



Vacuum Excavation in the vicinity of the Wellington Electricity Network

Contents

1. PURPOSE 3

2. POLICY 3

3. SCOPE 3

4. REFERENCES 3

5. GENERAL 4

6. PLANNING AND PROCESSES..... 4

7. QUALIFICATION AND TRAINING 4

8. PRESSURES AND FLOW RATES..... 5

9. LABOUR REQUIREMENTS 5

 Personal Protective Equipment..... 6

10. NETWORK PROTECTION 6

 Damaged or Suspect Cables 6

 Boom Movement and Maintaining Safe Limits from Powerlines 6

 Temporary Support of Paper Insulated Lead Covered Cables (PILC)..... 6

 Temporary Support of 33kV Gas and Oil Filled cables..... 7

11. ENVIRONMENTAL PROTECTION..... 7

 Tree Protection 7

 Site Reinstatement 7

 Waste Disposal 7

 Spill Management..... 8

12. EQUIPOTENTIAL ZONE PROTECTION 8

1. Purpose

To establish guidelines for undertaking vacuum excavation in close proximity of Wellington Electricity's underground distribution network.

2. Policy

Vacuum excavation is a means of soil extraction through vacuum when using pressurized water or air for breaking ground. This method of excavation is referred to as "soft excavation technology" and is commonly accepted as being equivalent or safer than hand digging around underground facilities.

Use of the equipment must be undertaken in accordance with this document.

3. Scope

This document covers hazard recognition, assessment and control practices along with the physical requirements to be followed by the operator of vacuum excavation plant when working in close proximity of Wellington Electricity's underground distribution network.

4. References

Reference Standards	Title	
ENS-321	Excavation Standard	
ENM-009	Wellington Electricity Close approach Consent Process	
ESG-003	Wellington Electricity Safe Work Practices Manual	
NZUAG	Working In The Road Code Of Practice	
NZCEP 34:2001	Electrical Safe Distances	
NZCEP 35:1993	Power Systems Earthing	
OSH	Guide for Safety with Underground Services	
End Of References		

5. General

The vacuum excavation equipment shall be operated in accordance with the manufacturers operating instructions.

The vacuum excavation equipment must be operated in accordance with practices that provide appropriate levels of worker and public safety and prevent damage to buried utilities.

The tools used (dig wand / vacuum tube) must be specifically designed for excavating around buried utilities (e.g. rubberized coating on dig wand and rubberized sleeve attached to the end of the vacuum tube).

This guideline is to be read in conjunction with OSH Guide for Safety with Underground Services

6. Planning and Processes

A documented company Safety program must be in place and available for review upon request by a representative of Wellington Electricity.

Documented vacuum excavation Safe Work Practices and Job Procedures must also be in place and available for review upon request by a representative of Wellington Electricity.

Safe Work Practices and controls must be implemented for all identified hazards after a proper risk assessment is completed.

Use of the equipment follows the documented Safe Work Practices and Job Procedures.

The Contractor using the vacuum equipment shall obtain obstruction plans and where required mark out and locate services prior to the commencement of work.

The work area must be appropriately fenced off to protect the public and personnel, such as the use of high visibility cones and barriers.

Operators should shroud excavation areas with shade cloths to protect public from projectile rocks and spray

7. Qualification and Training

Only Competent and Qualified Workers operate the equipment.

Vacuum excavation equipment shall only be operated by a competent person. The operator must have the knowledge, training and experience to perform the work, be familiar with any Worksafe requirements and the regulations that may apply to the work and have knowledge of all potential and actual danger to health and safety in the workplace.

It is good practice that workers have training recognised by industry, defined safe work practices, manufacturer's recommended procedures specific to the equipment they are operating, and training specific to any known utilities in the area of excavation.

8. Pressures and Flow Rates

The pressurised air or water wands shall never remain motionless during excavation. Aiming directly at the underground utilities shall be avoided at all times.

A distance of 200mm shall be maintained between the end of the pressure wand nozzle and the underground utility and / or subsoil. The nozzle shall never be inserted into the subsoil while excavating within the vicinity of the Wellington Electricity Network.

The operator shall only use vacuum-excavation equipment and pressure wand nozzles that have been specifically designed for use around underground utility services.

When pressurised water wands are used, the maximum water pressure to be used at any time with a straight tip nozzle during excavation shall be 1,500psi. All pressure measurements are to be monitored using a pressure gauge mounted on the excavation machine. A straight tip nozzle is a single orifice fitting that can be inserted into the end of the wand used with a hydro-excavation machine so there is a single concentrated jet of water exiting from the tip of the nozzle.

The maximum water pressure to be used at any time with a spinning nozzle during excavation shall be 2,000psi. When a spinning tip nozzle is used, pressure measurements are to be monitored using a pressure gauge mounted on the excavation machine. A spinning tip nozzle consists of a conically shaped housing that contains a single exit point (to facilitate the flow of the liquid) as well as a rotor insert. The rotor insert has a series of blades such that when liquid is flowing through the nozzle, the rotor is forced to spin around the longitudinal axis of the nozzle. The rotor insert also contains three or more channels that force liquid to flow in different pathways through the rotor insert to the tip of the rotor which, as a result of the high pressure liquid is forced into contact with the nozzle housing. The liquid flowing through the nozzle is dispersed through the tip of the nozzle housing in a conical shape, having an angle of not less than 20°.

If heated water is used during excavation, the temperature and pressure of the water shall never exceed 40°C and 2,000psi respectively (for spinning tip nozzle).

If damage to underground equipment (and/or coverings on these) occurs while using vacuum-excavation technology or any other method of excavation, the Contractor shall immediately stop work and contact Wellington Electricity 0800 248-148.

9. Labour Requirements

At least two fully-trained, competent operators per unit shall be used for vacuum excavation at all times – one to operate the air or water lance and one to operate the vacuum hose.

A handheld remote emergency shutoff switch shall be accessible to one of the operators at all times vacuum excavation is being carried out.

A third person must be used as a spotter while vacuum excavation is being undertaken on larger sites.

Every worker, or as a minimum the work supervisor, should have a basic understanding of electrical theory.

Personal Protective Equipment

The minimum requirement for safety equipment to be used by workers operating or participating in vacuum excavation in the vicinity of the Wellington Electricity network shall include:

- Eye protection that meets or is equivalent to AS/NZS 1337
- Hearing protection that meets or is equivalent to AS/NZS 1270
- Protective footwear that meets or is equivalent AS/NZS 2210.2
- Hard hat that meets or is equivalent AS/NZS 1801-1997
- Arc-rated / flame resistant clothing conforming with NFPA 70E (minimum 8 cal/cm²)
- Suitable hand protection
- Face Shield

10. Network Protection

The preferred work method when using hydro vacuum equipment in the vicinity of the Wellington Electricity underground network is to work with the network equipment de-energised.

Damaged or Suspect Cables

When the Electricity network is damaged or suspected to be damaged, the network in the vicinity of the excavation should be de-energised prior to the excavation process. Any damage to the Electricity network from the excavation process or discovered during the process shall be reported to Wellington Electricity (0800 248 148) prior to any backfilling.

Boom Movement and Maintaining Safe Limits from Power Lines

Boom movement must be monitored to ensure that safe distances are maintained as required by NZECP 34:2001. It is the responsibility of all those involved with vacuum operations to communicate with one another when any boom movement is required in the vicinity of overhead power lines. This includes during initial set-up or to reposition the boom.

If any part of the plant could encroach within 4 metres of the overhead power lines a written close approach consent (refer to ENM-009) is required from Wellington Electricity.

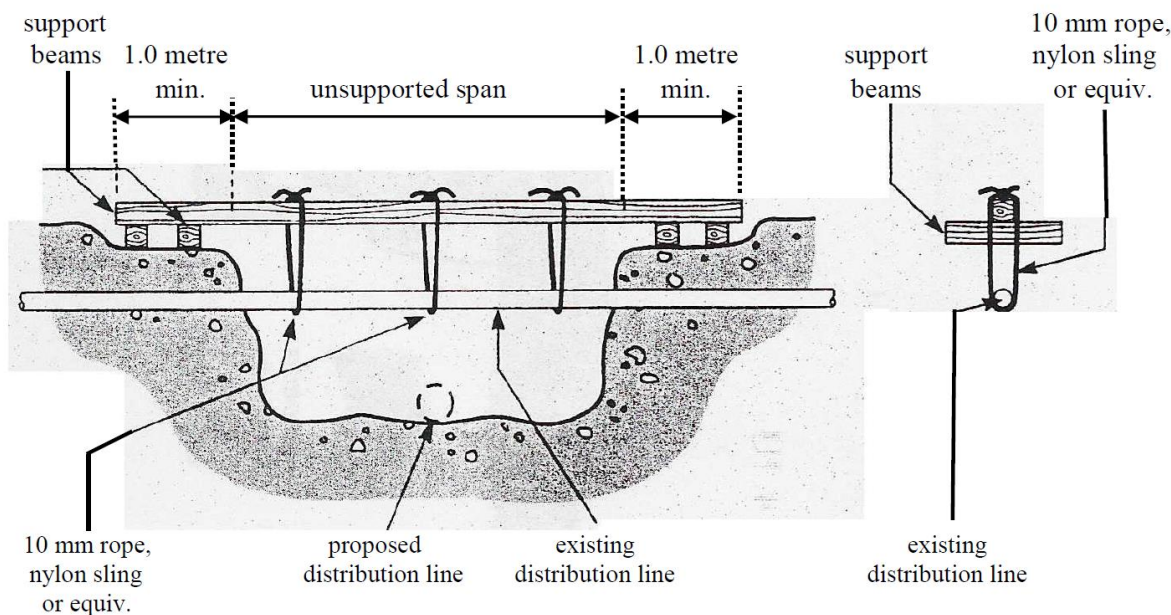
Temporary Support of Paper Insulated Lead Covered Cables (PILC)

When trenching beneath PILC cables a temporary support may be required to prevent deflection and damage to the mechanical and electrical properties of the cable.

Prior to trenching beneath the electric distribution line the Contractor is to install a temporary support if the unsupported span of cable in the trench exceeds 1.0 meter in length. The spacing intervals of the supporting slings must not exceed 800mm. Closer spacing intervals may be required to support cable joints.

A slip over split duct or equivalent shall be used for mechanical protection between the sling and the cable outer sheathing.

The installation of temporary supports for cables can only be undertaken by competent workers authorised to work on the Wellington Electricity network. Contact Wellington Electricity for more information.



Temporary Support of 33kV Gas and Oil Filled Cables

The requirements for temporary support will be determined by Wellington Electricity as part of the stand over service that is compulsory when working within 1.5m of the Wellington Electricity 33kV underground network.

11. Environmental Protection

Tree Protection

The relevant Council must be consulted regarding the presence of any nominated Amenity Trees before hydro or air vacuuming work commences. Where the Council issues instructions or consent conditions, such as the need for advice or supervision by a qualified Arborist, these instructions shall be followed explicitly.

Operators shall monitor water pump pressures and shall not let them exceed the maximum permissible pressures as defined in Section 8. When excavating around tree roots in particular, operators should use their own judgement and reduce pressures as required to prevent tree root damage.

Site Reinstatement

Once work is complete and backfilling has been undertaken, all excess soil shall be vacuumed and the worksite shall be washed down carefully. This is essential for aesthetic cleanliness and environmental protection (to prevent excess soil from entering waterways etc.)

Waste Disposal

All waste shall be processed through a consented dewatering facility.

Spill Management

A well-stocked spill kit with absorbent pads and bunding shall be kept in the hydro excavator unit at all times. Operators shall be trained in spill management and notification requirements.

12. Equipotential Zone Protection

Equipotential bonding is the preferred method of protecting workers and members of the public from injuries due to electrical contact and step voltage potential when working on energised electrical apparatus. The aim is to keep all workers, equipment and plant at the same potential to mitigate the risk of current flow.

Equipotential bonding is required if electrical underground cables are shown:

- a) In the intended excavation area or within a 3 meter perimeter zone of the intended excavation area if the underground cable/cables have been identified using plans only.
- b) In the intended excavation area or within a 1 meter perimeter zone of the intended excavation area if the underground electrical cable/cables have been identified using a mark out (using an appropriate location device).

The equipotential bonded work zone incorporates a system of conductive bonding clamps and conductors capable of maintaining the work zone at an equalised potential at all times. These connections include, but are not limited to the bonding of all conductive objects or equipment such as the high pressure water gun, the suction tube, the hydro vacuum truck chassis and the ground mat(s).

Before any worker participating in the excavation (i.e. water gun operator or suction tube operator) leaves the equipotential bonded work zone, the water must be turned off. This needs to happen every time the ground mat(s) are repositioned or a worker needs to step off the grounding mat(s). All hydro vacuum personnel must stay on the ground mat(s) during the work procedure.

Workers must take care not to touch any non-bonded conductive object in the immediate work area when the water gun and or the suction tube are inside the excavation.

Figure 1 and 2 below illustrates the recommended set-up using equipotential bonding equipment.

Temporary earthing is the mechanical connection of equipment to a recognised effective earth or system neutral. When this method is used for protection of workers the capacity of such earthing equipment must be capable of carrying system fault currents at the site where it is employed.

When equipotential bonding is required on the Wellington Electricity network, the minimum bonding conductor size shall be 25 mm² copper or equivalent. All clamps and connections made to create the equipotential zone shall have a similar conductivity. Equipotential bonding to an effective earth is required in all instances.

Note that for the temporary earth, the minimum earthing conductor size shall be 70 mm² copper or equivalent. All clamps used shall have a similar fault current rating. Extreme care needs to be exercised when driving in a temporary earth spike to avoid contact with the existing underground utility services.

Hydro vacuum operators are typically not qualified to connect any form of bonding or earthing to the system earth. In these situations Wellington Electricity or its approved contractors shall be contacted for guidance.

EQUIPOTENTIAL BONDING WITH EFFECTIVE EARTHING

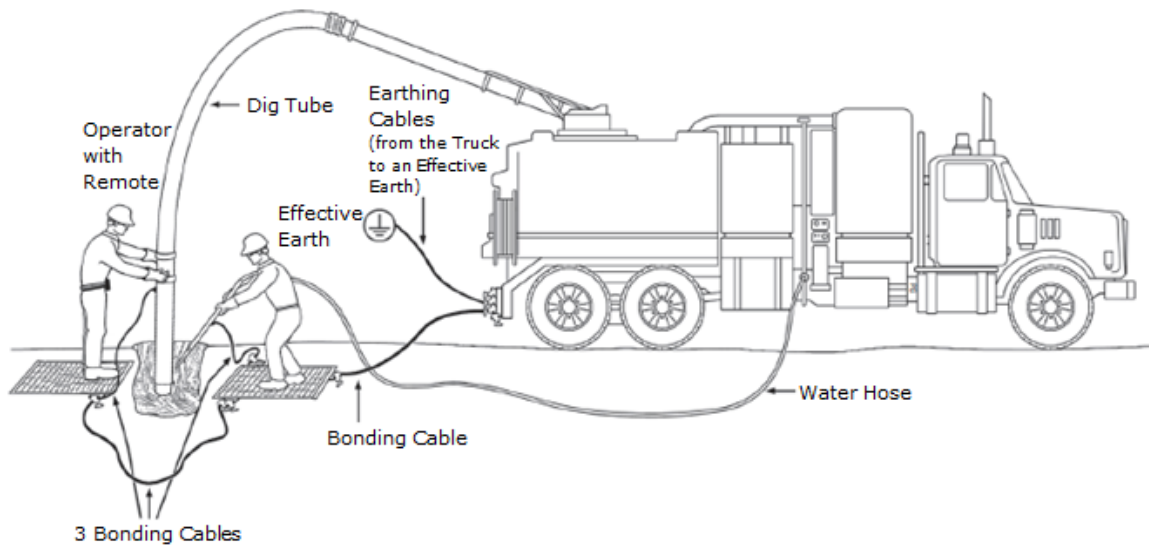


Figure 1: Equipotential Bonding of Hydro Vacuum Equipment

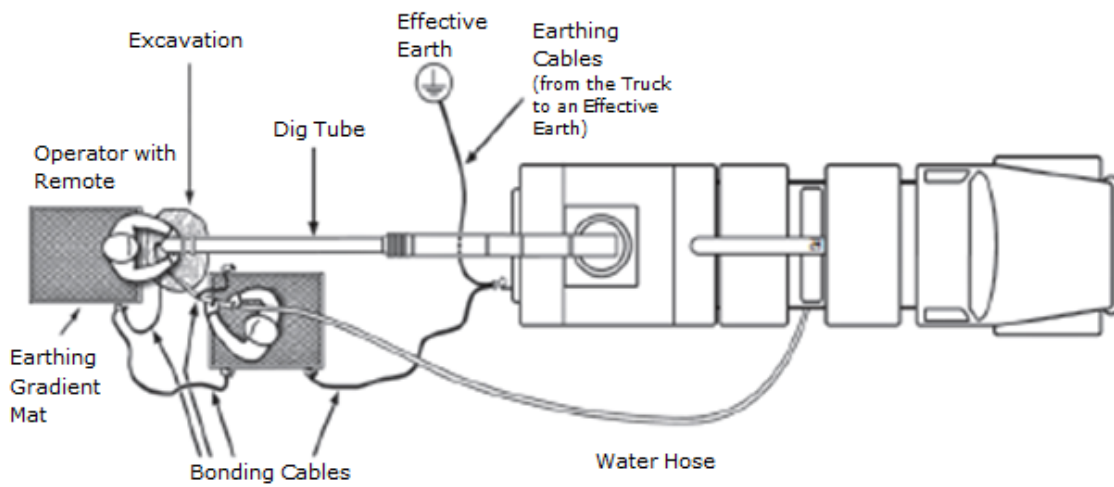


Figure 2: Plan View

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