Guide to Safe Work with Cables

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Revised 2021~~3~~, summary of changes:

- *Minor updates to include reference links to new sections of online SM-EI*
- *Reinforce requirement that work on LV shall be managed via a permitting system*
- *Application of LV bonds or task specific procedure required for work on deenergised LV cables*

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This guide has been prepared by representatives of the electricity supply industry to provide guidance on safety practices for use by the industry.

This guide is recommended as good practice by electricity supply industry representatives, but it is not a substitute for legislative or other regulatory requirements. If there is uncertainty on what guidelines or legislative requirements should apply in any particular situation, specialist advice, including legal advice, should be sought.

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This guide has been prepared on the basis that the user will be appropriately trained, qualified, authorised and competent.

Preface

The Technical Guide *Identification of and Work on Cables* was published in December 2004 in conjunction with the removal of the equivalent Appendix from SM-EI, in order to retain the information in an accessible form.

The sixth edition of the *Line Mechanics and Cable Jointers Handbook* (previously known as the *Line Mechanics Handbook*) was published in 2013, and for the first time included cable jointing in its scope.

The Technical Guide *Safe Work With Cables* has been prepared to provide a summary of key safety information for work on, with or in the vicinity of cables.

The content of this report will be monitored and revised periodically. Suggestions for changes should be sent to admin@eea.co.nz or Electricity Engineers' Association, P O Box 5324, Wellington, 6145. www.eea.co.nz.

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PURPOSE

This Technical Guide *Safe Work With Cables* sets out the essential safety requirements for identifying and making safe HV and LV cables.

Employees who are Cable Jointers, or undertaking cable jointing or termination work, are expected to be conversant with the relevant sections of the *Line Mechanics and Cable Jointers Handbook,* ~~and~~ this Guide does not contain the detail of the *Line Mechanics and Cable Jointers Handbook,* nor repeat all information relevant only to Cable Jointers or those undertaking cable jointing or termination work.

This Guide is an 'industry procedure' as defined in the Safety Manual – Electricity Industry (SM-EI), and provides a recommended method of achieving SM-EI requirements for work on cables. Specific and general requirements of SM-EI must also be followed when working on cables, and are not repeated in this Guide.

SCOPE

This Guide applies to work on cables operating at LV or HV.

The Guide does not cover technical requirements such as cable jointing for which reference should be made to the *Line Mechanics and Cable Jointers Handbook.*

The Guide outlines general safety requirements required by legislation and the industry, including the need to notify certain work, wear personal protective equipment, take precautions in confined spaces and have rescue techniques and procedures available in the event of emergency situations arising. This section is followed by the setting out of safety related aspects of specific situations or tasks, including –

(a) operation of existing network cables

(b) locating and identifying cables and fault finding

(c) isolating and earthing of cables for safe work

(d) creation of an equipotential zone before other work begins

(e) work near plant and equipment of other utilities

(f) working in transport corridors, including temporary traffic management.

Contents

1. LEGISLATION AND OTHER RELATED REQUIREMENTS

The principal legislation applying to safety and health in the workplace is the Health and Safety at Work Act 2015 and its regulations, the Electricity Act 1992 and its regulations, and the Hazardous Substances and New Organisms Act 1996 and its regulations. These statutes and regulations impose legal duties on the owners and operators of generating plant and electricity transmission and distribution networks, while international and national standards and electrical codes of practice (ECPs) issued under the authority of the Electricity Act 1992, when cited in regulations, impose further requirements.

Relevant codes for work on cables which have been published under the above legislation include;

(a) *A Guide to Safety with Underground Services* (WorkSafe)

(b) *Good Practice Guidelines for Excavation Safety* (WorkSafe)

(c) *Electrical Code of Practice for Electrical Safe Distances* (ECP 34)

(d) *Code of Practice for Temporary Traffic Management* (CoPTTM) (NZTA)

(e) *National Code of Practice for Utility Operators' Access to Transport Corridors* (NCoP) (NZUAG)

Work on cables as set out in the Electricity (Safety) Regulations 2010 where there is potential or actual exposure to conductive parts is prescribed electrical work (PEW), the requirements for which are prescribed under the Electricity Act 1992 and for which the work must be carried out by a licensed electrical worker, a person working under an employer licence, or a supervised person.

The ESI has developed its own safety rules intended to safeguard persons (employees and contractors) who carry out work on ESI plant and equipment. These are set out in the EEA publication *Safety Manual - Electricity Industry (SM-EI).* The rules must be followed to ensure that the risk of serious harm during work and in the workplace is minimised~~. SM-EI Part 1 sets out *Minimum Safety Requirements*, Part 2 is a *General Safety Guide* and Part 3 sets out *Rules for Work on Equipment.*~~

Relevant codes for work on cables which have been published by the EEA, consistent with SM-EI, include;

(a) *The Line Mechanics' and Cable Jointers' Handbook*

(b) *Guide to Supervision for Safety*

(c) *Guide to Electrical Safety for Emergency Services Personnel*

(d) *Guide to Live LV Electrical Work*

(e) *Guide for Portable Equipment for Work On or Near Conductors*

~~(e)~~(f) *Guide to Low Voltage Works Management for Distribution (Network) Infrastructure Assets*

The use of hyperlinks to SM-EI are utilised in this document and a highlighted as such *"SM-EI"*

2. WORK PLANNING – HAZARD IDENTIFICATION AND CONTROL

2.1 Work Planning and Control

~~Three basic r~~Rules for work on equipment specifically around planning a job must be considered before any work is undertaken. The requirements of ~~the following~~ the SM-EI "*Readiness*" section~~SM-EI rules~~ must be completed prior to the commencement of any work on site.~~;~~

~~3.302 - Control of Work,~~

~~3.303 - Hazard Identification and Risk Management, and~~

~~3.304 - Worksite Safety Plan.~~

For work on a cable, internal or external, it must be positively identified at the point of work.

For live work on LV cables refer to the EEA *Guide to Live LV Electrical Work*.

When planning work, the pre-worksite, at the worksite and also the work position activities must be considered. The planning work must include hazard identification and determination of appropriate control measures to minimise any risk from identified hazards, including those created by the intended work.

For work planning to be effective, knowledge of the general design arrangement of the cable system should be known such as:

(a) Where the cable system can be isolated, including in an emergency,

(b) Whether there is any embedded ~~local~~ generation connected,

(c) Other conductors and services in the vicinity,

(d) Conductor identification and layout.

(e) Age and type of cable.

~~(e)~~(f) Manufacturers guidance, instruction and information.

The competencies of the workers to undertake respective work tasks shall be considered as part of the overall planning process.

2.2 Worksite Safety Plan

As required by SM-EI, prior to the commencement of work, a worksite safety plan is to be established. For cable work this should include but not be limited to:

(a) A thorough assessment of the worksite for potential hazards paying particular attention to prevention of access into the work area of other parties and the general public, weather conditions if outside, and lighting.

(b) A method of management or control for each identified hazard or risk.

Commented [JG1]: Note this is italic and underlined and hyperlinks to the subject view 'readiness in SM-EI

(c) An assessment of the condition of cable insulation or covering, to plan where additional cover up may be required.

(d) Identification of personal protective equipment required.

(e) The scope of the work to be undertaken.

(f) Confirmation of the competencies of the electrical and other workers to undertake respective work tasks.

(g) Work procedure to be used including the selection of adequately rated safety equipment for performing the work.

2.3 Potential Work Hazards and Risks

Consideration is to be given to:

(a) Voltage difference when the sheath or cores at the point of work are connected to a different earthing area from the one at the point of the work, and an earth fault occurs in one of these earthing areas;

(b) Induced voltages which may result from HV circuits running physically parallel to the cable being worked on carrying fault current;

(c) Accidental livening from the cable being worked on being connected to an overhead line circuit;

(d) Risks that may arise from adjacent plant and equipment that is controlled by a third party. Gas, water pipes or any other utility assets that may pose a risk must be identified and appropriate safety measures applied to them. The risks of flame impingement on plastic gas piping and high pressure water piping must be considered and the piping protected.

(e) Flammable gas which may permeate into a cable excavation from ground contamination sources, heavier than air gases which may migrate from above ground sources, or toxic gases, e.g. carbon monoxide, which may diffuse throughout the excavation.

(f) Pressurised HV cables, either with oil or gas.

(g) Vehicular and pedestrian traffic that may be endangered or affect the worksite and must be controlled to the required local standards. Such control and/or the presence of assets of other utilities may require a sub-contractor to be employed to control a particular area in a specialised role.

Essential controls include:

(h) All tools, plant, and equipment, including all necessary personal protective equipment (PPE), used on the worksite must be safe and ~~in a serviceable state~~ fit for purpose so that they do not present any threat to safety or health and perform their protective task when used correctly.

(i) Joint holes and areas of work that are ~~must be~~ excavated ~~and~~ must be set up correctly so that there is ~~good~~ safe access to enter or exit the joint hole at all times. Barriers and signage ~~or shoring~~ must be placed around the worksite at all times where required to protect the public.

(j) Where work is to be carried out on any isolated, ~~and~~ earthed or LV bonded cable, it must first be electrically identified as the cable to which safety procedures at its terminations have been applied. The work control used, e.g. an access permit, and the isolations must be documented, and a copy of the documentation held by the work party.

(k) Where work is to be carried out on a live low voltage (LV) cable, industry and asset owner procedures must be followed.

(l) Existing cables must remain supported and not be moved unless this is planned work.

Non-electrical hazards that may be encountered are listed in Appendix 1.

3. GENERAL SAFETY REQUIREMENTS

3.1 Work On or Near Live Equipment

All LV and HV cables in the vicinity of the work shall be treated as live unless proven de-energised, isolated, earthed or LV bonded~~and, if HV, earthed~~. Otherwise, if not isolated (and earthed or LV bonded) all cables are to be treated the same as live exposed conductors unless the cable insulation is verified to be in a satisfactory condition.

Any cable whose condition is suspect must not be handled unless it is de-energised.

Live paper insulated lead covered (PILC) cables, both HV and LV, and pressurised cables must not be handled under any circumstance.

Any other HV cable which is live must not be handled unless it is completely surrounded by an earthed sheath or screen and precautions are taken to avoid risks from induced voltages and transferred earth potential.

All work on other live LV cables must be carried out in accordance with SM-EI and the EEA *Guide to Live LV Electrical Work.*

3.2 Work on Isolated LV Cables

For work on LV cables that have been isolated ~~but that are liable to become live,~~ and that have exposed metal, the cables shall have an access permit or test permit issued and either;

(a) ~~be earthed before~~have LV bonds applied before work on them is commenced and shall remain ~~earthed~~ LV bonded until all work is completed (Prior to ~~earthing~~ applying LV bonds, long cables (>100 m) shall have any capacitive effect discharged), or,

~~(a)~~ have a documented task specific procedure, the requirements of that procedure shall remain in place for the duration of the access permit ~~where it is not reasonably practicable for earths to be applied outlining the safe work method and equipment to be used~~

(b) Note: No work shall be commenced on any isolated and ~~earthed~~ LV bonded LV cable until:

i. the cable has been electrically identified at the point of work;

ii. the cable has been isolated from every point of network supply and suitable warning signs attached at each isolation point;

iii. a test, where practicable, has been made to ensure that the cable is safe to work on, otherwise an alternative suitable assessment used to ensure it is safe to work on.

~~or~~

~~(c) be treated as live and procedures set out in the EEA *Guide to Live LV Electrical Work* applied.~~

3.3 Working on Auxiliary Circuits

When working on any auxiliary circuits (e.g. street lighting, water heating, pilot, control, communications etc.), precautions may be made necessary by the high voltages which can appear due to:

(a) the capacitive effect where they parallel an HV circuit; or

(b) the inductive effect where they parallel a fault carrying circuit.

3.4 Pressurised Cables

Work on pressurised cables or associated pressure equipment, other than work external to the pressurised parts, shall be carried out only when the pressure has been adjusted to a level which avoids the risk of harm, using manufacturer's guidance where available.

3.5 Confined Space Working

Where the work is in a space such as in prepared cable jointing pits, cable trenches, etc, the work may qualify as work in a confined space (Refer to the definition in SM-EI).

SM-EI ~~Rule 2.1202~~ outlines the basic requirements for working in designated "*confined spaces*", including the requirements for a confined space management system.

4. OPERATIONAL SAFETY ISSUES

4.1 Stored Electrical Energy

Because of their construction with conductors in close proximity to each other, cables in operation have the ability to store energy in the form of electric charges on electrodes. This stored energy, which is proportional to the cable's operating voltage and the cable length, remains in place when the cable is no longer energised from a source of supply and, in the absence of any "discharge" measures, will leak away slowly. The longer the cable, the longer the time the charge will take to leak away. The same situation applies for any testing of the cable.

The stored energy presents a safety risk that requires adequate control to avoid harm. If any cable is to be worked on shortly after it has been de-energised or subjected to testing, the stored energy must be discharged before work commences, or before making or disconnecting test connections to the cores. This is accomplished by shorting the cable cores together and to earth by applying earths at one end, or preferably at both ends, for a sufficient period to remove the stored energy charge. Longer cables subject to HV testing should be discharged via a suitable discharge resistance device.

Any unearthed HV cable must be treated with caution, and work on any such cable must not be commenced until earthing has been carried out at both its ends and sufficient time has been provided to permit the cable capacitance to become discharged.

4.2 Cable Potheads

Historically, cable potheads were used to terminate HV and LV paper insulated lead covered (PILC) cables installed on poles to allow their tails to be connected to pole-mounted fuses or the conductors of overhead lines. Each pothead consists of a cast iron box fitted with insulated bushings and is filled with compound (pitch) when the termination of the cores on the bushings has been completed. The pothead is exposed to the elements during its life and to continual heating and cooling with the result that the compound may gradually deteriorate leaving a void. If moisture enters the void and deteriorates the paper insulation on the cores, a flashover may eventually occur with the resulting explosion (which will be dependent on the prevailing fault level) being sufficient to shatter the cast iron box.

4.3 Ferro-Resonance

Ferro-resonance occurs when switching is carried out on a phase by phase basis in circumstances where the capacitive reactance equals or nearly equals the inductive reactance at the frequency at which the circuit operates. A typical configuration within which ferro-resonance may occur is an HV circuit involving a cable of a minimum length (a length of 50 m is used in the *Line Mechanics and Cable Jointers Handbook*) connected in series with a transformer with nil or low load. Ferro-resonance results in an over voltage which could cause a flashover or other equipment damage, and other symptoms include audible noise and

overheating. The over voltage occurs between the core and sheath on two phases, for the full length of the cable, and also occurs between one transformer winding and earth.

Ferro-resonance is most likely to occur when closing a single phase device when livening a cable on a three phase system, e.g. closing a drop-out fuse or remaking a live line cut. Insulation failure at a cable termination crutch is to be specifically considered. Ferro-resonance may also occur when opening a single phase device, but is less likely than when closing.

Single phase livening on a three phase system which includes a long cable and transformer shall not be carried out without using controls to minimise the risk of ferro-resonance occurring. Controls to be considered include;

(a) apply a minimum resistive load to the connected transformer of at least 3% of the transformer rating

(b) minimise the length of cable switched

(c) switch the cable and transformer separately.

4.4 Ferranti Effect

The **Ferranti Effect** is a voltage increase in the receiving end of an electrical transmission line when it is operated in a no-load, or low-load, condition. This results in a receiving end voltage value higher than the sending point.
This phenomena can also occur in Medium Voltage distribution cable runs The Ferranti effect can be more pronounced in underground cables, even in short lengths, because of their high capacitance per unit length, and lower electrical impedance.

5. LOCATION, IDENTIFICATION AND FAULT FINDING

5.1 Location of Underground Cables and Other Services

Methods for locating services are outlined in the WorkSafe publication *Guide for Safety with Underground Services*.

Underground services (including cables) location and identification must be carried out before any in-service cable is excavated. Location and identification practices employ a mix of plan reading, the use of suitable tracing equipment to correctly locate and verify the services, and safe digging. Location of power cables in service may be effected by various means, including detection by portable equipment of the electro-magnetic fields emanating from the currents flowing in the cable cores or the electric fields emanating from the voltages on the cable cores. Alternatively, a cable requiring determination of location may be taken out of service and injected with a signal that may then be traced by portable equipment along the cable route.

Prior to commencing any excavations, copies of the latest plans from the respective authorities should be obtained and be maintained on the worksite. Particular care should be taken to locate and, where appropriate, protect all existing services. The recorded depth of cover may have

changed over time due to excavation or the addition of cover and the off-set references may have disappeared due to road or building reconstruction.

Services to be aware of include:

(a) Existing power cables

(b) Sewerage pipes

(c) Storm water pipes

(d) Potable water pipes

(e) Traffic light feeder cables and inductive detector loops and their associated cables.

(f) Telecommunications (including fibre) cables

(g) Gas pipes

(h) Oil (in some areas) pipes.

Wherever possible during cable laying, cables should be threaded under existing services or obstructions whilst maintaining minimum clearances in accordance with the service owner's requirements.

Typically, there will be both a horizontal and vertical requirement for separation due to owners' requirements to access their plant so, wherever possible, overlays should be avoided.

Reference should be made to the technical specifications for works or the relevant asset owners' requirements for clearances. Where separation cannot be maintained, approval should be obtained from the owner of the service.

5.2 Identification of Cables

The cable shall be positively identified. The identification methods may include:

(a) Physically tracing the exposed cable from one termination to the point of work. Where necessary to aid identification, adjacent cables shall be exposed.

(b) Using an appropriate electrical identifying test, such as a trace signal applied at the termination and identified at the point of work.

(c) Using reliable cable records:

- For HV cables, this shall be followed by using a spiking or remote cutting device. Precautions must be taken to prevent re-livening the cable after the spiking in case an error has been made in identification, including confirmation that the cable protection has not operated. After the cable has been cut and before any further work is carried out, it must be identified by an appropriate test that may also require a test permit.

- For LV cables, this method applies only where live jointing techniques are to be used. Care shall be exercised while opening the cable in case an HV or dc cable is opened due to an error in identification.

(d) Using the location of cable damage. Where the point of damage is visible and a protective device or devices operated at the time of damage, this may be taken as a preliminary identification. Final identification will be after application of an identification method described in (a), (b) or (c) above.

Where there is any doubt as to whether the exposed cable is the one to be worked on, in the case of HV cables (other than pressurised cables) industry rules require that a spike be driven through the cable or the cable is cut using a remote cutting device before work commences.

5.3 Finding Faults

The locating of faults in cables is not a simple process in the absence of some clear indicator such as a contractor's excavation along the route of the cable where a cable strike has probably occurred. Determination of the location will usually be carried out by test technicians using specialised equipment

Testing of a faulted cable will require its initial isolation and earthing to discharge any charge in the unfaulted conductors. The testing procedure will require the connection of the test equipment and the removal of the earths (only on the conductor being tested), at which time the protection against any earth potential rise (EPR) that might occur between the cable cores and the point at which the tests are conducted is also removed. The test equipment must be connected without delay after the removal of the earths so that the time of exposure to the risk of EPR is limited. In particular, the cores must be earthed at the end of each test to re-discharge the cable before the next test is applied.

6. ISOLATION, ~~AND~~ EARTHING, LV BONDING

6.1 General

Before work begins on any in-service HV cable which will include work on or within the minimum approach distance of the cores, the cable must be isolated from all points of supply, be proven de energised and the cores must be short circuited and earthed and an access or test permit issued.

Where the cable is being terminated onto switchgear or other terminals, earthing must also be applied to those terminals to ensure that, should any inadvertent livening of the cable take place while jointing is in progress, a phase to earth fault will occur and be detected by the protection, with the result that the supply to the cable will be immediately interrupted.

~~Before work begins on any in-service LV cable which will include work on or within the minimum approach distance of the cores, the cable must be isolated from any source of supply and earthed if practicable and safe to carry out.~~

~~not short~~ If the cable cannot be earthed then live work procedures must be used.

Where a cable is cut and fitted with a temporary capping pending its termination on switchgear or jointing to another length of cable, its cores under the capping should always be bonded together and to any sheath and armour on the cable. It may not be practicable to earth the cable capping effectively but, if the cable is livened, a phase to phase and/or phase to earth fault will occur, with consequent tripping of the supply.

Before work begins on any isolated LV cables they shall be bonded and have an Access or Test permit issued. For LV cables where it is not reasonably practicable to apply LV bonds then an Access Permit shall be issued along with a documented task specific procedure detailing the additional controls

6.2 Equipotential Zone

Equipotential zones (EPZ) are to be established where practicable. Guidance for establishing EPZ is contained in section 16.2 of the *Line Mechanics and Cable Jointers Handbook.*

The guidance in this section applies to HV cables up to and including 33 kV only. For cables at 66 kV and above the asset owner shall provide guidance on establishing an EPZ.

In accordance with SM-EI and the rules under "*Energy – Electrical hazards"* ~~rules 3.601 and 3.602 *Isolation and Earthing* and rule 3.731 *Power Cables,* equipotential zones~~protection from voltage differences and creation of equipotential zones are to be established whilst undertaking jointing of HV cables. All conductive parts that may be touched simultaneously, either by a person or conductive tooling, including cable screens, conductive sheaths, armouring and cores (where practicable) must be bonded due to the risk of differences in potential that may arise between cables being worked on due to fault currents or from cable induction.

When an earth fault occurs on the system of which the cables are a part, the paths along cable screens, sheaths or armour act as parallel paths to carry the earth fault current. Other than for newly laid cables that are not terminated to any equipment in a substation, the jointing of two cables will usually involve working on at least one cable that is terminated to a substation. Accordingly, the potential of the earth grid of that substation will be imported to the jointing position (the joint bay) via the screen, sheath and armour, and the cable cores. The Cable Jointer and anyone assisting must be fully aware of the hazard of remote earth potential and follow procedures that will minimise the likelihood of harm occurring. During any earth fault, the potential of the earth surrounding the jointing bay will be at a potential that will differ from the potential on the cores, screen, sheath and armour on which work is being done at the same time. The difference may be sufficient to cause serious harm from electric shock. Accordingly, in order to protect the Cable Jointer and other persons at the jointing position, it is necessary to establish an equipotential zone to avoid exposure to such an event. This may include, while

making contact with any part of the cable, the Cable Jointer is insulated from the local ground, typically using insulated mats or boots.

Bonding is to be undertaken in conjunction with the existing isolation and earthing requirements of any permit that may be in force and should be noted as a recipient applied safety measure on the appropriate documentation by the installation of a temporary earth bond lead with suitable clamps that bridge the earthing of cable cores, screen and conductive sheath at the point of origin so that differing potentials will not occur whilst jointing work is proceeding.

Apply an appropriate process to achieve adequate protection from voltage differences. This may include but not be limited to wearing HV insulating gloves and dielectric boots whilst connecting any bonding leads or screen connectors during the bonding of HV cable cores and screens. However, due to contamination issues and the requirement to use specialised stripping tools whilst working on cores, the wearing of HV insulating gloves while bonding cores may be impracticable, therefore a conductor that cannot practicably be bonded during work shall be shrouded from accidental contact until such time as work on the conductor is required, thereby minimizing the exposure time to non-bonded parts.

Rated mats shall also be used to cover all exposed areas of the cables and screens whilst jointing. The sides of joint pits/excavations and flooring should also be covered as dielectric boots are suitable only if not sitting or leaning against exposed ground.

There may be other conductive services in the cable trench or otherwise in the vicinity of the cable jointing work, e.g. gas piping, water piping, telephone cable etc. Such conductive services must also be shielded or bonded into the ~~EPZ~~equipotential zone.

Bonding and insulating equipment includes:

- Bonding lead with clamps
- Earth spike with lead
- Constant tension springs
- Set of core shrouds
- Insulating mat (floor)
- Insulation mats (for covering of pipes, services)
- Dielectric boots

6.3 Risk of Inadvertent Livening

The risk presented by possible inadvertent livening is best controlled by earthing and short-circuiting, or LV bonding of those cables that have been isolated but may become live before work on them is commenced, and retaining these measures in place, where practicable, until all work is complete. ~~Alternatively, and only in the case of LV cables, the cable should be treated as being live, with the work being carried out in accordance with live cable work procedures.~~

Earthing must always be carried out where work is being carried out on cables that are terminated on poles carrying LV and/or HV conductors, or being installed on or removed from such poles, or where the cables are in the vicinity of in-service circuits where contact with a live conductor could occur.

7. WORK ON CABLES

7.1 Safe Exposure of Buried Cables

The uncovering of cables for purposes of jointing, terminating, repair or any other access, e.g. inspection, needs to be done in such a way as to ensure no damage to undamaged lengths of the cable and to any other service assets that may be in the vicinity of the cable. Disturbed ground near the cable fault may be indicative of damage to the cable or, if the position is close to a recorded joint, the failure of the joint is a possibility.

Identification of assets of other service providers in the vicinity is covered in section 5.1. Unless the depth of any service assets and cable(s) are known (and also known to be unchanged), digging should be carried out by hand or hydrovac until the position of the cable or other services is found and established. Mechanical diggers should be used only where it is known that there are no buried services in the vicinity or the location of such services is confidently known. In any case, the use of a mechanical digger for digging must cease once the excavation nears the position of the cable.

7.2 Jointing Bays

Work in jointing bays and similar excavations may qualify as Notifiable Work and as such shall be notified to WorkSafe. ~~(Refer to Appendix A of SM-EI for the requirements)~~

As in the case of cable trenches, cable bay excavations must be examined for safety prior to carrying out the task. If deeper than 1.5 metres, they must be cut back to a safe slope, and the material in the face must be of good standing under all reasonably foreseeable conditions of work and weather or else be suitably shored. The bay must be fenced with barriers or equivalent to protect the public. Since flammable materials will almost always be used or be present during the jointing, it is essential to have a fire extinguisher within easy access. If the jointing bay qualifies as a confined space precautions must be taken before entry, and the atmosphere monitored during the work. Suitability of entry and exit points needs to be considered.

7.3 Digging, Trenching and Thrusting

Prior to commencing digging, trenching or thrusting some factors to consider are:

(a) Traffic management at the worksite including control of pedestrians

(b) Proximity of existing underground services (particularly where trenchless methods are used)

(c) Barriers to prevent uncontrolled access to the excavation area

(d) Ground stability

(e) Build-up of groundwater during excavations

(f) Ground contamination.

The route of any new cable must ensure that the cable, either in its final position or during its installation, will not be subjected to bending beyond its manufacturer's tolerance that would damage the insulation of its cores, its sheath, or screen and belt papers.

8. CABLE STORAGE AND TRANSPORT

Cables are supplied on cable drums, sized to permit their optimum handling (by crane or forklift) and transport. The cable drums are usually constructed of untreated wood, which will deteriorate over time, so drums should be stored, pending their use at a site, under shelter from the sun and weather to prolong their lives.

Transporting and storing drums should be with their axis horizontal and not turned over on their sides, which would permit the cable coils to fall to one side. It is essential that the drums be carefully secured to avoid both their falling over in transit or their rolling off the transporting vehicle.

Drums are heavy (weight should be stencilled on the drum side) and it is important to ensure that any crane used to lift a drum is suitably rated for the drum weight and the crane operating radius used is safe for the weight. The rating of the lifting attachment used, e.g. chains, slings, spreader bars, etc, must also be adequate for the weight.

9. WORKING IN TRANSPORT CORRIDORS

9.1 General

Much of the work carried out by cable workers will be carried out inside a transport corridor of some type. As for any other work, work in transport corridors will involve the identification and adequate controls of any hazards presented by the work to the forms of transport using the corridor and, conversely, by those forms of transport to the work and those performing it. Accordingly, persons working in transport corridors must be competent in recognising and managing the risks posed by these two sets of hazards.

Access to transport corridors and activities within these is controlled by the *National Code of Practice for Utilities' Access to Transport Corridors* (NCoP).

9.2 Temporary Traffic Management

Because many overhead lines and cables are sited in road reserves, cable workers should be trained in the requirements of the *Code of Practice for Temporary Traffic Management* (CoPTTM) and be competent to exercise the duties of various designated categories if necessary at any worksite.

10. FURTHER INFORMATION

A Guide to Safety with Underground Services (WorkSafe NZ)

Electrical Code of Practice for Electrical Safe Distances (ECP 34) (MBIE)

Electricity Act 1992 and amendments

Electricity (Safety) Regulations 2010 and amendments

Code of Practice for Temporary Traffic Management (CoPTTM) (NZTA)

Guide to Live Low Voltage Work (EEA)

Hazardous Substances and New Organisms Act 1996 and amendments

Health and Safety at Work Act 2015

National Code of Practice for Utility Operators' Access to Transport Corridors (NCoP) (NZUAG)

Safety Manual – Electricity Industry (SM-EI) (EEA)

The Line Mechanics' and Cable Jointers' Handbook (EEA)

Good Practice Guidelines for Excavation Safety (WorkSafe NZ)

APPENDIX 1 Common Non-Electrical Hazards That May Be Encountered

Non-electrical hazards which may contribute to risks while carrying out work on cables include:

(a) Potential for fall from heights, slippery surfaces

(b) Removal of cover plates near energised equipment

(c) Confined spaces (where there may be a hazardous atmosphere)

(d) Lack of sufficient light to work safely

(e) Lack of ventilation leading to uncomfortable, hot and humid working conditions

(f) Excessive fatigue of the workers, due to pressure of deadlines or other factors

(g) Adverse weather conditions, e.g. rain, lightning, wind, heat, cold

(h) Using a gas flame near exposed electrical conductors (a flame is a conductor)

(i) Using a gas flame near pipework carrying gas, particularly plastic piping

(j) Using conductive or flammable cleaning solvents

(k) Temperature rise as a result of combustion

(l) Cramped working conditions, including cable trenches and cable pits

(m) Explosive atmospheres

(n) Use of conductive tools and equipment, e.g. metallic tape measures and rulers

(o) Electric tools and equipment (e.g. hand lamps, drills, saws, torches and test instruments)

(p) Personal effects (e.g. rings, jewellery, watches, pens, cigarette lighters, matches, hearing aids, mobile phones and pagers, transistor radios and similar)

(q) General work activities (e.g. welding, cutting, brazing, using hand saws, drilling of all types, hammering and chiselling)

(r) Static electricity from materials and clothing

(s) Hot metal surfaces due to drilling, grinding, welding, etc

(t) Excavation associated with electrical work

(u) Molten metal from arcs

(v) Asbestos material/switchboards

(w) Spontaneous combustion of rags used with solvents or mineral oils.

(x) Water borne diseases.