SECTION 14: EXCAVATION & TRENCHING SAFETY

Regulatory Basis: T8 CCR Secs. 1539, 1540, 1541, 1541.1 (excavation sections relied on in this program); Cal/OSHA Title 8 Construction Safety Orders

14.1 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. In general, a trench is a narrow excavation where depth is greater than width and the width measured at the bottom is no greater than 15 feet. An excavation also is a trench when forms or other structures installed or constructed in it reduce the bottom dimension between the form or structure and the side of the excavation to 15 feet or less.

14.2 Competent Person Requirement

Company Policy - Continuous Competent-Person Presence: A Competent Person must be present on site during all excavation work. Separately, T8 CCR Sec. 1541(k) requires daily competent-person inspections of the excavation, adjacent areas, and protective systems, including an inspection before the start of work, as needed throughout the shift, and after every rainstorm or other hazard-increasing occurrence; those inspections are required when employee exposure can reasonably be anticipated. 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

14.3 Pre-Excavation Requirements

Before any digging:

1. Cal/OSHA Permit Check (8 CCR Secs. 341, 341.1): A Cal/OSHA Annual or Project Permit is required to construct a trench or excavation 5 feet or deeper into which any person is required to descend; “descend” includes entering any part of the trench or excavation once it has reached 5 feet (Sec. 341(d)(5)(A)). Section 341(e) excepts government bodies, public utilities subject to Public Utilities Commission jurisdiction, emergency repair work to underground facilities, work whose construction or final use does not require anyone to descend, grave construction, and swimming-pool excavation. Identify the employer conducting qualifying work, verify that employer holds the applicable permit, attach it, and do not begin permit-required work without it. When work proceeds under an Annual Permit, the permit holder must notify the Division district office with jurisdiction over the site at least 24 hours before the activity and provide the project location and planned start date and time (Sec. 341.1(h)(2)(B)).
2. Call 811 (DigAlert / Underground Service Alert) - at least 2 working days and not more than 14 calendar days before excavation under California Government Code Sec. 4216.2(b). The notification date does not count as part of the two-working-day notice. Do not begin excavation until all operators listed on the ticket have fulfilled their locate-and-mark obligations and any required onsite meeting is complete (Sec. 4216.2(g)(1)). Document all utility responses and photograph markings before excavation begins.
3. Mark utility locations on the ground. The statutory tolerance zone is 24 inches from each side of a single marking assumed to be the installation centerline; 24 inches plus one-half the specified installation size on each side of a single marking that specifies that size; or 24 inches from each outside marking that graphically shows the installation's outside width on a horizontal plane (Gov. Code Sec. 4216(u)). Within that zone, determine the exact location using hand tools; vacuum excavation may be used instead only if the 811 ticket declared the intent to use a vacuum excavation device and the operator agreed to its use (Sec. 4216.4(a)(1), (a)(2)(A)).

- Exact-location fallback (Gov. Code Sec. 4216.4(b)): If hand excavation cannot determine the exact location, request any available additional information from the operator. The operator must provide relevant existing additional information within one working day. Questions about an operator's markings may be routed through the regional notification center, which must provide the operator's contact telephone number.

4. Review job site conditions: soil type, groundwater, nearby structures/slopes, traffic, weather
5. Remove or support hazardous surface encumbrances as necessary to safeguard employees (T8 CCR Sec. 1541(a))
6. Determine protective system: sloping, benching, shoring, or trench box - based on soil classification

14.4 Soil Classification (T8 CCR Sec. 1541.1, Appendix A; 29 CFR 1926.652 Appendix A - federal equivalent)

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°)
Type A	Cohesive soils (clay, silty clay) with unconfined compressive strength >=1.5 tsf and none of the Type-A disqualifiers below	¾:1 (53°)

Soil Type	Description	Max Slope
Type B	Cohesive soil with UCS greater than 0.5 tsf but less than 1.5 tsf; granular cohesionless soils including angular gravel, silt, silt loam, sandy loam and, in some cases, silty clay loam and sandy clay loam; previously disturbed soil except soil that otherwise qualifies as Type C; soil that would be Type A except for fissures or vibration; unstable dry rock; qualifying layered systems dipping less steeply than 4H:1V	1:1 (45°)
Type C	Cohesive soil with UCS of 0.5 tsf or less; granular soils including gravel, sand, and loamy sand; submerged soil or soil with freely seeping water; unstable submerged rock; layered systems dipping into the excavation at 4H:1V or steeper	1.5:1 (34°)

Type-A disqualifiers (T8 CCR Sec. 1541.1, Appendix A): Soil is not Type A if it is fissured; is subject to vibration from heavy traffic, pile driving, or similar effects; has been previously disturbed; is part of a sloped, layered system whose layers dip into the excavation at a slope of 4H:1V or greater; or is subject to other destabilizing factors that require classification as a less stable material.

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

14.5 Protective Systems

Each employee in an excavation must be protected from cave-ins by an adequate protective system except when the excavation is entirely in stable rock, or when the excavation is less than 5 feet deep and a Competent Person's examination of the ground finds no indication of a potential cave-in (T8 CCR Sec. 1541.1(a)(1)). Without that examination and finding, the less-than-5-foot exception does not apply.

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 is permitted in Type A soil (T8 CCR Sec. 1541.1, Appendix B, B-1.1 (Excavations made in Type A soil)) and in Type B soil (Appendix B, B-1.2 (Excavations Made in Type B Soil)), each for excavations 20 feet or less in depth; Type C soil does not have a benching configuration under Appendix B. Maximum bench height and width for the soil type in use are set by the applicable Appendix B content; do not exceed the dimensions shown for that soil type.
- Do not permit employees to work on sloped or benched faces above other employees unless the lower employees are adequately protected from falling, rolling, or sliding material or equipment (T8 CCR Sec. 1541.1(f)).

Option 2: Shoring Systems

- Timber shoring, aluminum hydraulic shoring, or other engineered systems
- Select the protective-system design through one of the four options in T8 CCR Sec. 1541.1(c): the applicable appendices; manufacturer's tabulated data; other tabulated data under Sec. 1541.1(c)(3); or design by a registered professional engineer under Sec. 1541.1(c)(4). Do not treat the first three collectively as “non-engineer options”: at least one jobsite copy of other tabulated data must identify the registered professional engineer who approved the data under Sec. 1541.1(c)(3)(C).
- Company Policy - top-down shoring installation: Install shoring from the top down.
- Support-system installation and removal (T8 CCR Sec. 1541.1(e)): Install and remove support systems in a manner that protects employees from cave-ins, structural collapses, and being struck by support-system members, and closely coordinate installation with trench excavation. Begin removal at and progress from the bottom of the excavation, release members slowly while watching for possible failure or cave-in, and progress backfilling together with removal.

Option 3: Trench Box (Shield)

- Pre-manufactured trench boxes rated for the soil conditions

- Under T8 CCR Sec. 1541.1(g)(2), shield sides in a compound excavation must extend at least 18 inches above the vertical walls (see Appendix B, figures B-1, B-1.2 and B-1.3); in a vertically cut trench, the shield must extend to at least the trench catch point
- During work, employees must work within the trench box - not in front of or behind it
- No employee may remain inside a shield while it is being installed, removed, or moved vertically (T8 CCR Sec. 1541.1(g)(1)(D)).
- Under T8 CCR Sec. 1541.1(g)(1)(C), employees must be protected from cave-in hazards when entering or exiting the areas protected by a shield. Company Policy - Horizontal Box Advancement: Advance the box in small increments only after all employees have exited the shield to a protected location. Employees may re-enter only after repositioning is complete.

Adjacent structures, footings, and pavements - separate requirements (T8 CCR Sec. 1541(i))

- When excavation operations endanger an adjoining building, wall, or other structure, provide shoring, bracing, underpinning, or another support system that ensures the structure's stability and protects employees.
- Do not excavate below the base or footing of a foundation or retaining wall where the work could reasonably be expected to pose a hazard unless a support system such as underpinning is provided, the excavation is in stable rock, or a registered professional engineer has approved a determination that the work will not pose a hazard to employees.
- Do not undermine sidewalks, pavements, or appurtenant structures unless a support system or another protective method protects employees from possible collapse.

Sloping or benching for excavations greater than 20 feet deep must be designed by a registered professional engineer (T8 CCR Sec. 1541.1, Appendix B, Table B-1, Note 3); the standard slope and Appendix B tabulated benching options above apply only to excavations 20 feet or less in depth.

14.6 Excavation Safety Rules

- Company Policy - Spoil-pile setback: Place and keep excavated material (spoil) at least 2 feet from the excavation edge. The legal minimum protects employees from excavated or other materials or equipment that could fall or roll into the excavation through either a 2-foot setback, retaining devices sufficient to prevent the material or equipment from falling or rolling in, or both if necessary (T8 CCR Sec. 1541(j)(2)).
- Loose material on excavation faces: Protect employees from loose rock or soil that could fall or roll from an excavation face by scaling to remove loose material, installing protective barricades on the face as necessary, or using equivalent protection (T8 CCR Sec. 1541(j)(1)).
- Structural ramps (T8 CCR Sec. 1541(c)(1)(A)): An employee-only structural ramp used for excavation access or egress must be designed by a competent person. A structural ramp used for equipment access or egress must be designed by a competent person qualified in structural design and constructed in accordance with that design.
- Access/egress (T8 CCR Sec. 1541(c)(2)): In trench excavations 4 feet or more in depth, locate a stairway, ladder, ramp, or other safe means of egress so employees need no more than 25 feet of lateral travel.
- Daily inspection and removal: 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. If the Competent Person finds evidence of a possible cave-in, protective-system failure, a hazardous atmosphere, or another hazardous condition, remove exposed employees from the hazardous area until necessary precautions ensure their safety (T8 CCR Sec. 1541(k)(1)-(2)).

- Water accumulation: Employees must not work in accumulated or accumulating water unless adequate protective measures are taken. When water-removal equipment is used, a Competent Person must monitor the equipment and operations for proper operation. If excavation interrupts natural surface drainage, use diversion ditches, dikes, or other suitable means to prevent water from entering and provide adequate drainage beside the excavation; after heavy-rain runoff, a Competent Person must inspect and the water-control requirements must be met (T8 CCR Sec. 1541(h)(1)-(3)).
- Atmospheric testing and controls: Before employees enter an excavation greater than 4 feet deep, test where an atmosphere containing less than 19.5 percent oxygen or another hazardous atmosphere exists or could reasonably be expected. Prevent exposure to oxygen below 19.5 percent and other hazardous atmospheres by ventilation, proper respiratory protection, or other adequate precautions. Prevent exposure to flammable gas above 20 percent of its lower flammable limit. When controls reduce contaminants to acceptable levels, test as often as necessary to ensure the atmosphere remains safe (T8 CCR Sec. 1541(g)(1)(A)-(D)).
- Traffic controls and garments: Company Policy: Provide adequate warning systems, barriers, and flagging in traffic areas. Separately, employees exposed to public vehicular traffic must be provided with and wear warning vests or other suitable reflectorized or high-visibility garments (T8 CCR Sec. 1541(d)).
- Falling loads: Do not permit an employee underneath loads handled by lifting or digging equipment. Require employees to stand away from vehicles being loaded or unloaded to avoid spillage or falling materials; vehicle operators may remain only when the cabs are equipped in accordance with T8 CCR Sec. 1591(e) to provide adequate protection during loading and unloading operations (T8 CCR Sec. 1541(e)).
- Crossings and remote openings: Where employees or equipment cross an excavation over 6 feet deep and wider than 30 inches, provide a walkway or bridge with standard guardrails. Provide adequate physical barriers at remotely located excavations; barricade or cover wells, pits, shafts, and similar openings, and backfill temporary openings when exploration or similar operations end (T8 CCR Sec. 1541(l)(1)-(2)).
- Mobile equipment: Company Policy: Keep mobile equipment as far as feasible from excavation edges and establish a safe operating perimeter. Separately, when mobile equipment operates adjacent to an excavation or must approach its edge and the operator does not have a clear and direct view of the edge, provide a warning system such as barricades, hand or mechanical signals, or stop logs. If possible, the grade should be away from the excavation (T8 CCR Sec. 1541(f)).

California-Specific - Excavation Training and Competent-Person Duties: California's excavation standard is Cal/OSHA Construction Safety Orders, Article 6 (Excavations), T8 CCR Secs. 1539-1543, which closely parallels federal Subpart P. Only qualified persons may perform subsurface-installation locating; a person who completes an IIPP training program under T8 CCR Sec. 1509 that meets the CGA Best Practices, Version 3.0 (March 2006), or NULCA Standard 101, 2001 First Edition, is deemed qualified for that work (T8 CCR Sec. 1541(b)(1)(C)). Employees involved in excavation work and exposed to its hazards must be trained in the excavator notification and excavation practices required by T8 CCR Sec. 1541 and Government Code Secs. 4216-4216.9 (T8 CCR Sec. 1541(b)(1)(D)). A Competent Person is one who can identify existing and predictable hazards in the surroundings or working conditions and is authorized to take prompt corrective measures to eliminate them (T8 CCR Sec. 1504); competent-person inspection and hazard-response duties for excavations are set out in T8 CCR Sec. 1541(k).

Current statutory locator qualification (Gov. Code Sec. 4216(p)): Separately, a “qualified person” is a person who completes a training program in accordance with T8 CCR Sec. 1509's Injury and Illness Prevention Program requirements that meets “the minimum locators training guidelines and practices published in the most recent version of the Best Practices guide of the Common Ground Alliance.” Apply this current statutory criterion and the dated T8 CCR Sec. 1541(b)(1)(C) deemed-qualified paths on their own terms; do not treat them as interchangeable.

14.7 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 and not more than 14 calendar days before ground-disturbing activity (Gov. Code Sec. 4216.2(b)). The notification date does not count as part of the two-working-day notice. Do not begin until all ticket-listed operators have fulfilled their locate-and-mark obligations and any required onsite meeting is complete (Sec. 4216.2(g)(1)).
2. Before opening an excavation, determine the approximate location of subsurface installations reasonably expected to be encountered; mark the excavation area and obtain operator responses identifying installation locations or stating that no operated installation would be affected (T8 CCR Sec. 1541(b)(1)-(b)(1)(A)) - this includes electric, gas, water, sewer, telecommunications, fiber optic, and private utilities outside 811's statutory scope. Government Code Sec. 4216's “subsurface installation” definition excludes nonpressurized sewer lines, nonpressurized storm drains, and other nonpressurized drain lines, and its Sec. 4216.1 operator-registration rule excludes specified owner-controlled lines located exclusively on the owner's property. The T8 CCR Sec. 1541(b)(1) duty applies regardless of 811 scope. Advise all known owners of subsurface facilities in the area who are not notification-center members at least 2 working days before digging, except for qualifying emergency repair work (T8 CCR Sec. 1541(b)(2)). While an excavation is open, protect, support, or remove exposed subsurface installations as necessary to safeguard employees (Sec. 1541(b)(4)).
3. Maintain the tolerance zone: The zone is 24 inches from each side of a single marking assumed to be the installation centerline; 24 inches plus one-half the specified installation size on each side of a single marking that specifies that size; or 24 inches from each outside marking that graphically shows the installation's outside width on a horizontal plane (Gov. Code Sec. 4216(u)). Within it, determine exact installation locations using hand tools before power-driven excavation; use vacuum excavation instead only when the ticket declared that intent and the operator agreed (Sec. 4216.4(a)(1), (a)(2)(A)). White-line/delineate before notifying DigAlert (Sec. 4216.2(a)). Presume every subsurface installation is active and use the same care around one that may be inactive (Sec. 4216.4(a)(3)). Do not begin until all ticket-listed operators have fulfilled Sec. 4216.3(a)(1)(A) and any required onsite meeting is complete (Sec. 4216.2(g)(1)).

- Exact-location fallback (Gov. Code Sec. 4216.4(b)): If hand excavation cannot determine the exact location, request any available additional information from the operator. The operator must provide relevant existing additional information within one working day. Questions about an operator's markings may be routed through the regional notification center, which must provide the operator's contact telephone number.

4. High-priority installation onsite meeting: “High priority” includes high-pressure natural-gas pipelines operating above 60 psig, petroleum pipelines, pressurized sewage pipelines, electric supply lines, conductors, or cables with at least 60 kV potential to ground, and hazardous-material pipelines potentially hazardous if damaged (Gov. Code Sec. 4216(j); T8 CCR Sec. 1541(b)(1)(B)). When excavation is proposed within 10 feet, schedule the onsite meeting at a mutually agreed time. At the meeting, discuss with the operator the excavation methods and tools and the information the operator will provide to help verify the installation's location. Do not excavate until the meeting is complete (Gov. Code Sec. 4216.2(c)).

5. Track the 28-day ticket term: An 811 ticket is valid for 28 days from issuance. If work will continue beyond 28 days, renew the ticket through the regional notification center's website or by calling 811 by the end of day 28 (Gov. Code Sec. 4216.2(e)). If a ticket expires while excavation is ongoing, immediately stop excavation, contact the regional notification center, obtain a new ticket, and do not resume until the conditions in Gov. Code Sec. 4216.2(g) are satisfied (Gov. Code Sec. 4216.2(i)).
6. Verify utility marks on arrival - if marks are absent, faded, or appear incorrect, do NOT dig. Renotify the regional notification center with a request for remarks. If delineation is no longer reasonably visible, redelineate the area to be remarked. Report an operator's failure to identify installations to the regional notification center (Gov. Code Sec. 4216.3(b), (d)). Never assume an unmarked area is clear.
7. Emergency excavation: An “emergency” is a sudden, unexpected occurrence involving clear and imminent danger that demands immediate action to prevent or mitigate harm to life, health, property, or essential public services (Gov. Code Sec. 4216(f)). Company Policy - emergency workflow: Call 811 for an emergency locate, notify affected utilities directly, document the emergency, and complete a standard ticket as soon as possible. The Sec. 341 permit exception applies to emergency repair work to underground facilities, and T8 CCR Sec. 1541(b)(2)'s nonmember-owner notice exception applies only to qualifying emergency repair work.
8. Company Policy - 811 record retention: Retain ticket numbers, operator responses, locate dates, photographs, and related documentation for at least 3 years or for the duration of the project plus one year, whichever is longer.

Trench Box Requirements for Pipe Laying

When installing underground piping in any trench requiring a protective system under T8 CCR Sec. 1541.1(a)(1) and Section 14.5 above:

- Size the trench box for the pipe (Company Policy - Pipe-Side Working Clearance): The trench must be wide enough for the pipe diameter plus working clearance on each side of the pipe, and the trench box must accommodate that width. As a company default, allow at least 12 inches on each side for pipes up to 12 inches in diameter and 18 inches on each side for larger pipes, but only when consistent with project specifications and the trench-box manufacturer's specifications, recommendations, and limitations. These company/project defaults are not regulatory minimums; protective systems drawn from manufacturer's tabulated data must follow that data under T8 CCR Sec. 1541.1(c)(2)(A).
- 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 and handled loads: Under T8 CCR Sec. 1541.1(g)(2), shield sides in a compound excavation must extend at least 18 inches above the vertical walls (see Appendix B, figures B-1, B-1.2 and B-1.3); in a vertically cut trench, the shield must extend to at least the trench catch point. Employees must work inside the protected area of the box, never in front of or behind it, and must remain clear of any pipe, bucket, or other load while it is handled by lifting or digging equipment (T8 CCR Sec. 1541(e)).
- Moving the box: Under T8 CCR Sec. 1541.1(g)(1)(C), employees must be protected from cave-in hazards when entering or exiting the areas protected by a shield. No employee may remain inside a shield while it is being installed, removed, or moved vertically (Sec. 1541.1(g)(1)(D)). Company Policy - Horizontal Repositioning: Before the box is moved horizontally, all employees must exit the shield to a protected location; employees may re-enter only after repositioning is complete. After repositioning, employees work inside the protected area and never in an unprotected section of trench.
- Pipe bedding work: Under T8 CCR Sec. 1541.1(g)(2), do not excavate earth material more than 2 feet below the bottom of the trench box. Work below the box is permitted only if the box is designed to resist the forces calculated for the full depth of the trench and, while the trench is open, there are no indications of possible soil loss from behind or below the box. Before any employee works below the box, the Competent Person must verify that soil conditions do not create a cave-in hazard below it; if soil is unstable, stop work and use shoring below the box or widen the excavation with proper sloping.

- Trench box inspection and disposition: Company Policy: 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. Separately, when protective-system material or equipment is damaged, a competent person must examine it and evaluate its suitability for continued use. If the competent person cannot assure it can support the intended loads or is otherwise suitable for safe use, remove it from service; it may return only after a registered professional engineer evaluates and approves it (T8 CCR Sec. 1541.1(d)(3)).

Company/Project Backfill and Compaction Practices - Not Cal/OSHA Regulatory Minimums

Follow the approved project specifications, utility-owner standards, engineered or geotechnical requirements, local code, and manufacturer instructions wherever they differ from the company/project defaults below:

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, 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 atmospheric conditions exist or may reasonably be expected to develop during excavation work; the equipment must be attended while in use (T8 CCR Sec. 1541(g)(2)(A); 29 CFR 1926.651(g)(2) - federal equivalent).
- Employees entering bell-bottom pier holes or similar deep, confined footing excavations must wear a harness with a lifeline securely attached to it. The lifeline must be separate from any line used to handle materials and individually attended at all times while the employee wearing it is in the excavation (T8 CCR Sec. 1541(g)(2)(B)).

Utility damage / strike response: Stop work and keep personnel clear. For damage to a gas or hazardous-liquid pipeline that releases flammable, toxic, or corrosive gas or liquid, immediately call 911 and, immediately after calling 911, notify the installation operator. Follow the same sequence for damage to any high-priority subsurface installation unless all three conditions in Gov. Code Sec. 4216.4(c)(1)(B) are met: the excavator is the operator of the installation, the operator discovered the damage during operations and maintenance, and the damage does not involve the gas or hazardous-liquid release described above (Sec. 4216.4(c)(1)-(2)). For every other break, leak, nick, dent, gouge, groove, or other damage to lines, conduits, coatings, or cathodic protection, immediately notify the installation operator (T8 CCR Sec. 1541(b)(5); Gov. Code Sec. 4216.4(c)(2)). Notify the regional notification center within 48 hours of covered damage (Sec. 4216.4(c)(3)).

Additional T8 emergency trigger (T8 CCR Sec. 1541(b)(5)): If damage to a high-priority subsurface installation causes the escape of any flammable, toxic, or corrosive gas or liquid or endangers life, health or property, immediately notify 911 or, if 911 is unavailable, the emergency-response personnel having jurisdiction; also contact the facility owner/operator.

SECTION 15: ELECTRICAL SAFETY FOR HVAC/PLUMBING WORK

Regulatory Basis: California Electrical Safety Orders (Low-Voltage and High-Voltage Electrical Safety Orders), T8 CCR Subchapter 5

15.1 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).

Qualified persons only: Only employees who meet the applicable Cal/OSHA qualified-person requirement may perform electrical work on equipment or systems (T8 CCR Sec. 2320.1(a)). The company prohibition on energized electrical work by HVAC/plumbing technicians still applies; employees who are not qualified perform only non-electrical tasks within their training and authorization.

15.2 General Electrical Safety Rules

- Pre-work energized-circuit survey (T8 CCR Sec. 1518(d)): Before work begins, the employer must ascertain by inquiry, direct observation, or instruments whether any exposed or concealed energized electric power circuit is located so that the work may bring any person, tool, or machine into physical or electrical contact with it. Where such circuits exist, make a legible marking indicating their presence and location or post warning signs in accordance with T8 CCR Sec. 3340 of the General Industry Safety Orders, and advise employees of the circuits' location, the hazards involved, and the protective measures to be taken, in accordance with T8 CCR Sec. 1509 (Sec. 1518(d)(1)-(2)). This duty applies to jobsite electrical installations that do not involve excavations; for electrical installations involving excavations, T8 CCR Sec. 1541 governs.
- Treat all electrical circuits as energized until verified de-energized with an appropriately rated meter
- Before electrical work, de-energize the equipment, apply LOTO, and verify de-energization; do not begin work until all three steps are complete
- Company Policy - No Energized Electrical Work by HVAC/Plumbing Technicians: If de-energization is infeasible, STOP and refer the work to qualified electrical personnel. HVAC/plumbing technicians do not perform energized electrical work.
- Check for voltage with an appropriately rated contact meter before touching wiring. A non-contact voltage tester may be used only as a preliminary indication and never as the sole means of verifying de-energization.

- Under T8 CCR Sec. 2405.4(b), to protect employees on construction sites, the employer shall use either or both ground-fault circuit interrupters under subsection (c) or an assured equipment grounding conductor program under subsection (d); these requirements are in addition to other equipment-grounding-conductor requirements. Company Policy - GFCI protection: Use GFCI protection for all 120-volt AC, single-phase, 15- and 20-ampere receptacle outlets at construction sites. The legal GFCI path covers outlets that are not part of the permanent wiring of the building or structure and are in use by employees. This company policy applies GFCI protection universally and does not rely on subsection (c)'s generator exception.

Company Policy - De-Energize, Lock Out, and Verify: HVAC/plumbing technicians must de-energize equipment, apply LOTO, and verify de-energization before electrical work. If de-energization is infeasible, they must stop and refer the work; HVAC/plumbing technicians do not perform energized electrical work.

Company Policy - Referred Energized Electrical Work: When incident energy may exceed 40 cal/cm², de-energization is mandatory and no energized work is authorized under this program. Refer any other energized electrical work only to a licensed electrical contractor whose qualified electrical personnel operate under an NFPA 70E-compliant program with appropriate arc-flash PPE and incident-energy analysis. Verify the applicable edition of NFPA 70E and the California Electrical Safety Orders 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.

15.3 Working Near HVAC Electrical Systems

- Before servicing any HVAC unit: de-energize at the disconnect and apply LOTO (see Section 10: Lockout/Tagout (LOTO) Procedures)
- 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: follow the manufacturer's specified discharge procedure and interval, discharge with an appropriate tool, verify residual voltage with an appropriately rated meter, and treat the equipment as energized until verified de-energized
- Do not bypass safety controls or pressure switches to test a system
- Do not modify electrical wiring beyond scope of work authorization

15.4 Extension Cords

- Approval requirement (T8 CCR Sec. 2500.7(a)): Flexible cords and cables, including extension cords, shall be approved for the conditions of use and location. Cal/OSHA treats equipment as “approved” when it has been approved, listed, labeled, or certified as conforming to applicable governmental or other nationally recognized standards, or applicable scientific principles, based on a qualifying evaluation, or approved, listed, labeled, or certified by a Nationally Recognized Testing Laboratory (NRTL) (T8 CCR Sec. 3206(a)(1)-(2)). Cords must be rated for the intended use (outdoor, heavy-duty for tools).
- Company Policy - UL listing: Use only UL-listed extension cords rated for the intended use (outdoor, heavy-duty for tools). This stricter company rule supplements the legal approval floor.
- No damaged extension cords - inspect before each use
- No daisy-chaining extension cords

- Under T8 CCR Sec. 2405.4(b), to protect employees on construction sites, the employer shall use either or both ground-fault circuit interrupters under subsection (c) or an assured equipment grounding conductor program under subsection (d); these requirements are in addition to other equipment-grounding-conductor requirements. Company Policy - GFCI protection: Require GFCI protection under this program for all 120-volt AC, single-phase, 15- and 20-ampere receptacle outlets at construction sites. The legal GFCI path covers outlets that are not part of the permanent wiring of the building or structure and are in use by employees. This company policy applies GFCI protection universally and does not rely on subsection (c)'s generator exception.
- Physical protection (T8 CCR Sec. 2405.2(g)): Protect flexible cords and cables from accidental damage, avoid sharp corners and projections, and provide protection to avoid damage when they pass through doorways or other pinch points.
- Company Policy - cord routing: Do not route extension cords through doorways, windows, or wall openings unless no alternative routing is available. Where routing through a doorway or other pinch point is unavoidable, provide protection at the pinch point in accordance with Sec. 2405.2(g).

15.5 Overhead Power Lines (T8 CCR Sec. 2946; separate federal comparator: 29 CFR 1926.416(a))

- Section 2946 Table 1 - tools, machinery, materials, structures, scaffolds, the moving of any house or other building, or any part of an employee's body: Minimum clearance from energized overhead high-voltage conductors is 6 feet for 600-50,000 V; 10 feet for over 50,000-345,000 V; 16 feet for over 345,000-750,000 V; and 20 feet for over 750,000-1,000,000 V.
- Section 2946 Table 2 - material storage and boom-type lifting or hoisting equipment: Minimum clearance is 10 feet for 600-50,000 V; 11 feet for over 50,000-75,000 V; 13 feet for over 75,000-125,000 V; 15 feet for over 125,000-175,000 V; 17 feet for over 175,000-250,000 V; 21 feet for over 250,000-370,000 V; 27 feet for over 370,000-550,000 V; and 42 feet for over 550,000-1,000,000 V.
- These clearances apply to high-voltage overhead lines (over 600 volts). Company Policy - 600 volts or less: Maintain at least 10 feet. Unknown voltage: Do not approach based on a 10-foot default; have the line owner/operator confirm the voltage and then apply the operation-specific Table 1 or Table 2 clearance. Treat every overhead conductor as energized unless and until the owner/operator verifies that it is not energized and the line is visibly grounded at the work site (T8 CCR Sec. 2946(d)).
- Qualified-person gate for energized overhead conductors (T8 CCR Sec. 2320.1(b)): Only qualified persons shall be permitted to perform any function in proximity to energized overhead conductors unless means to prevent accidental contact have been provided in accordance with Articles 3 and 4 of the Low-Voltage Electrical Safety Orders (T8 CCR, Subchapter 5, Group 1). The separate Company Policy distance for conductors at 600 volts or less is not a substitute for this gate.
- Identify overhead power lines before setting up extension ladders
- Do not use metal ladders or metallic tools near overhead power lines
- Do not operate, erect, or handle tools, machinery, apparatus, supplies, or materials over energized overhead high-voltage lines (T8 CCR Sec. 2946(b)(1)).
- If work cannot maintain the applicable minimum clearance, coordinate with the line owner/operator for verified de-energization and visible grounding at the work site. Until both conditions are satisfied, maintain the applicable clearance; cage-type boom guards, insulating links, or proximity warning devices used on cranes do not alter the requirements of other Safety Orders and do not replace the applicable clearance requirements (Sec. 2946(b), (d), (f)).
- For all operations where site conditions or crane configurations make it difficult for the operator to maintain the desired clearance by visual means, designate a person to observe equipment clearance and give timely warning (T8 CCR Sec. 2946(e)).

- High-voltage equipment warning signs (T8 CCR Sec. 2947): For each crane, derrick, power shovel, drilling rig, or similar apparatus in this program's scope, the owner, agent, or employer responsible for operation must post and maintain in plain view of the operator and driver a durable warning sign legible at 12 feet reading: “Unlawful To Operate This Equipment Within 10 Feet Of High-Voltage Lines of 50,000 Volts Or Less.” In addition, the sign must state in small lettering: “For Minimum Clearances of High-Voltage Lines In Excess of 50,000 Volts, See California Code of Regulations, Title 8, Article 37, High-Voltage Electrical Safety Orders.”

SECTION 16: BRAZING & SOLDERING SAFETY

Regulatory Basis: Construction Safety Orders T8 CCR Sec. 1502(b)-(c) and Secs. 1536, 1740-1743; T8 CCR Secs. 3382, 5144, and 5155; 2025 California Fire Code, Title 24 Part 9, Chapter 35, subject to the AHJ and locally adopted amendments

16.1 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.

16.2 Torch and Fuel Gas Safety

Before Work

- Hot-work operator qualifications (2025 CFC Sec. 3503.4): Do not issue a permit for hot-work operations unless the individuals in charge are capable of performing the operations safely. Demonstration of a working knowledge of Chapter 35 is acceptable evidence of compliance.
- Hot-work warning signs (2025 CFC Sec. 3503.6): Where the hot-work area is open to persons other than the operator of the hot-work equipment, post conspicuous signs to warn others before they enter the hot-work area. The prescribed sign displays three lines: “CAUTION”, “HOT WORK IN PROGRESS”, “STAY CLEAR”.
- 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. For portable service, convey cylinders on suitable hand trucks to which they are securely fastened, or safely carry them where job conditions require; put valve protection caps, when provided for, in place before cylinders are moved, transported, or stored (T8 CCR Sec. 1740(c)). Keep cylinders far enough from hot work that sparks, hot slag, or flame cannot reach them; where that is impractical, provide fire-resistant shields (Sec. 1740(h)). Locate oxygen and fuel-gas cylinders away from the hot-work area so radiation from heated materials, sparks, slag, or a misdirected torch flame cannot heat them (2025 CFC Sec. 3505.5).
- Fuel-gas pressure regulators (T8 CCR Sec. 1741): Use a regulator wherever a fuel-gas hose runs between the fuel source and burner. Within structures or confined spaces, the regulator must reduce fuel-gas vapor pressure to not more than 20 psi unless the burner or appliance specifically requires higher pressure and equivalent safety is provided. Use regulators and automatic pressure-reducing valves only for the pressures and gas types for which they were designed.

- Fuel-gas and oxygen hoses and connections (T8 CCR Sec. 1742): Make fuel-gas hose and oxygen hose readily distinguishable. Do not use a single multipassage hose between a torch and gas outlet where a wall failure could permit gas crossover. LP-gas hose must resist LP gas, have a bursting pressure of at least 1,250 psi, and be marked “LPG” every 5 feet; hose over 1/2 inch in diameter must also show the manufacturer's name. Use extra-heavy Schedule 80 steel pipe, flexible metallic tubing, or hose suitable for the fuel-source-to-burner service, and protect exposed connections against physical damage. Cap unused manifold and header hose connections. Where parallel oxygen and fuel-gas hose sections are taped together, cover no more than 4 inches out of every 12 inches with tape. Use hose couplings that cannot disconnect by a straight pull without rotary motion.
- Protect hoses from damage, heat, and foot traffic; never allow torch to rest on or near hoses
- Do not take cylinders containing oxygen, acetylene, or fuel gas into confined spaces (T8 CCR Sec. 1740(b)).
- Separate stored oxygen cylinders from fuel-gas cylinders or combustible materials by at least 20 feet, or by a noncombustible barrier at least 5 feet high with at least a one-half-hour fire-resistance rating (Sec. 1740(g)).
- Do not generate or use acetylene above 15 psig, subject to Sec. 1743(b)'s exception for acetylene dissolved in a suitable solvent and stored in qualifying cylinders. Keep oxygen cylinders, fittings, regulators, hoses, and apparatus free from oil or grease; do not handle them with oily hands or gloves (Sec. 1743(b)-(c)).
- Compressed-oxygen misuse (T8 CCR Sec. 1743(i)): Do not use compressed oxygen for ventilation, testing, or similar purposes different from its intended function in welding and burning.
- Welding- and cutting-gas misuse (T8 CCR Sec. 1536(d)): Do not use compressed gases used for welding and cutting for ventilation, comfort cooling, blowing dust from clothing, or cleaning the work area.
- During substantial suspensions such as lunch or overnight, shut off gas cylinders and remove the torch and hose from a confined space. On completion or discontinuance, warn other workers where hot metal remains (Sec. 1743(l)).

During Brazing/Soldering

- Indoor brazing ventilation (T8 CCR Sec. 1536(a)-(b)): Provide local exhaust with at least 100 lineal feet per minute in the welding zone. If local exhaust is infeasible, provide mechanical dilution ventilation sufficient to keep airborne contaminants within Sec. 5155 limits. If both ventilation methods are infeasible, use respiratory protection under the controlling T8 CCR Sec. 5144 program. Section 1536(a)(2) still cross-references Sec. 1531; that section has been repealed, and its Note states that the requirements applicable to construction work under it are identical to those in Sec. 5144. In an enclosed space where hazardous base metals, fluxes, coatings, platings, or filler metals are used and local exhaust is ineffective, employees must wear supplied-air respirators (Sec. 1536(b)(1)-(2)).
- Company Policy - soft soldering ventilation: Apply the same ventilation sequence to indoor soft soldering and follow the solder/flux SDS and applicable exposure limits; Sec. 1536 expressly addresses welding, brazing, and cutting rather than soft soldering.
- Toxic substances in open-air brazing: When toxic substances listed in Sec. 1536(b)(1) are used outdoors, provide respiratory protection under the controlling T8 CCR Sec. 5144 program. Section 1536(c) still cross-references Sec. 1531; that section has been repealed, and its Note states that the requirements applicable to construction work under it are identical to those in Sec. 5144. Adequate ventilation does not remove the respirator requirement for beryllium, cadmium, lead, or mercury; beryllium operations require supplied-air respirators (Sec. 1536(c)(1)-(2)).
- Exposure monitoring: Whenever it is reasonable to suspect exposure above Sec. 5155(c) limits, monitor the work environment. If exposure is found or expected above allowable levels, institute controls; monitoring and control must be supervised or evaluated by a person competent in industrial hygiene practice, and results must be recorded and retained under Sec. 3204 (Sec. 5155(e)(1)-(4)).

- CFC pre-hot-work review and records: Before hot work is permitted and at least once per day while the permit is in effect, the individual responsible for authorizing hot work must inspect the area to ensure it is fire safe and verify permit information before signing (2025 CFC Sec. 3504.3). Before work, conduct the Sec. 3504.3.1 pre-hot-work check to ensure equipment is safe and hazards are recognized and protected. The check must confirm that hot-work equipment is in satisfactory condition and good repair; combustibles are cleared or protected; exposed construction is noncombustible or protected; openings are protected; floors are clean; exposed combustibles are not opposite partitions, walls, ceilings, or floors; required fire watches are assigned; approved actions prevent accidental activation of fire-protection equipment under Secs. 3504.1.8-3504.1.9; and extinguishers and any provided fire hoses are operable and available. Keep the report at the work site during the work and available on request. The individual responsible for the hot-work area must retain the prework check reports on the premises for at least 48 hours after work is complete (Sec. 3503.5). Company Policy - 35-foot hot-work control: 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.
- Extinguishers and fire watch: Keep a dry-chemical or carbon-dioxide extinguisher rated at least 10 B:C near operations using bottled fuel gas (T8 CCR Sec. 1743(j)). For hot work subject to the 2025 California Fire Code, provide an extinguisher complying with Section 906 and with a minimum 2-A:20-B:C rating and ready access within 30 feet (Sec. 3504.2.6); confirm requirements with the AHJ and check locally adopted, more-restrictive amendments (Sec. 1.1.8). These requirements apply together. Under 2025 CFC Sec. 3504.2.1, a fire watch must be provided during hot work and continue for at least 30 minutes after it ends, except where the hot-work area has no fire hazards or combustible exposures; the fire code official or responsible manager under a hot-work program may extend the watch based on the hazards or work. Under Sec. 3504.2.2, the fire watch must include the entire hot-work area, and areas with vertical or horizontal fire exposures that one person cannot observe require additional fire-watch personnel. Under Sec. 3504.2.3, watch personnel must have readily available fire-extinguishing equipment, be trained to use it, extinguish spot fires, and communicate an alarm. Section 3504.2.4 requires both hot-work performers and watch personnel to be trained to use portable fire extinguishers. Under Sec. 3504.2.5, any required hoselines must be connected, charged, and ready. The Sec. 3504.2.1 exception does not waive the separate Company Policy minimum. Company Policy - 60-minute fire watch: Use a minimum 20-lb ABC extinguisher that is marked at least 2-A:20-B:C, and maintain a designated fire watch during brazing and for at least 60 minutes after the torch is extinguished.
- Protect pipe insulation from torch heat. Under T8 CCR Sec. 4848(b), welding blankets, curtains, and pads must be approved for their intended use in accordance with Sec. 3206. Under Sec. 3206(a), “approved” includes approval, listing, labeling, or certification as conforming to applicable governmental or other nationally recognized standards, or applicable scientific principles, based on evaluation by an appropriately qualified or independent competent entity; it also includes NRTL approval, listing, labeling, or certification. Company Policy: Use only heat shields approved to the same Sec. 3206 standard.
- Do not braze or solder near refrigerant. Refrigerants can thermally decompose during brazing into toxic or corrosive products; the specific products depend on the refrigerant. Consult the refrigerant SDS before hot work. Separately, under 2025 CFC Sec. 3504.1.7, do not perform hot work on containers or equipment that contain or have contained flammable liquids, gases, or solids until they have been thoroughly cleaned, inerted, or purged, except for hot tapping on tanks and pipe lines by approved personnel; hot work on flammable or combustible liquid storage tanks must comply with Sec. 3510. The regulated dry-nitrogen brazing purge in Section 16.3 is a distinct manufacturer-process control and does not by itself satisfy this fire/explosion precondition.
- Phosphoric acid flux (for plumbing soft soldering): wear eye protection; avoid skin contact; flux fumes are irritating to eyes and respiratory tract

After Work

- Company Policy: Close all cylinder valves when work is complete. For a single oxygen cylinder and a single fuel-gas cylinder sharing a cart under the 2025 CFC Sec. 3505.2.1 separation allowance, cylinder valves must be closed when work is finished and before the cart is moved, and all other conditions of Sec. 3505.2.1 must be met. Put valve protection caps, when provided for, in place before cylinders are moved, transported, or stored (T8 CCR Sec. 1740(c)).
- 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

16.3 Nitrogen Purging for Brazing (HVAC)

- When brazing copper refrigerant lines, use regulated dry nitrogen at the equipment manufacturer's specified purge flow and pressure. Never use oxygen or compressed air for brazing purge.
- Use a pressure regulator on the nitrogen cylinder and follow the equipment manufacturer's purge procedure.
- Nitrogen cylinders are stored upright and secured

16.4 PPE for Brazing/Soldering

- Select filter lenses under T8 CCR Sec. 3382(b), Table EP-1: shade 2 for soldering and shade 3 or 4 for torch brazing; a denser shade may be used. Follow any more-protective manufacturer guidance. A face shield, when used, is worn over the primary eye protection and is not an alternative to it.
- Leather welding gloves
- Long sleeves - heat-resistant clothing
- Leather apron for heavy brazing work
- Use ventilation and respiratory protection as required by Section 16.2 and the controlling Written Respiratory Protection Program in Section 39. Ventilation is not a substitute for required respiratory protection in beryllium, cadmium, lead, or mercury operations.

California hot-work permit / AHJ check: The 2025 California Fire Code requires an operational permit for portable hot-work equipment used inside a structure, except work conducted under a construction permit (Sec. 105.5.25). Before indoor portable torch work, confirm the applicable operational permit, construction permit, approved hot-work program, and any more-restrictive local amendments with the fire code official/AHJ. A permit issued by an approved responsible person under a hot-work program must be available to the fire code official during the work and for 48 hours afterward (Sec. 3503.3). Building-owner or GC authorization does not replace an AHJ permit when one is required. Under Sec. 3501.3, conduct hot work only in areas designed or authorized for that purpose by the personnel responsible for a hot-work program. Unless approval has been obtained from the fire code official, do not conduct hot work where an automatic sprinkler system is impaired; where an explosive atmosphere could exist, including where flammable gases, liquids, or vapors are present; where readily ignitable materials are present; aboard ships at dock or under construction or repair; or in other locations specified by the fire code official.

Wildfire-risk-area operational permit (2025 CFC Sec. 105.5.25 item 4): Whether inside or outside a structure, hot work conducted within a wildfire risk area separately requires an operational permit. Confirm this permit limb and local amendments with the fire code official/AHJ; the inside-a-structure construction-permit exception in item 2 does not qualify this separate item 4 limb.