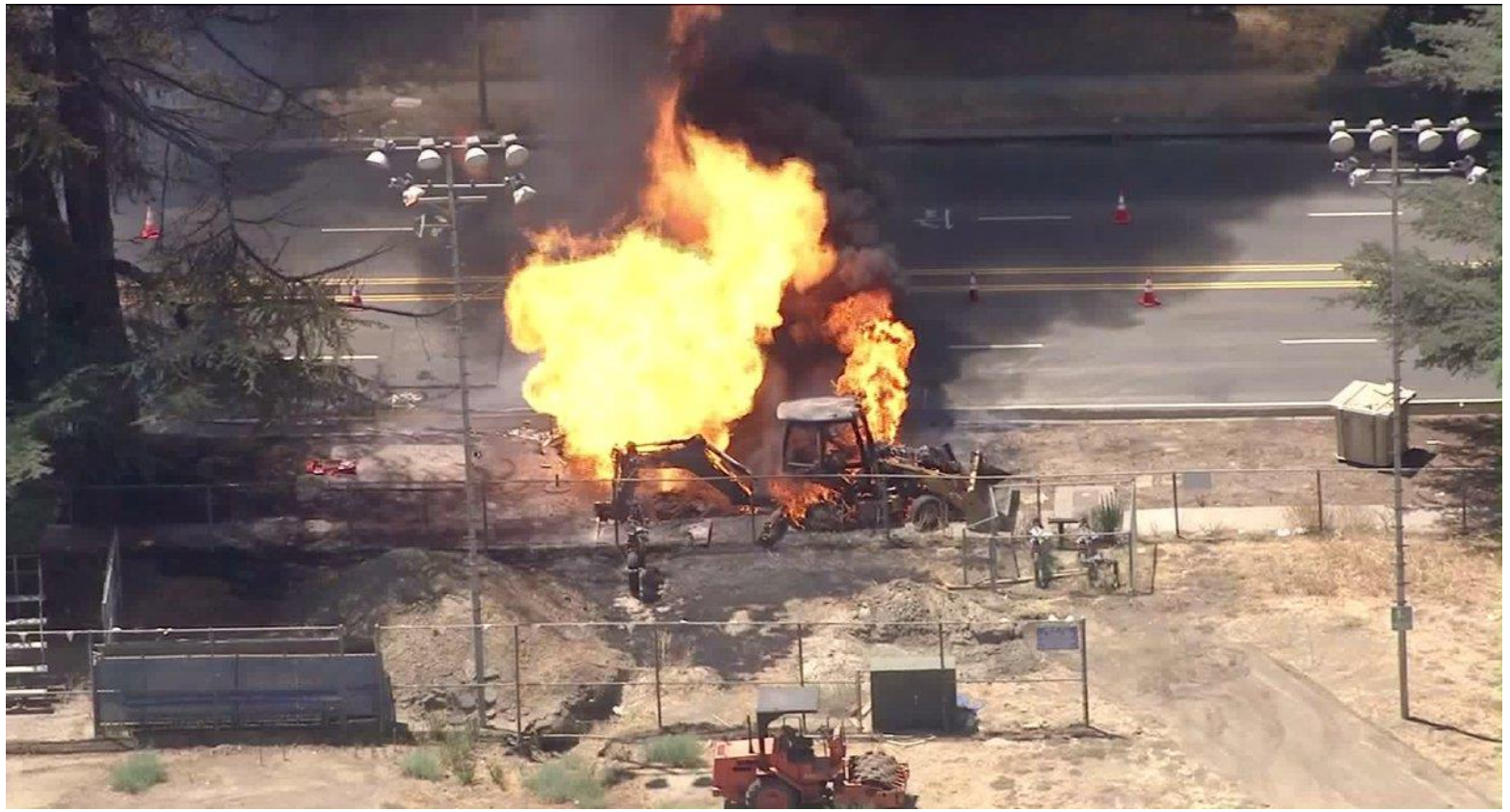
Best Practices for Tracer Wire System Installation

Basic locating practices overview, best installation procedures for tracer wire systems, products and testing

Why?
#1 Prevent Injuries



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Why?
#2 Prevent Property Damage

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Why?
#3 Save Time and Money

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Why?

#4 A Key Element of a Damage Prevention Program

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Why?

#5 Federal Code Requires a Tracer Wire with PE Pipe

PHMSA

U.S. Department of Transportation

Pipeline and Hazardous Materials Safety Administration

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Scope of Project – Collecting Data

- Over 2 years of documenting field research locates, talking to operators, communicating with locators of other utilities, and researching how theories of locating apply to tracer wire
- Year long effort collecting specifications and procedures for tracer wire installation from gas utilities across North America
- Large number of LDC's have an out-of-date, incomplete or a limited installation specification in their O & M manuals
- Some LDC's were having locating issues

Scope of Project – Action Plan

- Enlisted the services of Utility, Safety & Design, Inc. (USDI) as a partner to confirm compliance with all existing standards and regulations
- Establish complete tracer wire system standards predicated on locating accuracy and efficiency

USDI

Natural gas engineering and utility services

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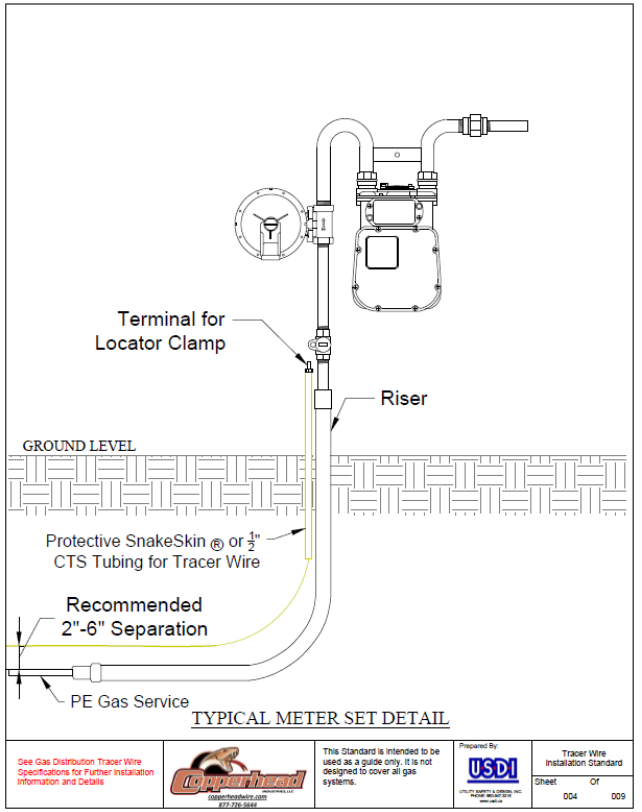
Result? – Tracer Wire System and Installation Standards.

- **Work Included**
  - Complete tracer wire system products and system parameters considering installation by trenching, plowing, or horizontal directional drilling for PE gas systems and pipelines

- **References**
  - APWA Uniform Color Code
  - Title 49 Transportation 192 – PHMSA Pipeline Safety
  - Compliance with state and local regulations
  - ANSI GPTC Code



Our process continues to evolve…

- We continue to teach, and learn more about the complete tracer wire system through ongoing field work, technical training sessions, frequent meetings with utility operators, consulting engineers, and utility contractors.

- The current design standards assume a life-cycle of 50+ years for pipe being installed today.

- Installation of a complete tracer wire system must not only provides for accurate and efficient locates, but meets the same life-cycle of the utility piping that it's being installed with.

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Utility Locating Basics

- Very high-level overview to gain a *basic* understanding of locating.
- A basic understand of utility locating will help us understand the value of complete tracer wire systems
- Any locating equipment can be used.

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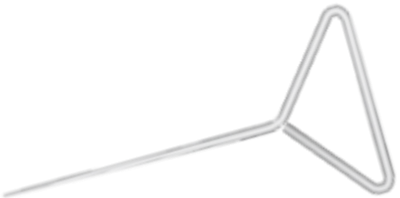
A typical line tracing kit consists of…

Transmitter

Connective Leads



Ground Stake

Receiver

Signal Clamp

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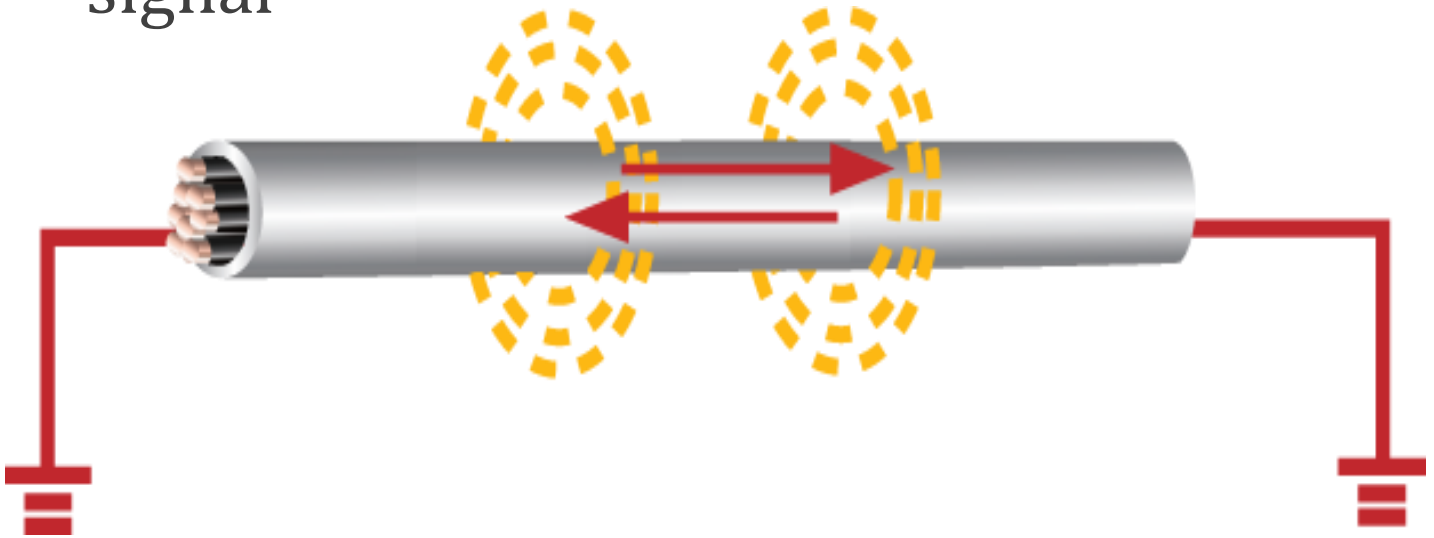
The locating signal…

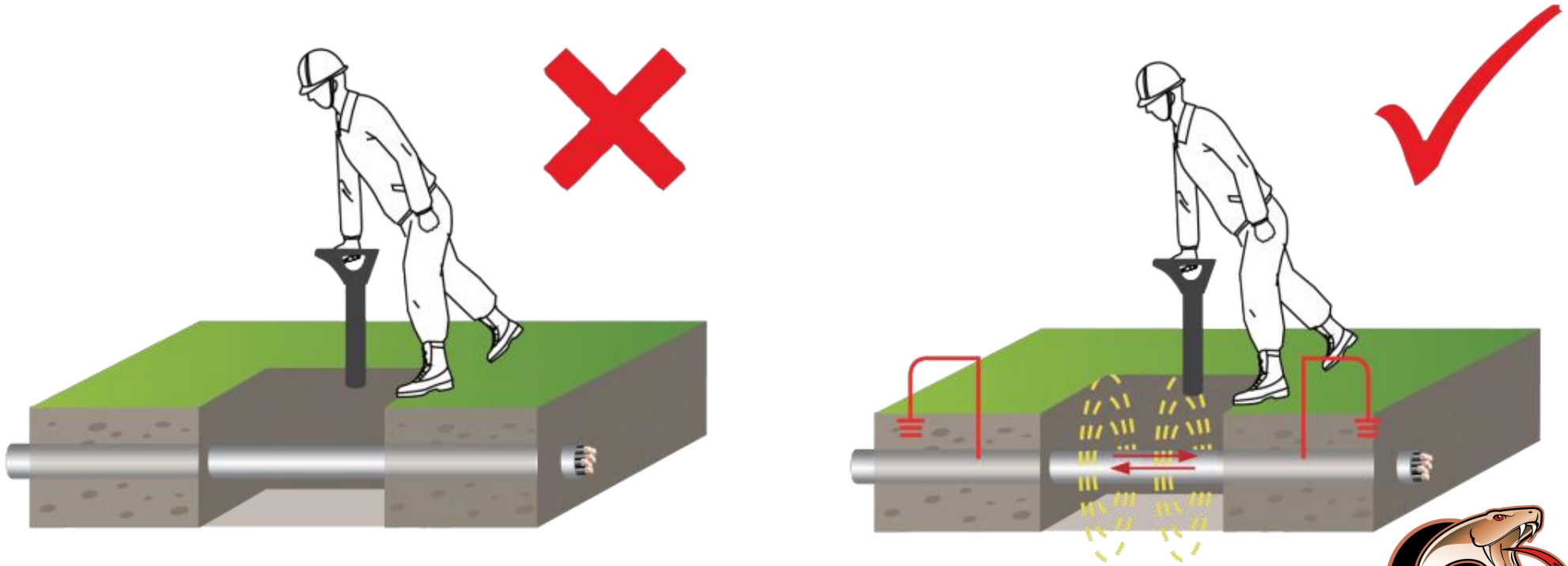
- Produced by the flow of the alternating current (AC) which creates an electromagnetic field.

- Electromagnetic field radiates from the line and is known as the signal

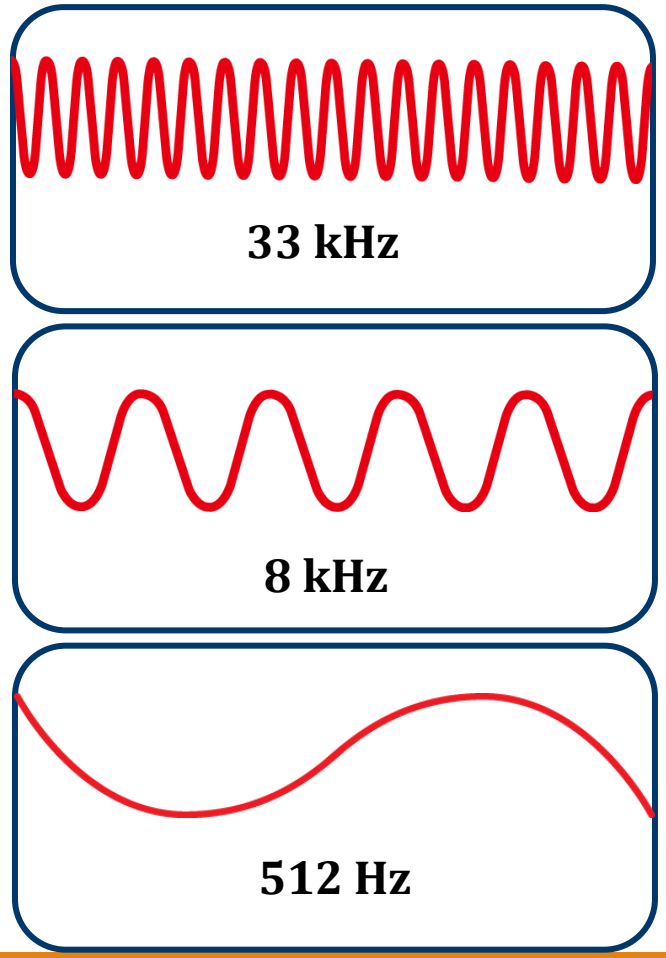


The locating signal…

- If there isn't any AC CURRENT FLOWING, there will not be a LOCATING SIGNAL



Active signal frequencies…



- High frequency (32.8 kHz)
  - Direct connection, clamp & induction
  - Shortest distance
  - Highest distortion
- Medium frequency (8.19 kHz)
  - Direct connection, clamp & induction
  - Reasonable distance
  - Increased distortion
- Low frequency (512 Hz)
  - Direct connection
  - Longest distance
  - Lowest distortion

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Complete tracer wire system products

- When designing a utility, how seriously is the design or specification of the tracer wire taken? Unfortunately, not nearly as much as the rest of the system.

- Tracer wire systems have been taken far too lightly with very broad specifications.

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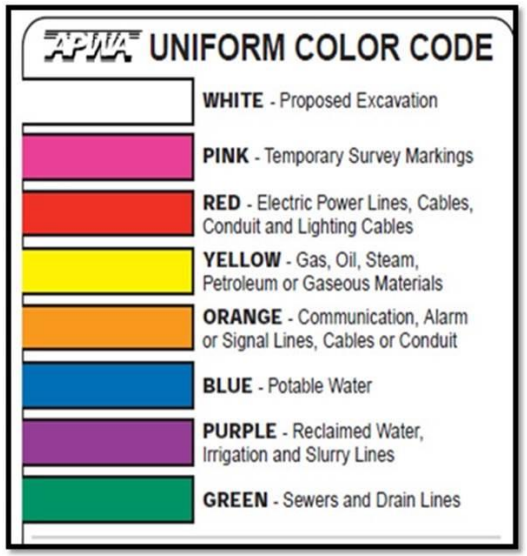
What should be specified?

- Write specifications to cover the entire tracer wire system, including:
  - **Wire (type of conductor and size to match installation method**
  - **Insulation type and color**
  - **Connectors**
  - **Tracer wire access points**
  - **Grounding**
  - **Procedures for installation & testing**



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Wire

- Wire Size or Gauge (AWG)
  - Myth: The bigger the wire the stronger the signal.
  - Fact: Larger diameter wire is specified for strength, not signal carrying qualities. Breakage is the most common reason for signal failure typically occurring during installation. The size and strength of the wire should coincide with the installation method.

Best Practices - Products

- **Tracer Wire**
  - **Open Trench**
    - 14 AWG American Made CCS with a minimum break load of 194 lbs. or a Solid CU with a break load of 112 lbs.
    - 12 AWG American Made CCS with a minimum break load of 302 lbs. or a Solid CU with a break load of 180 lbs.
    - Minimum 30 mil. HDPE insulation thickness

Best Practices - Products

- **Tracer Wire**
  - **Horizontal Directional Drilling & Plowing Installation**
    - 12 AWG American Made CCS Tracer Wire with a minimum break load of 1,150 lbs.
    - Multiple 8 AWG Solid Copper Tracer Wire with a minimum break load of 485 lbs.
    - Minimum 45 mil. HDPE Insulation

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Complete tracer wire system products

- **Wire Connectors**
  - Lockable connectors specifically designed for direct burial, dielectric silicone gel filled, designed to prevent uninsulated wire exposure.

  - Other connector options might include non-lockable direct bury lugs equipped with silicone gel specifically designed for direct burial.

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Complete tracer wire system products

- **Grounding**
  - Tracer wire must be properly grounded at all dead ends / stubs.
  - Grounding shall be achieved by use of 1.5 lb., drive-in magnesium grounding anode rod with a minimum of 20 feet of lead wire.

Complete tracer wire system products

- **Grounding**
  - If grounding the tracer wire at the meter, 2 Terminal access boxes are required to allow for locates to be done from the meter or toward the meter.
  - When the anode wire will be connected to a tracer wire access box, a minimum of 2 feet of slack wire is required after meeting final elevation.

Complete tracer wire system products

- **Termination / Access Boxes**
  - All locate access terminals will be designed for tracer wire and easily accessible.
    - Grade level access box
    - Above ground access box
    - Meter riser protective direct connect access point

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Installation methods

- **Do's and Don'ts**
  - No bare tracer wire shall be exposed either below or above ground. Exposed ends such as at meter risers are not allowed and shall be protected from exposure.
  - Tracer wire shall not be taped to the pipe.
  - Tracer wire shall not be wrapped around the pipe.
  - Tracer wire shall not be connected to existing foreign / conductive utilities.
  - Non-locking friction fit, wire nut, spray-on waterproofing or taped connectors shall not be used.

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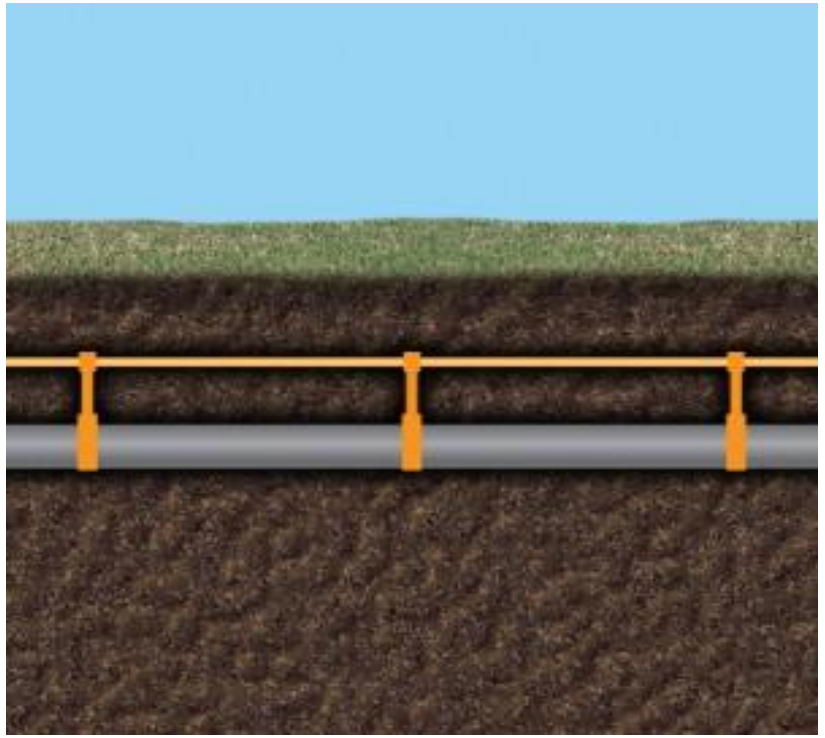
Installation methods

- **Do's and Don'ts**
  - Access through valve box is not allowed.
  - System shall not be looped. Looping of tracer wire will result in difficulty locating as the signal is nullified.
  - Continuous wire installations that have multiple wire laid side-by-side or in close proximity to one another shall not be allowed.

Installation methods

- **Installation**
  - Install tracer wire along the pipe above or to the side of the pipe. Contact with the pipe is allowed but shall be minimized. Recommended 2” – 6” separation. (ANSI-GPTC)
  - Install tracer wire as a single continuous wire. Splicing of wire, if necessary, shall be done in such a way to produce an electrically and mechanically sound connection.



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Best Practices - Execution

- **Completion Testing**
  - Verify tracer wire installation by using low frequency (512 Hz or similar) line locating equipment.
  - Verification shall be witnessed by the utility or their designated representative.
  - Verify tracer wire installation upon completion of rough grading and again prior to final acceptance of project.
  - Continuity testing of the tracer wire system in lieu of using locating equipment shall not be accepted.

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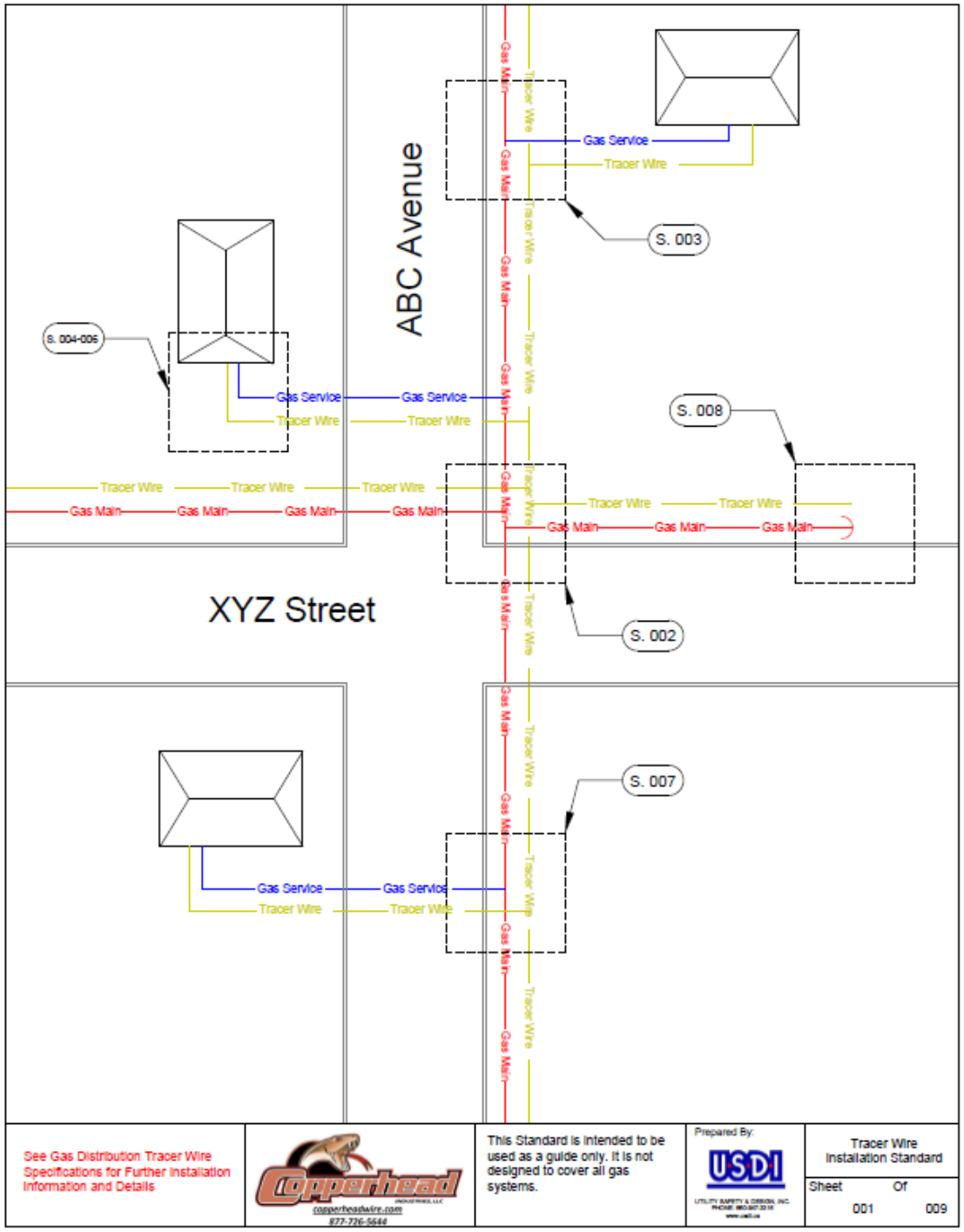
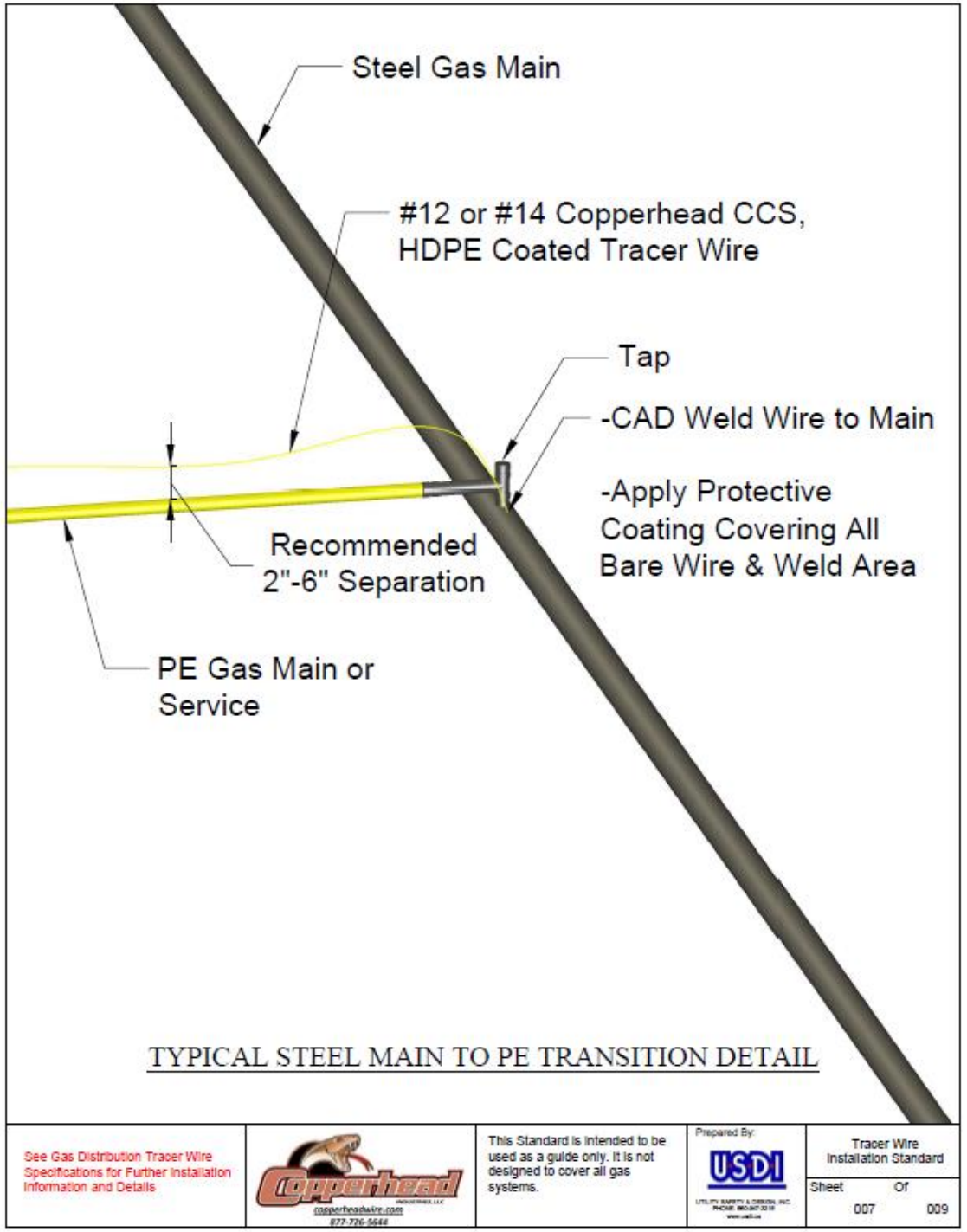
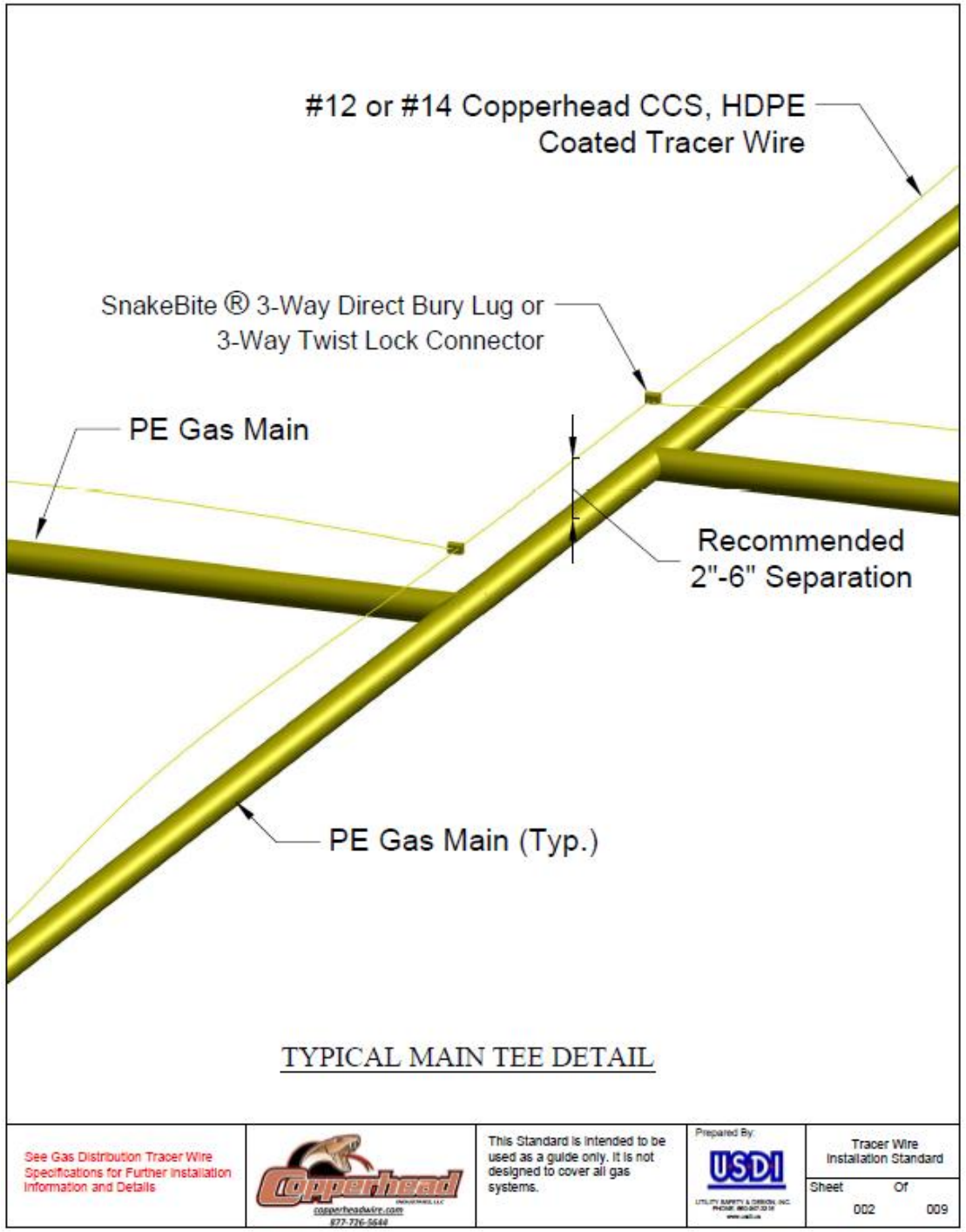
Mountain Top View of Installation Area



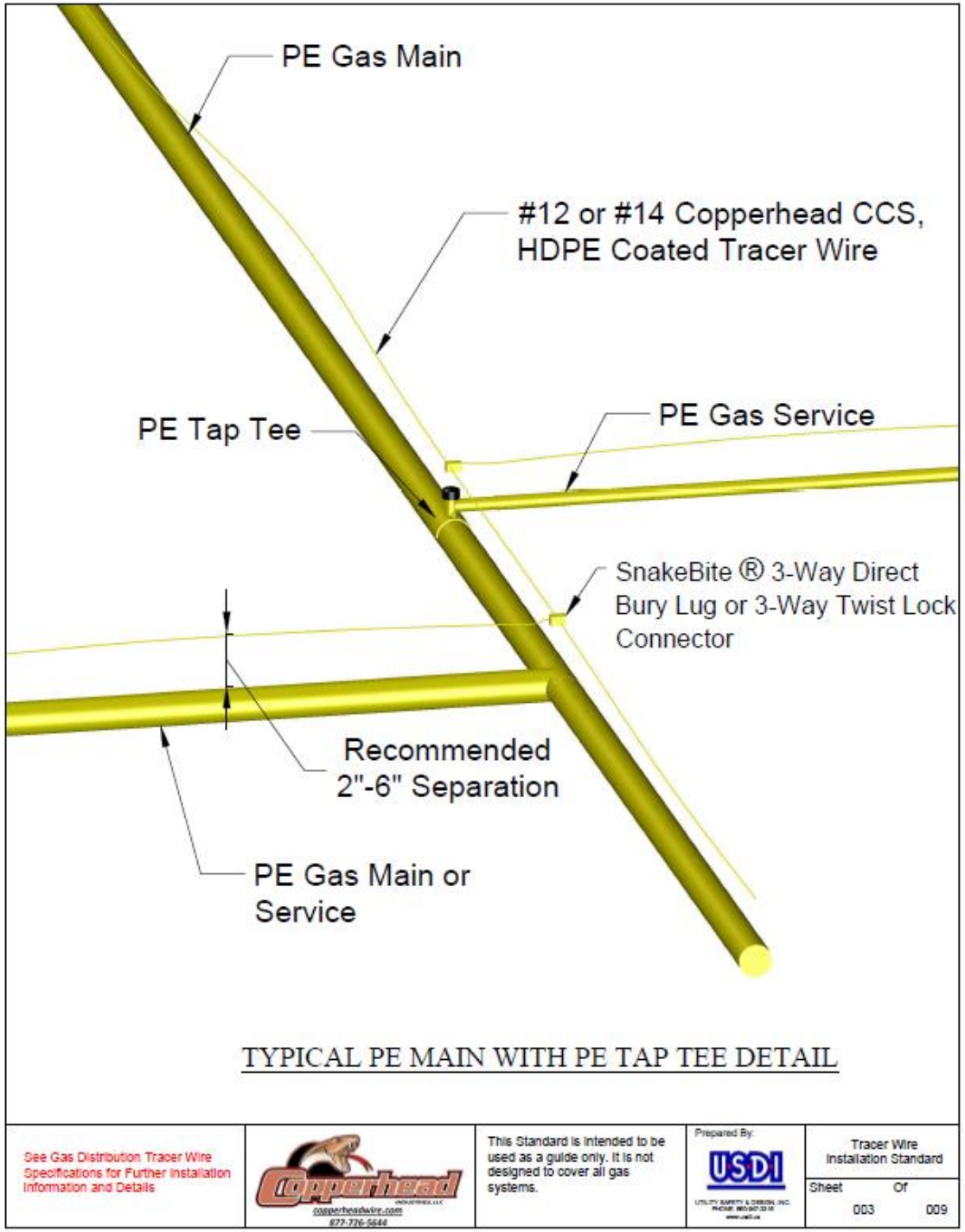
Steel to PE Pipe Transition



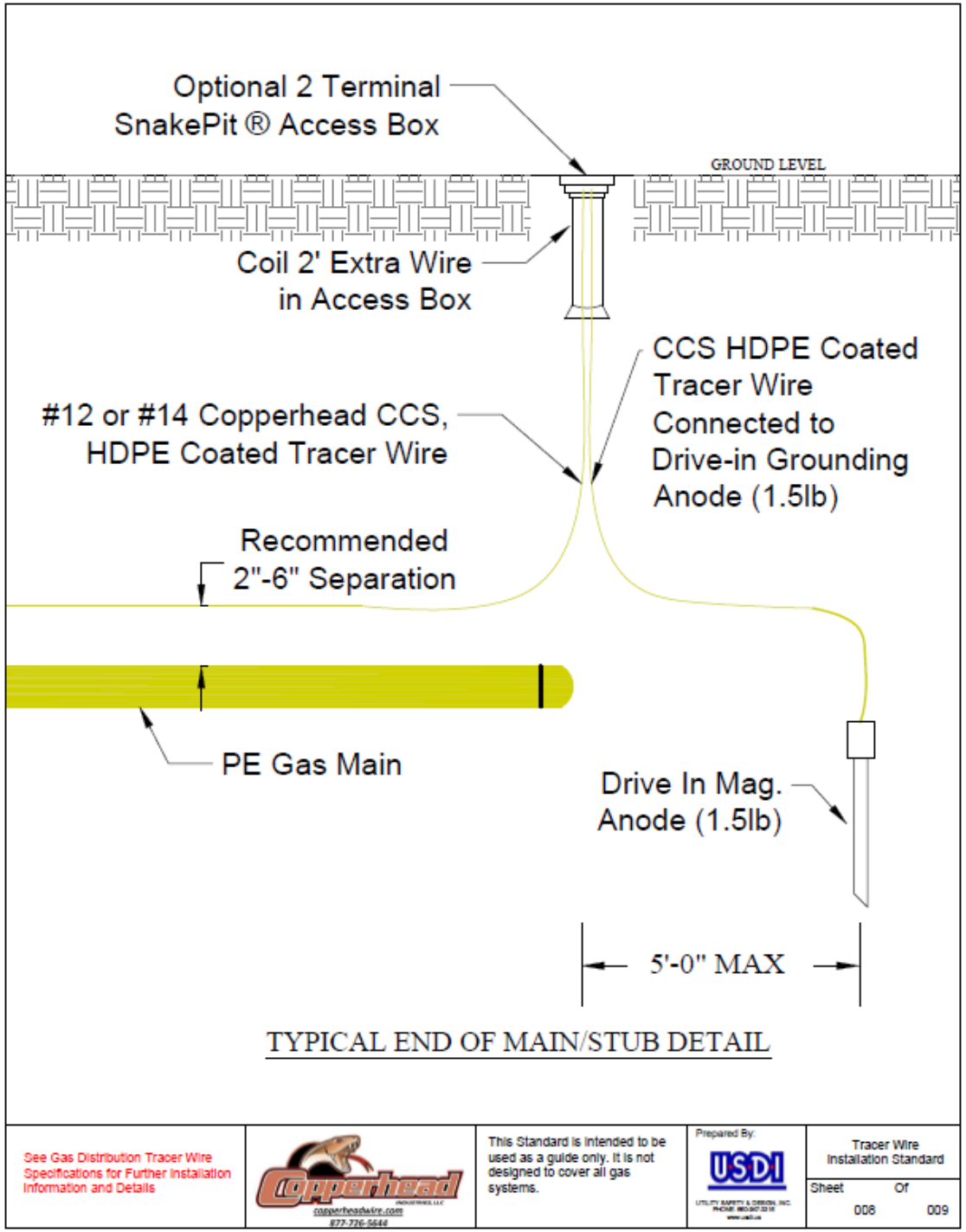
PE Gas Main Grid



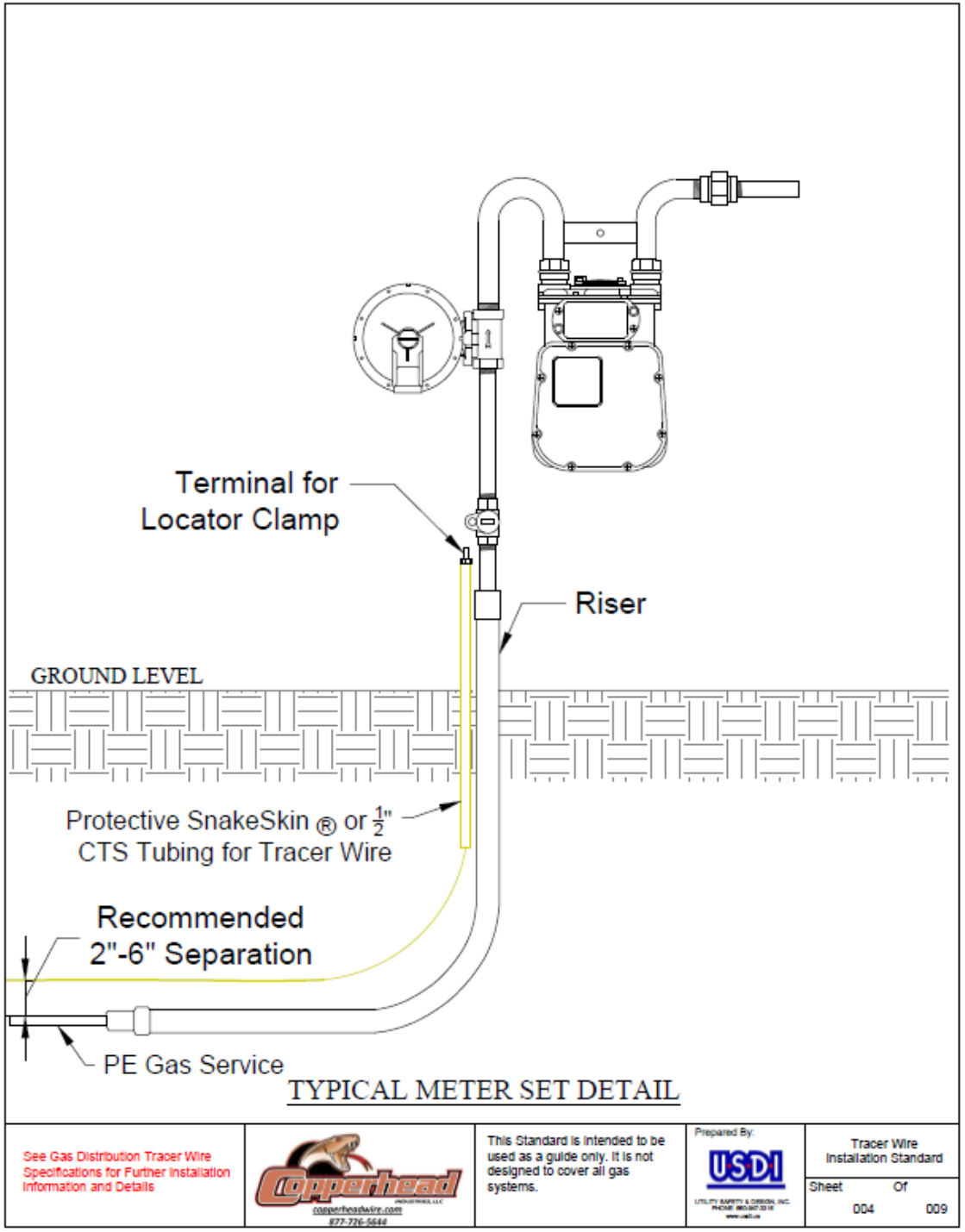
PE Main to Tap Tee Detail



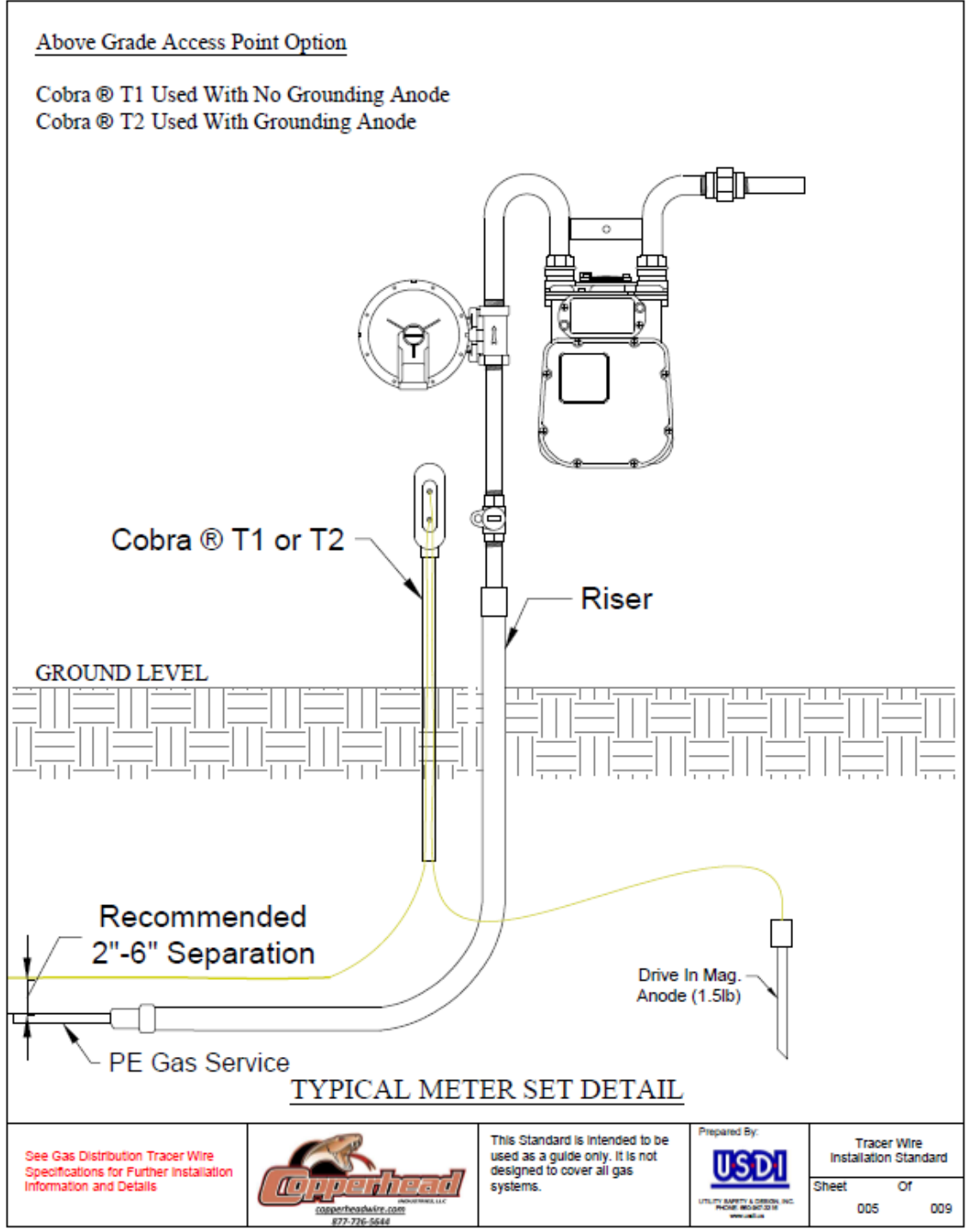
End of Main/ Stub Detail



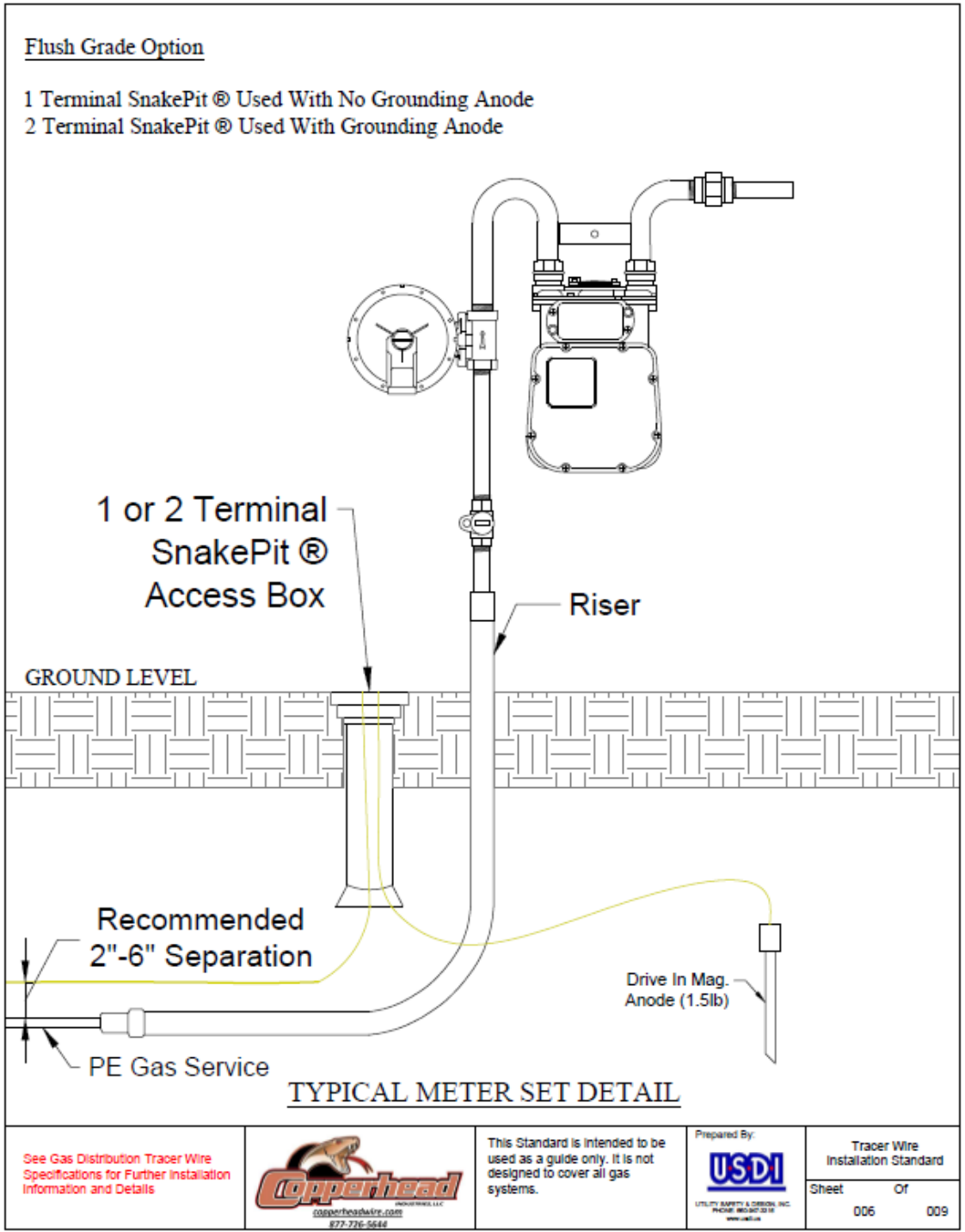
Meter Set Detail



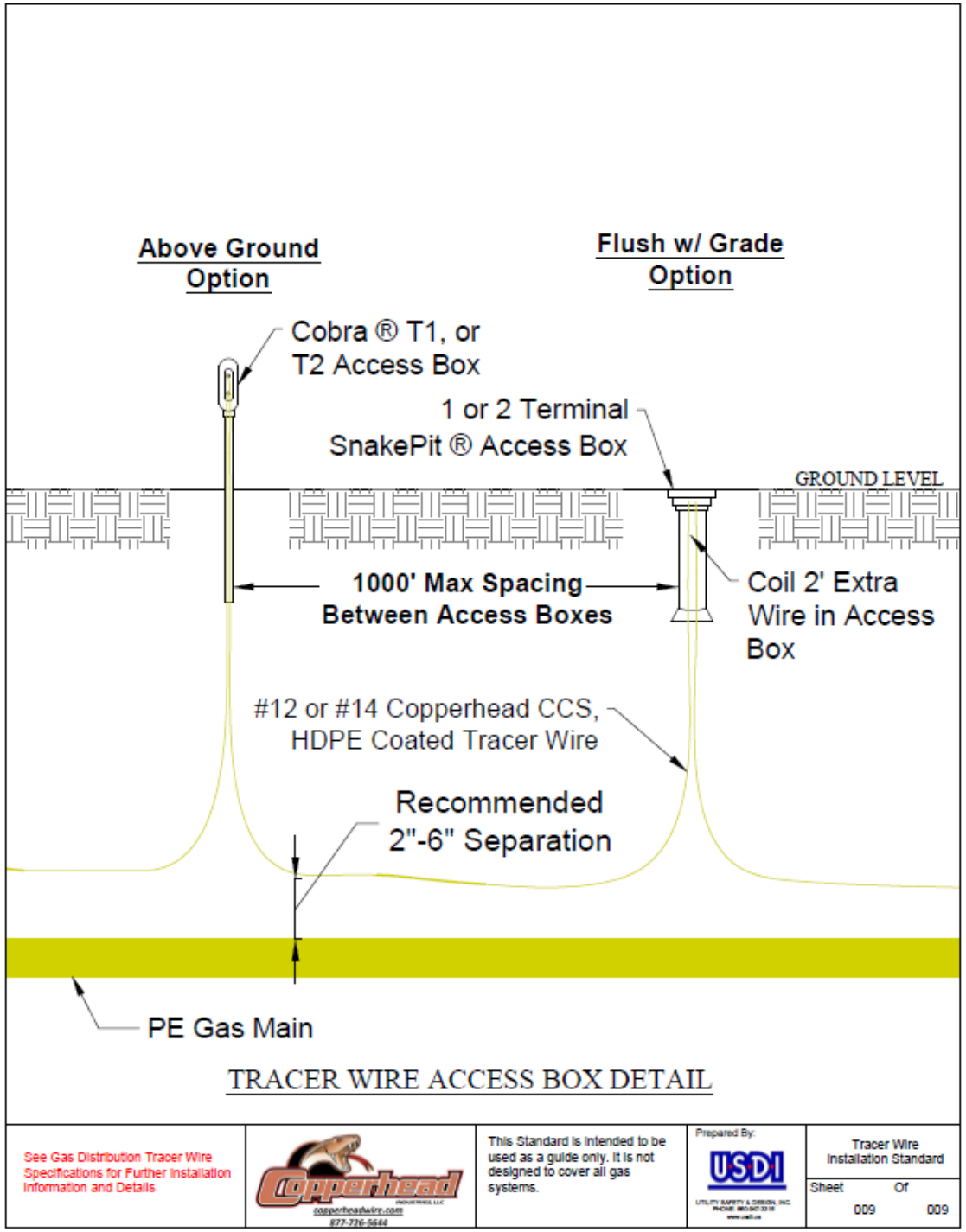
Meter Set with Grounding Anode and Above Ground Access Box



Meter Set with Grounding Anode and Below Ground Access Box



Tracer Wire Access Box Detail



Questions?

Paper or electronic versions of the Complete Tracer Wire System Products and Installation Guide are available

Lee Dester
Copperhead Industries, LLC

BEST PRACTICES
GAS DISTRIBUTION TRACER WIRE SYSTEM INSTALLATION

1. GENERAL
   1.1. WORK INCLUDED
      A. Tracer Wire Installation – Complete system installation by trenching, plowing or horizontal directional drilling for polyethylene (PE) gas systems and pipelines
   1.2. REFERENCES
      A. APWA Uniform Color Code
      B. Department of Transportation Pipeline Safety Regulations Part 192 – Transportation of Natural and Other Gas by Pipeline
      C. ANSI GPTC Code
      D. State Pipeline Safety Codes
   1.3. SUBMITTALS
      A. All materials shall be made in the U.S.A.
      B. All tracer wire shall have HDPE insulation intended for direct bury
      C. All tracer wire connectors shall be gel filled and rated for direct bury
      D. All locate access terminals will be designed for tracer wire and easily accessible
2. PRODUCTS
   2.1. TRACER WIRE
      A. Open Trench Installation: High Strength (HS) or SuperFlex (SF) Copper Clad Steel (CCS). Coating will be yellow in color, #14 AWG or #12 AWG by Copperhead Industries, LLC or preapproved equal.
         a. #14 AWG minimum break load 280 lb. for HS ;194 lb. for SF
         b. #12 AWG minimum break load 450 lb. for HS; 302 lb. for SF
         c. Minimum 30 mil, HDPE insulation thickness
      B. Horizontal Directional Drilling & Plowing Installation: CCS, #12 AWG, SoloShot EHS, Extra High Strength, by Copperhead Industries, LLC or preapproved equal.
         a. Minimum break load of 1,150 lb.
         b. Minimum 45 mil, HDPE insulation thickness
   2.2. WIRE CONNECTORS: Lockable connectors specifically designed for direct burial, dielectric silicone gel filled, designed to prevent uninsulated wire exposure.
      A. Main line or service line splice: Copperhead SnakeBite 3-way locking connector, LSC1430Y or LSC1230Y
      B. Main line connection to service line: For **new** PE main line and **new** service line being installed at the same time, Copperhead LSC1430Y, LSC1230Y or SnakeBite 3-way Direct Bury Lug 3WB-01.
         If adding a service line to existing main, SnakeBite 3-way Direct Bury Lug **must** be used as mainline tracer wire cannot be cut: Copperhead P/N 3WB-01

2.3. GROUNDING ANODES: To enhance the locate signal. Bare magnesium anode, 1.5 pound minimum, drive-in, Copperhead ANO-1005 (#14 AWG or #12 AWG lead wire) or preapproved equal.

2.4. TERMINATION/ACCESS:

A. Non-roadway grade level access box: Cast iron lid, yellow in color, labeled 'GAS' or 'TEST', Copperhead SnakePit Lite Duty LD14YTP or preapproved equal.
B. Concrete grade level access box: Cast iron lid, yellow in color, labeled 'GAS' or 'TEST', Copperhead SnakePit CD14YTP14 or preapproved equal.
C. Asphalt grade level access box: Cast iron lid yellow in color, labeled 'GAS' or 'TEST', Copperhead SnakePit RB14YTP or preapproved equal.
D. Above ground access box: Copperhead Cobra or preapproved equal.
E. Meter riser protective direct connect access point: SnakeSkin, SNSKY, Silver Bullet or preapproved equal

3. EXECUTION

3.1. PREPARATION

A. Access of the tracer wire system for locating purposes shall be provided at maximum intervals as appropriate. Access shall be provided by the following:
    a. Grade level access box
    b. Above ground access box
    c. Meter riser protective direct connect access point
B. Access through valve box is not allowed.
C. System shall not be looped. Looping of tracer wire can result in difficulty for locating as the signal is nullified.
D. Continuous wire installations that have multiple wires laid side-by-side or in close proximity to one another shall not be allowed.

3.2. INSTALLATION

A. Install tracer wire along the pipe above or to the side of the pipe. Contact with the pipe is allowed but shall be minimized. Recommended 2" – 6" separation.
B. Install tracer wire as a single continuous wire. Splicing of wire, if necessary, shall be done in such a way to produce an electrically and mechanically sound joint.
C. Damage to the wire occurring during installation shall be immediately repaired by removing the damaged wire and installing a new section of wire with approved connectors.
D. Grounding
    a. Tracer wire must be properly grounded at all dead ends/stubs.
    b. Grounding shall be achieved by use of a 1.5 pound, drive-in magnesium grounding anode rod with a minimum of 20 feet of lead wire. Copperhead ANO-1005
    c. If grounding the tracer wire at the meter, 2 Terminal access boxes are required to allow for locates to be done from the meter or toward the meter.
    d. When anode wire will be connected to a tracer wire access box, a minimum of 2 feet of slack wire is required after meeting final elevation.
E. No bare tracer wire shall be exposed either below or above ground. Exposed ends such as at meter risers are not allowed and shall be protected from exposure.

F. Tracer wire shall not be taped to pipe.
G. Tracer wire shall not be wrapped around pipe.
H. Tracer wire shall not be connected to existing foreign/conduction utilities.
I. Non-locking friction fit, wire nut, spray-on waterproofing or taped connectors shall not be used.

3.3. TESTING

A. Verify tracer wire installation by using typical low frequency (512 HZ or similar) line locating equipment.
B. Verification shall be witnessed by the utility or their designated representative.
C. Verify tracer wire installation upon completion of rough grading and again prior to final acceptance of project.
D. Continuity testing of the tracer wire system in lieu of using locating equipment shall not be accepted.

Products

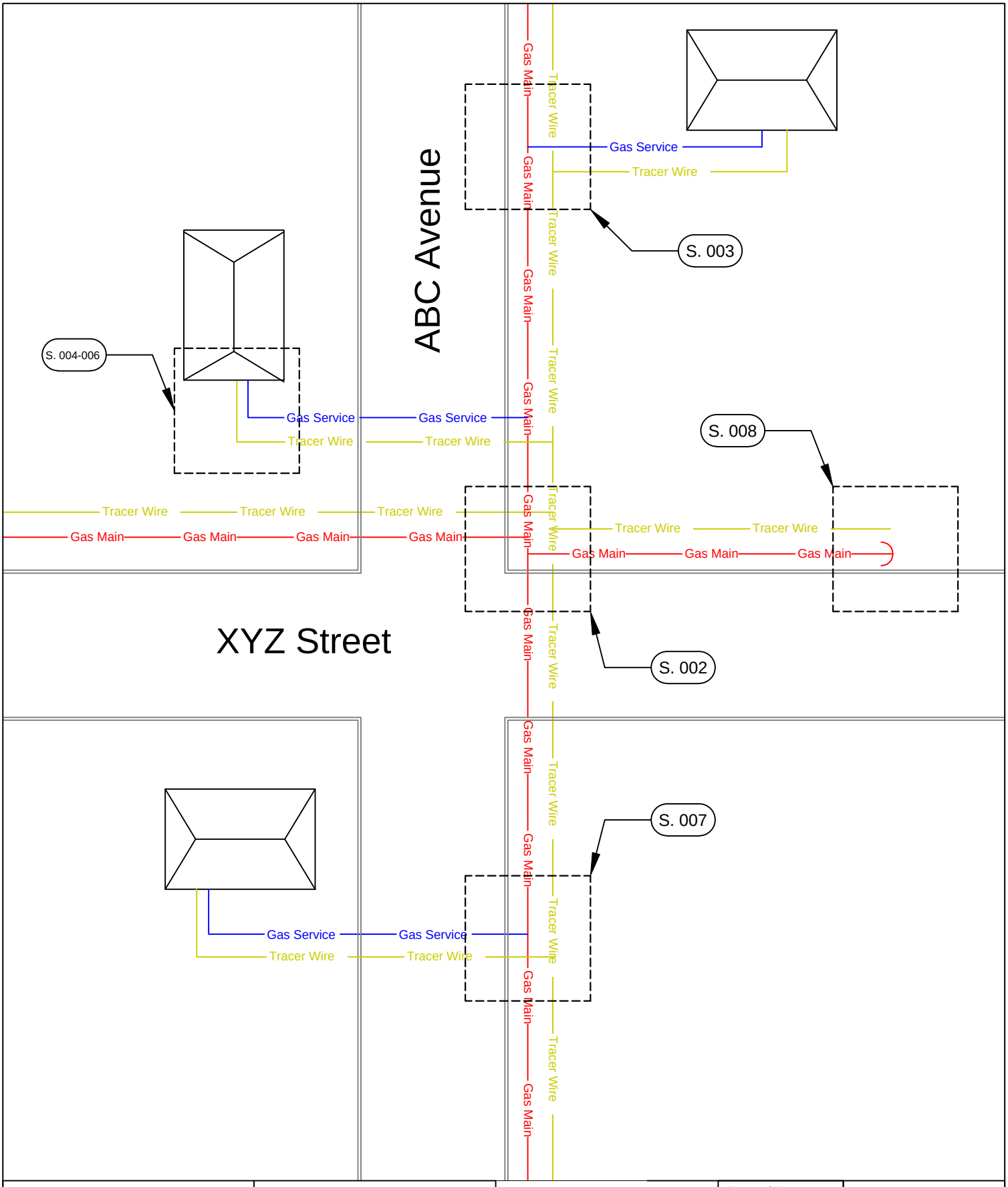
The following products have been deemed acceptable and appropriate. These products are a guide only to help choose the correct applications for your tracer wire project.

- Copper Clad Steel (CCS) Wire
  Open Trench – Copperhead #14 AWG or #12 AWG High Strength or SuperFlex, P/N's 1430Y-HS, 1230Y-HS, 1430Y-SF and 1230Y-SF
  Directional Drilling/Boring or Plowing - Copperhead SoloShot Extra High Strength, P/N 1245Y-EHS

- Connectors
  Copperhead 3-way SnakeBite locking connector, P/N's LSC1430Y and LSC1230Y
  SnakeBite 3-way Direct Bury Lug, P/N 3WB-01

- Access
  Grade level Non-Roadway applications – Copperhead lite duty Snake-Pit, P/N LD14YTP
  Grade level Concrete/Driveway applications – Copperhead SnakePit, P/N CD14YTP
  Grade level Roadway applications – Copperhead SnakePit, P/N RB14YTP
  Above grade – Copperhead Cobra, P/N Cobra - Y* (* denotes number of terminals)
  Meter riser direct connect – Copperhead SnakeSkin, P/N SNSK-Y or Silver Bullet

- Grounding
  Drive-in Magnesium Anode, 1.5 lb. – Copperhead P/N ANO-1005 (indicate #14 AWG or #12 AWG preference)



See Gas Distribution Tracer Wire Specifications for Further Installation Information and Details

This Standard is intended to be used as a guide only. It is not designed to cover all gas systems.

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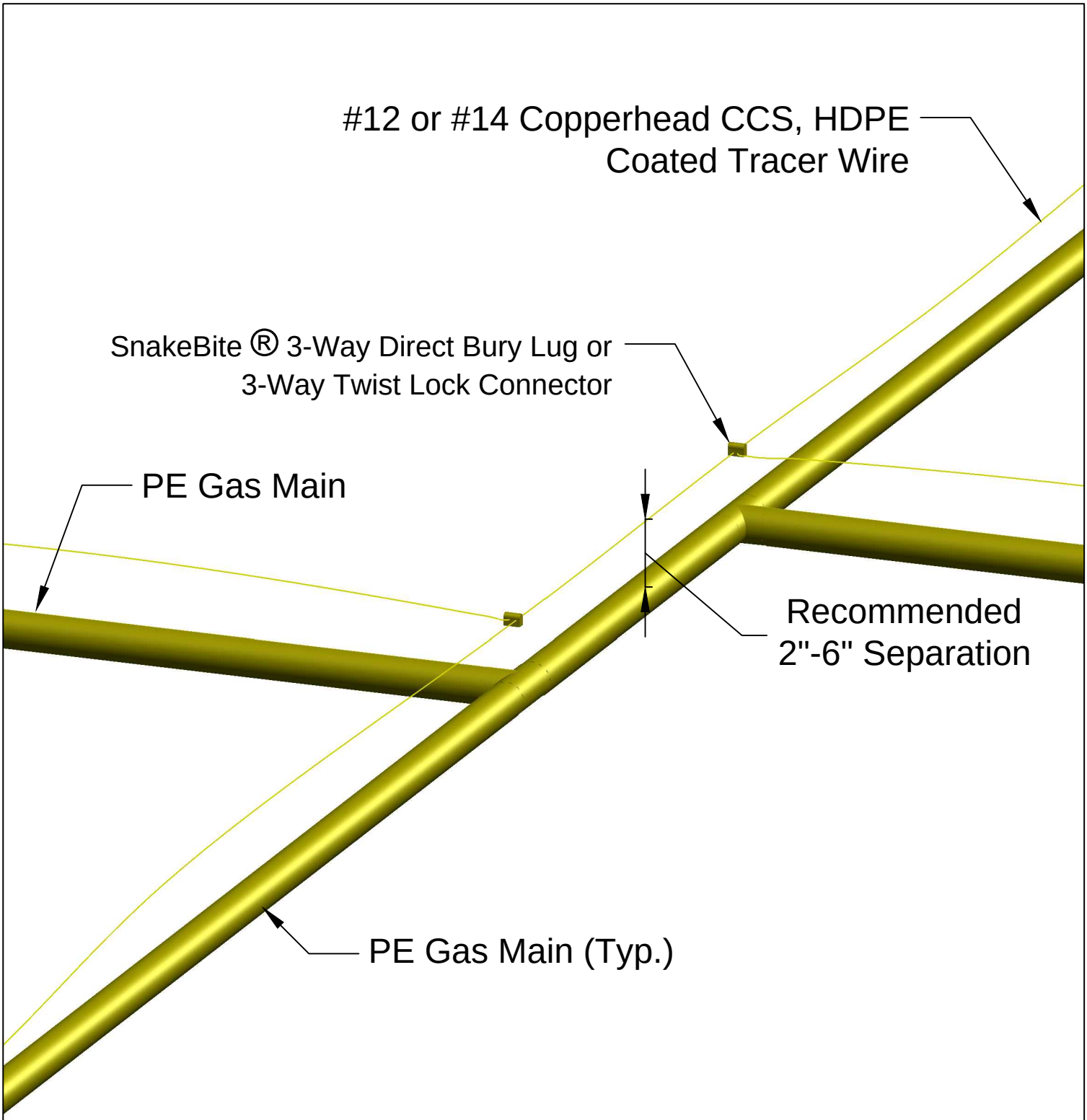
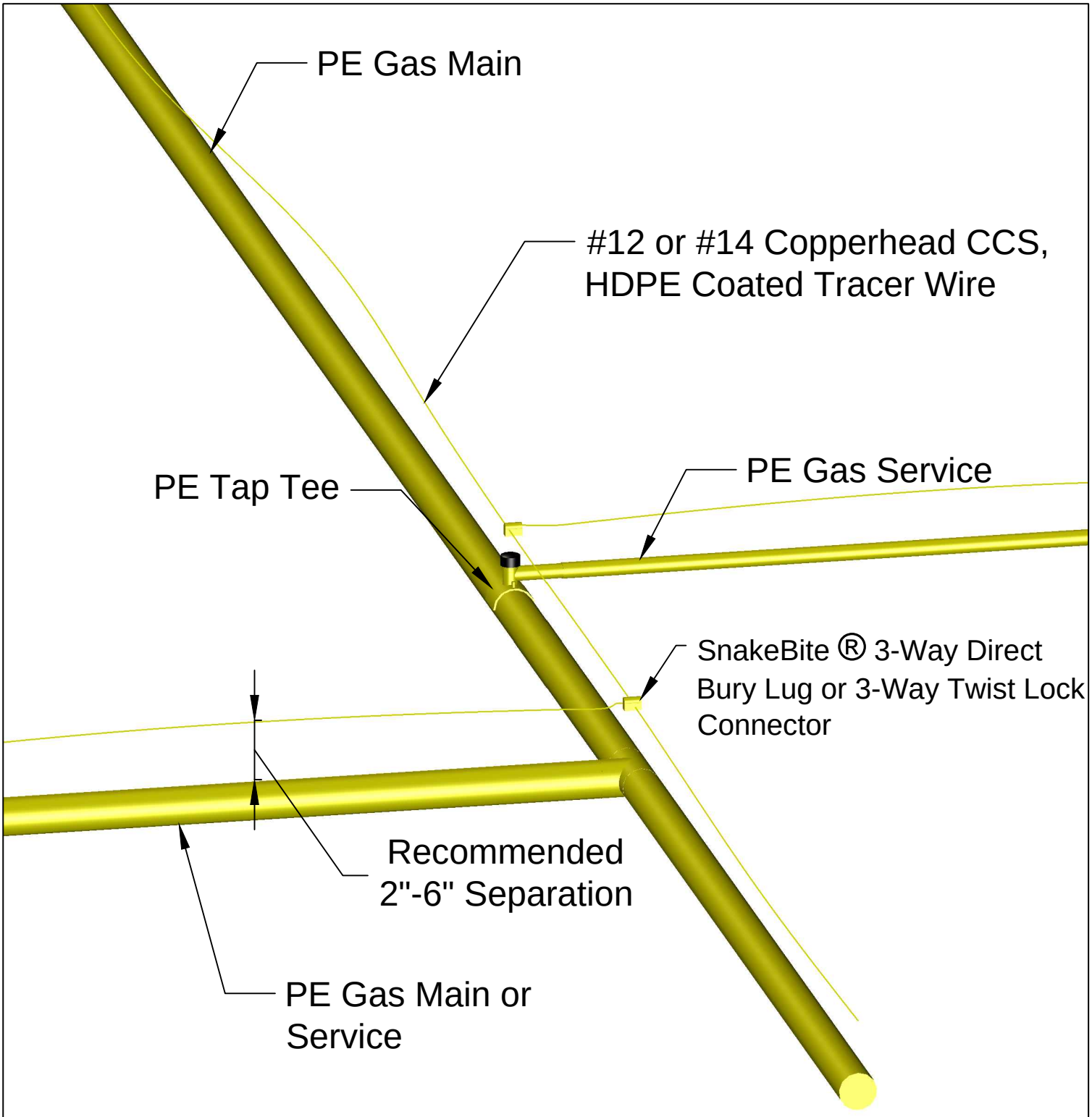
USDI
UTILITY SAFETY & DESIGN, INC.
PHONE: 660-947-3316
www.usdi.us

Tracer Wire Installation Standard



TYPICAL MAIN TEE DETAIL

See Gas Distribution Tracer Wire Specifications for Further Installation Information and Details	Copperhead INDUSTRIES, LLC copperheadwire.com 877-726-5644	This Standard is intended to be used as a guide only. It is not designed to cover all gas systems.	Prepared By: USDI UTILITY SAFETY & DESIGN, INC. PHONE: 660-947-3316 www.usdi.us	Tracer Wire Installation Standard Sheet 002 Of 009



TYPICAL PE MAIN WITH PE TAP TEE DETAIL

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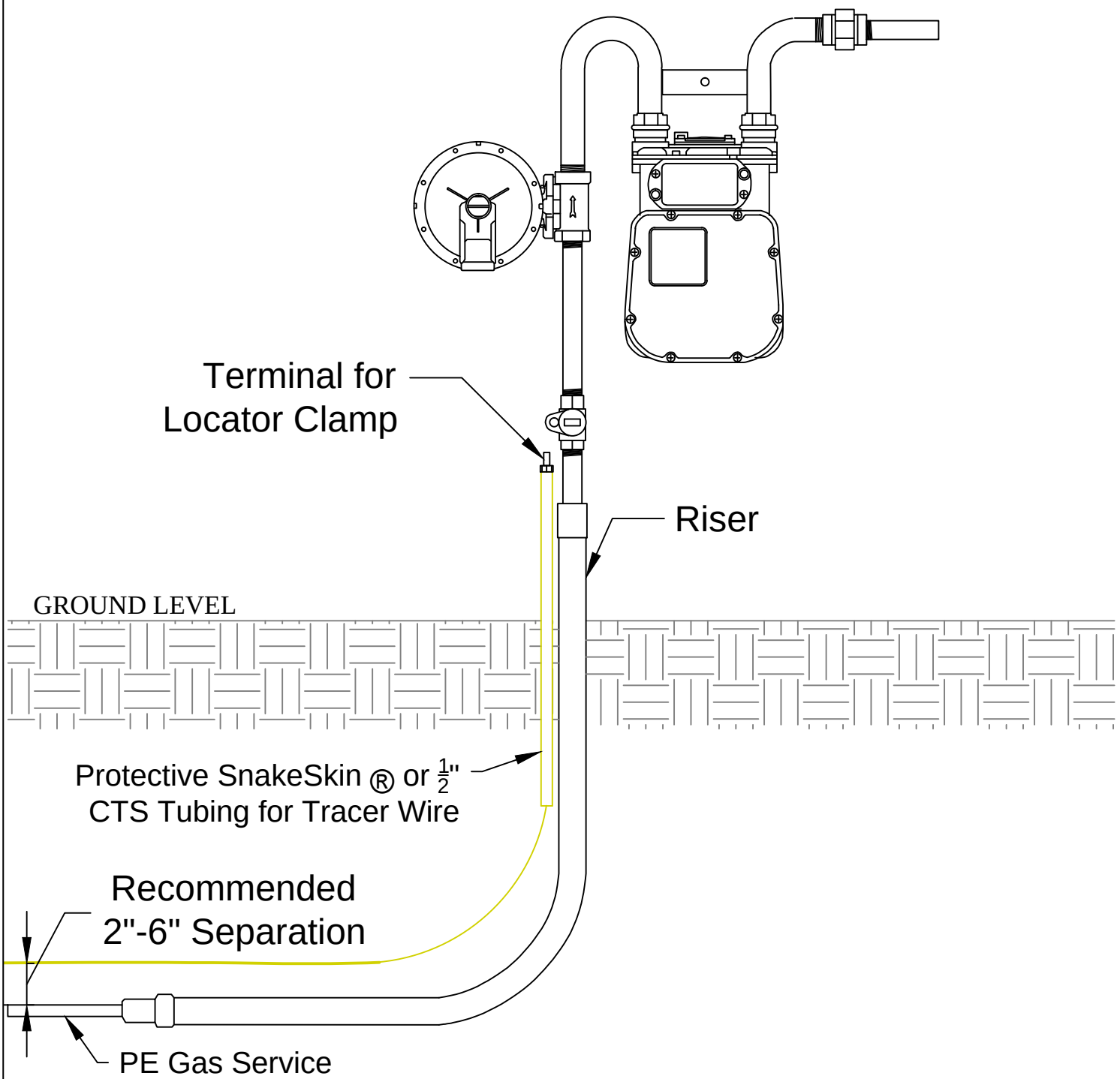

TYPICAL METER SET DETAIL

See Gas Distribution Tracer Wire Specifications for Further Installation Information and Details

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copperheadwire.com
877-726-5644

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PHONE: 660-947-3316
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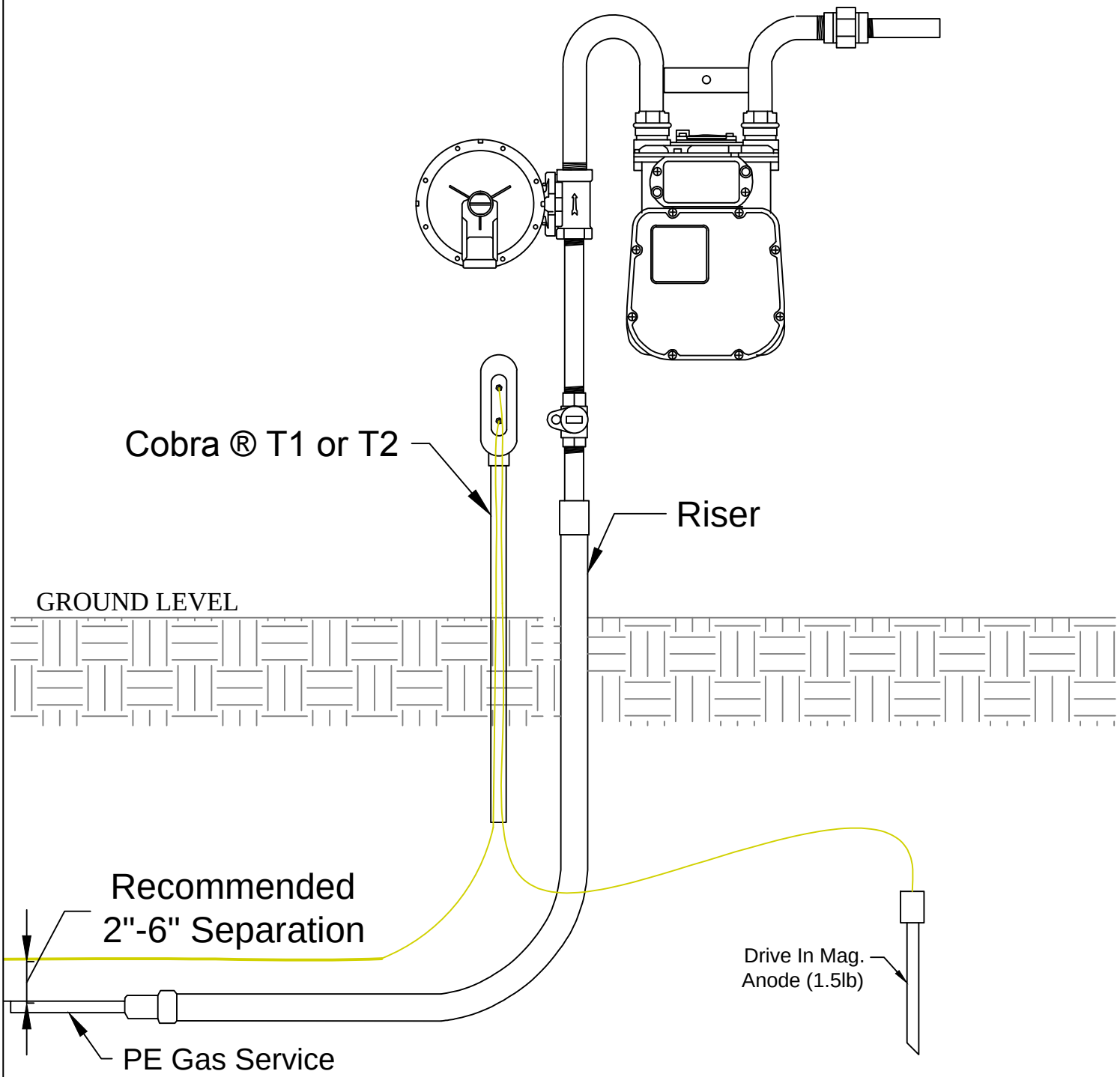
Tracer Wire Installation Standard

Sheet 004 Of 009

Above Grade Access Point Option

Cobra ® T1 Used With No Grounding Anode
Cobra ® T2 Used With Grounding Anode



TYPICAL METER SET DETAIL

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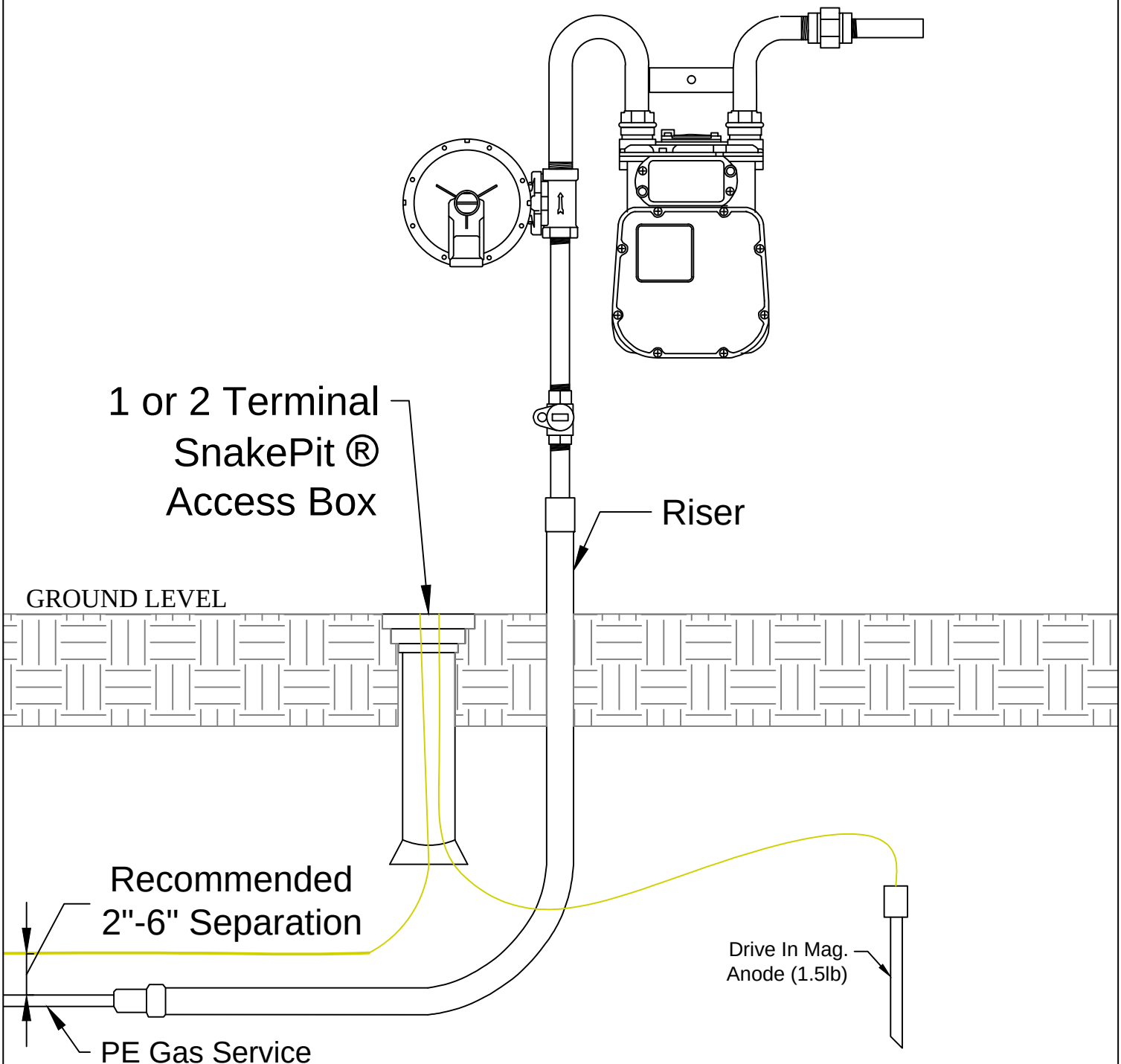
Flush Grade Option

1 Terminal SnakePit ® Used With No Grounding Anode
2 Terminal SnakePit ® Used With Grounding Anode



TYPICAL METER SET DETAIL

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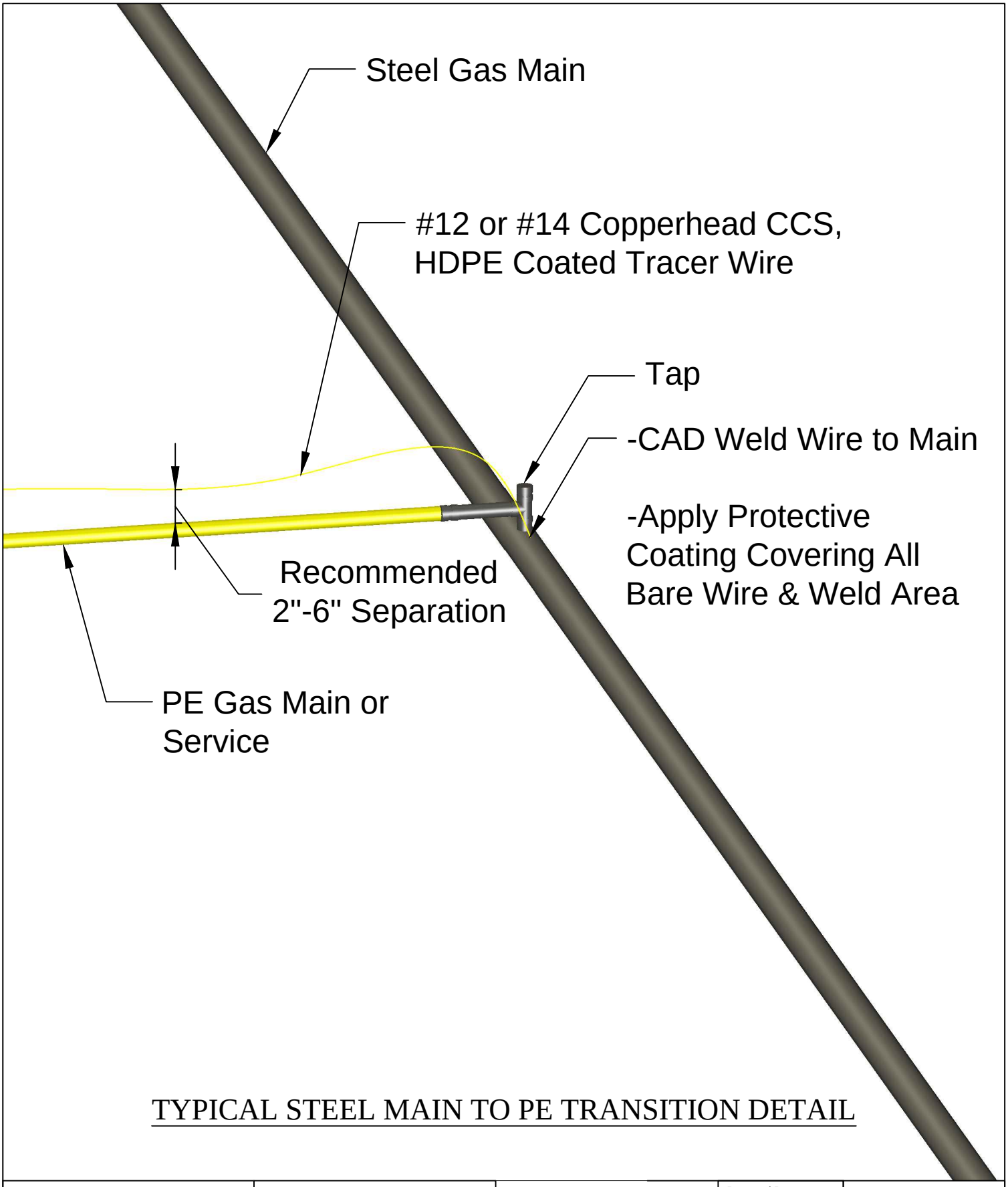

TYPICAL STEEL MAIN TO PE TRANSITION DETAIL

See Gas Distribution Tracer Wire Specifications for Further Installation Information and Details

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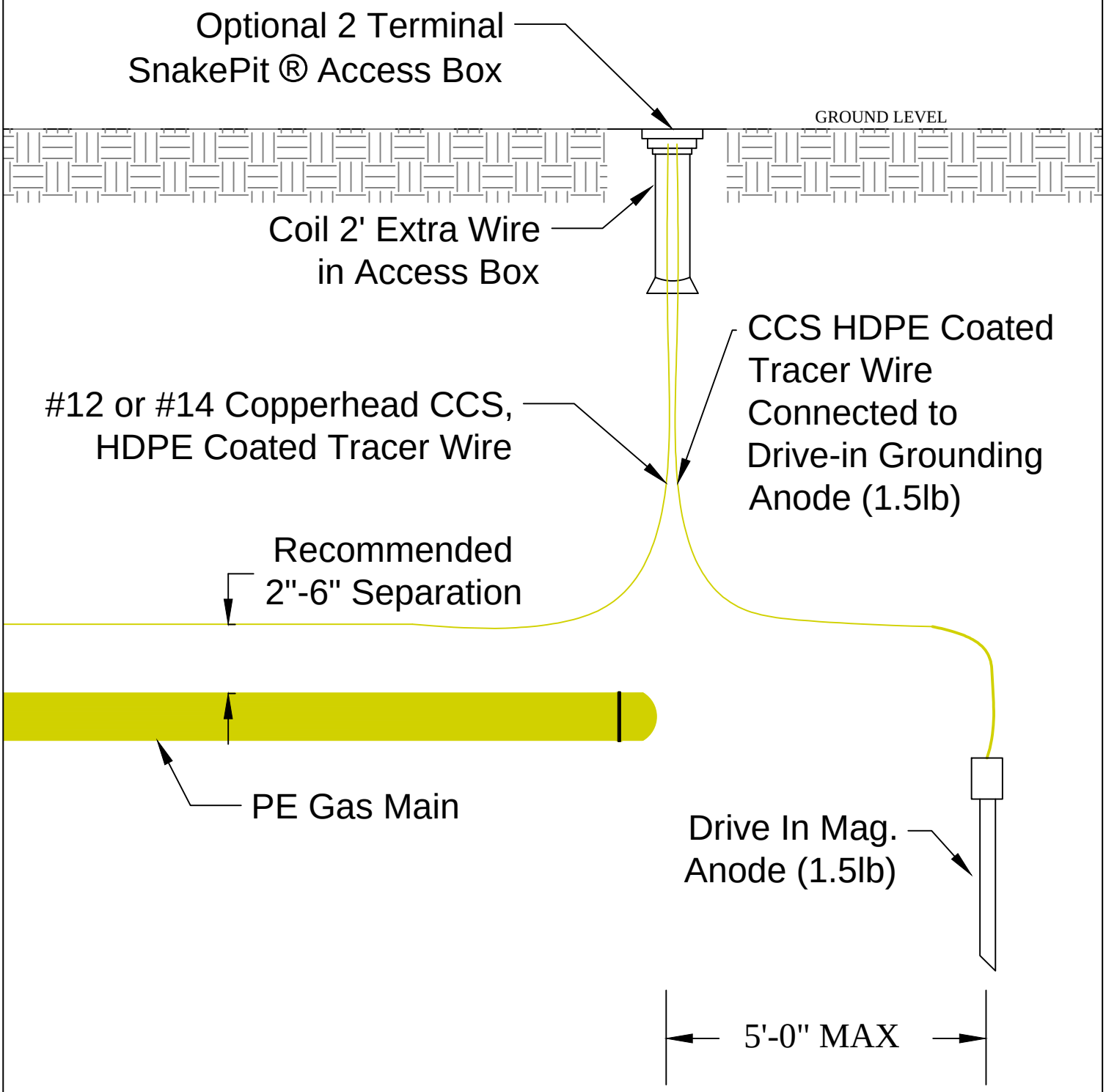
Tracer Wire Installation Standard

Sheet 007 Of 009



TYPICAL END OF MAIN/STUB DETAIL

See Gas Distribution Tracer Wire Specifications for Further Installation Information and Details

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877-726-5644

This Standard is intended to be used as a guide only. It is not designed to cover all gas systems.

Prepared By:
USDI
UTILITY SAFETY & DESIGN, INC.
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Tracer Wire Installation Standard

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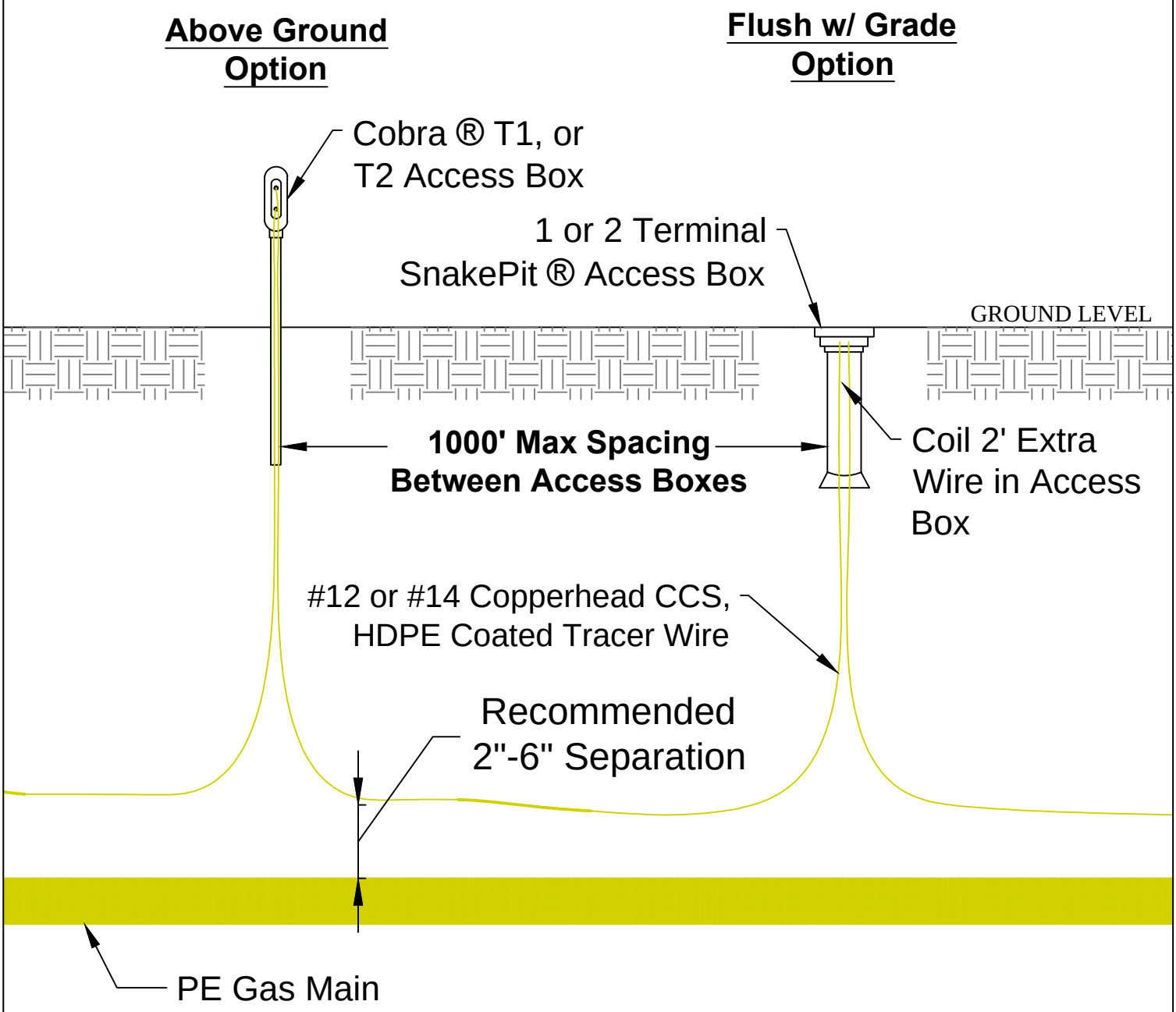

TRACER WIRE ACCESS BOX DETAIL

See Gas Distribution Tracer Wire Specifications for Further Installation Information and Details

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