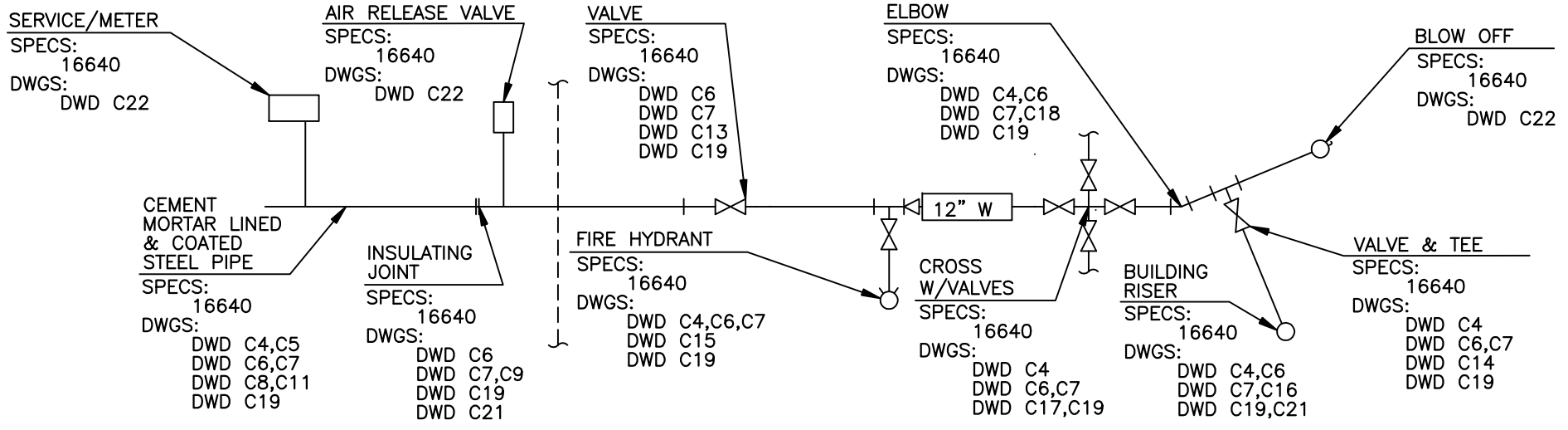
7. Cathodic Protection

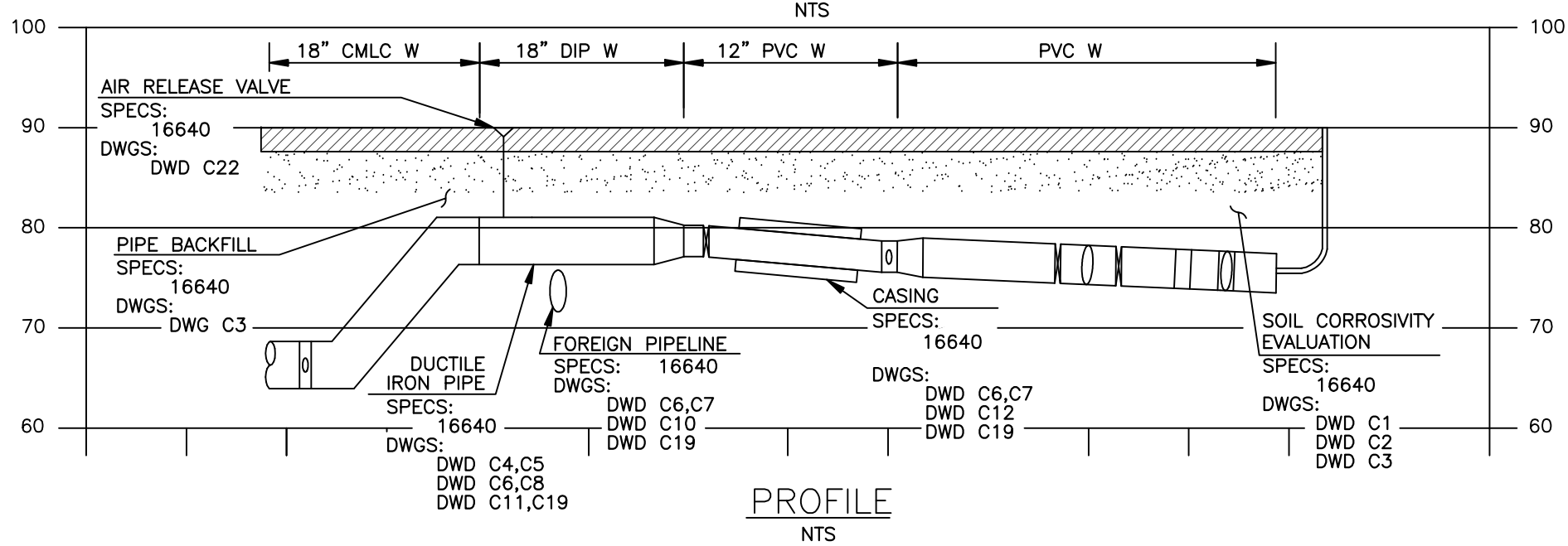
DIABLO WATER DISTRICT
STANDARD SPECIFICATIONS AND DRAWINGS

CATHODIC PROTECTION SYSTEM DRAWINGS

DWD C1	Wenner Four Pin Resistivity Test
DWD C2	Barnes Layer Resistivity
DWD C3	Soil Box Resistivity Test
DWD C4	Bond Cables – Metallic Pipe Joints
DWD C5	Bond Cables – Across Fittings on Metallic Pipe
DWD C6	Exothermic Weld
DWD C7	Flush Grade Test Station
DWD C8	CTS – Corrosion Test Station
DWD C9	IJTS – Insulating Joint Test Station
DWD C10	FPTS – Foreign Pipeline Test Station
DWD C11	ATS – Anode Test Station
DWD C12	CATS – Casing Test Station
DWD C13	VATS – Valve Anode Test Station
DWD C14	Valve and Tee Anode Test Station
DWD C15	Fire Hydrant
DWD C16	Metallic Riser
DWD C17	Cross and Valves
DWD C18	Elbow
DWD C19	Double Detector Check Assembly Preventer or Reduced Pressure Backflow Preventer
DWD C20	Double Offset
DWD C21	Cable Identification
DWD C22	Anode at Leak Repair Clamp
DWD C23	Insulating Flange Kit
DWD C24	Copper Water Laterals
DWD C25	Splice Detail
DWD C26	Galvanic Cathodic Protection System Checkout
DWD C27	Impressed Current Cathodic Protection System Checkout (page 1)
DWD C28	Impressed Current Cathodic Protection System Checkout (page 2)
DWD C29	Leak Repair Report

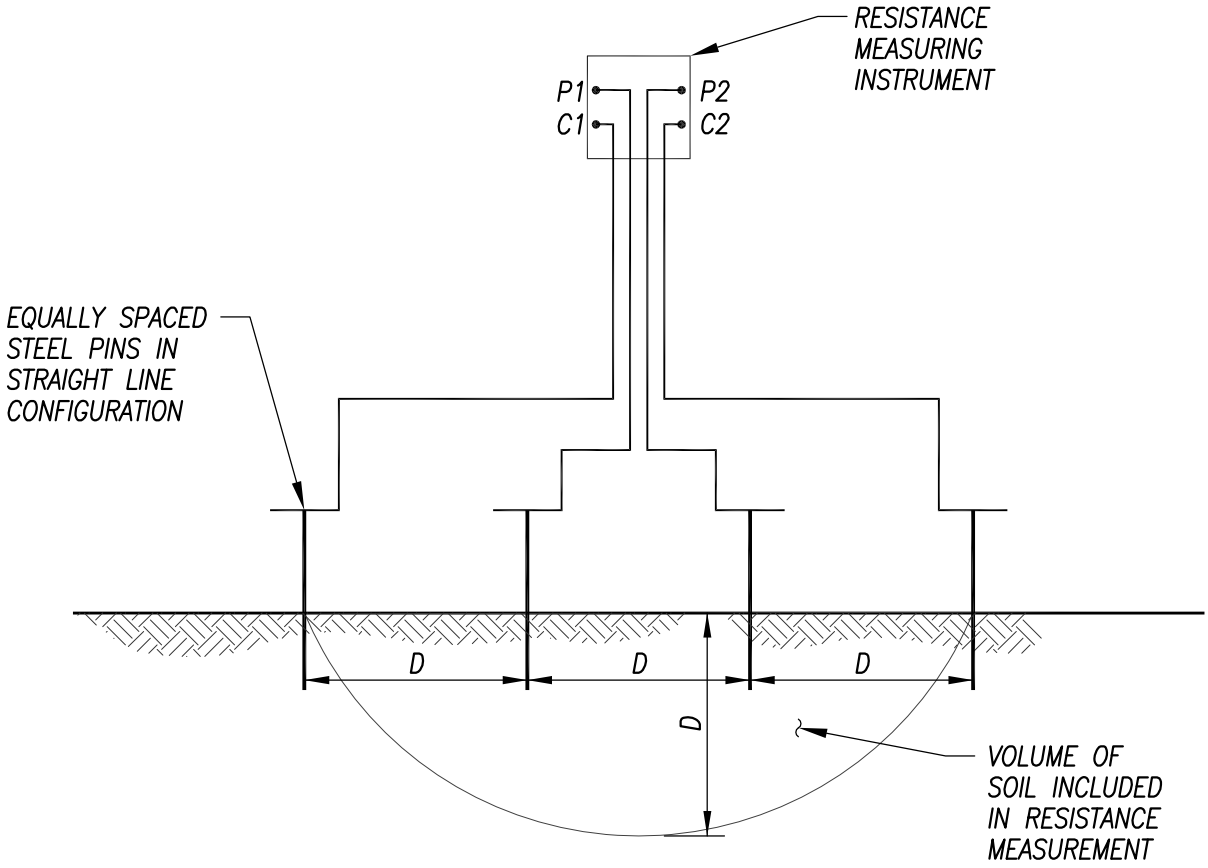


PLAN
NTS



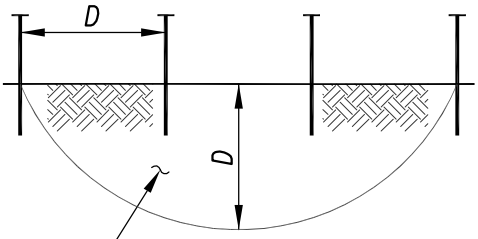
PROFILE
NTS

DIABLO WATER DISTRICT	STANDARD DRAWING **QUICK REFERENCE GUIDE – CATHODIC PROTECTION**			
DESIGNED MA	DRAWN CCW/TH	APPROVED MY	DATE JUNE 2007	DWG. NO. **DWD CO**

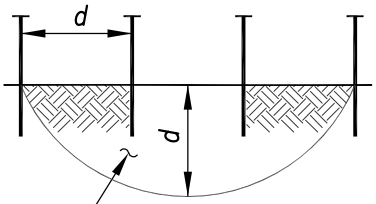


WHERE D=SAMPLE DEPTH.

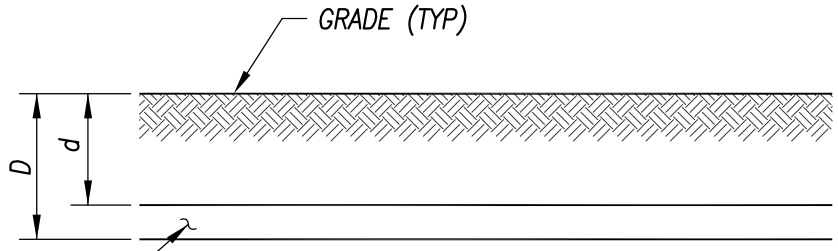
DIABLO WATER DISTRICT		STANDARD DRAWING WENNER FOUR PIN RESISTIVITY TEST		
DESIGNED MA	DRAWN SC	APPROVED JDH	DATE JUNE 2007	DWG. NO. DWD C1



VOLUME OF SOIL
WITH RESISTANCE R
AND RESISTIVITY RHO

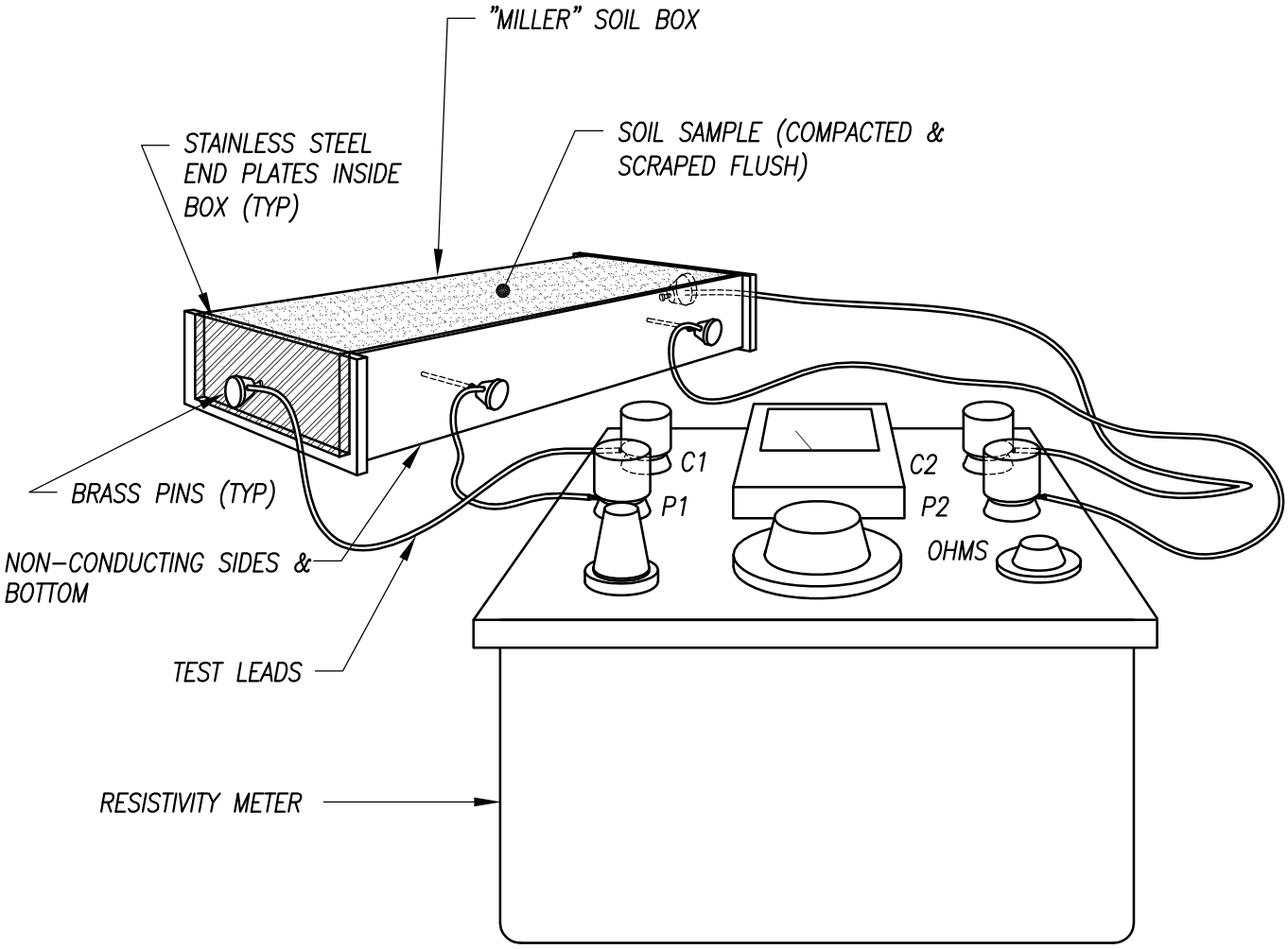


VOLUME OF SOIL
WITH RESISTANCE r
AND RESISTIVITY rho

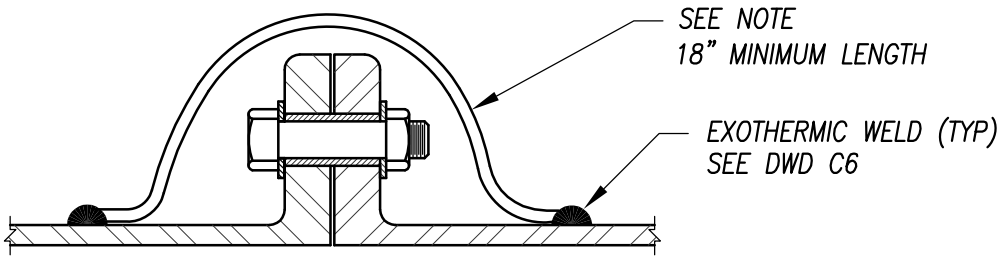


LAYER OF SOIL
WITH RESISTIVITY $= \left(\frac{1}{\frac{1}{R} - \frac{1}{r}} \right)$ X (SPACING FACTOR)

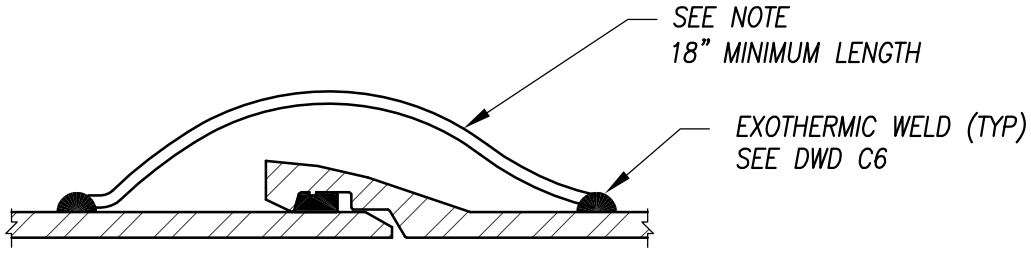
DIABLO WATER DISTRICT	STANDARD DRAWING BARNES LAYER RESISTIVITY			
DESIGNED MA	DRAWN SC	APPROVED JDH	DATE JUNE 2007	DWG. NO. DWD C2



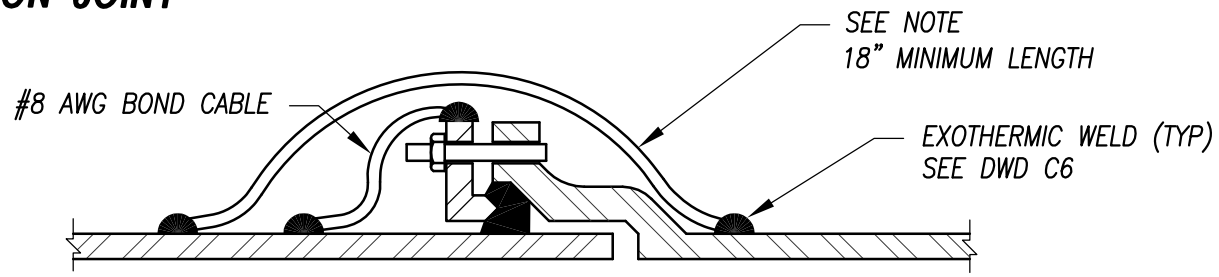
DIABLO WATER DISTRICT	STANDARD DRAWING SOIL BOX RESISTIVITY TEST			
DESIGNED MA	DRAWN SC	APPROVED JDH	DATE JUNE 2007	DWG. NO. DWD C3



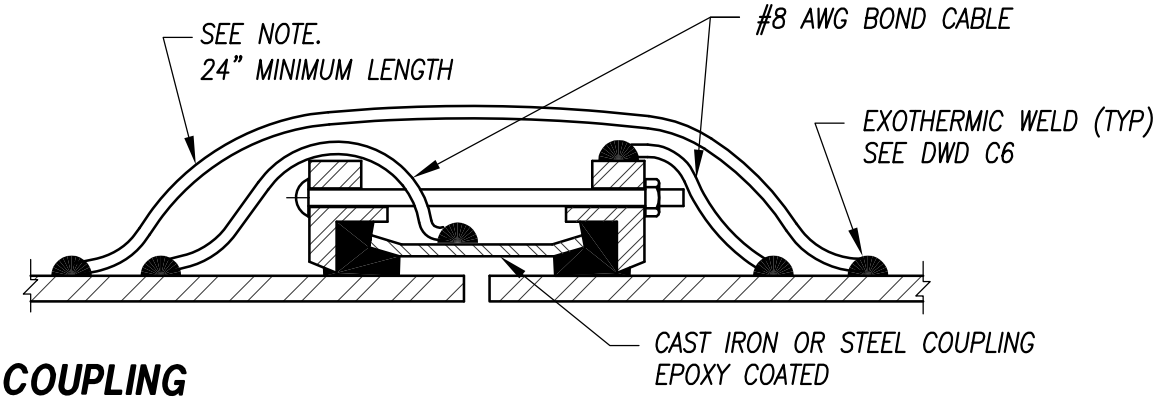
FLANGED JOINT



PUSH-ON JOINT



MECHANICAL JOINT

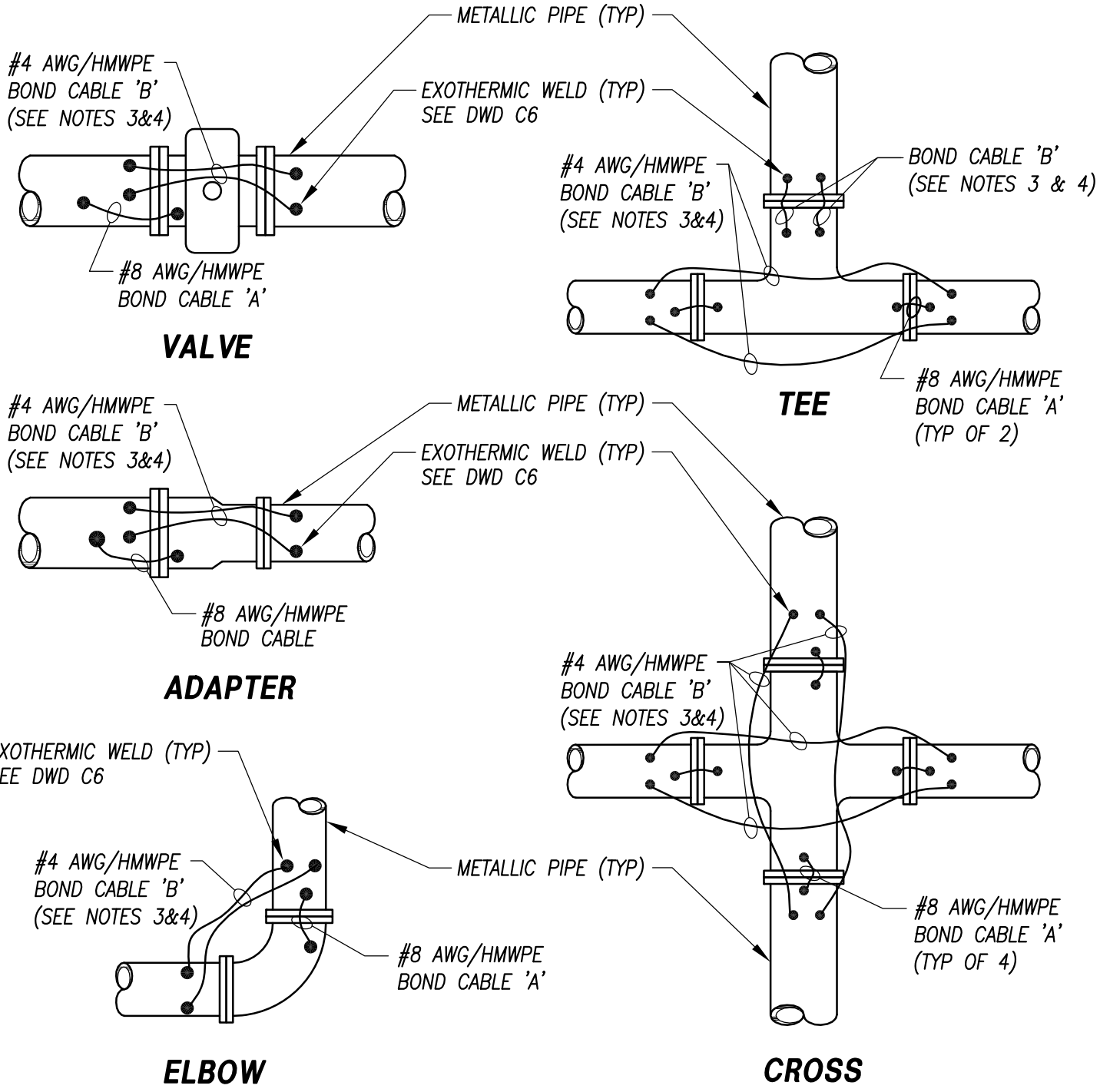


FLEXIBLE COUPLING

NOTE:

1. USE #8 AWG/HMWPE BOND CABLES FOR BONDING METALLIC FITTINGS ON NON-METALLIC PIPING SYSTEMS.
2. USE #4 AWG/HMWPE BOND CABLES FOR BONDING PIPE JOINTS ON METALLIC PIPING SYSTEMS PER SPECIFICATIONS.

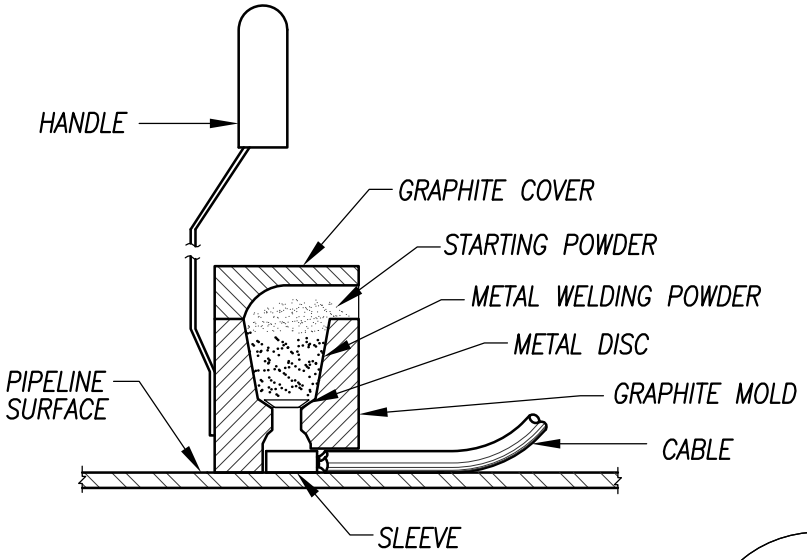
DIABLO WATER DISTRICT	STANDARD DRAWING BOND CABLES - METALLIC PIPE JOINTS			
DESIGNED MA	DRAWN SC	APPROVED JDH	DATE JUNE 2007	DWG. NO. DWD C4



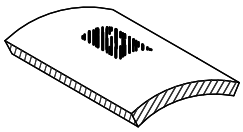
NOTE:

1. ALL BOND 'B' WIRES SHALL BE #4 AWG/HMWPE STRANDED COPPER WIRE.
2. ALL FITTING BOND WIRES 'A' SHALL BE #8 AWG/HMWPE STRANDED COPPER WIRE.
3. USE ONE (1) BOND CABLE 'B' ACROSS EACH FITTING FOR PIPE SIZES 18" IN DIAMETER OR SMALLER.
4. USE TWO (2) BOND CABLES 'B' ACROSS EACH FITTING FOR PIPE SIZES 20" IN DIAMETER OR LARGER.

DIABLO WATER DISTRICT		STANDARD DRAWING BOND CABLES - ACROSS FITTINGS ON METALLIC PIPE		
DESIGNED MA	DRAWN SC	APPROVED JDH	DATE JUNE 2007	DWG. NO. DWD C5

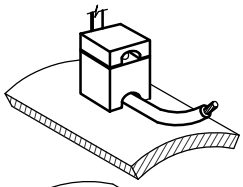


STEP 1. FILE STRUCTURE CONNECTION AREA TO BARE SHINY METAL AND CLEAN.

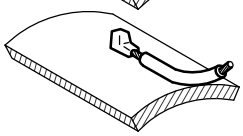


STEP 2. STRIP INSULATION FROM WIRE. ATTACH SLEEVE REQUIRED ON #6 AWG WIRE OR SMALLER

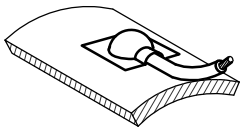
STEP 3. HOLD MOLD FIRMLY WITH OPENING AWAY FROM OPERATOR AND IGNITE WITH FLINT GUN.



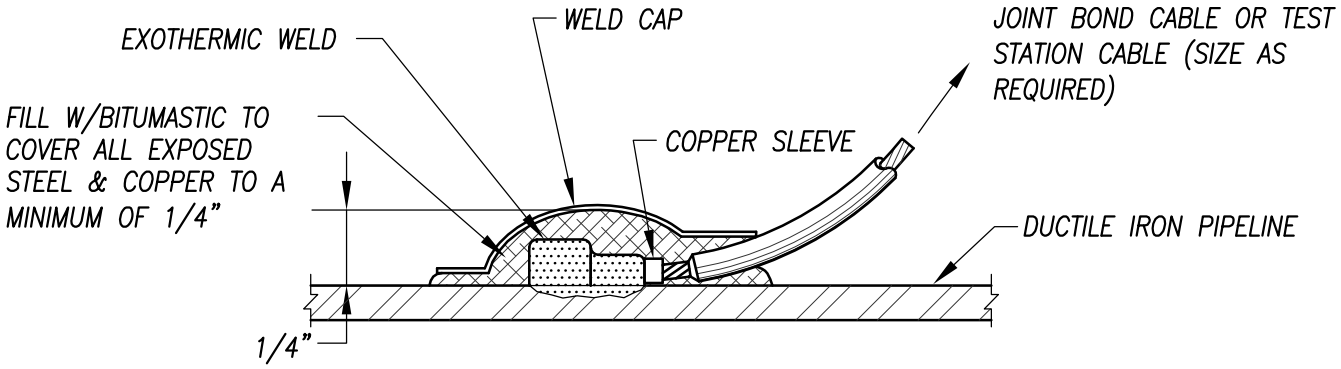
STEP 4. REMOVE SLAG FROM CONNECTION AND PEEN WELD FOR SOUNDNESS.



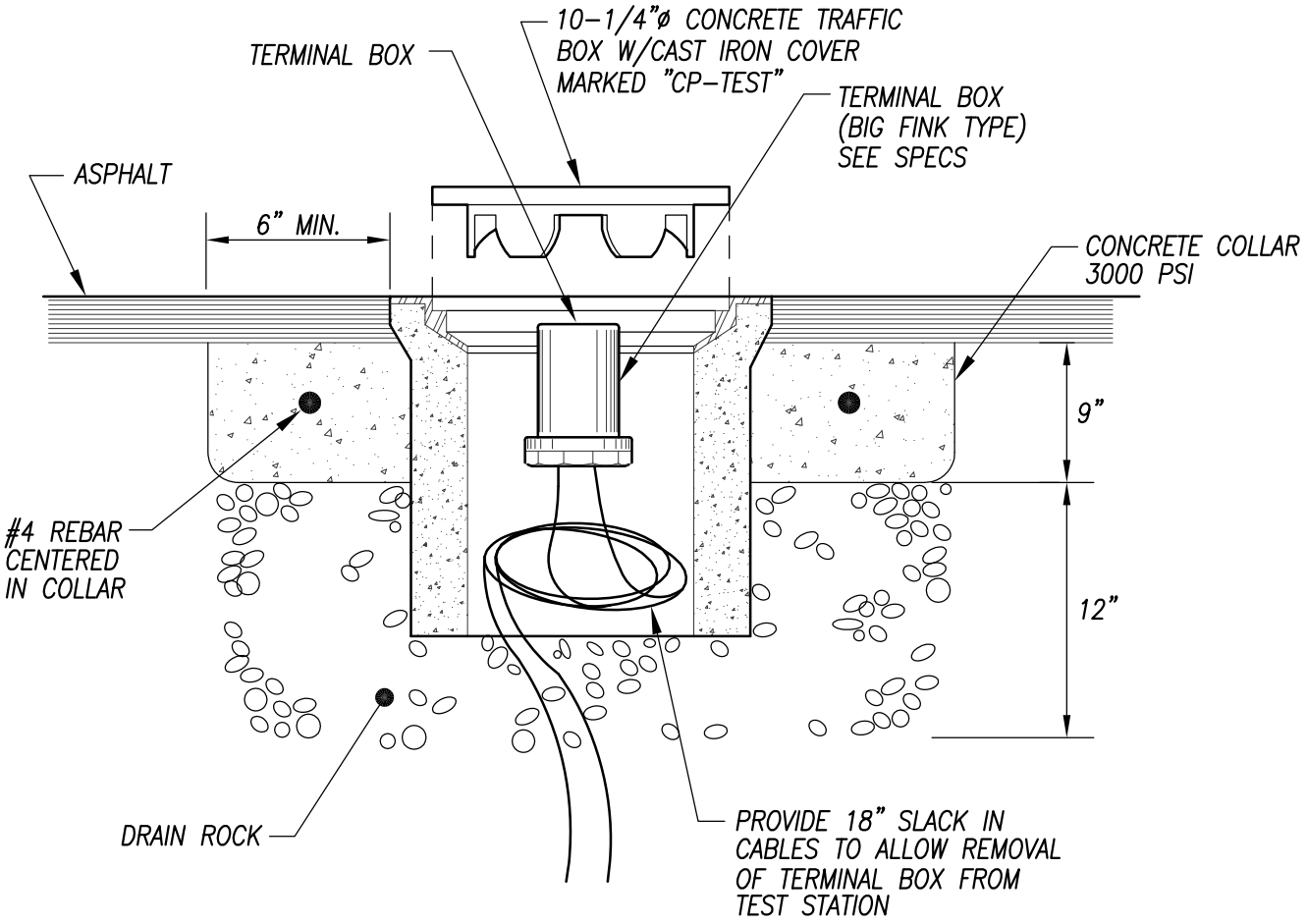
STEP 5. COVER CONNECTION AND EXPOSED STRUCTURE SURFACE WITH PLASTIC CAP & BITUMASTIC



NOTE:
PROCEDURE SHOWN ABOVE IS TO BE USED AS A GENERAL GUIDE ONLY.
CONSULT MANUFACTURER'S LITERATURE FOR SPECIFIC INSTALLATION INSTRUCTIONS.



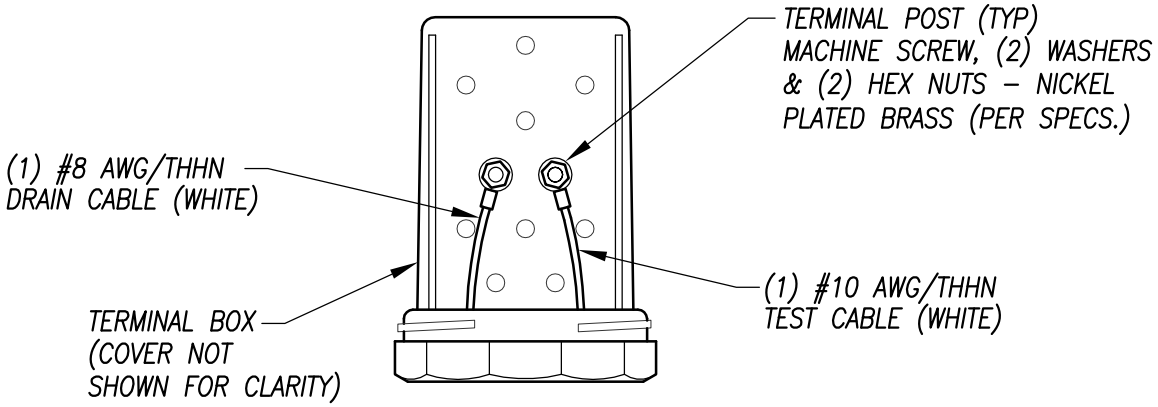
DIABLO WATER DISTRICT	STANDARD DRAWING EXOTHERMIC WELD			
DESIGNED MA	DRAWN SC	APPROVED JDH	DATE JUNE 2007	DWG. NO. DWD C6



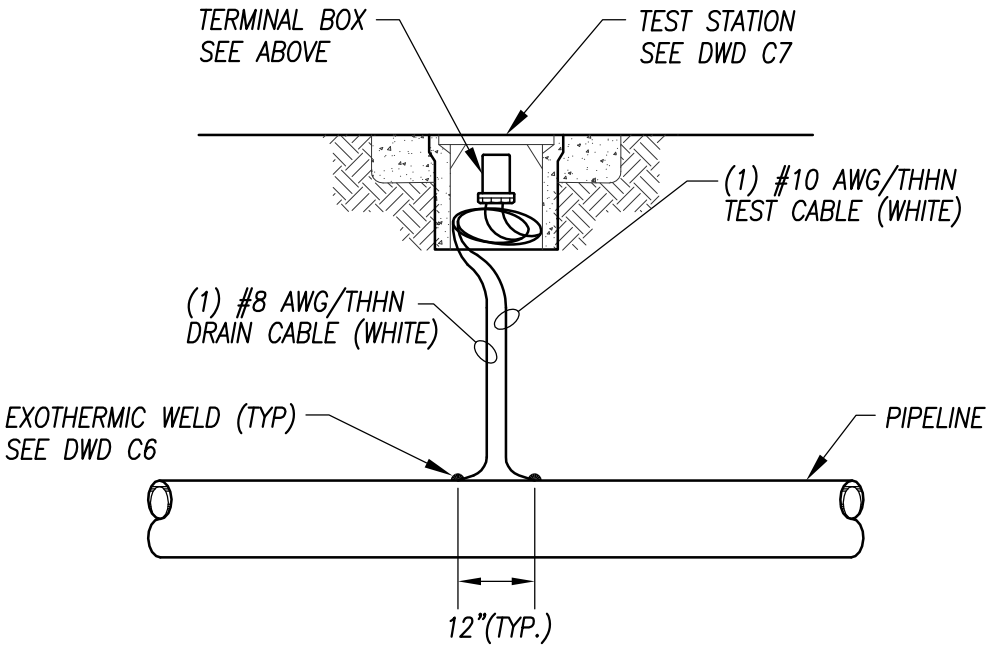
NOTES:

1. USE FLUSH TO GRADE TEST STATIONS FOR DEVELOPED AREAS.
2. IDENTIFY CABLES WITH NYLON ID LABELS

DIABLO WATER DISTRICT	STANDARD DRAWING FLUSH GRADE TEST STATION			
DESIGNED MA	DRAWN SC	APPROVED JDH	DATE JUNE 2007	DWG. NO. DWD C7

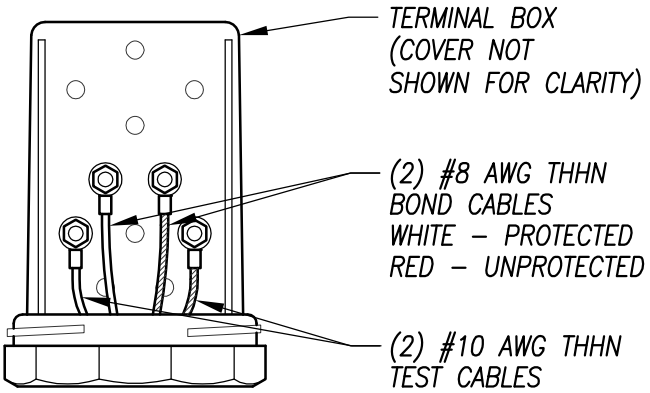


CTS TERMINAL BOX

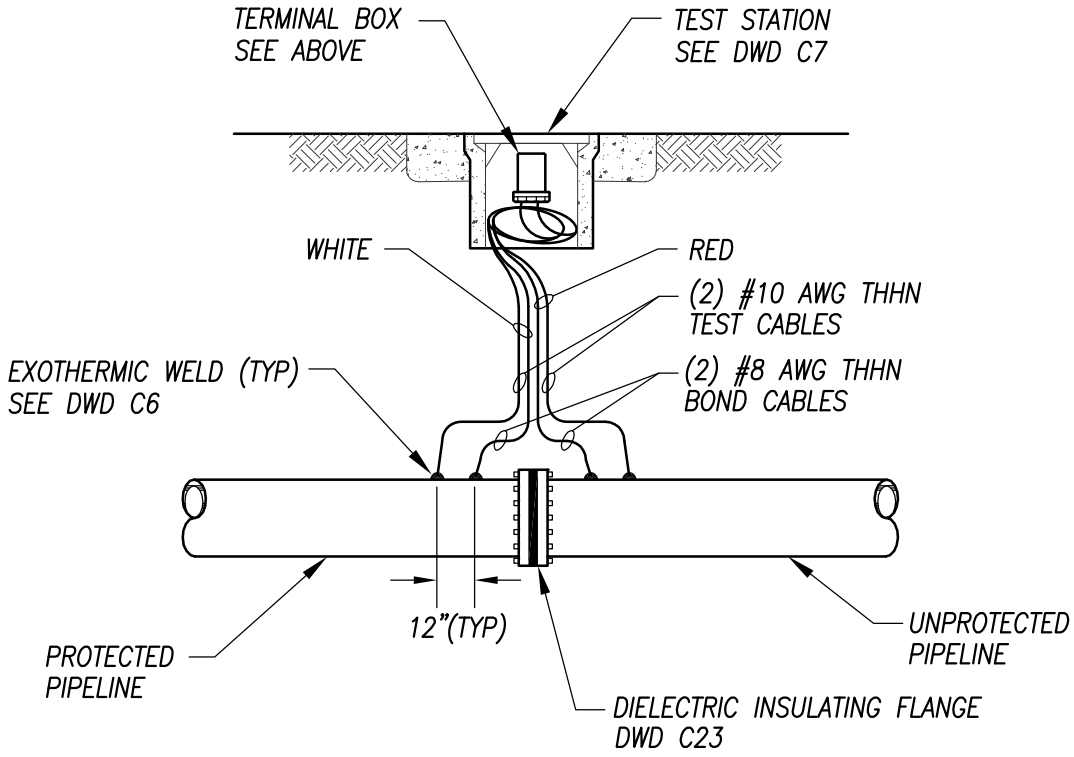


NOTE:
IDENTIFY CABLES PER DRAWING DWD C21.

DIABLO WATER DISTRICT	STANDARD DRAWING CTS - CORROSION TEST STATION			
DESIGNED MA	DRAWN SC	APPROVED JDH	DATE JUNE 2007	DWG. NO. DWD C8

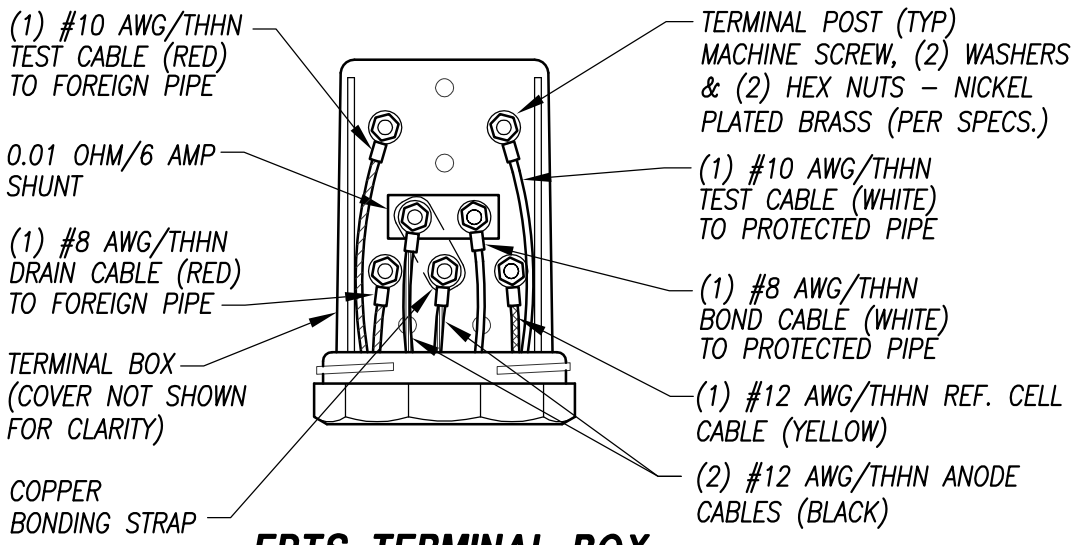


IJTS TERMINAL BOX

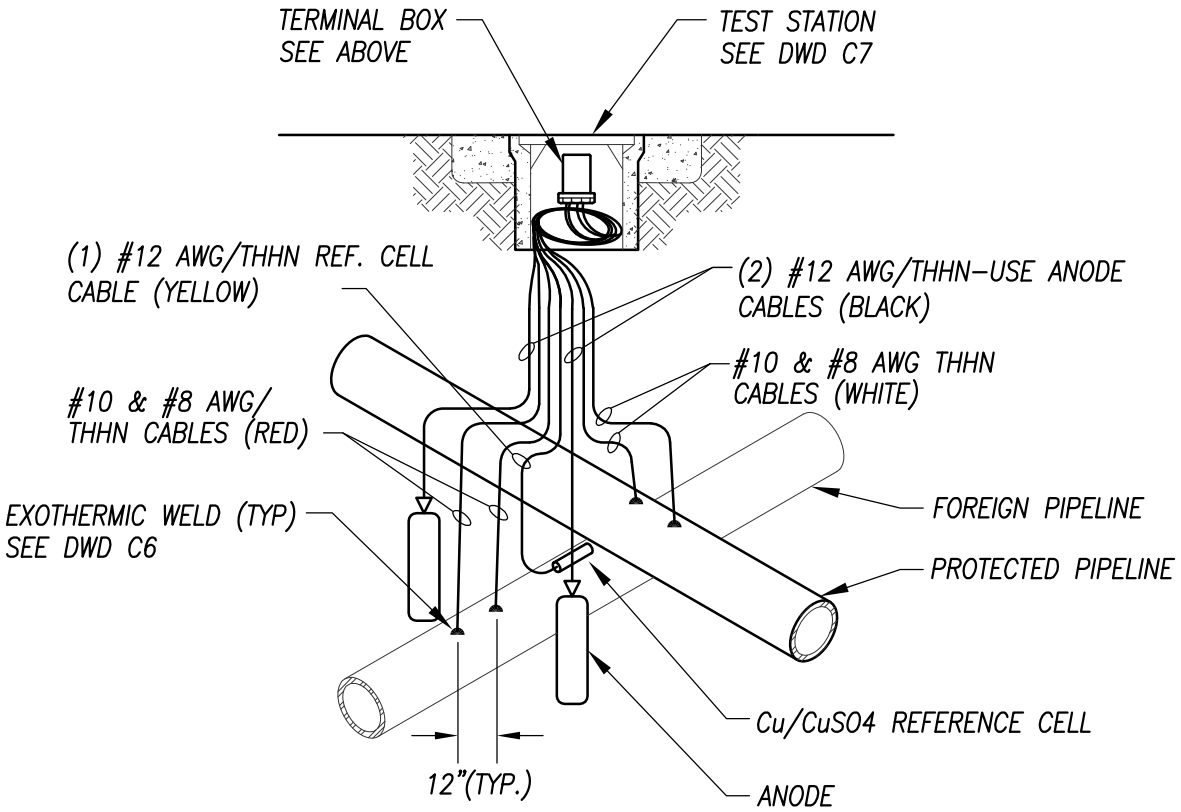


NOTE:
IDENTIFY CABLES PER DRAWING DWD C21.

DIABLO WATER DISTRICT		STANDARD DRAWING IJTS - INSULATING JOINT TEST STATION		
DESIGNED MA	DRAWN SC	APPROVED JDH	DATE JUNE 2007	DWG. NO. DWD C9



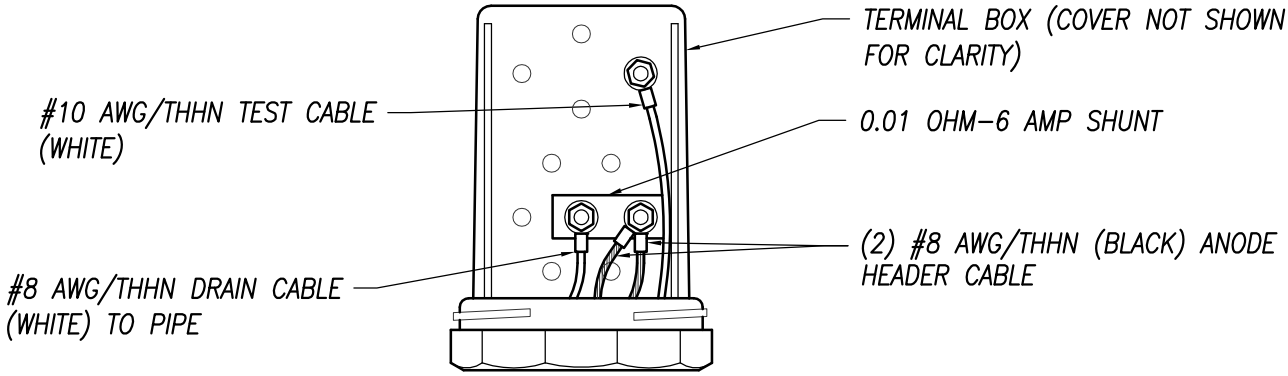
FPTS TERMINAL BOX



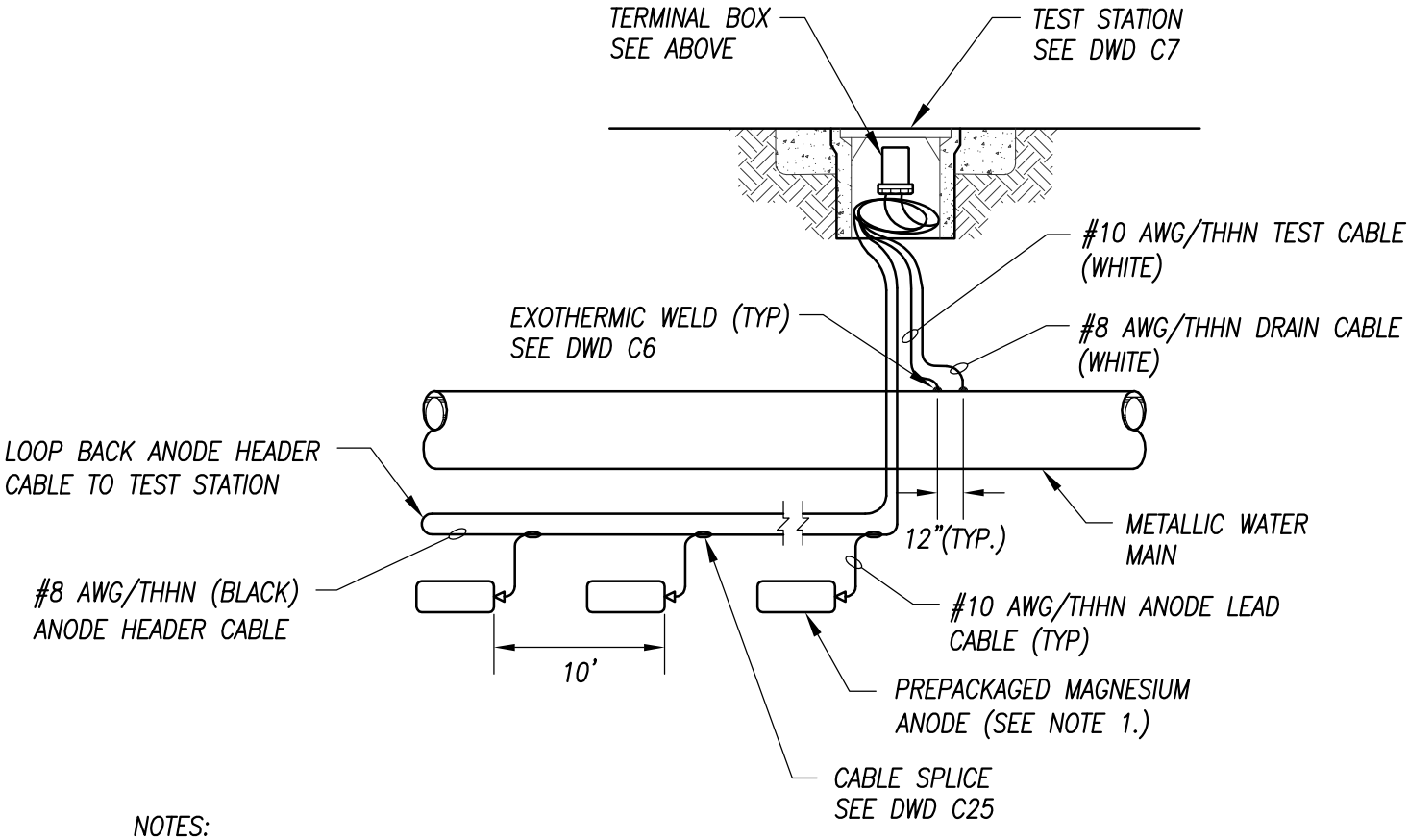
NOTES:

1. IDENTIFY CABLES PER DRAWING DWD C21.
2. INSTALL THE REFERENCE CELL BETWEEN THE TWO PIPELINES.
3. PERMISSION MUST BE OBTAINED FROM THE FOREIGN PIPELINE OWNER PRIOR TO ATTACHMENT OF TEST WIRES.

DIABLO WATER DISTRICT	STANDARD DRAWING FPTS - FOREIGN PIPELINE TEST STATION			
DESIGNED MA	DRAWN SC	APPROVED JDH	DATE JUNE 2007	DWG. NO. DWD C10



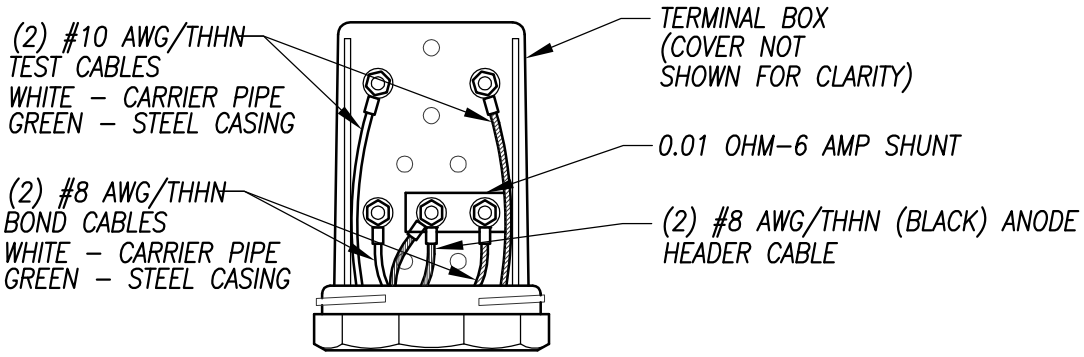
ATS TERMINAL BOX



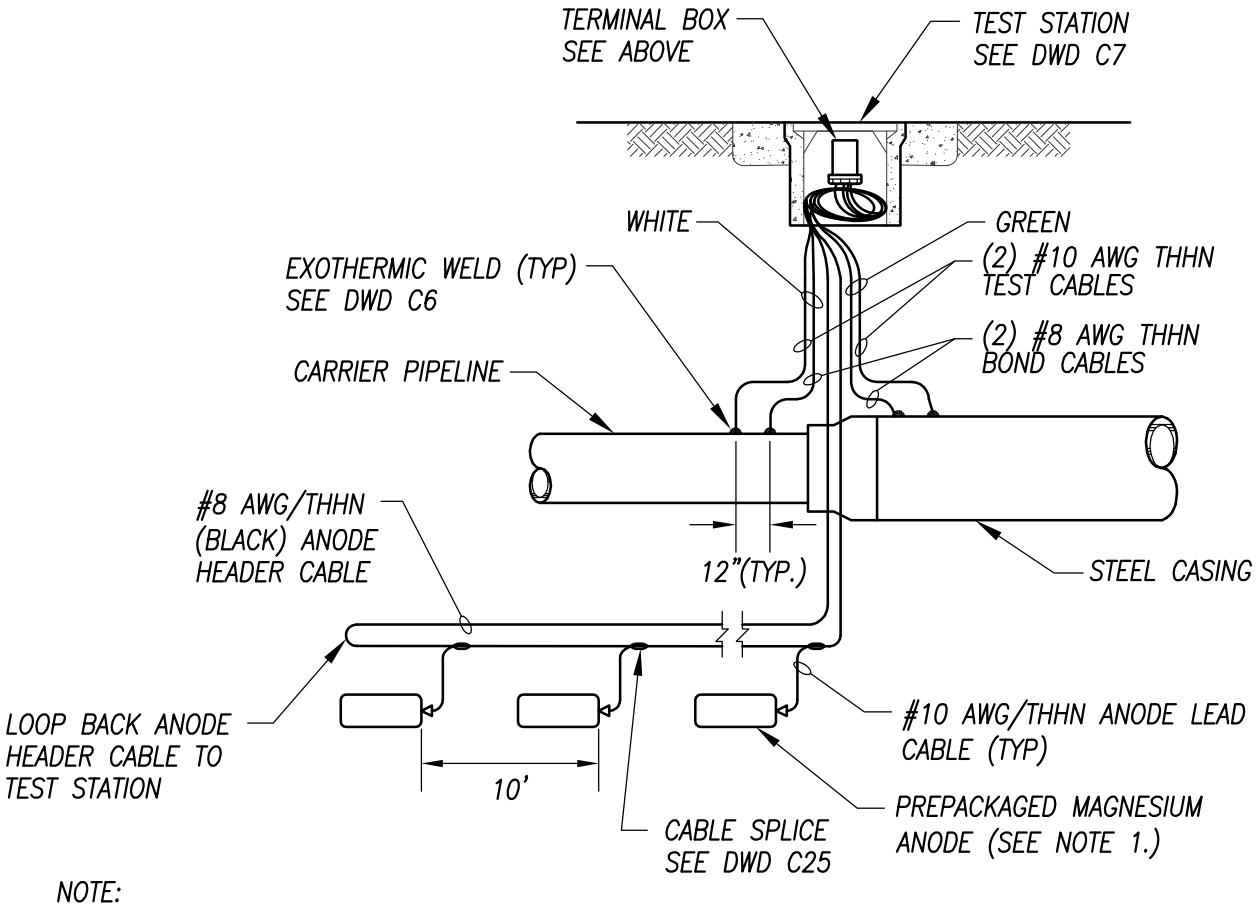
NOTES:

1. NUMBER AND SIZE OF ANODES SHALL BE DETERMINED BY THE PROJECT CORROSION ENGINEER.
2. THE ANODES SHALL BE INSTALLED A MINIMUM OF 3 FT. OFF THE WALL OF THE WATER PIPE.
3. BOND ALL PIPE JOINTS PER DRAWING DWD C6.
4. IDENTIFY CABLES PER DRAWING DWD C21.

DIABLO WATER DISTRICT		STANDARD DRAWING ATS - ANODE TEST STATION		
DESIGNED MA	DRAWN SC	APPROVED JDH	DATE JUNE 2007	DWG. NO. DWD C11



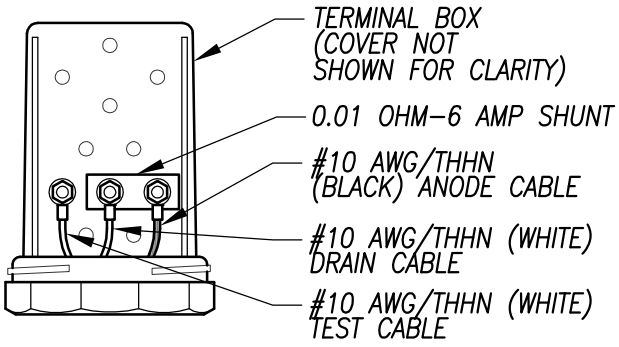
CATS TERMINAL BOX



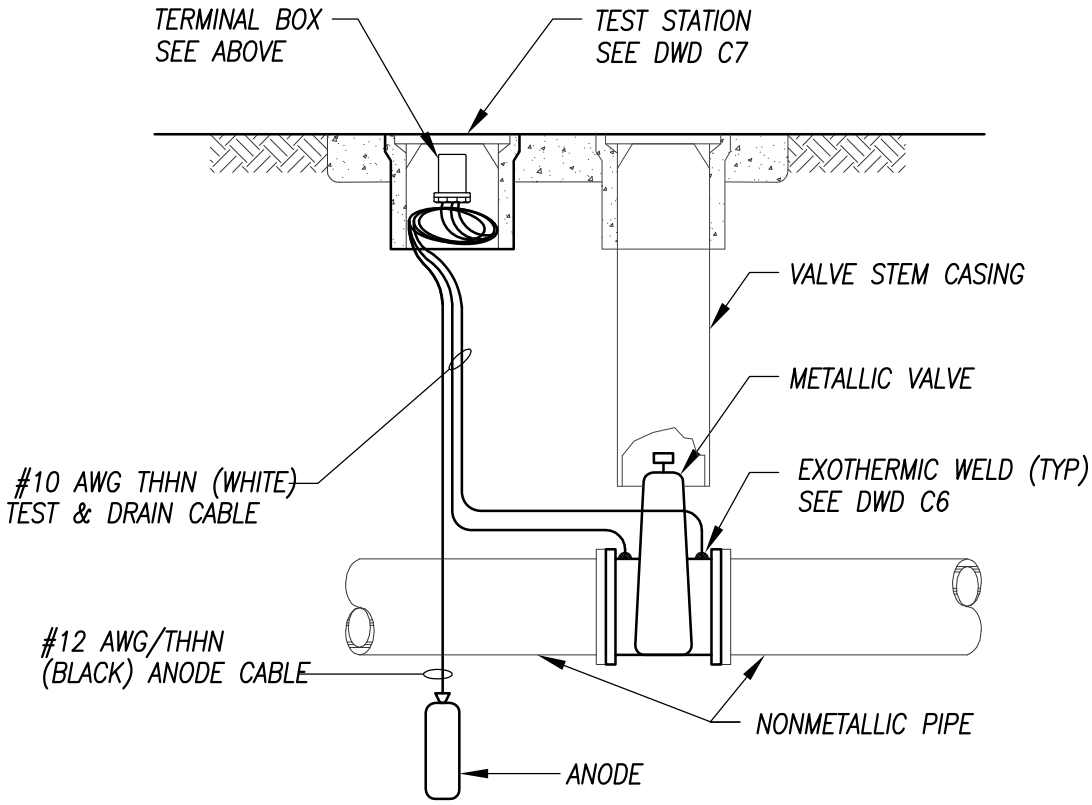
NOTE:

1. NUMBER AND SIZE OF ANODES SHALL BE DETERMINED BY THE PROJECT CORROSION ENGINEER.
2. CARRIER PIPE & CASING ARE TO BE ELECTRICALLY ISOLATED VIA CASING INSULATORS.
3. IF CARRIER PIPE IS NON–METALLIC DELETE WHITE CABLES AND EXOTHERMIC WELDS.
3. BOND ALL PIPE JOINTS PER DRAWING DWD C6.
4. IDENTIFY CABLES PER DRAWING DWD C21.

DIABLO WATER DISTRICT	STANDARD DRAWING CATS - CASING TEST STATION			
DESIGNED MA	DRAWN SC	APPROVED JDH	DATE JUNE 2007	DWG. NO. DWD C12

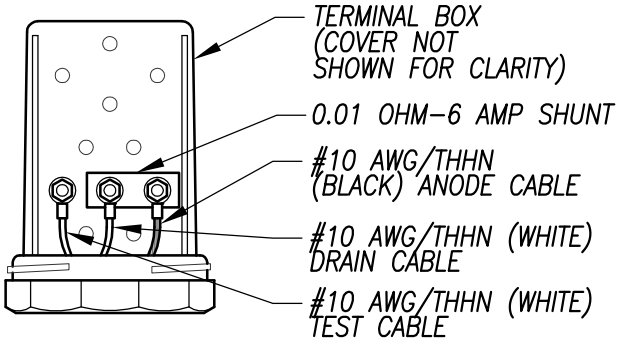


ATS TERMINAL BOX

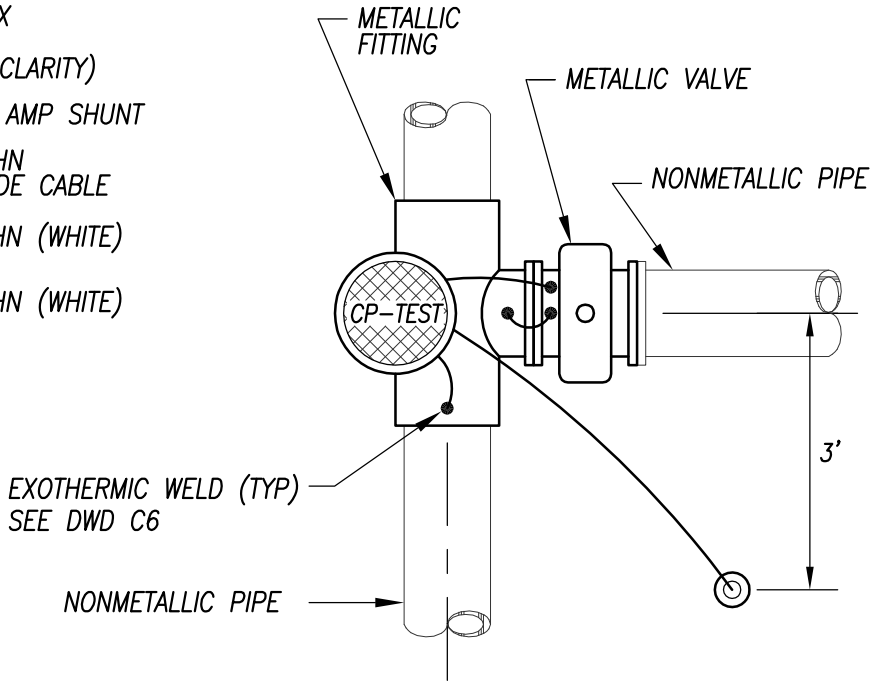


NOTE:
1. INSTALL ANODE A MINIMUM OF 3–FEET FROM VALVE.
2. IDENTIFY CABLES PER DRAWING DWD C21.

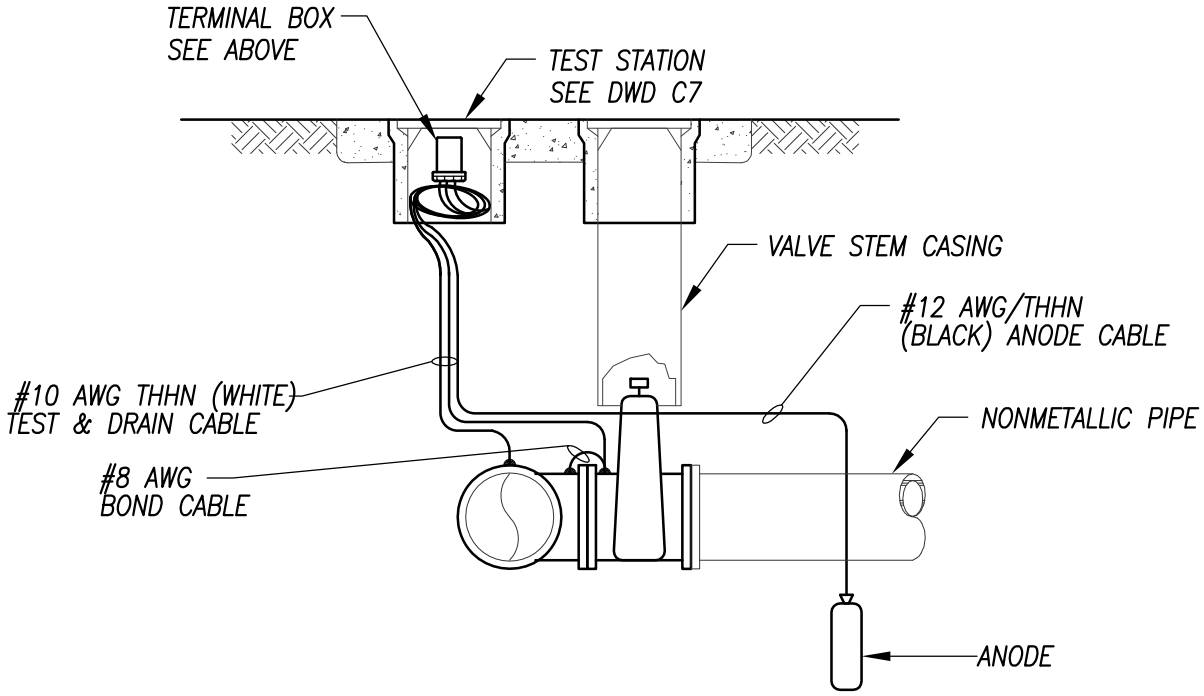
DIABLO WATER DISTRICT	STANDARD DRAWING VATS - VALVE ANODE TEST STATION			
DESIGNED MA	DRAWN SC	APPROVED JDH	DATE JUNE 2007	DWG. NO. DWD C13



ATS TERMINAL BOX



PLAN

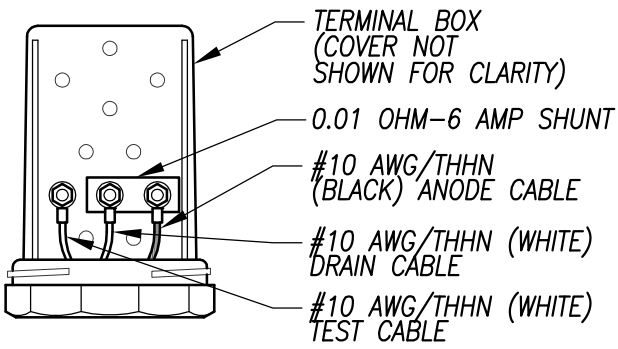


PROFILE

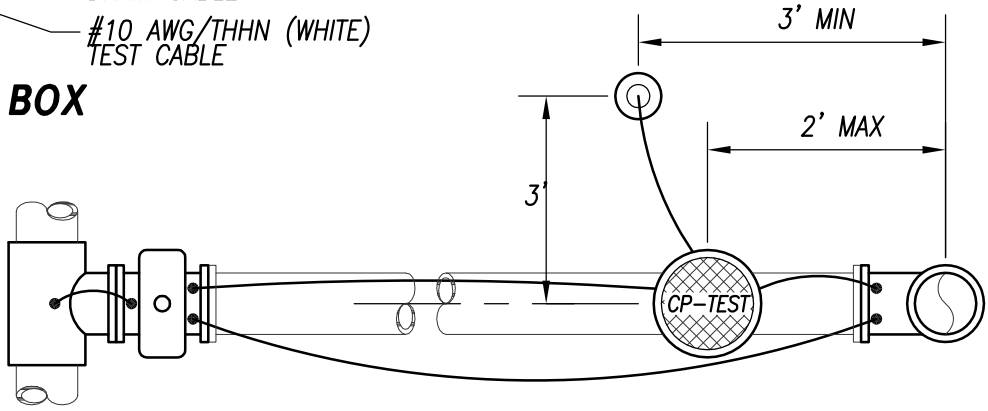
NOTES:

1. INSTALL ANODE A MINIMUM OF 3–FEET FROM THE VALVE & TEE.
2. IDENTIFY ALL CABLES PER DRAWING DWD C21.

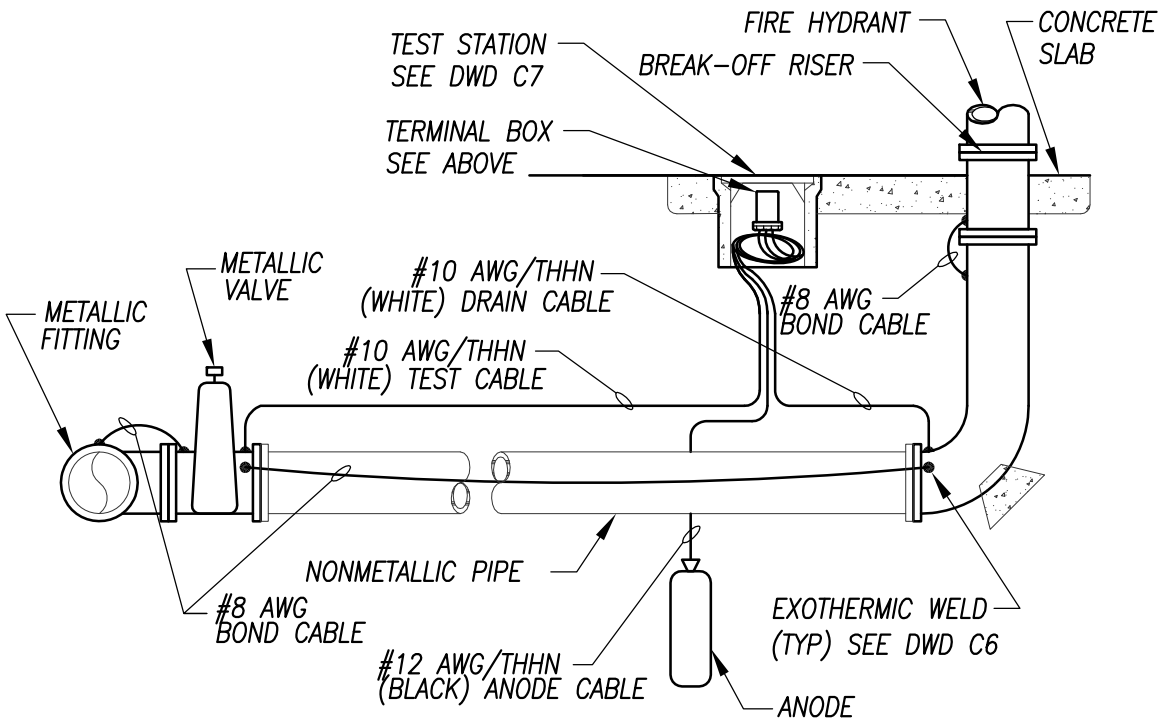
DIABLO WATER DISTRICT		STANDARD DRAWING VALVE AND TEE ANODE TEST STATION		
DESIGNED MA	DRAWN SC	APPROVED JDH	DATE JUNE 2007	DWG. NO. DWD C14



ATS TERMINAL BOX



PLAN

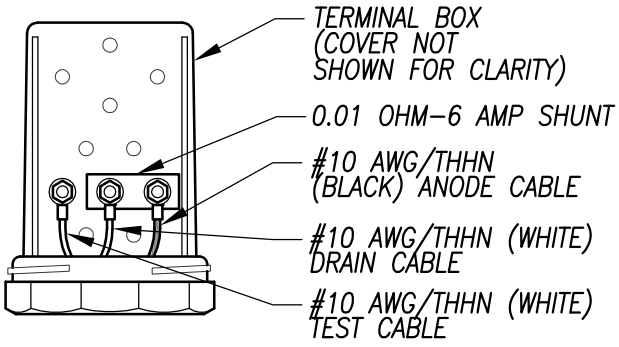


PROFILE

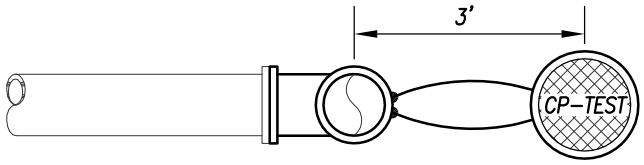
NOTES:

1. IDENTIFY ALL CABLES PER DRAWING DWD C21.
2. INSTALL TEST STATION IN COMMON CONCRETE SLAB WITH F.H. RISER.

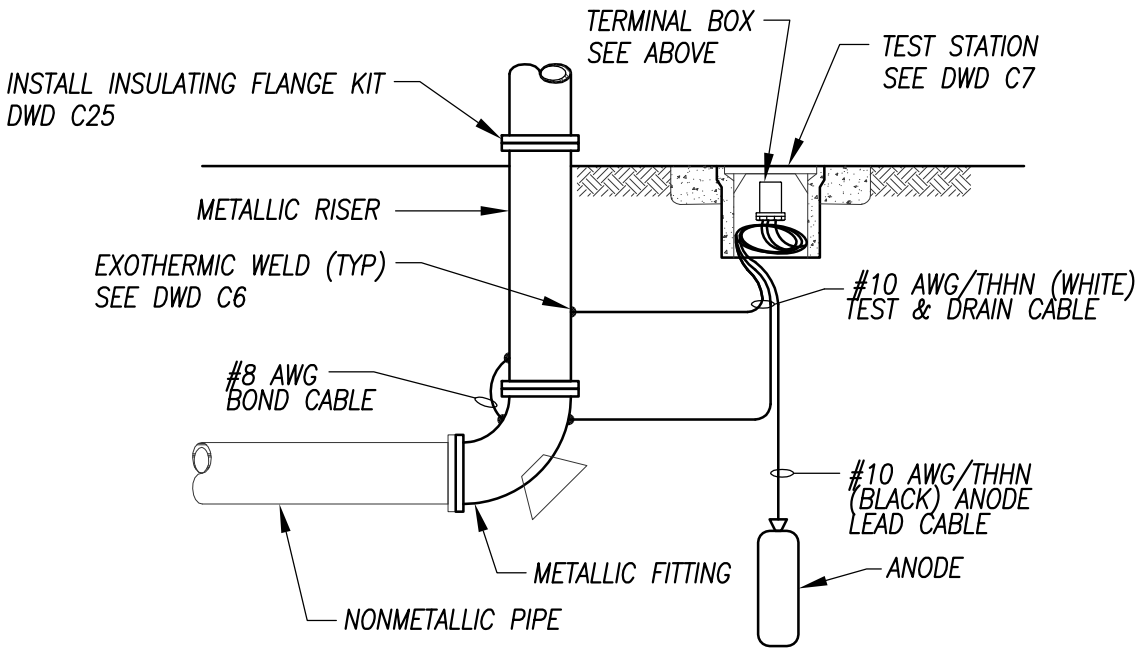
DIABLO WATER DISTRICT		STANDARD DRAWING FIRE HYDRANT		
DESIGNED MA	DRAWN SC	APPROVED JDH	DATE JUNE 2007	DWG. NO. DWD C15



ATS TERMINAL BOX



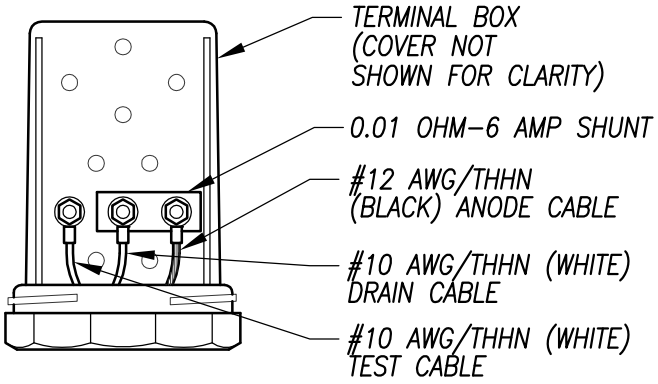
PLAN



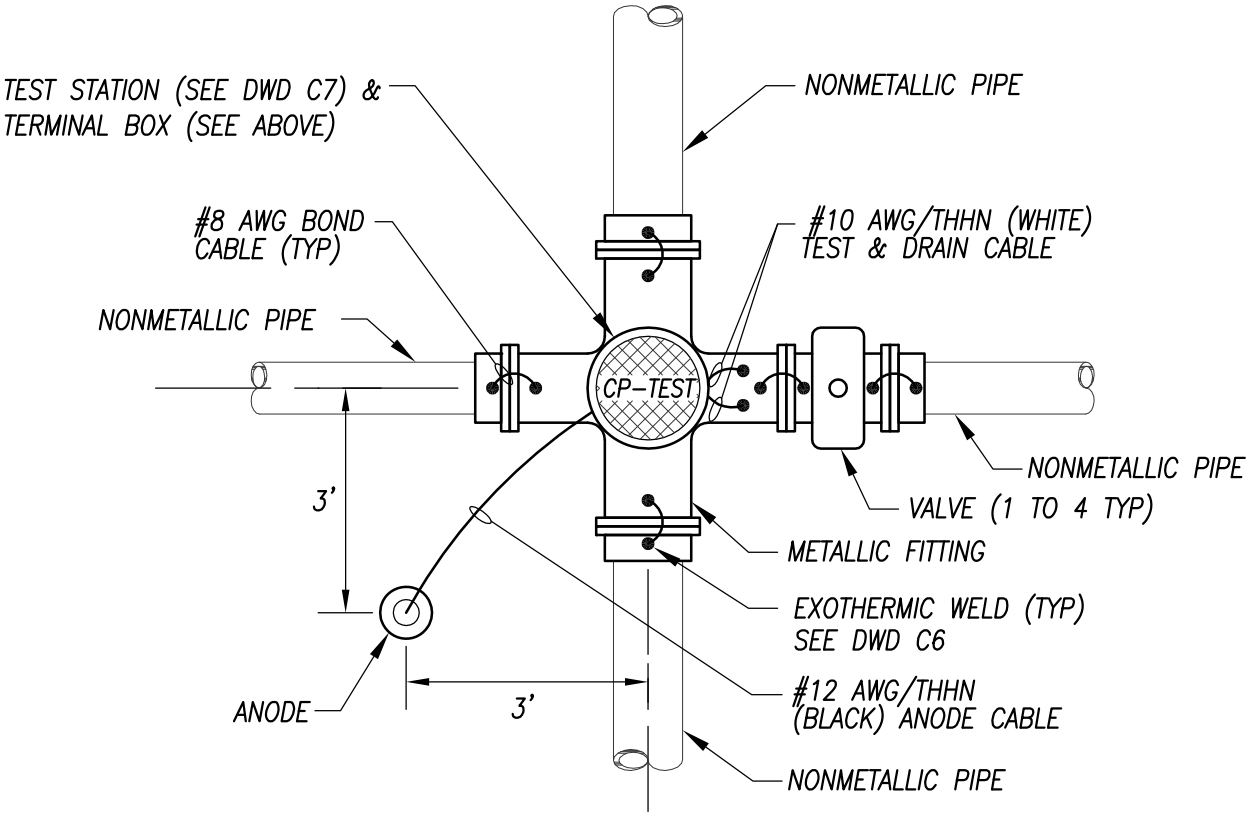
PROFILE

NOTE:
1. IDENTIFY ALL CABLES PER DRAWING DWD C21.

DIABLO WATER DISTRICT		STANDARD DRAWING METALLIC RISER		
DESIGNED MA	DRAWN SC	APPROVED JDH	DATE JUNE 2007	DWG. NO. DWD C16



ATS TERMINAL BOX

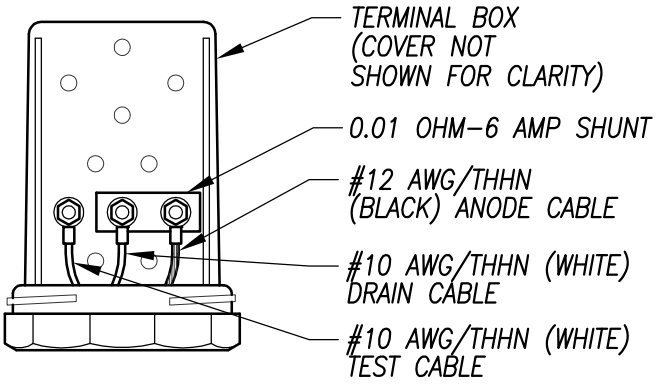


PLAN

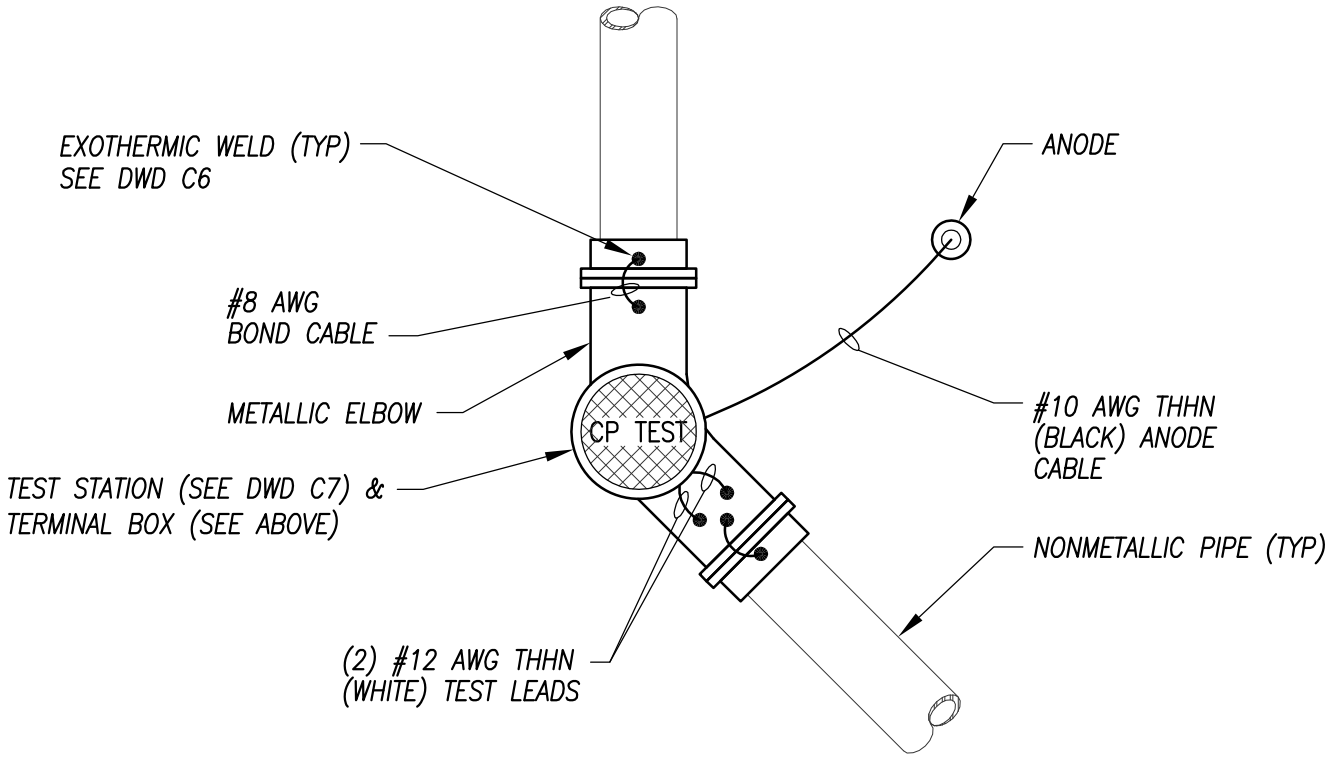
NOTE:

1. IDENTIFY ALL CABLES PER DRAWING DWD C21.

DIABLO WATER DISTRICT		STANDARD DRAWING CROSS AND VALVES		
DESIGNED MA	DRAWN SC	APPROVED JDH	DATE JUNE 2007	DWG. NO. DWD C17



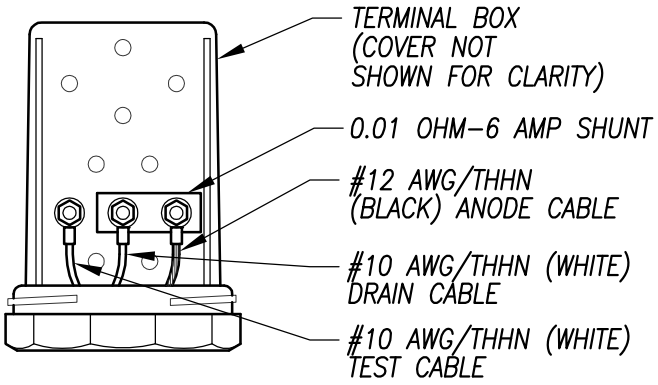
ATS TERMINAL BOX



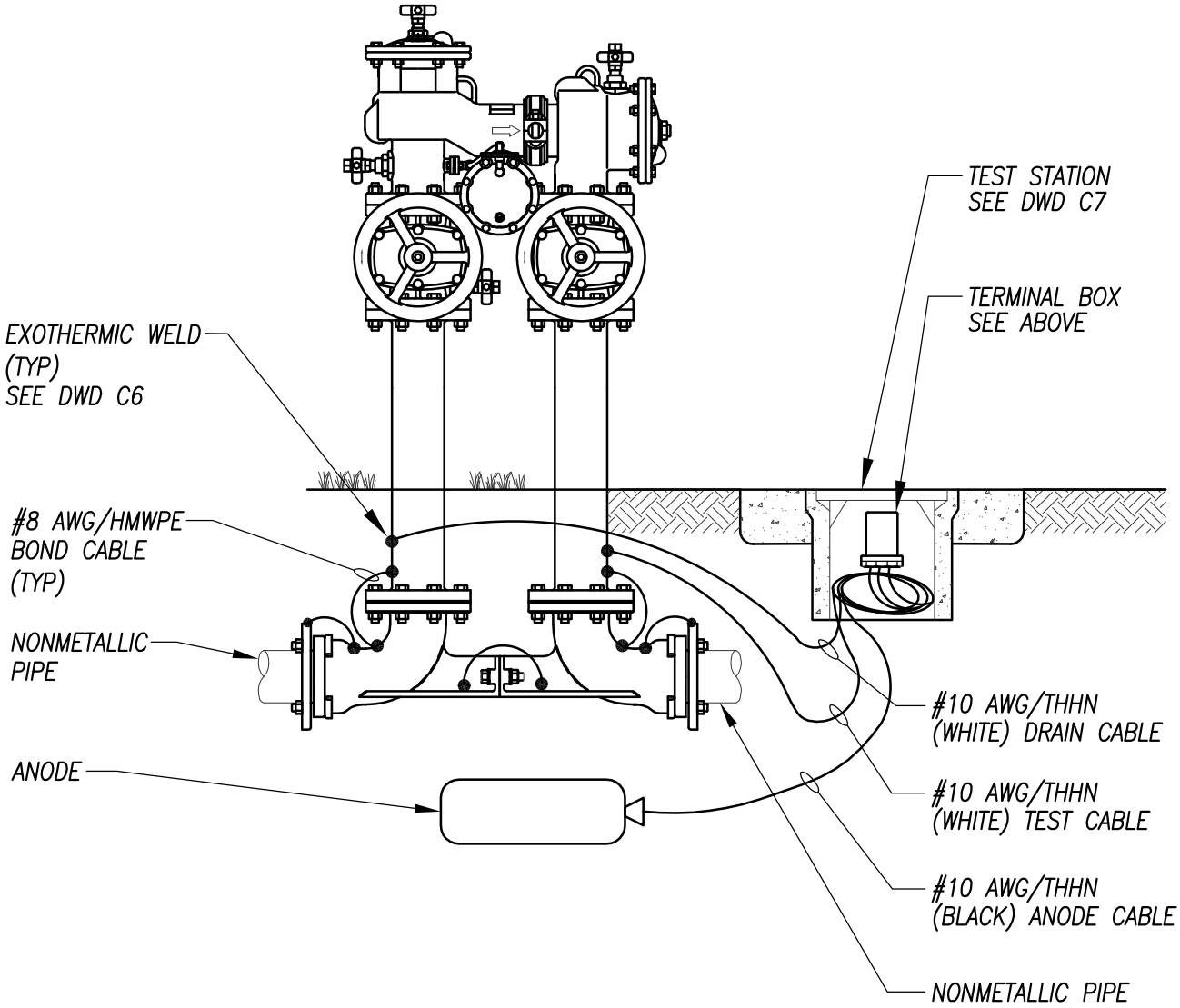
PLAN

NOTE:
1. IDENTIFY ALL CABLES PER DRAWING DWD C21.

DIABLO WATER DISTRICT		STANDARD DRAWING ELBOW		
DESIGNED MA	DRAWN SC	APPROVED JDH	DATE JUNE 2007	DWG. NO. DWD C18

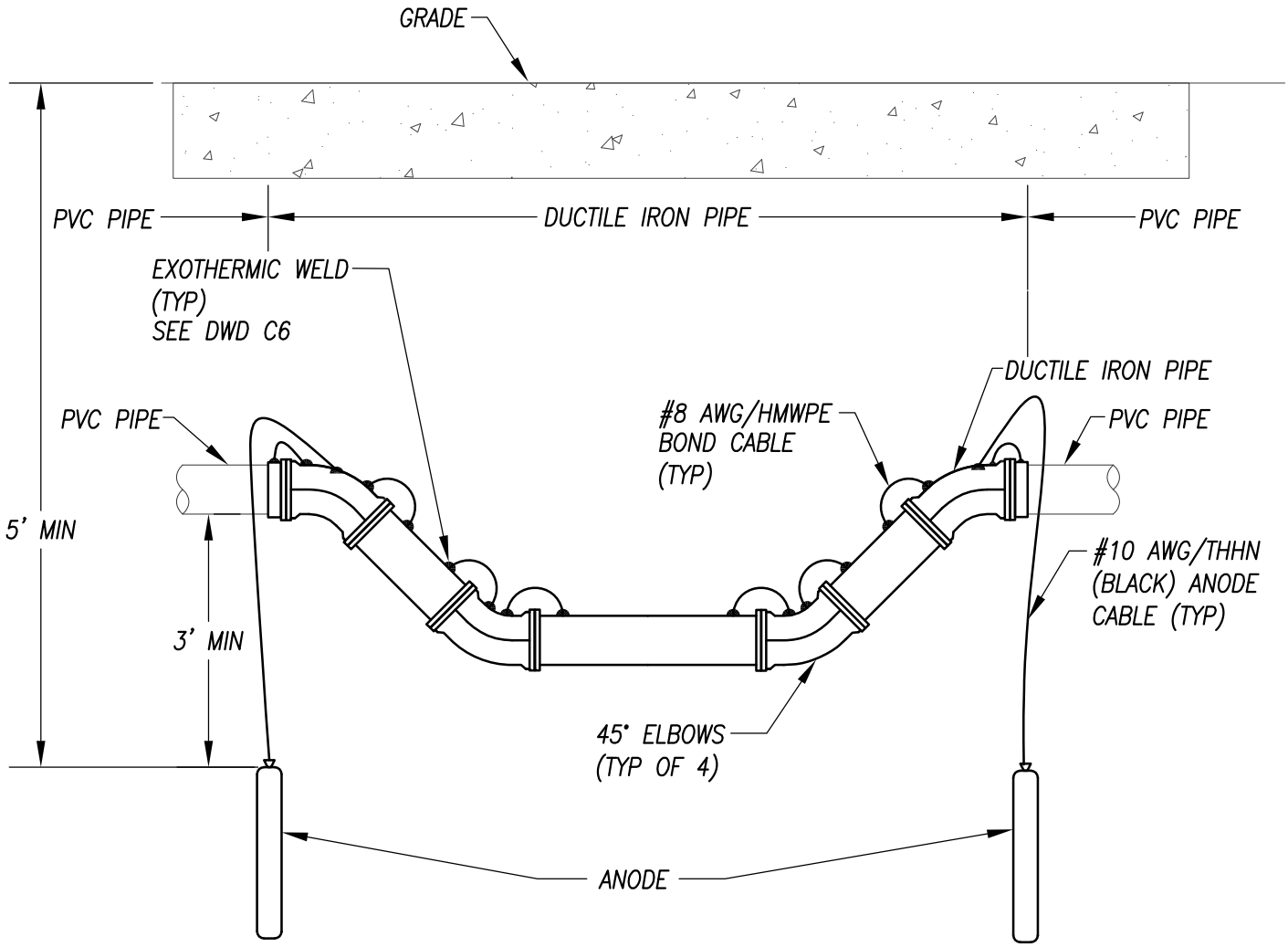


ATS TERMINAL BOX



NOTES:
1. INSTALL ANODE A MINIMUM OF 3–FEET FROM RISER.
2. IDENTIFY ALL CABLES PER DRAWING DWD C19.

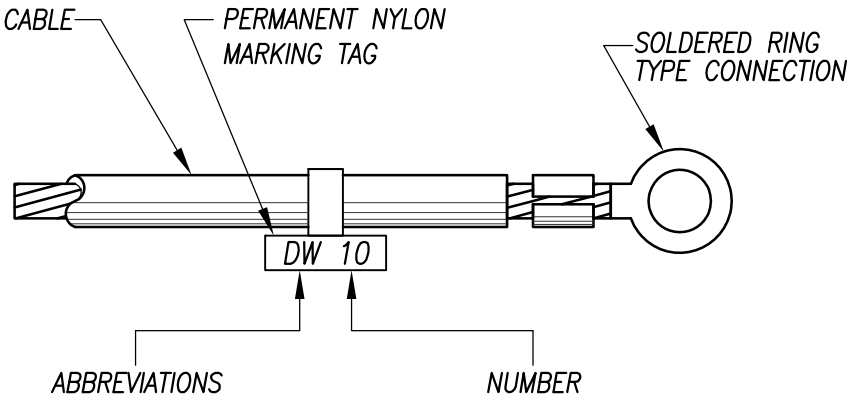
DIABLO WATER DISTRICT	STANDARD DRAWING DOUBLE DETECTOR CHECK ASSEMBLY PREVENTER OR REDUCED PRESSURE BACKFLOW PREVENTER			
DESIGNED MA	DRAWN SC	APPROVED JDH	DATE JUNE 2007	DWG. NO. DWD C19



NOTE:

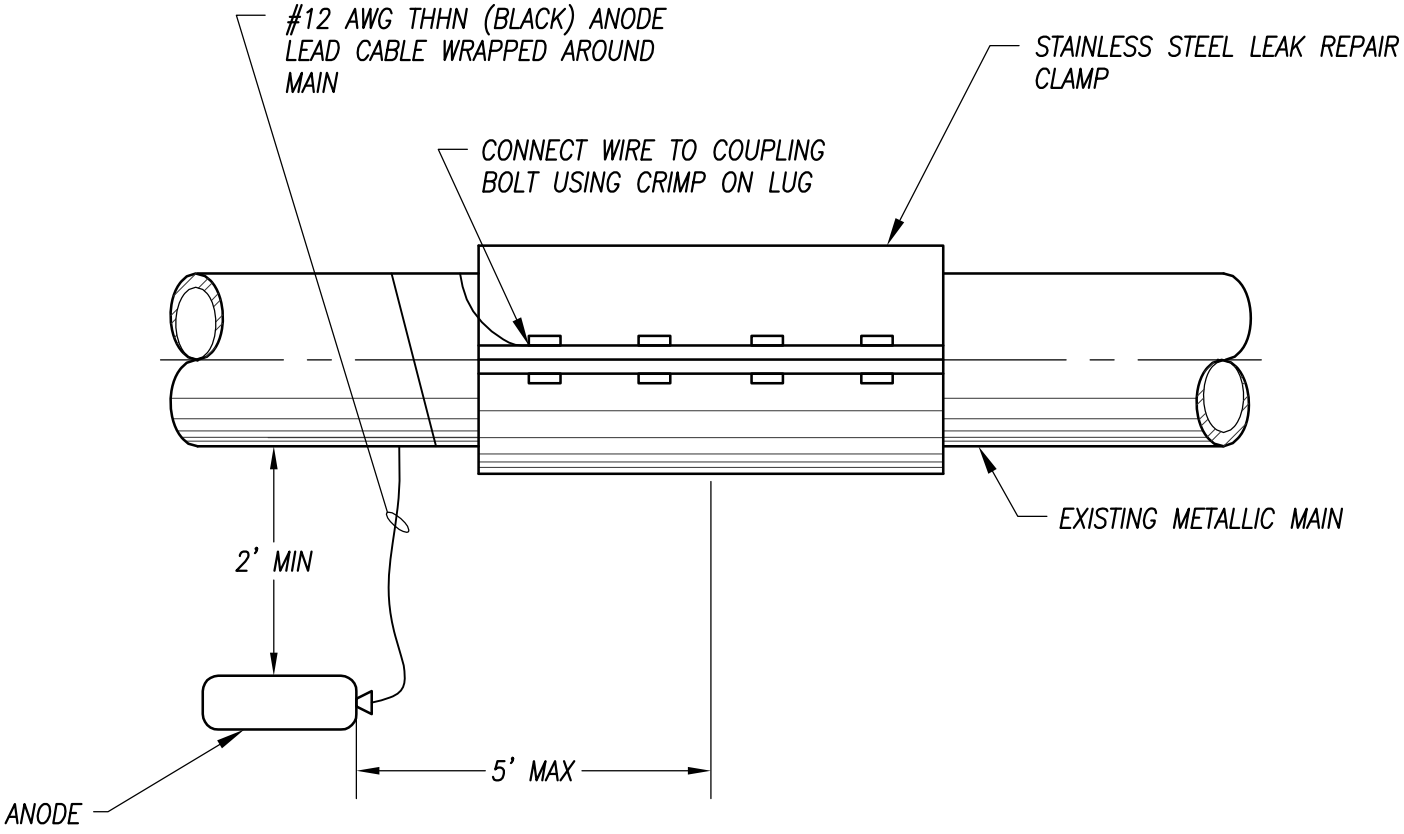
1. THIS DETAIL MAY BE USED FOR ALL UNDERGROUND SECTIONS OF DUCTILE IRON PIPE INCLUDING CROSSING UNDER OR OVER A PIPE, BRIDGE AND SHORT RUNS OF DUCTILE IRON PIPE. IN ALL CASES A MINIMUM OF ONE ANODE SHALL BE INSTALLED ON EACH END OF A DUCTILE IRON PIPE SEGMENT.
2. THE ANODE SHALL BE INSTALLED VERTICALLY OR HORIZONTALLY WITH THE TOP OF THE ANODE 5 FT. BELOW GRADE AND 3 FT. BELOW PIPE.
3. THE BOND CABLES MAY NOT BE REQUIRED IF IT IS DETERMINED DURING TESTING THAT THE DUCTILE IRON PIPE SEGMENT IS ELECTRICALLY CONTINUOUS FROM END TO END.

DIABLO WATER DISTRICT		STANDARD DRAWING DOUBLE OFFSET		
DESIGNED MA	DRAWN SC	APPROVED JDH	DATE JUNE 2007	DWG. NO. DWD C20



DW – DOMESTIC WATER
RW – RAW WATER
BO – BLOW OFF
CA – CASING
EL – ELBOW
FH – FIRE HYDRANT
FP – FOREIGN PIPELINE
DR – DRAIN
AN – ANODE
RE – REFERENCE ELECTRODE

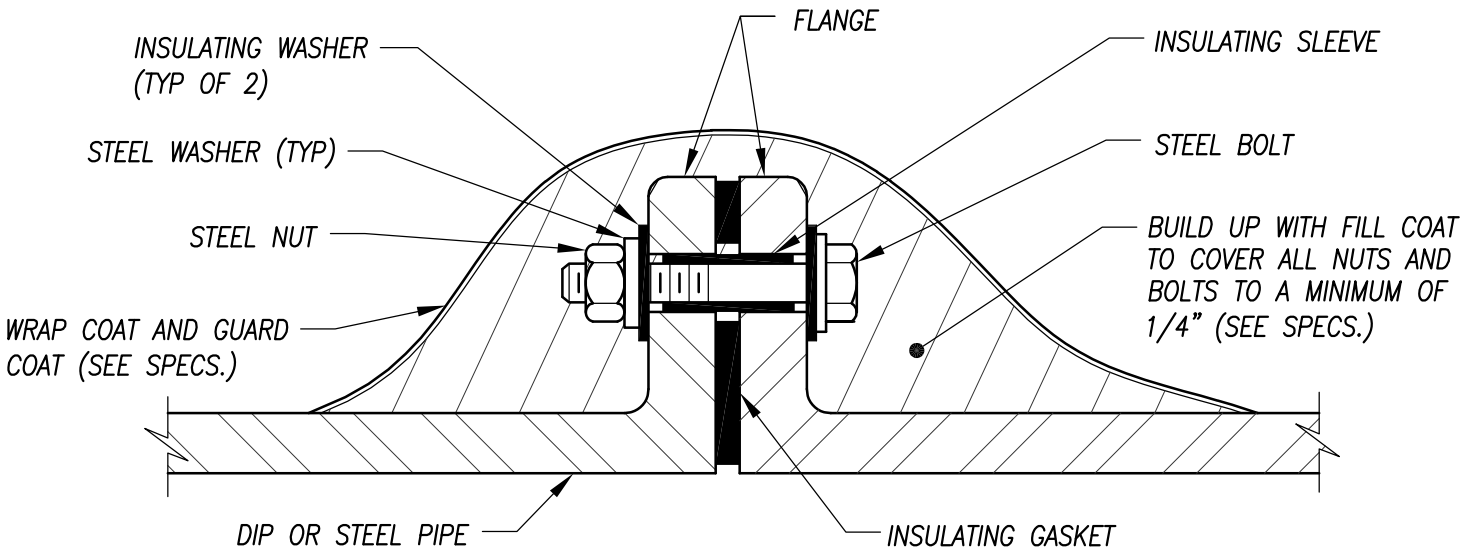
DIABLO WATER DISTRICT	STANDARD DRAWING CABLE IDENTIFICATION			
DESIGNED MA	DRAWN SC	APPROVED JDH	DATE JUNE 2007	DWG. NO. DWD C21



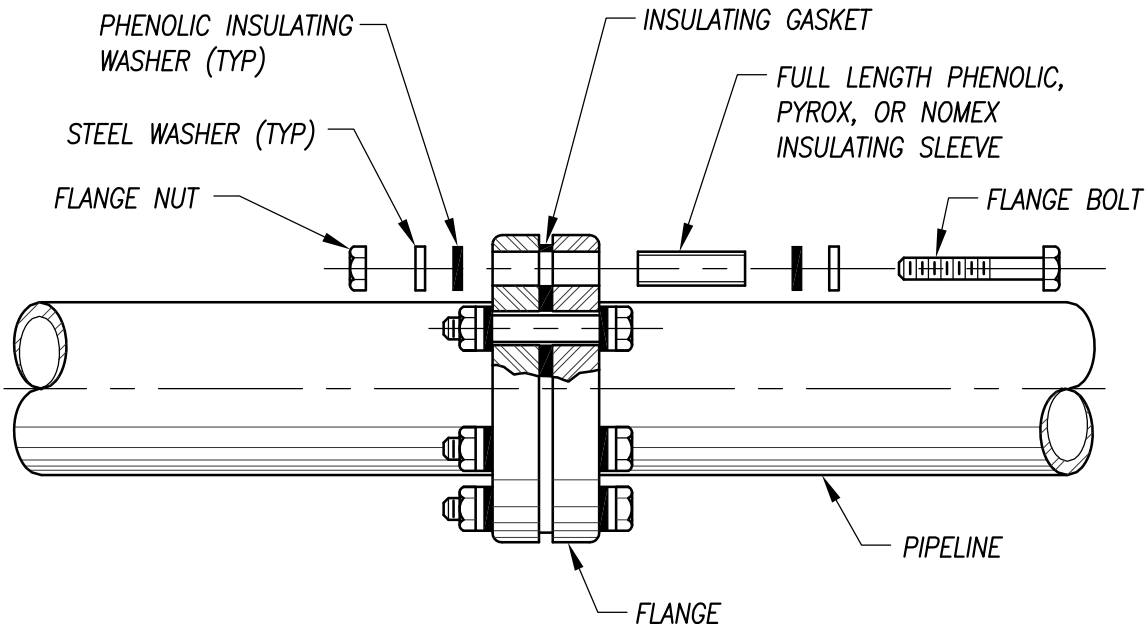
NOTES:

1. INSTALL ANODE A MINIMUM OF 2-FEET BELOW PIPE DEPTH IN NATIVE SOIL.
2. MAXIMUM HORIZONTAL DISTANCE FROM ANODE TO LEAK REPAIR CLAMP IS 5-FEET.

DIABLO WATER DISTRICT		STANDARD DRAWING ANODE AT LEAK REPAIR CLAMP		
DESIGNED MA	DRAWN SC	APPROVED JDH	DATE JUNE 2007	DWG. NO. DWD C22



BELOW GRADE INSULATING JOINT COATING

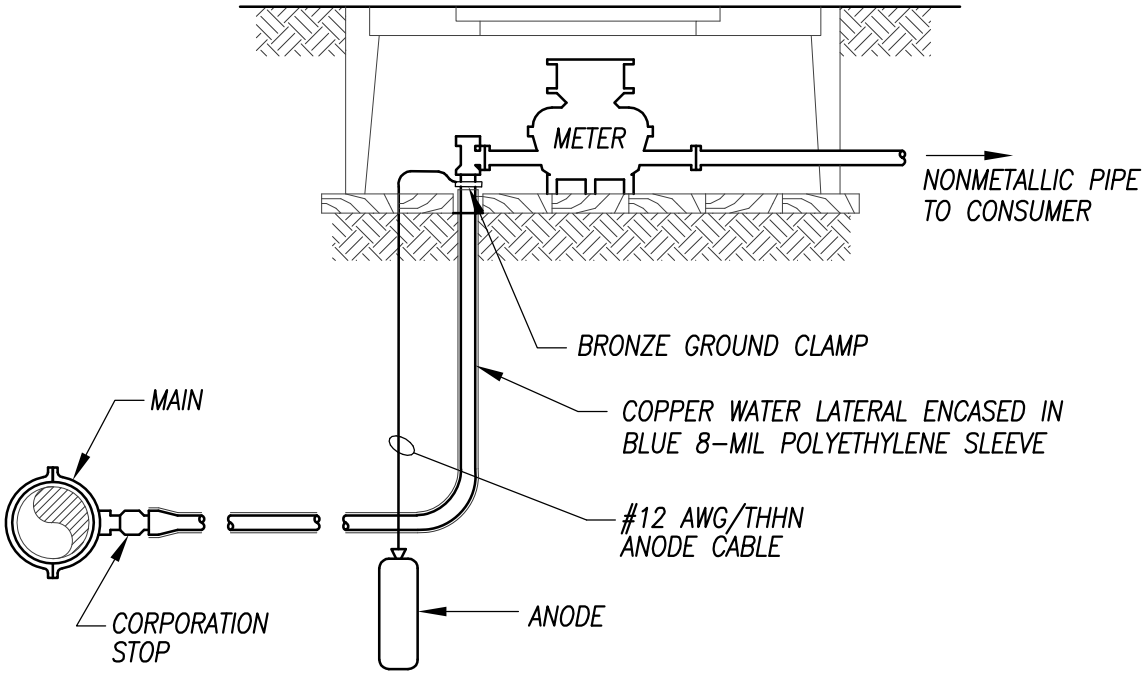


ABOVE GRADE INSULATING JOINT COATING

NOTE:

1. GASKET SHALL BE FOR WATER SERVICE AND BE OF THE SAME PRESSURE RATING AS THE FLANGE.

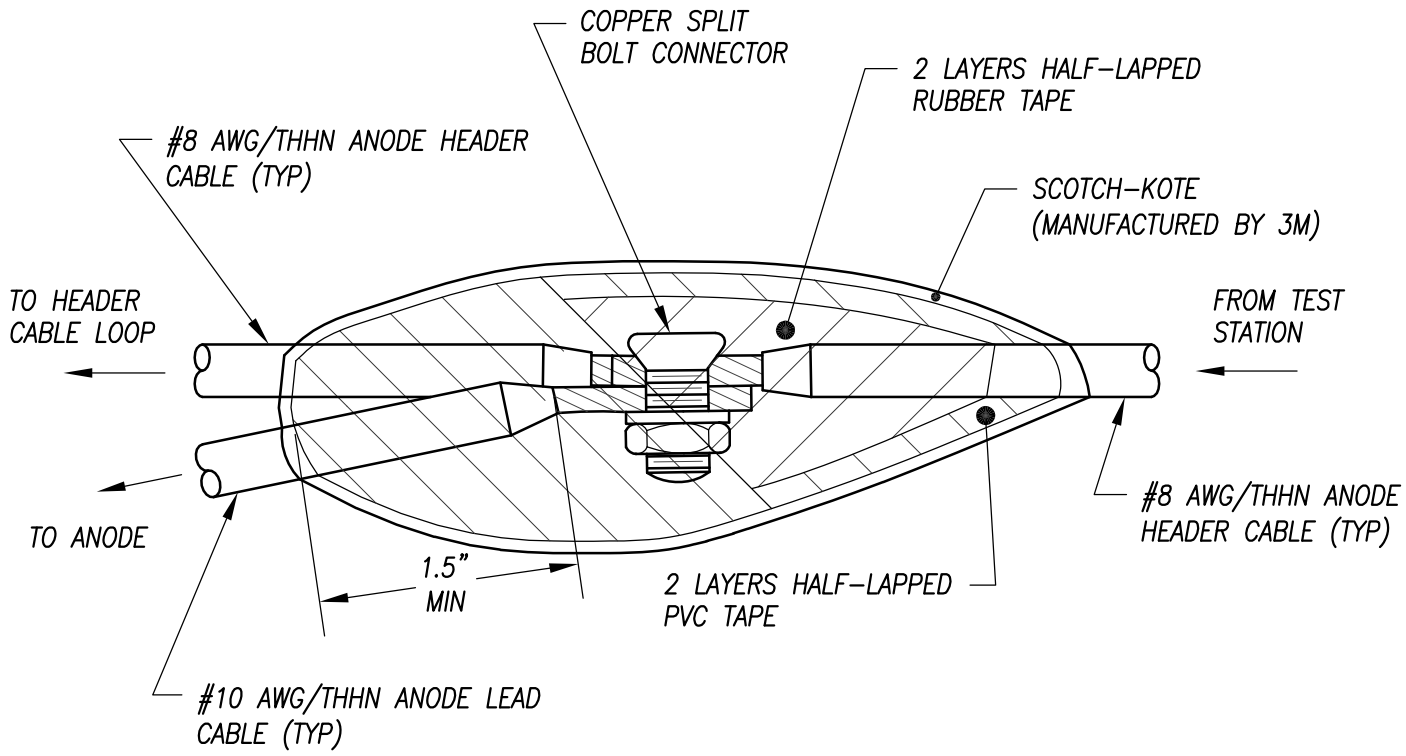
DIABLO WATER DISTRICT		STANDARD DRAWING INSULATING FLANGE KIT		
DESIGNED MA	DRAWN SC	APPROVED JDH	DATE JUNE 2007	DWG. NO. DWD C23



NOTES:

1. IF WATER MAIN IS METALLIC, PLACE INSULATING COUPLING BETWEEN COPPER WATER LATERAL AND WATER MAIN.
2. MAINTAIN A MINIMUM CLEARANCE OF 2 FEET BETEWEEN THE ANODE AND THE LATERAL.
3. TOP OF ANODE SHALL BE 5 FEET MINIMUM FROM THE GROUND SURFACE.

DIABLO WATER DISTRICT		STANDARD DRAWING COPPER WATER LATERALS		
DESIGNED MA	DRAWN SC	APPROVED JDH	DATE JUNE 2007	DWG. NO. DWD C24



DIABLO WATER DISTRICT	STANDARD DRAWING SPLICE DETAIL			
DESIGNED MA	DRAWN SC	APPROVED JDH	DATE JUNE 2007	DWG. NO. DWD C25

DIABLO WATER DISTRICT
Galvanic Cathodic Protection System Checkout

Date: _____ Data Sheet No. _____

Job. No. _____ Job Title: _____

System No.: _____ Location: _____

Engr.: _____ Structure: _____

Station	Anode Potential (mV)	Structure Potential Disconnected (mV)	Structure Potential Connected (mV)	Shift in Potential (mV)	Shunt Measurement (A)

DIABLO WATER DISTRICT
Impressed Current Cathodic Protection System Checkout

Date: _____ Data Sheet No. _____

Job. No. _____ Job Title: _____

Rectifier No. _____ Location: _____

Engr.: _____ Structure: _____

RECTIFIER DATA:

Input (AC): _____ Volts: _____ Amps: _____

Phase: _____ Cycles: _____

Rated Output (DC): _____ Volts: _____ Amps: _____

Coarse: _____ Fine: _____

Date Energized: _____

DC OUTPUT:

By Panel Meter: Volts: _____ Amps: _____

By Volt Meter: Volts: _____ Amps: _____

Shunt Potential Measured: _____

Shunt Rating: Amps: _____ per mV: _____

Current Calculated: _____ Amps

ANODE DATA:

Anode Description: _____ No. _____

Size: _____ X _____ Long _____ Lbs. _____

Shunt Rating: _____ mV

Anode No.	Reading (mV)	Amps

Anode No.	Reading (mV)	Amps

DWD C27

DIABLO WATER DISTRICT
Impressed Current Cathodic Protection System Checkout

Date: _____ Data Sheet No. _____

Job. No. _____ Job Title: _____

System No.: _____ Location: _____

Engr.: _____ Structure: _____

Station	Structure Potential Rectifier "On" (mV)	Structure Potential Rectifier "Off" (mV)	Comments

DIABLO WATER DISTRICT
Leak Repair Report

Date: _____ Data Sheet No. _____

Job. No. _____ Location: _____

Structure Description:
Type of Pipe: _____
Pipe Diameter: _____
Year Installed: _____
Internal Lining: _____
Exterior Coating: _____
Polywrap: _____
Cathodic Protection: _____ Yes: _____ No: _____

What Part of the Main was damaged? _____

Describe the Leak:
Approximate Size: _____
Orientation on Pipe: _____
Photographs: Yes: _____ No: _____

Describe backfill around pipe: _____

Does damage appear to be mechanical or corrosion related? _____

What type of corrosion damage:
_____ No corrosion damage
_____ Pitting
_____ General corrosion
_____ Graphitized cast or ductile iron (looks okay but cuts easily)

If corrosion related, collect soil sample for chemical analysis!

Describe the condition of the pipe adjacent to the failure: _____

Describe repairs made: _____

Materials used: _____