when re-installed, must not be set deeper than the original depth.

Recovered poles (over 10 years old) must not be re-used as supports in our overhead lines and newer poles only after a thorough test has proven them to be "sound".

Recovered poles (over 15 years old) are not to be re-used as supports for any private overhead line.

Condemned poles must not be re-used for poles under any circumstances.

The removal of the butt or deteriorated section of a condemned pole designed to leave a shortened pole for re-use is not permitted.

The butt of a "sound" pole is not to be cut off to produce the required pole length. Any excess length is to be removed from the top of the pole and the pole recapped.

12•2•8 Affixed Assets

12•2•8•1 Cross Arms

12•2•8•1•1 Aged Cross Arms

When working with existing assets old wooden cross arms encountered may have been installed for many years and deteriorated to an extent that care must be taken when working with them. The following pictures show the impaired state that some old cross arms may deteriorate to over time.

Cross arm end split – loose insulator pin Old rotten cross arm moss covered.

Suspect cross arm end & broken platform rail Splintered end of cross arm

12•2•8•1•2 Replacing Cross Arms

CAUTION : When replacing cross arms, especially old deteriorated cross arms with conductors connected at an angle to the cross arm, care must be taken to ensure insulator pins and ties don't suddenly give way and release the conductor(s) without warning.

Therefore, when working aloft, ensure you are always on the side opposite to where the conductor(s) would suddenly release to.

A safe way to replace old cross arms is to mount a temporary cross arm to lift, support and take the strain of the conductors, leaving the old cross arm free to be easily removed and replaced. Refer to Section 12.2.14 Temporary Support Of Conductors for full details on all the options available for use of a temporary cross arm.

Example Of V Type Temporary Cross Arm Being Used

12•2•8•1•3 LV Services Attached To Cross Arm

When replacing any cross arm with an LV service attached to it, you must comply with the requirements under Section 12.3.1 LV Services which may require and upgrade of the service if the height is too low or if the service is substandard or any associated fittings are substandard and;

You may also be required, under NECF requirements, to provide proper notification to affected customers prior to isolating supply to perform the work.

12•2•8•1•4 Low Voltage Fibreglass Reinforced Plastic (FRP) Cross Arms

MK1 Fibreglass cross arm installed on a stobie pole

Full details on how to correctly use and install LV Fibreglass Reinforced Plastic Cross Arms are contained in work practice Fibreglass Cross Arms Handling And Use.The following is a summary of the key points.

Low voltage fibreglass cross arms are a direct replacement for low voltage wooden cross arms. It is the intent to progressively use fibreglass cross arms in all applications where wooden cross arms have previously been used.

The main benefits of using FRP cross arms are :-

- Lower overall cost as cross arms will last the lifetime of the pole.
- Half the weight of wooden cross arms.

The FRP cross arms can be damaged during transport and so care must be taken to use packing material where the arm may be resting on something abrasive. If the cross arm is damaged refer Section 7.1 of **"Fibreglass Cross Arms – Handling and Use Work Practice"** for the acceptable limits of damage.

The cross arms come predrilled from the supplier with TasNetworks specified existing hole placements and hole sizes. **FRP cross arms cannot be sawn or drilled.** Modifications in this manner can significantly reduce the strength of the cross arms. The mounting system used on LV fuses and links will pierce the underside of the cross arms and so cannot be used currently (September 2017).

If FRP cross arms are found to be broken and fibres are exposed then gloves must be worn when handling.

Fibreglass cross arms are fitted with internal blocks at each pre-drilled hole, this stops the fibreglass cross arm from being crushed. This allows the use of all types of impact drivers, electronic and hydraulic.

12•2•8•2 Single Wire Earth Return (SWER)

In rural areas when distances between customers are large and the load small, a traditional method of supply has been a system known as Single Wire Earth Return (SWER). As its name implies, this system uses only one HV conductor and utilises the "ground" as a return conductor. It is less costly than conventional construction but its use is limited to areas of light load.

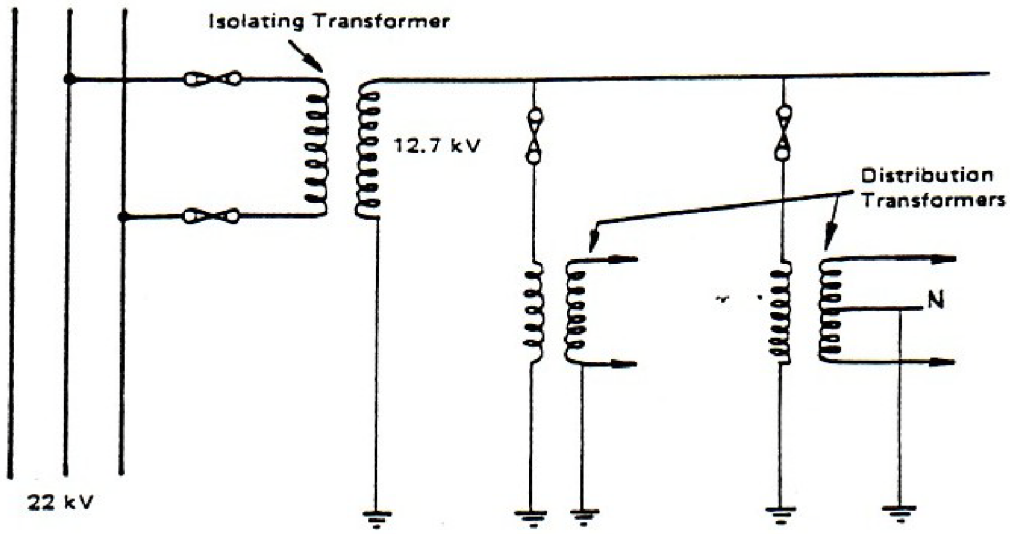


Diagram Example of a SWER System.

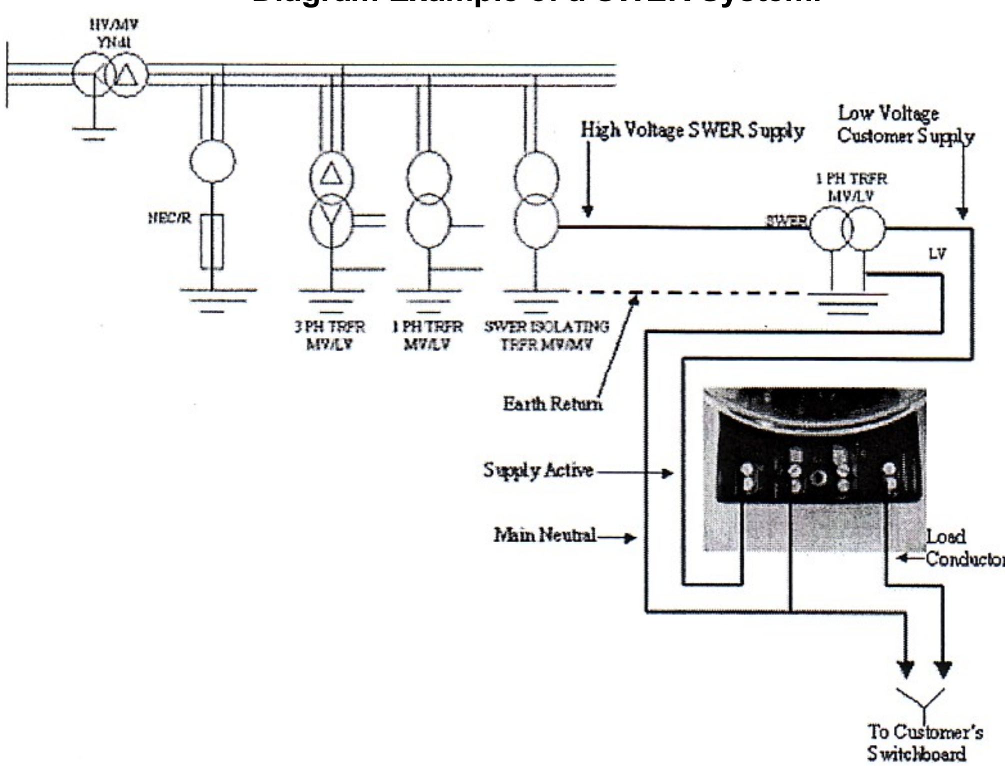


Diagram Example Of LV Customer Connection To SWER System

The installation of a SWER system is governed by regulations laid down by the Telecommunications Authority and details of each installation must be submitted to them for approval before any work is carried out.

The Telecommunications Authority "Regulations" are aimed at protecting their telecommunication system from interference caused by the Earth Return currents.

12•2•8•2•1 Safe Approach To SWER Test

As there is no neutral in a SWER System and the return path is the earth, if there is an issue with a poor earth connection there is the possibility of harmful voltage appearing at ground level.

Therefore, it is important to test, as per the following work practice, for safe approach before working on or near any SWER structure during live commissioning or maintenance or fault work.

Safe Approach Testing Of SWER Structures

12•2•8•2•2 Isolation Of SWER System Apparatus

No SWER apparatus cannot be worked on until :-

- The HV supply has been isolated and;
- A test for energised is conducted to confirm the SWER assets have been de-energised and isolated prior to working on the apparatus.

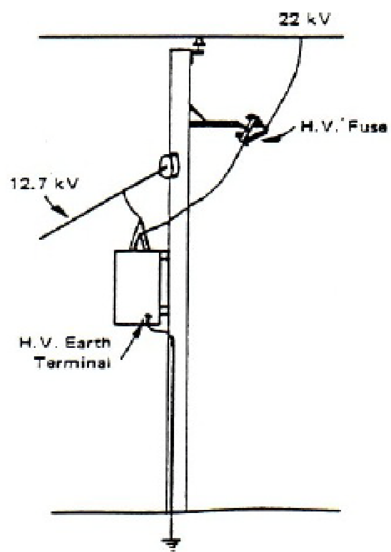
The above requirement to de-energise and isolate also applies to persons qualified as a Live Line Worker. The reason is no HV live line suppression protection is available on SWER lines to trip off the HV should inadvertent contact be made.

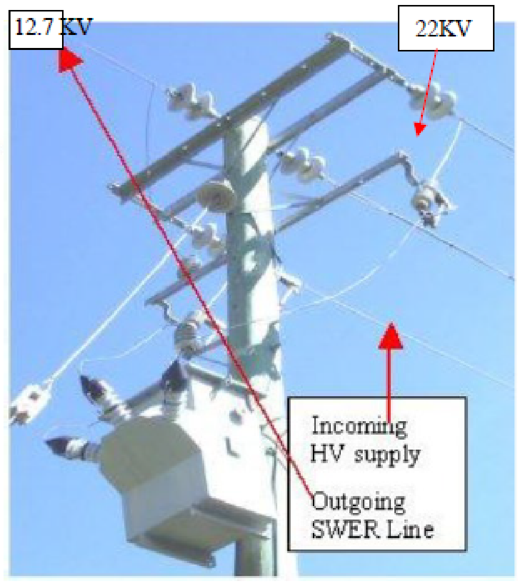
If testing and/or repairing the earth of a SWER system comply with the following work practices :

- Safe Approach Testing Of SWER Structures
- SWER Earth Testing Procedure.
- Install, Test, Repair SWER Earthing.

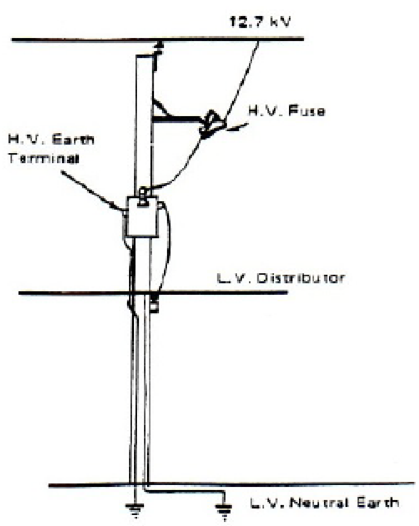
12•2•8•2•3 SWER Transformers

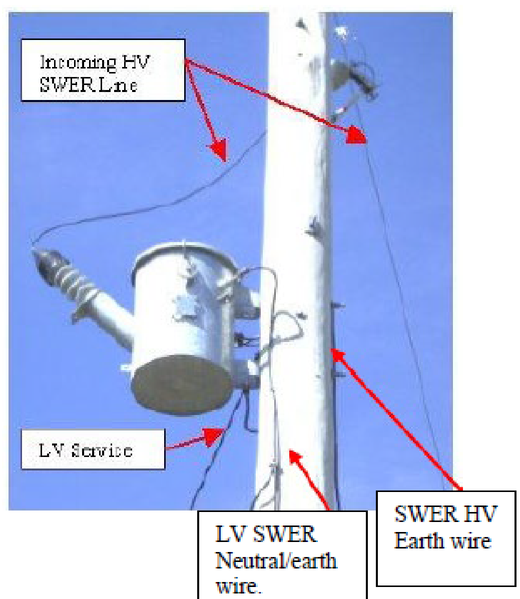
The following shows an example of the two different SWER substation structures.





SWER Isolating Transformer





SWER Distribution Transformer

12•2•8•2•4 Replace SWER Apparatus

Installation of SWER apparatus shall comply with :-

- In general to **Section 3 - 11/22kV & SWER Constructions** in the TasNetworks OH Construction Manual.

- **Installing And Commissioning A pole Mounted Transformer**.

- Requirement to certify that all construction work has been completed to the standard in the OH Construction Manual by filling out the section for completion of **infrastructure work** on the **Electrical Work Certification (EWC) Form.**

12•2•8•2•5 Commissioning Of SWER Apparatus

- After SWER is livened up comply with **Safe Approach Testing Of SWER Structures** then **:-**

- For each SWER transformer conduct electrical tests to check for correct voltage and record results on the **Pole Mounted Transformer Test Form.**

- Conduct SWER earthing tests in accordance with **Install, Test Or Repair SWER Earthing**.
- At each customer installation supplied from the SWER system, an Electrical Practitioner – Electrician to :-

  - Check that the earth connection is sound and conduct an earth resistance test to ensure the earth value is low enough (typically below 1 ohm) to operate the protective device.
  - Conduct all other relevant tests as per the **LV Testing Procedure**,
  - Record all electrical tests on an **Electrical Work Certification (EWC) Form.**

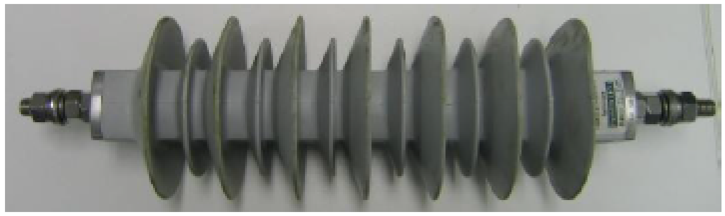
12•2•8•3 Pole Mounted Transformers

12•2•8•3•1 General Requirements

When there is a need to replace and existing pole mounted transformer :-

1. All new three phase and single phase replacement transformers, regardless of KVA rating, must have arrestors installed for protection against lightning strike. This also applies to single phase transformers. In fact, all new transformers are now provided by the supplier fitted with lightning arrestors and lead attachment ready for installation but;

If you were to use an existing spare transformer, it must also be fitted with lightning arrestors.



Typical Lightning Arrestor

2. Where transformer LV output isolating links had been previously installed, these must be replaced with an appropriately rated set of HRC fuses and fittings.

3. **Note:** Non-standard pole mounted transformer installations, where customer neutrals had been connected to the transformer LV earth wire, must be brought up to standard when a transformer is being replaced. All customer neutrals must be connected to the distribution neutral.

4. The HV and LV earths must be tested in accordance with work practice **Standard Earth Tests In The Distribution System** prior to energisation of the transformer and, should any earth value be outside the maximum allowed limit, you must follow the requirements detailed in this work practice on how to resolve this problem and;

5. This may require the transformer to be left de-energised and the earth repaired in accordance with work practice **Maintain And Repair Distribution Earths** and a re-test done to confirm earth values are correct prior to energisation and commissioning.

6. All earth wires running down the pole must have an earth cover guard affixed as per work instruction **Install Cover Guard Over Pole Earths** to protect against conductors theft.

7. Fully comply with the work practice **Pole Mounted Transformer Installation Replacement And Testing** for commissioning and testing.

12•2•8•4 HV Metering Transformers

If you have to replace a metering transformer, work in consultation with the local TasNetworks, Complex Metering Officer and, **Section 9.14.12.10 HV Metering**.

12•2•8•5 Voltage Regulators

- Taking An Oil Sample From Coopers Regulator.
- Coopers Regulator CL-6 series Maintenance Instructions.

12•2•8•6 Switch Gear

12•2•8•6•1 General

Electrical apparatus is employed throughout the distribution system to provide protection and control points for transferring load, managing and reducing fault levels, sectionalising faults, and providing isolation and control points for maintenance.

Electrical apparatus includes all major items of distribution infrastructure such as open switches, fuses, reclosers, gas switches, surge diverters and voltage regulators.

Switches, of various types, are used to interrupt the power supply. With the exception of "enclosed" switches such as : Reclosers, Gas Switches, etc, pole mounted switchgear has the ability to carry load, but only limited ability, according to its category, to interrupt load.

12•2•8•6•2 Switchgear Categories

Switchgear falls into four (4) main categories, these are : -

(1). ***Fault make – Fault break***.
- Circuit Breakers.
- Pole Mounted Reclosers.

(2). ***Fault make – Load break***.
- Ground mounted Switch.
- Ground mounted Switch Fuse.
- Pole mounted Switch.

(3). ***Load make – Load break***.
- Pole mounted Sectionaliser.
- Pole mounted Ganged Isolator (ABS).
- Pole mounted Fuses (EDO) – Light loads only.

(4). ***Isolators***.
- By definition are a non-load break device.

Switches are divided into broad general classes related to the type of insulation medium, eg “air”, “oil” and “gas“ switches. The “oil” and “gas” switches are the ENCLOSED type.

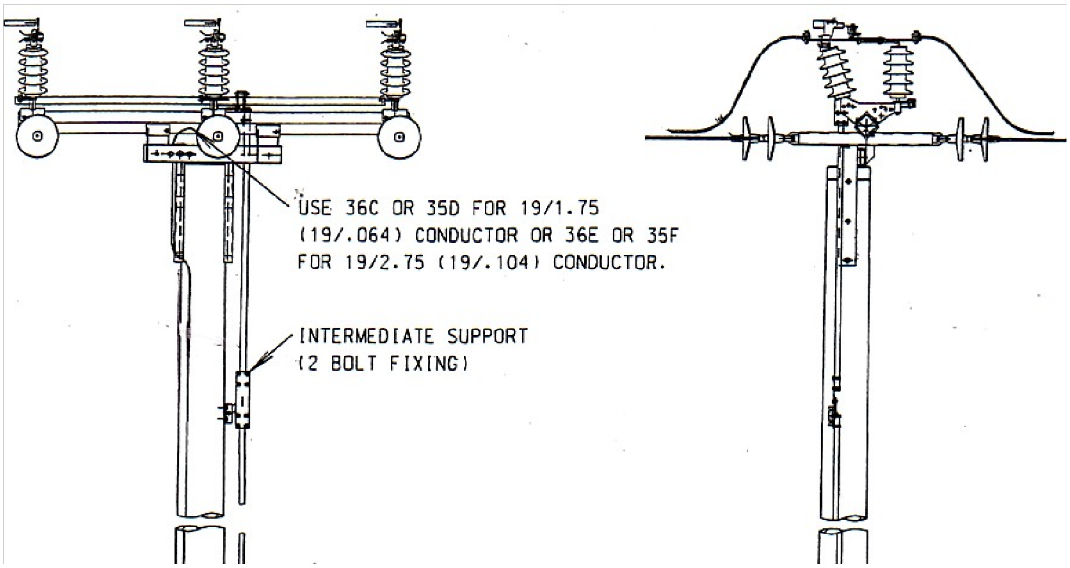
12•2•8•6•3 Air Break Switches

Air Break Switches (ABS) are used on a high voltage Feeder to sectionalise the feeder for control or to disconnect a Feeder from a substation supply.

In all cases, their purpose is to disconnect a section of line or apparatus, to effect repairs or carry out tests or alterations to that section of line or apparatus. They are usually hand operated and the three blades of the switch open or close simultaneously.

ABS’s fitted with arcing horns can be operated under light load conditions but NOT usually as line interrupters.

Modern ABS’s are fitted with “arc chutes” and can be used to interrupt large loads. They have been used extensively for this purpose in rural areas. They are pole mounted and may be used in both the vertical and horizontal plane.



If the switch is fitted with arcing horns, they should be adjusted so they all make contact together, BEFORE the “main contacts” of the air break switch, and they break contact together AFTER the “main contacts”.

The mounting height of the air break switch “handle” must be a minimum of 5 metres above ground. The switch must therefore be operated from a ladder with the Operator using an approved safety belt or harness.

To provide protection for anyone operating the air break switch handle, in all cases, the metal parts of the switch and the handle MUST be bonded together and earthed, with a maximum resistance of 10 ohms.

There is an issue with porcelain insulators on Air Breaks Switches (ABS) cracking where there is a possibility of bits breaking away and falling down that could cause serious injury to personnel therefore;

When working with existing ABS comply with Section 13.8.5.8 Air Break Switches for careful inspection and carrying out safe work practice.


Stanger, USB air break switch

If there are no issues with any cracks being found and you are required to perform an inspection and maintenance of the ABS then check the following and perform the appropriate action :-

- **Conductors and Conductor Connections**
  - Visually inspect conductor connections
  - Replace all 'U' bolts with palm lugs

- **Earthing**
  - Check earthing connections
  - Undertake earthing resistance test in accordance with work practice Standard Earth Tests In The Distribution System.

- **Pole top assembly**
  - Tighten all bolted connections.

- **Insulator assembly**
  - Check insulator condition.
  - If near coast wash insulator.

- **Mechanism**
  - Clean and grease contacts
  - Check operation of blades and arc chutes
  - Re-align as necessary
  - Lubricate mechanical linkages
  - Check the fit of, and tighten mechanical connections

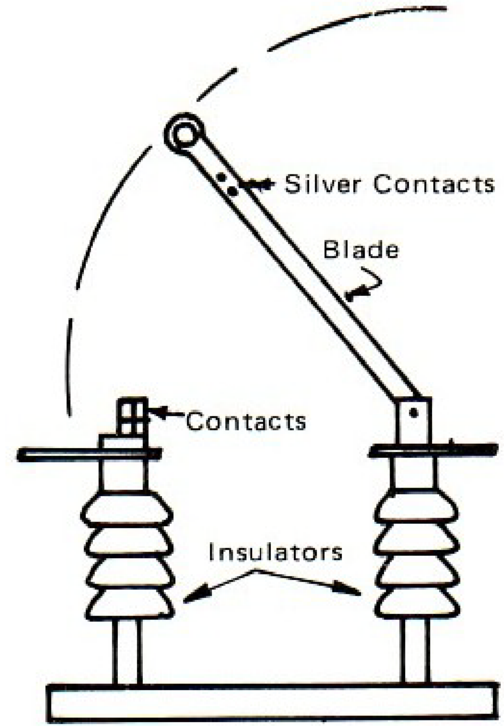
- **Standard of Installation**
  - Check installation is to current design standard

- **Defects**

  All defects found of a safety or environmental nature shall be attended to immediately. If this is not possible then report the issue to TasNetworks, Fault Centre for immediate follow up if serious, else report the maintenance problem to your Team Leader for scheduling in as a required maintenance task.

- **Reporting Requirements**
  - All defects to be reported as per standards reporting form
  - Report on all non-compliances using standard reporting form and, as per Service Level Agreement, including a site photograph both before and after.

12•2•8•6•4 High Voltage Links



High Voltage links, unlike the Air Break Switch where the three blades open simultaneously, must be opened separately.

Due to circulating currents it is desirable that single blade links are not used for switching load.

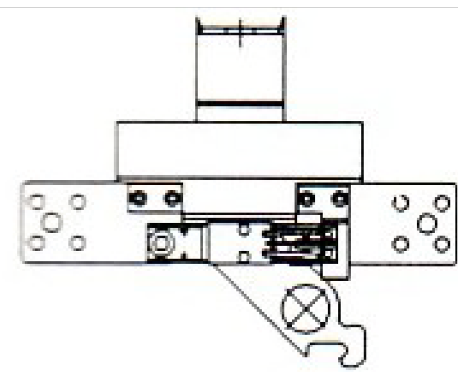
High Voltage links with NO arc-quenching device should NOT be opened under load.

High Voltage Links fitted with arc chutes CAN be used as interrupters for loaded lines.

They can be mounted vertically, upright or underslung.

When "links" of the two insulator post type, shown, are installed in the underslung position it is essential to ensure that the insulator posts are arranged so that they shed water. It is, therefore, necessary to invert the posts before mounting.

12•2•8•6•5 Low Voltage Links



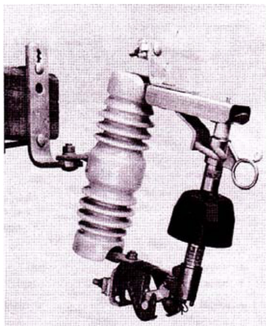
These are used as switches for connecting or disconnecting sections of low voltage mains.

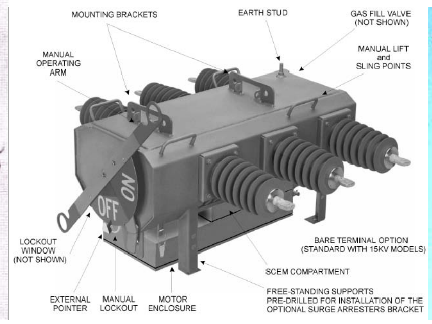
They are normally fitted to poles between low voltage circuits of adjacent substations as a means of making and breaking parallel connections.

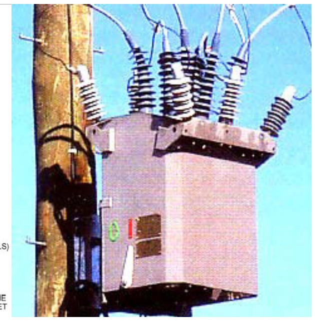
They are sometimes used on low voltage leads on pole type substations and on low voltage cable poles as a ready means of disconnection.

Low Voltage Links are used as isolators only and should not be used to
break large currents.

12•2•8•6•6 Reclosers, Load Break Switches & Sectionalisers







Reclosers, Load Break Switches and Sectionalisers are fitted with telecommunication equipment to enable remote operation through TasNetworks SCADA network and therefore;

Any problems that may occur with operation of these devices is normally detected through the SCADA communications but;

If Line Workers detect any issues in the field then either report this through TasNetworks, Operations Section for maintenance work on these devices to be done by the Asset Engineering, Protection & Control Team or, email them directly via **mailto:PandCEng@tasnetworks.com.au.**

Full details on maintenance requirements is covered in **Section 6. Maintenance** of the work practice **Automatic Reclosers Load Break Switches And Sectionalisers**.

12•2•8•7 Surge Diverters (Lightning Arrestors)

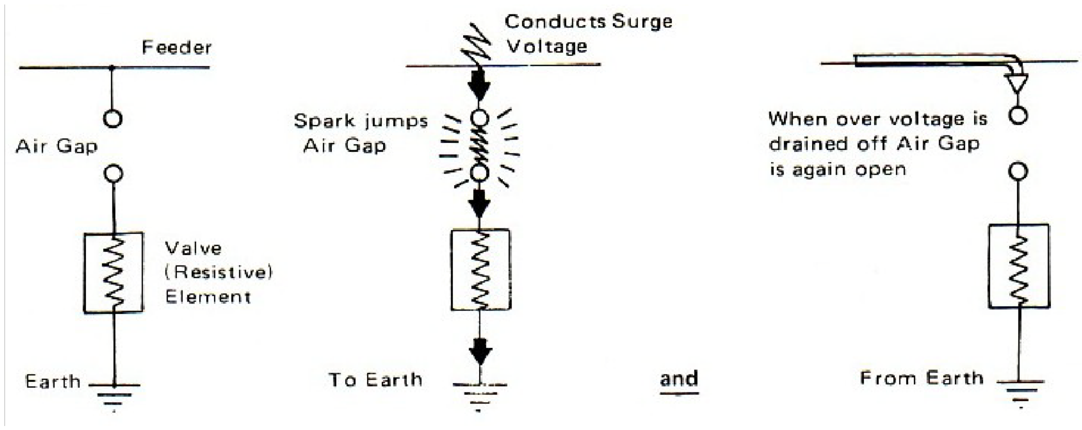
Lightning flashes are the result of electricity flowing from one cloud to another, or from a cloud to earth. They always flow in the path of least resistance. The potential of lightning flashes is measured in millions of volts with current flows in the order of thousands of amps. Protection of distribution system powerlines and apparatus is provided by surge diverters, which are also known as lightning arresters.

Surge diverters serve the same purpose on a line as a safety valve on a steam boiler. The safety valve on a boiler relieves high pressure by blowing off steam until the high pressure is reduced to normal. When it is down to normal, the safety valve closes again and is ready for the next abnormal condition.

When a high voltage, greater than the normal line voltage, exists in the line, the surge diverter immediately provides a path to earth and thus “drains off” the excess voltage. The function of the surge diverter is therefore to provide a point in the circuit at which the lightning impulse may pass to earth, thus reducing possible damage to lines and electrical apparatus.

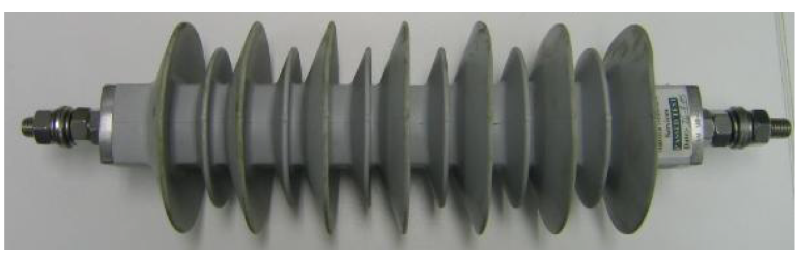
A lightning arrester in its **simplest form** consists of an air gap created by the use of arcing horns. In some installations the construction is such that an air gap is created in series with a resistive element.

Later versions consist of fully enclosed resistive elements. The overload voltage surge breaches the air gap and passes direct to earth via the arcing horns or through a resistive element. The resistive element consists of a material that allows a low resistance path for a voltage higher than the line voltage but presents a high resistance to the line voltage.



Special Notes: -

1) All new pole mounted transformers are now supplied with lightning arrestors already fitted ready for installation.
2) In the past transformers may have been installed without lightning arrestors fitted. Now, when any transformer gets replaced the new transformer (even if it is a re-used transformer) must have lightning arrestors fitted.
3) Re-used arrestors must be insulation resistance tested and have a current valid test certificate affixed before they can be installed.



Typical Lightning Arrestor Resistor Element

4) Refer Section 13.8.5.10.2 Replacing Faulty Surge Diverters on testing diverters and safe work practice steps for replacing faulty diverters.

12•2•8•8 Public Lighting

12•2•8•8•1 General

Over the years many different makes and models of public lighting, luminaires, control boxes and lamp types have been installed and, some of these have the hazardous materials, asbestos and PCB capacitors. These type of fittings would not be installed now but there would still be quite a number of the old type fittings still installed and care must be taken when working with them.

12•2•8•8•2 Light Fittings That May Contain Asbestos

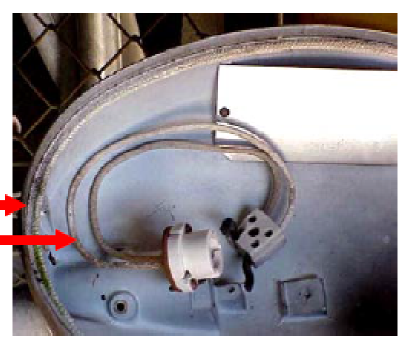
Street Light Fittings that may have asbestos seals.

BGE Light Fitting

Vertical Burner Light Fitting

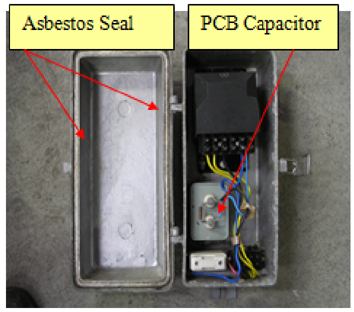
Reevo Light Fitting

The Light Fitting, at right, shows :
The "asbestos" SEAL
And "asbestos" SLEEVING over wires inside the fitting.



12•2•8•8•3 Control Boxes Containing Asbestos And/Or PCB

GEC Hinged Type Choke Box
Asbestos Seal and PCB Capacitor



Choke Box showing Asbestos Seal and PCB Capacitor

AEI Hinged Type Choke Boxes
Asbestos Seal and PCB Capacitor

Remove lower bolt and slide Approved bag up over Choke Box

Remove upper bolt and lower Choke Box into Approved bag

Secure with cable tie, fold over excess part of bag and secure with duct tape.

When dealing with light fittings containing asbestos comply with work practice **Asbestos Management – Street Light Fittings And PCBs**.

12•2•8•9 LV Distribution Mains Fuses

Also refer to **Section 9.15.2 Overhead Service Fuses**.

Some existing pole mounted transformers only have LV isolating links fitted. It is now a requirement that when an existing transformer gets replaced the LV isolating links must be replaced with fuses to provide adequate protection of the LV output from the transformer.

When installing new LV fuses it is important to select the correct size appropriate to the size of the transformer – **Refer to Section 9.14.8.3 Selection Of Fuse Size**.

12•2•8•10 EDOs

12•2•8•10•1 General

- **Refer** Section 13.8.5.6 for dealing with EDOs in fault response situation.
- Amber Lesson Correct EDO Fuses.

12•2•8•10•2 Use Of Talon Hooks

New Talon Disconnecting Hook

Current Disconnect Hook

- Talon Hooks can only be installed on the Extendable Operating Sticks. Talon hooks must be used for the removal and installation of EDOs when using an Extendable Operating Stick.

- Short Operating Sticks can be used for removing and installing EDOs with the current Disconnect Hooks when working from a ladder or EWP.

- The current Disconnect Hooks can be used for other operations including Disconnecting and Reconnecting EDOs, Fuse Links and HV Links.

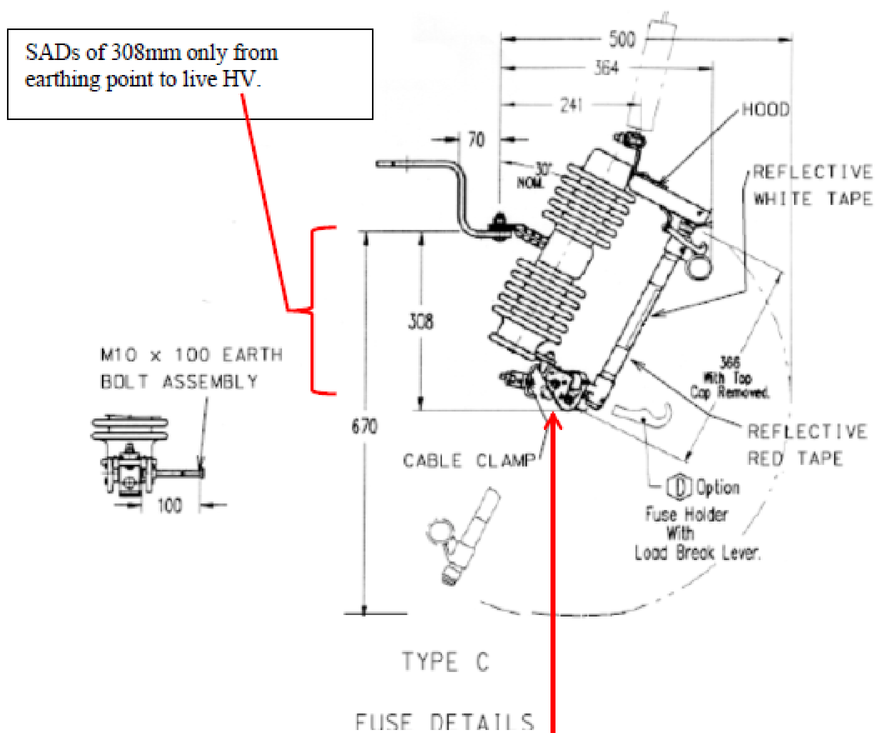
12•2•8•10•3 Safe Application Of Earths

(1) High Voltage EDO type NGK Stanger (AB Chance) as per Section 5.3.6 in OH Construction Manual has only 300mm SAD clearance from closest live HV point to where a temporary earth would be applied (as shown in sample diagram shown below) and;

(2) Where earths have been applied to the EDO earthing point by lifting the earth lead up, over and down to clamp to the earthing point. This causes a potential safety issue when removing the earth lead if it is lifted upwards, breaching the 300mm SAD with the potential for making live contact with energised HV above.

(3) In addition, Portable earths appear to have been lifted without any proper support, which could cause a safety issue e.g. if an earth lead inadvertently touches live HV while resting across a person's body.

(4) **Note**: All new NGK Stanger units are now supplied with an earthing stirrup to increase the SAD to 700mm safe distance. Refer to **Blue Lesson** for compliance and technical details of the earthin stirrup.



	DROPOUT EXPULSION FUSE 24kV 100 AMP
S.I. No. COMPLETE FUSE	23.63.23
S.I. No. FUSE TUBE	23.55.01
RATED VOLTAGE	24kV
RATED CURRENT	100 AMP
RATED BREAKING CAPACITY (SYM)	8kA
BASIC INSULATION LEVEL	150kV
CREEPAGE TO EARTH	450mm

REFER TO NOTES ON DRAWING OH/1.5/4

HIGH VOLTAGE DROP-OUT FUSE
NGK STANGER (AB CHANCE)

DRAWN. JOHN SPENCE | APPROVED
DESIGNED: H. KREMER | DSSM.

D-OH1-1.5/6

DSD-OH1-1.5/6 REV 0 11 MAY '98 PAGE 8 of 12

12•2•8•11 Capacitor Banks

Typical Capacitor Bank Installed

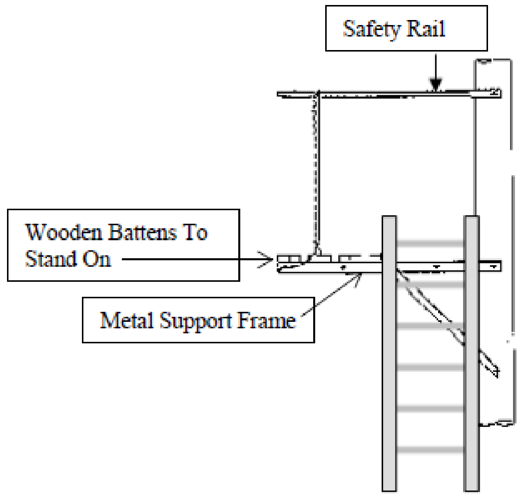
CAUTION : Even though the supply may have been isolated, a capacitor bank will still have a substantial charge built up that could cause an electrical shock.

Therefore, if there is a need to perform work on a pole where a capacitor bank has been installed **you must first ensure the capacitor bank has any residual capacitance charge left discharged by a Field Operator**.

After the capacitor bank has been discharged, a voltage test should be done to confirm there is no residual voltage charge left prior to carrying out any maintenance work in accordance with Work Practice Capacitor Banks In The Distribution System.

12•2•8•12 Pole Operating Platforms

Pole operating platforms have been installed for many years and over time, due to deterioration (mainly rusting and rotten battens), they have been deemed unsafe and are not allowed to be used anymore.



Typical Pole Platform With Ladder Resting On It Ready To Ascend

A program has been put in place to remove old pole operating platforms in accordance with work practice **Remove Pole Operating Platforms**.

If you come across a situation where you need to ascend a pole that has a pole operating platform to perform work but cannot access the height required via any other means (ladder, EWP) then **DO NOT use the pole platform.** Instead, report this issue with your Team Leader for resolution.

12•2•9 Vegetation Clearing

When vegetation work is to be performed alongside or close to a High Voltage overhead Distribution Feeder the person responsible for the work shall liaise with the Distribution Operating Authority and arrange for “protection devices” controlling that Feeder to be “SET” in accordance with their requirement for vegetation clearing.

Service Providers carrying out vegetation clearing work must comply with :-

- The overarching **ENA Guidelines For Safe Vegetation Near Live OH Power Lines** and;
- In particular, the **Vegetation Work Practice/Technical Specification For Authorised Service Providers**.

12•2•10 Insulated Hot Sticks

12•2•10•1 High Voltage Grip-All Clampstick

The Grip-All Clampstick, commonly called a “shotgun” stick, is used by Line workers and others to “clamp” onto various types of fittings, used for connection to high voltage conductors and apparatus. It can also be used, in conjunction with a “hook” arrangement, to operate various types of links and fuses.

The shotgun stick ensures a secure clamping method for connecting /disconnecting these fittings from live conductors.

The operating mechanism incorporates a sliding hand grip that opens the hook to grasp a fitting eye screw and retract it into the tool head. A safety thumb latch must then be depressed to release the locked hand-grip so it can open the hook.

While the tool head is of an insulated material – the person using it must maintain the recommended safe working distance solely on the Epoxiglas pole section of the handle as the hook and its actuator are metal parts.

These grip-all sticks do not require field stripping to clean. All insulated parts are readily accessible to wipe dry or regularly clean with a silicone impregnated cloth.

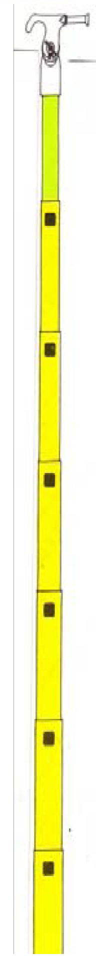
De-greasing Silicon Cleaning Cloth

Before each use the Shotgun stick shall be examined for signs of cracks, surface damage or mechanical defects and shall be wiped thoroughly with a clean dry cloth.

Silicon cloth pads shall be used regularly to wipe the surface of each glass fibre operating stick to ensure the surface glazing is maintained in good condition.

The Shotgun stick must be visually examined by an authorised person at intervals not exceeding six (6) months and electrically tested every twelve (12) months as described in TasNetworks Distribution Network Operating Manual.

12•2•10•2 High Voltage Operating (Hot) Sticks



The high voltage operating (hot) sticks come in a range of different styles and types.

"Telescoping" type sticks come in both circular and triangular configurations. The triangular shape, shown at right, is easier and quicker to extend and lock into position than the round one. It also tends to be more rigid when in use.

Telescoping types enable switchgear to be operated while standing on the ground at the base of the pole.

"Fixed length" type sticks are available with different heads attached. See below. These are for different operating activities.

All Operating sticks shall be examined before use for signs of cracks, surface damage or mechanical defects and shall be wiped thoroughly with a clean dry cloth.

Silicon cloth pads shall be used regularly to wipe the surface of each glass fibre operating stick to ensure the surface glazing is maintained in good condition.

NOTE: Operating sticks must be visually examined by an authorised person at intervals not exceeding six (6) months and electrically tested every twelve (12) months as described in the Distribution Network Operation Manual.

UNIVERSAL HEAD

DISCONNECT HEAD

The standard length of fixed length sticks used by TasNetworks = 2.8 metres.

NOTE:

- The following section details limited Live Line Tasks that Line Workers not qualified as Live Line Workers can perform and these tasks may use a shotgun stick but;
- Outside the limited live line tasks detailed in Section 12.2.6 the shotgun stick or any other type of insulating hot stick must only be used for the purpose it was intended for and;
- The person using the stick must ensure they do not breach the SADs they are authorised to work to.

12•2•11 Limited Live Line Tasks

These are non-complex limited live line tasks, that is working with live HV e.g. puttng bird flappers on HV conductors but at a safe distance away using insulated hot sticks, that Line Workers can perform subject to compliance with the requirements listed in the following relevant work practices.

12•2•12 Attach Fittings To Conductors

12•2•12•1 Install Bird Diverters

Install Bird diverters In The Distribution System

12•2•12•2 Install D Clamp

Install Or Remove D Clamp In Distribution System

12•2•12•3 Install Double Spindle Clamp

Install Double Spindle Clamp In The Distribution System

12•2•12•4 Install Sighter Ball

1) Identify overhead lines requiring sighter balls such as those at risk from a plane flying into them (e.g. a crop duster) and the safest method of access to install them.

2) Always try to de-energise and lower the conductors to ground level if possible.

3) If Live Line method used, the safe working principles of TasNetworks "Live Line Handbook Distribution Network" must be used.

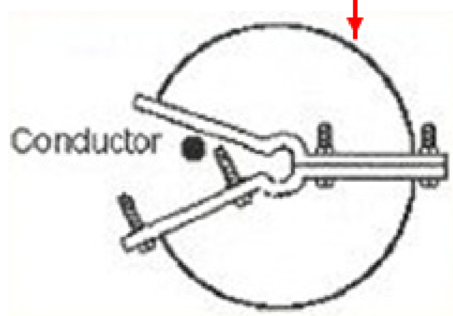
4) Develop traffic management plan to protect people and property under overhead work.

5) Manage vehicle parking and movement areas on site.

6) Ensure temporary earths are applied properly and prove dead each time you access the conductors in case of induced voltage.

7) Fit either, the bolted type ball or, slide on type ball secured with helical wrap on.

Bolt together sighter ball.



12•2•13 Cutting Away & Releasing Conductors

It should be particularly noted that poles which have been inspected and appear to be "sound" may be weakened by decay or rust below ground level.

A sudden and significant, unbalanced load at the pole top such as that caused by the cutting away or releasing of tension in conductors can result in the pole breaking off and falling over.

Line workers and others should be aware of the need for special precautions when conductors have to be released or cut away from poles. This is even more critical with heavy conductors and old poles. The precautions to be adopted will need to be considered in the light of the particular circumstances associated with each situation.

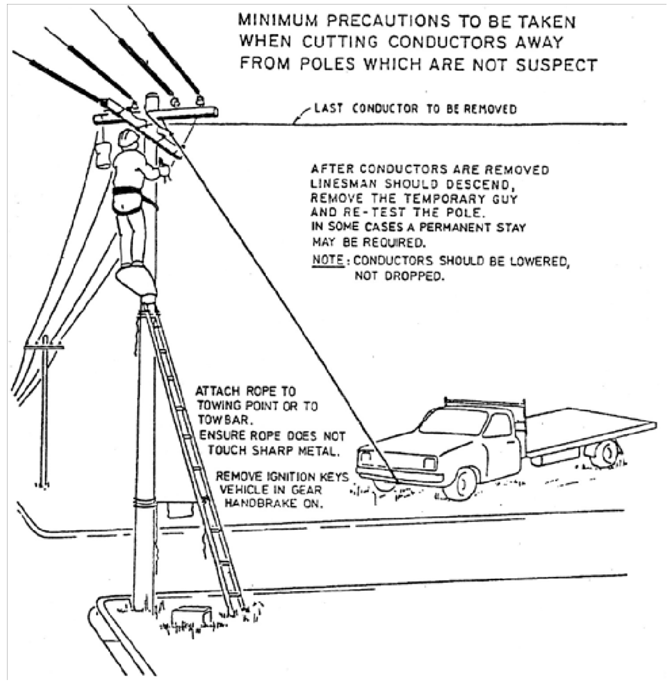


Diagram shows temp. "stay" on vehicle.

CAUTION : **Every endeavour shall be made to arrange the work so that unless the pole is stayed or otherwise secured – conductors shall not be released from the pole WHERE it could allow the pole to move or to fall.**

YOU MUST ENSURE :

- If the LV conductors to be cut/released are below HV conductors then :-
  - An assessment must be one to determine the level of risk of released conductors whipping up in the air and making accidental contact with live HV conductors and/or apparatus and if this is too risky and cannot be contained with adequate control measures ;
  - The overhead HV shall be de-energised and isolated prior to the conductors being released else;

  - If the risk assessment deems the risk will be negligible (e.g. control measures put in place such as insulated guy ropes to prevent the conductors form whipping up) then Distribution Operations must be contacted to implement live line suppression to one trip to lock out prior to the conductors being cut/ released.

- If HV conductors above LV conductors are being cut away and released then you must ensure the LV conductors below are de-energised and isolated beforehand (generally the case as nearby isolated HV normally feeds the nearby LV supply through the pole mounted transformer).
- Each pole is secure before releasing conductors. If not, hold pole secure by attaching crane or other suitable method (e.g. temporary stay).

- In all cases where it is necessary to remove conductors from a pole, each conductor shall be held by a rope, or rope blocks, while being released and then lowered to the ground.

- Under no circumstances, shall conductors just be cut through and allowed to drop to the ground. The sudden shock loads applied to the pole could cause it to break off and fall over.

- Set up a safe work zone clear of where conductors and associated apparatus may fall and unnecessary persons clear of the work zone and barricade off if necessary (e.g. to guard against public access).

- Take into consideration if the conductor is an aged suspect or substandard conductor in accordance with the **Policy On Aged Overhead Conductors** and if so, implement the safe work guidelines detailed in the policy.

12•2•14 Temporary Support Of Conductors

Special Notes : -

- It is permissible to use temporary LV cross arms arm under live HV conductors for replacement of old cross arms and, live line suppression is not required subject to :

- A JRA inspection of conductors and associated apparatus a minimum of two spans either side of the work site and;

- If the inspection finds suspect apparatus that may fail or aged suspect conductors then, the work team would need to assess if it safe to proceed to do the work under live conditions and if so;

- Live Line Suppression must be put in place.

- **NOTE**: The following methods are intended to cover temporary support of LV conductors e.g. when doing LV cross arm replacement work. However, the same principles can be applied for temporary support of HV conductors but, in doing so you must ensure :-

    - The equipment used for temporary support has the correct insulating properties for use with live High Voltage and;

    - You comply with the requirements of TasNetworks, **Distribution Live Line Manual** for using safe work methods.

- If you are using temporary LV cross arms to support energised conductors then you must ensure you use correct methods for performing live LV work i.e. correct use of, SADs, PPE and insulating material (mats, covers etc.).

12•2•14•1 Using V Type Temporary Cross Arm

The objective of using the temporary V push up cross arm is to enable efficient and easy replacement of LV cross arms with the LV conductors still energised, using live LV work practice methods.

The temporary V arm can only be used on wooden power supply poles due to the restricted attachment arrangement not being suitable for attaching the V arm to steel, concrete and stobie poles.

Work Steps for using the V arm :

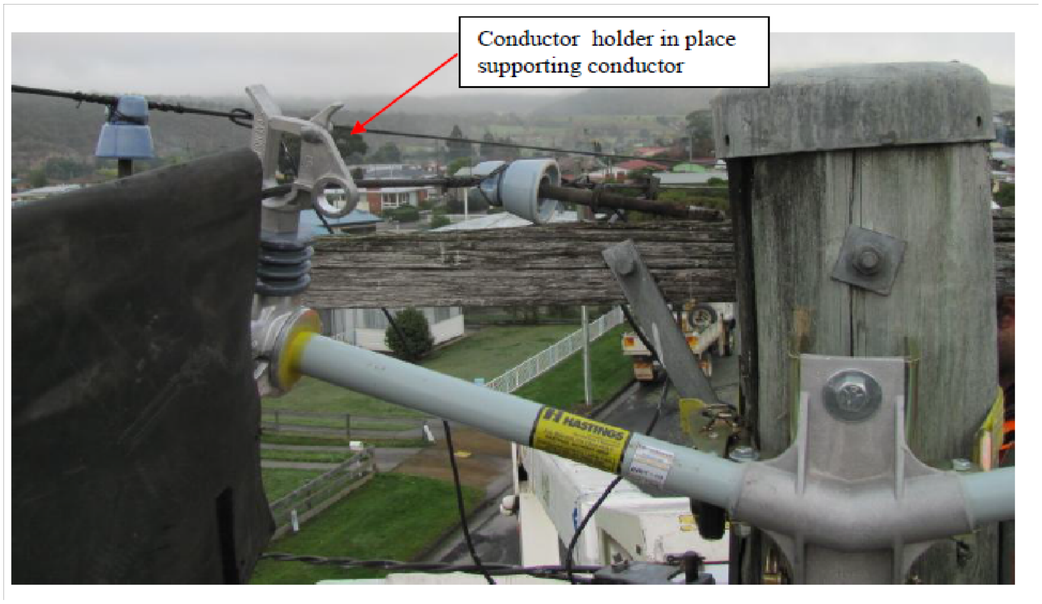
1) Minimum of two man crew if using an EWP else;

2) Minimum of three man crew if working off ladders (e.g. one ladder either side of the pole).

3) Affix support bracket to side of pole as shown just below the wooden cross arm king bolt.

4) Fit the temporary V arm to the support bracket as shown and lock it into position with the safety pin as shown.

5) Attach the conductor holders as shown ready to lift and place the conductors in.



6) Unbolt each insulator pin rod, pull the insulator pin out, and then place each conductor into its holder as shown below.

Note: As shown above, where practical to do so, it would be handy to leave the insulator pins tied to the conductor so the pins slide out of the old cross arm and are then ready to push into the new replacement cross arm and;

To maintain SADs remove and support the outer pins first before doing the inner pins.

7) Remove the old cross arm as per normal work practice.

The following picture shows the full value of the temporary V arm holding the conductors and insulator pins up with the old cross arm removed.

8) Affix the new replacement cross arm.

9) Lift up each conductor from the support holder and slide in the insulator pin and bolt up as shown.

10) After all the cross arm work is completed remove the V arm and conductor supports.

11) Then remove the support bracket.

12) Then move onto the next pole and repeat these steps and so on for each old cross arm to be replaced.

12•2•14•2 By Suspension

The following shows a temporary cross arm that suspends the conductors. This type of cross arm is handy for use over the top of the conductors if there is restriction below and, has an attachment for use with round poles and also for non-round poles ,such as the Stobie Pole shown in the picture,

If you have any of these temporary cross arms in use, apply the safe work principles as above for the V type cross arm.

12•2•14•3 Push Up Conductors Using Ratchet Up Temporary Cross Arm

The above method, using a T-MAC ratchet up temporary cross arm, is ideal to push conductors up from below if there is restriction in working above the conductors. Again, apply the safe work principles as above for the V type cross arm.

12•2•14•4 Using Cross Arm Attached To Crane

This method is handy for use where you need to lift a span of conductors up out of the way e.g. lift LV conductors clear when doing pole replacement work.

Comply with work **Temporary Support Of LV Conductors Using A Crane** to perform this work in a safe manner.

12•2•14•5 Across Road Ways

The main safety concern with stringing conductors across roadways is persons taking a risk in running conductors across the road during a break in traffic and not being able to raise the conductors high enough in time to avoid being snagged by passing traffic. This can be a major safety issue and must be avoided by conducting a risk assessment and implementing the following options :-

1) A sound traffic management plan – which may require implementation of STOP/ SLOW BAT to stop traffic movement until the conductors are soundly tensioned up to a safe height.

2) The use of EWPs or other types of Lifts to help get the height required to lift the conductors clear of traffic.

3) For stringing over very wide roadway (e.g. four lane highway) may require the use of hurdles. **Refer** **Section 9.15.2.5.5 Stringing Conductors Above Energised Conductors** that describes the full use of hurdles.

12•2•15 Stringing Conductors Under Live Conditions

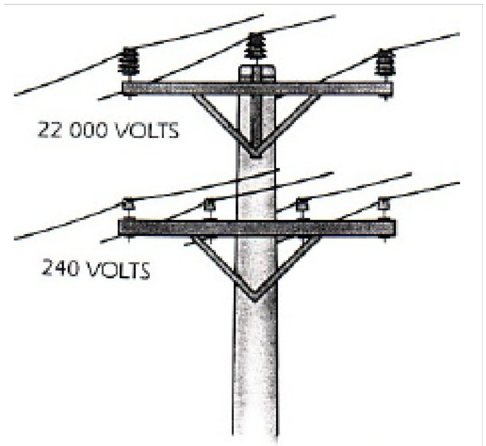
12•2•15•0•1 Decision Flow Chart

The **Decision Flow Chart** must be followed to determine :-

- Non permitted conditions.
- Critical safety conditions to be met.
- If and complex job conditions apply and if so;
- If someone is required to manage the work site, such as Project Manager or Field Service Co-odinator.

12•2•15•0•2 Stringing LV Conductors Under Live HV

Preferably, the overhead HV supply should be isolated prior to stringing LV conductors underneath. However, if there are practical issues in isolating HV supply stringing LV conductors under live HV is permitted provided the following requirements are complied with :



22 000 and 240 volt distribution lines.

- The **Decision Flow Chart** is followed.
- Prior to commencing work, a thorough written JRA must be done and safety control measures put in place.
- The leader of the work party running the LV conductors shall liaise with the Distribution Operating Authority and arrange for the "protection devices" on the HV Feeder, where the LV conductors are to be run, to be "SET" for that type of work.
- Particular care must be taken to ensure any movement of LV conductors (e.g. sudden release under tension or pole movement) does not cause the conductors to fling up and contact the live HV conductors.
- After the LV conductors have been run and the work is finished, the leader of the work party shall again liaise with the Distribution Operating Authority and arrange for the "protection devices" to be "RESET" to normal.

Note : The leader of the work party running the LV conductors must immediately notify the Distribution Operating Authority of any incident, such as contact with the live HV, which may cause the feeder to be accidentally tripped, interrupting the power supply.

12•2•15•0•3 Stringing HV Conductors Over Live LV

HV conductors may need to be strung over existing LV conductors when there is a need to, extend a section of HV line or, replace a section of HV conductors due to, the need to upgrade in size to cater for an increase in load or, conductor being an aged substandard conductor or, conductor being badly damaged from a fault condition.

For any Line Workers (including Live Line Workers), due to the safety risks involved, under NO circumstances shall HV conductors be installed and strung over live LV conductors.

Instead, the LV supply and also the HV supply must be isolated and made safe in accordance with the PSSR back far enough to allow the HV conductors to be installed without any risk of, persons, plant and machinery and conductor ends being able to breach the relevant SADs to HV and LV apparatus.

12•2•15•0•4 Stringing Bare LV Conductors Under Live LV

Due to increase in customers and load, there may be a need to string another run of LV conductors beneath energised LV conductors. In this situation every effort must be made to isolate the supply to the existing overhead LV conductors before stringing the new conductors and;

Stringing conductors under existing energised LV conductors should only be done as a last resort subject to :-

The Decision Flow Chart is complied with.

1) A careful inspection being done of the existing energised conductors and associated infrastructure to check age and condition and from that;

2) A risk assessment being done to determine if it is safe to proceed (i.e. existing energised conductors not likely to break and fall down) and if so, safety control measures being put in place where necessary to reduce risk to an acceptable level e.g. :-

   - May be better to install LV ABC conductor that installing bare conductors (check with Team Leader and Design Section if this could be done) and failing this;
   - May need to use insulated guy ropes mid span and insulated LV gloves to ensure conductors will not spring up).

3) A Safety Observer being appointed to observe that conductors being strung will not spring up and inadvertently clash with energised conductors.

12•2•16 ABC Conductors

The maintenance replacement and upgrade of existing LV ABC conductors shall comply with the following requirements.

12•2•16•1 LV ABC

- Section 2 - LV Constructions in the Overhead Line Design & Construction Manual.
- LV ABC Manual.

12•2•16•2 HV ABC

- HV ABC Manual

12•2•17 Tensioning Conductors

With existing conductors, care must be taken not to over tension aged substandard conductors of the type detailed in the Policy On Substandard HV Distribution Conductors and;

In accordance with the Policy, a risk assessment must be done and where there is any doubt at all the supply must be isolated prior to working on the conductors and/or associated infrastructure.

Other than the special requirements for tensioning aged substandard conductors, comply with the conductor stringing charts and tensioning requirements detailed in **Section 9.15 Installing And Connecting Distribution Conductors**.

12•2•18 Clearances

When conductors were originally installed they were meant to comply with the clearances listed in the Overhead Line Design Construction Manual and the Service & Installation Rules (SIR).

In recent times, changes have been made to overhead clearances to comply with latest requirements of AS 7000 and the AS/NZS 3000 Wiring Rules which affect clearances of conductors over roadways and driveways.

The new clearance heights have been updated in the SIR and, work practice **Dealing With Low & Substandard LV Services & Fittings**.

Over time conductor clearances may have changed due to such factors as pole movement or from wind action and, this can be a concern for safety is clearance is below the minimum allowed over roadways and driveways.

Therefore, where a conductor clearance looks low check it with an insulated height measuring stick and check the reading against the following Tables in the work practice **Dealing With Low & Substandard LV Services & Fittings** :-

Location	Height (m)	Action
Over Centre of Roadway	<4.3	Leave Disconnected – (1) Leave Customer Notification
	<5.5	Follow reporting process – (2) Leave Customer Notification
	≥5.5	Compliant - No further action required
Over any other part of Road	<4.3	Leave Disconnected – Leave Customer Notification
	<4.6	Follow reporting process – Leave Customer Notification
	≥4.6	Compliant - No further action required
Over Driveways	<3.0	Leave Disconnected – Leave Customer Notification
	<4.6	Follow reporting process – Leave Customer Notification
	≥4.6	Compliant - No further action required
Over open land (no vehicular access), including POA	<2.7	Leave Disconnected – Leave Customer Notification
	<3.0	Follow reporting process – Leave Customer Notification
	≥3.0	Compliant - No further action required
Over a fence or railing From a blank wall or window	<0.1	Leave Disconnected – Leave Customer Notification
	<2.0	Follow reporting process – Leave Customer Notification
	≥2.0	Compliant - No further action required
From a blank wall or window	<0.1	Leave Disconnected – Leave Customer Notification
	<1.0	Follow reporting process – Leave Customer Notification
	≥1.0	Compliant – No further action required
Over non-accessible roof or veranda	<0.1	Leave Disconnected – Leave Customer Notification
	<2.0	Follow reporting process – Leave Customer Notification
	≥2.0	Compliant – No further action required

#Table 2 Service Heights For Distribution Line Work for faults

In the above Table covering LV distribution mains conductors and the following Table covering LV services, where the measured height is in the Red or Yellow range follow the work practice and carry out the relevant action to fix the problem.

In addition, refer to the work practice LV Overhead Service Replacement Requirements to check requirements where it is necessary to replace or fix aged fittings to bring services up to current standard to ensure electrical compliance and safety for the public.

Location	Height (m)	Action
Over Centre of Roadway	<5.5	Leave Disconnected – Leave Customer Notification
	≥5.5	Compliant - No further action required
Over any other part of Road	<4.6	Leave Disconnected – Leave Customer Notification
	≥4.6	Compliant - No further action required
Over Driveways	<4.6	Leave Disconnected – Leave Customer Notification
	≥4.6	Compliant - No further action required
Over open land (no vehicle access), including POA	<3.0	Leave Disconnected – Leave Customer Notification
	≥3.0	Compliant - No further action required
Over a fence or railing	<2.0	Leave Disconnected – Leave Customer Notification
	≥2.0	Compliant - No further action required
From a blank wall or window	<1.0	Leave Disconnected – Leave Customer Notification
	≥1.0	Compliant - No further action required
Over non-accessible roof or veranda	<2.0	Leave Disconnected – Leave Customer Notification

#Table 1 Service Heights For Direct LV Servicing Work

12•2•19 Underground Cables On Pole

12•2•19•1 HV Cable

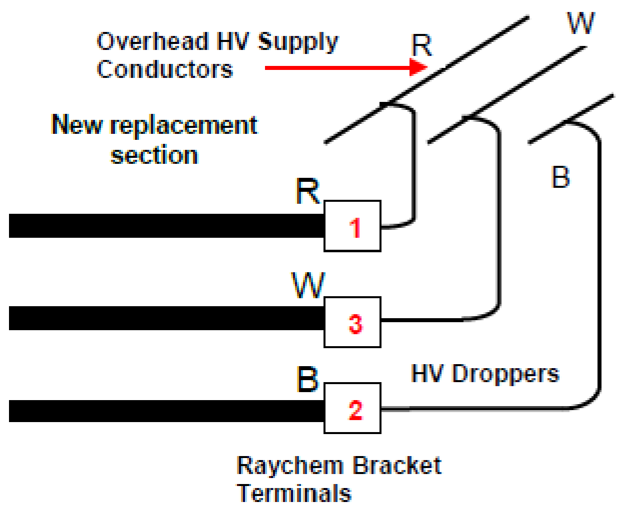
There may be occasions where a line work crew would need to work in liaison with Electricians to connect a new or replaced length of HV underground cable up a pole to the overhead supply.

In this situation Line Workers would be involved in making or breaking connection of droppers to overhead supply conductors (as shown in this diagram) in the following scenarios :-

1) Connecting droppers from a HV underground cable to the overhead lines.

2) Connecting droppers to the top of a Raychem Bracket and then to the overhead lines for a new or replacement underground HV cable install or;

3) Connecting the droppers from the Raychem Bracket to an Air Break Switch (ABS) and from the ABS to the overhead lines if the opportunity is taken to install a new ABS when upgrade work is done.



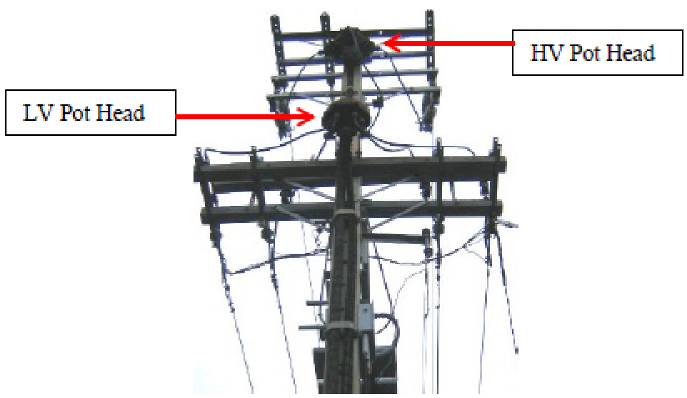
Note: When installing a new or replacing an existing cable on a pole it is important to establish the existing phase sequence before making connections to avoid re-work if phase conductors need to be swapped if the phase sequence is found to be incorrect.

If phases need to be swapped for a HV cable you must not swap the HV cable cores as this will cause failure of the cable crutch over time resulting in a costly repair. Instead, the dropper connections to the overhead line will need to be swapped over.

E.g. Failure of HV Cable Crutch

Comply with the following work practice when a new underground HV cable is being replaced or installed as new on a pole.

- Install Or Replace HV Cable On Pole (Including Pot Heads)

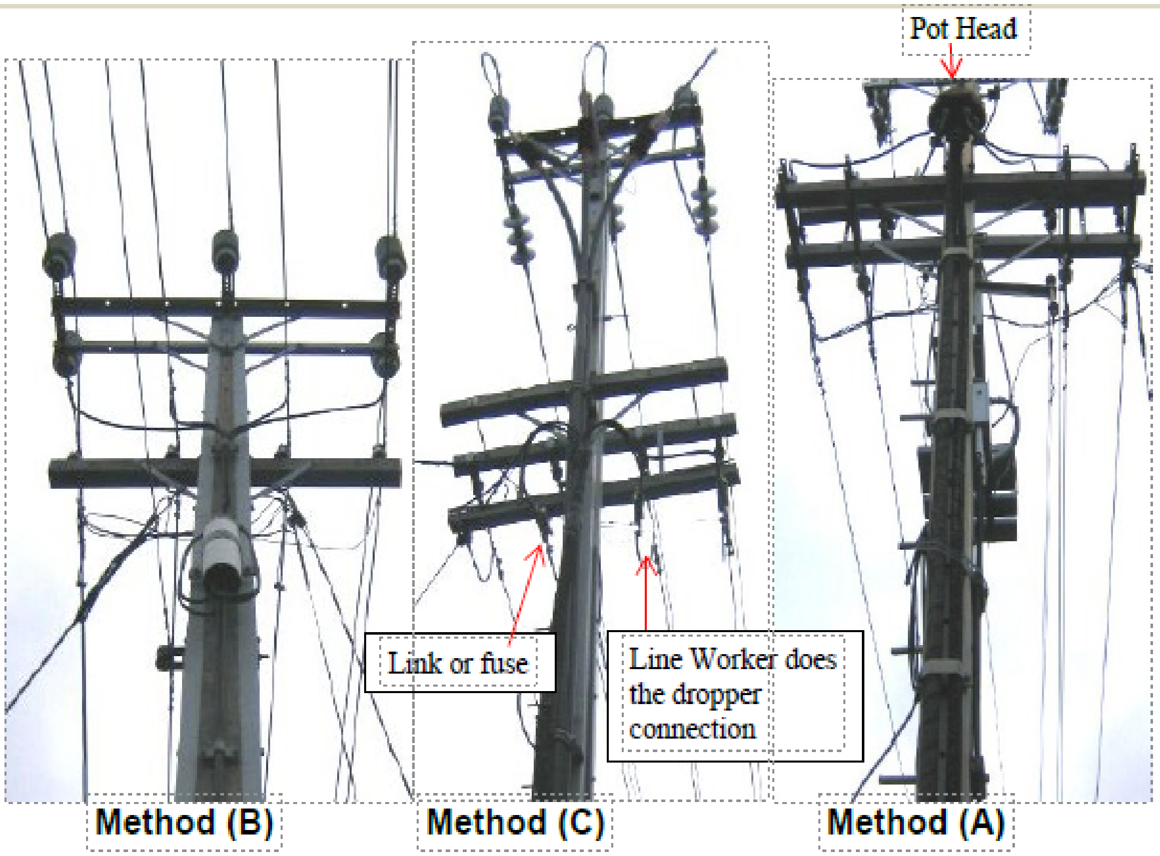


Example Of Old Cable Pot Heads

Where possible, the overhead HV should be isolated to perform the work safely. Where HV isolation is not possible then a Live Line Crew would be needed to make live connection of the HV droppers to the cable HV Raychem Bracket on the pole after completion of work done by the Electricians.

12•2•19•2 LV Cable

At existing installations you may find underground LV distribution cables terminated on the pole in one of the following methods showing three phase connection to the overhead distribution mains.



Method (A) is a really old style of connection in that the cable is first terminated in a casing called a “pot head” and then the casing is impregnated with a pitch like resin to provide additional protection, especially against the ingress of moisture. Tails were then taken from the pot head and connected onto the overhead distribution mains. This method is not used now and old pot head joints have been listed under a program of work to be removed over time due to age causing failure.

Method (B) is similar to Method (A) except that a plastic cap instead of a pot head has been used to protect the cable joint on the pole. In this situation and also with pot heads, the Cable Jointer would have done all the cable connection work and also onto the distribution mains as well.

Method (C) is the standard method now done for termination of underground LC cables on the pole. In this situation the Cable Jointer would do all the cable connection work up to one side of the fuse or link used. Then the Line Worker would do the dropper connection from the other side of the fuse or link onto the distribution mains.

12•3 Apparatus Beyond Distribution Supply Mains

This covers all supply equipment at existing installations beyond the distribution supply mains, such as overhead and underground services and metering equipment.

12•3•1 LV Services

12•3•1•1 Low Services

Check that an existing service is within the minimum allowed service height as per the Tables contained in the WP Dealing With Low & Substandard Services.

Where a service is found to be too low comply with requirements of :-

- Section 9.15.6 Conductor Clearances of this Handbook.
- Steps in for **WP Dealing With Low & Substandard Services** for bringing the low service up to the minimum height required.
- The following **Section 12.3.1.2 Replacement Of Conductors & Fittings** if any substandard service fittings need to be replaced to bring the service up to standard.

12•3•1•2 Replacement Of Conductors & Fittings

12•3•1•2•1 General

Comply with work practice **LV Overhead Service Replacement Requirements** to determine what fittings need to be upgraded and what is paid for by TasNetworks or the customer.

As part of the upgrade, the following old services *must* **be replaced** when encountered, with a new service at 25mm squared minimum *conductor* size :-

- Old open service wires – any size.
- 7/.044 imperial flat ribbon service.
- 7/.044 twisted 3 and 4 wire.

Due to poor performance issues, all Sicame type service fuses and fittings *must* be replaced with the approved type and;

The same applies to type Stanger 55 amp fuses and fittings.

12•3•1•2•2 Check Existing Phase Rotation/Sequence

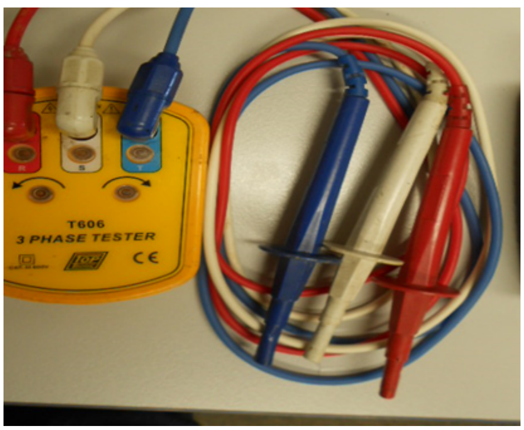
Correct phase rotation is necessary to ensure that multi-phase metering and installed equipment, such as motors or pumps operates correctly

Before a three phase service is replaced, a phase rotation is required to determine what the existing phase rotation is, so the same final phase rotation test after energisation of the new service reads the same.

A phase rotation/sequence tester will give a false indication if the leads are connected in the wrong order.

Also, correct polarity should be proven before the phase sequence test (to prove 3 phases are present).

There are different styles of phase sequence testers available, but operating principles of each type are the same.



Direct Contact Type

Non-Contact Clip On Type

Standard connections should be the following when conducting testing.

At Point of Attachment	Red lead	A phase	Left/front fuse
	White lead	B phase	centre fuse
	Blue lead	C phase	Right/back fuse

Clock wise arrow is standard rotation , Anti-clockwise is non-standard rotation .

Note: Prior to testing double check connections etc. are correct as an incorrect/false indication may occur if :-

- **One or more phases is de-energised**.
- The test leads are incorrectly connected.
- **One or more leads have an open circuit.**
- One or more phases are the same.

13•0 LINE WORK - FAULT RESPONSE

Click on page No. to go to topic.

13•1 Introduction

Section 13.0 covers safety and work practice requirements when responding to faults and;

This type of work can differ in regard to work methods and approach to safety in comparison to performing new construction work as in Section 9.0 or performing work on existing assets in Section 12.0.

13•2 Preparation Prior To Departure To Site

This is about making sure prior to departure that you :-

- Are properly prepared with all the tools and equipment required.
- Have all the safety equipment and PPE required.
- Have appropriate work vehicle and communications equipment and;
- If necessary, have a safety plan in place if working alone or in a remote area.
- Are aware of the environmental conditions (storms, bushfires etc.) in the area you will be working and are properly prepared.

13•3 Working Safely

13•3•1 General

Although persons performing fault response may encounter conditions such as, Electrical Storms, Floods, Bush Fire, Severe Winds, Ice and Snow – the work must be done as safely as possible in accordance with :-

- **Section 6 Safety** in general and in particular, the following sub sections;
- **Section 6.2 Power System Safety Rules (PSSR).**
- **Section 6.12 Other Safety Considerations**.
- **Section 6.12.13 Working In Adverse Weather Conditions**.
- **Section 6.18 Working Remotely Or Working Alone**.

Note: Although there might be pressure to fix a fault and restore supply as soon as possible safety comes first and, if it is too risky to continue you must cease work until conditions improve or seek help and additional resources to make it safer to perform the work.

13•3•2 Fault Response Safety Rules

1) Assess where you will be travelling to and the likely conditions to be encountered and ensure you are properly prepared with appropriate, vehicle, food, water, additional clothing to keep warm if necessary, Spot Tracker if working alone in a high risk area, first aid kit, #fire extinguisher, PPE, tools and equipment and, communication equipment before heading off.

   #As part of your regular vehicle checks, make sure your fire extinguisher has been serviced in the past 6 months and the vehicle is clean and tidy. If the fire extinguisher in your vehicle expires prior to the next vehicle service, you are required to take it to the vehicle Service Provider to have the extinguisher serviced.

2) To counter fatigue, do not exceed TasNetworks Policy on the maximum number of continuous works hours before a break is required.

3) First response person on site - secure and make safe before carrying out any other task.

4) Conduct a Job Risk Assessment and don't do anything to increase risk to yourself and / or public above that of normal work.

5) Don't leave site until people, vehicles and property are safe from critical risks and contact Emergency Services (Fire, Ambulance etc.) where necessary.

6) When site is secure and safe proceed with supply isolation and prove dead and install temporary earths to conductors / apparatus as required.

   Then carry out whatever is the next correct task and / or rectify fault.

7) Don't cut any conductors supporting a fallen pole or tree - release tension in conductors first by lifting heavy object off using a suitable crane or cutting tree or branches away with chainsaw (if safe to do so).

8) Where 1 fuse has failed in any ground or pole mounted switchgear, all 3 fuses must be replaced.

9) Be careful to avoid reclosing back onto a fault and, where applicable, wear appropriate level of PPE to protect against arc flash.

10) When fault has been rectified, communicate with the Fault Centre to advise them of supply restoration and then, remove local earths and re-energise power supply.

11) Carry out all relevant electrical tests. If tests are correct, restore supply to customer(s) and report details.

13•4 Responsibilities For Dealing With Faults

Depending on the type of fault encountered it could mean that :-

1) TasNetworks has to deal with and fix the fault or;

2) The fault has to be dealt with by the **State Government Department**, external Service Provider, that has Electrical Inspectors that deal with certain issues pertaining to electrical work and compliance with electrical Legislation and AS/NZS 3000 Wiring Rules and associated Standards.

When responding to a fault gather as much information about the nature of the fault and then check the fault against the following Work Guideline and carry out the action corresponding steps described.

Fault Response Guidelines For Fault Centre Staff And Stand By Officers

13•5 Limitations On What Tasks Can Be Done

When fault finding, particularly in a pressure situation, it is tempting to operate switchgear etc. or attempt to perform other work that you are not competent, accredited or authorised to perform.

Although you may be under pressure to locate and repair a fault and restore supply as soon as possible you are NOT PERMITTED to perform work outside what you are competent and accredited/authorised to perform and;

This particularly applies to operating switchgear. You must have the appropriate training and currency in level of authorisation to operate the type of switchgear encountered on site. If not, you will have to report to the Fault Centre to pass the fault onto a Field Operator to fix.

13•6 Basic Steps To Locate Fault

13•6•1 General

The primary role of fault response is to rectify the immediate problem and leave the installation in a SAFE condition.

If additional work is required but it cannot be done at the time of finding the fault due to lack of resources or expertise, then the work shall be reported to be done during normal working hours within a timeframe that is dependent on the severity of the impaired equipment.

13•6•2 Narrow Down Location Of Fault

13•6•2•1 Gather Information

Inspect for damage such as :-

- Burnt off connections or hot joints.
- Cracked / faulty insulators.
- Oil spill.
- Loose / faulty pole top hardware.
- Faulty underground cables.
- Faulty transformers.
- Also, the **Defect List Maintenance Guideline** contains a useful list of maintenance and fault issues that may also help to track down the fault problem and the likely cause(s).

When fault has been rectified, remove local earths & re-energise power supply.

Gather as much information as possible from whoever has reported the fault or asked you to attend the fault, such as TasNetworks, Fault Centre.

Ensure you get an address and power pole ID number if possible to narrow down the starting point for tracing out the fault.

This will help you ascertain, the type of fault and what repair equipment etc. you need to have on site and, what fault finding steps may need to be applied.

Also, this narrows the search for the fault down to a specific part of the overhead circuit, which is a starting point for a physical inspection of conductors, poles and pole mounted equipment.

Signs of equipment damage at least gives a defined starting point.

High winds and lightning strikes can mean having to patrol the line to discover the fault and can be a very demanding task often carried out at night in difficult weather conditions.

Locating faults can prove to be time consuming and often difficult.

In rural areas, long feeders frequently need to be patrolled, and spur lines may need to be isolated in a systematic elimination process to pinpoint the location of faults.

Locating the fault can often take longer than making the repairs.

The most effective method to locate an actual “fault” is to start at the beginning and systematically work through a process of elimination.

Having found the fault, the situation is assessed, and depending on the nature of the fault and extent of damage to assets or equipment, repairs are arranged and carried out.

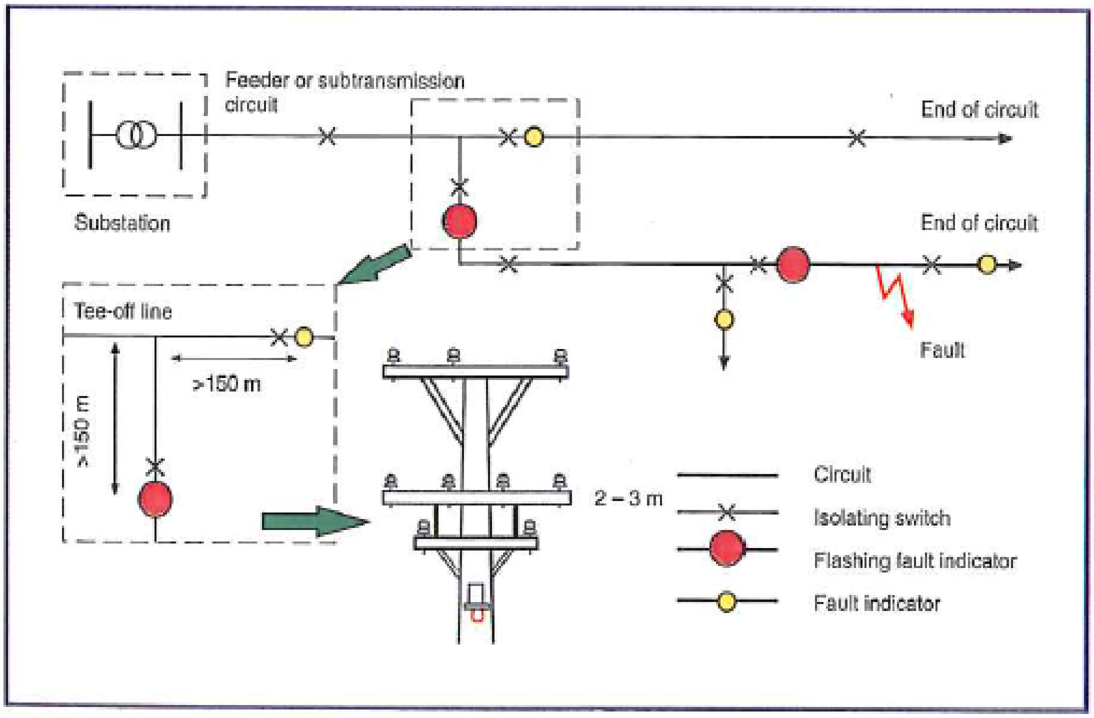
Wherever possible the fault affected section will be isolated whilst repairs are carried out. The remainder of the feeder / line re-energised to restore supply to the majority of affected customers with minimal delays.

13•6•2•2 Check Fault Indicators

Fault indicators can be installed on lines where frequent outages occur, and can continuously monitor line condition through electric and magnetic fields.

Fault indicators can be a valuable tool to expedite fault location on long feeders with multiple spurs, by providing a visual indication of the location of the fault, thus reducing the duration of outages and improving the reliability of supply. One such “indicator” is the Line Tracker LT30.

They provide visual indication for a range of fault types using Xenon indicators and coded Light Emitting Diodes that flash in prescribed codes to indicate the fault type. This is shown below.

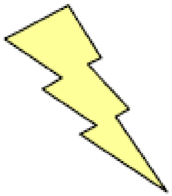


Example diagram of fault indicators in distribution feeders.

Line Tracker LT30 Indicator System Guide.

The following "guide" is to be used for "reading" the results of the Line Tracker Indicator.

Xenon Flash 1 flash every 4 to 8 seconds
(4 seconds during daylight and 8 seconds at night)



Permanent Fault has occurred within the last 4 hours and the supply is off. The indicator will reset after 4 hours or when power supply is restored.

Red LED Flash burst every 10 seconds indicates most recent fault seen in the last 7 days.

3 = Permanent Fault.

2 = Transient Fault.

1 = 'Self Clearing Fault'

Amber LED Flash burst every 30 seconds indicates the current line status.

3 = No Voltage present on line.

2 = Voltage on line but zero or low amps

1 = Everything is normal & indicator OK

O = Check battery volts on indicator.

The Line Tracker will indicate the "location" of a fault in a section of line by the colour and action of the LED's of respective Indicators.

13•6•2•3 Check Protection Devices

13•6•2•3•1 Fuses

In compliance with the current Distribution Switching Operations Manual, if during fault response, any one of a set of fuses is to be replaced all the fuses in that set must be replaced.

For example – a 3 phase service or EDO with one faulty fuse – replace all three fuses.

While attending to the fault, visually check the rest of the service(s) and associated fittings, attachments, etc. for general safety condition.

13•6•2•3•2 Check Displays On Apparatus

A quick check is to look at displays on apparatus such as, reclosers, sectionalisers, load break switches etc., that may show a fault code that may assist in narrowing down what type of fault it is.

13•6•3 Electrical Testing

With reference to and application of the LV Testing Procedure, performing the following electrical tests may help to track down where the fault is and what type it is (e.g. phase to phase, phase to earth, open circuit etc.) :-

1) Testing for presence (or lack of) of HV using a Modiewark or equivalent tester.
2) Testing for presence LV using a Volt Stick (e.g. testing conductive surfaces such as steel poles and steel pole bonds) and;
3) Following up, if necessary, using a voltmeter to confirm results.
4) Testing LV voltage levels e.g. if phase voltage values are not similar this may indicate a fault transformer, incorrect connection or a floating neutral that needs to be tracked down.
5) Testing for incorrect polarity.
6) Testing insulation resistance value between phases and to neutral and earth (e.g. for HV or LV ABC conductors).
7) Testing circuit continuity to check for an open circuit.
8) Testing circuit resistance and impedance. A high value may indicate a poor or hot joint that needs to be tracked down.

13•7 If Basic Steps Fail To Locate Fault

13•7•1 Sectionalising

If you cannot localise and locate the fault using basic fault finding methods then, as a last resort, you may need to sectionalise to narrow down the area (e.g. the length of overhead line) where the fault is and then;

Patrol the narrowed down section to inspect, check and test until you have located and determined the fault.

Sectionalising involves halving the fault finding area by half (e.g. open half of an overhead line) then checking one section by :-

1) Performing electrical tests or;
2) Reclosing the electricity supply and;
3) If no fault appears on that section (fault protection devices do not operate) then the fault must be on the remaining section so;
4) Halve the remaining section and do steps 1) or 2) again and so on until the fault is narrowed down to a small enough section to enable a patrol and inspection and testing to be done to nail down the fault.

CAUTION :

1) As sectionalising may involve reclosing supply onto a fault care must be taken to wear appropriate PPE and to keep other persons clear of the immediate work area.

2) Repeatedly closing onto a fault during sectionalising has the potential to damage supply apparatus. Therefore, first consult with TasNetworks Fault Centre to confirm if it is okay to proceed with sectionalising.

13•8 Dealing With Fault Found

13•8•1 Assessment On What To Do

You need to assess if you what is required to fix the fault and whether you can fix it there and then as a temporary or permanent repair and how long will this take.

If the repair will take too long or cannot be repaired until later when more resources are called in and, a number of customers are affected form the supply outage you will need to advise the Fault Centre of the situation and ;

This may result in the Fault Centre looking at options to keep supply connected to as many customers as possible by disconnecting the section of line where the fault is and then :-

1) Restoring supply to the non faulty section of line or;

2) Implement a switching option to provide supply from another source (e.g. supply from another LV Transformer) or, if this not possible;

3) Looking at perhaps using a portable generator to provide temporary supply until the fault is fixed. This would be in accordance with the **Policy - Power Supply Interruptions Affecting Cusomters Connected To TasNetworks Distribution Network**.

13•8•2 Replacement Of Known Defective Equipment

Below is an approved list of equipment which should be replaced on fault if found to be substandard, suspect or defective only if:

1. Safe to do so within the environment at the time.
2. Will not take an excessive amount of time.
3. Is not costly in terms of asset or labor costs.

If opportunistic equipment replacements are not appropriate at the time then please raise them as a defect notification.

- Conductor (segment only)
- [deteriorated/damaged/broken/clashing]
- Conductor insulation [deteriorated/damaged]
- Conductor loop [damaged/broken/ unsupported]
- Conductor [low/under clearance over road] - 6.7m HV, 5.5m LV
- Conductor has foreign object
- Tie [deteriorated/damaged/broken/missing]
- Helical wrap/termination [deteriorated/damaged/not compliant]
- Equipment leads [damaged/broken]
- Conductor crimp [dissimilar metals]
- Joint/ connector [damaged/loose/ hot]
- In span fitting [loose/broken/missing]
- [HV/LV] Insulator/ insulator pin [deteriorated/ damaged/polluted]
- Missing / Loose Nuts or Bolts
- Pole top has foreign object
- Pole cap [deteriorated/missing/loose]
- Pole top hardware redundant
- Operating platform installed
- Possum guard [damaged/missing/loose]
- Pole top animal mitigation device [damaged/deteriorated/ loose]
- Stay sighter [damaged/missing]
- Transformer arcing horns installed
- Transformer neutral [broken/missing]
- Cable guard [deteriorated/damaged/missing/loose]
- Cable mounting loose
- Earth [connection/clamps] loose

13•8•3 Temporary Repair

A temporary repair should only be considered as an interim measure where a permanent fix will take too long and the temporary repair :-

1) Can be done without affecting electrical compliance (e.g. not contrary to AS/NZS 3000 Wiring rules or TasNetworks Construction Standards and Work Practices) and;

2) Will not affect public safety and;

3) Protection devices (e.g. service fuse) are still in place to provide protection should a fault occur again.

You must notify the Fault Centre on the details of the temporary repair so arrangements can be made to provide sufficient resources to make a proper repair.

NOTE : Where a metering fault occurs, under no circumstances is the bypassing of electricity meters allowed.

13•8•4 Permanent Repair

13•8•4•1 General

In a fault response situation a permanent repair should only be done if you are qualified to do so and have sufficient, time available , resources and equipment and, the repair work can be done and "certified" in accordance with the relevant TasNetworks construction manual.

13•8•4•2 If Permanent Repair Cannot Be Done

You must :-

1) Make the site safe e.g. isolate and barricade.

2) Notify the Fault Centre on the details of the fault and urgency so a decision can be made to either send out resources to repair the fault as soon as possible or get by until resources can be provided the next day.

13•8•5 Power Distribution System Faults

The following covers the main faults likely to be encountered with power distribution apparatus.

13•8•5•1 Site Inspection

Comply with any immediate directions given by the Operations Fault Centre and report back what you find on site based on a quick risk assessment of the following conditions and any immediate hazards that may affect public safety and then carry out any further instructions given to make the site safe. :-

- Persons milling around an accident scene (e.g. car smashed into a padmount substation setting it alight) getting in the way or with a chance of suffering an injury from any of the following hazards.

- Electrical – live conductors on the ground.
- Fire – pole fire or substation alight.
- Traffic or transformer – large oil spill.
- Any other hazard found that may affect personal or public safety.

13•8•5•2 Fallen Conductors

Example of fallen conductors

Fallen HV or LV conductors must always be treated as being alive until you have confirmed 100 % they are proven de-energised by :-

1) Testing with an appropriate tester and if found alive;

2) If public safety is at risk (e.g. live conductors on a road) ensure you barricade the site first and then;

3) Notify the Fault Centre to isolate the supply or, you may be able to isolate the supply at the local level if you are qualified to do so (e.g. operate Air Break Switch or remove Transformer fuses).

CAUTION :

1) Do not assume anything - to be fail safe always test again after supply has been isolated to ensure conductors are not alive prior to touching them and;

2) If fallen HV conductors are still alive you must make the site safe and ensure supply is isolated and re-test again to ensure conductors are not alive prior to handling them.

3) If for some reason supply cannot be isolated or cannot be isolated immediately :-

   You are not permitted to handle live HV conductors. The best you can do here is to ensure the conductors are barricaded until supply is isolated.

   Provided you are an Electrical Practitioner, competent and have appropriate PPE, you can use live LV work methods to handle live LV conductors provided that :-

   - Open bare wire conductors can be moved to a safer location without clashing with each other.
   - With LV ABC conductors the ends must be capped with insulation prior to moving them.
   - If it is not possible to practically isolate LV supply (isolation switch, fuses or links) and/or isolate by disconnection of conductors as the next preferred option but, you need to cut live conductors away to make the site safe you must ensure :-
     - You apply safe working principles from the Low Voltage Standard.
     - You are wearing appropriate PPE to protect against electric shock and possible arc flash.
     - All load ends have been disconnected and conductors on the ground are not touching any conductive surfaces that could create a circuit to ensure conductors will not be carrying any load current when cut.
     - All conductors are kept separate to ensure no short circuit will occur between conductors. **Note**: Careful risk assessment must be done on open wire conductors to determine if these can be kept separate especially if fallen and tangled in a tree, shrub or foliage.
     - **CAUTION** : To avoid injury from arc flash, as occurred in this **Blue Lesson,** only one conductor to be cut each time (keep cutting distance away from face and neck) and the cut remainder to be carefully removed out of the way before cutting the next conductor.
     - The live remaining conductors and ends to be kept, separate from each other (barriered, insulated and capped as applicable) and, out of reach from the public and Hazardous or Danger Tag applied if the fault will not be fixed immediately.

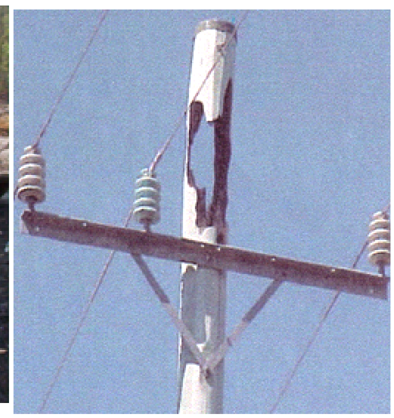
13•8•5•3 Damaged Or Fallen Power Pole

This could be a fallen or badly leaning pole caused by such things as impact from a vehicle or damage from bushfire or flood erosion.

Examples of fallen poles – caused by bush fire or storms.

Do not cut any conductors under tension (e.g. tree or fallen pole suspended) – release the tension (by lifting the heavy object with a crane or similar) before cutting.

13•8•5•4 Poles Damaged By Fire



CAUTION : Wooden poles and cross arms in the distribution network are treated with Copper Chrome Arsenate (CCA) to extend the life of the wood. CCA is hazardous to our heath and can be absorbed into the body through smoke, char and ash from burning or fire-damaged poles. Inhalation can lead to nasal and other respiratory cancers.

Therefore ensure the following is complied with :-

- You have a **Bushfire Response Kit** to deal with burnt poles in the aftermath of a fire. Refer to the Amber Lesson for full details on the kit contents and how to obtain a kit.
- When removing CCA Ash comply with WP Hazard Materials -Transportation Spill Management For CCA.

13•8•5•5 Fallen Vegetation

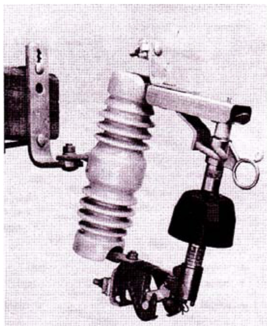
13•8•5•6 Expulsion Drop Out (EDO) Fuses

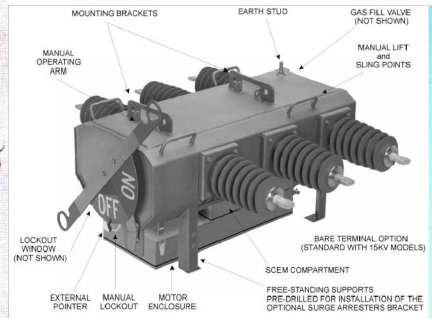
Expulsion Drop Out (EDO) fuse units that have been installed for some time may be prone to faulty operation and failure, shown by the following example of faulty operation with EDO fuse and holder hanging down.

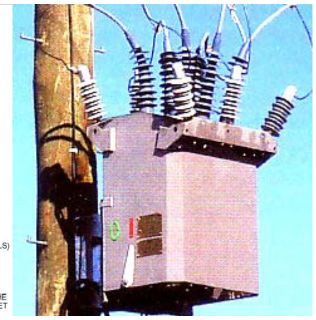
Faulty EDOs are most likely to be of the NGK Stanger C type and, therefore, comply with the Compliance Communication for safe inspection and operation of these EDOs.

13•8•5•7 Reclosers, Load Break Switches & Sectionalisers

13•8•5•7•1 General







Reclosers, Load Break Switches and Sectionalisers are fitted with telecommunication equipment to enable remote operation through TasNetworks SCADA network and therefore;

Any problems that may occur with operation of these devices is normally detected through the SCADA communications but;

If Line Workers on fault response are called out to check one of these devices :-

- For simple faults like broken or burnt connections or insulators can be repaired at the time under the appropriate maintenance task.

- For more complex fault issues, like damaged tank or control cubical and electronics, refer these TasNetworks, Operations Section for the Asset Engineering, Protection & Control Team to deal with (or email **mailto:PandCEng@tasnetworks.com.au)** and;

- Where a faulty device needs to be replaced, the Protection & Control Team will determine what model type should be used for the replacement and, in the interim;

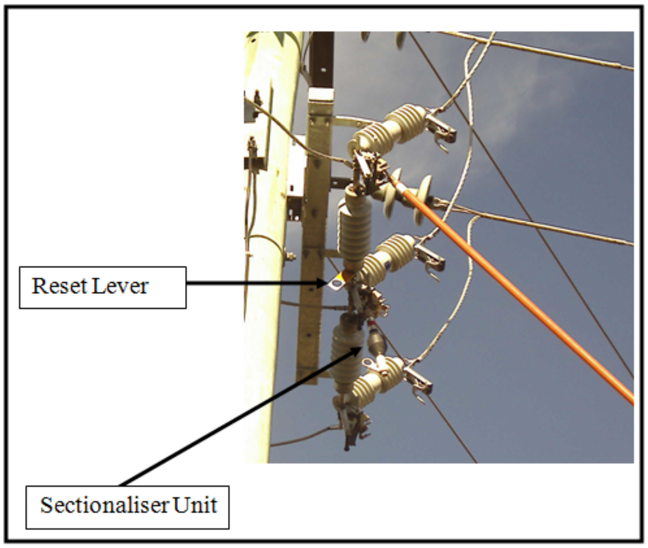
- Determine if a Line Crew needs to be involved with connecting by pass loops to keep supply going until the replacement device gets installed.

Full details on fault response is covered in **Section 6.2 Fault Response** of the work practice **Automatic Reclosers Load Break Switches And Sectionalisers**.

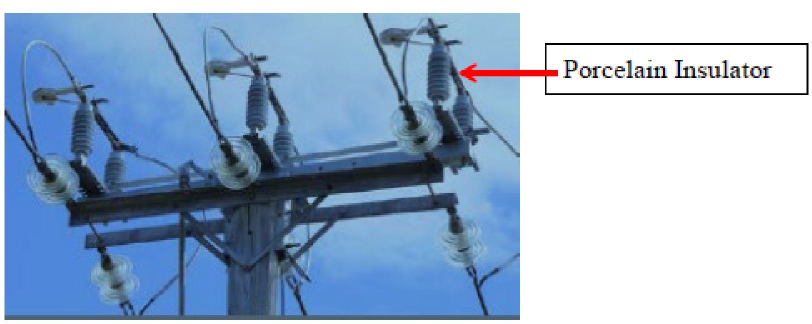
13•8•5•7•2 AK Power Solutions Electronic Sectionalisers (AKPS)

Care must be taken when operating an APKS Sectionaliser that when pulling on the "reset lever" to SET or RESET after a fault, one or more of the Sectionaliser units may dislodge from their EDO fuse base and become a dangerous missile therefore;

1. Check that all three (3) sectionaliser units are hanging correctly in their respective fuse base.
2. Pull firmly, but slowly and carefully, on the "reset lever" with the operating stick until the Sectionaliser has reset and locked in.
3. Close all three (3) sectionaliser units and check for correct operation.



13•8•5•8 Air Break Switches (ABS)



E.g. ABB, S Series Air Break Switch

There is an issue with porcelain insulators on Air Breaks Switches cracking where there is a possibility of bits breaking away and falling down.

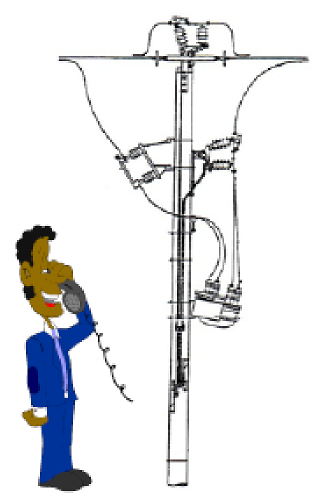
Therefore, when on fault response be aware of this hazard and, until the problem is fully fixed comply with the following safety requirements :-

- Air Break Failures.
- Safe Operation Of Suspect Air Break Switches.
- Safety Alert ABB And Stanger Type ABS.
- Safety Alert AK Power ABS Operational Restrictions.
- Green Lesson Air Break Failure (controls update).

13•8•5•9 Manual Reclose Of HV Apparatus After Fault Operation

IS IT SAFE TO RECLOSE ?

The following procedure shall be applied to the reclosing after fault tripping of high voltage feeders.



Generally, if reclosing is not carried out within 60 seconds of a feeder tripping, it shall be deferred for a period of not less than 15 minutes. During this period the Operating Authority may contact the police and ambulance, and in the fire season, fire authorities to establish whether any emergency exists that could have contributed to the switchgear tripping e.g., car hitting pole.

Such an event may require attendance at the accident scene to establish possible damage and to ensure it is safe to attempt a reclose.

13•8•5•10 Faulty Surge Diverters (Lightning Arrestors)

13•8•5•10•1 General

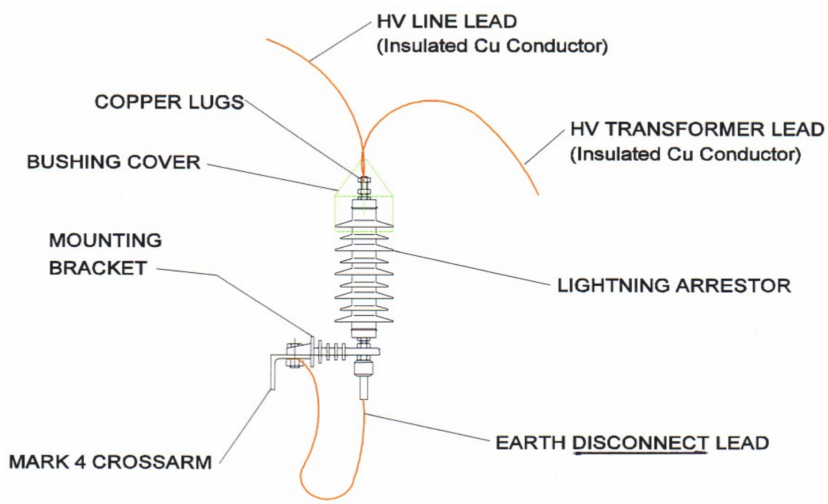
Whenever called upon to replace a faulty surge diverter / lightning arrester it is important that it be done in the correct manner.

A faulty surge diverter can be detected by anyof the following conditions :-

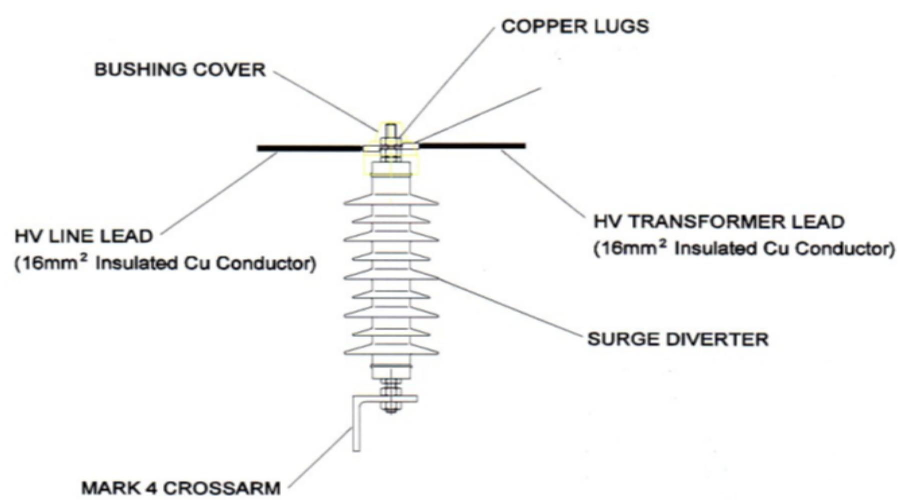
- **Upstream supply trips off**, where surge diverter is installed.
- **Bottom earth lead** and earth connection lug **blows off and drops away** from a dis-connect type surge diverter.

- **Tracking** down the outside of the surge diverter.
- Small "**pin holes**" through the outside of a solid connect type surge diverter.

Note. If a faulty surge diverter has tripped the upstream supply, BUT has NO visible "signs", the only way to check its condition is to disconnect it and then re-energise the supply to see if it holds in. If it does, then that surge diverter WAS faulty.



Example Disconnect Type Surge Diverter



Example Of Direct Connect Type Surge Diverter

The direct connect type of surge diverter may be more difficult to locate when faulty but until it has been located and replaced, the electrical apparatus to which it is connected can NOT be returned to service. This is because, unlike the "disconnect" type, it continues to remain "connected", which creates a "fault" to earth.

This unit does NOT have the earth disconnect lead fitted at the bottom. It bolts directly to the steel cross arm or mounting bracket.

Note. Where the "apparatus" trips out due to a faulty surge diverter, the apparatus will remain out of service until the surge diverter is disconnected or renewed.

13•8•5•10•2 Replacing Faulty Surge Diverters

There are TWO (2) ways in which a faulty surge diverter may be replaced :-

1. Under Access Authority where the high voltage power supply is de-energised and earthed.

   In this situation, to avoid costly re-work should a surge diverter fail, it is advisable to do an insulation resistance test again as below if spare diverters to be used are more than 12 months old.

2. By Live Line personnel under live line conditions.

Surge diverters, to be installed by Live Line workers in accordance with the Live Line Handbook Distribution, MUST be "TESTED" by authorised personnel BEFORE they are installed and;

This applies irrespective of replacement surge diverters already having a test certificate affixed to them, as the insulation resistance of these diverters may have deteriorated over time.

This "test" consists of :-

- An AC test of 9 kV RMS at 50 Hz. for 1 minute on 11 kV units.
- An AC test of 18 kV RMS at 50 Hz. for 1 minute on 22 kV units

13•8•5•11 Faulty Transformers

13•8•5•11•1 Electrical Fault

Where there is a need to replace a faulty transformer due to an electrical fault you must cover off the following requirements as a minimum :-

1. Tag/tape each and record the existing HV and LV conductor **connections, prior to disconnection, to ensure correct** HV and LV phase sequence will be maintained.
2. Ensure new lightning arrestors (check within test date sticker) are fitted to the replacement transformer.
3. Do a Tilt Transformer Test to check new transformer is electrically sound prior to connection and livening up.
4. An electrical test is done on the pole earths (HV and LV) in accordance with work practice **Standard Earth Tests In The Distribution System** to ensure the earth values are within the allowed maximum values for public safety before being permitted to liven up and commission the transformer.
5. Performing commissioning and electrical tests in accordance with work practice **Pole Mounted Transformer Installation Replacement And Testing**.
6. Ensure output LV voltages are within the allowed range specified on the work practice under step 4) above.
7. Ensure the **Report Of Transformer Installed Or Changed Form** is correctly filled out and attached to other paper work for this job for record keeping.

13•8•5•11•2 Transformer (PCB) Contaminated Oil

PCBs (Polychlorinated Biphenyl) were once widely used as a dielectric fluid in electrical transformers and capacitors. Their manufacture ceased in 1977.

However, there remains a large number of installations which may still contain PCB and these particular units were not always labelled.
All transformers, particularly older ones, should be treated as possibly being PCB contaminated until PCB tests are available.

PCB's are non-biodegradable and can be absorbed through the skin, causing a skin rash called chloracne, liver damage and an increase of fat in the blood. Appropriate protective clothing must be worn when handling equipment that may contain PCBs.

13•8•5•11•3 Transformer Oil Spillage Requirements

The following shall be carried out whenever an oil spillage occurs : -

1. Estimate the quantity of oil that has leaked from the transformer.
2. Verify the quantity of oil lost when the transformer is removed from the pole.
3. Contain the area of contamination on the ground. Remove the leaking transformer and contaminated soil ASAP.

   Note. If the PCB level of the oil is unknown, treat as PCB contaminated and take all necessary precautions.
4. Encase the leaking transformer in a plastic bag and place it on a SOLID, bunded pallet for transportation back to depot.
5. Place the contaminated soil under cover at the depot, while awaiting PCB results.
6. Contact TasNetworks Environmental Officer as soon as possible.
7. **Note**. Environmental Pollution Control Act specifies that the incident be reported to the appropriate Authority within 24 hours. The required information needed is the serial number of the transformer, KVA rating, location, time, transformer leak details, volume of oil lost, area of contamination, quantity of oily soil removed, remediation of the area and current location of the transformer and contaminated soil.
8. Get the oil sample tested ASAP for PCB levels. Contact your local Oil Management Officer.
9. Consult with TasNetworks Environmental Officer for appropriate disposal of the contaminated waste.
10. **Note**. For clean-up instructions, help or sample testing of the contaminated soil, contact your local Oil Management Officer.

For further information on hazardous substances and how to deal with them in a safe manner refer to TasNetworks : -

- Safety documents – "Managaing Incidents Emergency Preparedness, and PPE Procedure".
- Procedures : -
  - Hazardous Materials - Transportation Spill Management For Oils And Fuels.
  - Managing Hazardous Substances.
- ChemWatch - Material Safety Data Sheets.

13•8•6 Street Lighting

When attending a fault response care must be taken with the following :-

1. Streetlight control circuits must be treated as alive at all times and appropriate live Low Voltage work procedures adopted to minimise the risk of shock from work carried out remotely that could cause control circuit components to become live.

   Alternatively the work crew should isolate the switch wire and or control circuits and lock and tag control points as appropriate to ensure there is no possibility of the circuit becoming live.

2. Most street light columns only have a small cover latch that, once removed, leaves very little working room. In this situation avoid working with hands inside the column on energised apparatus where ever possible i.e. isolate supply to the column, and lock and tag where applicable.

   Where it may be a practical problem in trying to isolate supply then a thorough risk assessment must be done in accordance with the principles in the Low Voltage Standard and;

   Mitigating measures (e.g. LV insulating gloves and insulating barrier material inside the column) may need to be used to ensure work is performed as safely as possible near energised apparatus.

13•8•7 Fibre Optic Cables

Where a fault response involves a damaged or broken NBN fibre optic cable (e.g. tree fallen on power line, this may require a Line Crew to fix the problem and remove and coil the damage or broken NBN fibre optic cable to a safe location to enable a Contractor with expertise in fibre optic cable repairs to be brought in to repair the fibre optic cable.

Comply with the work practice **Fibre Optic Cables Fault Maintenance** that covers off what work needs to be done by Line Workers to roll back the fibre optic cable to ground level so a Contractor can carry out repairs in a safe manner.

13•8•8 SWER

CAUTION : If a "broken" or "damaged" earth wire is discovered near a SWER Isolating or Distribution transformer DO NOT TOUCH IT. At the time you may NOT KNOW whether it is the high voltage (HV) or low voltage (LV) earth.

A broken HV earth wire can have a **potential difference of 12,700 volts between the broken ends** of the wire.

When a broken or damaged earth wire is discovered : -

- DO NOT TOUCH IT without some form of approved protection.
- Notify the Customer and every other person that may be on site.
- Test and ensure the substation structure is safe to touch as per WP **Safe Approach Testing Of SWER Structures**
- Isolate the transformer in accordance with standing instructions.
- Electrically TEST the earth wire concerned and prove it is NOT alive.
- Excavate and carry out appropriate repairs – refer to WP **Install, Test, Repair SWER Earthing.**
- Re-bury the earth wire and ensure it is left secure and safe.
- Arrange for an Electrician to perform an earth measure test to confirm the SWER earth resistance value is within the allowed limit as per the **SWER Earth Testing Procedure.**
- Re-energise the transformer.
- Advise the Customer.

13•9 OH Servicing And Customer Issues

13•9•1 General

As a reminder to Line Workers, if any electrical work is required beyond the POS or a fault or noncompliance is found to be beyond the POS then, unless you are a dual trader and hold an Electricians Licence as well or you are accredited under TasNetworks ESMS **Work Practice For Work At Customer Switchboards** you must refer the problem found onto an Electrician or notify the Fault Centre for an Electrician to attend.

13•9•2 Duty Of Care Site Inspection

Generally, fault response work by TasNetworks employees and Service Providers would be restricted to the electricity supply infrastructure up to the point of service (POS) and the metering equipment and;

It is the customer's responsibility to engage an Electrical Contractor to fix faults related to the consumers mains, customer switchboard and beyond.

However, where customer safety may be an issue, all TasNetworks employees and Service Providers carrying out electrical work have a duty of care when doing fault response work to ensure the electricity supply is not left in an unsafe state for customers, even if this means checking areas of the electrical installation that would normally be done by an Electrical Contractor.

In addition to faults, site inspection could reveal problems related to non-electrical compliance (e.g. noncompliance to AS/NZS 3000 Wiring Rules) and/or revenue protection issues (electricity theft, tampering, damage etc.).

13•9•3 Technical Support And Who Pays For What

If the fault or non compliance found is the responsibility of the customer then the customer must pay for fixing the problem.

However, it can be tricky sometimes determining whether it is TasNetworks or the customer who should pay but, guidance on this can be found in :-

1. Work practice **WP Dealing With Low & Substandard Services** and**;**
2. Work practice **LV Overhead Service Replacement Requirements** (this tells you what substandard fittings need to be replaced and who is responsible) and;
3. Associated support document **Defective Overhead LV Frequently Asked Questions**.

If you still cannot resolve the problem on who pays for what or have technical issues that need resolution :-

1. Contact your local Team Leader or Stand By Officer (SBO) for support else, as a last resort;
2. Contact the Technical Support Line ph: 1300 300 545 Monday to Friday (7:30 am to 4:30 Pm) or;
3. Email the **Regulator Requests Drawer**.

13•9•4 Isolation Of Supply TasNetworks Issue

Where the fault or problem found is a TasNetworks issue (e.g. faulty burnt service fuse) then :-

1. It is not necessary to issue a **Notice Of Disconnection Of Supply For Safety** but;
2. Fix the problem there and then as a **#**temporary repair or, permanent repair to construction standard if you can else, if not able to, notify the Fault Centre to determine if assistance can be provided fairly soon to fix the problem otherwise, if not;
3. You will have to notify the customer that the supply will need to be isolated in accordance with work practice **Isolation Of LV Supply** until assistance can be provided to fix the problem.

Note: **#** A temporary repair must be done in a compliant manner as per **Section 13.8.3 Temporary Repair.**

13•9•5 Isolation Of Supply Customer Issue

Where a site inspection shows safety is an issue from an electrical noncompliance the customer is responsible for (e.g. live wires sticking out of wall because stove ripped out) or fault found (e.g. burnt fittings on customer switchboard) then :-

1. The supply must be isolated and, made safe in accordance with work practice **Isolation Of LV Supply** and;
2. And the customer must be issued with a **Notice Of Disconnection Of Supply For Safety** and;
3. Notify TasNetworks, Fault Centre as well.
4. **Note**: The supply is not allowed to be re-connected until TasNetworks has received a copy of a **"Certificate Of Electrical Compliance"** from the customer's Electrical Contractor.

   Typical problems (but not inclusive) that may be a customer issue where supply may need to be isolated are :-

   - Cable PI issues.
   - Flickering lights – loose connections at pole top, POS, in a turret, at the transformer, or faulty main switch or customer's wiring.
   - Electric shock.
   - Power surge.
   - Revenue loss events.

13•9•6 Dealing With Electrical Non Compliances

What Is An Electrical Non Compliance?

An electrical non-compliance is any electrical condition or electrical equipment condition that does not meet the requirements of a standard (e.g. AS/NZS 3000 Wiring Rules), manufacturer's instructions or the Service & Installations Rules.

Reporting of these conditions is to make the customer aware of a condition before it becomes an electrical or personal safety risk.

Why Report On Non Compliant Conditions ?

As part of the conditions to be permitted to hold an Electrical Practitioners License, it is a requirement of the Occupational Licensing Act 2005 (Code of practice, Part 3 - Duty to Notify) for the attending electrical practitioner who identifies a non-compliant condition to report the issue to the owner of the installation.

IMPORTANT: Identifying non-compliant installations, in addition to customer safety, is a requirement under an electrical practitioners "duty of care" obligations.

Remember:

Under the Electrical Supply industry Act 1995:

- An Electricity Officer who identifies any unsafe condition should always be disconnecting for safety, a 'Notice of Disconnection of Electrical Supply for Safety' must be issued for that installation & the Fault Centre advised of the disconnection for safety action.
- Supply must not be re-connected until the non-compliance has been fixed and TasNetworks receives a Certificate of Electrical Compliance (CEC) from the customer's Electrical Contractor.

13•9•7 Reporting Electrical Non Compliances

Non-compliant conditions are formally reported to the owner by completing a 'Notice of non-compliant Electrical Installation' form.

A clear description of the issue & what needs to occur to rectify the issues is to be outlined in the comments section. The forms are provided in triplicate as follows :-

- White copy is issued to the customer.
- Blue copy is sent to 'Regulators Requests' email Drawer.
- Green copy remains in the practitioner's book.

As a working example, where a customer installation has a non compliance that the customer needs to have fixed but the noncompliance (e.g. low service in the yellow range as per work practice **WP Dealing With Low & Substandard Services**) is not bad enough to warrant disconnecting supply for safety then;

The customer must be issued with a **Notice Of Non Compliant Electrical Installation** to engage an Electrical Contractor to fix the noncompliance.

13•9•8 Non-Compliant Earth Connection

Example of poor earth connection

It is very important to ensure all earths have a solid connection and low enough resistance value to operate the protection device (normally a fuse) if a fault occurs.

Therefore, report any poor customer earth found to the customer to get an Electrical Contractor to repair it as soon as possible. As back up also report this issue to TasNetworks, Fault Centre.

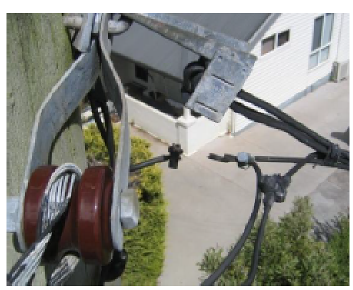
13•9•9 Servicing Faults

Perform a visual check at the POA, pole when you arrive looking for obvious signs of a poor connection :-

- Connection Type
- Service cable type
- Service cable size
- Point of attachment type
- Point of attachment condition

NOTE: 55 amp Stanger fuses or flat ribbon cables must be replaced.

Poor IPC connection



Broken service neutral at pole

Broken service neutral at POA

Examples Of What To Look Out For At POA Or Service Pole

13•9•10 Switchboard Faults

Test all metallic parts for live using a volt stick or independent earth and multi meter.

Line Workers can visually check for obvious issues such as the following examples :-

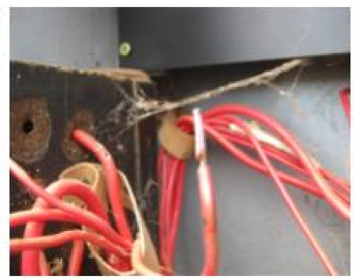
Burnt out fuse

Poor rewirable fuse wedge contact

Poor termination / corrosion on link

Failed active bus on federal switchboard

Loose RCD connection



Termination loose - over heating

Examples Of What To Look Out For At Customer Switchboard

The following link [Non-Compliant Installations] shows additional examples of non-compliances to look out for.

13•9•11 Investigating Fires & Making Safe

13•9•11•1 General

Electrical Inspectors, when working for TasNetworks, used to do all fire investigations.

However, now that the Electrical Inspectors do not work for TasNetworks may be called upon to investigate a fire scene where no fatality is involved.

Note: Only an Electrician can investigate the electrical installation, as a Line Worker is only licensed to work up to the POS. However, Line Worker may be able to assist the Electrician, particularly where the electricity supply needs to be isolated e.g. overhead service disconnected and rolled back.

13•9•11•2 Access at Fire Scene


If you arrive at the fire scene before the Fire Brigade then you will need to quickly assess the situation and see what can be safely done to help out and, you may be able to isolate the electrical supply to make safe.


1. On arrival at fire scene report to the Chief Fire Officer who is Person In Charge (PIC).
2. PIC then logs "Inspector" on-site & informs Fire Communications at base that an Electrician from TasNetworks has arrived.
3. PIC briefs Electrician on what has happened and points out hazards before allowing Electrician and nay offsiders to enter site.
4. **Note**. Police investigation may be underway at same time (depending on circumstances) and if so;
5. Electrician shall liaise with Police on-site and takes direction from them.

6. Police in control will log Electrician in and out in accordance with their investigation.
7. **In summary** - you must obey all instructions given by the PIC and/or the Police, especially if the fire damage looks suspicious as you will need to be careful not to damage any evidence and;
8. You may be called upon to write up a report on your findings regarding the status of the electrical installation and provide this to the Police or in Court.

13•9•11•3 Removal Of Overhead Service

Where fire has badly damaged a domestic installation it may be necessary to isolate the electricity supply and make safe by removing the service.

- If time is available and you are able to do so, take readings from electronic meters before isolating the power. Electro-mechanical meters can be read afterwards or by a Meter Reader later on.
- Disconnect power supply to that building (electrical installation).
- Disconnect the service tails at the pole top.
- Completely remove the service conductor from the Point of Attachment.
- Cap and insulated the ends and roll the service conductor up and attach it to the pole in a safe and secure position at least three (3) metres above the ground.
- Notify the customer (if present) and the Fault Centre.
- Notify TasNetworks, Customer Advocacy Team of the meter readings so they can be passed onto the Electricity Retailer

13•9•11•4 Isolate To Point Of Supply

Where damage is less severe there may only be a need to isolate and make safe back to the POS i.e. the service fuse.

In this situation :

- Comply with the work practice Isolation Of LV Supply
- Notify the customer (if present) and the Fault Centre.

13•9•12 Reconnections After Fault

TasNetworks will require a copy of the Certificate Of Electrical Compliance (CEC) from an Electrical Contractor requesting a reconnection after fault.

This helps protect TasNetworks from connecting an installation that has not been appropriately "certified" as compliant.

All Electrical Contractors have been advised of this change.

TasNetworks will require a copy of the CEC for reconnection after a fault as outlined in the following steps :-

- Electrical Contractor to take a photo of the completed CEC.
- Email it to fault.centre@tasnetworks.com.au
- Call the Fault Centre to ensure the CEC has been received and that a job is created.
- The Fault Centre will then organise for a fault crew to attend
- If the site has been upgraded (not a like for like connection, e.g. OH to UG) or it is more than 10 business days since disconnection an EWR will also be required.

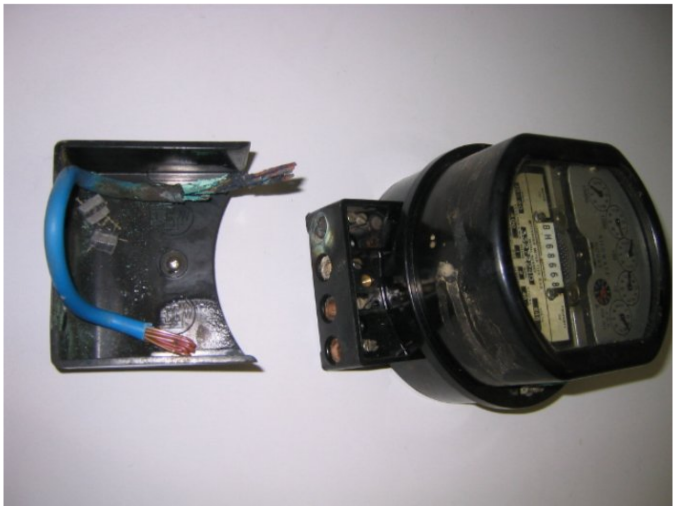
13•9•13 HV Or Lightning Contact With LV Apparatus

The following steps shall be followed in checking installations after HV or lightning contact with LV apparatus :-

1. Reported damage to a **"number"** of installations :-
    - The main overhead circuit shall be left disconnected until all customer installations have been inspected.
2. Reported damage to a "single" installation :-
    - All other installations supplied from the same overhead main circuit shall be checked for damage before restoration of supply. If no other damage is found, the circuit shall be restored with the damaged installation left disconnected until it has been inspected.
3. No reported damage but possible or known HV and LV line contact :-
    - The main overhead circuit shall be left disconnected until all customer installations have been inspected.
    - Inspection of these affected installations shall be in accordance with the Work Practice Dealing With HV Contact With Lightning Strike And Broken Neutral.

13•9•14 Metering Faults

13•9•14•1 General Response To Fault



Example of metering fault

Only persons trained and accredited can perform metering installation of fault response work.
Test any metal case meters found to check that the metal cover has not become alive (some have been found alive).

If you are trained and authorised then fix the metering fault otherwise make safe and report to Fault Centre to arrange for an Electrician to attend as soon as possible to fix the problem.

13•9•14•2 Bypassing Meters.

Where a fault stops the metering equipment from operating and recording electricity consumption, this fault must be passed onto a Customer Connections Electrician to resolve the fault in accordance with **WP Meter Bypass And Fault Response**.

13•9•15 Cable PI Response

The Cable PI Device was introduced to help the public with safety in regard to this device by being plugged into the customer's power point to monitor the LV supply and the inform the customer via an alarm going off if a problem was detected e.g. broken neutral or low voltage etc.

To know what to do on fault response, Line workers need to understand how the Cable PI operates and what all the alarms mean and what to do about the type of fault that the alarm gives an indication of.

Therefore, follow the work practice **Attending Cable PI Faults** to assist with Cable PI faults and, fix the problem up to the POS if you are able to else, make the site safe where necessary and/or isolate as per work practice **Isolation Of LV Supply** and report the problem to TasNetworks, Fault Centre for immediate follow up and repair.