

SECTION 13: EXCAVATION & TRENCHING SAFETY

Regulatory Basis: T8 CCR Secs. 1539-1547 (Excavations); Cal/OSHA Title 8 Construction Safety Orders

13.1 Scope

This section applies to all plumbing work involving excavation and trenching, including:

- Underground piping installation (water, sewer, gas service)
- Underground utility connections
- Slab penetration and underpinning work
- Septic system installation
- Any digging operation where an employee may enter or be exposed to a trench or excavation

An excavation is any man-made cut, cavity, trench, or depression in the earth's surface. A trench is a narrow excavation where depth exceeds width and width does not exceed 15 feet.

13.2 Competent Person Requirement

A Competent Person must be present on site during all excavation work. The Competent Person must:

- Have training in soil classification, sloping/benching requirements, support systems, protective systems, and excavation hazards
- Have authority to immediately correct hazardous conditions
- Be designated in writing by Michael Reed

Designated Competent Person(s): Michael Reed

13.3 Pre-Excavation Requirements

Before any digging:

0. Cal/OSHA Permit Check (8 CCR Sec. 341 et seq.): Determine whether a Cal/OSHA permit is required for the planned excavation, trenching, construction, or demolition activity. If a permit is required, the customer/employer must obtain and attach the permit before work starts. Do not begin permit-required work without the Cal/OSHA permit.
1. Call 811 (DigAlert / Underground Service Alert) - minimum 2 working days before excavation per California Government Code Sec. 4216.2. Do not begin excavation until all utilities have been located and marked, or the utility operator has indicated "no conflict." Document all utility responses and photograph markings before excavation begins.
2. Mark utility locations on the ground - maintain clearance from marked utilities as defined by California law and the operator markings. Determine exact location with hand tools or vacuum excavation within the tolerance zone.
3. Review job site conditions: soil type, groundwater, nearby structures/slopes, traffic, weather
4. Identify surface encumbrances that must be removed or supported
5. Determine protective system: sloping, benching, shoring, or trench box - based on soil classification

13.4 Soil Classification (T8 CCR Secs. 1539-1541 (29 CFR 1926.652 - federal equivalent) Appendix A)

The Competent Person must classify soil at each excavation site by visual and manual testing:

Soil Type	Description	Max Slope
Stable Rock	Natural solid mineral material that can be excavated with vertical sides and remains stable	Vertical (90°)

Soil Type	Description	Max Slope
Type A	Cohesive soils (clay, silty clay) with unconfined compressive strength ≥ 1.5 tsf; previously undisturbed	$\frac{3}{4}$:1 (53°)
Type B	Cohesive soils with UCS 0.5-1.5 tsf; fissured soils; near vibration sources; previously disturbed	1:1 (45°)
Type C	Cohesive soils with UCS < 0.5 tsf; granular soils (gravel, sand); submerged soil; slopes seeping water	1.5:1 (34°)

When in doubt, classify as Type C - the most conservative.

13.5 Protective Systems

Excavations 5 feet or deeper (and shallower if the Competent Person determines hazard exists) require a protective system unless excavated in stable rock:

Option 1: Sloping/Benching

- Slope sides at or back from the maximum allowable angle for the soil type (see table above)
- Measure slope from the bottom of the excavation to the top
- Benching: step configuration - only permitted in Type A soil; each bench max 4 feet high

Option 2: Shoring Systems

- Timber shoring, aluminum hydraulic shoring, or other engineered systems
- Must be designed by a registered PE for excavations > 20 feet deep
- Install from top down; remove from bottom up

Option 3: Trench Box (Shield)

- Pre-manufactured trench boxes rated for the soil conditions
- Box must extend 18 inches above the surrounding surface if the potential for soil collapse exists
- Employees must work within the trench box - not in front of or behind it
- Move box in small increments to maintain protection at all times

Excavations 20 feet or deeper require a Registered Professional Engineer to design the protective system.

13.6 Excavation Safety Rules

- Spoil pile setback (T8 CCR Sec. 1541.1): Excavated material (spoil) must be placed minimum 2 feet back from the excavation edge
- Access/egress: A means of access (ladder, stairway, ramp) must be within 25 lateral feet of employees in excavations 4 feet or deeper. Ladders must extend 3 feet above the top of the excavation.
- Daily inspection: The Competent Person must inspect the excavation, adjacent areas, and protective systems at the start of each shift, after any rain or other hazard-increasing event, and as conditions change
- Water accumulation: Employees must not work in accumulated water unless protective measures are taken; water removal must be controlled to prevent instability
- Atmospheric testing: Required in excavations > 4 feet where atmospheric hazards could exist (sewer work, near gas lines, industrial areas)
- Traffic barriers: Excavations in traffic areas must have adequate warning systems, barriers, and flagging
- Mobile equipment: Keep mobile equipment as far as feasible from excavation edges; establish safe operating perimeter

California-Specific: California's excavation standard at T8 CCR Secs. 1539-1547 mirrors federal Subpart P closely. Key Cal/OSHA note: California requires specific CalOSHA training for excavation competent persons - confirm competent person has completed recognized excavation competency training.

13.7 Underground Pipe Installation - HVAC/Plumbing Specific

HVAC and plumbing contractors perform underground work including domestic water service, sanitary sewer, storm drain, natural gas service, chilled water / hydronic piping, and geothermal loop installation. The following requirements apply in addition to the general excavation standards above.

811 Utility Locate - Mandatory Pre-Dig Process

1. Submit an 811 locate request - contact DigAlert / Underground Service Alert at least 2 working days before ANY ground-disturbing activity per California Government Code Sec. 4216.2. Do not begin excavation until all utilities have been located and marked, or the utility operator has indicated "no conflict."
2. All underground utilities must be marked before excavation begins - this includes electric, gas, water, sewer, telecommunications, fiber optic, and any private utilities not covered by 811 (private utility locating may require a separate private locator)
3. Maintain the tolerance zone around marked utilities per California Government Code Sec. 4216.4(a). Within the tolerance zone, determine the exact location of subsurface installations using hand tools or vacuum excavation only before using any power-driven excavation equipment. White-line/delineate the planned excavation area before notifying DigAlert (Gov. Code Sec. 4216.2(a)). Do not begin excavation until positive response is received from all affected operators (Gov. Code Sec. 4216.3(c)). Notice must be at least 2 working days and not more than 14 calendar days before beginning excavation.
4. Verify utility marks on arrival - if marks are absent, faded, or appear incorrect, do NOT dig. Contact 811 to request a re-mark. Never assume an unmarked area is clear.
5. Emergency excavation: If an emergency dig is required (e.g., water main break), call 811 for an emergency locate and notify all affected utilities directly. Document the emergency and complete a standard 811 ticket as soon as possible.
6. Retain 811 ticket documentation including ticket number, utility responses, and locate dates for the duration of the project plus one year

Trench Box Requirements for Pipe Laying

When installing underground piping in trenches 5 feet or deeper (or shallower if the Competent Person identifies a cave-in hazard):

- Size the trench box for the pipe: The trench must be wide enough for the pipe diameter plus working clearance on each side (minimum 12 inches each side for pipes up to 12" diameter; 18 inches for larger pipes). The trench box must accommodate this width.
- Trench box depth rating: Select a trench box rated for the actual trench depth and soil type. Manufacturer tabulated data must be available on site.
- Box positioning: The top of the trench box must extend at least 18 inches above the surrounding grade when there is potential for soil to slide into the trench. Employees must work inside the box - never in front of or behind it.
- Moving the box: Advance the trench box incrementally as pipe is laid. Employees must remain inside the protected area at all times - never stand in an unprotected section of trench while the box is being repositioned.
- Pipe bedding work: When employees must work below the bottom of the trench box to set pipe bedding or make connections, the Competent Person must verify that soil conditions do not create a cave-in hazard below the box. If soil is unstable, use shoring below the box or widen the excavation with proper sloping.
- Trench box inspection: The Competent Person must inspect the trench box for damage, cracking, or deformation before each use and after any incident that could affect structural integrity

Backfill and Compaction

Proper backfill is critical for underground piping integrity and for preventing future surface settlement or utility damage:

1. Do not backfill until: pipe installation is complete, joints are tested (pressure test or visual inspection as applicable), and the installation has been inspected by the applicable authority having jurisdiction if required
2. Initial backfill (pipe zone): Place select backfill material (clean sand, pea gravel, or crushed stone per project specifications) from the bottom of the trench to 12 inches above the pipe crown. Place by hand or by careful mechanical means - do not drop material directly onto pipe. No rocks, frozen material, or debris in the pipe zone.
3. Compaction of pipe zone: Compact pipe zone backfill in 6-inch lifts to the specified density (typically 90-95% Standard Proctor for utility trenches). Use hand tampers or light mechanical compactors - do not use heavy vibratory compactors directly over pipe until adequate cover depth is achieved (minimum 24 inches of compacted fill over the pipe crown, or as specified)
4. Final backfill: Backfill remaining trench depth with approved material in lifts not exceeding 12 inches. Compact each lift to project specifications. Remove all trench box components as backfill progresses (pull from top down as fill is placed).
5. Surface restoration: Restore surface to match surrounding grade. Replace pavement, landscaping, or surface materials as required by project specifications and local code.
6. Settle monitoring: Mark backfilled trench locations. Monitor for settlement for 30 days after backfill; re-compact and restore surface if settlement occurs.

Emergency Response and Rescue Planning

Before trench entry, the Competent Person must confirm emergency response arrangements for the excavation. Workers must not attempt untrained trench-collapse rescue or enter an unprotected collapse area. If a cave-in, hazardous atmosphere, water accumulation, utility strike, or other excavation emergency occurs:

- Stop work, remove exposed workers from the excavation area, and call 911/site emergency contacts.
- Keep workers out of the trench until the excavation is protected and qualified responders control rescue operations.
- Preserve utility-mark, inspection, and locate-ticket information for responders when it is safe to do so.
- Provide readily available rescue equipment, such as breathing apparatus, harness and line, or basket stretcher, where hazardous atmospheres exist or may reasonably develop during excavation work (29 CFR 1926.651(g)(2)).

SECTION 14: ELECTRICAL SAFETY FOR HVAC/PLUMBING WORK

Regulatory Basis: T8 CCR Secs. 2299-2599 (Electrical Safety Orders); T8 CCR Sec. 2320 (General Electrical Safety for Construction)

14.1 Scope

HVAC/plumbing technicians regularly work with and near electrical systems: HVAC equipment disconnects, control panels, 240V/480V motor wiring, low-voltage control wiring, and boiler controls. This section covers electrical safety for HVAC/plumbing workers - not full electrical installations (those are covered by electrical contractors with appropriate licensing).

14.2 General Electrical Safety Rules

- Assume all electrical circuits are energized until proven otherwise - verify with a meter before touching
- Never work on energized circuits unless absolutely necessary - always LOTO first
- If energized work above low-voltage controls is required, stop work and engage a licensed electrical contractor with appropriate arc flash PPE per NFPA 70E - HVAC/plumbing technicians must not perform energized electrical work
- Check for voltage presence using a properly rated non-contact voltage tester or meter before touching any wiring
- GFCI protection: Use GFCI-protected extension cords and power tools on all 120-volt, single-phase, 15- and 20-ampere receptacle outlets on construction sites per T8 CCR Sec. 2395.6 (California Construction Safety Orders)

Company Policy - De-Energize Before Energized Work: HVAC/plumbing technicians must de-energize equipment whenever feasible. When incident energy may exceed 40 cal/cm², de-energization is mandatory under this program. Refer all energized electrical work to qualified electrical personnel operating under an NFPA 70E-compliant program with appropriate arc flash PPE and incident energy analysis. This is a company policy; verify the applicable edition of NFPA 70E and Cal/OSHA electrical safety requirements (8 CCR Secs. 2299-2599) with a qualified electrical safety professional before establishing energized work procedures.

Hearing Protection Near Arc Flash Hazards: Personnel working near arc flash boundaries should wear hearing protection as arc flash events can produce harmful sound levels. Specific requirements should be determined by the qualified electrical contractor performing the energized work under their NFPA 70E program.

14.3 Working Near HVAC Electrical Systems

- Before servicing any HVAC unit: de-energize at the disconnect and apply LOTO (see Section 9)
- Verify the disconnect is the correct one for the unit being serviced - multiple disconnects may be present
- Verify de-energization with a volt meter before opening control panels
- On units with capacitors: wait a minimum of 5 minutes after de-energization and discharge capacitors with appropriate discharge tool before touching capacitor terminals - capacitors store lethal voltage even after power is removed
- Do not bypass safety controls or pressure switches to test a system
- Do not modify electrical wiring beyond scope of work authorization

14.4 Extension Cords

- Use only UL-listed extension cords rated for the intended use (outdoor, heavy-duty for tools)
- No damaged extension cords - inspect before each use
- No daisy-chaining extension cords
- GFCI protection required for all 120-volt, single-phase, 15- and 20-ampere receptacles on construction sites per T8 CCR Sec. 2395.6 (California Construction Safety Orders)
- Do not run extension cords through doorways, windows, or walls where they can be damaged

14.5 Overhead Power Lines (T8 CCR Sec. 2946; 29 CFR 1926.416(a) - federal equivalent)

- Minimum approach distance for unqualified workers: 10 feet for lines up to 50 kV; greater distances for higher voltages
 - Identify overhead power lines before setting up extension ladders
 - Do not use metal ladders or metallic tools near overhead power lines
 - Call the utility company for de-energization or line guarding if work must be performed closer than minimum approach distances
-

SECTION 15: BRAZING & SOLDERING SAFETY

15.1 Scope

HVAC technicians use oxy-acetylene or air-acetylene torches for brazing copper refrigerant lines. Plumbers use propane or MAPP gas torches for soldering copper water lines. Both operations carry fire, fume, and thermal burn hazards.

15.2 Torch and Fuel Gas Safety

Before Work

- Inspect torch, hoses, regulators, and cylinders for damage, leaks, or deterioration before each use
- Check connections with approved leak detection solution - never use flame to check for leaks
- Keep fuel gas cylinders upright and secured when in use and in storage
- Protect hoses from damage, heat, and foot traffic; never allow torch to rest on or near hoses

During Brazing/Soldering

- Ventilation: Provide adequate ventilation - brazing flux and silver brazing alloys generate fumes (zinc oxide, fluorides from flux, silver). Work outdoors or in well-ventilated areas whenever possible; use local exhaust ventilation in confined/enclosed spaces
- Fire prevention (T8 CCR Sec. 4848; NFPA 51B; 29 CFR 1926.352): Before torch work in any structure, inspect the work area for combustible materials within 35 feet. Wet down, remove, or shield combustibles that cannot be moved.
- Fire watch: A designated employee with a readily accessible fire extinguisher (minimum 10-lb ABC dry chemical) monitors the work area during brazing and for minimum 30 minutes after the torch is extinguished. Fire can smolder inside walls, insulation, and structural members long after visible flame is extinguished.
- Protect pipe insulation from torch heat - use heat shields/reflective material
- Do not braze or solder near refrigerant - refrigerant decomposed by heat produces phosgene and hydrofluoric acid fumes
- Phosphoric acid flux (for plumbing soft soldering): wear eye protection; avoid skin contact; flux fumes are irritating to eyes and respiratory tract

After Work

- Close all cylinder valves when work is complete
- Bleed hose pressure by opening torch valves briefly after cylinder is closed
- Allow all work to cool completely before leaving the work area
- Check fire watch area one final time

15.3 Nitrogen Purging for Brazing (HVAC)

- When brazing copper refrigerant lines, flow dry nitrogen through the pipe during brazing to prevent internal oxidation (copper oxide deposits damage compressors)
- Use a pressure regulator on nitrogen cylinder - never braze with unregulated nitrogen flow
- Nitrogen cylinders are stored upright and secured

15.4 PPE for Brazing/Soldering

- Brazing goggles (shade 4-5) or face shield - protect eyes from UV and heat
- Leather welding gloves
- Long sleeves - heat-resistant clothing
- Leather apron for heavy brazing work
- Ventilate work area or use respiratory protection appropriate for fumes generated (see Section 23)