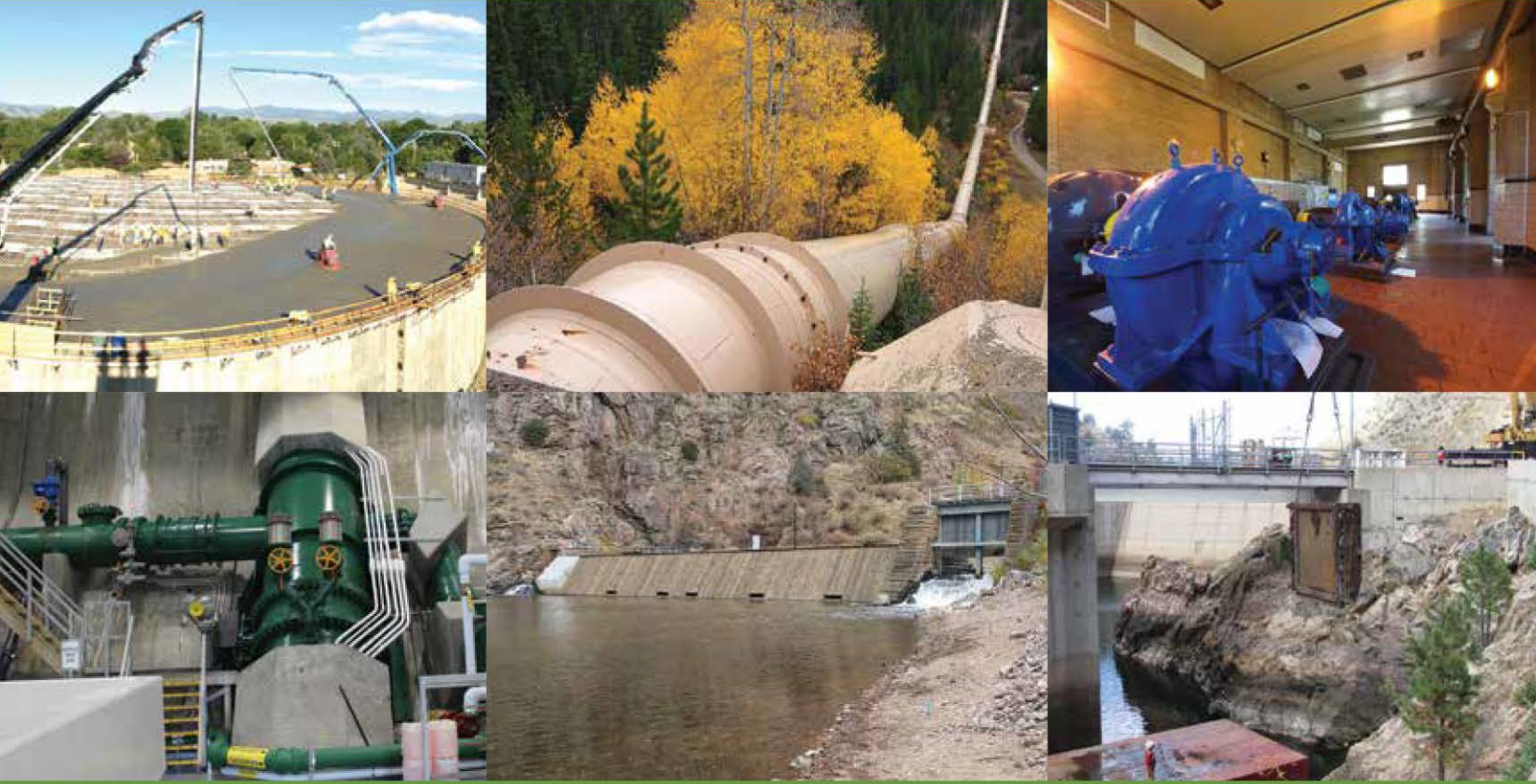


# CAPITAL PROJECTS CONSTRUCTION STANDARDS



Volume 3 of 3  
3rd Edition  
Standard Details  
Divisions 1-40

**Capital Projects Construction Standards  
Volume 3 of 3  
3rd Edition**

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**Denver Water**  
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Denver, Colorado 80204  
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# Capital Projects Construction Standards

## Volume 3 of 3 – 3rd Edition

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DENVER WATER

## Capital Projects Construction Standards January 2017

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The 3rd Edition of Denver Water's *Capital Projects Construction Standards* (CPCS) establishes the minimum standard requirements for constructing Denver Water's capital projects. It includes General Conditions, Standard Technical Specifications, and Standard Details that are no longer produced in the individual project Contract Documents. Project-specific changes and additions to the CPCS, in the form of the Supplementary Technical Specifications, along with bidding and other contract requirements and detailed drawings, will be prepared separately for each project.

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<http://www.denverwater.org/DoingBusinesswithUs/EngineeringOverview/CPCS/>



⊙	AT (SPACING)	ATO	AUTOMATIC TRANSFER OPERATION
&	AND	AUTO	AUTOMATIC
∠	ANGLE	AUX	AUXILIARY
Ⓢ	CENTERLINE	AV	AIR VALVE, AUDIO VISUAL
°C	DEGREE CELSIUS	AVE	AVENUE
°F	DEGREE FAHRENHEIT	AVRV	AIR AND VACUUM RELEASE VALVE
∅	DIAMETER	AVG	AVERAGE
η	EFFICIENCY	AWG	AMERICAN WIRE GAUGE
ℓ	FLOW LINE	AWS	AMERICAN WELDING SOCIETY
<	LESS THAN	AWWA	AMERICAN WATER WORKS ASSOCIATION
>	GREATER THAN	B	BELL, BLUE
√	MACHINED SURFACE	BD	BOARD, BALANCING DAMPER
Ω	OHM	BDD	BACKDRAFT DAMPER
1/2	ONE TWO SELECTOR, ONE HALF	BE	BELL END
φ	PHASE	BF	BLIND FLANGE, BOTH FACES
+	PLUS	BFI	BLOWN FUSE INDICATOR
±	PLUS/MINUS	BFP	BACKFLOW PREVENTER
ℙ	PROPERTY LINE	BFV	BUTTERFLY VALVE
Σ	SUMMATION	BHP	BRAKE HORSEPOWER
A	AMMETER, AMPERAGE, AMPERE, AMBER, ANALOG, AUTOMATIC, AUTO, AUXILIARY, AIR, PLANT UTILITY, ANODE	BIL	BASIC IMPULSE INSULATION LEVEL
AASHTO	AMERICAN ASSOCIATION of STATE HIGHWAY and TRANSPORTATION OFFICIALS	BK	BACK, BRAKE
AB	ANCHOR BOLT	BKR	BREAKER
ABBR	ABBREVIATION	BL	BEARING LUBE
ABS	ACRYLONIRILE--BUTADIENE--STYRENE	BLDG	BUILDING
ABUT	ABUTMENT	BLK	BLACK
A/C	AIR CONDITIONING	BLU	BLUE
AC	ASPHALTIC CONCRETE, ALTERNATING CURRENT	BLVD	BOULEVARD
ACI	AMERICAN CONCRETE INSTITUTE	BM	BENCH MARK, BEAM
ACK	ACKNOWLEDGE	BNSF	BURLINGTON NORTHERN/SANTA FE RAILROAD
ACP	ASBESTOS--CEMENT PIPE	BO	BLOW OFF
ACS	ACCESS	BOC	BACK OF CURB
ACSR	ALUMINUM CONDUCTOR STEEL REINFORCED	BOF	BOTTOM OF FOOTING
ACU	AIR CONDITIONING UNIT	BOT	BOTTOM
AD	AREA DRAIN	BP	BACK PRESSURE
ADA	AMERICANS WITH DISABILITIES ACT	BRG	BEARING
ADDL	ADDITIONAL	BRN	BROWN
ADH	ADHESIVE	BS	BACK-SIPHONAGE
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AFD	ADJUSTABLE FREQUENCY DRIVE	BTU	BRITISH THERMAL UNITS
AFF	ABOVE FINISH FLOOR	BTWN	BETWEEN
AFG	ABOVE FINISH GRADE	BUR	BUILT UP ROOFING
AG	AIR GAP	BV	BALL VALVE
AGGR	AGGREGATE	BVC	BEGINNING OF VERTICAL CURVE
Ah	AMPERE HOUR	BWS	BACKWASH SUPPLY
AH	AHEAD	BWW	BACKWASH WASTE
AHJ	AUTHORITY HAVING JURISDICTION	C	CHANNEL (BEAM), CONDUIT, CONTROLLER, COUPON
AHR	ANCHOR	C TO C	CENTER TO CENTER
AHU	AIR HANDLING UNIT	C&CT	CONVENTIONAL & CHEMICAL TREATMENT
AI	AIR INSTRUMENT, ANALOG INPUT	C&G	CURB AND GUTTER
AIC	AMPERE INTERRUPTING CURRENT	CA	COMPRESSED AIR
AISC	AMERICAN INSTITUTE OF STEEL CONSTRUCTION	CAB	CABINET
AISI	AMERICAN IRON AND STEEL INSTITUTE	CAD	COMPUTER AIDED DRAFTING
ALT	ALTERNATE, ALTITUDE	cal/cm <sup>2</sup>	ARC FLASH HAZARD LEVEL
ALUM	ALUMINUM	CAP	CAPACITOR
AM	AUTO-MANUAL, AMMETER	CB	CATCH BASIN, CIRCUIT BREAKER
AMP	AMPERES	CC	CALIBRATION COLUMN, CLOSING COIL
ANOD	ANODIZE	CCP	CONCRETE CYLINDER PIPE (PRETENSION)
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE	CCW	COUNTER CLOCKWISE
AO	ANALOG OUTPUT	CD	CEILING DIFFUSER, CONDENSATE DRAIN, CHLORINE DETECTOR
AP	ANGLE POINT	CF	CUBIC FEET, CABINET FAN
APPD	APPROVED	CFM	CUBIC FEET PER MINUTE
APPROX	APPROXIMATE, APPROXIMATELY	CFS	CUBIC FEET PER SECOND
AQ	AQUASTAT	CG	CEILING GRILLE, CHLORINE GAS (PRESSURE)
AR	AUXILIARY RELAY	CGV	CHLORINE GAS VACUUM
ARCH	ARCHITECTURAL	CG/V	CHLORINE GAS/VENT
ARMC	ALUMINUM RIGID METAL CONDUIT	CHEM	CHEMICAL
ARV	AIR RELIEF VALVE, AIR RELEASE VALVE	CHFR	CHAMFER
AS	AMMETER SWITCH	CHKD	CHECKED, CHECKERED
ASME	AMERICAN SOCIETY OF MECHANICAL ENGINEERS	CHKV	CHECK VALVE
ASSY	ASSEMBLY	CHWR	CHILLED WATER RETURN
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS	CHWS	CHILLED WATER SUPPLY
ASYMM	ASYMMETRICAL	CI	CAST IRON, CONTOUR INTERVAL
AT	AMPERE TRIP, AUTOTRANSFORMER	CIMJ	CAST IRON MECHANICAL JOINT
ATC	AUTOMATIC THROWOVER CONTROL, AIR TERMINAL CHAMBER	CIP	CAST IRON PIPE, CAST-IN-PLACE
ATS	AUTOMATIC TRANSFER SWITCH	CIR	CIRCLE, CIRCUIT
		CISP	CAST IRON SOIL PIPE
		CJ	CONSTRUCTION JOINT
		CKT	CIRCUIT
		Cl <sub>2</sub> L	CHLORINE LIQUID
		Cl <sub>2</sub>	CHLORINE
		Cl <sub>2</sub> RESD	CHLORINE RESIDUAL

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## 01001 ABBREVIATIONS AND SYMBOLS

 **DENVER WATER**

1600 West 12th Ave  
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denverwater.org

CLF	CURRENT LIMITING FUSE	DO	DIGITAL OUTPUT, DISSOLVED OXYGEN
CLG	CEILING	DP	DISTRIBUTION PANELBOARD
CLO	CLOSET	DPC	DISTRIBUTED PROCESS CONTROLLER
CLR	CLEAR, CLEARANCE	DPDT	DOUBLE POLE DOUBLE THROW
CLSM	CONTROLLED LOW STRENGTH MATERIAL	DPST	DOUBLE POLE SINGLE THROW
CMC	CEMENT MORTAR COATING	DPS	DIFFERENTIAL PRESSURE SWITCH
CMP	CORRUGATED METAL PIPE	DR	DRAIN, DOOR, DRIVE
CMU	CONCRETE MASONRY UNIT	DS	DISCONNECT, DISCONNECT SWITCH, DOWNSTREAM
CNR	CORNER	DT	DOUBLE TEE
CO	CLEANOUT, CARBON MONOXIDE, COUNTY	DV	DISCHARGE VALVE
CO <sub>2</sub>	CARBON DIOXIDE	DW	DENVER WATER, DOMESTIC WATER, DISINFECTED WATER
COL	COLUMN	DWG	DRAWING
COM	COMMON, COMMUNICATIONS	DWL	DOWEL
CONC	CONCRETE, CONCENTRIC	E	EAST, ELECTRIC, EDUCTOR, ENGINE
COND	CONDUIT, CONDUCTIVITY	EA	EACH
CONN	CONNECT, CONNECTION	EAT	ENTERING AIR TEMPERATURE
CONST	CONSTRUCTION	EC	EMERGENCY CLOSE
CONT	CONTINUE, CONTINUED, CONTINUOUS	ECC	ECCENTRIC
CONT JT	CONTRACTION JOINT	ECP	ENVIRONMENTAL CONTROL PANEL
COORD	COORDINATE	EEW	EMERGENCY EYE WASH
CP	COOLING WATER PUMP, CONTROL PANEL, CONTROL POWER, CATHODIC PROTECTION	EF	EACH FACE, EXHAUST FAN
CPLG	COUPLING	EFF	EFFICIENCY
CPT	CONTROL POWER TRANSFORMER	EFL	EFFLUENT
CPU	CENTRAL PROCESSING UNIT	EHH	ELECTRICAL HANDHOLE
CPVC	CHLORINATED POLY (VINYL CHLORIDE)	EL	ELEVATION
CR	CONDENSATE RETURN, CEILING REGISTER, CONTROL RELAY	ELB	ELBOW
CRM	CONTROL RELAY MASTER	ELC	ELECTRICAL LOAD CENTER
CRS	COLD ROLLED STEEL	ELEC	ELECTRIC, ELECTRICAL
CRT	CATHODE RAY TUBE, MONITOR	EMBED	EMBEDMENT
CRZ	CRITICAL ROOT ZONE	EMER	EMERGENCY
CS	CONTROL STATION, CLOSE SOLENOID, CHLORINE SOLUTION	EMI	ELECTROMAGNETIC INTERFACE
CST	CARBON STEEL	EMT	ELECTRICAL METALLIC TUBING
CT	COURT, CURRENT TRANSFORMER	ENCL	ENCLOSURE
CTD	CAPACITIVE TRIP DEVICE	END	ENCODER
CTE	COAL-TAR ENAMEL	ENG	ENGINEERING
CTKR	CARETAKER	ENGR	ENGINEER
CTL JT	CONTROL JOINT	ENTR	ENTRANCE
CTR	CENTER, COUNTER	EO	EMERGENCY OVERFLOW, ELECTRIC OPERATOR
CTRD	CENTERED	EOA	EDGE OF ASPHALT
CTRL	CONTROL	EOL	END OF LINE RESISTOR
CTV	CABLE TELEVISION	EPDM	ETHYLENE PROPYLENE DIENE MONOMER (M-CLASS)
CU	CUBIC	EPT	EXCITER POWER TRANSFORMER
Cu	COPPER	EQ	EQUAL
CuCuSO <sub>4</sub>	COPPER/COPPER SULFATE	EQL SP	EQUALLY SPACED
CV	CONTROL VALVE, CONE VALVE	EQN	EQUATION
CW	CLOCK WISE, COLD WATER, CHLORINATED WATER	EQUIP	EQUIPMENT
CWR	COOLING WATER RETURN	ER	ENABLE, EMERGENCY RELAY
CWS	COOLING WATER SUPPLY	ES	EMERGENCY STOP
D	PENNY (NAIL SIZE), DAMPER, DIGITAL, DIODE, DRAIN	ESEW	EMERGENCY SHOWER/EYEWASH
DB	DISTRIBUTION BOX, DRY BULB, DIRECT BURIED	ESMT	EASEMENT
Db	DECIBEL	ESTOP	EMERGENCY STOP
DBA	DEFORMED BAR ANCHOR	ETC	ET CETERA
DbA	DECIBEL (WEIGHTED SCALE)	ETM	ELAPSED TIME METER
DBL	DOUBLE	EUH	ELECTRIC UNIT HEATER
DC	DIRECT CURRENT	EVC	END OF VERTICAL CURVE
DCP	DISTRIBUTION CONTROL PANEL	EW	EACH WAY
DCS	DISTRIBUTED CONTROL SYSTEM	EWI	ENTERING WATER TEMPERATURE
DCW	DOMESTIC COLD WATER	EXC	EXCITER
DE	DRIVE END	EXH	EXHAUST
DEC	DECREASE	EXIST	EXISTING
DECS	DIGITAL EXCITATION CONTROL SYSTEM,	EXP	EXPANSION, EXPOSED, EXPLOSION PROOF
DEFL	DEFLECTION	EXT	EXTERIOR, EXTEND, EXTENSION
DEMO	DEMOLISH	F	FREQUENCY, FUSE, FAHRENHEIT, FIELD GENERATOR
DESC	DESCRIPTION, DESCRIBED	f <sub>c</sub>	REQUIRED DESIGN STRENGTH OF CONCRETE
DET	DETAIL	FAAP	FIRE ALARM ANNUNCIATION PANEL
DF	DOUGLAS FIR, DRINKING FOUNTAIN, DUCT FURNACE,	FACP	FIRE ALARM CONTROL PANEL
DFT	DRY FILM THICKNESS	FC	FLEXIBLE COUPLING, FLEXIBLE CONNECTION
DG	DOOR GRILLE	FCA	FLANGED COUPLING ADAPTER
DHW	DOMESTIC HOT WATER	FCU	FAN COIL UNIT
DI	DUCTILE IRON, DROP INLET, DIGITAL INPUT, DOOR INTERLOCK	FCV	FLOW CONTROL VALVE
DIAG	DIAGONAL	FD	FLOOR DRAIN, FIRE DAMPER
DIL	DILUTE	FDA	FLOOR DRAIN W/INTEGRAL TRAP
DIM	DIMENSION	FDR	FEEDER
DIMJ	DUCTILE IRON MECHANICAL JOINT	FDRS	FIELD DISCHARGE RESISTOR
DIP	DUCTILE IRON PIPE	FDS	FUSED DISCONNECT SWITCH
DISC	DISCONNECT	FDTN	FOUNDATION
DISP	DISPLAY	FE	FIRE EXTINGUISHER, FILTER EFFLUENT
DIST	DISTANCE, DISTRIBUTED, DISTRICT	FEC	FIRE EXTINGUISHER CABINET
DLS	DAMPER LIMIT SWITCH	FeCl <sub>3</sub>	FERRIC CHLORIDE
DN	DOWN	FF	FINISH FLOOR, FAR FACE
		FG	FINISH GRADE, FLOOR GRILLE
		FH	FIRE HYDRANT
		FIG	FIGURE
		FIN	FINISH

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## 01002 ABBREVIATIONS



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FIT	FLOW TRANSMITTER (INDICATING)	HPS	HIGH PRESSURE SODIUM
FIPT	FEMALE IRON PIPE THREAD	HPT	HIGH POINT
FL	FLUORIDE	HPU	HYDRAULIC POWER UNIT, HYDRAULIC PRESSURE UNIT
FLA	FULL LOAD AMPERES	HQ	HEADQUARTERS
FLASH	FLASHING	HR	HOSE RACK
FLD	FIELD	HRG	HIGH RESISTANCE GROUND
FLEX	FLEXIBLE	HR WS	HYDROPHILIC WATER STOP
FLG	FLANGE	HS	HIGH STRENGTH, HAND SWITCH
FLR	FLOOR	HSS	HOLLOW STRUCTURAL SECTION
FLS	FLOW SWITCH	HT	HEIGHT
FLTR	FILTER	HTIP	HEAT TRACE INSULATED PIPE
FLUOR	FLUORESCENT	HTR	HEATER
FMC	FLEXIBLE METAL CONDUIT	HTS	HEAT TAPE SYSTEM
FO	FIBER OPTIC	HV	HOSE VALVE
FOR	FUEL OIL RETURN	HVAC	HEATING, VENTILATING AND AIR CONDITIONING
FOS	FUEL OIL SUPPLY	HVY	HEAVY
FPM	FEET PER MINUTE	HW	HOT WATER
FPS	FEET PER SECOND	HWP	HOT WATER PUMP
FPT	FEMALE PIPE THREAD	HWR	HOT WATER RETURN, HEATING WATER RETURN
FR	FORWARD-REVERSE	HWS	HOT WATER SUPPLY, HEATING WATER SUPPLY
FRMG	FRAMING	HWT	HOT WATER TANK
FRP	FIBERGLASS REINFORCED PLASTIC	HWY	HIGHWAY
FS	FLOW SWITCH	HX	HEAT EXCHANGER
FT	FOOT OR FEET, FLOW TRANSMITTER	HY	HYDROPHILIC
FTD	FREQUENCY TRANSDUCER	HYD	HYDRANT, HYDRAULIC
FTG	FOOTING, FITTING	Hz	HERTZ
FTS	FOOT SWITCH	I	CURRENT
FU	FUSE	IBC	INTERNATIONAL BUILDING CODE
FV	FLOW VALVE	IC	INTERRUPTING CAPACITY, INTEGRATED CIRCUIT
FVNR	FULL VOLTAGE NON-REVERSING	ICBO	INTERNATIONAL CONFERENCE OF BUILDING OFFICIALS
FVR	FULL VOLTAGE REVERSING	ICS	INTERCOM CONTROL STATION
FW	FINISHED WATER	ID	INSIDE DIAMETER
FWD	FORWARD	IE	INVERT ELEVATION, INCIDENT ENERGY
F <sub>y</sub>	YIELD STRENGTH	IEEE	INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS
G	NATURAL GAS, GREEN, GROUND (ELECTRICAL), GENERATOR, GATE	IF	INSIDE FACE
GA	GAGE	I/I	CURRENT TO CURRENT ISOLATOR
GAL	GALLON	IL	INDICATING LIGHT
GALV	GALVANIZED	IN	INCH
GB	GRAB BAR	INC	INCREASE
GC	GROOVED COUPLING	IND	INDICATION, INDUCTION, INDUCTOR
GCF	GROOVED COUPLING FITTING	INFL	INFLUENT
GCP	GENERATOR CONTROL PANEL	INSLFG	INSULATED FLANGE
GE	GROOVED END	INST	INSTANTANEOUS, INSTRUMENT
GEN	GENERATOR	INSTL	INSTALL
GFCI	GROUND FAULT CIRCUIT INTERRUPTER	INSTM	INSTRUMENTATION
GFEP	GROUND FAULT EQUIPMENT PROTECTION	INSUL	INSULATE, INSULATION
GFI	GROUND FAULT INTERRUPTER	INT	INTERIOR
GFR	GROUND FAULT RELAY, GROUND FAULT RECEPTACLE	INV	INVERT, INVERTER
GH	GAUGE HOUSE	IP	IRON PIPE
GL	GLASS	IRR	IRRIGATION
GND	GROUND (ELECTRICAL)	ISA	INTERNATIONAL SOCIETY OF AUTOMATION
GOX	GASEOUS OXYGEN	ISW	ISOLATION SWITCH
GPD	GALLONS PER DAY	I/O	INPUTS AND OUTPUTS
GPH	GALLONS PER HOUR	IO	INPUTS AND OUTPUTS
GPM	GALLONS PER MINUTE	I&C	INSTRUMENTATION AND CONTROL
GPS	GENERATOR PROTECTION SYSTEM	IR	INTRUSION RELAY, INTERPOSING RELAY
GR	GRADE	IS	ISOLATING/INSULATING GASKET
GRN	GREEN	J	JUNCTION BOX
GRY	GRAY	JB	JUNCTION BOX
GUI	GRAPHICAL USER INTERFACE	JAN	JANITOR
GSP	GALVANIZED STEEL PIPE	JT	JOINT
GV	GATE VALVE	K	KEY INTERLOCK
GVL	GRAVEL	kAIC	KILOAMP INTERRUPTING CAPACITY
GYP BD	GYPSONUM WALLBOARD	KB	KICKBLOCK, KNOX BOX
H	HAND, HIGH, HIGH SPEED, HORN	kcmil	THOUSAND CIRCULAR MILLS
HA	HAND-AUTO	KIP	THOUSAND POUNDS
HAB	HEADED ANCHOR BOLT	KMnO <sub>4</sub>	POTASSIUM PERMANGANATE
HAS	HEADED ANCHOR STUD	KO	KNOCKOUT
HAZ	HAZARD, HAZARDOUS	KP	KEY PAD
HDPE	HIGH DENSITY POLYETHYLENE	KSI	KIPS PER SQUARE INCH
HDW	HARDWARE	KSF	KIPS PER SQUARE FOOT
HEX	HEXAGONAL	kV	KILOVOLT
HGE	HYDRAULIC GRADE LINE	kVA	KILOVOLT AMPERES, KILOVOLTAMPERES
HH	HANDHOLE	kVAR	KILOVAR, KILOVOLT AMPERES REACTIVE
HI	HIGH	kW	KILOWATT
HID	HIGH INTENSITY DISCHARGE	kWh	KILOWATT-HOUR
HM	HOLLOW METAL	L	LENGTH, LINE, LOUVER, LOCAL, LOW SPEED INDUCTOR, LIGHTING CONTACTOR, LOW SPEED LIGHTNING ARRESTORS
HMI	HUMAN MACHINE INTERFACE	LA	LABORATORY
HMWPE	HIGH MOLECULAR WEIGHT POLYETHYLENE	LAH	LEVEL ALARM HIGH
HNDRL	HANDRAIL	LAN	LOCAL AREA NETWORK
HOA	HAND-OFF-AUTO	LAT	LEAVING AIR TEMPERATURE, LATITUDE
HOR	HAND-OFF-REMOTE	LAV	LAVATORY
HORIZ	HORIZONTAL		
HP, hp	HORSEPOWER, HIGH PRESSURE		

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## 01003 ABBREVIATIONS

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LB	POUND	MTR	MOTOR
LBS	POUNDS	MV	MEDIUM VOLTAGE, MERCURY VAPOR
LC	LIGHTING CONTACTOR	MW	MANWAY, MEGAWATT
LCC	LIGHTING CONTROL CABINET	MWS	MAXIMUM WATER SURFACE
LCP	LOCAL CONTROL PANEL	N	NORTH, NEUTRAL
LCS	LOCAL CONTROL STATION	N/A	NOT APPLICABLE
LED	LIGHT EMITTING DIODE	Na	SODIUM
LF	LINEAR FEET	NaCl	SODIUM CHLORIDE
LFMC	LIQUIDTIGHT FLEXIBLE METAL CONDUIT	NaOH	SODIUM HYDROXIDE
LH	LEFT HAND	NAC	NOTIFICATION ALARM CIRCUIT
LIT	LEVEL TRANSMITTER (INDICATING)	NAH	TORQUE ALARM HIGH
LLV	LONG LEG VERTICAL	NAHH	TORQUE ALARM HIGH-HIGH
LLDPE	LINEAR LOW DENSITY POLYETHYLENE	NC	NORMALLY CLOSED
lm	LUMEN	NCTC	NORMALLY CLOSED TIME CLOSED
LM	LIME	NCTO	NORMALLY CLOSED TIME OPEN
LNTL	LINTEL	NEC	NATIONAL ELECTRICAL CODE
LO	LOW	NEMA	NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION
LOA	LOAD-OUT ACCEPTED	NEU	NEUTRAL
LOC	LOCATION, LOCATE, LOAD-OUT COMPLETE	NF	NEAR FACE
LOI	LOAD-OUT INITIATED	NFDS	NONE FUSED DISCONNECT SWITCH
LONG	LONGITUDE, LONGITUDINAL	NFPA	NATIONAL FIRE PROTECTION ASSOCIATION
LOP	LOSS OF POWER	NFS	NATIONAL FOREST SERVICE
LOR	LOCAL-OFF-REMOTE	NG	NATURAL GAS
LOSP	LOAD-OUT SET-POINT	NH <sub>3</sub>	AMMONIA
LOX	LIQUID OXYGEN	NIC	NOT IN CONTRACT
LP	LIGHTING PANELBOARD, LEGEND PLATE, LOW PRESSURE	NO	NUMBER, NORMALLY OPEN
LPG	LIQUEFIED PETROLEUM GAS	NOM	NOMINAL
LPS	LIGHTING PROTECTION SYSTEM	NOTO	NORMALLY OPEN TIME OPEN
LPT	LOW POINT	NP	NAME PLATE
LR	LONG RADIUS, LATCHING RELAY, LOCAL-REMOTE	NPT	NATIONAL PIPE THREAD
LRA	LOCKED ROTOR AMPERES	NSF	NATIONAL SANITATION FOUNDATION, NATIONAL SCIENCE FOUNDATION
LS	LIMIT SWITCH, LEVEL SWITCH, LIME SLURRY	NTS	NOT TO SCALE
LSC	LIMIT SWITCH CLOSE	NWS	NORMAL WATER SURFACE
LSIG	LONG TIME, SHORT TIME, INSTANTANEOUS, GROUND FAULT TRIP FUNCTION	O	OVER
LSO	LIMIT SWITCH OPEN	O <sub>2</sub>	OXYGEN
LT	LEFT, LIGHT, LEVEL TRANSMITTER	OA	OVERALL, OUTSIDE AIR
LTG	LIGHTING	OBD	OPPOSED BLADE DAMPER
LVDT	LINEAR VARIABLE DIFFERENTIAL TRANSFORMER	OC	ON CENTER, OPEN-CLOSE, OVERCURRENT
LVR	LOUVER	OD	OUTSIDE DIAMETER, OVERFLOW DRAIN
LWT	LEAVING WATER TEMPERATURE	ODE	OPPOSITE DRIVE END
M	MAGNETIC CONTACTOR, MOTOR, MOTOR STARTER, MANUAL, MECHANICAL EQUIPMENT, MAIN	OF	OUTSIDE FACE
mA	MILLIAMPERE	OH	OVERHEAD
MA	MANUAL-AUTO	OHP	OVERHEAD POWER
MATL	MATERIAL	OHW	OVERHEAD WIRE
MAU	MAKE-UP AIR UNIT	OHWL	ORDINARY HIGH WATER LINE
MAX	MAXIMUM	OL	OVERLOAD RELAY
MC	METAL-CLAD CABLE, METAL-CLAD, MOTOR CONTROLLER	OMAD	OFF-MANUAL-AUTO-DCS
MCC	MOTOR CONTROL CENTER	OO	ON-OFF (MAINTAINED CONTROL)
MCM	THOUSAND CIRCULAR MILS	OOA	ON-OFF-AUTO
MCP	MOTOR CIRCUIT PROTECTOR, MAIN CONTROL PANEL	OOAR	ON-OFF-AUTO-REMOTE
MD	MOTORIZED DAMPER, MOTION DETECTOR	OOC	ON-OFF-COMPUTER
MDP	MAIN DISTRIBUTION PANEL	OOR	ON-OFF-REMOTE
ME	METAL-ENCLOSED	OPNG	OPENING
MECH	MECHANICAL	OPP	OPPOSITE
MEE	MACHINED EACH END	OPS	OVERCURRENT PROTECTION SYSTEM
MELM	MINIATURE EMBEDDED LIGHT MODULE	ORG	ORANGE
MERC	MERCURY VAPOR	OS	OPEN SOLENOID
MFD	MANUFACTURED	OSA	OUTSIDE AIR
MFR	MANUFACTURER	OSC	OPEN-STOP-CLOSE
MG	MOTOR GENERATOR	OSD	OPEN SITE DRAIN
MGD	MILLION GALLONS PER DAY	OSHA	OCCUPATIONAL SAFETY & HEALTH ADMINISTRATION
MH	MANHOLE, METAL HALIDE	OV	OPEN VALVE
MIN	MINIMUM, MINUTE	OVFL	OVERFLOW
MIP	MALE IRON PIPE	OZ	OUNCE
MIPT	MALE IRON PIPE THREAD	P	POLE, PHASE, PUMP, PIPE CONNECTION (CP)
MISC	MISCELLANEOUS	PA	PUBLIC ADDRESS
MJ	MECHANICAL JOINT	PB	PULL BOX, PUSHBUTTON, PANELBOARD, PULLBOX
ML	MOTORIZED LOUVER	PBD	PARALLEL BLADE DAMPER
MLO	MAIN LUGS ONLY	PC	POINT OF CURVE, PHOTO CELL, PERSONAL COMPUTER
MO	MASONRY OPENING, MOTOR OPERATOR	PCCP	PRESTRESSED CONCRETE CYLINDER PIPE
MOA	MACHINED OVER ALL	PCF	POUNDS PER CUBIC FOOT
MOC	MECHANISM OPERATED CONTACT	PCV	PRESSURE CONTROL VALVE
MOV	METAL OXIDE VARISTOR	PD	PULSATION DAMPER
MPC	MANUFACTURER PROVIDED CABLE	PDS	PRODUCT DATA SHEET
MPR	MOTOR PROTECTIVE RELAY	PE	PLAIN END, POLYETHYLENE
MPT	MALE PIPE THREAD, MAIN POWER TRANSFORMER	PERIM	PERIMETER
MPZ	MINI-POWER ZONE	PF	POWER FACTOR
MS	MILD STEEL, MOTOR STARTER	PFCC	POWER FACTOR CORRECTING CAPACITOR
MSC	MANUFACTURER SUPPLIED CABLE	PH	PHASE
MSK	MOP SINK	PI	POINT OF INTERSECTION, PRESSURE INDICATOR
MTD	MOUNTED	PIT	PRESSURE TRANSMITTER (INDICATING)
MTG	MOUNTING	PJF	PREMOLDED JOINT FILLER
MTL	METAL	PL	PLATE, PLACE
		PLC	PROGRAMMABLE LOGIC CONTROLLER
		PL LAM	PLASTIC LAMINATE

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## 01004 ABBREVIATIONS



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PLYWD	PLYWOOD	SAE	SOCIETY OF AUTOMOTIVE ENGINEERS
PNL	PANEL	SAN	SANITARY, SANITARY SEWER
PNK	PINK	SB	STANDBY
POD	POINT OF DELIVERY	SC	SOLID CORE, SURGE CAPACITORS, SYNC CHECK
POE	POWER OVER ETHERNET	SCADA	SUPERVISORY CONTROL AND DATA ACQUISITION
POLY	POLYMER, POLYETHYLENE	SCFM	STANDARD CUBIC FEET PER MINUTE
POS	POINT OF SERVICE	SCHED	SCHEDULE
POT	POTENTIOMETER	SCP	SECURITY CONTROL PANEL
PPE	PERSONAL PROTECTIVE EQUIPMENT	SCR	SILICON CONTROLLED RECTIFIER
PQM	POWER QUALITY METER	SD	STORM DRAIN, SOAP DISPENSER, SUPPLY DIFFUSER
PRE	PERMANENT REFERENCE ELECTRODE	SDBC	SOFT DRAWN BARE COPPER
PREF	PREFERRED	SDS	SAFETY DATA SHEET
PREFAB	PREFABRICATED	SEC	SECONDARY, SECONDS
PREFIN	PREFINISHED	SECT	SECTION
PRELIM	PRELIMINARY	SES	STATIC EXCITATION SYSTEM
PRESS	PRESSURE	SF	SQUARE FEET, SQUARE FOOT, SERVICE FACTOR
PRI	PRIMARY	SG	SUPPLY GRILLE, SPILLWAY GATE
PROJ	PROJECTION, PROJECT	SH	SHIELD
PROP	PROPERTY	SHC	SOCKET HEAD CAP
PRV	PRESSURE REGULATING VALVE, PRESSURE RELIEF VALVE	SHLD	SHIELD
		SHT	SHEET
PS	PUMP STATION, PRESSURE SWITCH, POWER SUPPLY, POWER SOLENOID, POTASSIUM SOLUTION	SIM	SIMILAR
		SJI	STEEL JOIST INSTITUTE
PSF	POUNDS PER SQUARE FOOT	SL	SYNCHRONIZING LIGHT
PSI	POUNDS PER SQUARE INCH	SLC	SIGNALING LINE CIRCUIT
PSIA	POUNDS PER SQUARE INCH, ABSOLUTE	SLV	SLEEVE
PSIG	POUNDS PER SQUARE INCH, GAUGE	SLIP	SLIP ON PIPE CONNECTION
PT	POINT OF TANGENCY, POST TENSIONED, POTENTIAL TRANSFORMER, PRESSURE TRANSMITTER	SMP	SUMP PUMP
		SNSR	SENSOR
PUR	PURPLE	SOL	SOLENOID
PV	PLUG VALVE	SOLN	SOLUTION
PVB	PRESSURE VACUUM BREAKER	SP	SET POINT, SPARE, STATIC PRESSURE, SINGLE POLE
PVC	POLYVINYL CHLORIDE (CONDUIT OR COATING)	SPA	SPACE, SPACING
PVMT	PAVEMENT	SPD	SUMP PUMP DISCHARGE, SURGE PROTECTION DEVICE
PW	POTABLE WATER	SPDT	SINGLE POLE DOUBLE THROW
PWR	POWER	SPEC	SPECIFICATIONS, SPECIFIED
PWS	POWER SUPPLY	SPLY	SUPPLY
Q	RATE OF FLOW, OIL	SPRT	SUPPORT
QDRNT	QUADRANT	SPST	SINGLE POLE SINGLE THROW
QTY	QUANTITY	SQ	SQUARE
R	RADIUS, RANGE, RED, REMOTE, RESISTANCE, RELAY, REFERENCE ELECTRODE	SQRT	SQUARE ROOT
		SR	START OR STOP RELAY
RA	RETURN AIR	SS	SOLID SLEEVE, START-STOP, SOLID STATE
RAD	RADIANT	SST	STAINLESS STEEL
RCCP	REINFORCED CONCRETE CYLINDER PIPE	SSOL	SOLID STATE OVERLOAD
RCP	REINFORCED CONCRETE PIPE	SSPC	THE SOCIETY FOR PROTECTIVE COATINGS
RCPT	RECEPTACLE	ST	STREET
RD	ROAD, ROOF DRAIN	STA	STATION
RDCR	REDUCER	STB	SHORTING TEST BLOCK
REC	RECTIFIER	STD	STANDARD
REF	REFER, REFERENCE, REFERENCED	STDS	STANDARDS
REFR	REFRIGERATOR	STIF	STIFFENER
REINF	REINFORCED, REINFORCING, REINFORCE	STL	STEEL
RES	RESERVOIR, RESISTOR	STR	STRAINER
REQD	REQUIRED	STRM	STORM SEWER
REQMTS	REQUIREMENTS	STRUCT	STRUCTURE, STRUCTURAL
RET	RETURN	SUP	SUPPRESSOR
RFI	RADIO FREQUENCY INTERFERENCE	SUSP	SUSPEND
RGS	RIGID GALVANIZED STEEL	SV	SOLENOID VALVE
RH	RIGHT HAND, ROOF HATCH, RADIANT HEATER, RHEOSTAT	SW	SERVICE WATER, SOURCE WATER, SURFACE WASH, SWITCH
		SWBD	SWITCH BOARD
R/I	RESISTANCE TO CURRENT CONVERTOR	SWGR	SWITCH GEAR
RM	ROOM	SWV	STOP AND WASTE VALVE
RMS	ROOT MEAN SQUARE	SWYD	SWITCHYARD
RND	ROUND	SYM	SYMMETRICAL, SYMBOL
RO	ROUGH OPENING	SYMM	SYMMETRICAL
ROD	ROLLING OVERHEAD DOOR	SYNC	SYNCHRONOUS
ROW	RIGHT-OF-WAY	T	TOWNSHIP, THERMOSTAT, TRANSFORMER, TELEPHONE, TANK
RP	REDUCED PRESSURE PRINCIPAL		
RPDA	REDUCED PRESSURE DETECTOR ASSEMBLY	T/C	THERMOCOUPLE
RPM	REVOLUTIONS PER MINUTE	T&B	TOP AND BOTTOM
RR	RAILROAD	T&G	TONGUE AND GROOVE
RST	REINFORCING STEEL	TACH	TACHOMETER GENERATOR, TACHOMETER
RT	RIGHT, RING-TITE	TAN	TANGENT
RTD	RESISTANCE TEMPERATURE DEVICE	TAS	THREADED ANCHOR STUD
RTU	ROOFTOP AIR CONDITIONING UNIT, REMOTE TERMINAL UNIT	TB	TERMINAL BLOCK
		TBD	TO BE DETERMINED
RV	ROOF VENT	TBG	TUBING
RVSS	REDUCED VOLTAGE SOFT START	TBK	TEST BLOCK
RW	RAW WATER OR RECYCLED WATER	TC	TRAY CABLE, TIME CLOCK, TIME CLOSE, TRIP COIL
RWD	REDWOOD	TD	TIME DELAY RELAY
RWR	RAW WATER RETURN	TDH	TOTAL DYNAMIC HEAD
RWS	RAW WATER SUPPLY	TECH	TECHNICAL
S	SOUTH, SLOPE, I-BEAM, SWITCH, SPIGOT	TEL	TELEPHONE
SA	SUPPLY AIR, SURGE ARRESTOR, SAMPLE WATER	TEMP	TEMPERATURE, TEMPORARY

DRAWN BY: *SCHULTE*

CHKD BY: *K ROSS/vlb*

APPD BY: *Stephen C. Reim*

ORIGINATION DATE: *JANUARY 2017*

REVISION DATE:

## 01005 ABBREVIATIONS



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TH	TEST HOLE	WDW	WINDOW
THD	THREAD, THREADED	WH	WATER HEATER, HOT WATER HEATER, WATT HOUR
THK	THICK, THICKNESS		DEMAND METER
THKD	THICKENED	WHP	WATER HIGH PRESSURE
THM	THERM	WHT	WHITE
THY	THYRITE SURGE SUPPRESSOR	WLP	WATER LOW PRESSURE
TIT	TEMPERATURE TRANSMITTER (INDICATING)	WOF	WATER ON FLOOR
TIV	TURBINE INLET VALVE	WOG	WATER-OIL-GAS
TJB	TERMINAL JUNCTION BOX	WP	WEATHERPROOF
TO	TIME OPEN	WRA	WATER REDUCING AGENT
TOC	TOP OF CURB, TRUCK OPERATED CONTACT	WS	WATER STOP, WELDED STEEL
TOP	TOP OF PIPE	WSC	WATER SERVICE CONTRACTOR
TORQ	TORQUE	WSP	WELDED STEEL PIPE, WORKING STEAM PRESSURE
TOS	TAKE-OFF STRUCTURE	WT	WEIGHT
TOW	TOP OF WALL	WTR	WATER
TPD	TONS PER DAY	WWF	WELDED WIRE FABRIC
TPE-R	THERMOPLASTIC ELASTOMERIC	X	REACTANCE
TPH	TOILET PAPER HOLDER	XING	CROSSING
TR	TIMING RELAY	Y	YELLOW, WYE
TRANSV	TRANSVERSE	YD	YARD
TS	TEMPERATURE SWITCH, THICKENED SLUDGE, TEST STATION	YEL	YELLOW
TSC	TORQUE SWITCH CLOSE	Z	IMPEDANCE
TSDR	TRANSDUCER	ZIT	POSITION TRANSMITTER (INDICATING TYPE)
TSH	TEMPERATURE SWITCH HIGH	ZS	POSITION (LIMIT) SWITCH
TSL	TEMPERATURE SWITCH LOW		
TSO	TORQUE SWITCH OPEN		
TSP	TWISTED SHIELDED PAIR		
TST	TWISTED SHIELDED TRIAD		
TSTAT	THERMOSTAT		
TSTL	TUBE STEEL		
TT	THRUST TIE		
TURB	TURBINE, TURBIDITY		
TVSS	TRANSIENT VOLTAGE SURGE SUPPRESSOR		
TW	THERMOPLASTIC WIRE, TREATED WATER		
TX	TRANSFORMER		
TXPH	PHASE SHIFTING TRANSFORMER		
TYP	TYPICAL		
U	UNDER		
UBC	UNIFORM BUILDING CODE		
UG	UNDERGROUND		
UH	UNIT HEATER		
UL	UNDERWRITERS LABORATORY		
UMC	UNIFORM MECHANICAL CODE		
UNO	UNLESS NOTED OTHERWISE		
UPC	UNIFORM PLUMBING CODE		
UPRR	UNION PACIFIC RAILROAD		
UPS	UNINTERRUPTIBLE POWER SUPPLY		
UR	URINAL		
US	UPSTREAM		
USC	UNIVERSITY OF SOUTHERN CALIFORNIA		
FCCCHR	FOUNDATION FOR CROSS CONNECTION CONTROL AND HYDRAULIC RESEARCH		
UVR	UNDER VOLTAGE RELAY		
V	VENT, VOLT, VOLTMETER, VOLTAGE		
VA	VOLT AMPERE		
VAC	VACUUM, VACANT, VOLT OF ALTERNATING CURRENT		
VAR	VOLT AMPERE REACTIVE, VARISTOR		
VAV	VARIABLE AIR VOLUME		
VB	VALVE BOX		
VC	VERTICAL CURVE		
VDC	VOLTS DIRECT CURRENT		
VERT	VERTICAL		
VFD	VARIABLE FREQUENCY DRIVE		
VH	VALVEHOUSE		
VIB	VIBRATION		
VIF	VERIFY IN FIELD		
VLV	VALVE		
VMS	VOLTAGE MONITORING SYSTEM		
VR	VOLTAGE REGULATOR		
VS	VOLTMETER SWITCH		
VTD	VOLTAGE TRANSDUCER		
VTR	VENT TO ROOF		
W	WEST, WATER, WIDE FLANGE (BEAM), WATTS, WHITE, WIRE		
W/	WITH		
W/O	WITHOUT		
WAH	WALL HEATER		
WB	WET BULB		
WC	WATER CLOSET, WATER COLUMN		
WDG	WINDING		

DRAWN BY: *SCHULTE*

CHKD BY: *K ROSS/KR*

APPD BY: *Stephen C. Penn*






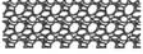





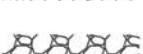




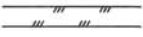







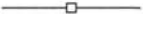



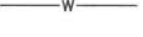

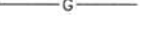
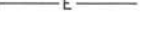



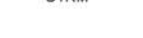
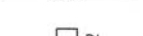


ORIGINATION DATE: *JANUARY 2017*

REVISION DATE:

## 01006 ABBREVIATIONS

 **DENVER WATER**

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	UNDISTURBED EARTH		CENTERLINE
	COMPACTED FILL		DENVER WATER PROPERTY LINE
	ASPHALT		DENVER WATER RIGHT-OF-WAY
	CRUSHED ROCK		SECTION LINE - FULL
	CONCRETE		SECTION LINE - QUARTER
	SAND		SECTION LINE - 16TH
	RIPRAP		SECTION LINE - 64TH
	EXISTING EMBANKMENT SLOPE AS INDICATED		RANGE LINE
	NEW EMBANKMENT SLOPE AS INDICATED		CURB & GUTTER
	DRAINAGE DITCH		PAVED ROAD
	ELEVATION (EXISTING)		UNPAVED ROAD
	FINISH ELEVATION		TRAIL
	CONTOUR (EXISTING)		FENCE - BARB WIRE
	CONTOUR (NEW)		FENCE - CHAIN LINK
	DEMOLITION		FENCE - WOOD
	ABANDONED		RAILROAD TRACKS
	WATER CONDUIT		STRUCTURE
	WATER MAIN		STRUCTURE - BURIED
	NATURAL GAS MAIN		
	ELECTRIC		
	TELEPHONE		
	FIBER OPTIC CABLE		
	CABLE TV		
	STORM DRAIN		
	SANITARY SEWER		
	DROP INLET		
	CLEANOUT		

**NOTE:**

NEW FEATURE: SOLID LINETYPE  
 EXISTING FEATURE: SCREENED LINETYPE

DRAWN BY: <i>MCMILLEN</i>
CHKD BY: <i>K ROSS/KR</i>
APPD BY: <i>Stephen C. Rem</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**01010  
CIVIL LEGEND**

**DENVER WATER**  
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	ACCESS MANHOLE		CASING
	AIR VALVE ASSEMBLY		NATURAL GAS METER
	AIR VALVE W/ ACCESS		ELECTRIC METER
	BLOWOFF VALVE ASSEMBLY		BUSH - DECIDUOUS
	PITOT		BUSH - EVERGREEN
	BUTTERFLY VALVE ASSEMBLY		TREE - DECIDUOUS
	GATE VALVE - OPEN		TREE - EVERGREEN
	GATE VALVE - CLOSED		WELL
	GATE VALVE - INOPERABLE		IRRIGATION WELL
	CORP STOP	BH	BORE HOLE
	CURB STOP	MW	MONITORING WELL
	FIRE HYDRANT	PZ	PIEZOMETER
	WATER METER MANHOLE	PH	POTHOLE
	WATER METER VAULT	TH	TEST HOLE
	PRV MANHOLE		BACKFLOW PREVENTER
	PRV VAULT		ANGLE POINT
		N ####	COORDINATE LABEL
		E ####	

**NOTE:**

NEW FEATURE: SOLID LINETYPE  
 EXISTING FEATURE: SCREENED LINETYPE

DRAWN BY: <i>MCMILLEN</i>
CHKD BY: <i>K ROSS/KLR</i>
APPD BY: <i>Stephen C. Ren</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**01011  
CIVIL LEGEND**

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SECT (LETTER) OR DET (NUMERAL) DESIGNATION



M-1

DWG NO

ON DRAWING WHERE SECT OR DET IS TAKEN:

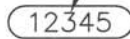
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DRAWING NUMBER(S) WHERE TAKEN

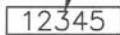
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CPCS DET DESIGNATION (NUMERAL)



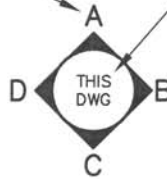
### STANDARD DETAIL DESIGNATION

NON-CPCS DET DESIGNATION (NUMERAL)



### NON-STANDARD DETAIL DESIGNATION

ELEVATION DESIGNATION



ON DRAWING WHERE ELEVATION IS SHOWN

### STANDARD ELEVATION DESIGNATOR

DRAWN BY: MCMILLEN

CHKD BY: K ROSS/KLR

APPD BY: Stephen C. Reim

ORIGINATION DATE: JANUARY 2017

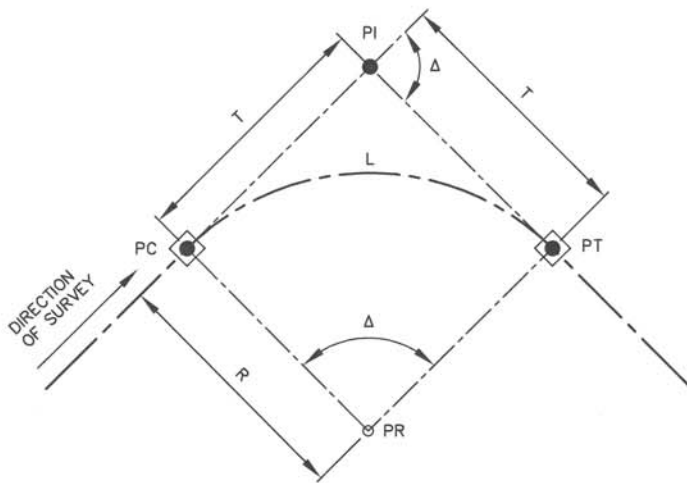
REVISION DATE:

## 01012 DRAWING SYMBOL LEGEND



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	ALUMINUM CAP		IRON PIPE
	AXLE		NAIL
	BAR		NATIONAL GEODETIC SURVEY
	BENCHMARK		PLASTIC CAP
	BRASS CAP		PANEL POINT
	CHISELED CROSS		RANGE POINT
	CROW'S FOOT		REBAR
	CONTROL POINT		ROD
	COPPER PLUG		PLSS CORNER
	DRILL HOLE		SHINER
	DW CAP		STONE
	HUB		



R = RADIUS  
 Δ = DELTA ANGLE  
 L = ARC LENGTH  
 T = TANGENT  
  
 PR - POINT OF RADIUS  
 PC - POINT OF CURVATURE  
 PI - POINT OF INTERSECTION  
 PT - POINT OF TANGENCY

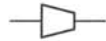


















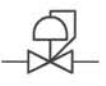
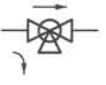
**CURVE DATA**

DRAWN BY: <i>MCMILLEN</i>
CHKD BY: <i>K ROSS/KR</i>
APPD BY: <i>Stephen C. Rem</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

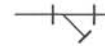
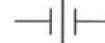

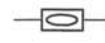


**01015  
SURVEY LEGEND**

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## VALVE SYMBOLS

	CONE VALVE
	GATE, FREE DISCHARGE, RING JET
	KNIFE GATE
	BALL
	GLOBE
	VEE-BALL
	PINCH
	BUTTERFLY
	PLUG
	SEAT PORT ECCENTRIC PLUG
	DIAPHRAGM
	NEEDLE
	SWING CHECK
	BALL CHECK
	SOLENOID
	HOSE BIB (HB- X) X = NO IN SPECS
	MUD
	PRESSURE RELIEF
	AIR AND/OR VACUUM RELIEF
	REGULATED SIDE PRESSURE CONTROL
	MULTI-PORT VALVE (BALL VALVE SHOWN, USE APPROPRIATE SYMBOLS FOR OTHER VALVE TYPES) ARROWS INDICATE FLOW PATTERN, SEAT PORTS ARE IMPLIED BY INDICATED FLOW PATTERN











## MISCELLANEOUS SYMBOLS

	STRAINER
	TRUE UNION
	SAMPLE STATION
	SITE GLASS
	FLEXIBLE (ELASTOMER) PIPE CONNECTION
	ROTAMETER

## GATE SYMBOLS

### ELEVATION

### PLAN

		SLUICE
		BUTTERFLY
		FLAP
		SHEAR
		FABRICATED SLIDE

DRAWN BY: SCHULTE

CHKD BY: K ROSS/WR

APPD BY: Stephen C. Rem

ORIGINATION DATE: JANUARY 2017

REVISION DATE:

01020  
MECHANICAL, ELECTRICAL,  
INSTRUMENTATION AND  
CONTROL GENERAL LEGEND

**DENVER WATER**

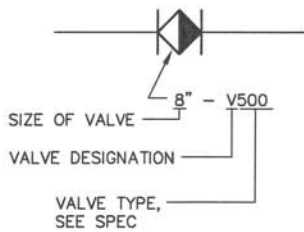
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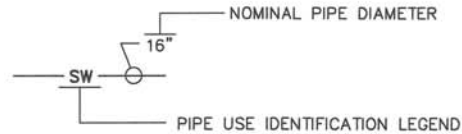
**GENERAL PIPING NOTES:**

1. LAY PIPE TO UNIFORM GRADE BETWEEN INDICATED ELEVATION POINTS.
2. SIZE OF FITTINGS SHOWN ON DRAWINGS SHALL CORRESPOND TO ADJACENT STRAIGHT RUN OF PIPE. TYPE OF JOINT AND FITTING MATERIAL SHALL BE THE SAME AS SHOWN FOR ADJACENT STRAIGHT RUN OF PIPE.
3. LOCATION AND NUMBER OF PIPE HANGERS AND PIPE SUPPORTS SHOWN ARE ONLY APPROXIMATE. FINAL SUPPORT REQUIREMENTS SHALL BE DETERMINED IN THE FIELD AND APPROVED BY THE ENGINEER PRIOR TO INSTALLATION.
4. JOINTS SHALL BE WATERTIGHT. PENETRATION TYPE DETAIL SHALL BE USED WHEREVER PIPING PASSES FROM A STRUCTURE TO BACKFILL.
5. FLEXIBLE CONNECTORS OR FLANGED COUPLING ADAPTERS SHALL BE PROVIDED WITH THRUST TIES, BLOCKS, OR ANCHORS. THRUST PROTECTION SHALL BE ADEQUATE FOR PRESSURES SPECIFIED.
6. SYMBOLS, LEGENDS, AND PIPE USE IDENTIFICATIONS SHOWN SHALL BE FOLLOWED THROUGHOUT THE PLANS, WHEREVER APPLICABLE. ALL OF THE VARIOUS PIPING APPLICATIONS ARE NOT NECESSARILY USED IN THE PROJECT.
7. BURIED PIPING SPECIFIED TO BE PRESSURE TESTED, EXCEPT FLANGED, WELDED, OR SCREWED PIPING, SHALL BE PROVIDED WITH THRUST RESTRAINT. SEE DRAWINGS AND SPECIFICATIONS FOR MORE INFORMATION.
8. NUMBER AND LOCATION OF UNIONS SHOWN ON DRAWINGS ARE APPROXIMATE. PROVIDE UNIONS NECESSARY TO FACILITATE CONVENIENT REMOVAL OF VALVES AND MECHANICAL EQUIPMENT.
9. WHERE A GROOVED END COUPLING IS SHOWN, IT SHALL BE THE RIGID JOINT TYPE. WHERE A FLANGED COUPLING ADAPTER IS SHOWN, A STANDARD FLANGE SHALL BE USED TO JOIN THE COUPLING ADAPTER.
10. SYMBOLS SHOWN ARE GENERIC. REFER TO THE CONTRACT DOCUMENTS FOR SPECIFIC END CONNECTIONS FOR PIPE AND FITTINGS.

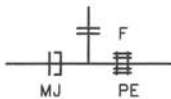
**VALVE DESIGNATIONS**



**PIPING DESIGNATION**



**PIPE AND FITTING END PATTERNS**



**PLUMBING FIXTURE IDENTIFICATION**




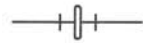


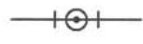
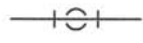
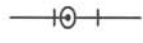


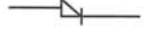

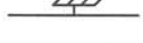

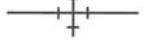
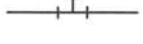

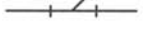

DRAWN BY: <i>MCMILLEN</i>
CHKD BY: <i>K ROSS/kr</i>
APPD BY: <i>Steph C. Rem</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**01030  
MECHANICAL NOTES  
AND LEGENDS**

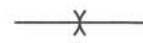
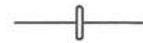
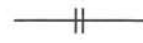
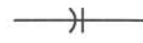

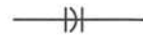

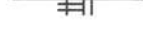

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# PIPE AND FITTING SYMBOLS


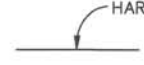

## SINGLE LINE

	STEEL BELLOWS EXP JOINT
	ELASTOMER BELLOWS EXP JOINT
	ELBOW UP
	ELBOW DOWN
	TEE UP
	TEE DOWN
	LATERAL UP
	LATERAL DOWN
	CONCENTRIC REDUCER
	ECCENTRIC REDUCER
	CAP
	ANCHOR
	ELBOW, 90°
	CROSS
	TEE
	ELBOW, 45°
	LATERAL
	BLIND FLANGE





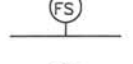
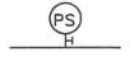

## SINGLE LINE

	WELDED JOINT
	GROOVED END JOINT
	FLANGED JOINT
	MECHANICAL RESTRAINED JOINT
	PUSH-ON JOINT
	BALL JOINT
	GROOVED END ADAPTER FLANGE
	FLANGED COUPLING ADAPTER (SEE 01030 GENERAL PIPING NOTE 5)
	FLEXIBLE COUPLING (SEE 01030 GENERAL PIPING NOTE 5)

## PLANT AIR LEGEND

	AIR PURGE SET
	HARD Cu COPPER TUBING
	INSTRUMENT AIR

## MISCELLANEOUS PIPING SYMBOLS

	GAUGE WITH OUTLET
	THERMOMETER
	PIPE ALIGNMENT GUIDE
	GAUGE GLASS WITH OUTLET
	FLOW SWITCH
	PRESSURE SWITCH
	XX AIR SET XX = SUPPLY PRESSURE - PSIG

DRAWN BY: *MCMILLEN*

CHKD BY: *K ROSS/KRP*

APPD BY: *Steph C. Pen*

ORIGINATION DATE: *JANUARY 2017*

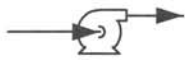
REVISION DATE:

## 01031 MECHANICAL LEGEND

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## PUMP AND COMPRESSOR SYMBOLS



HORIZONTAL PUMP  
(DRY PIT)



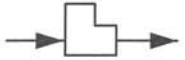
PISTON PUMP



VERTICAL PUMP  
(WET PIT)



PROGRESSING  
CAVITY PUMP



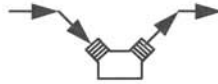
CHEMICAL FEED PUMP  
(METERING)



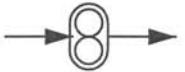
SUBMERSIBLE  
SUMP PUMP



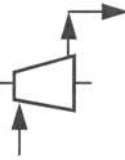
DIAPHRAGM PUMP



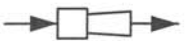
COMPRESSOR  
(PISTON)



GEAR PUMP OR BLOWER  
(POSITIVE DISPLACEMENT)



COMPRESSOR  
(CENTRIFUGAL)  
OR BLOWER



EJECTOR



PERISTALTIC HOSE PUMP  
(POSITIVE DISPLACEMENT)

DRAWN BY: *MCMILLEN*

CHKD BY: *K ROSS/VLR*

APPD BY: *Stephen C. Kern*

ORIGINATION DATE: *JANUARY 2017*

REVISION DATE:

### 01032 MECHANICAL LEGEND

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## HEATING, VENTILATING, AND AIR CONDITIONING SYMBOLS

	WALL REGISTER OR GRILLE (SUPPLY) SG
	CEILING DIFFUSER OR REGISTER (SUPPLY) CD, CR
	CEILING REGISTER OR GRILLE (RETURN AND EXHAUST) CG, CR
	WALL REGISTER OR GRILLE (RETURN AND EXHAUST) RG
	FG FLOOR GRILLE (SUPPLY AND RETURN)
	TURNING VANES
	EXTRACTOR VANES
	SOUND ATTENUATED DUCT
	FD FIRE DAMPER
	SPLITTER DAMPER
	MANUAL OPPOSED-BLADE DAMPER
	MOTORIZED DAMPER
	SD SMOKE DAMPER
	FLEXIBLE CONNECTION
	FLEXIBLE DUCTWORK
	R INCLINED RISE IN DUCT
	D INCLINED DROP IN DUCT
	SUPPLY DUCT (SECTION)
	INTAKE, RETURN, OR EXHAUST DUCT (SECTION)
	TEMPERATURE SENSOR
	THERMOSTAT
	CARBON MONOXIDE SENSOR

## HEATING, VENTILATING, AND AIR CONDITIONING SYMBOLS

	HUMIDISTAT
	ENVIRONMENTAL CONTROL PANEL
	VIBRATION ELIMINATOR
(200)	200 ACFM (AIRFLOW AT ACTUAL ELEV)
	MOTORIZED VALVE
	BOD EL-XX BOTTOM OF DUCT ELEVATION

## BUILDING SERVICES SYMBOLS

	PRESSURE SWITCH
	HOSE RACK (TYPE AS INDICATED)
	FIRE EXTINGUISHER X = NO IN SPECS
	X = F - FLOOR CLEANOUT D - DECK CLEANOUT W - WALL CLEANOUT
	HUB DRAIN X - NO IN SPECS Y-T WITH TRAP Y-P WITH PRIMED TRAP
	FLOOR DRAIN X - NO IN SPECS Y - T WITH TRAP Y - P WITH PRIMED TRAP
	OVERFLOW DRAIN X = NO IN SPECS
	ROOF DRAIN X = NO IN SPECS
	WATER HAMMER ARRESTOR
	BACKFLOW PREVENTER

DRAWN BY: MCMILLEN

CHKD BY: K ROSS/KUR

APPD BY: Stephen C. Rem

ORIGINATION DATE: JANUARY 2017

REVISION DATE:

## 01033 MECHANICAL LEGEND

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**NOTES:**

1. SEE DRAWINGS FOR ADDITIONAL LEGENDS, SYMBOLS AND ABBREVIATIONS USED.
2. DEVICES SHOWN IN LCP, MCC, ECP SHALL BE MOUNTED IN THE ENCLOSURE INTERIOR.
3. RELAYS AND CONTACTORS SHALL BE PROVIDED AND INSTALLED WITH SURGE PROTECTION ACROSS THE COILS.
4. THE NUMBER OF AUXILIARY CONTACTS INDICATED FOR RELAYS, CONTACTORS, SWITCHES AND DEVICES ARE THE MINIMUM ACCEPTABLE NUMBER.
5. INDICATING LIGHTS SHALL BE PUSH-TO-TEST TYPE. CONSTANT POWER SHALL BE CONNECTED TO THE PUSH-TO-TEST TERMINAL WHETHER INDICATED OR NOT.
6. PROVIDE AND INSTALL ELECTRICAL, INSTRUMENTATION AND CONTROLS, COMPLETE WITH DEVICES AND ASSOCIATED CIRCUITRY NECESSARY TO PERFORM THE INTENDED FUNCTIONS OF THE CONTRACT DOCUMENTS. ANY MATERIALS, DEVICES AND CIRCUITRY NOT SPECIFICALLY INDICATED BUT NECESSARY TO PERFORM INTENDED FUNCTIONS AND CORRECT OPERATION SHALL BE PROVIDED AND INSTALLED.
7. EQUIPMENT, DEVICE, GROUND AND RACEWAY SYSTEM LOCATIONS, DIMENSIONS, PLANS AND ELEVATIONS INDICATED ARE APPROXIMATE. USE ACTUAL EQUIPMENT FOR INSTALLATION. COORDINATE EXACT LOCATIONS WITH THE CIVIL, STRUCTURAL AND MECHANICAL WORK, AS WELL AS THE EQUIPMENT MANUFACTURERS, ENGINEER AND OTHER TRADES.
8. NOT ALL INTERFERENCES, UNDERGROUND UTILITIES ARE SHOWN ON THE DRAWINGS. LOCATE ALL INTERFERENCES AND UNDERGROUND UTILITIES TO ROUTE RACEWAYS ACCORDINGLY.
9. PACKAGE PROVIDED EQUIPMENT MAY REQUIRE ADDITIONAL DEVICES, CONDUITS AND CONDUCTORS FOR PROPER OPERATION. PROVIDE AND INSTALL ADDITIONAL CONDUITS, CONDUCTORS AND CABLES REQUIRED BY THE EQUIPMENT MANUFACTURERS TO COMPLETE THE INSTALLATION.
10. OVERCURRENT DEVICE SIZES INDICATED ARE ESTIMATED. PROVIDE AND INSTALL OVERCURRENT DEVICES SIZED AS REQUIRED FOR THE ACTUAL EQUIPMENT RATING. OVERCURRENT DEVICES SIZES SHALL BE APPROVED BY THE ENGINEER.
11. INSTALLATION DRAWING DETAILS AND SPECIFICATION REQUIREMENTS ARE REQUIRED WHETHER SPECIFICALLY REFERENCED BY A DETAIL NUMBER OR NOT.
12. CONDUIT TERMINATIONS SHALL BE PROVIDED AND INSTALLED WITH GROUND BUSHINGS AND SHALL BE BONDED TO THE GROUND GRID. THE BONDING CONDUCTOR SHALL BE SOLID #10 AWG, MINIMUM.
13. CONDUIT, RACEWAY, CONDUCTOR AND CABLE SIZES ARE THE MINIMUM ACCEPTABLE SIZE, CONDUITS SHALL BE CONCEALED.
14. WHERE ONLY HOMERUNS AND CIRCUIT NUMBERS OR SCHEMATIC CONNECTION DIAGRAMS ARE SHOWN, PROVIDE AND INSTALL THE COMPLETE RACEWAY SYSTEM.
15. CONTROLS ARE SHOWN DE-ENERGIZED, CONTROL DIAGRAMS SHOW INTENDED CONTROL FUNCTION. INCORPORATE OTHER NECESSARY FUNCTIONS AND DEVICES FOR PROPER OPERATIONS AND PROTECTION OF THE SYSTEMS.
16. COMPONENTS AND PANELS SHOWN WITH A DOUBLE ASTERISK (\*\*) WILL BE PROVIDED BY OTHERS.

DRAWN BY: *MCMILLEN*

CHKD BY: *K ROSS/ KR*

APPD BY: *Stephen C. Row*

ORIGINATION DATE: *JANUARY 2017*

REVISION DATE:


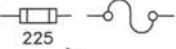
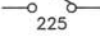
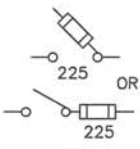






















**01040  
ELECTRICAL,  
INSTRUMENTATION AND  
CONTROL NOTES**



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



















## SYMBOL

## DESCRIPTION





	LOW VOLTAGE CIRCUIT BREAKER - 20 AMPERE, 3 POLE (THERMAL MAGNETIC UNLESS INDICATED OTHERWISE)
	FUSE - RATING INDICATED
	DISCONNECT SWITCH - RATING INDICATED
	FUSED DISCONNECT SWITCH (3 POLE UNLESS INDICATED OTHERWISE)
	POLE MOUNTED CUTOUT WITH FUSIBLE LINK
	FUSED OR NONFUSED DISCONNECT SWITCH 3 POLE FUSED UNLESS INDICATED OTHERWISE
	POWER CIRCUIT BREAKER
	DRAWOUT POWER CIRCUIT BREAKER
	KIRK KEY INTERLOCK
	DISCONNECT (ROLLOUT, ETC)
	TERMINAL POINT (TERMINAL BLOCK OR DEVICE TERMINAL)
	TERMINAL BLOCK/POINT TO INTERFACE WITH "FIELD DEVICES"
	KNIFE-DISCONNECT TERMINAL BLOCK
	DENOTES CABLE NUMBER FOR INTERCONNECTION WIRING
	TERMINAL POINT
	TERMINAL BLOCK
	P - POWER
	C - CONTROL/COMMUNICATIONS
	A - SIGNAL
	NOT CONNECTED
	CONNECTED
	PANEL, TERMINAL BOX, PULL BOX, JUNCTION BOX, ETC
	EQUIPMENT, DEVICE, METER, PROTECTIVE RELAY, ETC.
	MOTOR, SQUIRREL CAGE INDUCTION, HORSEPOWER INDICATED
	LUMINAIRE, SEE SCHEDULE
	EXIT LIGHT

## SYMBOL

## DESCRIPTION

	EXPOSED CONDUIT OR HEAT TAPE SYSTEM
	CONCEALED CONDUIT OR HEAT TAPE SYSTEM
	GROUND CABLE
	GROUND ROD
	GROUND PIGTAIL OR LOOP
	EXOTHERMIC WELD CONNECTION
	* WALL SWITCH: 2-DOUBLE POLE      P-PILOT LIGHT 3-THREE WAY        K-KEY OPERATED 4-FOUR WAY         D-DIMMER WP-WEATHERPROOF
	MANUAL MOTOR STARTER SWITCH, WITH HEATERS
	CONVENIENCE RECEPTACLE - DUPLEX UNLESS SPECIFIED OTHERWISE
	RECEPTACLE - 240V, 1Ø, AMPERAGE INDICATED
	INSTRUMENT, DEVICE, ETC
	VOICE
	DATA JACK
	JUNCTION BOX OR PULL BOX
	STRIP HEATER
	THERMOSTAT
	RELAY
	ELAPSED TIME METER
	FLASHING BEACON
	INDICATING LIGHT - LETTER INDICATES COLOR A - AMBER                      R - RED B - BLUE                        W - WHITE C - CLEAR                       Y - YELLOW G - GREEN SL - SYNCHRONIZING LIGHT
	INDICATING LIGHT, PUSH-TO-TEST, LETTER INDICATES COLOR
	POWER POLE
	GUY WIRE
	LIGHT POLE

## LEVEL SWITCH INDICATOR

	LEVEL SWITCH HIGH HIGH
	LEVEL SWITCH HIGH
	LEVEL SWITCH LOW
	LEVEL SWITCH LOW LOW

DRAWN BY: MCMILLEN

CHKD BY: K ROSS/VLR

APPD BY: Stephen C. Reim

ORIGINATION DATE: JANUARY 2017

REVISION DATE:

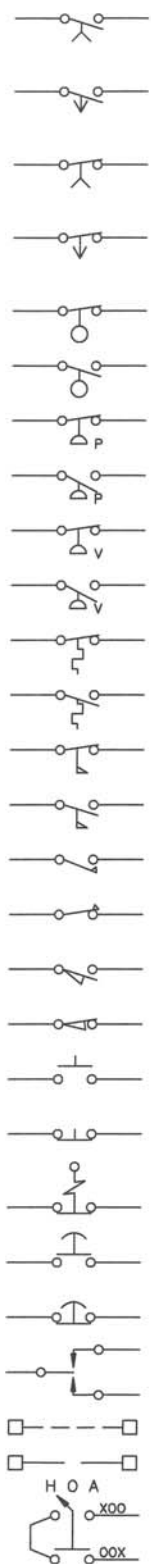
# 01050 ELECTRICAL AND CATHODIC PROTECTION LEGEND

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**SYMBOL**

**DESCRIPTION**



ON TIME DELAY SWITCH  
(NORMALLY OPEN WITH TIME DELAY CLOSING  
AFTER COIL IS ENERGIZED) NOTC

OFF TIME DELAY SWITCH  
(NORMALLY OPEN WITH TIME DELAY OPENING  
AFTER COIL IS DE-ENERGIZED) NOTO

ON TIME DELAY SWITCH  
(NORMALLY CLOSED WITH TIME DELAY  
OPENING AFTER COIL IS ENERGIZED) NCTO

OFF TIME DELAY SWITCH  
(NORMALLY CLOSED WITH TIME DELAY  
CLOSING AFTER COIL IS DE-ENERGIZED) NCTC

FLOAT SWITCH  
(OPENING ON RISING LEVEL)

FLOAT SWITCH  
(CLOSING ON RISING LEVEL)

PRESSURE SWITCH  
(OPENING ON RISING PRESSURE)

PRESSURE SWITCH  
(CLOSING ON RISING PRESSURE)

VACUUM SWITCH  
(OPENING ON RISING PRESSURE)

VACUUM SWITCH  
(CLOSING ON RISING PRESSURE)

TEMPERATURE SWITCH  
(OPENING ON RISING TEMPERATURE)

TEMPERATURE SWITCH  
(CLOSING ON RISING TEMPERATURE)

FLOW ACTUATED SWITCH  
(OPENING ON INCREASE OF FLOW)

FLOW ACTUATED SWITCH  
(CLOSING ON INCREASE OF FLOW)

TORQUE SWITCH  
(NORMALLY OPEN)

TORQUE SWITCH  
(NORMALLY CLOSED)

LIMIT SWITCH  
(NORMALLY OPEN)

LIMIT SWITCH  
(NORMALLY CLOSED)

PUSH-BUTTON SWITCH, MOMENTARY  
CONTACT, NORMALLY OPEN

PUSH-BUTTON SWITCH, MOMENTARY  
CONTACT, NORMALLY CLOSED

EMERGENCY STOP PULL CORD

PUSH BUTTON, MAINTAINED CONTACT,  
MUSHROOM HEAD, NORMALLY CLOSED

PUSH BUTTON, MAINTAINED CONTACT,  
MUSHROOM HEAD, NORMALLY OPEN

3 POSITION SELECTOR SWITCH SPRING  
RETURN TO CENTER

REMOTE OR FIELD DEVICE

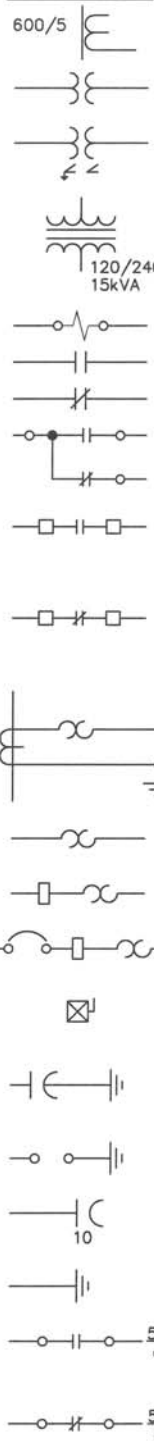
SELECTOR SWITCH - MAINTAINED CONTACT -  
CHART IDENTIFIES OPERATION:

CKT	POSITION		
	HAND	OFF	AUTO
1	X	O	O
2	O	O	X

X - CLOSED CONTACT  
O - OPEN CONTACT

**SYMBOL**

**DESCRIPTION**



600/5  
CURRENT TRANSFORMER  
(600/5 INDICATES RATIO)

POTENTIAL TRANSFORMER

POTENTIAL TRANSFORMER  
WITH DESIGNATORS

TRANSFORMER, SECONDARY VOLTAGES,  
PHASE AND RATING INDICATED AS  
APPLICABLE  
120/240V  
15kVA

SOLENOID COIL OR PROTECTIVE RELAY COIL

CONTACT - NORMALLY OPEN

CONTACT - NORMALLY CLOSED

SIGNAL/CONTROL CIRCUIT SWITCHING RELAYS  
INDICATED BY FORM C CONTACTS

MAGNETIC CONTROL, MACHINE TOOL AND  
INDUSTRIAL RELAYS INDICATED BY MULTIPLE  
SINGLE POLE SINGLE THROW CONTACTS  
(NORMALLY OPEN)

MAGNETIC CONTROL, MACHINE TOOL AND  
INDUSTRIAL RELAYS INDICATED BY MULTIPLE  
SINGLE POLE SINGLE THROW CONTACTS  
(NORMALLY CLOSED)

SOLID STATE OVERLOAD

OVERLOAD RELAY HEATER

MAGNETIC STARTER

COMBINATION MAGNETIC STARTER

COMBINATION MAGNETIC STARTER

SURGE CAPACITOR

LIGHTNING ARRESTOR

CAPACITOR - kVAR INDICATED  
10

GROUND

CIRCUIT BREAKER  
NORMALLY OPEN "a" CONTACT  
(OPEN WHEN 52 BREAKER IS OPEN)

CIRCUIT BREAKER  
NORMALLY CLOSED "b" CONTACT  
(CLOSED WHEN 52 BREAKER IS OPEN)

DRAWN BY: MCMILLEN

CHKD BY: K ROSS/KLR

APPD BY: Stephen C. Penner

ORIGINATION DATE: JANUARY 2017



















REVISION DATE:

01051  
ELECTRICAL AND CATHODIC  
PROTECTION LEGEND




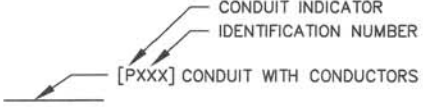
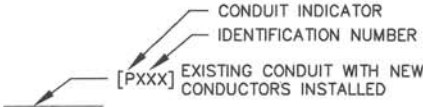







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**SYMBOL    DESCRIPTION**

	PRESSURE SENSING LOOP
	TURBINE
	GENERATOR
	TEST BLOCK OR SHORTING TEST BLOCK
	KEYPAD
	SECURITY DOOR INTER LOCK (DETECTION)
	PHOTOELECTRIC SMOKE DETECTOR
	HEAT DETECTOR
	ION DUCT DETECTOR
	PHOTO DUCT DETECTOR
	MANUAL PULL STATION
	HORN/STROBE (WALL MOUNT)
	HORN/STROBE (CEILING MOUNT)
	RESISTOR
	DIODE
	LIGHT EMITTING DIODE
	METAL OXIDE VARISTOR
	BATTERY

**SYMBOL    DESCRIPTION**

	HORN
	INDICATES EQUIPMENT LOCATED ON THE ROOF
	MECHANICAL EQUIPMENT TAG, REFER TO SCHEDULE
	CONDUIT INDICATOR IDENTIFICATION NUMBER [PXXX] CONDUIT WITH CONDUCTORS
	CONDUIT INDICATOR IDENTIFICATION NUMBER [PXXX] EXISTING CONDUIT WITH NEW CONDUCTORS INSTALLED
	ANODE
T_XXXX	TEST STATION IDENTIFICATION NUMBER
	REFERENCE ELECTRODE
	COUPON
	TEST STATION
	AT GRADE TEST STATION
—CP—	CATHODIC PROTECTION

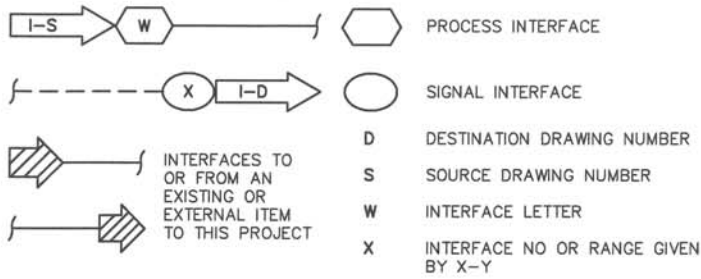
DRAWN BY: MCMILLEN
CHKD BY: K ROSS/VLR
APPD BY: Stephen C. Rem
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**01052  
ELECTRICAL AND CATHODIC  
PROTECTION LEGEND**

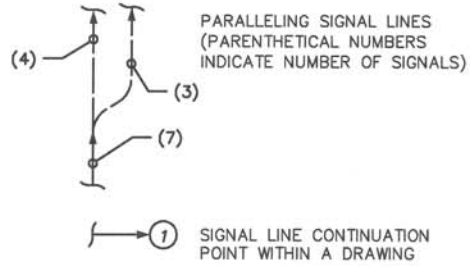
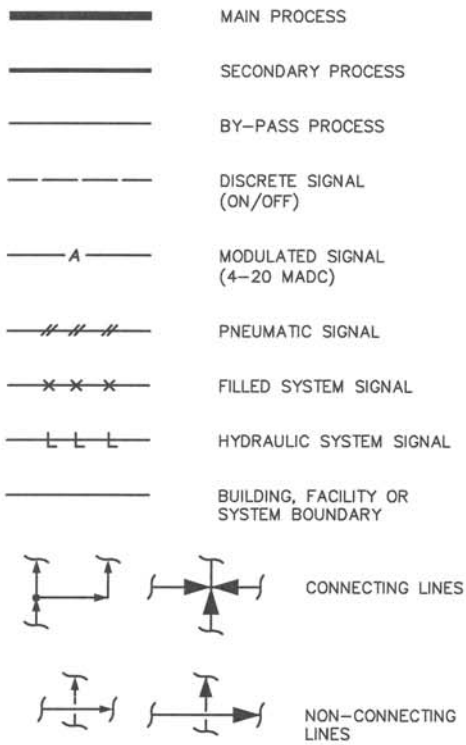
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## INTERFACE SYMBOLS



## LINE LEGEND



DRAWN BY: *MCMILLEN*

CHKD BY: *K ROSS/KLR*

APPD BY: *Steph C. Ren*

ORIGINATION DATE: JANUARY 2017

REVISION DATE:

# 01060 INSTRUMENTATION AND CONTROL LEGEND

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## PRIMARY ELEMENT SYMBOLS

	ORIFICE PLATE
	FLOW TUBE/FLUME
	PITOT-STATIC
	PROPELLER OR TURBINE METER
	ELECTROMAGNETIC FLOWMETER
	ULTRASONIC FLOWMETER
	CORIOLIS MASS FLOWMETER
	DENSITY METER X: N= NUCLEAR O= OPTICAL U= ULTRASONIC
	SWIRL FLOWMETER
	LEVEL (FLOAT)
	LEVEL (ULTRASONIC)
	LEVEL (ROTARY PADDLE)

## MISCELLANEOUS SYMBOLS

	DIAPHRAGM SEAL
	ANNULAR DIAPHRAGM SEAL
	PIG INSERT POINT
	PIG CATCH POINT
	MIXER
	ELECTRIC MOTOR
	AIR GAP
	VENT TO ATMOSPHERE
	CALIBRATION COLUMN
	AIR SUPPLY
	PURGE POINT X: W = WATER A = AIR
	SEAL WATER
	FLUSHING CONNECTION
	LOAD CELL OR STRAIN GAUGE
	PULSATION DAMPENERS
	POWER SUPPLY INPUT

## EQUIPMENT TAG NUMBERS

VVWW-XX-ZZ

VV	UNIT PROCESS NUMBER
WW	LOOP NUMBER
-XX	TRAIN/UNIT NUMBER
-ZZ	MULTIPLE UNIT NUMBER

DRAWN BY: MCMILLEN

CHKD BY: K ROSS/KR

APPD BY: Stephen C. Penn

ORIGINATION DATE: JANUARY 2017

REVISION DATE:

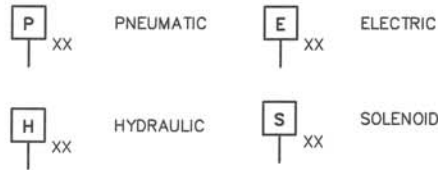
## 01061 INSTRUMENTATION AND CONTROL LEGEND

**DENVER WATER**

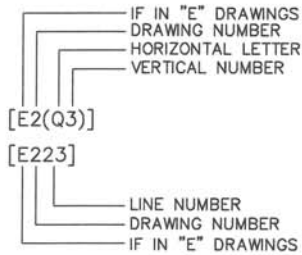
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# ACTUATOR SYMBOLS

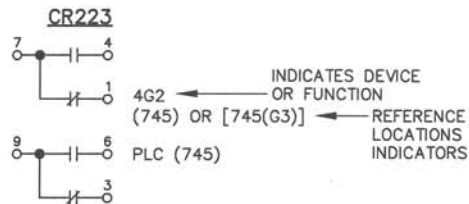
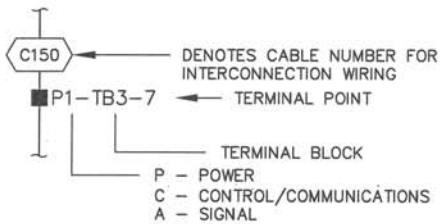
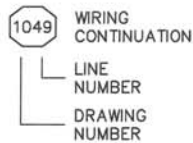
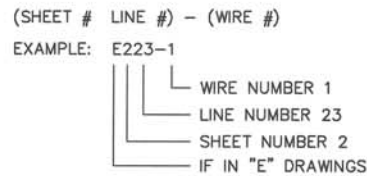
XX DENOTES: FO = FAIL OPEN  
 FC = FAIL CLOSED  
 FLP = FAIL TO LAST POSITION



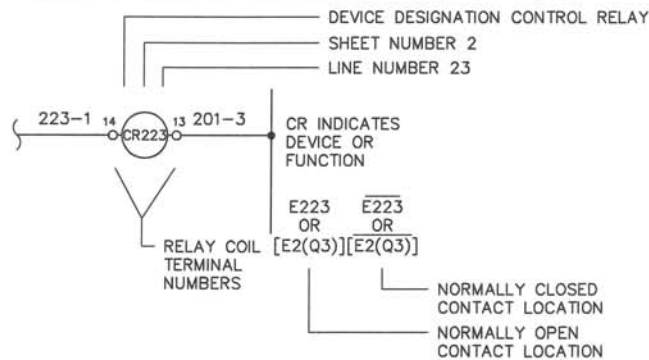
## DRAWING LOCATION INDICATOR



## WIRE NUMBERING INDICATOR



## DEVICE NUMBERING CONVENTION



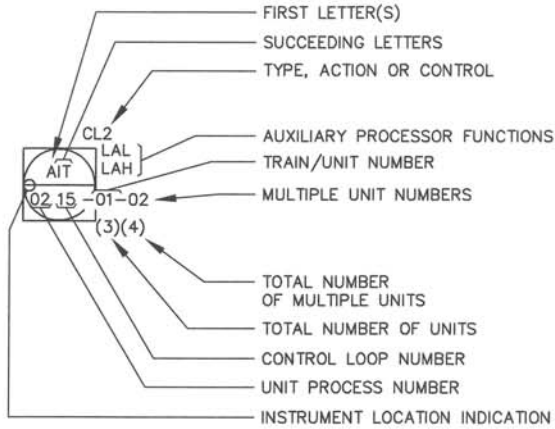
DRAWN BY: MCMILLEN  
 CHKD BY: K ROSS/ KLR  
 APPD BY: Stephen C. Ren  
 ORIGINATION DATE: JANUARY 2017  
 REVISION DATE:

01062  
 INSTRUMENTATION AND  
 CONTROL LEGEND

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## P&ID/I&C IDENTIFICATION



- FIELD MOUNTED INSTRUMENT
- REAR-OF-PANEL MOUNTED INSTRUMENT
- PANEL MOUNTED INSTRUMENT
- HARD-WIRED CONTROL LOGIC INTERLOCK & PERMISSIVES
- HARD-WIRED CONTROL LOGIC
- LOGIC CONTROL INTEGRAL TO THE SOFTWARE (NOT ACCESSIBLE TO THE OPERATOR)
- LOGIC CONTROL INTEGRAL TO THE SOFTWARE (FUNCTION OPERATOR ACCESSIBLE)
- CONTROL OR DISPLAY FUNCTION VIA SOFTWARE (FUNCTION NOT NORMALLY ACCESSIBLE TO THE OPERATOR)
- CONTROL OR DISPLAY FUNCTION VIA SOFTWARE (FUNCTION OPERATOR ACCESSIBLE)

## INTERNATIONAL SOCIETY OF AUTOMATION (ISA) TABLE

LETTER	FIRST LETTER(S)		SUCCEEDING LETTERS	
	PROCESS OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION MODIFIER
A	ANALYZER		ALARM	
B	BURNER		USERS CHOICE (*)	USERS CHOICE (*)
C	CONDUCTIVITY			CONTROL
D	DENSITY, DISCHARGE	DIFFERENTIAL		
E	VOLTAGE		PRIMARY ELEMENT	
F	FLOW RATE	RATIO		
G	GAUGE		GLASS	GATE
H	HAND (MANUAL)			HIGH
I	CURRENT		INDICATE	
J	POWER	SCAN		
K	TIME OR SCHEDULE			CONTROL STATION
L	LEVEL		LIGHT (PILOT)	LOW
M	MOTION			MIDDLE
N	TORQUE		USERS CHOICE (*)	USERS CHOICE (*)
O	USERS CHOICE (*)		ORIFICE	
P	PRESSURE (OR VACUUM)		POINT (TEST CONNECTION)	
Q	QUANTITY OR EVENT (*)	INTEGRATE	INTEGRATE	
R			RECORD OR PRINT	
S	SPEED OR FREQUENCY	SAFETY		SWITCH
T	TEMPERATURE			TRANSMIT
U	MULTIVARIABLE (*)		MULTIFUNCTION (*)	
V	VISCOSITY			VALVE
W	WEIGHT OR FORCE	WELL		
X	UNCLASSIFIED (*)		UNCLASSIFIED (*)	UNCLASSIFIED (*)
Y	USERS CHOICE (*)			RELAY OR COMPUTE (*)
Z	POSITION			DRIVE, ACTUATE OR UNCLASSIFIED FINAL CONTROL ELEMENT

(\*) WHEN USED, EXPLANATION MAY BE SHOWN ADJACENT TO INSTRUMENT SYMBOL. SEE ABBREVIATIONS AND LETTER SYMBOLS.

DRAWN BY: MCMILLEN

CHKD BY: K ROSS/KUR

APPD BY: Stephen C. Reem

ORIGINATION DATE: JANUARY 2017

REVISION DATE:

01070  
ELECTRICAL AND  
INSTRUMENTATION LEGEND

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**DEVICE  
NUMBER**

**FUNCTION**

1	MASTER ELEMENT
2	TIME-DELAY STARTING OR CLOSING RELAY
3	CHECKING OR INTERLOCKING RELAY
4	MASTER CONTACTOR
5	STOPPING DEVICE
6	STARTING CIRCUIT BREAKER
7	RATE-OF-RISE RELAY
8	CONTROL POWER DISCONNECTING DEVICE
9	REVERSING DEVICE
10	UNIT SEQUENCE SWITCH
11	MULTIFUNCTION DEVICE
12	OVERSPEED DEVICE
13	SYNCHRONOUS-SPEED DEVICE
14	UNDERSPEED DEVICE
15	SPEED OR FREQUENCY MATCHING DEVICE
16	RESERVED
17	SHUNTING OR DISCHARGE SWITCH
18	ACCELERATING OR DECELERATING DEVICE
19	STARTING-TO-RUNNING TRANSITION CONTACTOR
20	ELECTRICALLY OPERATED VALVE
21	DISTANCE RELAY
22	EQUALIZER CIRCUIT BREAKER
23	TEMPERATURE CONTROL DEVICE
24	VOLTS PER HERTZ RELAY
25	SYNCHRONIZING OR SYNCHRONISM CHECK DEVICE
26	APPARATUS THERMAL DEVICE
27	UNDERVOLTAGE RELAY
28	FLAME DETECTOR
29	ISOLATING CONTACTOR
30	ANNUNCIATOR RELAY
31	SEPARATE EXCITATION DEVICE
32	DIRECTIONAL POWER RELAY
33	POSITION SWITCH
34	MASTER SEQUENCE DEVICE
35	BRUSH-OPERATING OR SLIP-RING SHORT-CIRCUITING DEVICE
36	POLARITY OR POLARIZING VOLTAGE DEVICE
37	UNDERCURRENT OR UNDERPOWER RELAY
38	BEARING PROTECTIVE DEVICE - THERMAL
39	MECHANICAL CONDITION MONITOR - VIBRATION
40	FIELD RELAY - LOSS OF EXCITATION
41	FIELD CIRCUIT BREAKER
42	RUNNING CIRCUIT BREAKER-GENERATOR BREAKER
43	MANUAL TRANSFER OR SELECTOR DEVICE
44	UNIT SEQUENCE STARTING RELAY
45	ATMOSPHERIC CONDITION MONITOR
46	REVERSE-PHASE OR PHASE-BALANCE CURRENT RELAY (NEG SEQ)
47	PHASE-SEQUENCE OR PHASE-BALANCE VOLTAGE RELAY (NEG SEQ)
48	INCOMPLETE SEQUENCE RELAY
49	MACHINE OR TRANSFORMER THERMAL DEVICE
50	INSTANTANEOUS OVERCURRENT RELAY
51	AC TIME OVERCURRENT RELAY

**DEVICE  
NUMBER**

**FUNCTION**

52	AC CIRCUIT BREAKER
53	EXCITER OR DC GENERATOR RELAY
54	TURNING GEAR ENGAGING DEVICE
55	POWER FACTOR RELAY
56	FIELD APPLICATION RELAY
57	SHORT-CIRCUITING OR GROUNDING DEVICE
58	RECTIFICATION FAILURE RELAY
59	OVERVOLTAGE RELAY
60	VOLTAGE OR CURRENT BALANCE RELAY
61	DENSITY SWITCH OR SENSOR
62	TIME-DELAY STOPPING OR OPENING RELAY
63	PRESSURE SWITCH
64	GROUND PROTECTIVE RELAY
65	GOVERNOR
66	NOTCHING OR JOGGING DEVICE
67	AC DIRECTIONAL OVERCURRENT RELAY
68	BLOCKING RELAY
69	PERMISSIVE CONTROL DEVICE
70	RHEOSTAT
71	LEVEL SWITCH
72	DC CIRCUIT BREAKER
73	LOAD-RESISTOR CONTACTOR
74	ALARM RELAY
75	POSITION CHANGING MECHANISM
76	DC OVERCURRENT RELAY
77	TELEMETERING DEVICE
78	PHASE-ANGLE MEASURING OR OUT-OF-STEP PROTECTIVE RELAY
79	AC RE-CLOSING RELAY
80	FLOW SWITCH
81	FREQUENCY RELAY
82	DC LOAD-MEASURING RE-CLOSING RELAY
83	AUTOMATIC SELECTIVE CONTROL OR TRANSFER RELAY
84	OPERATING MECHANISM
85	CARRIER OR PILOT-WIRE RECEIVER RELAY
86	LOCKOUT RELAY
87	DIFFERENTIAL PROTECTIVE RELAY
88	AUXILIARY MOTOR OR MOTOR GENERATOR
89	LINE SWITCH
90	REGULATING DEVICE
91	VOLTAGE DIRECTIONAL RELAY
92	VOLTAGE AND POWER DIRECTIONAL RELAY
93	FIELD-CHANGING CONTACTOR
94	TRIPPING OR TRIP-FREE RELAY (NON-LOCKOUT)
95	USED ONLY FOR SPECIFIC APPLICATIONS IN INDIVIDUAL INSTALLATIONS WHERE NONE OF THE ASSIGNED NUMBER FUNCTIONS FROM 1 TO 94 ARE SUITABLE. POTENTIAL THROWOVER
96	
97	
98	
99	

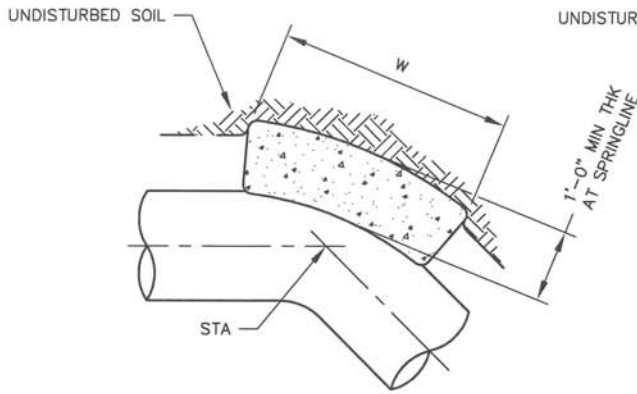
**DEVICE  
SUFFIX LETTERS**

A	AUXILIARY OR AUTOMATIC
BK	BRAKE
C	CONTROLLER
D	DRIVE END
DC	DIRECT CURRENT
F	FIELD GENERATOR
G	GENERATOR
L	LINE
N	NEUTRAL
O	OVER
ODE	OPPOSITE DRIVE END
Q	OIL
SC	SYNC CHECK
T	TRANSFORMER
U	UNDER
V	VOLTAGE

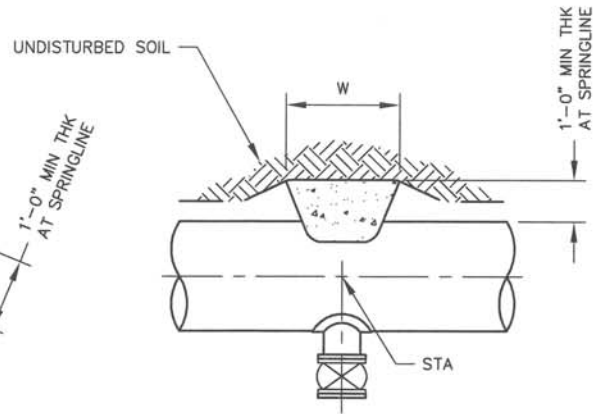
DRAWN BY: <i>MCMILLEN</i>
CHKD BY: <i>K ROSS/KLR</i>
APPD BY: <i>Stephen C. Remm</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**01080  
IEEE STANDARD DEVICE  
IDENTIFICATION**

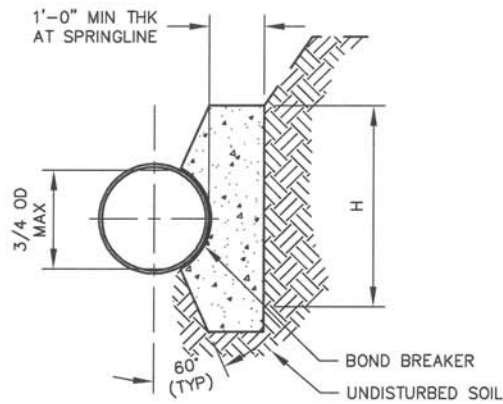
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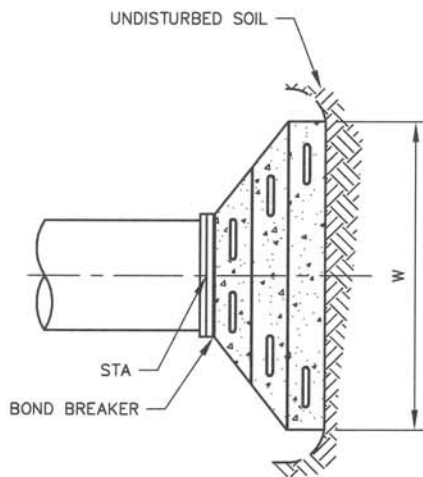
**PLAN-TYPE 1**



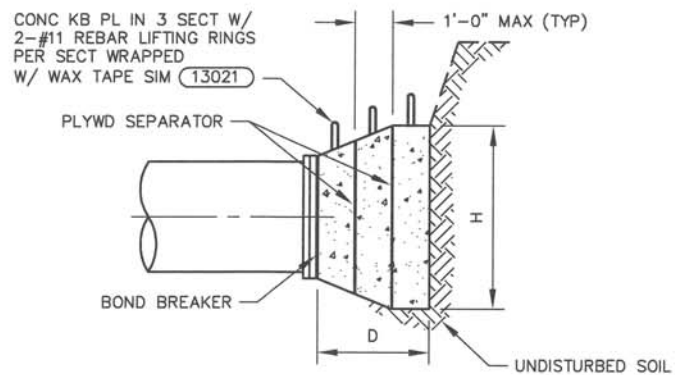
**PLAN-TYPE 2**



**ELEVATION-TYPE 1&2**



**PLAN-TYPE 3**



**ELEVATION-TYPE 3**

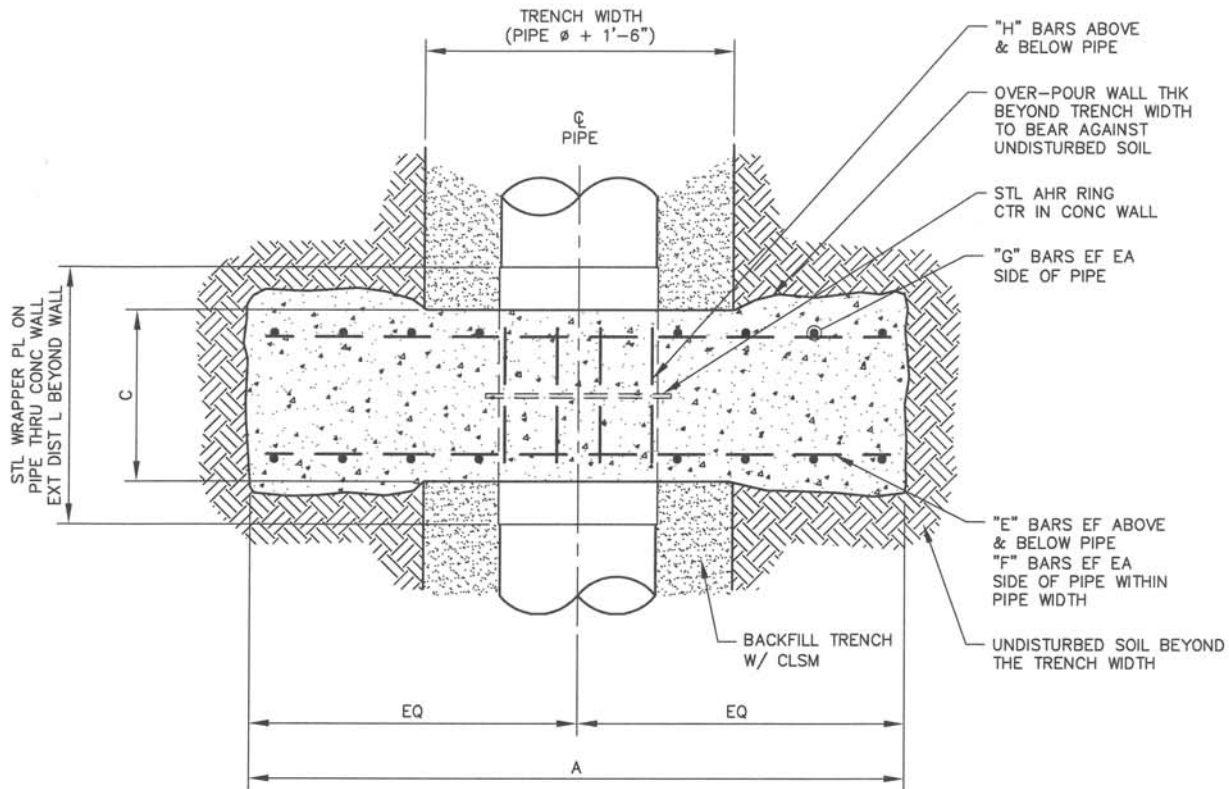
**NOTE:**

SEE DRAWINGS FOR CONCRETE KICKBLOCK DIMENSION TABLE.

DRAWN BY: MCMILLEN
CHKD BY: K ROSS/KUR
APPD BY: Stephen C. Pann
ORIGNATION DATE: JANUARY 2017
REVISION DATE:

**03001  
CONCRETE KICKBLOCKS**

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**PLAN**

(SEE 03003 FOR ELEVATION & TYPICAL SECTION)

PIPE Ø (NOMINAL)	CONCRETE WALL DIMENSIONS			CONCRETE WALL REINFORCEMENT					THICKENED STEEL PIPE AT THRUST WALL (NOTE 1)		STEEL ANCHOR RING		
	WIDTH A	DEPTH B	THK C	"E" BARS	"F" BARS	"G" BARS	"H" BARS	"J" BARS	EXT LENGTH L	MIN TOTAL THK M	HEIGHT N	MIN THK P	MIN WELD SIZE Tw
24"	12'-0"	6'-0"	1'-10"	4-#6	3-#6	7-#6	4-#4	2-#6x6'-0"	7"	1/2"	1 1/2"	1/2"	1/4"
36"	21'-0"	9'-0"	3'-9"	6-#9	4-#9	12-#7	4-#4	3-#6x8'-0"	10"	1"	2"	1"	5/16"

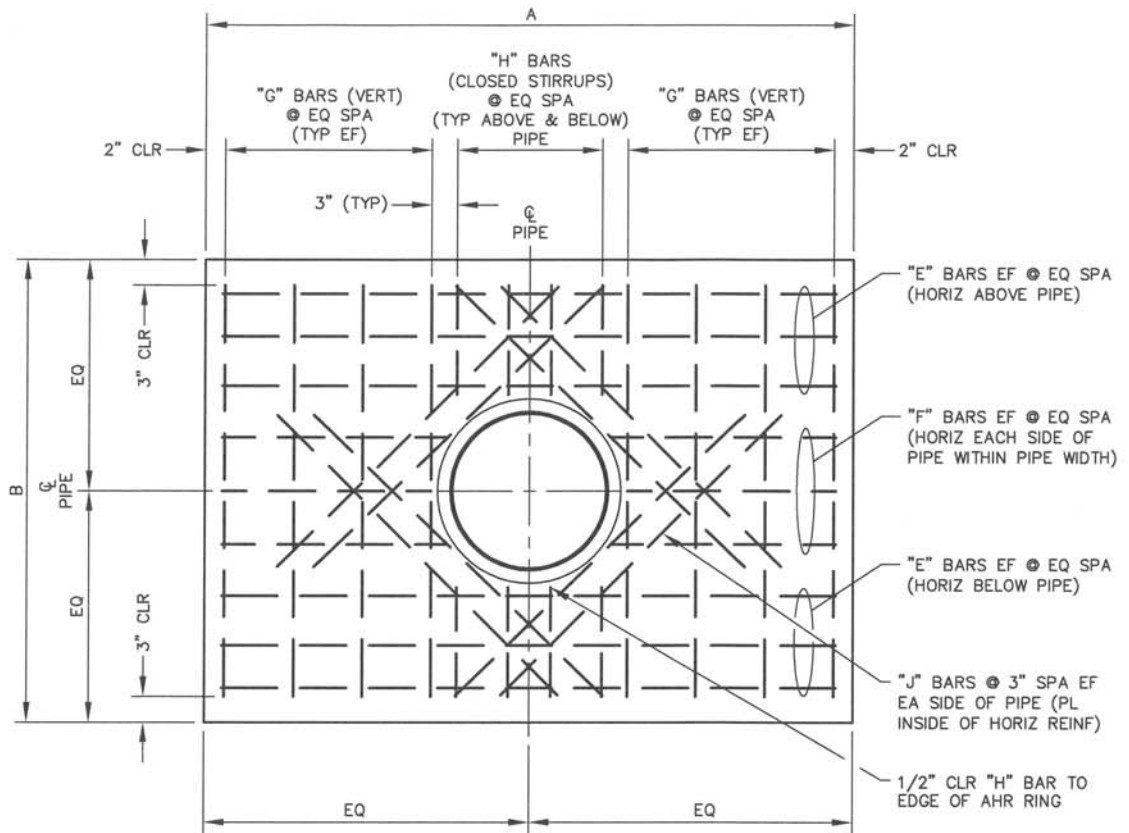
**NOTES:**

1. THE MINIMUM WRAPPER PLATE THICKNESS (TR) SHALL BE DIMENSION (M) LESS THE BASE PIPE THICKNESS (TS). THE FILLET WELD SIZE SHALL BE EQUAL TO THE THINNEST OF THE WRAPPER PLATE (TR) OR (TS).
2. CONCRETE SHALL BE CLASS D STRUCTURAL CONCRETE PER SPECIFICATION 03 30 00.
3. SEE SPECIFICATION 33 11 01.01 FOR STEEL MATERIAL AND WELDING REQUIREMENTS FOR THICKENED PIPE WALLS AND ANCHOR RINGS.
4. DESIGN THRUST PRESSURES = 150PSI + 70PSI WATER HAMMER = 220PSI FOR THE LARGEST PIPE DIAMETER INFLUENCING THE VALVE ADJACENT TO THE THRUST WALL.
5. DESIGN ALLOWABLE PASSIVE BEARING PRESSURES ARE LOCATION SPECIFIC AS PROVIDED IN THE PROJECT GEOTECHNICAL AND ENVIRONMENTAL EVALUATION.
6. FIELD COORDINATE ALL EXISTING UTILITIES AND OBSTRUCTIONS PRIOR TO THRUST WALL EXCAVATION.

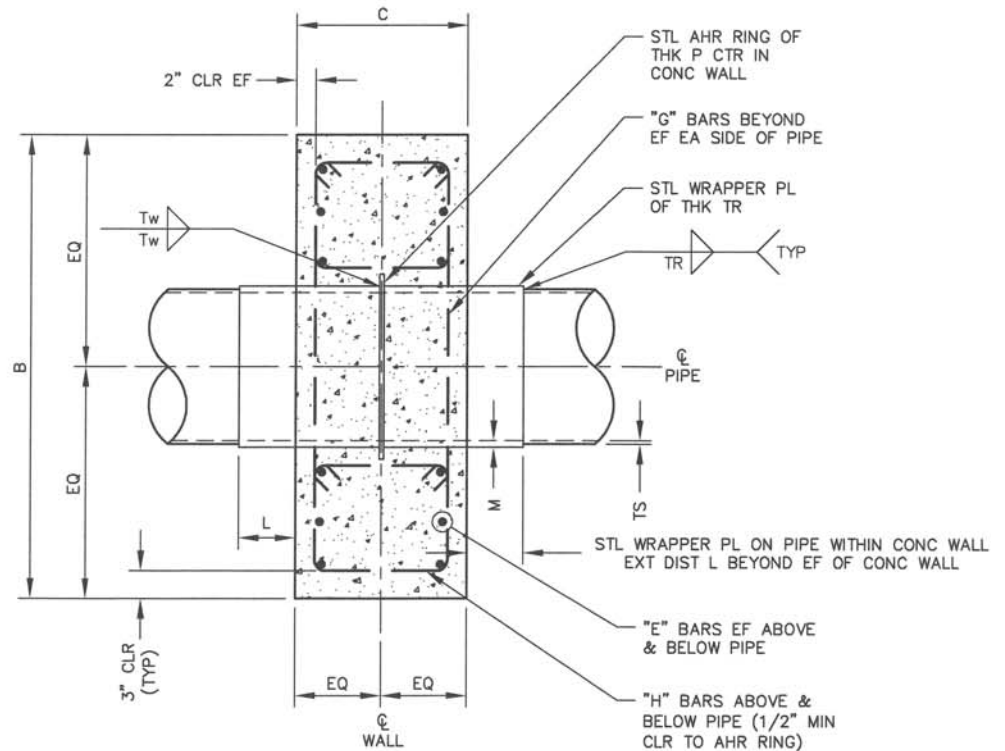
DRAWN BY: ALVARADO
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Ren
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**03002  
THRUST WALL**

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**ELEVATION**



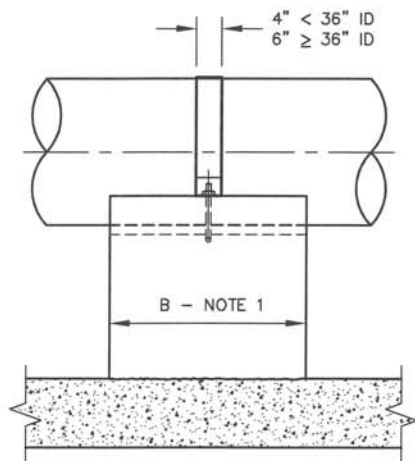
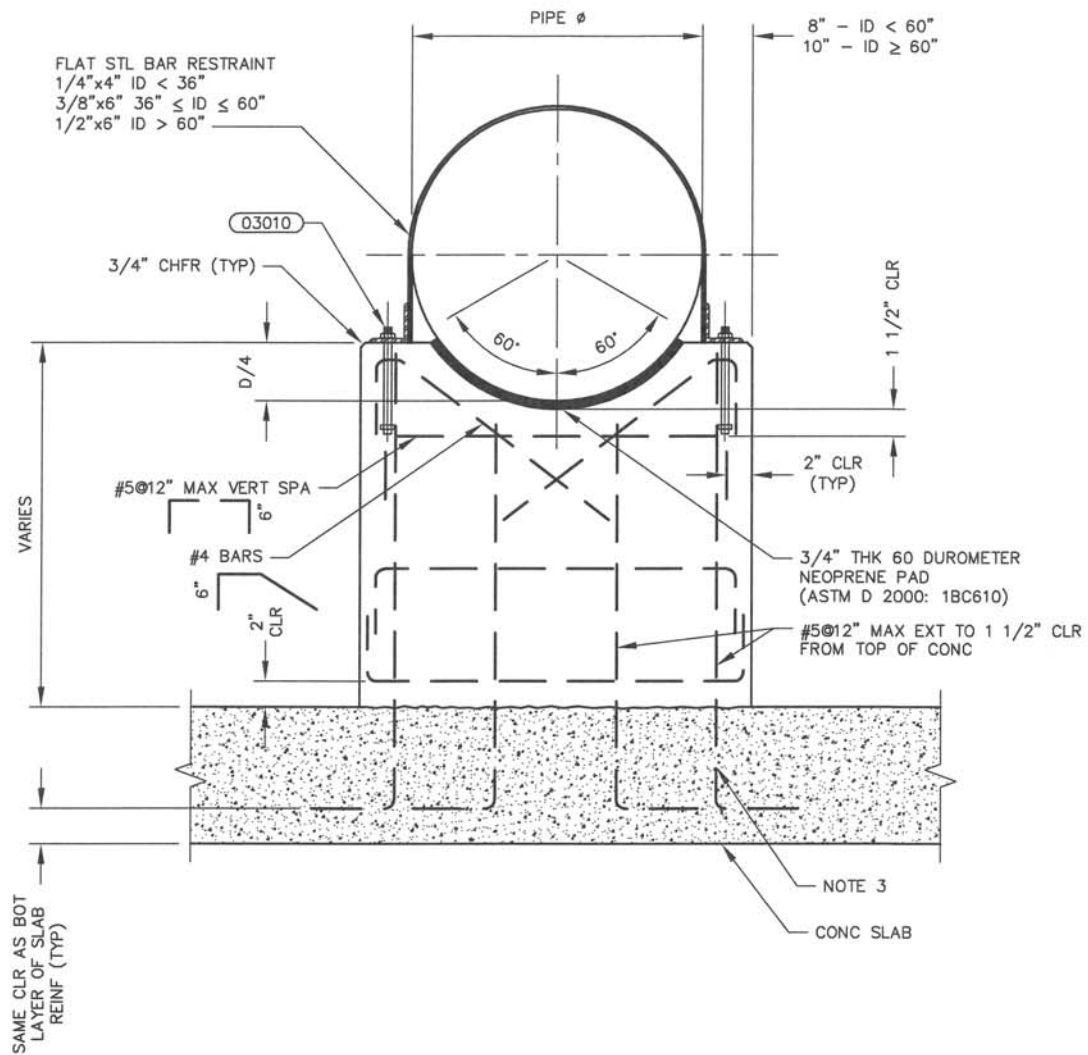
**TYPICAL SECTION**

DRAWN BY: ALVARADO
CHKD BY: K ROSS/KR
APPD BY: <i>Stephen C. Klein</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:


**03003  
THRUST WALL ELEVATION  
AND TYPICAL SECTION**

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**NOTES:**

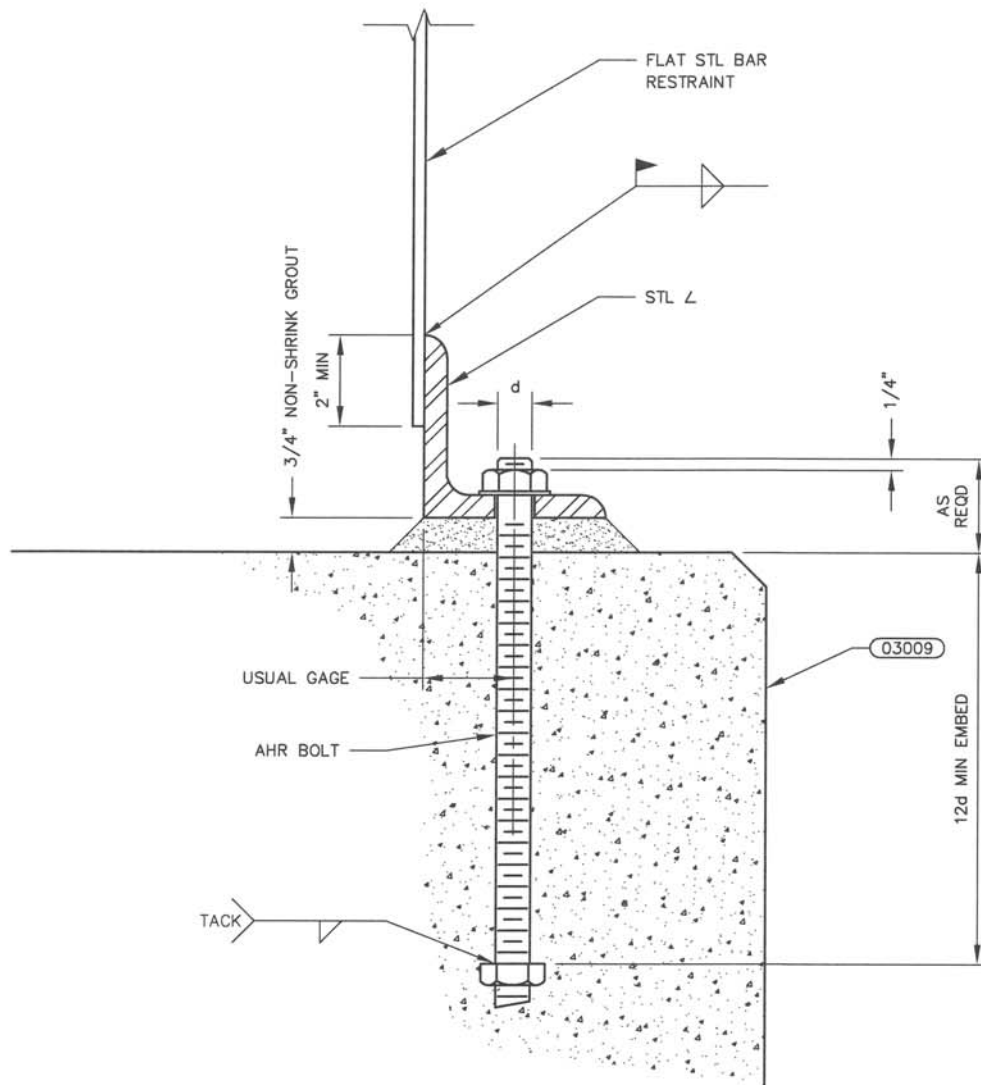
1. B = 8-INCHES WHEN ID < 24-INCHES  
 B = 10-INCHES WHEN 24-INCHES ≤ ID ≤ 42-INCHES  
 B = 12-INCHES WHEN ID > 42-INCHES  
 USE 2 MATS OF REINFORCING.
2. TURN HORIZONTAL BARS 90° TO HOOK AROUND VERTICALS. 
3. ADHESIVE ANCHORED DOWELS MAY BE USED IN EXISTING SLABS.

DRAWN BY: <i>MCMILLEN</i>
CHKD BY: <i>K ROSS/KLR</i>
APPD BY: <i>Steph C. Rem</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**03009  
 CONCRETE PIPE SUPPORT**

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PIPE ID	ANCHOR BOLT $\phi$ , d	ANGLE SIZE, $\angle$
ID $\leq$ 36"	3/4"	4"x4"x1/2" x 0'-5"
36" $\leq$ ID $\leq$ 60"	1"	4"x4"x3/4" x 0'-8"
ID $>$ 60"	1 1/4"	6"x6"x1" x 0'-8"

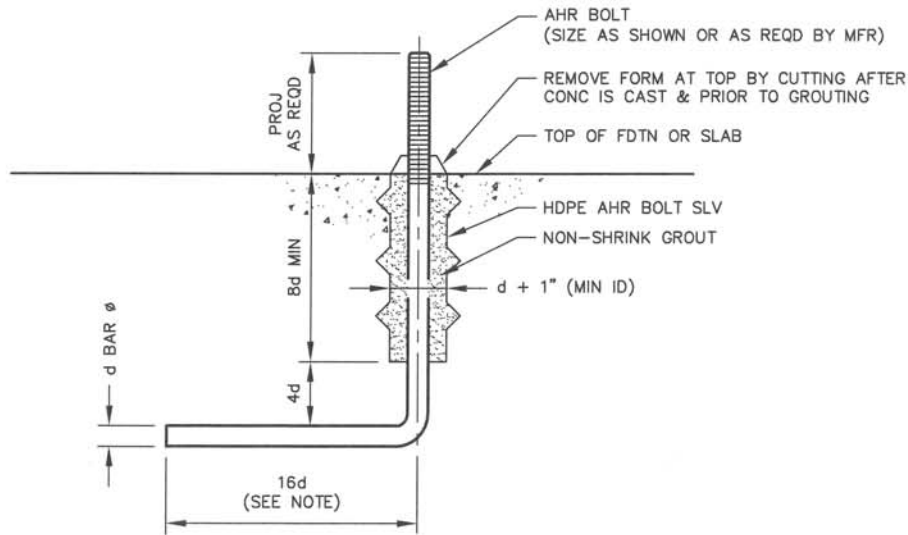
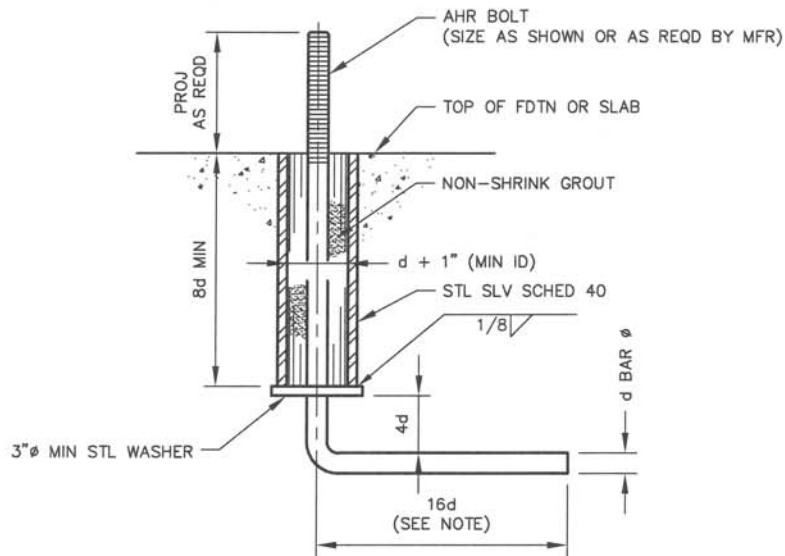
**NOTES:**

1. STEEL FLAT BAR AND STEEL ANGLE SHALL BE ASTM A 36.
2. COAT FLAT BAR AND ANGLE WITH LIQUID EPOXY, 16 MIL DRY FILM THICKNESS IN ACCORDANCE WITH AWWA C210. COLOR AND SHEEN TO MATCH PIPE COATING.

DRAWN BY: MCMILLEN  
 CHKD BY: K ROSS/KLR  
 APPD BY: Stephen C. Reem  
 ORIGINATION DATE: JANUARY 2017  
 REVISION DATE:

**03010  
 FLAT BAR RESTRAINT  
 CONNECTION**

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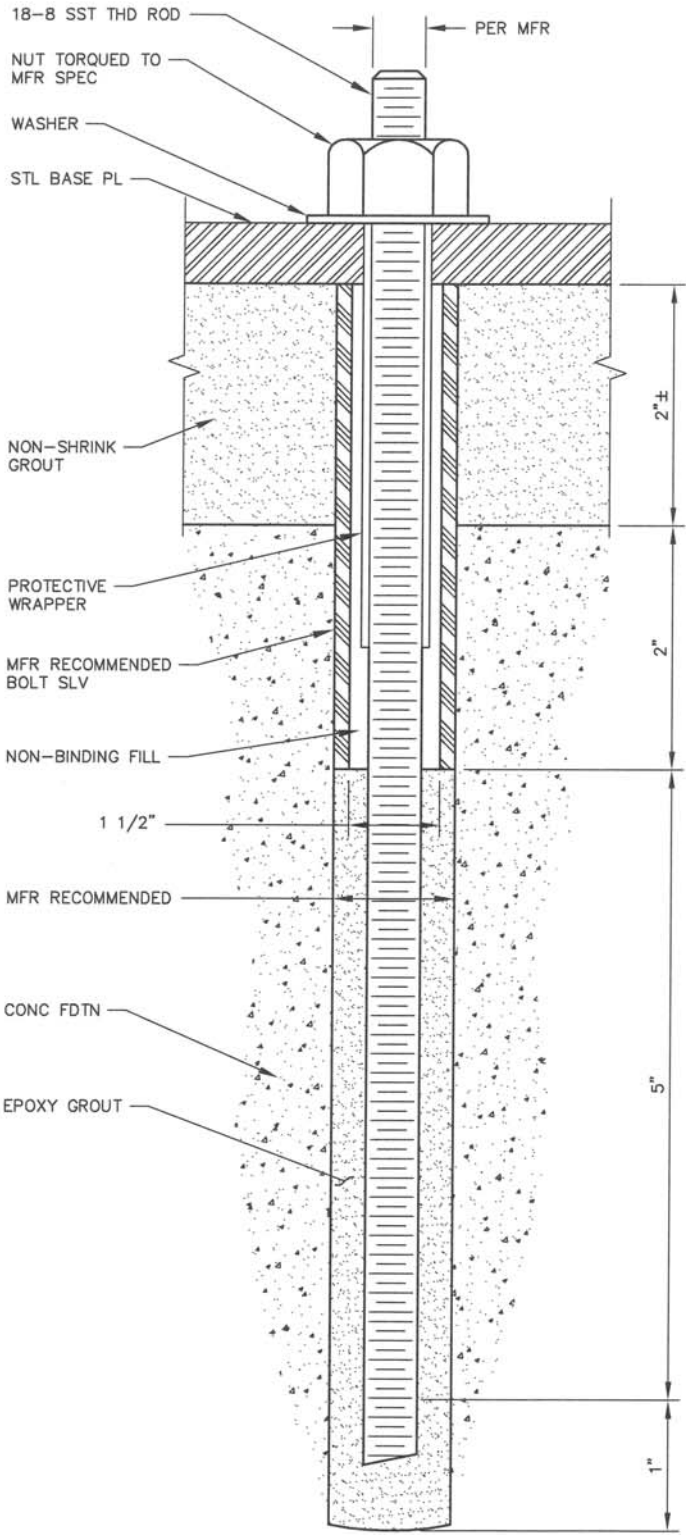
**NOTE:**

3d WHERE EQUIPMENT MANUFACTURER VERIFIES NO BOLT PULLOUT RESISTANCE IS REQUIRED.

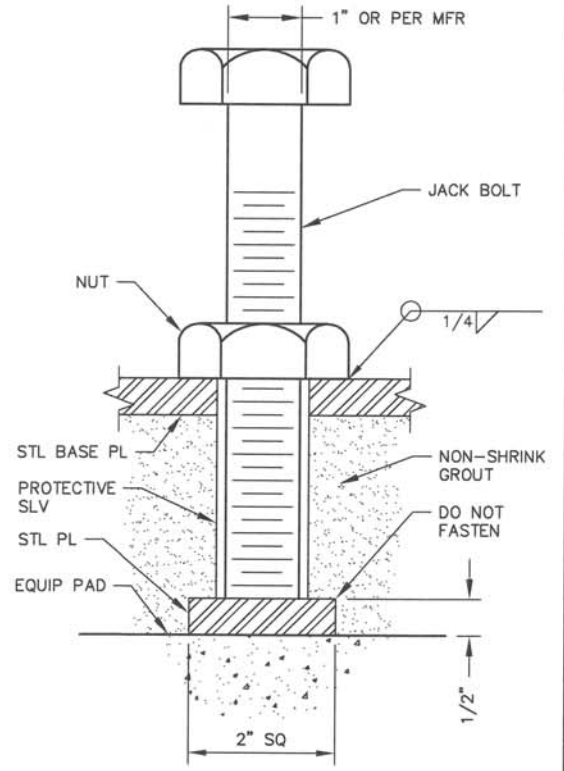
DRAWN BY: <i>MCMILLEN</i>
CHKD BY: <i>K ROSS/KLR</i>
APPD BY: <i>Stephen C. Penn</i>
ORIGINATION DATE: JANUARY 2017
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**03011  
MACHINERY ANCHOR BOLT**

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**EQUIPMENT  
ANCHOR BOLT**



**JACK BOLT**

**NOTE:**

REMOVE JACK BOLT AFTER  
NON-SHRINK GROUT SETS.

DRAWN BY: MCMILLEN
CHKD BY: K ROSS/UR
APPD BY: Stephen C. Remm
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**03012  
EQUIPMENT MOUNT  
INSTALLATION**

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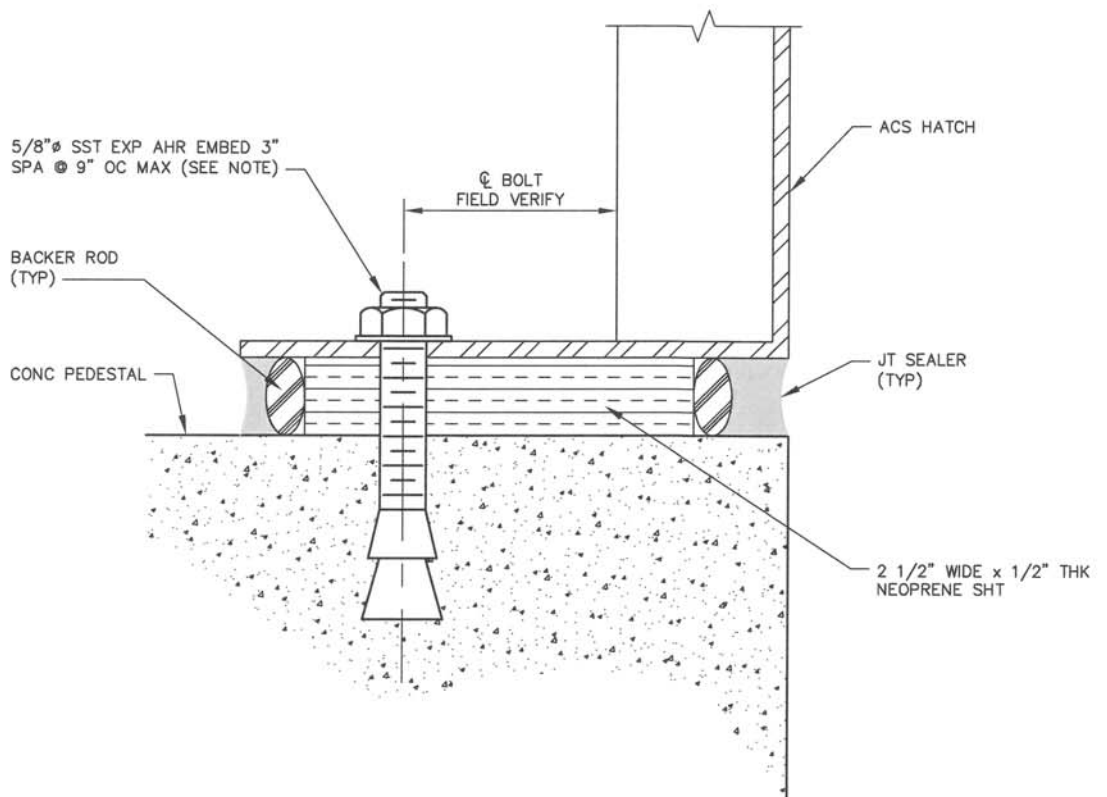
**NOTES:**

1. AFTER CONCRETE EQUIPMENT PAD HAS BEEN BUILT TO SIZE, FINISH ROUGH, OR ROUGHEN UP EXISTING CONCRETE SURFACE WITH SMALL, HAND HELD PNEUMATIC CHIPPER TO PROVIDE BONDING SURFACE FOR NON-SHRINK GROUT. THOROUGHLY CLEAN BEFORE GROUT APPLICATION.
2. CORE DRILL OR BLOCK OUT CONCRETE IN PROPER LOCATIONS FOR ANCHOR BOLTS IN ACCORDANCE WITH MANUFACTURERS INSTRUCTIONS. SET ANCHOR BOLTS IN NON-SHRINK GROUT AS SHOWN ON THE DRAWINGS. PROVIDE RIGID BOLT SLEEVE WITH 1/4-INCH ANNULAR CLEARANCE AROUND BOLT TO PREVENT LEVELING GROUT FROM STICKING TO BOLT AND TO ALLOW FOR PROPER STRETCH OF BOLT DURING TIGHTENING.
3. MOUNT AND LEVEL EQUIPMENT BASE WITH JACKING BOLTS.
  - A. ENSURE THAT PUMP SUCTION AND DISCHARGE LINE UP VERTICALLY AND ANGULARLY WITH PIPING. DOWELS OR BOLTS MAY BE USED FOR INITIAL ALIGNMENT, BUT MUST BE IMMEDIATELY REMOVED AFTER ALIGNMENT TO ALLEVIATE STRESS.
  - B. LEVEL EQUIPMENT BASE WITH A STARRETT 98 MACHINIST'S LEVEL UNTIL A LEVEL OF 0.0005-INCH/FEET IS OBTAINED ON MACHINE SURFACES IN TWO DIRECTIONS 90 DEGREES APART.
  - C. ANCHOR BOLTS CAN BE TEMPORALLY SNUGGED DOWN TO HOLD BASE IN POSITION FOR NON-SHRINK GROUT PLACEMENT.
  - D. PROVIDE DUXSEAL OR CAULKING COMPOUND AND DUCT TAPE AROUND JACKING BOLTS SO THAT REMOVAL CAN BE ATTAINED AFTER NON-SHRINK GROUT SETS.
4. INSTALL REBAR AND BUILD FORMS FOR GROUT PLACEMENT. NON-SHRINK GROUT PLACEMENT SHALL BE A SINGLE CONTINUOUS PLACEMENT. PROVIDE GROUT APPLICATION AND VENT HOLES. ENSURE THAT GROUT WILL FLOW CONTINUOUSLY THROUGH ALL AREAS BY PROVIDING 2-INCH MINIMUM FLOW HOLES THROUGH ANY OBSTRUCTING FRAMEWORK.
5. FILL AREA BETWEEN STEEL BASE AND CONCRETE EQUIPMENT PAD WITH NON-SHRINK GROUT TO JUST BELOW THE LEVEL OF THE HOLD-DOWN BOLTS, ON BOTH THE PUMP AND THE MOTOR.
6. TORQUE DOWN ANCHOR BOLTS AND HOLD-DOWN BOLTS TO MANUFACTURER'S SPECIFICATIONS.
7. PERFORM FINAL LASER ALIGNING TO FACTORY SPECIFICATIONS.

DRAWN BY: <i>MCMILLEN</i>
CHKD BY: <i>K ROSS/KR</i>
APPD BY: <i>Stephen C. Reun</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**03013  
EQUIPMENT MOUNT  
INSTALLATION NOTES**

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**NOTE:**

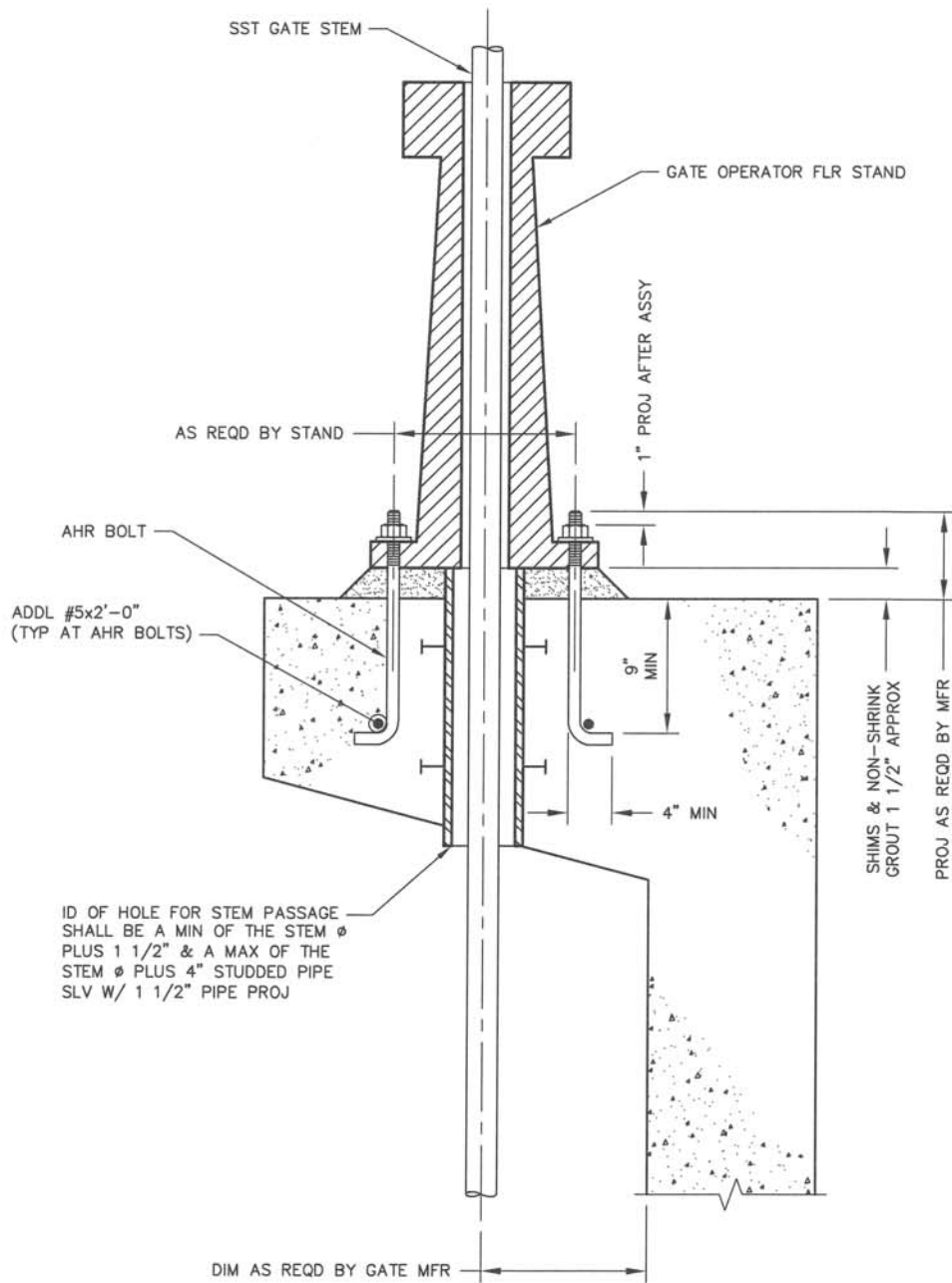
ACCESS HATCH SHALL BE PRE-DRILLED  
FOR CONCRETE ANCHOR INSTALLATION.

DRAWN BY: <i>DITTERLINE</i>
CHKD BY: <i>K ROSS/KUR</i>
APPD BY: <i>Stephen C. Reim</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**03015  
ACCESS HATCH MOUNTING**

**D DENVER WATER**

1600 West 12th Ave  
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F: 303.628.6851  
denverwater.org



ADDL #5x2'-0"  
(TYP AT AHR BOLTS)

AHR BOLT

AS REQD BY STAND

GATE OPERATOR FLR STAND

SST GATE STEM

1" PROJ AFTER ASSY

9" MIN

4" MIN

ID OF HOLE FOR STEM PASSAGE  
SHALL BE A MIN OF THE STEM  $\phi$   
PLUS 1 1/2" & A MAX OF THE  
STEM  $\phi$  PLUS 4" STUDDED PIPE  
SLV W/ 1 1/2" PIPE PROJ

SHIMS & NON-SHRINK  
GROUT 1 1/2" APPROX  
PROJ AS REQD BY MFR

DIM AS REQD BY GATE MFR

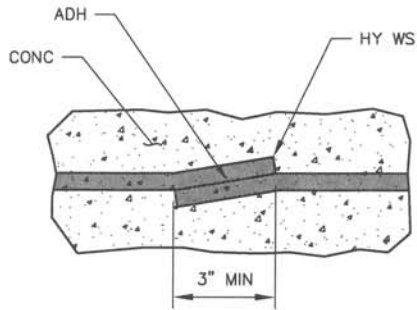
**NOTE:**

FLOOR STAND IS REPRESENTATIVE ONLY.

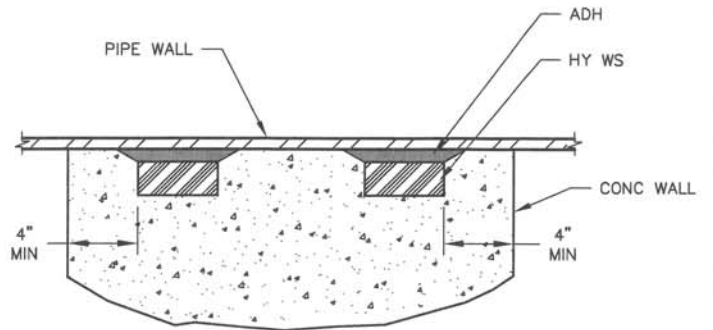
DRAWN BY: <i>MCMILLEN</i>
CHKD BY: <i>K ROSS/KUR</i>
APPD BY: <i>Stephen C. Pean</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**03020  
FLOOR STAND INSTALLATION**

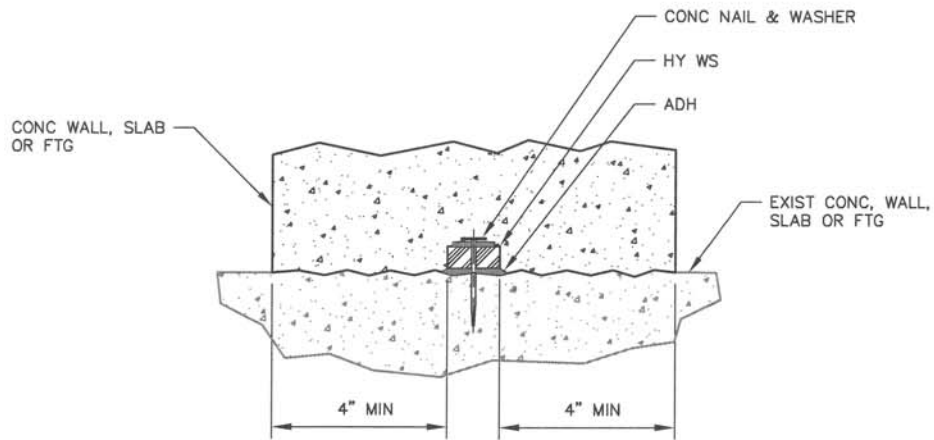
**D DENVER WATER**  
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 F: 303.628.6851  
 denverwater.org



**END OVERLAP**



**PIPE PENETRATION**



**TYPICAL SECTION**

**NOTE:**

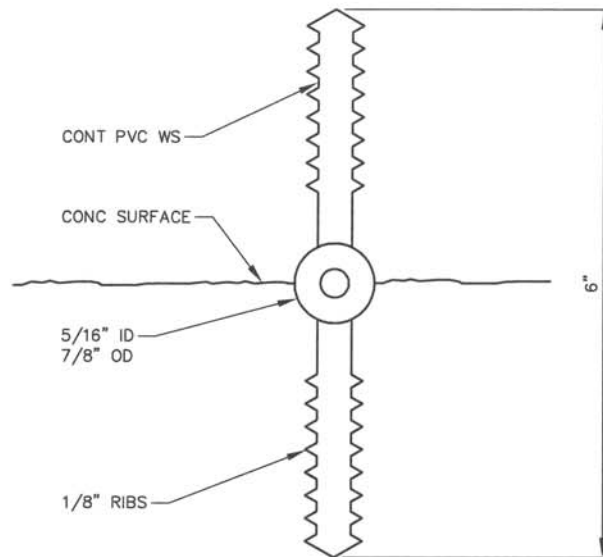
APPLY BEAD OF ADHESIVE TO ENSURE SMOOTH SURFACE.  
 ATTACH HYDROPHILIC WATERSTOP USING CONCRETE NAIL  
 AND WASHER AT INTERVALS OF 10-INCHES TO 12-INCHES.

DRAWN BY: ALVARADO
CHKD BY: K ROSS/KUR
APPD BY: Stephen C. Rem
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**03030**  
**HYDROPHILIC WATERSTOP**

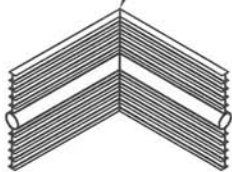
**D DENVER WATER**  
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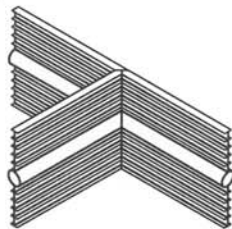


**SECTION**

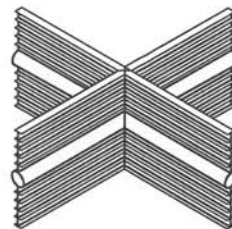
MITER CNR OF VERT JT &  
WELD SIMILAR AS SHOWN  
BELOW FOR FLAT JT



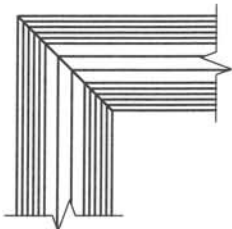
**VERTICAL ELL**



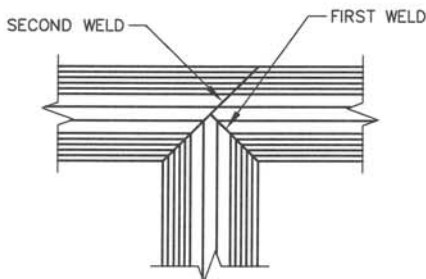
**VERTICAL TEE**



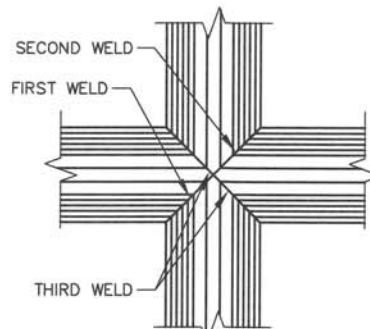
**VERTICAL CROSS**



**FLAT ELL**



**FLAT TEE  
SPLICE DETAIL**



**FLAT CROSS**

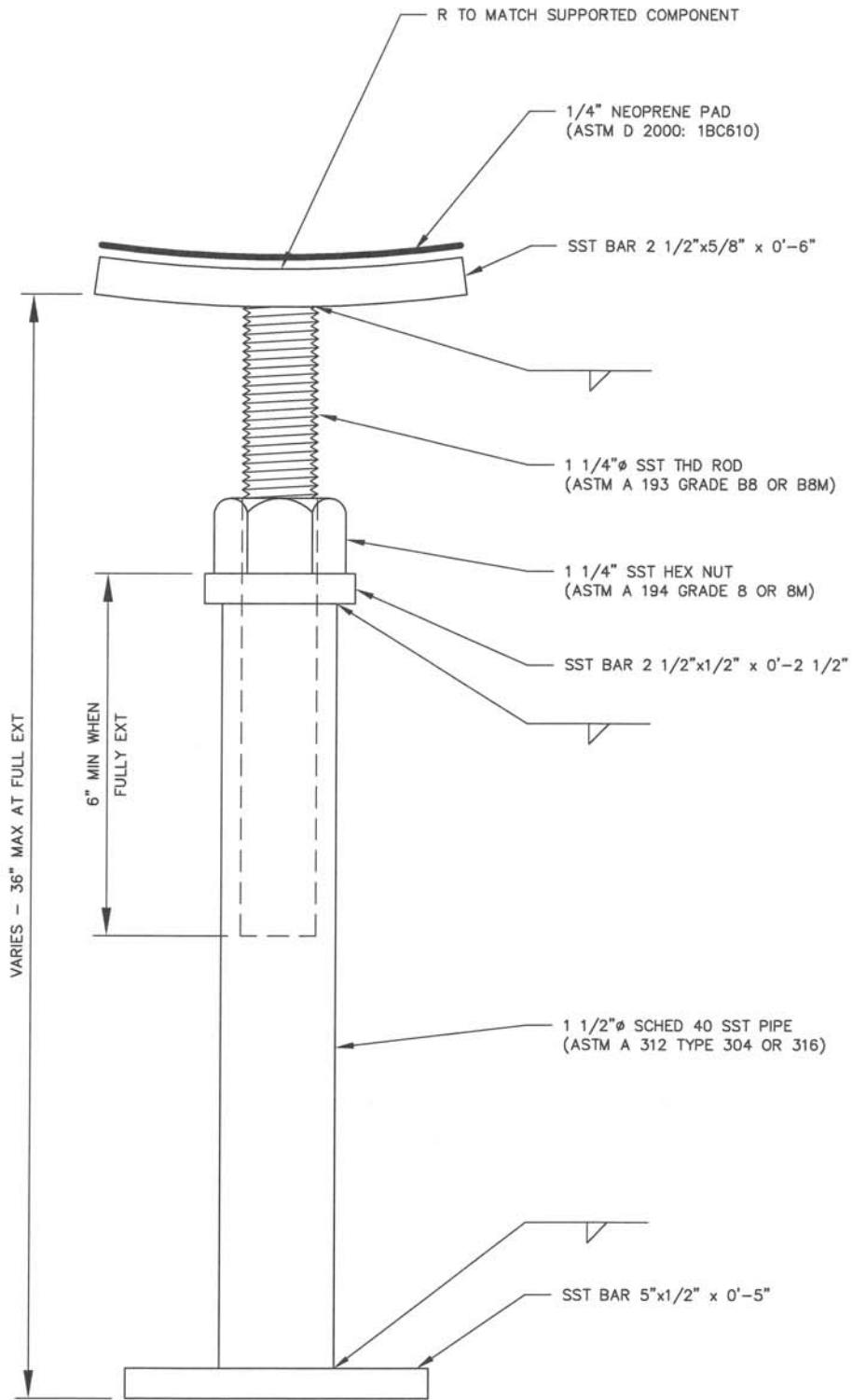
**NOTES:**

1. FIELD WELDS SHALL BE MADE PER WATERSTOP MANUFACTURER'S RECOMMENDATIONS.
2. THE INDICATED 3-D WATERSTOP JOINTS SHALL BE PRE-FABRICATED BY WATERSTOP MANUFACTURER.
3. WATERSTOPS SHALL BE MADE CONTINUOUS BY SPLICING AND CONNECTING TO OTHER WATERSTOPS AS SHOWN ON THE DRAWINGS.
4. SEE JOINT NOTES AND SPECIFICATIONS FOR REQUIRED LOCATIONS.

DRAWN BY: <i>MCMILLEN</i>
CHKD BY: <i>K ROSS/KLR</i>
APPD BY: <i>Stephen C. Paine</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**03031**  
**6" PVC CENTER BULB**  
**WATERSTOP**

**D DENVER WATER**  
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**NOTE:**

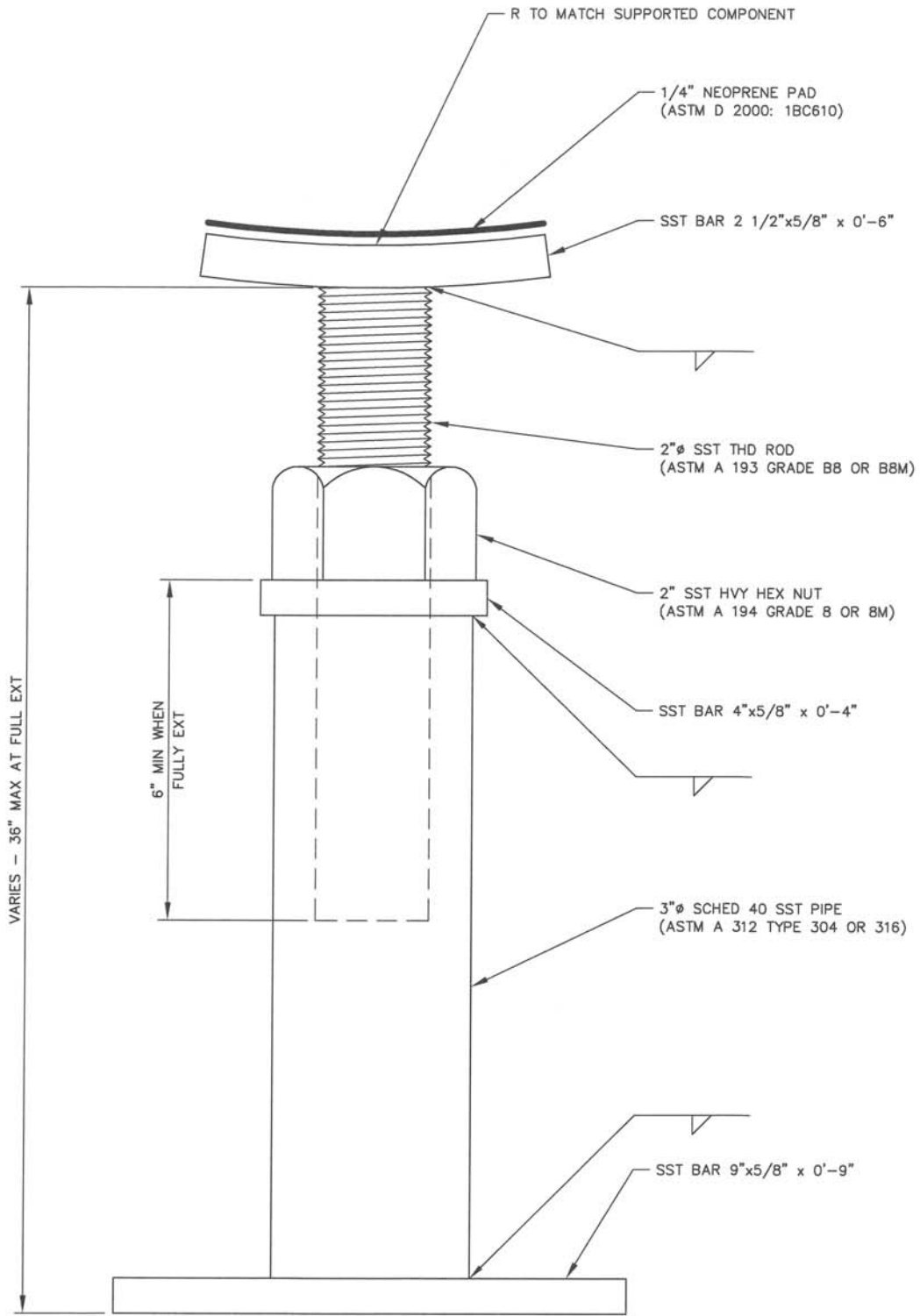
BAR MATERIAL TO BE ASTM A 240  
TYPE 304 OR 316 (F<sub>y</sub> = 30 KSI MINIMUM).

DRAWN BY: MCMILLEN
CHKD BY: K ROSS/ <i>KUR</i>
APPD BY: <i>Stephen C. Ream</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**05001  
STANDARD  
ADJUSTABLE SUPPORT**

**D DENVER WATER**

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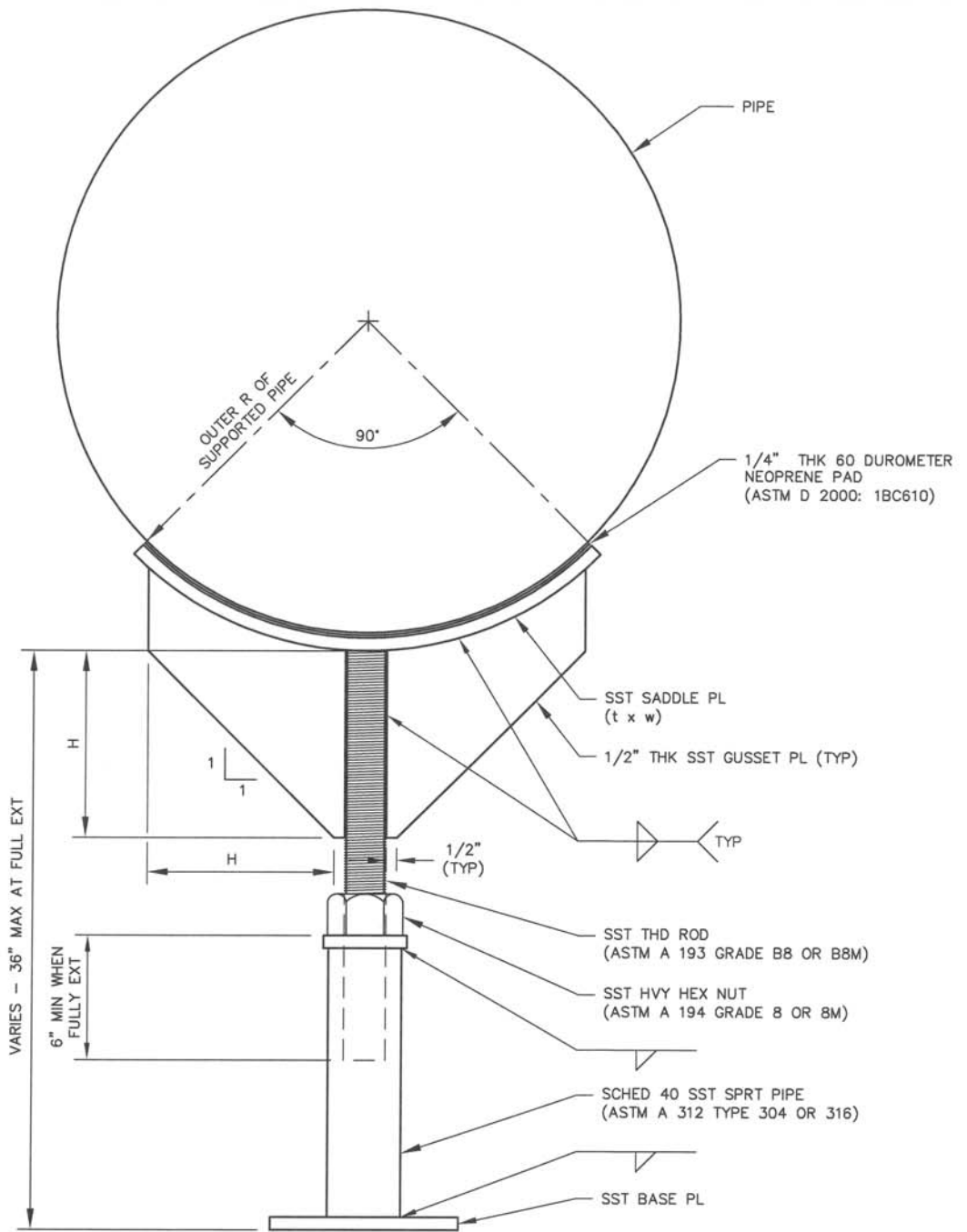
**NOTE:**

BAR MATERIAL TO BE ASTM A 240  
TYPE 304 OR 316 (F<sub>y</sub> = 30 KSI MINIMUM).

DRAWN BY: <i>MCMILLEN</i>
CHKD BY: <i>K ROSS/KIR</i>
APPD BY: <i>Stephen C. Penn</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**05002  
HEAVY DUTY  
ADJUSTABLE SUPPORT**

**D DENVER WATER**  
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PIPE $\phi$	SADDLE PL THK (t)	SADDLE PL WIDTH (w)	GUSSET PL HEIGHT (H)	THD ROD $\phi$	SPRT PIPE $\phi$	BASE PL DIM
$\phi \leq 12"$	1/2"	2 1/2"	N/A	1 1/4"	1 1/2"	1/2"x 5"x 5"
12" < $\phi \leq 20"$	5/8"	4"	4"	2"	3"	5/8"x 9"x 9"
20" < $\phi \leq 30"$	5/8"	6"	6"	2"	3"	5/8"x 9"x 9"

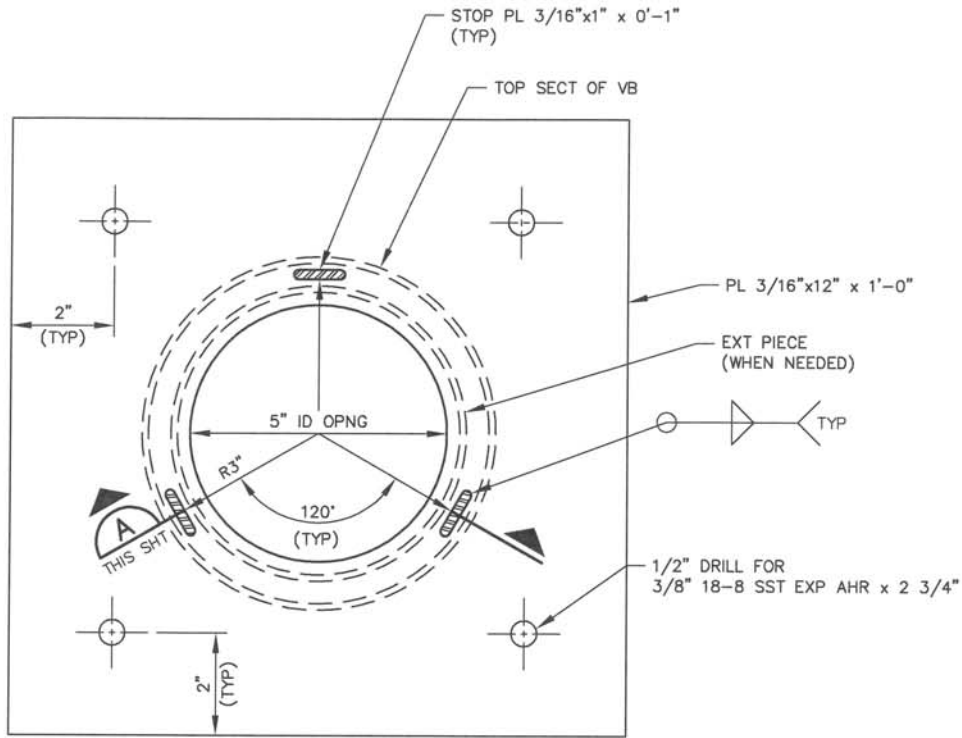
**NOTE:**

BAR AND PLATE MATERIAL SHALL BE ASTM A 240 TYPE 304 OR 316 ( $F_y = 30$  KSI MINIMUM).

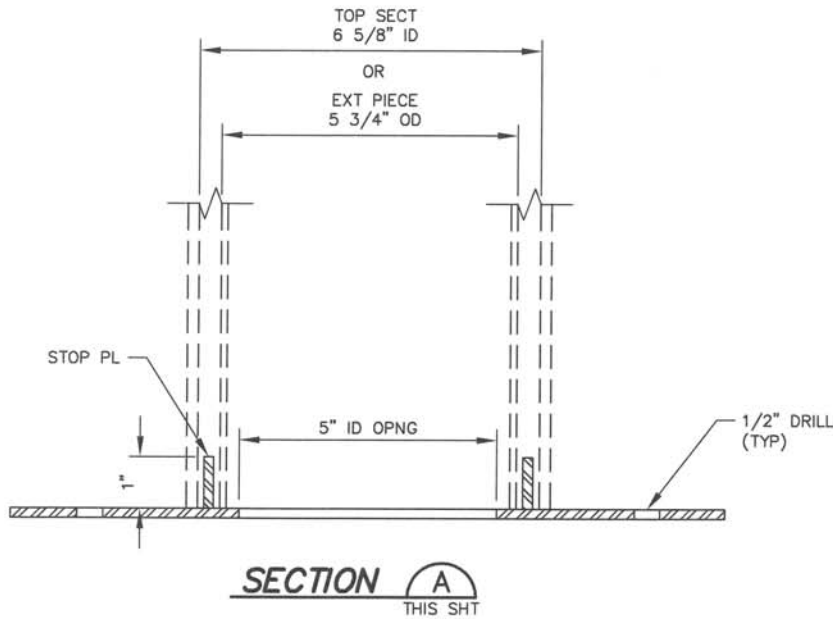
DRAWN BY: MCMILLEN  
 CHKD BY: K ROSS/KLR  
 APPD BY: Stephen C. Paine  
 ORIGINATION DATE: JANUARY 2017  
 REVISION DATE:

**05003  
 PIPE BODY  
 ADJUSTABLE SUPPORT**

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**VALVE BOX SUPPORT PLATE PLAN**



**NOTES:**

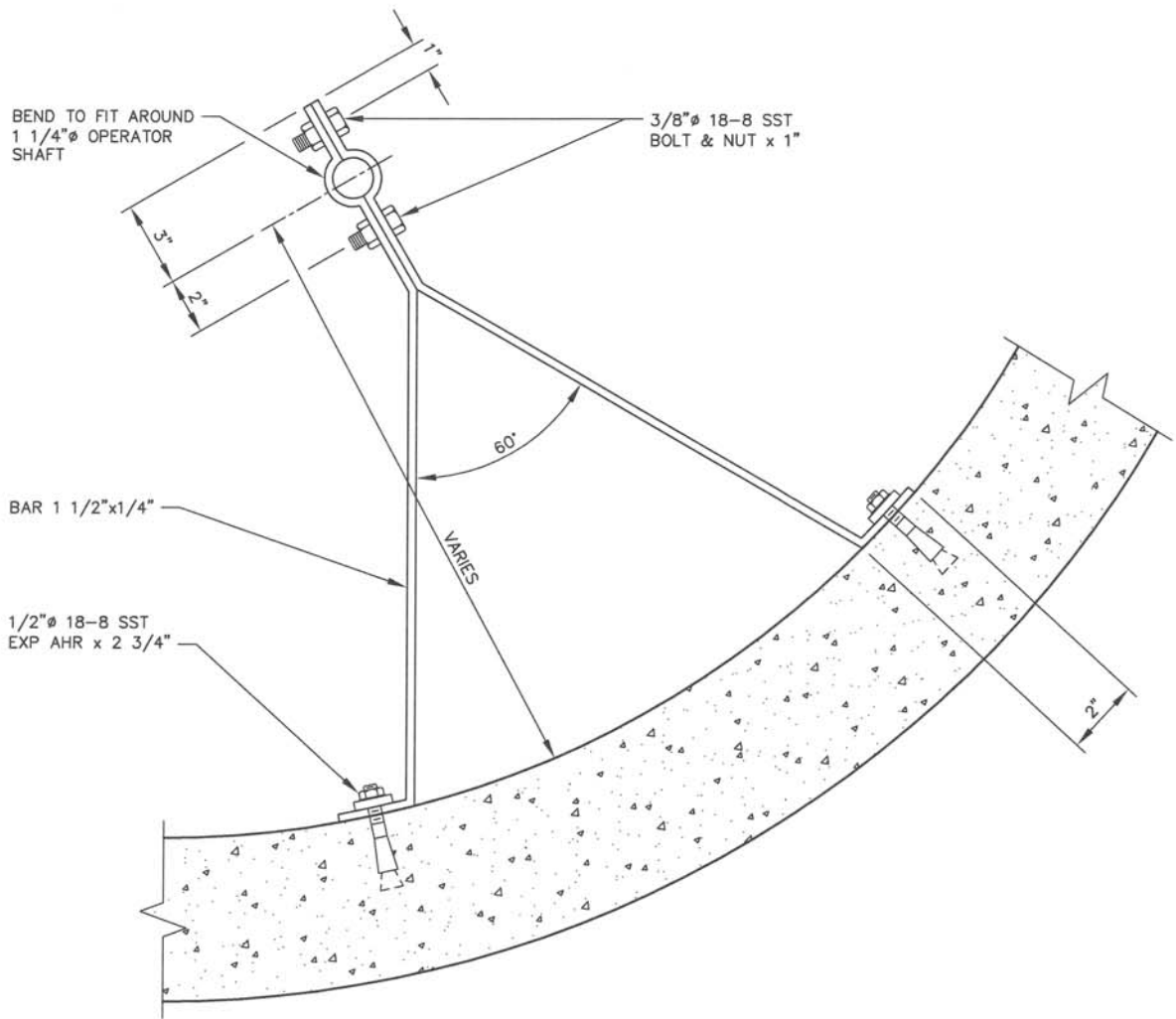
1. PLATE SHALL BE ASTM A 36.
2. PLATE SHALL BE COATED WITH LIQUID EPOXY, 16 MIL DRY FILM THICKNESS IN ACCORDANCE WITH AWWA C210. COLOR: BLACK SHEEN: FLAT.

DRAWN BY: MCMILLEN
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Flynn
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**05010  
VALVE BOX  
SUPPORT PLATE**

**D DENVER WATER**

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**NOTES:**

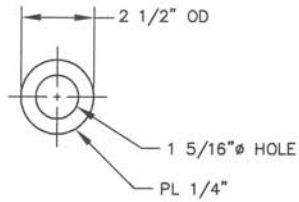
1. BAR SHALL BE ASTM A 36.
2. BAR SHALL BE COATED WITH LIQUID EPOXY, 16 MIL DRY FILM THICKNESS IN ACCORDANCE WITH AWWA C210. COLOR: BLACK SHEEN: FLAT.

DRAWN BY: <i>MCMILLEN</i>
CHKD BY: <i>K ROSS/KLR</i>
APPD BY: <i>Stephen C. Peltz</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

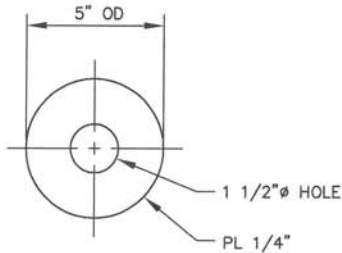
**05011**  
**VALVE OPERATOR GUIDE**

**D DENVER WATER**

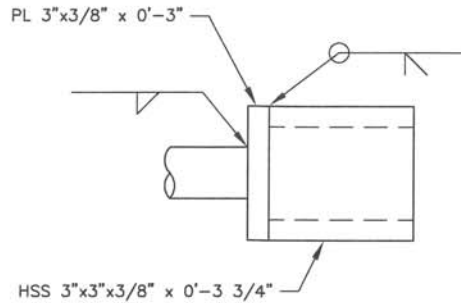
1600 West 12th Ave  
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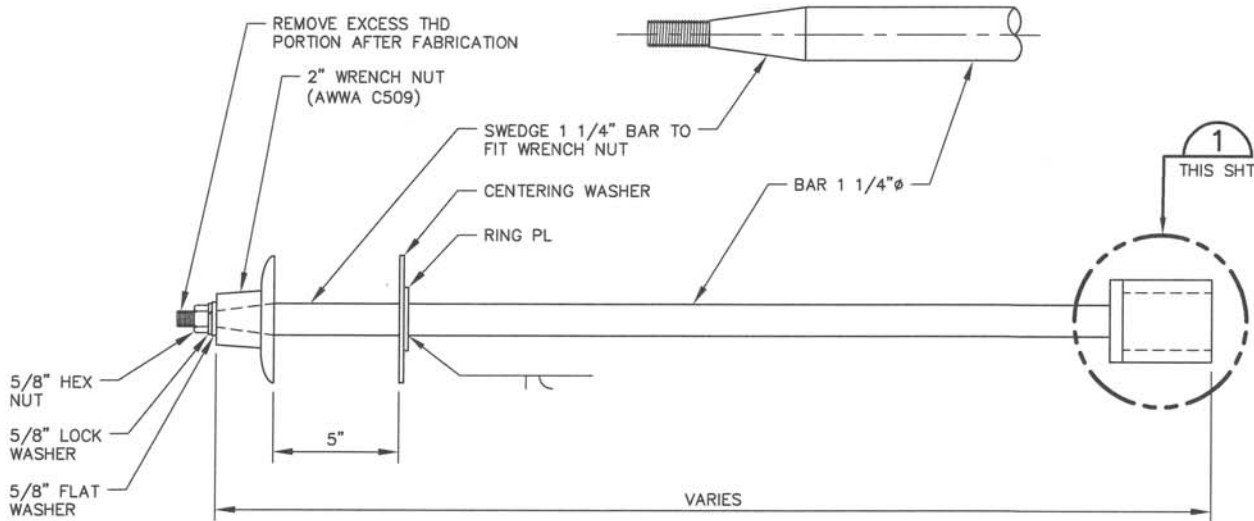
**RING PLATE**



**CENTERING WASHER**



**DETAIL** 1  
THIS SHT



**VALVE OPERATOR EXTENSION**

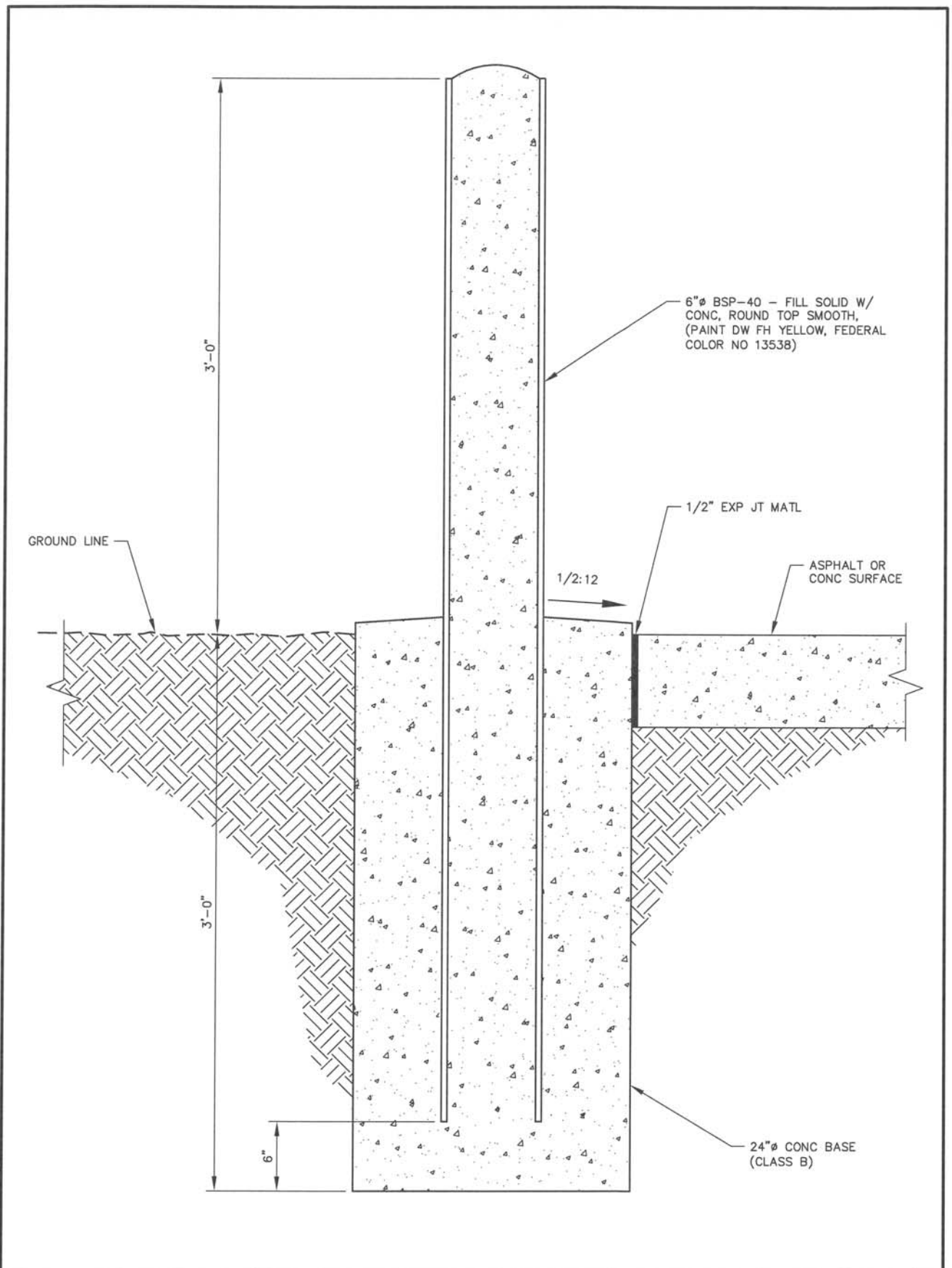
**NOTES:**

1. BAR AND PLATE SHALL BE ASTM A 36.
2. HSS SHALL BE ASTM A 500 GR B.
3. ASSEMBLY SHALL BE COATED WITH LIQUID EPOXY, 16 MIL DRY FILM THICKNESS IN ACCORDANCE WITH AWWA C210. COLOR: BLACK SHEEN: FLAT

DRAWN BY: <i>MCMILLEN</i>
CHKD BY: <i>K ROSS/KUR</i>
APPD BY: <i>Stephen C. Penn</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**05012**  
**VALVE OPERATOR EXTENSION**

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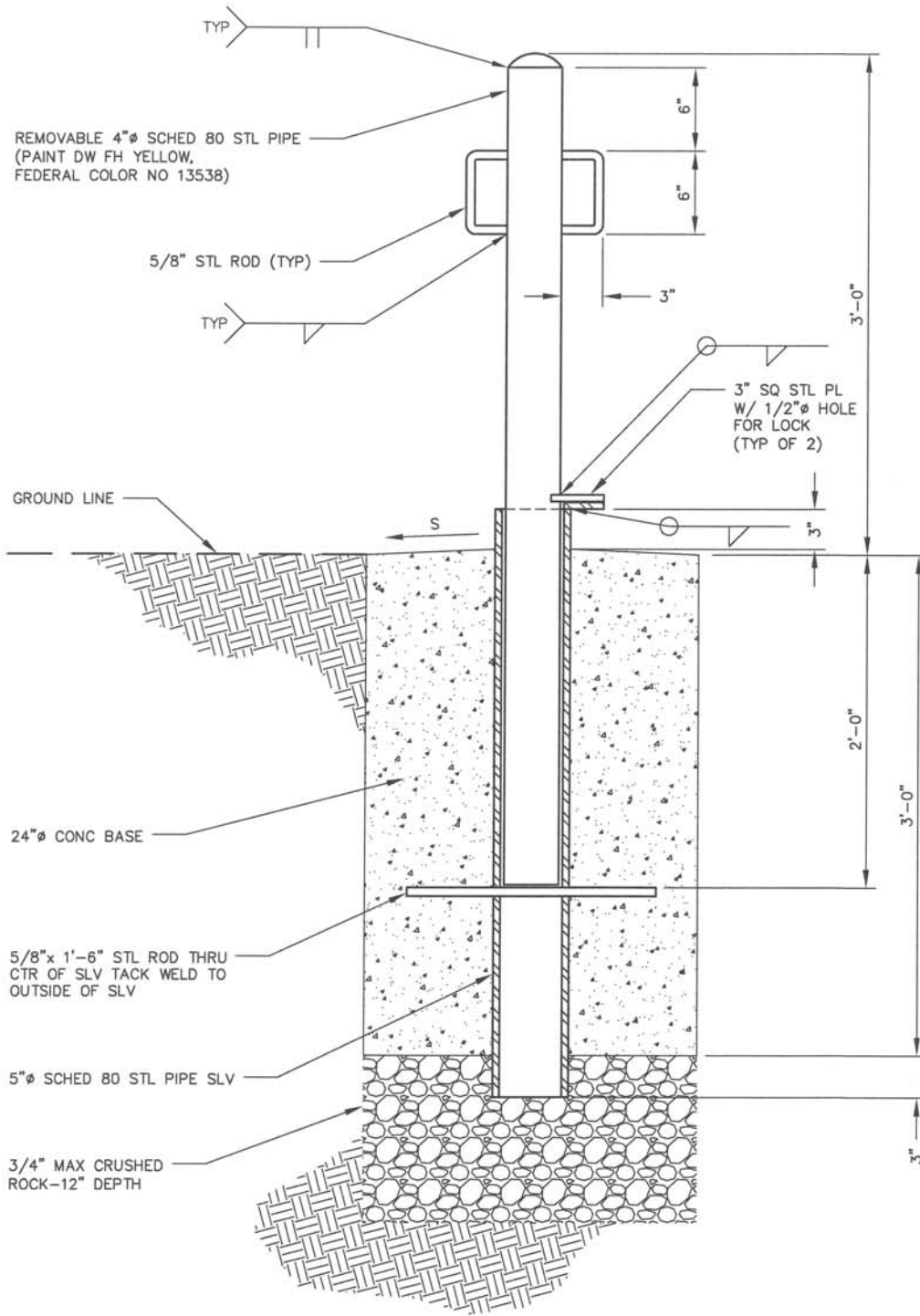


DRAWN BY: MCMILLEN
CHKD BY: K ROSS/KR
APPD BY: <i>Stephen C. P...</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

05020  
TRAFFIC IMPEDIMENT  
BOLLARD

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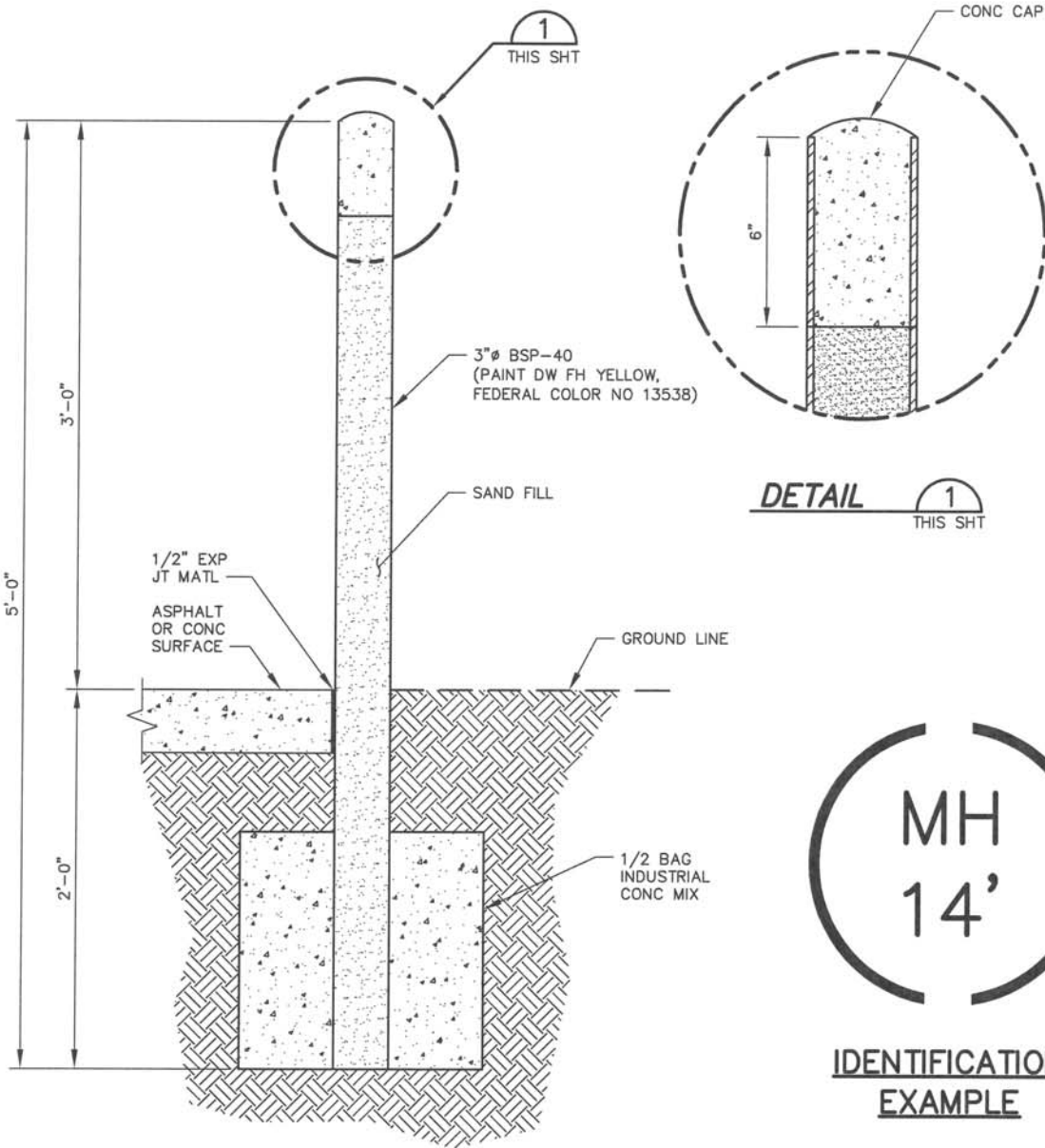


DRAWN BY: <i>MCMILLEN</i>
CHKD BY: <i>K ROSS/KLR</i>
APPD BY: <i>Stephen C. Reun</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**05021**  
**REMOVABLE TRAFFIC**  
**IMPEDIMENT BOLLARD**

**D DENVER WATER**

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 F: 303.628.6851  
 denverwater.org



**NOTE:**

IDENTIFICATION MARKS ON POSTS SHALL BE 3-INCH DIAMETER CIRCLES BROKEN IN VERTICAL CENTER ( ) POINTING TO APPURTENANCE, WITH 1-INCH STENCILS INSIDE CIRCLE INDICATING TYPE OF APPURTENANCE (MANHOLE, 12-INCH GATE VALVE, 6-INCH BLOW OFF, AIR VALVE, ETC) AND THE DISTANCE IN FEET AND INCHES FROM THE POST.

DRAWN BY: MCMILLEN

CHKD BY: K ROSS/KLR

APPD BY: Stephen C. Penn

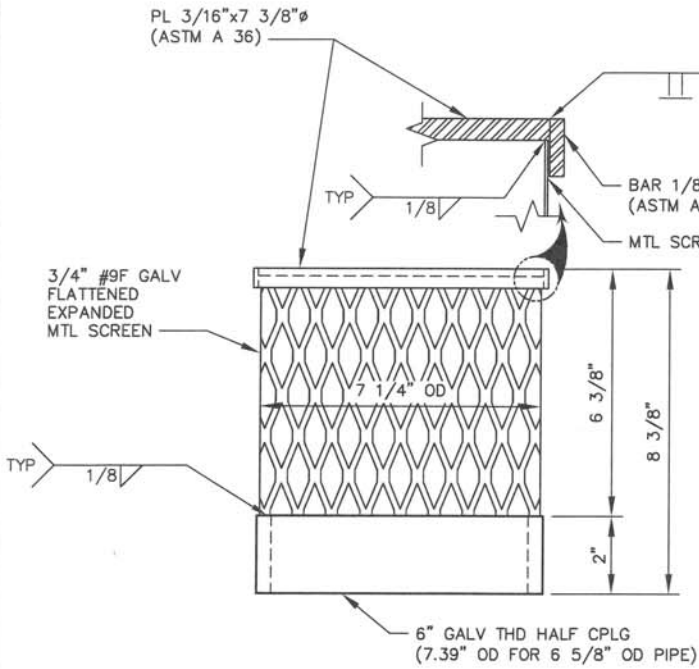
ORIGINATION DATE: JANUARY 2017

REVISION DATE:

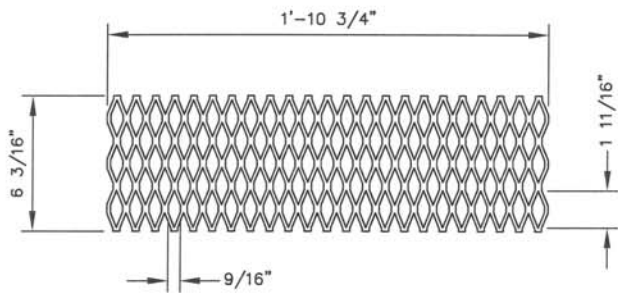
05022  
REFERENCE POST

**D DENVER WATER**

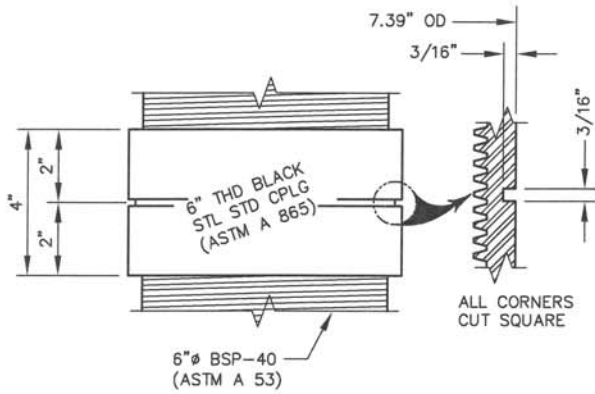
1600 West 12th Ave  
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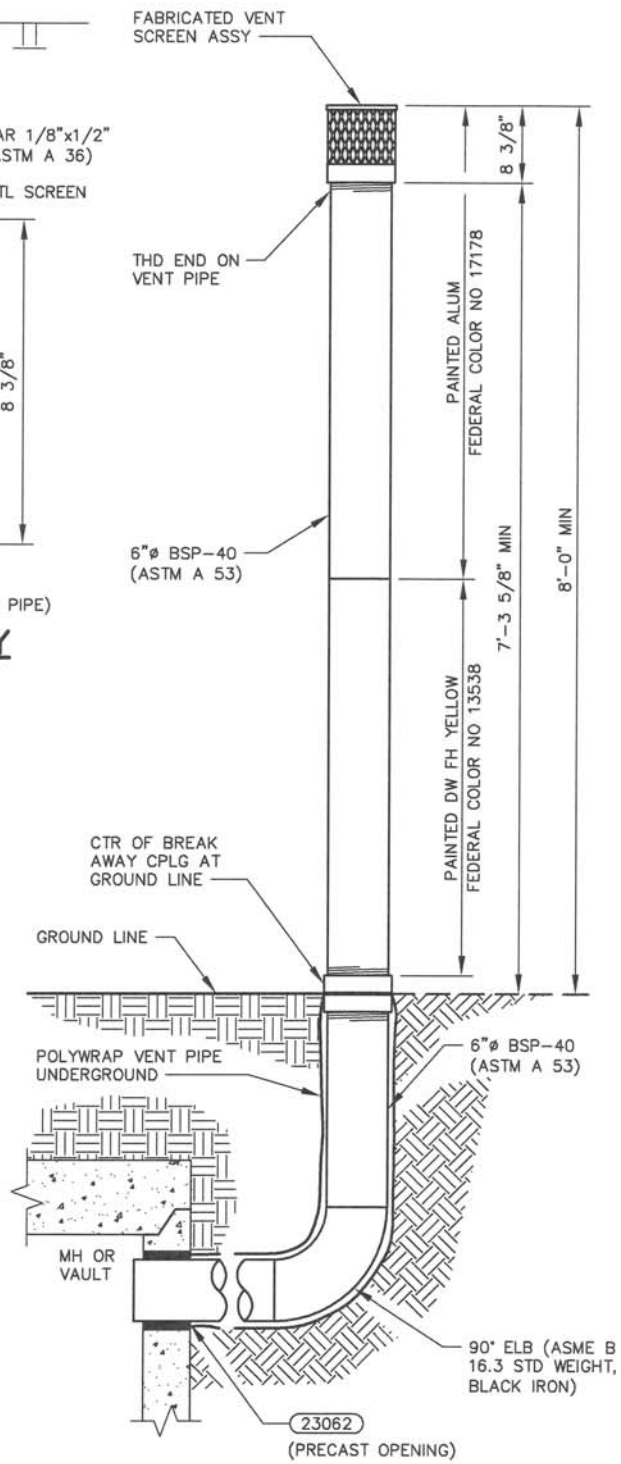
**VENT SCREEN ASSEMBLY**



**METAL SCREEN**



**BREAK AWAY COUPLING**



**VENT PIPE ELEVATION**

DRAWN BY: *MCMLLEN*

CHKD BY: *K ROSS/KLR*

APPD BY: *Stephen C. Rem*

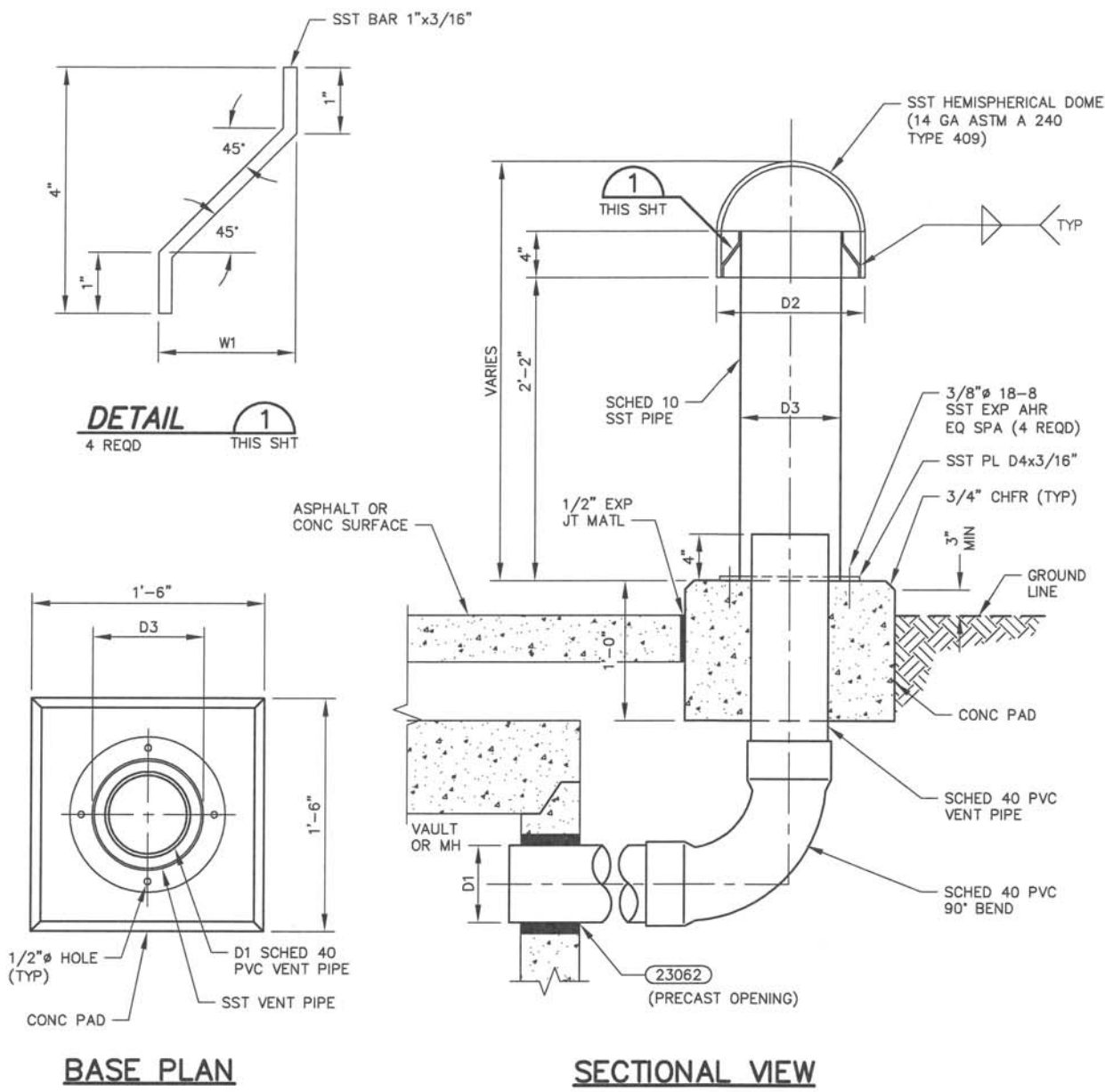
ORIGINATION DATE: JANUARY 2017

REVISION DATE:

05030  
6"Ø INDUSTRIAL  
VENT PIPE AND SCREEN

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**BASE PLAN**

**SECTIONAL VIEW**

VENT PIPE Ø IN VAULT	CAP Ø	VENT CAP PIPE NOMINAL Ø	FLANGE Ø	BRACKET WIDTH
D1	D2	D3	D4	W1
6"	14"	8"	12"	3 1/4"
8"	18"	10"	14"	3 1/16"
10"	24"	12"	16"	4 15/16"

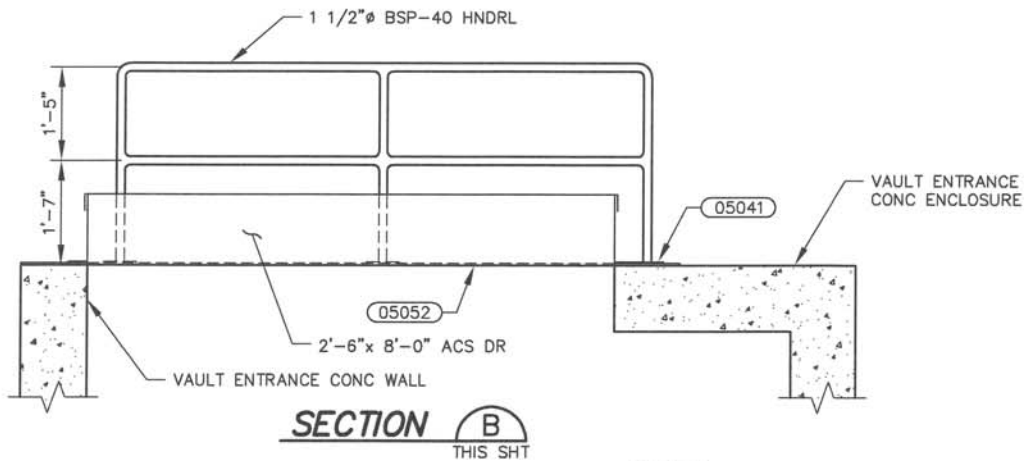
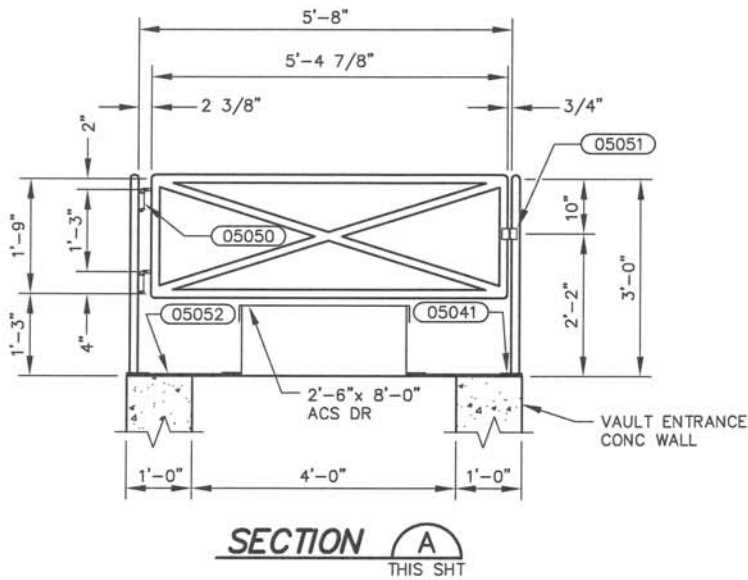
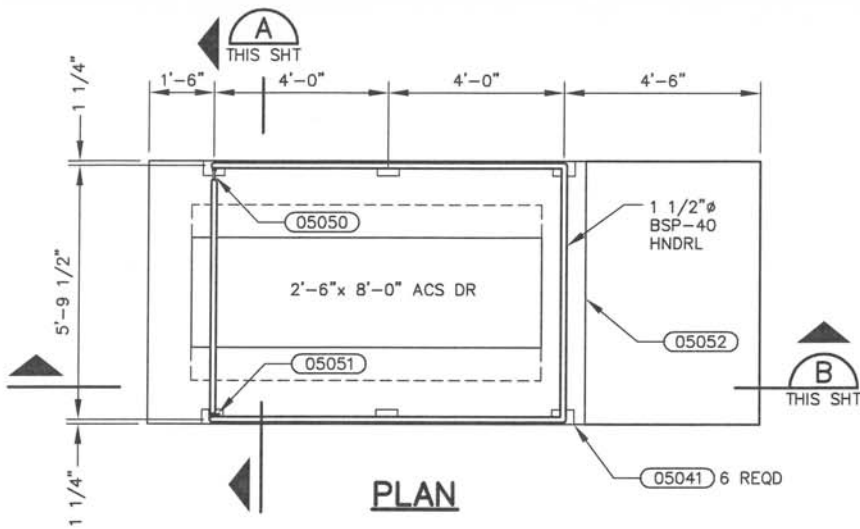
**NOTE:**

COAT ASSEMBLY WITH EPOXY, 8 MILS MINIMUM.  
COLOR: BLACK SHEEN: FLAT.

DRAWN BY: MCMILLEN  
 CHKD BY: K ROSS/KLR  
 APPD BY: Stephen C. Rem  
 ORIGINATION DATE: JANUARY 2017  
 REVISION DATE:

05031  
 6" Ø RESIDENTIAL VENT PIPE

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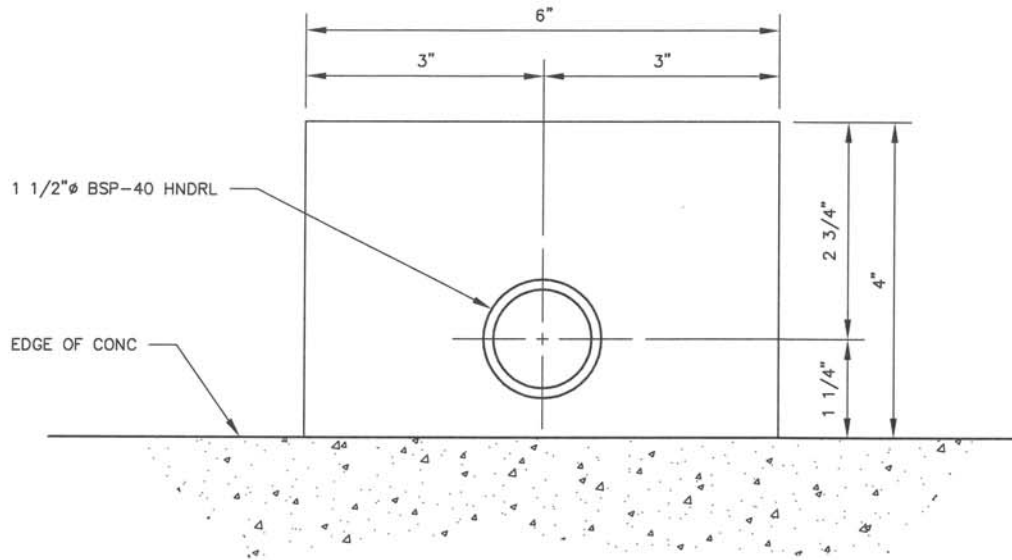


**NOTE:**  
HOT DIP GALVANIZE HANDRAIL AND APPURTENANCES AFTER FABRICATION.

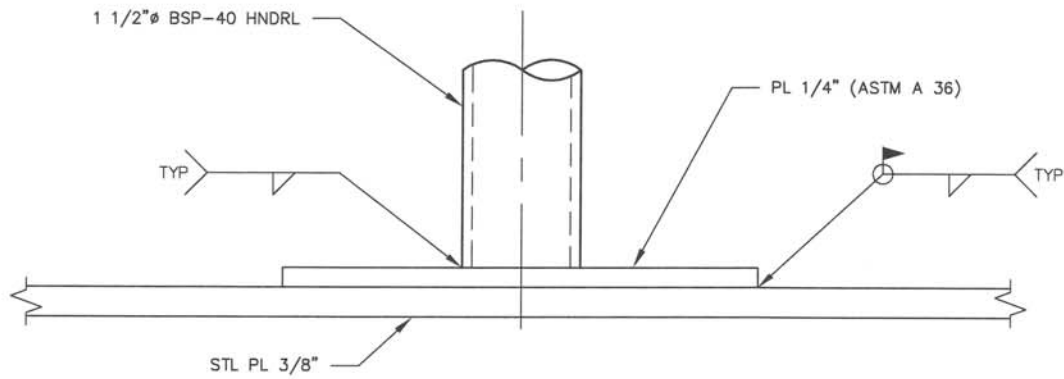
DRAWN BY: <i>MCMILLEN</i>
CHKD BY: <i>K ROSS/KR</i>
APPD BY: <i>Stephen C. Penn</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**05040**  
**HANDRAIL ASSEMBLY**  
**FOR 2'-6" x 8'-0"**  
**ACCESS DOOR**

**D DENVER WATER**  
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**PLAN**



**ELEVATION**

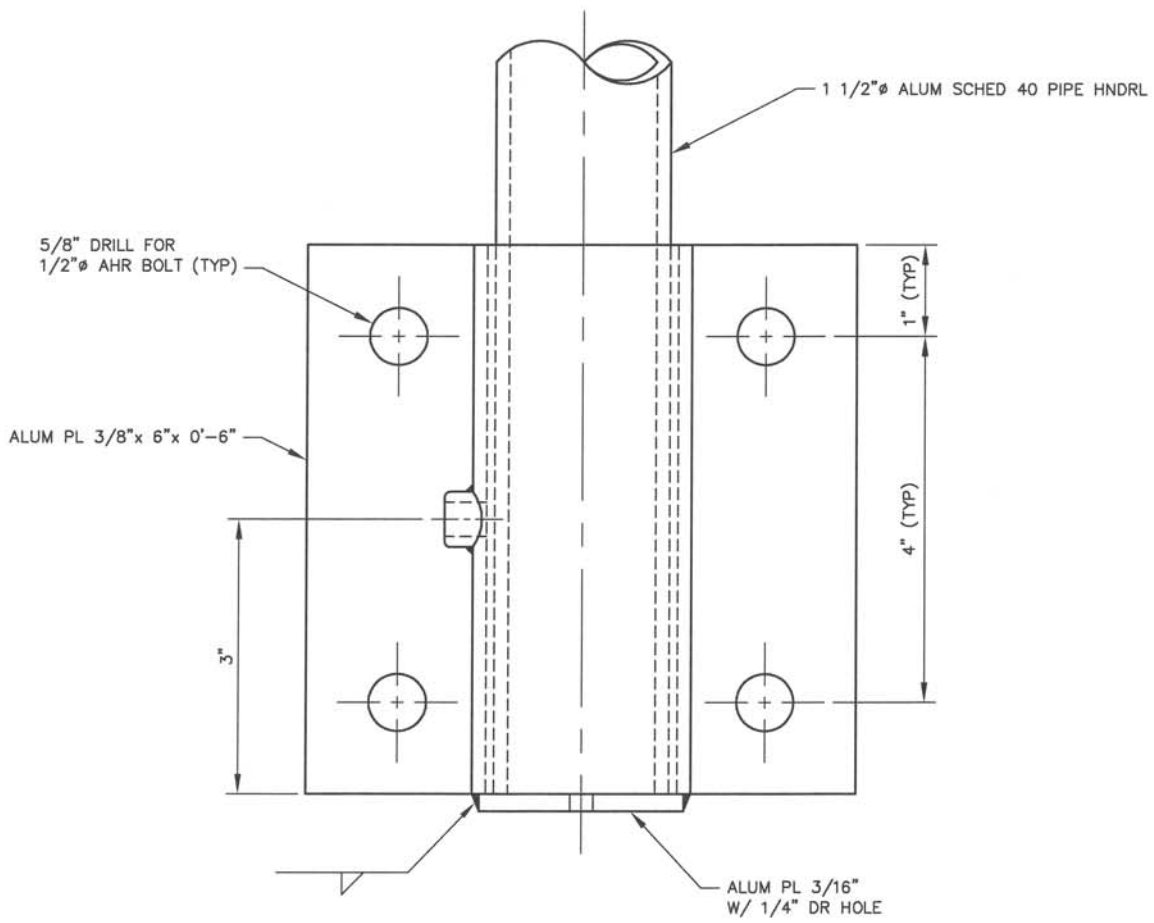
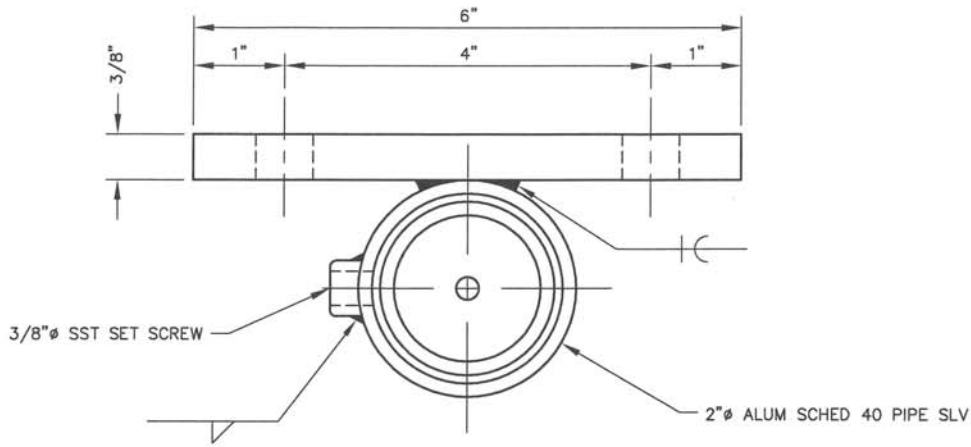
**NOTES:**

1. HOT DIP GALVANIZE ASSEMBLY AFTER FABRICATION.
2. REPAIR PLATE AND HANDRAIL COATING AFTER FIELD WELDING.

DRAWN BY: MCMILLEN
CHKD BY: K ROSS/KR
APPD BY: Stephen C. Remm
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**05041  
HANDRAIL CONNECTION  
PLATE**

**D DENVER WATER**  
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**NOTE:**

MOUNTING HARDWARE SHALL BE  
18-8 STAINLESS STEEL.

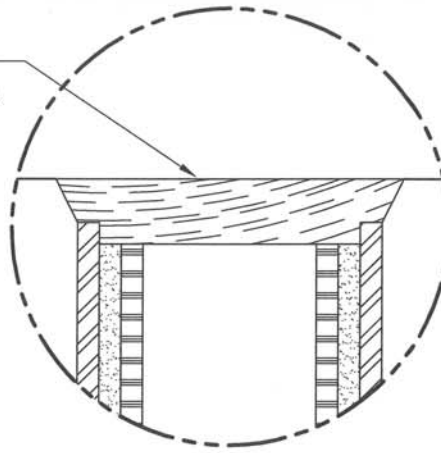
DRAWN BY: SCHULTE
CHKD BY: K ROSS/VLR
APPD BY: Stephen C. Reem
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

05042  
ANCHOR PLATE FOR  
REMOVABLE HANDRAIL

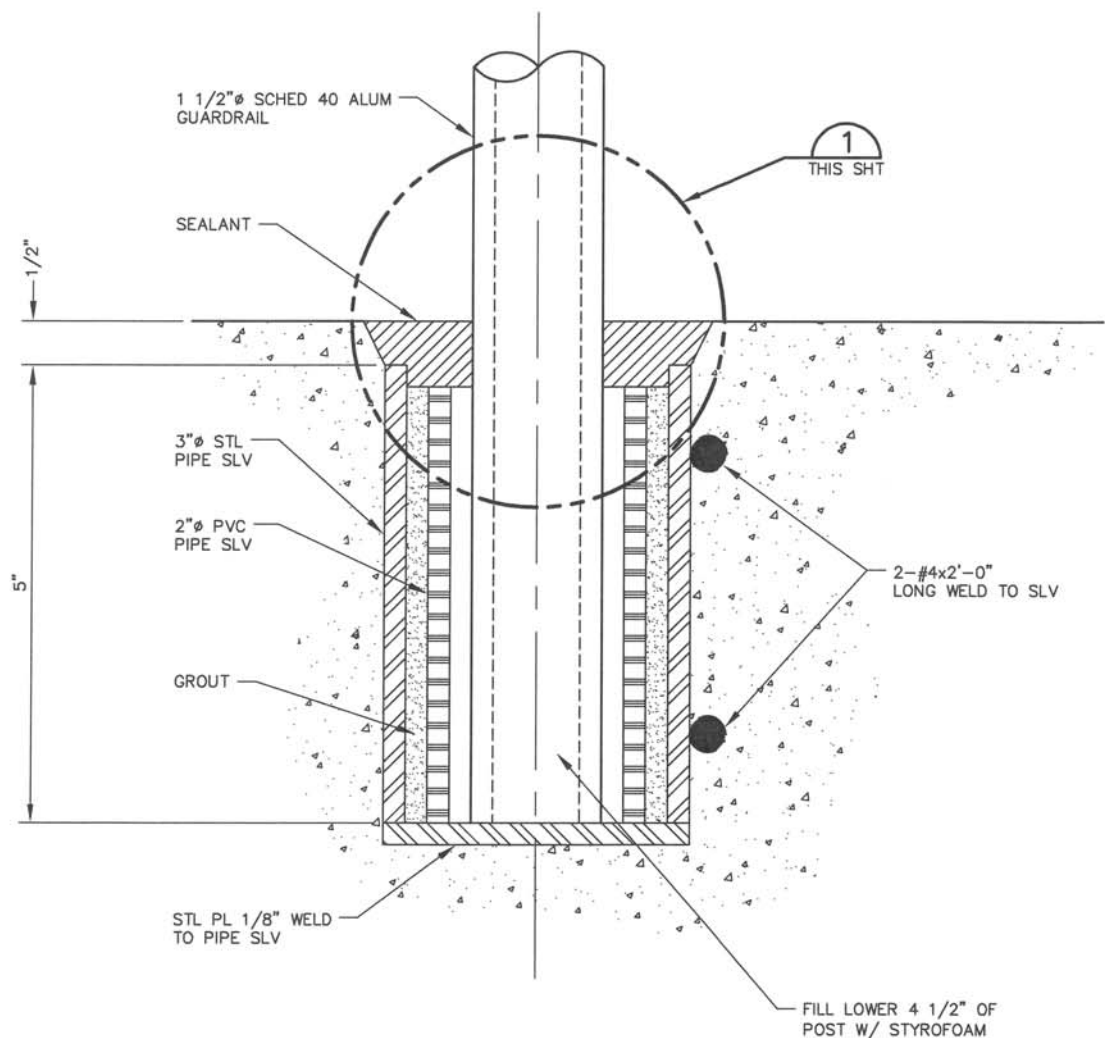


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TEMP WOOD PLUG COVER TO BE SET FLUSH W/ TOP OF CONC (REMOVE AFTER CONC HAS CURED & FILL W/ SEALANT)



**DETAIL 1**  
THIS SHT

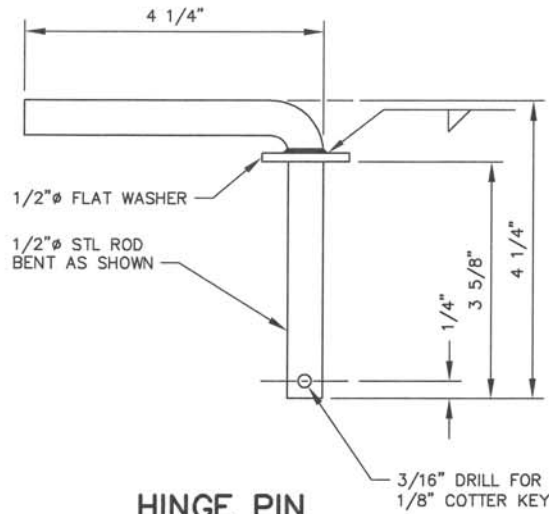


DRAWN BY: MCMILLEN
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Benn
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

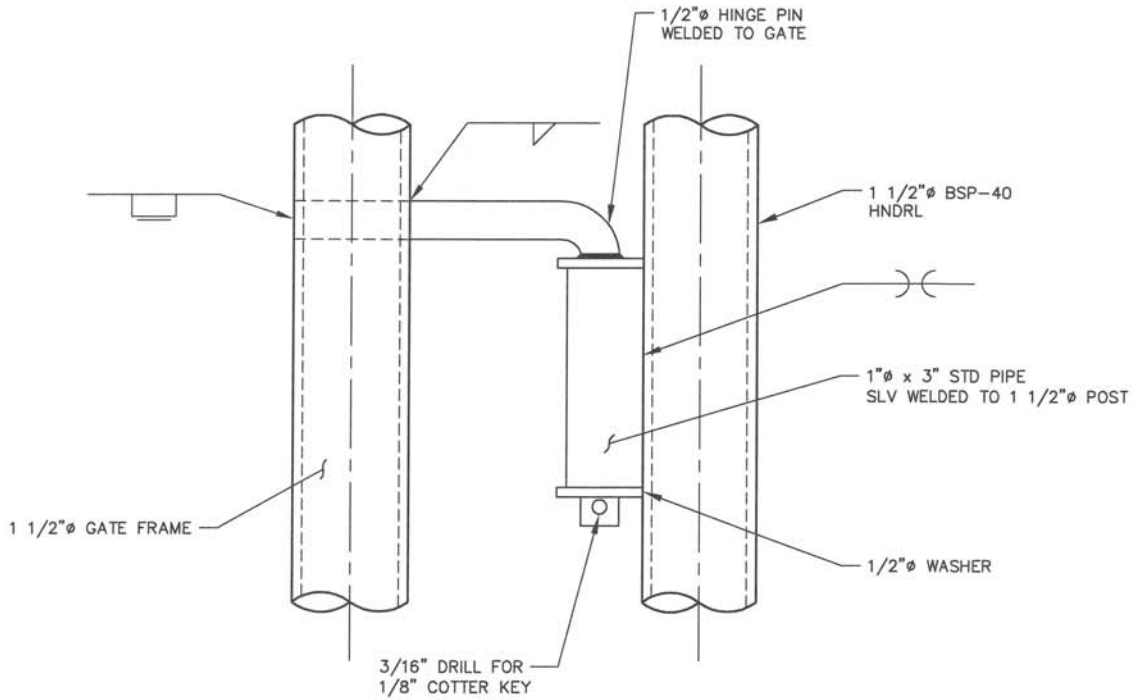
**05043**  
**REMOVABLE GUARDRAIL**  
**POST SETTING**

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**HINGE PIN**  
2 REQD



**HINGE INSTALLATION**  
PLACED AS SHOWN

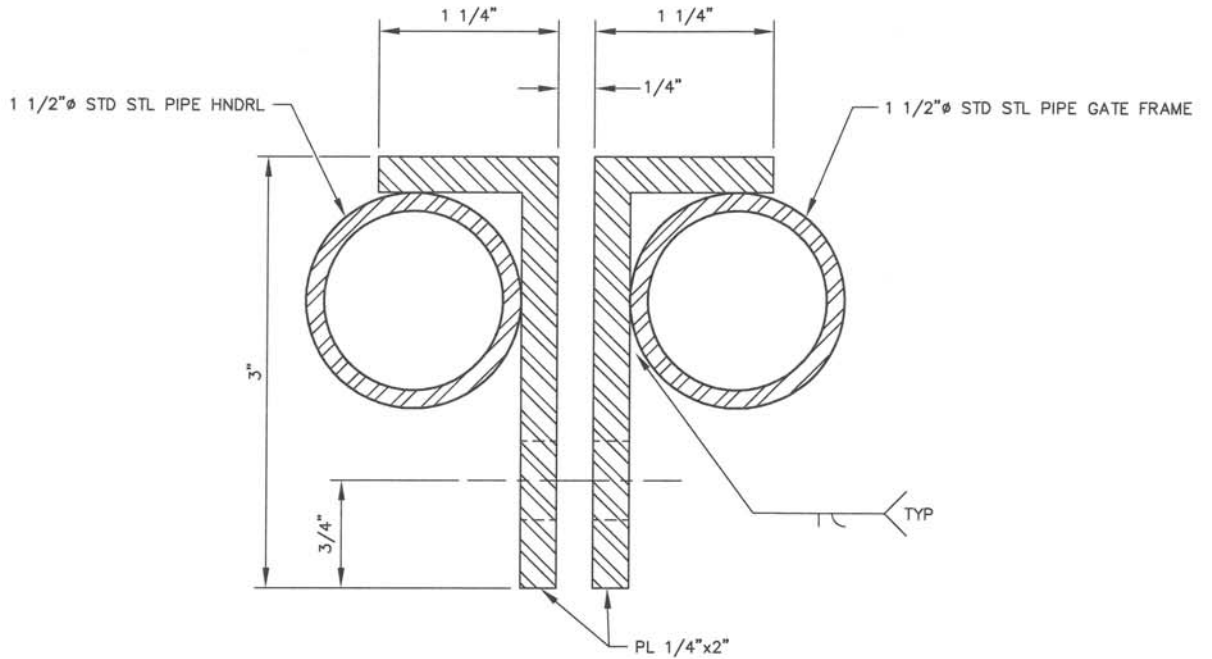
**NOTE:**

HOT DIP GALVANIZE ASSEMBLY  
AFTER FABRICATION.

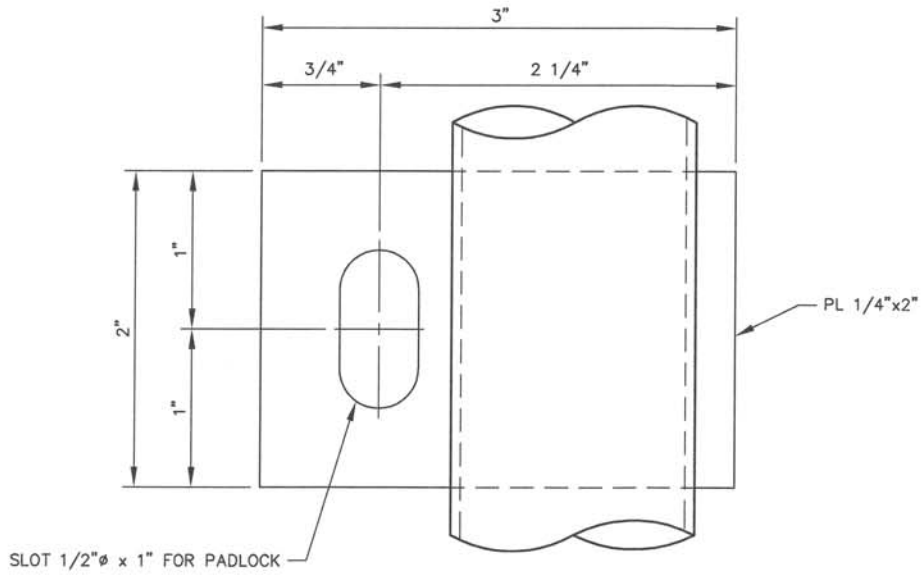
DRAWN BY: <i>MCMILLEN</i>
CHKD BY: <i>K ROSS/ KLR</i>
APPD BY: <i>Stephen C. Rem</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**05050**  
**GATE HINGE ASSEMBLY**

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**PLAN**



**SIDE VIEW**

2 REQD

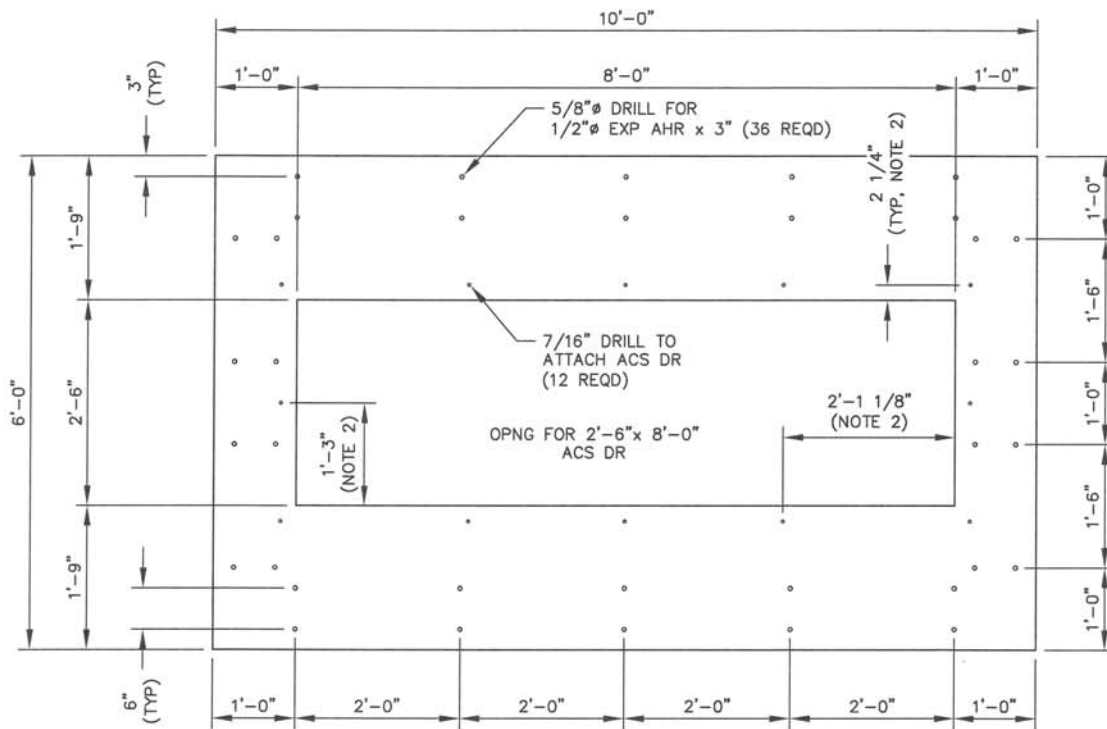
**NOTE:**

HOT DIP GALVANIZE ASSEMBLY  
AFTER FABRICATION.

DRAWN BY: MCMILLEN
CHKD BY: K ROSS/KLR
APPD BY: <i>Stephen C. Benn</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

05051  
GATE LOCK ASSEMBLY

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**PLAN**

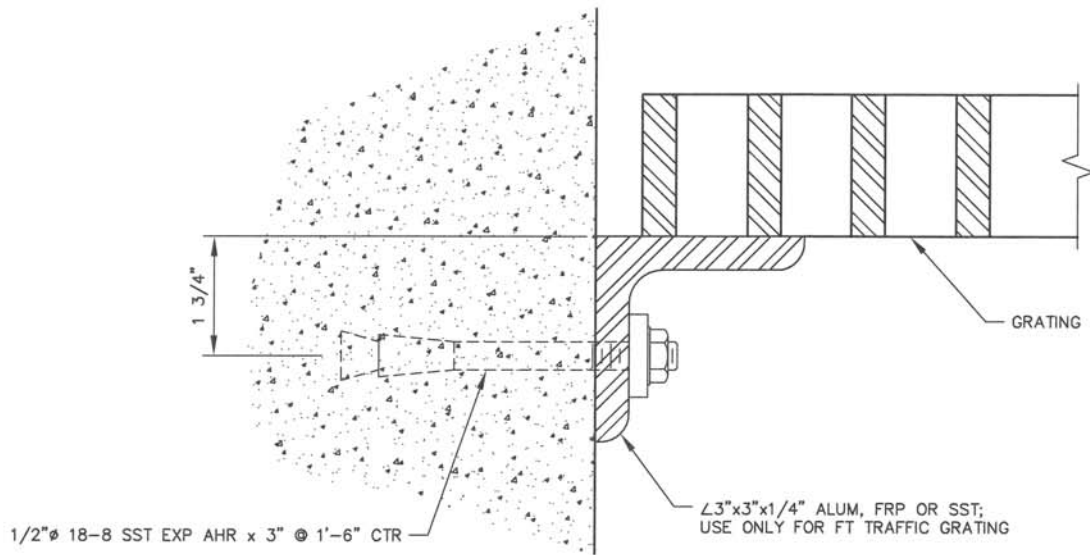
**NOTES:**

1. HOT DIP GALVANIZE PLATE AFTER FABRICATION.
2. VERIFY HOLE LOCATIONS FOR ACCESS DOOR PRIOR TO DRILLING.

DRAWN BY: <i>MCMILLEN</i>
CHKD BY: <i>K ROSS/KUR</i>
APPD BY: <i>Steph. C. Penn</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**05052**  
**3/8" STEEL PLATE FOR**  
**ACCESS DOOR ATTACHMENT**


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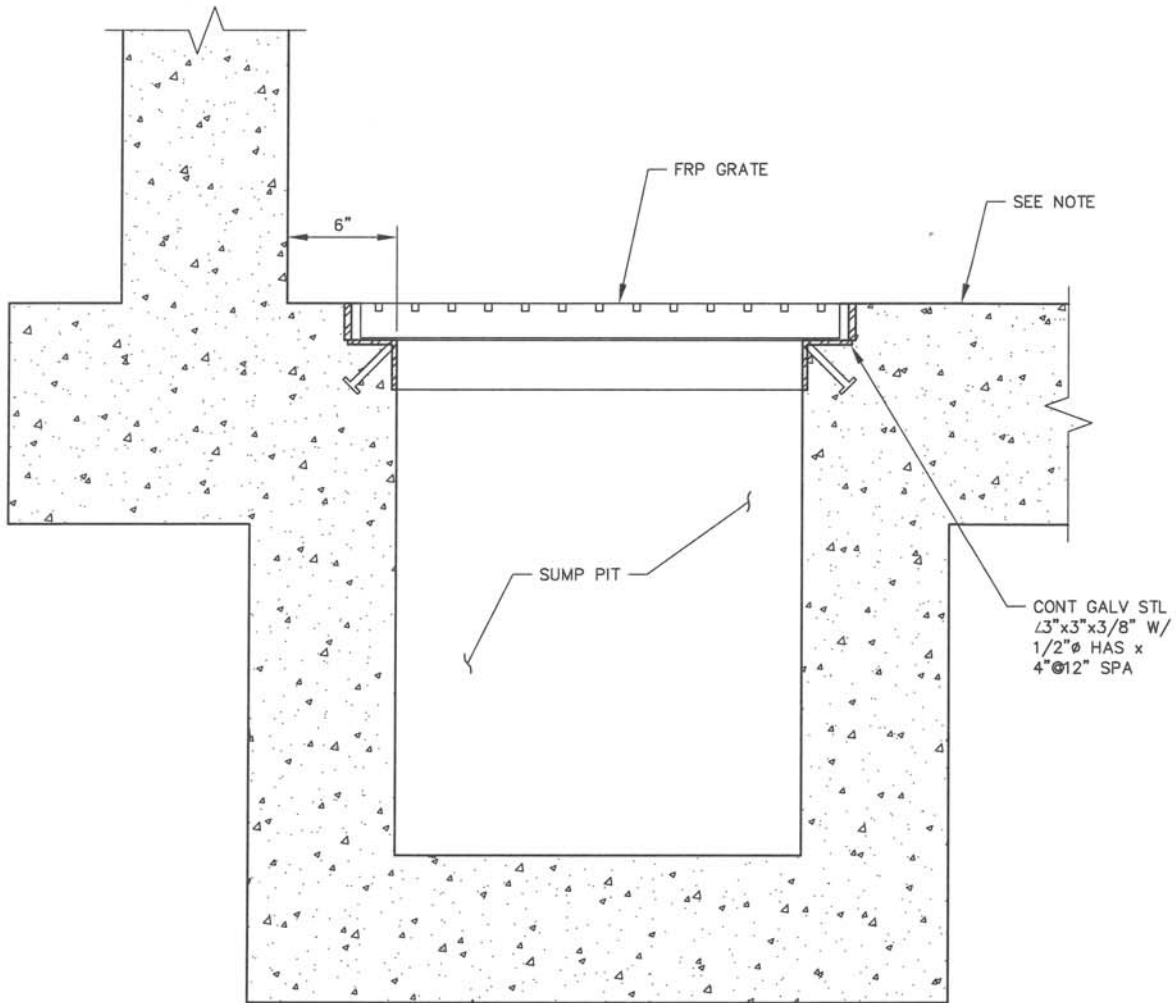
**SECTION**

DRAWN BY: <i>MCMILLEN</i>
CHKD BY: <i>K ROSS/KLR</i>
APPD BY: <i>Stephen C. Penner</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**05060  
SUMP GRATE SUPPORT**

**D DENVER WATER**

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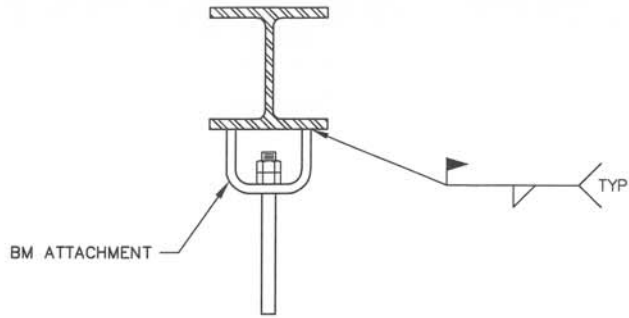
**NOTE:**

COORDINATE DIMENSION WITH THICKNESS OF GRATING.

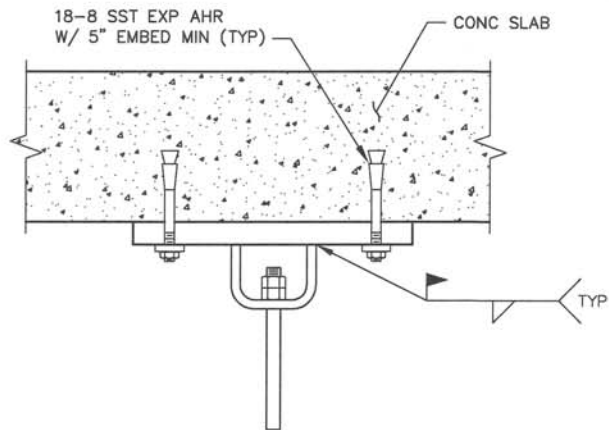
DRAWN BY: ALVARADO
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Remm
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**05061  
SUMP GRATE SUPPORT**

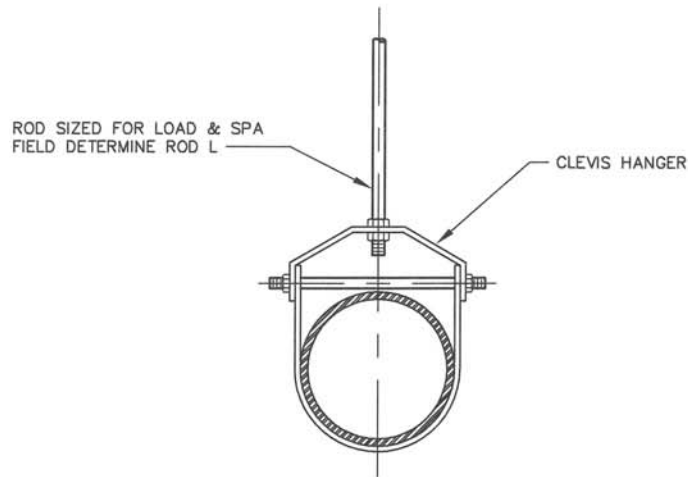
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**HANGER ROD  
CONNECTION FOR BEAMS**



**HANGER ROD CONNECTION  
FOR OVERHEAD CONC SLABS**



**HANGER ROD  
AND CLEVIS**

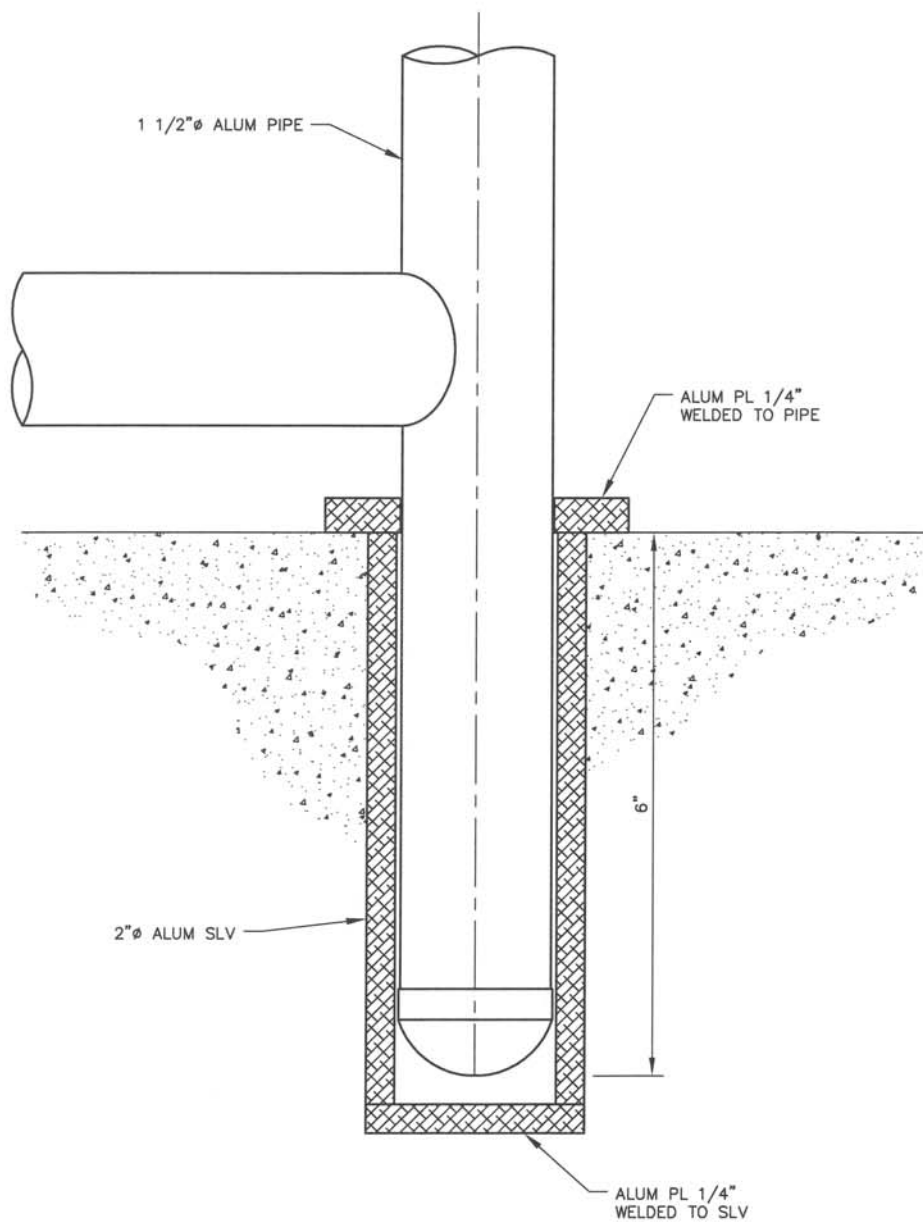
**NOTE:**

EXPANSION ANCHORS SHALL BE DESIGNED FOR OVERHEAD USE.

DRAWN BY: <i>MCMILLEN</i>
CHKD BY: <i>K ROSS/VLR</i>
APPD BY: <i>Stephen C. Ren</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**05070  
PIPE HANGER**

**D DENVER WATER**  
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**NOTE:**

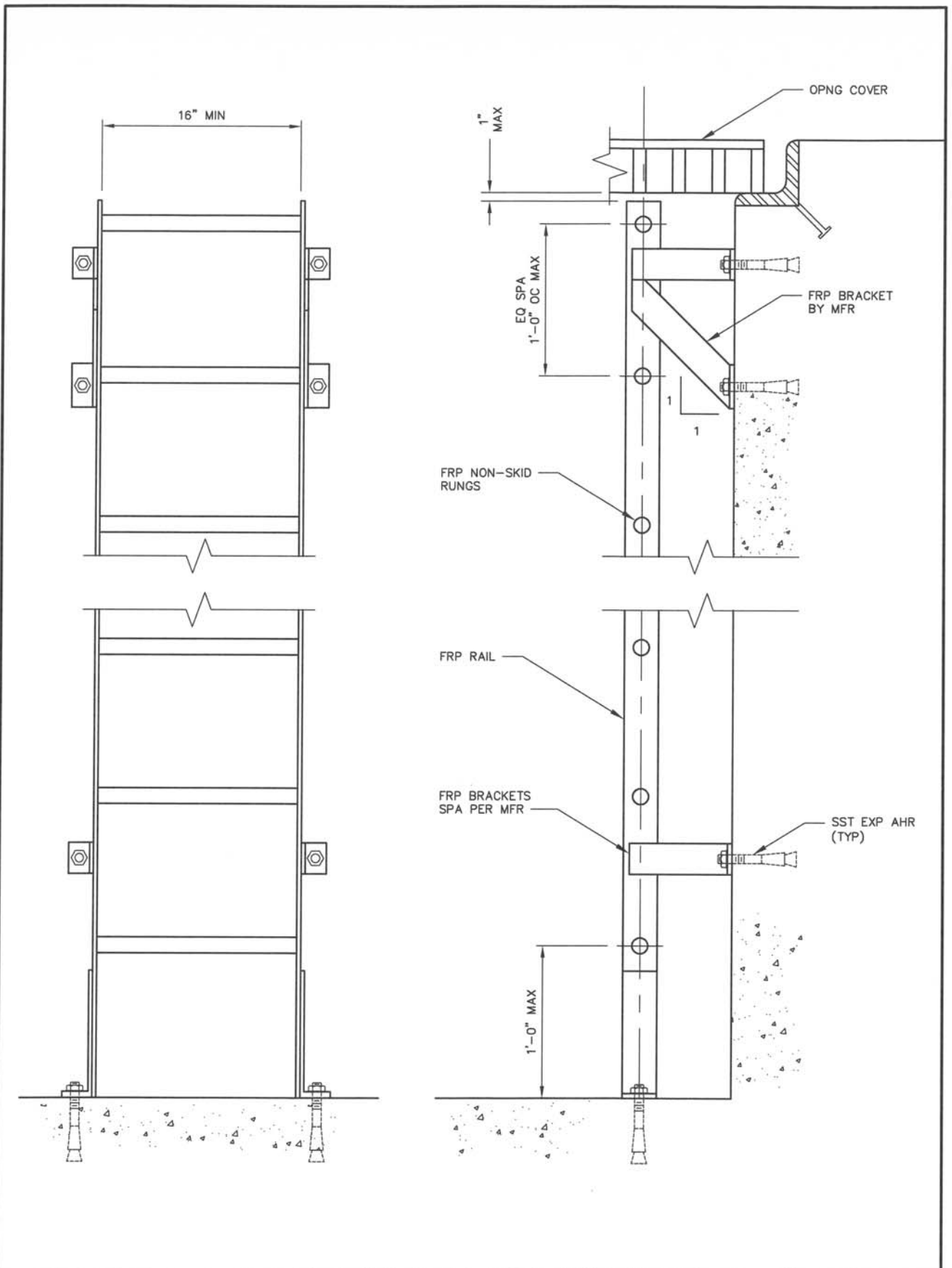
APPLY BITUMINOUS COATING TO ALUMINUM SURFACES IN CONTACT WITH CONCRETE.

DRAWN BY: <i>MCMILLEN</i>
CHKD BY: <i>K ROSS/VLR</i>
APPD BY: <i>Stephen C. Reun</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

05080  
REMOVABLE LADDER POST

**D DENVER WATER**

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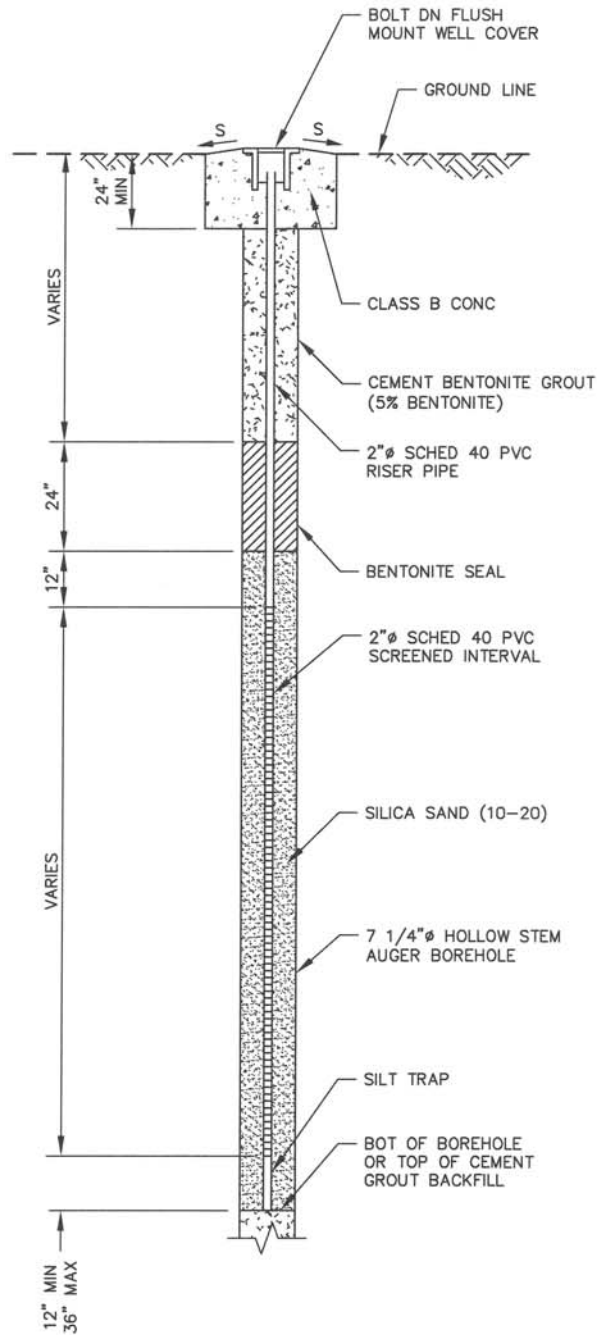


DRAWN BY: <i>MCMILLEN</i>
CHKD BY: <i>K ROSS/vlr</i>
APPD BY: <i>Stephen C. Rom</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**06001**  
**FIBERGLASS REINFORCED**  
**PLASTIC LADDER**


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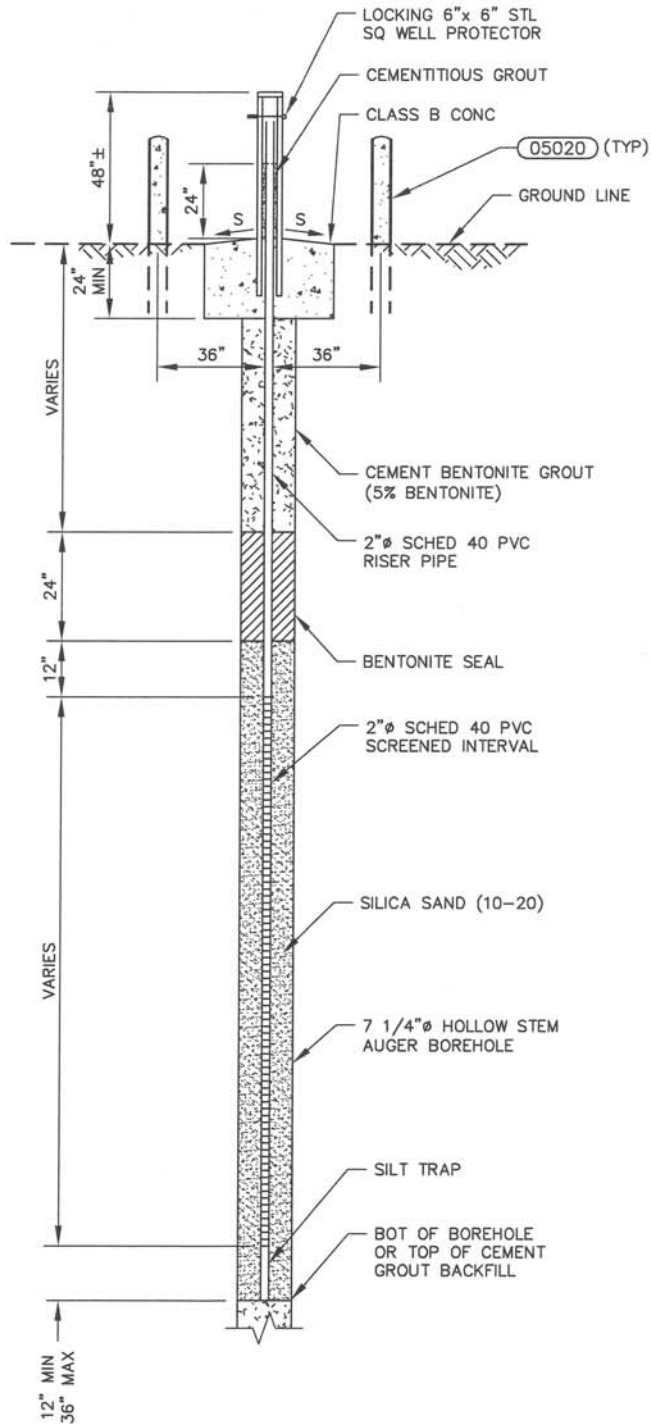




DRAWN BY: MCMILLEN
CHKD BY: K ROSS/KR
APPD BY: Stephen C. Ream
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

13001  
SINGLE-LEVEL PIEZOMETER  
FLUSH MOUNT

**D DENVER WATER**  
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 denverwater.org



DRAWN BY: *MCMILLEN*

CHKD BY: *K ROSS/KRP*

APPD BY: *Stephen C. Pean*

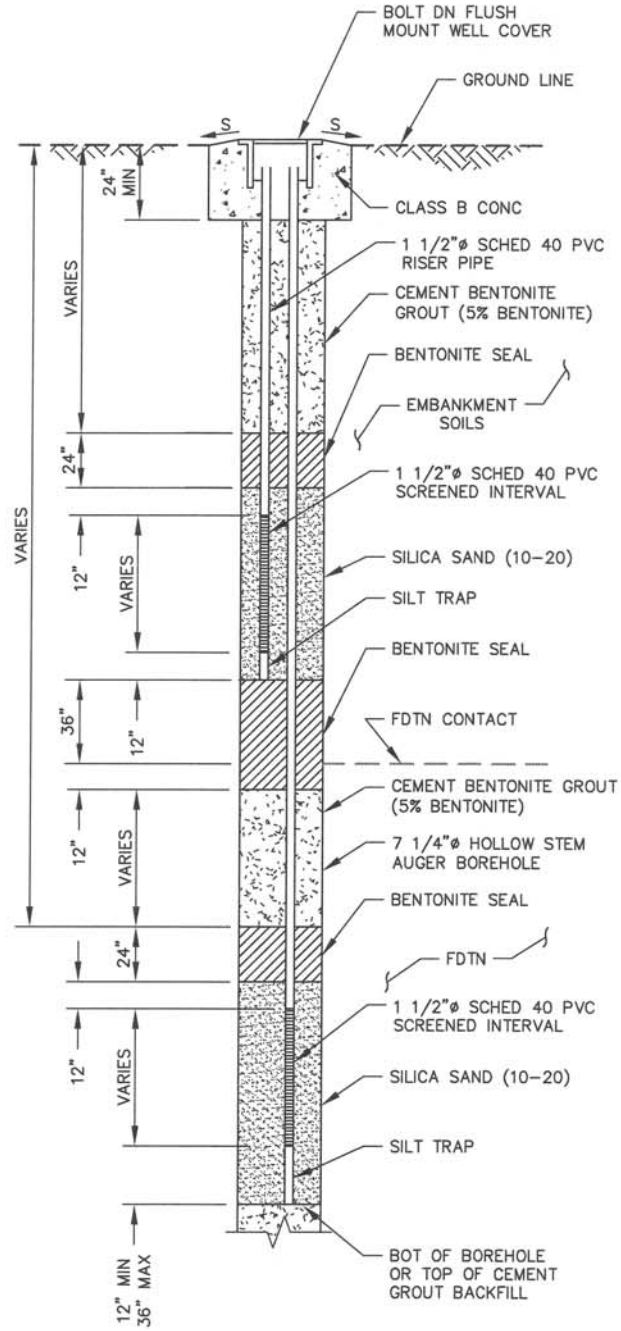
ORIGINATION DATE: JANUARY 2017

REVISION DATE:

13002  
SINGLE-LEVEL PIEZOMETER  
STICK UP MOUNT

**D DENVER WATER**

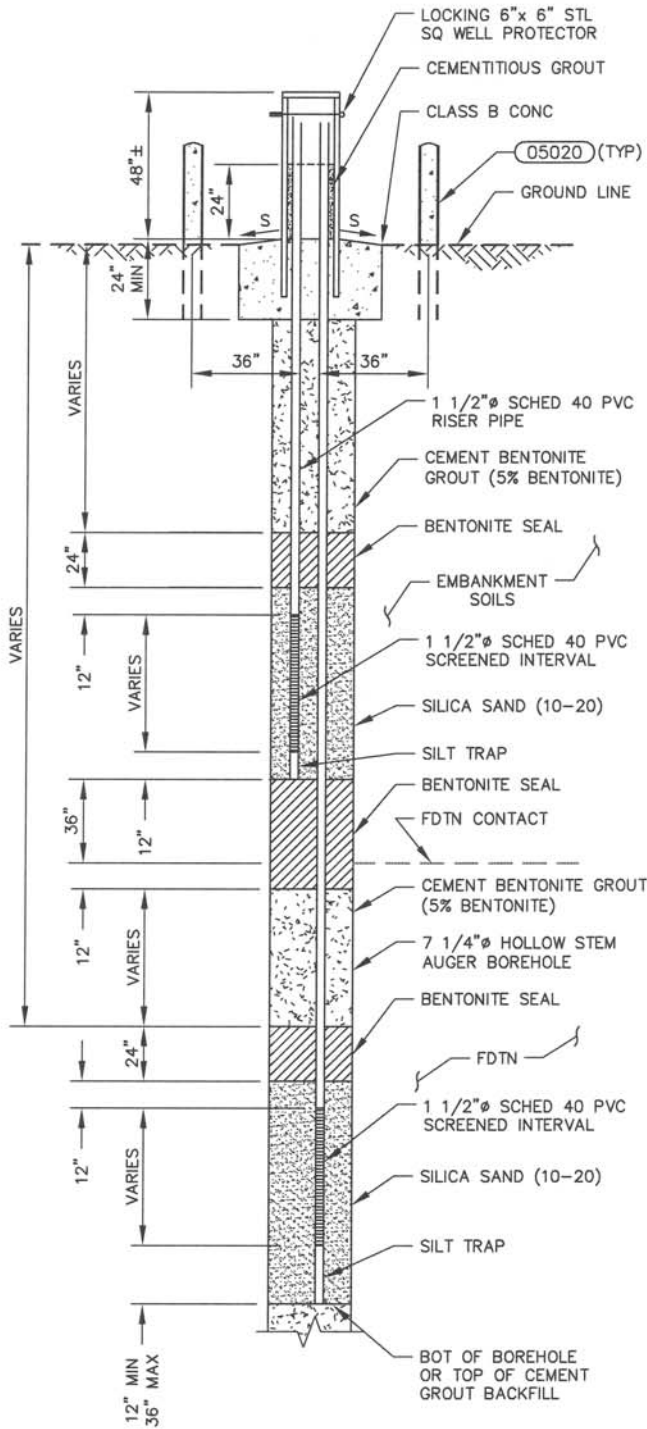
1600 West 12th Ave  
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DRAWN BY: MCMILLEN  
 CHKD BY: K ROSS/KUR  
 APPD BY: Stephen C. Pean  
 ORIGINATION DATE: JANUARY 2017  
 REVISION DATE:

13003  
 DUAL-LEVEL PIEZOMETER  
 FLUSH MOUNT

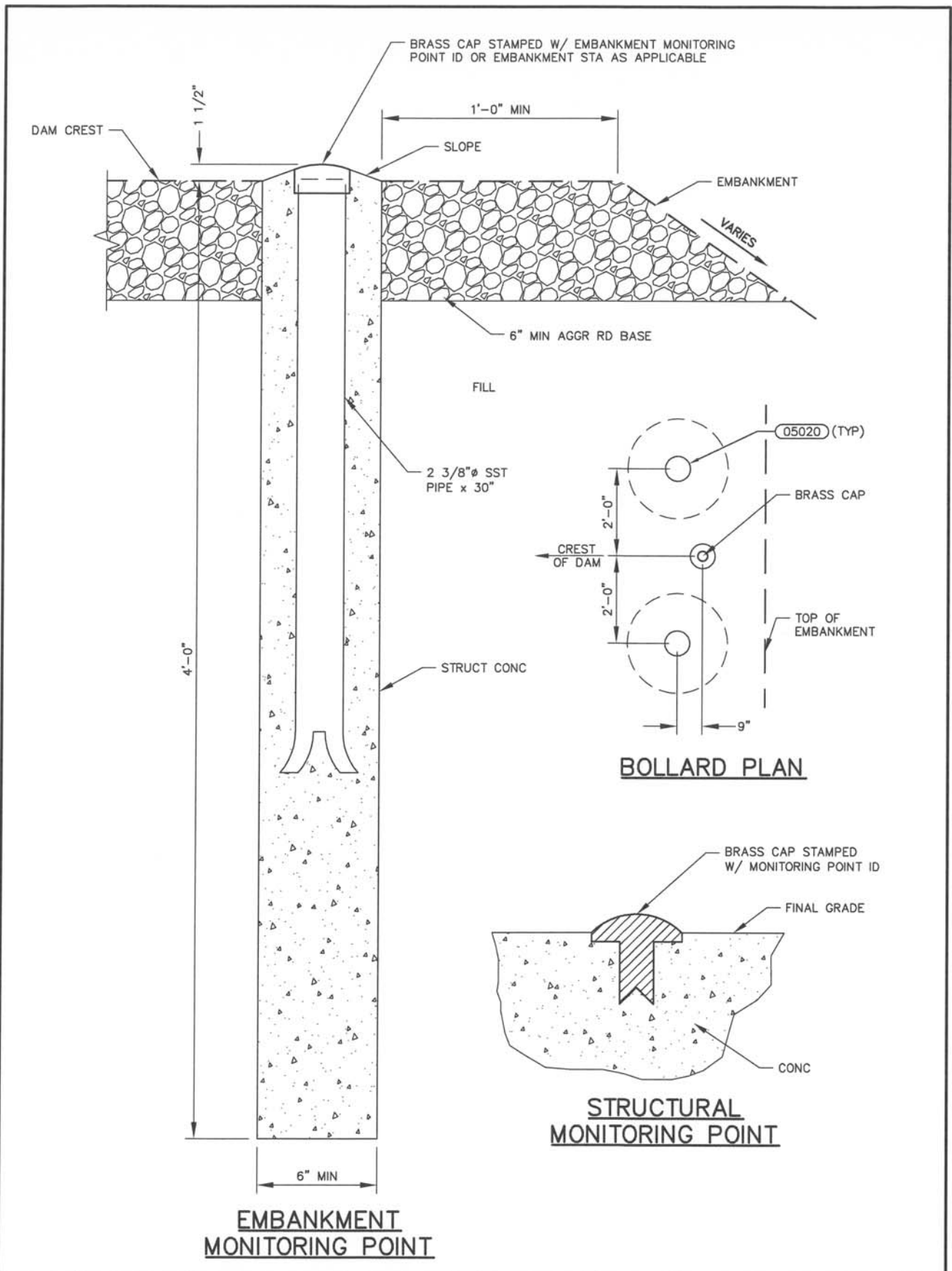
**DENVER WATER**  
 1600 West 12th Ave  
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DRAWN BY: *MCMILLEN*  
 CHKD BY: *K ROSS/VLR*  
 APPD BY: *Stephen C. Rein*  
 ORIGINATION DATE: JANUARY 2017  
 REVISION DATE:

13004  
 DUAL-LEVEL PIEZOMETER  
 STICK UP MOUNT

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DRAWN BY: SCHULTE

CHKD BY: K ROSS/KLR

APPD BY: Stephen C. Reem

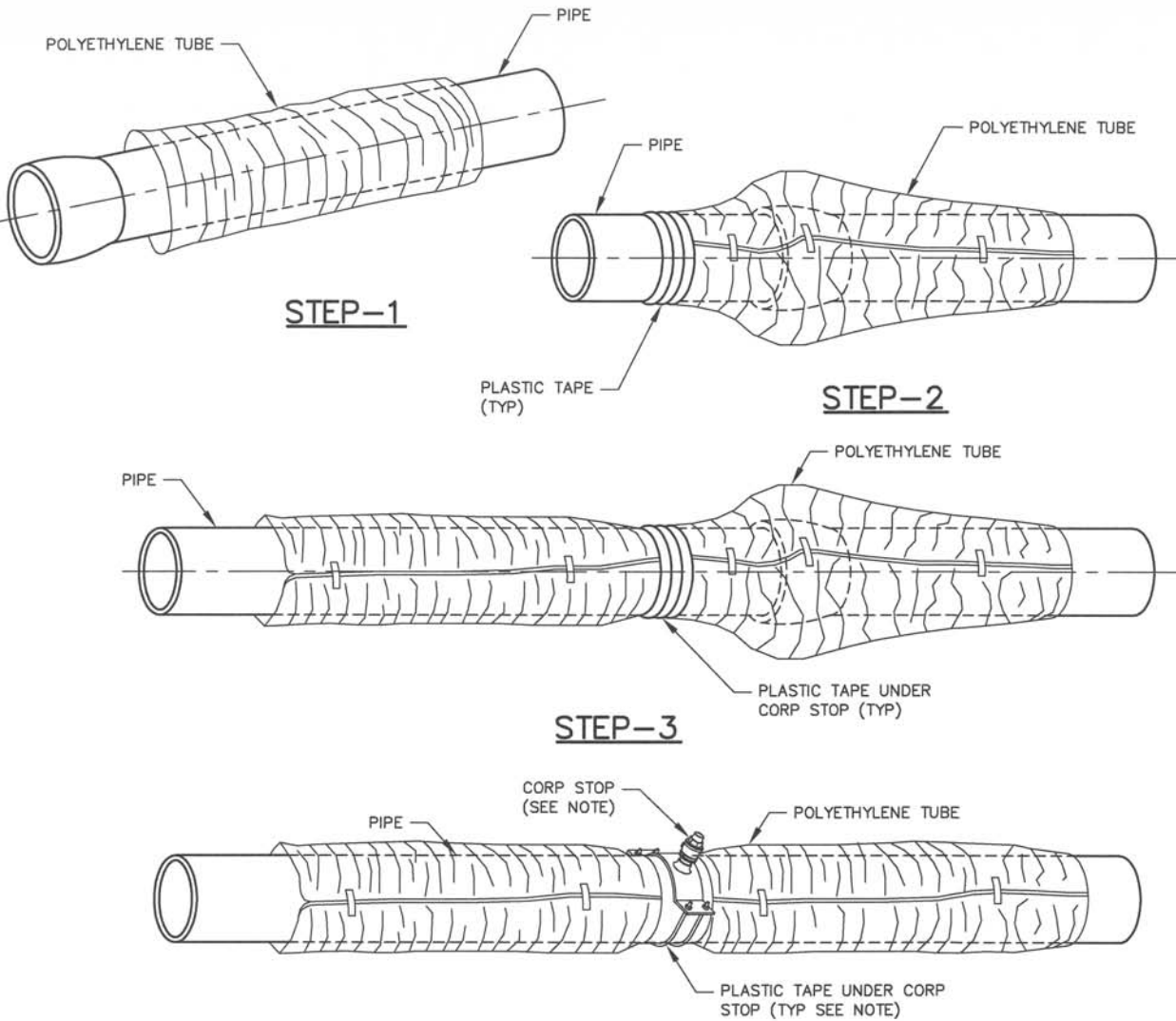
ORIGINATION DATE: JANUARY 2017

REVISION DATE:

13005  
 MONITORING POINT/  
 STATION MARKER

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### CORP STOP

### FIELD INSTALLATION – POLYETHYLENE WRAP

**STEP-1** PLACE THE TUBE OF POLYETHYLENE MATERIAL AROUND THE PIPE PRIOR TO LOWERING IT INTO THE TRENCH.

**STEP-2** PULL THE TUBE OVER THE LENGTH OF THE PIPE. TAPE THE TUBE TO THE PIPE AT THE JOINT. FOLD MATERIAL AROUND THE ADJACENT SPIGOT END AND WRAP WITH THREE CIRCUMFERENTIAL TURNS OF 2-INCH WIDE PLASTIC TAPE TO HOLD PLASTIC TUBE AROUND SPIGOT END.

**STEP-3** ADJACENT TUBE OVERLAPS FIRST TUBE AND SECURED WITH PLASTIC ADHESIVE TAPE. THE POLYETHYLENE TUBE MATERIAL COVERING THE PIPE WILL BE LOOSE. EXCESS MATERIAL SHALL BE NEATLY DRAWN UP AROUND THE PIPE BARREL, FOLDED INTO AN OVERLAP ON TOP OF THE PIPE, AND HELD IN PLACE BY MEANS OF PIECES OF PLASTIC TAPE AT APPROXIMATELY 3-FOOT INTERVALS.

#### NOTE:

AT LOCATION OF TAP, APPLY FOUR WRAPS OF PLASTIC TAPE AROUND THE PIPE FOR A WIDTH THAT WILL PROVIDE PROTECTION OF THE POLYETHYLENE WRAP FROM THE TAPPING MACHINE.

DRAWN BY: *BOWMAN*

CHKD BY: *K ROSS/KLR*

APPD BY: *Stephen C. Remm*

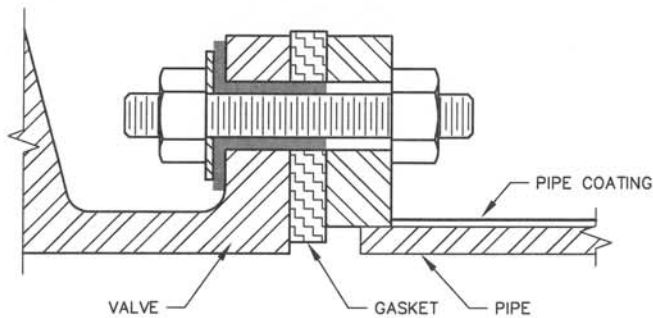
ORIGINATION DATE: *JANUARY 2017*

REVISION DATE:

13020  
FIELD INSTALLATION  
POLYETHYLENE WRAP

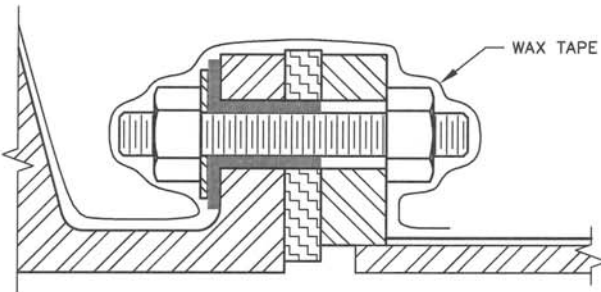
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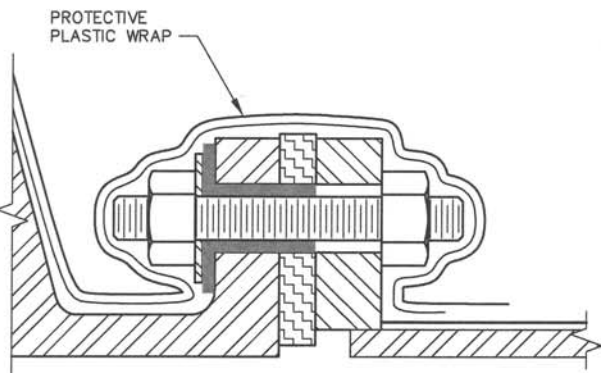
**STEP-1**

CLEAN TO REMOVE ALL FOREIGN MATTER AND EXCESS MOISTURE. ACHIEVE SSPC-SP2. APPLY 3 MILS OF PRIMER TO FLANGED JOINT AND VALVE.



**STEP-2**

CUT, FIT, FORM AND WRAP WAX TAPE AROUND FLANGED JOINT AND VALVE TO PROVIDE MINIMUM THICKNESS OF 70 MILS. OVERLAPS SHALL BE 1-INCH MINIMUM. OVERLAP ON PIPE COATING SHALL BE 2-INCH MINIMUM.




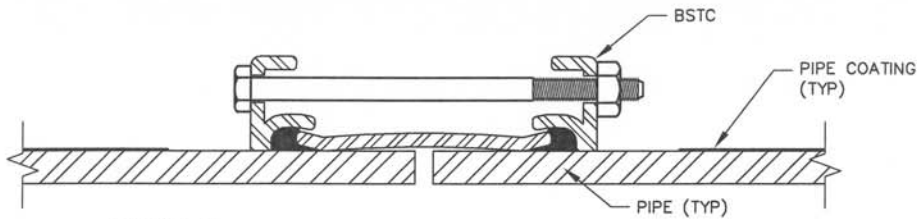
**STEP-3**

CIRCUMFERENTIALLY INSTALL PROTECTIVE PLASTIC WRAP 1.5 MILS MINIMUM THICKNESS OVER WAX TAPE. OVERLAPS SHALL BE 1-INCH MINIMUM.

**NOTES:**

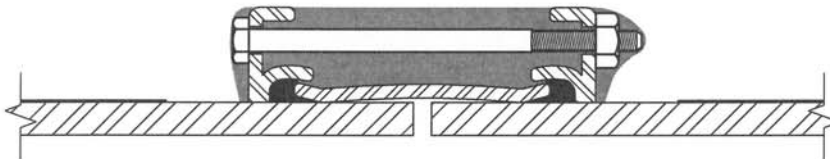
1. FOR GATE VALVES, INSTALL WAX TAPE SYSTEM UP TO VALVE STEM. FOR BUTTERFLY VALVES, INSTALL WAX TAPE SYSTEM ON ACTUATOR TO MANHOLE PENETRATION.
2. INSULATED VALVE FLANGE CONNECTION SHOWN. DETAIL APPLIES TO ANY FLANGE CONNECTION.

DRAWN BY: <i>BOWMAN</i> CHKD BY: <i>K ROSS/KR</i> APPD BY: <i>Stephen C. Penn</i> ORIGINATION DATE: <i>JANUARY 2017</i> REVISION DATE:	<p>13021</p> <p><b>FIELD INSTALLATION WAX TAPE</b></p> <p><b>(FLANGED CONNECTION)</b></p>	 1600 West 12th Ave Denver, Colorado 80204-3412 T: 303.628.6000 F: 303.628.6851 <a href="http://denverwater.org">denverwater.org</a>
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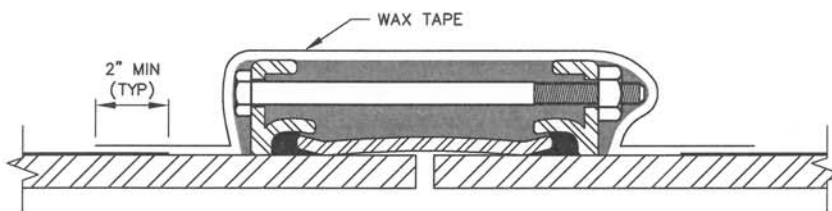
**STEP-1**

CLEAN TO REMOVE ALL FOREIGN MATTER AND EXCESS MOISTURE. ACHIEVE SSPC-SP2. APPLY 3 MILS OF PRIMER TO UNCOATED PIPE, COUPLING SURFACES, AND PIPE COATING WHERE WAX TAPE AND WRAP WILL LAP.



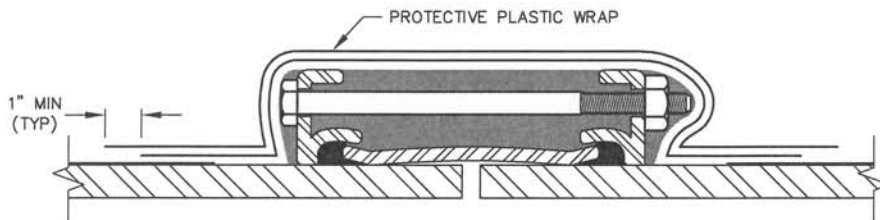
**STEP-2**

APPLY FILL MASTIC IN SHADED AREA TO PROVIDE A UNIFORM SURFACE TO WHICH WAX TAPE CAN BE APPLIED WITHOUT BRIDGING OR VOIDS.



**STEP-3**

CIRCUMFERENTIALLY INSTALL WAX TAPE AROUND PIPE AND COUPLING TO PROVIDE A MINIMUM THICKNESS OF 70 MILS. OVERLAPS SHALL BE 1-INCH MINIMUM. OVERLAP ON PIPE COATING SHALL BE 2-INCH MINIMUM.



**STEP-4**

CIRCUMFERENTIALLY INSTALL PROTECTIVE PLASTIC WRAP 1.5 MILS MINIMUM THICKNESS OVER WAX TAPE. OVERLAPS SHALL BE 1-INCH MINIMUM.

**NOTE:**

NON-INSULATED BOLTED SLEEVE TYPE COUPLING CONNECTION SHOWN. DETAIL APPLIES TO ANY BURIED BOLTED SLEEVE TYPE COUPLING CONNECTION.

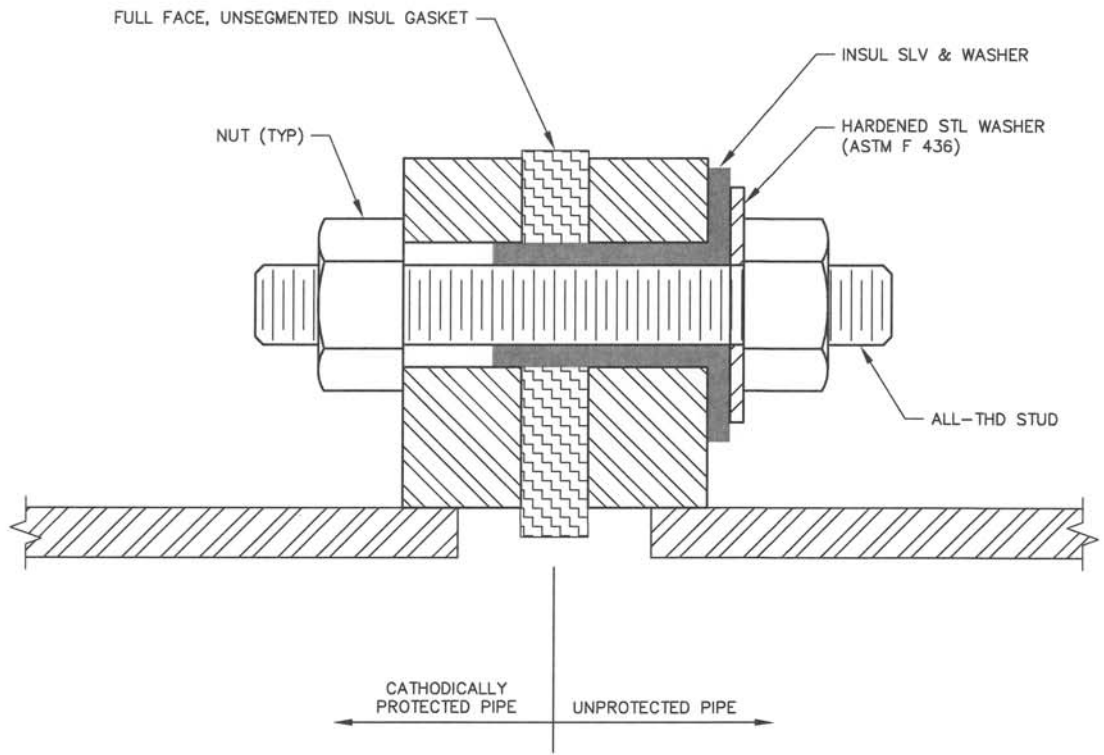
DRAWN BY: <i>BOWMAN</i>
CHKD BY: <i>K ROSS/vce</i>
APPD BY: <i>Stephen C. Roman</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

13022  
 FIELD INSTALLATION WAX TAPE  
 (BOLTED SLEEVE TYPE  
 COUPLING CONNECTION)

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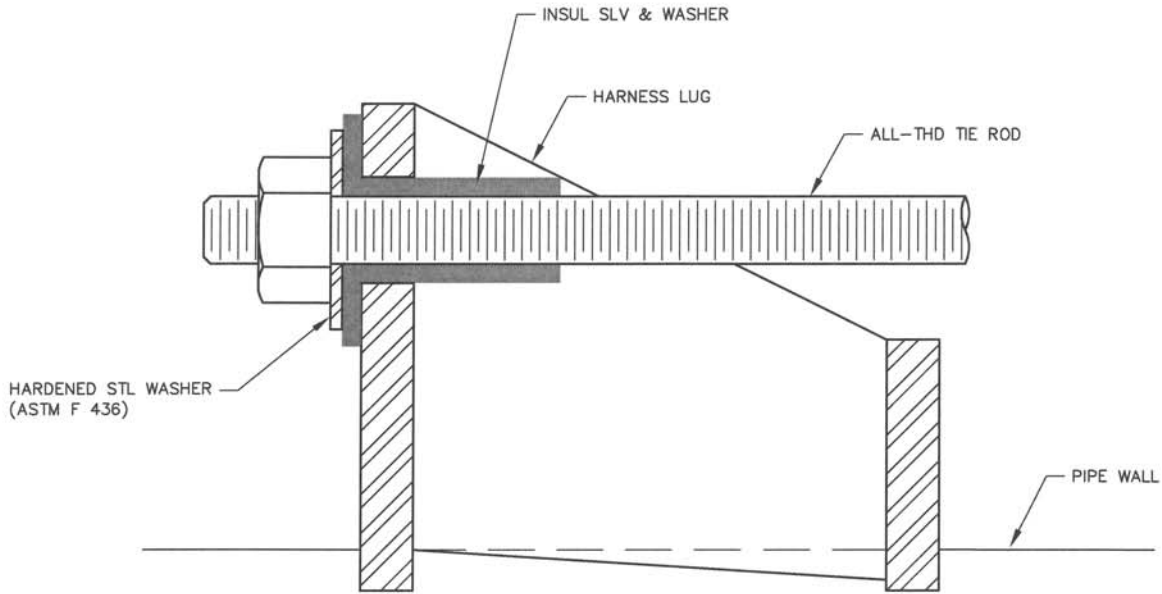
**NOTE:**

INSULATED SLEEVES AND WASHERS SHALL BE INSTALLED FROM THE SAME SIDE OF UNPROTECTED FLANGE.

DRAWN BY: <i>BERKNESS</i>
CHKD BY: <i>K ROSS/KLR</i>
APPD BY: <i>Stephen C. Palmer</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**13023  
INSULATED FLANGE**

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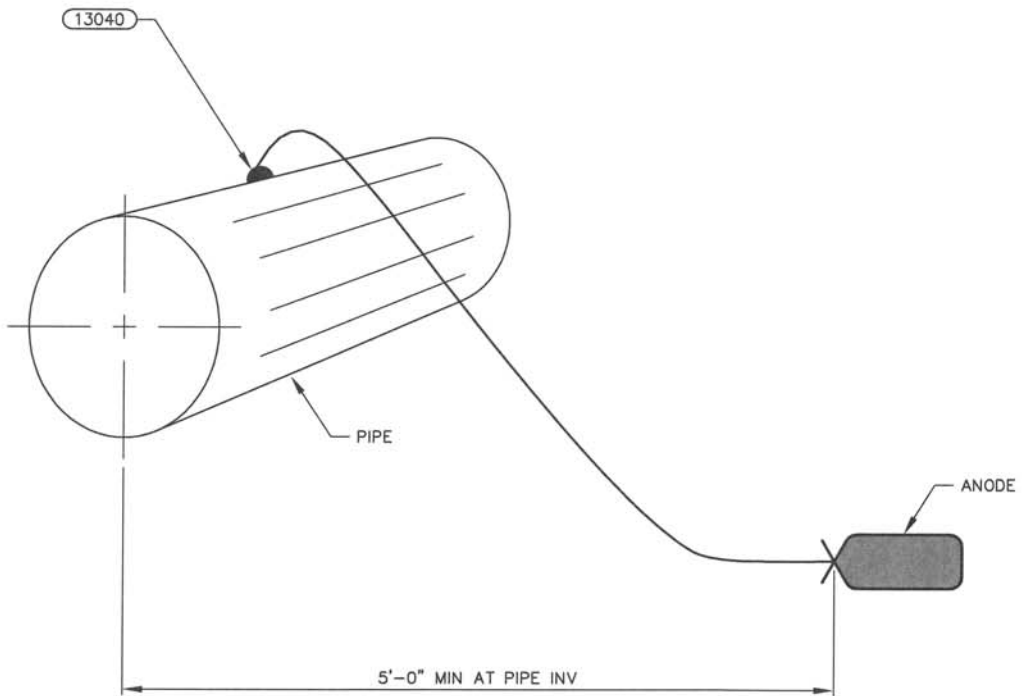
**NOTE:**

INSULATING HARNESS LUGS SHALL HAVE BOLT HOLES  
1/4-INCH DIAMETER LARGER THAN ROD DIAMETER.

DRAWN BY: <i>BOWMAN</i>
CHKD BY: <i>K ROSS/ KLR</i>
APPD BY: <i>Stephen C. Reem</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**13024  
INSULATED ROD ON  
HARNESS LUG**

**D DENVER WATER**  
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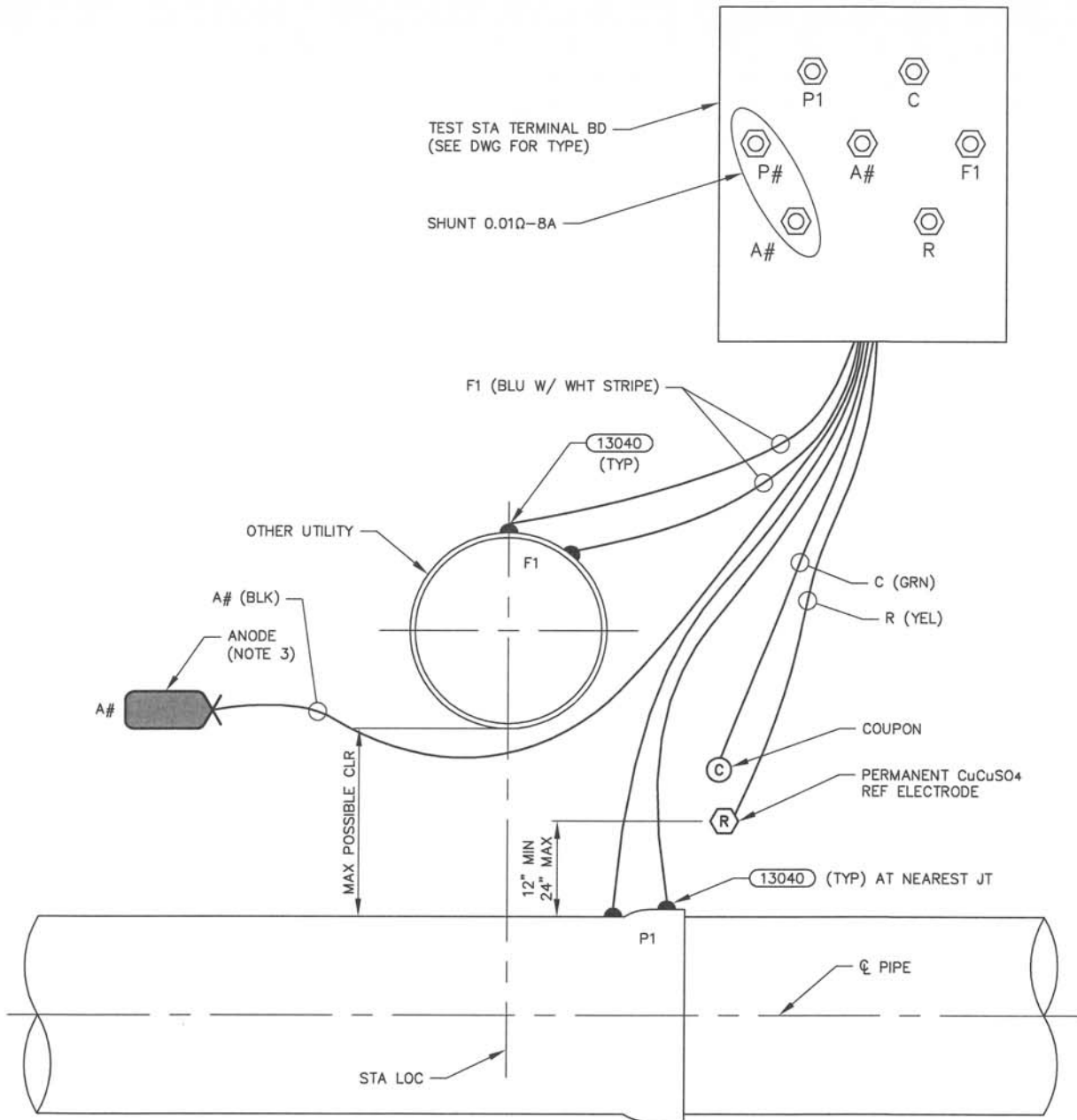
**NOTE:**

NUMBER OF ANODES MAY VARY.

DRAWN BY: <i>BOWMAN</i>
CHKD BY: <i>K ROSS/KR</i>
APPD BY: <i>Stephen C. Penner</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**13025  
ANODE INSTALLATION**

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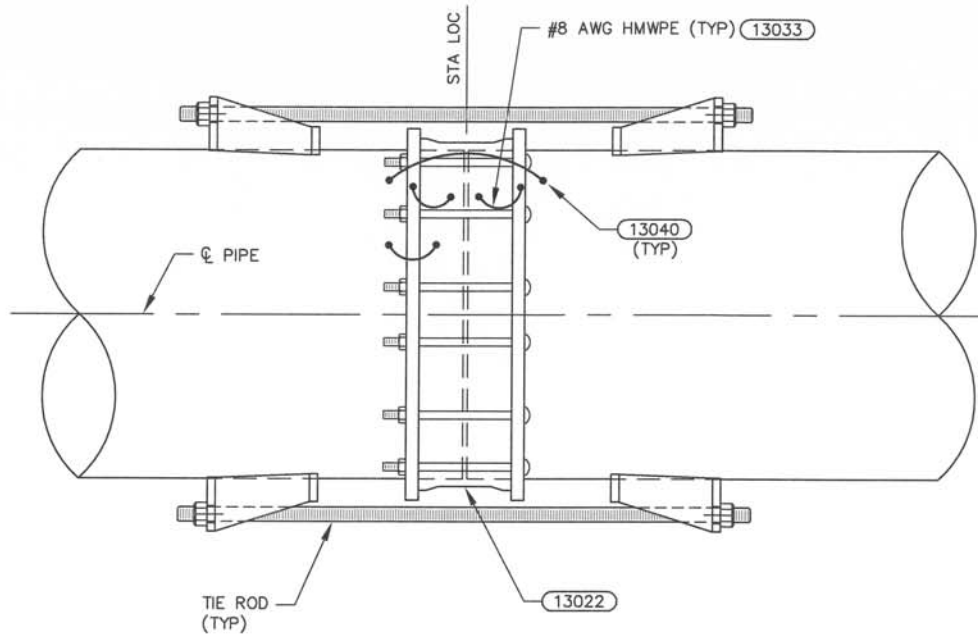
**NOTES:**

1. OBTAIN PERMISSION FROM OTHER UTILITY OWNER PRIOR TO INSTALLING TEST LEAD ON THEIR LINE.
2. COORDINATE CONNECTION OF WIRE F1 FOR STRAY CURRENT MITIGATION WITH OTHER UTILITY.
3. INSTALLATION MAY NOT CONTAIN ANODES.

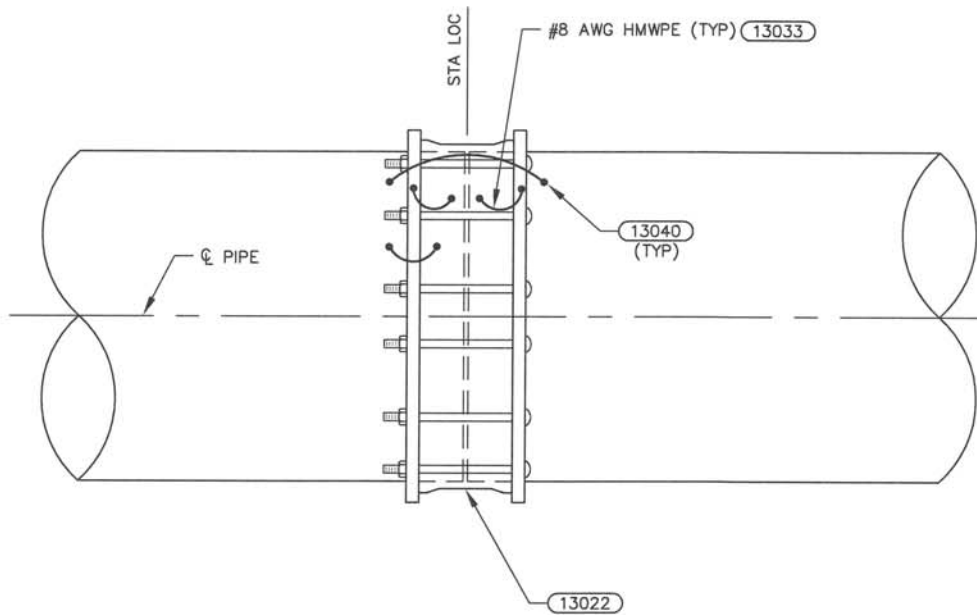
DRAWN BY: <i>BOWMAN</i>
CHKD BY: <i>K ROSS/KR</i>
APPD BY: <i>Stephen C. P...</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**13030  
INTERFERENCE PROTECTION**

**D DENVER WATER**  
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**RESTRAINED SINGLE NON-INSULATED COUPLING**



**NON-RESTRAINED SINGLE NON-INSULATED COUPLING**

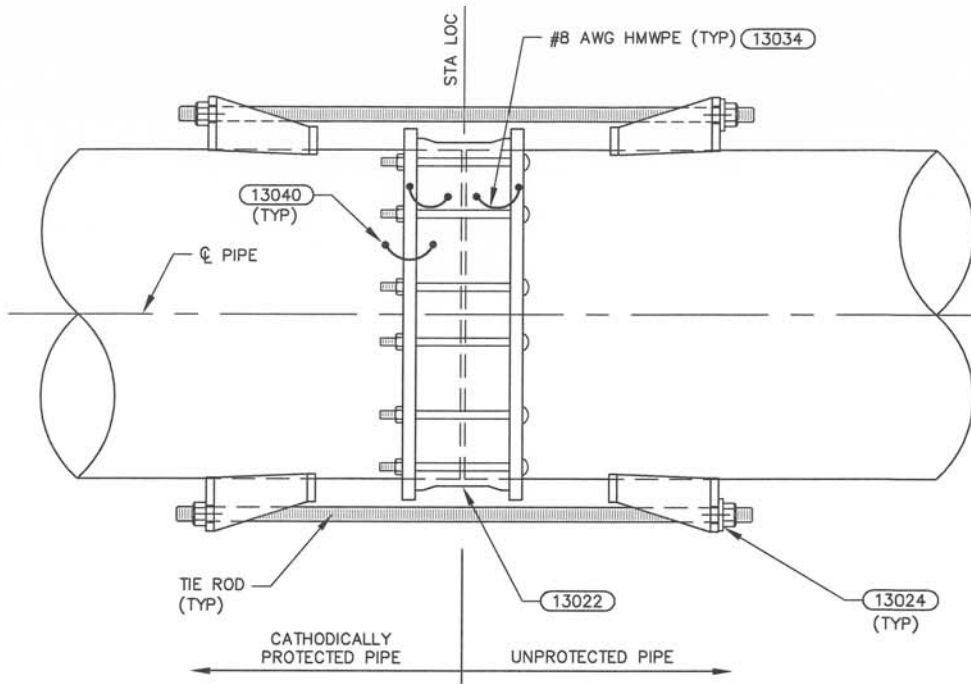
**NOTE:**

FOR BURIED LOCATIONS OR LOCATIONS SUSCEPTIBLE TO SUBMERSION. SEE (13022)

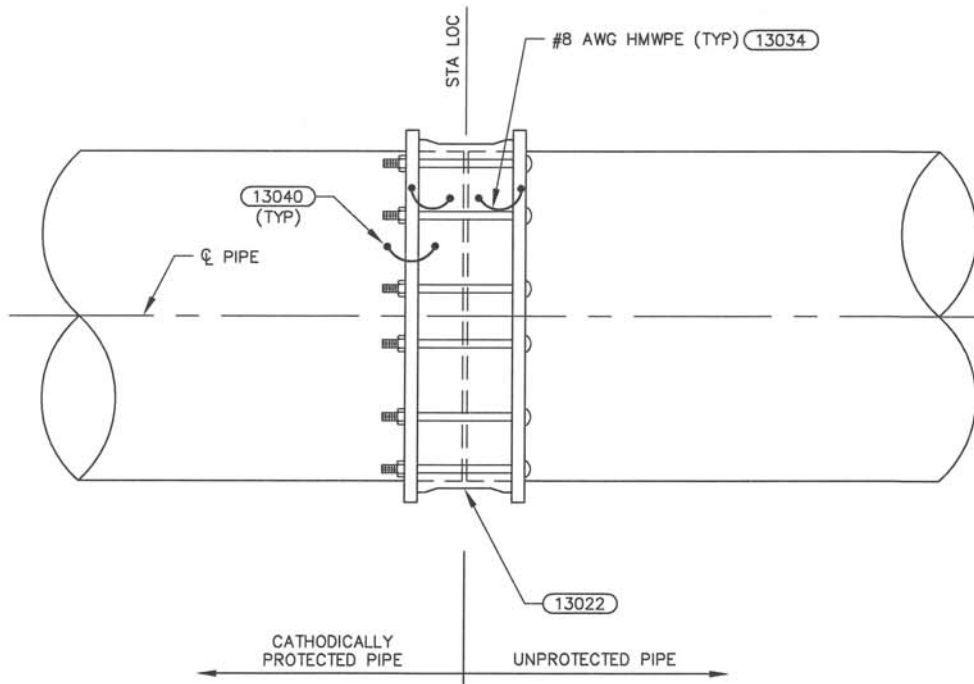
DRAWN BY: BOWMAN
CHKD BY: K ROSS/KUR
APPD BY: Stephen C. Parn
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**13031**  
**BOLTED SLEEVE TYPE**  
**COUPLING BONDING**  
**NON-INSULATED**


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**RESTRAINED SINGLE INSULATED COUPLING**



**NON-RESTRAINED SINGLE INSULATED COUPLING**

**NOTE:**

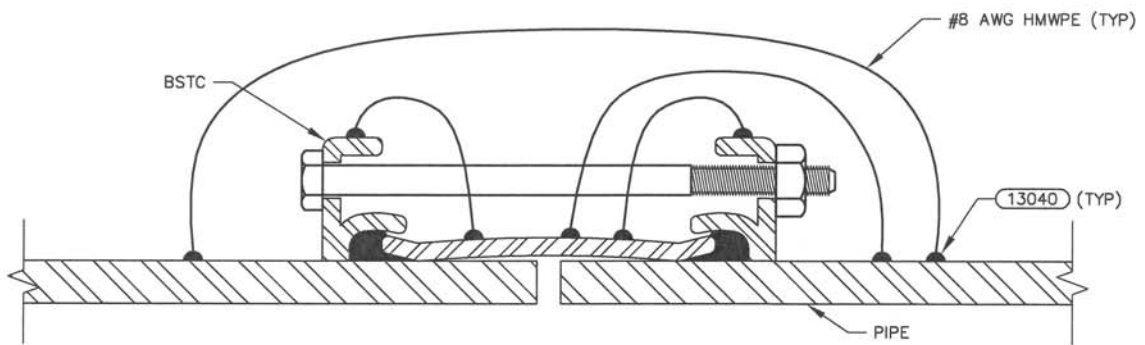
FOR BURIED LOCATIONS OR LOCATIONS SUSCEPTIBLE TO SUBMERSION. SEE (13022)

**13032**  
**BOLTED SLEEVE TYPE**  
**COUPLING BONDING**  
**INSULATED**

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DRAWN BY: <b>BOWMAN</b>
CHKD BY: <b>K ROSS/KR</b>
APPD BY: <b>Stephen C. Penn</b>
ORIGINATION DATE: <b>JANUARY 2017</b>
REVISION DATE:



SINGLE NON-INSULATED COUPLING

DRAWN BY: *BOWMAN*

CHKD BY: *K ROSS/KUR*

APPD BY: *Stephen C. Peen*

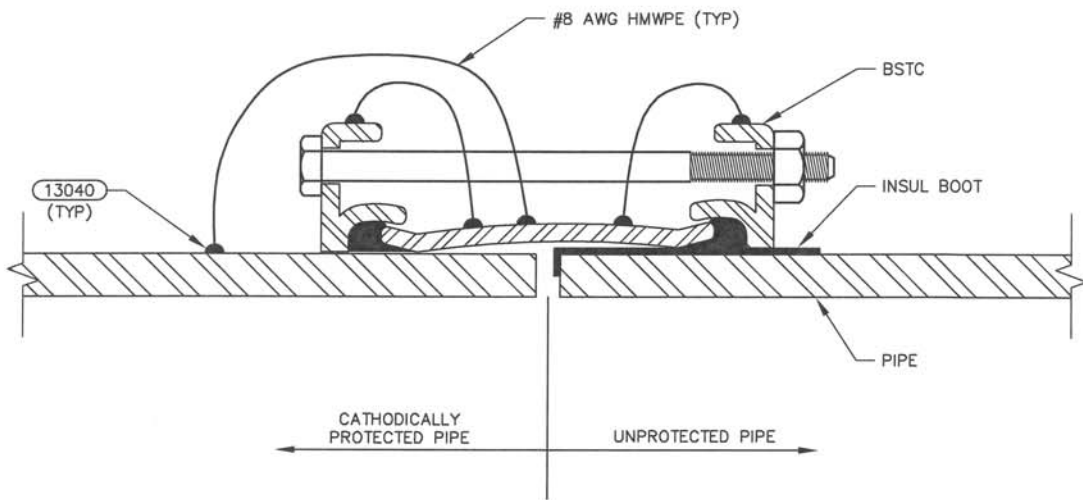
ORIGINATION DATE: *JANUARY 2017*

REVISION DATE:

*13033*  
**BOLTED SLEEVE TYPE  
 COUPLING BONDING  
 NON-INSULATED**

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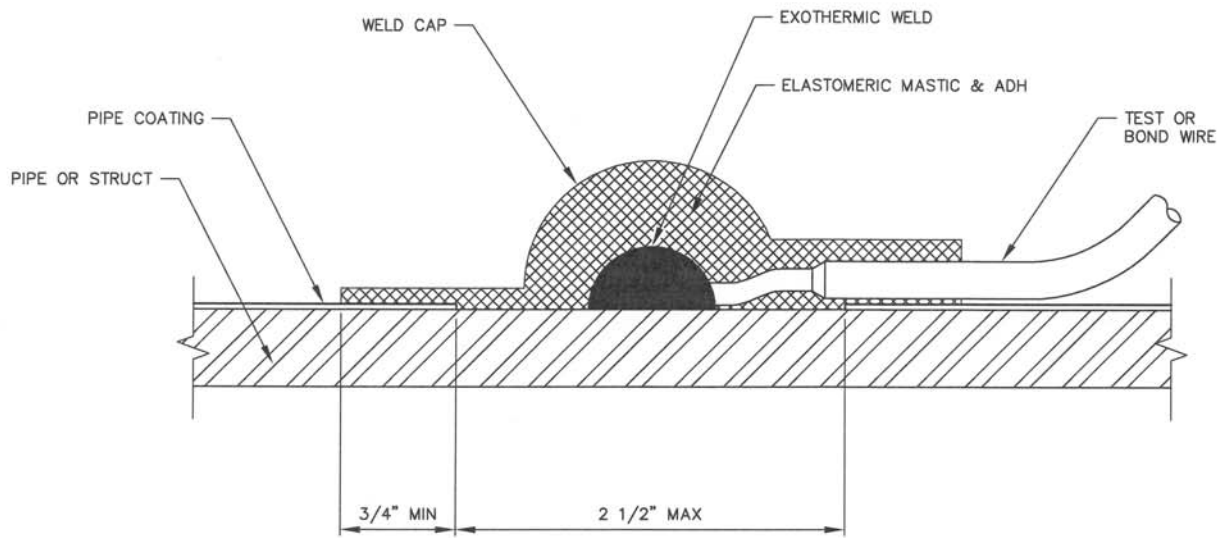
**SINGLE INSULATED COUPLING**

DRAWN BY: <i>BOWMAN</i>
CHKD BY: <i>K ROSS/KLR</i>
APPD BY: <i>Stephen C. Benn</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**13034**  
**BOLTED SLEEVE TYPE**  
**COUPLING BONDING**  
**INSULATED**


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DRAWN BY: *BOWMAN*

CHKD BY: *K ROSS/KUR*

APPD BY: *Stephen C. Peun*

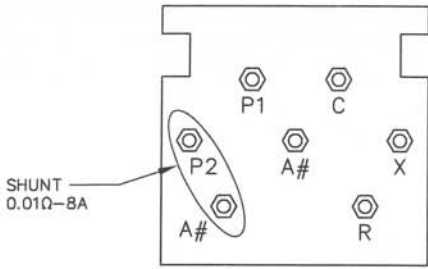
ORIGINATION DATE: *JANUARY 2017*

REVISION DATE:

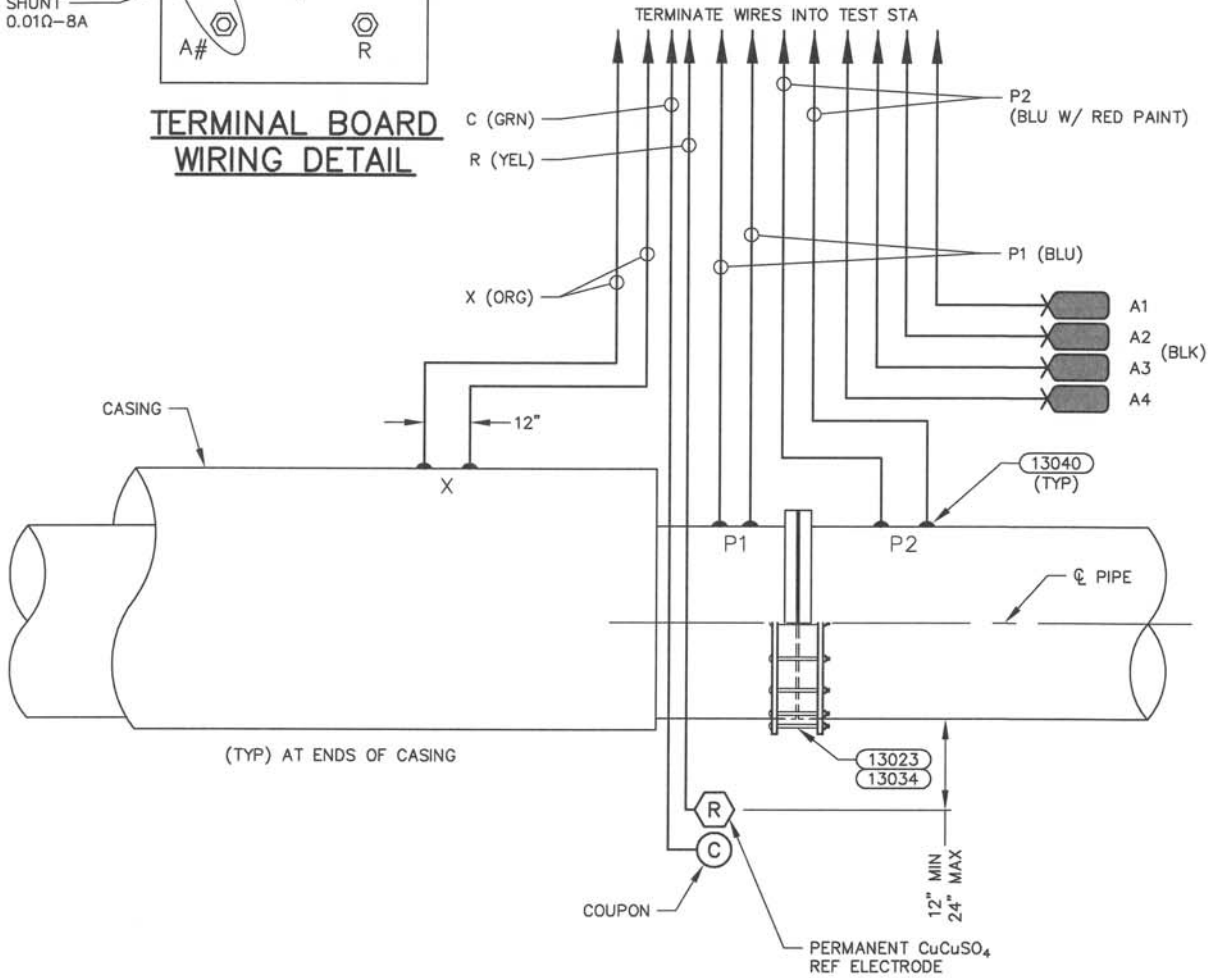
13040  
EXOTHERMIC WELD  
CONNECTION



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denverwater.org



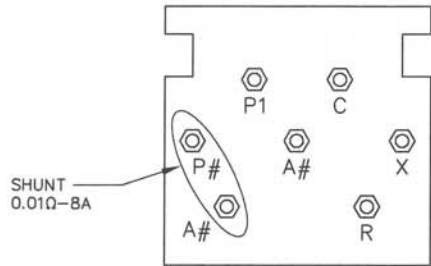
**TERMINAL BOARD  
WIRING DETAIL**



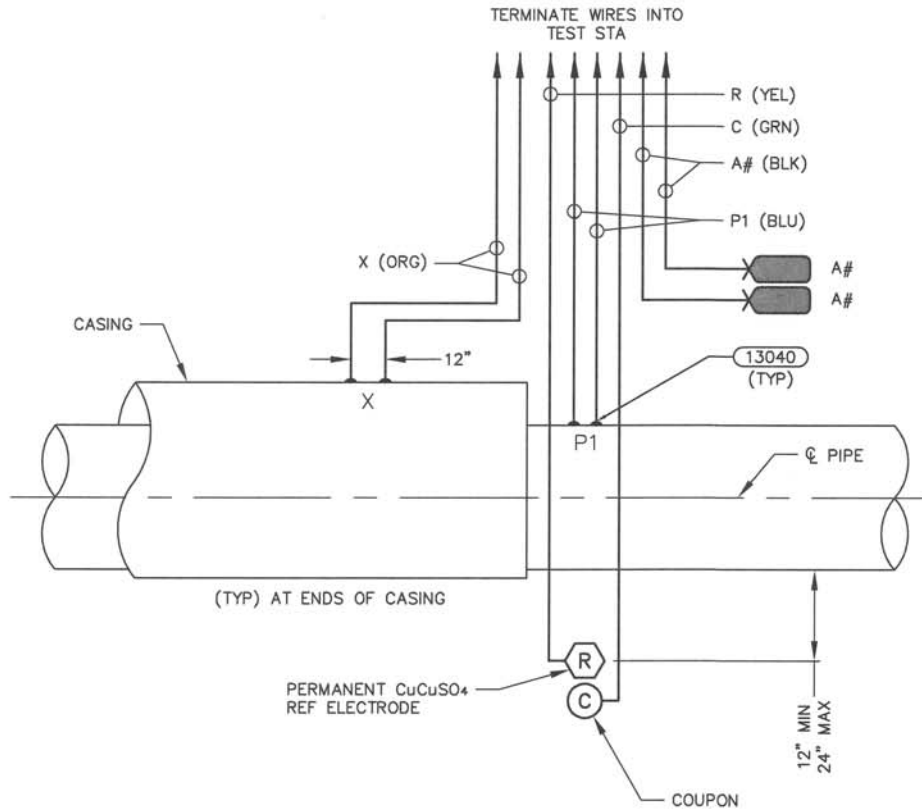
DRAWN BY: <i>BOWMAN</i>
CHKD BY: <i>K ROSS/KUR</i>
APPD BY: <i>Stephen C. Rem</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**13041  
CASING TEST STATION  
(INSULATED FLANGE  
OR COUPLING)**

**D DENVER WATER**  
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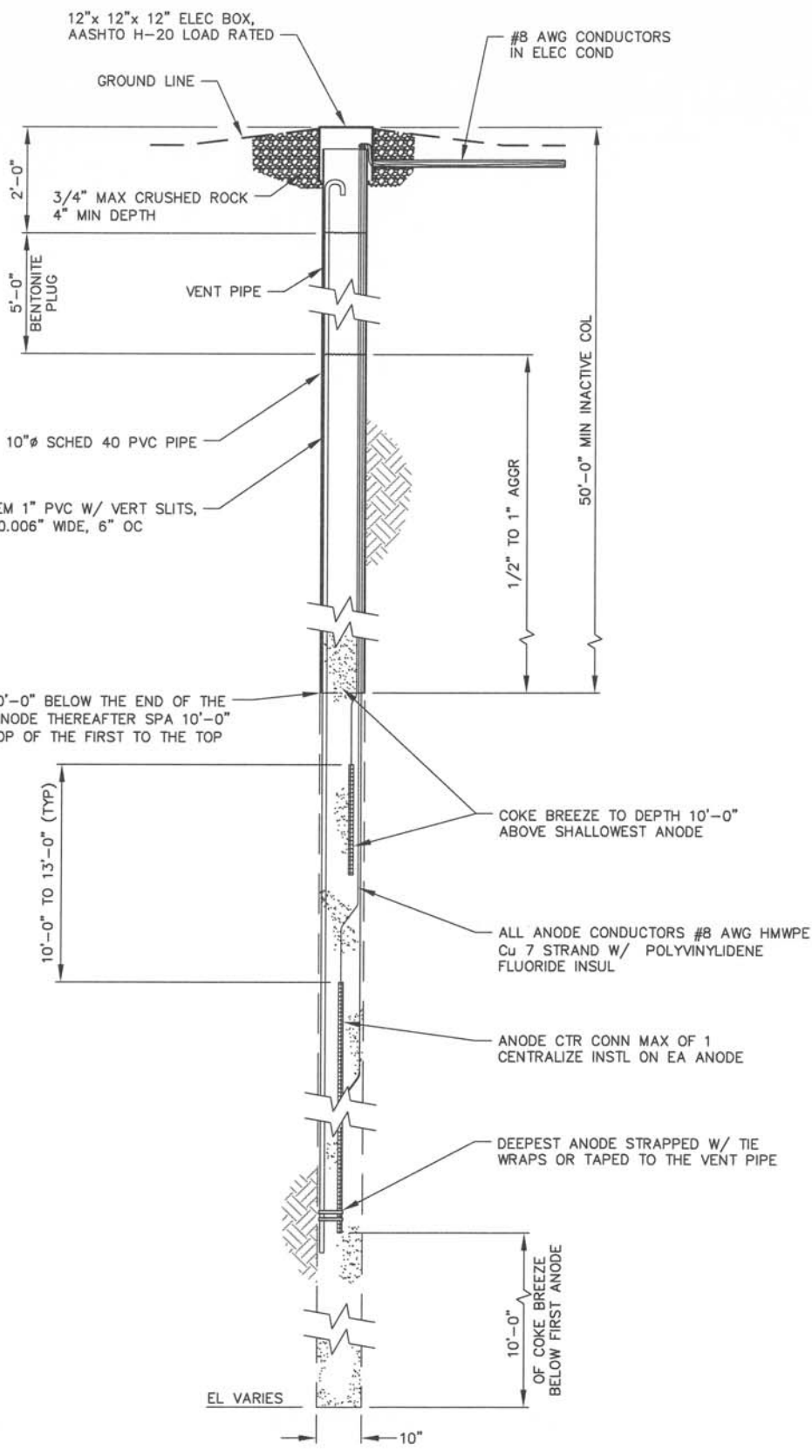
**TERMINAL BOARD  
WIRING DETAIL**



DRAWN BY: BOWMAN  
 CHKD BY: K ROSS/VLR  
 APPD BY: Stephen C. Remer  
 ORIGINATION DATE: JANUARY 2017  
 REVISION DATE:

13042  
 CASING TEST STATION  
 (NON-INSULATED FLANGE  
 OR COUPLING)

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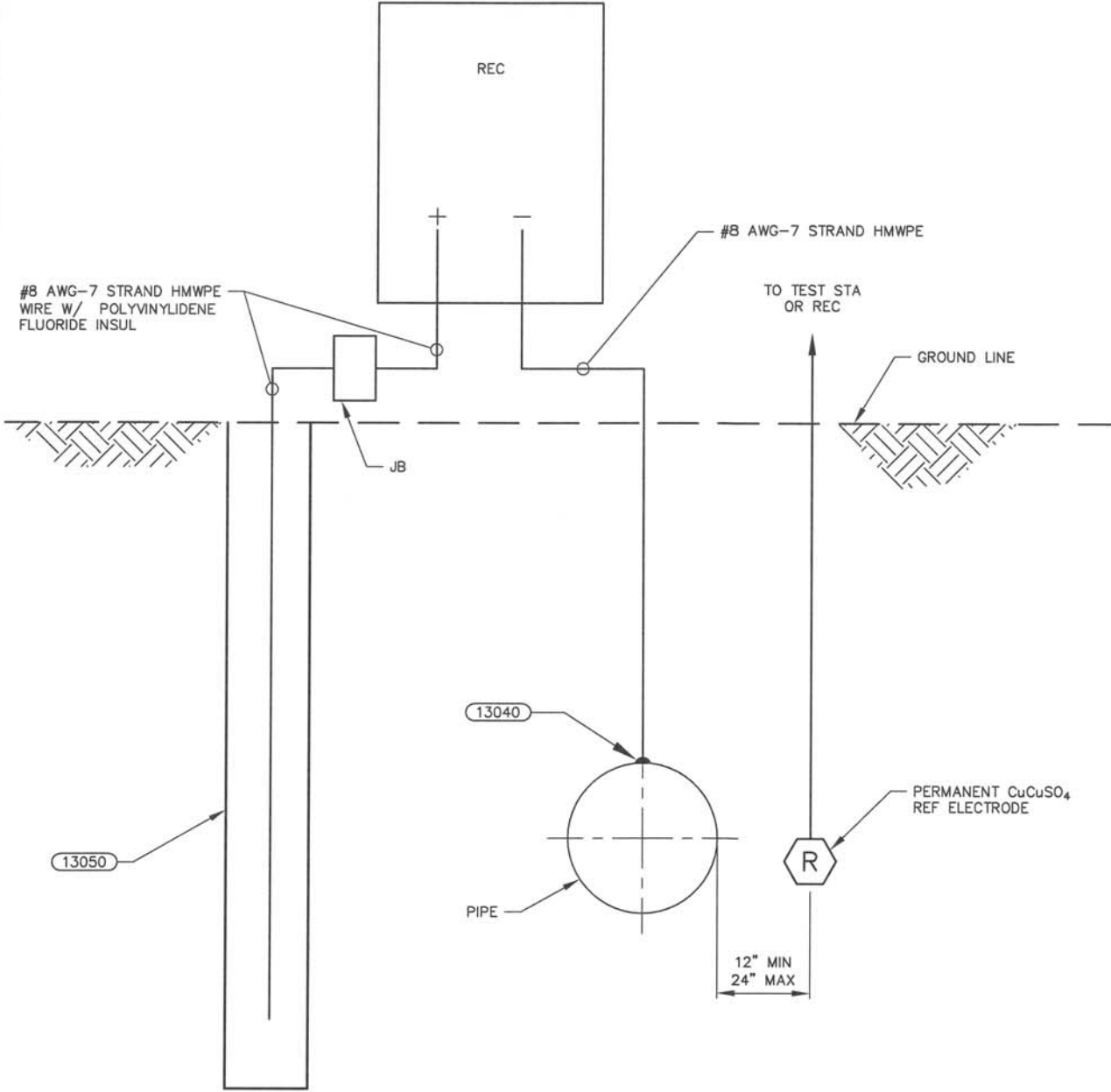


DRAWN BY: ALVARADO
CHKD BY: K ROSS/KUR
APPD BY: Stephen C. Ram
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

13050  
DEEP WELL GROUND BED

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**NOTE:**

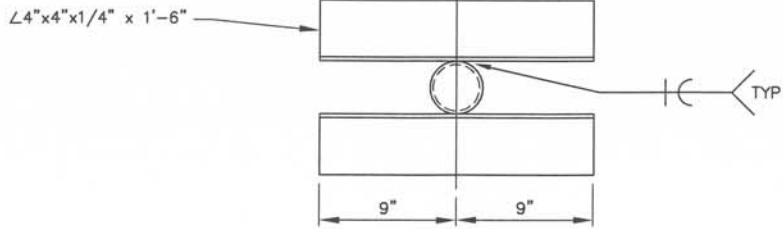
SIZE OF RECTIFIER, JUNCTION BOX, AND NUMBER OF TERMINALS MAY VARY.

DRAWN BY: <i>BOWMAN</i>
CHKD BY: <i>K ROSS/KLR</i>
APPD BY: <i>Stephen C. Rem</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

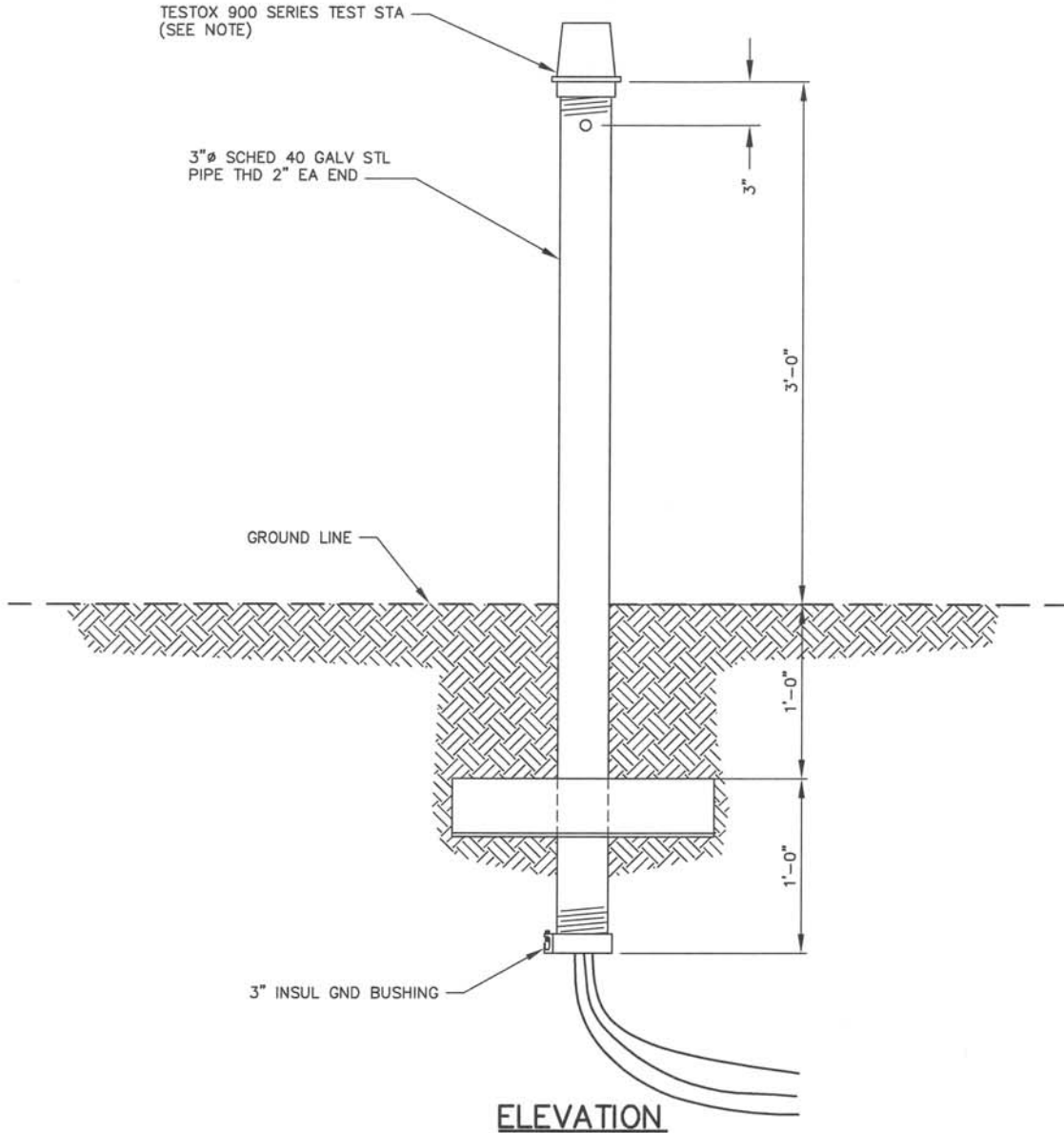
**13051  
RECTIFIER CONNECTION  
ONE-LINE**

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**PLAN**



**ELEVATION**

**NOTE:**

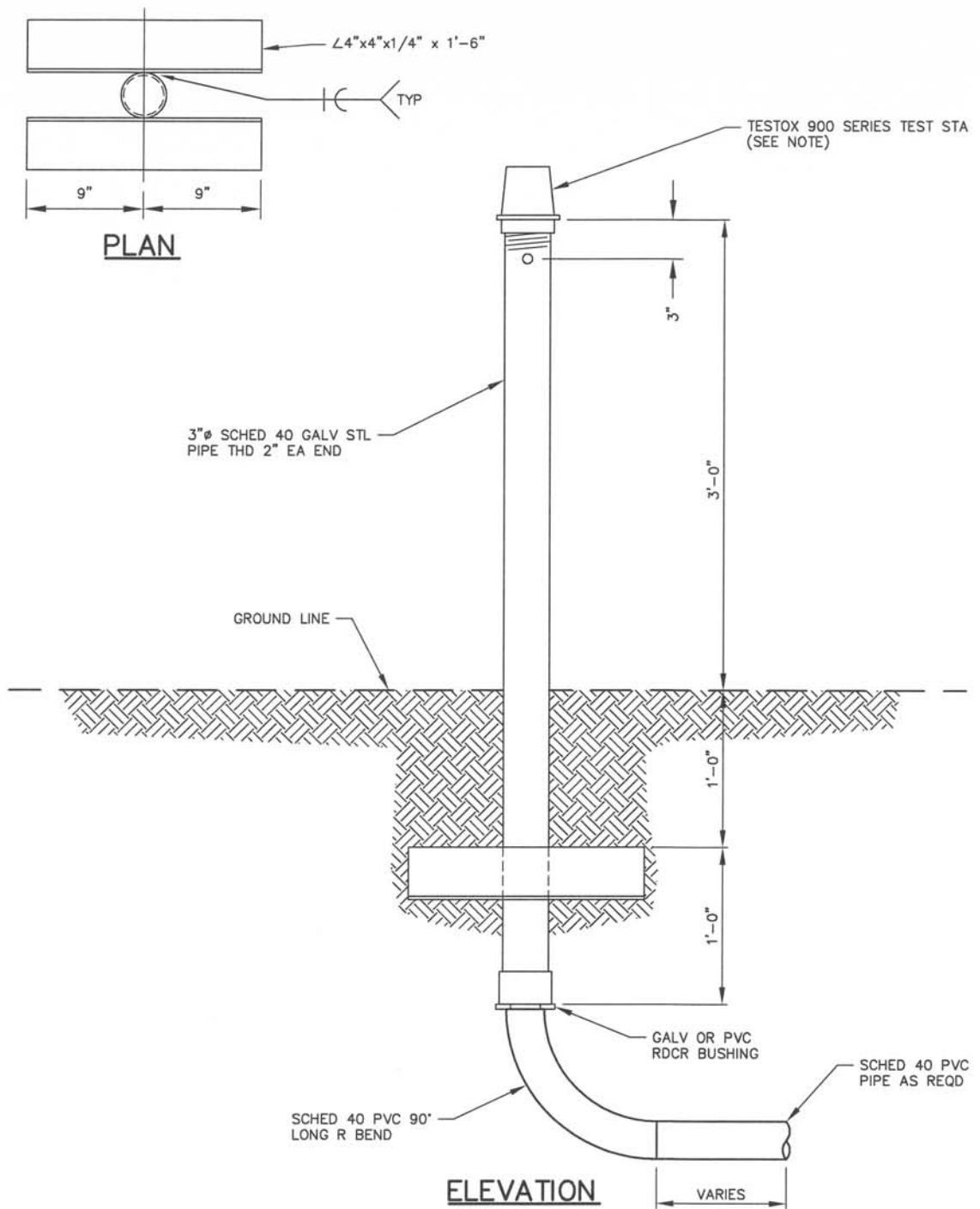
ENGRAVE T\_#### ON TESTOX 900 LID.

DRAWN BY: BERKNESS
CHKD BY: K ROSS/KR
APPD BY: Stephen C. Reim
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

13060  
TEST STATION  
ABOVE GRADE

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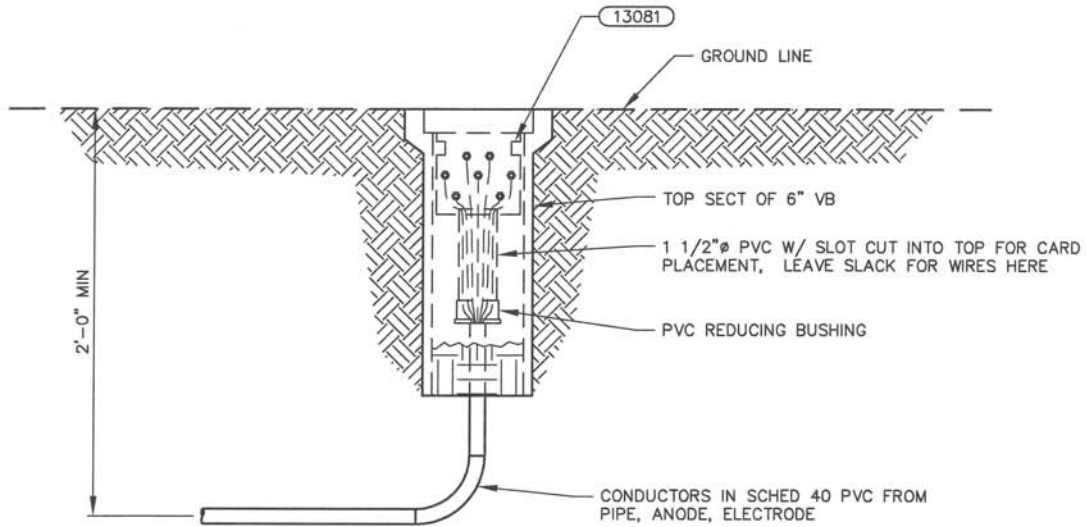
**NOTE:**

ENGRAVE T\_#### ON TESTOX 900 LID.

DRAWN BY: BERKNESS
CHKD BY: K ROSS/VLR
APPD BY: Stephen C. Rasmussen
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

13061  
 TEST STATION ABOVE  
 GRADE WITH CONDUIT

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**NOTE:**

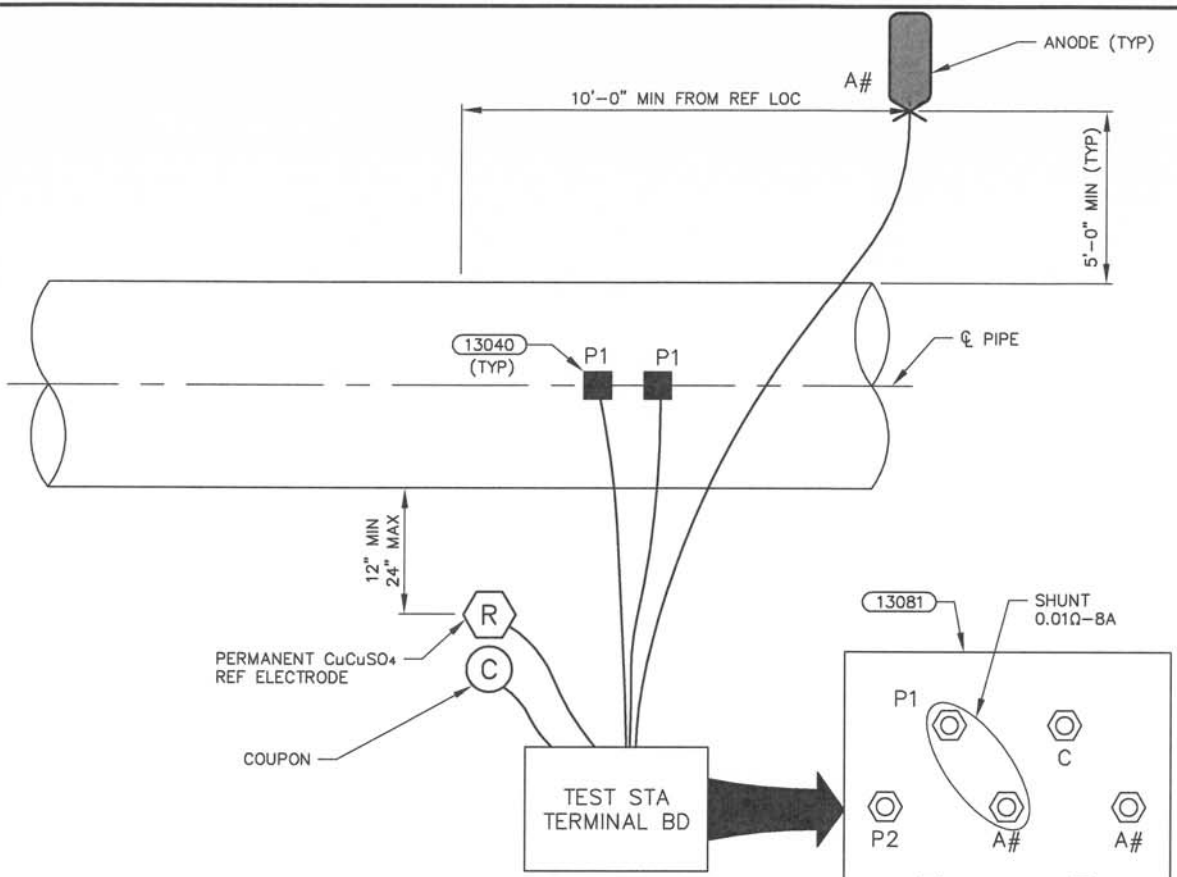
AT GRADE TEST STATION SHALL BE USED WHERE 13061 IS NOT POSSIBLE.

DRAWN BY: BERKNESS
CHKD BY: K ROSS/ KLR
APPD BY: Stephen C. P... (signature)
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

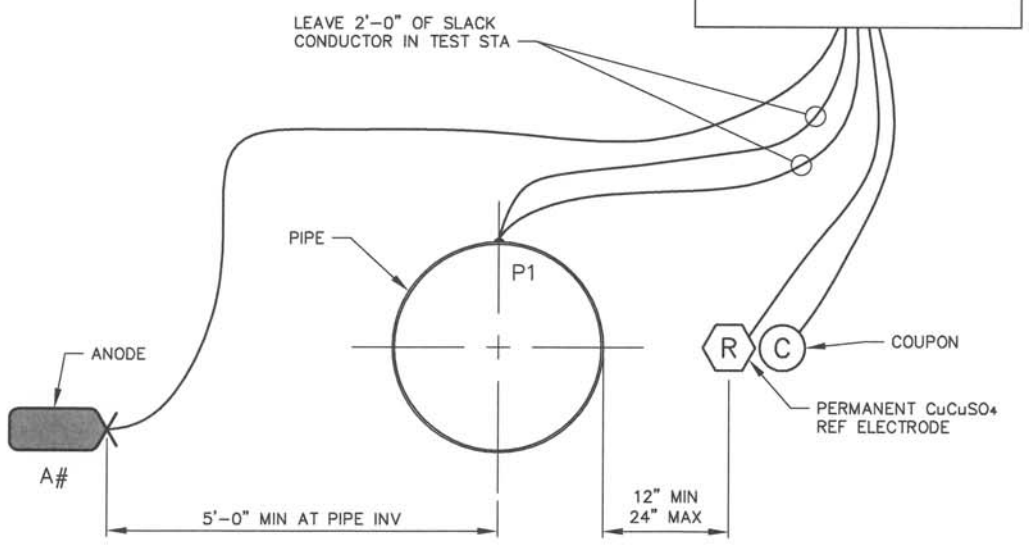
13062  
 TEST STATION AT GRADE  
 WITH CONDUIT

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**PLAN**



**ELEVATION**

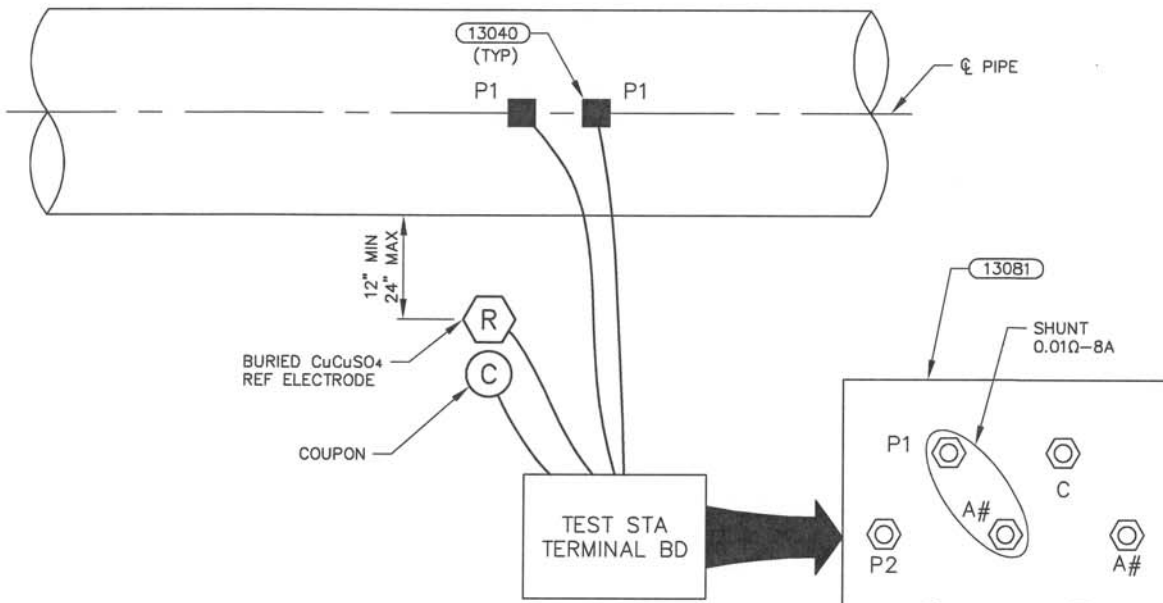
**NOTE:**

NUMBER OF ANODES MAY VARY.

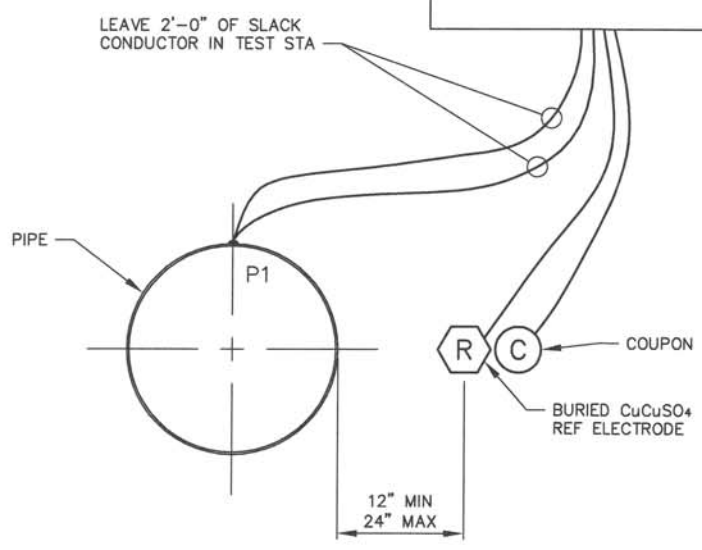
DRAWN BY: BERKNESS
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Reun
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**13063  
TYPICAL CATHODIC  
PROTECTION TEST STATION**

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**PLAN**

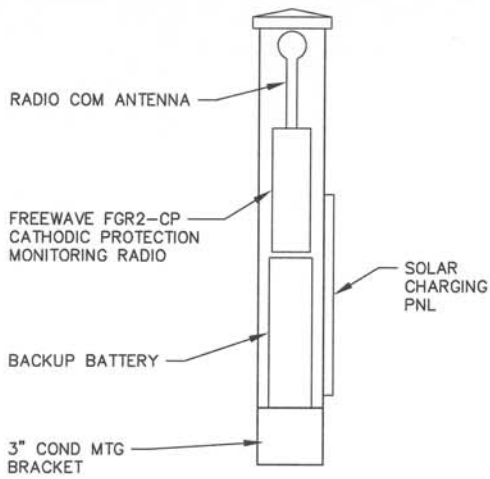


**ELEVATION**

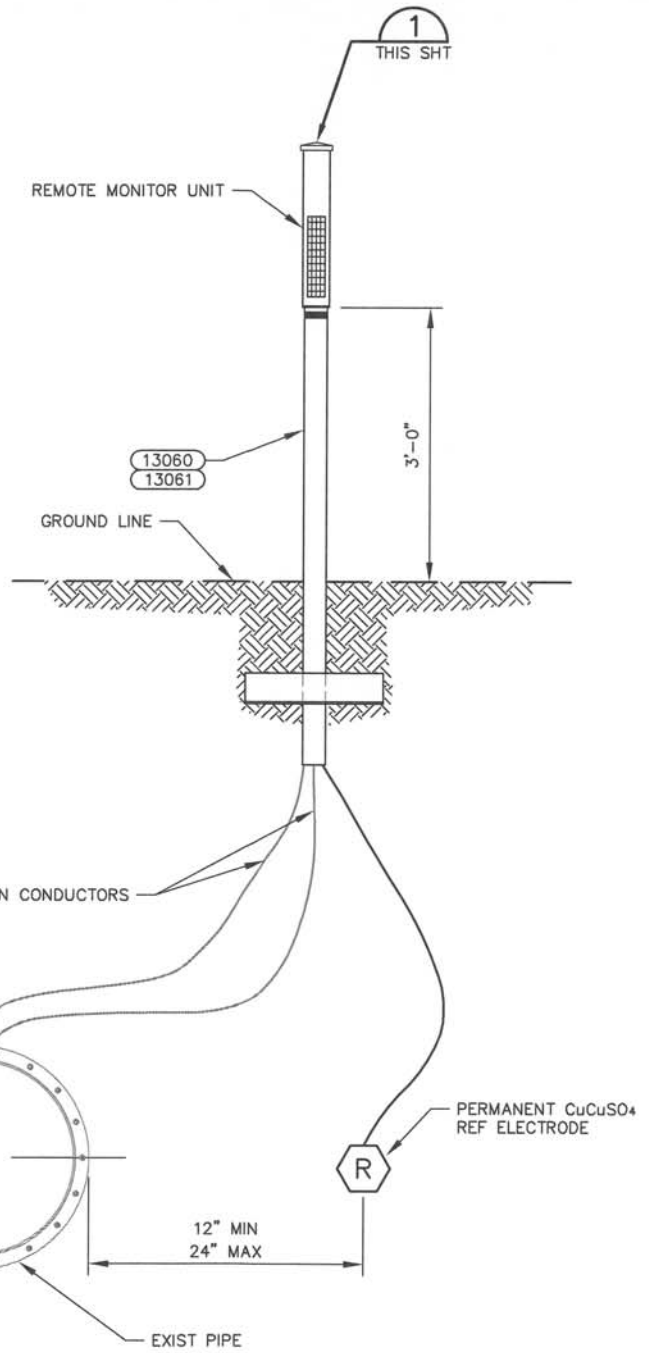
DRAWN BY: BERKNESS
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Rem
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**13064**  
**TYPICAL CATHODIC**  
**PROTECTION TEST STATION**  
**WITHOUT ANODE**


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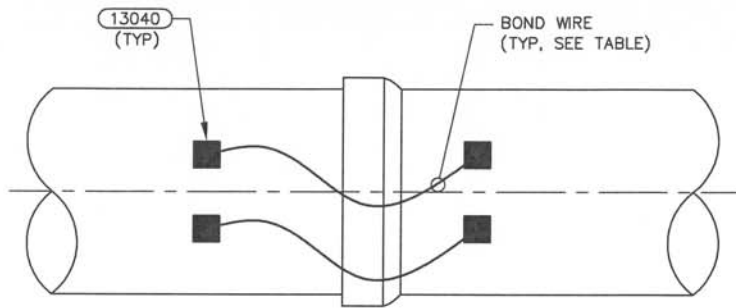
**DETAIL** 1 THIS SHT



DRAWN BY: BERKNESS
CHKD BY: K ROSS/KR
APPD BY: Stephen C. Reim
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

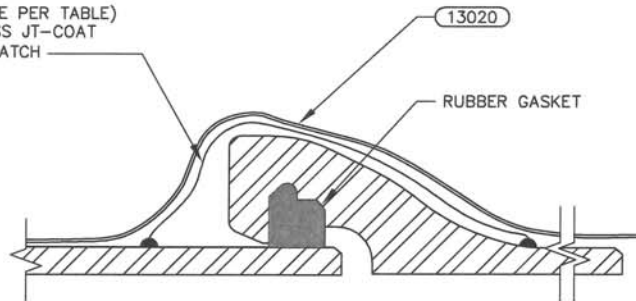
13070  
 REMOTE MONITOR  
 TEST STATION

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PLAN

INSUL STRANDED Cu WIRE (SIZE PER TABLE)  
 CADWELD TO BARE MTL ACROSS JT-COAT  
 W/ APPD EXOTHERMIC WELD PATCH



SECTION

NOMINAL PIPE $\phi$	WIRE SIZE
24" $\leq$ 36"	#4 HMWPE
36" $\leq$ 60"	#2 HMWPE
60" OR LARGER	2x #2 HMWPE

NOTES:

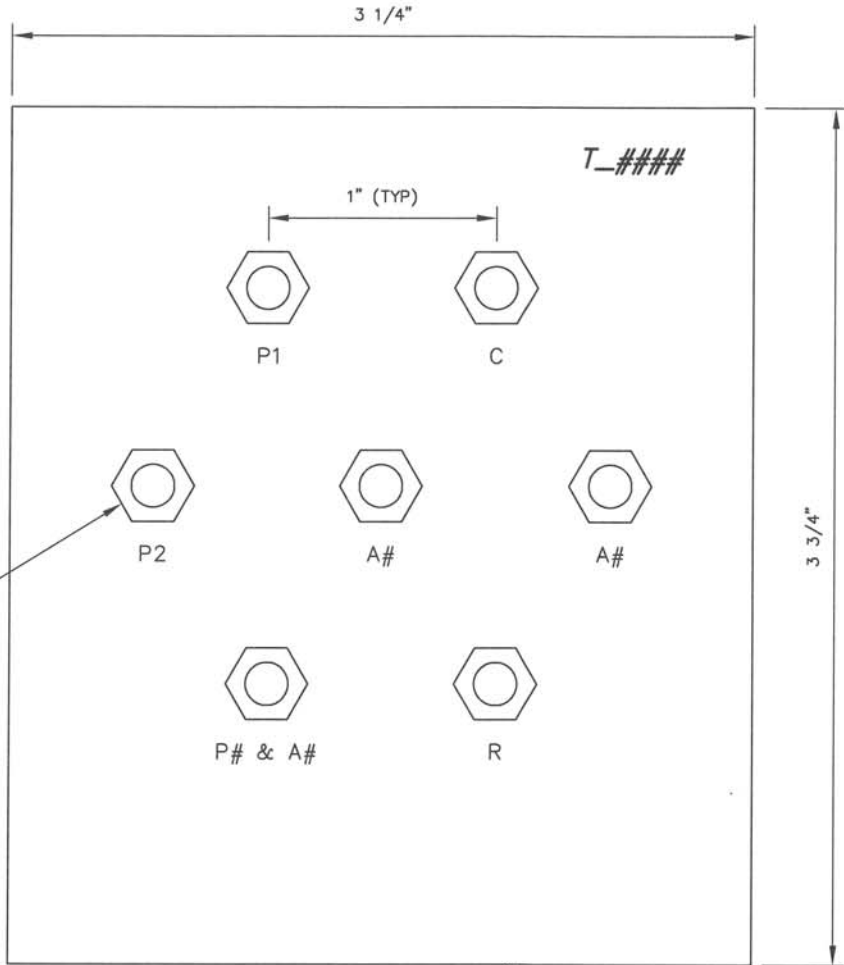
1. PROVIDE AND INSTALL REDUNDANT BOND WIRES, EVENLY SPACED AROUND THE PIPE.
2. REMOVE A 2 1/2-INCH SQUARE (MAXIMUM) OF PIPE COATING FOR EXOTHERMIC WELD CONNECTION.
3. WELD CAP SHALL EXTEND AT LEAST 3/4-INCH OVER PIPE COATING.
4. EXOTHERMIC WELDS SHALL BE CLEANED AND COATED.

DRAWN BY: <i>BERKNESS</i>
CHKD BY: <i>K ROSS/KLR</i>
APPD BY: <i>Stephen C. Rawn</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**13080**  
**DUCTILE IRON PIPE**  
**JOINT BONDING**

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CONDUCTOR  
TERMINAL W/  
7/16" NUT

1/8" THK WHITE HDPE TERMINAL  
BD WHITE W/ BLK CORE

DRAWN BY: BERKNESS

CHKD BY: K ROSS/KUR

APPD BY: *Steph C. Rem*

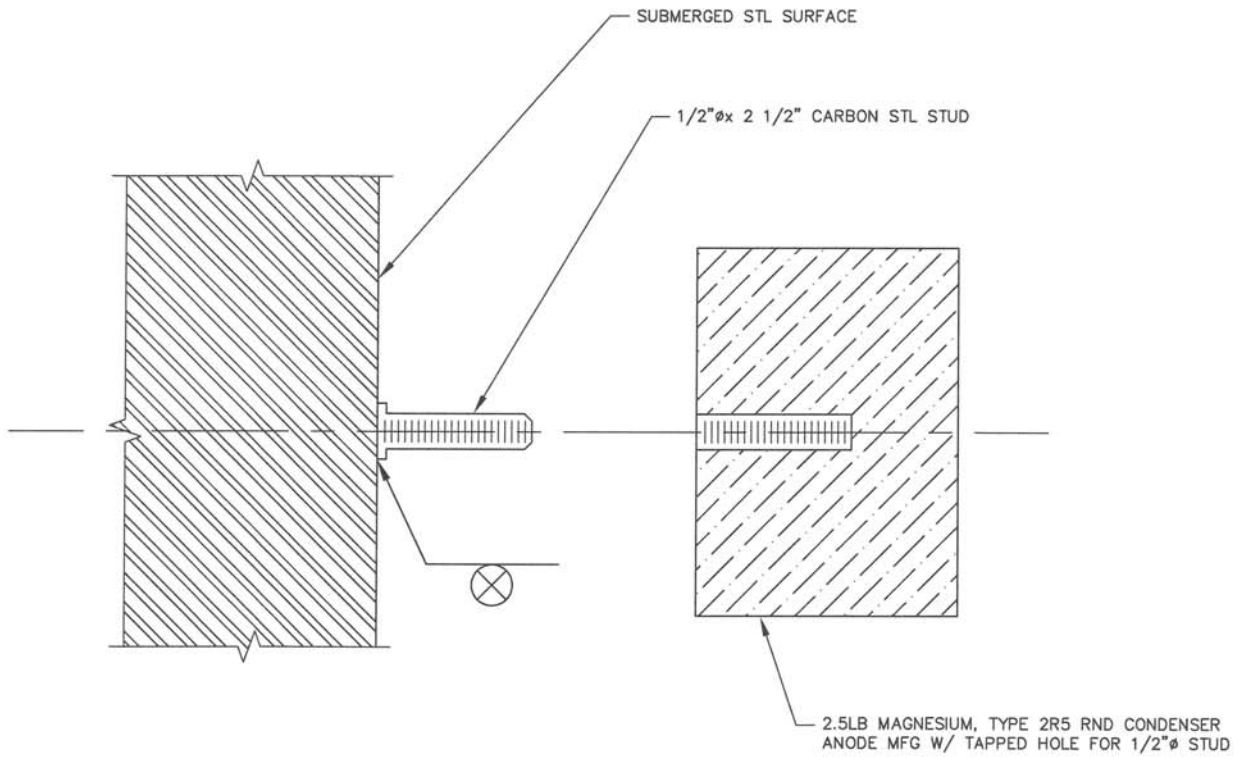
ORIGINATION DATE: JANUARY 2017

REVISION DATE:

13081  
TERMINAL BOARD CARD

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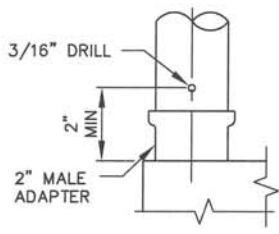


DRAWN BY: <i>BERKNESS</i>
CHKD BY: <i>K ROSS/KRP</i>
APPD BY: <i>Steph C. Rem</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

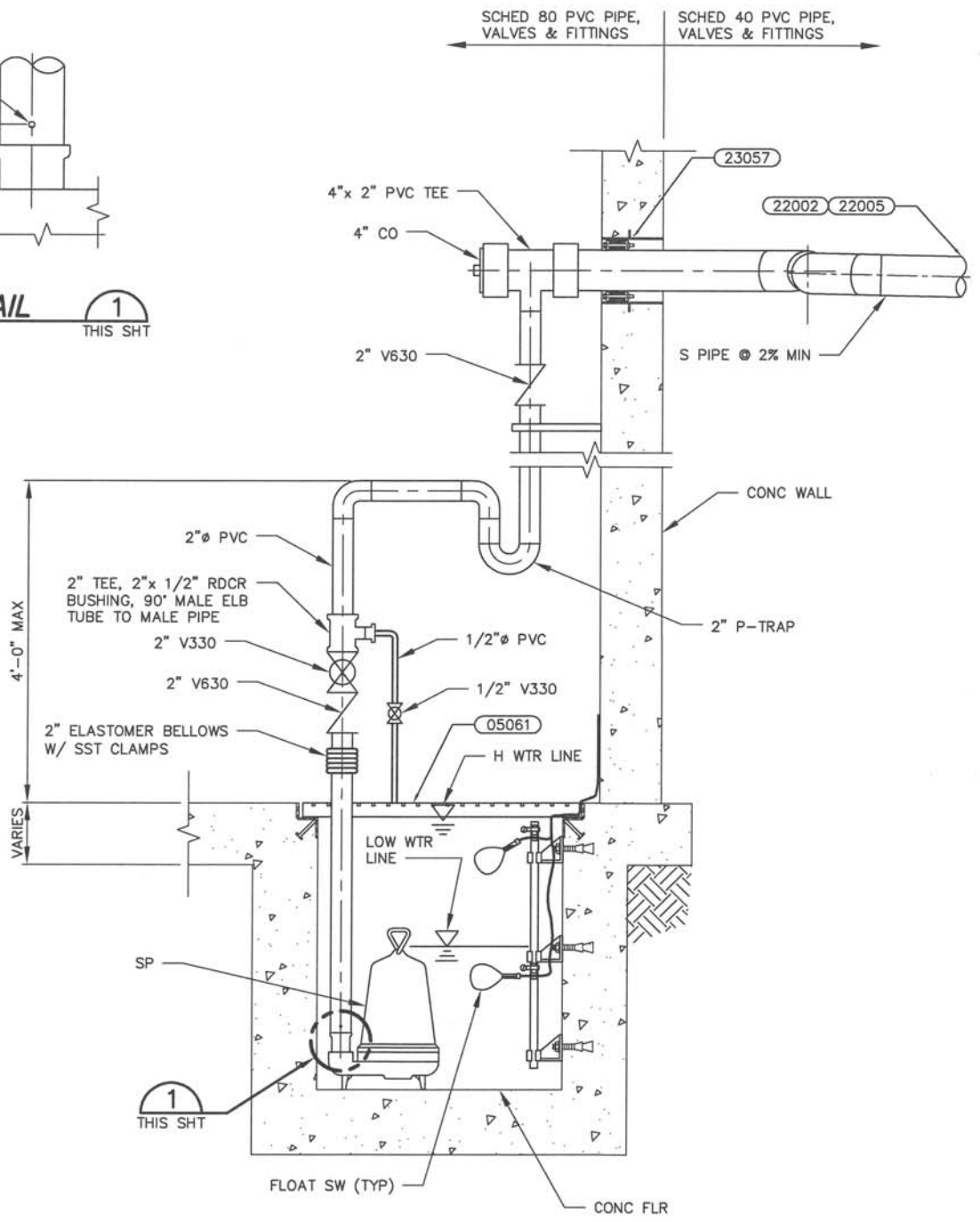
13090  
CONDENSER ANODE  
INSTALLATION

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**DETAIL** 1  
THIS SHT

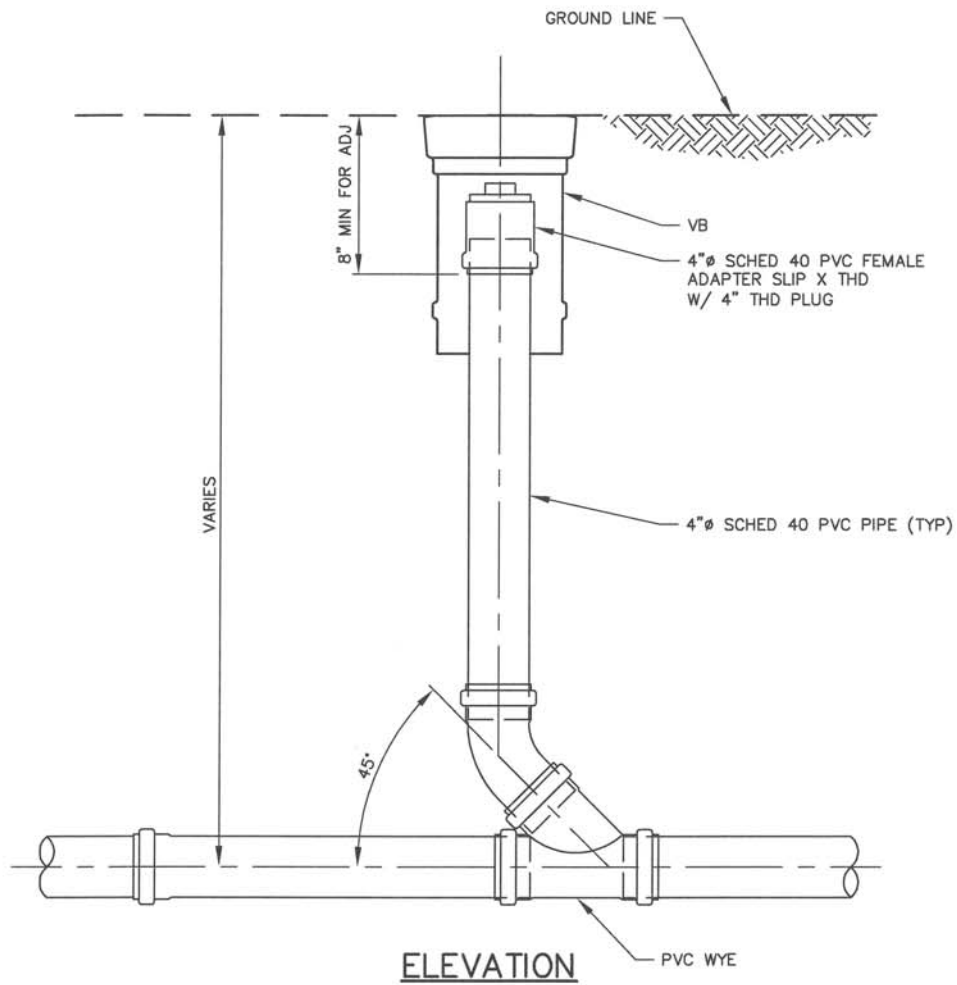


**NOTE:**  
PIPES, VALVES AND FITTINGS INSIDE STRUCTURE SHALL BE SCHEDULE 80 PVC

DRAWN BY: SCHULTE
CHKD BY: K ROSS/KLR
APPD BY: <i>Stephen C. Reem</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**22001  
SUMP ASSEMBLY AND PIPING**

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**NOTE:**

COVER SHALL BE MARKED "CO".

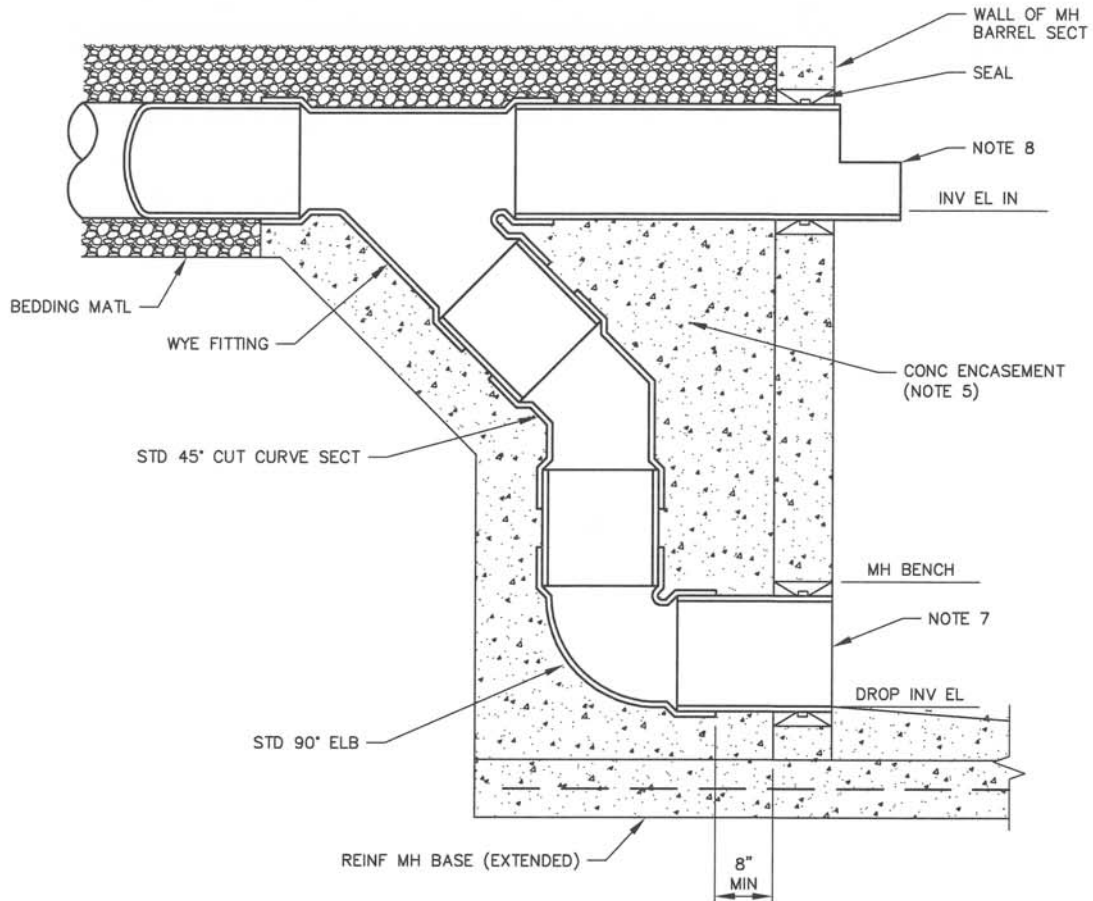
DRAWN BY: <i>DITTERLINE</i>
CHKD BY: <i>K ROSS/KLR</i>
APPD BY: <i>Steph C. Pen</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**22002**  
**4" IN-LINE CLEANOUT**

**D DENVER WATER**

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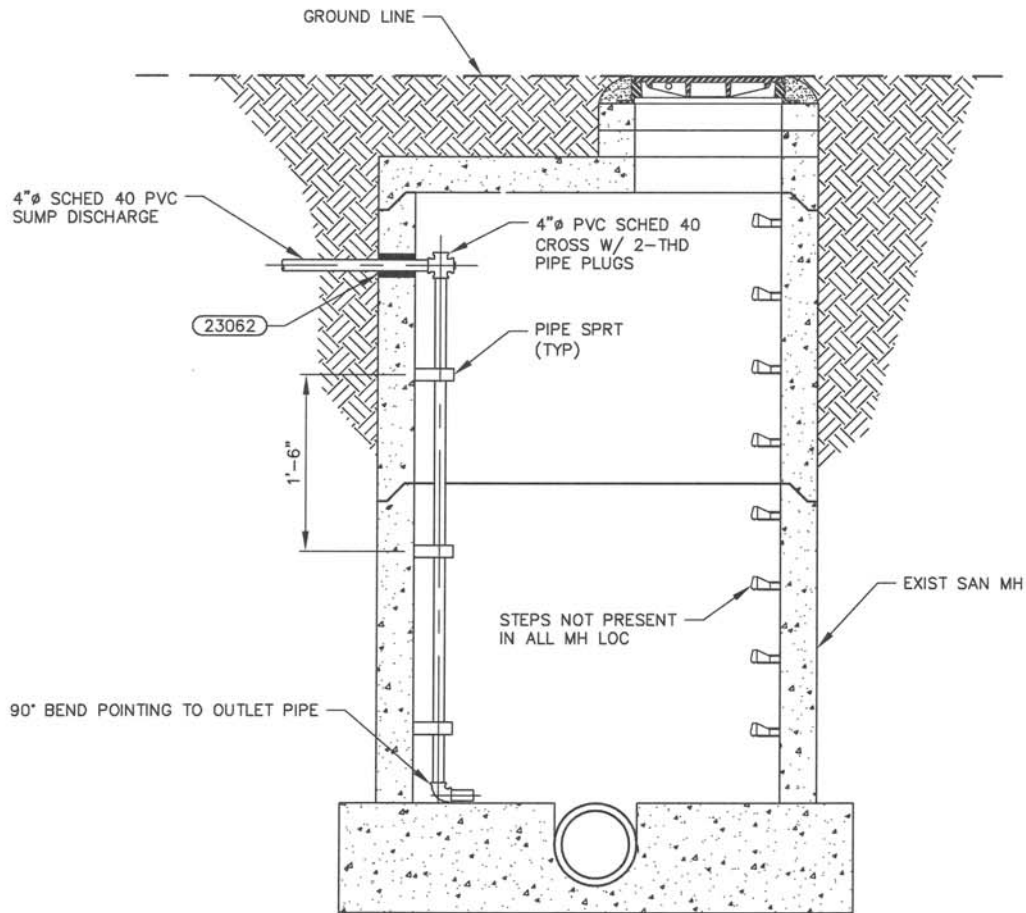
**NOTES:**

1. PIPE AND FITTINGS SHALL BE ASTM AND AUTHORITY HAVING JURISDICTION APPROVED.
2. DIAMETER OF THE PIPE SHALL NOT BE LESS THAN MAIN LINE PIPE DIAMETER.
3. THE APPROPRIATE MANHOLE SEAL, ADAPTOR OR CONNECTOR SHALL BE USED FOR THE SPECIFIED PIPE MATERIAL, AND SHALL BE APPROVED BY THE AUTHORITY HAVING JURISDICTION.
4. OUTSIDE DROP SHALL BE ALL OF ONE MATERIAL.
5. CONCRETE ENCASEMENT SHALL BE A MINIMUM OF 8-INCHES THICK ALL AROUND. FOR DROPS OVER 4- FEET PLACE #4@18 INCHES ON CENTER HORIZONTALLY AND VERTICAL REINFORCEMENT EACH SIDE OF THE PIPE.
6. PIPE DIMENSIONS ARE APPROXIMATE AND MAY VARY FROM ONE MANUFACTURER TO ANOTHER.
7. ALL REQUIRED WALL OPENINGS SHALL BE PRECAST BLOCK-OUTS OR CORE DRILLED. JACK HAMMERING OF OPENINGS IS NOT ALLOWED.
8. CUT TOP HALF OF PIPE TO CREATE 4-INCH LONG SHELF.

DRAWN BY: *DITTERLINE*  
 CHKD BY: *K ROSS/KR*  
 APPD BY: *Stephen C. Reem*  
 ORIGINATION DATE: *JANUARY 2017*  
 REVISION DATE:

**22003**  
**OUTSIDE DROP MANHOLE**  
**CONNECTION**

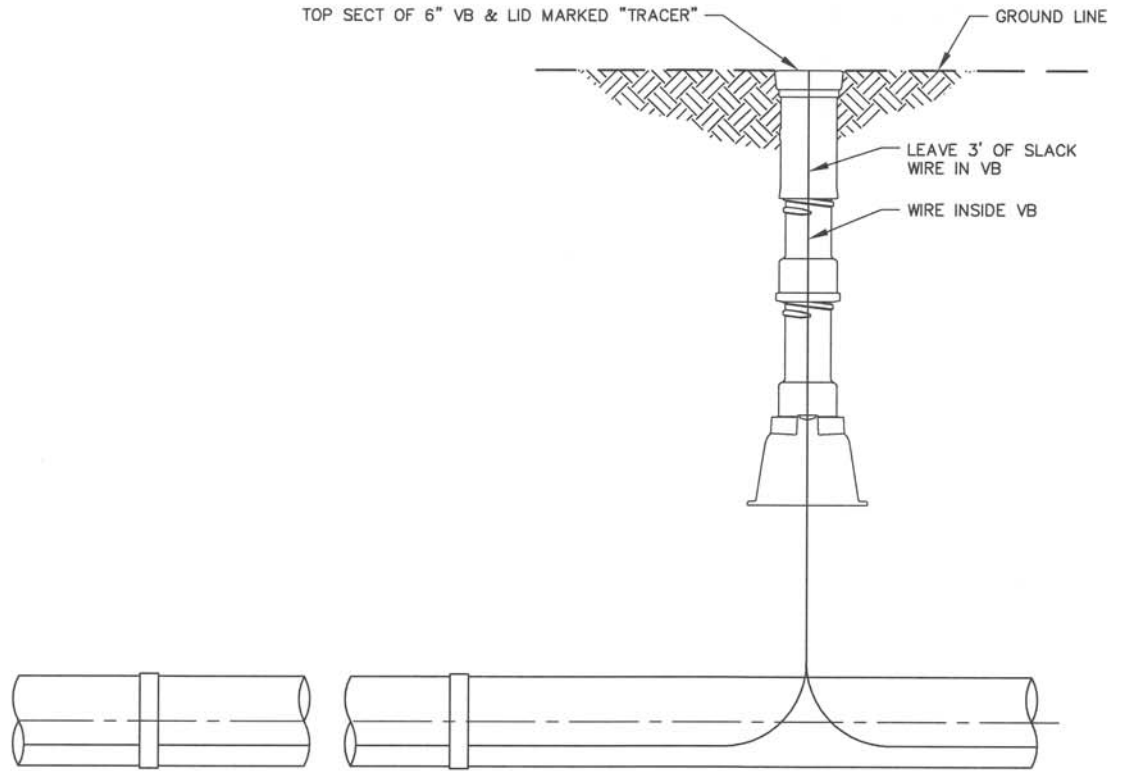
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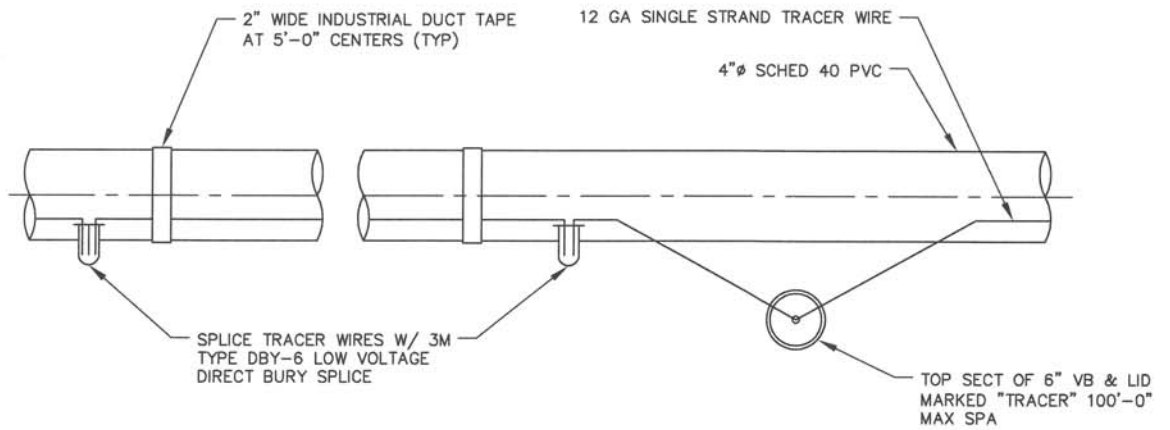
DRAWN BY: MITCHELL
CHKD BY: K ROSS/KR
APPD BY: Stephen C. Reim
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

22004  
 SUMP DRAIN INTO EXISTING  
 SANITARY SEWER MANHOLE

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ELEVATION

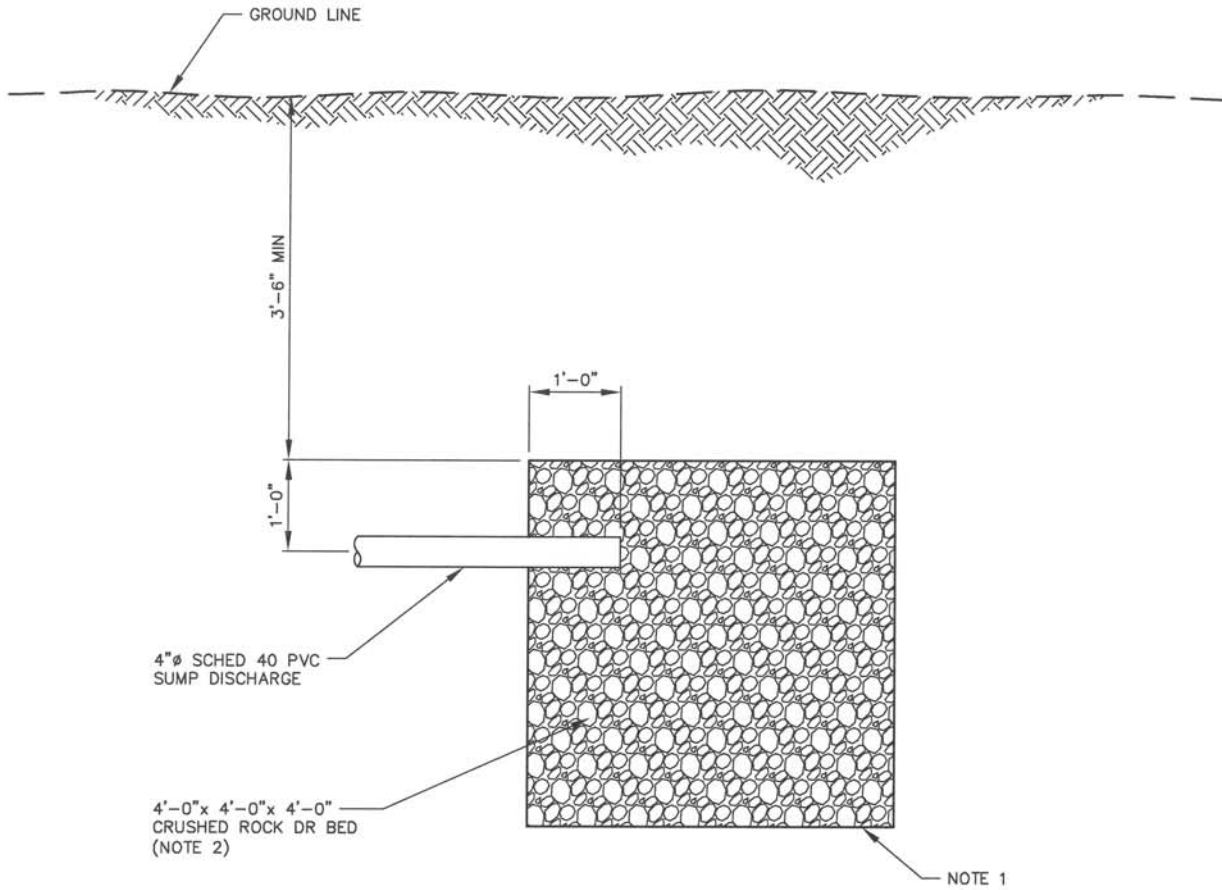


PLAN

DRAWN BY: MITCHELL  
 CHKD BY: K ROSS/KIR  
 APPD BY: Stephen C. Reem  
 ORIGINATION DATE: JANUARY 2017  
 REVISION DATE:

22005  
 TRACER WIRE INSTALLATION  
 FOR PVC SUMP PUMP DRAIN

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**NOTES:**

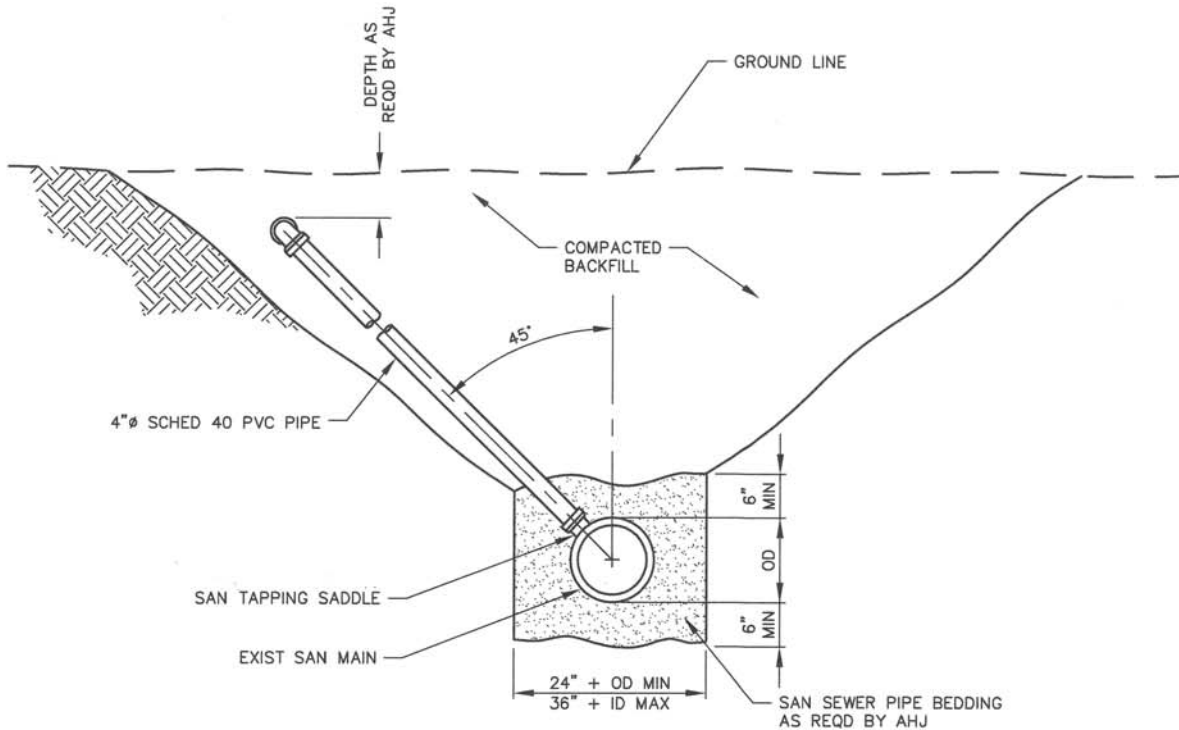
1. CRUSHED ROCK BED SHALL BE LINED WITH GEOTEXTILE FABRIC ON ALL SIDES.
2. CRUSHED ROCK SHALL BE 3-INCH WASHED ANGULAR ROCK.

DRAWN BY: MITCHELL
CHKD BY: K ROSS/KUR
APPD BY: Stephen C. Reim
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

22006  
SUMP PUMP DISCHARGE  
TO GRAVEL BED

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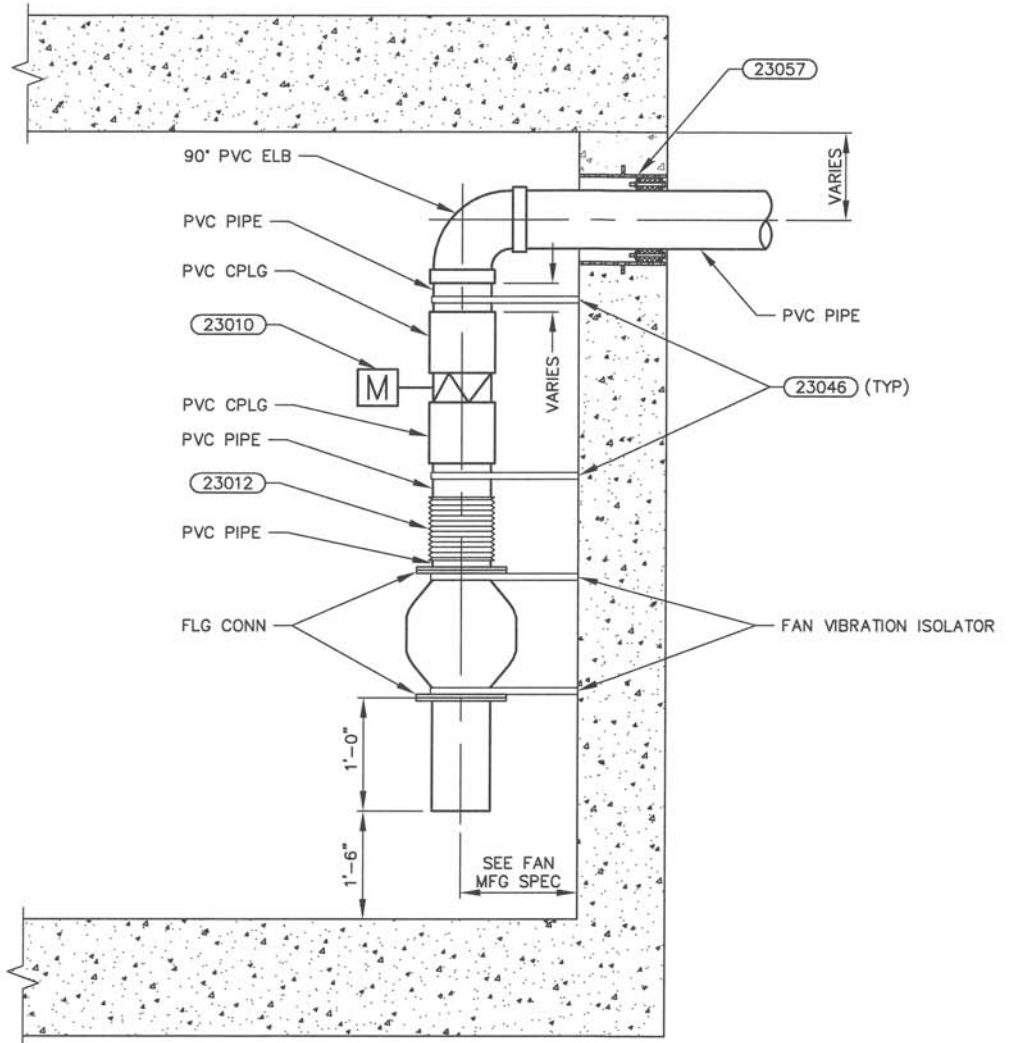
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DRAWN BY: MITCHELL
CHKD BY: K ROSS/VLR
APPD BY: Stephen C. Fern
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

22007  
 SUMP PUMP DISCHARGE  
 TO EXISTING SANITARY SEWER

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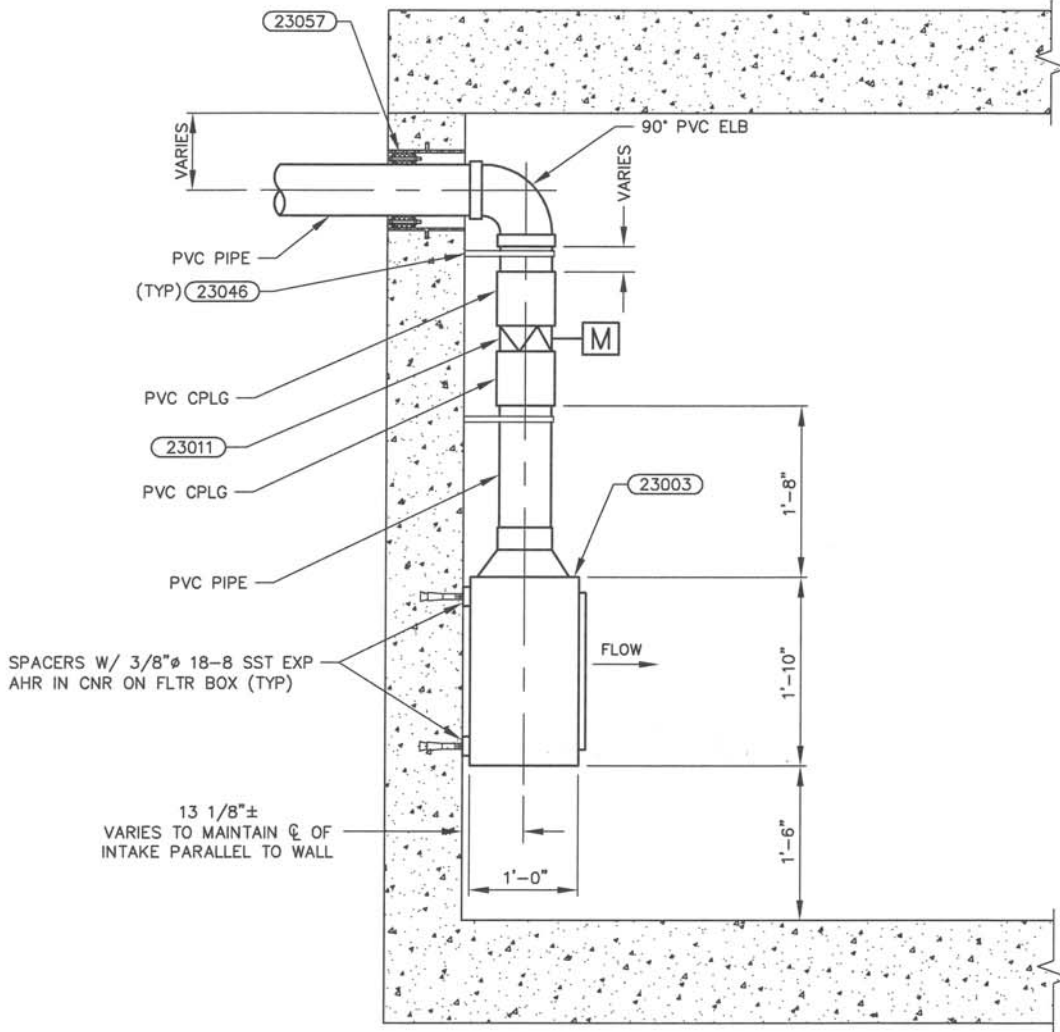
**NOTES:**

1. EXHAUST FAN DIMENSIONS ARE APPROXIMATE, SEE MANUFACTURER DRAWINGS.
2. SEAL PIPE CONNECTIONS WITH PVC PIPE SEALER AND ADHESIVE, AND/OR GASKET AT FLANGE CONNECTIONS.
3. PIPE AND FITTINGS SHALL BE SCHEDULE 40 PVC.

DRAWN BY: MCMILLEN
CHKD BY: K ROSS/KR
APPD BY: Stephen C. Reem
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**23001**  
**TYPICAL EXHAUST FAN**

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**NOTES:**

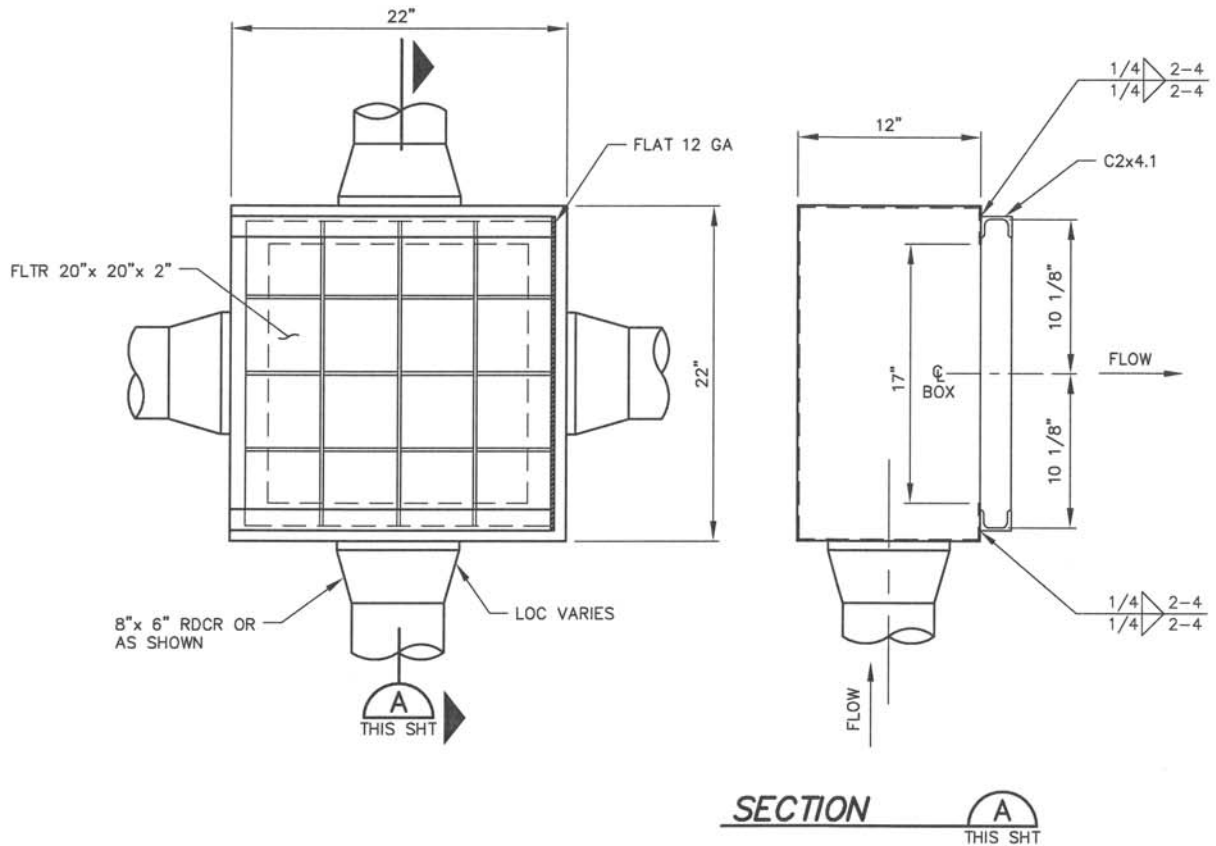
1. SEAL PIPE CONNECTIONS WITH PVC PIPE SEALER AND ADHESIVE.
2. PIPE AND FITTINGS SHALL BE SCHEDULE 40 PVC.

DRAWN BY: <i>MCMILLEN</i>
CHKD BY: <i>K ROSS/KLR</i>
APPD BY: <i>Stephen C. Reim</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**23002**  
**TYPICAL INTAKE**



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**NOTES:**

1. SEE SPECIFIC VAULT DRAWINGS FOR PROPER ORIENTATION.
2. 8-INCH x 6-INCH REDUCER CAN BE MOUNTED ON EITHER SIDE OF FILTER BOX TO OBTAIN CORRECT ORIENTATION OF BOX.
3. MATERIAL: ASTM A 240 TYPE 304 OR 316 SST.

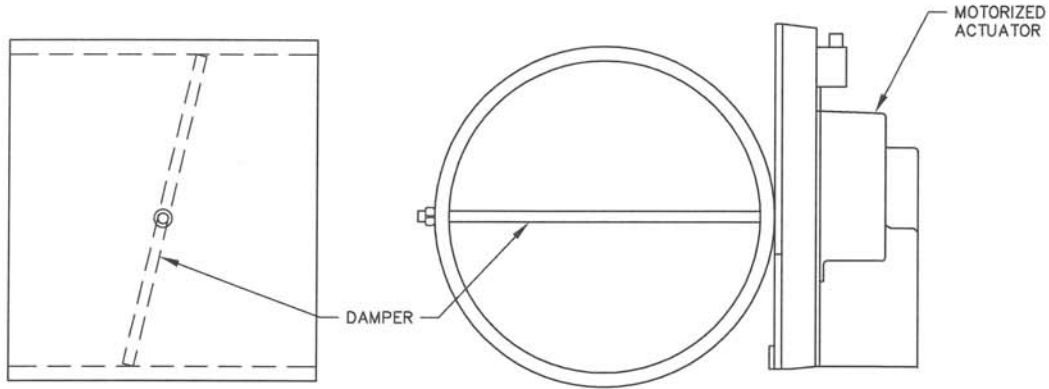
DRAWN BY: ALVARADO
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Fenn
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**23003  
FILTER BOX**

**DENVER WATER**

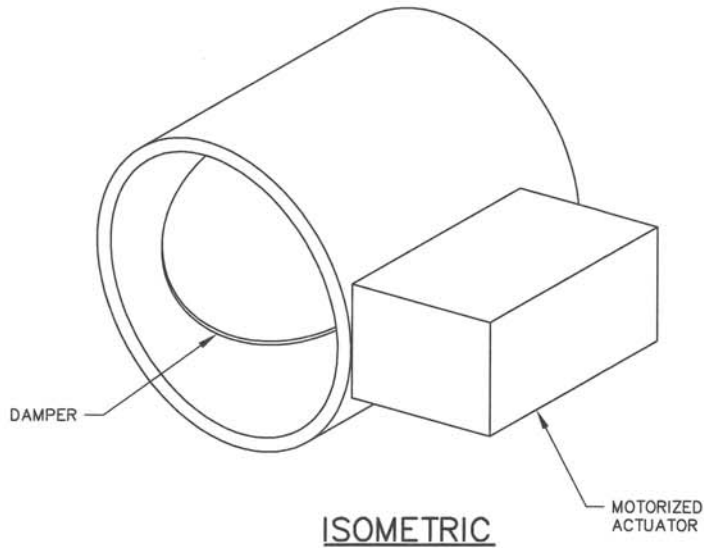
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FRONT

SIDE



ISOMETRIC

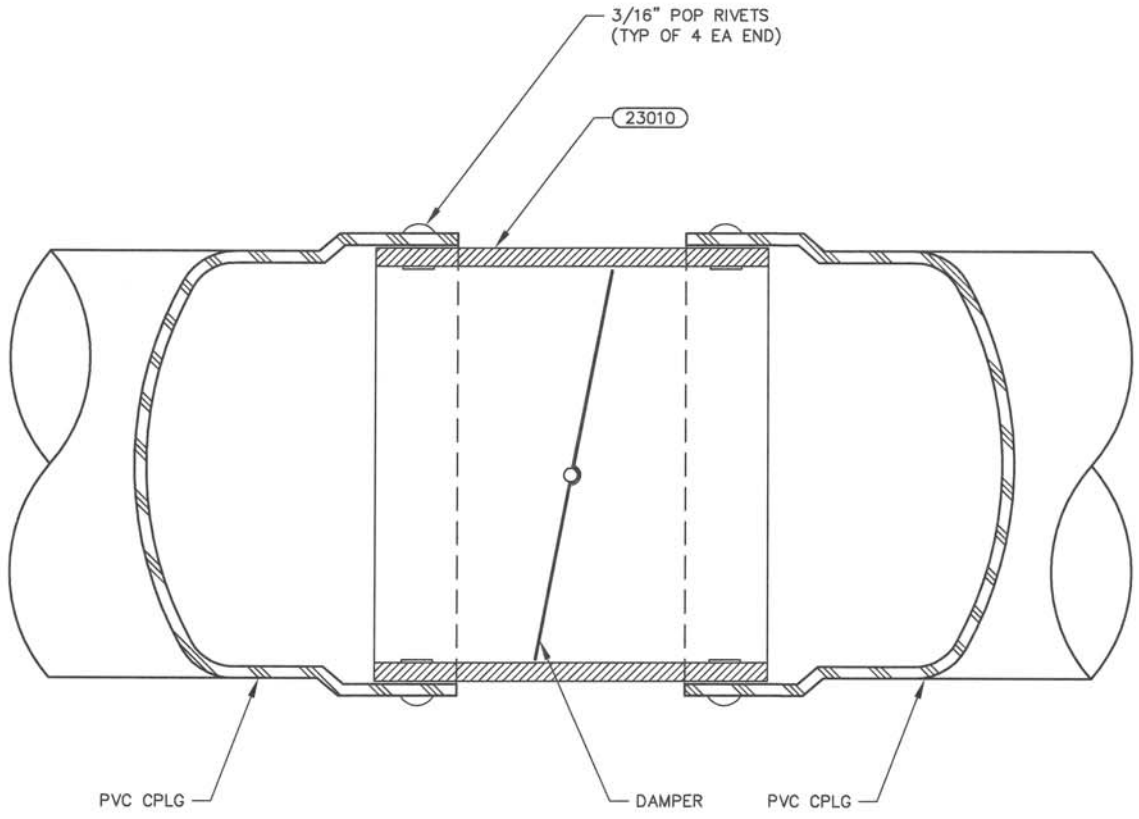
NOTE:

SEAL PIPE CONNECTIONS WITH PVC PIPE SEALER AND ADHESIVE.

DRAWN BY: <i>WENKHEIMER</i>
CHKD BY: <i>K ROSS/KLR</i>
APPD BY: <i>Stephen C. Rem</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

*23010  
PVC MOTORIZED DAMPER*

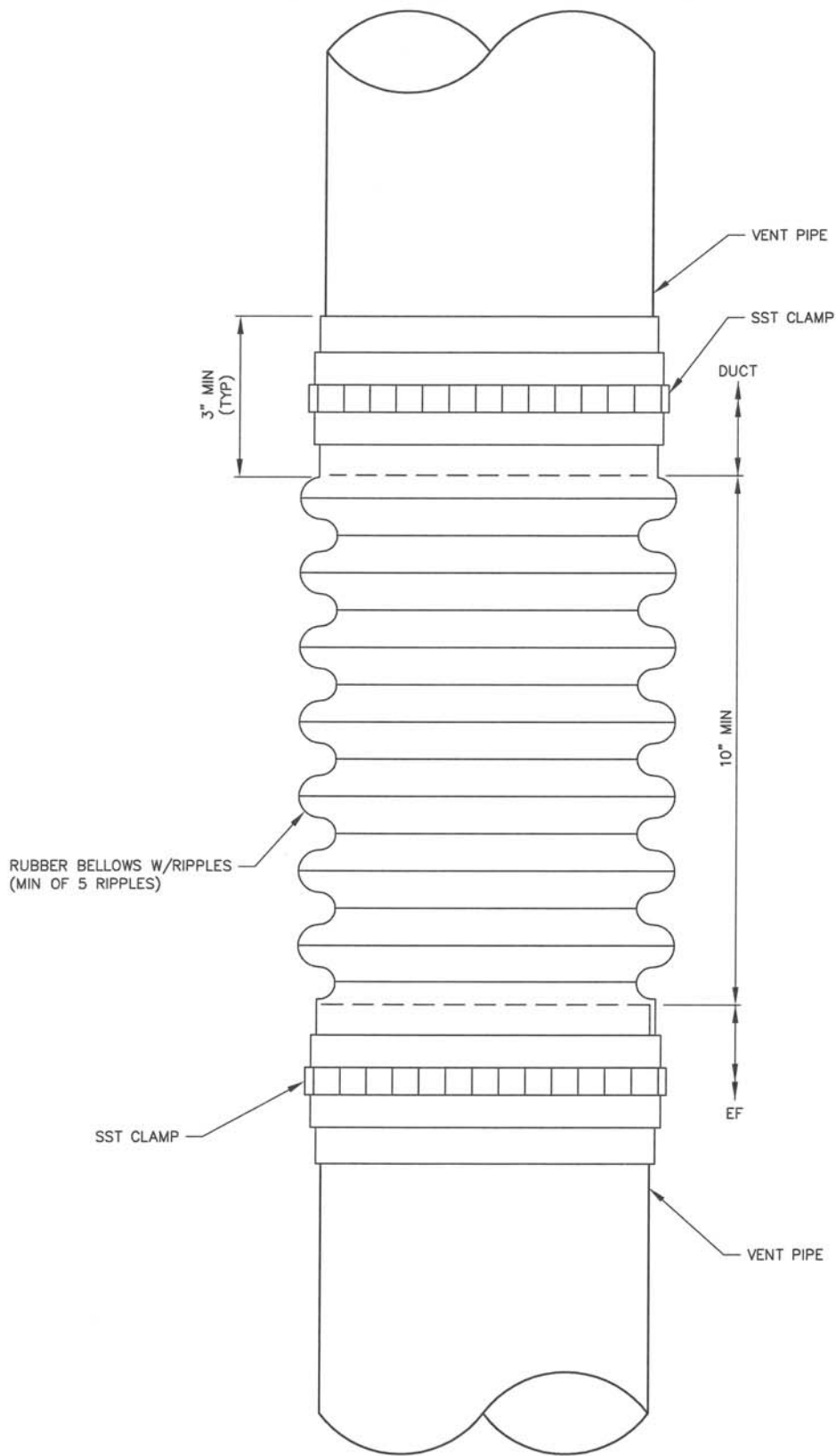
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DRAWN BY: WENKHEIMER  
 CHKD BY: K ROSS/KLR  
 APPD BY: *Steph C. Row*  
 ORIGINATION DATE: JANUARY 2017  
 REVISION DATE:

23011  
 INLINE DAMPER INSTALLATION

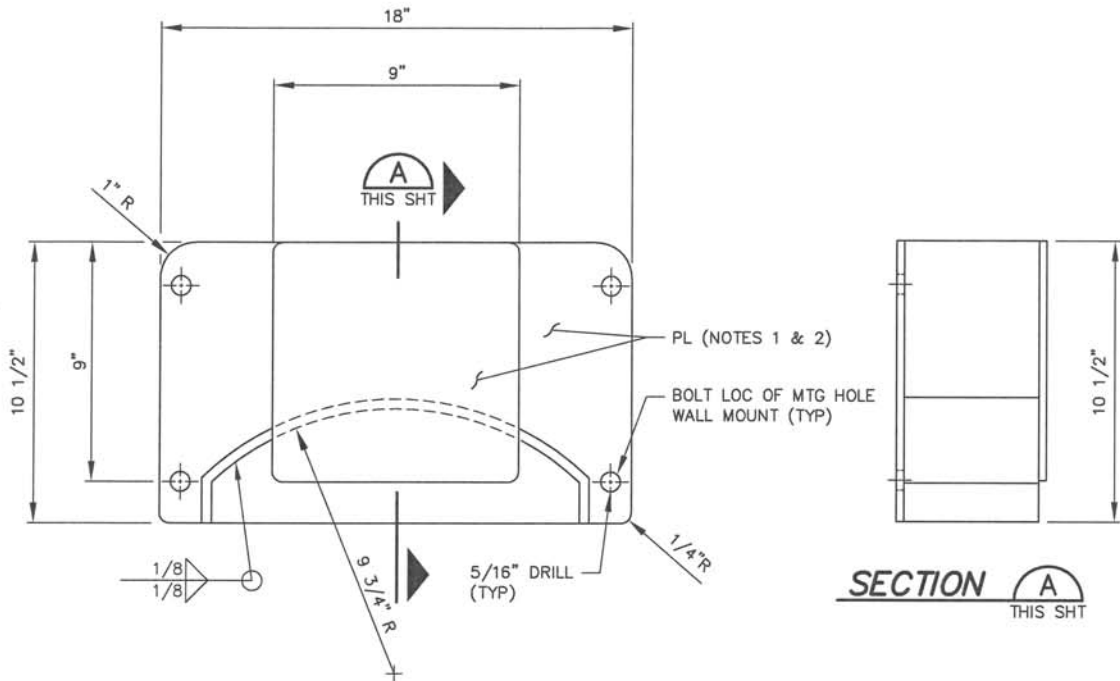
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DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Pen
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

23012  
FLEXIBLE CONNECTION

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WALL MOUNTED

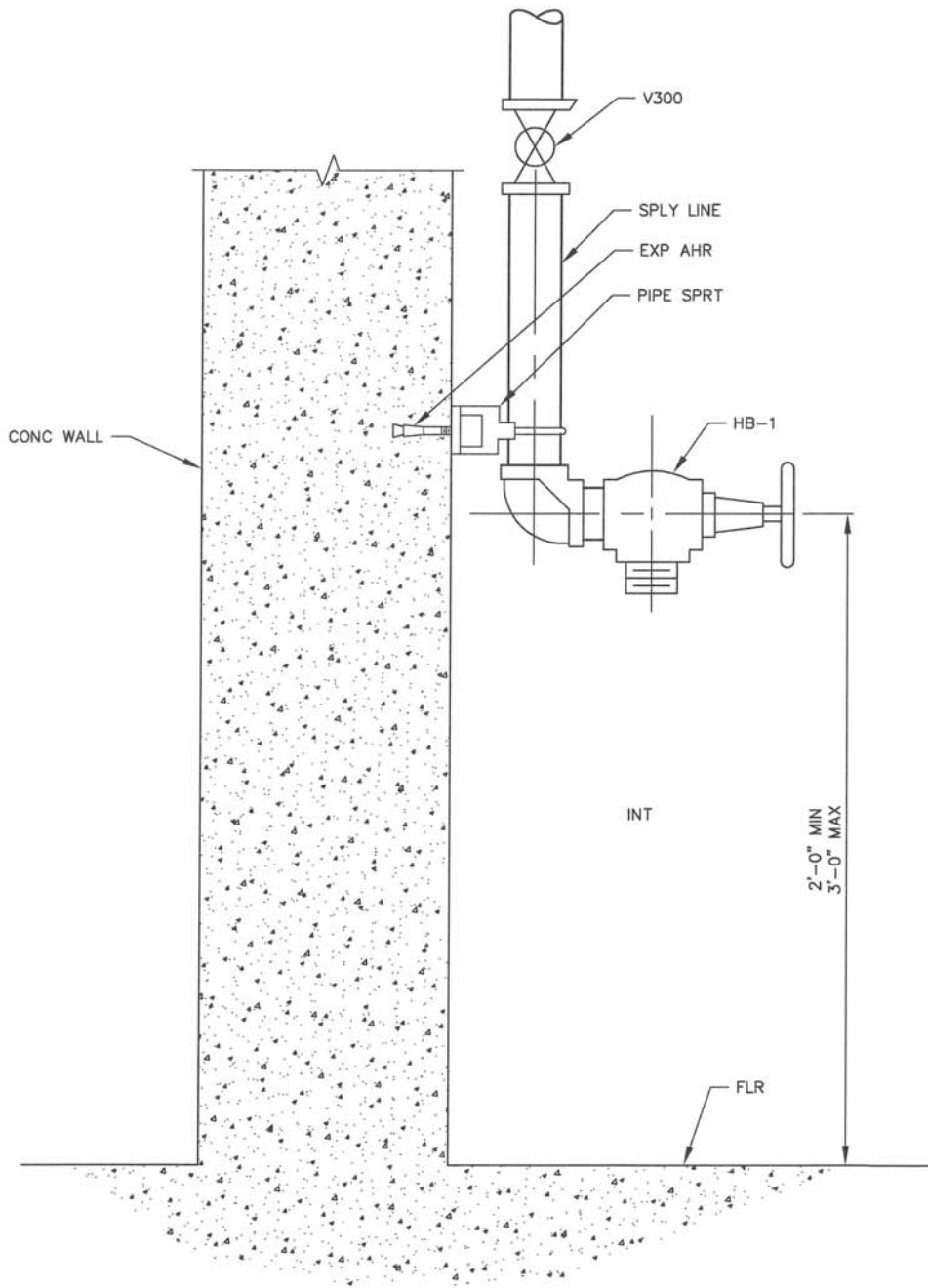
NOTES:

1. INTERIOR UNITS SHALL BE FABRICATED FROM 1/8-INCH ASTM A 36 STEEL PLATE AND HOT DIP GALVANIZED AFTER FABRICATION IN ACCORDANCE WITH ASTM A 153.
2. EXTERIOR UNITS SHALL BE FABRICATED FROM 3/16-INCH 6061-T6 ALUMINUM ALLOY PLATE.
3. ATTACH TO CONCRETE WALL WITH FOUR 1/4-INCH 18-8 STAINLESS STEEL EXPANSION ANCHORS.
4. MOUNT HOSE RACK 3- FEET ABOVE FINISHED FLOOR OR GROUND ELEVATION.

DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/KIR
APPD BY: Stephen C. Peen
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

23019  
WALL MOUNTED HOSE RACK  
FOR 3/4" AND 1" HOSE

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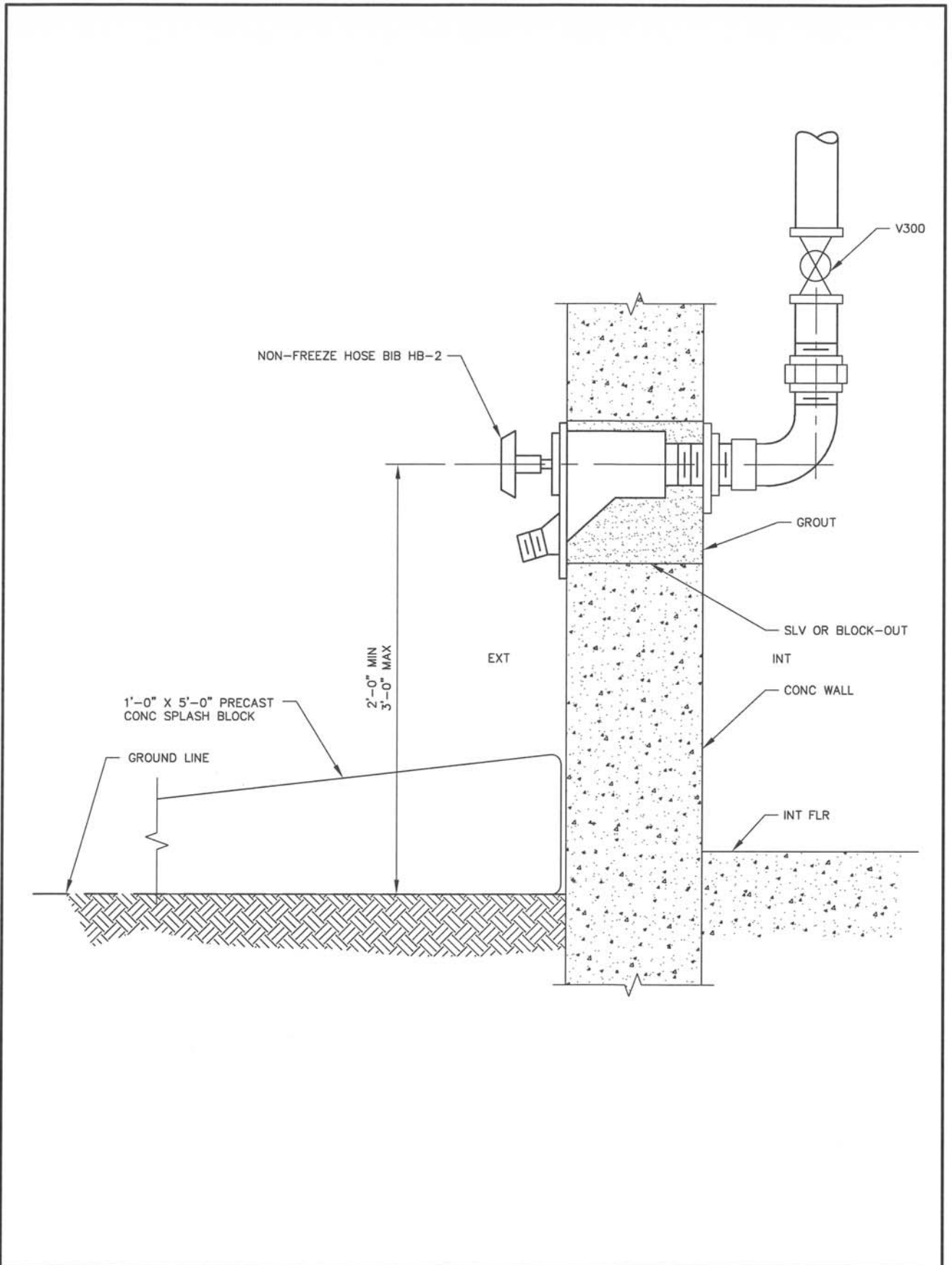


DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Reim
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

23020  
INTERIOR HOSE BIB, HB-1

**D DENVER WATER**

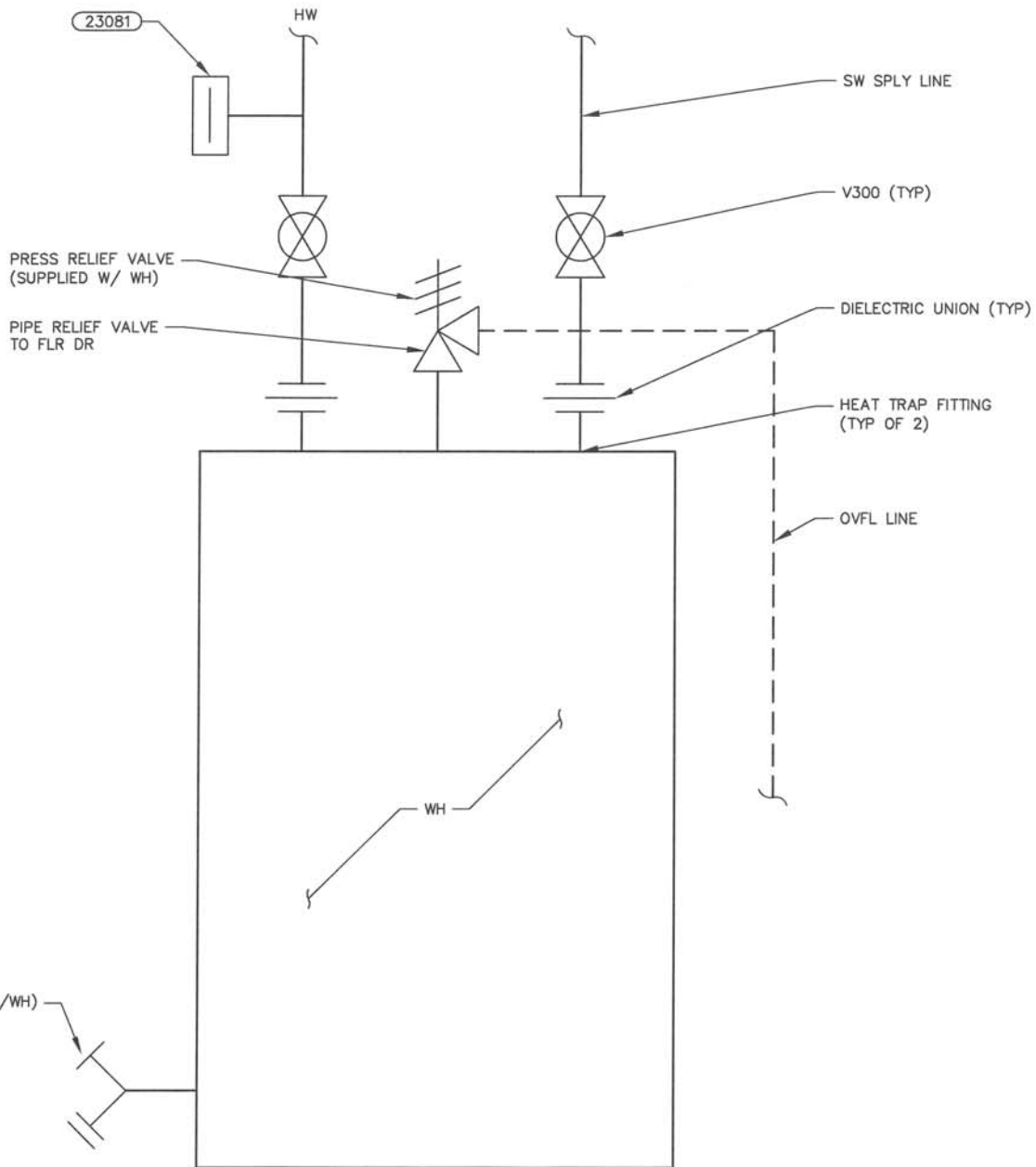
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DRAWN BY: <i>WENKHEIMER</i>
CHKD BY: <i>K ROSS/KIR</i>
APPD BY: <i>Stephen C. Penn</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**23021**  
**NON-FREEZE**  
**WALL HYDRANT, HB-2**

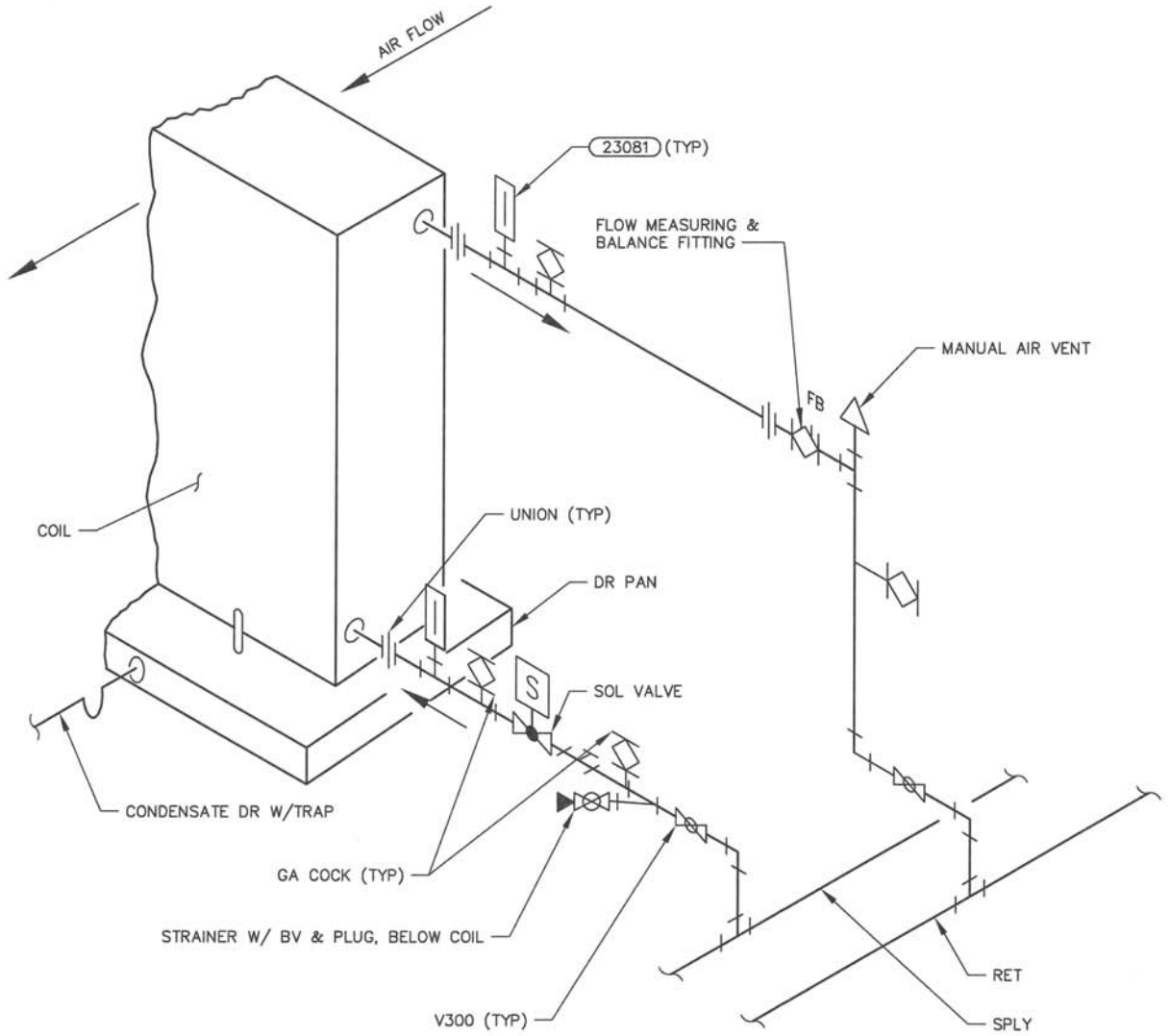

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DRAWN BY: <i>WENKHEIMER</i>
CHKD BY: <i>K ROSS/KLR</i>
APPD BY: <i>Stacy C. Rose</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**23022**  
**WATER HEATER**

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**NOTE:**

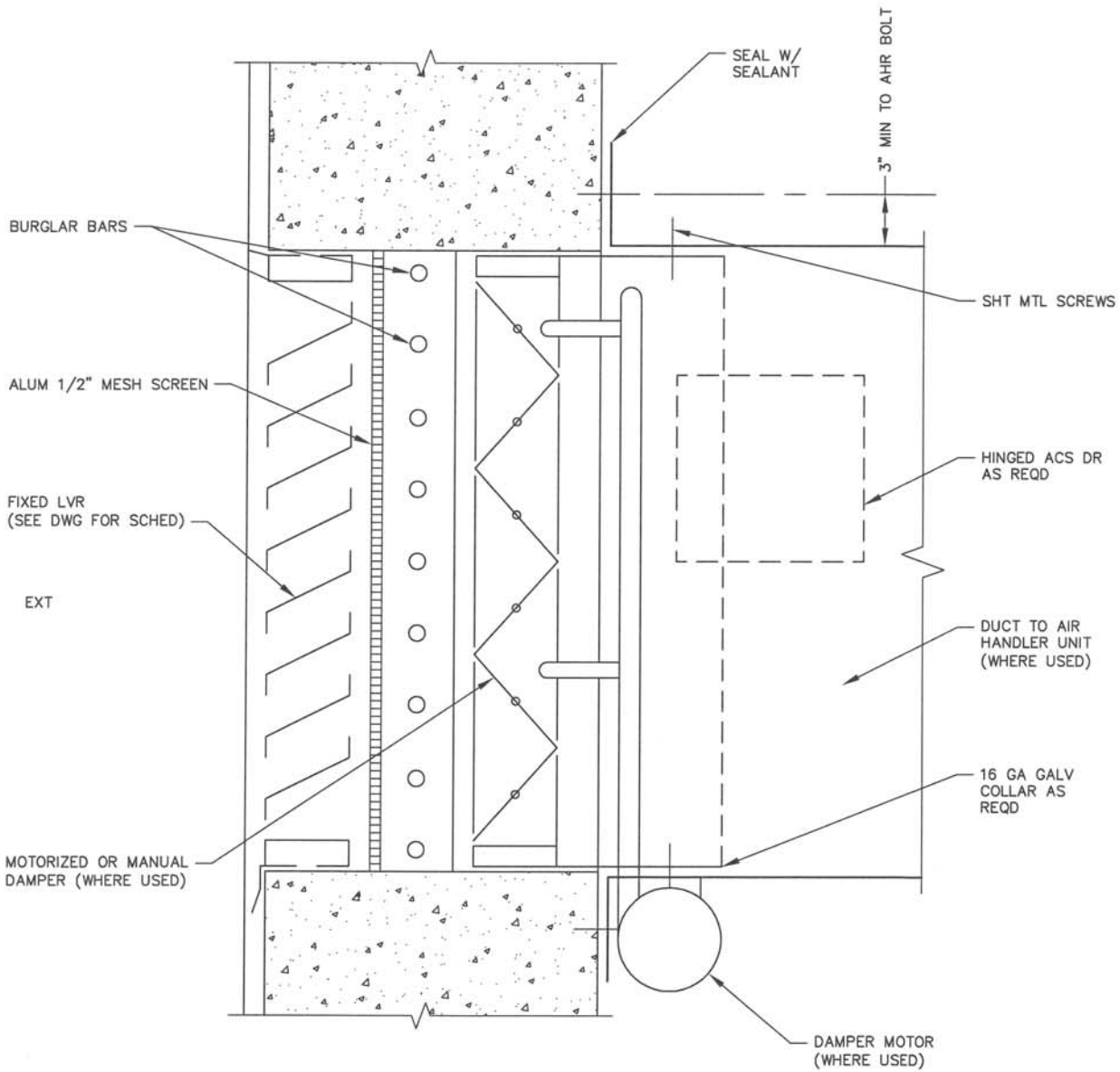
DETAIL GIVES REQUIRED SEQUENCE OF EQUIPMENT AND VALVES.  
 PIPING ARRANGEMENT MAY VARY TO SUIT FIELD REQUIREMENTS.  
 PIPE COIL FOR COUNTER FLOW WITH AIR.

DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/KR
APPD BY: Stephen C. Ram
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

23023  
 COOLING COIL CONNECTION

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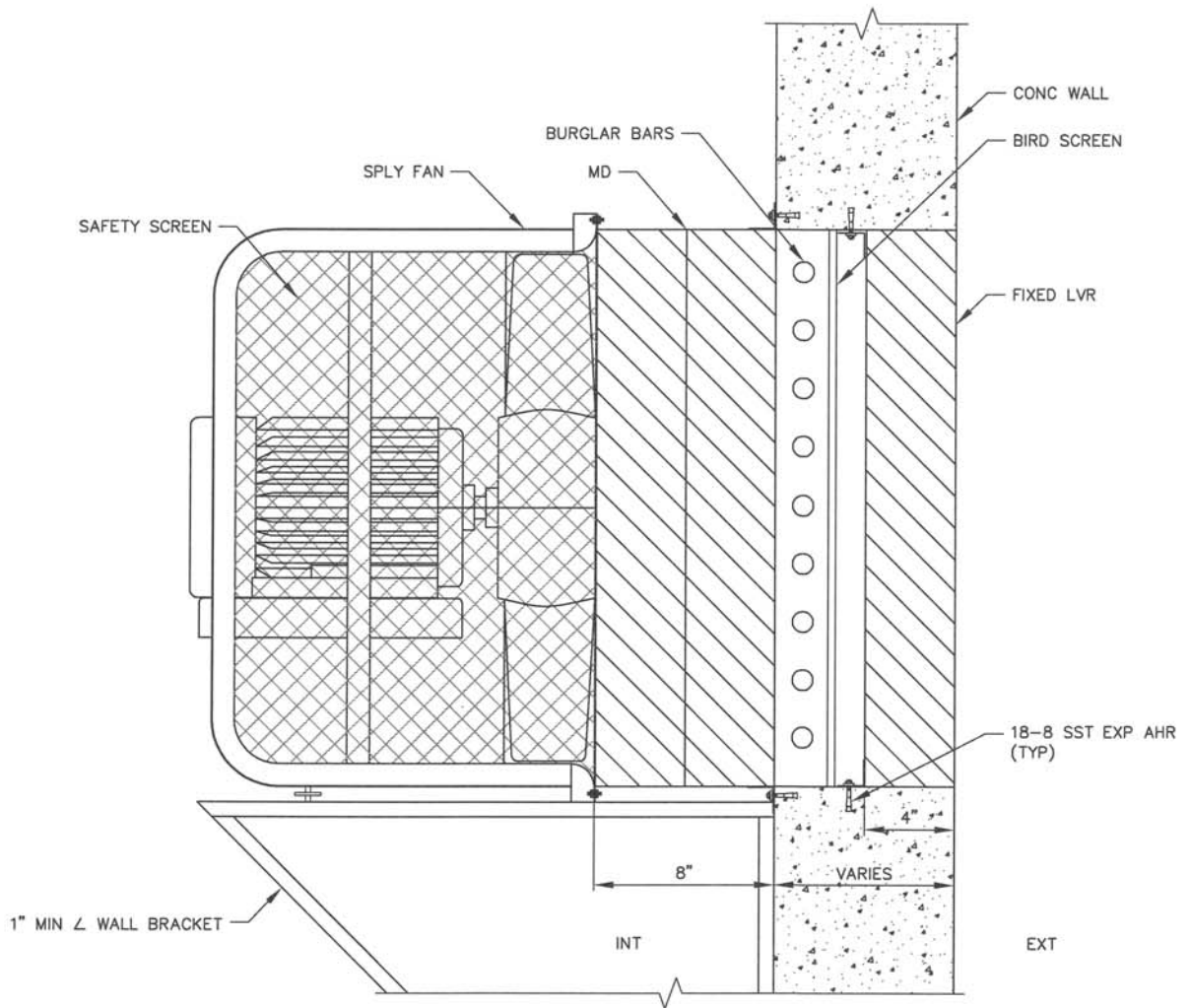




DRAWN BY: <i>WENKHEIMER</i>
CHKD BY: <i>K ROSS/WR</i>
APPD BY: <i>Stephen C. Penner</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**23030**  
**OUTSIDE AIR INTAKE**

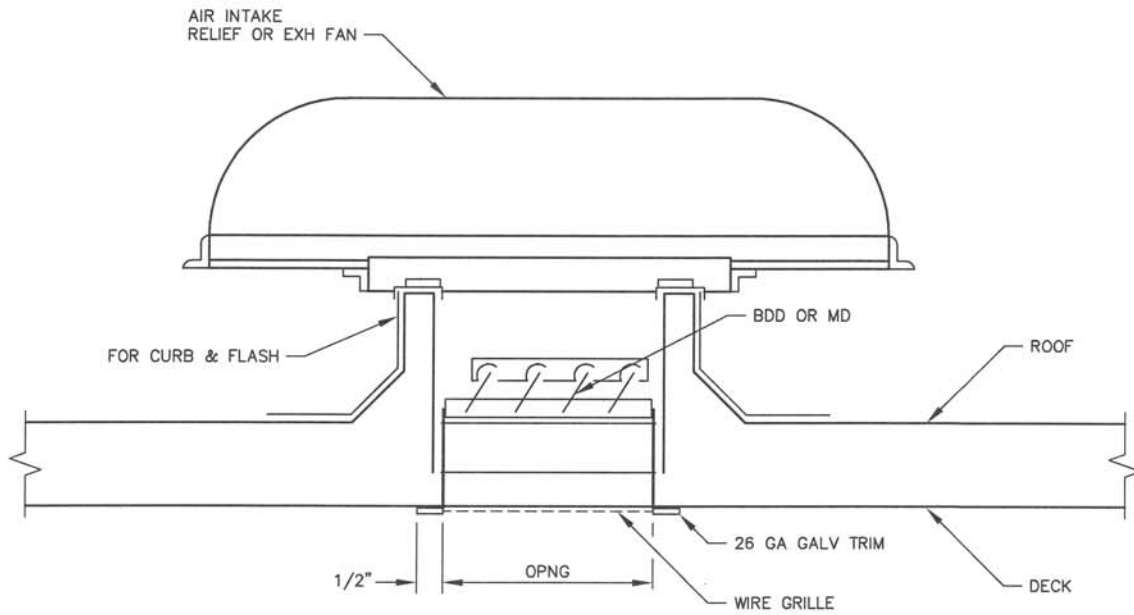

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DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/KR
APPD BY: <i>Steph C. Fern</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

23031  
 PROPELLER FAN MOUNT

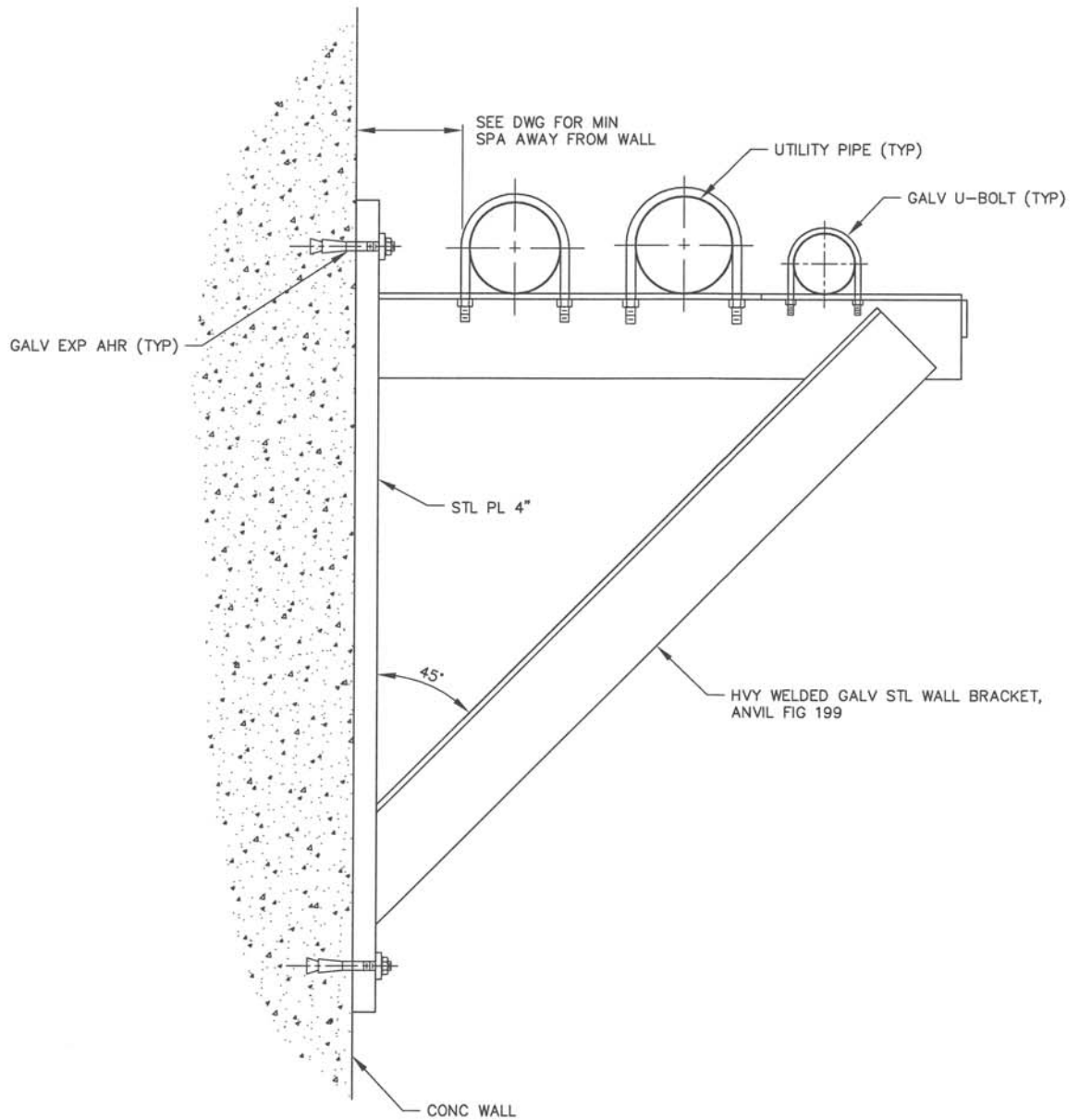
**D DENVER WATER**  
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DRAWN BY: WENKHEIMER  
 CHKD BY: K ROSS/VR  
 APPD BY: Stephen C. Reem  
 ORIGINATION DATE: JANUARY 2017  
 REVISION DATE:

23032  
 ROOF EXHAUST OR INTAKE

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**NOTE:**

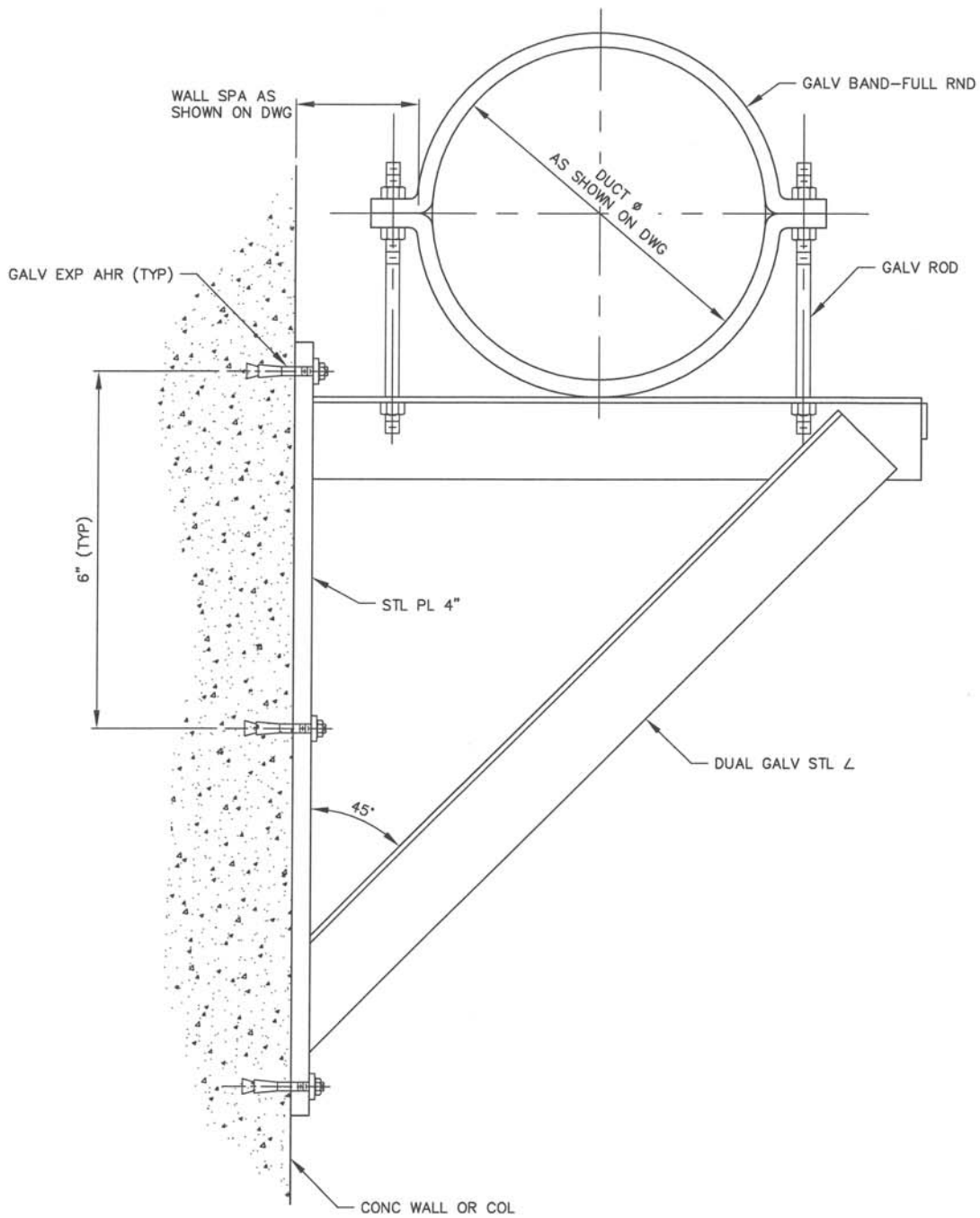
SIZE AS REQUIRED FOR PIPE DIAMETER, NUMBER, AND LOAD.

DRAWN BY: <i>WENKHEIMER</i>
CHKD BY: <i>K ROSS/KR</i>
APPD BY: <i>Steph C. Penn</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**23040  
WALL BRACKET**

**D DENVER WATER**

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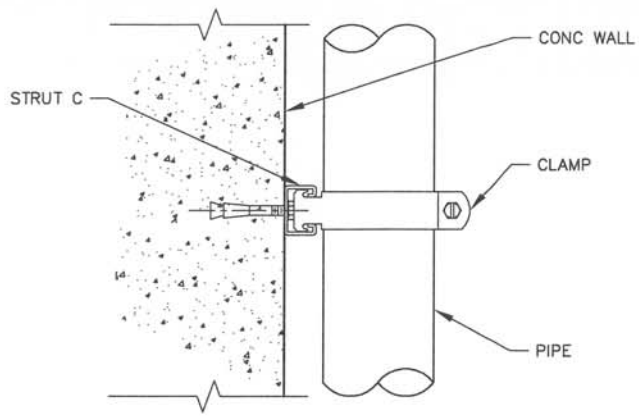
**NOTE:**

SIZE AS REQUIRED FOR DUCT DIAMETER AND LOAD.

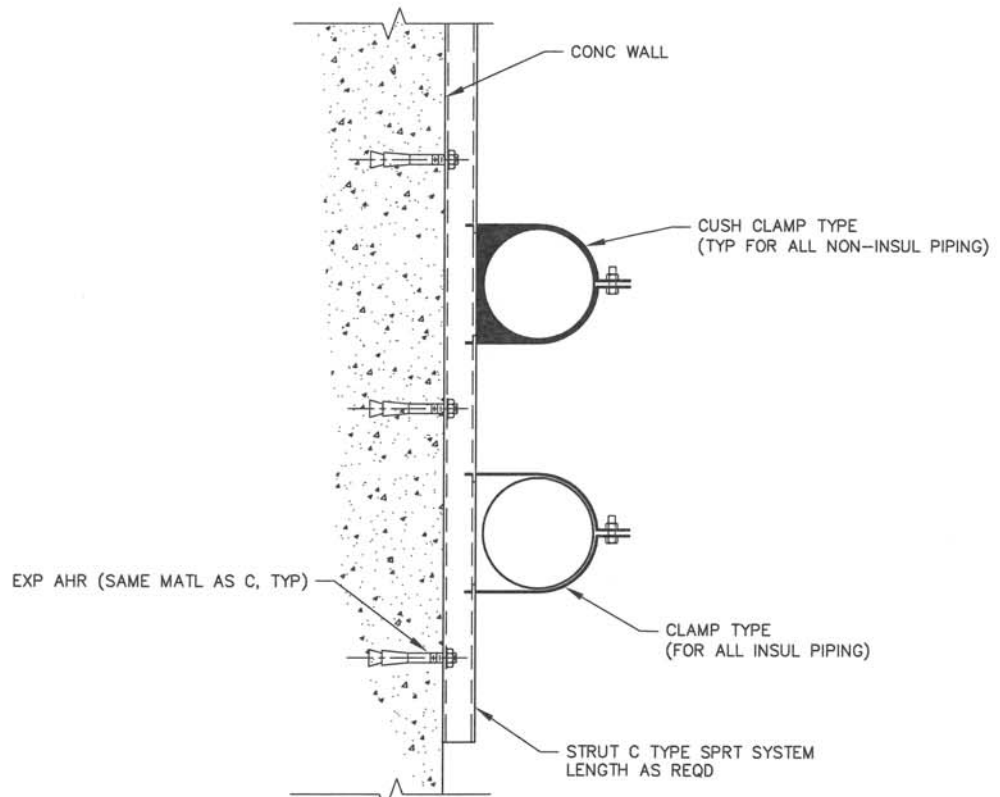
DRAWN BY: <i>WENKHEIMER</i>
CHKD BY: <i>K ROSS/KUR</i>
APPD BY: <i>Stephen C. Row</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**23041  
DUCT SUPPORT-  
BRACKET SYSTEM**

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VERTICAL



HORIZONTAL

NOTES:

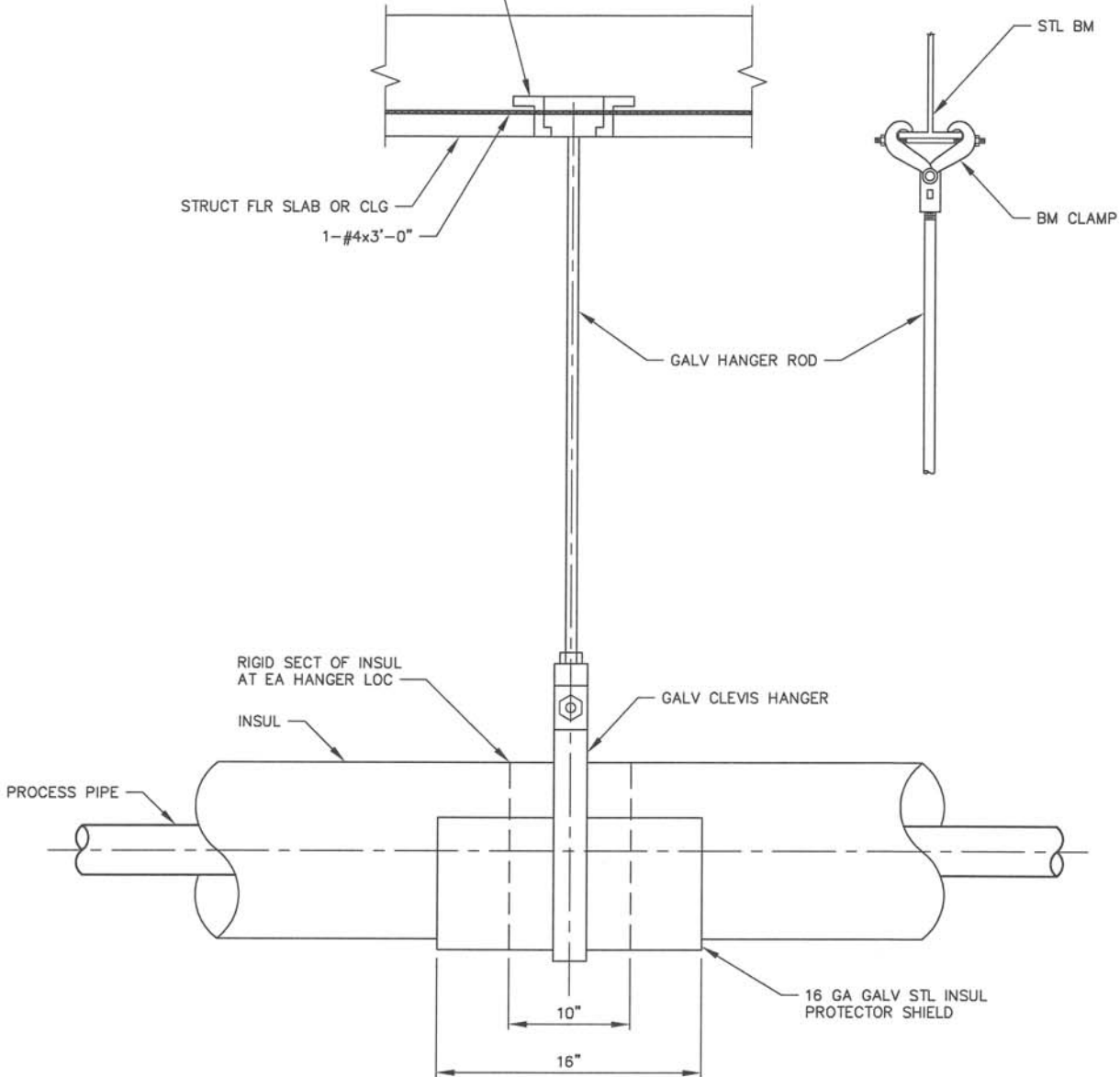
1. CLAMP MATERIAL SHALL BE THE SAME AS CHANNEL MATERIAL.
2. WHERE INSULATED, PIPE SHALL BE FITTED WITH RIGID PVC JACKET FOR PROTECTION.
3. PROVIDE STAINLESS STEEL CLAMPS, FASTENERS, INSERTS AND CHANNEL FOR SUBMERGED OR WETTED AREAS. PROVIDE GALVANIZED MATERIALS FOR ALL OTHER LOCATIONS.

DRAWN BY: SCHULTE
CHKD BY: K ROSS/KJR
APPD BY: Stephen C. Reim
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

23042  
PIPE SUPPORT-  
STACKED WALL SYSTEM

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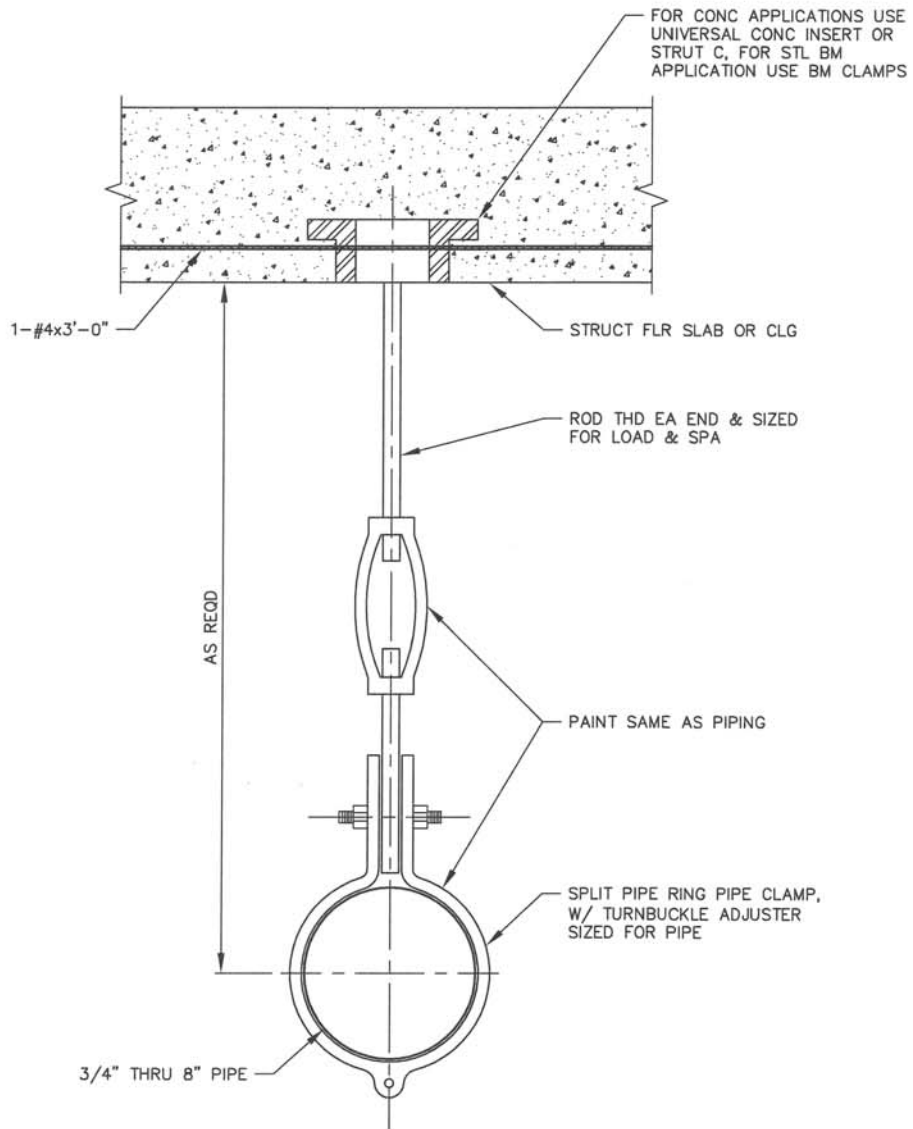
FOR CONC APPLICATIONS USE UNIVERSAL  
 CONC INSERT OR STRUT C, FOR STL BM  
 APPLICATION USE BM CLAMPS



DRAWN BY: WENKHEIMER  
 CHKD BY: K ROSS/ *KR*  
 APPD BY: *Steph C. Rem*  
 ORIGINATION DATE: JANUARY 2017  
 REVISION DATE:

23043  
 HANGER SUPPORT  
 SYSTEM-INSULATED  
 HORIZONTAL PIPING

**D DENVER WATER**  
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**NOTE:**

TOTAL LOADING ON EACH CONCRETE INSERT OR OTHER TYPE HANGER ROD ANCHOR SHALL NOT EXCEED MANUFACTURER'S RECOMMENDED LOADING.

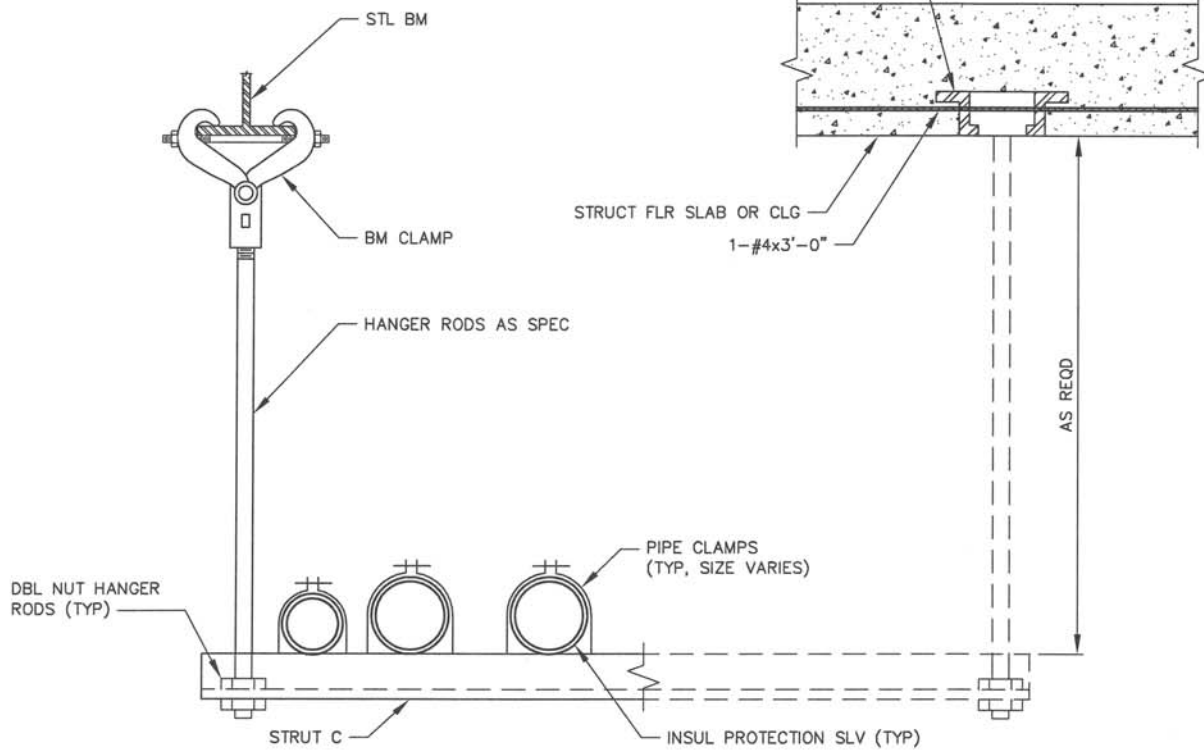
DRAWN BY: <i>WENKHEIMER</i>
CHKD BY: <i>K ROSS/KUR</i>
APPD BY: <i>Stephen C. Reim</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**23044  
PIPE HANGER**

**D DENVER WATER**  
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FOR CONC APPLICATIONS USE UNIVERSAL CONC INSERT  
OR STRUT C, FOR STL BM APPLICATION USE BM CLAMPS

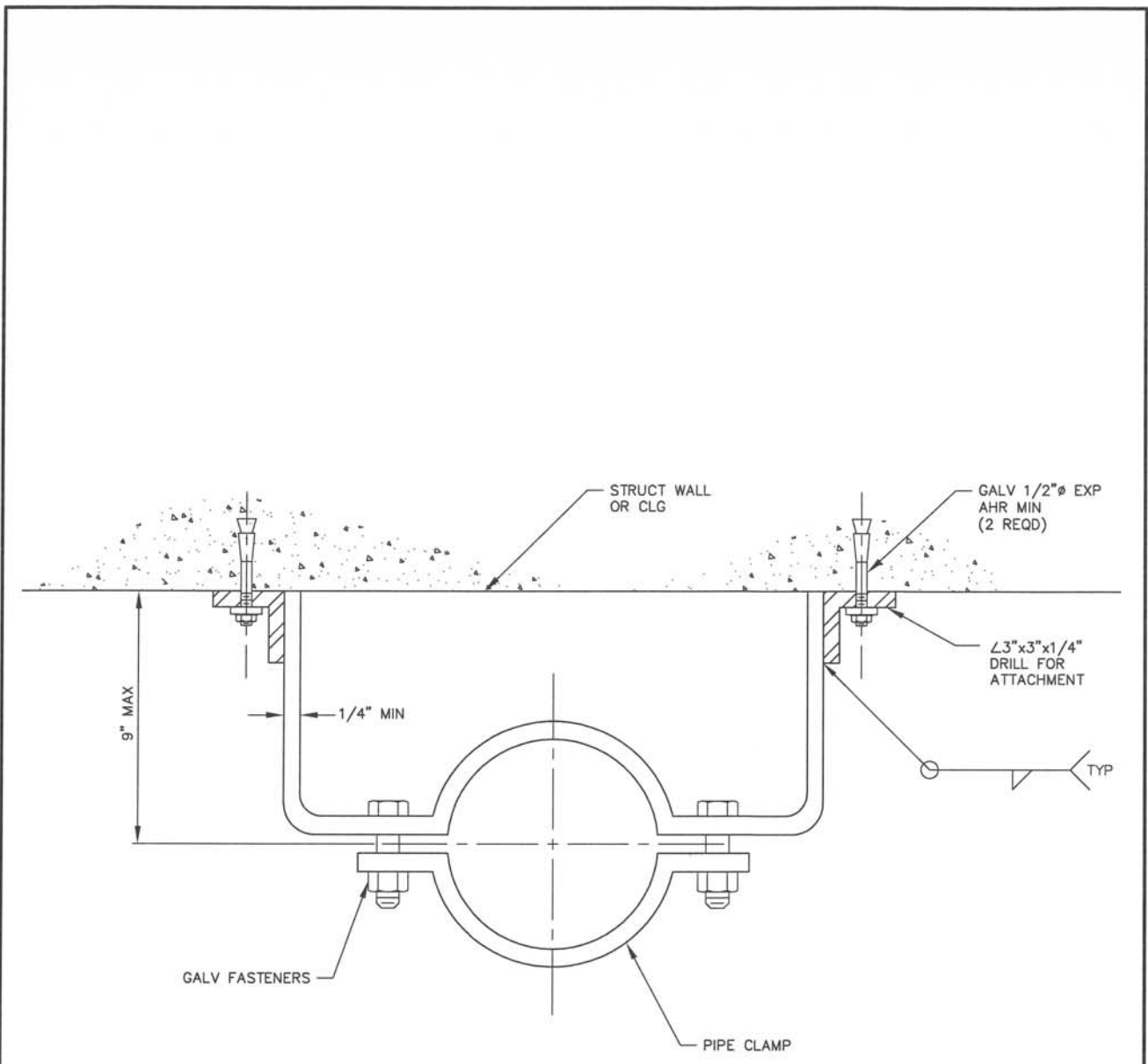


DRAWN BY: <i>WENKHEIMER</i>
CHKD BY: <i>K ROSS/ KLR</i>
APPD BY: <i>Stephen C. Rem</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**23045**  
**TRAPEZE PIPE HANGER**

**D DENVER WATER**

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**NOTES:**

1. HOT DIP GALVANIZE ASSEMBLY AFTER FABRICATION.
2. FOR INSULATED PIPING, CLAMP INSIDE DIAMETER MUST BE SUITABLE FOR OUTSIDE DIAMETER OF INSERT.
3. MAXIMUM PIPING DIAMETER 6-INCH.
4. EXPANSION ANCHORS SHALL BE DESIGNED FOR OVERHEAD USE.

DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Reem
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**23046  
OFFSET PIPE CLAMP**

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PENETRATION TABLE			
PENETRATION	CONDITION	TYPE	LIMITATION
WATER HOLDING STRUCTURE	ABOVE WS	C,D,F,G	
	BELOW WS	A,B,F,L,Q	
INTERIOR WALL	CONCRETE	C,D,F,M	PIPE > 4"
		H,M	PIPE < 4"
	BLOCK	H	
FOUNDATION WALL	ALL	E	PIPE > 4"
		F,G,M,S	
		L	RCP
EXTERIOR WALL	ALL	-	AS SHOWN
ROOF	ALL	I	AS SHOWN
CEILING, FLOOR	ALL	I	
FOUNDATION FLOOR	METAL PIPE	A,B	PIPE > 4"
		I,H,Q	PIPE < 4"
DUCT	ALL	I	
		J,K	
ELECTRICAL	EXT WALLS	G,F,N,R,T,U	
	INT FLOORS	O,Q,R,S	
	INT WALLS	G,N,P,Q,R,S	
	EXT FDTN FLOORS, SLABS & EQUIP PADS	R,S,T,U	

**NOTES:**

- PENETRATIONS CONFORM TO THE PENETRATION TABLE FOR THE CONDITION INDICATED UNLESS OTHERWISE NOTED ON THE DRAWINGS.
- TABLE TERMINOLOGY:
  - WATER HOLDING STRUCTURE – ANY PART OF A STRUCTURE CONTAINING WATER
  - WATER SURFACE (WS) – AN ELEVATION 9-INCHES ABOVE MAXIMUM WATER SURFACE SHOWN ON THE DRAWINGS
- COAT EMBEDDED WALL AND FLOOR PIPES AND SLEEVES WITH SPECIFIED PAINT SYSTEM PRIOR TO CONCRETE PLACEMENT.
- PENETRATION DETAILS ARE NOT SHOWN FOR ABOVE GRADE EXTERIOR WALLS AND ROOFS. DETAILS SHALL BE AS SPECIFIED OR SHOWN ON THE DRAWINGS.
- SLEEVES IN FOUNDATION WALLS AND TANK WALLS SHALL HAVE 5/16-INCH MINIMUM THICKNESS WALL COLLARS. COLLARS ARE NOT REQUIRED ON ALL OTHER WALL SLEEVES.

DRAWN BY: *WENKHEIMER*

CHKD BY: *K ROSS/KUR*

APPD BY: *Steph C. Rem*

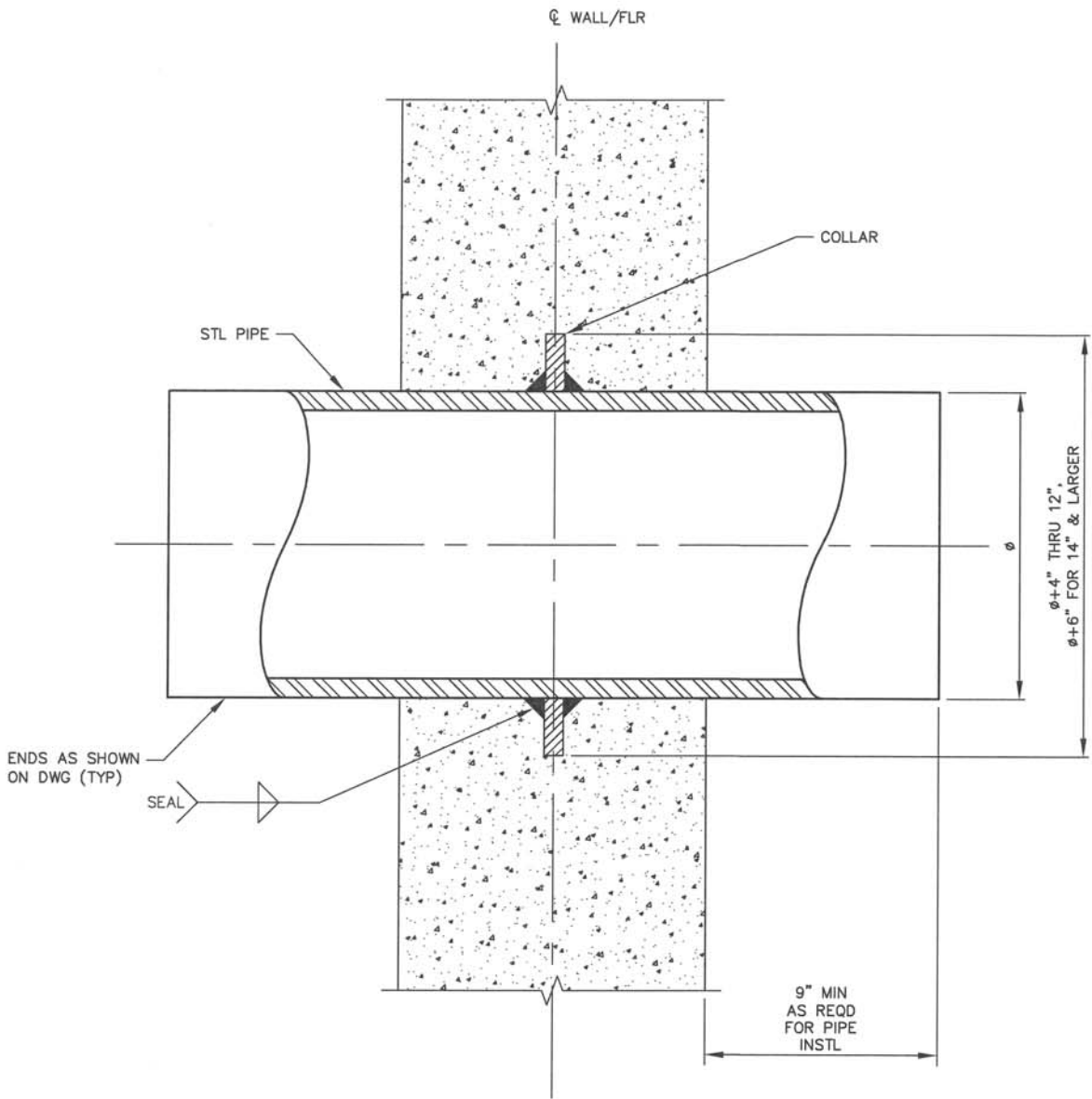
ORIGINATION DATE: *JANUARY 2017*

REVISION DATE:

*23050  
PIPE PENETRATION  
TABLE AND NOTES*



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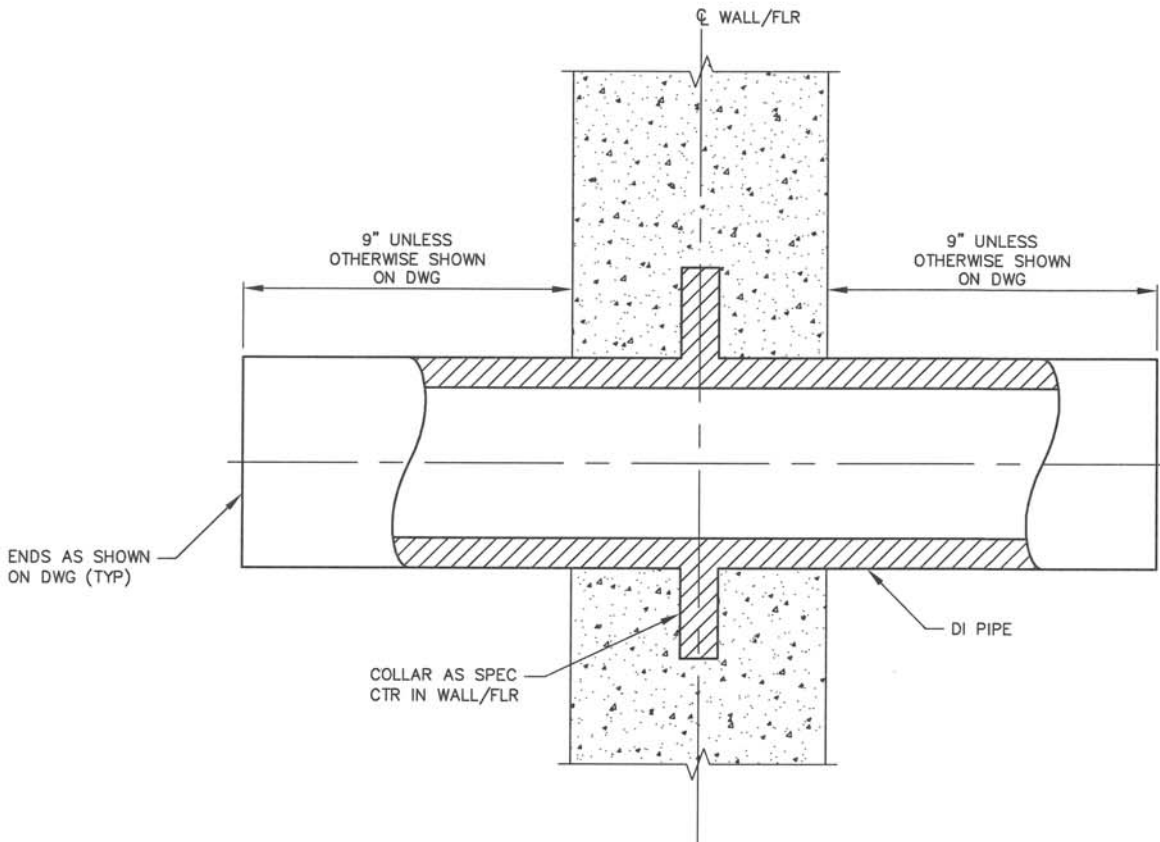
**NOTE:**

FOR PIPE PENETRATION TABLE AND NOTES SEE (23050).

DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/KR
APPD BY: Stephen C. Benn
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**23051**  
**TYPE A PENETRATION**

**D DENVER WATER**  
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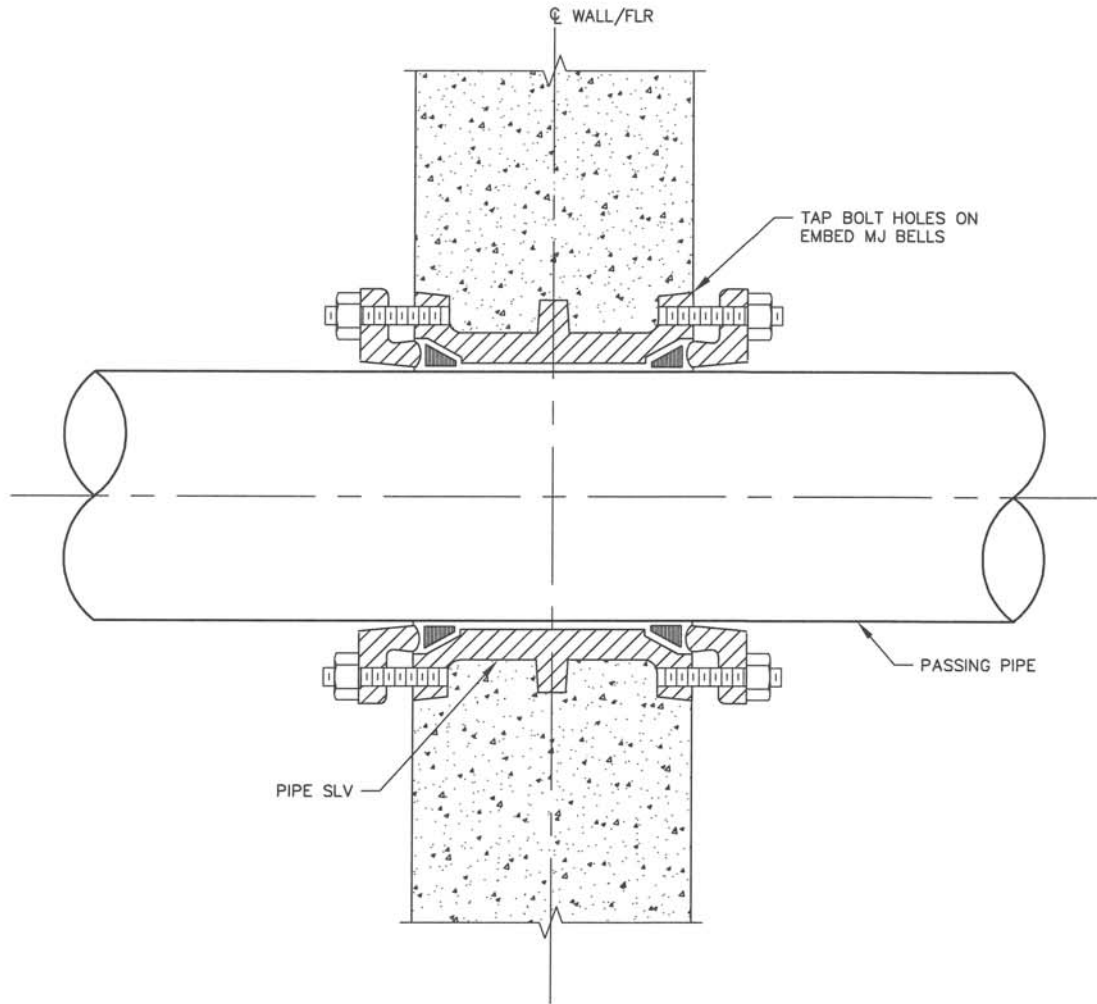
**NOTE:**

FOR PIPE PENETRATION TABLE AND NOTES SEE (23050).

DRAWN BY: <i>WENKHEIMER</i>
CHKD BY: <i>K ROSS/KR</i>
APPD BY: <i>Stephen C. Rasmussen</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**23052**  
**TYPE B PENETRATION**

**D DENVER WATER**  
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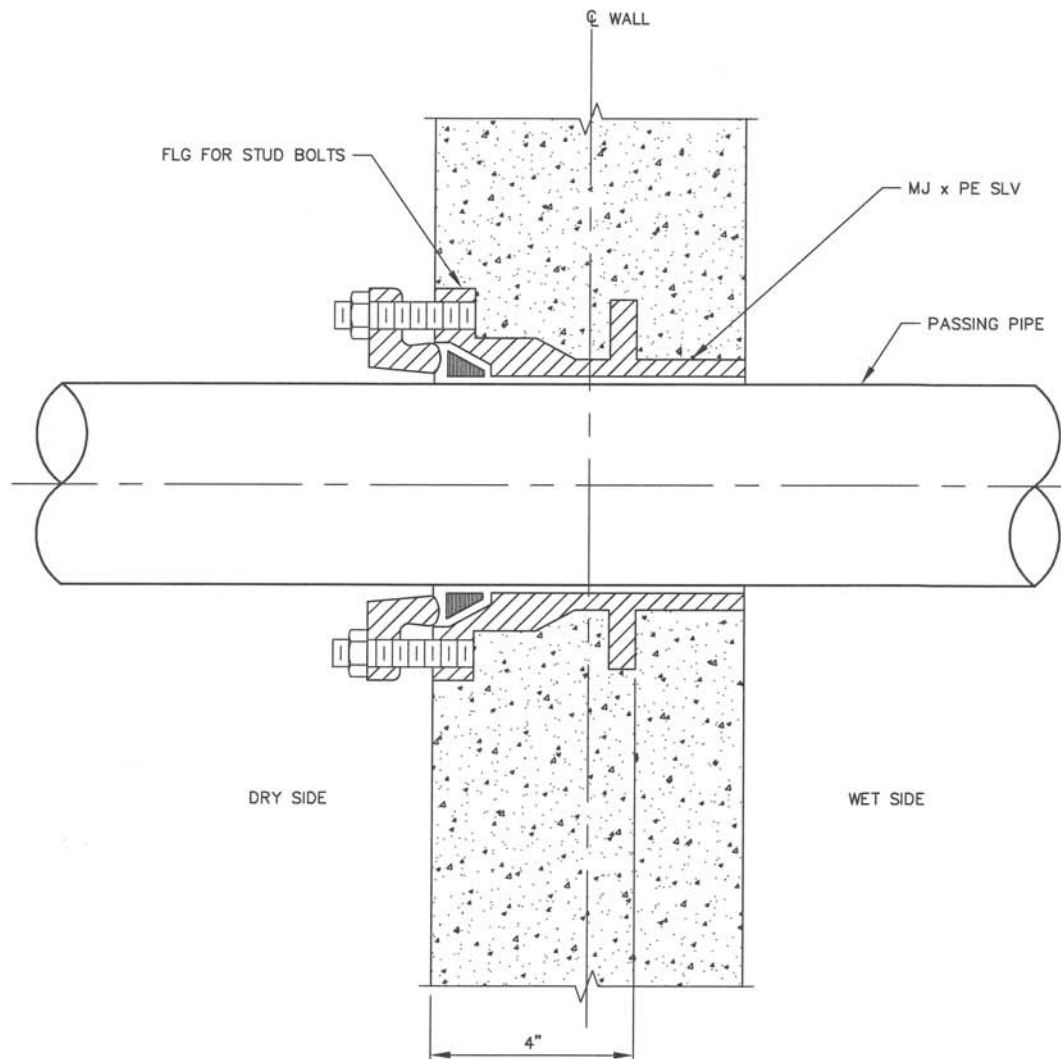
**NOTE:**

FOR PIPE PENETRATION TABLE AND NOTES SEE (23050).

DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/KUR
APPD BY: Stephen C. Rem
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

23053  
TYPE C PENETRATION

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**NOTE:**

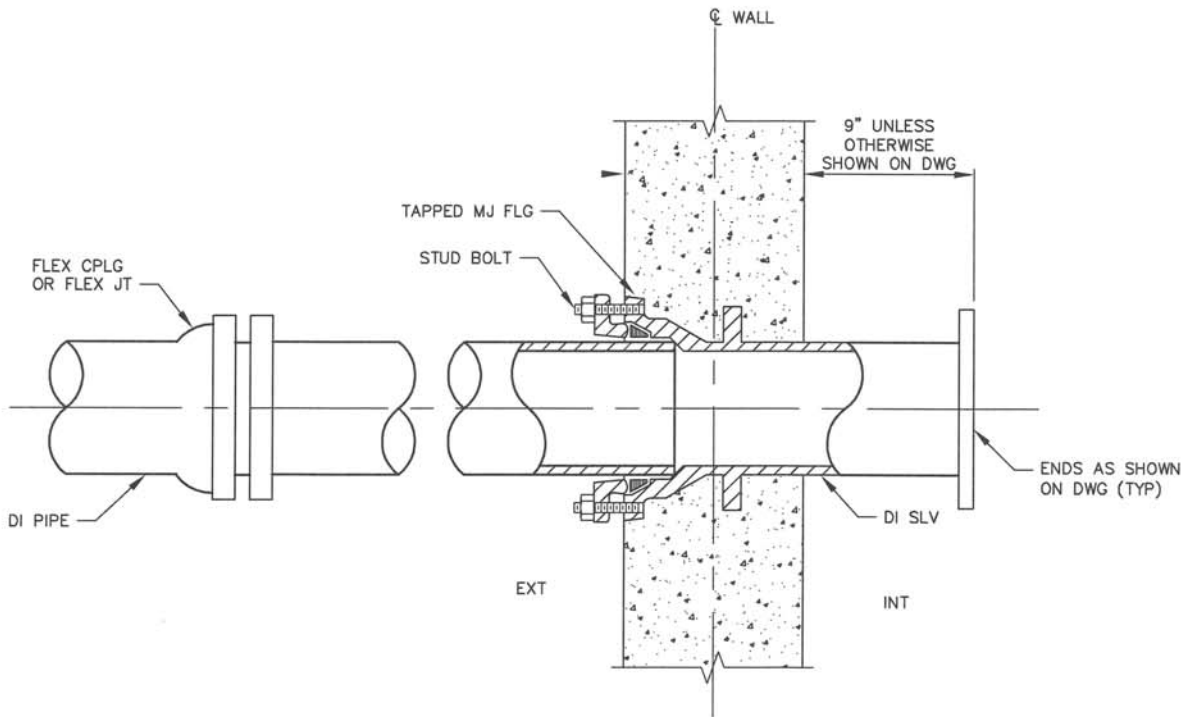
FOR PIPE PENETRATION TABLE AND NOTES SEE (23050).

**23054**  
**TYPE D PENETRATION**

DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/KR
APPD BY: Stephen C. Rem
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

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**NOTES:**

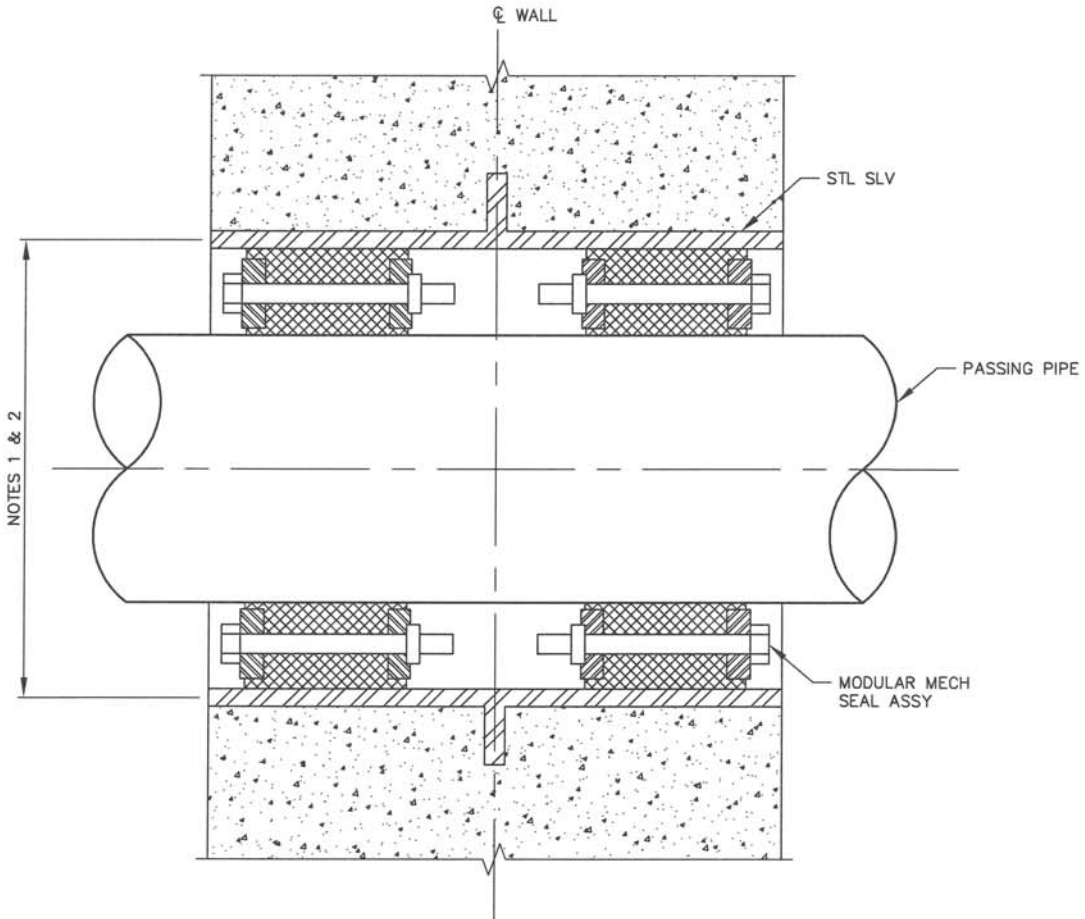
1. ONE NOMINAL PIPE DIAMETER BUT NOT LESS THAN 2- FEET.
2. FOR PIPE PENETRATION TABLE AND NOTES SEE (23050) .

DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/KR
APPD BY: Stephen C. Reems
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**23055**  
**TYPE E PENETRATION**

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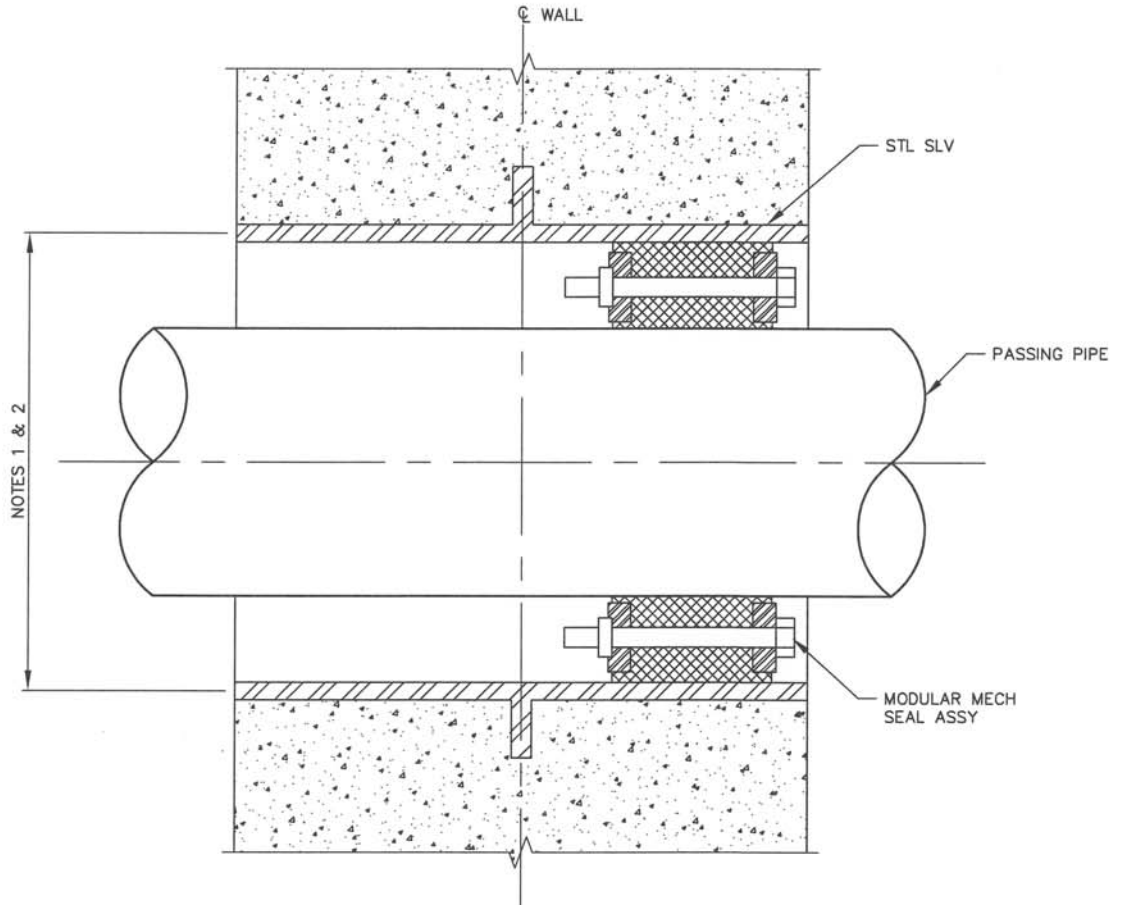
**NOTES:**

1. INSIDE DIAMETER OF PIPE SLEEVE AS REQUIRED BY THE MODULAR MECHANICAL SEAL ASSEMBLY MANUFACTURER, FOR THE PASSING PIPE SEAL.
2. FOR EXISTING WALL OMIT PIPE SLEEVE. CORE DRILL AS REQUIRED FOR PASSING PIPE AND MECHANICAL SEAL ASSEMBLY.
3. FOR PIPE PENETRATION TABLE AND NOTES SEE (23050) .

DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/KR
APPD BY: Stephen C. Rem
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**23056  
TYPE F PENETRATION**

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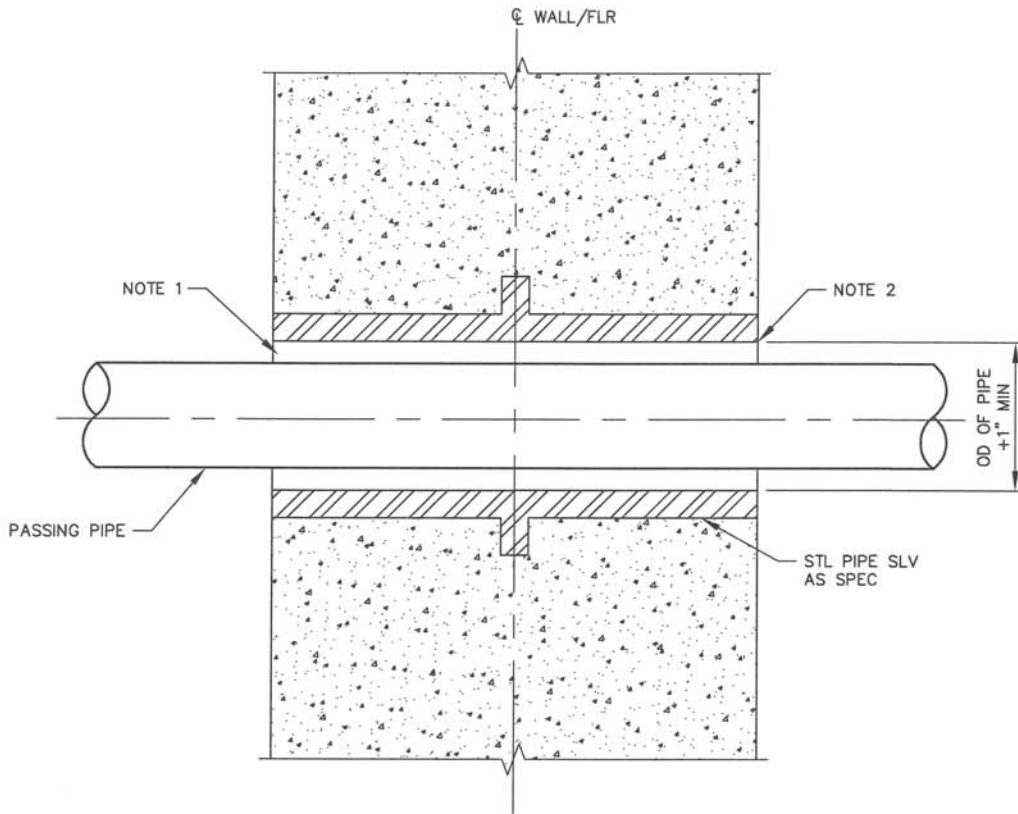
**NOTES:**

1. INSIDE DIAMETER OF PIPE SLEEVE AS REQUIRED BY THE MODULAR MECHANICAL SEAL ASSEMBLY MANUFACTURER, FOR THE PASSING PIPE SEAL.
2. FOR EXISTING WALL OMIT PIPE SLEEVE. CORE DRILL AS REQUIRED FOR PASSING PIPE AND MECHANICAL SEAL ASSEMBLY.
3. USE THIS DETAIL FOR ELECTRICAL CONDUIT WHEN APPROVED FOR WALLS TOO NARROW FOR TYPE F PENETRATION, (23056). FILL VOIDS WITH OAKUM.
4. FOR PIPE PENETRATION TABLE AND NOTES SEE (23050).

DRAWN BY: <i>WENKHEIMER</i>
CHKD BY: <i>K ROSS/KLR</i>
APPD BY: <i>Stephen C. Rem</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**23057**  
**TYPE G PENETRATION**

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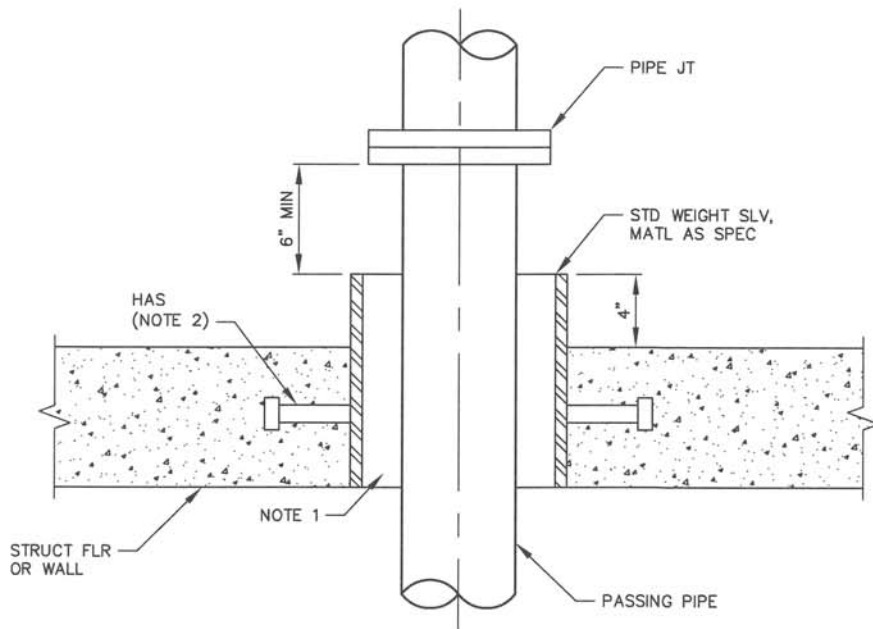
**NOTES:**

1. ANNULAR SPACES BETWEEN PASSING PIPE AND SLEEVES SHALL BE SEALED AS FOLLOWS:
  - A. ANNULAR SPACES IN PENETRATIONS OF FIRE RATED WALLS SHALL MEET FIRE CODE REQUIREMENTS OF AUTHORITY HAVING JURISDICTION.
  - B. FOUNDATION FLOOR SLEEVES SEALED WITH NON-SHRINK GROUT. WRAP PIPE WITH POLYETHYLENE BAGGING INSIDE SLEEVE.
  - C. INTERIOR WALLS AND SLABS SEALED WITH ELASTOMERIC SEALANT AND BACKER ROD.
2. FOR CMU PENETRATIONS, GROUT SLEEVE IN PLACE AND PROVIDE GALVANIZED PIPE COLLAR BOTH SIDES.
3. FOR PIPE PENETRATION TABLE AND NOTES SEE (23050).

DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/ KLR
APPD BY: Stephen C. Rem
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**23058**  
**TYPE H PENETRATION**

**D DENVER WATER**  
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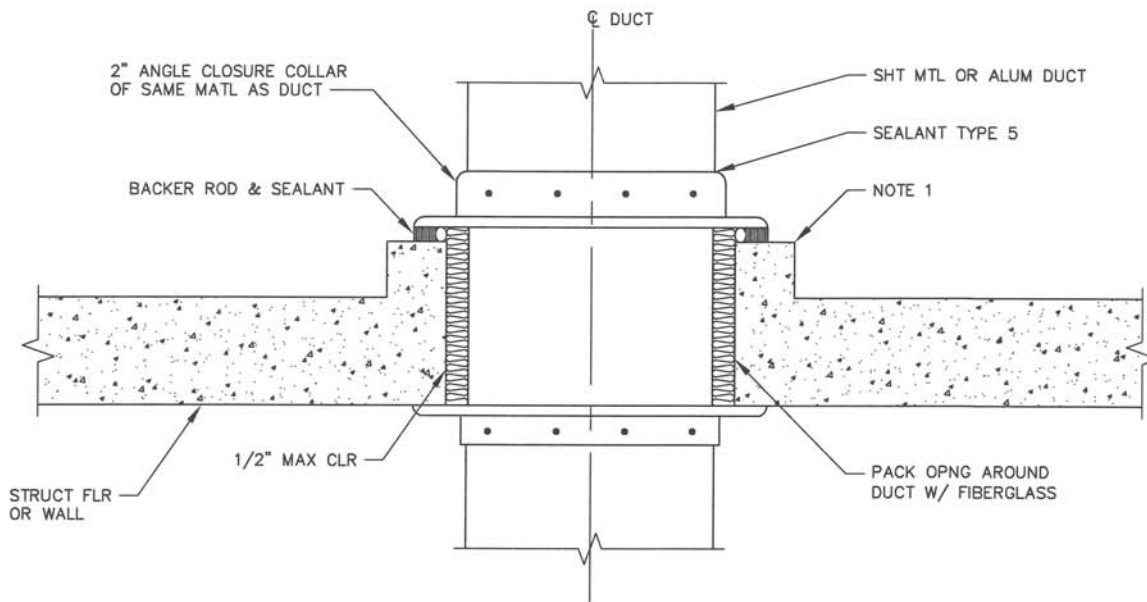
**NOTES:**

1. ANNULAR SPACES BETWEEN PASSING PIPE AND SLEEVES SHALL BE SEALED AS FOLLOWS:
  - A. ANNULAR SPACES IN PENETRATIONS OF FIRE RATED WALLS SHALL MEET FIRE CODE REQUIREMENTS OF AUTHORITY HAVING JURISDICTION.
  - B. FOUNDATION FLOOR SLEEVES SEALED WITH NON-SHRINK GROUT. WRAP PIPE WITH POLYETHYLENE BAGGING INSIDE SLEEVE.
  - C. INTERIOR WALLS AND SLABS SEALED WITH ELASTOMERIC SEALANT AND BACKER ROD.
2. PROVIDE A MINIMUM OF 3 HEADED ANCHOR STUDS PER SLEEVE, EQUALLY SPACED.
3. INSIDE DIAMETER OF SLEEVE SHALL BE A MINIMUM OF THE DIAMETER REQUIRED TO REMOVE THE PASSING PIPE PLUS LARGE ENOUGH TO INSTALL THE INDICATED ANNULAR PIPE SEAL.
4. FOR PIPE PENETRATION TABLE AND NOTES SEE (23050).

DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Rem
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

23059  
TYPE I PENETRATION

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**NOTES:**

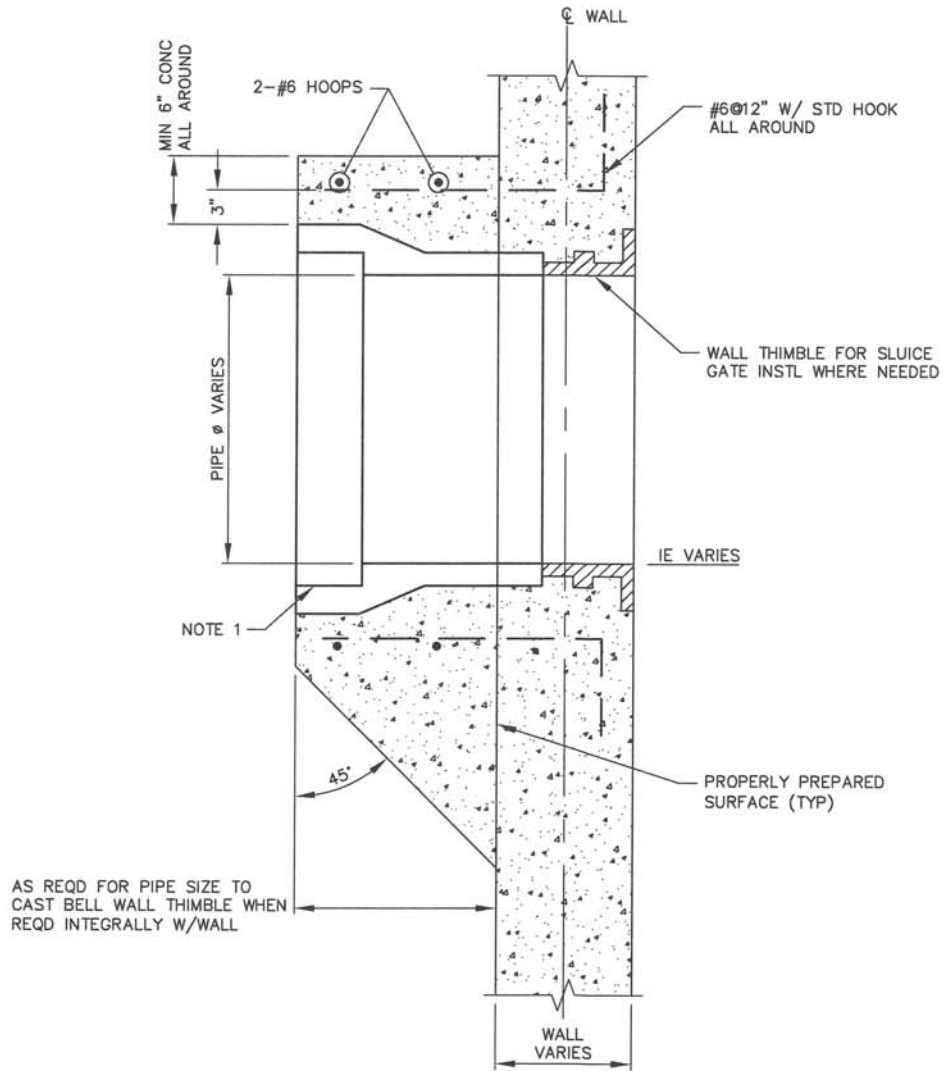
1. FOR DUCT PENETRATIONS IN FLOOR AREAS 3 1/2-INCH x 3 1/2-INCH. PROVIDE CURB ALL AROUND. CURB NOT REQUIRED FOR WALL PENETRATIONS.
2. TYPE K PENETRATION FOR DRY AREAS—CURB NOT REQUIRED.
3. FOR PIPE PENETRATION TABLE AND NOTES SEE (23050).

DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/KIR
APPD BY: Stephen C. Ross
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

23060  
 TYPE J PENETRATION AND  
 TYPE K PENETRATION

**D DENVER WATER**

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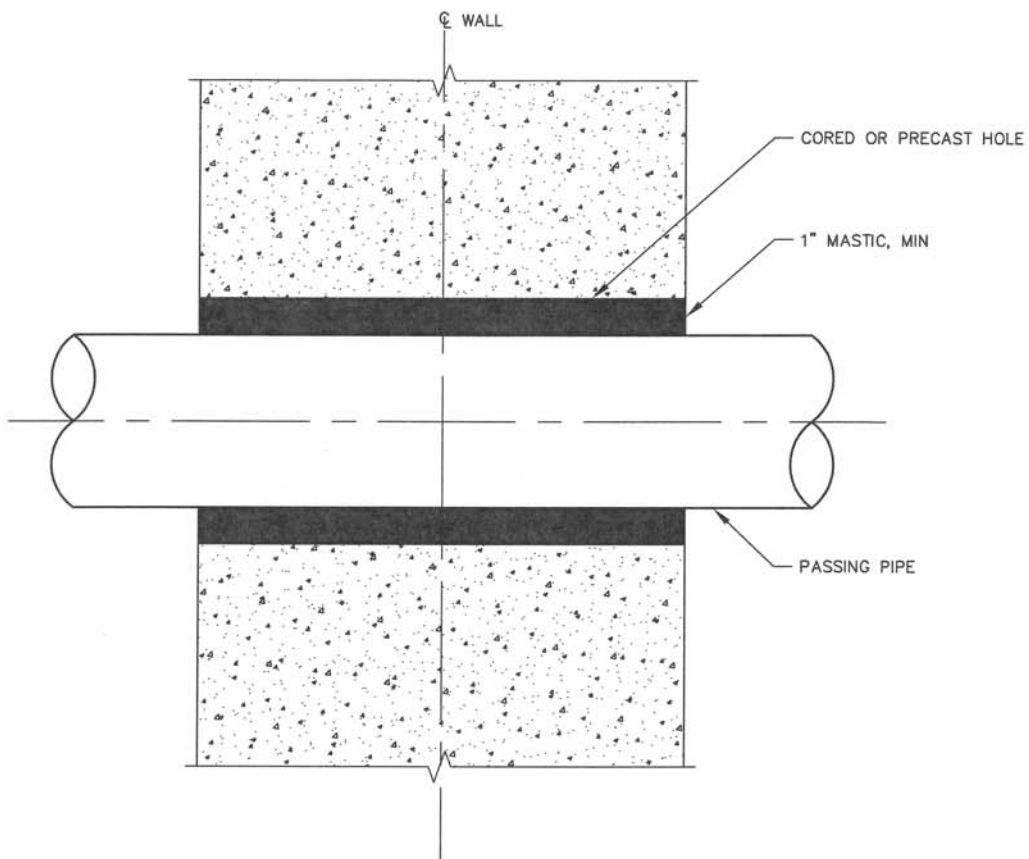
**NOTES:**

1. REINFORCED CONCRETE SPOOL OR SPECIAL WALL THIMBLE WITH BELL TYPE GASKETED JOINT AS SPECIFIED. PROVIDE SECOND JOINT WITHIN ONE PIPE DIAMETER OF WALL.
2. FOR PIPE PENETRATION TABLE AND NOTES SEE (23050).

DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Rem
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

23061  
TYPE L PENETRATION

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**NOTE:**

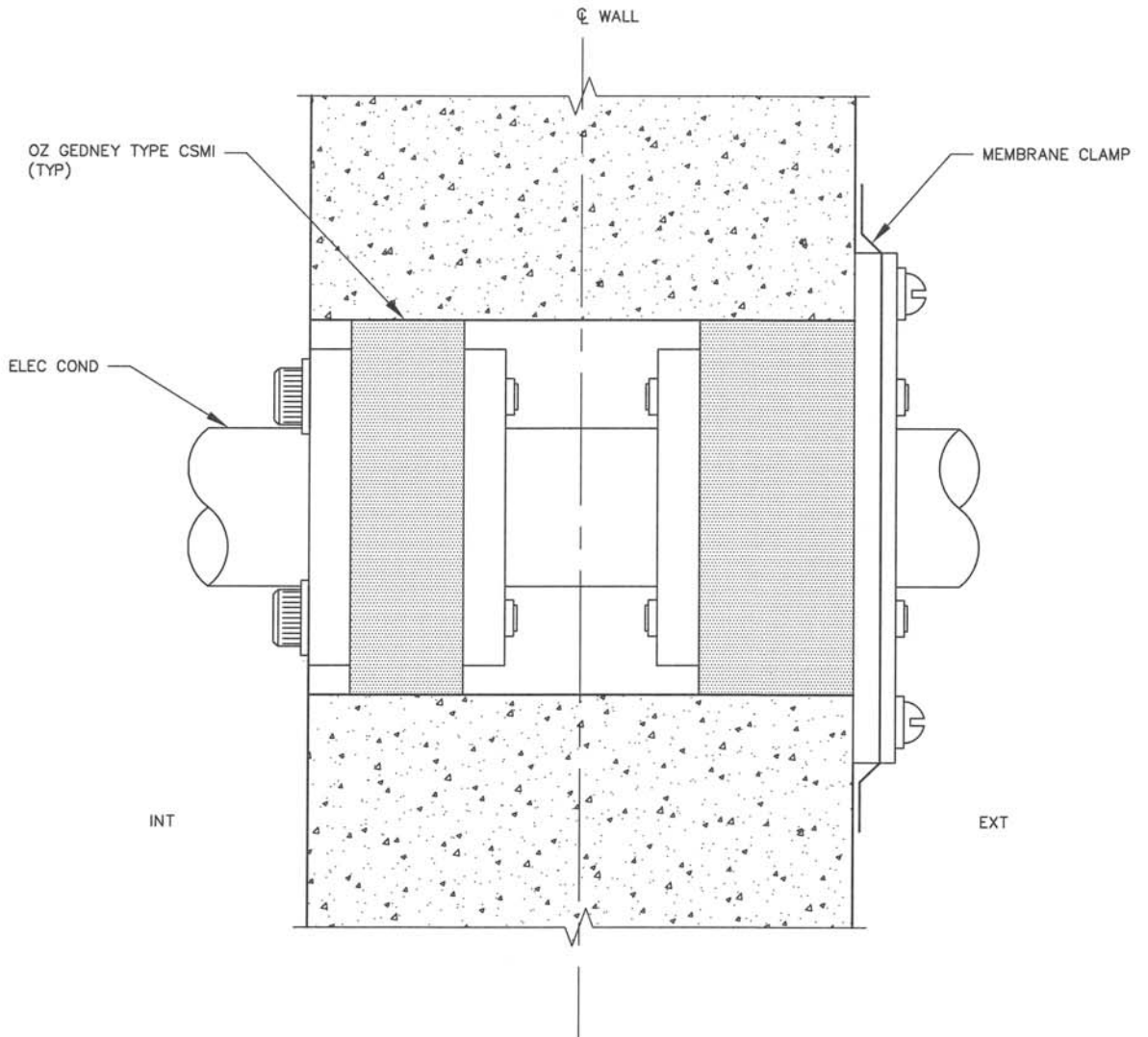
FOR PIPE PENETRATION TABLE AND NOTES SEE (23050).

**23062  
TYPE M PENETRATION**



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DRAWN BY: <i>WENKHEIMER</i>
CHKD BY: <i>K ROSS/KR</i>
APPD BY: <i>Stephen C. Rem</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:



**NOTE:**  
 FOR PIPE PENETRATION TABLE AND NOTES SEE (23050).

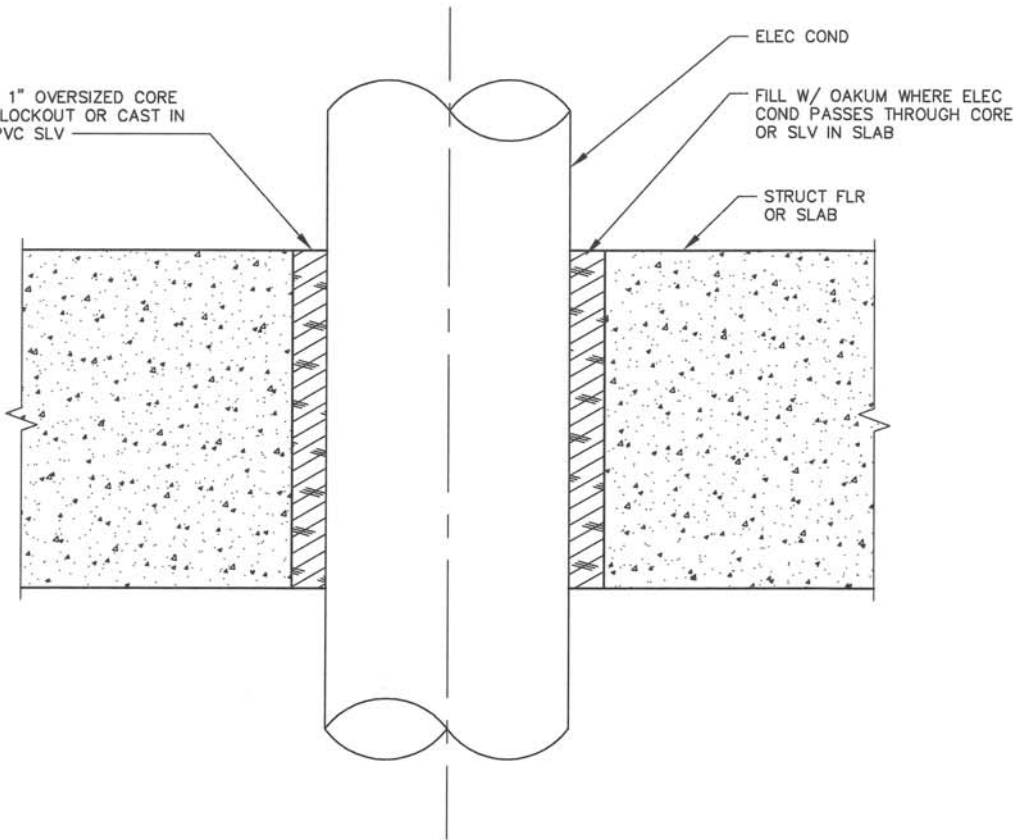
DRAWN BY: <i>WENKHEIMER</i>
CHKD BY: <i>K ROSS/ KLR</i>
APPD BY: <i>Stephen C. Ben</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**23063**  
**TYPE N PENETRATION**

**D DENVER WATER**  
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PROVIDE 1" OVERSIZED CORE  
DRILL, BLOCKOUT OR CAST IN  
PLACE PVC SLV



**NOTE:**

FOR PIPE PENETRATION TABLE AND NOTES SEE (23050).

DRAWN BY: WENKHEIMER

CHKD BY: K ROSS/ KRP

APPD BY: Stephen C. Pen

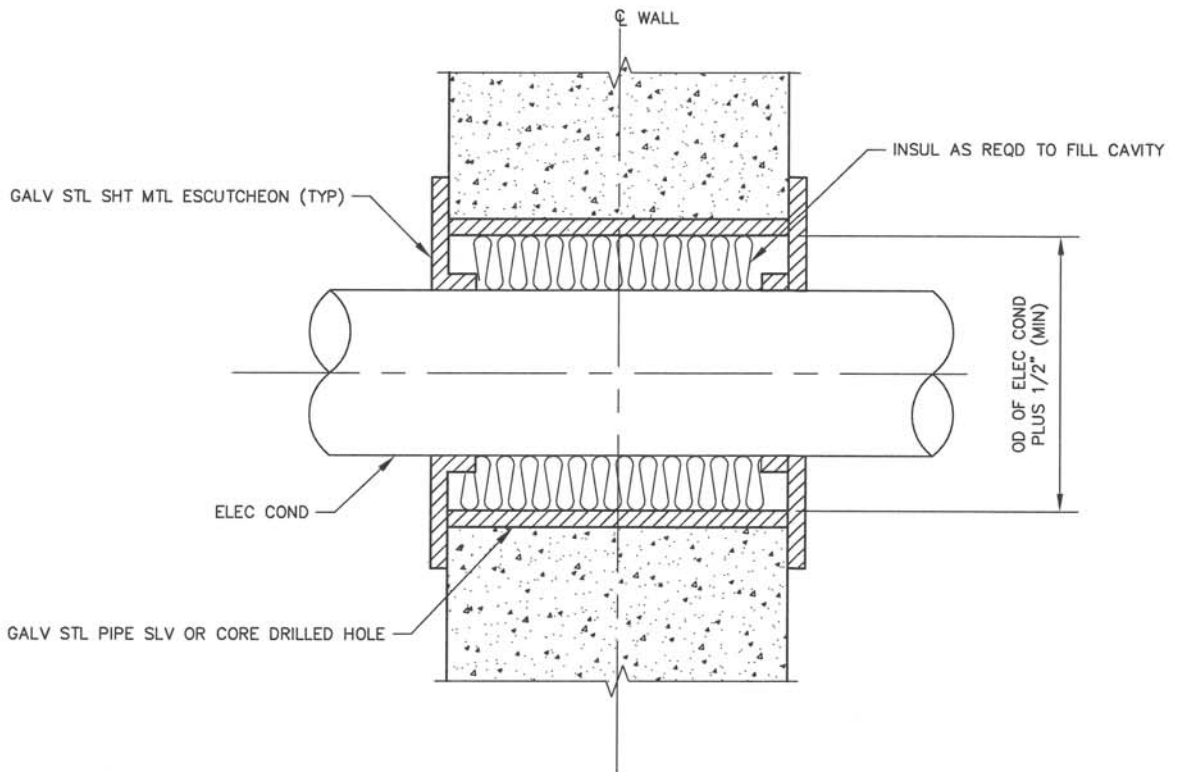
ORIGINATION DATE: JANUARY 2017

REVISION DATE:

23064  
TYPE O PENETRATION

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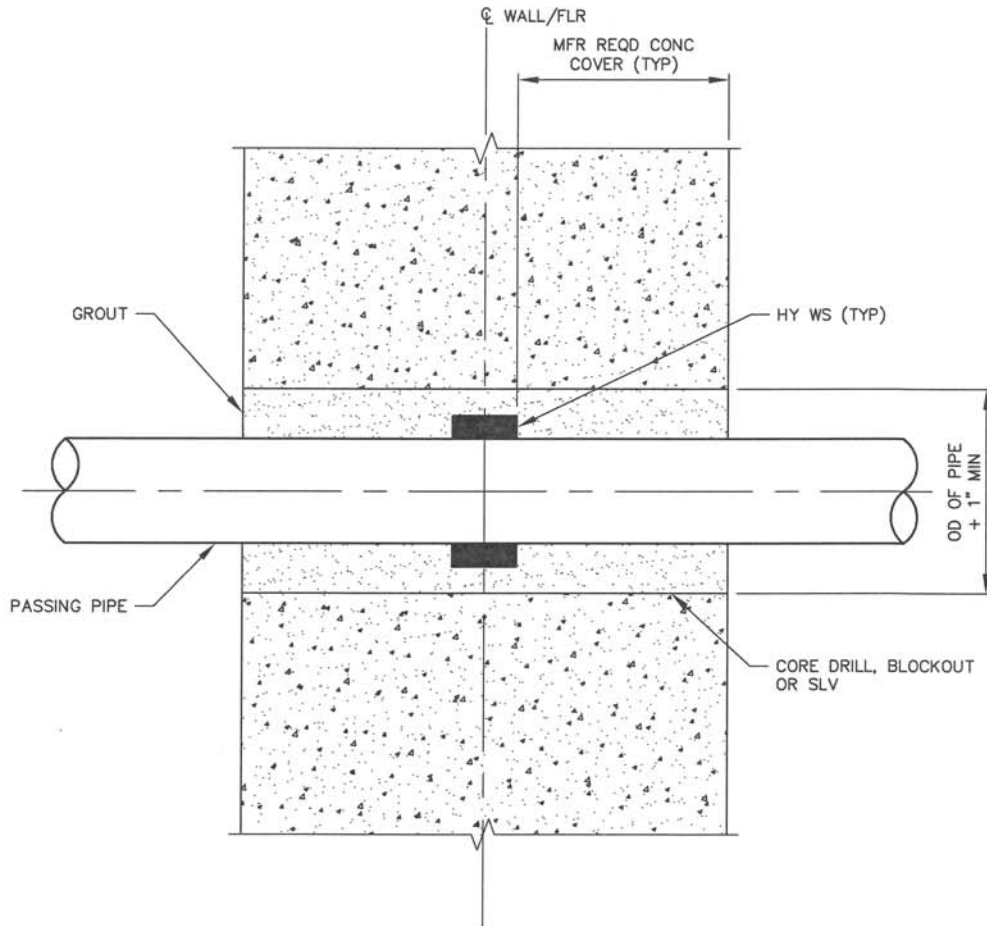
**NOTES:**

1. CONDUITS WHICH INDIVIDUALLY PASS THROUGH AN INTERIOR WALL SHALL BE INSTALLED IN ACCORDANCE WITH THIS DETAIL.
2. IF THE WALL IS A FIRE WALL, FILL CAVITY WITH FIRE STOP SEALANT.
3. FOR PIPE PENETRATION TABLE AND NOTES SEE (23050).

DRAWN BY: <i>WENKHEIMER</i>
CHKD BY: <i>K ROSS/KR</i>
APPD BY: <i>Stephen C. Ream</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**23065**  
**TYPE P PENETRATION**

**D DENVER WATER**  
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 F: 303.628.6851  
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**NOTES:**

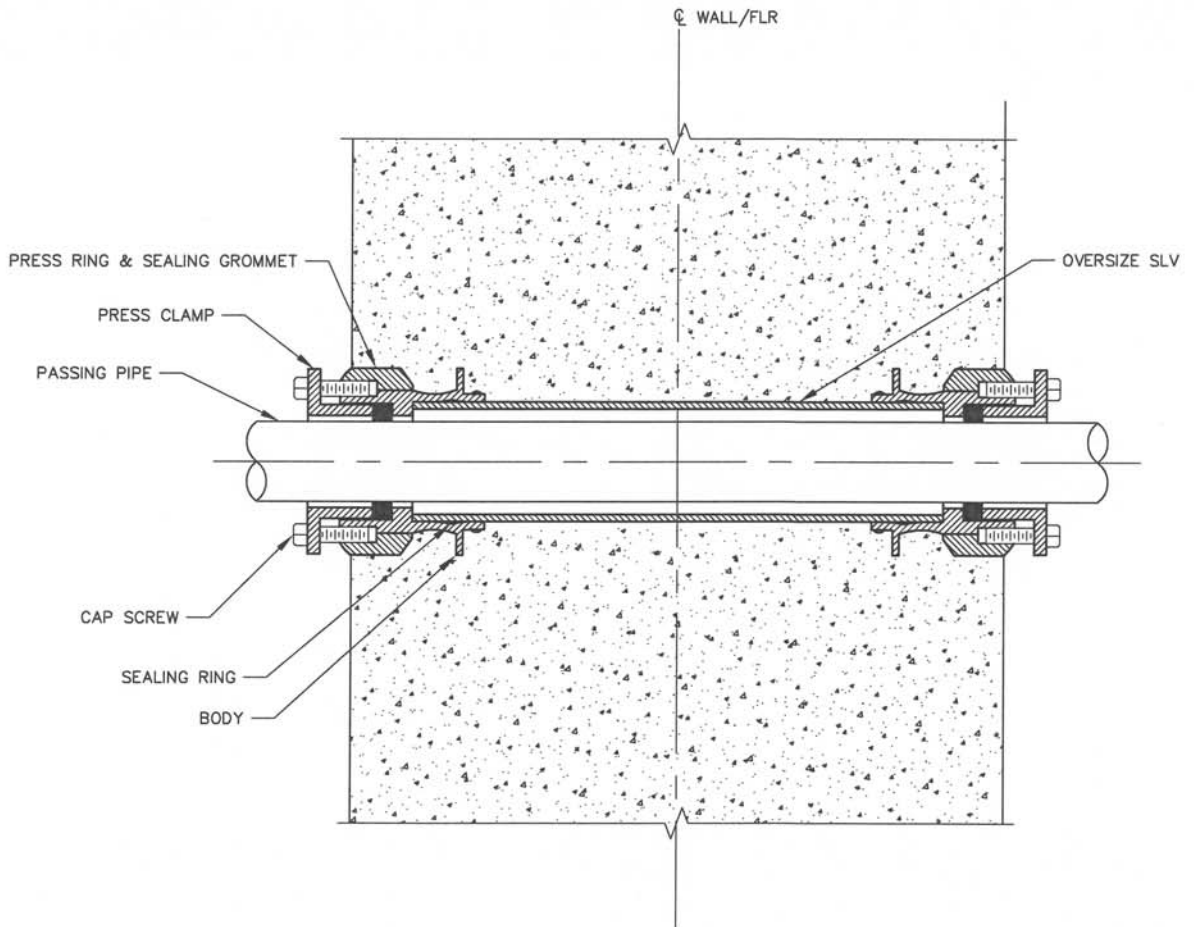
1. NOT FOR USE IN CMU WALLS.
2. FOR PIPE PENETRATION TABLE AND NOTES SEE (23050).

DRAWN BY: <i>WENKHEIMER</i>
CHKD BY: <i>K ROSS/KR</i>
APPD BY: <i>Stephen C. Ryan</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**23066**  
**TYPE Q PENETRATION**

**D DENVER WATER**

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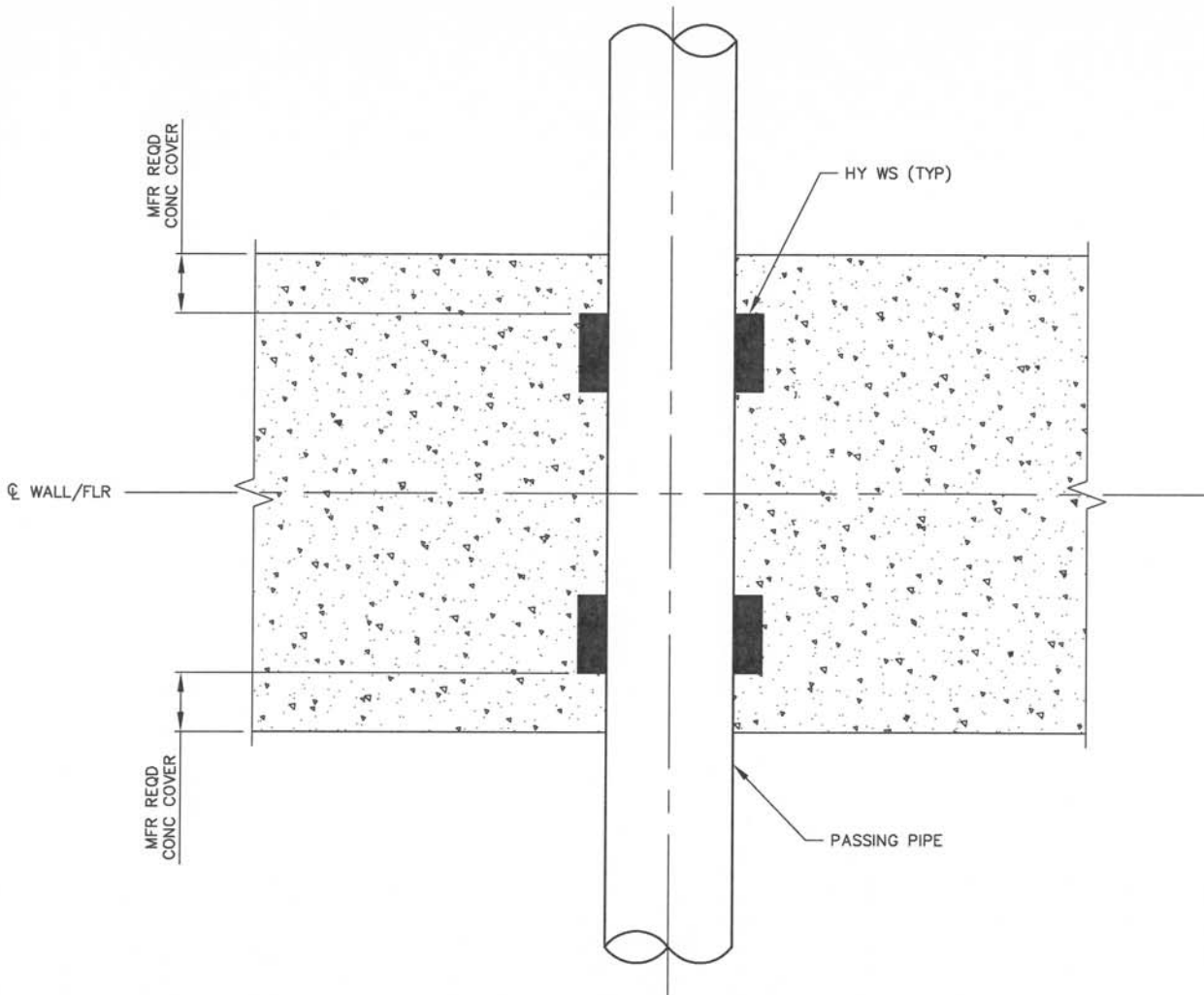
**NOTES:**

1. WHEN SINGLE-ENDED SEALS ARE APPROVED, SEAL SHALL BE ON THE OUTSIDE OF THE WALL OR ON THE TOP OF THE FLOOR.
2. FOR PIPE PENETRATION TABLE AND NOTES SEE (23050).

DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/KLR
APPD BY: <i>Stephen C. Reim</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

23067  
TYPE R PENETRATION

**D DENVER WATER**  
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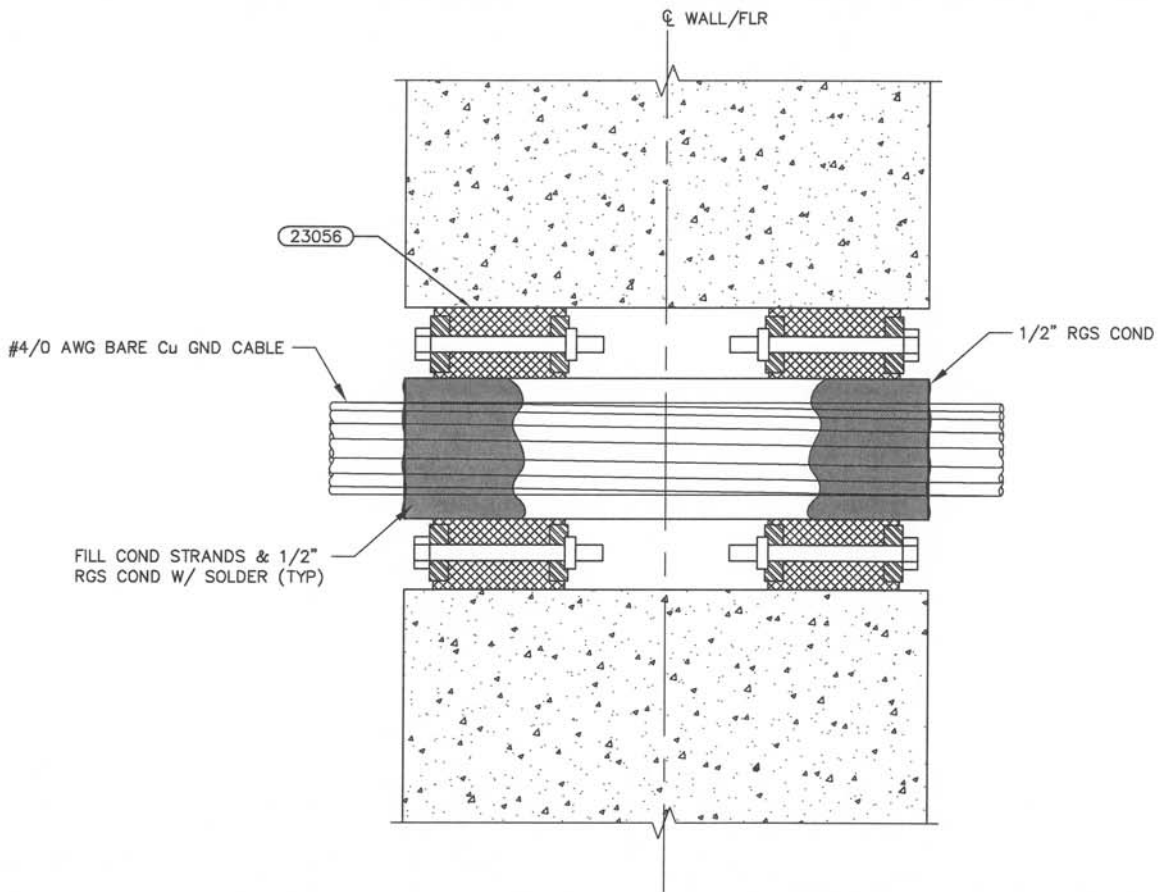
**NOTES:**

1. FOR EXTERIOR SLABS AND EQUIPMENT PADS OR WHEN APPROVED FOR PIPES TOO DENSE FOR TYPE R PENETRATIONS.
2. FOR PIPE PENETRATION TABLE AND NOTES SEE (23050).

DRAWN BY: ROMERO
CHKD BY: K ROSS/ KLR
APPD BY: Stephen C. Rem
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

23068  
TYPE S PENETRATION

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**NOTE:**

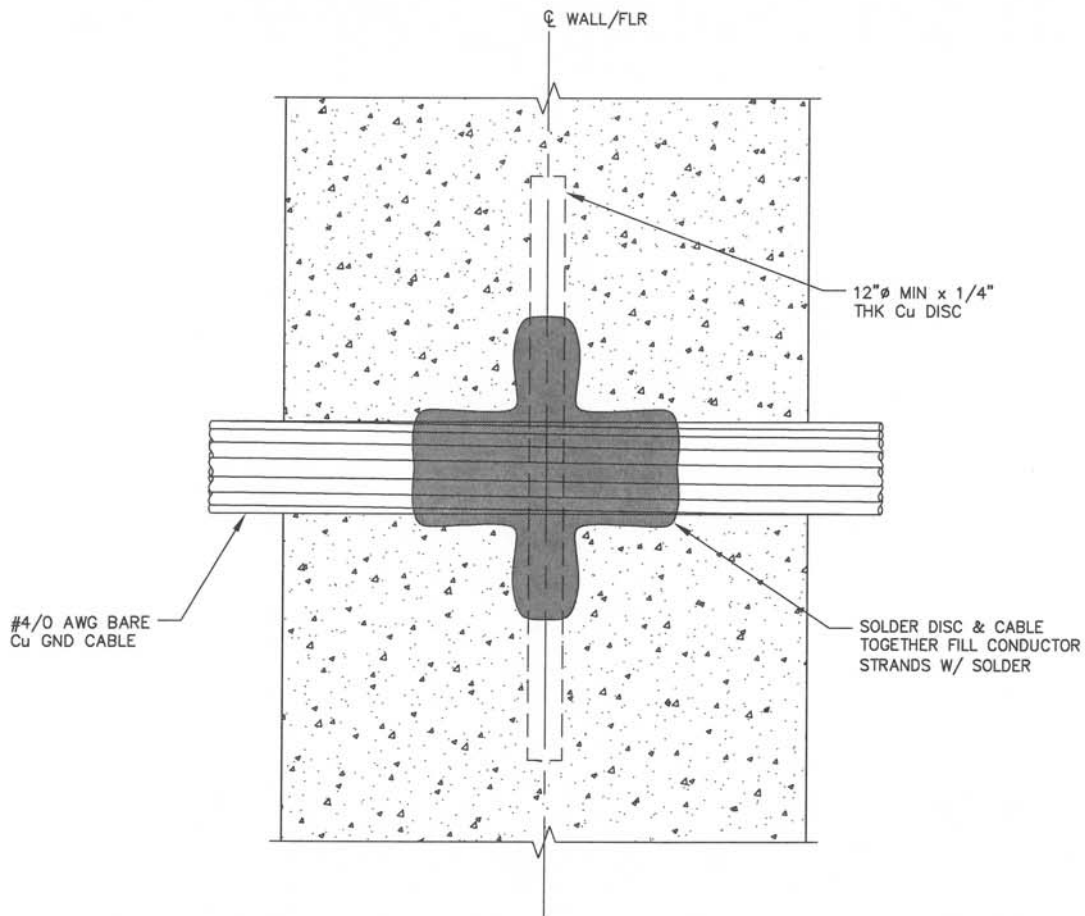
FOR PIPE PENETRATION TABLE AND NOTES SEE 23050

DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Pann
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

23069  
TYPE T PENETRATION

**D DENVER WATER**

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**NOTE:**

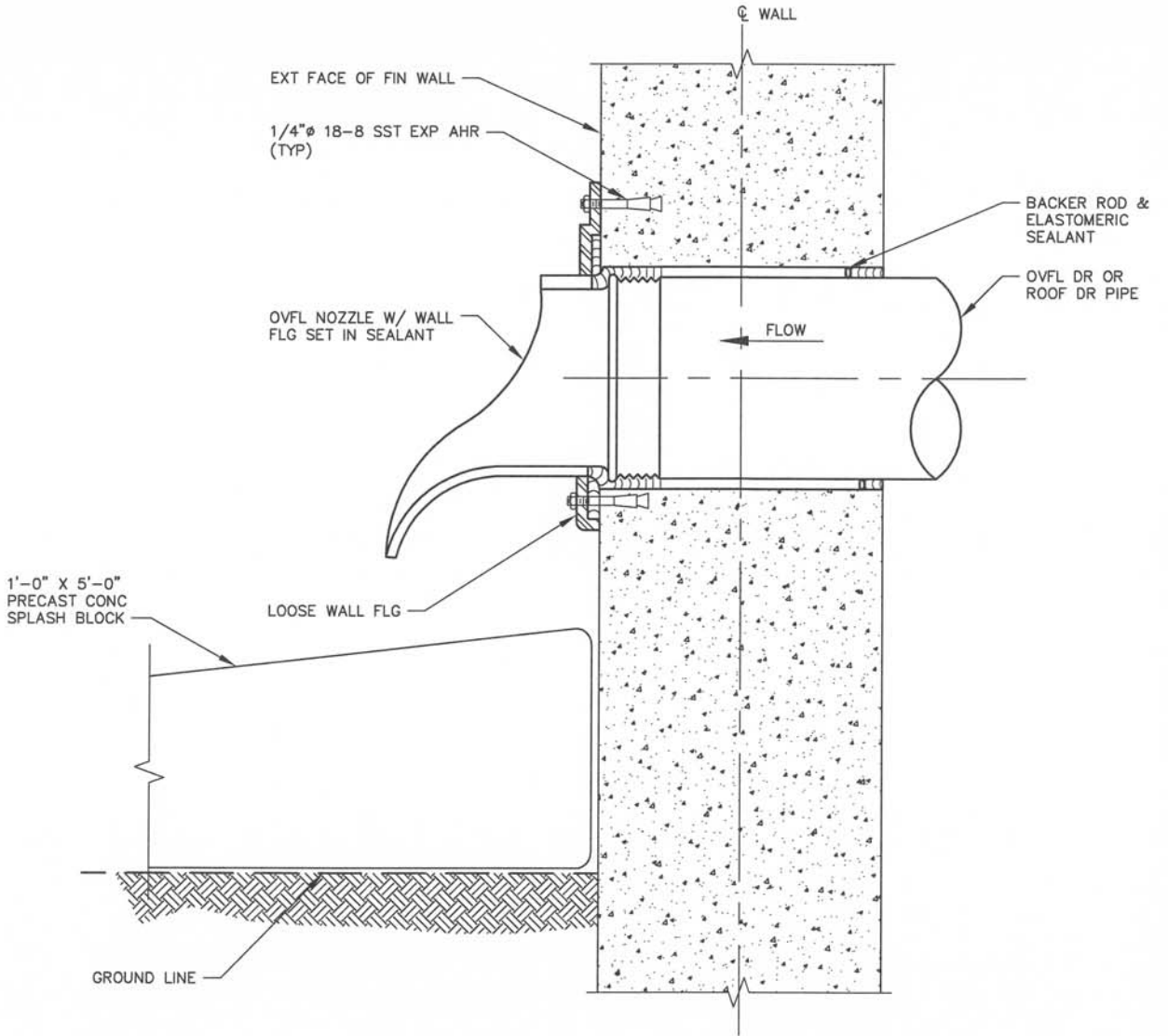
FOR PIPE PENETRATION TABLE AND NOTES SEE (23050).

23070  
TYPE U PENETRATION



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DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/VLR
APPD BY: Stephen C. Rem
ORIGINATION DATE: JANUARY 2017
REVISION DATE:



**NOTES:**

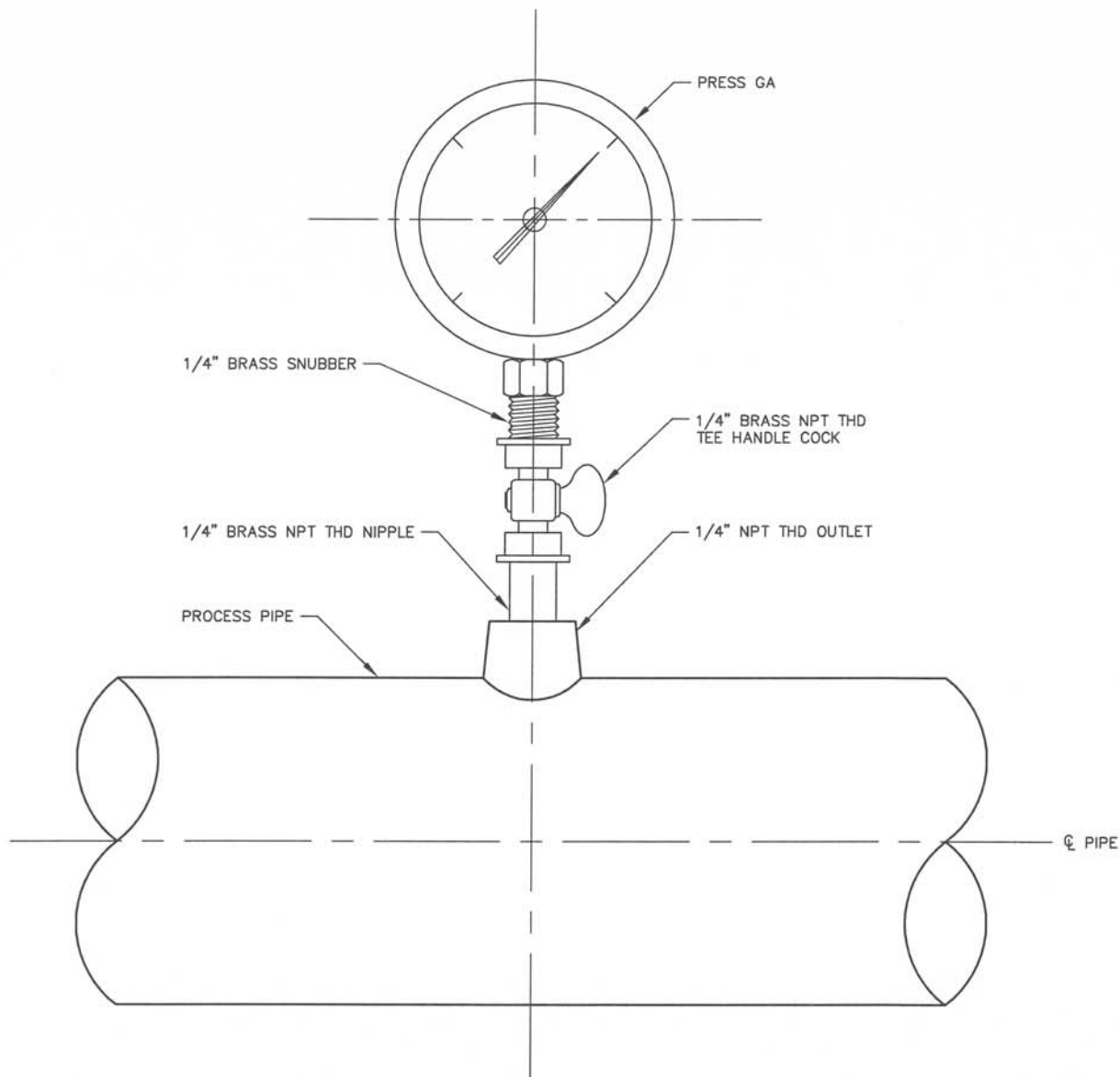
1. SATIN FINISH BRONZE.
2. SAME SIZE AS DOWNSPOUT PIPING.

DRAWN BY: <i>WENKHEIMER</i>
CHKD BY: <i>K ROSS/KLR</i>
APPD BY: <i>Stephen C. Rem</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**23071  
DOWNSPOUT NOZZLE**

**D DENVER WATER**  
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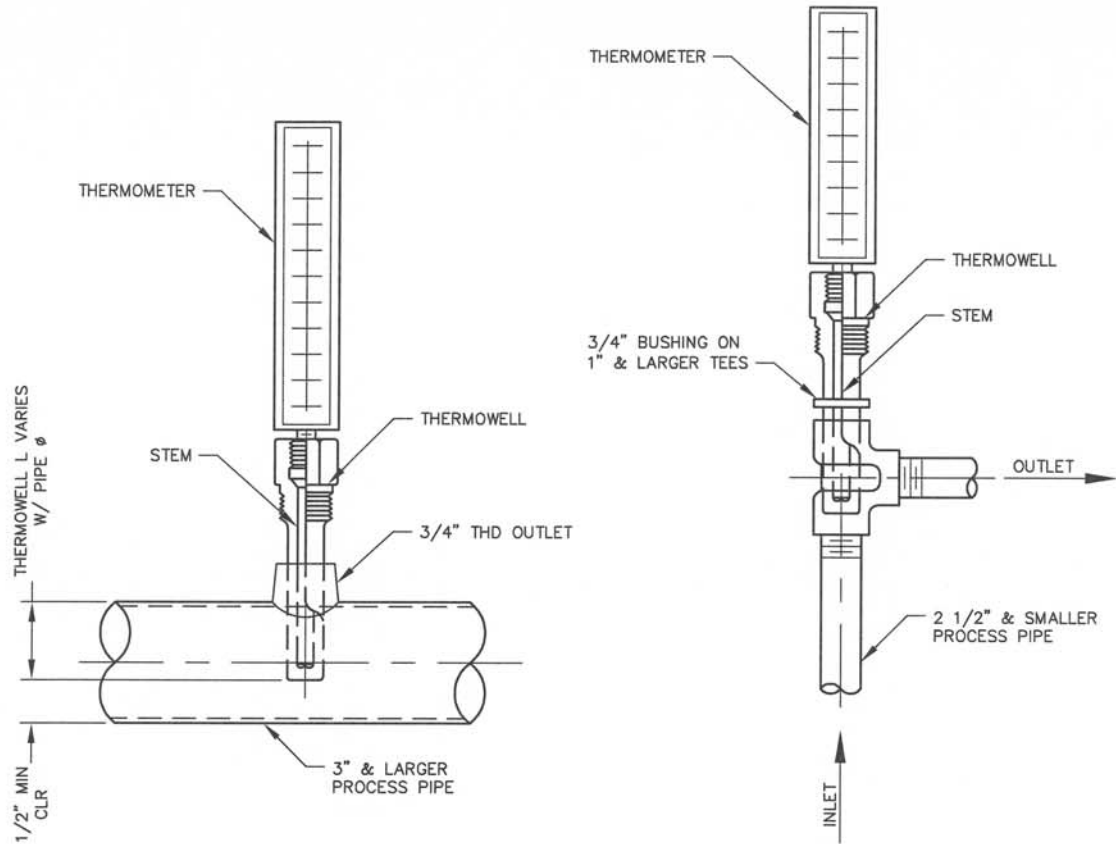




DRAWN BY: <i>WENKHEIMER</i>
CHKD BY: <i>K ROSS/KR</i>
APPD BY: <i>Stephen C. Rose</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**23080**  
**PRESSURE GAUGE**  
**INSTALLATION**

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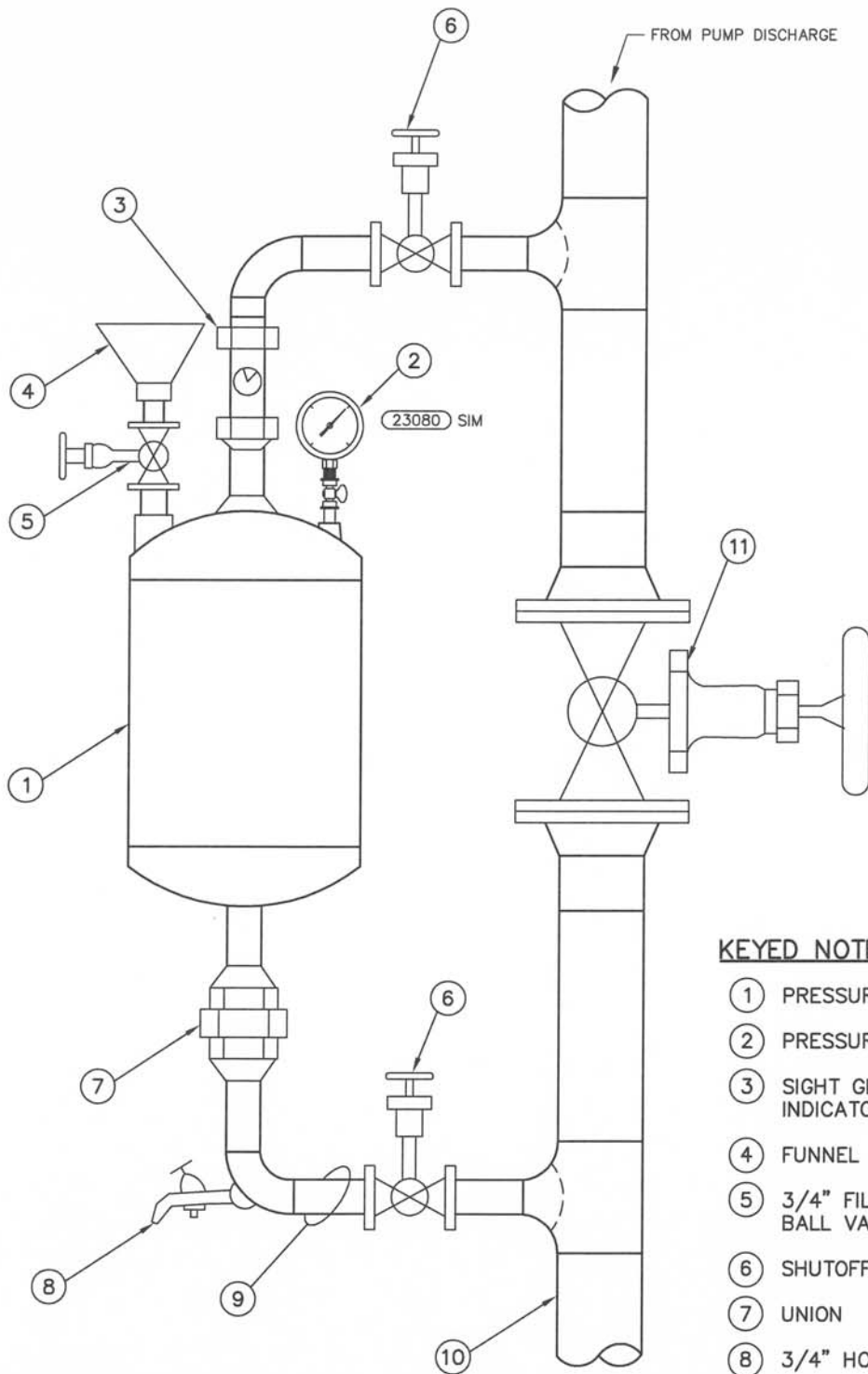
**NOTES:**

1. FOR STEEL, GALVANIZED STEEL, COPPER AND PVC 2 1/2-INCH AND SMALLER, USE A 3/4-INCH BUSHING IN TEE.
2. FOR DUCTILE IRON AND FIBERGLASS REINFORCED PLASTIC PIPE, ALL SIZES, USE A 3/4-INCH TAPPING SADDLE.
3. FOR STEEL AND STAINLESS STEEL PIPES 3-INCH AND LARGER, AND PRESSURE VESSELS, USE 3/4-INCH THREADED OUTLET AS SHOWN.

DRAWN BY: <i>WENKHEIMER</i>
CHKD BY: <i>K ROSS/KLR</i>
APPD BY: <i>Stephen C. Rem</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**23081**  
**THERMOMETER INSTALLATION**

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**KEYED NOTES:**

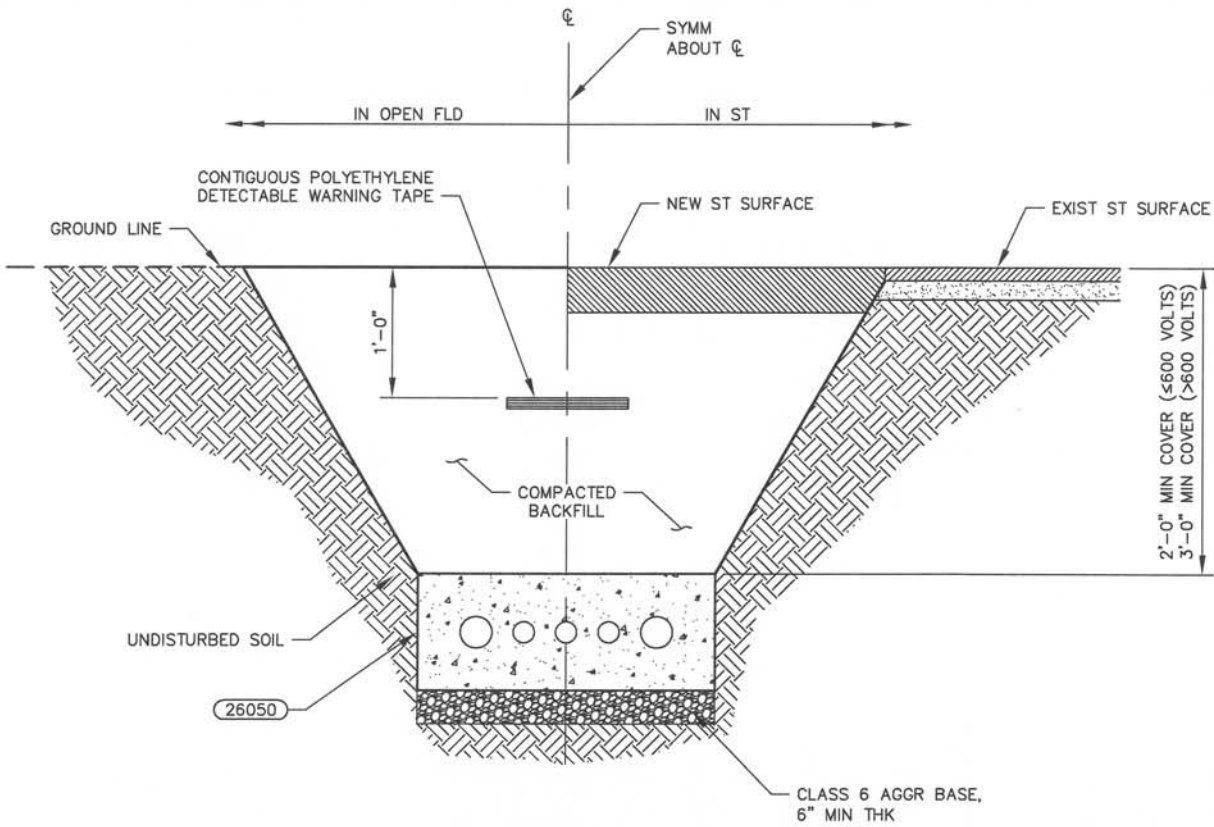
- ① PRESSURE-RATED FEEDER
- ② PRESSURE GAUGE & COCK
- ③ SIGHT GLASS OR FLOW INDICATOR
- ④ FUNNEL
- ⑤ 3/4" FILL & VENT BALL VALVE (V300)
- ⑥ SHUTOFF BALL VALVE (V300)
- ⑦ UNION
- ⑧ 3/4" HOSE COCK (V201)
- ⑨ ONE-HALF MAIN PIPE SIZE
- ⑩ SYSTEM MAIN TO BE TREATED W/ CHEMICAL
- ⑪ BALL VALVE (V300)

DRAWN BY: WENKHEIMER  
 CHKD BY: K ROSS/ KLR  
 APPD BY: Stephen C. Rem  
 ORIGINATION DATE: JANUARY 2017  
 REVISION DATE:

23090  
 CHEMICAL SHOT FEEDER

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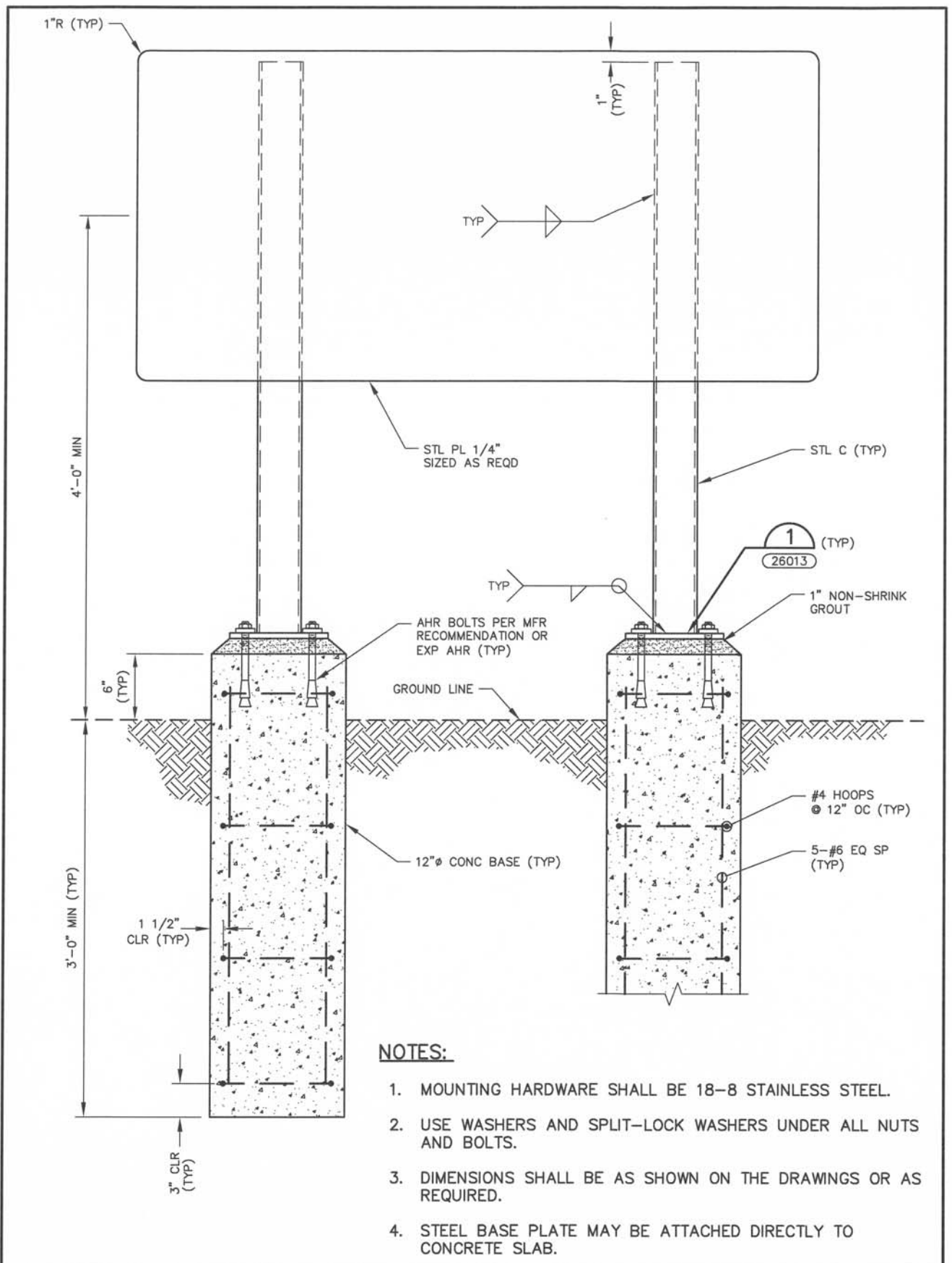
**NOTE:**

TRENCH SHALL CONFORM TO APPLICABLE OSHA REQUIREMENTS.

DRAWN BY: <i>BERKNESS</i>
CHKD BY: <i>K ROSS/KLR</i>
APPD BY: <i>Steph C. Ren</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**26006**  
**DUCTBANK TRENCH SECTION**

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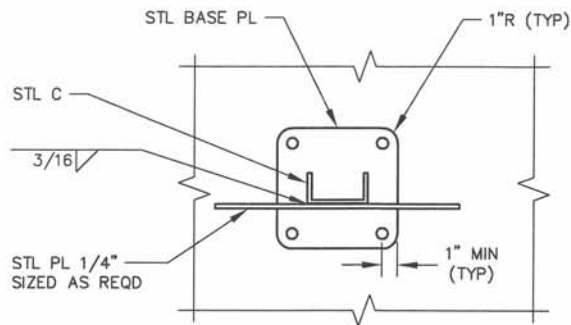
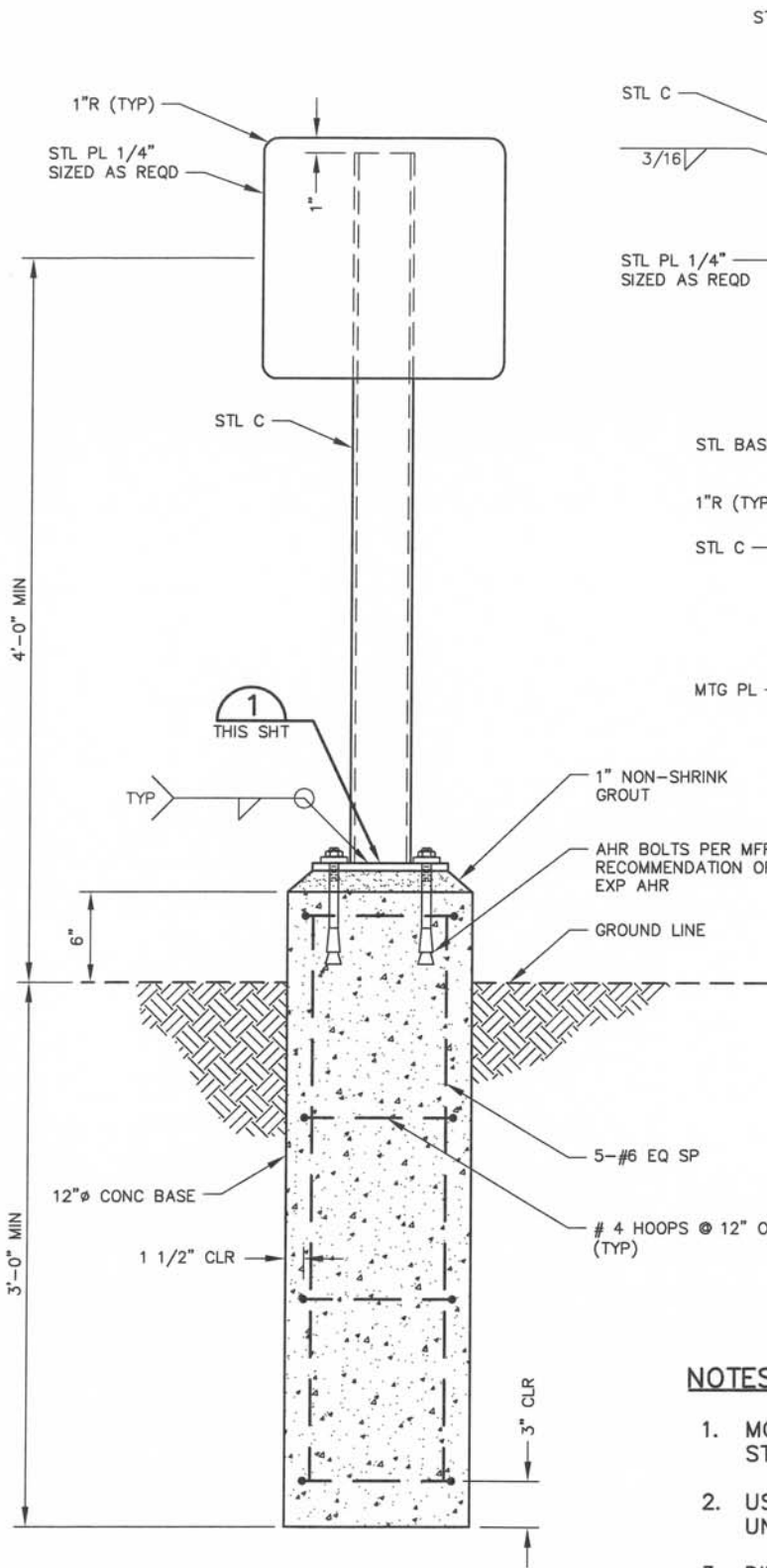


DRAWN BY: ALVARADO
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Ross
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

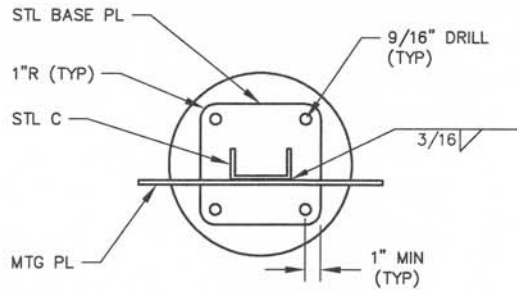
26012  
LARGE EQUIPMENT PEDESTAL

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**PLAN**  
(CONC SURFACE)



**PLAN**  
(CONC PIER)

**DETAIL**  
1  
THIS SHT  
26012

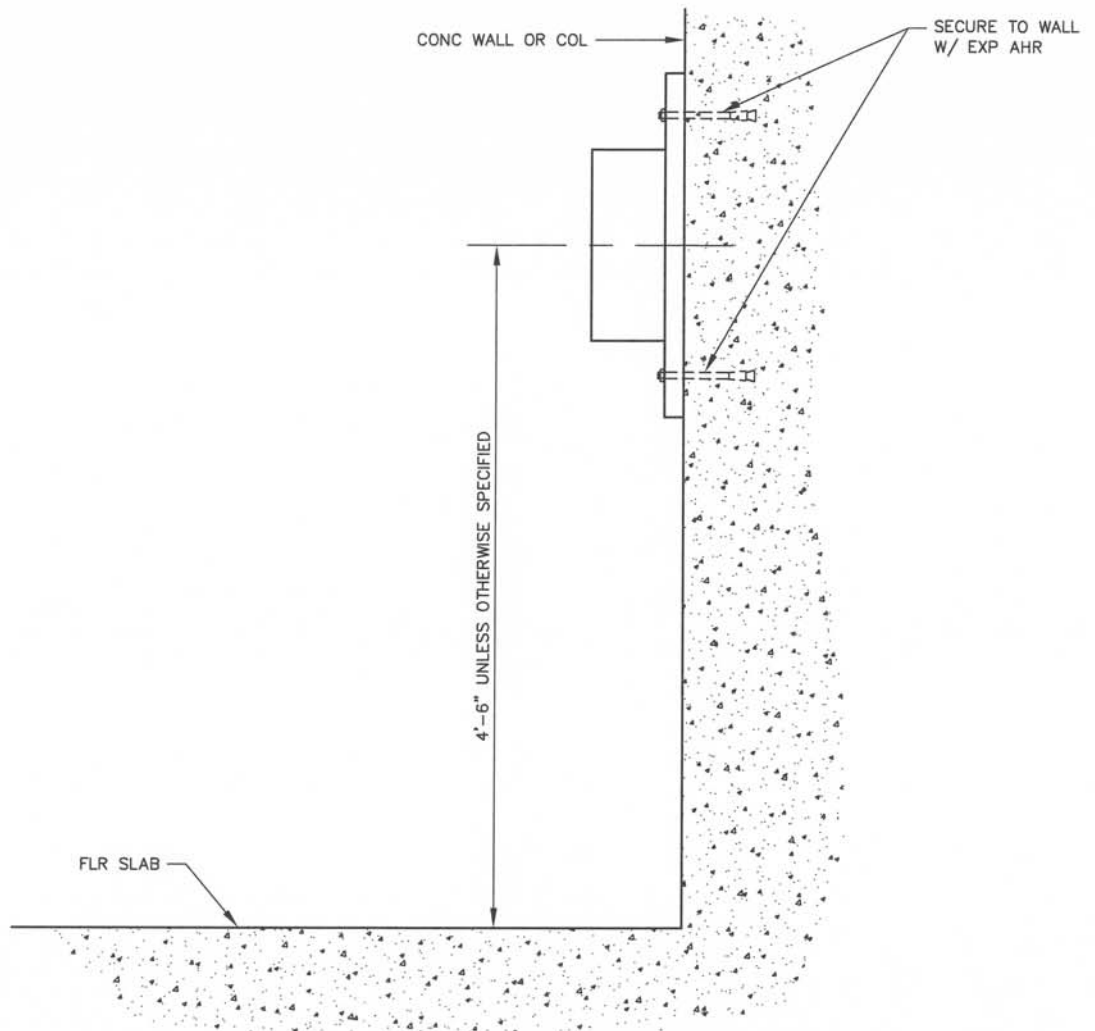
**NOTES:**

1. MOUNTING HARDWARE SHALL BE 18-8 STAINLESS STEEL.
2. USE WASHERS AND SPLIT-LOCK WASHERS UNDER ALL NUTS AND BOLTS.
3. DIMENSIONS SHALL BE AS SHOWN ON THE DRAWINGS OR AS REQUIRED.
4. STEEL BASE PLATE MAY BE ATTACHED DIRECTLY TO CONCRETE SLAB.

DRAWN BY: BERKNES
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Rein
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**26013**  
**SMALL EQUIPMENT PEDESTAL**

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NOTE:

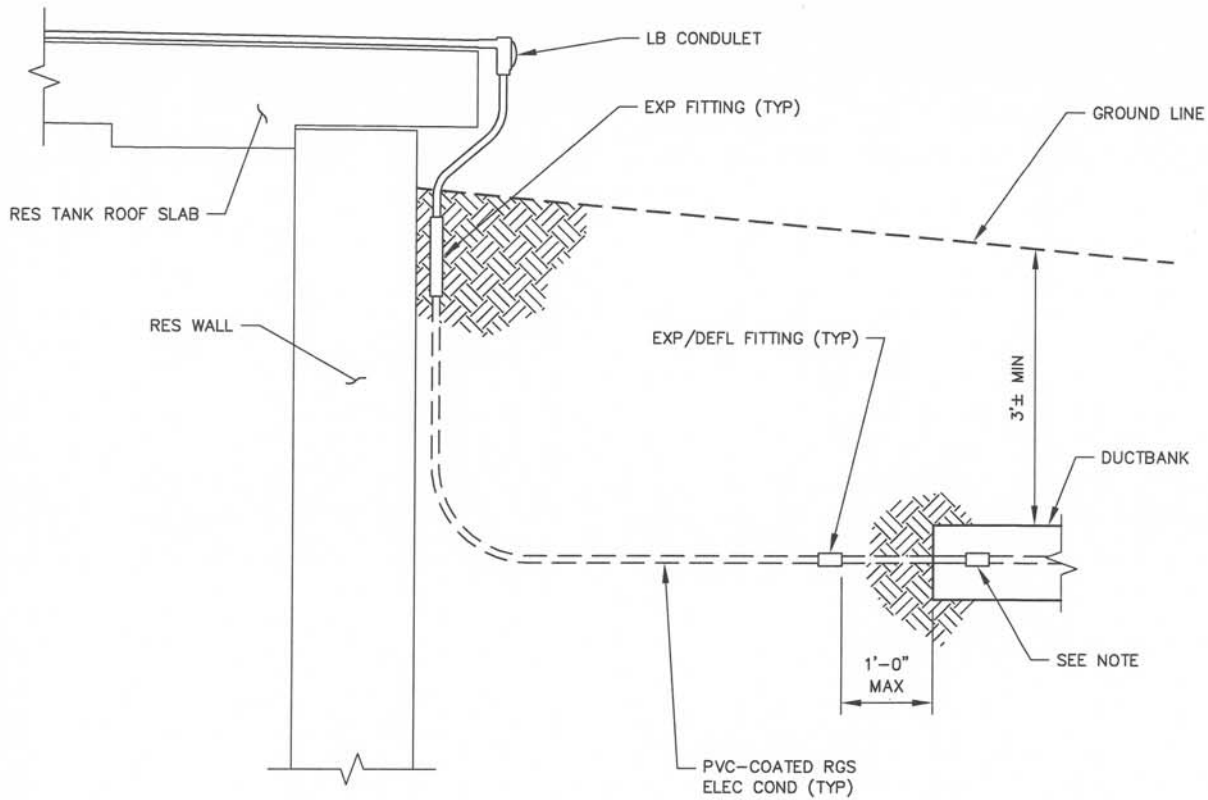
MOUNTING HARDWARE SHALL BE 18-8 STAINLESS STEEL.

DRAWN BY: ALVARADO
CHKD BY: K ROSS/KLR
APPD BY: <i>Stephen C. Rem</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

26014  
EQUIPMENT WALL MOUNTING

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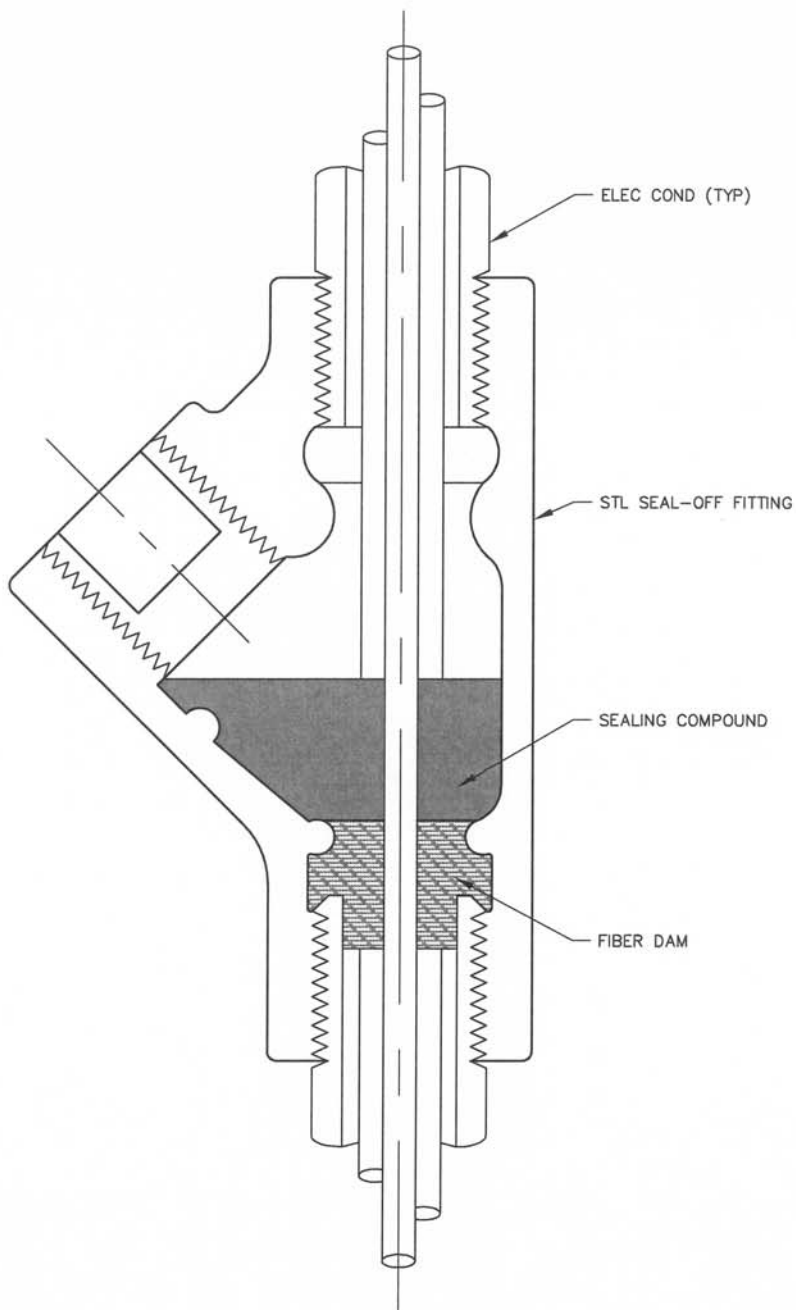
**NOTE:**

TRANSITION FROM PVC TO PVC-COATED RGS BEFORE EXITING DUCTBANK.

DRAWN BY: BERKNESS
CHKD BY: K ROSS/KLR
APPD BY: <i>Steph C. Penn</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

26038  
RESERVOIR LID-DUCTBANK  
EXPOSED CONDUIT  
INTERFACE

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DRAWN BY: *BOWMAN*

CHKD BY: *K ROSS/KIR*

APPD BY: *Stephen C. Rem*

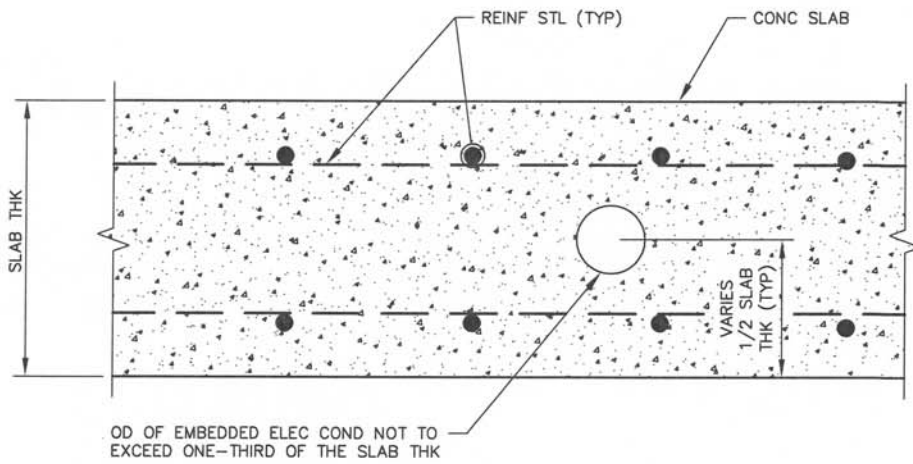
ORIGINATION DATE: *JANUARY 2017*

REVISION DATE:

**26040**  
**CONDUIT SEAL-OFF FITTING**

**D DENVER WATER**

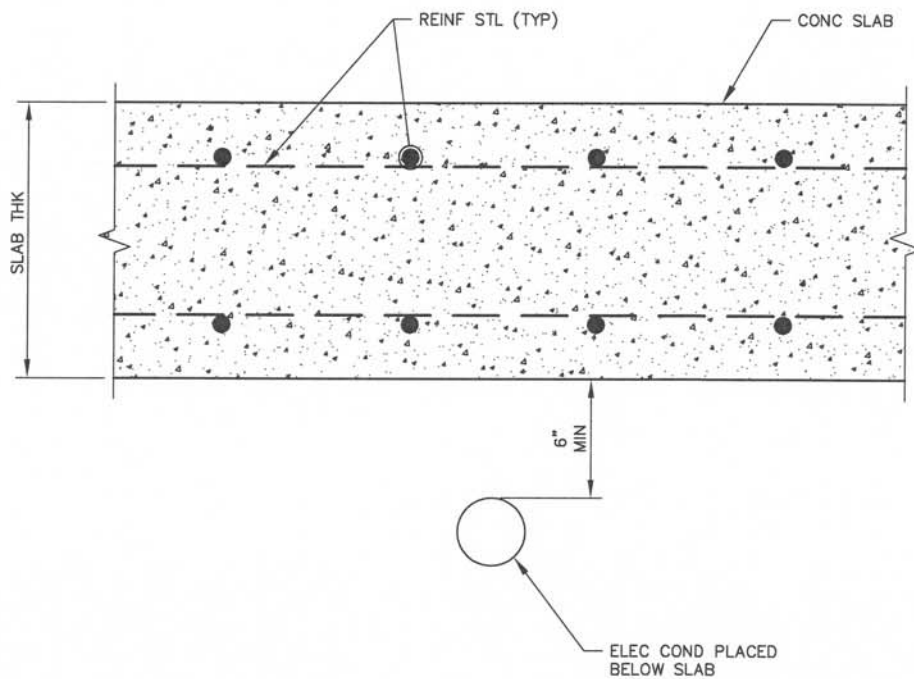
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26044  
ELECTRICAL CONDUIT  
IN SLAB PLACEMENT

DRAWN BY: BOWMAN  
 CHKD BY: K ROSS/KUR  
 APPD BY: Stephen C. Pen  
 ORIGINATION DATE: JANUARY 2017  
 REVISION DATE:

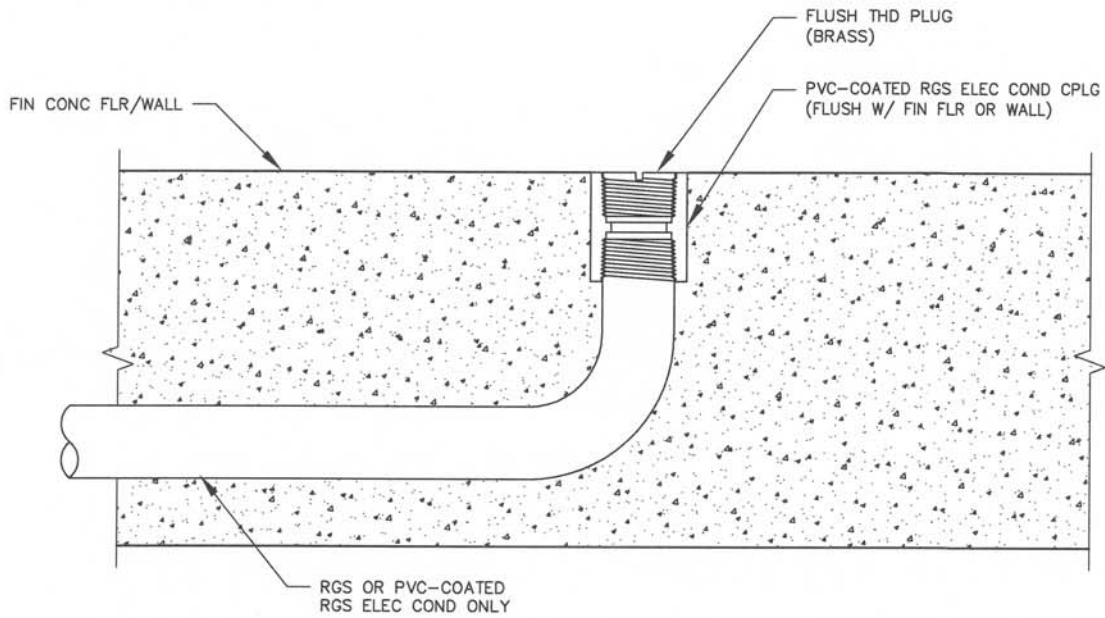
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DRAWN BY: *BOWMAN*  
 CHKD BY: *K ROSS/KLR*  
 APPD BY: *Stephen C. Pen*  
 ORIGINATION DATE: *JANUARY 2017*  
 REVISION DATE:

26045  
 ELECTRICAL CONDUIT  
 UNDER SLAB PLACEMENT

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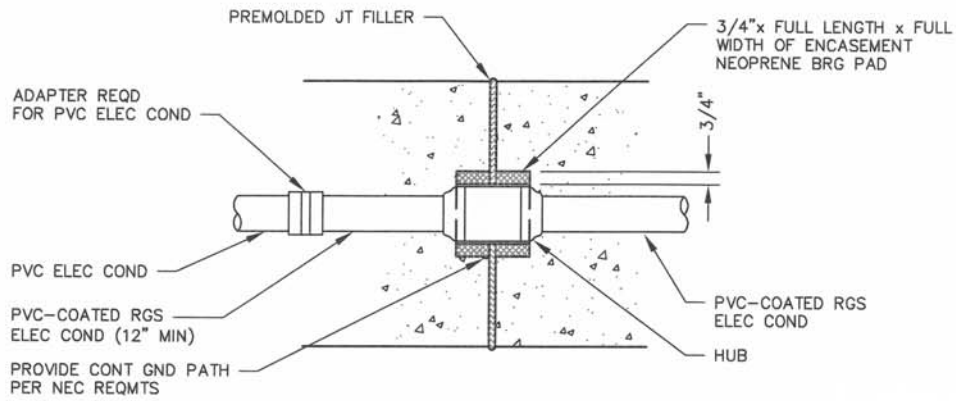


26046  
ELECTRICAL CONDUIT  
FLUSH TERMINATION  
IN FLOOR OR WALL

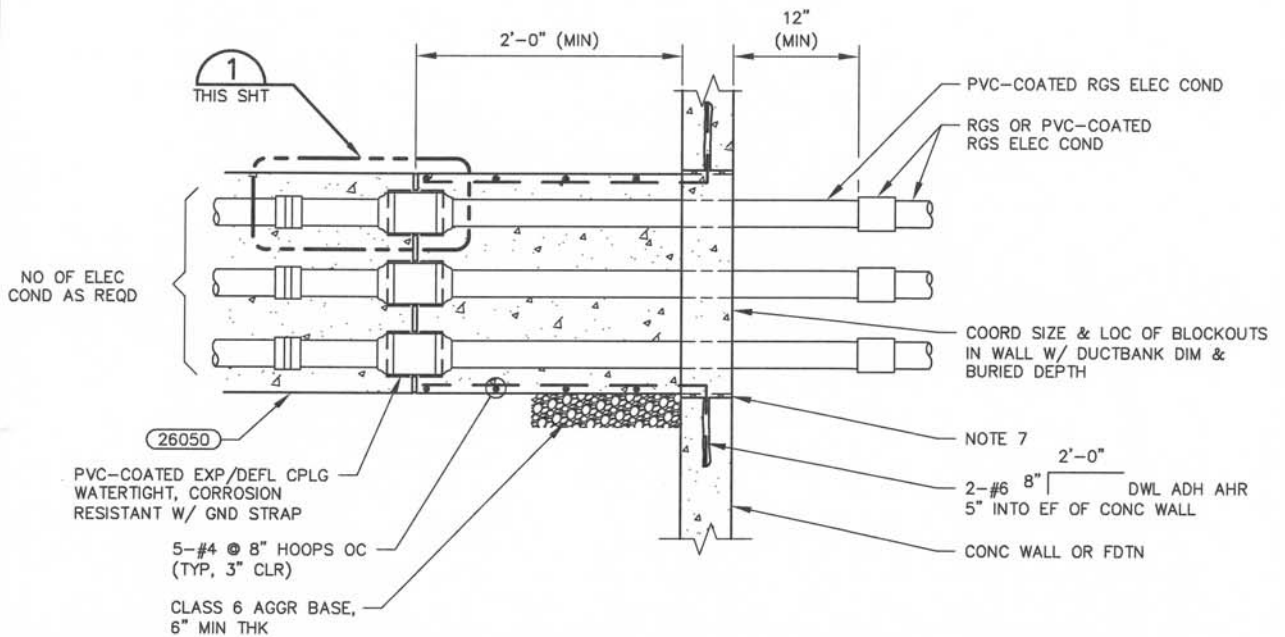
DRAWN BY: <i>BOWMAN</i>
CHKD BY: <i>K ROSS/KLR</i>
APPD BY: <i>Stephen C. Rem</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

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**DETAIL** 1  
THIS SHT  
26052



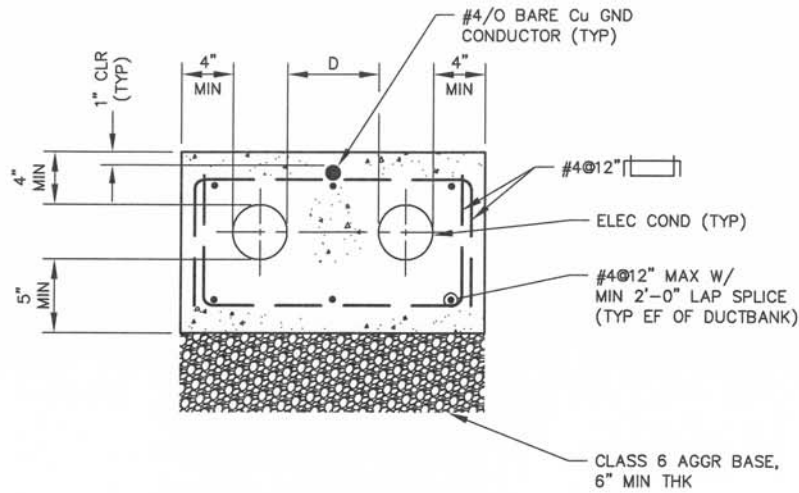
**NOTES:**

1. DETAIL APPLIES TO ELECTRICAL CONDUIT EMBEDDED IN STRUCTURAL CONCRETE AT CONCRETE WALL OR FOUNDATION INTERFACES AND AT STRUCTURAL EXPANSION JOINTS.
2. DETAIL APPLIES TO ALL EXPANSION JOINTS FOR THE UNDERGROUND CONCRETE ENCASED ELECTRICAL CONDUITS.
3. DETAIL SHOWN IS SECTION.
4. TERMINATE DUCTBANK REINFORCEMENT 3-INCHES EACH SIDE OF JOINT.
5. CONTINUATION OF ELECTRICAL CONDUITS IN THE INTERIOR SHALL BE RIGID GALVANIZED STEEL OR PVC-COATED RIGID GALVANIZED STEEL.
6. THIS DETAIL APPLIES TO HANDHOLES AND MANHOLES WHEN INDICATED.
7. SEAL WALL ALL AROUND DUCTBANK WITH HYDROPHILIC WATER STOP. INSTALL PER MANUFACTURER'S INSTRUCTIONS.

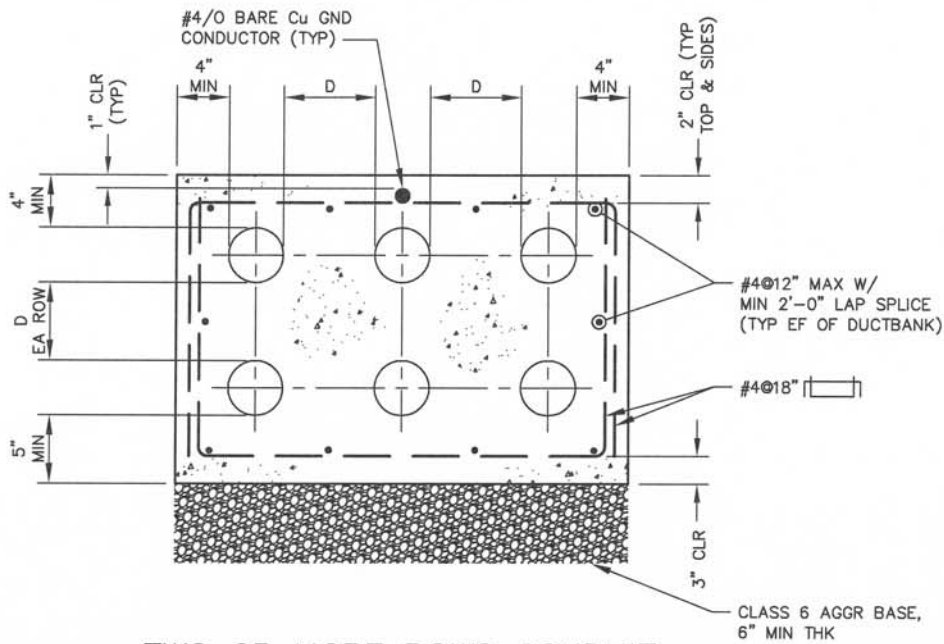
DRAWN BY: BERKNESS
CHKD BY: K ROSS/KR
APPD BY: Stephen C. Row
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**26049**  
**DUCTBANK INTERFACE AT**  
**WALL BLOCKOUT**

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### SINGLE ROW CONDUIT



### TWO OR MORE ROWS CONDUIT

#### NOTES:

1. SEE (26006) FOR TRENCH REQUIREMENTS.
2. D = 2-INCH MINIMUM FOR 1 1/2-INCH AND SMALLER CONDUITS  
D = 3-INCH MINIMUM FOR 2-INCH AND LARGER CONDUITS
3. REFERENCE COLORADO DEPARTMENT OF TRANSPORTATION ROAD AND BRIDGE SPECIFICATIONS FOR CLASS 6 AGGREGATE BASE REQUIREMENTS.

DRAWN BY: BERKNESS

CHKD BY: K ROSS/KLR

APPD BY: Stephen C. Rem

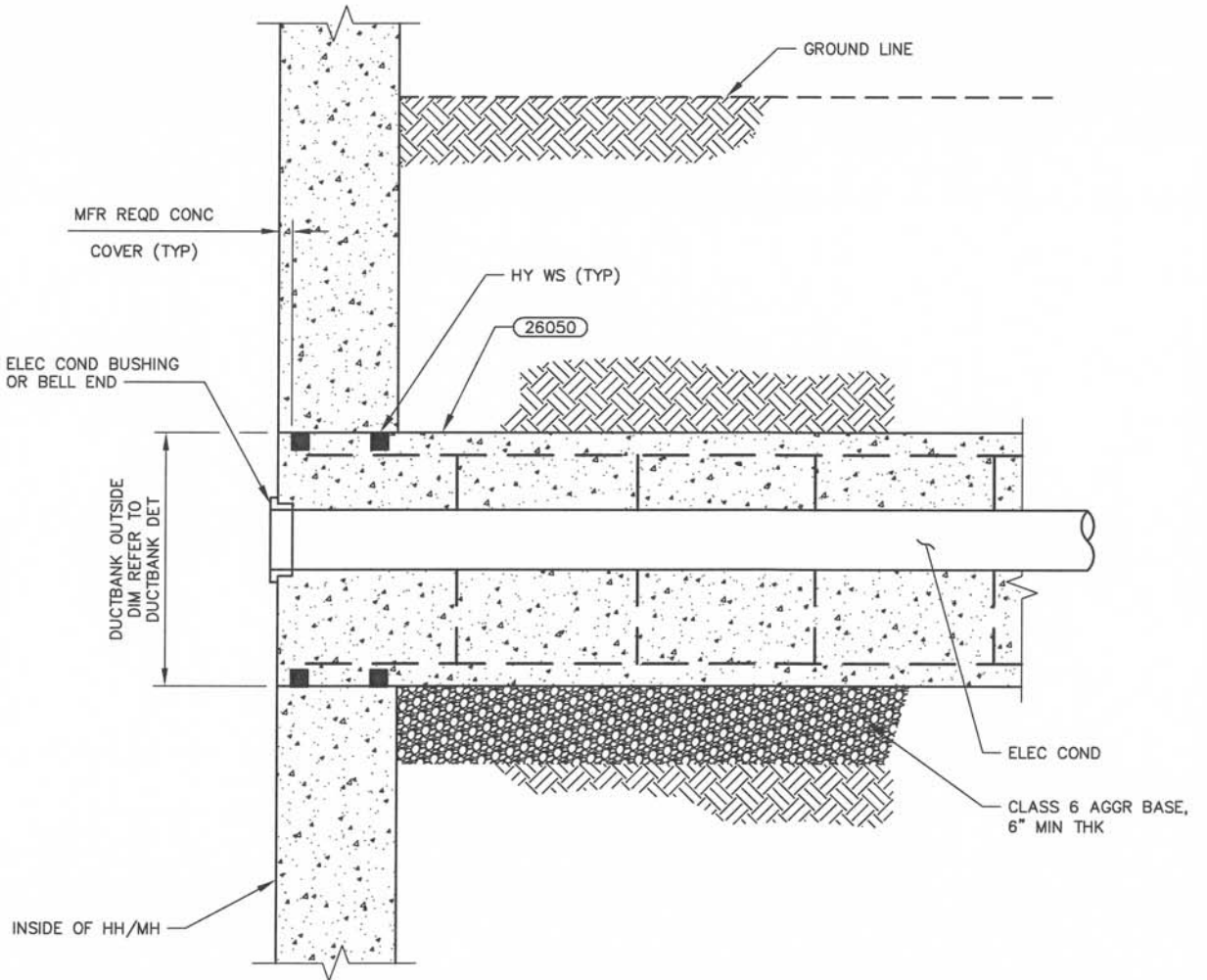
ORIGINATION DATE: JANUARY 2017

REVISION DATE:

## 26050 CONCRETE-ENCASED STEEL-REINFORCED DUCTBANK

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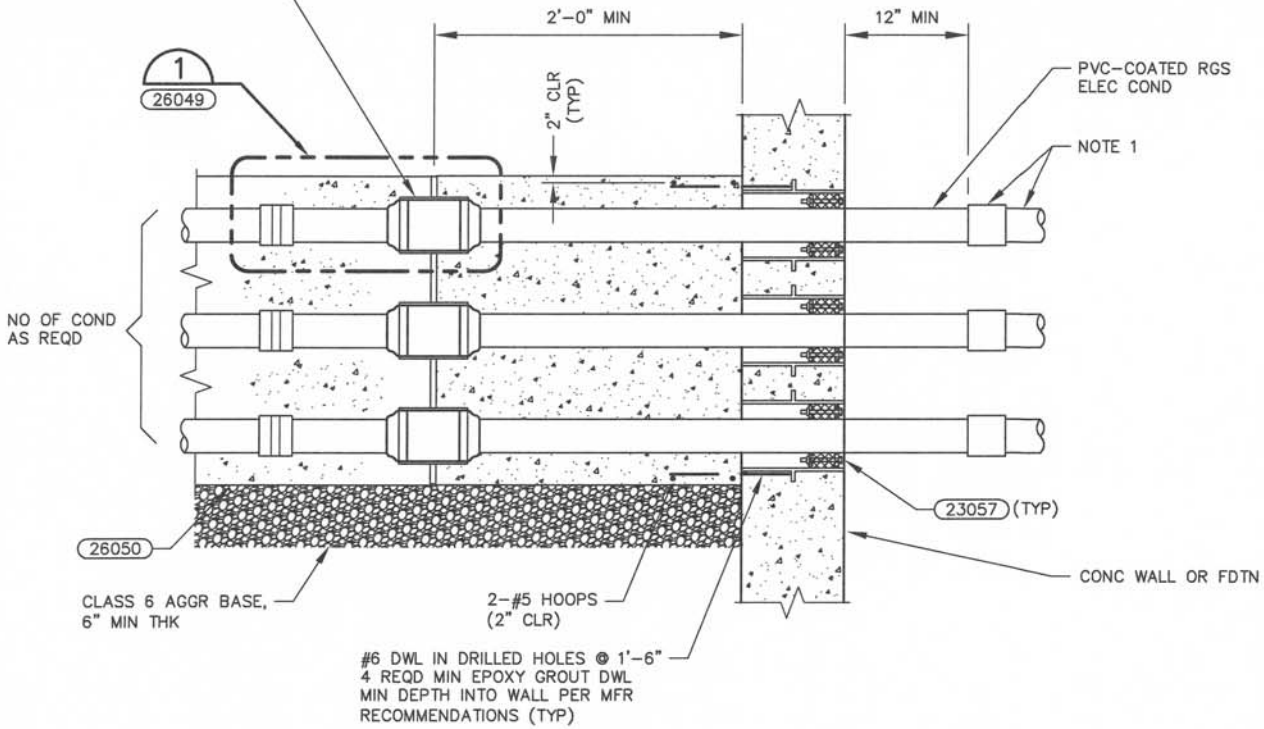
DRAWN BY: <i>BOWMAN</i>
CHKD BY: <i>K ROSS/KLR</i>
APPD BY: <i>Stephen C. Pen</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**26051**  
**DUCTBANK HANDHOLE**  
**AND MANHOLE INTERFACE**


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PVC COATED EXP/DEFL CPLG  
WATERTIGHT, CORROSION  
RESISTANT W/ GND STRAP



**NOTES:**

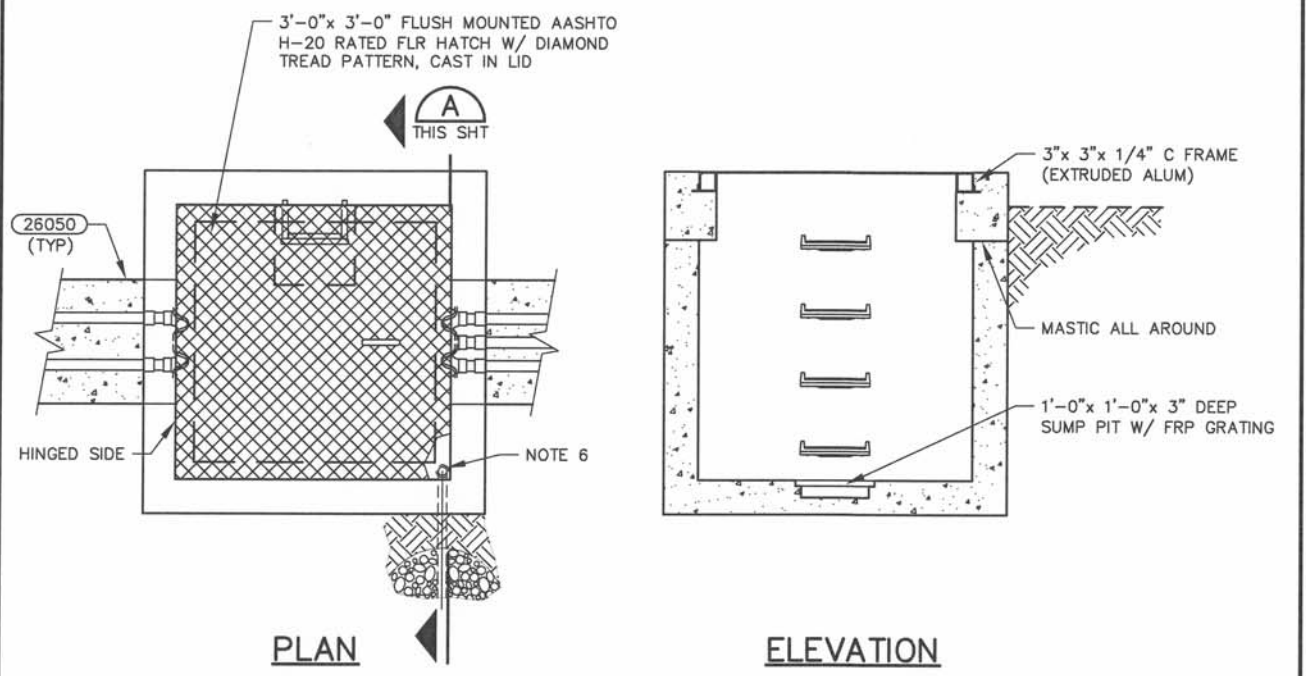
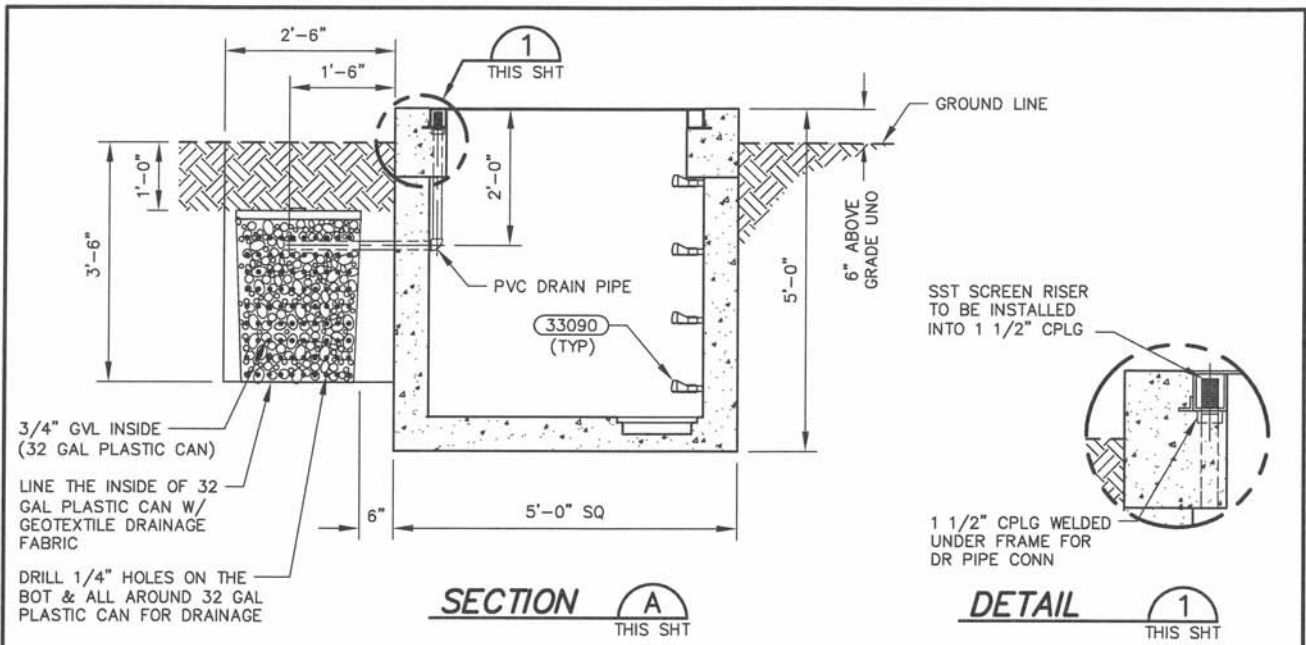
1. CONTINUATION OF ELECTRICAL CONDUITS IN THE INTERIOR SHALL BE RIGID GALVANIZED STEEL OR PVC-COATED RIGID GALVANIZED STEEL.
2. THIS DETAIL APPLIES TO ALL DUCTBANK CONCRETE WALL OR FOUNDATION PENETRATIONS INCLUDING BUILDING AND VAULTS. THIS DETAIL APPLIES TO HANDHOLES AND MANHOLES WHEN INDICATED.

DRAWN BY: <i>BOWMAN</i>
CHKD BY: <i>K ROSS/KLR</i>
APPD BY: <i>Stephen C. Roman</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**26052**  
**DUCTBANK INTERFACE**  
**AT WALL**

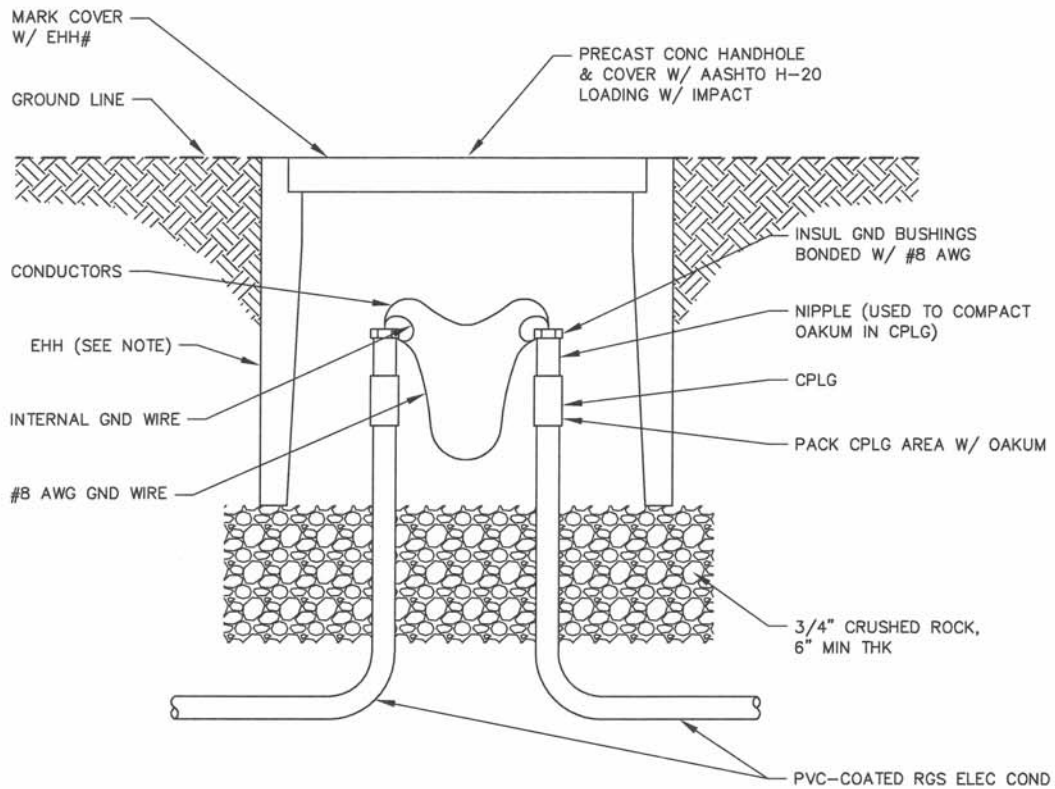
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- NOTES:**
1. ELECTRICAL CONDUITS SHOWN IN DUCTBANKS DO NOT NECESSARILY REFLECT NUMBER OF ELECTRICAL CONDUITS REQUIRED.
  2. VAULT AND LID DESIGN LOADING SHALL BE AASHTO H-20, WITH IMPACT.
  3. #4/0 GROUND CONDUCTORS SHALL BE CADWELDED/BONDED TOGETHER. EHH LID SHALL BE BONDED TO THE GROUND GRID. BONDING/GROUNDING METHOD AND MATERIAL SHALL BE APPROVED BY THE ENGINEER AND SHALL MEET THE REQUIREMENTS OF NEC 314-30.
  4. VAULTS SHALL BE PROVIDED WITH 1 1/4-INCH ID PULLING EYES (REMOVAL STYLE).
  5. PROVIDE BEST LOCK CORE WITH BRASS PLUG ENGRAVED WITH EHH NUMBER.
  6. SUBJECT TO ENGINEER APPROVAL, ROUTE VAULT LID DRAIN PIPING AND GRAVEL DRAIN SYSTEM TO THE CORNER OF THE VAULT TO SUIT THE FIELD CONDITIONS.

DRAWN BY: BERKNESS	<p>26053</p> <p>ELECTRICAL HANDHOLE (EHH)</p>	<p><b>D DENVER WATER</b></p> <p>1600 West 12th Ave          Denver, Colorado 80204-3412          T: 303.628.6000          F: 303.628.6851          denverwater.org</p>
CHKD BY: K ROSS/KLR		
APPD BY: Stephen C. Rem		
ORIGINATION DATE: JANUARY 2017		
REVISION DATE:		



**NOTE:**

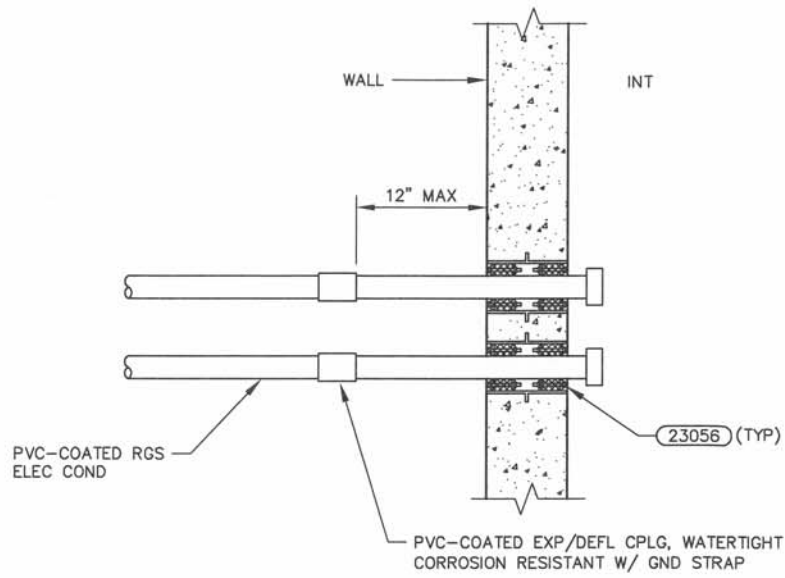
ELECTRICAL HANDHOLE DIMENSIONS ARE 18-INCH BY 12-INCH BY 12-INCH MIINIMUM.

DRAWN BY: <i>BOWMAN</i>
CHKD BY: <i>K ROSS/KR</i>
APPD BY: <i>Stephen C. Ren</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

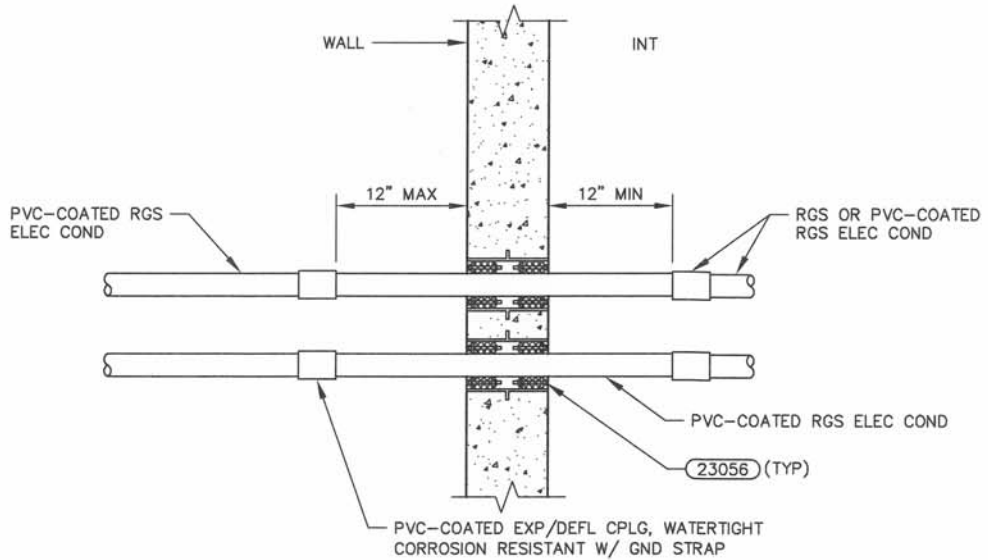
**26054  
SMALL ELECTRICAL  
HANDHOLE**

**D DENVER WATER**

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EHH



STRUCTURE

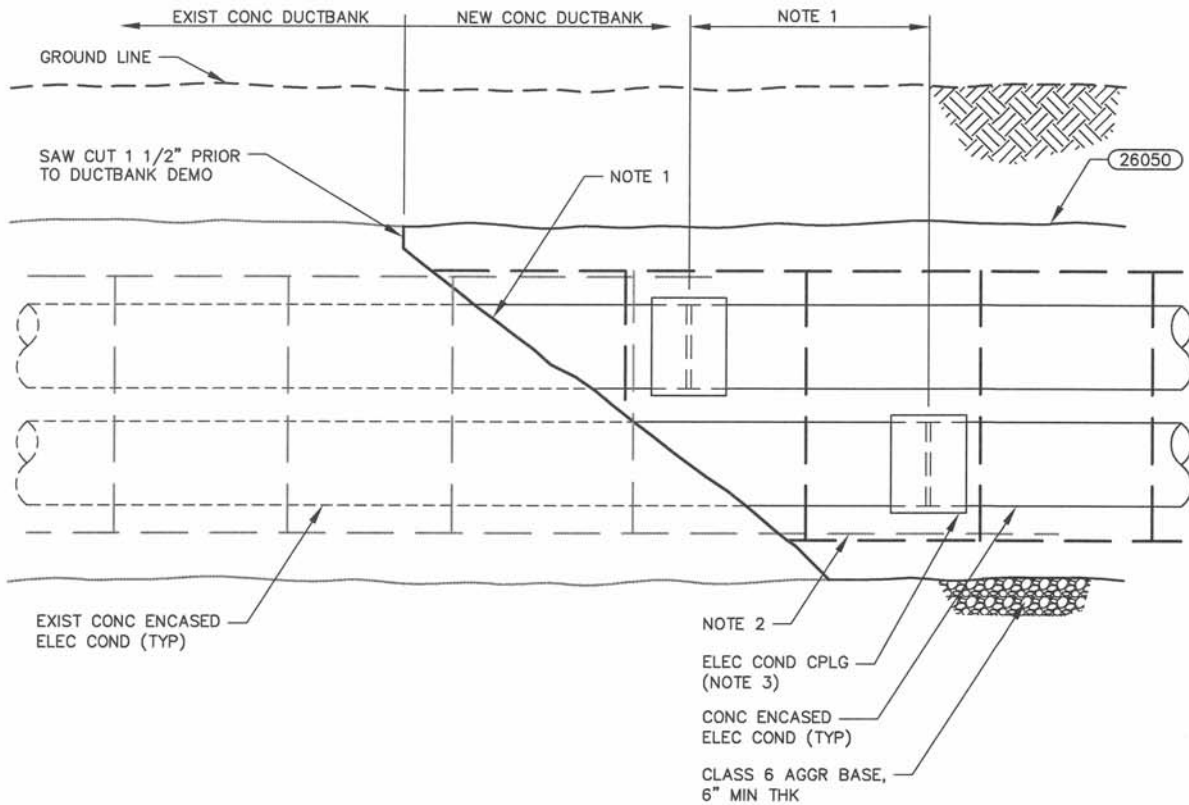
NOTES:

FOR PIPE PENETRATION TABLE AND NOTES SEE (23050).

DRAWN BY: <i>BOWMAN</i>
CHKD BY: <i>K ROSS/KLR</i>
APPD BY: <i>Stephen C. Penner</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

26055  
UNDERGROUND CONDUIT  
INTERFACE

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**ELEVATION**

**NOTES:**

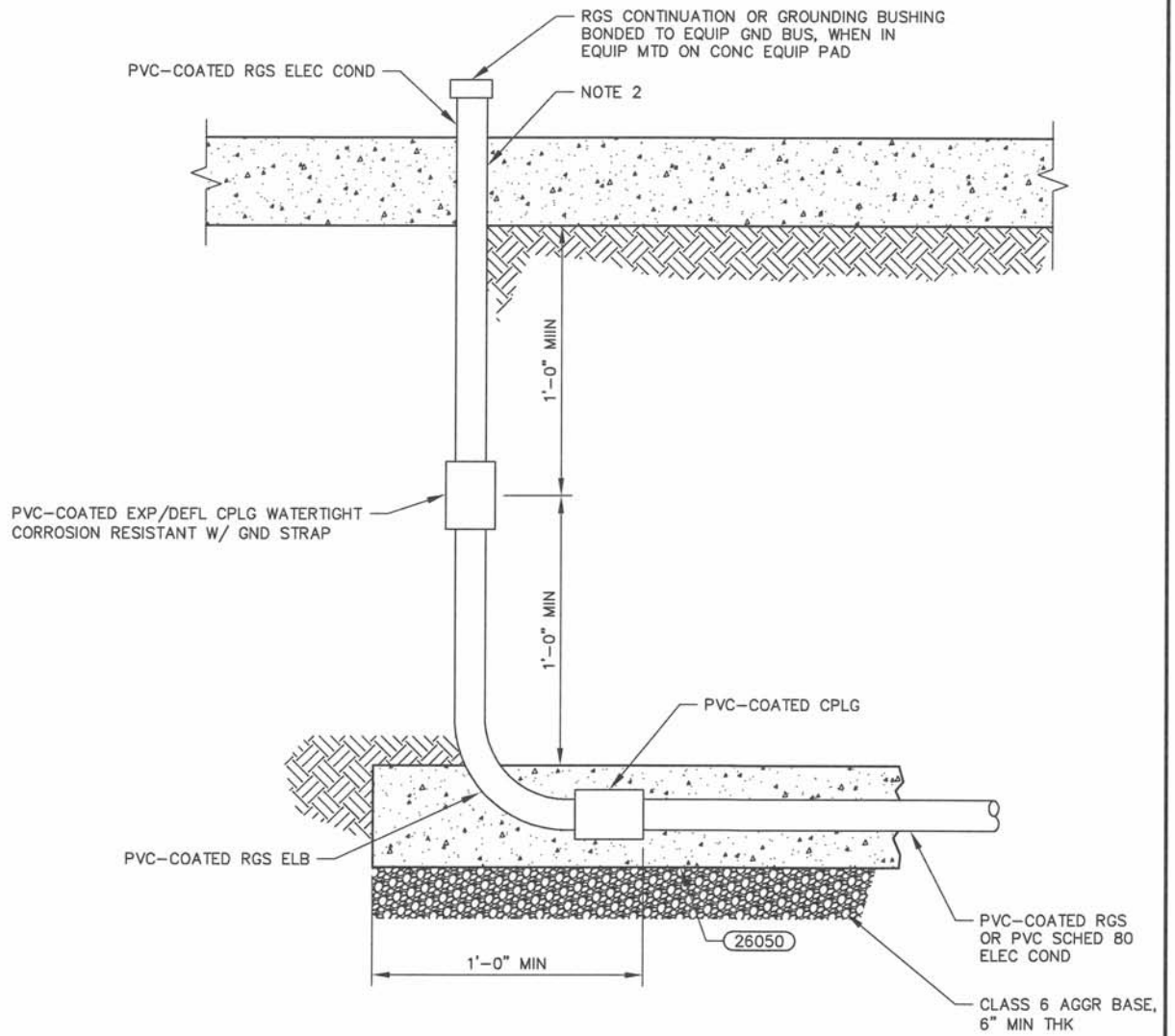
1. REMOVE EXISTING CONCRETE FROM DUCTBANK WITHOUT DAMAGING ELECTRICAL CONDUITS, AND REINFORCING STEEL. LOWER ELECTRICAL CONDUIT SHALL EXTEND A MINIMUM OF 18-INCHES BEYOND UPPER ELECTRICAL CONDUIT.
2. CONNECT NEW REINFORCING STEEL TO EXISTING REINFORCING STEEL BY OVERLAPPING STEEL A MINIMUM OF 29-INCHES AND SECURING WITH TIE WIRE.
3. EXTEND EXISTING ELECTRICAL CONDUIT WITH ELECTRICAL CONDUIT OF LIKE MATERIAL (PVC-COATED RIGID STEEL CONDUIT, RIGID STEEL CONDUIT OR SCHEDULE 80 PVC). FOR STEEL ELECTRICAL CONDUIT, PROVIDE CONCRETE RATED TYPE THREADLESS COUPLING TO CONNECT EXISTING RIGID ELECTRICAL STEEL CONDUIT TO NEW ELECTRICAL CONDUIT. FOR PVC-COATED RIGID STEEL CONDUIT, RE-COAT ANY DAMAGED PVC COATING AND THREADLESS COUPLING WITH NEW PVC COATING TOUCH UP MATERIAL. FOR SCHEDULE 80 PVC ELECTRICAL CONDUIT, CONNECT EXPOSED UNDAMAGED SCHEDULE 80 PVC ELECTRICAL CONDUIT TO NEW ELECTRICAL CONDUIT WITH PVC COUPLING AND APPROPRIATE CEMENT.

26058  
EXISTING DUCTBANK  
EXTENSION



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DRAWN BY: <i>BOWMAN</i>
CHKD BY: <i>K ROSS/KJR</i>
APPD BY: <i>Stephen C. Penn</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:



**NOTES:**

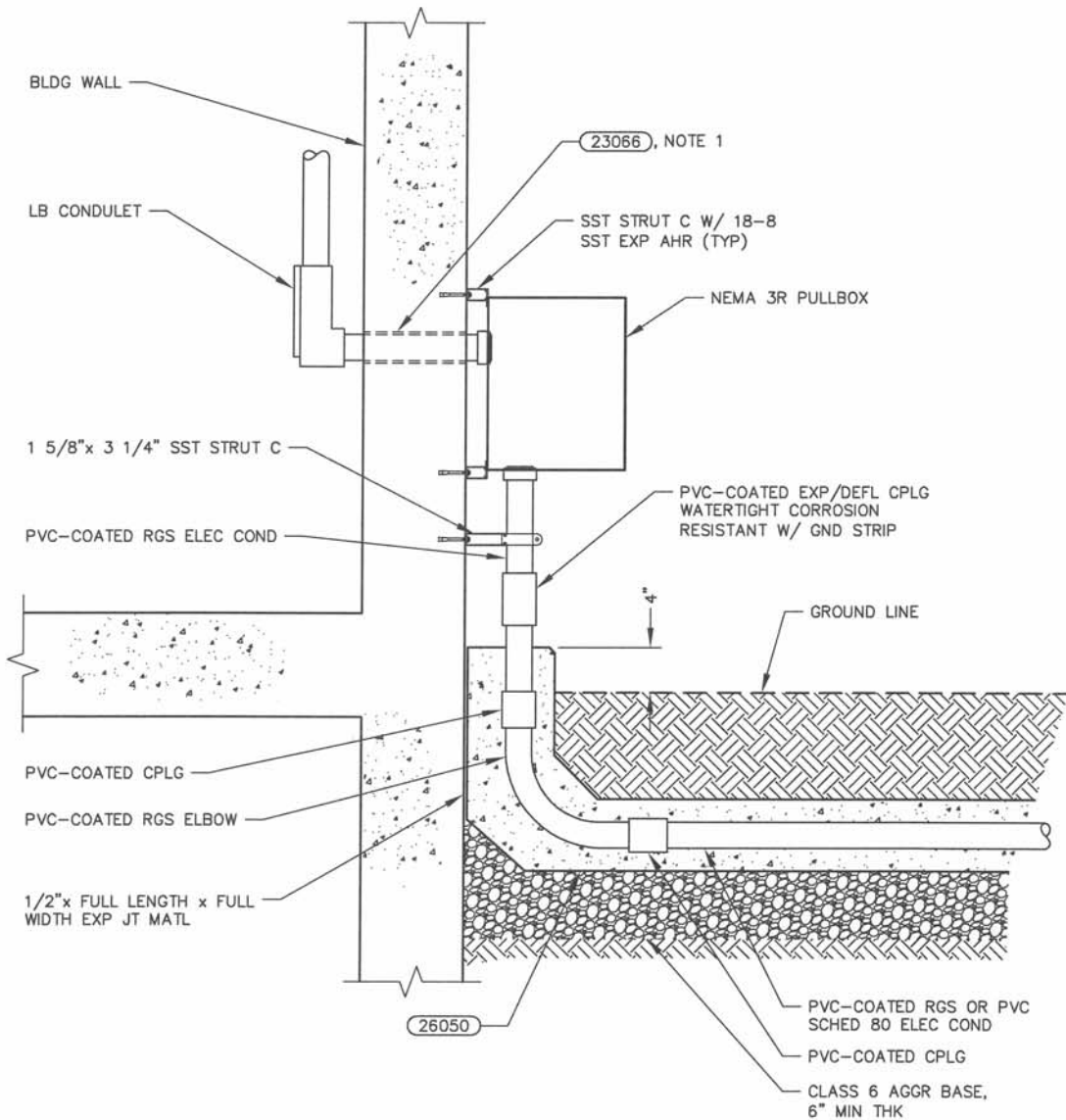
1. THIS DETAIL APPLIES TO RISER FROM UNDERGROUND CONDUIT BENEATH CONCRETE SLABS, CONCRETE FLOORS AND EQUIPMENT.
2. FOR PIPE PENETRATION TABLE AND NOTES SEE (23050).

DRAWN BY: ALVARADO
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Reem
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**26059**  
**CONDUIT RISER FROM**  
**UNDERGROUND DUCTBANK**

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**NOTES:**

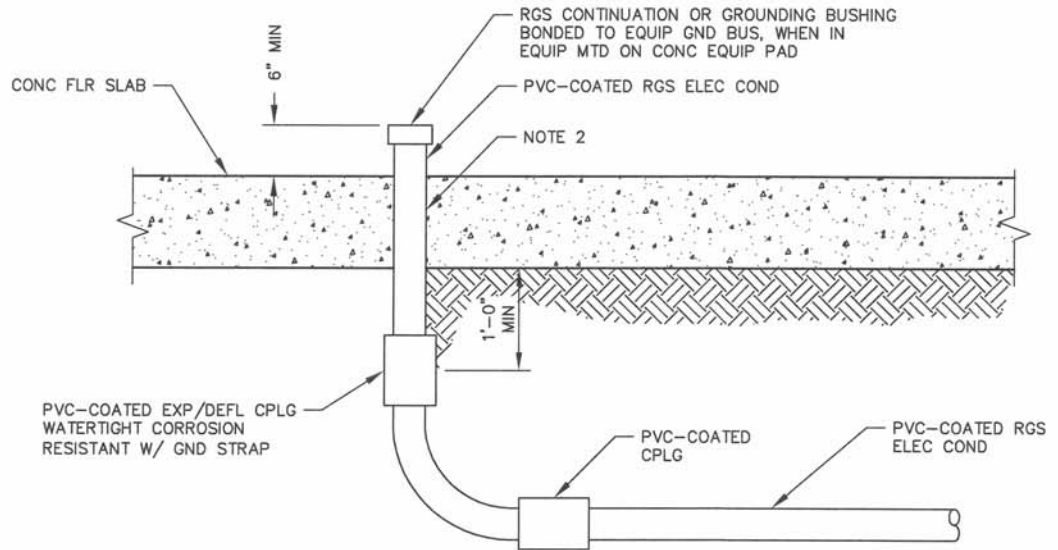
1. X-RAY AND CORE DRILL HOLE THROUGH WALL TO MISS REINFORCING STEEL.
2. FOR PIPE PENETRATION TABLE AND NOTES SEE (23050).

DRAWN BY: ALVARADO
CHKD BY: K ROSS/ KUR
APPD BY: Stephen C. Rev
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**26060**  
**BUILDING UNDERGROUND**  
**CONDUIT ENTRANCE**

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**NOTES:**

1. THIS DETAIL APPLIES TO RISER FROM UNDERGROUND ELEC CONDUIT BENEATH CONCRETE SLABS, CONCRETE FLOORS AND EQUIPMENT.
2. FOR PIPE PENETRATION TABLE AND NOTES SEE (23050).

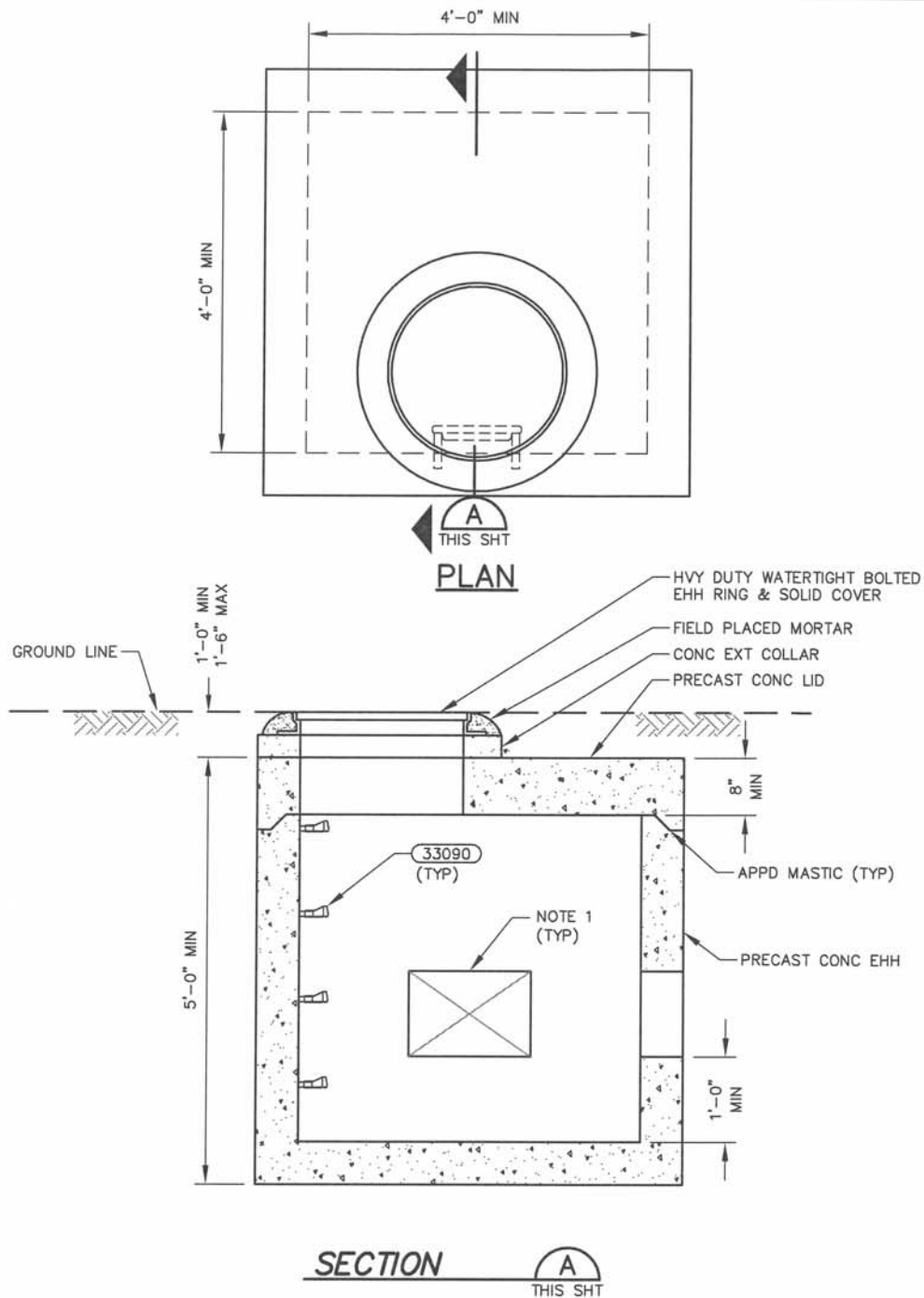
DRAWN BY: ALVARADO
CHKD BY: K ROSS/KIR
APPD BY: <i>Stephen C. Rem</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

26061  
 CONDUIT RISER FROM  
 UNDERGROUND DIRECT BURIED

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**NOTES:**

1. PROVIDE BLOCKOUTS FOR DUCTBANK AND ELECTRICAL CONDUIT PENETRATIONS INTO THE HANDHOLE PER (26049).
2. PROVIDE CABLE RACKS AT A MAXIMUM SPACING OF 2- FEET. ALL SUPPORT MATERIALS AND INSTALLATION SHALL BE APPROVED BY THE ENGINEER.
3. DESIGN PRECAST CONCRETE ELECTRICAL HANDHOLE PER ASTM C 857 AND C 858. VAULT AND LID DESIGN LOADING SHALL BE AASHTO H-20, WITH IMPACT.
4. VAULTS SHALL BE PROVIDED WITH 1.25-INCH PULLING EYES (REMOVABLE STYLE).

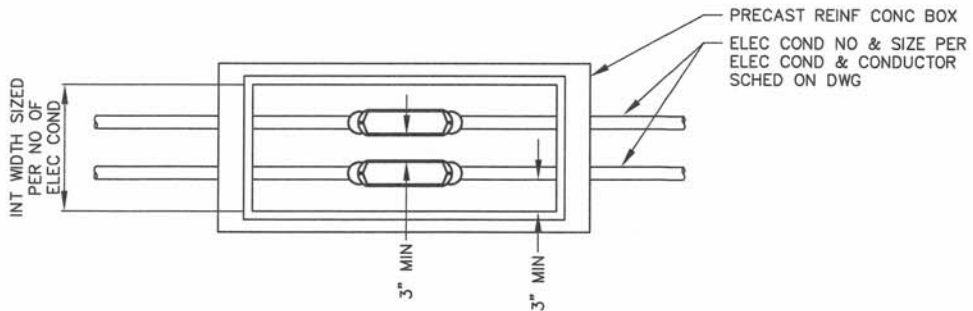
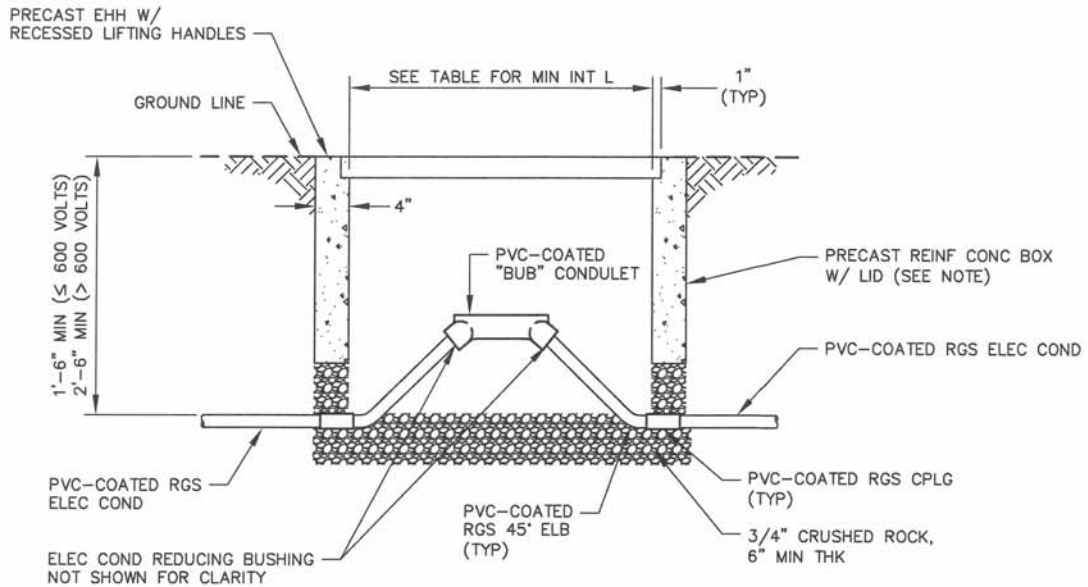
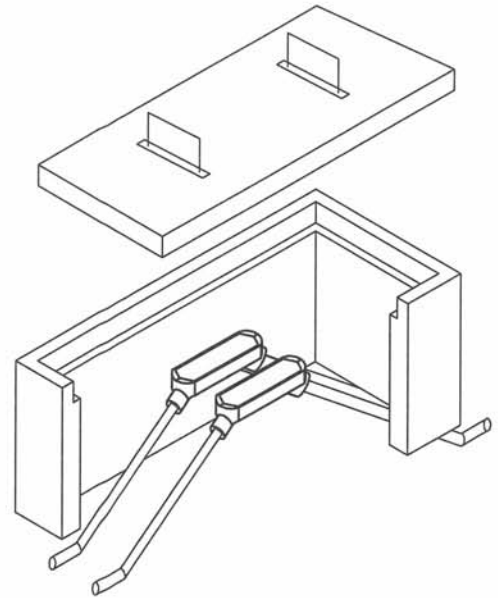
DRAWN BY: BERKNES
CHKD BY: K ROSS/ KJR
APPD BY: Stephen C. Pen
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**26064**  
**IN-STREET ELECTRICAL**  
**HANDHOLE**

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LARGEST SIZE	MIN INT EHH LENGTH
1"	30"
1 1/4"	36"
1 1/2"	36"
2"	48"
2 1/2"	48"
3"	66"



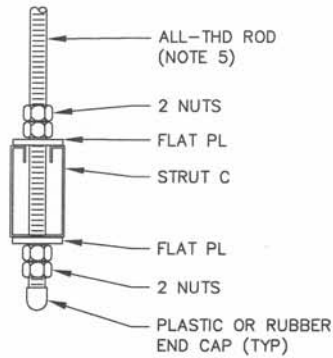
**NOTE:**

DESIGN PRECAST CONCRETE ELECTRICAL HANDHOLE PER ASTM C 857 AND C 858. VAULT AND LID DESIGN LOADING SHALL BE AASHTO H-20, WITH IMPACT.

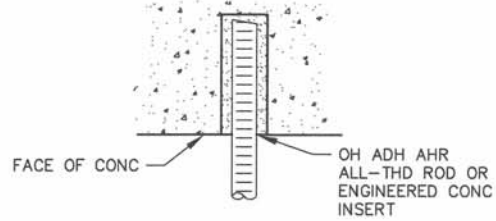
DRAWN BY: ALVARADO
CHKD BY: K ROSS/KUR
APPD BY: Stephen C. Pen
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

26067  
SMALL ELECTRICAL  
HANDHOLE WITH CONDULET

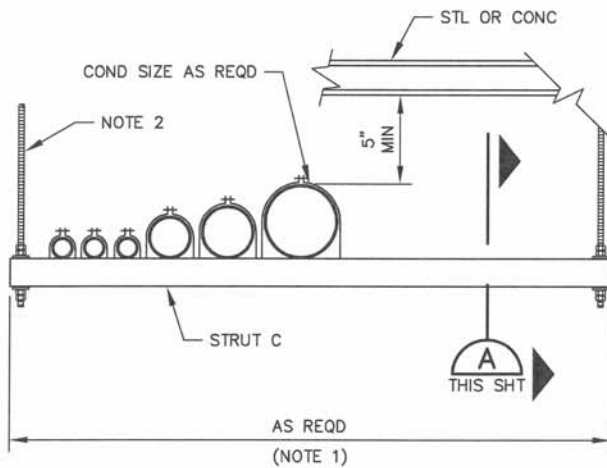
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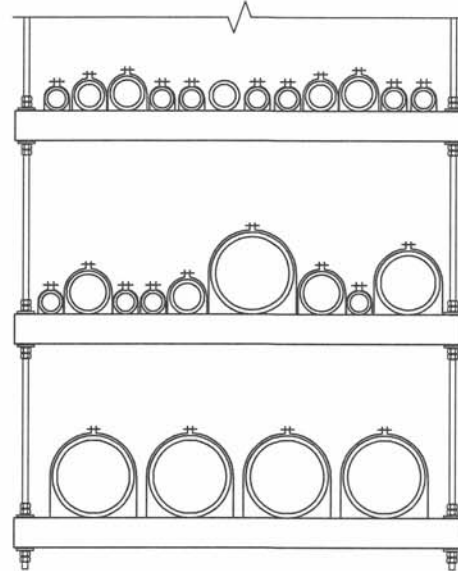
**SECTION A**  
THIS SHT



**CONCRETE INSERT**



**SINGLE RACK**



**MULTIPLE RACK**

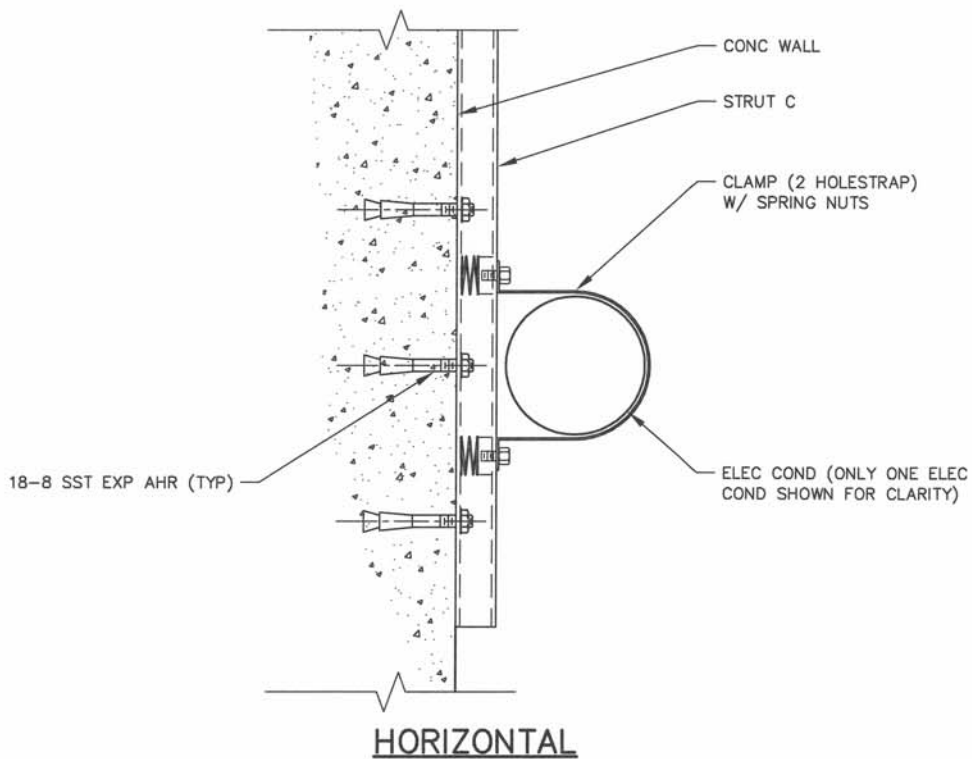
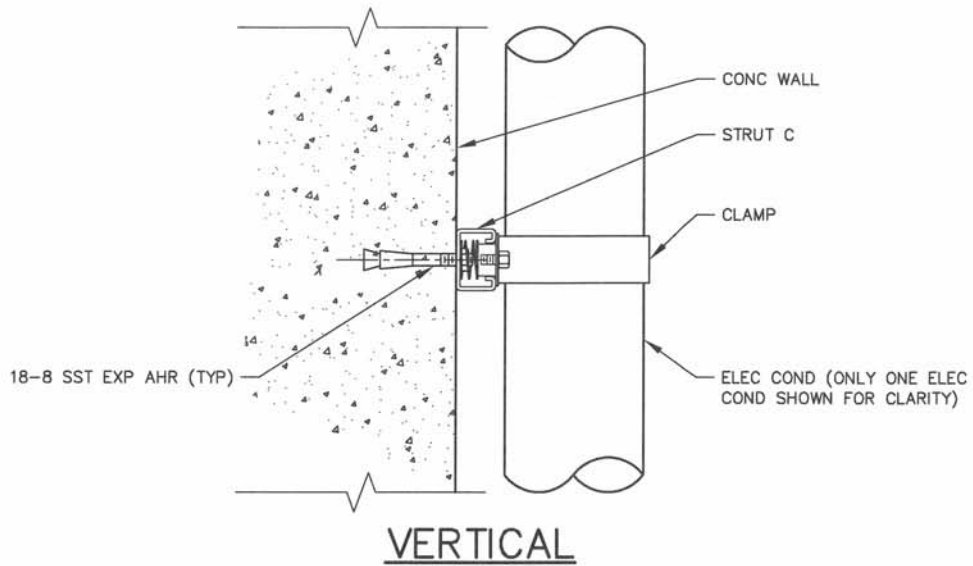
**NOTES:**

1. LENGTH VARIES WITH NUMBER OF ELECTRICAL CONDUITS TO BE SUPPORTED AND SPACING BETWEEN ELECTRICAL CONDUITS.
2. HANGER RODS SHALL BE SIZED FOR LOADS AND SPACING. CALCULATIONS SHALL BE SUBMITTED FOR APPROVAL.
3. ALLOWABLE SPAN, NUMBER AND SIZE OF SUPPORT RODS AND ALLOWABLE LOADING IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.
4. FOR HANGAR ROD SUPPORT IN CONCRETE APPLICATIONS, USE SWIVEL CONCRETE INSERTS. FOR STEEL BEAM APPLICATIONS, USE SWIVEL BEAM CLAMPS.
5. ALL MATERIALS INCLUDING HARDWARE SHALL BE STAINLESS STEEL IN WET AND CORROSIVE AREAS.
6. SPACE ELECTRICAL CONDUIT SUFFICIENTLY TO ALLOW REMOVAL OF ONE CONDUIT WITHOUT DISTURBING ADJACENT ELECTRICAL CONDUITS.
7. RACK MOUNTED ELECTRICAL CONDUIT SHALL BE INSTALLED IN ACCORDANCE WITH THIS DETAIL.

DRAWN BY: <i>BOWMAN</i>
CHKD BY: <i>K ROSS/KLR</i>
APPD BY: <i>Stephen C. Pen</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

26090  
STRUT CHANNEL TRAPEZE  
CONDUIT  
RACKING SYSTEM

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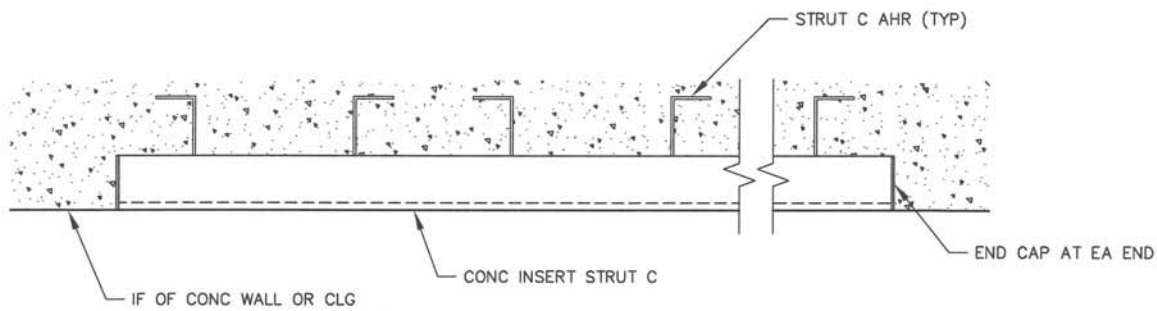
**NOTES:**

1. HORIZONTAL PIPES SHALL BE PLACED ABOUT THE SUPPORTS AS SYMMETRICALLY AS POSSIBLE.
2. EXPANSION ANCHORS SHALL BE PLACED ON 12-INCH CENTERS AS NECESSARY, BUT IN NO CASE SHALL THERE BE FEWER THAN 3 EXPANSION ANCHORS PER SECTION OF STRUT CHANNEL (ONE AT EACH END AND ONE IN THE CENTER). CAP OPEN ENDS OF STRUT CHANNELS.

DRAWN BY: <i>BOWMAN</i>
CHKD BY: <i>K ROSS/KR</i>
APPD BY: <i>Stephen C. Pen</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**26091  
STRUT CHANNEL  
CONDUIT MOUNTING**

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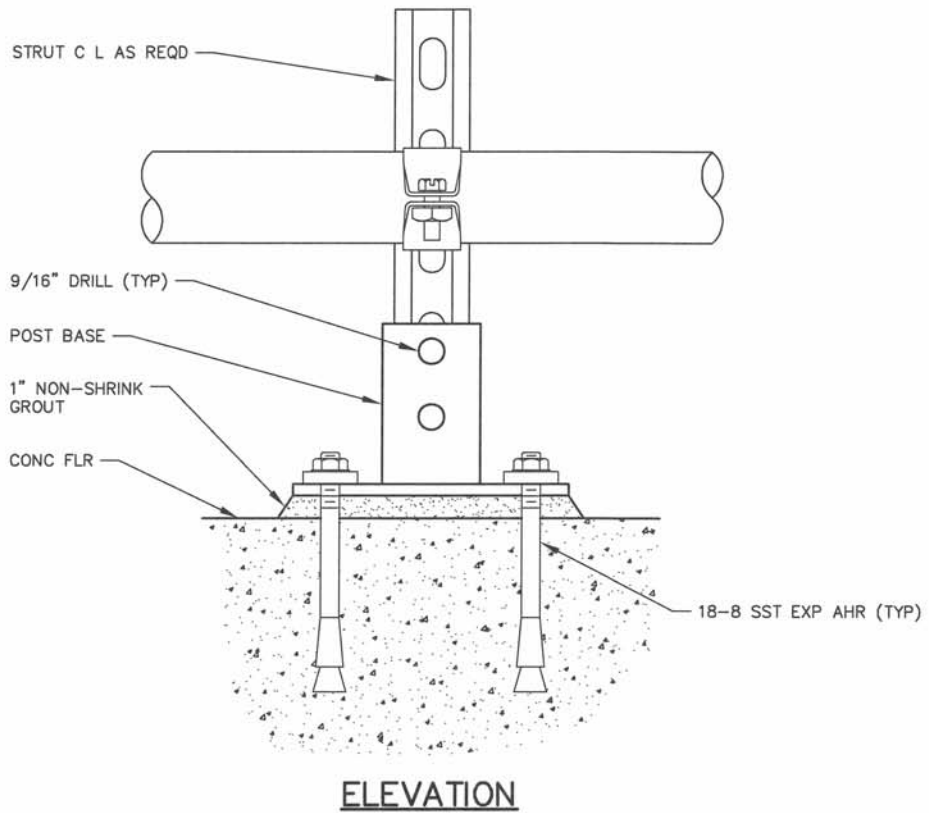
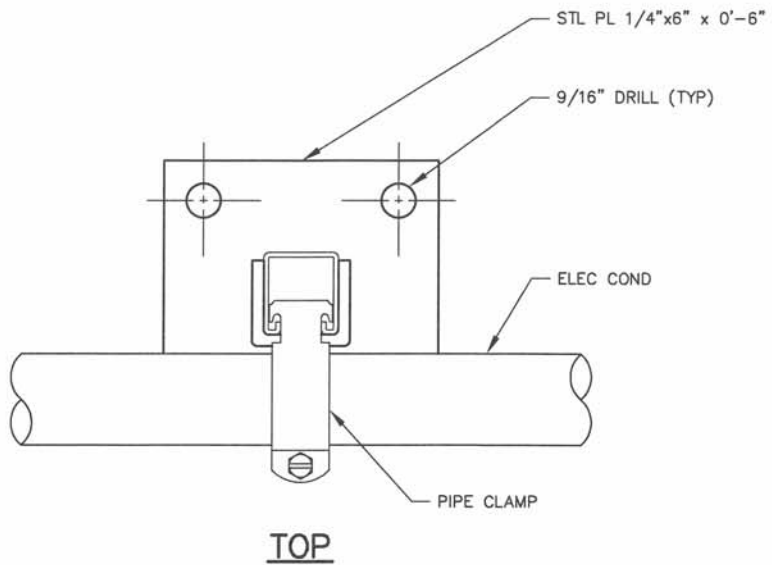
**NOTE:**

PROVIDE AND INSTALL CONCRETE INSERT STRUT CHANNEL CAPABLE OF HANDLING THE LOADING OF TWICE ALL CONDUITS, CONDUCTORS AND CLAMPS. SUBMIT CALCULATIONS FOR APPROVAL.

DRAWN BY: <i>BOWMAN</i>
CHKD BY: <i>K ROSS/KR</i>
APPD BY: <i>Stephen C. Penn</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**26092  
STRUT CHANNEL  
CONCRETE INSERT**

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**NOTE:**

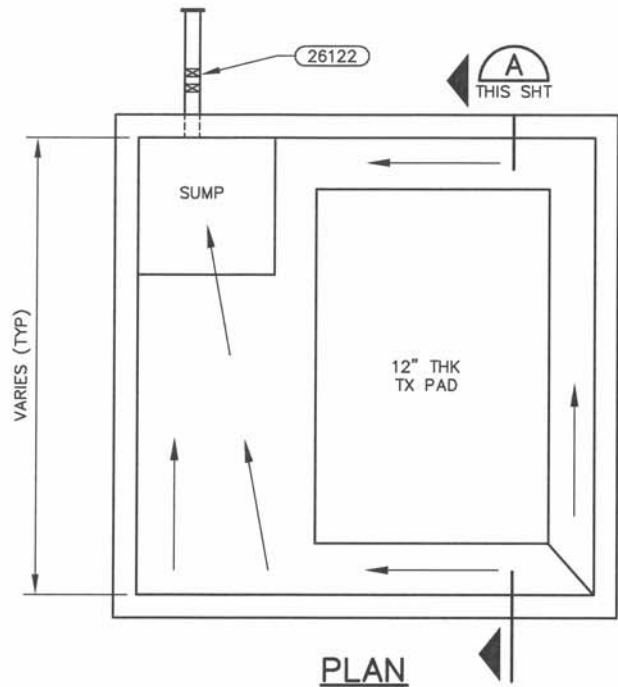
MOUNTING HARDWARE SHALL BE 18-8 STAINLESS STEEL.

DRAWN BY: <i>BOWMAN</i>
CHKD BY: <i>K ROSS/KJR</i>
APPD BY: <i>Stephen C. Ren</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

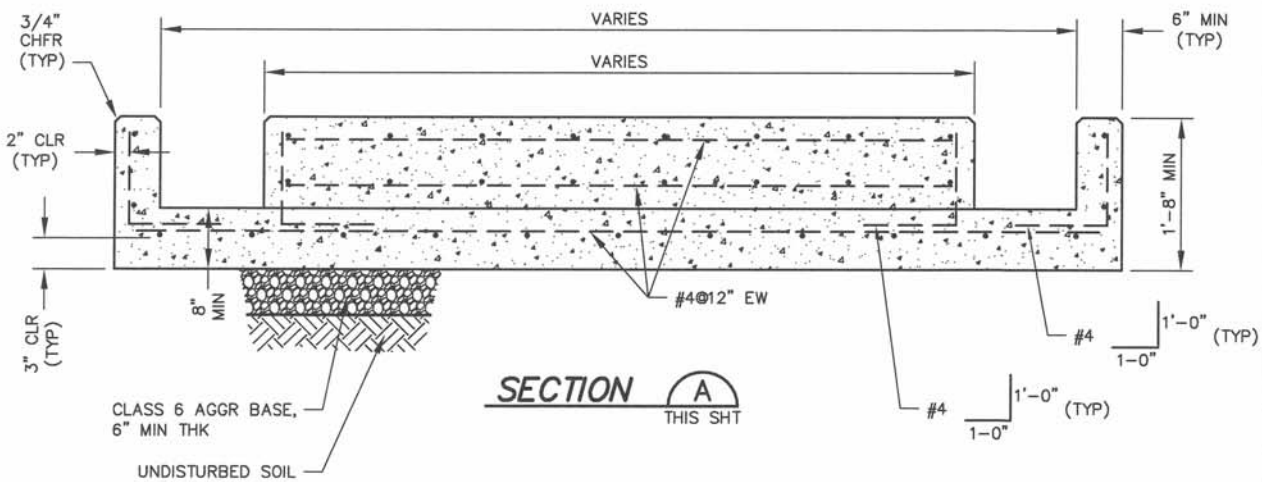
**26093**  
**STRUT CHANNEL CONDUIT**  
**FLOOR SUPPORT SYSTEM**

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PLAN



SECTION A THIS SHT

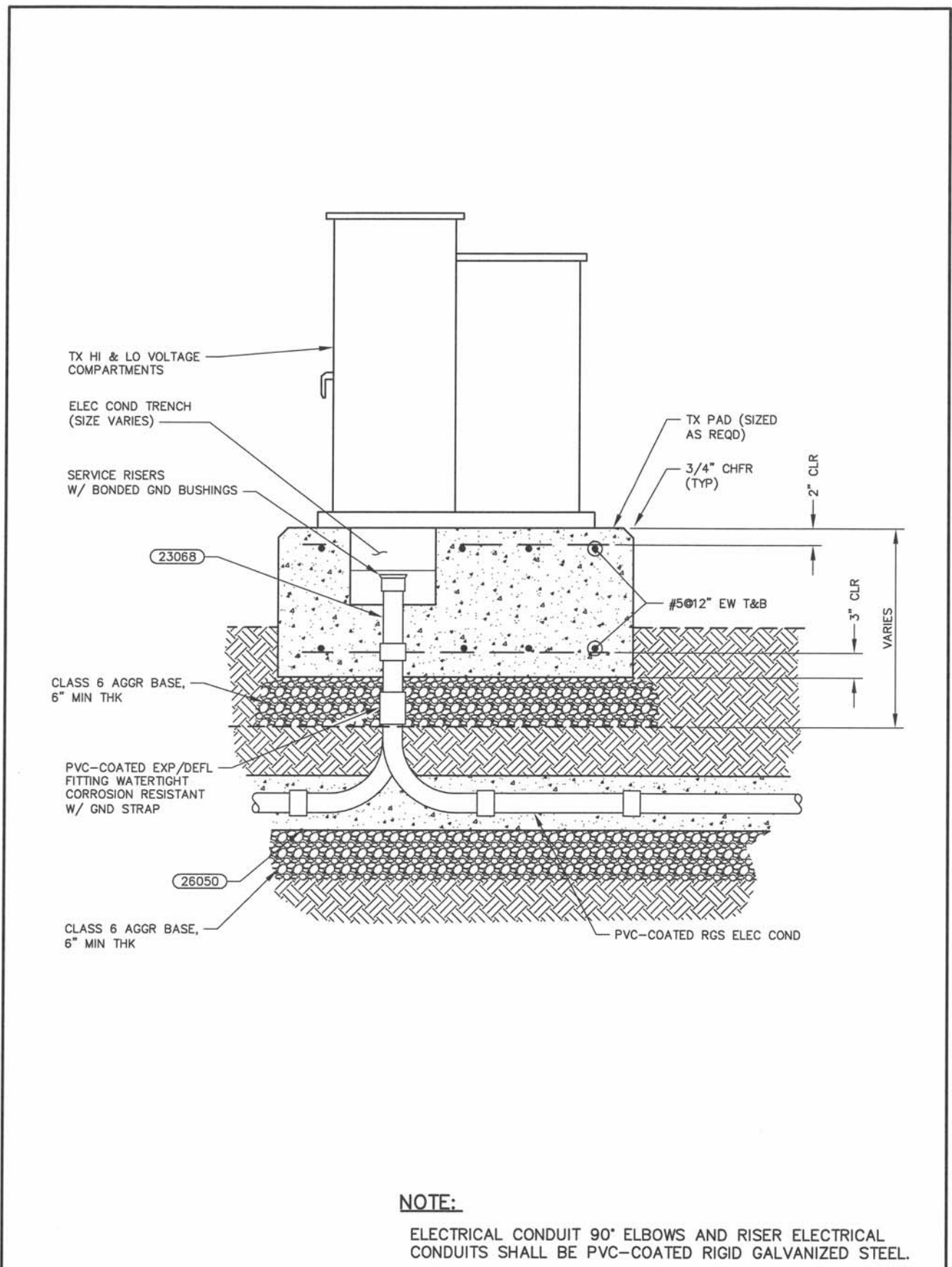
**NOTE:**

SLOPE CONTAINMENT SLAB TO DRAIN (1/4-INCH PER FOOT).

DRAWN BY: BERKNES
CHKD BY: K ROSS/ KLR
APPD BY: Stephen C. Reim
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

26120  
TRANSFORMER PAD WITH  
CONTAINMENT CURB

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**NOTE:**

ELECTRICAL CONDUIT 90° ELBOWS AND RISER ELECTRICAL CONDUITS SHALL BE PVC-COATED RIGID GALVANIZED STEEL.

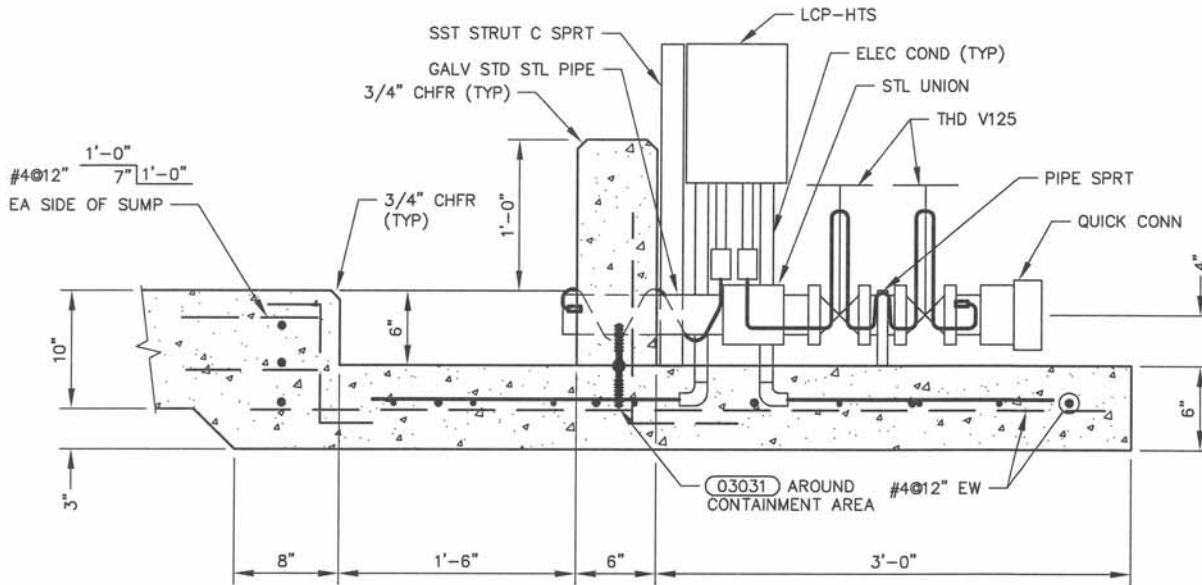
DRAWN BY: <i>BERKNESS</i>
CHKD BY: <i>K ROSS/KLR</i>
APPD BY: <i>Stephen C. Rem</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**26121  
TRANSFORMER-DUCTBANK  
INTERFACE**

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**ELEVATION**

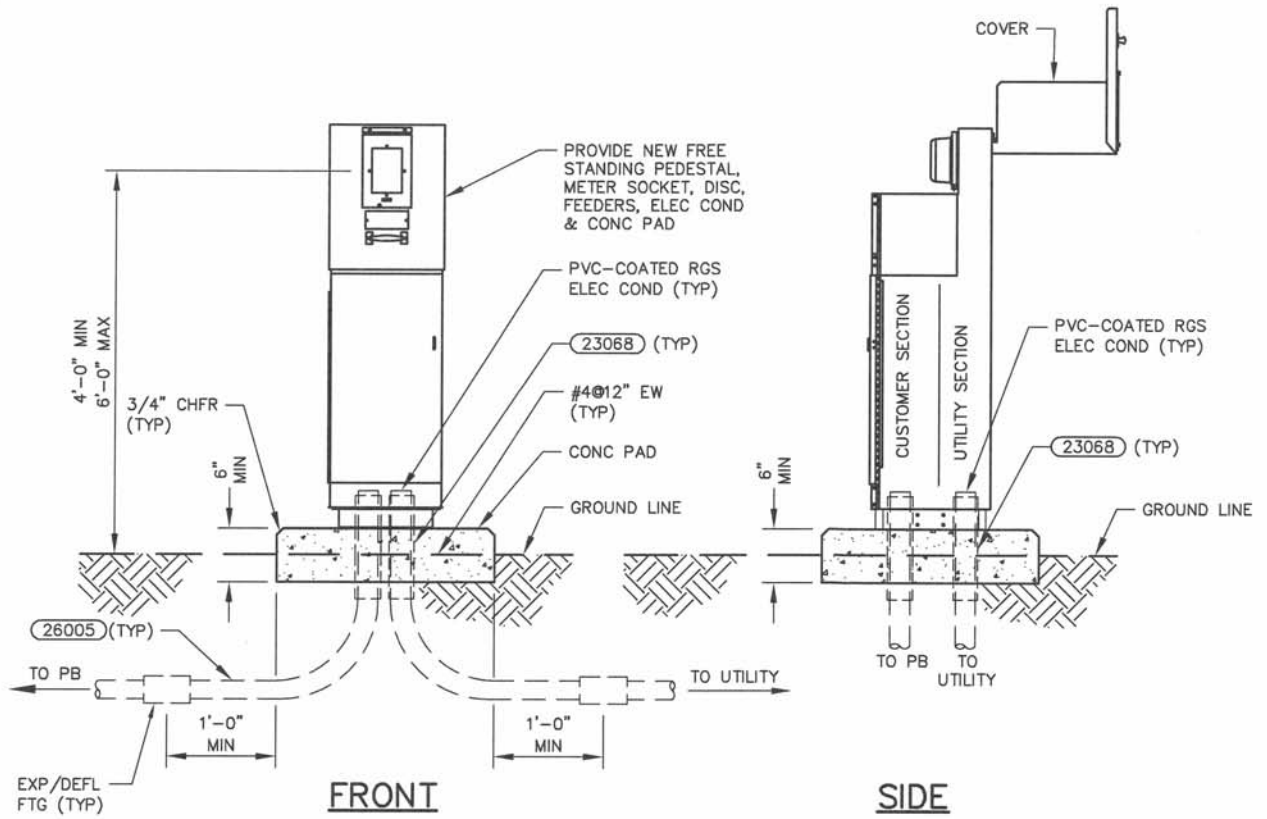
**NOTES:**

1. ALL ELECTRICAL CONDUITS SHALL BE PVC-COATED RIGID GALVANIZED STEEL CONDUIT, 3/4-INCH MINIMUM.
2. INSTALL HEAT TAPE 2-INCHES MINIMUM BELOW SURFACE OF SLAB.
3. INSTALL 2-INCHES OF INSULATION ON PIPE AND VALVES.
4. INSTALL HEAT TAPE 3-INCHES FROM CONCRETE EDGE.

DRAWN BY: BERKNESS
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Ren
ORIGINATION DATE: JANAUARY 2017
REVISION DATE:

**26122**  
**CONTAINMENT DRAIN**  
**ASSEMBLY**  
**WITH HEAT TAPE**


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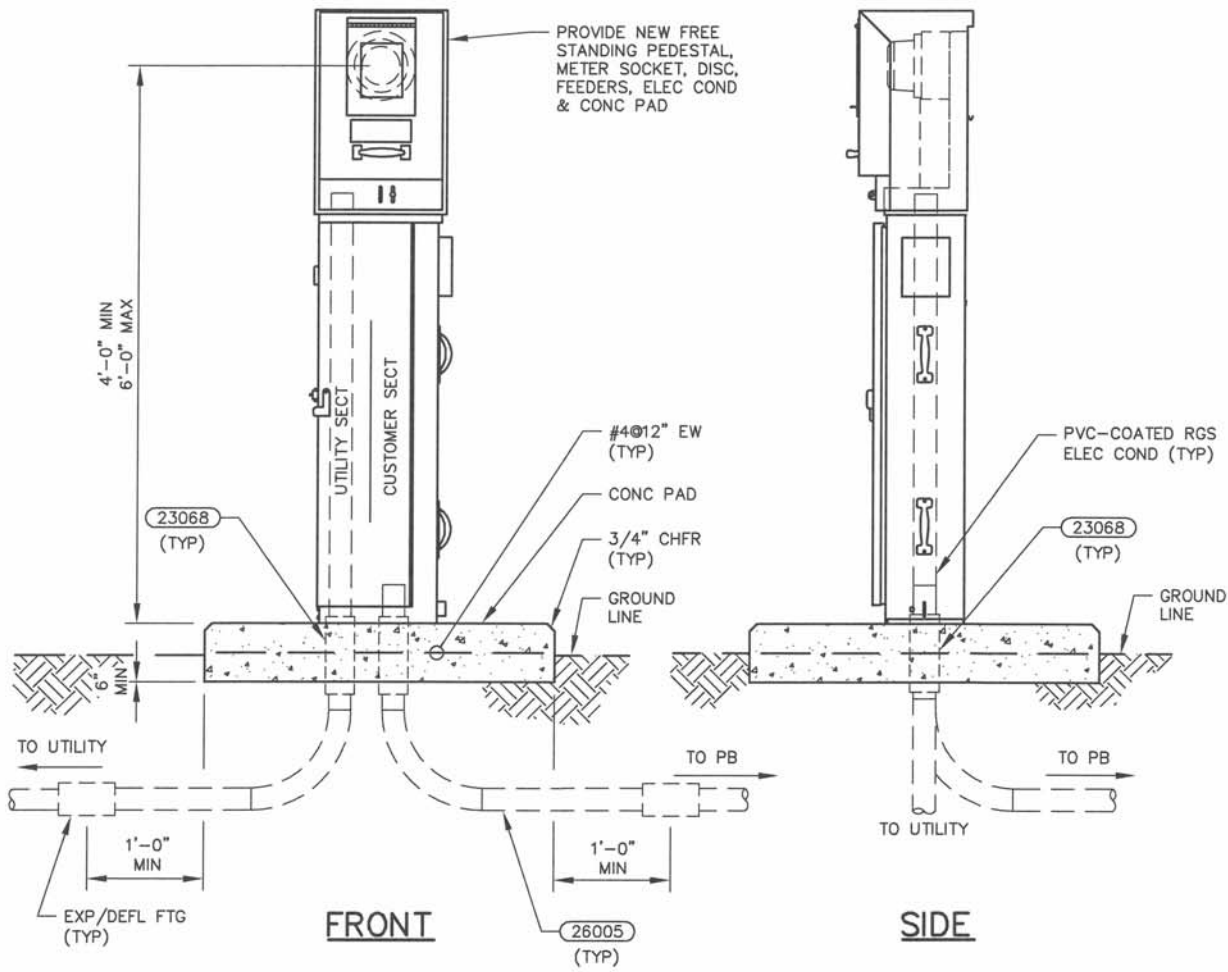
**NOTES:**

1. ELECTRIC UTILITY (HEAVY DUTY) APPROVED SERVICE METER PEDESTAL. INCLUDE PAD MOUNTING KIT, 24-INCH MINIMUM WIDTH.
2. PEDESTAL SHALL MEET REQUIREMENTS OF THE NATIONAL ELECTRICAL CODE AND ELECTRICAL UTILITY HAVING JURISDICTION.

DRAWN BY: ALVARADO
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Pen
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**26142**  
**ELECTRICAL SERVICE**  
**EQUIPMENT FREE STANDING**  
**METER PEDESTAL 3-PHASE**


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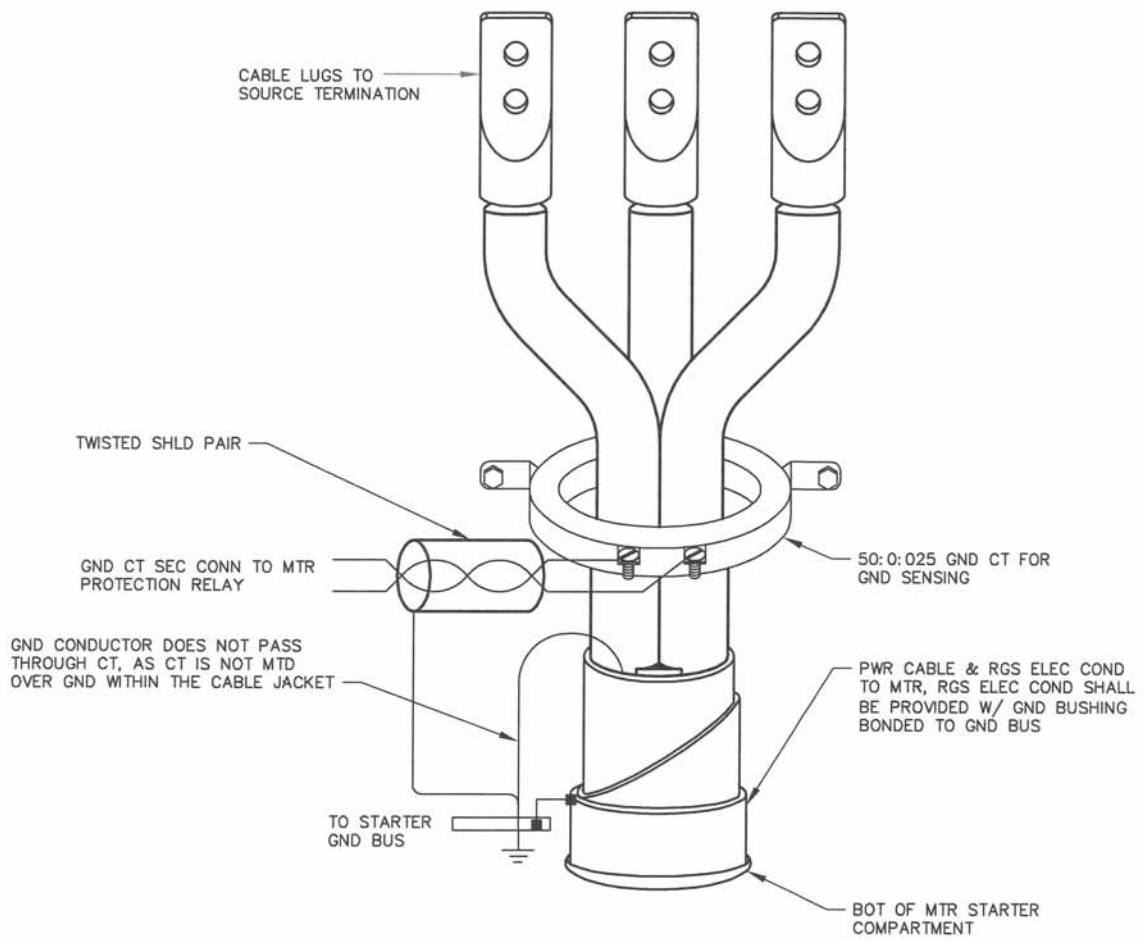
**NOTES:**

1. ELECTRIC UTILITY (HEAVY DUTY) APPROVED SERVICE METER PEDESTAL. INCLUDE PAD MOUNTING KIT, 24-INCH MINIMUM WIDTH.
2. PEDESTAL SHALL MEET REQUIREMENTS OF THE NATIONAL ELECTRICAL CODE AND ELECTRICAL UTILITY HAVING JURISDICTION.

DRAWN BY: BERKNES
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Ren
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**26144**  
**ELECTRICAL SERVICE**  
**EQUIPMENT FREE STANDING**  
**METER PEDESTAL 1-PHASE**


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DRAWN BY: BERKNESS

CHKD BY: K ROSS/KLR

APPD BY: Stephen C. Pein

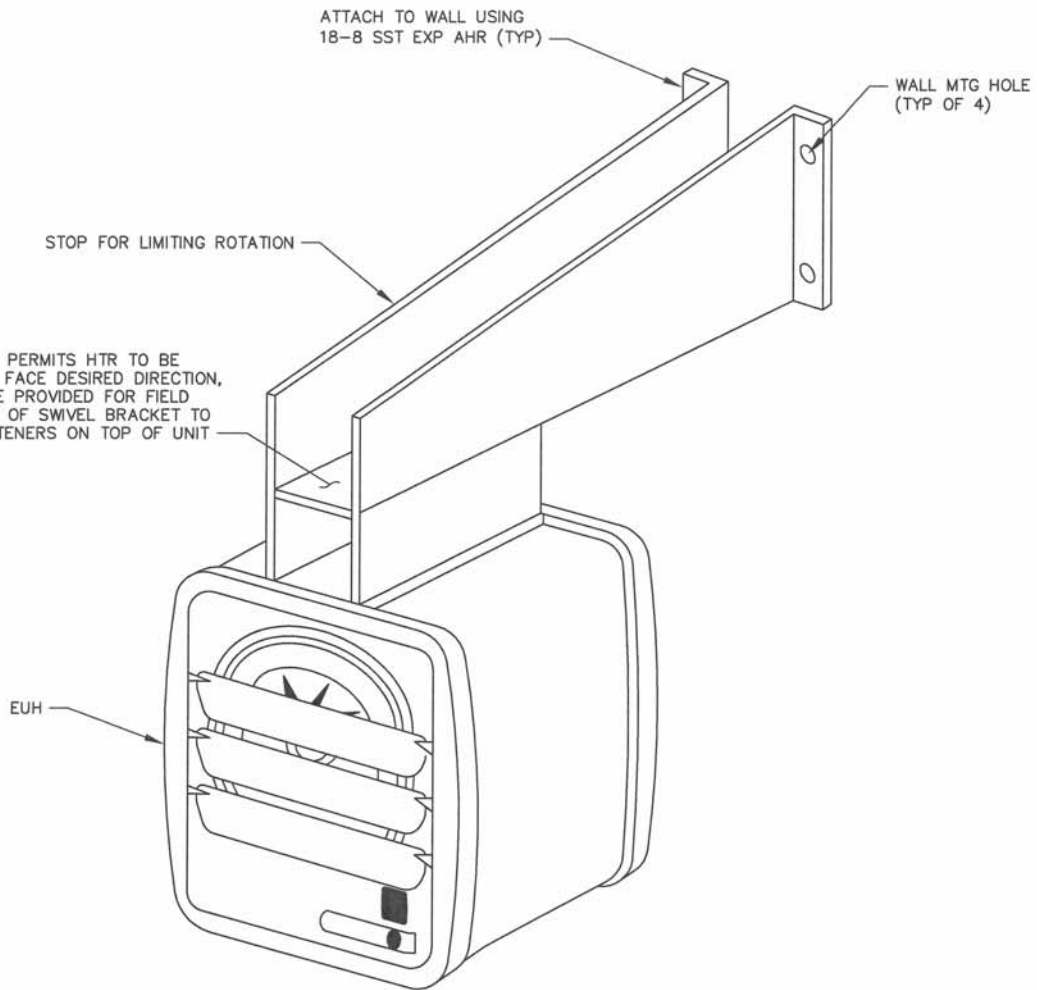
ORIGINATION DATE: JANUARY 2017

REVISION DATE:

26189  
 MOTOR GROUND CURRENT  
 TRANSFORMER INSTALLATION

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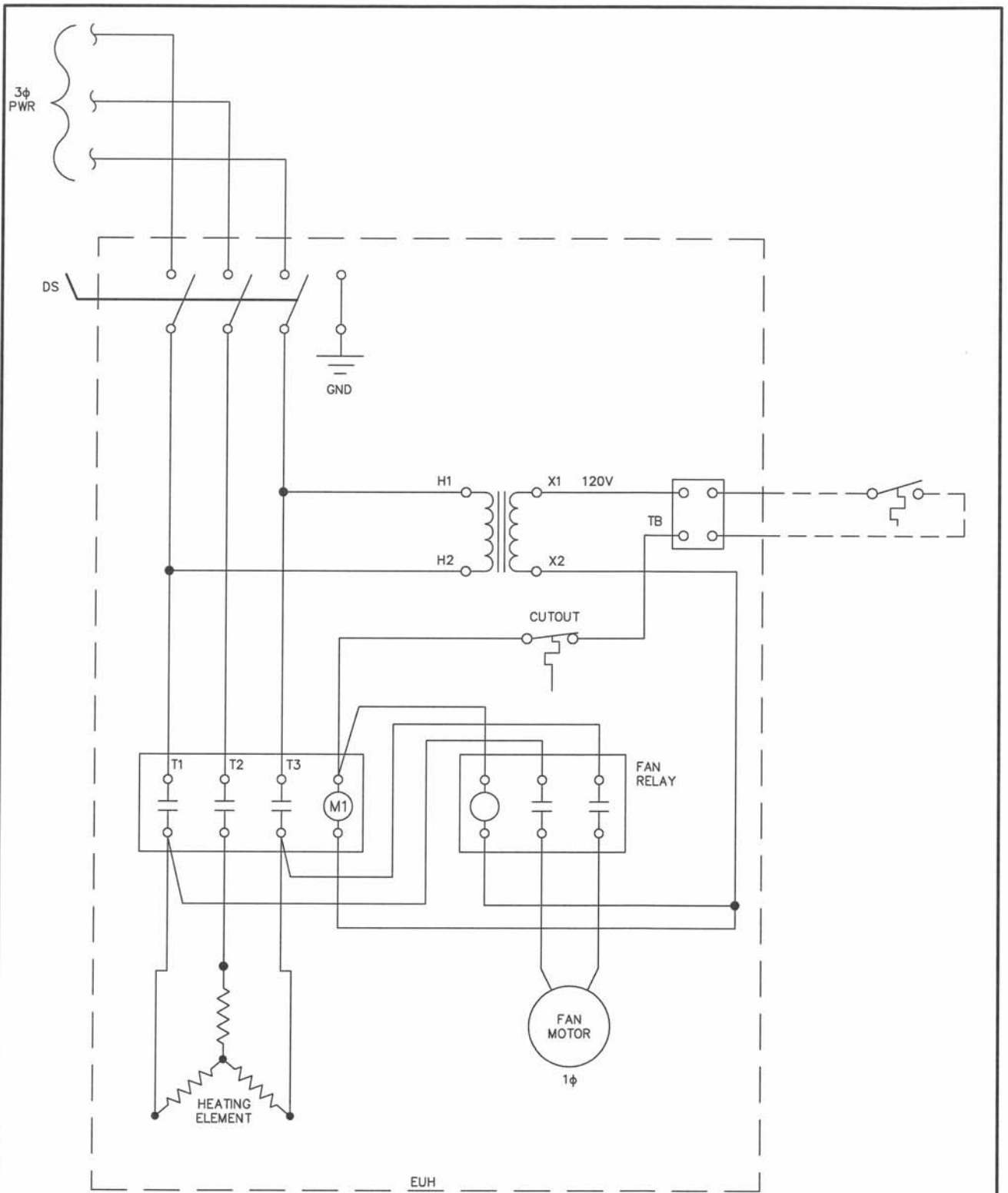
**NOTE:**

MINIMUM MOUNTING HEIGHT SHALL BE APPROVED BY THE ENGINEER.

DRAWN BY: <i>ALVARADO</i>
CHKD BY: <i>K ROSS/KLR</i>
APPD BY: <i>Stephen C. Reem</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**26230  
ELECTRIC UNIT HEATER  
MOUNTING**

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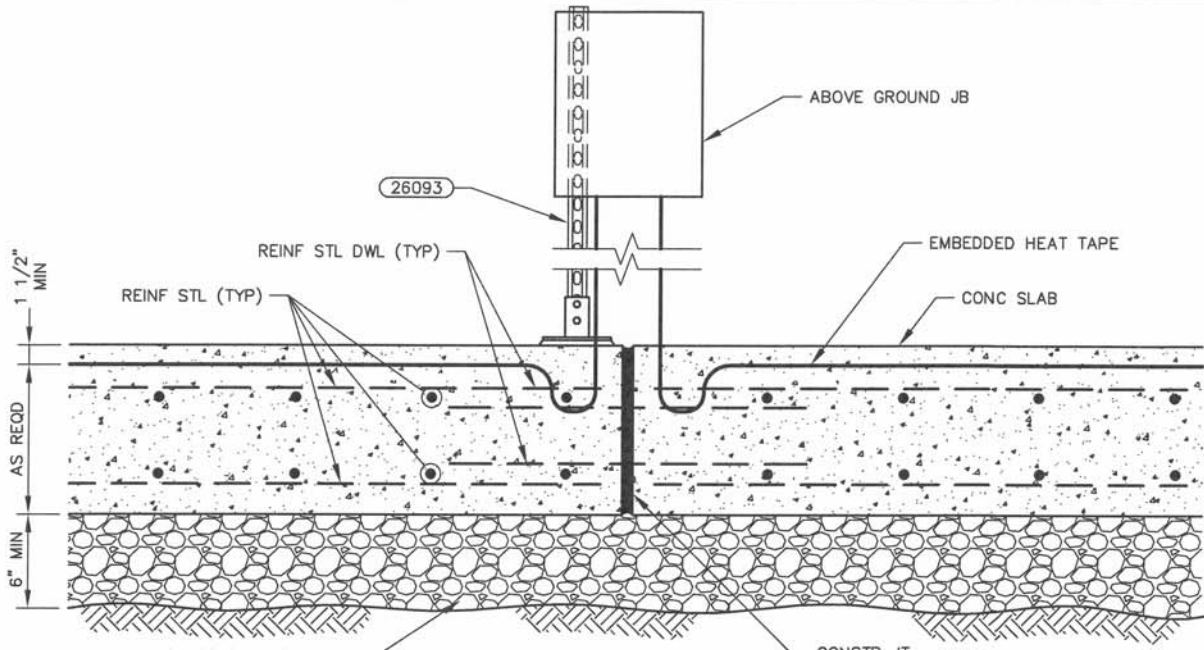
**NOTE:**

ELECTRICAL SCHEMATIC FOR 3 PHASE HEATING ELEMENT, 1 PHASE FAN MOTOR, 120V CONTROL TRANSFORMER AND FAN RELAY WITH EXTERNAL THERMOSTAT AND SUMMER FAN SWITCH.

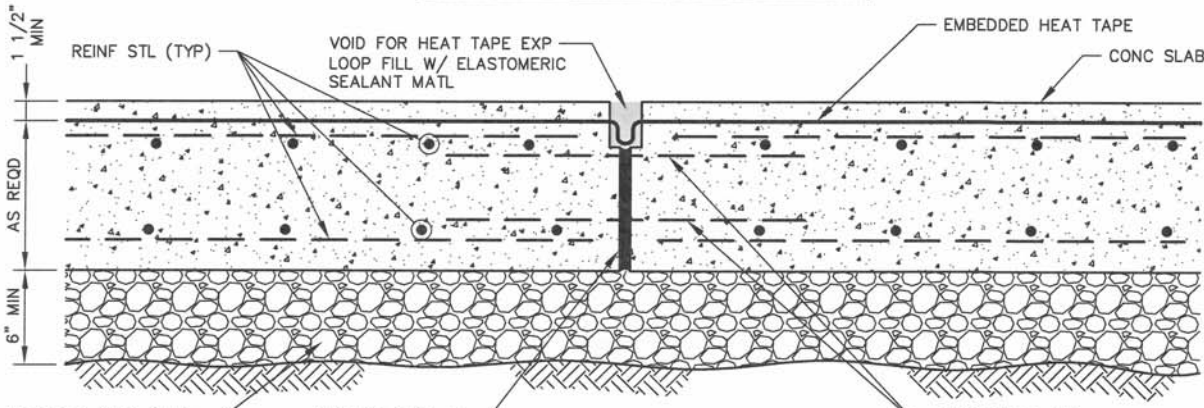
DRAWN BY: BERKNESS
CHKD BY: K ROSS/KJR
APPD BY: Stephen C. Rose
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

26231  
ELECTRIC UNIT HEATER  
CONTROL SCHEMATIC

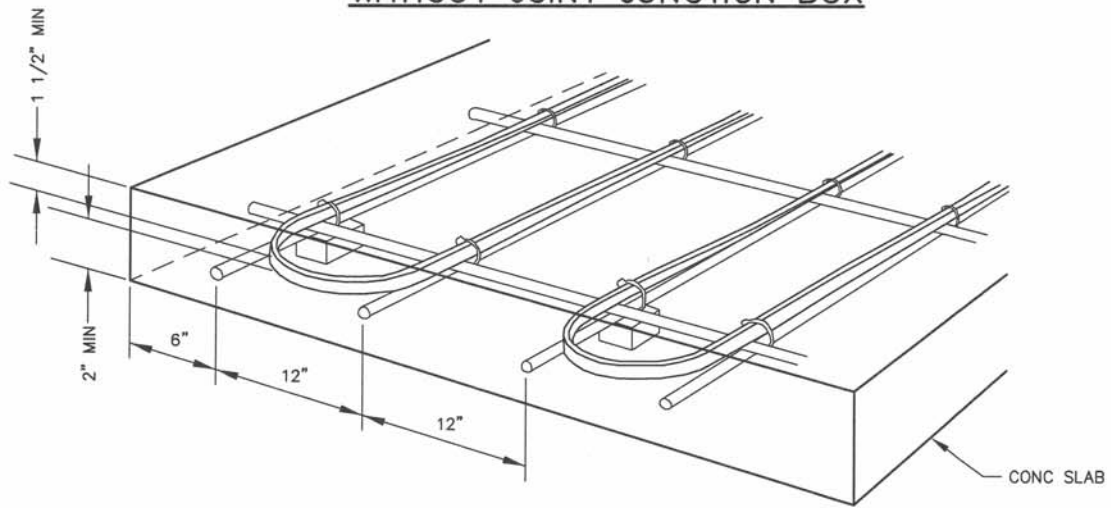
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**WITH JOINT JUNCTION BOX**



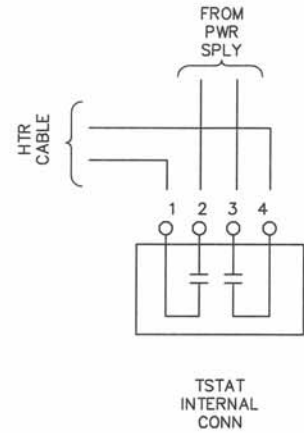
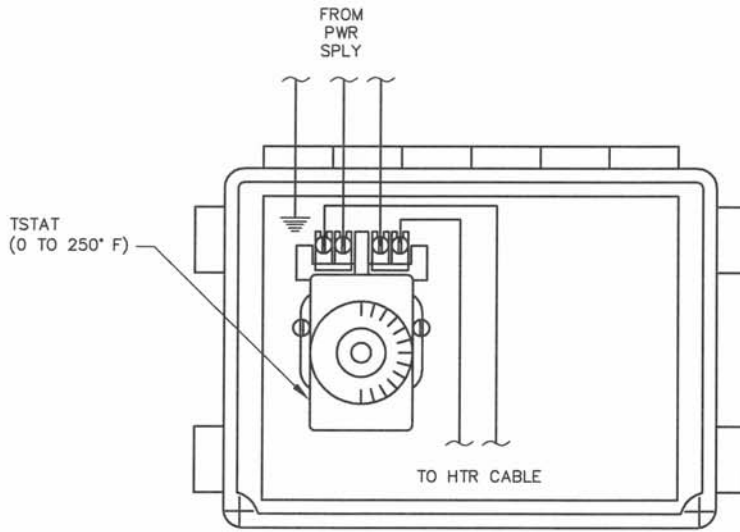
**WITHOUT JOINT JUNCTION BOX**



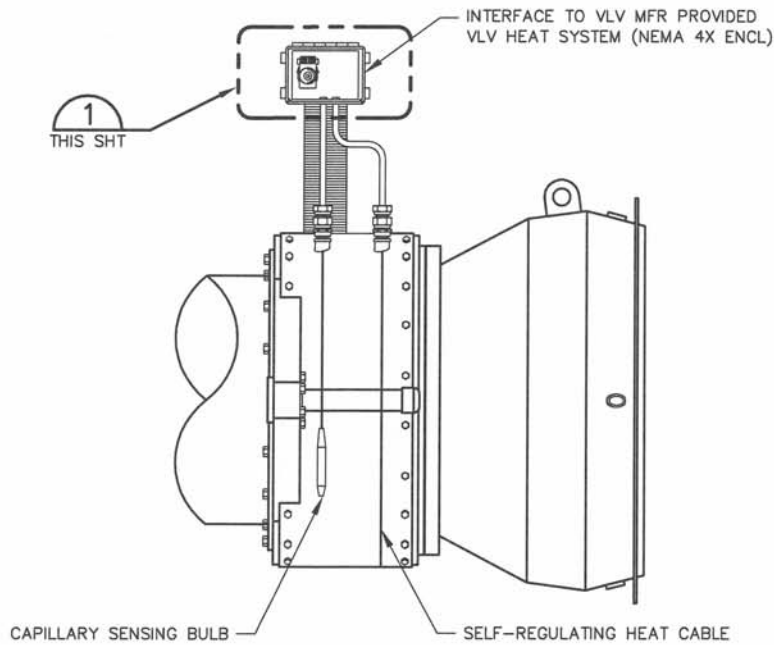
DRAWN BY: <i>BERKNES</i>
CHKD BY: <i>K ROSS/KLR</i>
APPD BY: <i>Stephen C. Row</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

26232  
EMBEDDED HEAT TAPE

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**DETAIL** 1  
THIS SHT



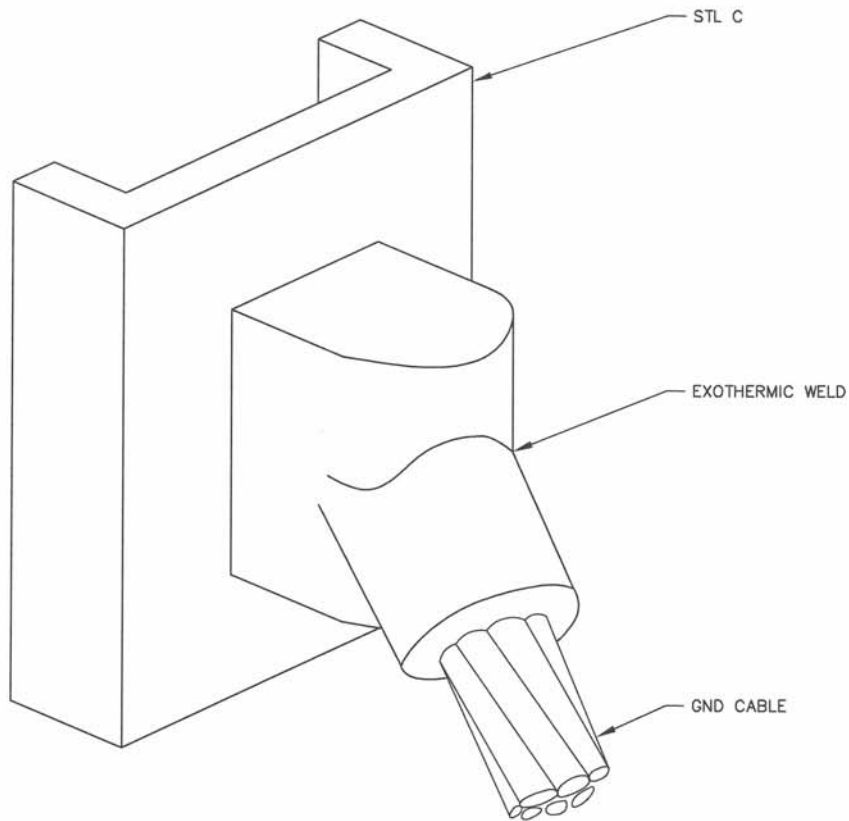
DRAWN BY: <i>BERKNESS</i>
CHKD BY: <i>K ROSS/KLR</i>
APPD BY: <i>Stephen C. Ross</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**26233**  
**DISCHARGE VALVE (RING JET)**  
**HEAT SYSTEM**

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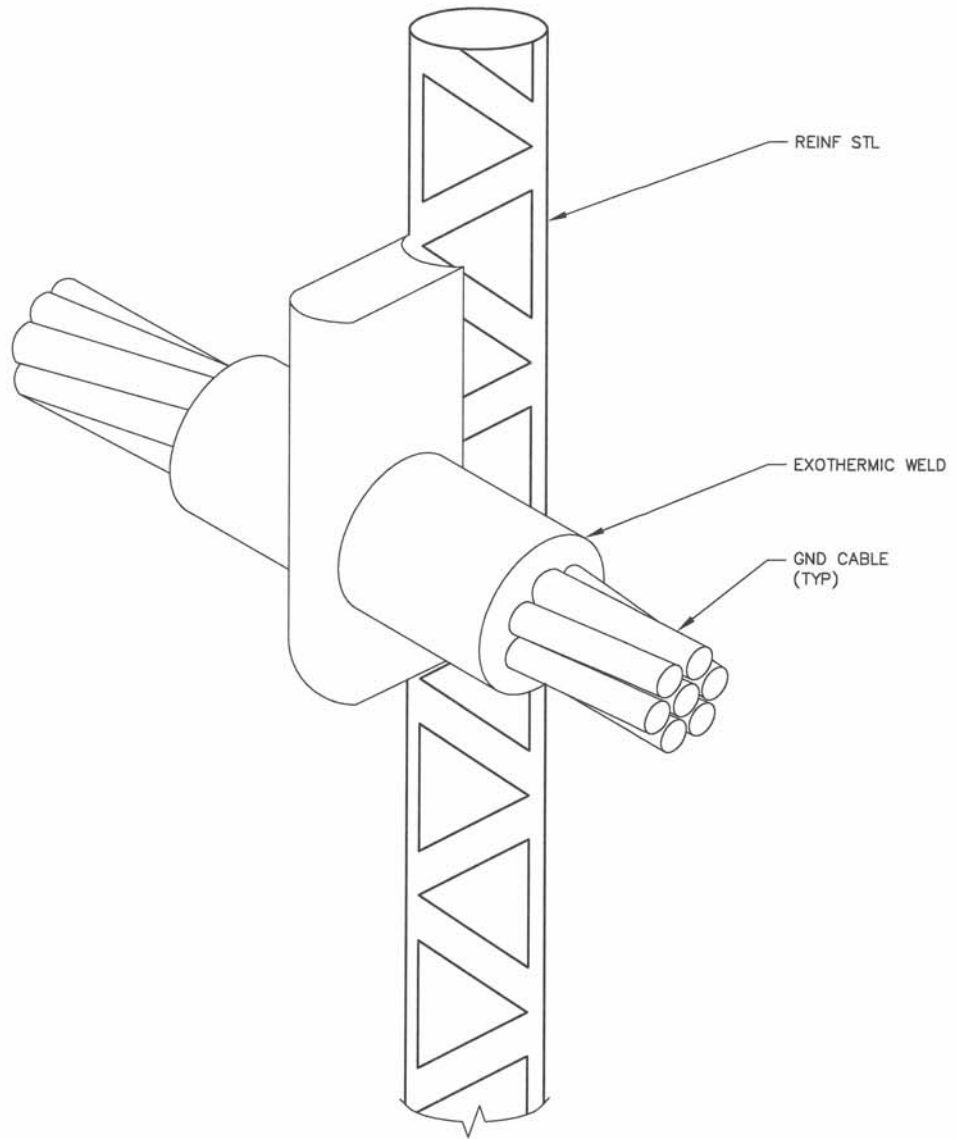




DRAWN BY: BERKNESS  
 CHKD BY: K ROSS/KIR  
 APPD BY: Stephen C. Rem  
 ORIGINATION DATE: JANUARY 2017  
 REVISION DATE:

26260  
 GROUND CABLE TO  
 CHANNEL CONNECTION

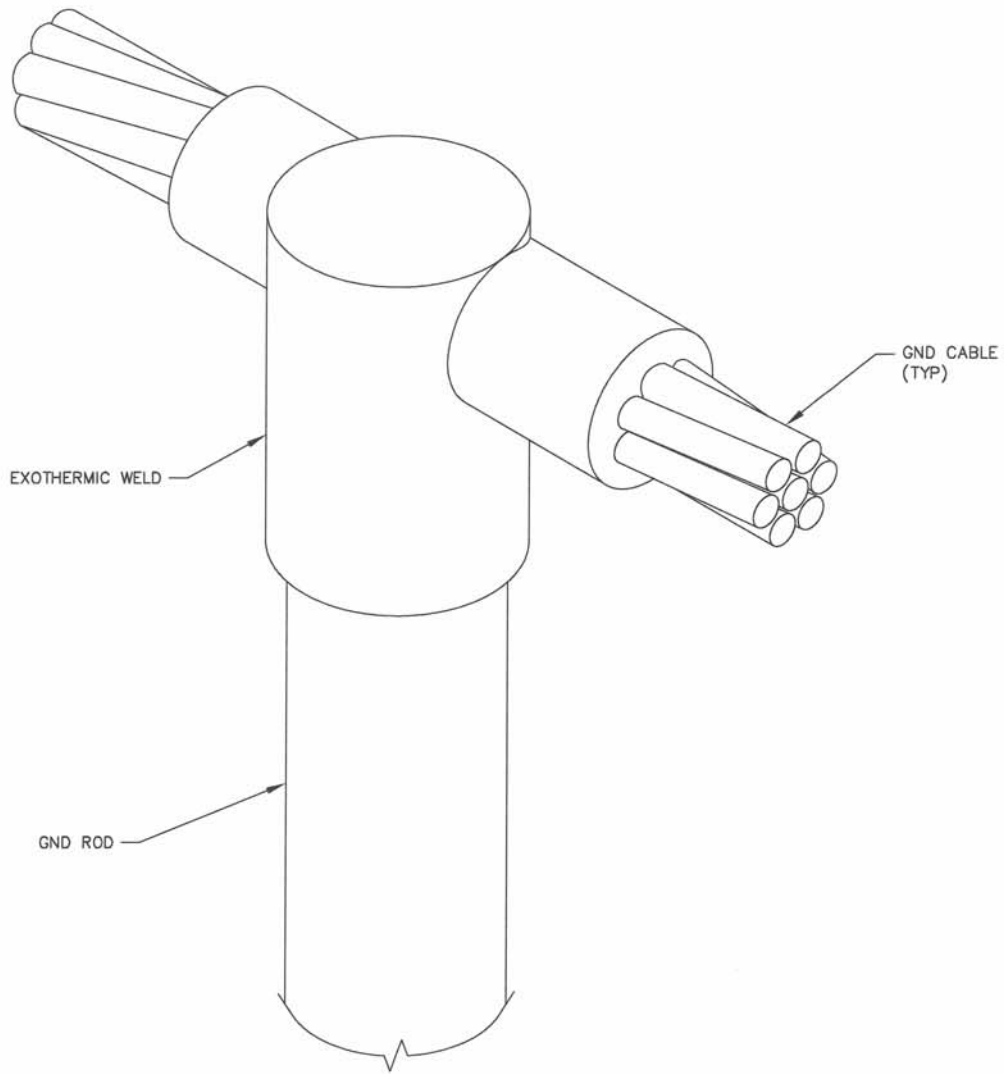
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DRAWN BY: BERKNESS  
 CHKD BY: K ROSS/KR  
 APPD BY: Stephen C. Rem  
 ORIGINATION DATE: JANUARY 2017  
 REVISION DATE:

26261  
 GROUND CABLE  
 CONNECTION TO  
 REINFORCING STEEL

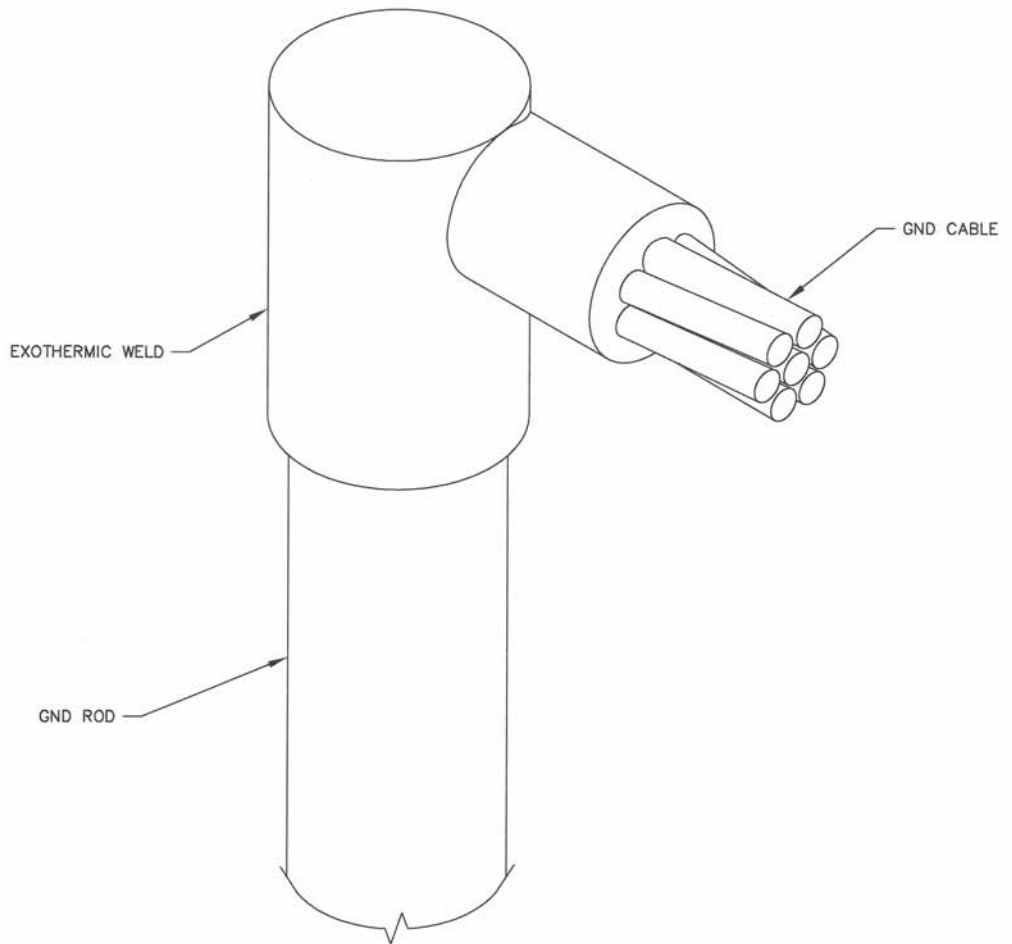
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DRAWN BY: *BERKNESS*  
 CHKD BY: *K ROSS/VLR*  
 APPD BY: *Stephen C. Ren*  
 ORIGINATION DATE: JANUARY 2017  
 REVISION DATE:

26262  
 THROUGH GROUND CABLE  
 CONNECTION TO GROUND ROD

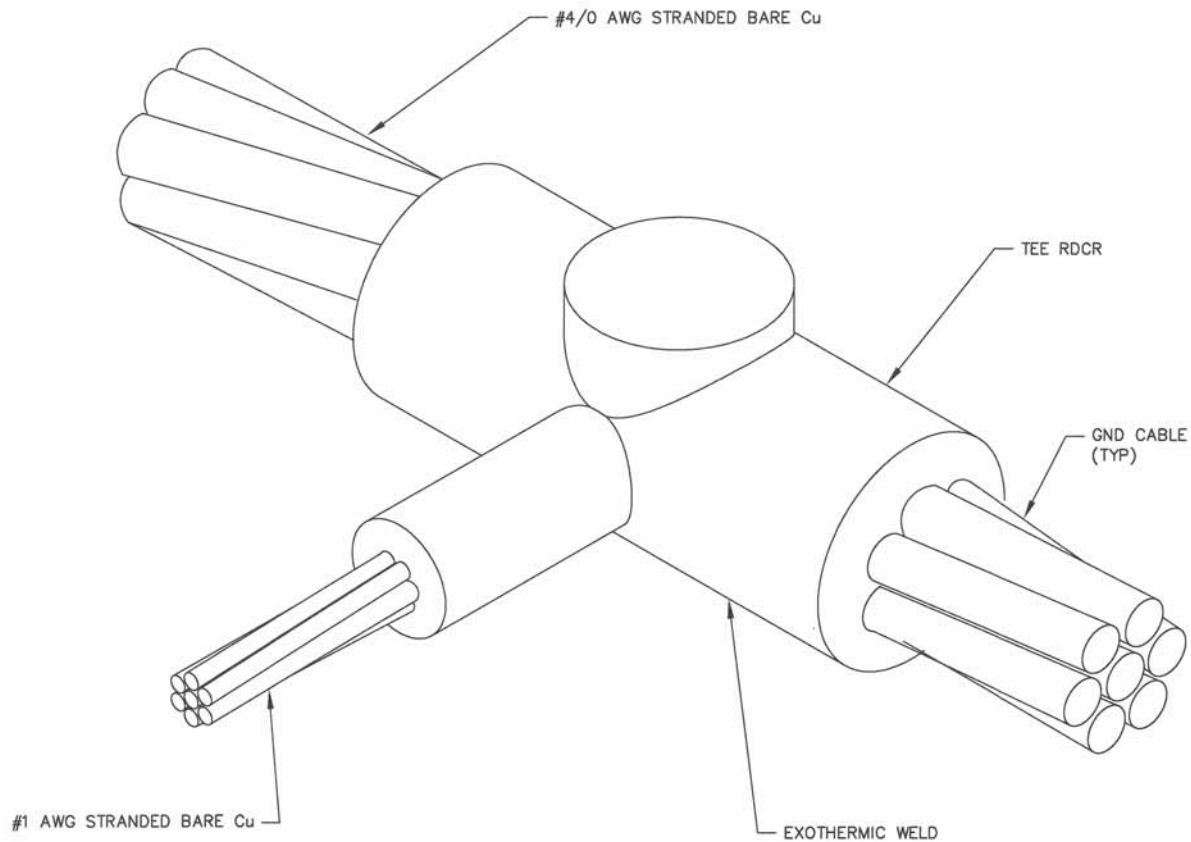
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DRAWN BY: <i>BERKNESS</i>
CHKD BY: <i>K ROSS/KLR</i>
APPD BY: <i>Stephen C. Row</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

26263  
GROUND CABLE CONNECTION  
TO GROUND ROD

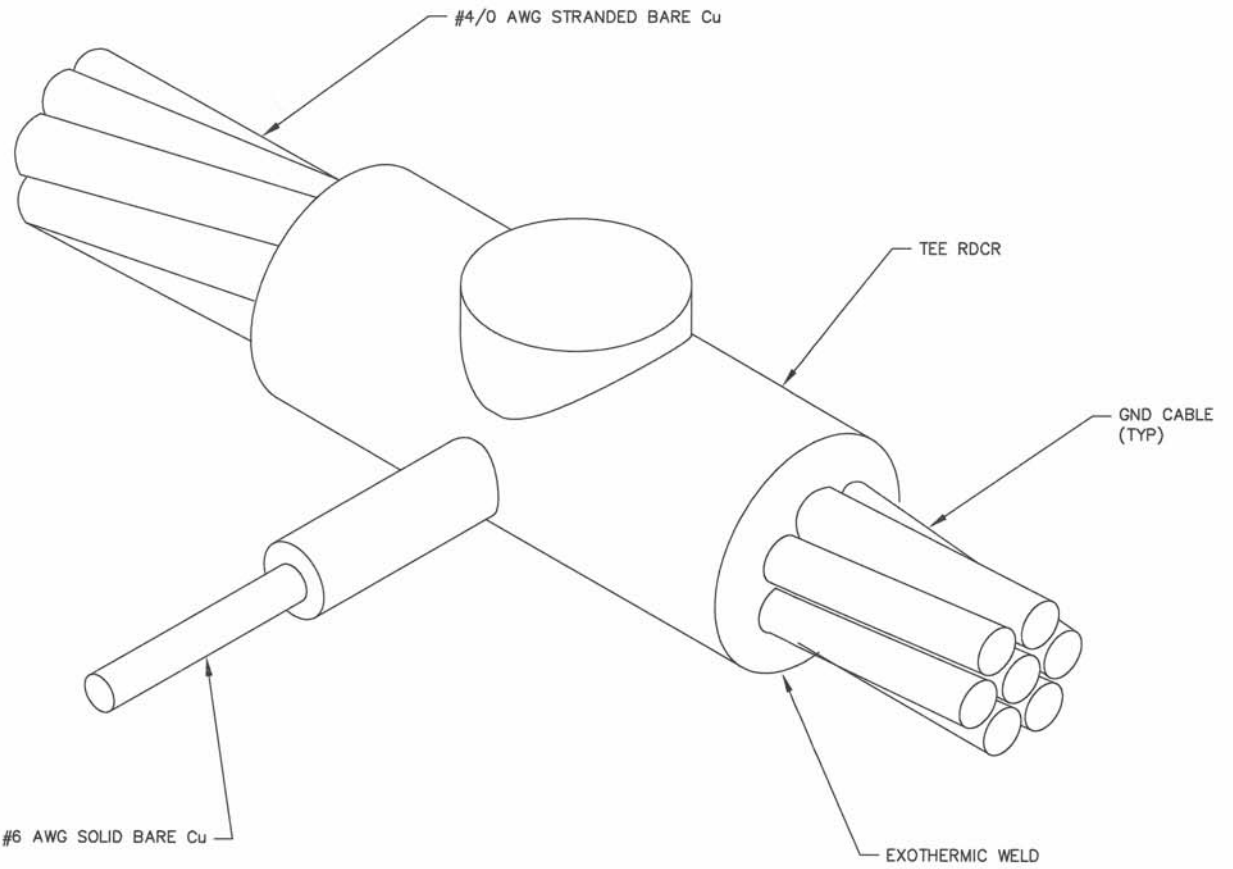
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DRAWN BY: <i>BERKNESS</i>
CHKD BY: <i>K ROSS/KR</i>
APPD BY: <i>Stephen C. Rem</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**26264**  
**GROUND CABLE TEE**  
**REDUCER #1 AWG**

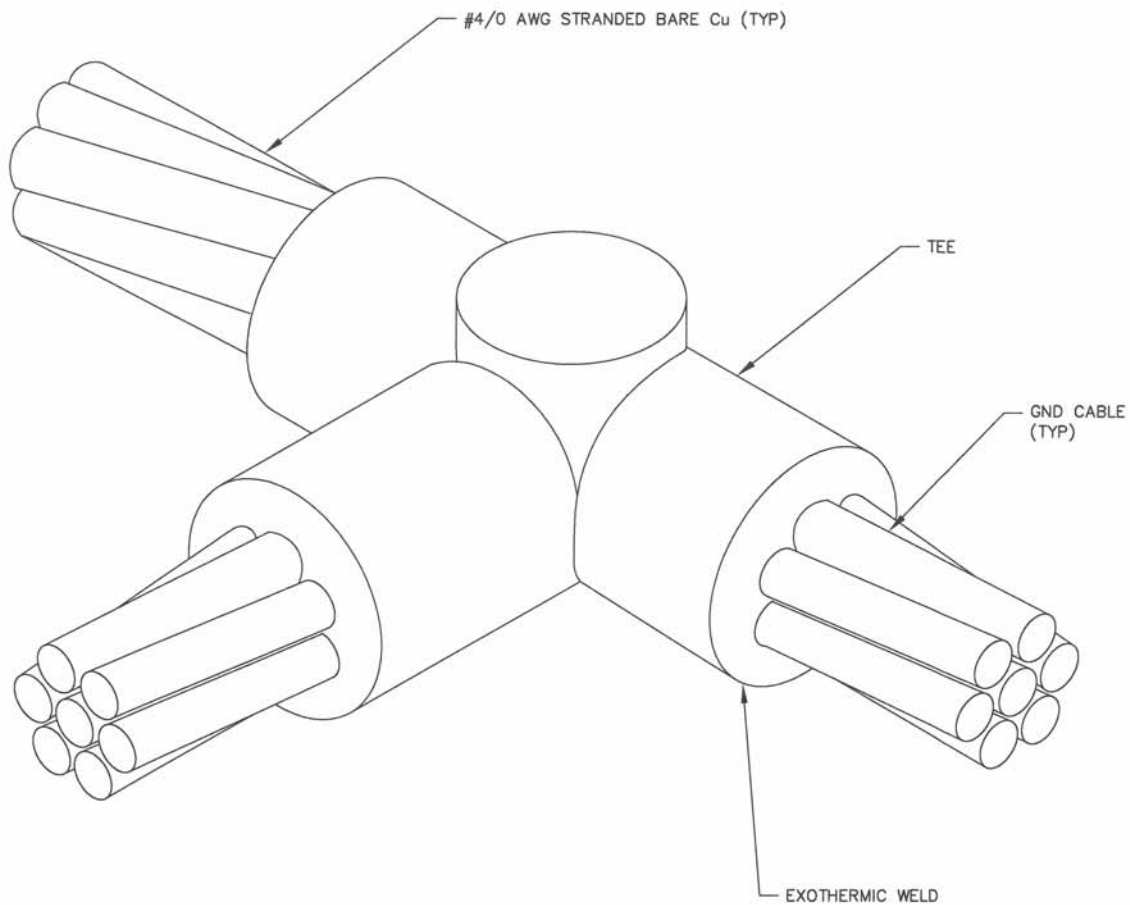

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DRAWN BY: BERKNESS  
 CHKD BY: K ROSS/KIR  
 APPD BY: Stephen C. Rem  
 ORIGINATION DATE: JANUARY 2017  
 REVISION DATE:

26265  
 GROUND CABLE TEE  
 REDUCER #6 AWG

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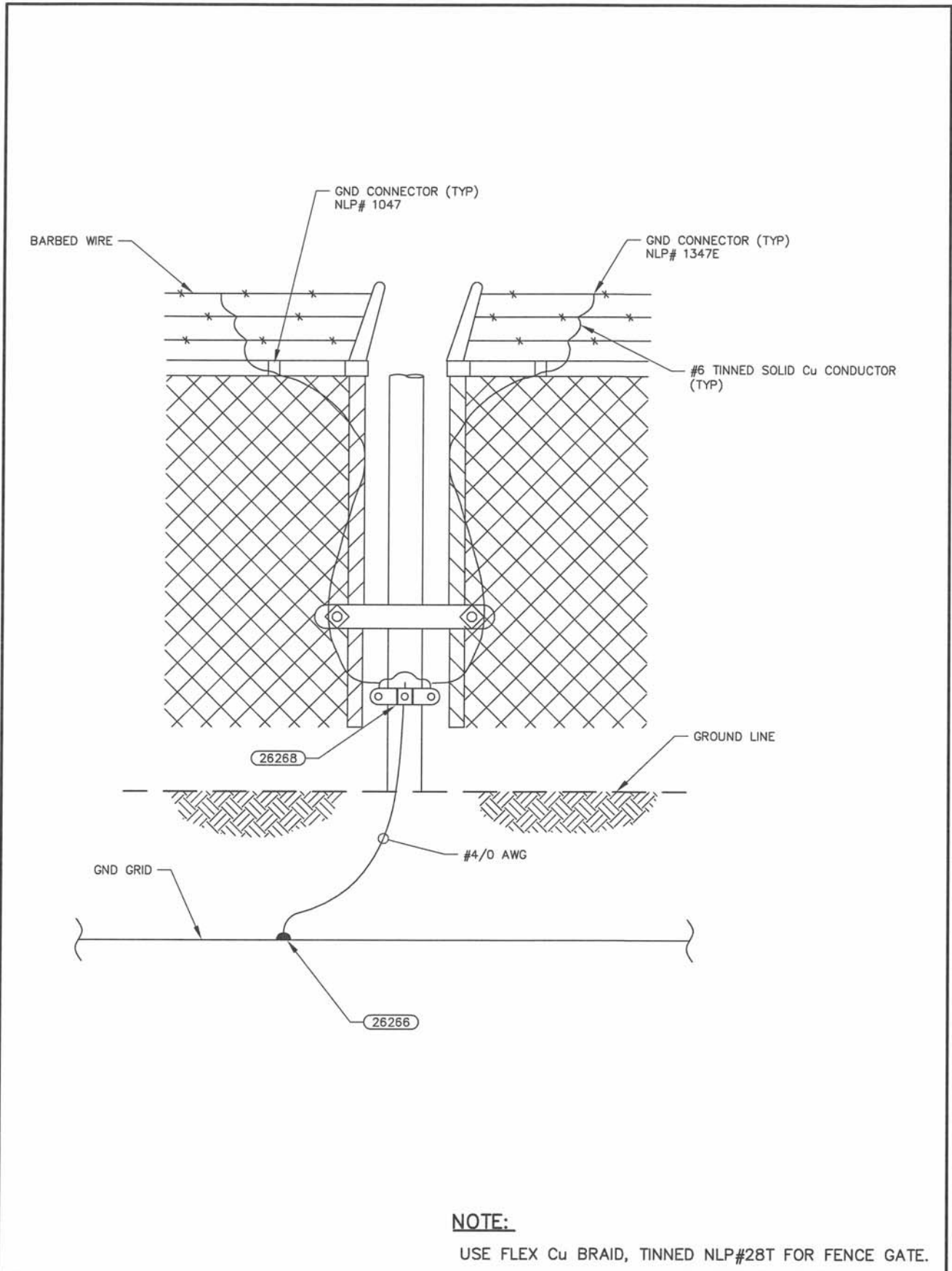


DRAWN BY: <i>BERKNESS</i>
CHKD BY: <i>K ROSS/KLR</i>
APPD BY: <i>Stephen C. Rose</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

26266  
GROUND CABLE TEE



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**NOTE:**

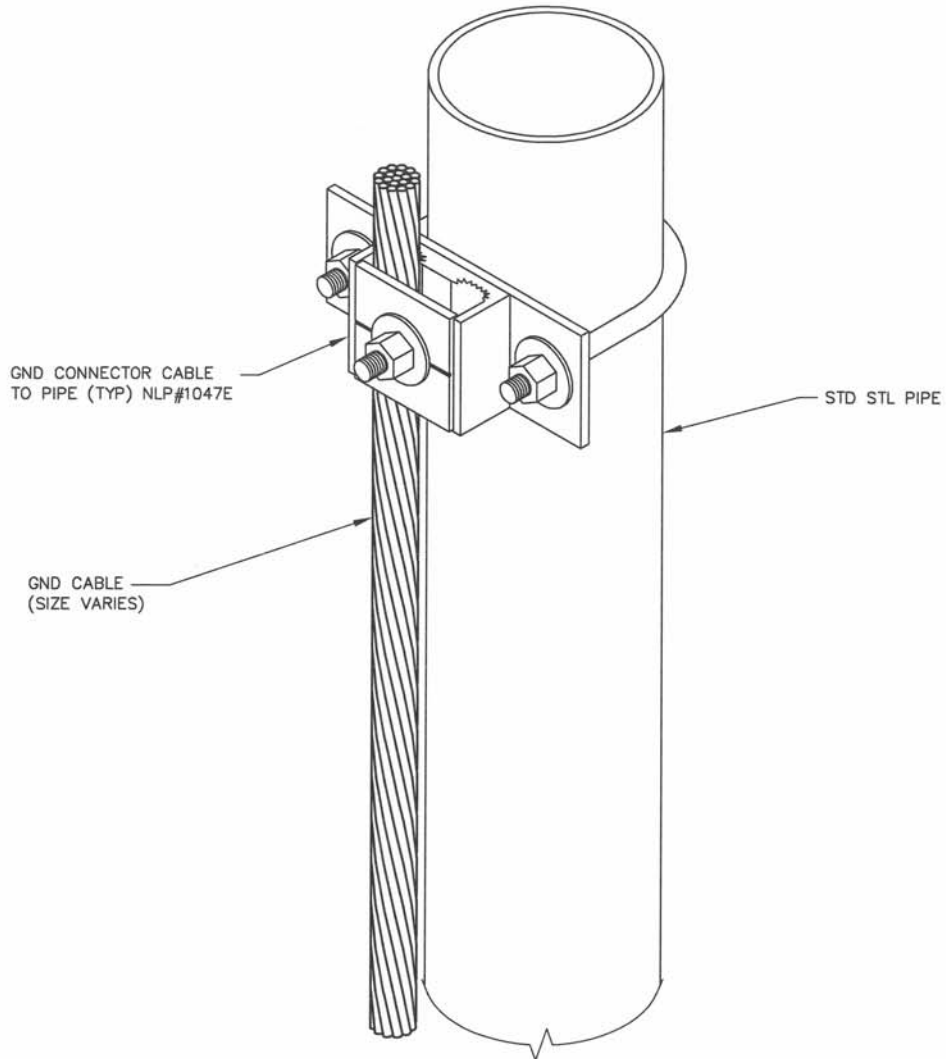
USE FLEX Cu BRAID, TINNED NLP#28T FOR FENCE GATE.

DRAWN BY: BERKNESS
CHKD BY: K ROSS/KJR
APPD BY: Stephen C. Ren
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**26267**  
**FENCE POST AND FABRIC**  
**GROUNDING**


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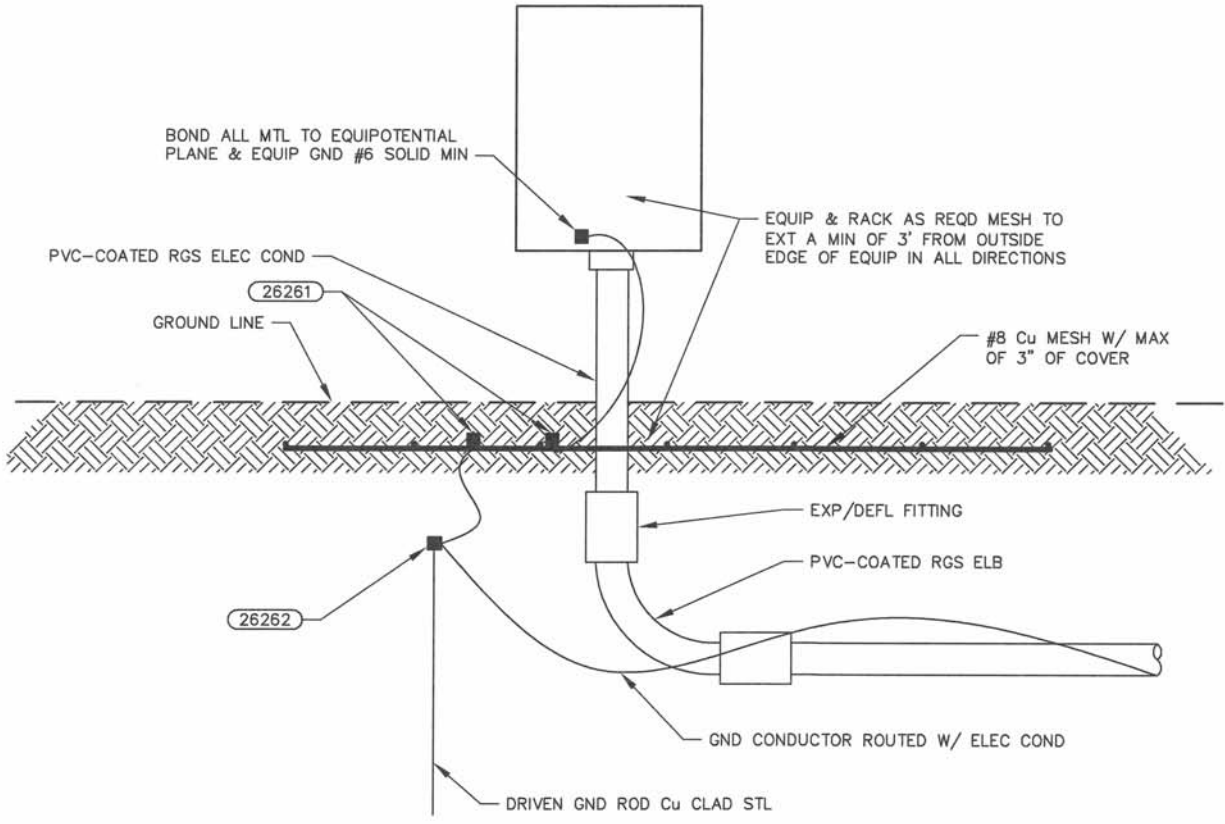




DRAWN BY: BERKNESS  
 CHKD BY: K ROSS/KR  
 APPD BY: Stephen C. Reun  
 ORIGINATION DATE: JANUARY 2017  
 REVISION DATE:

26268  
 RAILING AND POST  
 GROUNDING

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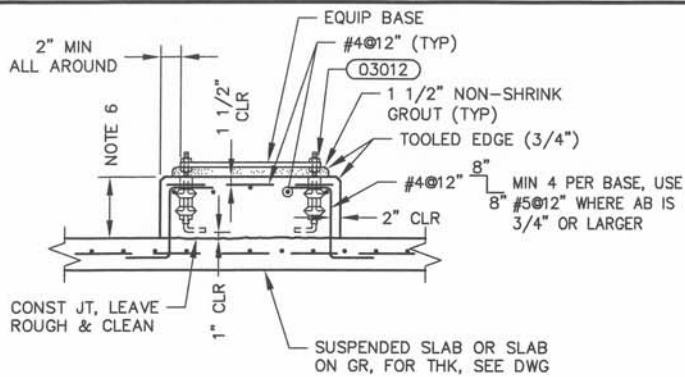


**NOTE:**  
 PROVIDE EQUIPOTENTIAL PLANE MEETING THE REQUIREMENTS OF NEC 682.33.

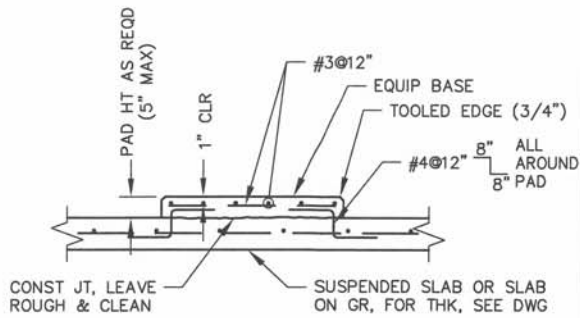
DRAWN BY: BERKNESS
CHKD BY: K ROSS/KUR
APPD BY: <i>Steph C. Ren</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

26269  
 EQUIPOTENTIAL PLANE FOR  
 EQUIPMENT

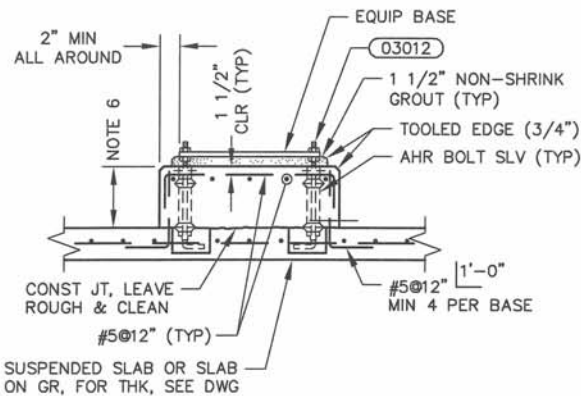
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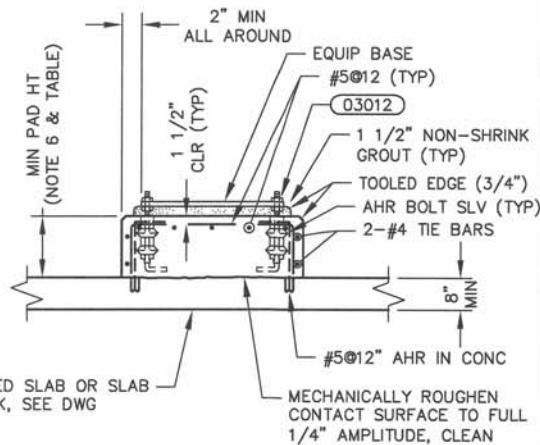
**TYPE A**



**TYPE B**



**TYPE C**



**TYPE D**

**NOTES:**

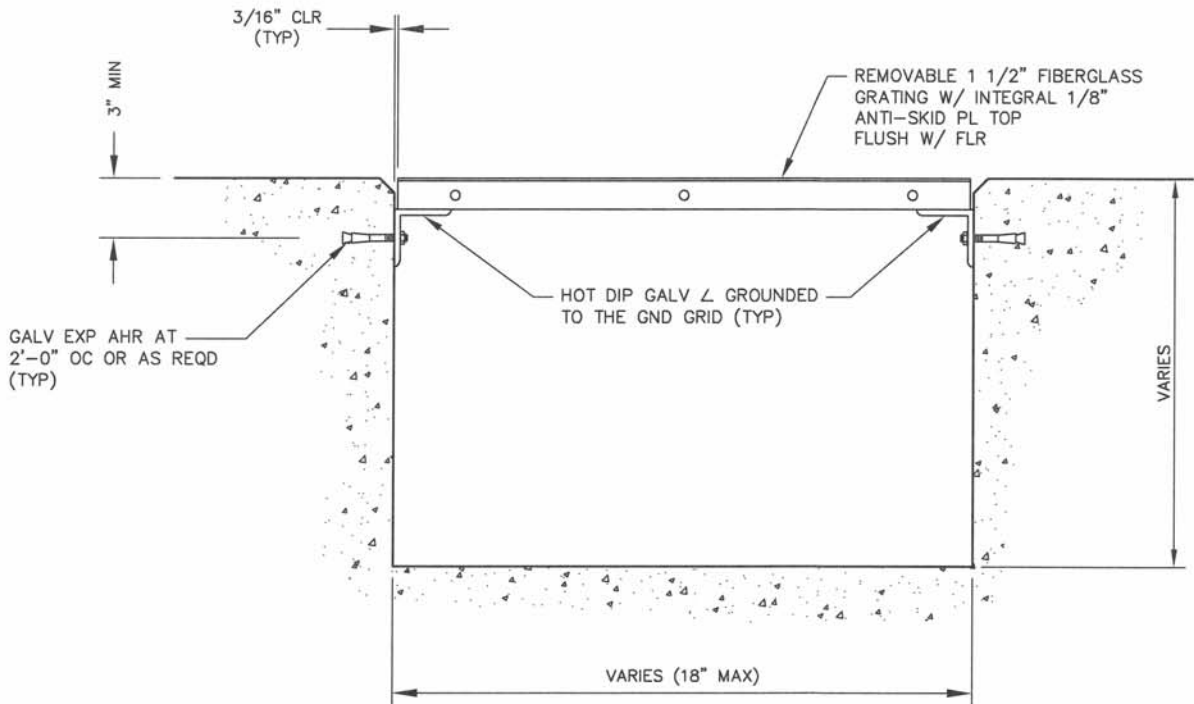
- PAD SIZE SHALL BE MINIMUM INDICATED OR AS SHOWN ON THE DRAWINGS OR AS INDICATED BY THE MANUFACTURER.
- THE SIZE, NUMBER, TYPE, LOCATION, AND THREAD PROJECTION OF THE ANCHOR BOLTS SHALL BE DETERMINED BY THE EQUIPMENT MANUFACTURER, AND SHALL BE AS APPROVED BY THE ENGINEER. ANCHOR BOLTS SHALL BE HELD IN POSITION WITH A ONE PIECE TEMPLATE, MATCHING THE BASE PLATE, WHILE PAD IS BEING POURED.
- ANCHOR BOLT SLEEVES SHALL BE USED TO PROVIDE THE ANCHOR BOLT A MINIMUM MOVEMENT OF 1/2-INCH IN ALL DIRECTIONS.
- EQUIPMENT BASES SHALL BE INSTALLED LEVEL.
- WEDGES OR SHIMS SHALL BE USED TO SUPPORT THE BASE WHILE THE NON-SHRINK GROUT IS PLACED. TEMPORARY LEVELING NUTS SHALL BE BACKED OFF. IF LEFT IN, THE WEDGES OR SHIMS SHALL NOT BE EXPOSED TO VIEW.
- HEIGHT OF PADS SHALL BE THE MINIMUM REQUIRED FOR ANCHOR BOLT CLEARANCE. PROVIDE PROPER ANCHOR BOLT PROJECTION OUT OF SLAB (SEE TABLE BELOW). WHERE EQUIPMENT OR PIPING ELEVATION REQUIRE A PAD HEIGHT LESS THAN THE MINIMUM SHOWN, USE TYPE B WITH BLOCKOUT.

AB $\phi$	1/2"	5/8"	3/4"	7/8"	1"	1 1/4"	1 3/8"	1 1/2"	1 3/4"	2"
MIN PAD HT	7"	8 1/2"	10"	11"	12 1/2"	15"	16 1/2"	18"	21"	24"

DRAWN BY: ALVARADO
CHKD BY: K ROSS/WR
APPD BY: Stephen C. Rom
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**26300  
CONCRETE  
EQUIPMENT PADS**

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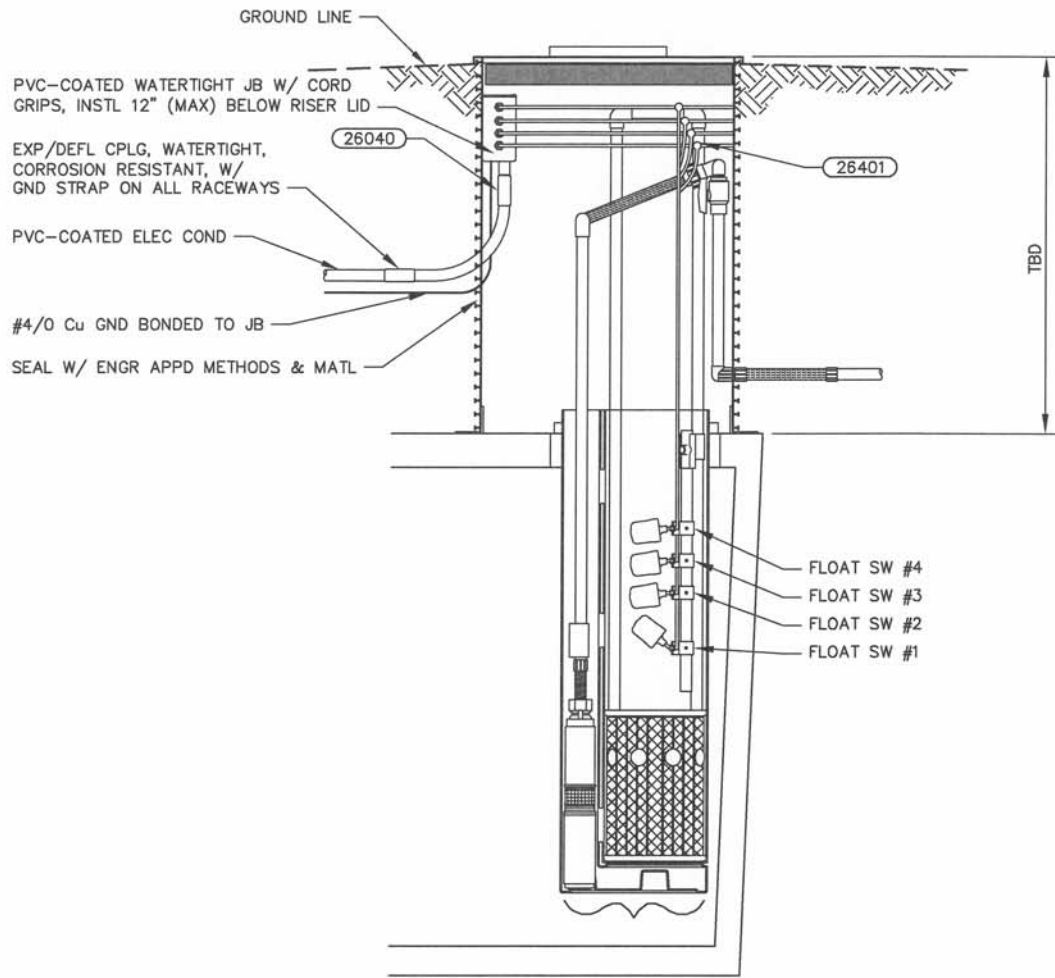


DRAWN BY: BERKNESS
CHKD BY: K ROSS/klr
APPD BY: Stephen C. Reem
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

26310  
CABLE FLOOR TRENCH

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FLOAT SWITCH	FUNCTION
FLOAT SW #4 LSHA	HIGH WATER ALARM
FLOAT SW #3 LSHH	LAG PUMP ON, HIGH WATER ALARM
FLOAT SW #2 LSH	LEAD PUMP ON
FLOAT SW #1 LSL	PUMP OFF

DRAWN BY: *BOWMAN*

CHKD BY: *K ROSS/KLR*

APPD BY: *Stephen C. Rem*

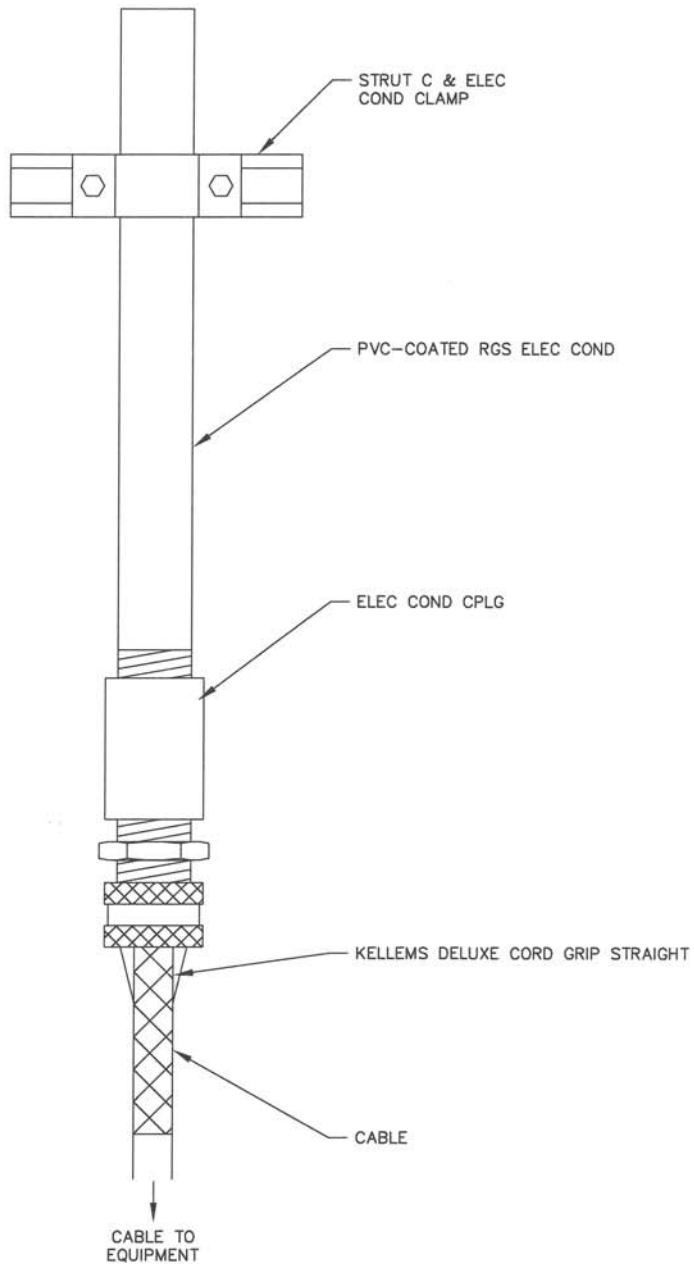
ORIGINATION DATE: JANUARY 2017

REVISION DATE:

**26400**  
**SUMP PIT CABLE SUPPORT**

**D DENVER WATER**

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DRAWN BY: *BOWMAN*

CHKD BY: *K ROSS/KR*

APPD BY: *Stephen C. Ream*

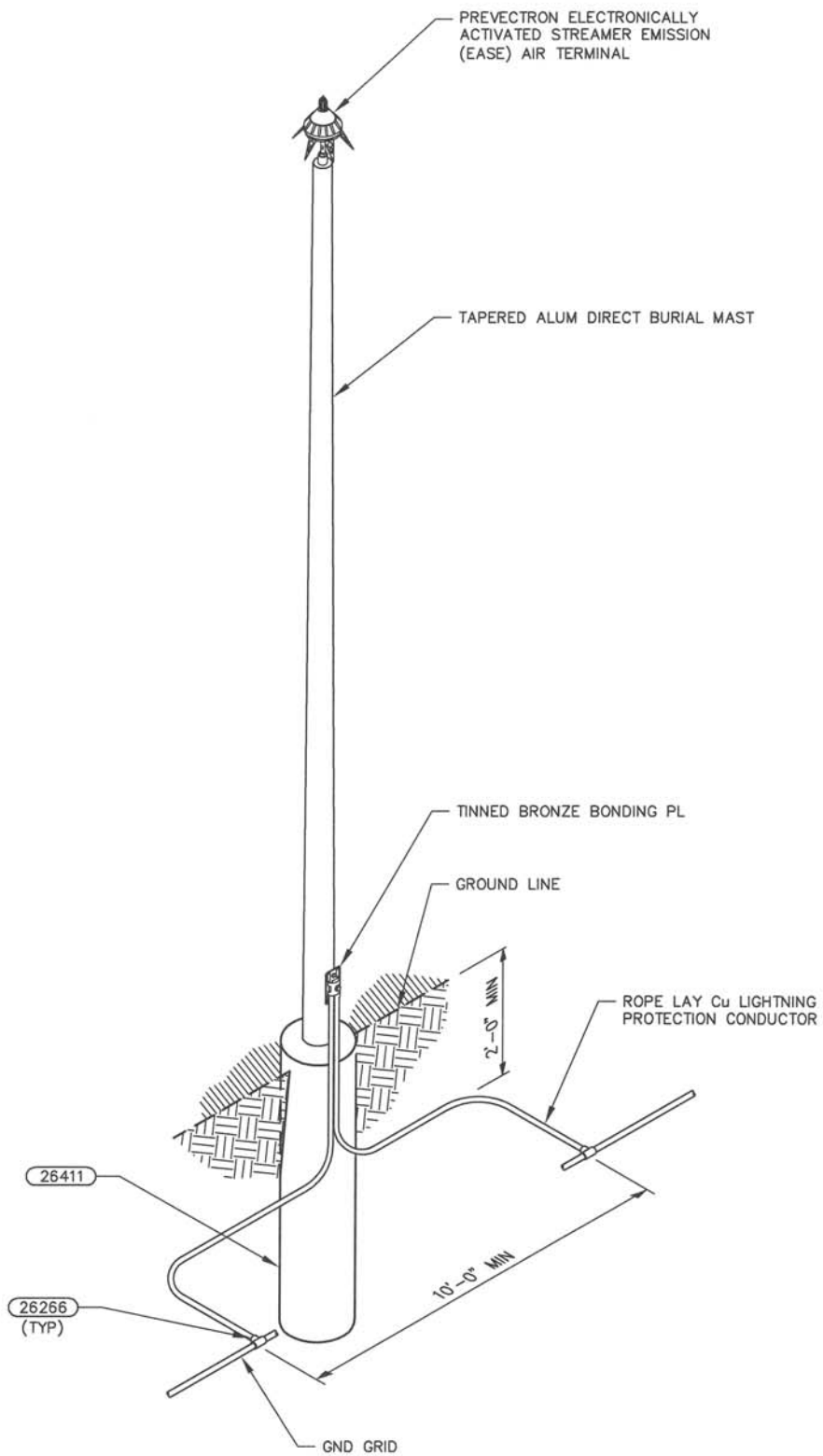
ORIGINATION DATE: *JANUARY 2017*

REVISION DATE:

26401  
CABLE SUPPORT

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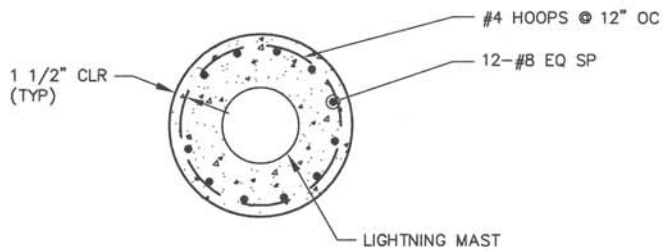


DRAWN BY: <i>BOWMAN</i>
CHKD BY: <i>K ROSS/KR</i>
APPD BY: <i>Stephen C. Ross</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

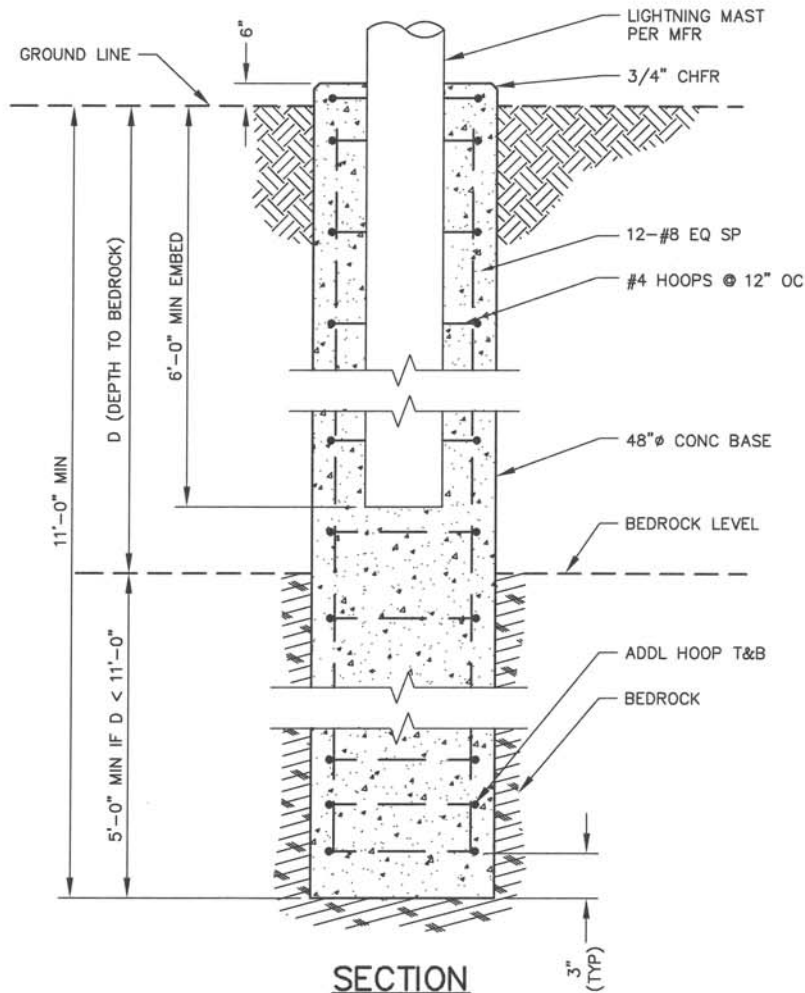
**26410**  
**LIGHTNING PROTECTION**  
**SYSTEM MAST**

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**PLAN**



**SECTION**

**NOTES:**

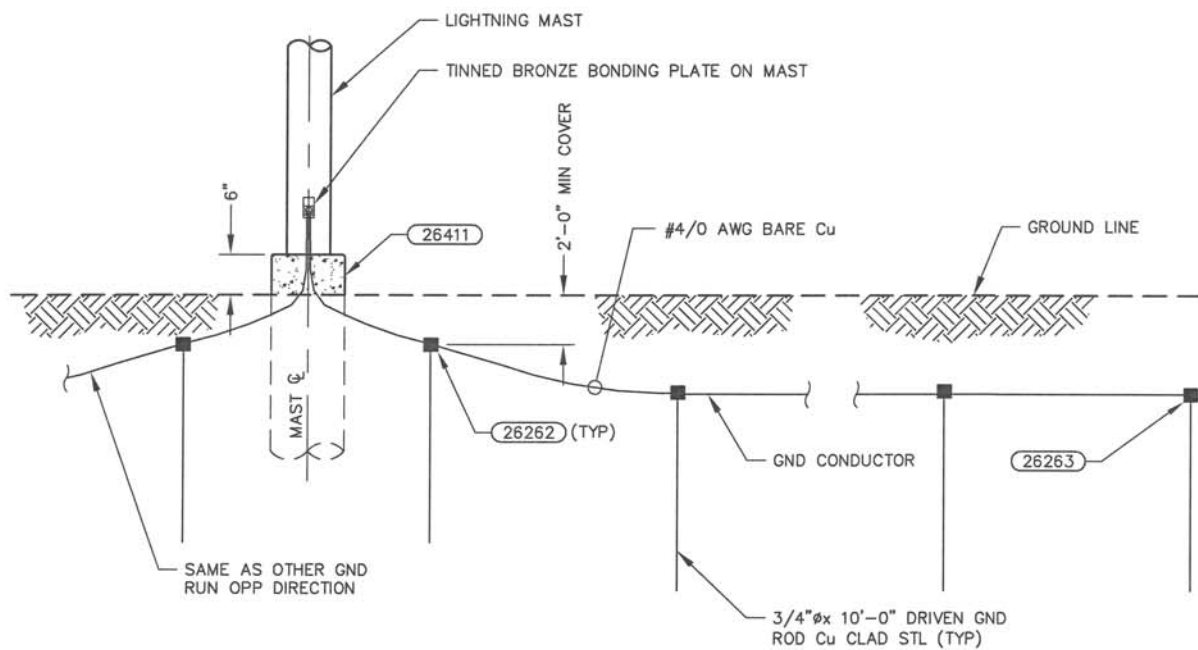
1. THE LIGHTNING PROTECTION INSTALLATION DETAILS ARE THE MINIMUM ESTIMATED REQUIREMENTS.
2. CALCULATIONS FOR CONCRETE BASE DIMENSIONS, REINFORCING STEEL SIZES, AND ANCHOR BOLT SIZES SHALL BE APPROVED BY ENGINEER, AUTHORITY HAVING JURISDICTION, AND MANUFACTURER. CALCULATIONS FOR CONCRETE BASE SHALL BE BASED ON 110-MILES PER HOUR WIND SPEED OR AS REQUIRED BY AUTHORITY HAVING JURISDICTION.

DRAWN BY: <i>BOWMAN</i>
CHKD BY: <i>K ROSS/KLR</i>
APPD BY: <i>Stephen C. Ren</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**26411**  
**LIGHTNING PROTECTION**  
**MAST SUPPORT**

  
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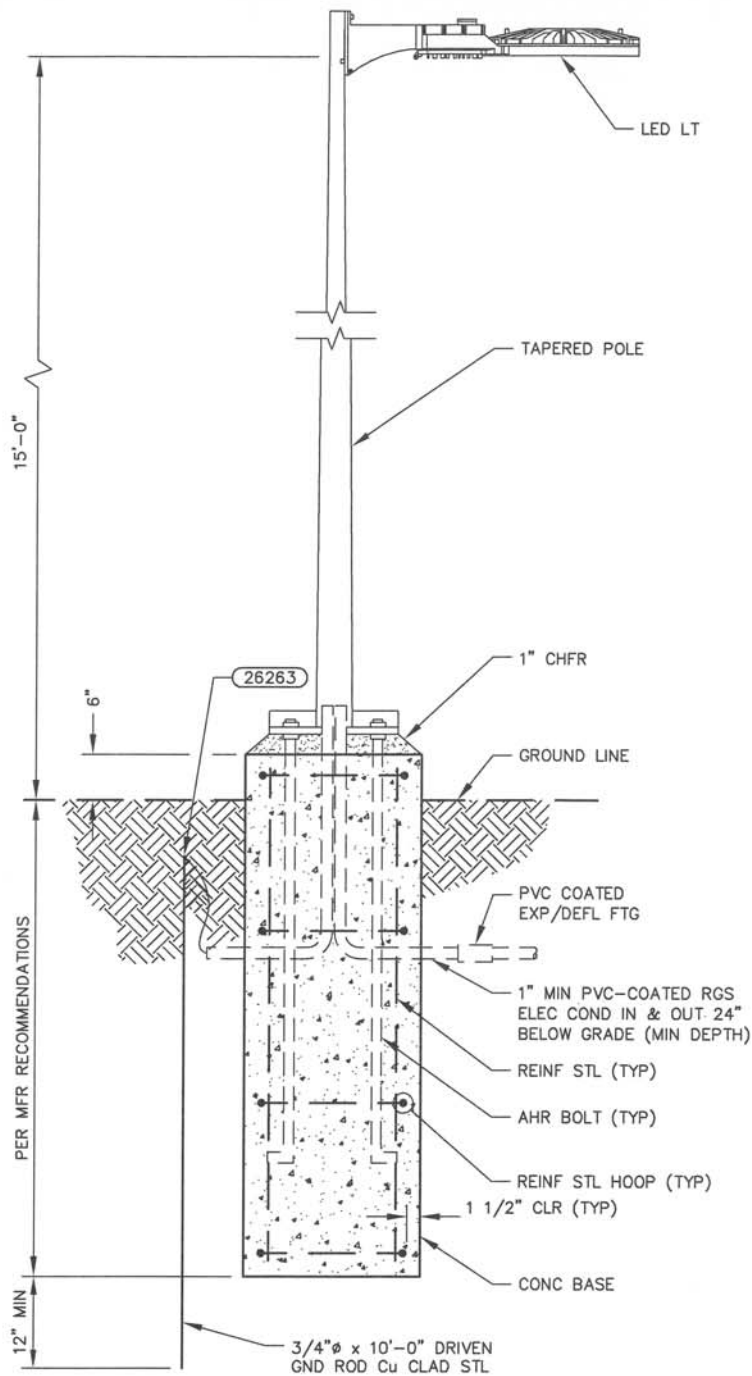
**NOTE:**

A MINIMUM OF 7 GROUND RODS PER DOWN CONDUCTOR SHALL BE INSTALLED AT 7-FOOT SPACING MINIMUM.

DRAWN BY: BERKNESS
CHKD BY: K ROSS/KR
APPD BY: Stephen C. Ran
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**26413**  
**LIGHTNING PROTECTION**  
**MAST GROUNDING**

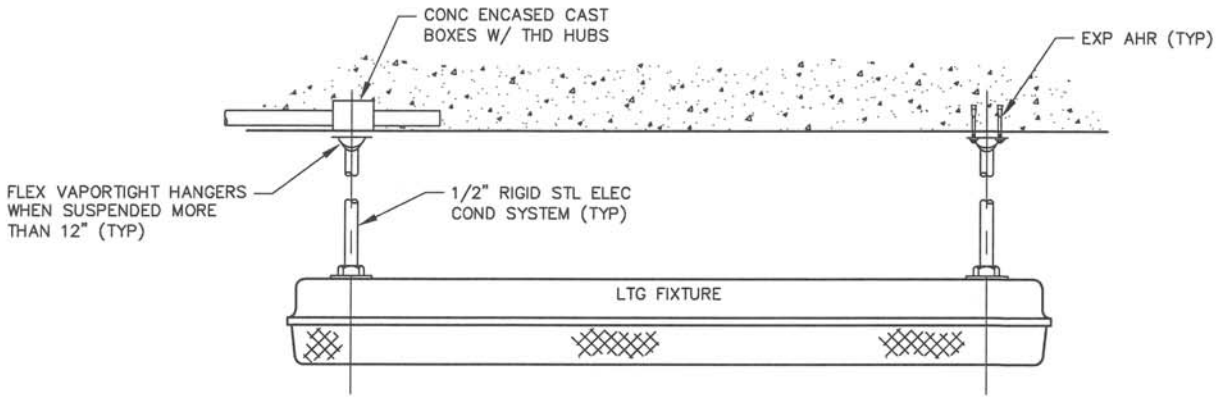
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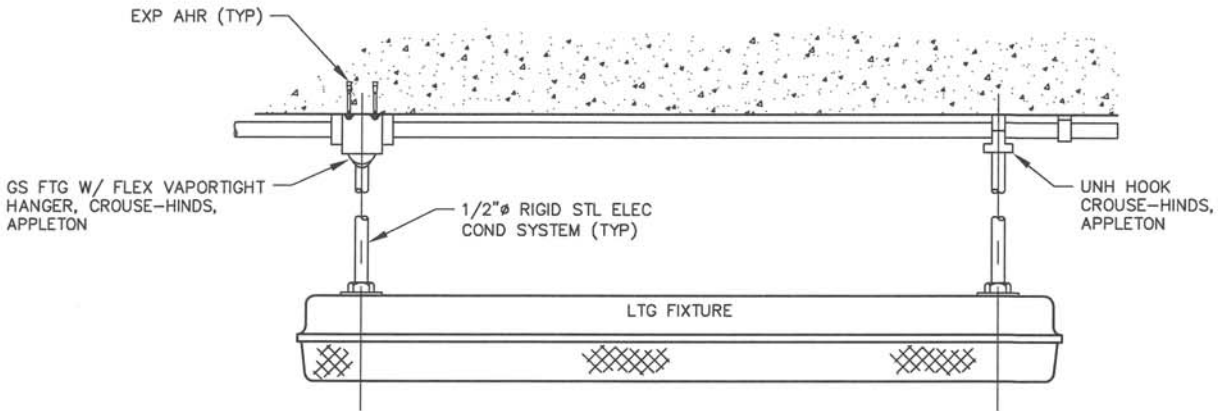
**NOTES:**

1. MOUNTING AND LEVELING BOLTS SHALL BE PLACED PER MANUFACTURERS TEMPLATE. PROVIDE BOLT COVERS. FILL MOUNTING PLATE VOID WITH NON-SHRINK GROUT AFTER LEVELING.
2. CALCULATIONS FOR CONCRETE BASE DIMENSIONS, REINFORCING STEEL SIZES, AND ANCHOR BOLT SIZES SHALL BE APPROVED BY ENGINEER, AUTHORITY HAVING JURISDICTION, AND MANUFACTURER. CALCULATIONS FOR CONCRETE BASE SHALL BE BASED ON 110-MILES PER HOUR WIND SPEED OR AS REQUIRED BY AUTHORITY HAVING JURISDICTION.

DRAWN BY: BERKNESS	<h2 style="margin: 0;">26414</h2> <h3 style="margin: 0;">LED LIGHT POLE</h3>	<p style="font-size: small; margin-top: 5px;">1600 West 12th Ave Denver, Colorado 80204-3412 T: 303.628.6000 F: 303.628.6851 denverwater.org</p>
CHKD BY: K ROSS/KR		
APPD BY: Stephen C. Reem		
ORIGINATION DATE: JANUARY 2017		
REVISION DATE:		



CONCEALED COND

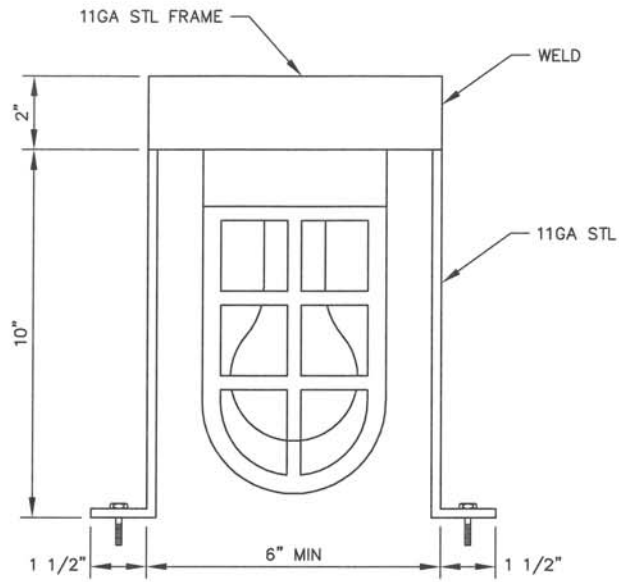


EXPOSED COND

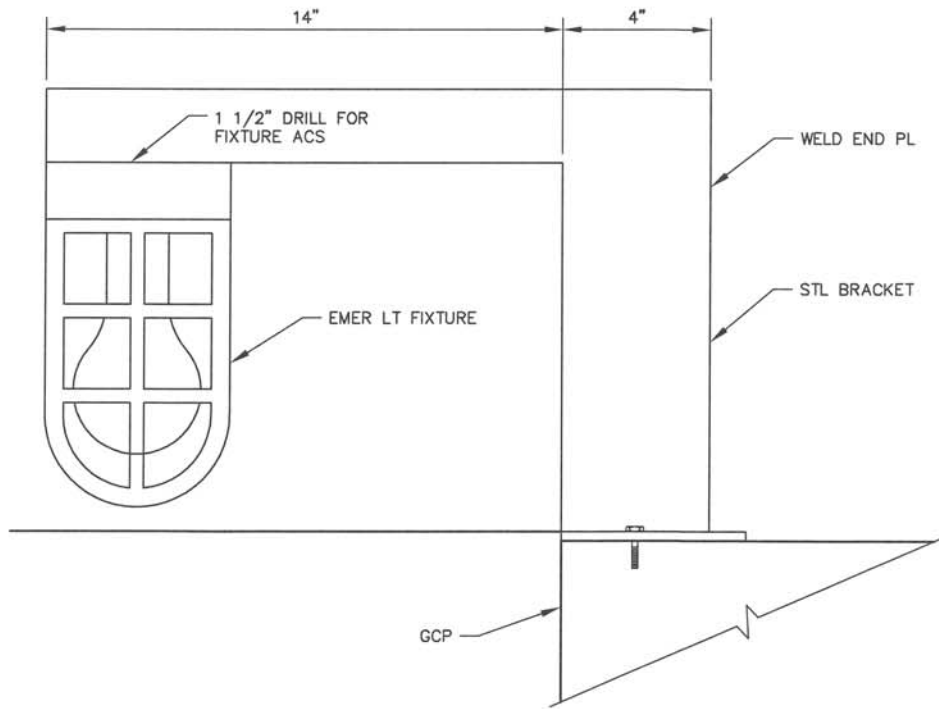
DRAWN BY: BERKNESS
CHKD BY: K ROSS/KRP
APPD BY: Stephen C. Ross
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

26501  
 FLUORESCENT FIXTURE  
 CEILING MOUNTED

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FRONT



SIDE

DRAWN BY: BERKNESS

CHKD BY: K ROSS/ KIR

APPD BY: Stephen C. Ream

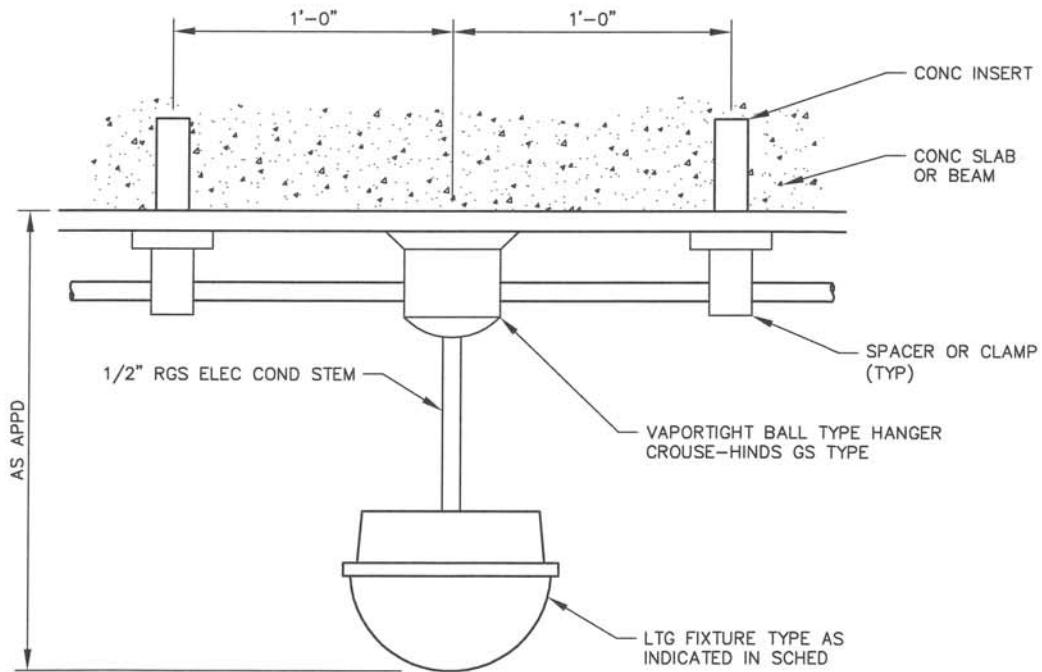
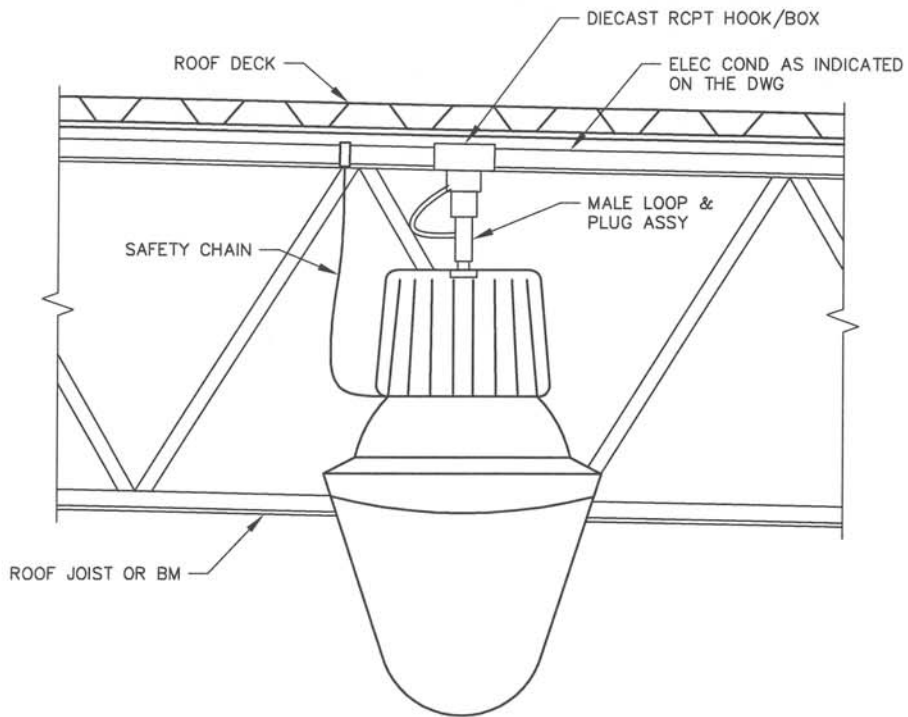
ORIGINATION DATE: JANUARY 2017

REVISION DATE:

26504  
 GENERATOR CONTROL  
 PANEL EMERGENCY  
 LIGHT FIXTURE BRACKET

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DRAWN BY: BERKNESS
CHKD BY: K ROSS/KR
APPD BY: Stephen C. Penn
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

26509  
 LOW-HIGH BAY LIGHT  
 FIXTURE INSTALLATION

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# WARNING

## Arc Flash and Shock Hazard Appropriate PPE Required

0' - 7" Arc Flash Boundary  
0.3 cal/cm<sup>2</sup> Incident Energy Arc Flash Hazard at 18 Inches

### Recommended Protection

Protective clothing, nonmelting or untreated natural fiber.  
Shirt (long sleeve) and pants (long) or coverall; Hearing protection;  
Face shield for projectile protection (AN); Safety glasses or safety goggles (SR)  
Heavy-duty leather gloves or rubber insulating gloves with leather protectors (AN).  
AN: As Needed, SR: Selection Required  
Reference NFPA 70E-2015 Table H.3(b) For Additional Details

0.48 kV Shock Hazard when cover is removed - Class 0 Voltage Gloves  
3' - 6" Limited Approach  
1' - 0" Restricted Approach  
0' - 1" Prohibited Approach

Equipment Name and Label Number: HW 120FLV AF1123  
Fed by: HW CB M4-1A-2  
WARNING: Changes in the system configuration or equipment settings may invalidate the label values and PPE requirements.

May-2015

### NOTES:

1. LABEL VALUES, EQUIPMENT NAME, AF####, AND SOURCE FEED NAME SHALL BE AS DETERMINED BY THE ELECTRICAL SYSTEMS ANALYSIS AND ENGINEER.
2. LABELS SHALL MEET ANSI Z535 REQUIREMENTS INCLUDING ORANGE COLOR IN WARNING RECTANGLE, AND YELLOW COLOR IN TRIANGLE.

DRAWN BY: ROMERO

CHKD BY: K ROSS/KLR

APPD BY: Stephen C. Rom

ORIGINATION DATE: JANUARY 2017

REVISION DATE:

26700  
ARC FLASH LESS THAN OR  
EQUAL TO 1.2 cal/cm<sup>2</sup> LABEL



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# WARNING

## Arc Flash and Shock Hazard Appropriate PPE Required

2' - 11" Arc Flash Boundary  
3.5 cal/cm<sup>2</sup> Incident Energy Arc Flash Hazard at 18 Inches

### Recommended Protection

Arc-rated clothing and equipment arc rating equal to or greater than the determined incident energy. Arc-rated long-sleeve shirt and arc-rated pants or arc-rated coverall or arc flash suit (SR); Arc-rated face shield and arc-rated balaclava or arc flash suit hood (SR); Arc-rated jacket, parka, or rainwear (AN); Hard hat Class G or E. Arc-rated hard hat liner (AN); Safety glasses or safety goggles (SR); Hearing protection; Heavy-duty leather gloves or rubber insulating gloves with leather protectors (SR); Leather footwear. AN: As Needed. SR: Selection Required.  
Reference NFPA 70E-2015 Table H.3(b) For Additional Details.

0.208 kV Shock Hazard when cover is removed - Class 00 Voltage Gloves  
3' - 6" Limited Approach  
Avoid Contact Restricted Approach  
Avoid Contact Prohibited Approach

Equipment Name and Label Number: FP 2NDFL AF1412  
Fed by: FP M4 DP

WARNING: Changes in the system configuration or equipment settings may invalidate the label values and PPE requirements.

May-2015

### NOTES:

1. LABEL VALUES, EQUIPMENT NAME, AF####, AND SOURCE FEED NAME SHALL BE AS DETERMINED BY THE ELECTRICAL SYSTEMS ANALYSIS AND ENGINEER.
2. LABELS SHALL MEET ANSI Z535 REQUIREMENTS INCLUDING ORANGE COLOR IN WARNING RECTANGLE, AND YELLOW COLOR IN TRIANGLE.

DRAWN BY: ROMERO

CHKD BY: K ROSS/KR

APPD BY: Stephen C. Roman

ORIGINATION DATE: JANUARY 2017

REVISION DATE:

26701  
ARC FLASH GREATER THAN  
1.2 TO 12 cal/cm<sup>2</sup> LABEL



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# WARNING

## Arc Flash and Shock Hazard Appropriate PPE Required

6' - 2" Arc Flash Boundary  
12.1 cal/cm<sup>2</sup> Incident Energy Arc Flash Hazard at 18 Inches

### Recommended Protection

Arc-rated clothing and equipment arc rating equal to or greater than the determined incident energy. Arc-rated long-sleeve shirt and arc-rated pants or arc-rated coverall and/or arc flash suit (SR); Arc-rated arc flash suit hood; Arc-rated gloves; Arc-rated jacket, parka, or rainwear (AN); Hard hat Class G or E. Arc-rated hard hat liner (AN); Safety glasses or safety goggles (SR); Hearing protection; Arc-rated gloves or rubber insulating gloves with leather protectors (SR); Leather footwear.

AN: As Needed. SR: Selection Required.

Reference NFPA 70E-2015 Table H.3(b) For Additional Details.

0.208 kV Shock Hazard when cover is removed - Class 00 Voltage Gloves  
3' - 6" Limited Approach  
Avoid Contact Restricted Approach  
Avoid Contact Prohibited Approach

Equipment Name and Label Number: FP L4 AF1367

Fed by: FP CB DP4 61-65

**WARNING:** Changes in the system configuration or equipment settings may invalidate the label values and PPE requirements.

May-2015

### NOTES:

1. LABEL VALUES, EQUIPMENT NAME, AF####, AND SOURCE FEED NAME SHALL BE AS DETERMINED BY THE ELECTRICAL SYSTEMS ANALYSIS AND ENGINEER.
2. LABELS SHALL MEET ANSI Z535 REQUIREMENTS INCLUDING ORANGE COLOR IN WARNING RECTANGLE, AND YELLOW COLOR IN TRIANGLE.

DRAWN BY: ROMERO

CHKD BY: K ROSS/KLR

APPD BY: Stephen C. Rom

ORIGINATION DATE: JANUARY 2017

REVISION DATE:

26702  
ARC FLASH GREATER THAN  
12 TO 40 cal/cm<sup>2</sup> LABEL



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# WARNING

## Arc Flash and Shock Hazard Appropriate PPE Required

17' - 4" Arc Flash Boundary  
66.6 cal/cm<sup>2</sup> Incident Energy Arc Flash Hazard at 18 Inches

### Recommended Protection

**Do Not Work on Energized Equipment**

0.208 kV Shock Hazard when cover is removed

**Do Not Remove Cover if Equipment is Energized**

Equipment Name and Label Number: QC EM DS AF1243

Fed by: FS DS3-A

WARNING: Changes in the system configuration or equipment settings may invalidate the label values and PPE requirements.

May-2015

### NOTES:

1. LABEL VALUES, EQUIPMENT NAME, AF####, AND SOURCE FEED NAME SHALL BE AS DETERMINED BY THE ELECTRICAL SYSTEMS ANALYSIS AND ENGINEER.
2. LABELS SHALL MEET ANSI Z535 REQUIREMENTS INCLUDING ORANGE COLOR IN WARNING RECTANGLE, AND YELLOW COLOR IN TRIANGLE.

DRAWN BY: ROMERO

CHKD BY: K ROSS/KR

APPD BY: Stephen C. Rem

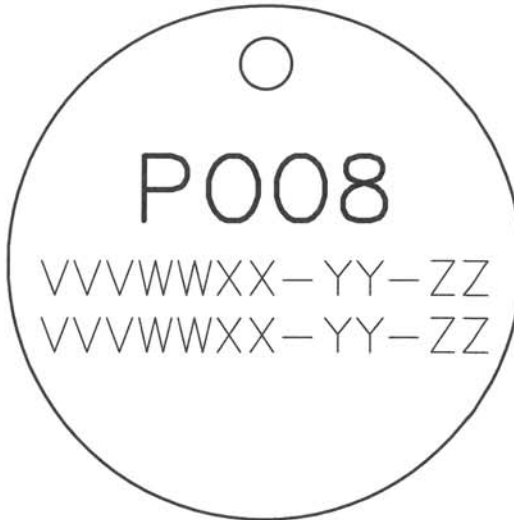
ORIGINATION DATE: JANUARY 2017

REVISION DATE:

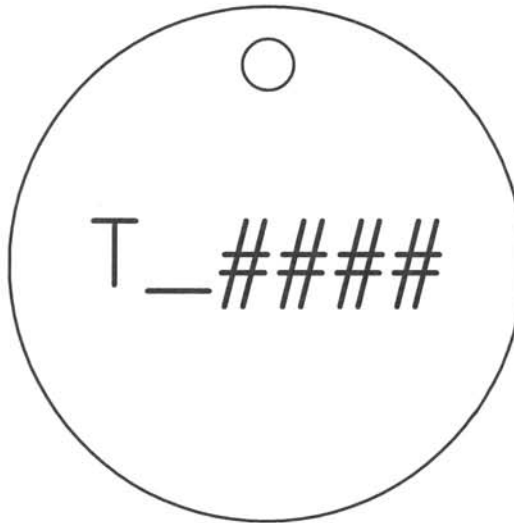
26703  
ARC FLASH ABOVE  
40 cal/cm<sup>2</sup> LABEL



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CONDUIT ID



TEST STATION ID

NOTES:

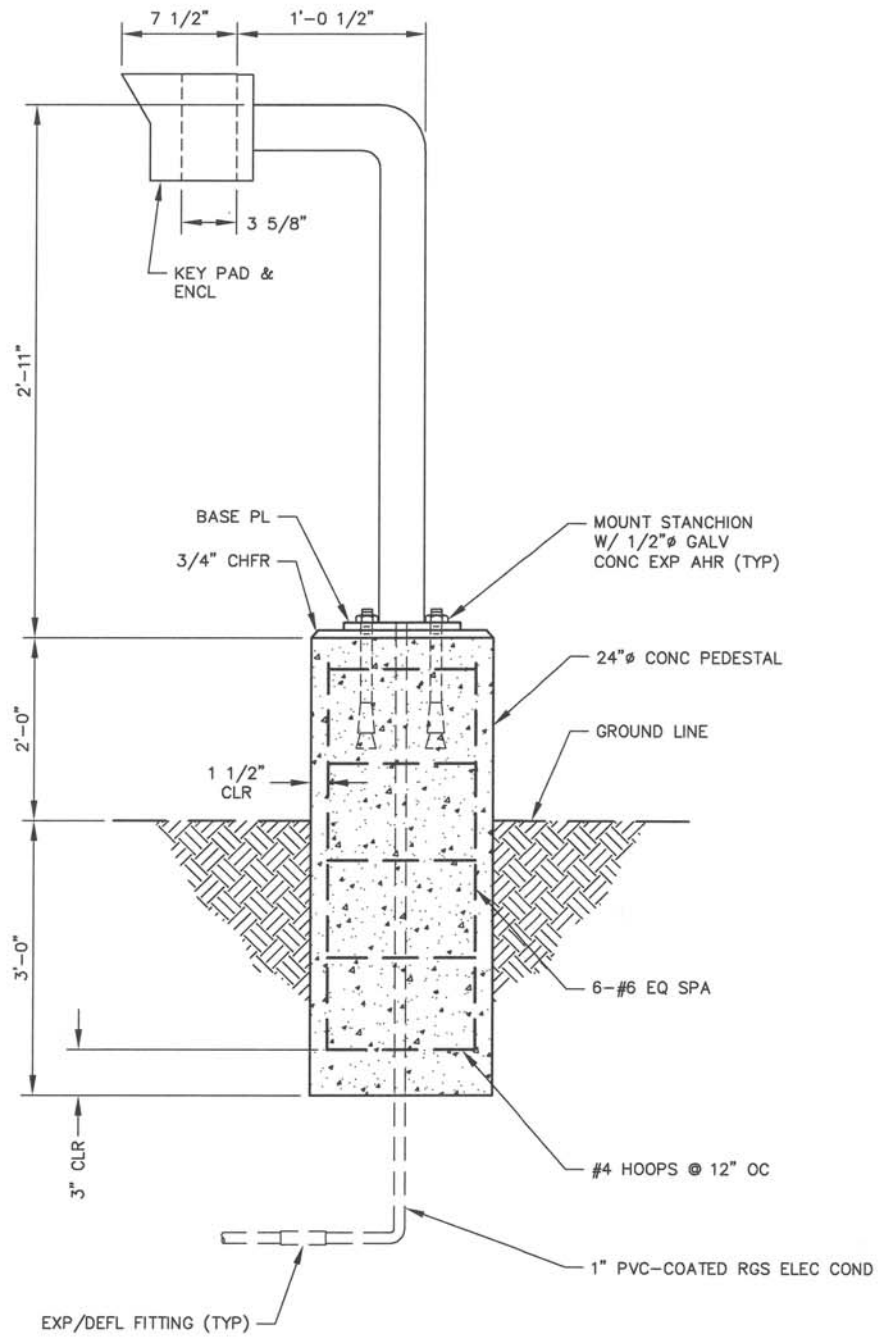
TEXT: 0.188-INCH HEADER  
0.11-INCH TEXT  
TEXT CENTERED ON TAG

TAG: 0.125-INCH THICKNESS  
LASER ENGRAVED STAINLESS STEEL  
1.5-INCH DIAMETER

DRAWN BY: BERKNESS
CHKD BY: K ROSS/ <i>KR</i>
APPD BY: <i>Stephen C. Rosen</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

26706  
CONDUIT AND TEST STATION  
ID TAGS

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DRAWN BY: BERKNESS
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Penn
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

28100  
GATE SECURITY KEYPAD

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DR CONTACT REQUIRES A  
3/4"Ø HOLE IN DR FRAME

SCRAMBLE PROX READER

ELEC HINGE

KEYPAD - BACK  
BOX SURFACE MTD  
ON EXT W/ 1/4"  
AHR (TYP)

ELEC MORTISE LOCK

1/2"Ø ELEC  
COND

4" JB W/ MELM3

3/4"Ø ELEC  
COND

TO SCP

58"

DRAWN BY: BERKNESS

CHKD BY: K ROSS/KLR

APPD BY: Stephen C. Penn

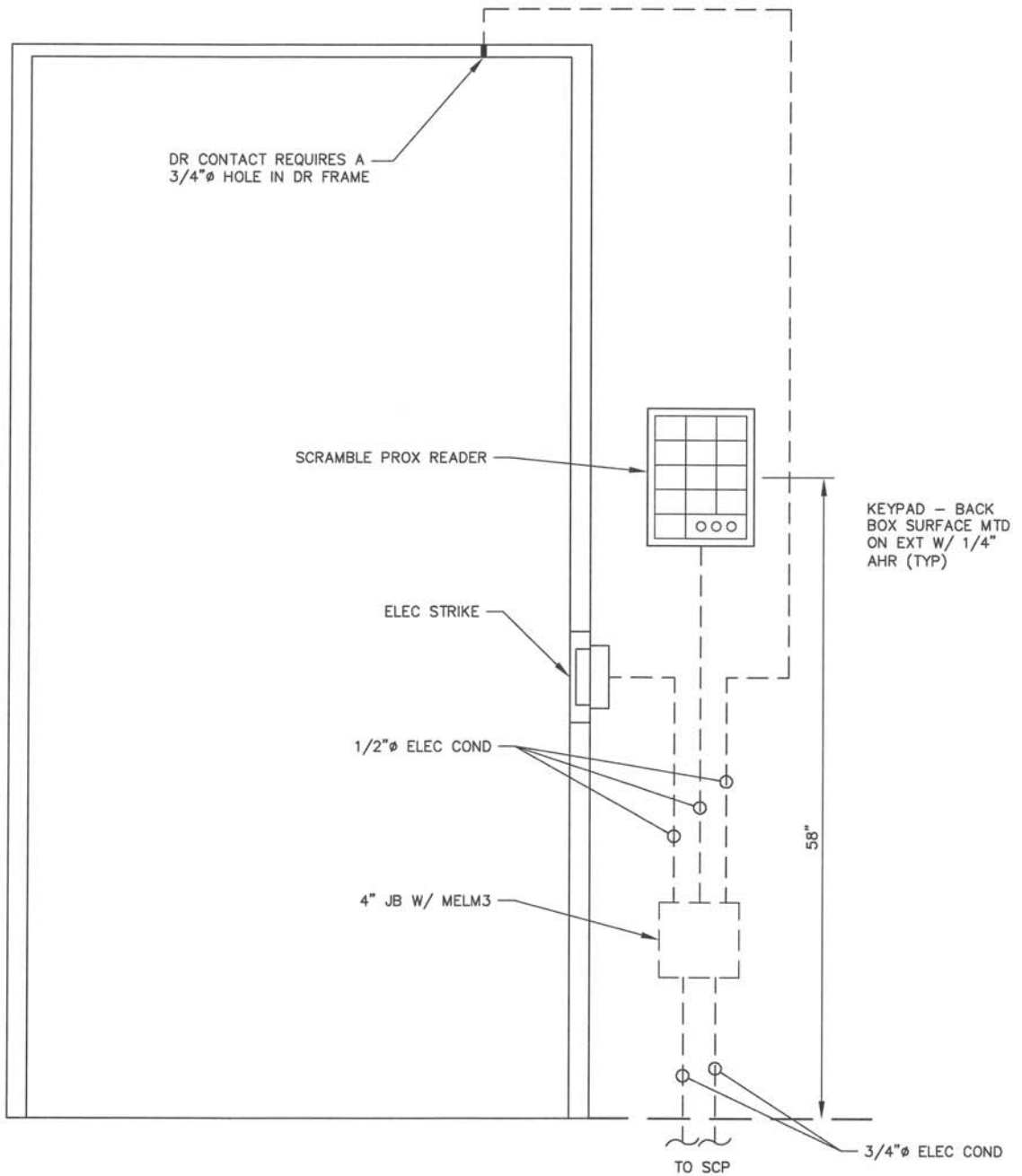
ORIGINATION DATE: JANUARY 2017

REVISION DATE:

28105  
SECURITY-SCP DOOR

**D DENVER WATER**

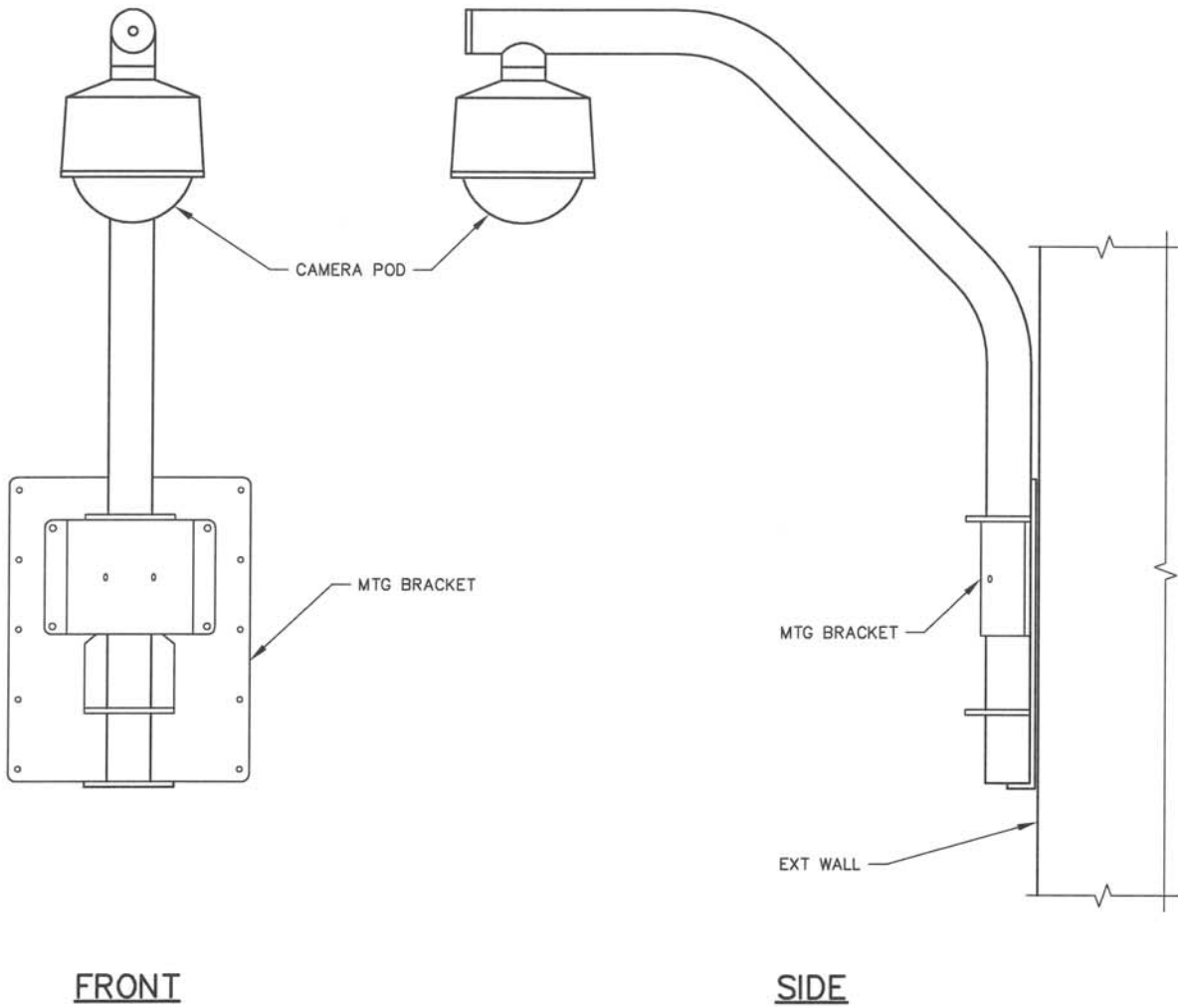
1600 West 12th Ave  
Denver, Colorado 80204-3412  
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F: 303.628.6851  
denverwater.org



DRAWN BY: BERKNESS
CHKD BY: K ROSS/WR
APPD BY: Stephen C. Ram
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

28109  
 SECURITY DOOR WITH  
 ELECTRIC STRIKE

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**NOTES:**

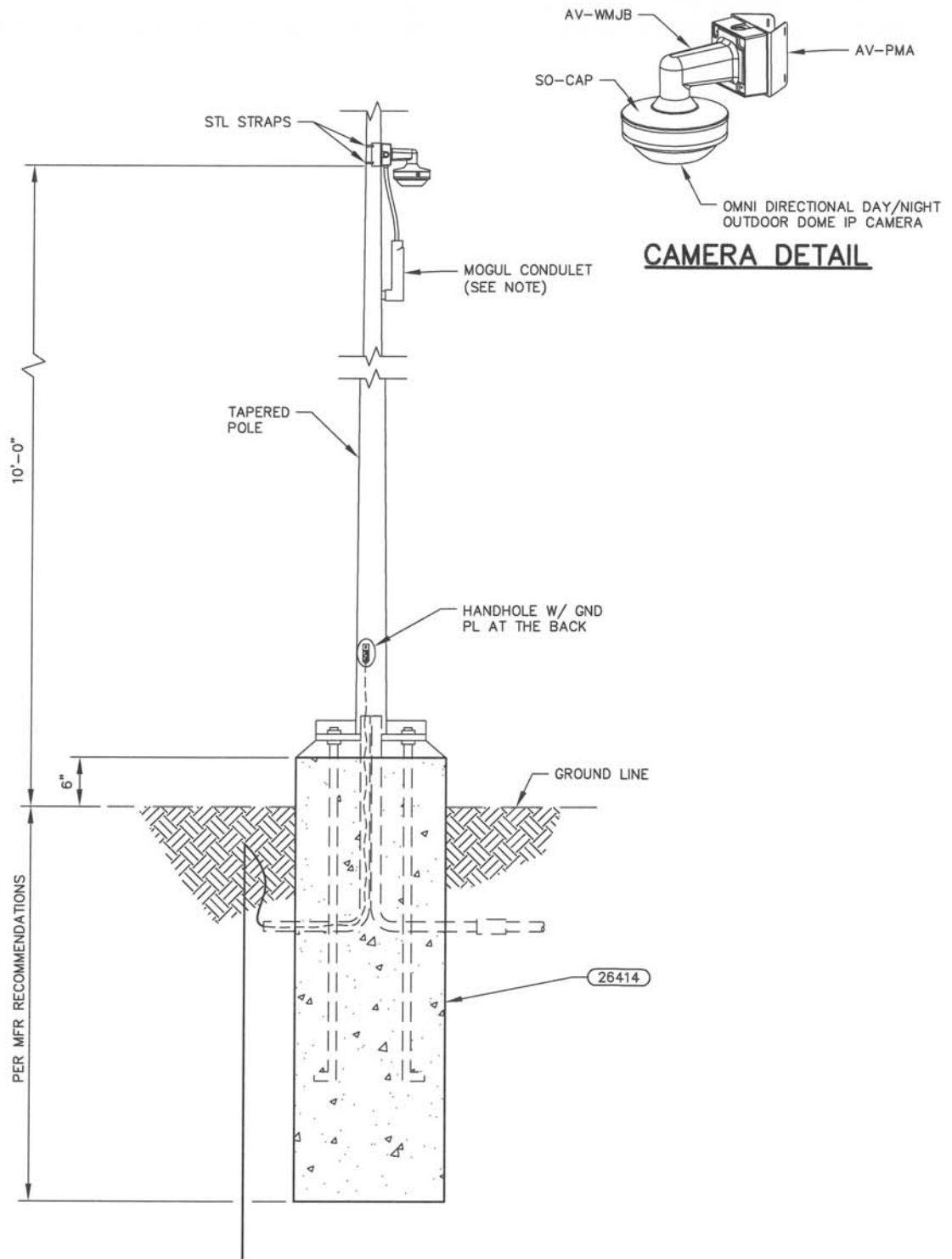
1. MOUNTED AT TOP OF WALL.
2. USE ANGLE BRACKET IF MOUNTED ON CORNER.

DRAWN BY: <i>BOWMAN</i>
CHKD BY: <i>K ROSS/KLR</i>
APPD BY: <i>Stephen C. Ren</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**28112  
SECURITY CAMERA  
WALL MOUNT**

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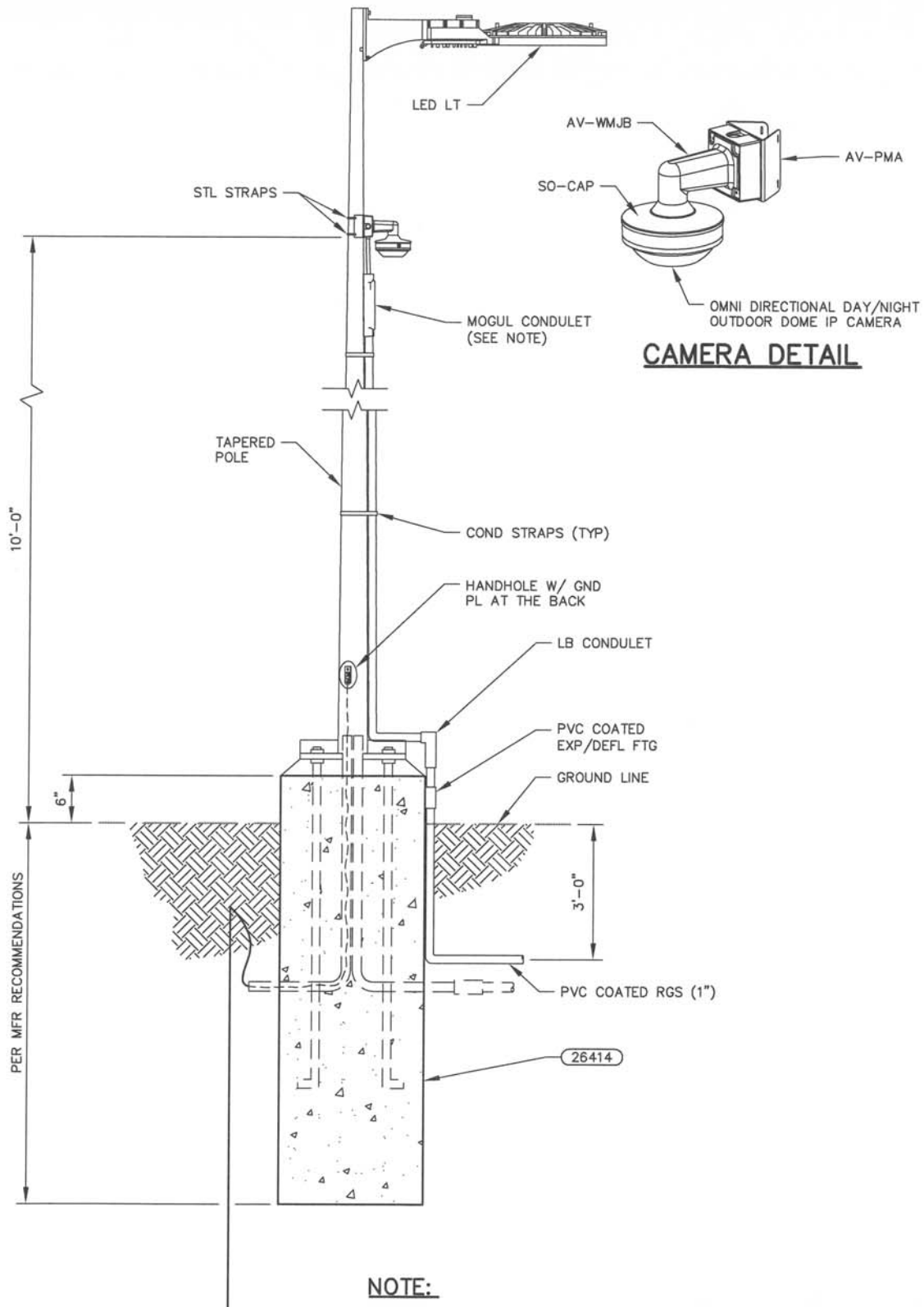
**NOTE:**

INSTALL AXIS T8061 ETHERNET SURGE PROTECTOR INSIDE MOGUL CONDULET. CONNECT THE GROUND STRAP FROM SURGE PROTECTOR TO THE LIGHT POLE GROUND.

DRAWN BY: ROMERO
CHKD BY: K ROSS/vlr
APPD BY: Stephen C. Rem
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**28113  
OUTDOOR POLE MOUNTED  
CAMERA**

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**NOTE:**

INSTALL AXIS T8061 ETHERNET SURGE PROTECTOR INSIDE MOGUL CONDULET. CONNECT THE GROUND STRAP FROM SURGE PROTECTOR TO THE LIGHT POLE GROUND.

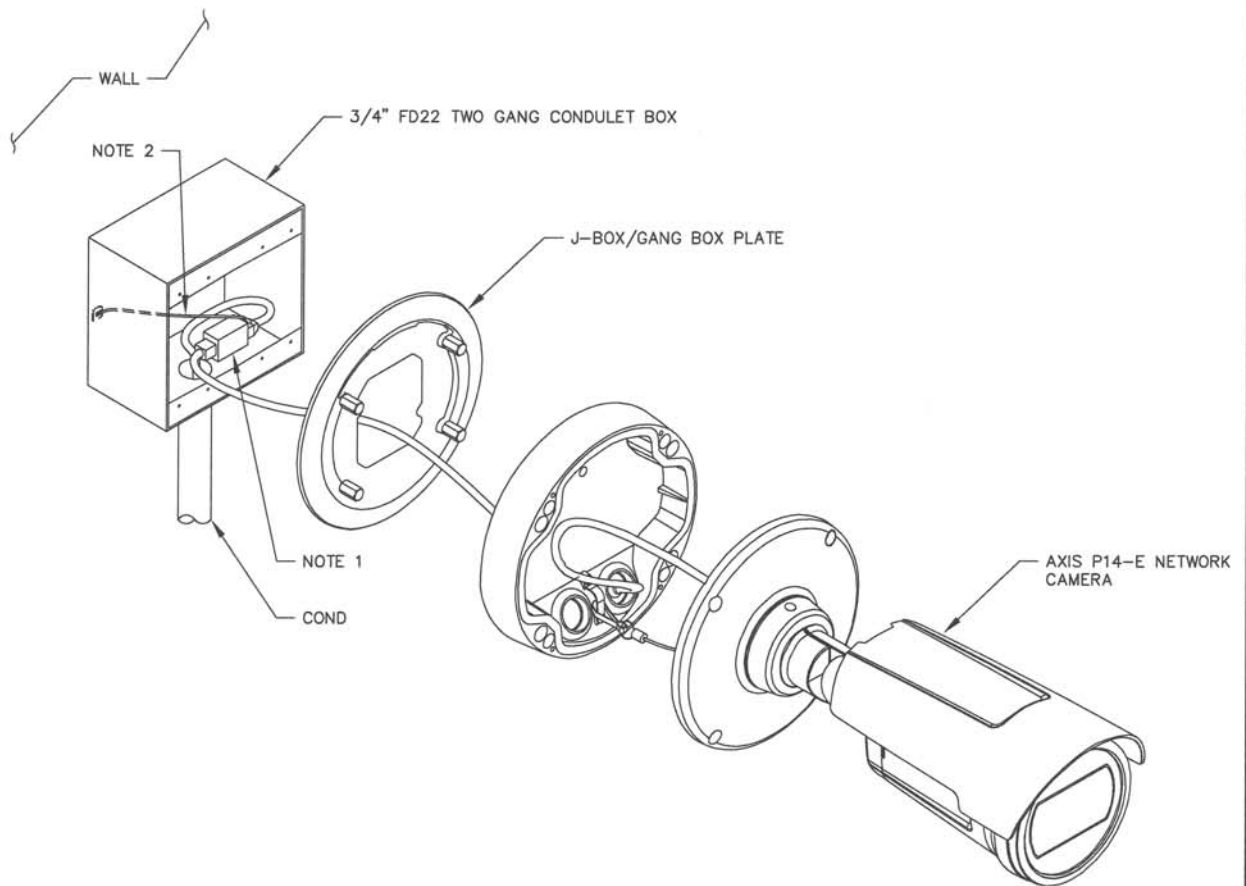
DRAWN BY: ROMERO
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Rem
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**28114**  
**OUTDOOR POLE MOUNTED**  
**CAMERA WITH LED LIGHT**

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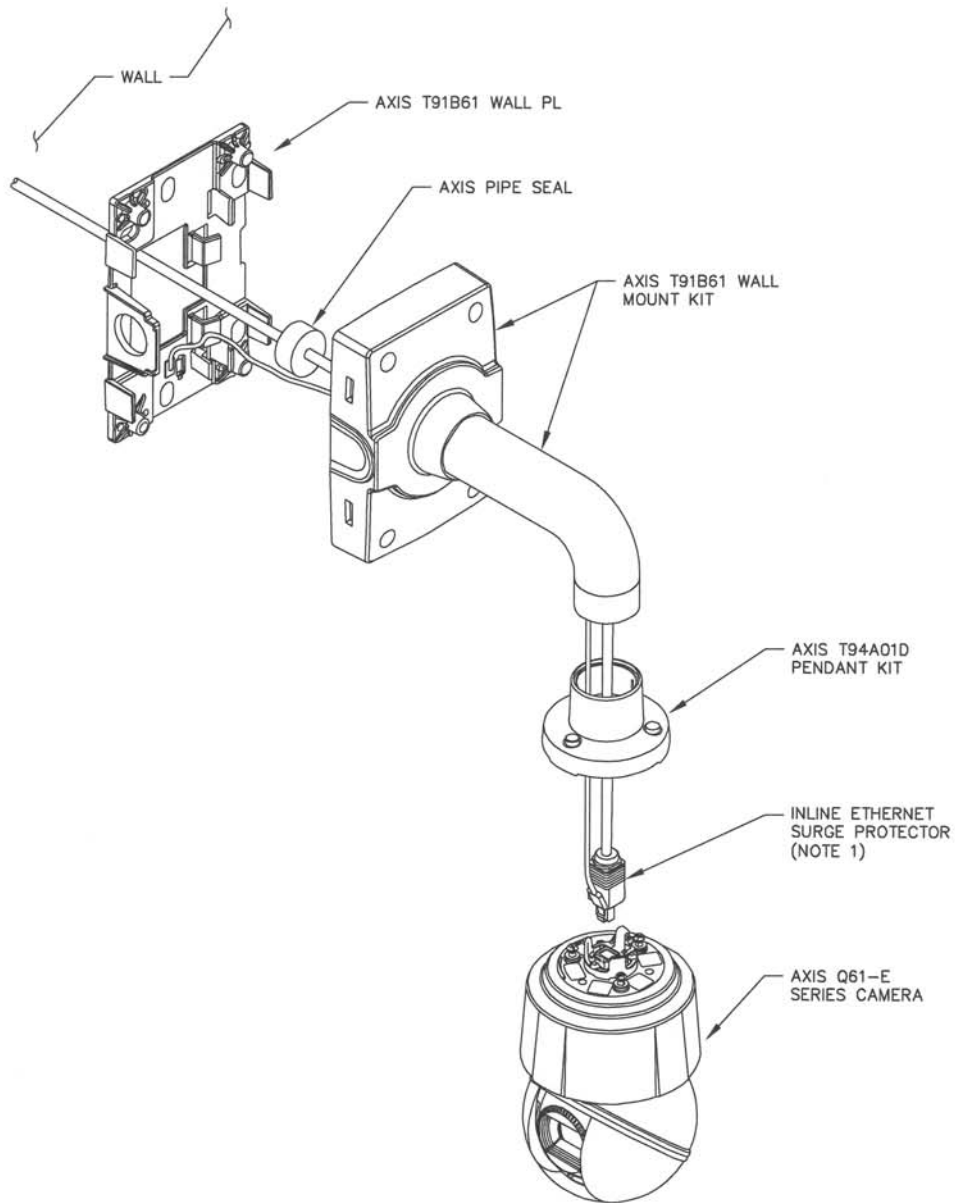
**NOTES:**

1. INLINE ETHERNET SURGE PROTECTOR CONNECTORS (VIGITRON V:2001) ARE RJ45 10 BASE-T/100 BASE-TX PoE.
2. INLINE ETHERNET SURGE PROTECTOR AND RJ45 SHIELDS SHALL BE GROUNDED THROUGH RACEWAY SYSTEM AND FD BOX BY #14AWG STRAND GROUND WITH COMPRESSION TERMINAL CONNECTOR.

DRAWN BY: ROMERO
CHKD BY: K ROSS/VLR
APPD BY: Stephen C. Rem
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**28115  
INDOOR NETWORK CAMERA**

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**NOTES:**

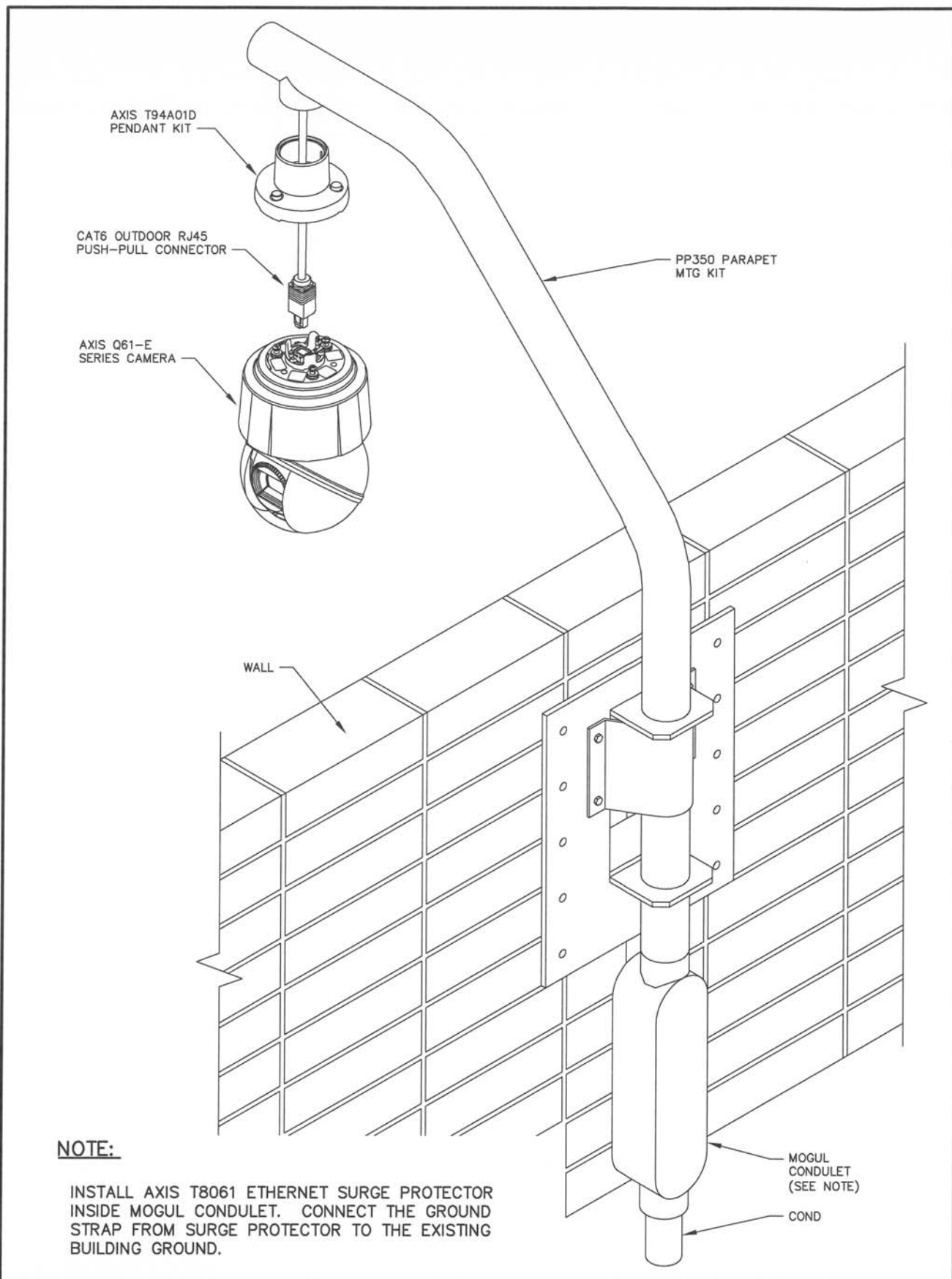
1. INLINE ETHERNET SURGE PROTECTOR CONNECTORS (VIGITRON V:2001) ARE RJ45 10 BASE-T/100 BASE-TX PoE.
2. INLINE ETHERNET SURGE PROTECTOR AND RJ45 SHIELDS SHALL BE GROUNDED THROUGH RACEWAY SYSTEM AND FD BOX BY #14AWG STRAND GROUND WITH COMPRESSION TERMINAL CONNECTOR.

DRAWN BY: ROMERO
CHKD BY: K ROSS/ KLR
APPD BY: Stephen C. Ren
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**28116  
OUTDOOR WALL MOUNTED  
CAMERA**

**D DENVER WATER**

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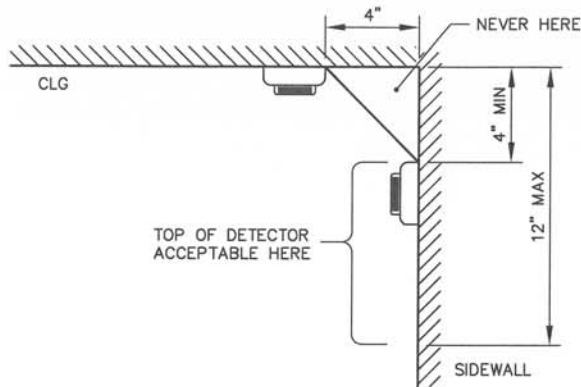
**NOTE:**

INSTALL AXIS T8061 ETHERNET SURGE PROTECTOR INSIDE MOGUL CONDULET. CONNECT THE GROUND STRAP FROM SURGE PROTECTOR TO THE EXISTING BUILDING GROUND.

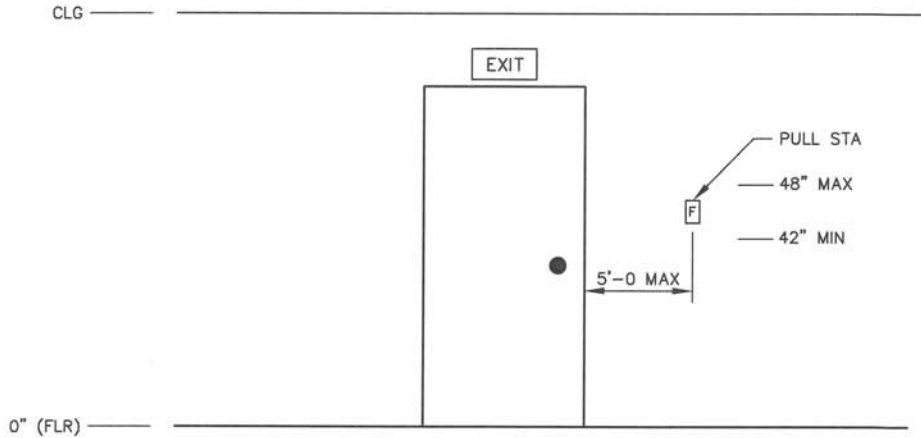
DRAWN BY: ROMERO
CHKD BY: K ROSS/KLR
APPD BY: <i>Steph C. Pen</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**28117  
PARAPET MOUNTED OUTDOOR  
CAMERA**

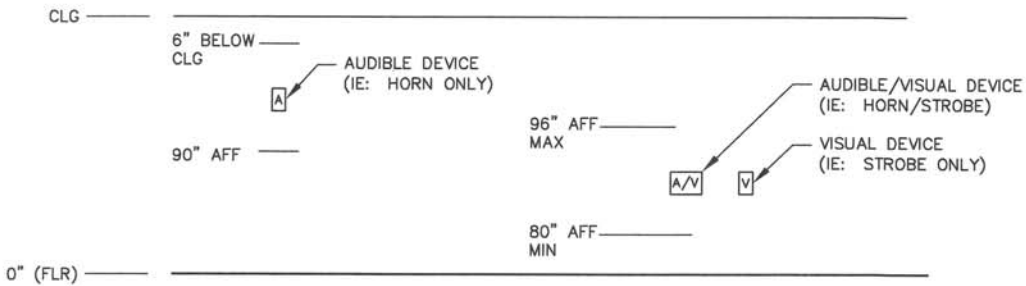
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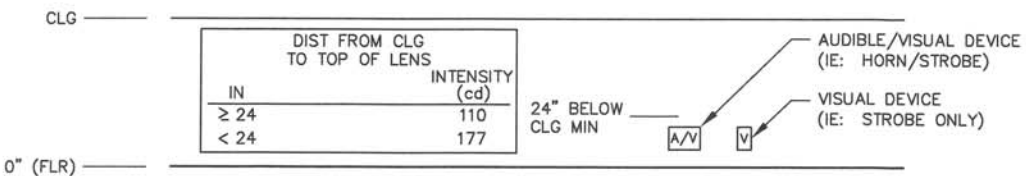
**TYPICAL DEVICE MOUNTING FOR DETECTORS**



**TYPICAL DEVICE MOUNTING FOR PULL STATION**



**TYPICAL DEVICE MOUNTING FOR NOTIFICATION DEVICES**



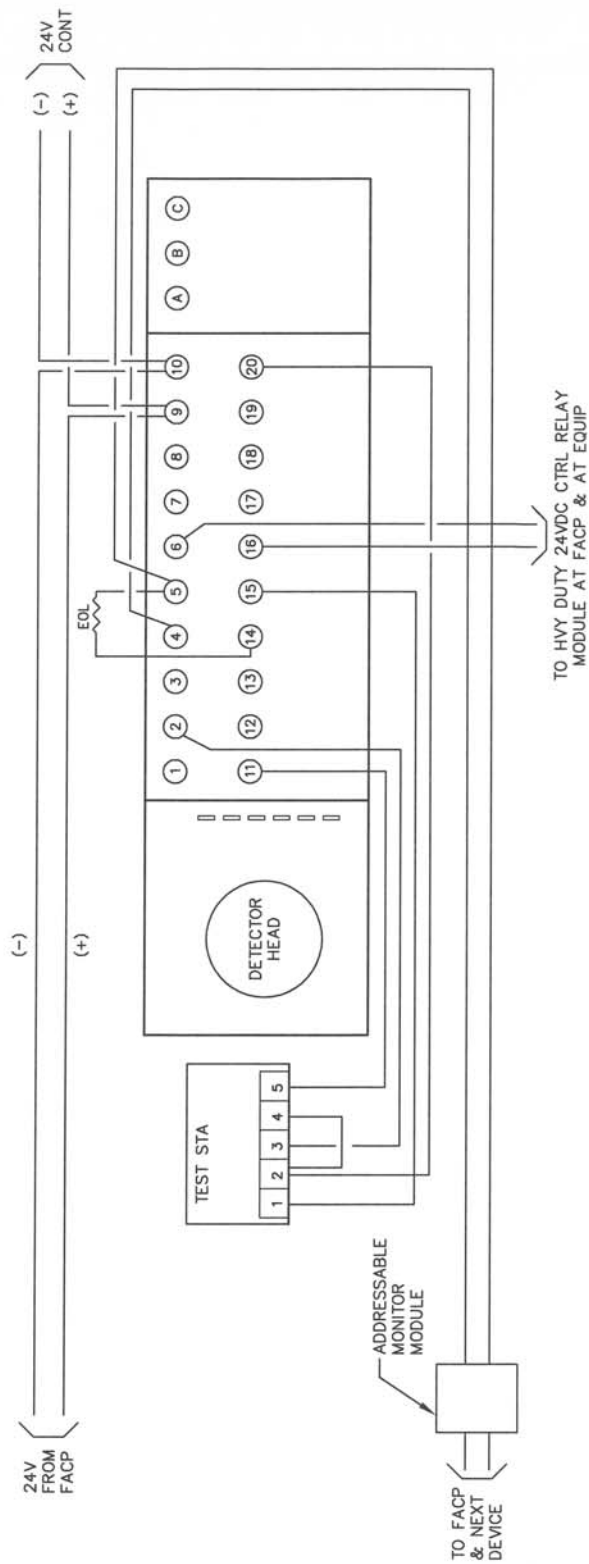
**TYPICAL DEVICE MOUNTING FOR NOTIFICATION DEVICES IN HANDICAP ACCESSIBLE SLEEPING ROOMS**

28310  
FIRE ALARM SYSTEM  
DEVICE MOUNTING



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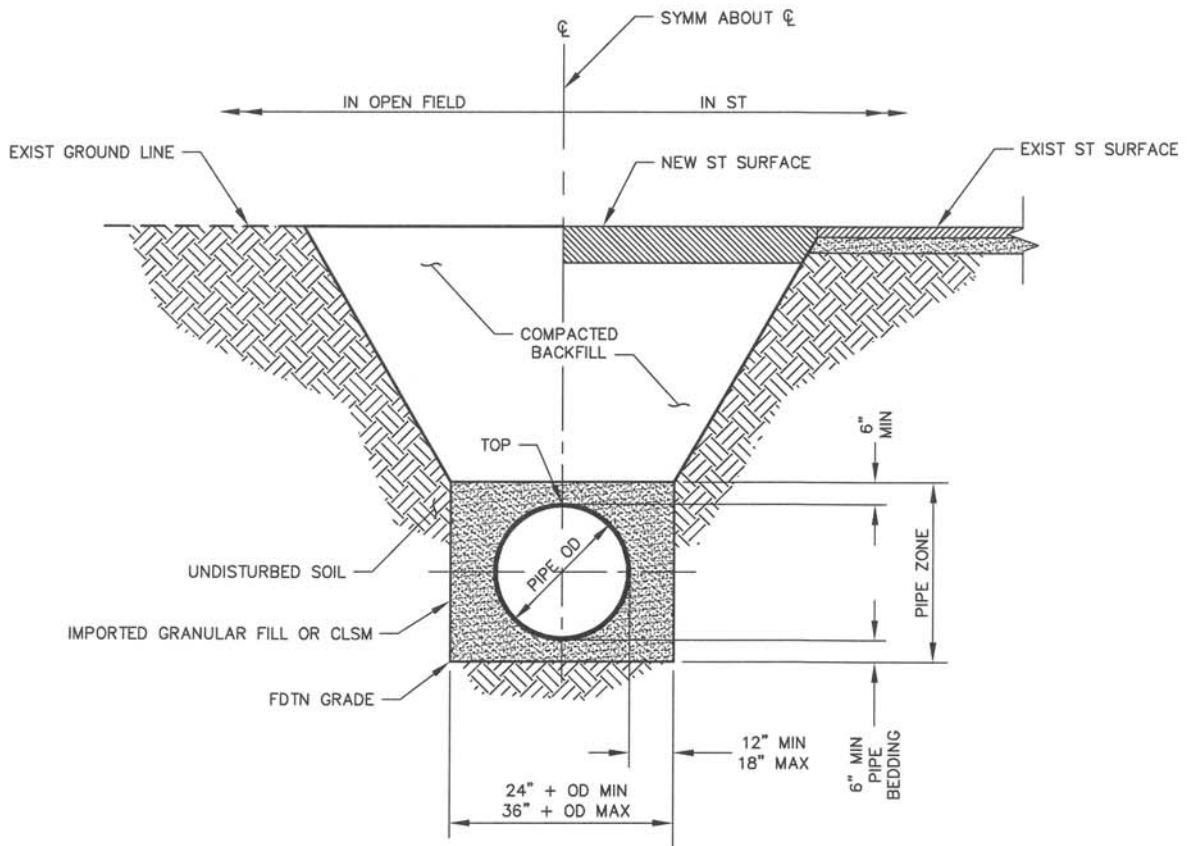
DRAWN BY: BOWMAN
CHKD BY: K ROSS/ KLR
APPD BY: Stephen C. Pean
ORIGINATION DATE: JANUARY 2017
REVISION DATE:



DRAWN BY: <i>BOWMAN</i>
CHKD BY: <i>K ROSS/KUR</i>
APPD BY: <i>Stephen C. Rem</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

## 28311 DUCT DETECTOR


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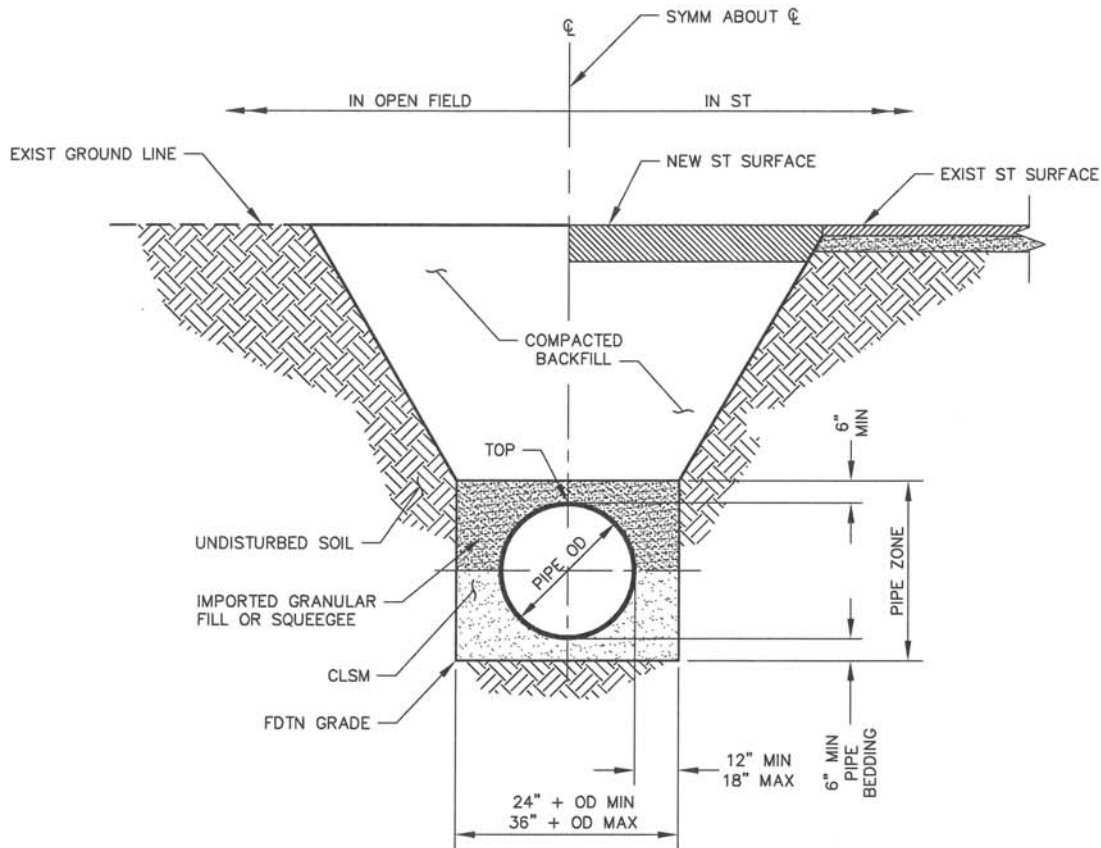
**NOTES:**

1. TRENCH SHALL CONFORM TO APPLICABLE OSHA REQUIREMENTS.
2. ADDITIONAL CATHODIC PROTECTION MAY BE REQUIRED ALONG THE PIPE AT THE TRANSITION FROM CLSM BACKFILL TO GRANULAR BACKFILL.

DRAWN BY: MITCHELL
CHKD BY: K ROSS/KR
APPD BY: Stephen C. Ren
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

31001  
TYPICAL TRENCH SECTION  
FOR PIPE 24"Ø AND LARGER

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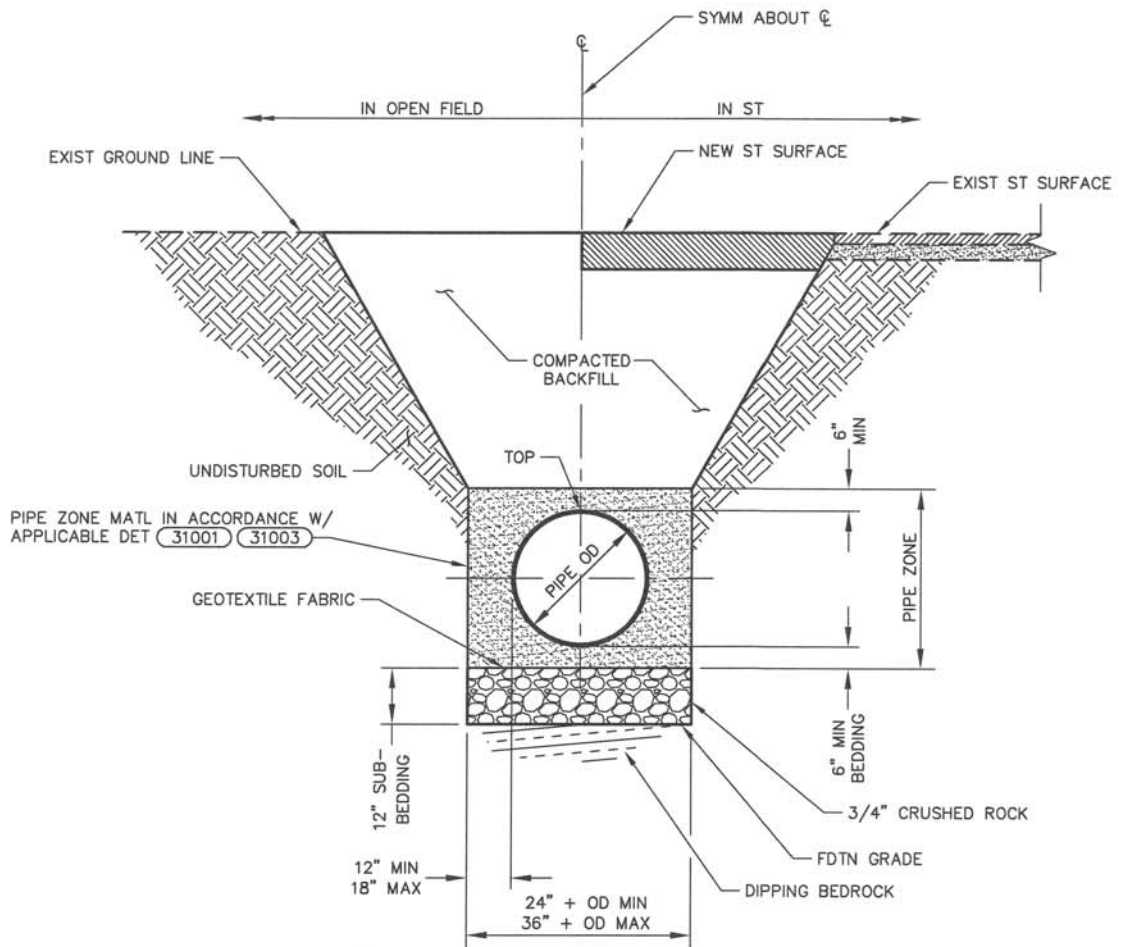
**NOTES:**

1. TRENCH SHALL CONFORM TO APPLICABLE OSHA REQUIREMENTS.
2. VERIFY CATHODIC PROTECTION REQUIREMENTS AT TRANSITION FROM CLSM BACKFILL TO SOIL BACKFILL WITH ENGINEER. PREFERRED CLSM FILL METHOD IS FULL ENCASEMENT, PER 31001 AND 31002.
3. ENGINEER APPROVAL IS REQUIRED PRIOR TO BACKFILL.

DRAWN BY: MITCHELL
CHKD BY: K ROSS/KIR
APPD BY: Stephen C. Reem
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**31003**  
**OPTIONAL TRENCH**  
**SECTION FOR PVC PIPE**

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**NOTES:**

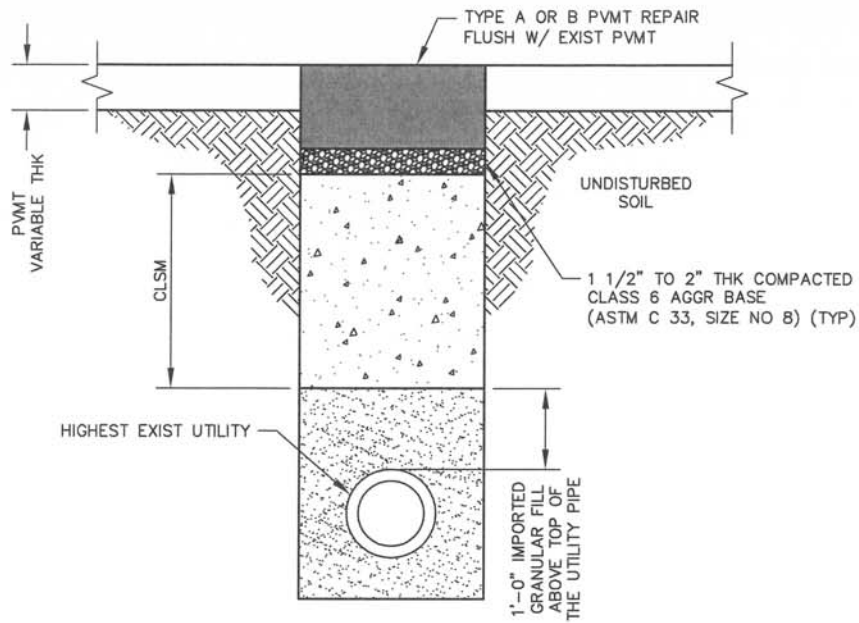
1. TRENCH SHALL CONFORM TO APPLICABLE OSHA REQUIREMENTS.
2. IF TRENCH CONDITIONS CHANGE ADDITIONAL CATHODIC PROTECTION IS REQUIRED ALONG THE PIPE AT THE TRANSITION FROM CLSM BACKFILL TO GRANULAR BACKFILL.

DRAWN BY: MITCHELL  
 CHKD BY: K ROSS/ KLR  
 APPD BY: Stephen C. Roman  
 ORIGINATION DATE: JANUARY 2017  
 REVISION DATE:

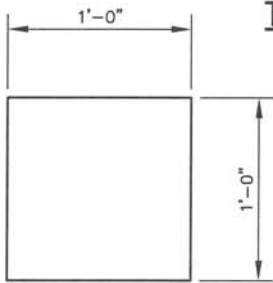
**31004**  
**TYPICAL TRENCH**  
**SECTION FOR PIPELINE**  
**IN DIPPING BEDROCK**

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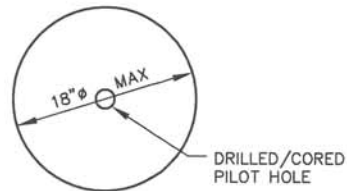




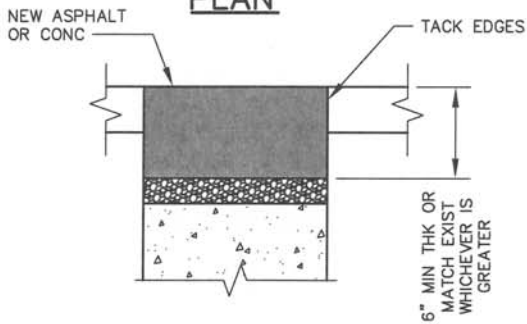
**TYPICAL TRENCH SECTION**



**PLAN**

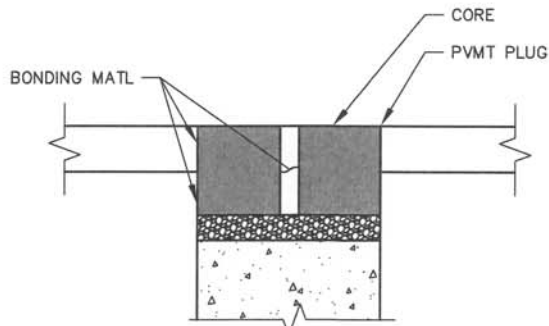


**PLAN**



**SECTION**

**TYPE A PAVEMENT REPAIR**



**SECTION**

**TYPE B PAVEMENT REPAIR**

**NOTES:**

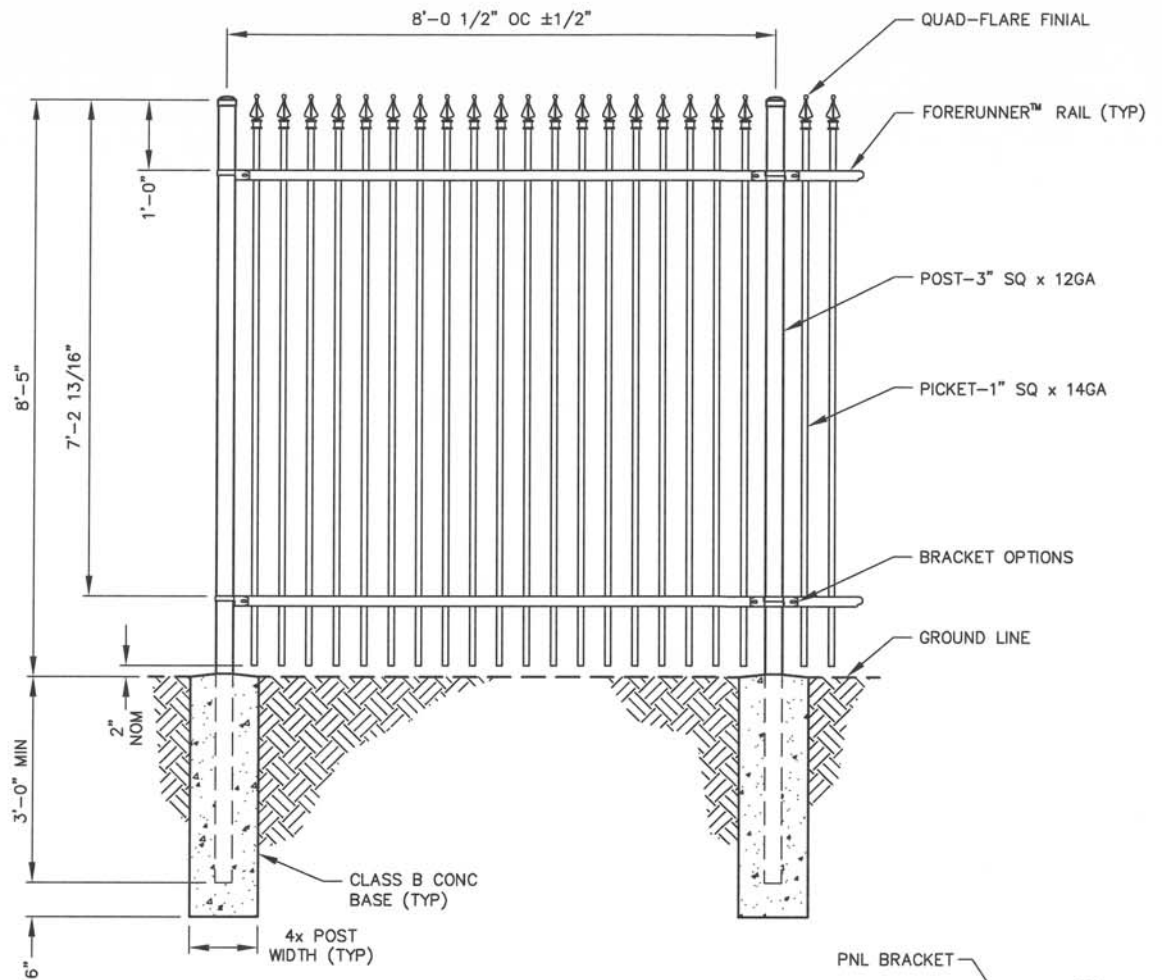
1. DIMENSIONS ARE NOMINAL.
2. EDGES SHALL BE CUT TO A NEAT VERTICAL FACE.

DRAWN BY: MITCHELL
CHKD BY: K ROSS/KRP
APPD BY: Stephen C. Penn
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

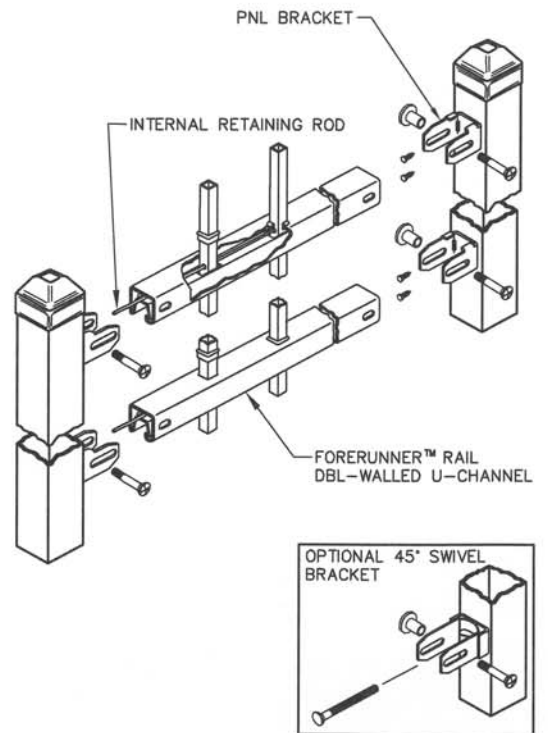
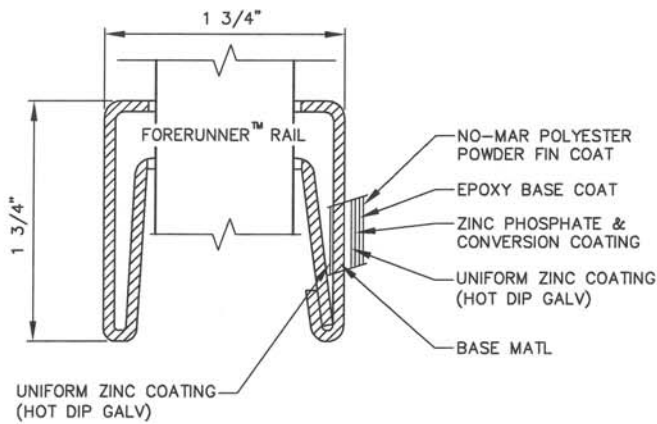
31005  
VACUUM EXCAVATION HOLE  
PAVEMENT REPAIR

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**ELEVATION**

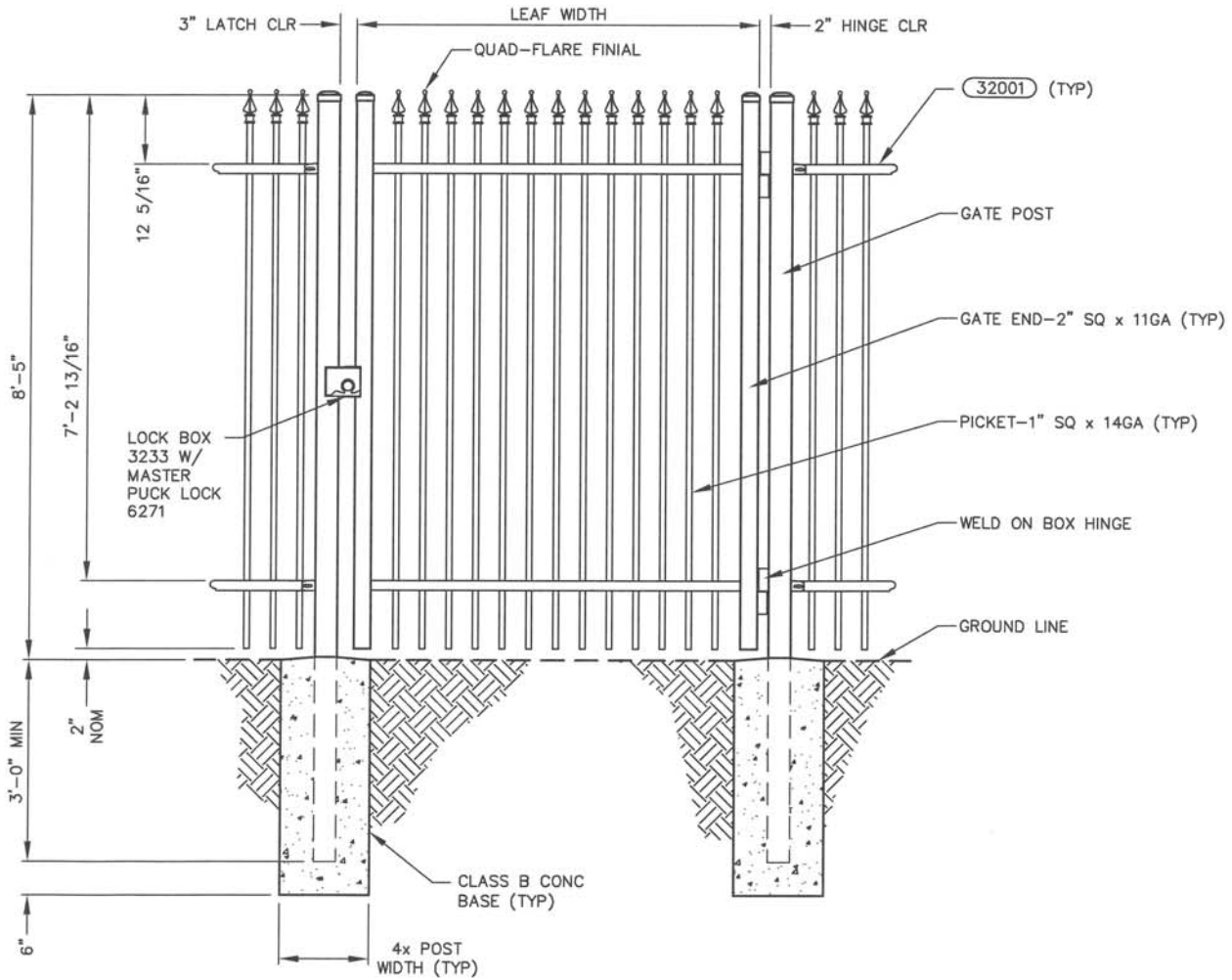


DRAWN BY: MITCHELL
CHKD BY: K ROSS/KRP
APPD BY: Stephen C. Penn
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

32001  
 AMERISTAR  
 AEGIS II GENESIS 2-RAIL  
 FENCE INSTALLATION

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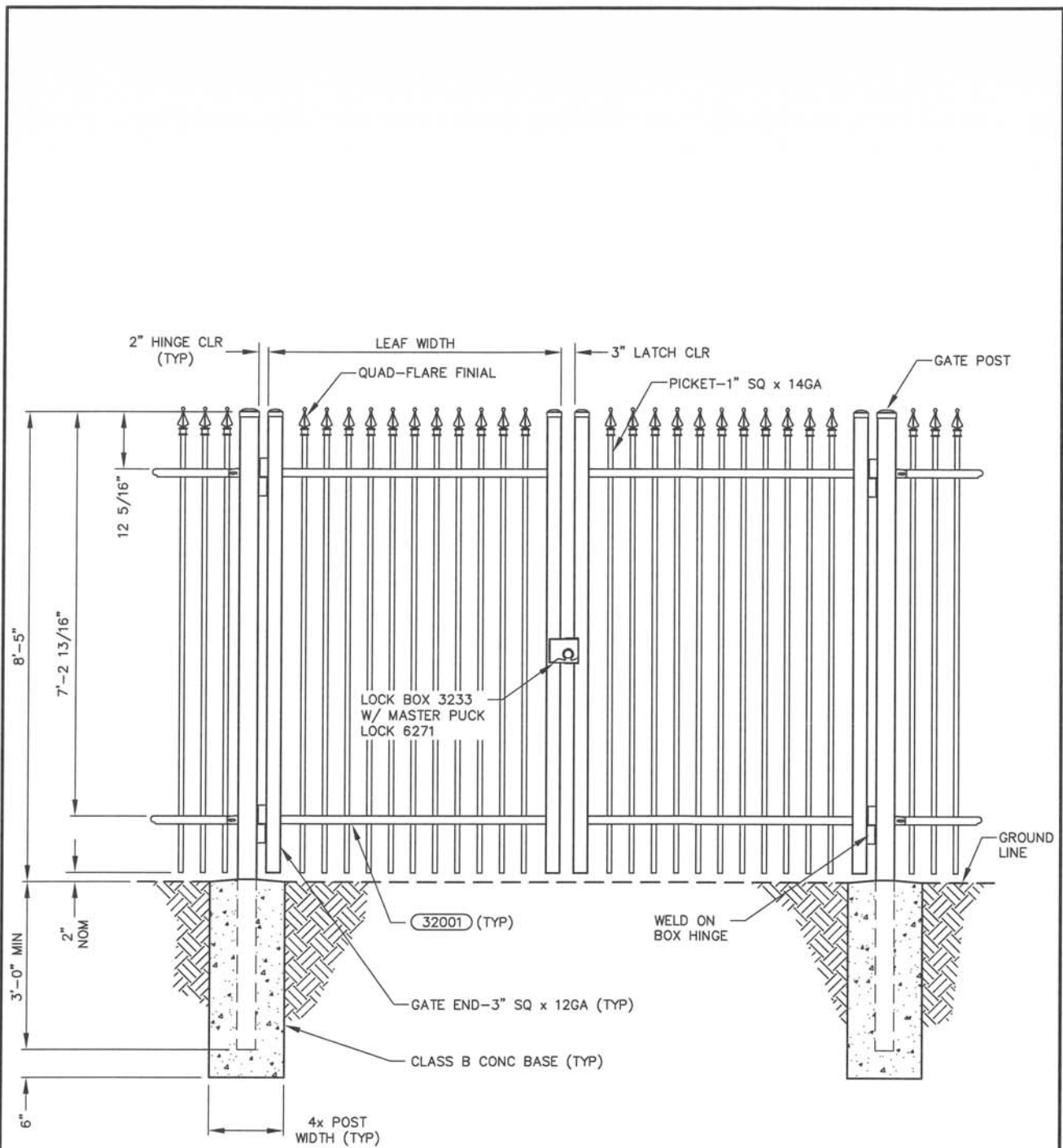
ELEVATION

DRAWN BY: MITCHELL
CHKD BY: K ROSS/KRP
APPD BY: Stephen C. P... (signature)
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

32002  
 AMERISTAR  
 AEGIS II GENESIS 2-RAIL  
 SINGLE GATE INSTALLATION

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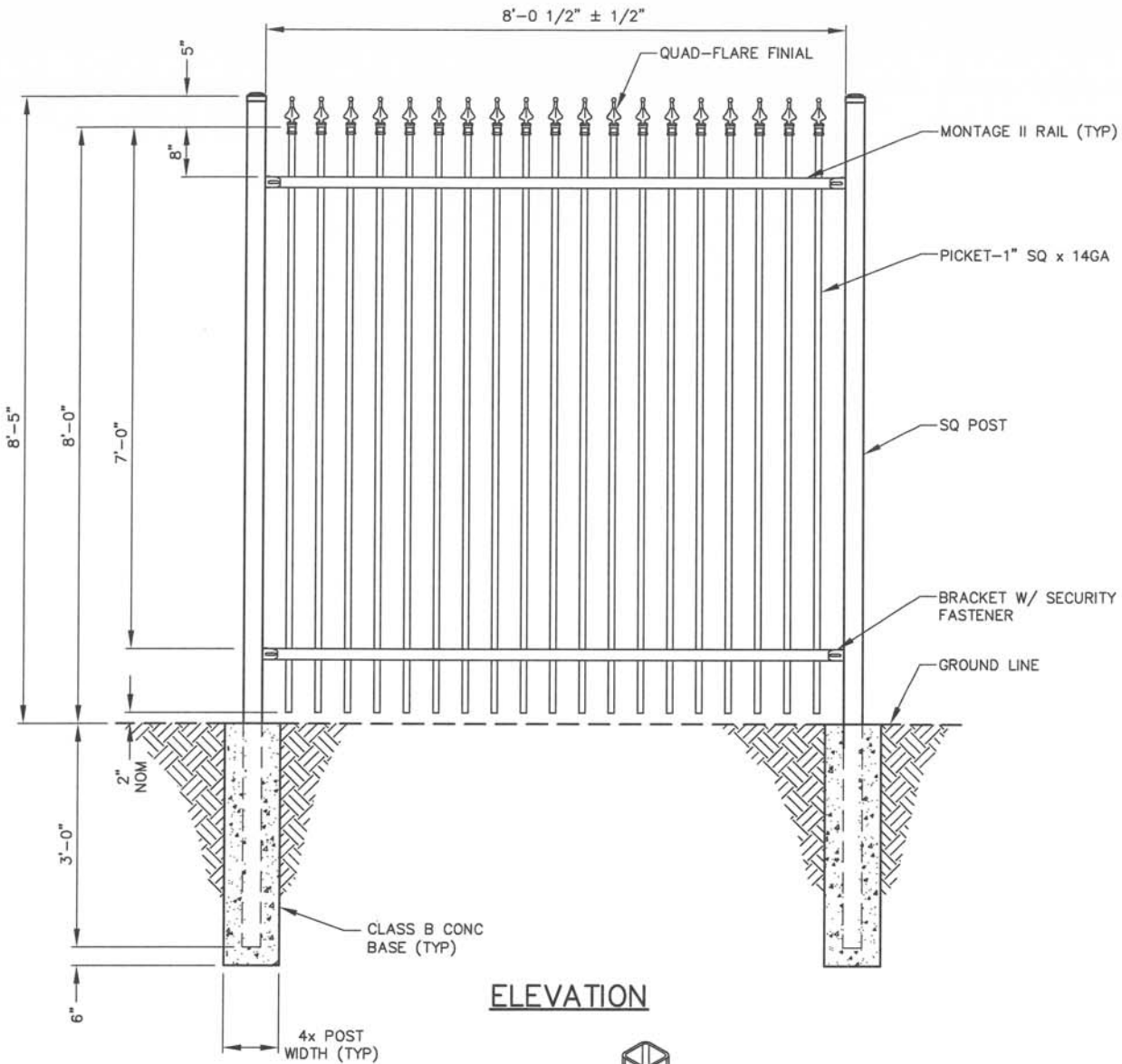
**ELEVATION**

DRAWN BY: MITCHELL
CHKD BY: K ROSS/KR
APPD BY: Stephen C. Rom
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**32003**  
**AMERISTAR**  
**AEGIS II GENESIS 2-RAIL**  
**DOUBLE GATE INSTALLATION**

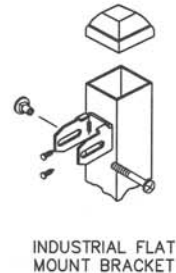
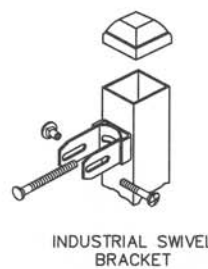
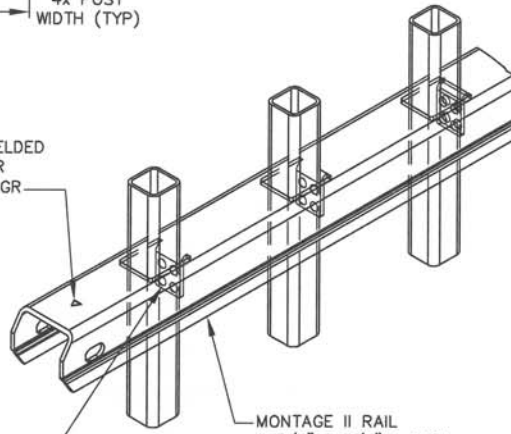
**D DENVER WATER**

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**ELEVATION**

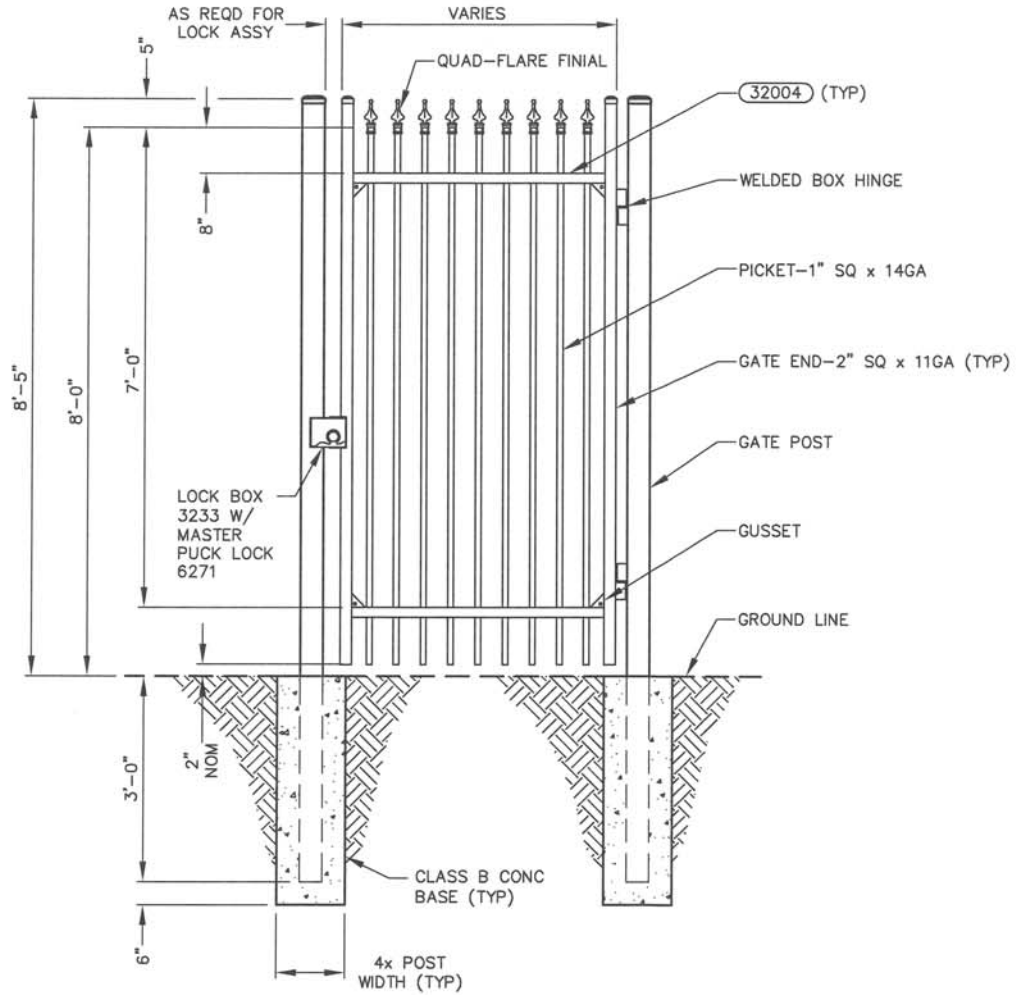
RAKING DIRECTIONAL ARROW, WELDED  
PNL CAN BE RAKED 2'-6" OVER  
8'-0" W/ ARROW POINTING DN GR



DRAWN BY: MITCHELL
CHKD BY: K ROSS/KUR
APPD BY: Stephen C. Ross
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**32004  
AMERISTAR  
MONTAGE II GENESIS  
2-RAIL PANEL**

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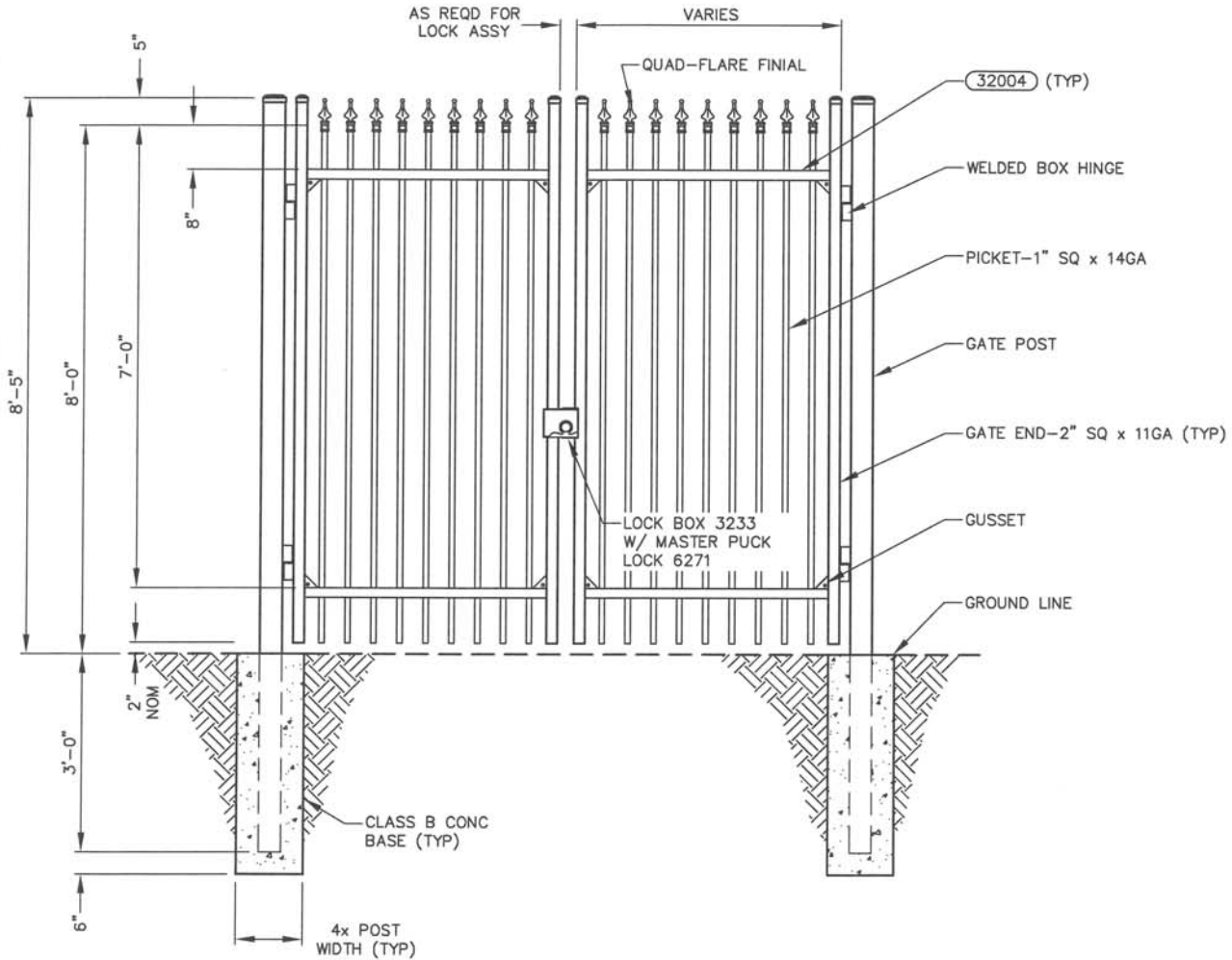


ELEVATION

DRAWN BY: MITCHELL
CHKD BY: K ROSS/KIR
APPD BY: Stephen C. Rasmussen
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

32005  
 AMERISTAR  
 MONTAGE II GENESIS  
 2-RAIL SINGLE GATE

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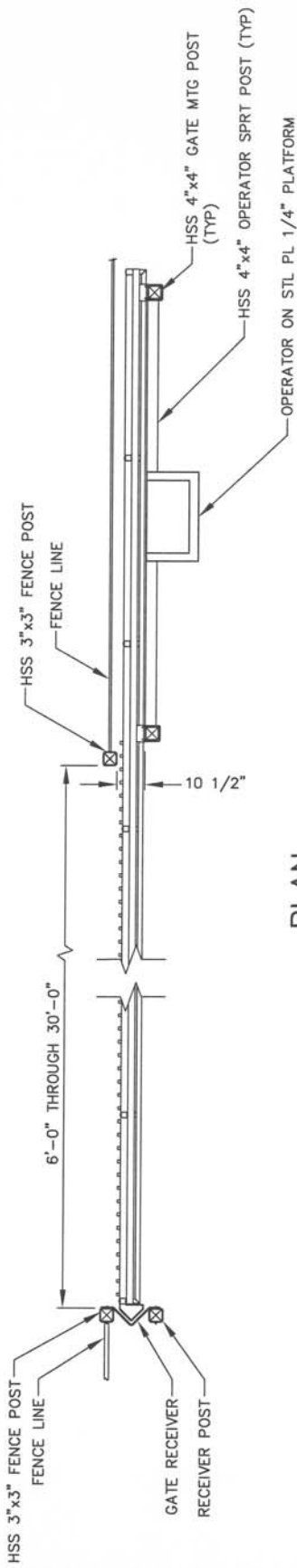
ELEVATION

DRAWN BY: MITCHELL
CHKD BY: K ROSS/ KUR
APPD BY: Stephen C. Ren
ORINATION DATE: JANUARY 2017
REVISION DATE:

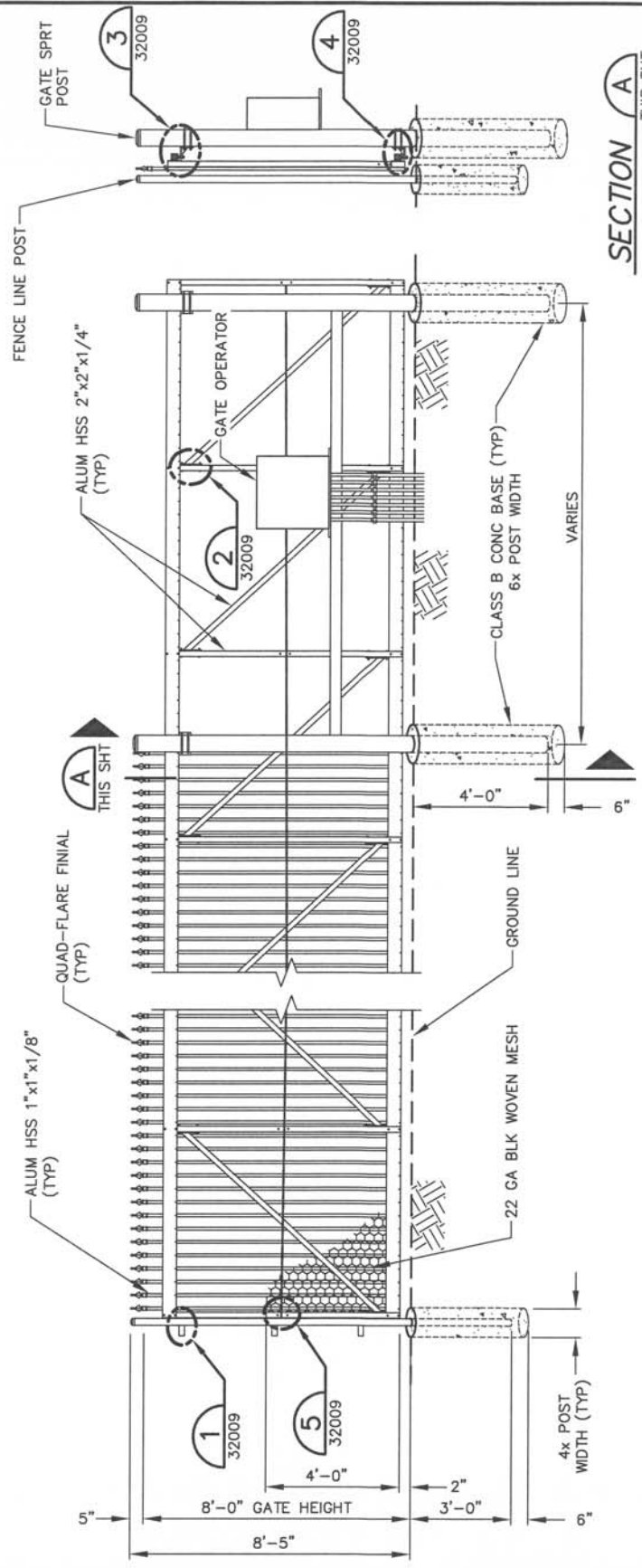
32006  
 AMERISTAR  
 MONTAGE II GENESIS  
 2-RAIL DOUBLE GATE

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**PLAN**



**SECTION A**  
THIS SHT

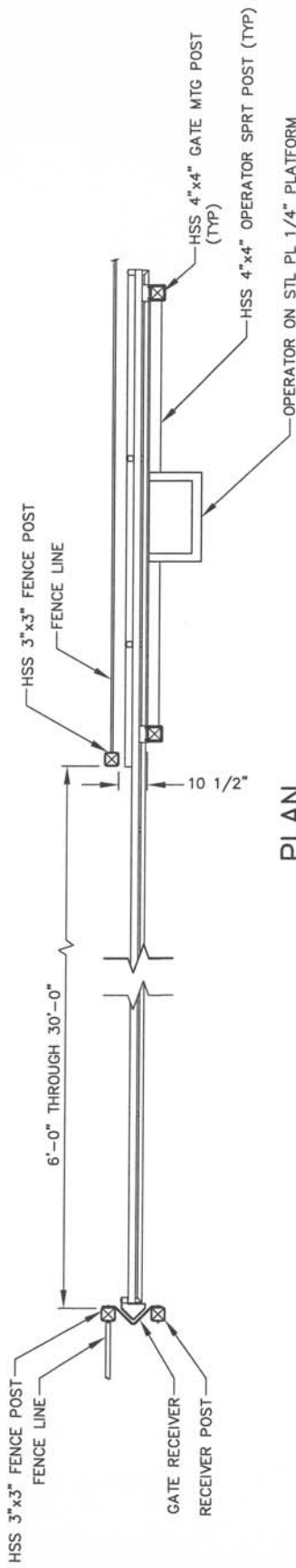
**ELEVATION**

DRAWN BY: MITCHELL
CHKD BY: K ROSS/KJR
APPD BY: Stephen C. Pann
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

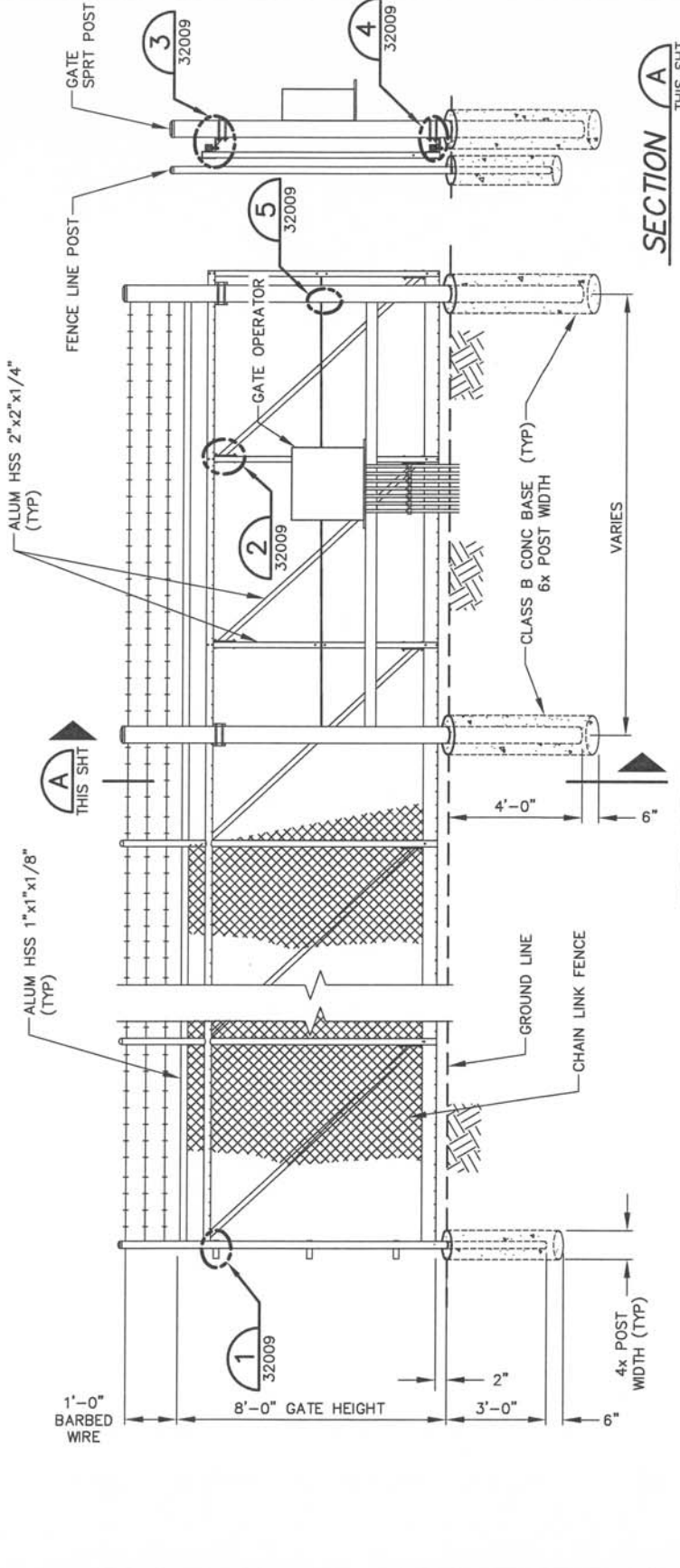
**32007**  
**AMERISTAR**  
**TRANSPORT II GENESIS**  
**CANTILEVER GATE SYSTEM**


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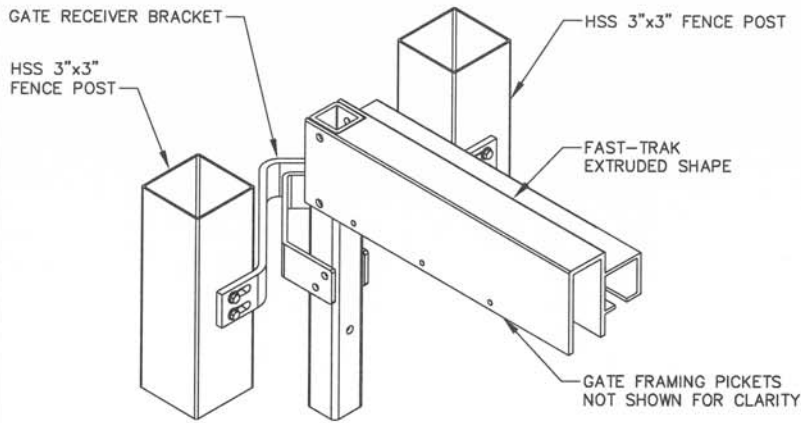
PLAN



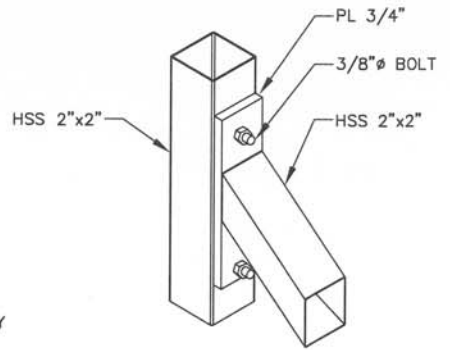
DRAWN BY: MITCHELL
CHKD BY: K ROSS/KJR
APPD BY: Stephen C. Ren
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

32008  
 AMERISTAR  
 TRANSPORT LINK  
 CANTILEVER GATE SYSTEM

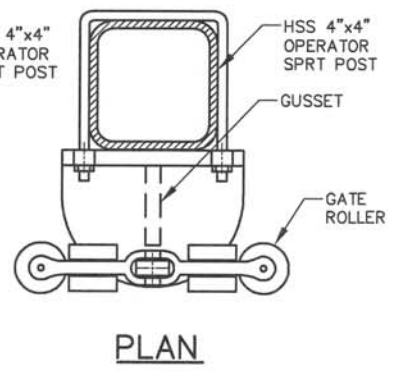
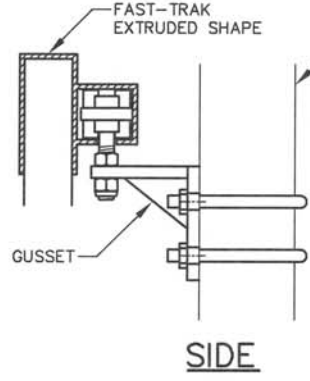
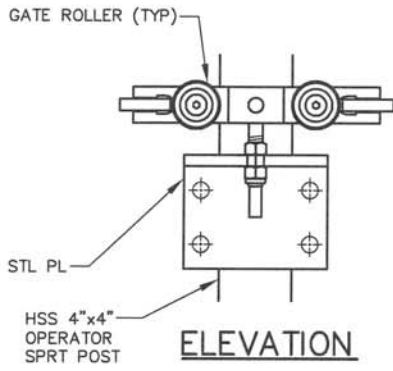
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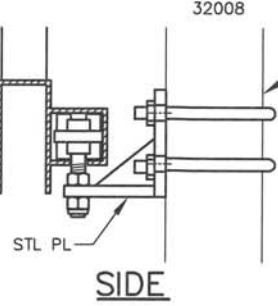
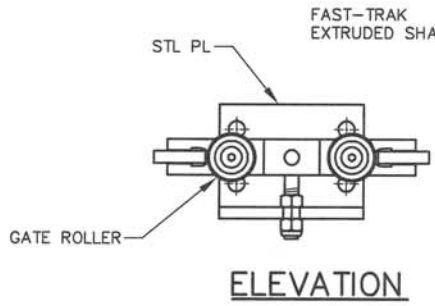
**GATE RECEIVER BRACKET** 1  
32007  
32008



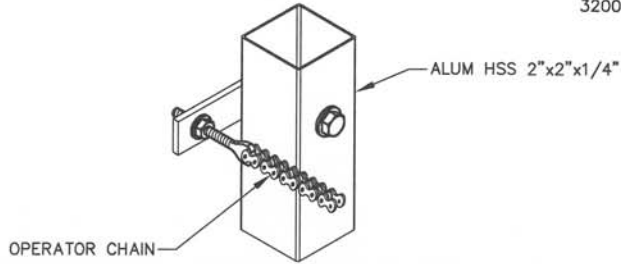
**FRAME SUPPORTS** 2  
32007  
32008



**GATE ROLLER BEARING - TOP** 3  
32007  
32008



**GATE ROLLER BEARING - BOTTOM** 4  
32007  
32008



**OPERATOR CHAIN ATTACHMENT** 5  
32007  
32008

DRAWN BY: MITCHELL
CHKD BY: K ROSS/KJR
APPD BY: Stephen C. Rem
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

32009  
AMERISTAR TRANSPORT II  
GENESIS AND TRANSPORT LINK  
CANTILEVER GATE SYSTEM  
DETAILS

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FENCE MATERIAL						
FABRIC HEIGHT	END, CORNER AND LINE BRACE POSTS		LINE POSTS		TOP & BRACE RAILS	
H	ROUND PIPE ID	ROLL-FORMED STEEL	ROUND PIPE ID	ROLL-FORMED STEEL	ROUND PIPE ID	ROLL-FORMED STEEL
3' THRU 6'	2.5"	3.5" x 3.5"	1.5"	1.875" x 1.625"	1.25"	1.25" x 1.625"
> 6' THRU 8'	2.5"	3.5" x 3.5"	2.0"	1.875" x 1.625"	1.25"	1.25" x 1.625"
> 8' THRU 12'	2.5"	3.5" x 3.5"	2.0"	2.250" x 1.625"	1.25"	1.25" x 1.625"

ORDINARY PIPE			
NOMINAL ID	OD	WALL THICK	WEIGHT (LB/FT)
1.25"	1.660"	0.140"	2.27
1.50"	1.900"	0.145"	2.72
2.00"	2.375"	0.154"	3.65
2.50"	2.875"	0.203"	5.79
3.00"	3.500"	0.216"	7.58
3.50"	4.000"	0.226"	9.11
4.00"	4.500"	0.237"	10.79
5.00"	5.563"	0.258"	14.62
6.00"	6.625"	0.280"	18.97
8.00"	8.625"	0.322"	28.55

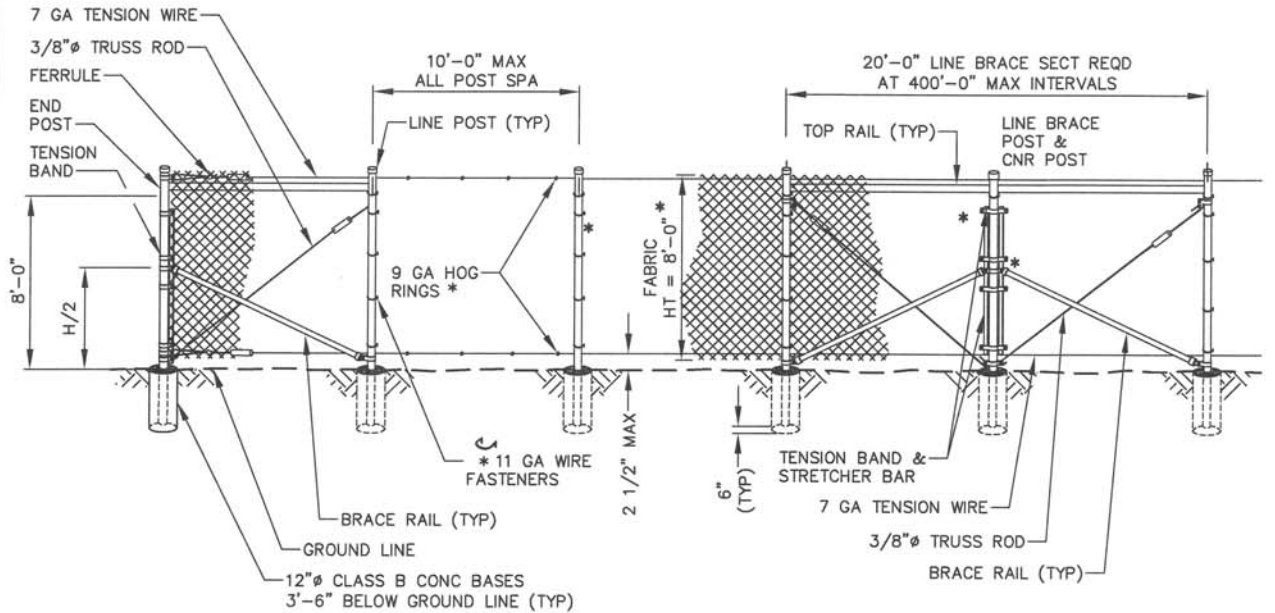
GATE MATERIAL				
GATE FRAME WIDTH	STRAIN POST		CONC BASE	
	ROUND ID	ROLL-FORMED	DEPTH	DIA
3' THRU 6'	2.5"	3.5" x 3.5"	36"	12"
> 6' THRU 13'	3.5"	-----	42"	12"
> 13' THRU 18'	6.0"	-----	48"	18"
> 18' THRU 23'	8.0"	-----	48"	24"
GATE FRAME		FRAME PIPE ID	BRACING PIPE ID	
WIDTH	HEIGHT			
3' THRU 8'	3' THRU 6'	1.25"	1.25"	
> 8' THRU 23'	6'	1.50"	1.25"	
> 8' THRU 23'	> 6' THRU 12'	1.50"	1.50"	

ROLL-FORMED STEEL			
PART	SIZE	THICK (GAGE)	WEIGHT (LB/FT)
TOP AND BRACE RAILS	1.250" x 1.625"	14	2.08
LINE POST (H: 3' - 6')	1.875" x 1.625"	12	2.75
LINE POST (H: > 6' - 8')	1.875" x 1.625"	11	3.36
LINE POST (H: > 8' - 12')	2.250" x 1.625"	11	4.02
END, CORNER AND LINE BRACE POSTS	3.50" x 3.50"	10	7.59

DRAWN BY: MITCHELL  
 CHKD BY: K ROSS/KR  
 APPD BY: *Stephen C. Rame*  
 ORIGINATION DATE: JANUARY 2017  
 REVISION DATE:

32010  
 CHAIN LINK FENCE  
 POST AND FRAME SIZES

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**LEGEND:**

\* ATTACH FABRIC TO ALL FENCE AND GATE STRUCTURES AT 1'-0" INTERVALS VERTICAL AND AT 1'-8" HORIZONTAL.

TIGHTENER OR TURNBUCKLE SYMBOL.

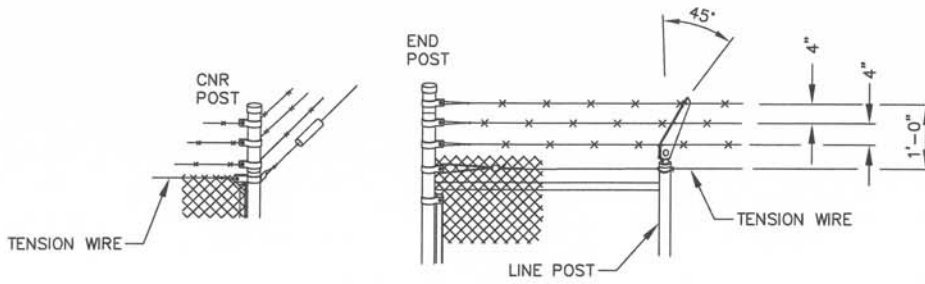
**NOTES:**

1. CHAIN LINK FENCE, GATE AND HARDWARE SHALL MEET CDOT STANDARD PLAN NUMBER M-607-2 FOR ROUND PIPE FRAMING.
2. POST AND FRAME SIZES IN ACCORDANCE WITH 32010.

DRAWN BY: MITCHELL
CHKD BY: <i>K ROSS/KRP</i>
APPD BY: <i>Stephen C. Rauer</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

32011  
 8' CHAIN LINK FENCE

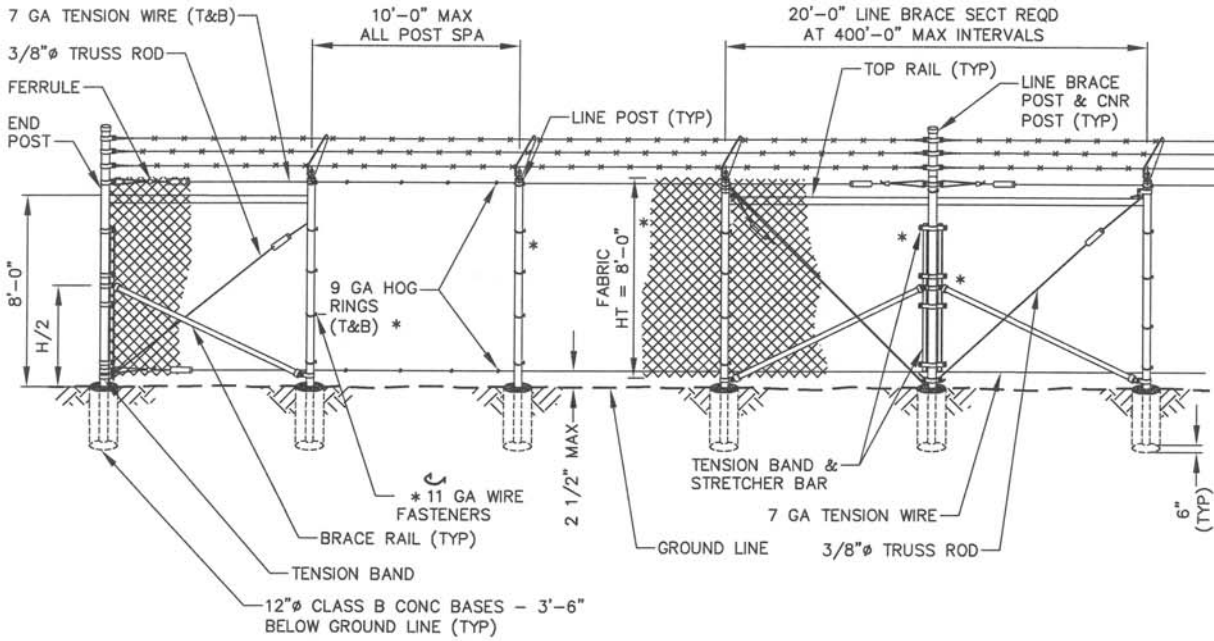
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**NOTE:**

SLOPE TOP OUT 45 DEGREES.

**BARBED WIRE TOP**



**LEGEND:**

\* ATTACH FABRIC TO ALL FENCE AND GATE STRUCTURES AT 1'-0" INTERVALS VERTICAL AND AT 1'-8" HORIZONTAL.

 TIGHTENER OR TURNBUCKLE SYMBOL.

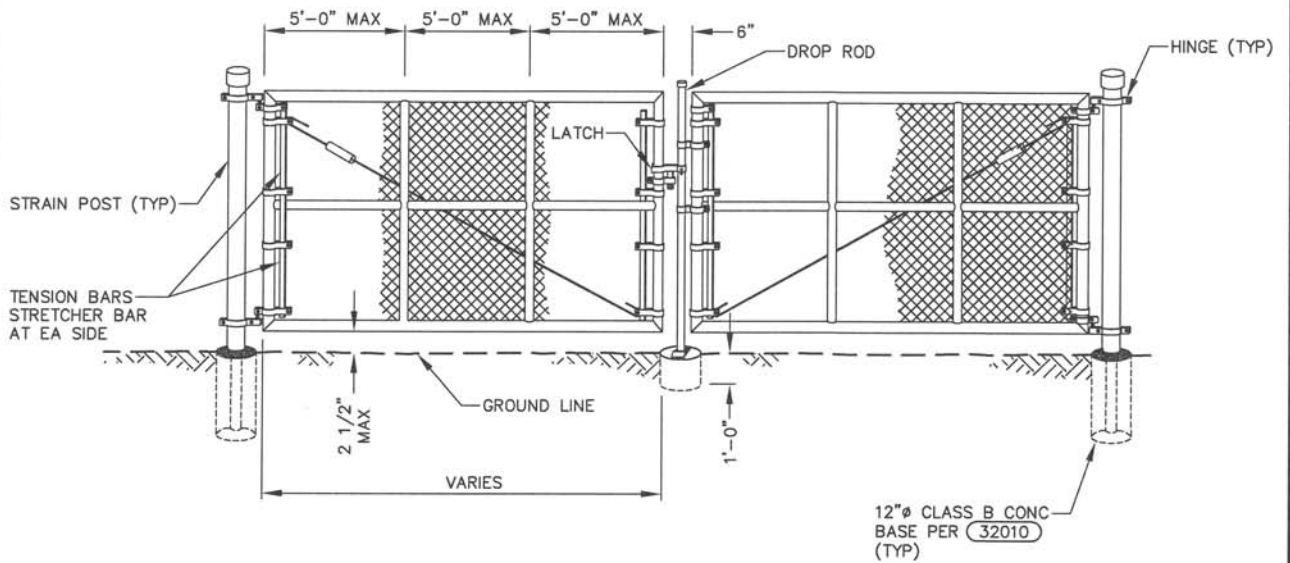
**NOTES:**

1. CHAIN LINK FENCE, GATE AND HARDWARE SHALL MEET CDOT STANDARD PLAN NUMBER M-607-2 FOR ROUND PIPE FRAMING.
2. POST AND FRAME SIZES IN ACCORDANCE WITH (32010).

DRAWN BY: MITCHELL
CHKD BY: K ROSS/KR
APPD BY: Stephen C. Rem
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**32012**  
**8' CHAIN LINK FENCE**  
**WITH BARBED WIRE**

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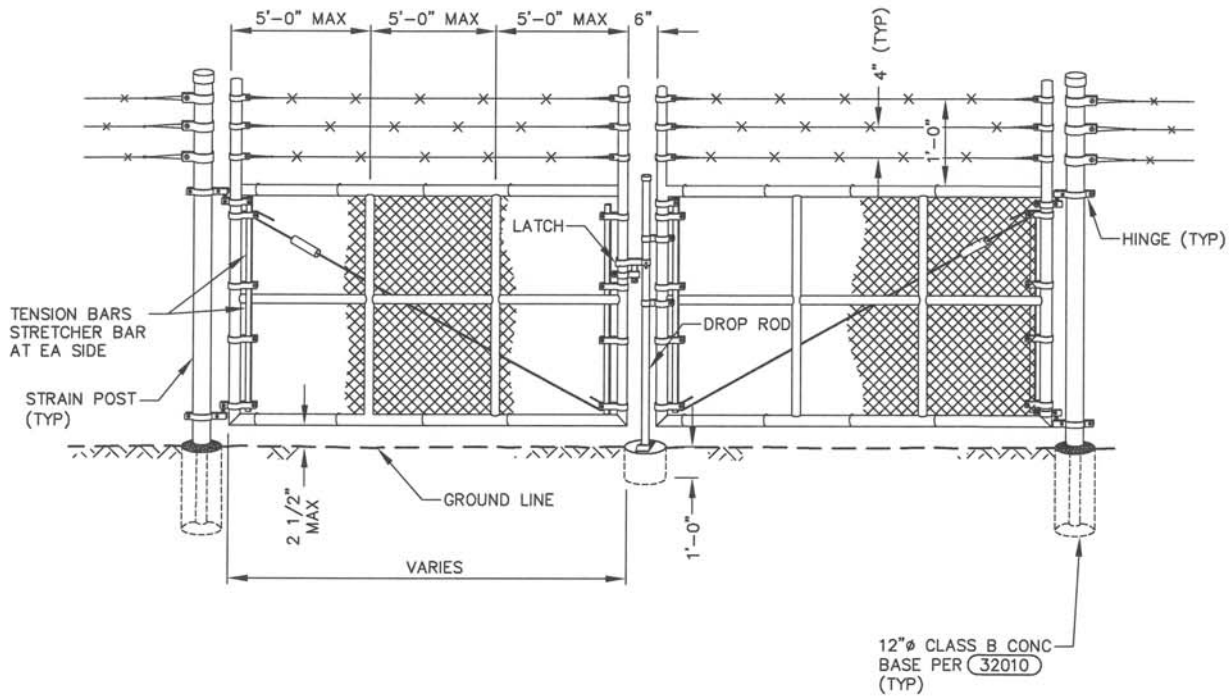
**NOTE:**

POST, FRAME AND CONCRETE BASE SIZES IN ACCORDANCE WITH (32010) .

DRAWN BY: ALVARADO
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Pen
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**32013  
DOUBLE SWING GATE**

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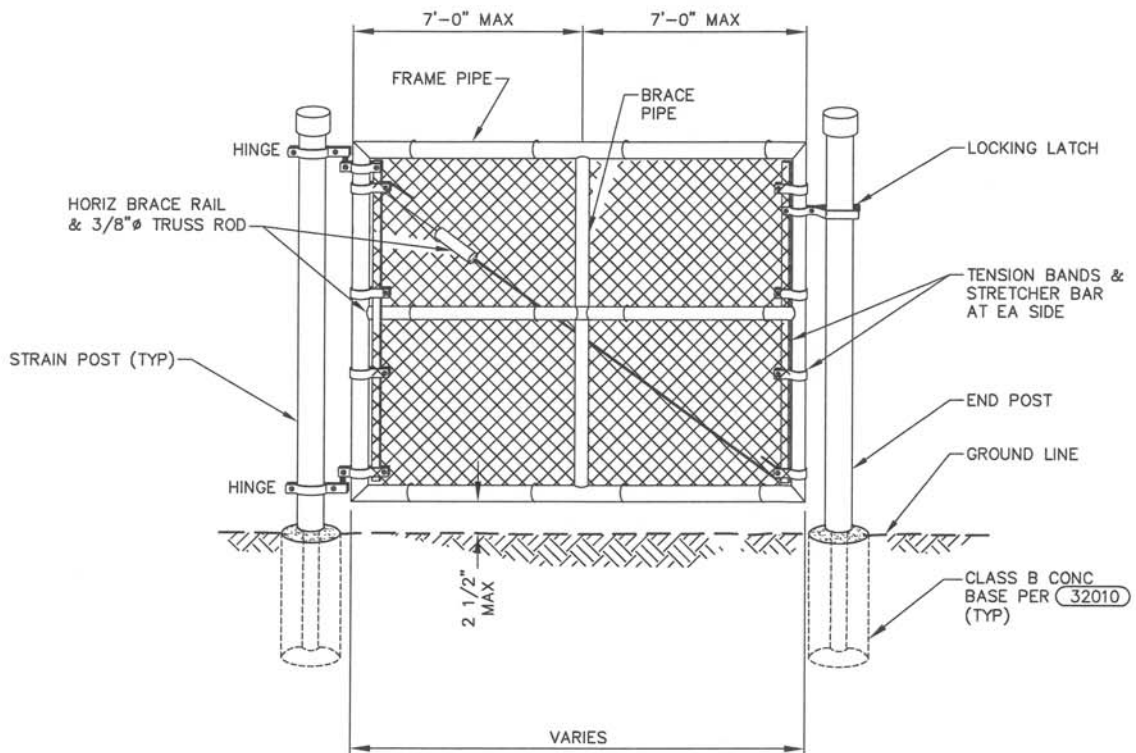
**NOTE:**

POST, FRAME AND CONCRETE BASE SIZES IN ACCORDANCE WITH (32010).

DRAWN BY: MITCHELL
CHKD BY: K ROSS/KUR
APPD BY: Stephen C. Reim
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

32014  
DOUBLE SWING GATE  
WITH BARBED WIRE

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**NOTE:**

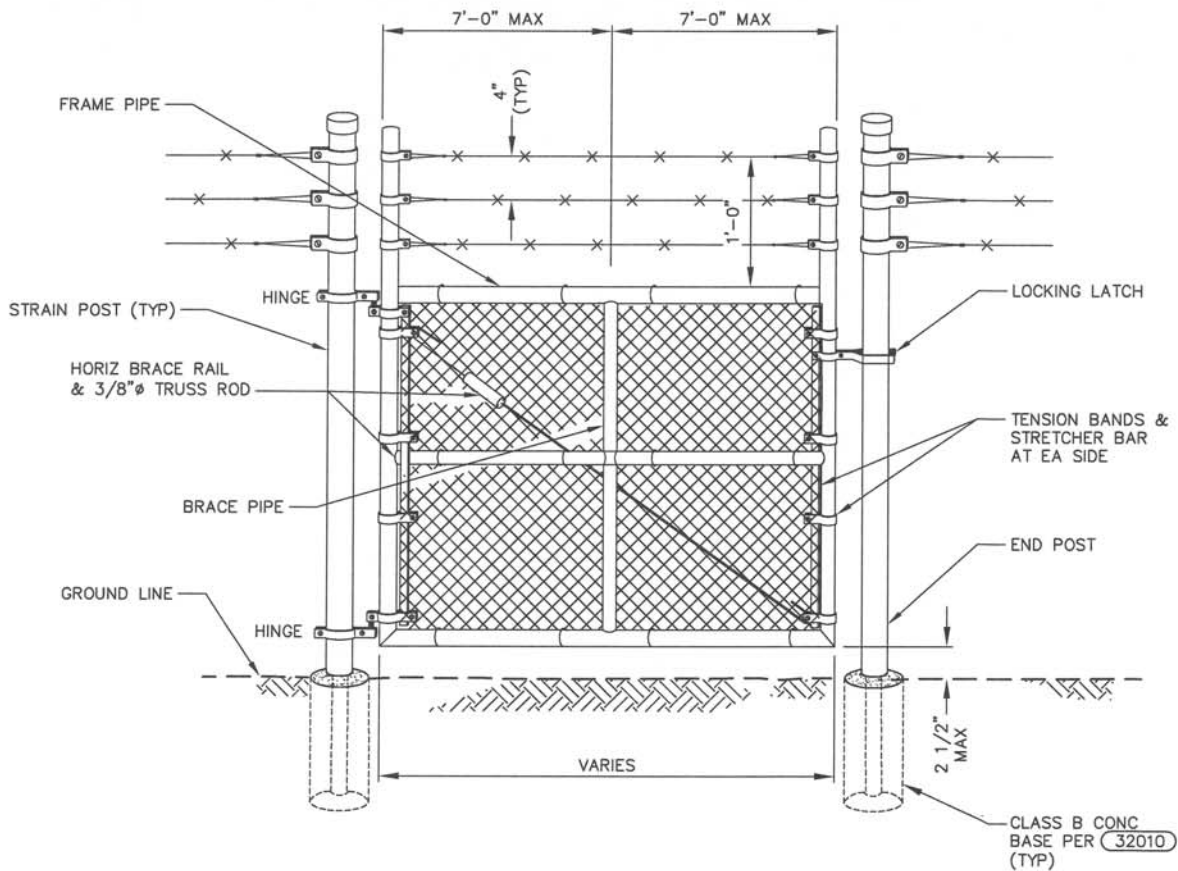
POST, FRAME AND CONCRETE BASE SIZES IN ACCORDANCE WITH (32010).

DRAWN BY: ALVARADO
CHKD BY: K ROSS/KUR
APPD BY: Stephen C. Reem
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

32015  
SINGLE SWING GATE

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**NOTE:**

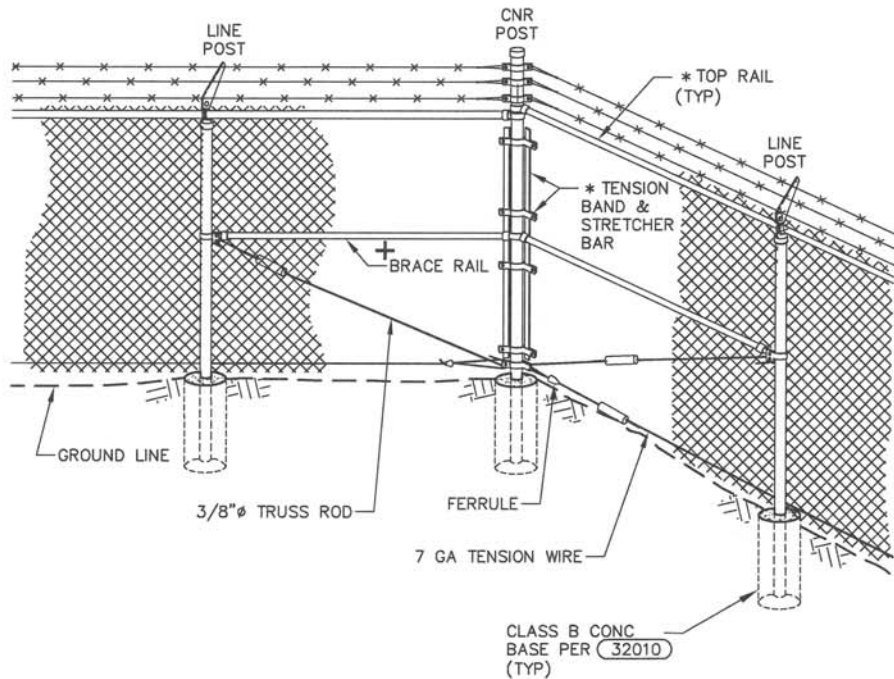
POST, FRAME AND CONCRETE BASE SIZES IN ACCORDANCE WITH 32010 .

**32016  
SINGLE SWING GATE  
WITH BARBED WIRE**



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DRAWN BY: ALVARADO
CHKD BY: K ROSS/KUR
APPD BY: Stephen C. Ream
ORIGINATION DATE: JANUARY 2017
REVISION DATE:



**LEGEND:**

\* ATTACH FABRIC TO ALL FENCE AND GATE STRUCTURES AT 1'-0" INTERVALS VERTICALLY AND AT 1'-8" HORIZONTALLY

 TIGHTENER OR TURNBUCKLE SYMBOL

+ BRACE RAIL IS NOT REQUIRED FOR 36", 42", OD 48" H FABRIC HEIGHTS. BRACE RAIL FOR FENCE WITH ROLL-FORMED STEEL ELEMENTS IS 1'-0" BELOW THE TOP RAIL

**NOTES:**

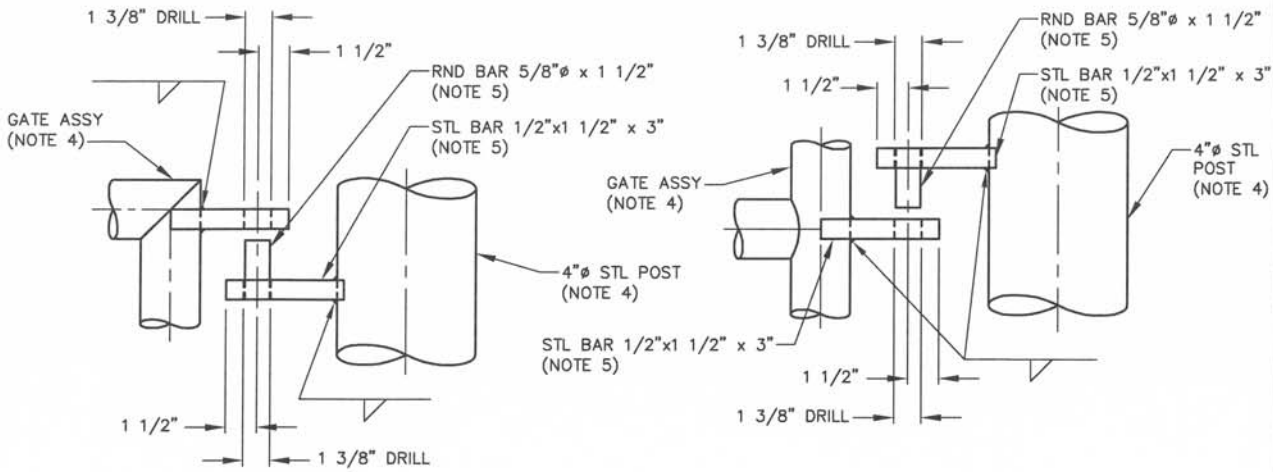
1. CHAIN LINK FENCE, GATE AND HARDWARE SHALL MEET CDOT STANDARD PLAN NUMBER M-607-2 FOR ROUND PIPE FRAMING.

2. POST AND FRAME SIZES IN ACCORDANCE WITH 32010.

DRAWN BY: ALVARADO
CHKD BY: K ROSS/KJR
APPD BY: Stephen C. Reem
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

32017  
 8' CHAIN LINK FENCE  
 CORNER POST  
 WITH BARBED WIRE

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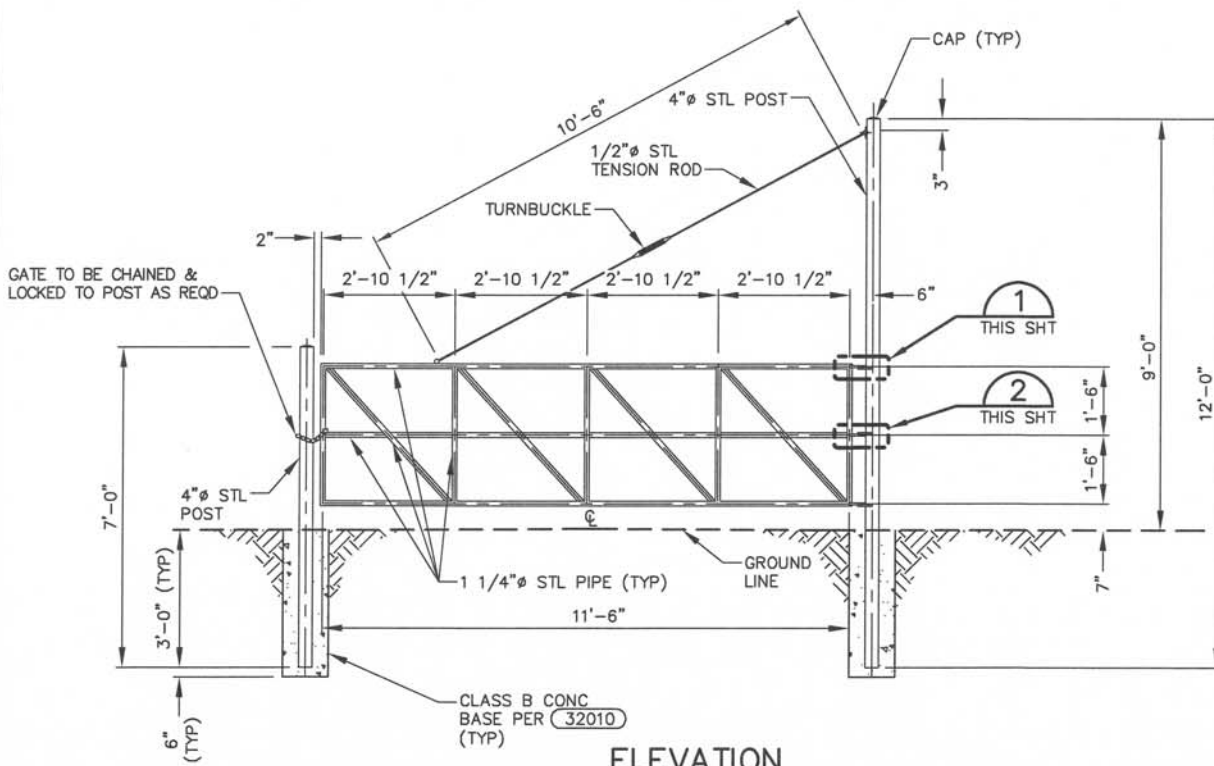


**TOP & BOTTOM  
HINGE ASSEMBLY**

1  
THIS SHT

**MIDDLE HINGE ASSEMBLY**

2  
THIS SHT



**ELEVATION**

**NOTES:**

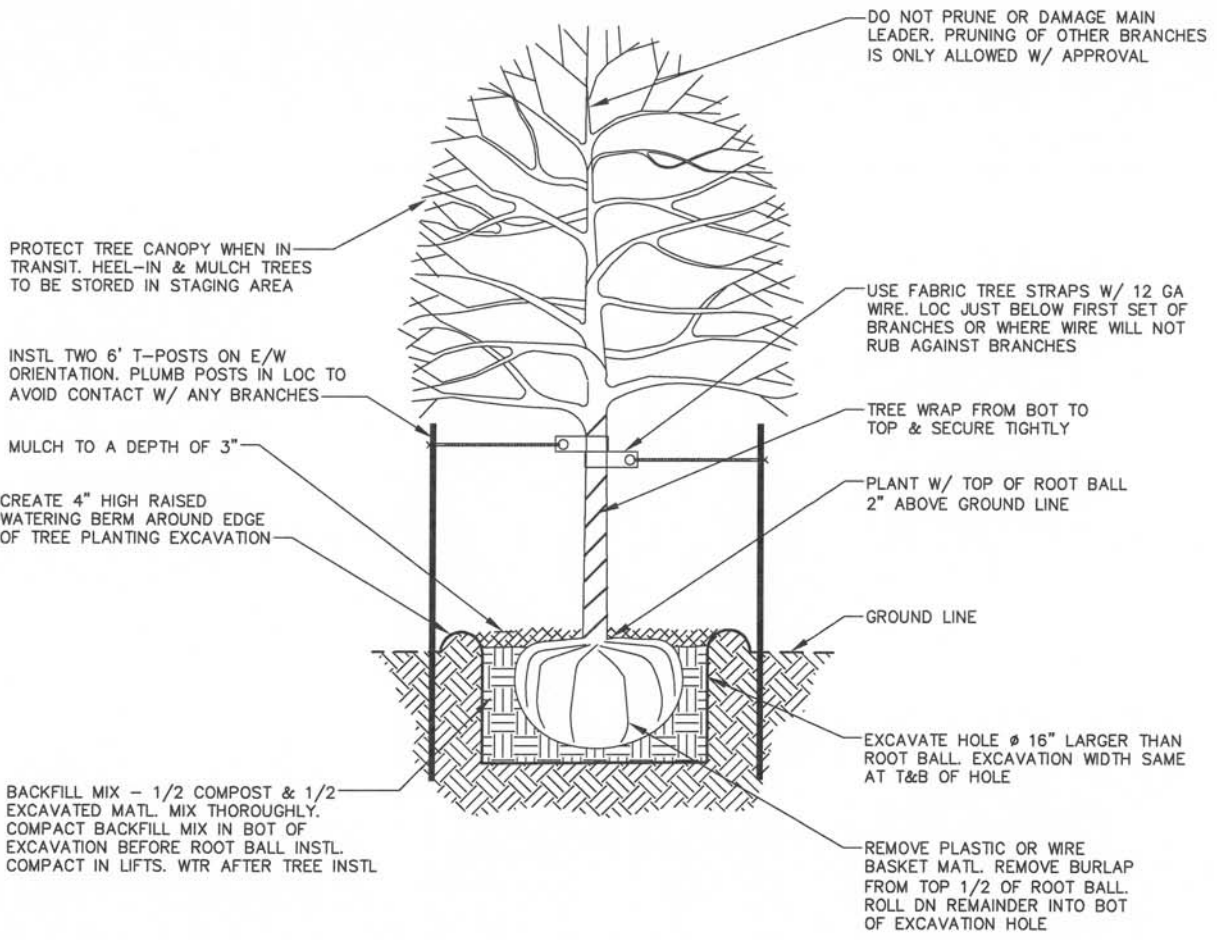
1. GATE AND POSTS SHALL BE PAINTED WITH PITTSBURGH PAINT, TWO PART EPOXY. PART NUMBERS B95-249 AND A95-2402 IN AVOCADO GREEN.
2. HINGES ARE 1/2-INCH BY 1 1/2-INCH FLAT BAR 3-INCHES LONG WITH 5/8-INCH ROUND PIN.
3. 12-FOOT GATE OUTSIDE TO OUTSIDE 11-FOOT 7 5/8-INCH DIAGONAL PIECES AT 3-FOOT 11 5/8-INCH DIAGONAL PIECES CUT AT 48-DEGREES.
4. PLUG WELD INSIDE DIAMETER AFTER PLACING BAR INTO DRILLED HOLE.
5. LOCATE AFTER GATE ASSEMBLY HINGES HAVE BEEN WELDED KEEPING GATE ASSEMBLY LEVEL.

DRAWN BY: MITCHELL
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Penn
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

32018  
ACCESS GATE



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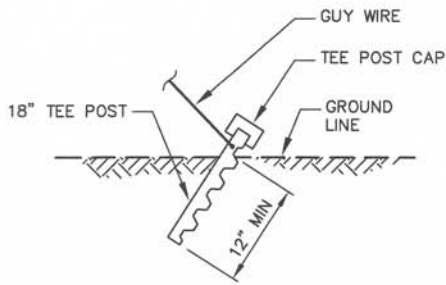
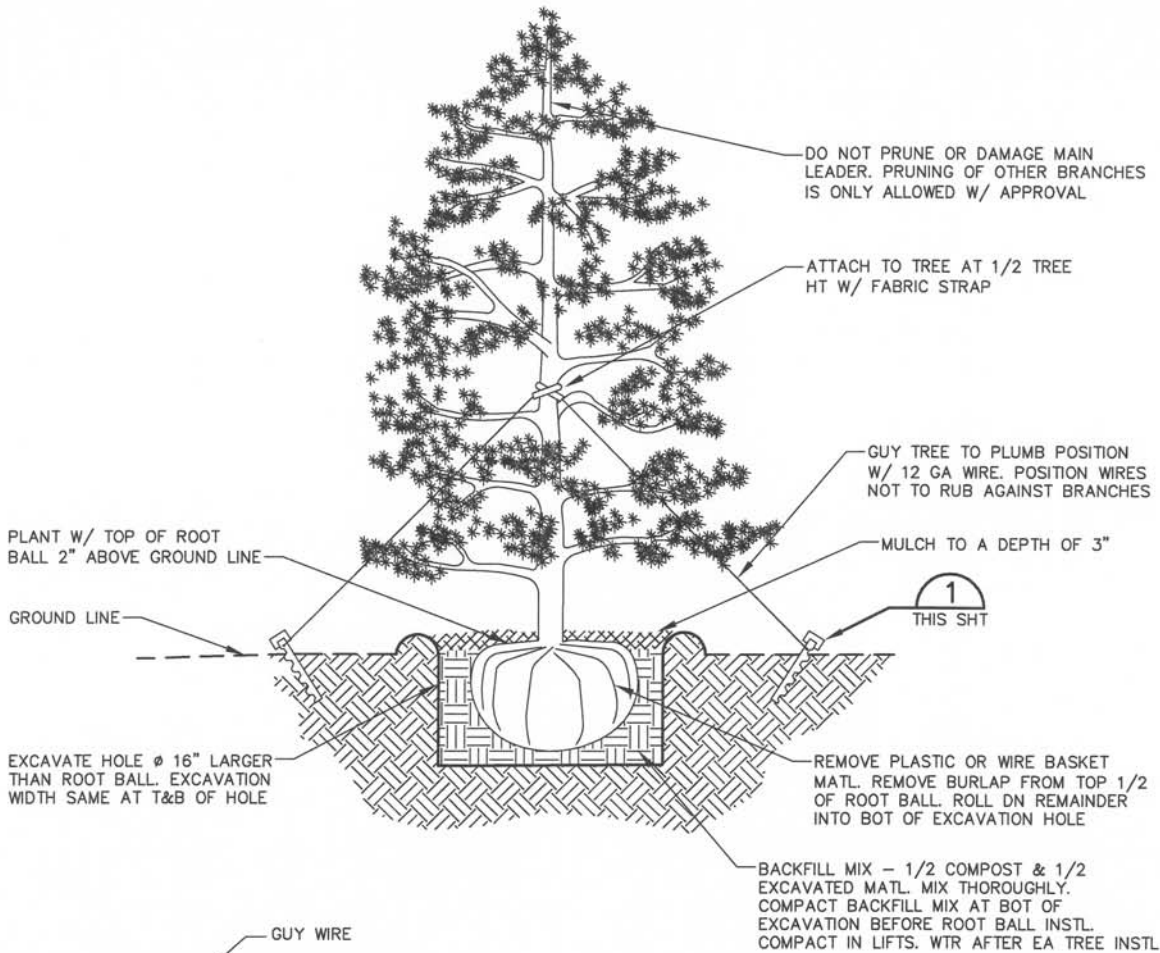


DRAWN BY: MITCHELL
CHKD BY: K ROSS/KUR
APPD BY: Stephen C. Paine
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

32020  
DECIDUOUS TREE PLANTING

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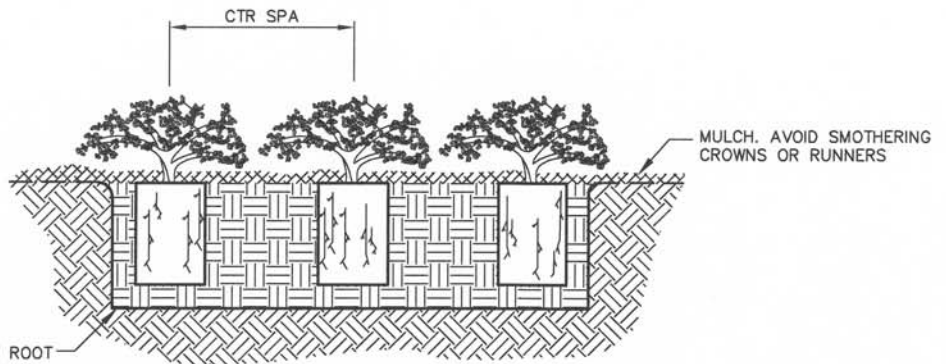
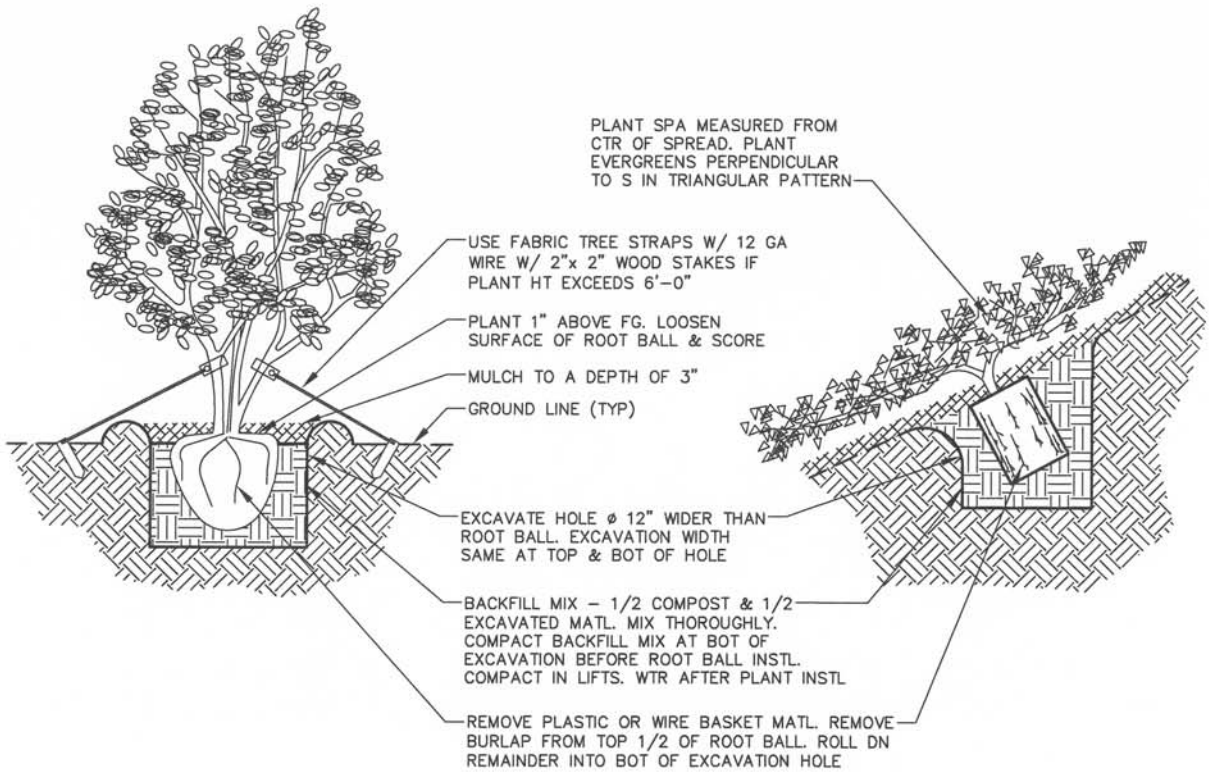


**DETAIL** 1  
(3 REQD) THIS SHT

DRAWN BY: MITCHELL
CHKD BY: K ROSS/VLR
APPD BY: Stephen C. Rein
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

32021  
EVERGREEN TREE PLANTING

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EXCAVATE PLANTING PIT 2" BELOW ROOT BALL. MAINTAIN 1/2 COMPOST TO 1/2 EXIST SOIL MIX. COMPACT AREA BELOW ROOT BALL. PLANT USING ON CTR MEASUREMENTS. WTR THOROUGHLY

DRAWN BY: MITCHELL

CHKD BY: K ROSS/KUR

APPD BY: Stephen C. Rain

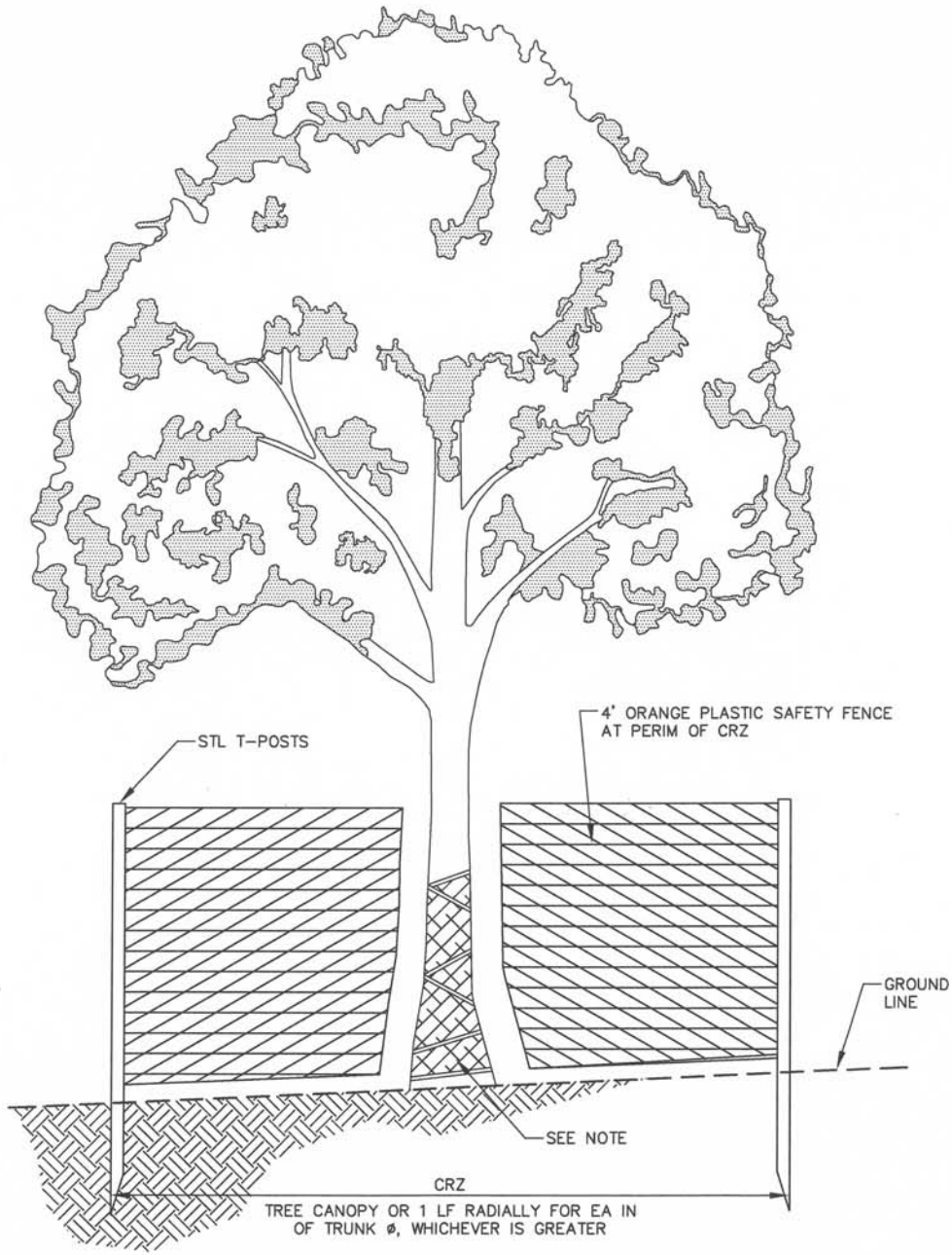
ORIGINATION DATE: JANUARY 2017

REVISION DATE:

## 32022 SHRUB AND PERENNIAL PLANTING

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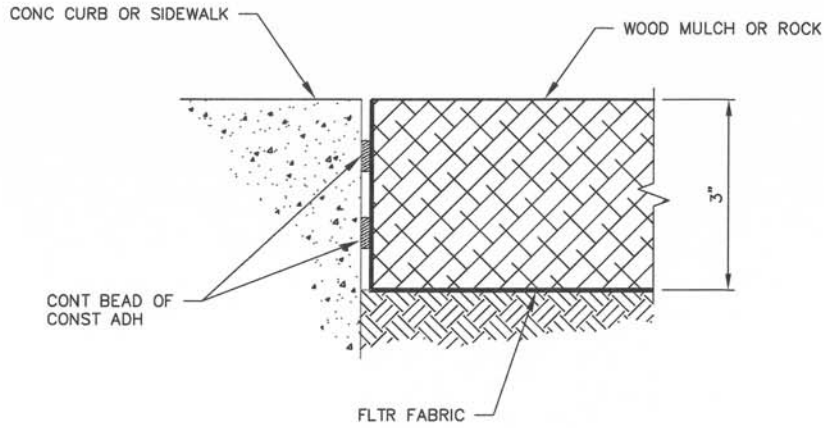
**NOTE:**

TREE WRAP ONLY REQUIRED IF EXCAVATION IS WITHIN CRITICAL ROOT ZONE.

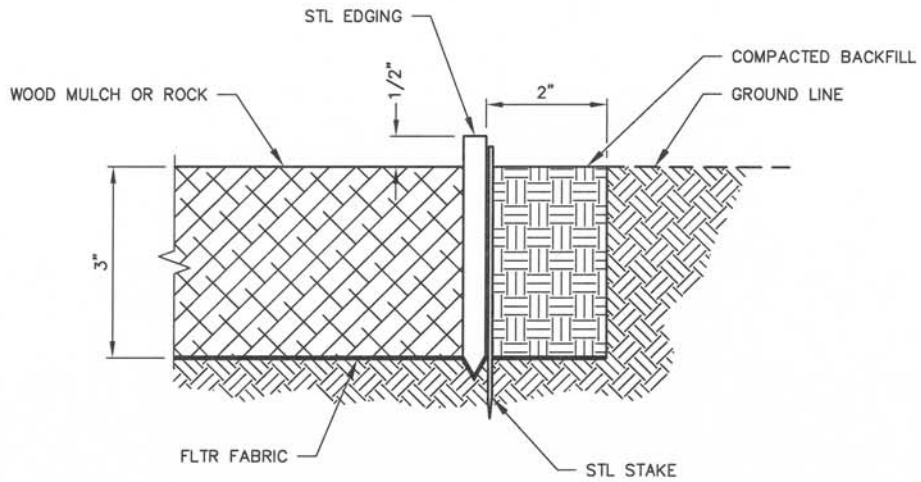
DRAWN BY: ALVARADO
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Pen
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

32023  
TREE PROTECTION FENCE

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HARD EDGE FABRIC



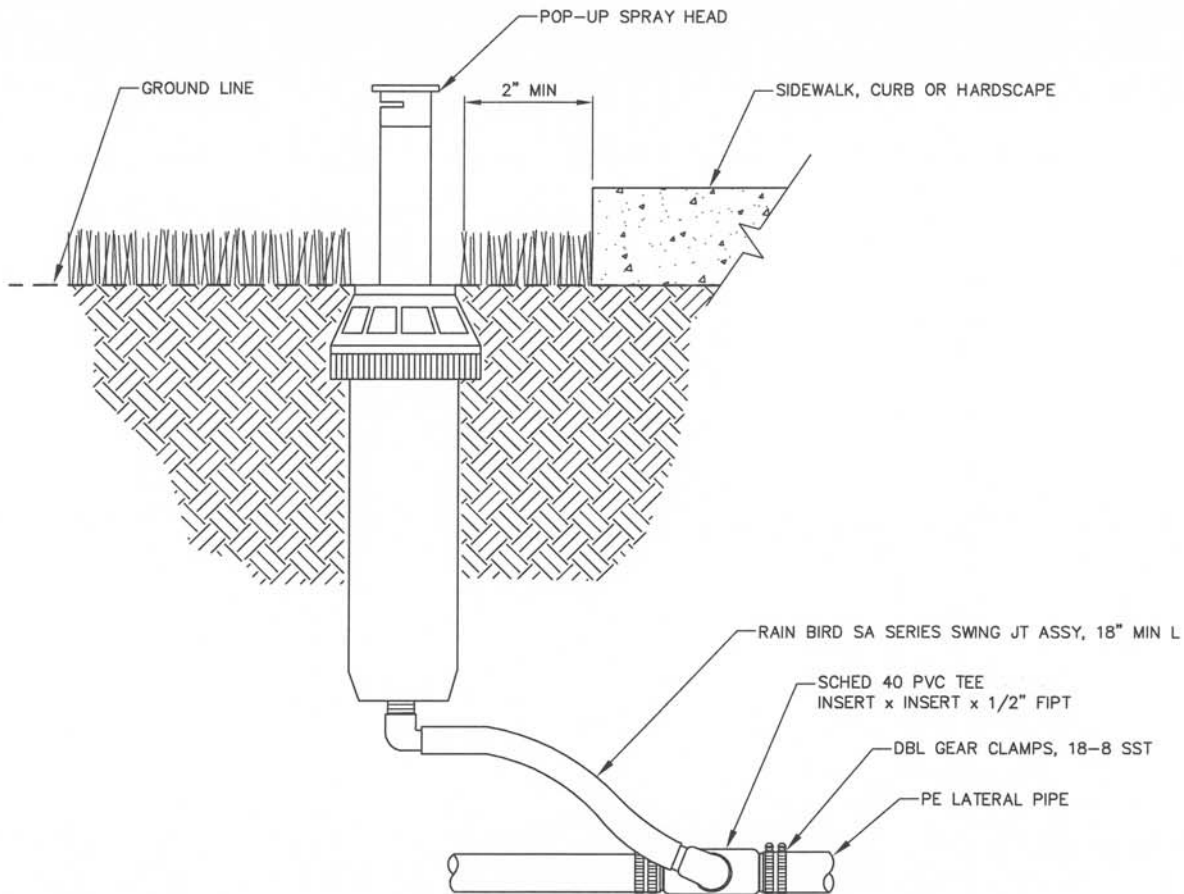
STEEL EDGING AND FABRIC

DRAWN BY: MCMILLEN  
 CHKD BY: K ROSS/KLR  
 APPD BY: Stephen C. Peen  
 ORIGINATION DATE: JANUARY 2017  
 REVISION DATE:

32025  
 LANDSCAPE EDGING

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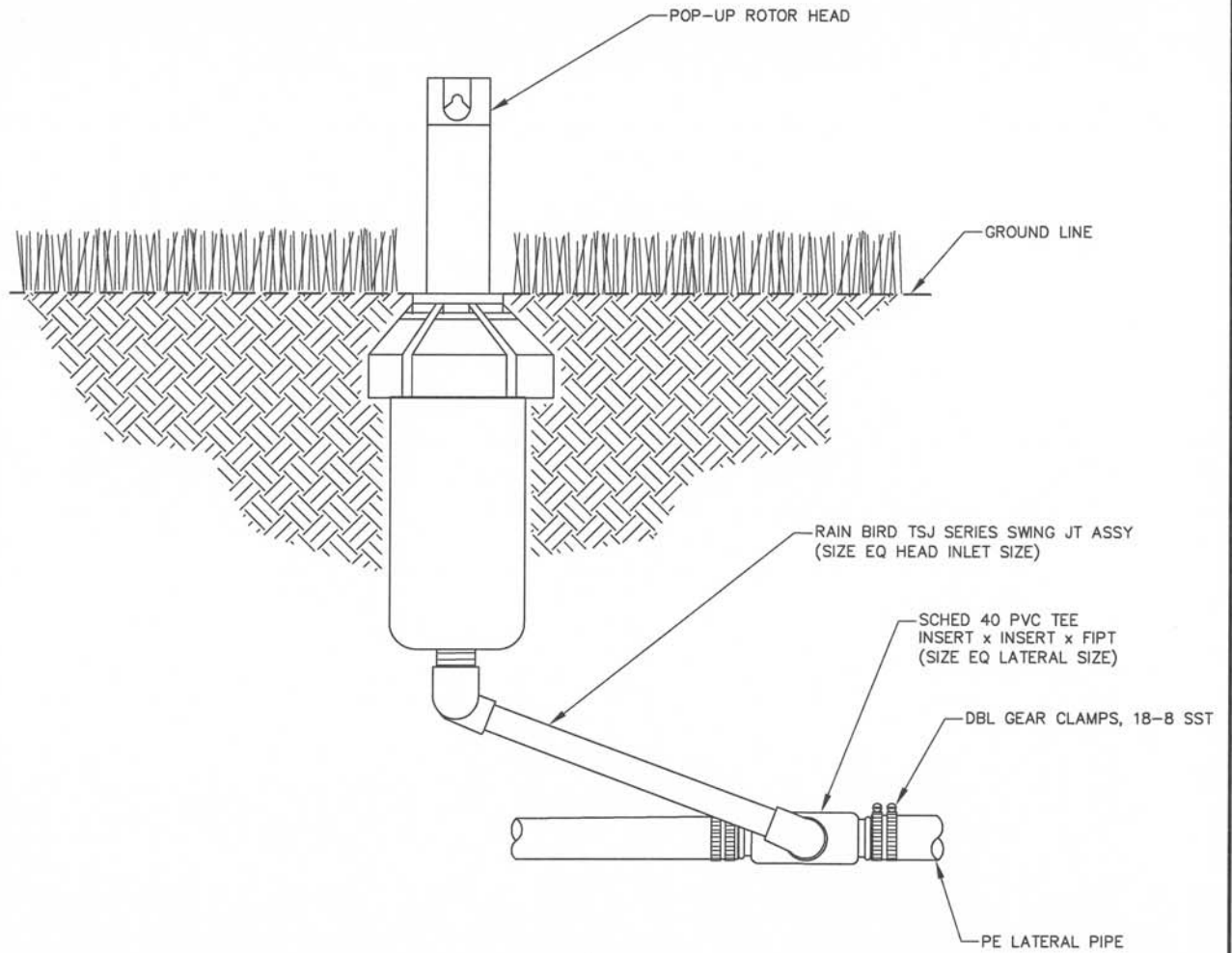




DRAWN BY: MITCHELL  
 CHKD BY: K ROSS/KLR  
 APPD BY: Stephen C. Ben  
 ORIGINATION DATE: JANUARY 2017  
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32030  
 POP-UP SPRAY HEAD

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DRAWN BY: MITCHELL

CHKD BY: K ROSS/*KR*

APPD BY: *Stephen C. Penn*

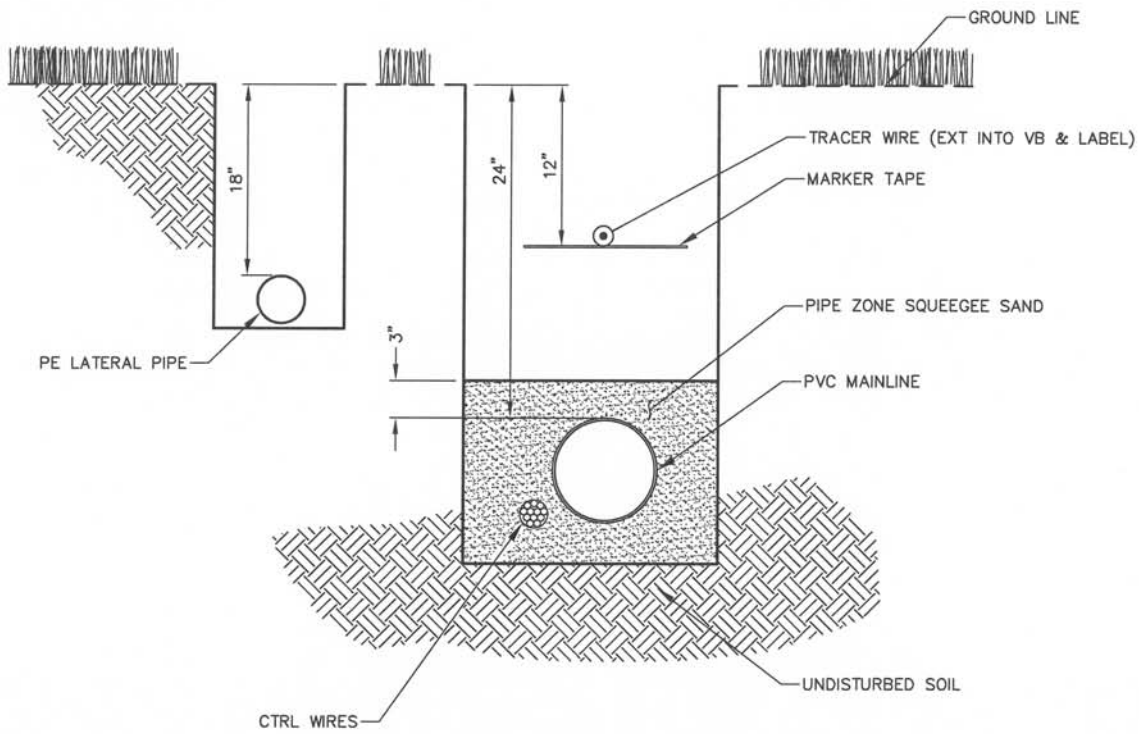
ORIGINATION DATE: JANUARY 2017

REVISION DATE:

32031  
GEAR DRIVEN ROTOR HEAD

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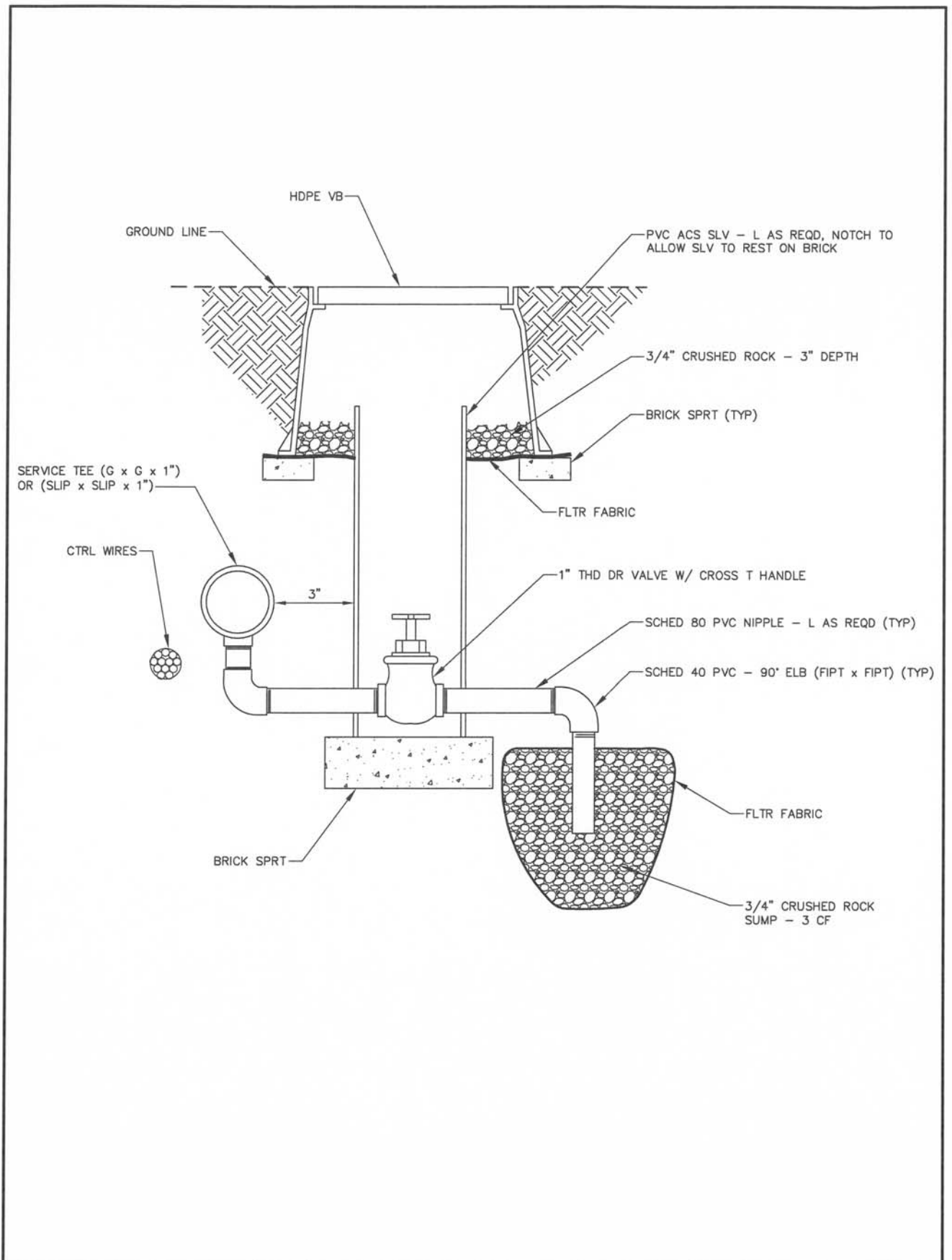


32032  
TYPICAL IRRIGATION  
PIPE TRENCH



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CHKD BY: K ROSS/KR
APPD BY: Stephen C. Ren
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

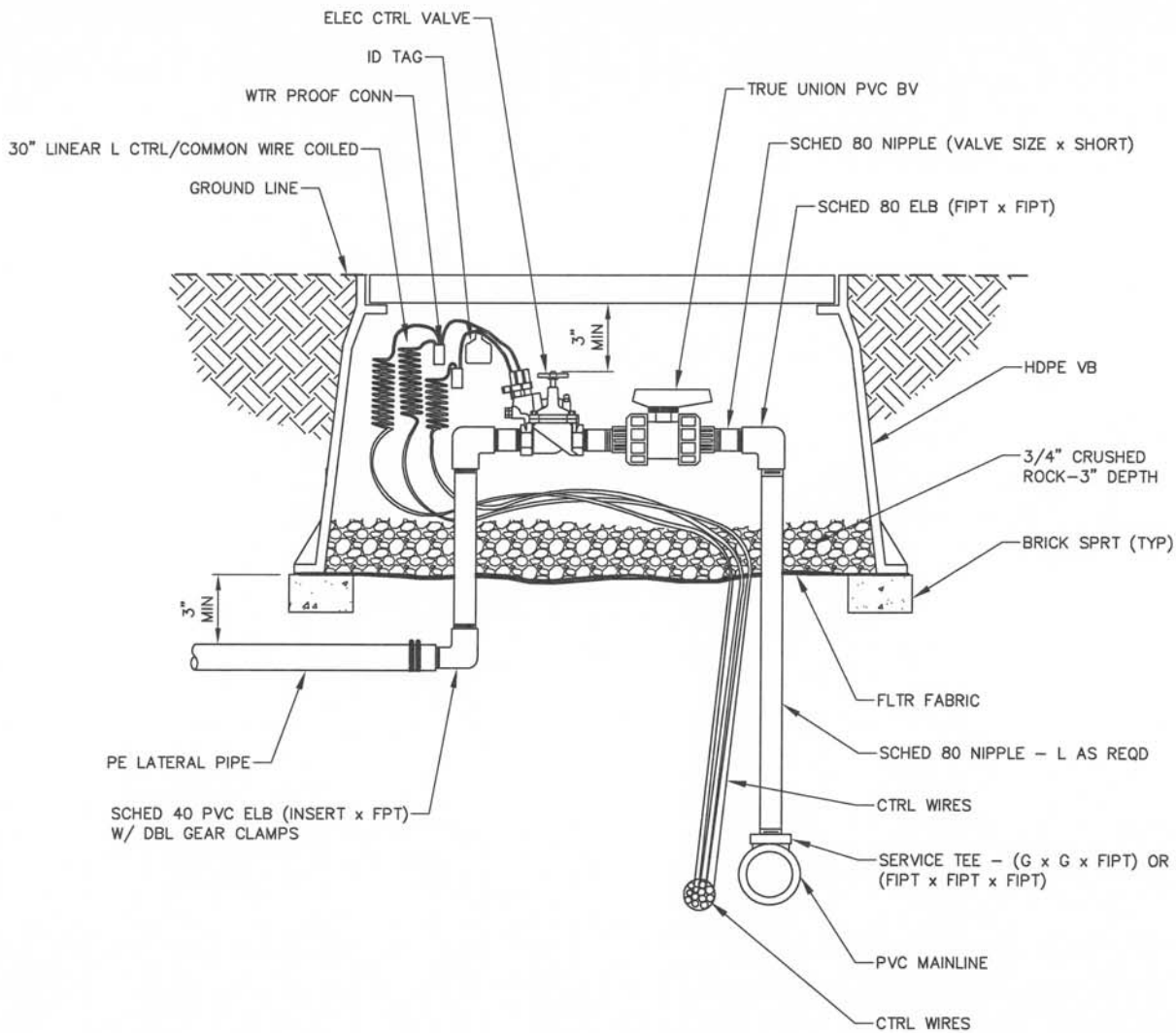


DRAWN BY: MITCHELL
CHKD BY: K ROSS/ <i>KR</i>
APPD BY: <i>Stephen C. Pann</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

32040  
MANUAL DRAIN VALVE

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DRAWN BY: MITCHELL

CHKD BY: K ROSS/KLR

APPD BY: Stephen C. P...  
*Stephen C. P...*

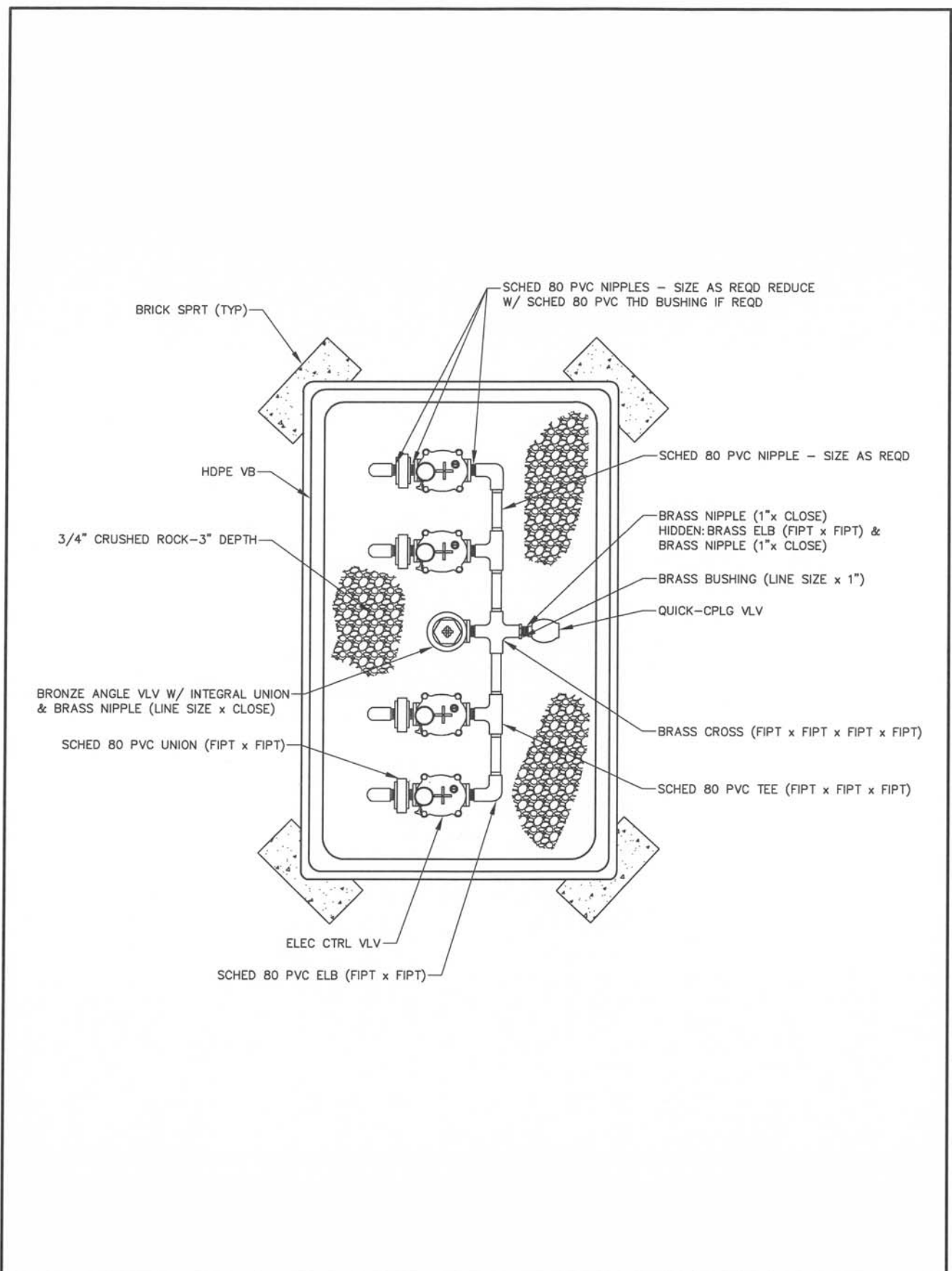
ORIGINATION DATE: JANUARY 2017

REVISION DATE:

## 32041 SINGLE CONTROL VALVE

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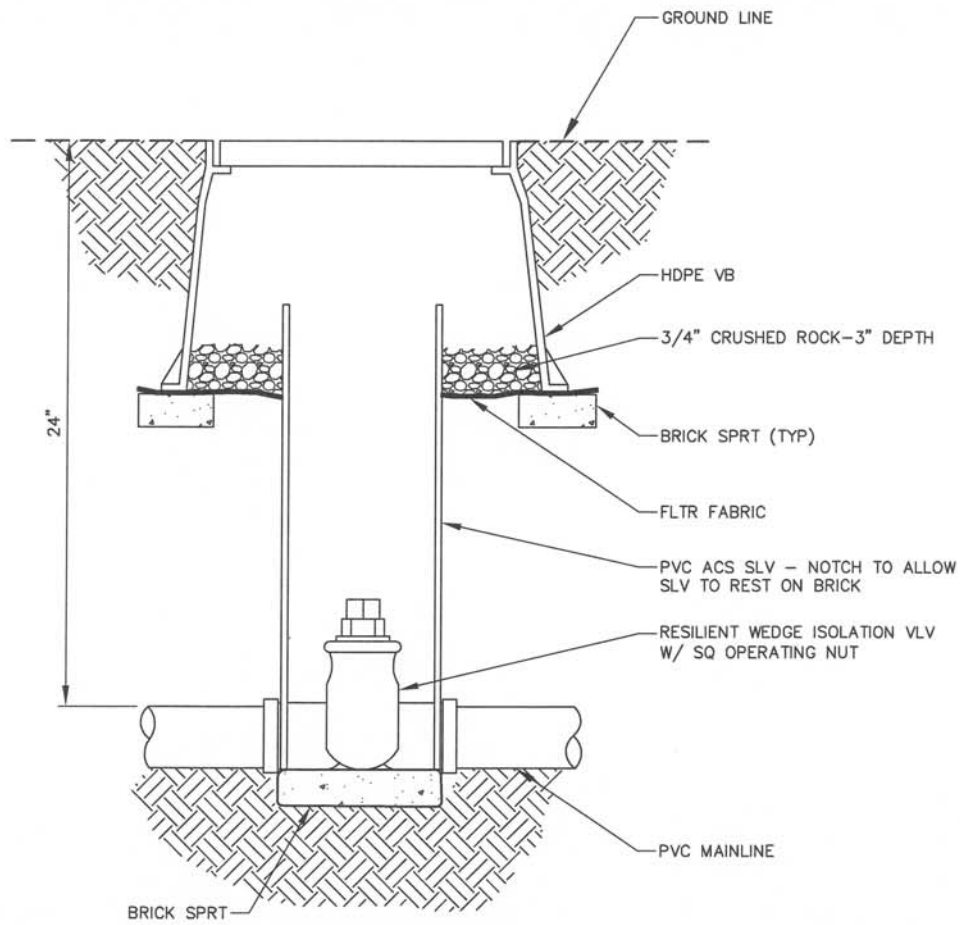


- BRICK SPRT (TYP)
- HDPE VB
- 3/4" CRUSHED ROCK-3" DEPTH
- BRONZE ANGLE VLV W/ INTEGRAL UNION & BRASS NIPPLE (LINE SIZE x CLOSE)
- SCHED 80 PVC UNION (FIPT x FIPT)
- ELEC CTRL VLV
- SCHED 80 PVC ELB (FIPT x FIPT)
- SCHED 80 PVC NIPPLES - SIZE AS REQD REDUCE W/ SCHED 80 PVC THD BUSHING IF REQD
- SCHED 80 PVC NIPPLE - SIZE AS REQD
- BRASS NIPPLE (1"x CLOSE)  
HIDDEN: BRASS ELB (FIPT x FIPT) & BRASS NIPPLE (1"x CLOSE)
- BRASS BUSHING (LINE SIZE x 1")
- QUICK-CPLG VLV
- BRASS CROSS (FIPT x FIPT x FIPT x FIPT)
- SCHED 80 PVC TEE (FIPT x FIPT x FIPT)

DRAWN BY: MITCHELL
CHKD BY: K ROSS/VLR
APPD BY: <i>Stephen C. Ross</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

32042  
 CLUSTER CONTROL  
 VALVE PLAN

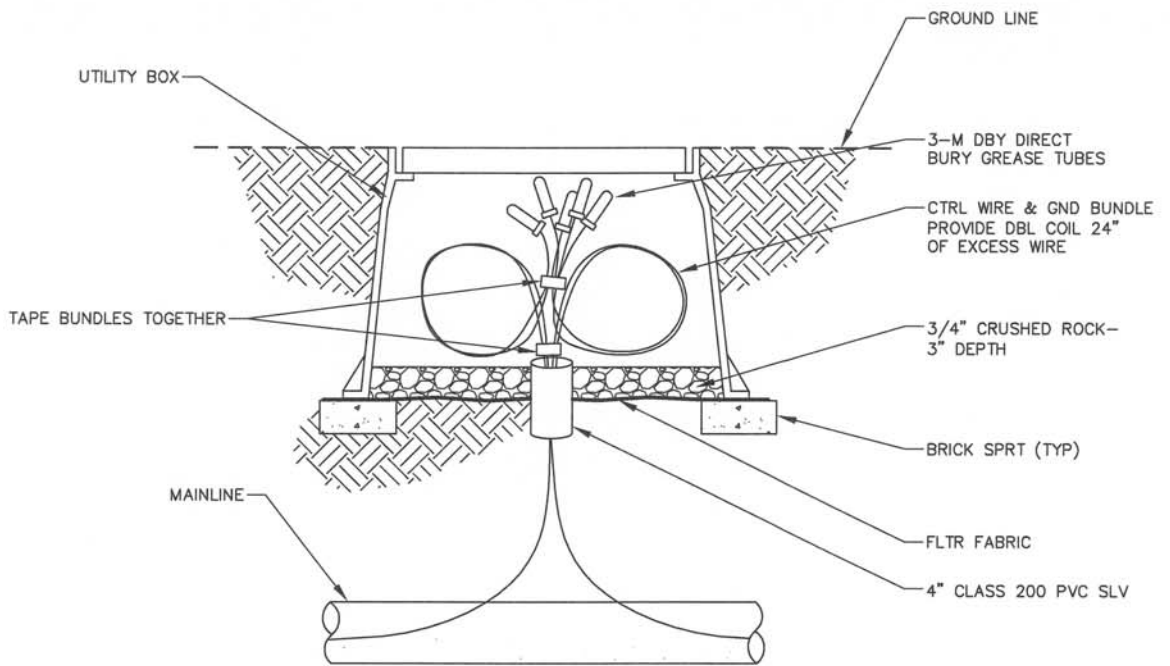
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DRAWN BY: MITCHELL
CHKD BY: K ROSS/KIR
APPD BY: <i>Steph C. Pen</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

32043  
ISOLATION VALVE

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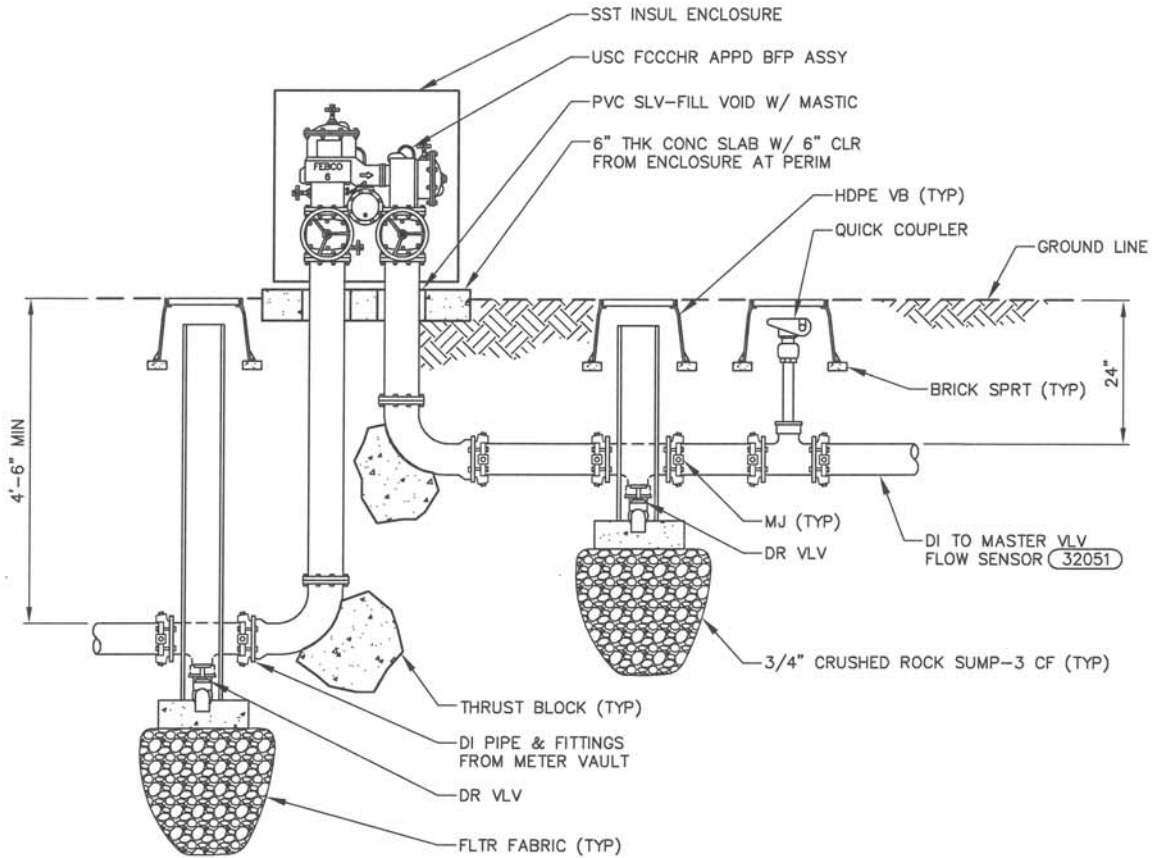
DRAWN BY: ALVARADO
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Peem
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

32044  
IRRIGATION WIRE  
SPLICE BOX

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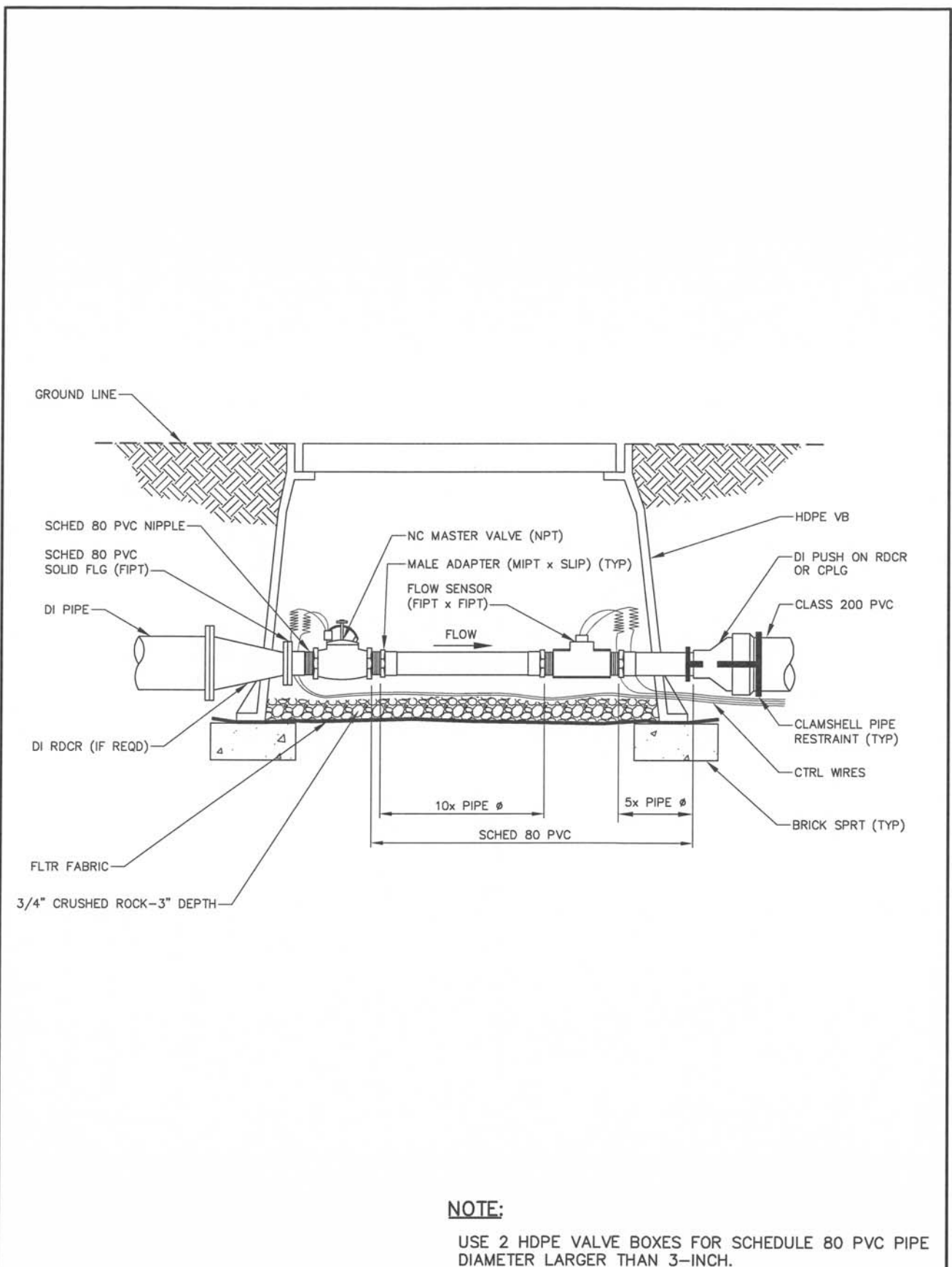




DRAWN BY: MITCHELL
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Penn
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

32050  
 3"Ø AND LARGER  
 BACKFLOW PREVENTER

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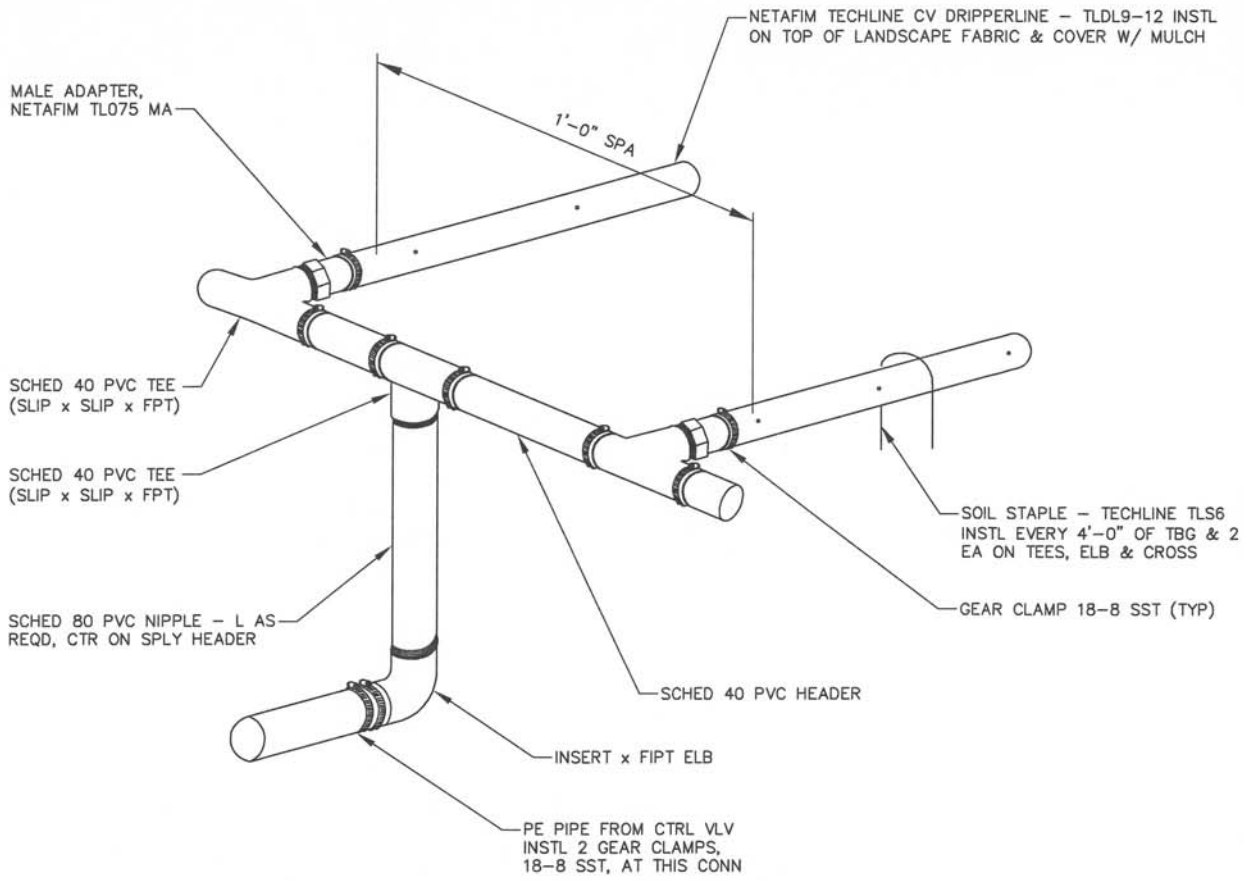
**NOTE:**

USE 2 HDPE VALVE BOXES FOR SCHEDULE 80 PVC PIPE DIAMETER LARGER THAN 3-INCH.

DRAWN BY: MITCHELL
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Rem
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**32051  
MASTER VALVE  
FLOW SENSOR**

**D DENVER WATER**  
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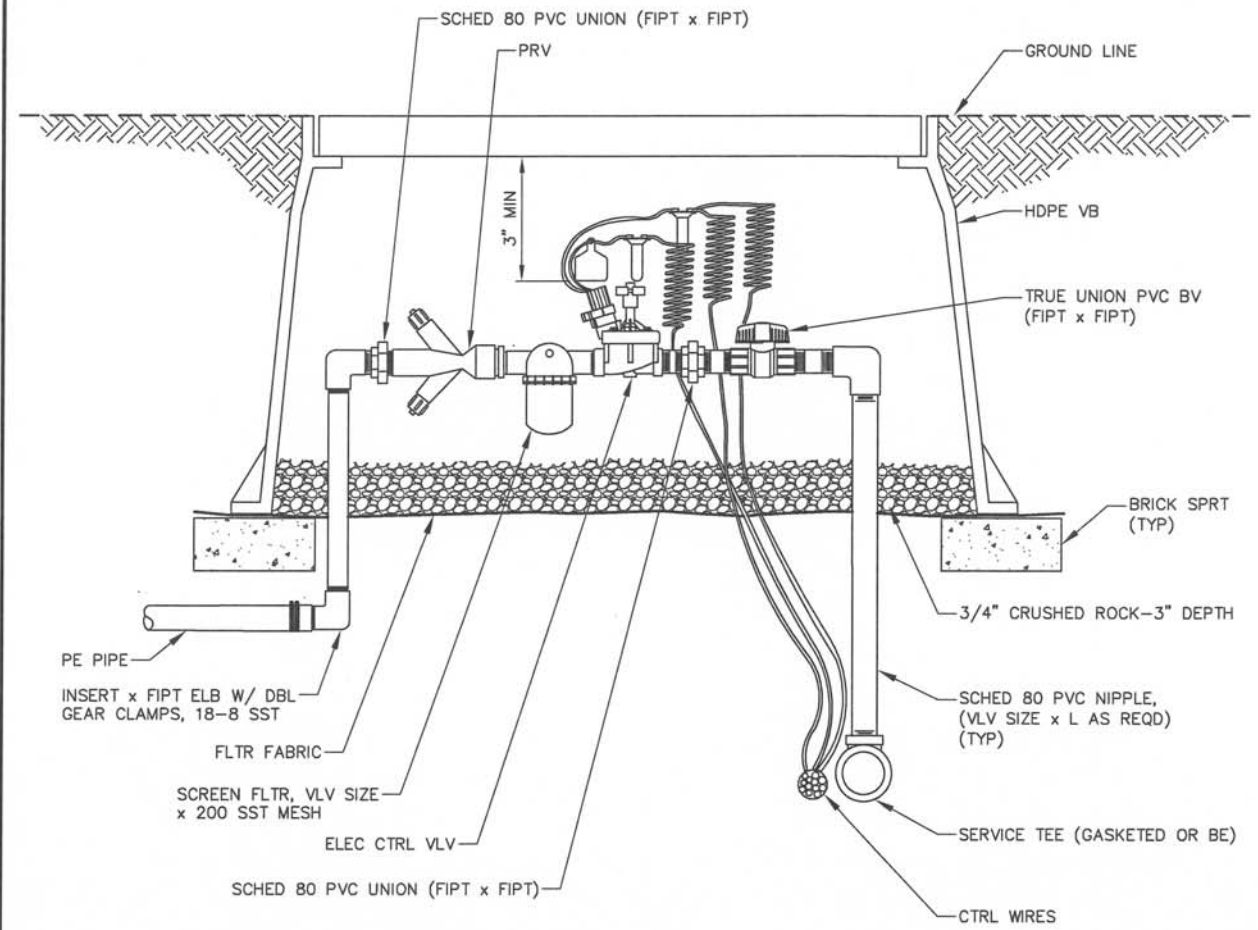


DRAWN BY: MITCHELL
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Fenn
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

### 32052 DRIPLINE PIPE

**D DENVER WATER**

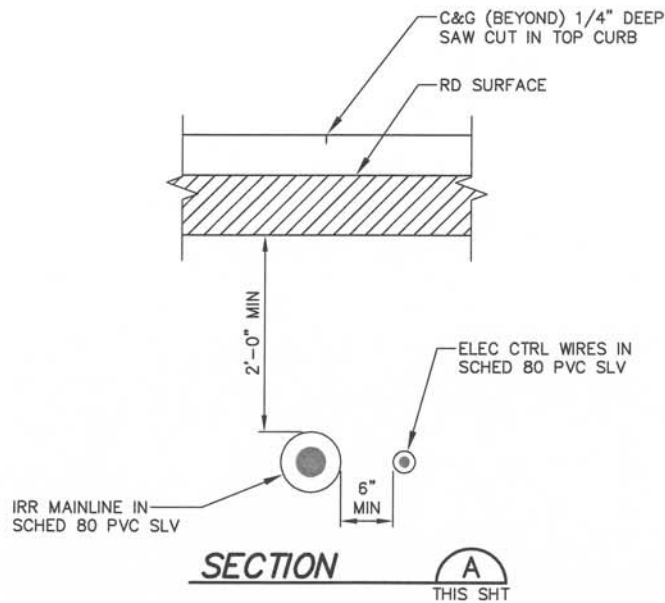
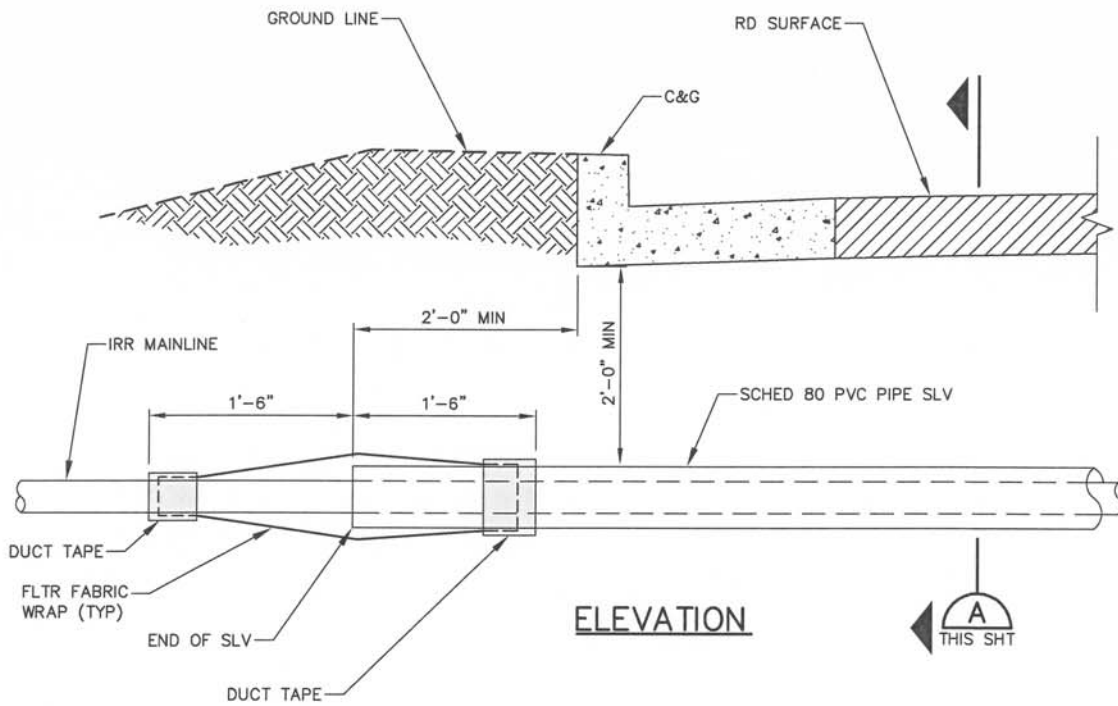
1600 West 12th Ave  
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 F: 303.628.6851  
 denverwater.org



DRAWN BY: MITCHELL
CHKD BY: <i>K ROSS/KLR</i>
APPD BY: <i>Stephen C. P...</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

32053  
DRIPLINE CONTROL VALVE

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DRAWN BY: *MCMILLEN*

CHKD BY: *K ROSS/KR*

APPD BY: *Stephen C. Rom*

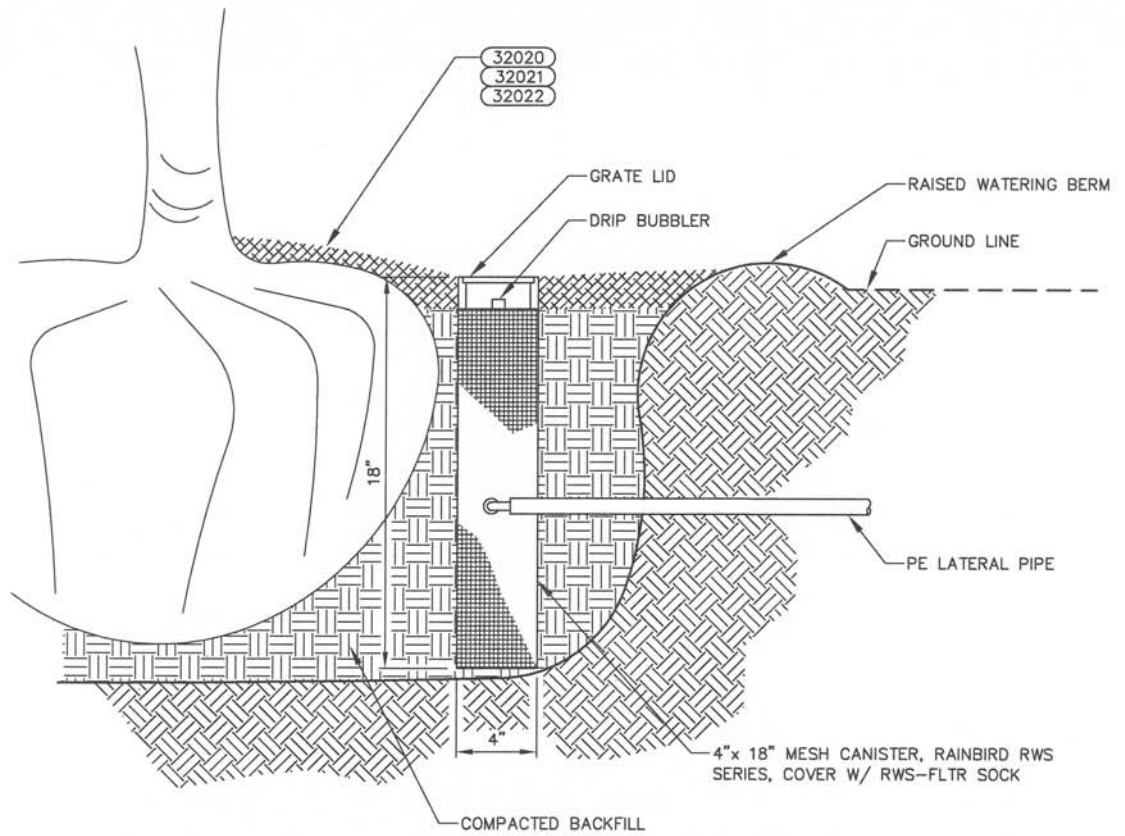
ORIGINATION DATE: **JANUARY 2017**

REVISION DATE:

**32055  
IRRIGATION SLEEVE**

**D DENVER WATER**

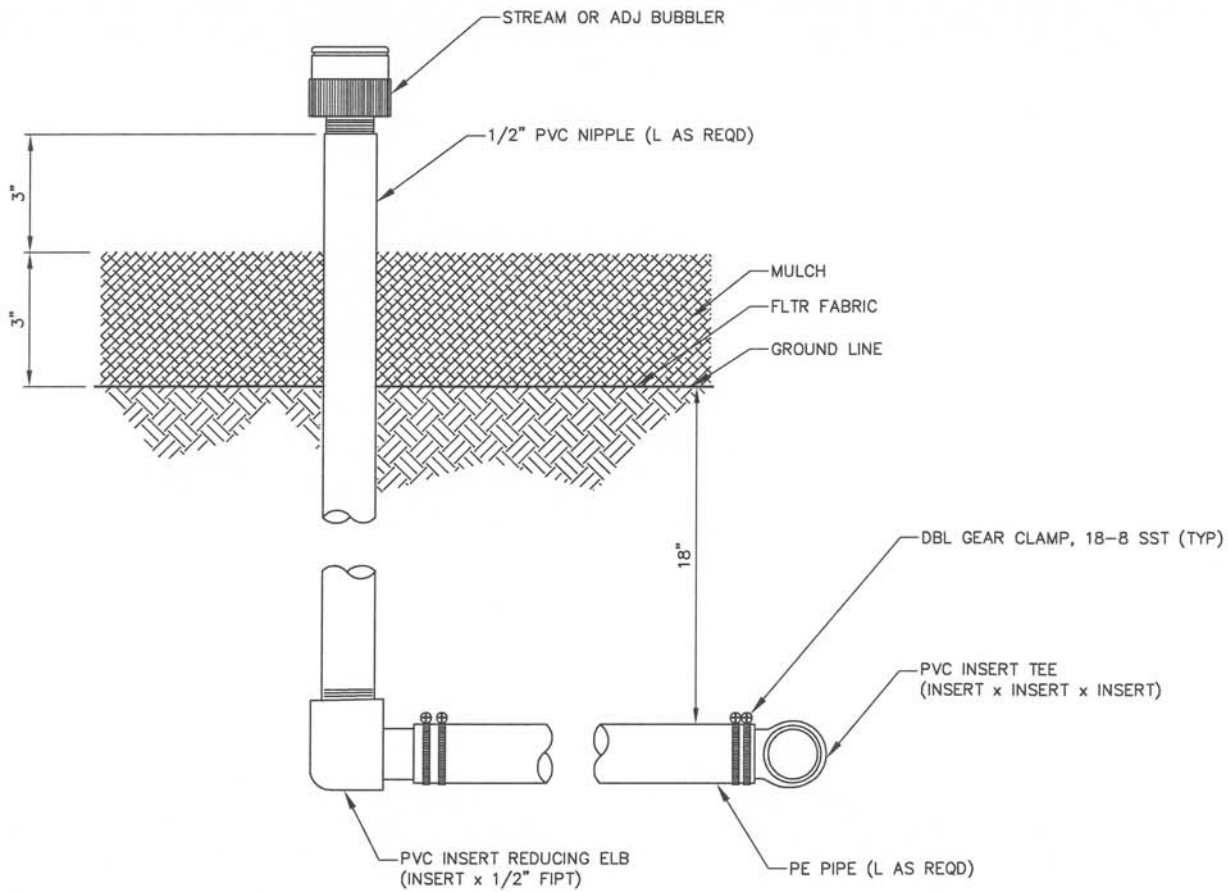
1600 West 12th Ave  
Denver, Colorado 80204-3412  
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denverwater.org



DRAWN BY: MITCHELL
CHKD BY: K ROSS/KIR
APPD BY: Stephen C. Ren
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

32060  
TREE BUBBLER

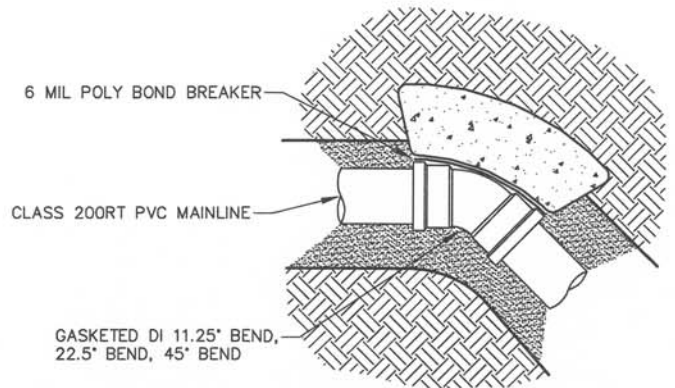
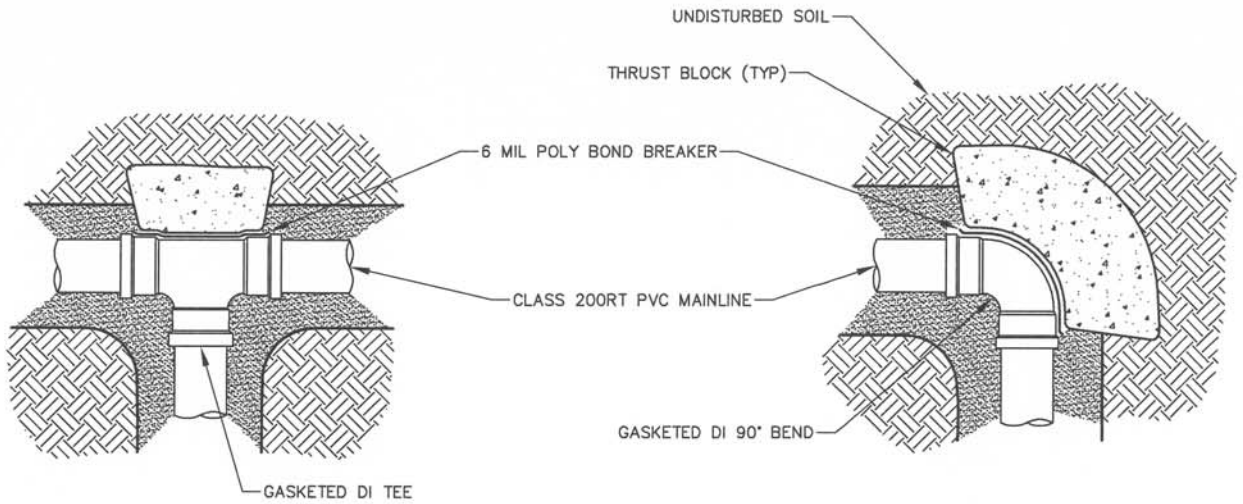
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DRAWN BY: MITCHELL
CHKD BY: K ROSS/ <i>KR</i>
APPD BY: <i>Stephen C. P...</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**32061**  
**FIXED RISER BUBBLER**

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**NOTE:**

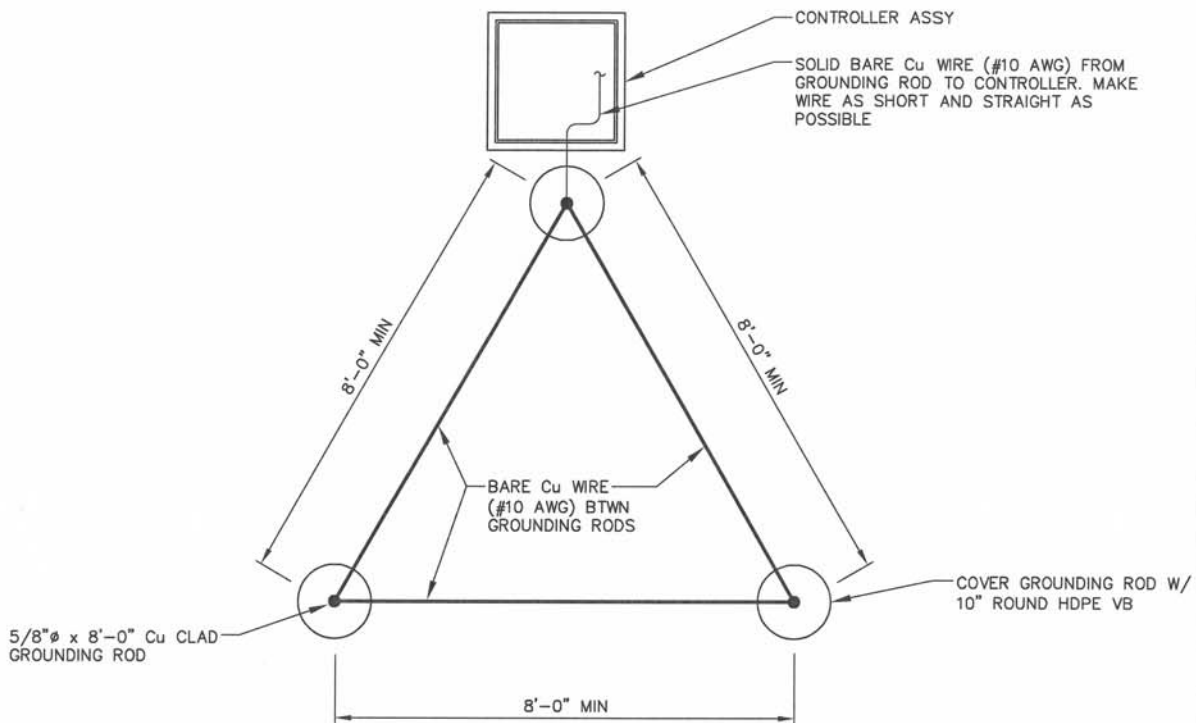
THRUST BLOCKS SHALL BE SIZED AND PLACED IN ACCORDANCE WITH SPECIFICATION SECTION 32 80 00.

DRAWN BY: MITCHELL
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Rose
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

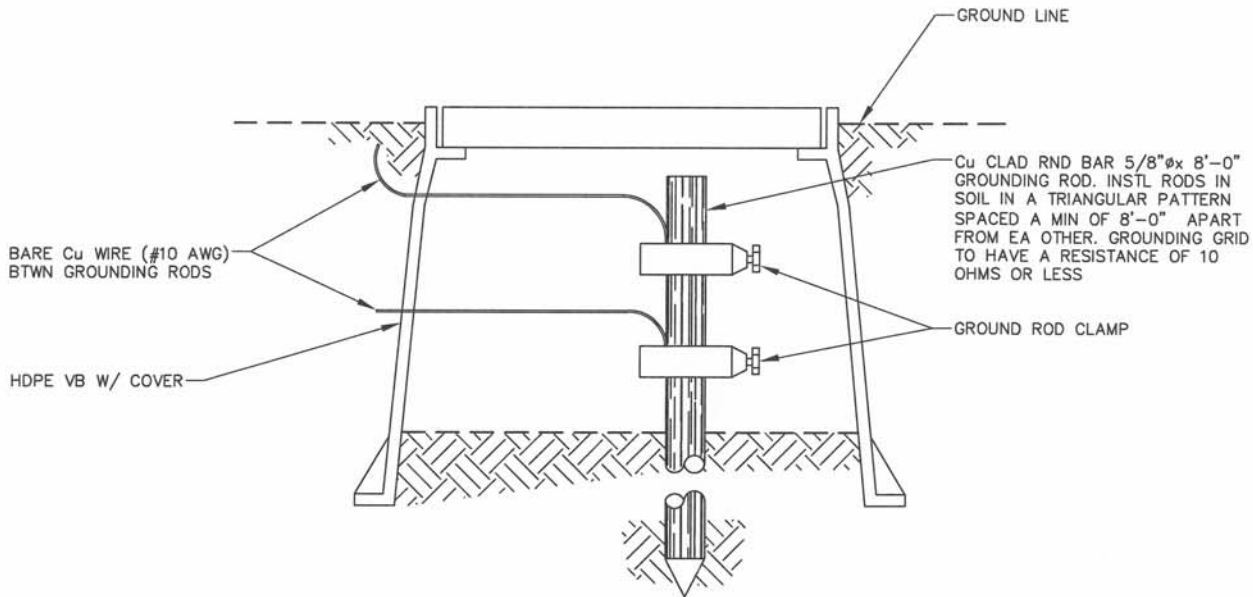
**32070**  
**THRUST BLOCKS FOR**  
**IRRIGATION PIPING**

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**GROUND ROD LAYOUT**



**GROUND ROD ASSEMBLY**

**NOTE:**

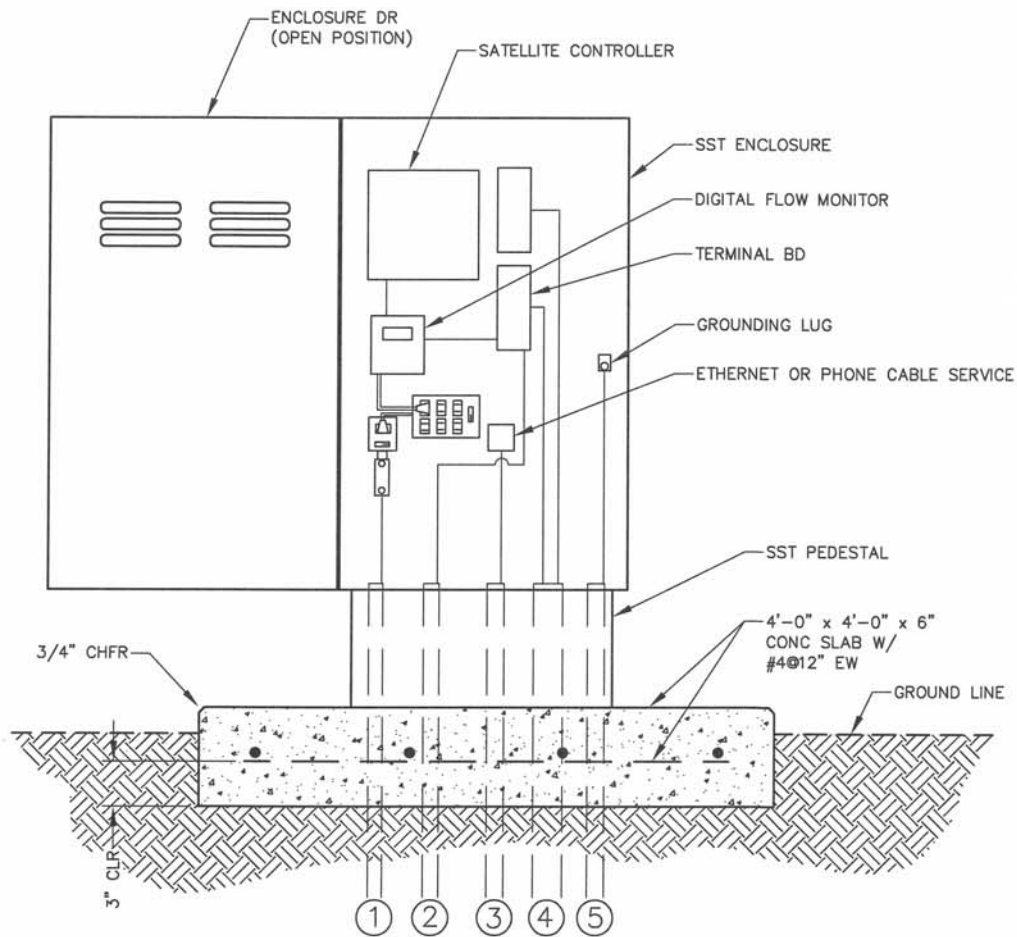
USE ONLY WHERE FACILITY GROUNDING GRID IS NOT AVAILABLE FOR CONNECTION.

DRAWN BY: MITCHELL
CHKD BY: K ROSS/KR
APPD BY: Stephen C. Reem
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

32080  
CENTRAL CONTROL UNIT  
OR FIELD SATELLITE  
GROUNDING ROD

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**KEYED NOTES:**

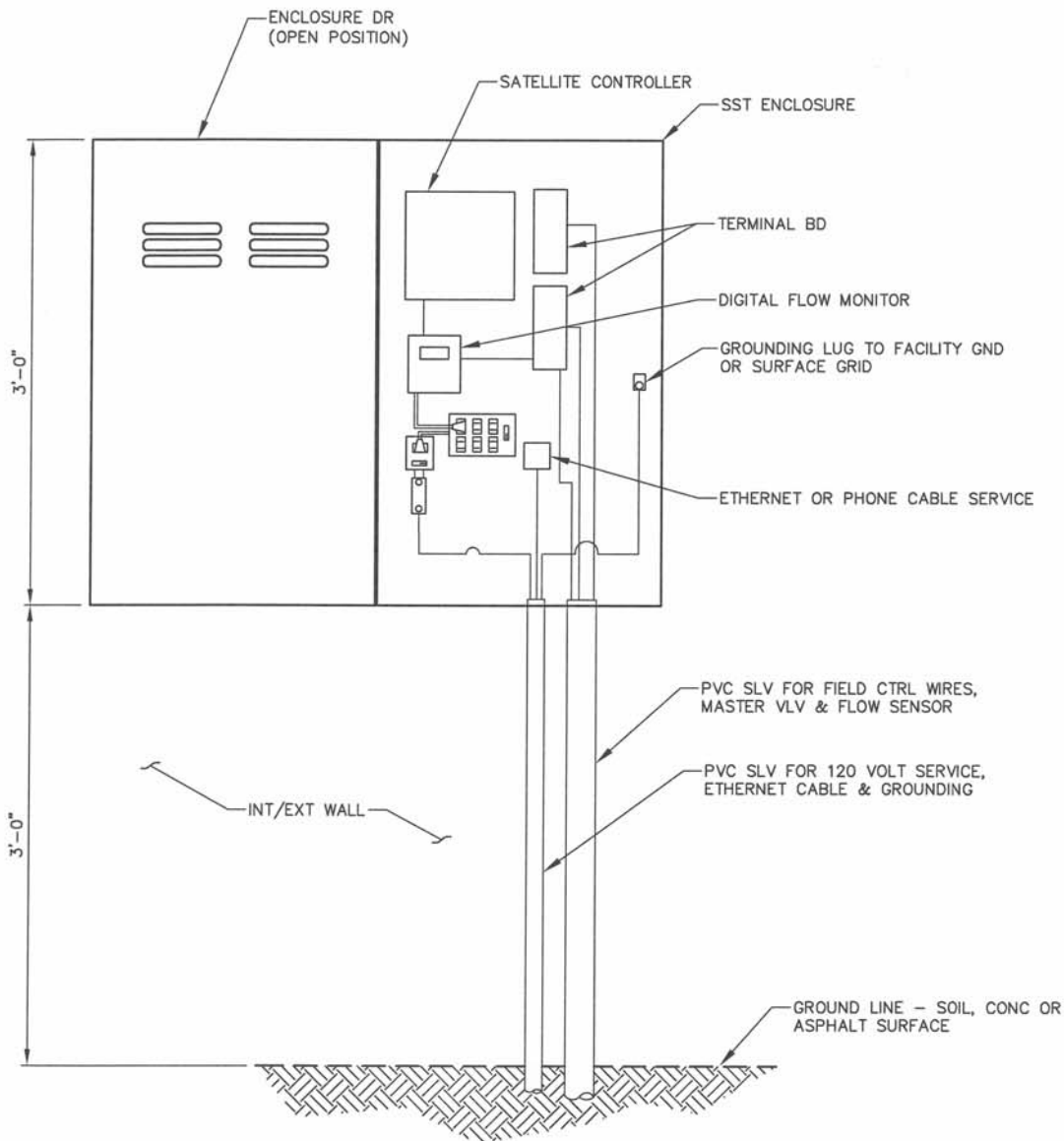
- ① 120 VAC ELECTRICAL SERVICE
- ② COMMUNICATION WIRE TO FLOW MONITOR
- ③ ETHERNET OR PHONE SERVICE
- ④ 14/1 REMOTE CONTROL WIRES TO VALVES
- ⑤ GROUND WIRE TO GROUNDING ROD GRID

DRAWN BY: MITCHELL
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Peim
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**32081  
MAXICOM SATELLITE  
ASSEMBLY SURFACE MOUNT**

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DRAWN BY: MITCHELL

CHKD BY: K ROSS/KIR

APPD BY: Stephen C. Rem

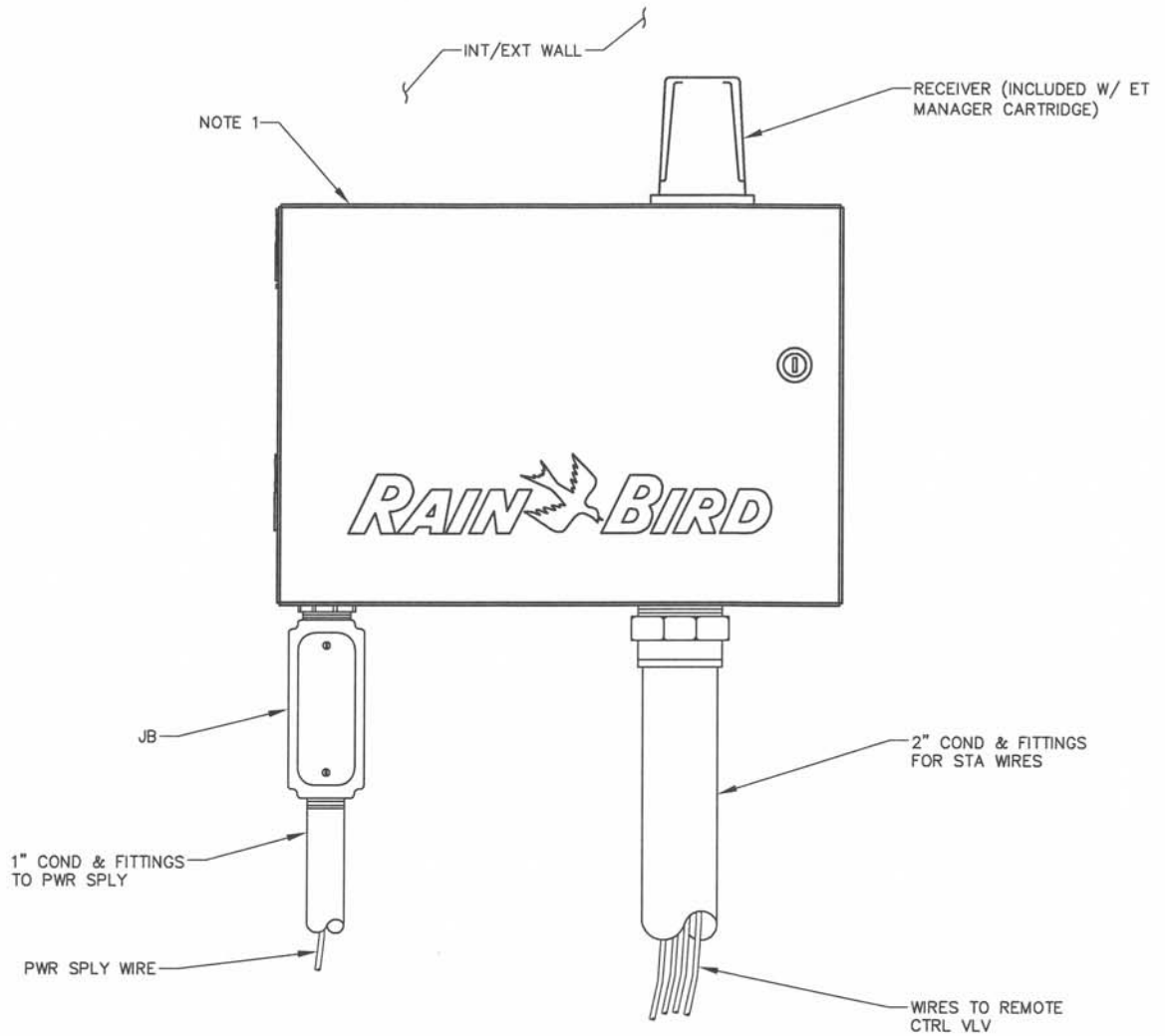
ORIGINATION DATE: JANUARY 2017

REVISION DATE:

32082  
 MAXICOM SATELLITE  
 CONTROLLER ASSEMBLY  
 WALL MOUNT

**D DENVER WATER**

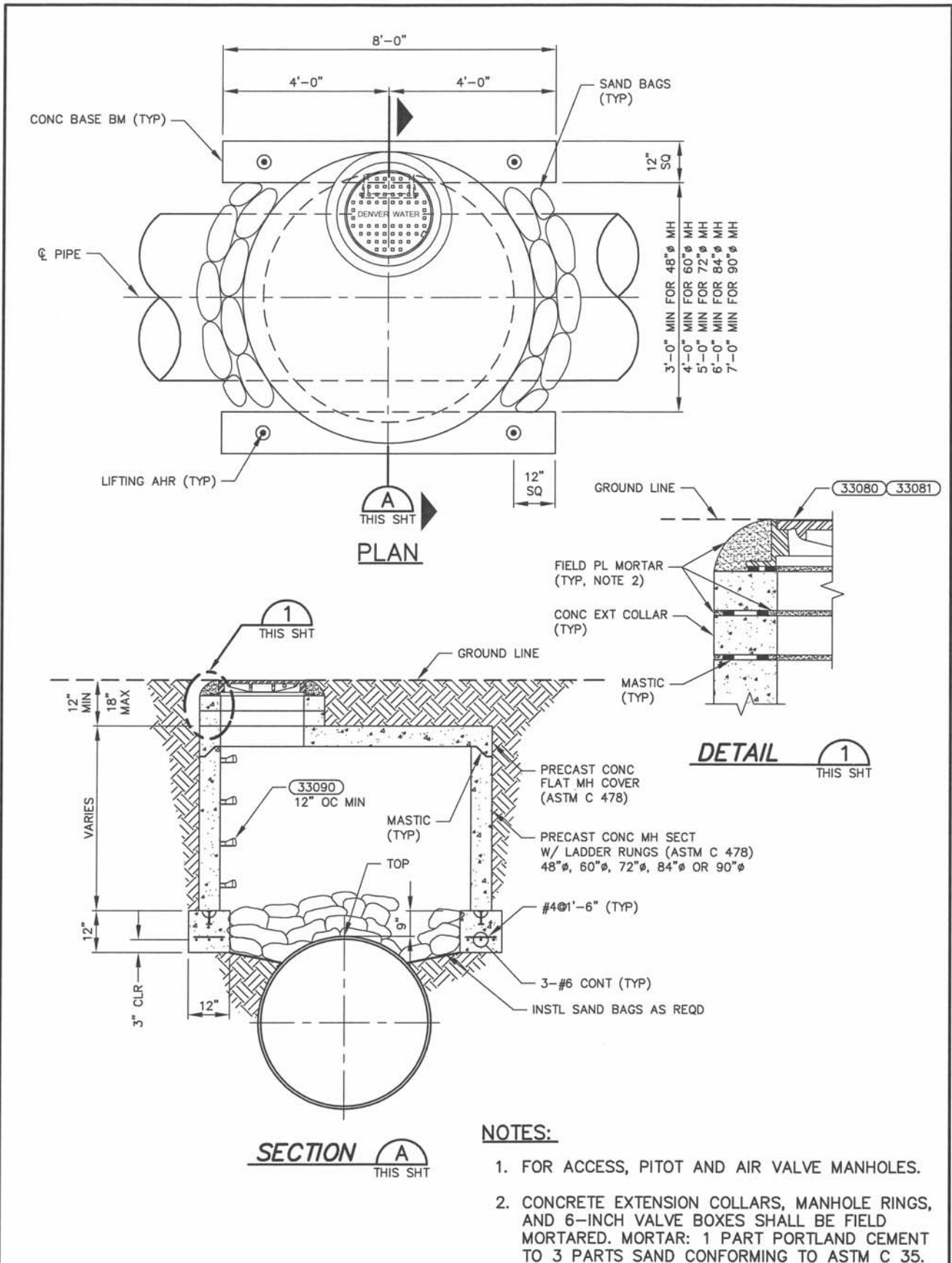
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**NOTES:**

1. IRRIGATION CONTROLLER: RAIN BIRD ESP-LXMET SMART CONTROLLER WITH ET MANAGER CARTRIDGE IN LXMM METAL CABINET WITH OUTSIDE WALL MOUNT.
2. ESP-LXMET CONTROLLER IS AVAILABLE IN 8 OR 12 STATION BASE MODELS. ADDITIONAL MODULES IN 4, 8 AND 12 STATION VERSIONS MAY BE ADDED TO BRING THE CONTROLLER UP TO 48 STATIONS MAXIMUM.
3. INSTALL SCHEDULE 40 PVC ELECTRICAL CONDUIT FOR ALL SLEEVES TO CONTROLLER.
4. PROVIDE PROPER GROUNDING COMPONENTS TO ACHIEVE GROUND RESISTANCE OF 10 OHMS OR LESS.
5. INSTALL CONTROLLER IN A LOCATION TO MAXIMIZE RECEIVER RECEPTION. INSTALL ET MANAGER REMOTE MOUNTING KIT (ETM-RMK) IN CONDITIONS WHERE RADIO EXTENSION IS NEEDED.

DRAWN BY: MITCHELL	<p>32090</p> <p><b>ESP-LXMET CONTROLLER WITH ET MANAGER CARTRIDGE IN METAL CABINET</b></p>	<p><b>D DENVER WATER</b></p> <p>1600 West 12th Ave Denver, Colorado 80204-3412 T: 303.628.6000 F: 303.628.6851 denverwater.org</p>
CHKD BY: <i>K ROSS/KR</i>		
APPD BY: <i>Stephen C. Pean</i>		
ORIGINATION DATE: JANUARY 2017		
REVISION DATE:		



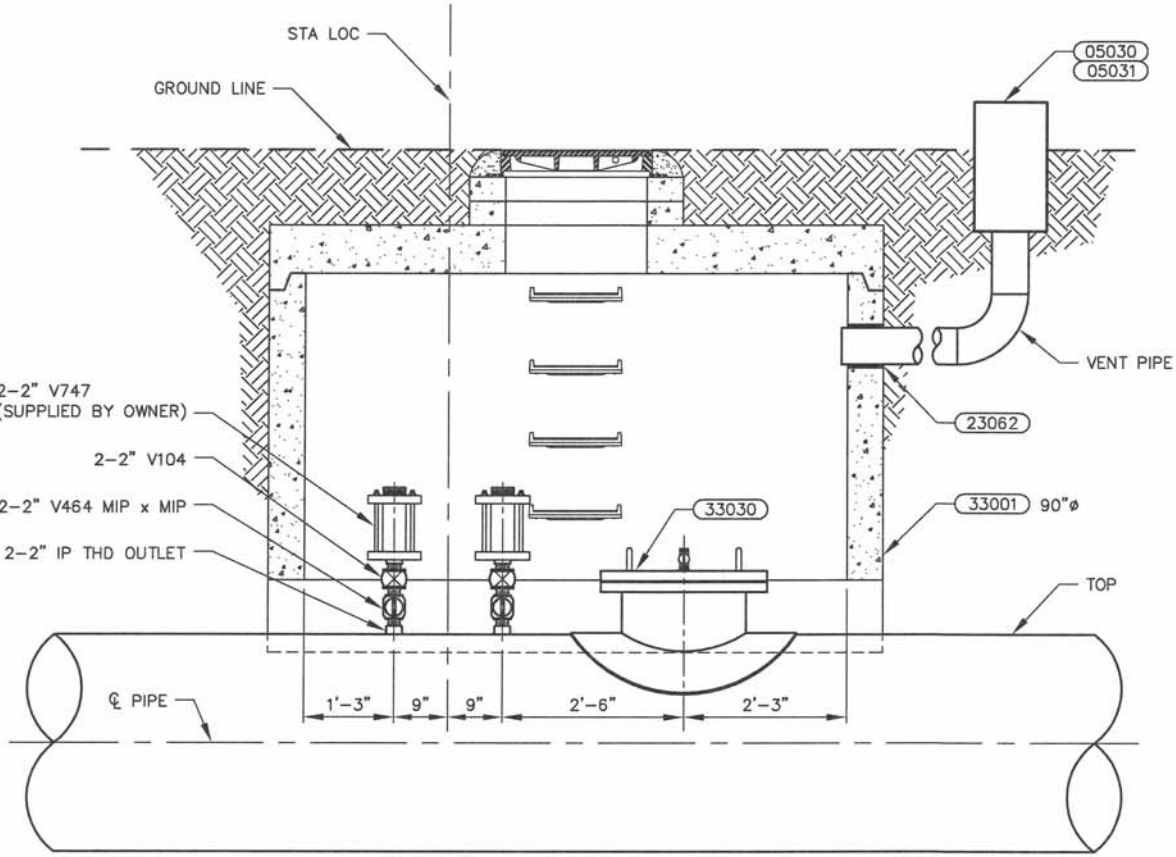
- NOTES:**
1. FOR ACCESS, PITOT AND AIR VALVE MANHOLES.
  2. CONCRETE EXTENSION COLLARS, MANHOLE RINGS, AND 6-INCH VALVE BOXES SHALL BE FIELD MORTARED. MORTAR: 1 PART PORTLAND CEMENT TO 3 PARTS SAND CONFORMING TO ASTM C 35.

DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Penn
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

33001  
TYPICAL CONCRETE MANHOLE  
INSTALLATION

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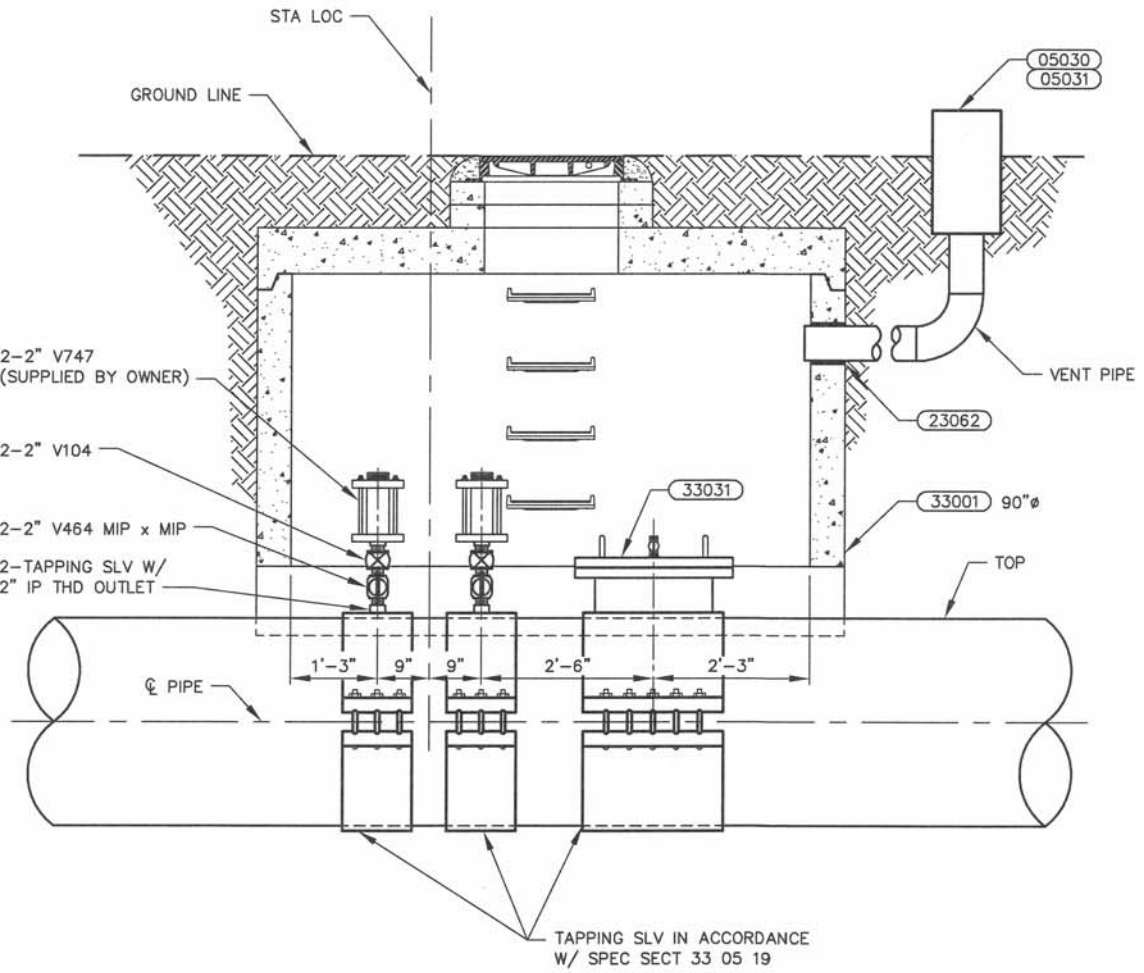
**NOTE:**

COAT PIPE, VALVES AND FITTINGS WITHIN MANHOLE IN ACCORDANCE WITH SPECIFICATION SECTION 09 97 13.04.

DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/ <i>KLR</i>
APPD BY: <i>Stephen C. Rann</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**33004**  
**2" AIR VALVE ASSEMBLY**  
**WITH 20" ACCESS MANHOLE**  
**(STEEL PIPE)**


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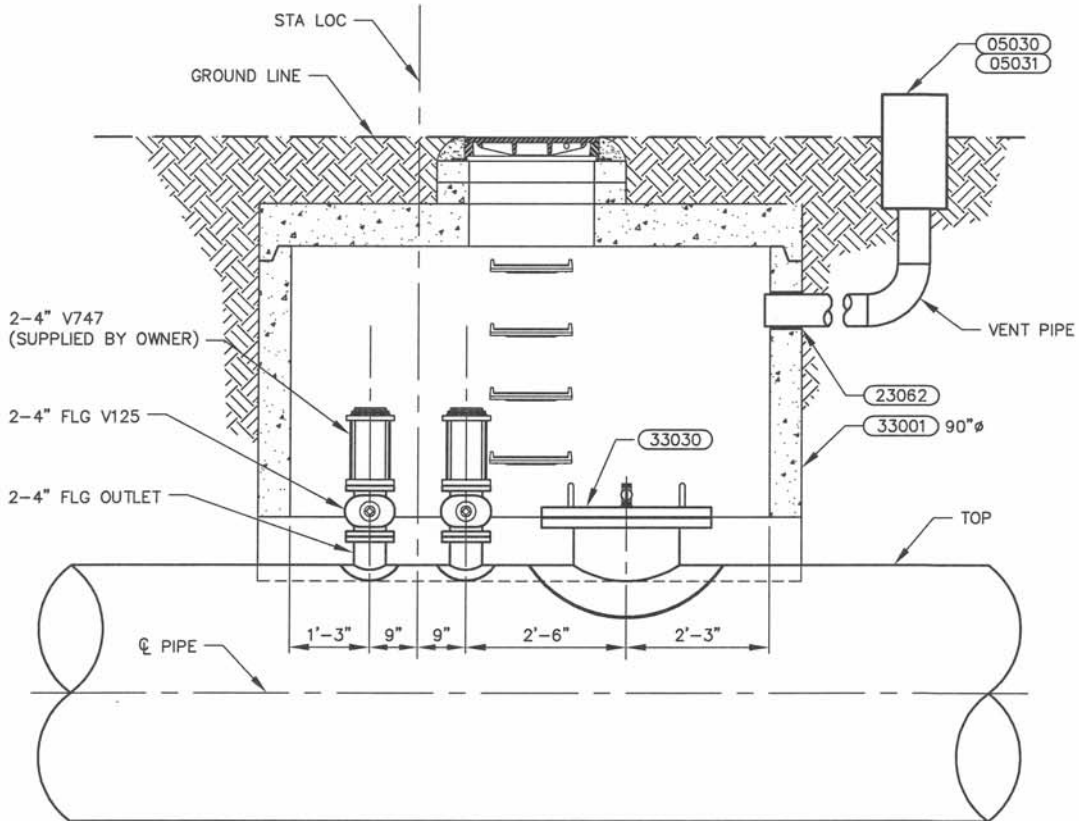
**NOTES:**

1. WELD-ON OUTLETS ARE PERMISSIBLE IF QUALIFIED WELDERS AND PROCEDURES ARE USED IN ACCORDANCE WITH ANSI/AWS D11.2.
2. ALSO FOR USE ON 24-INCH PVC PIPE.
3. COAT PIPE, VALVES AND FITTINGS WITHIN MANHOLE IN ACCORDANCE WITH SPECIFICATION SECTION 09 97 13.04.

DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Rem
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**33005**  
**2" AIR VALVE ASSEMBLY**  
**WITH 20" ACCESS MANHOLE**  
**(DUCTILE IRON PIPE)**


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**NOTE:**

COAT PIPE, VALVES AND FITTINGS WITHIN MANHOLE IN ACCORDANCE WITH SPECIFICATION SECTION 09 97 13.04.

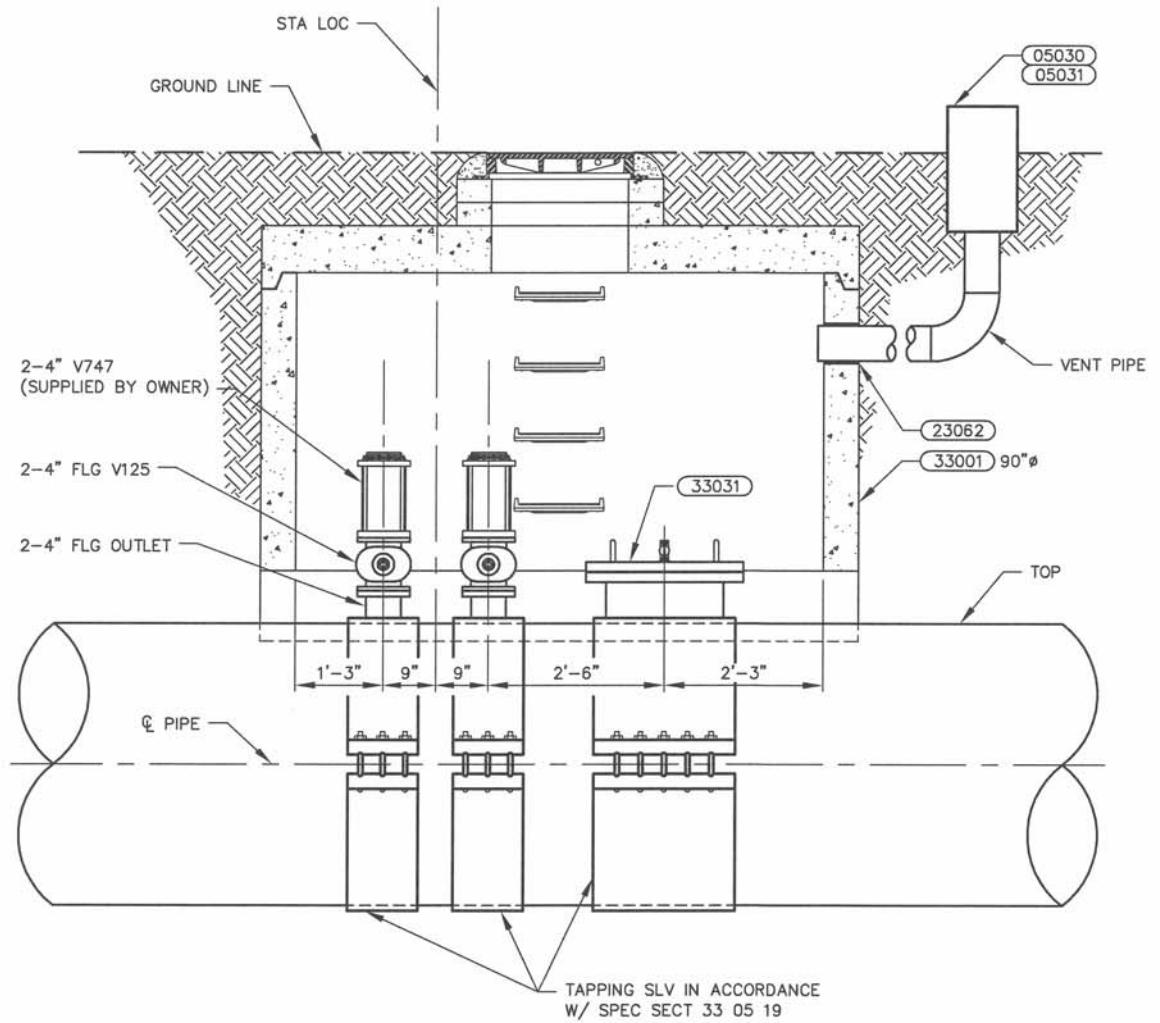
DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Ren
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**33006**  
**4" AIR VALVE ASSEMBLY**  
**WITH 20" ACCESS MANHOLE**  
**(STEEL PIPE)**

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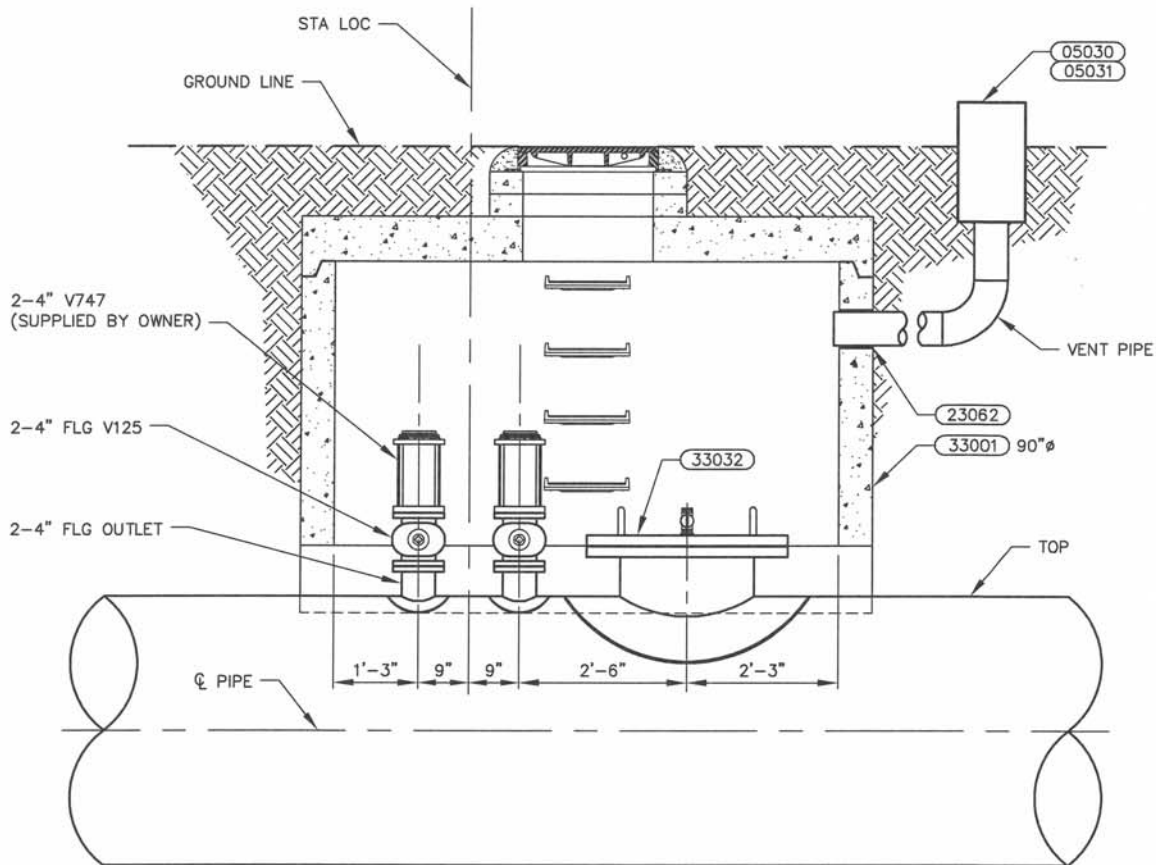
**NOTES:**

1. WELD-ON OUTLETS ARE PERMISSIBLE IF QUALIFIED WELDERS AND PROCEDURES ARE USED IN ACCORDANCE WITH ANSI/AWS D11.2.
2. COAT PIPE, VALVES AND FITTINGS WITHIN MANHOLE IN ACCORDANCE WITH SPECIFICATION SECTION 09 97 13.04.

DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Reun
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**33007**  
**4" AIR VALVE ASSEMBLY**  
**WITH 20" ACCESS MANHOLE**  
**(DUCTILE IRON PIPE)**


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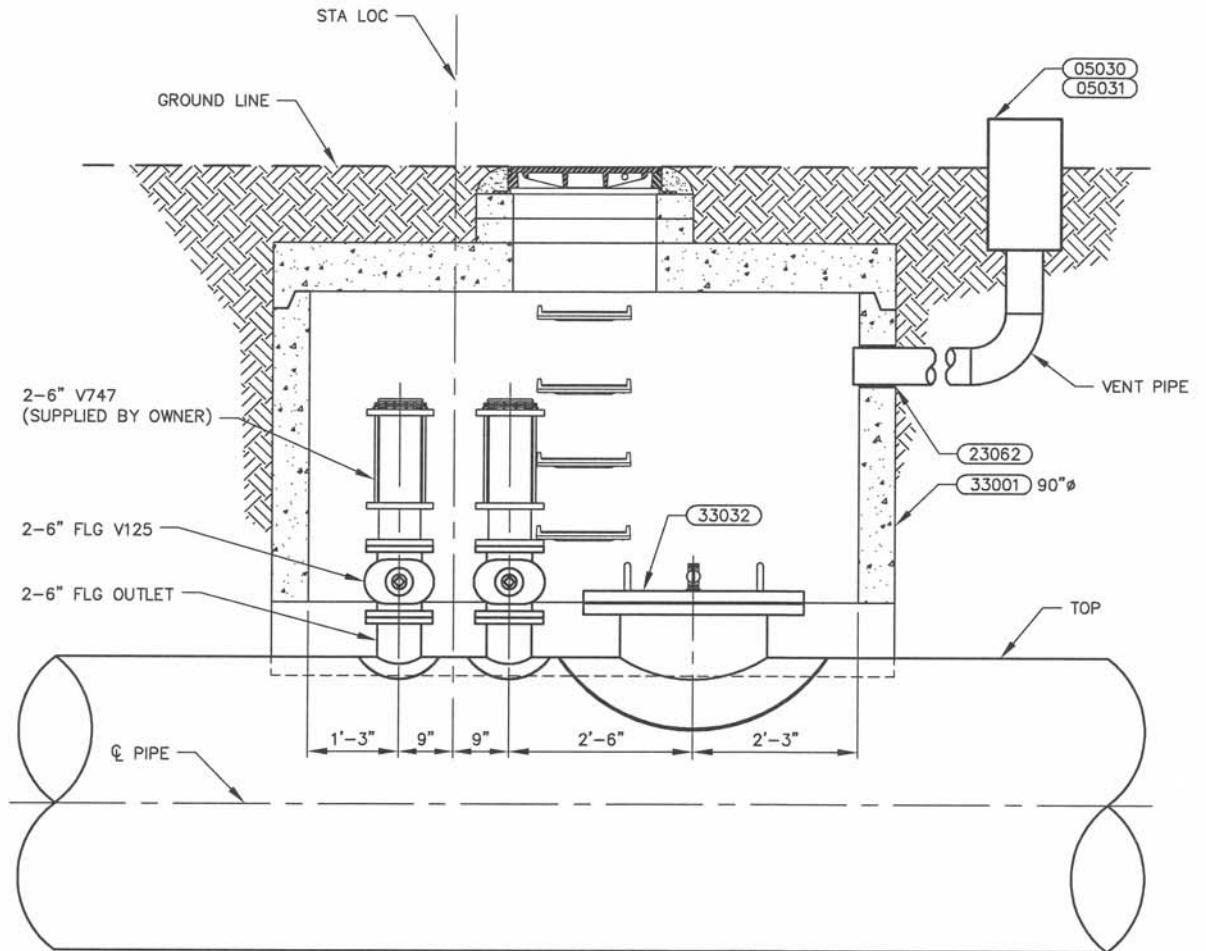
**NOTE:**

COAT PIPE, VALVES AND FITTINGS WITHIN MANHOLE IN ACCORDANCE WITH SPECIFICATION SECTION 09 97 13.04.

DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/VLR
APPD BY: Stephen C. Row
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**33008**  
**4" AIR VALVE ASSEMBLY**  
**WITH 24" ACCESS MANHOLE**  
**(STEEL PIPE)**


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**NOTE:**

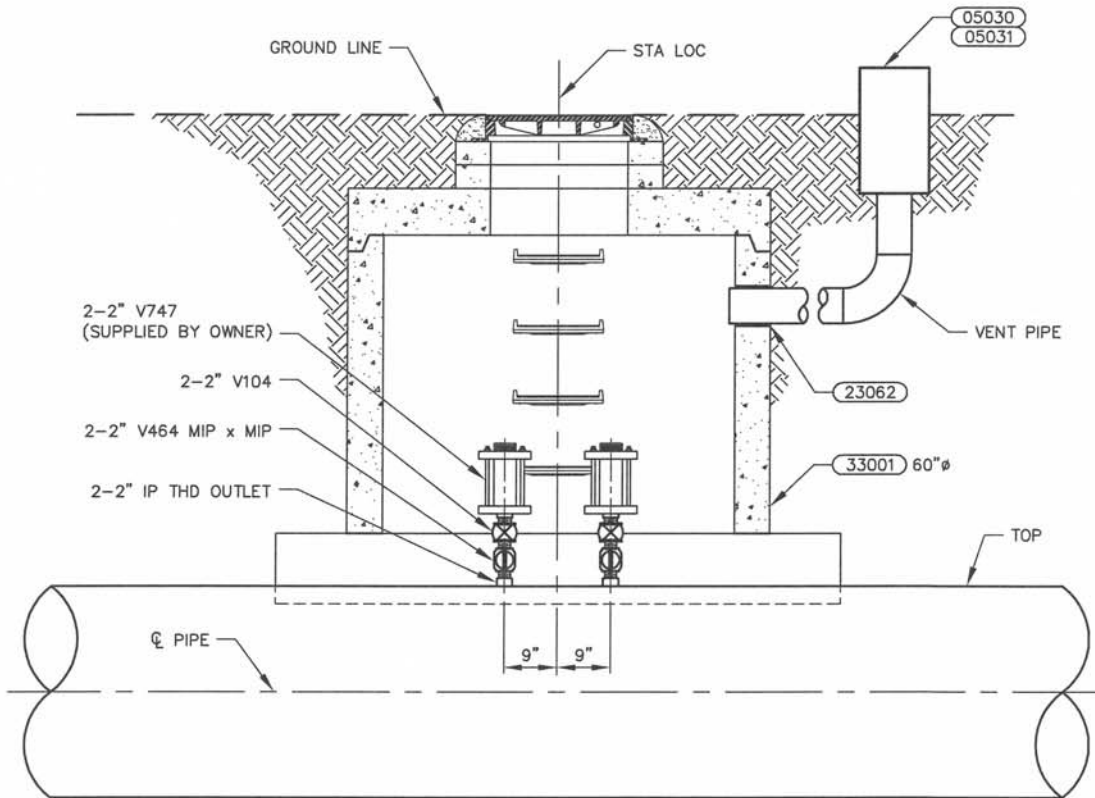
COAT PIPE, VALVES AND FITTINGS WITHIN MANHOLE IN ACCORDANCE WITH SPECIFICATION SECTION 09 97 13.04.

DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/KUR
APPD BY: Stephen C. Rem
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

33010  
6" AIR VALVE ASSEMBLY  
WITH 24" ACCESS MANHOLE  
(STEEL PIPE)

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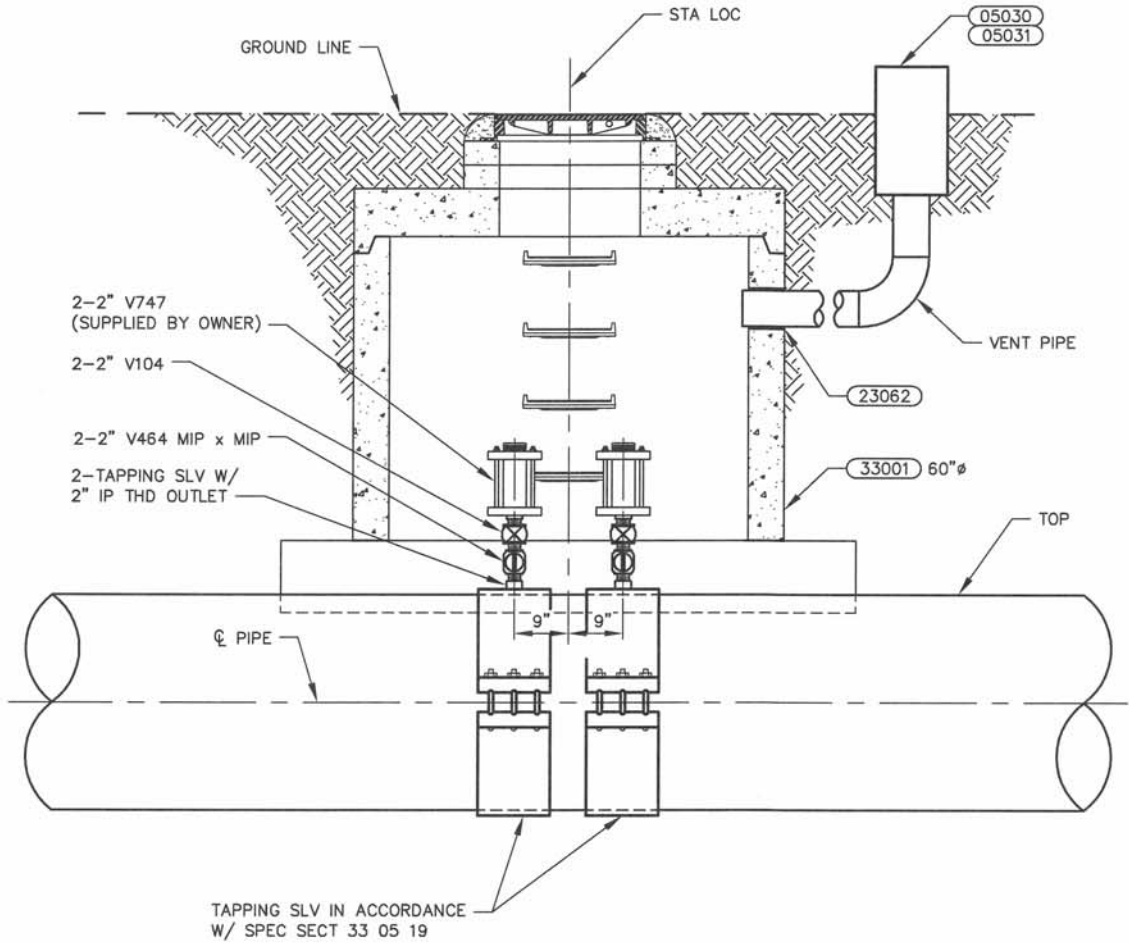
**NOTE:**

COAT PIPE, VALVES AND FITTINGS WITHIN MANHOLE IN ACCORDANCE WITH SPECIFICATION SECTION 09 97 13.04.

DRAWN BY: <i>WENKHEIMER</i>
CHKD BY: <i>K ROSS/KR</i>
APPD BY: <i>Stephen C. Rea</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**33011**  
**2" AIR VALVE ASSEMBLY**  
**(STEEL PIPE)**

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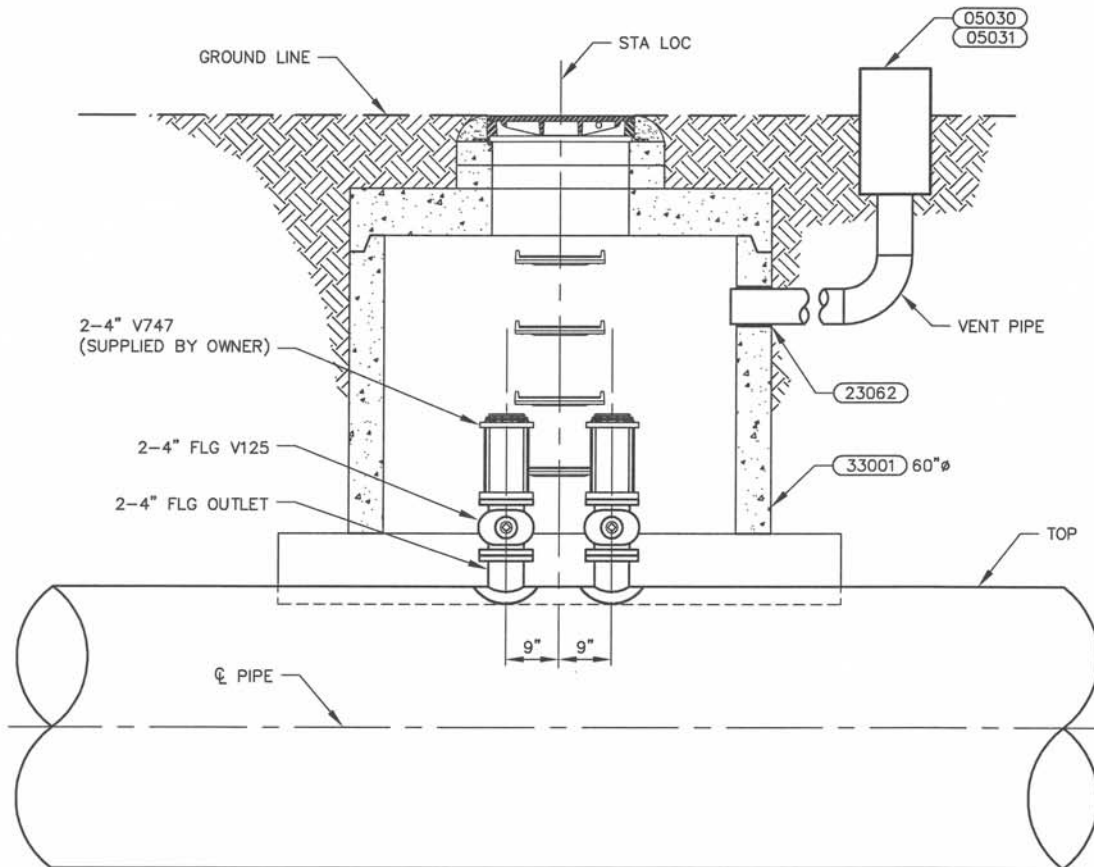
**NOTES:**

1. WELD-ON OUTLETS ARE PERMISSIBLE IF QUALIFIED WELDERS AND PROCEDURES ARE USED IN ACCORDANCE WITH ANSI/AWS D11.2.
2. ALSO FOR USE ON 24-INCH PVC PIPE.
3. COAT PIPE, VALVES AND FITTINGS WITHIN MANHOLE IN ACCORDANCE WITH SPECIFICATION SECTION 09 97 13.04.

DRAWN BY: <i>WENKHEIMER</i>
CHKD BY: <i>K ROSS/KLR</i>
APPD BY: <i>Stephen C. Rem</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**33012**  
**2" AIR VALVE ASSEMBLY**  
**(DUCTILE IRON PIPE)**

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**NOTE:**

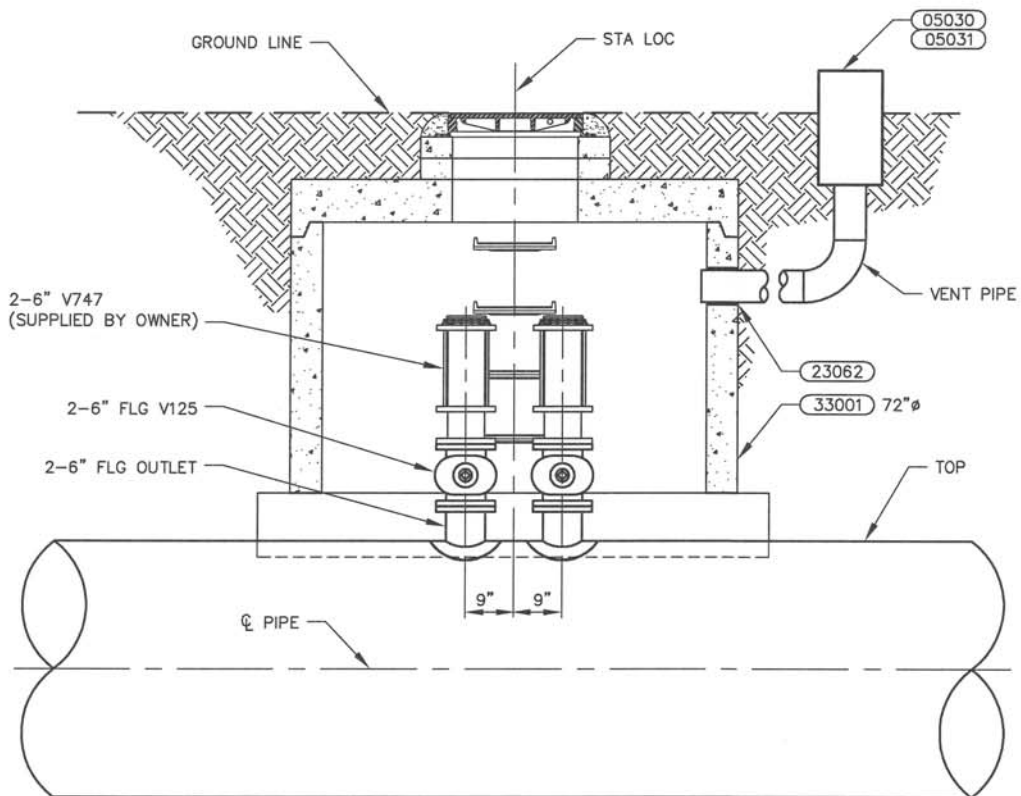
COAT PIPE, VALVES AND FITTINGS WITHIN MANHOLE IN ACCORDANCE WITH SPECIFICATION SECTION 09 97 13.04.

DRAWN BY: <i>WENKHEIMER</i>
CHKD BY: <i>K ROSS/ KLR</i>
APPD BY: <i>Stephen C. Rain</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**33013**  
**4" AIR VALVE ASSEMBLY**  
**(STEEL PIPE)**

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**NOTE:**

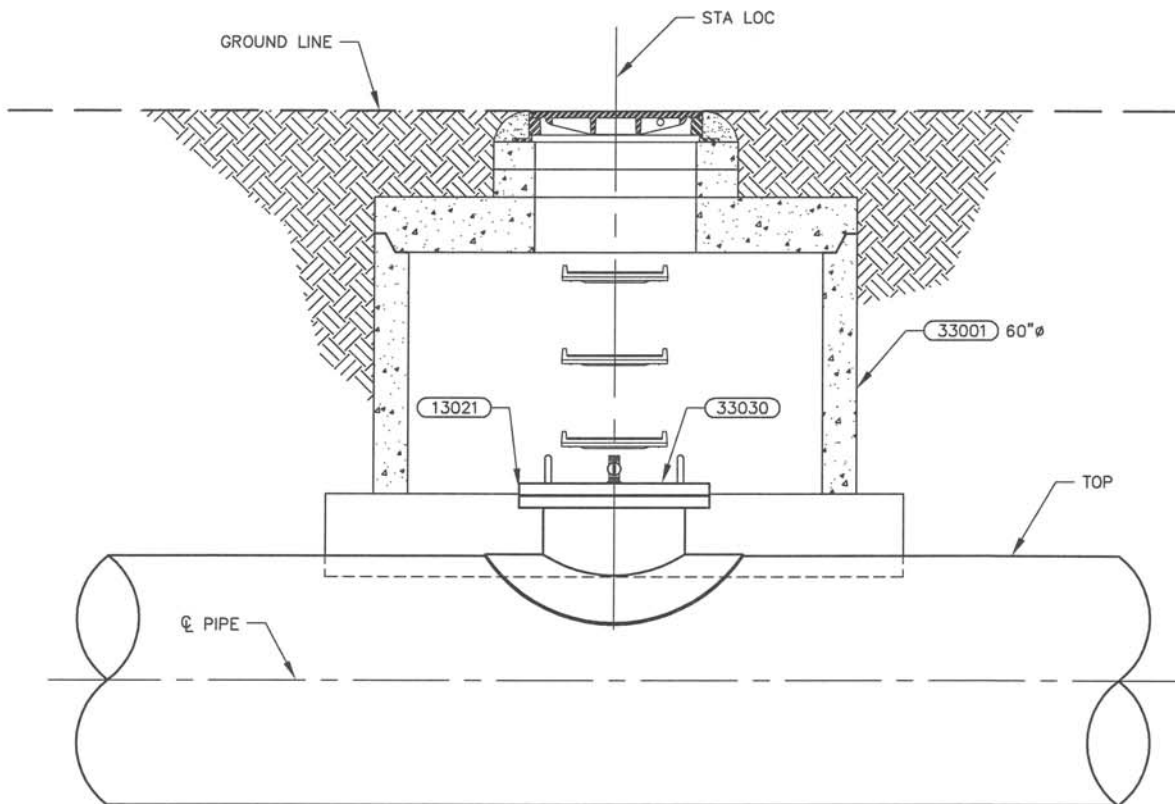
COAT PIPE, VALVES AND FITTINGS WITHIN MANHOLE IN ACCORDANCE WITH SPECIFICATION SECTION 09 97 13.04.

DRAWN BY: <i>WENKHEIMER</i>
CHKD BY: <i>K ROSS/KIR</i>
APPD BY: <i>Stephen C. Rem</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**33015**  
**6" AIR VALVE ASSEMBLY**  
**(STEEL PIPE)**

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**NOTES:**

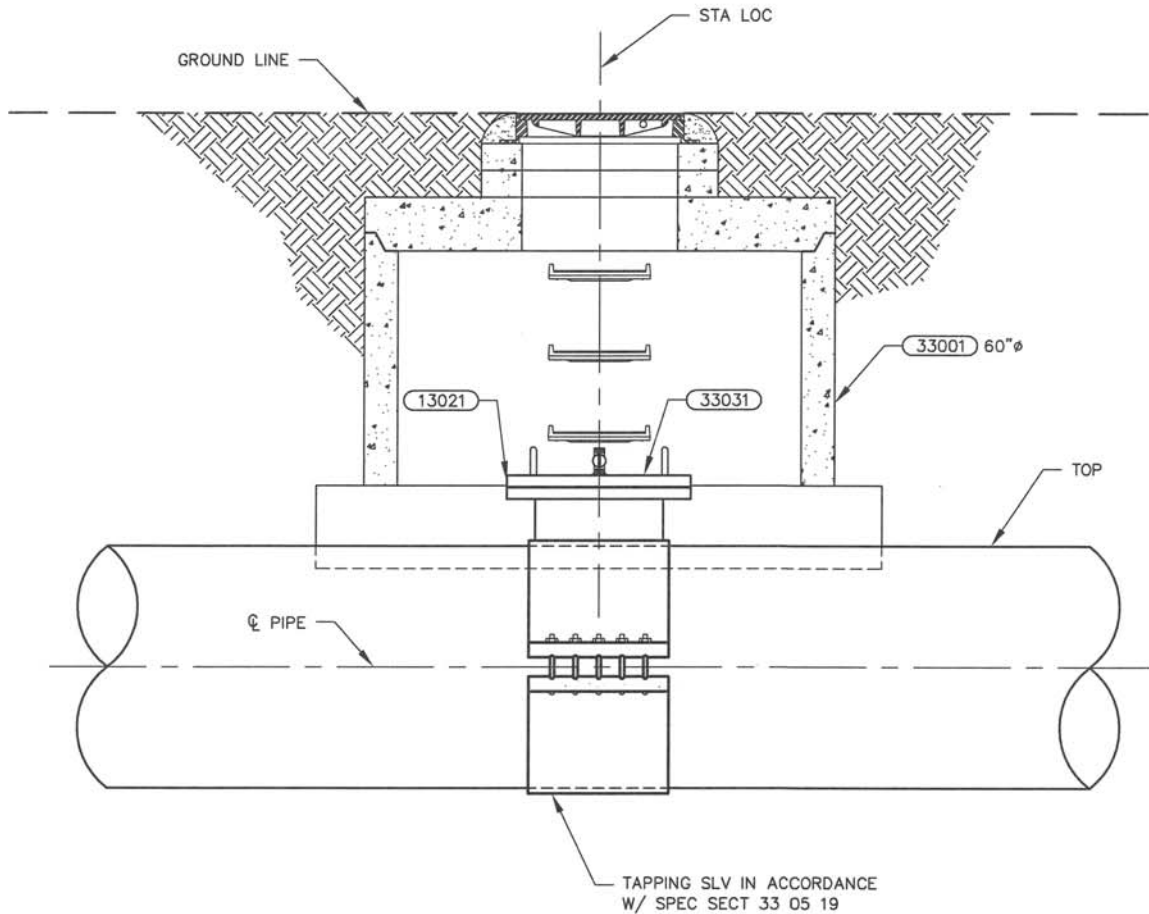
1. FOR PIPE DIAMETER GREATER THAN OR EQUAL TO 24-INCHES AND LESS THAN OR EQUAL TO 42-INCHES.
2. PIPE LINING AND COATING NOT SHOWN FOR CLARITY.
3. COAT PIPE, VALVES AND FITTINGS WITHIN MANHOLE IN ACCORDANCE WITH SPECIFICATION SECTION 09 97 13.04.

DRAWN BY: <i>WENKHEIMER</i>
CHKD BY: <i>K ROSS/KRP</i>
APPD BY: <i>Stephen C. Row</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**33020**  
**20" ACCESS MANHOLE**  
**ASSEMBLY (STEEL PIPE)**

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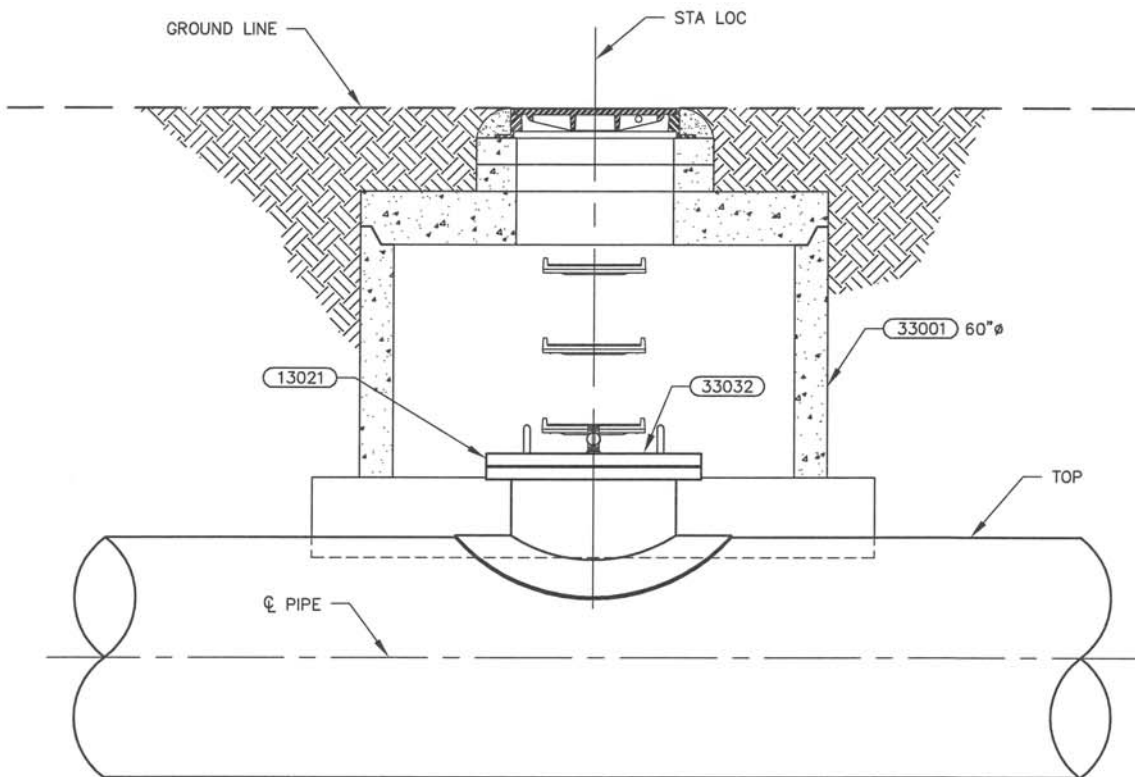
**NOTES:**

1. FOR PIPE DIAMETER GREATER THAN OR EQUAL TO 24-INCHES AND LESS THAN OR EQUAL TO 42-INCHES.
2. WELD-ON OUTLETS ARE PERMISSIBLE IF QUALIFIED WELDERS AND PROCEDURES ARE USED IN ACCORDANCE WITH ANSI/AWS D11.2.
3. COAT PIPE, VALVES AND FITTINGS WITHIN MANHOLE IN ACCORDANCE WITH SPECIFICATION SECTION 09 97 13.04.

DRAWN BY: <i>WENKHEIMER</i>
CHKD BY: <i>K ROSS/KIR</i>
APPD BY: <i>Stephen C. Bean</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**33021**  
**20" ACCESS**  
**MANHOLE ASSEMBLY**  
**(DUCTILE IRON PIPE)**


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**NOTES:**

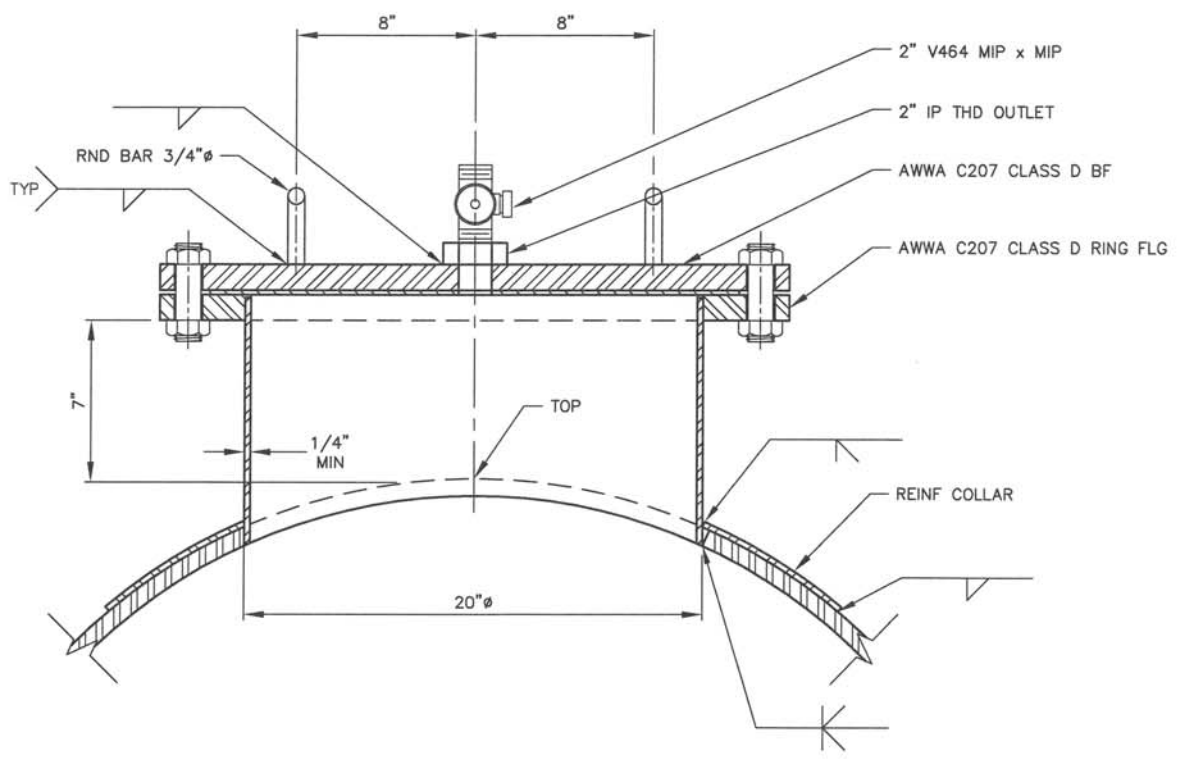
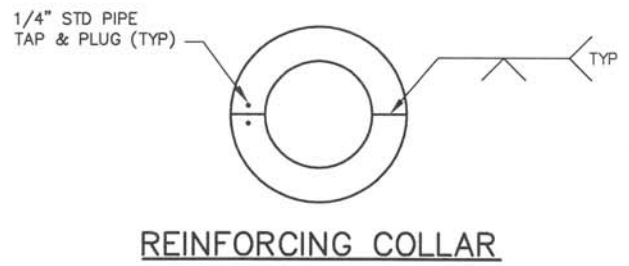
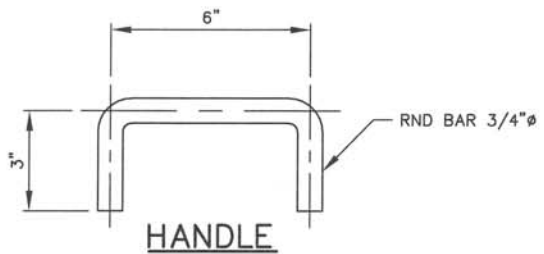
1. FOR PIPE DIAMETERS GREATER THAN 42-INCHES.
2. PIPE LINING AND COATING NOT SHOWN FOR CLARITY.
3. COAT PIPE, VALVES AND FITTINGS WITHIN MANHOLE IN ACCORDANCE WITH SPECIFICATION SECTION 09 97 13.04.

**33022**  
**24" ACCESS**  
**MANHOLE ASSEMBLY**  
**(STEEL PIPE)**



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DRAWN BY: <i>WENKHEIMER</i>
CHKD BY: <i>K ROSS/ KLR</i>
APPD BY: <i>Stephen C. Peem</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

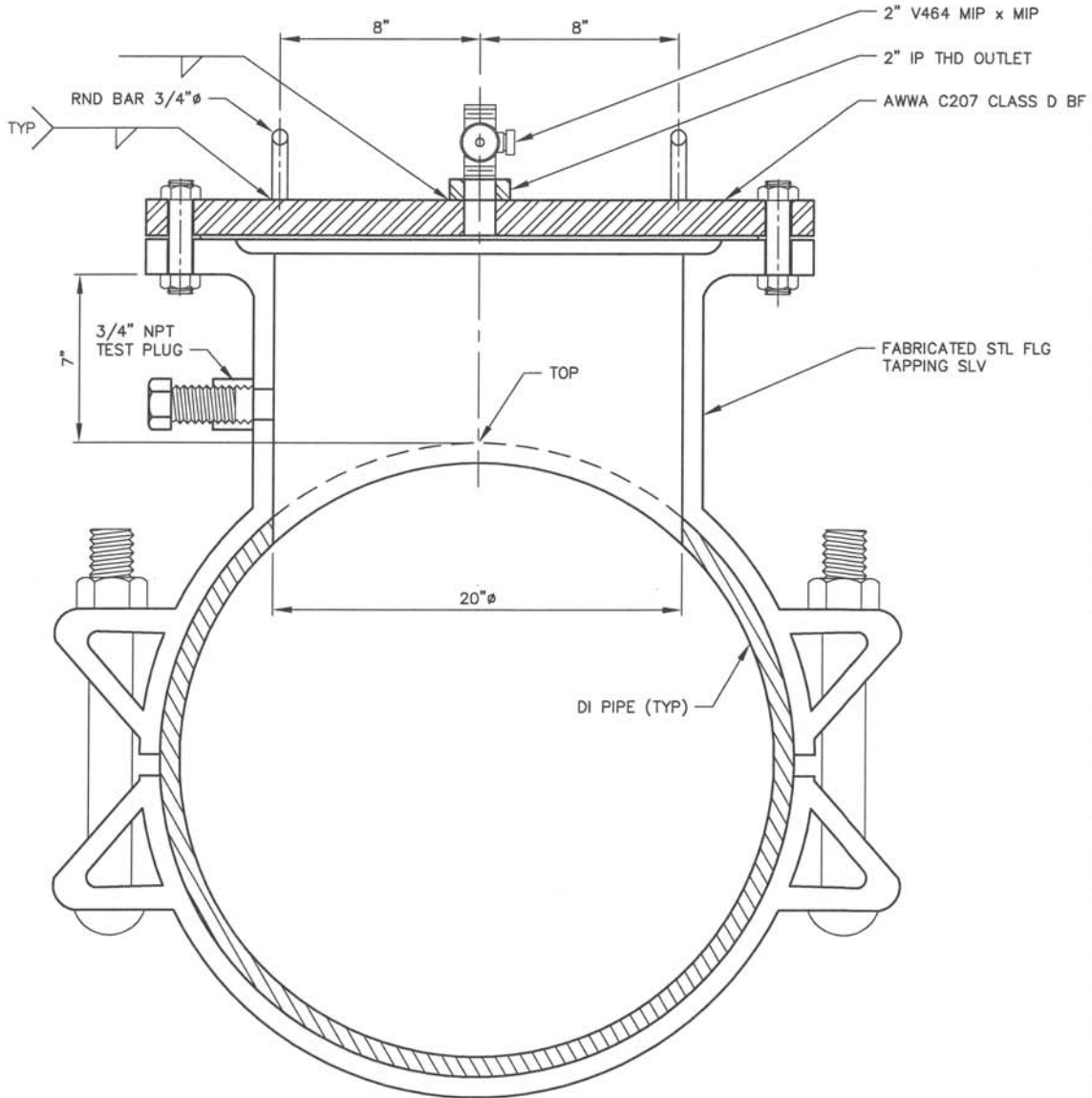
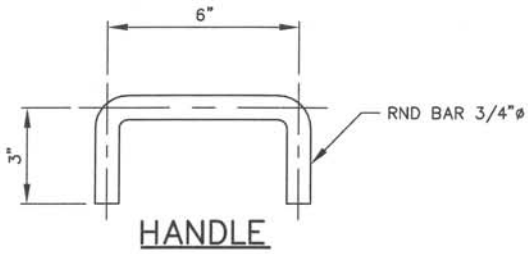


**NOTE:**  
PIPE LINING AND COATING NOT SHOWN FOR CLARITY.

DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Row
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

33030  
20" ACCESS MANHOLE  
(STEEL PIPE)

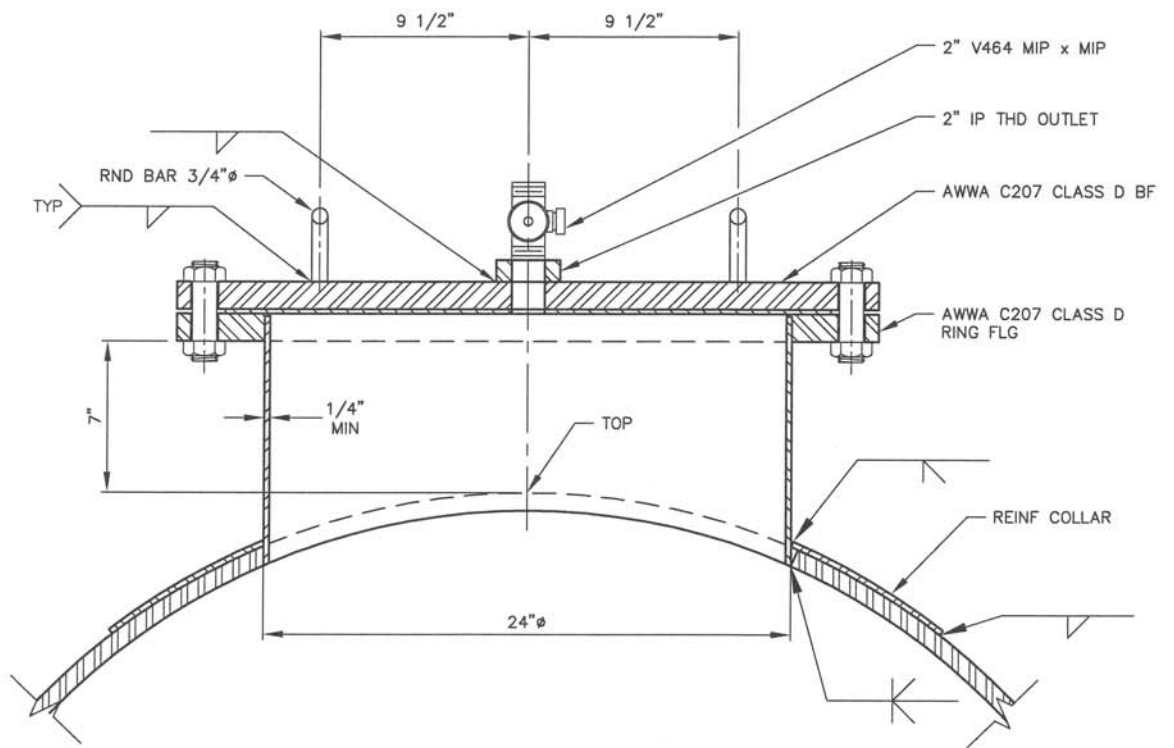
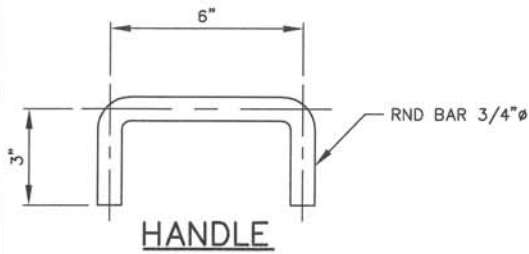
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DRAWN BY: WENKHEIMER  
 CHKD BY: K ROSS/KIR  
 APPD BY: Stephen C. Rem  
 ORIGINATION DATE: JANUARY 2017  
 REVISION DATE:

33031  
 20" ACCESS MANHOLE  
 (DUCTILE IRON PIPE)

**D DENVER WATER**  
 1600 West 12th Ave  
 Denver, Colorado 80204-3412  
 T: 303.628.6000  
 F: 303.628.6851  
 denverwater.org



**NOTE:**

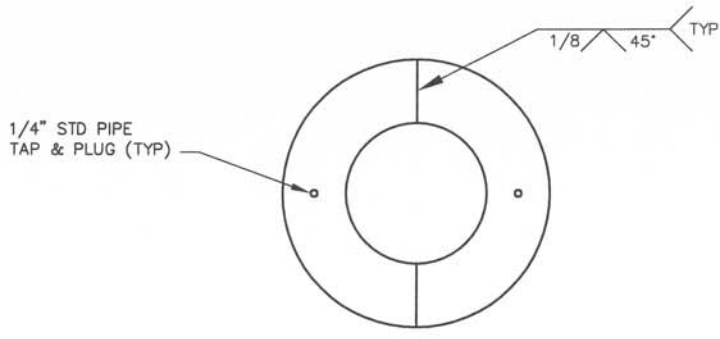
PIPE LINING AND COATING NOT SHOWN FOR CLARITY.

DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Ryan
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

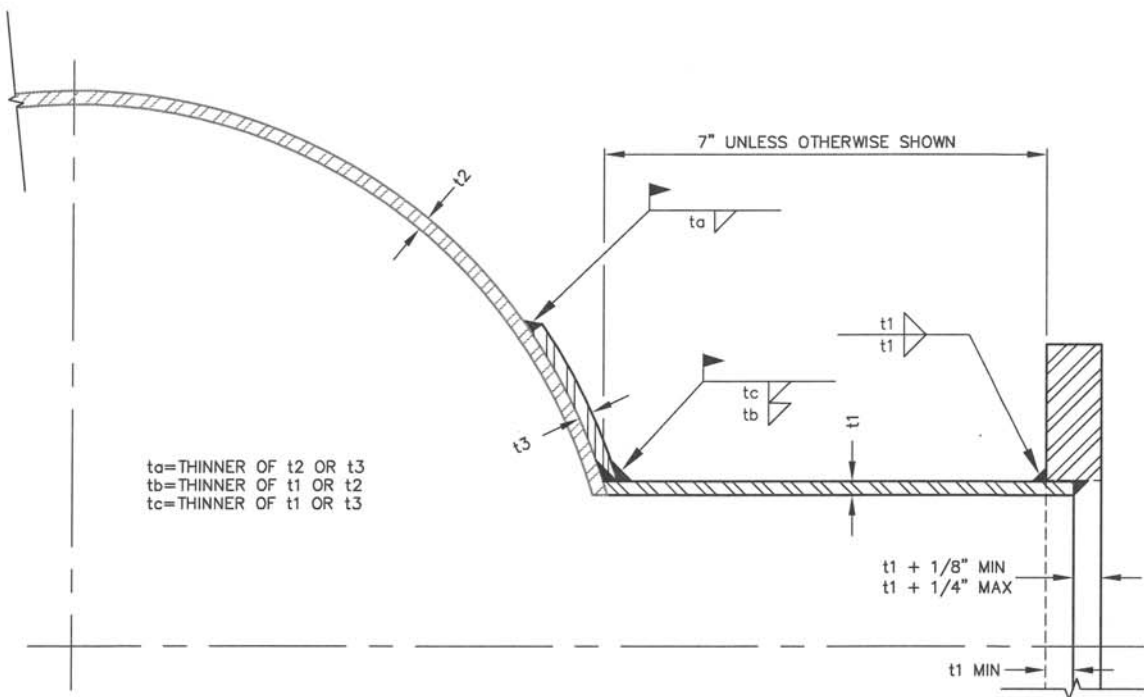
33032  
24" ACCESS MANHOLE  
(STEEL PIPE)

**D DENVER WATER**

1600 West 12th Ave  
Denver, Colorado 80204-3412  
T: 303.628.6000  
F: 303.628.6851  
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REINFORCING PLATE



NOTES:

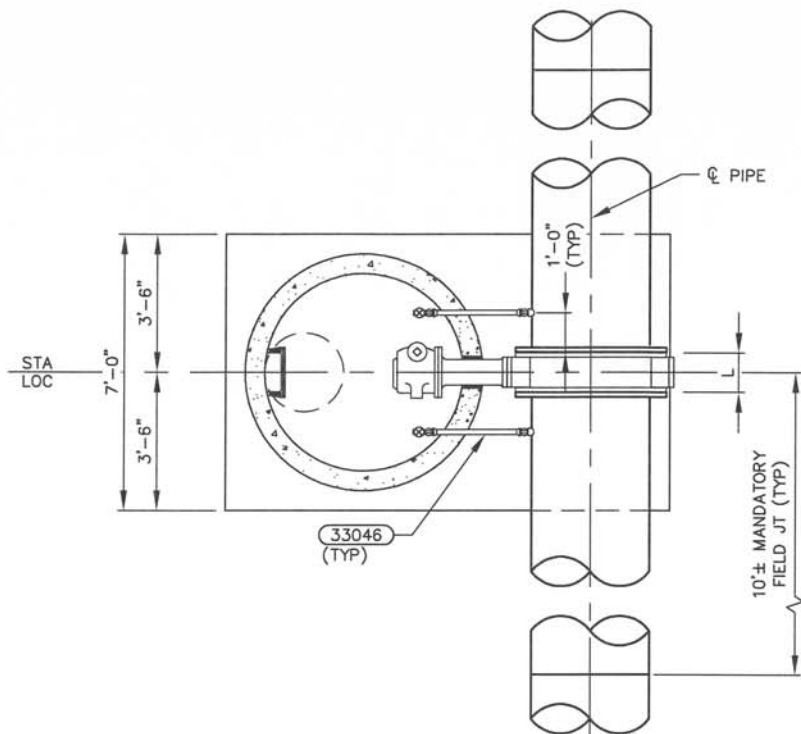
1. LINING AND COATING NOT SHOWN FOR CLARITY.
2. REPAIR LINING AND COATING.
3. REINFORCING PLATE WIDTH AND THICKNESS AND OUTLET NOZZLE THICKNESS SHALL BE DESIGNED IN ACCORDANCE WITH AWWA C200.

DRAWN BY: <i>DITTERLINE</i>
CHKD BY: <i>K ROSS/UR</i>
APPD BY: <i>Stephen C. Rein</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

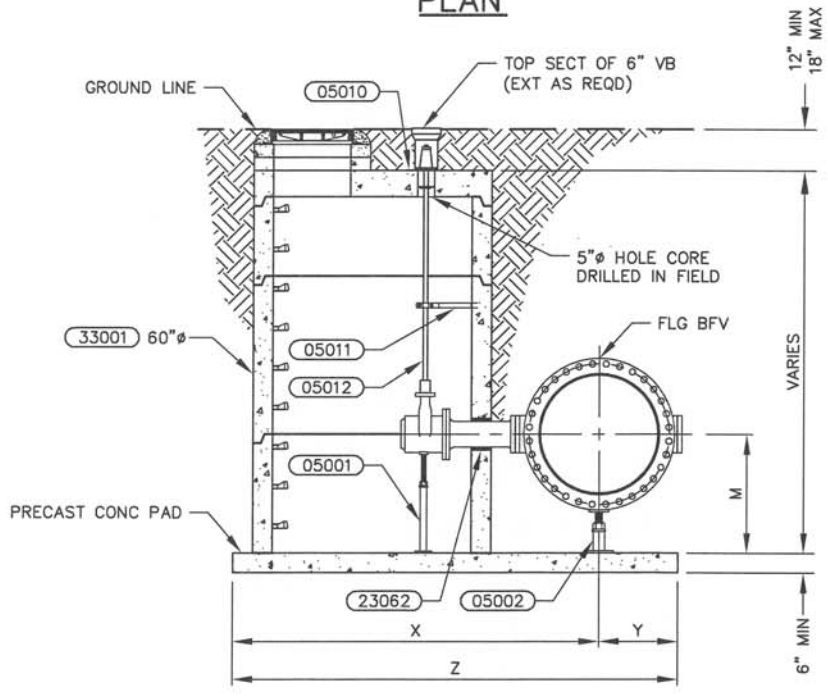
**33033**  
**FIELD ATTACHED**  
**FLANGED OUTLET**

**D DENVER WATER**

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Denver, Colorado 80204-3412  
T: 303.628.6000  
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**PLAN**



**ELEVATION**

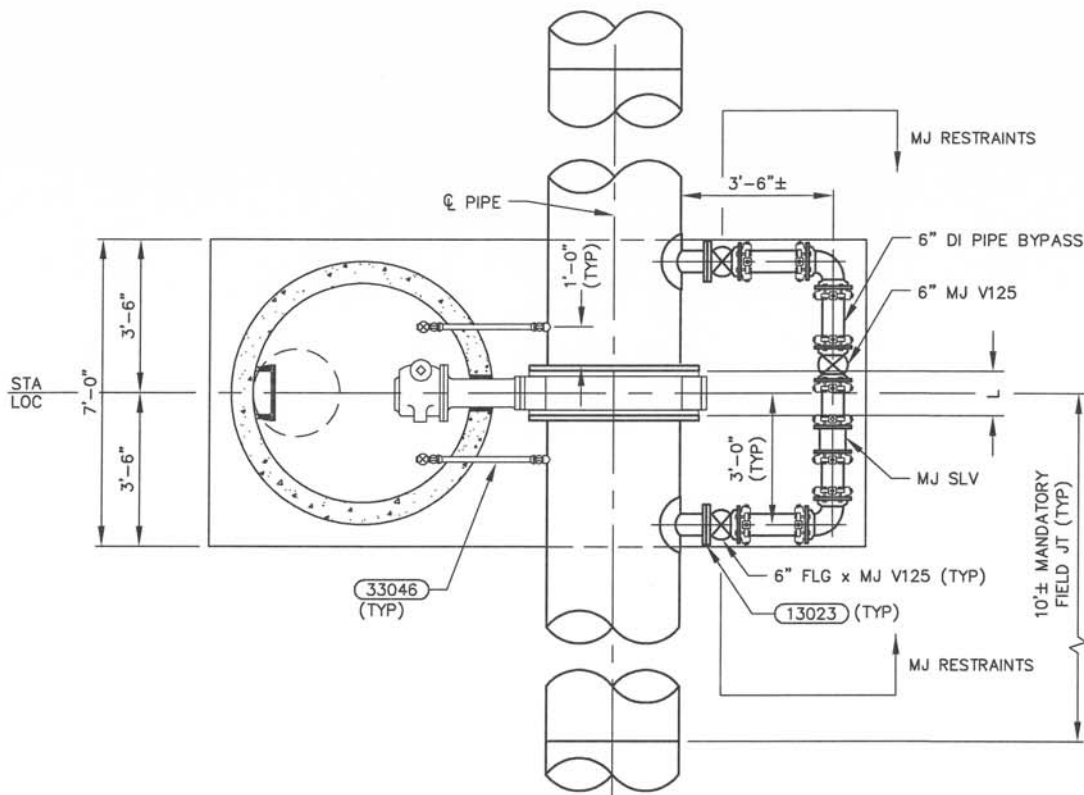
**NOTE:**

SEE (33045) FOR DIMENSION TABLE.

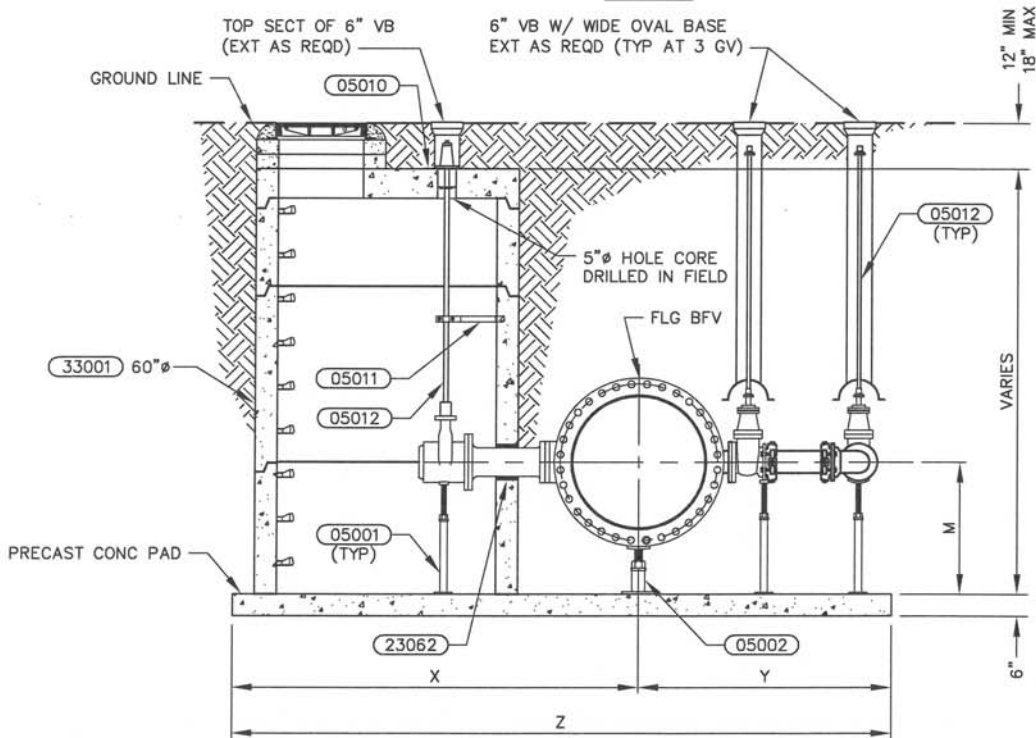
DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Rem
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**33040  
BUTTERFLY VALVE ASSEMBLY  
(STEEL PIPE)**

**D DENVER WATER**  
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**PLAN**



**ELEVATION**

**NOTE:**

SEE (33045) FOR DIMENSION TABLE.

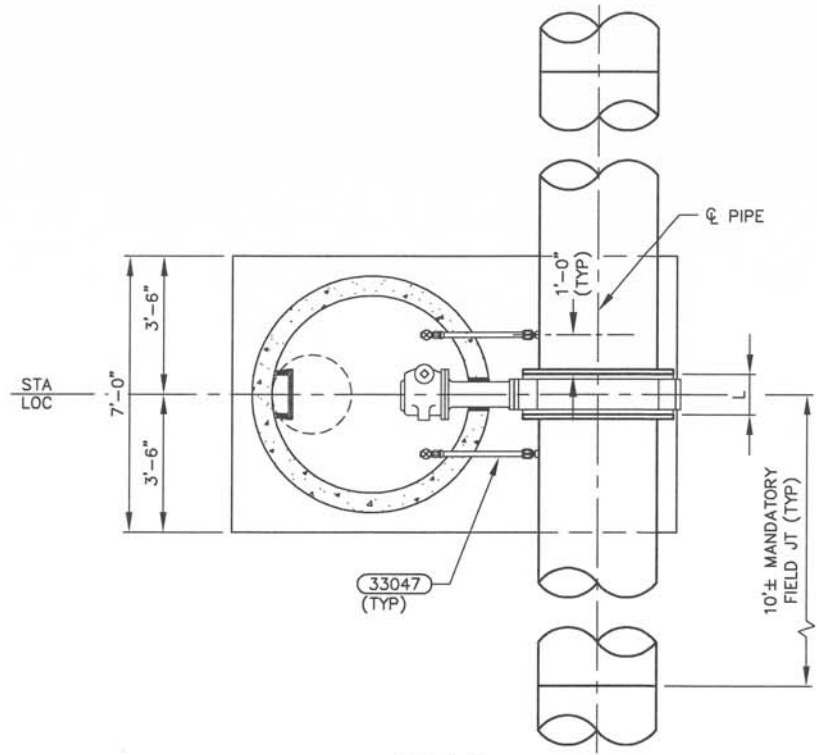
DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/KUR
APPD BY: <i>Stephen C. P...</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**33041**  
**BUTTERFLY VALVE ASSEMBLY**  
**WITH BY-PASS (STEEL PIPE)**

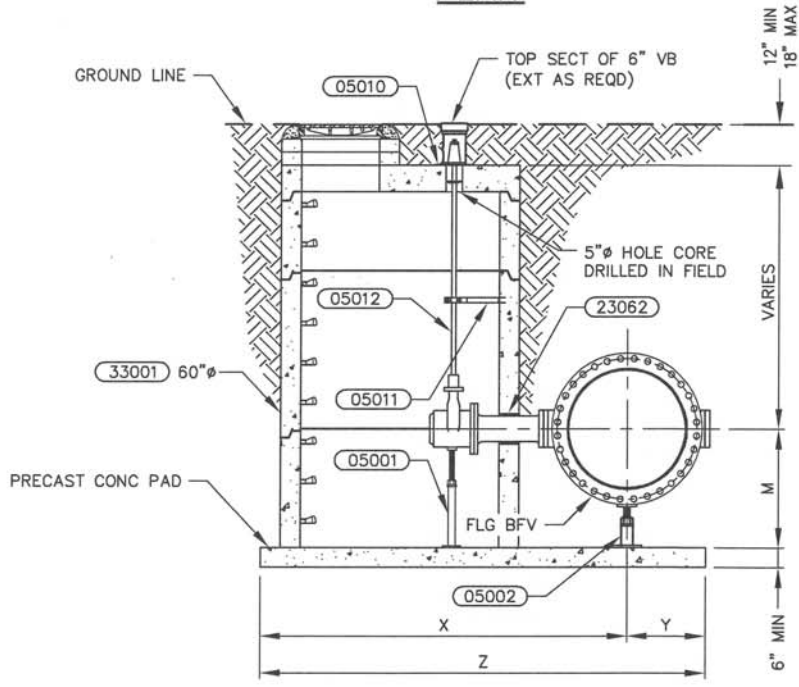
**D DENVER WATER**

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 T: 303.628.6000  
 F: 303.628.6851  
 denverwater.org





**PLAN**



**ELEVATION**

**NOTE:**

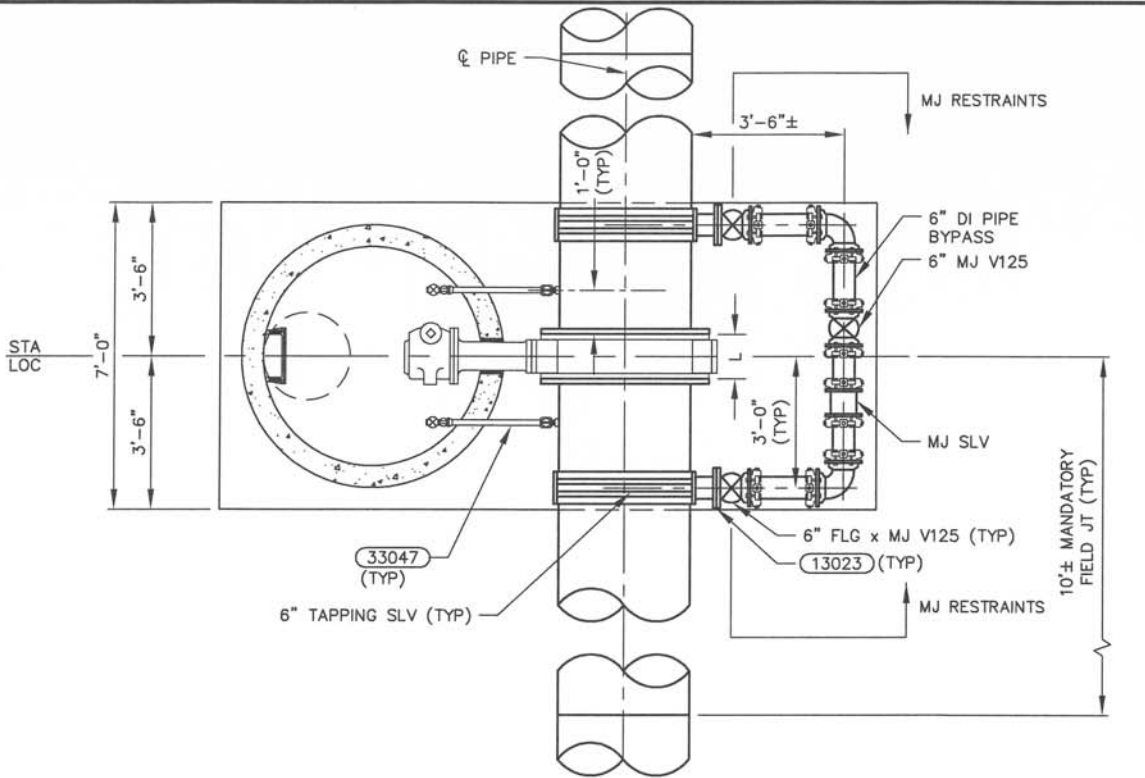
SEE **33045** FOR DIMENSION TABLE.

DRAWN BY: <i>WENKHEIMER</i>
CHKD BY: <i>K ROSS/KIR</i>
APPD BY: <i>Stephen C. Ren</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

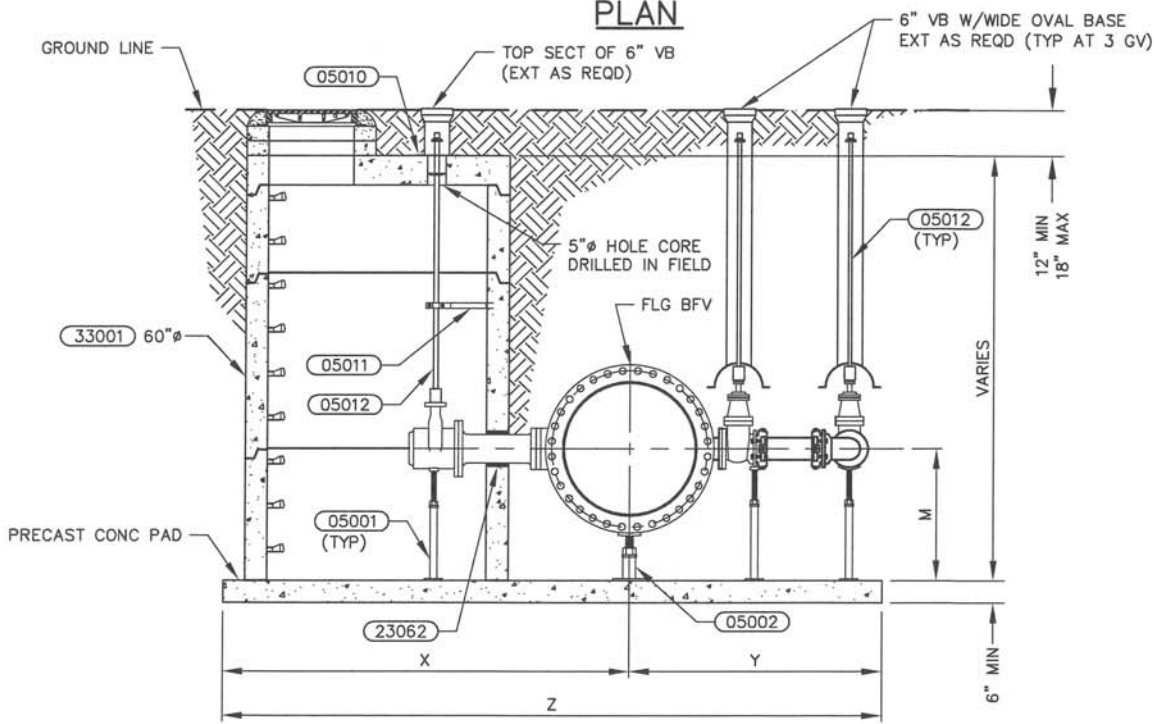
**33042**  
**BUTTERFLY VALVE ASSEMBLY**  
**(DUCTILE IRON PIPE)**

**D DENVER WATER**

1600 West 12th Ave  
 Denver, Colorado 80204-3412  
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 F: 303.628.6851  
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**PLAN**



**ELEVATION**

**NOTES:**

1. WELD-ON OUTLETS ARE PERMISSIBLE IF QUALIFIED WELDERS AND PROCEDURES ARE USED IN ACCORDANCE WITH ANSI/AWS D11.2.
2. SEE (33045) FOR DIMENSION TABLE.

DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Rasmussen
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**33043**  
**BUTTERFLY VALVE**  
**ASSEMBLY WITH BY-PASS**  
**(DUCTILE IRON PIPE)**

**DENVER WATER**  
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 F: 303.628.6851  
 denverwater.org

33040 33042 DIMENSION TABLE

VALVE SIZE	L	M	X	Y	Z
24"	8"	2'-6"	8'-9"	2'-0"	10'-9"
30"	12"	3'-0"	9'-3"	2'-0"	11'-3"
36"	12"	3'-0"	9'-3"	2'-0"	11'-3"
42"	12"	3'-6"	9'-9"	2'-0"	11'-9"

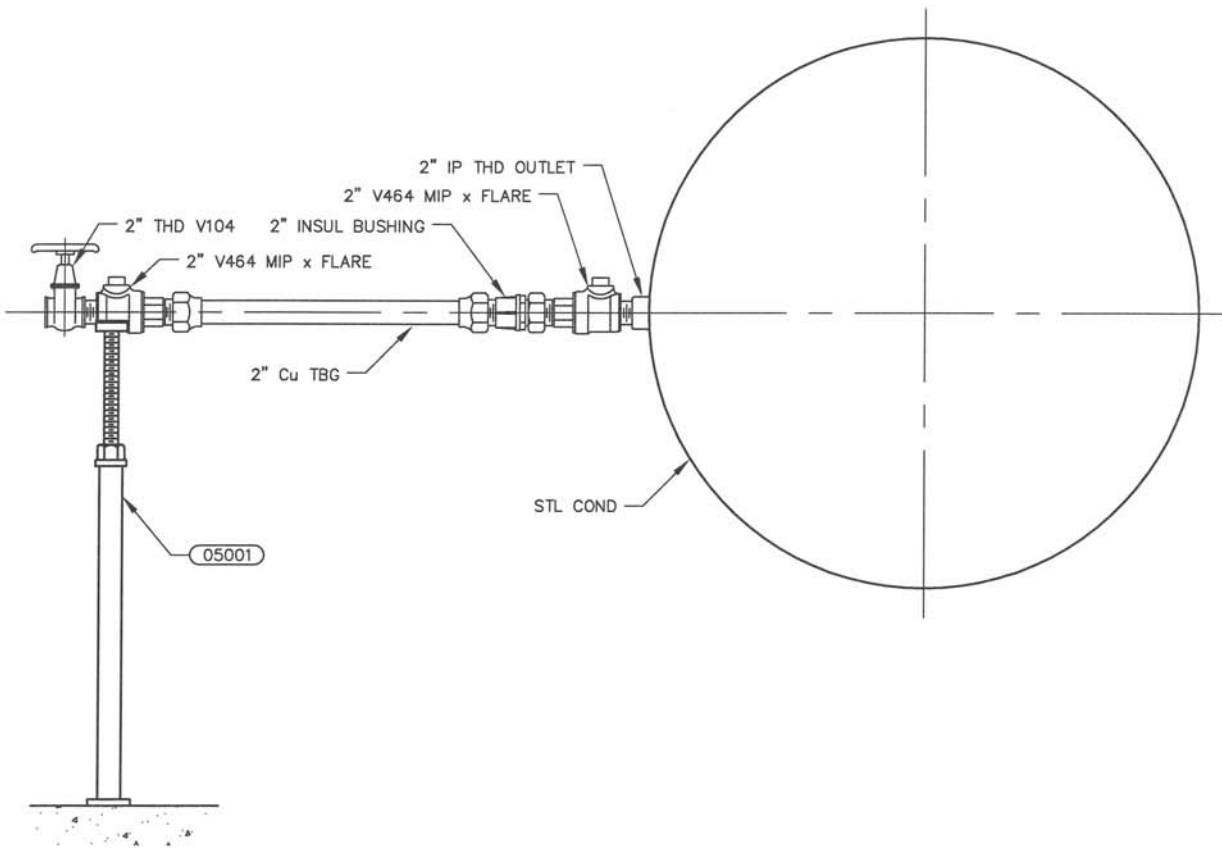
33041 33043 DIMENSION TABLE

VALVE SIZE	L	M	X	Y	Z
24"	8"	2'-6"	8'-9"	5'-6"	14'-3"
30"	12"	3'-0"	9'-3"	5'-9"	15'-0"
36"	12"	3'-0"	9'-3"	6'-0"	15'-3"
42"	12"	3'-6"	9'-9"	6'-3"	16'-0"
48"	15"	3'-6"	10'-0"	6'-9"	16'-0"
54"	15"	4'-0"	10'-6"	6'-9"	17'-3"
60"	15"	4'-6"	10'-9"	7'-3"	18'-0"
66"	18"	4'-6"	11'-3"	7'-6"	18'-9"
72"	18"	5'-0"	11'-6"	7'-9"	19'-3"
84"	18"	5'-6"	12'-6"	8'-3"	20'-9"
90"	21"	5'-6"	12'-9"	8'-6"	21'-3"
96"	24"	6'-0"	12'-9"	8'-9"	21'-6"
108"	28"	6'-6"	13'-6"	9'-6"	23'-0"

DRAWN BY: WENKHEIMER  
 CHKD BY: K ROSS/KLR  
 APPD BY: Stephen C. Reem  
 ORIGINATION DATE: JANUARY 2017  
 REVISION DATE:

33045  
 BUTTERFLY VALVE ASSEMBLY  
 DIMENSION TABLES

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 F: 303.628.6851  
 denverwater.org



**NOTE:**

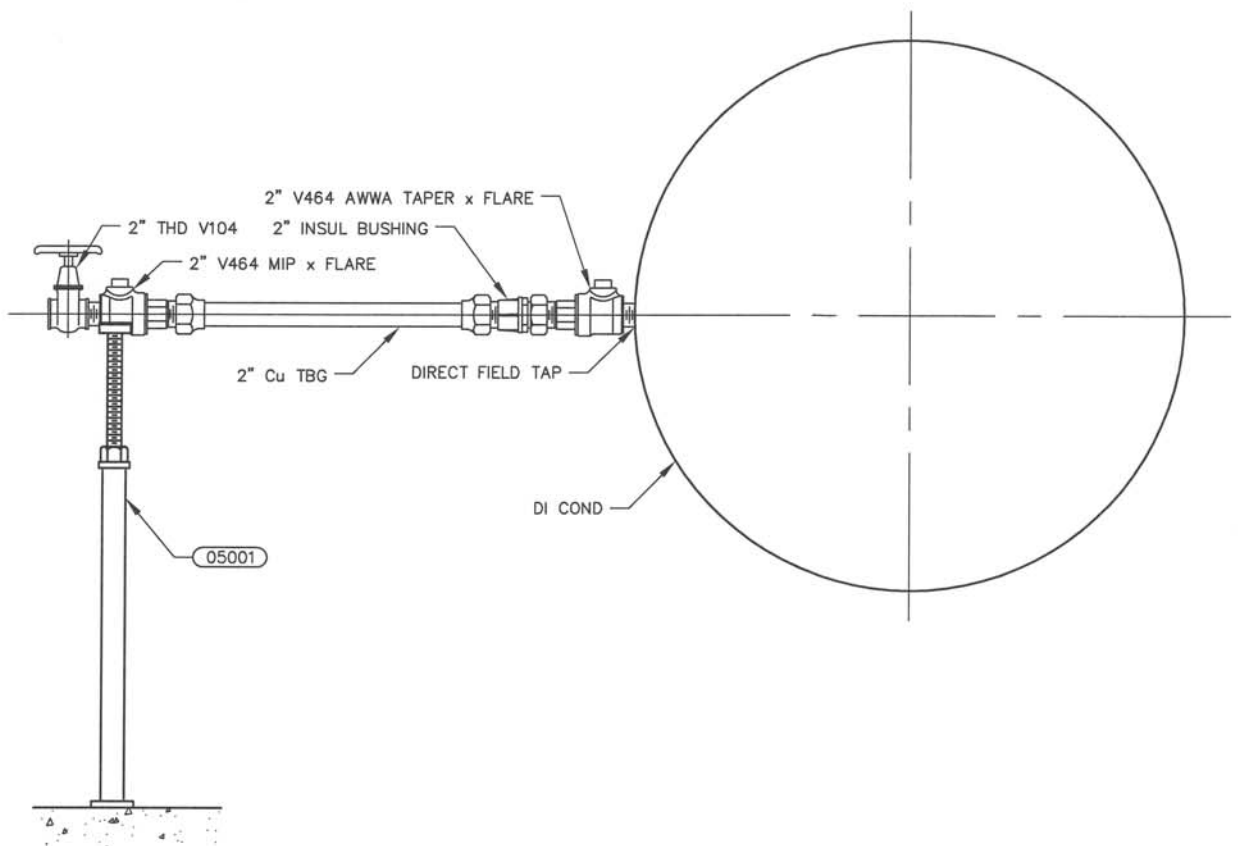
MANHOLE AND PENETRATION NOT SHOWN FOR CLARITY.

**33046  
CHLORINATION TAP  
(STEEL PIPE)**



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 F: 303.628.6851  
 denverwater.org

DRAWN BY: <i>WENKHEIMER</i>
CHKD BY: <i>K ROSS/KLR</i>
APPD BY: <i>Stephen C. Pen</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:



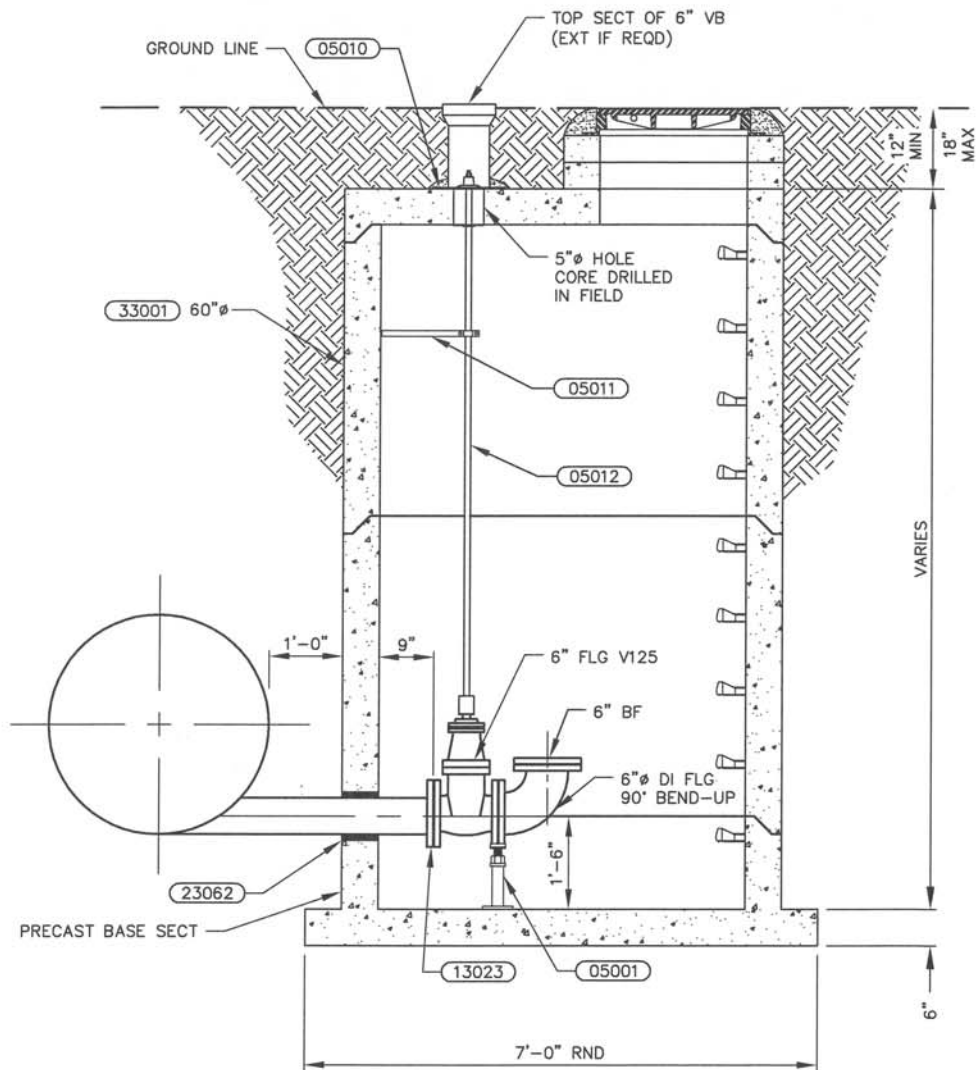
**NOTES:**

1. MANHOLE AND PENETRATION NOT SHOWN FOR CLARITY.
2. TAPPING SLEEVE WITH THREADED OUTLET IS AN ALLOWABLE ALTERNATIVE TO A DIRECT TAP.

DRAWN BY: <i>WENKHEIMER</i>
CHKD BY: <i>K ROSS/KLR</i>
APPD BY: <i>Stephen C. Ren</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**33047  
CHLORINATION TAP  
(DUCTILE IRON PIPE)**

**D DENVER WATER**  
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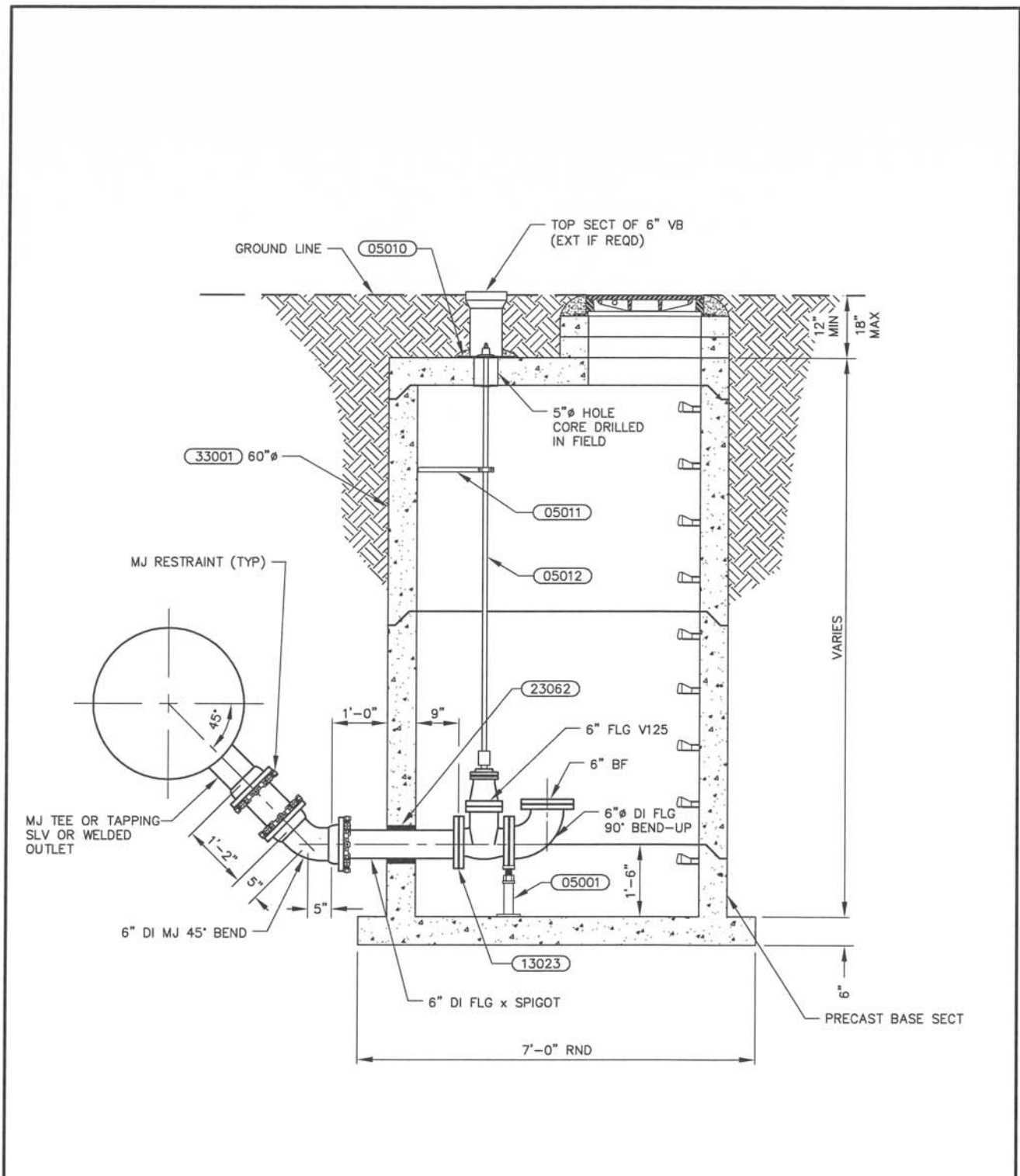
**NOTE:**

COAT PIPE, VALVES AND FITTINGS WITHIN MANHOLE IN ACCORDANCE WITH SPECIFICATION SECTION 09 97 13.04.

DRAWN BY: <i>WENKHEIMER</i>
CHKD BY: <i>K ROSS/ KLR</i>
APPD BY: <i>Stephen C. Reem</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**33050**  
**6" BLOWOFF VALVE**  
**ASSEMBLY (STEEL PIPE)**

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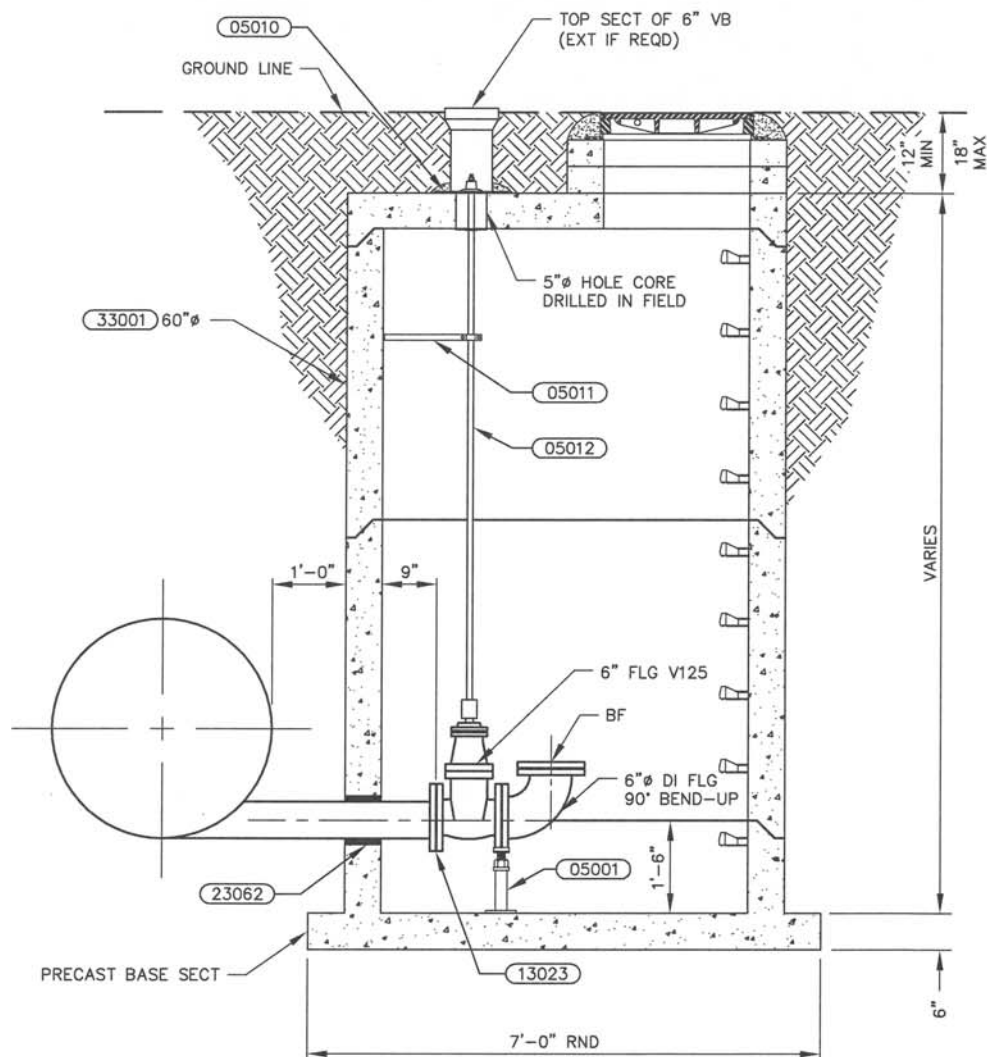
**NOTES:**

1. WELD-ON OUTLETS ARE PERMISSIBLE IF QUALIFIED WELDERS AND PROCEDURES ARE USED IN ACCORDANCE WITH ANSI/AWS D11.2.
2. COAT PIPE, VALVES AND FITTINGS WITHIN MANHOLE IN ACCORDANCE WITH SPECIFICATION SECTION 09 97 13.04.

DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/KIR
APPD BY: Stephen C. Ren
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**33051**  
**6" BLOWOFF VALVE**  
**ASSEMBLY**  
**(DUCTILE IRON PIPE)**

  
 1600 West 12th Ave  
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**NOTES:**

1. WELD-ON OUTLETS ARE PERMISSIBLE IF QUALIFIED WELDERS AND PROCEDURES ARE USED IN ACCORDANCE WITH ANSI/AWS D11.2.
2. COAT PIPE, VALVES AND FITTINGS WITHIN MANHOLE IN ACCORDANCE WITH SPECIFICATION SECTION 09 97 13.04.

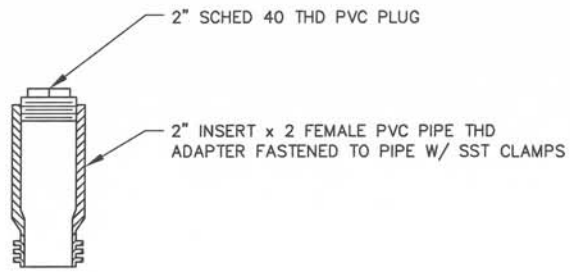
DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/KR
APPD BY: Stephen C. Rem
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**33052**  
**6" BLOWOFF VALVE**  
**ASSEMBLY**  
**(DUCTILE IRON PIPE)**

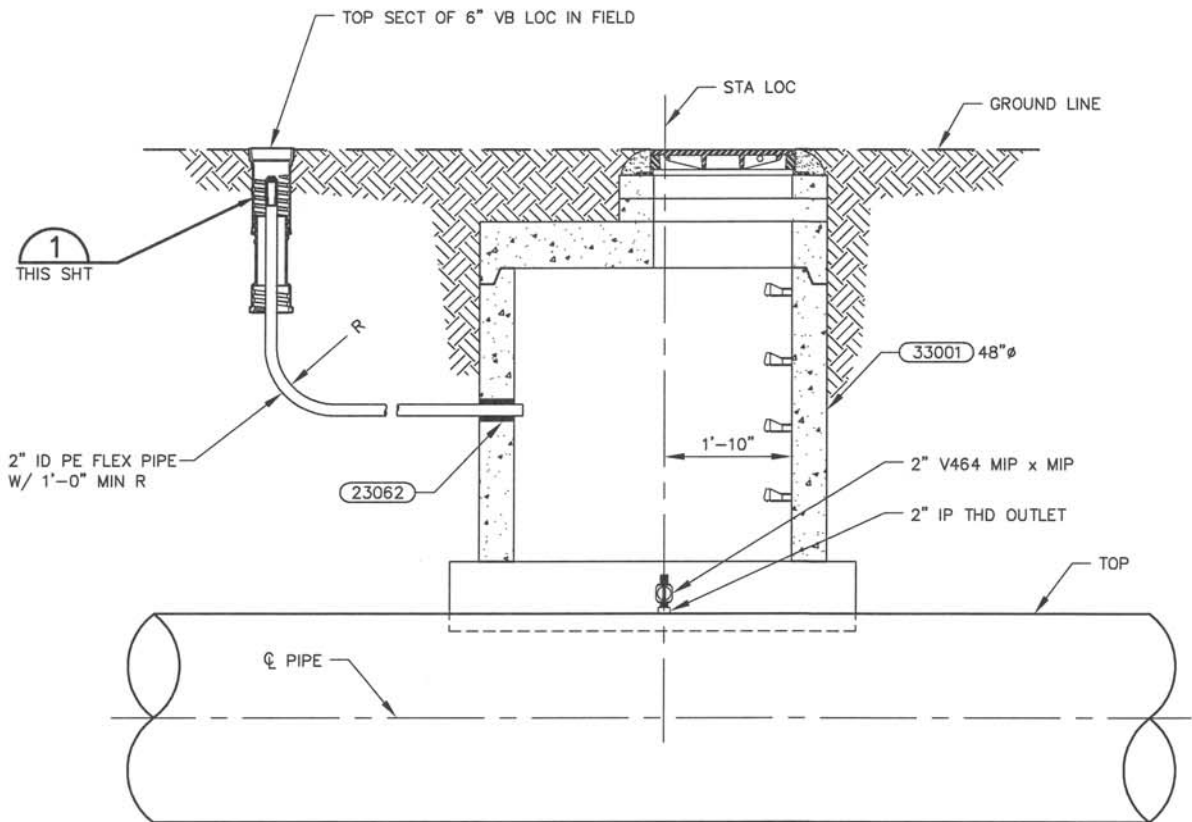
**D DENVER WATER**

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 T: 303.628.6000  
 F: 303.628.6851  
 denverwater.org





**DETAIL** 1  
THIS SHT

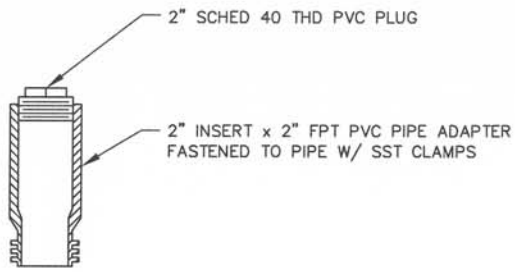


DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Ren
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

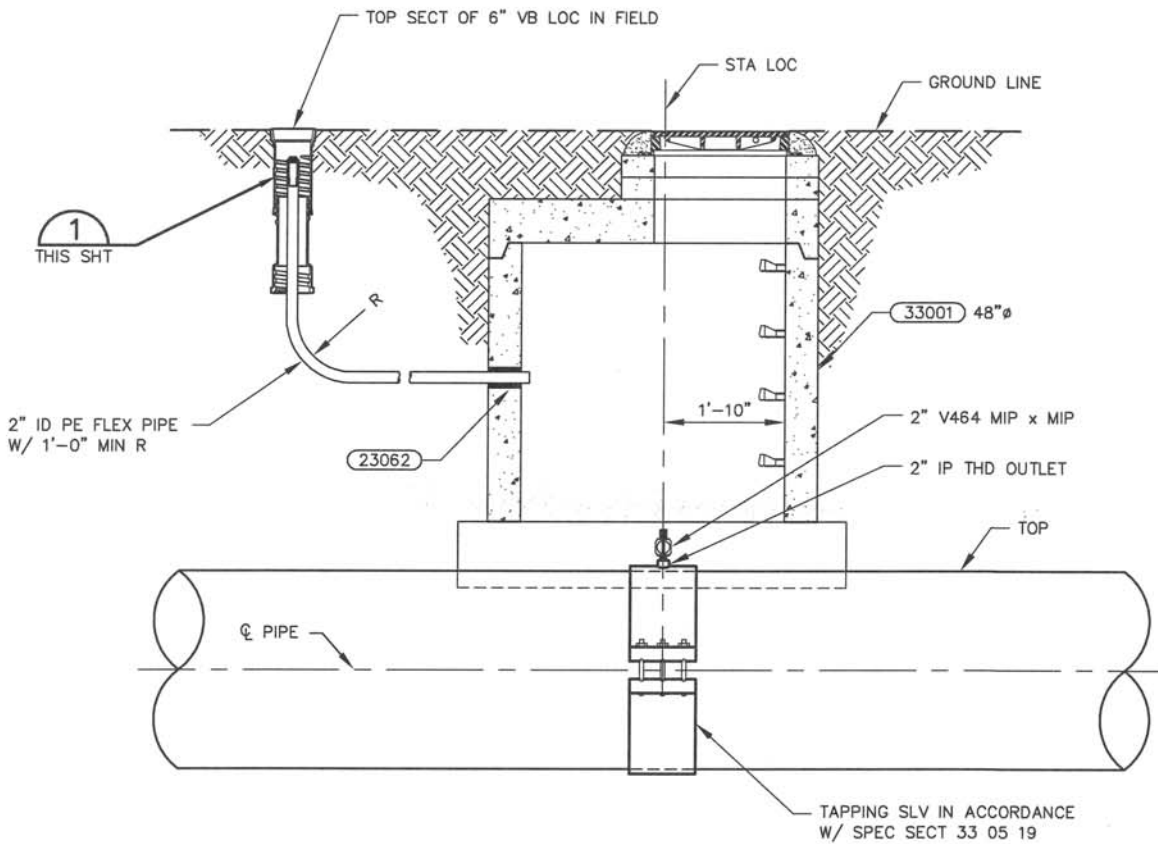
33060  
2" PITOT MANHOLE  
(STEEL PIPE)

**DENVER WATER**

1600 West 12th Ave  
Denver, Colorado 80204-3412  
T: 303.628.6000  
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denverwater.org



**DETAIL** 1  
THIS SHT

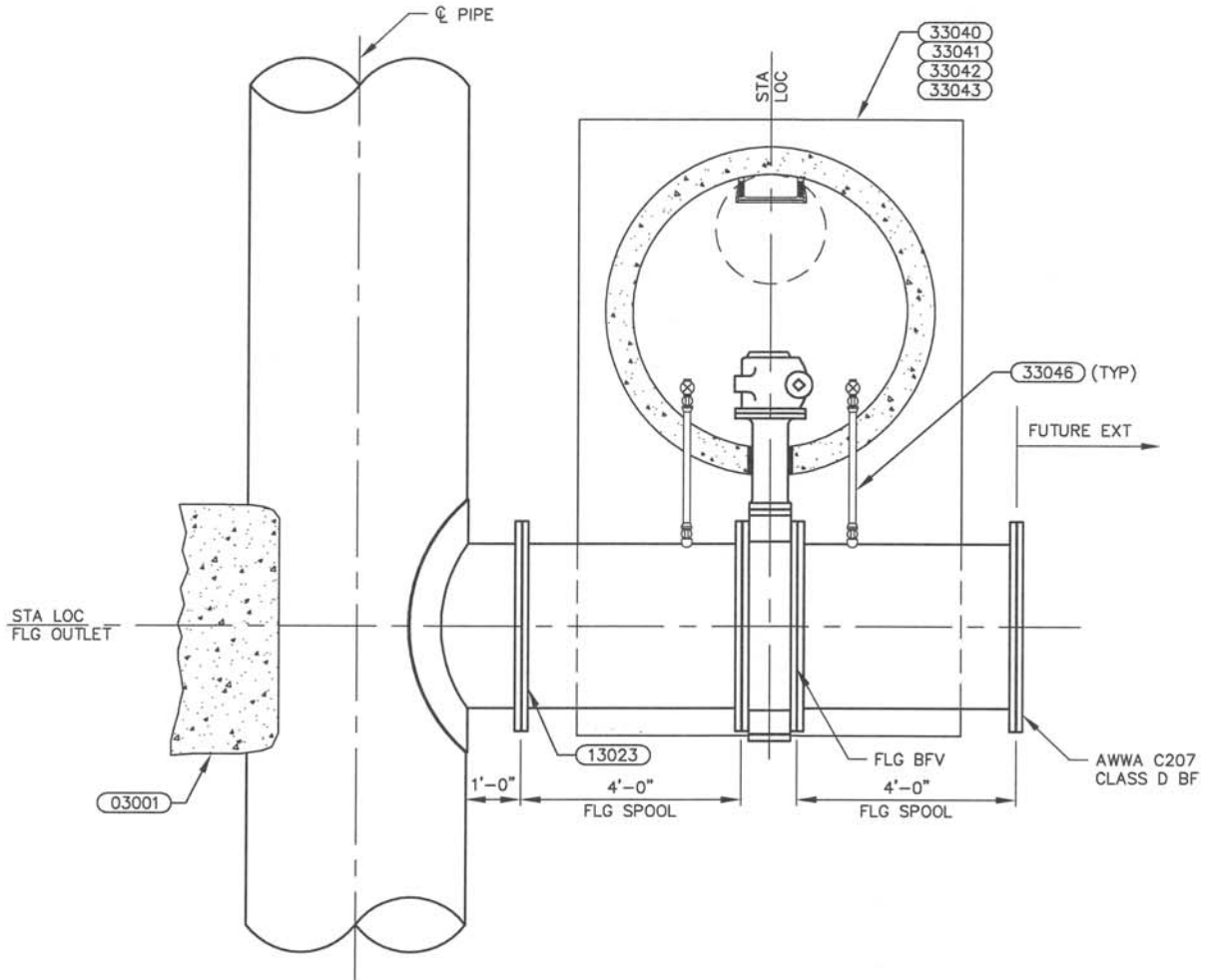


DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. P...
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

33061  
2" PITOT MANHOLE  
(DUCTILE IRON PIPE)

**DENVER WATER**

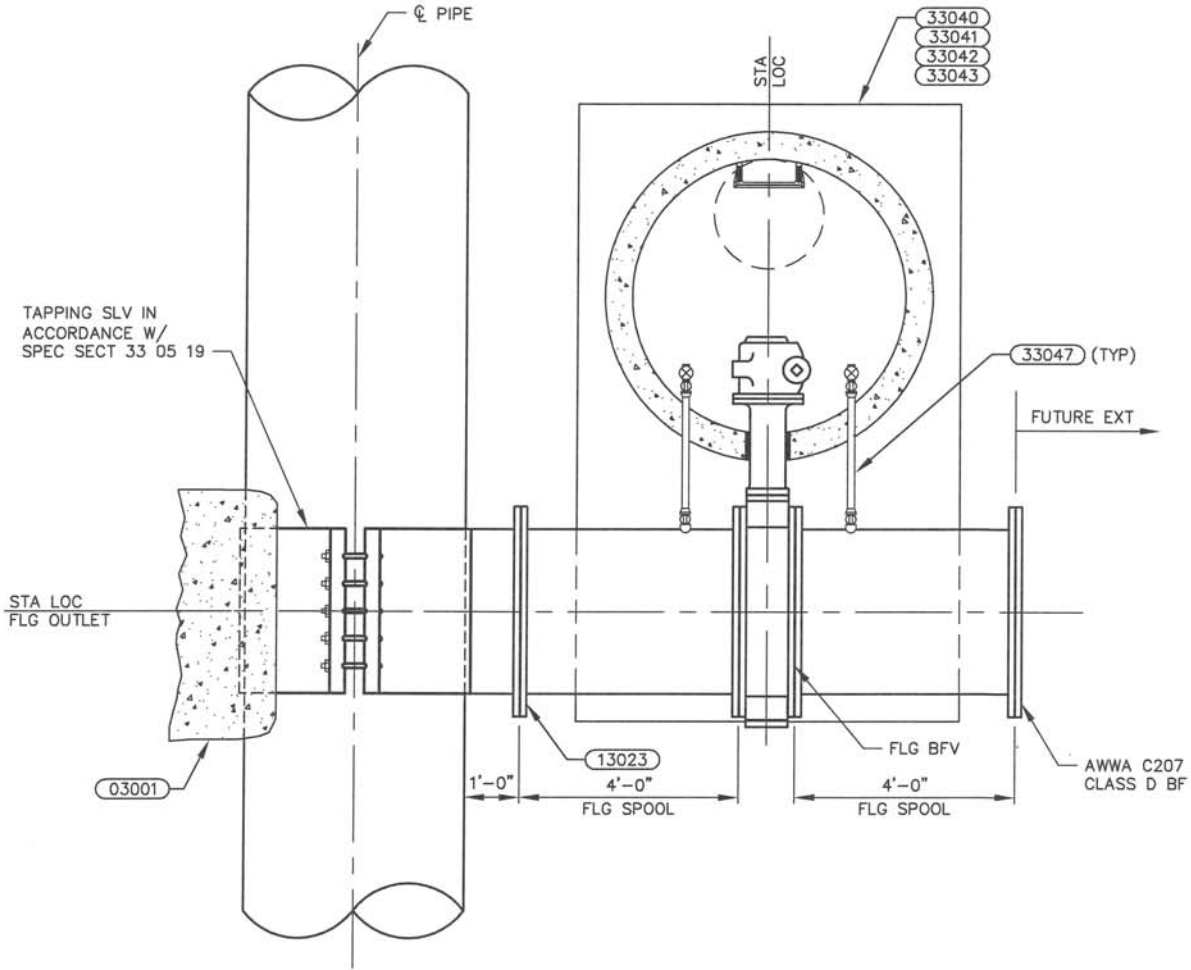
1600 West 12th Ave  
Denver, Colorado 80204-3412  
T: 303.628.6000  
F: 303.628.6851  
denverwater.org



DRAWN BY: WENKHEIMER  
 CHKD BY: K ROSS/KLR  
 APPD BY: *Steph. C. Rea*  
 ORIGINATION DATE: JANUARY 2017  
 REVISION DATE:

33070  
 16"Ø AND LARGER OUTLET  
 (STEEL PIPE)

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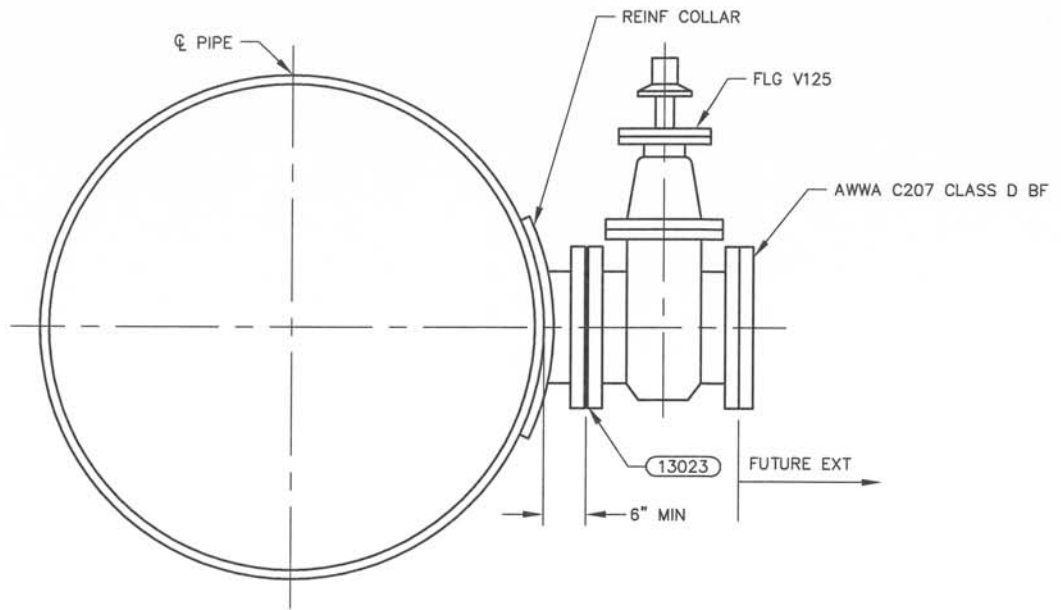
**NOTE:**

WELD-ON OUTLETS ARE PERMISSIBLE IF QUALIFIED WELDERS AND PROCEDURES ARE USED IN ACCORDANCE WITH ANSI/AWS D11.2.

DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/WR
APPD BY: Stephen C. Poon
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

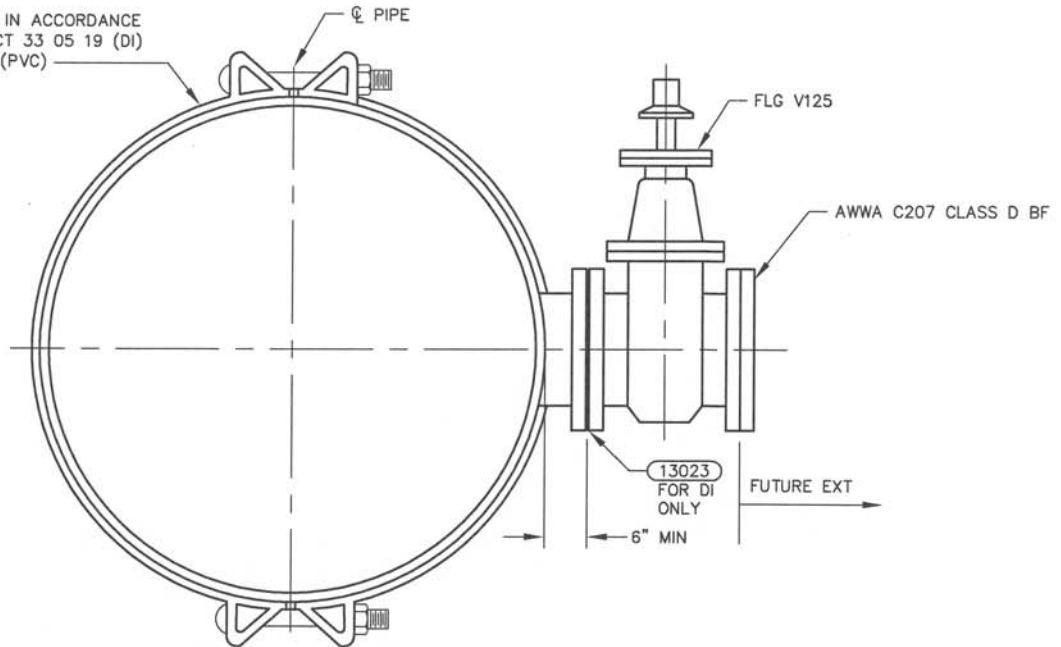
33071  
 16"Ø AND LARGER OUTLET  
 (DUCTILE IRON PIPE)

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STEEL OUTLET

TAPPING SLV IN ACCORDANCE  
W/ SPEC SECT 33 05 19 (DI)  
33 05 31.13 (PVC)

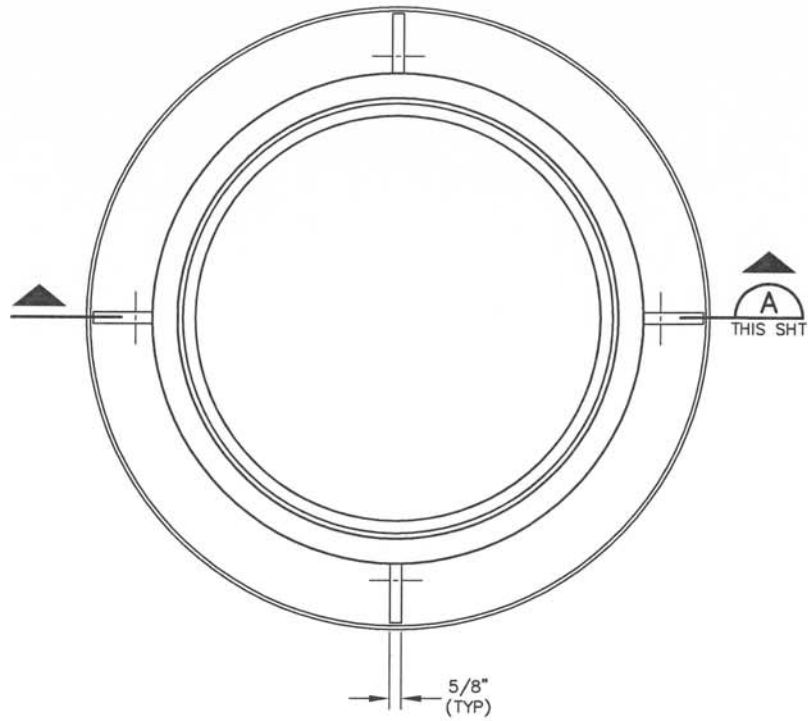


DUCTILE IRON & PVC OUTLETS

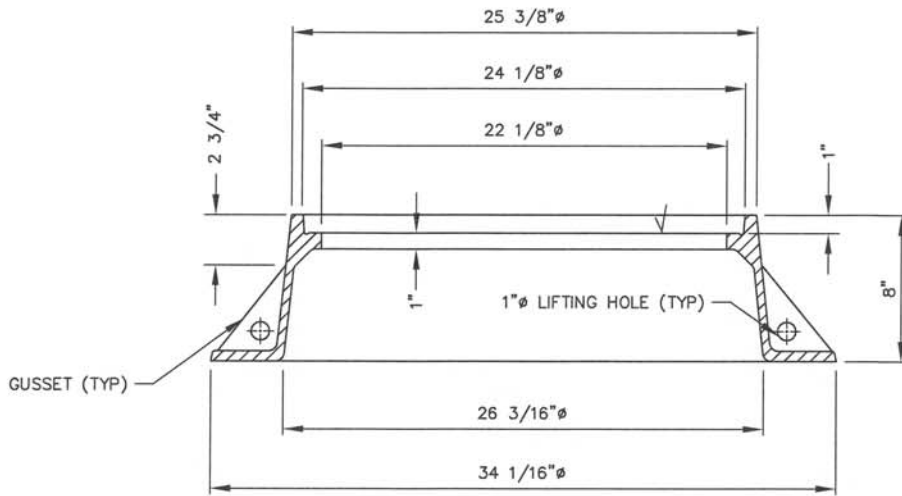
DRAWN BY: <i>WENKHEIMER</i>
CHKD BY: <i>K ROSS/KR</i>
APPD BY: <i>Stephen C. Rein</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

33072  
20"Ø AND SMALLER OUTLET

**D DENVER WATER**  
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PLAN



SECTION A  
THIS SHT

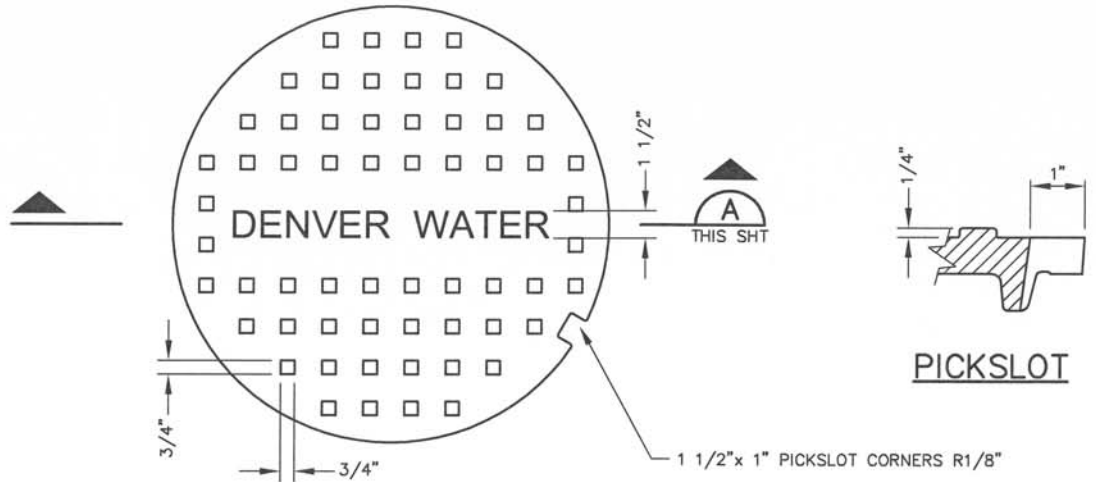
NOTE:

√ = MACHINED SURFACE

DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/KR
APPD BY: Stephen C. Penn
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

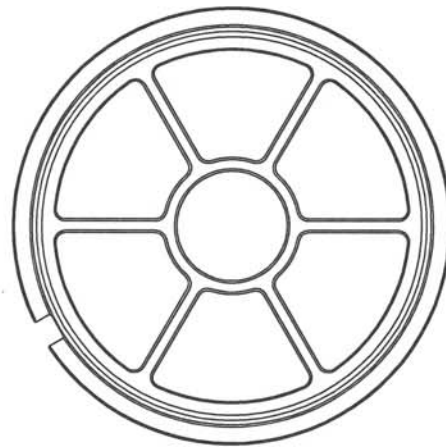
33080  
24"∅ MANHOLE RING

**D DENVER WATER**  
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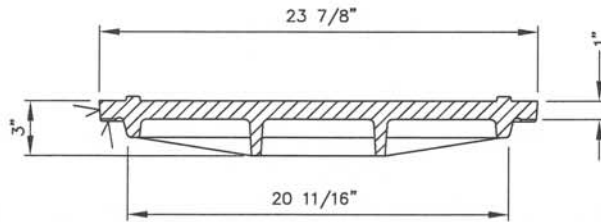


PICKSLOT

TOP PLAN



BOTTOM PLAN



SECTION A  
THIS SHT

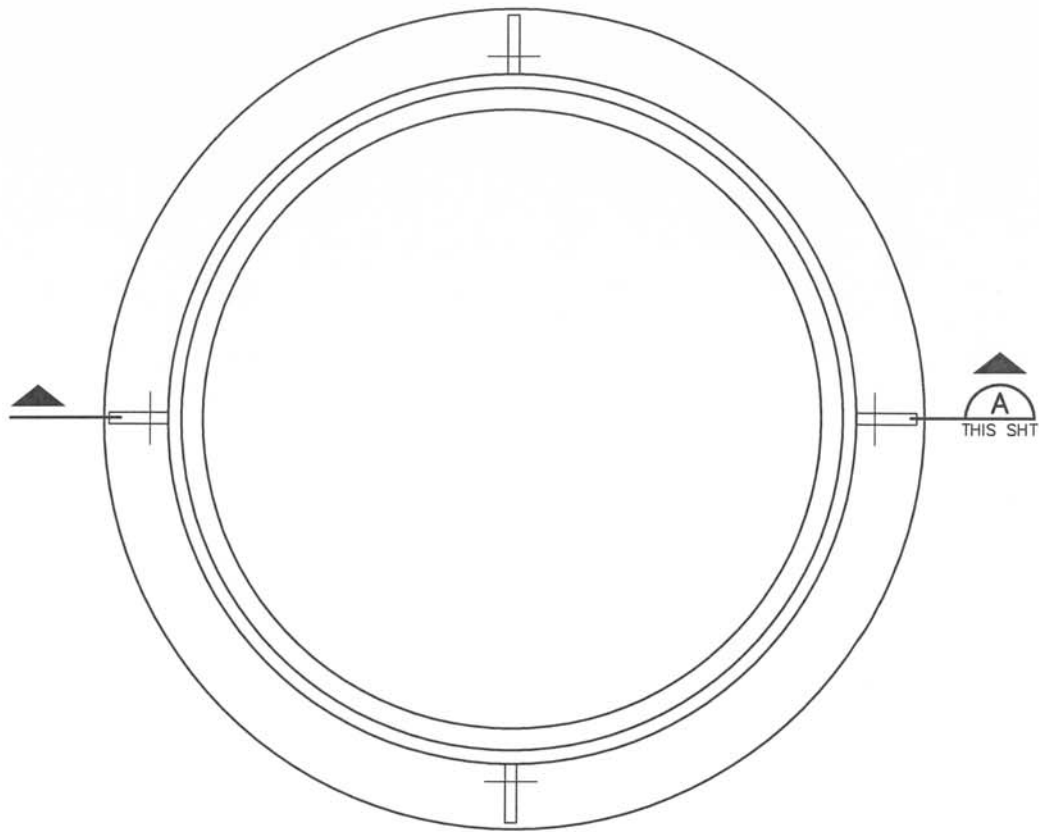
**NOTE:**

√ = MACHINED SURFACE

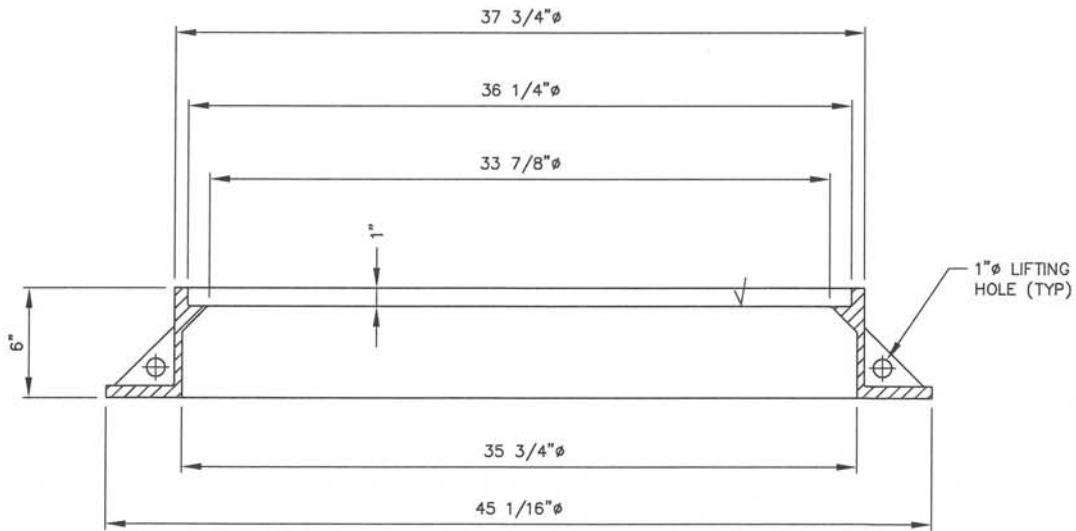
DRAWN BY: <i>WENKHEIMER</i>
CHKD BY: <i>K ROSS/KLR</i>
APPD BY: <i>Stephen C. Reem</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

33081  
24"Ø MANHOLE COVER

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F: 303.628.6851  
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PLAN



SECTION A  
THIS SHT

NOTE:

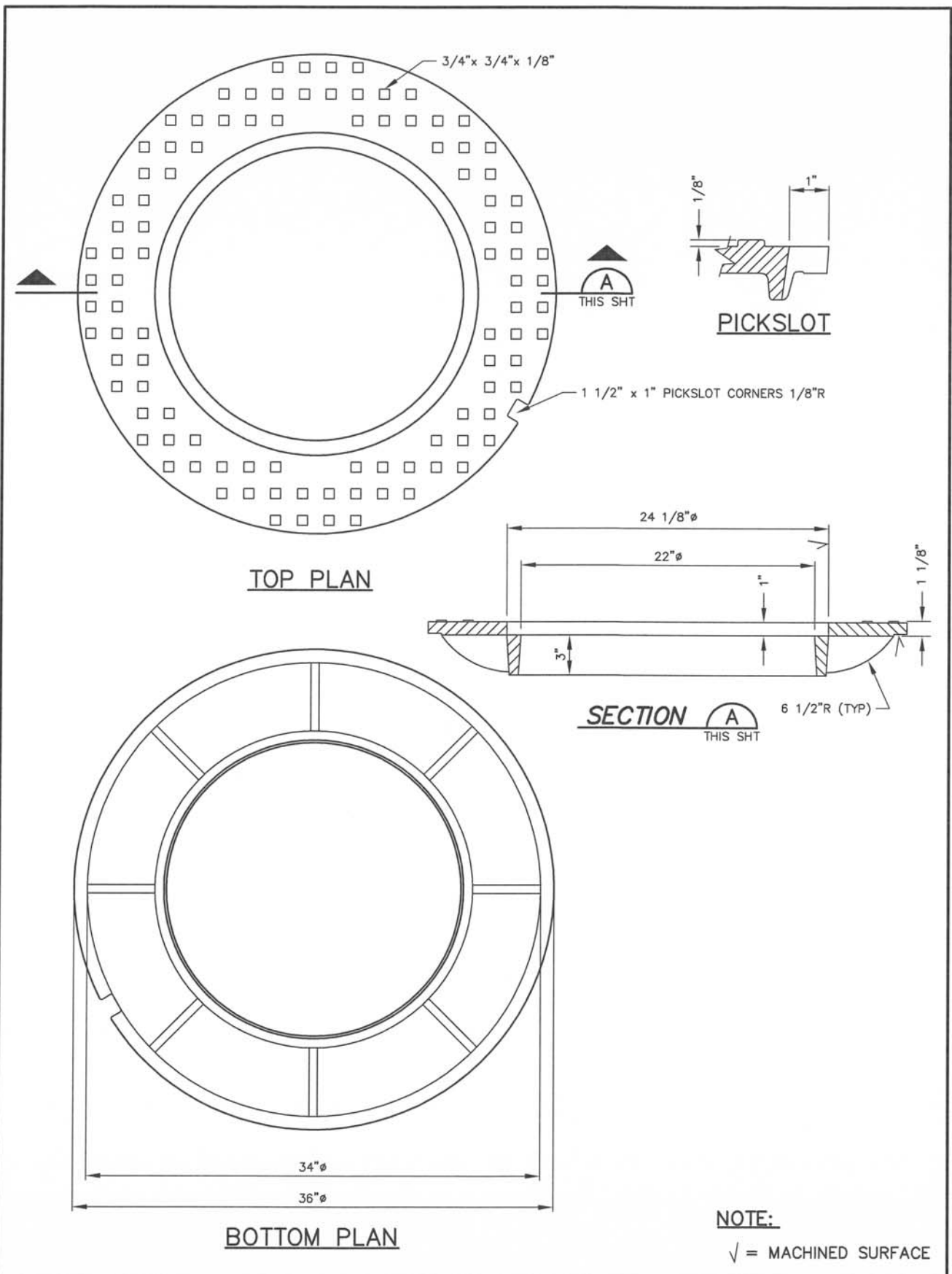
√ = MACHINED SURFACE

DRAWN BY: <i>WENKHEIMER</i>
CHKD BY: <i>K ROSS/KLR</i>
APPD BY: <i>Stephen C. Pomeroy</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

33082  
36"∅ MANHOLE RING

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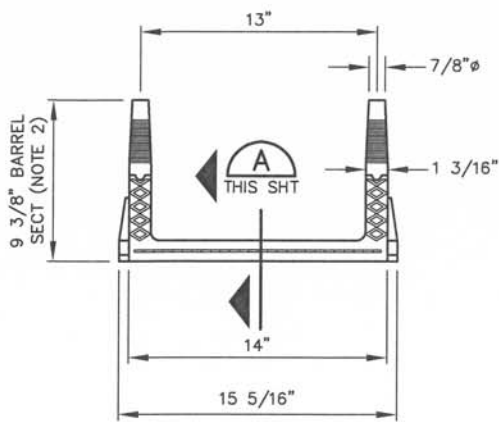


DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Rem
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

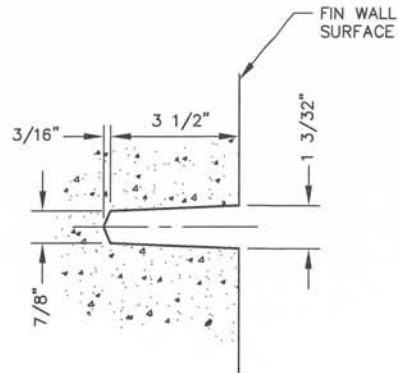
33083  
 36" x 24"  $\phi$  MANHOLE COVER

**D DENVER WATER**

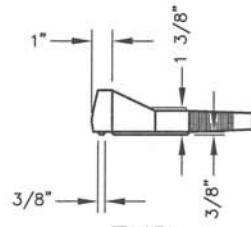
1600 West 12th Ave  
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 F: 303.628.6851  
 denverwater.org



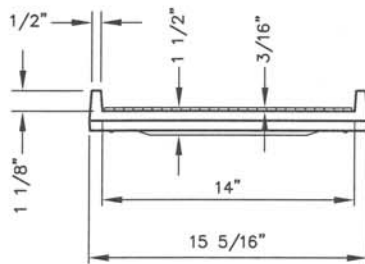
PLAN



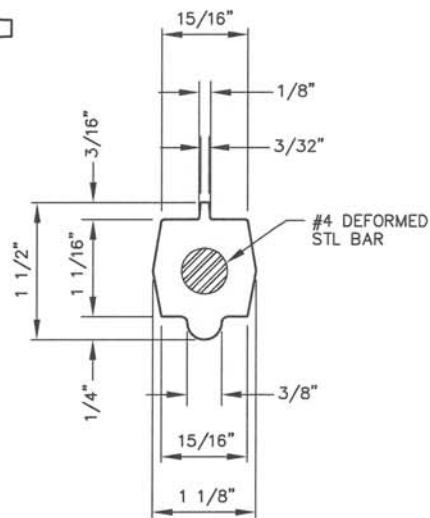
PIN BLOCK OUT



END



ELEVATION



SECTION

A  
THIS SHT

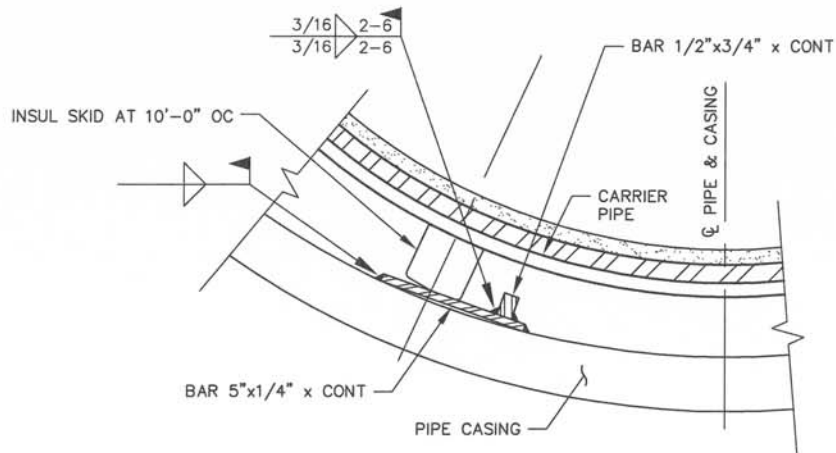
**NOTES:**

1. ASTM SPECIFICATIONS:
  - A. ASTM C 478
  - B. ASTM A 615 GRADE 60 STL REBAR
  - C. ASTM D 4101 CLASSIFICATION PP0311 POLYPROPYLENE
2. STEPS SHALL HAVE A PENETRATION DEPTH INTO THE WALL OF 3 3/8-INCH.
3. STEP SHALL BE INSTALLED BY THE "PRESS-FIT" METHOD UTILIZING A SPECIALLY TAPERED PIN TO FORM THE INSERT HOLE AS SHOWN, FOLLOWING MANUFACTURER'S RECOMMENDED PROCEDURE AND SHALL NOT BE GROUTED IN PLACE.
4. INSTALLED STEPS SHALL BE CAPABLE OF WITHSTANDING A PULL OUT FORCE OF 2500 LB PER LEG FOR A MINIMUM PERIOD OF TWO MINUTES.
5. STEP SHALL BE SMOOTH AND CONTINUOUSLY TAPERED. DIMENSIONS OF THE PIN AND THE INSERTED PORTION OF THE MANHOLE STEPS ARE TYPICAL ONLY. INSTALLATIONS REQUIRE A MATCHED COMBINATION OF A TAPERED INSERT PIN AND MANHOLE STEPS, AS RECOMMENDED OR REQUIRED BY SPECIFIC MANUFACTURER OF THE STEP TO BE USED.

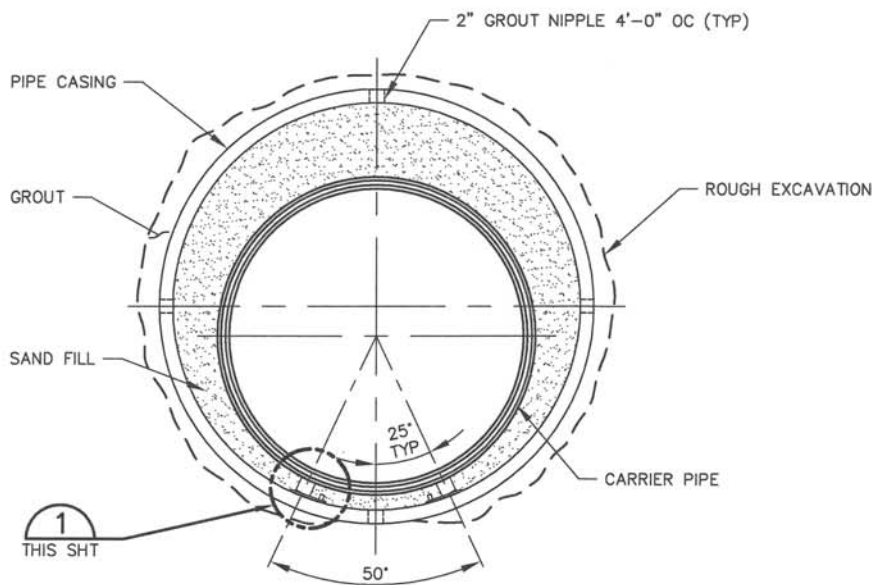
DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/KR
APPD BY: Stephen C. Pen
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

33090  
POLYPROPYLENE REINFORCED  
PLASTIC MANHOLE STEP

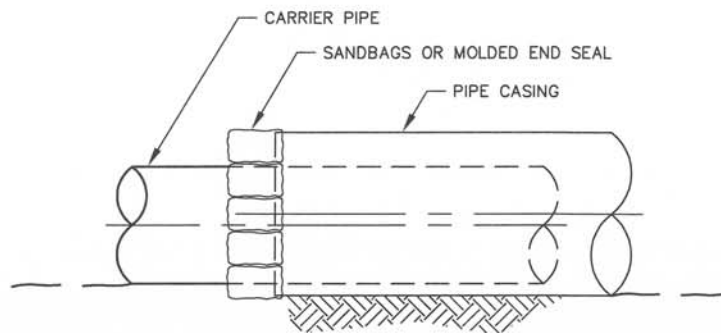
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**DETAIL 1**  
THIS SHIT



**CROSS SECTION**

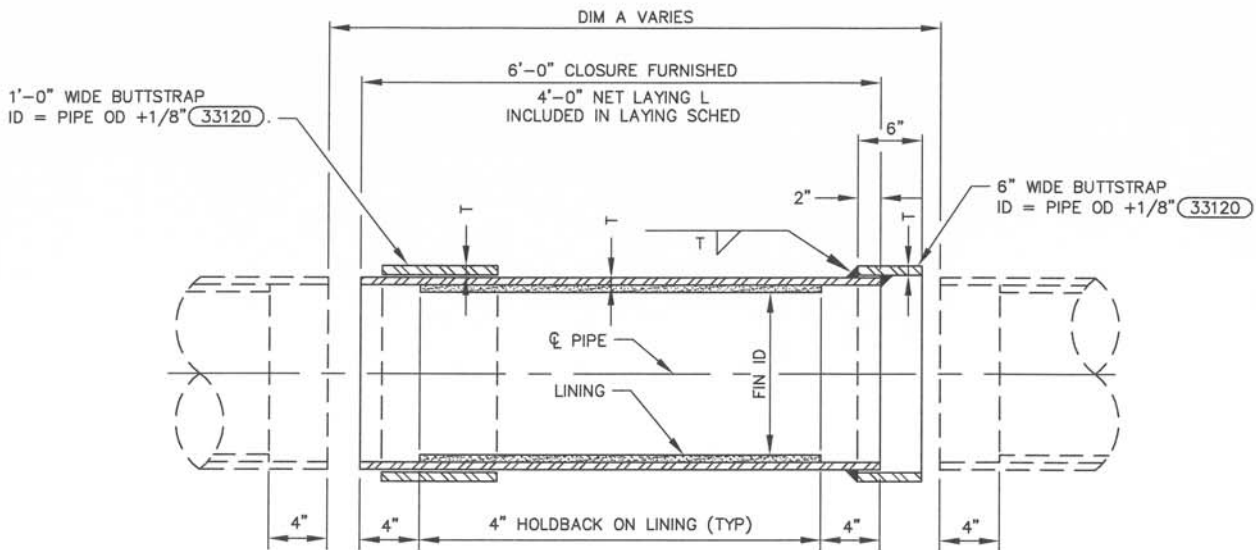


**ELEVATION**

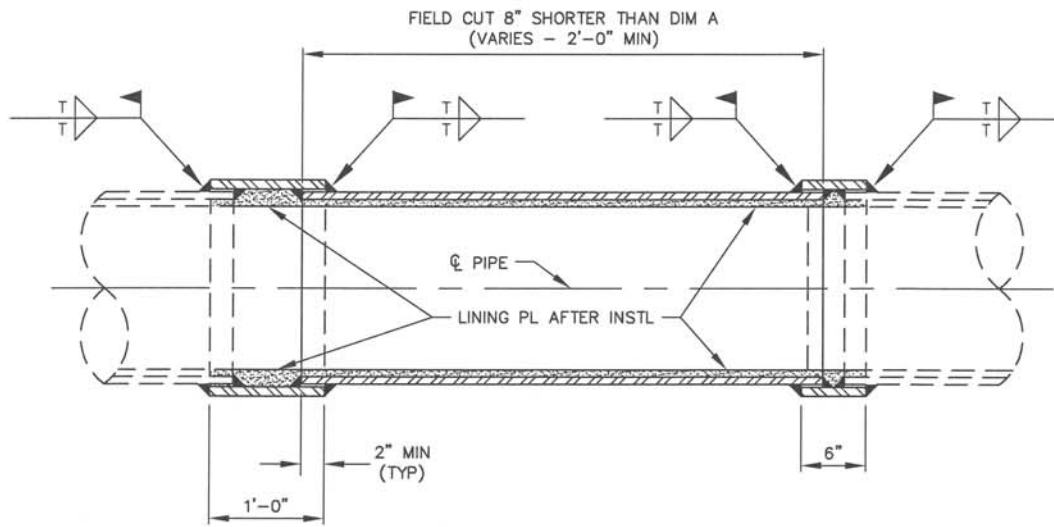
DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/KR
APPD BY: Stephen C. Ream
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

33101  
INSULATED SKID AND PIPE  
CASING (24"Ø AND LARGER)

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**OPEN POSITION**



**CLOSED POSITION**

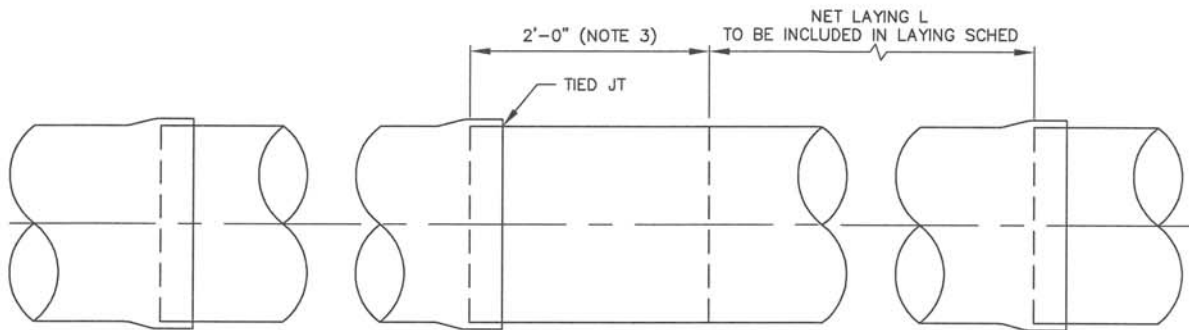
**NOTE:**

AFTER INSTALLATION, CLOSURE ASSEMBLY SHALL BE FIELD COATED AND LINED WITH SAME BASIC COATING AND LININGS AS MAIN PIPELINE.

DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/KRP
APPD BY: Stephen C. Ren
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

3311  
24"Ø AND LARGER CLOSURE  
(STEEL PIPE)


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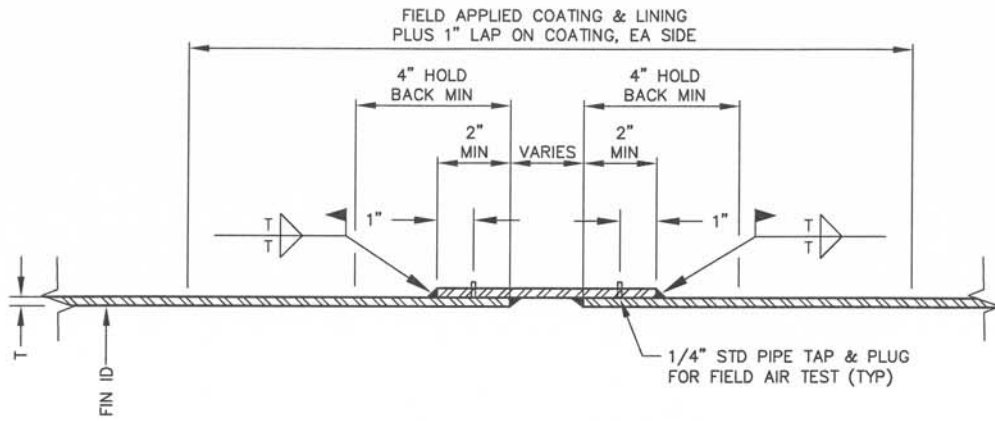


CORRECTION PIECE

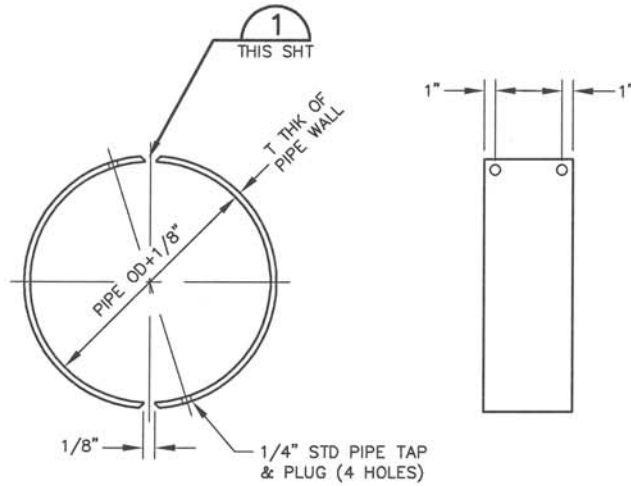
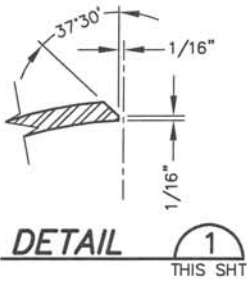
NOTES:

1. AFTER INSTALLATION, CORRECTION PIECE SHALL BE FIELD COATED AND LINED WITH SAME COATING AND LINING AS MAIN PIPELINE.
2. CORRECTION PIECES SHALL BE PLACED AT APPROXIMATE INTERVALS OF 2000- FEET AND JUST PRIOR TO 45- DEGREE AND 90- DEGREE BENDS, AND AT END OF CONTRACT. CORRECTION PIECES ARE LOCATED IN TIED JOINT REACHES.
3. THIS SECTION OF PIPE IS FOR FIELD TRIM. BARE OUTSIDE, LINED INSIDE. LENGTH SHALL NOT TO BE INCLUDED IN LAYING SCHEDULE.

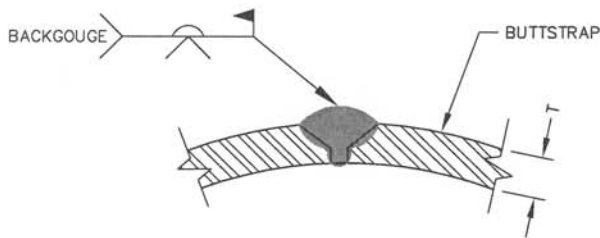
DRAWN BY: <i>WENKHEIMER</i>	<p><b>33112</b>  <b>CORRECTION PIECE</b>  <b>(STEEL PIPE)</b></p>	 1600 West 12th Ave Denver, Colorado 80204-3412 T: 303.628.6000 F: 303.628.6851 denverwater.org
CHKD BY: <i>K ROSS/KIR</i>		
APPD BY: <i>Stephen C. Ben</i>		
ORIGINATION DATE: <i>JANUARY 2017</i>		
REVISION DATE:		



**TIED JOINT BUTTSTRAP**



**LOOSE BUTTSTRAP**



**LONGITUDINAL WELD**

**NOTE:**

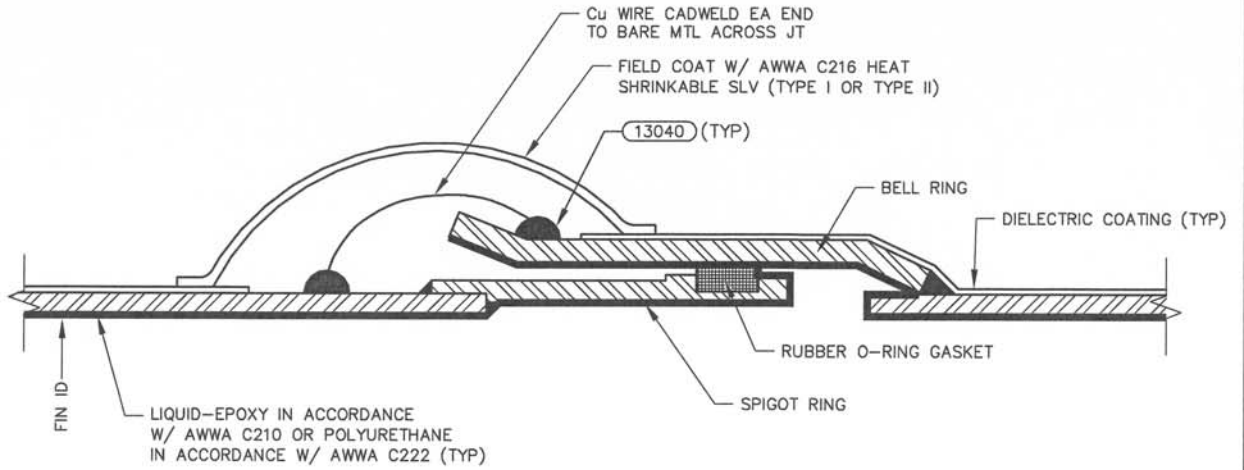
SEE 33122 TO 33129 FOR COATING AND LINING.

DRAWN BY: DITTERLINE
CHKD BY: K ROSS/KJR
APPD BY: Stephen C. Parn
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

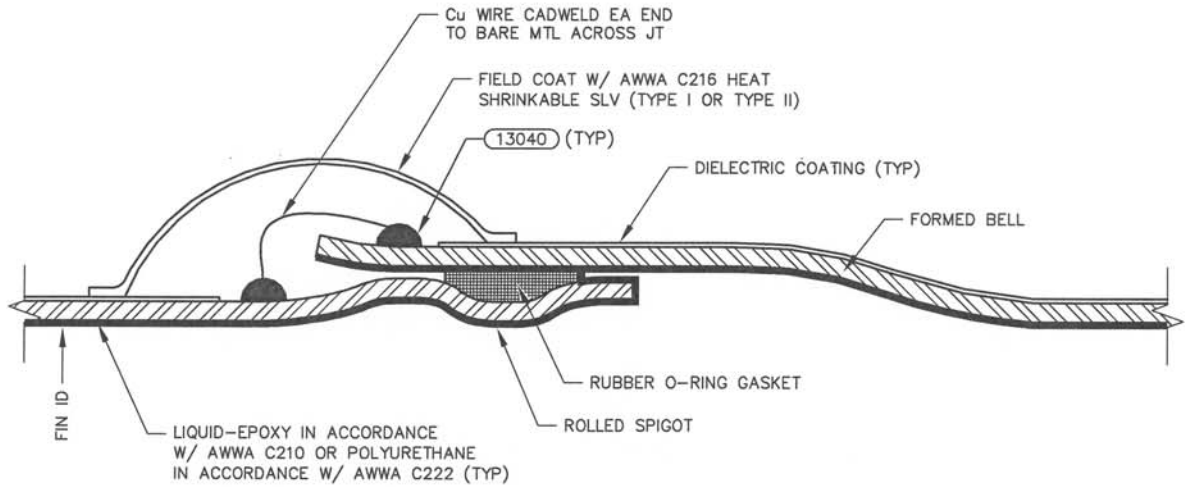
33120  
BUTTSTRAP

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### O-RING CARNEGIE JOINT

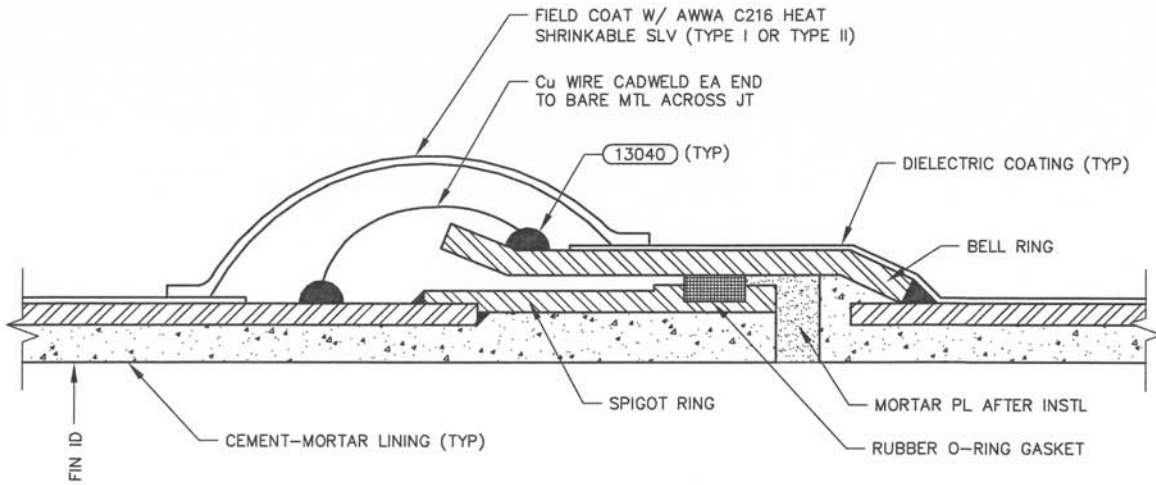


### ROLLED SPIGOT JOINT

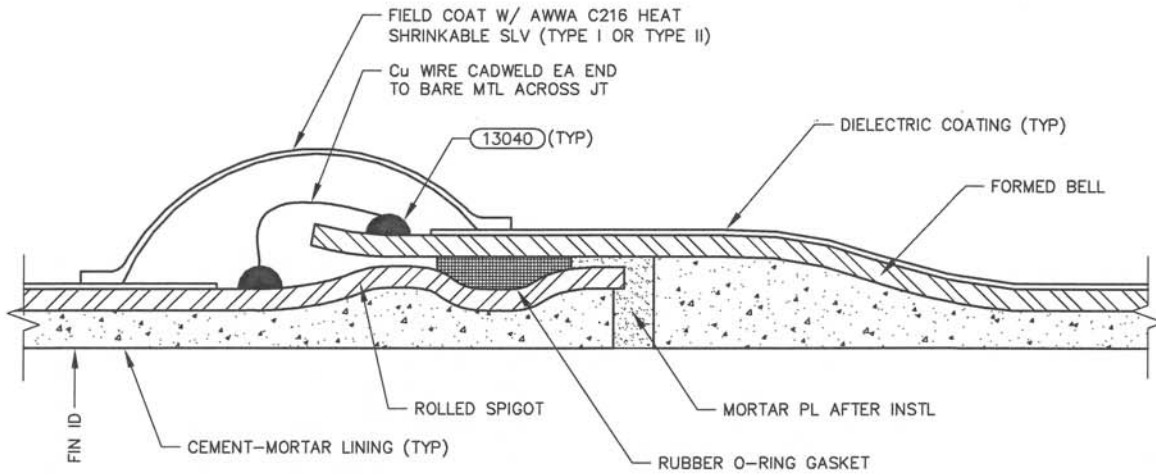
**NOTE:**

THE DIELECTRIC COATING SHALL BE LIQUID-EPOXY, POLYURETHANE OR TAPE.

DRAWN BY: WENKHEIMER	<p>33122</p> <p>STEEL PIPE O-RING JOINTS</p> <p>(LIQUID-EPOXY OR</p> <p>POLYURETHANE LINING)</p>	<p>1600 West 12th Ave Denver, Colorado 80204-3412 T: 303.628.6000 F: 303.628.6851 denverwater.org</p>
CHKD BY: K ROSS/KIR		
APPD BY: Stephen C. Rau		
ORIGINATION DATE: JANUARY 2017		
REVISION DATE:		



O-RING CARNEGIE JOINT



ROLLED SPIGOT JOINT

NOTE:

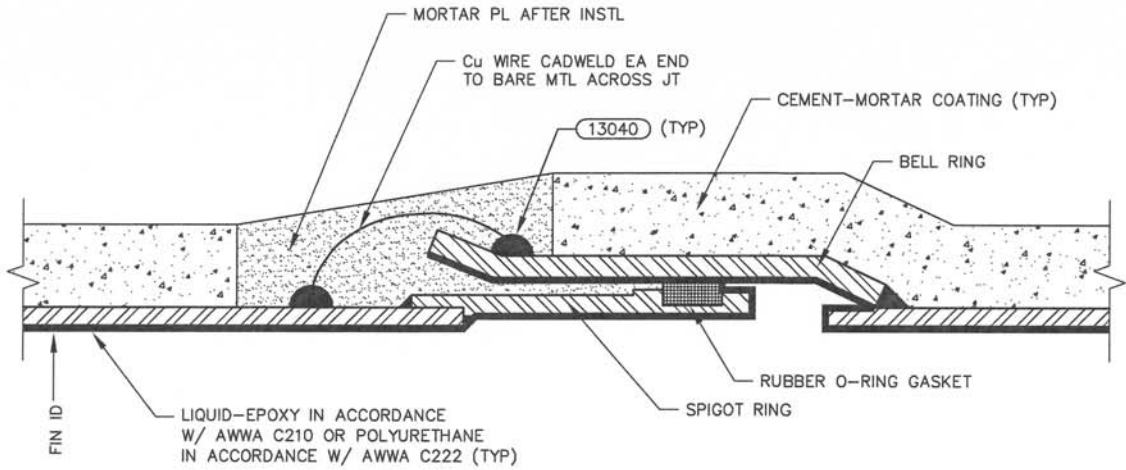
THE DIELECTRIC COATING SHALL BE LIQUID-EPOXY, POLYURETHANE OR TAPE.

DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/ <i>KR</i>
APPD BY: <i>Steph C. Rem</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

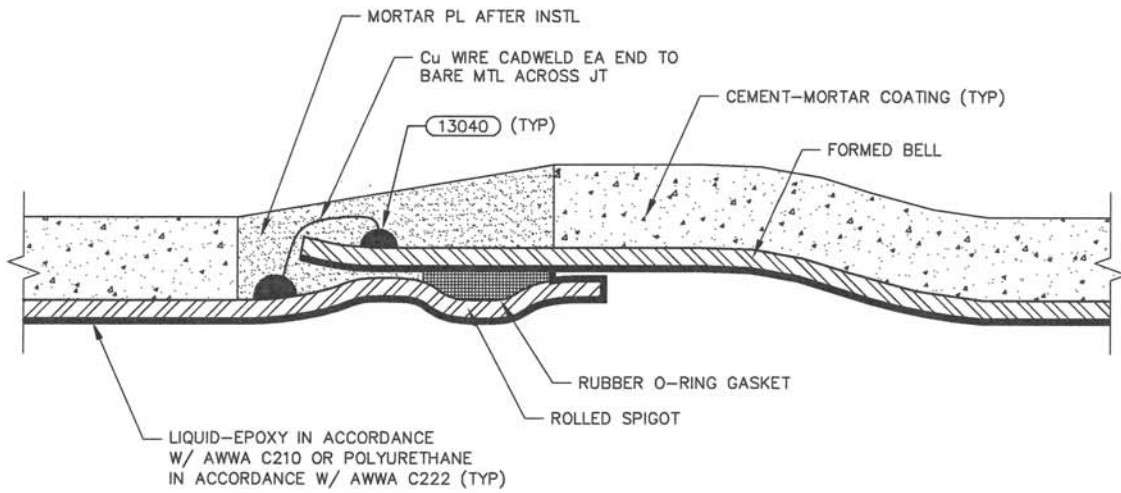
33123  
 STEEL PIPE O-RING JOINTS  
 (CEMENT-MORTAR LINING)

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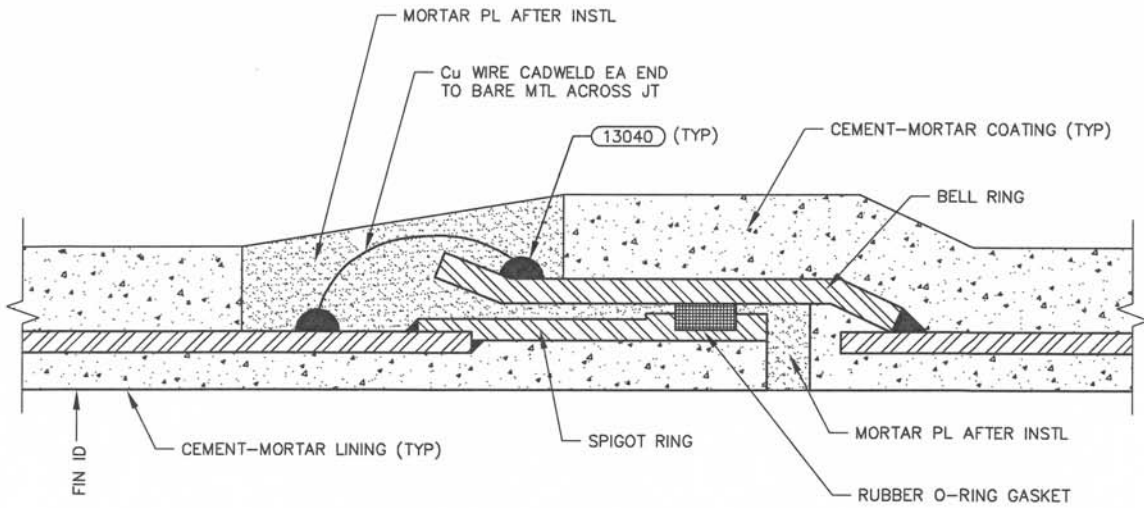


O-RING CARNEGIE JOINT

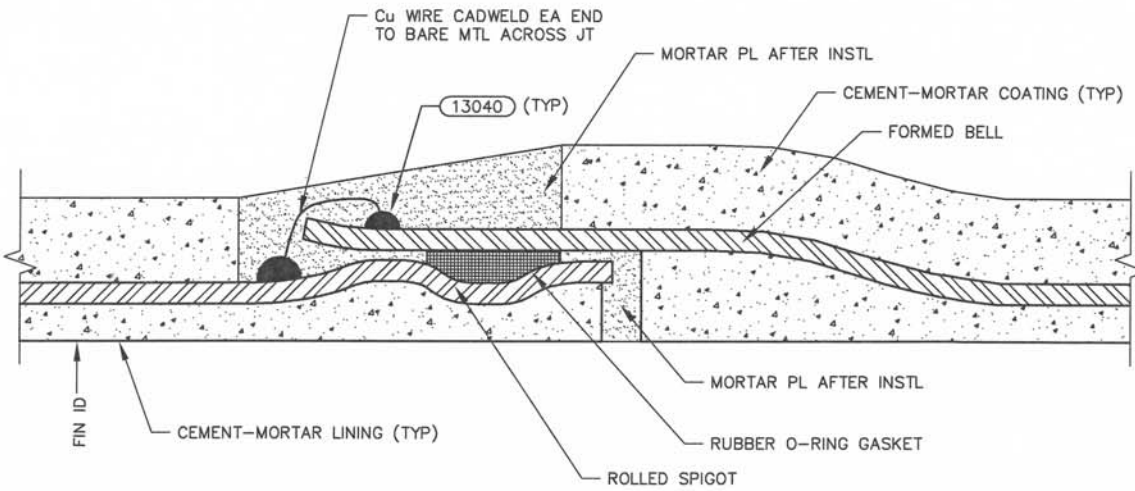


ROLLED SPIGOT JOINT

DRAWN BY: WENKHEIMER	<p>33124</p> <p><b>CEMENT-MORTAR COATED STEEL PIPE</b></p> <p><b>O-RING JOINTS (LIQUID-EPOXY OR</b></p> <p><b>POLYURETHANE LINING)</b></p>	<p><b>DENVER WATER</b></p> <p>1600 West 12th Ave          Denver, Colorado 80204-3412          T: 303.628.6000          F: 303.628.6851          denverwater.org</p>
CHKD BY: K ROSS/ KLR		
APPD BY: <i>Stephan C. Pilon</i>		
ORIGINATION DATE: JANUARY 2017		
REVISION DATE:		



O-RING CARNEGIE JOINT

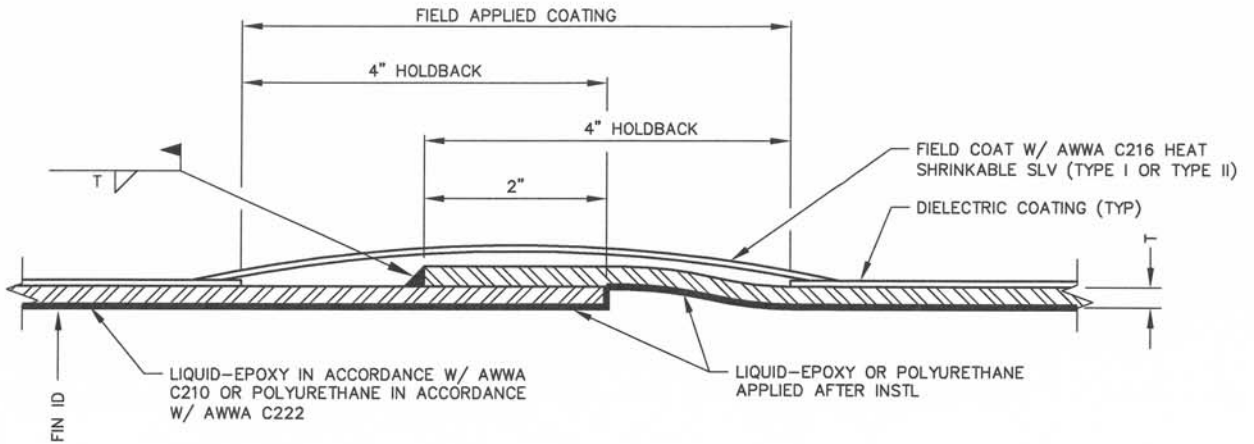


ROLLED SPIGOT JOINT

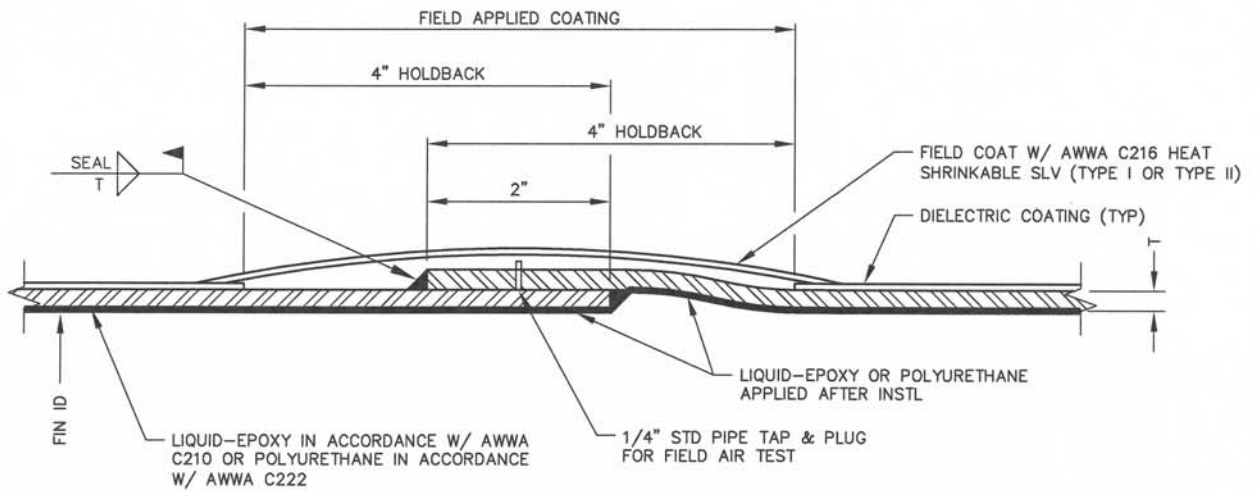
DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/KIR
APPD BY: Stephen C. Pen
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

33125  
 CEMENT-MORTAR COATED  
 STEEL PIPE O-RING JOINTS  
 (CEMENT-MORTAR LINING)

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**SINGLE WELDED LAP JOINT**



**SINGLE WITH SEAL WELDED LAP JOINT**

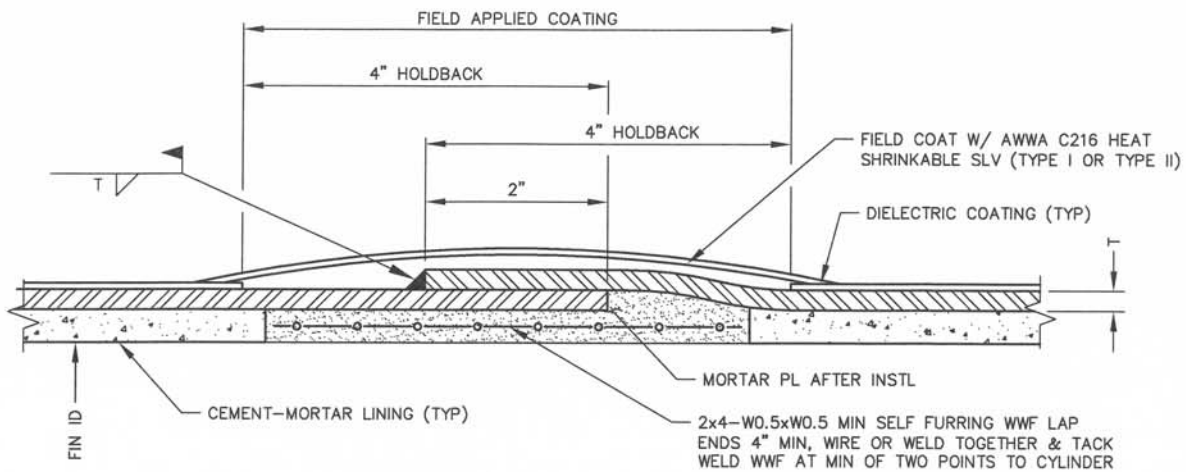
**NOTES:**

1. THE DIELECTRIC COATING SHALL BE LIQUID-EPOXY, POLYURETHANE OR TAPE.
2. THE FULL FILLET WELD MAY BE ON EITHER THE INTERIOR OR EXTERIOR OF THE PIPE.

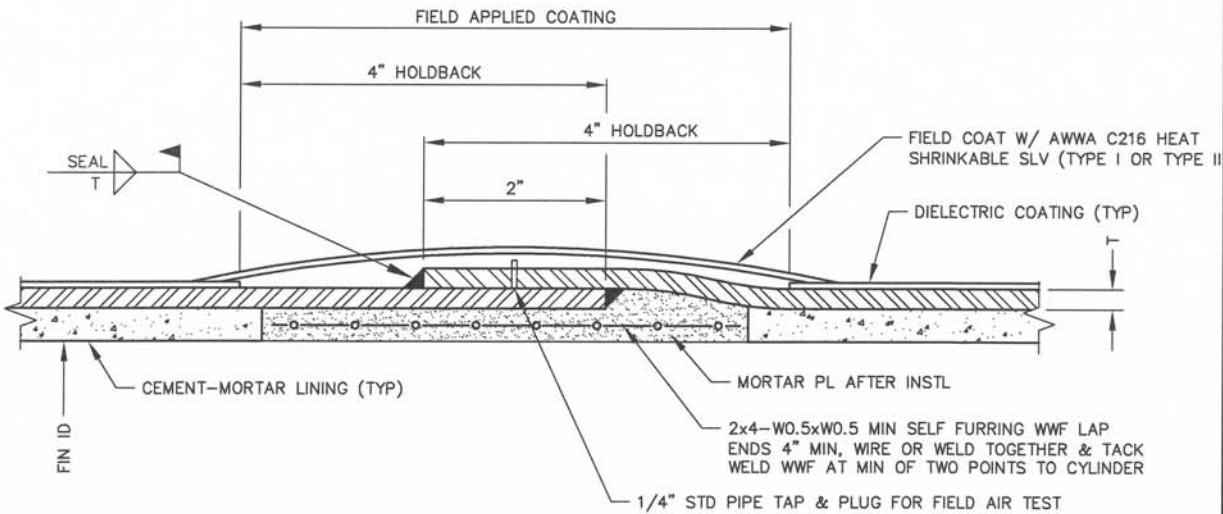
DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/KR
APPD BY: Stephen C. Penn
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**33126**  
**STEEL PIPE TIED JOINT-LAP**  
**JOINTS (LIQUID-EPOXY OR**  
**POLYURETHANE LINING)**

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### SINGLE WELDED LAP JOINT



### SINGLE WITH SEAL WELDED LAP JOINT

#### NOTES:

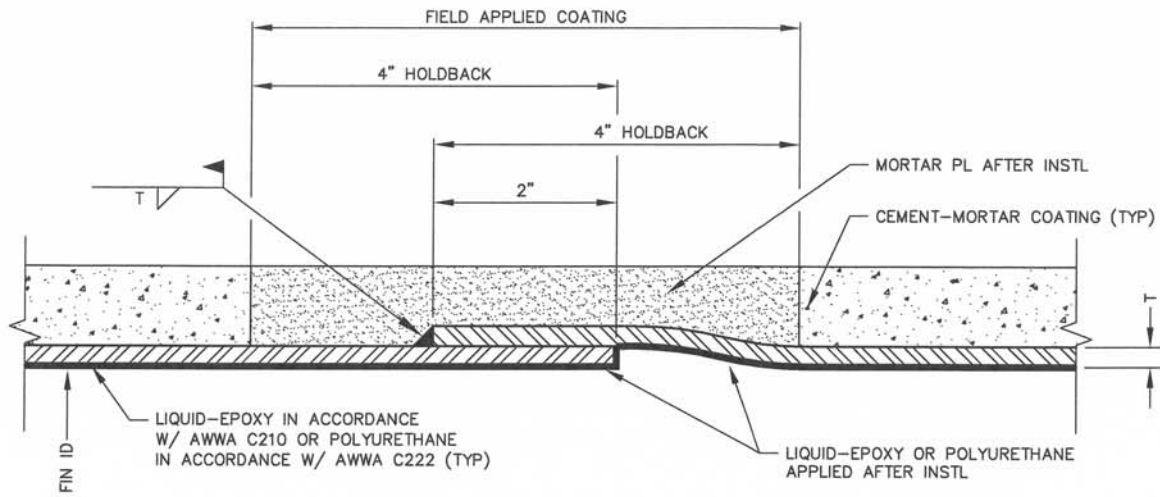
1. THE DIELECTRIC COATING SHALL BE LIQUID-EPOXY, POLYURETHANE OR TAPE.
2. THE FULL FILLET WELD MAY BE ON EITHER THE INTERIOR OR EXTERIOR OF THE PIPE.

DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/KLR
APPD BY: <i>Steven C. Ross</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

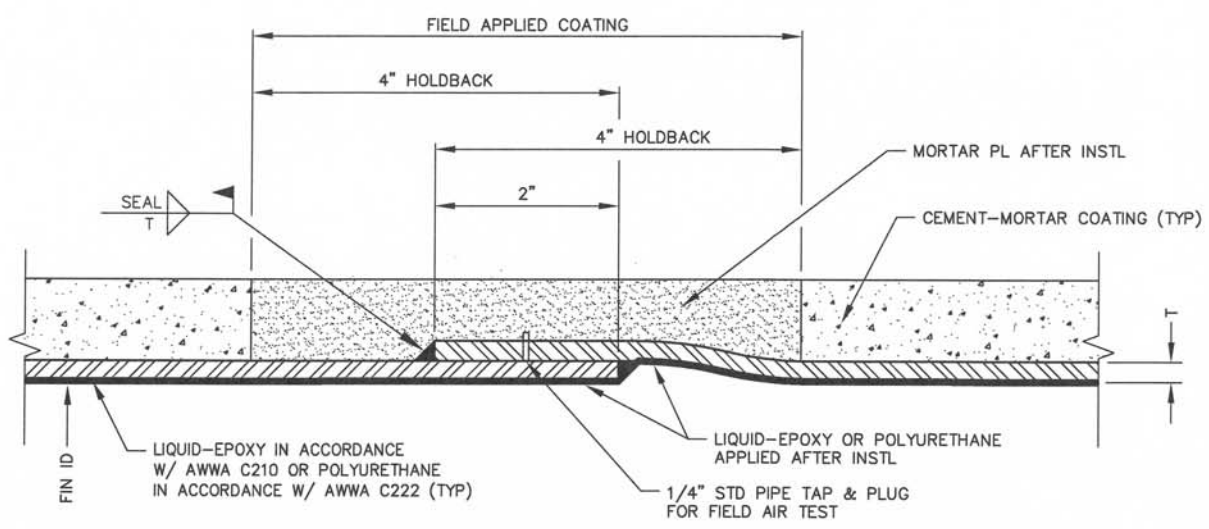
**33127**  
**STEEL PIPE TIED**  
**JOINT-LAP JOINTS**  
**(CEMENT-MORTAR LINING)**

**D DENVER WATER**

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SINGLE WELDED LAP JOINT



SINGLE WITH SEAL WELDED LAP JOINT

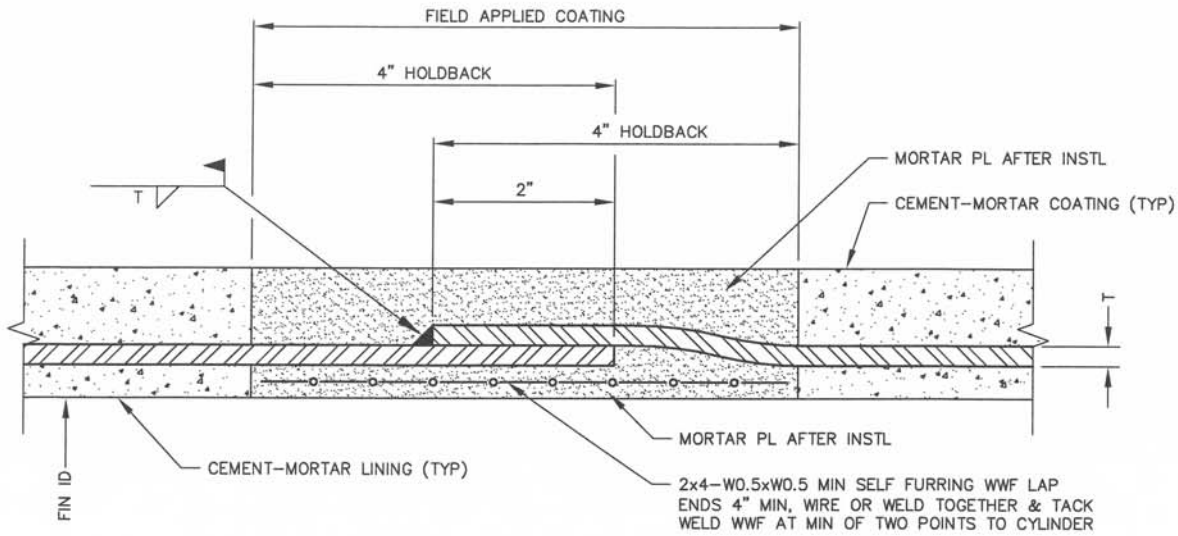
**NOTES:**

1. THE DIELECTRIC COATING SHALL BE LIQUID-EPOXY, POLYURETHANE OR TAPE.
2. THE FULL FILLET WELD MAY BE ON EITHER THE INTERIOR OR EXTERIOR OF THE PIPE.

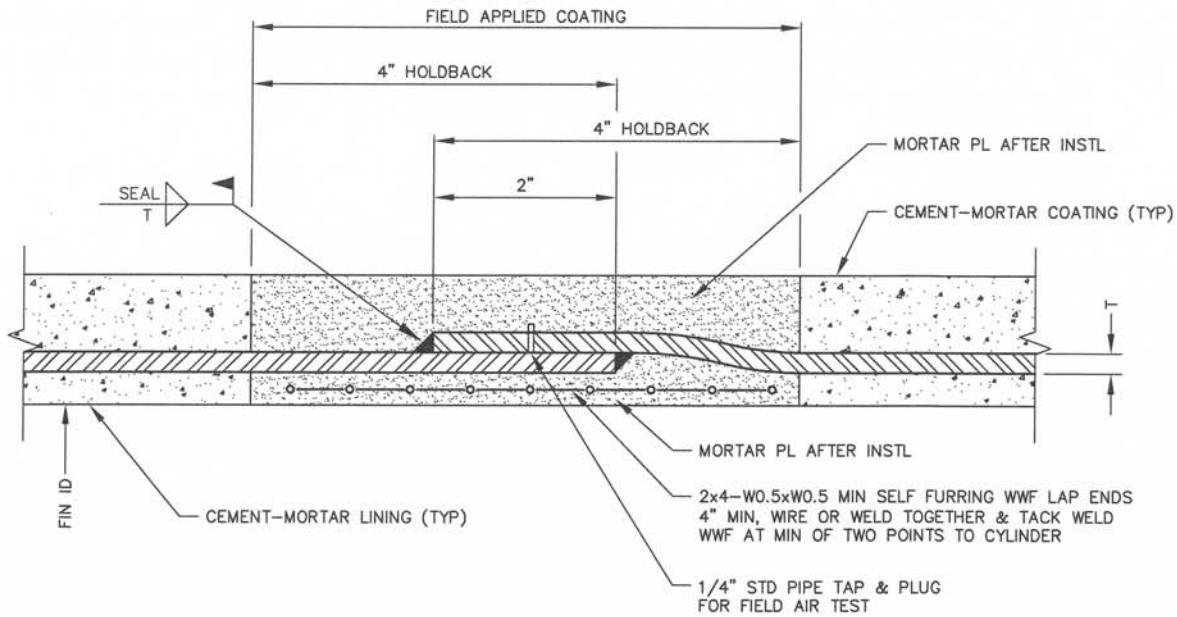
DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/ <i>KR</i>
APPD BY: <i>Stephen C. Row</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**33128**  
**CEMENT-MORTAR COATED STEEL PIPE**  
**TIED JOINT-LAP JOINTS**  
**(LIQUID-EPOXY OR**  
**POLYURETHANE LINING)**


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SINGLE WELDED LAP JOINT



SINGLE WITH SEAL WELDED LAP JOINT

NOTES:

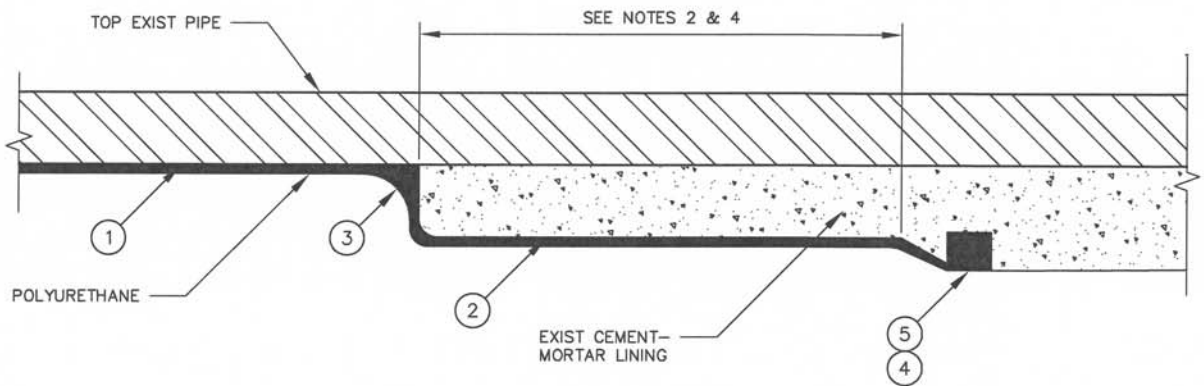
1. THE DIELECTRIC COATING SHALL BE LIQUID-EPOXY, POLYURETHANE OR TAPE.
2. THE FULL FILLET WELD MAY BE ON EITHER THE INTERIOR OR EXTERIOR OF THE PIPE.

DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/WR
APPD BY: Stephen C. Pen
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

33129  
**CEMENT-MORTAR COATED STEEL  
 PIPE TIED JOINT-LAP JOINTS  
 (CEMENT-MORTAR LINING)**

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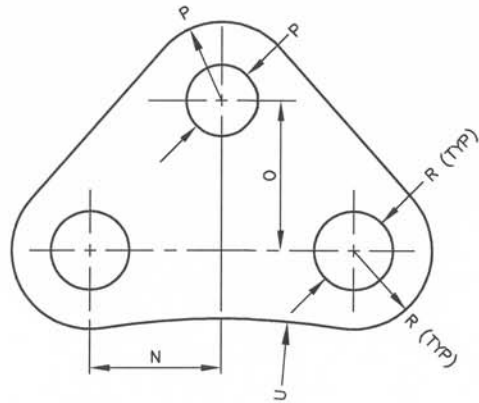
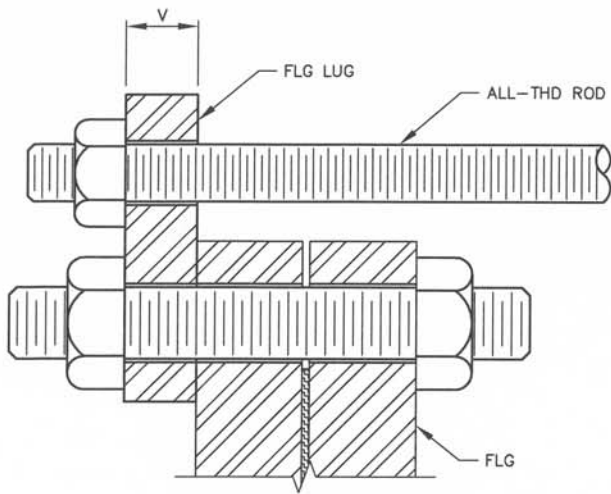
**KEYED NOTES:**

- ① ABRASIVE BLAST SSPC-SP-10 MINIMUM TO ANCHOR PROFILE SPECIFIED BY COATING MANUFACTURER.
- ② BRUSH BLAST SSPC-SP-7 MORTAR 6-INCHES MINIMUM TO PROVIDE ANCHOR TO MORTAR.
- ③ APPLY LINING TO PROVIDE SMOOTH TRANSITION BETWEEN BARE STEEL AND MORTAR.
- ④ FEATHER POLYURETHANE TO EDGES OF BRUSH BLASTED LENGTH.
- ⑤ CUT 1/8-INCH KEYWAY IN MORTAR AROUND CIRCUMFERENCE. TAPE AT EDGE OF MORTAR CUT.

DRAWN BY: <i>BERKNESS</i>
CHKD BY: <i>K ROSS/ KLR</i>
APPD BY: <i>Stephen C. Row</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**33130  
POLYURETHANE TO  
CEMENT-MORTAR TRANSITION**

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DIMENSION TABLE

PIPE $\phi$	N	O	P	ROD $\phi$	NO of RODS	R	U	V	PIPE $\phi$
24"	2 5/16"	2 5/8"	1 1/8"	1"	4	1 3/8"	13 3/8"	1 1/4"	24"
30"	2"	2 3/4"	1 3/8"	1 1/4"	4	1 3/8"	16 5/8"	1 1/2"	30"
36"	2 1/8"	3 1/8"	1 5/8"	1 1/2"	4	1 5/8"	19 3/4"	1 3/4"	36"
42"	2 3/16"	3 1/4"	1 7/8"	1 3/4"	4	1 5/8"	23 1/8"	2"	42"
48"	2"	3 3/8"	2 1/8"	2"	4	1 5/8"	26 3/8"	2 1/2"	48"
54"	2 1/4"	3 3/8"	2 1/8"	2"	4	1 7/8"	29 1/2"	2 1/2"	54"
60"	2 1/16"	3 1/2"	2 3/8"	2 1/4"	4	1 7/8"	32 3/4"	2 3/4"	60"
66"	2 5/16"	3 3/4"	2 5/8"	2 1/2"	4	1 7/8"	36 1/8"	3 1/4"	66"
72"	2 3/16"	3 3/4"	2 3/8"	2 1/4"	6	1 7/8"	39 3/8"	3"	72"

**NOTES:**

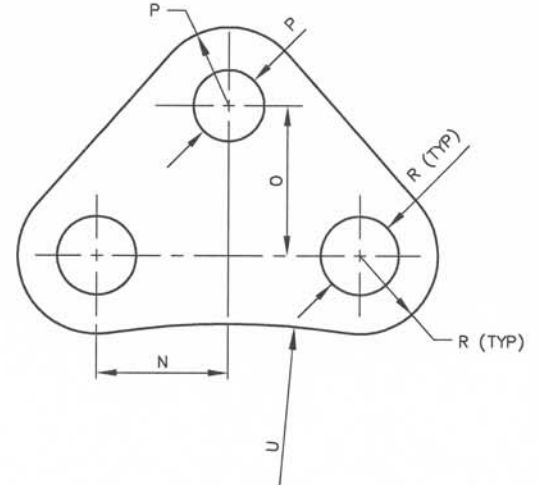
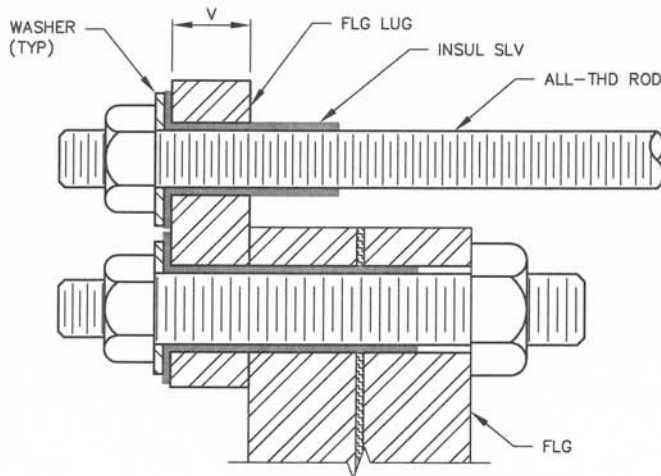
1. EQUALLY SPACE RODS AND FLANGE LUGS AROUND FLANGE.
2. RODS ARE ASTM A 193 GRADE B7 WITH ASTM A 194 GRADE 2H NUTS.
3. LUGS ARE ASTM A 36 PLATE.
4. DESIGN PRESSURE:  
24-INCH THROUGH 72-INCH – 220 PSI.

DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/KUR
APPD BY: Stephen C. Ren
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

33140  
NON-INSULATED  
FLANGE LUGS

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DIMENSION TABLE

PIPE $\phi$	N	O	P	ROD $\phi$	NO of RODS	R	U	V	PIPE $\phi$
24"	2 5/16"	2 5/8"	1 1/4"	1"	4	1 1/2"	13 3/8"	1 1/4"	24"
30"	2"	2 3/4"	1 1/2"	1 1/4"	4	1 1/2"	16 5/8"	1 1/2"	30"
36"	2 1/8"	3 1/8"	1 3/4"	1 1/2"	4	1 5/8"	19 3/4"	1 3/4"	36"
42"	2 3/16"	3 1/4"	2"	1 3/4"	4	1 5/8"	23 1/8"	2"	42"
48"	2"	3 3/8"	2 1/4"	2"	4	1 5/8"	26 3/8"	2 1/2"	48"
54"	2 1/4"	3 3/8"	2 1/4"	2"	4	1 7/8"	29 1/2"	2 1/2"	54"
60"	2 1/16"	3 1/2"	2 1/2"	2 1/4"	4	1 7/8"	32 3/4"	2 3/4"	60"
66"	2 5/16"	3 3/4"	2 3/4"	2 1/2"	4	1 7/8"	36 1/8"	3 1/4"	66"
72"	2 3/16"	3 3/4"	2 1/2"	2 1/4"	6	1 7/8"	39 3/8"	3"	72"

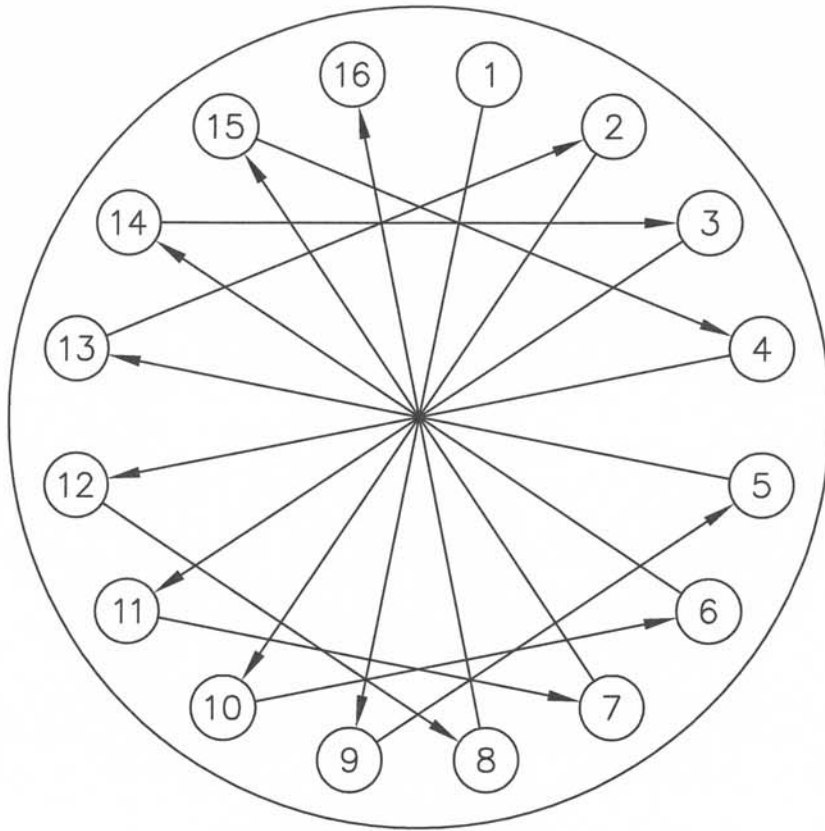
**NOTES:**

- EQUALLY SPACE RODS AND FLANGE LUGS AROUND FLANGE.
- RODS ARE ASTM A 193 GRADE B7 WITH ASTM A 194 GRADE 2H NUTS.
- LUGS ARE ASTM A 36 PLATE.
- DESIGN PRESSURE:  
24 INCH THROUGH 72 INCH - 220 PSI.

DRAWN BY: WENKHEIMER  
 CHKD BY: K ROSS/KLR  
 APPD BY: Stephen C. Ren  
 ORIGINATION DATE: JANUARY 2017  
 REVISION DATE:

33141  
 INSULATED FLANGE LUGS

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16 STUD EXAMPLE

NOTES:

1. STUDS AND NUTS SHALL BE CLEAN AND DRY (UNLUBRICATED).
  - A. HAND TIGHTEN ALL NUTS.
  - B. CONSECUTIVELY NUMBER THE STUDS AROUND THE FLANGE.
2. TIGHTEN STUD NUTS TO ONE-THIRD OF TARGET TORQUE IN SEQUENCE GIVEN.
3. TIGHTEN STUD NUTS TO TWO-THIRDS OF TARGET TORQUE IN SEQUENCE GIVEN.
4. TIGHTEN STUD NUTS TO FULL TARGET TORQUE IN SEQUENCE GIVEN.
5. AFTER 24 HOURS, RE-TIGHTEN STUD NUTS TO FULL TARGET TORQUE IN SEQUENCE GIVEN.
6. TORQUE WRENCHES AND WRENCHES USED FOR STUD NUT TIGHTENING SHALL BE IN GOOD CONDITION AND CERTIFIED BY AN INDEPENDENT TESTING AGENCY WITHIN 6 MONTHS OF USE.
7. SEQUENCE GIVEN FOR AWWA C207 CLASS B, D AND E AND ANSI CLASS 150 FLANGES.

DRAWN BY: WENKHEIMER
CHKD BY: K ROSS/KUR
APPD BY: Stephen C. Pen
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

33142  
STUD NUT  
TIGHTENING SEQUENCE

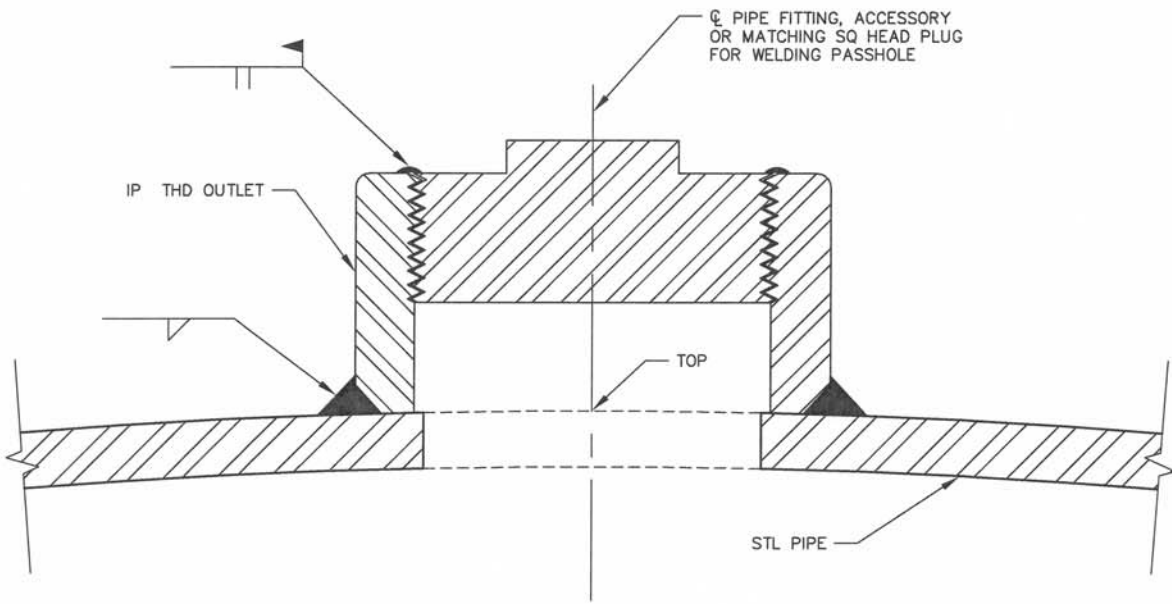
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NO OF STUDS	NOMINAL PIPE SIZE	STUD NUT TIGHTENING SEQUENCE
24	26"	1, 13, 7, 19, 2, 14, 8, 20, 3, 15, 9, 21, 4, 16, 10, 22, 5, 17, 11, 23, 6, 18, 12, 24
28	28", 30", 32"	1, 15, 8, 22, 2, 16, 9, 23, 3, 17, 10, 24, 4, 18, 11, 25, 5, 19, 12, 26, 6, 20, 13, 27, 7, 21, 14, 28,
32	34", 36", 38"	1, 17, 9, 25, 2, 18, 10, 26, 3, 19, 11, 27, 4, 20, 12, 28, 5, 21, 13, 29, 6, 22, 14, 30, 7, 23, 15, 31, 8, 24, 16, 32
36	40", 42"	1, 19, 10, 28, 2, 20, 11, 29, 3, 21, 12, 30, 4, 22, 13, 31, 5, 23, 14, 32, 6, 24, 15, 33, 7, 25, 16, 34, 8, 26, 17, 35, 9, 27, 18, 36
40	44", 46"	1, 21, 11, 31, 2, 22, 12, 32, 3, 23, 13, 33, 4, 24, 14, 34, 5, 25, 15, 35, 6, 26, 16, 36, 7, 27, 17, 37, 8, 28, 18, 38, 9, 29, 19, 39, 10, 30, 20, 40
44	48", 50", 52", 54"	1, 23, 12, 34, 2, 24, 13, 35, 3, 25, 14, 36, 4, 26, 15, 37, 5, 27, 16, 38, 6, 28, 17, 39, 7, 29, 18, 40, 8, 30, 19, 41, 9, 31, 20, 42, 10, 32, 21, 43, 11, 33, 22, 44
52	60", 66"	1, 27, 14, 40, 2, 28, 15, 41, 3, 29, 16, 42, 4, 30, 17, 43, 5, 31, 18, 44, 6, 32, 19, 45, 7, 33, 20, 46, 8, 34, 21, 47, 9, 35, 22, 48, 10, 36, 23, 49, 11, 37, 24, 50, 12, 38, 25, 51, 13, 39, 26, 52
60	72"	1, 31, 16, 46, 2, 32, 17, 47, 3, 33, 18, 48, 4, 34, 19, 49, 5, 35, 20, 50, 6, 36, 21, 51, 7, 37, 22, 52, 8, 38, 23, 53, 9, 39, 24, 54, 10, 40, 25, 55, 11, 41, 26, 56, 12, 42, 27, 57, 13, 43, 28, 58, 14, 44, 29, 59, 15, 45, 30, 60
64	78", 84"	1, 33, 17, 49, 2, 34, 18, 50, 3, 35, 19, 51, 4, 36, 20, 52, 5, 37, 21, 53, 6, 38, 22, 54, 7, 39, 23, 55, 8, 40, 24, 56, 9, 41, 25, 57, 10, 42, 26, 58, 11, 43, 27, 59, 12, 44, 28, 60, 13, 45, 29, 61, 14, 46, 30, 62, 15, 47, 31, 63, 16, 48, 32, 64
68	90", 96"	1, 35, 18, 52, 2, 36, 19, 53, 3, 37, 20, 54, 4, 38, 21, 55, 5, 39, 22, 56, 6, 40, 23, 57, 7, 41, 24, 58, 8, 42, 25, 59, 9, 43, 26, 60, 10, 44, 27, 61, 11, 45, 28, 62, 12, 46, 29, 63, 13, 47, 30, 64, 14, 48, 31, 65, 15, 49, 32, 66, 16, 50, 33, 67, 17, 51, 34, 68
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76	114", 120"	1, 39, 20, 58, 2, 40, 21, 59, 3, 41, 22, 60, 4, 42, 23, 61, 5, 43, 24, 62, 6, 44, 25, 63, 7, 45, 26, 64, 8, 46, 27, 65, 9, 47, 28, 66, 10, 48, 29, 67, 11, 49, 30, 68, 12, 50, 31, 69, 13, 51, 32, 70, 14, 52, 33, 71, 15, 53, 34, 72, 16, 54, 35, 73, 17, 55, 36, 74, 18, 56, 37, 75, 19, 57, 38, 76
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DRAWN BY: WENKHEIMER  
 CHKD BY: K ROSS/KLR  
 APPD BY: Stephen C. Row  
 ORIGINATION DATE: JANUARY 2017  
 REVISION DATE:

**33143**  
**STUD NUT**  
**TIGHTENING SEQUENCE TABLE**


**DENVER WATER**  
 1600 West 12th Ave  
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 T: 303.628.6000  
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 denverwater.org



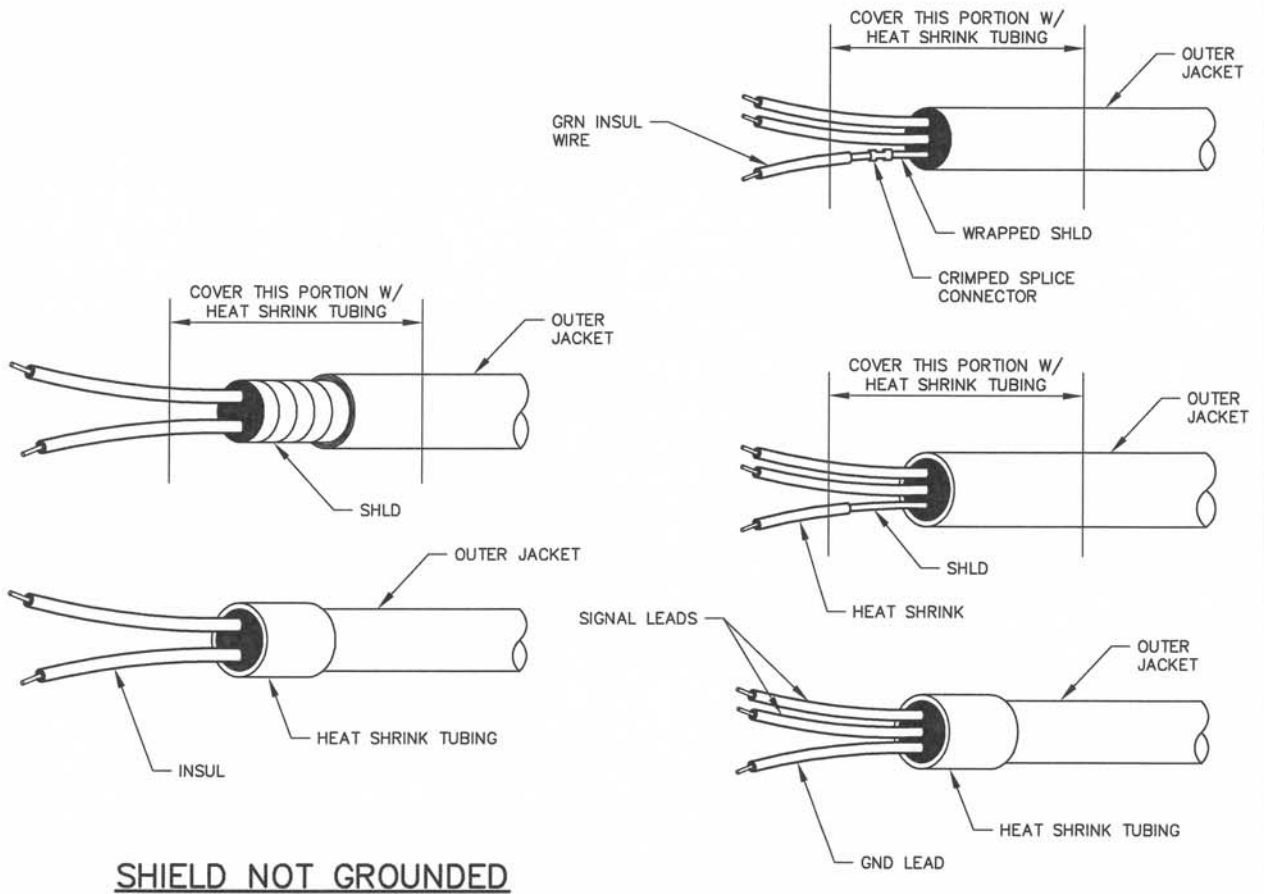
**NOTE:**

LINING AND COATING NOT SHOWN FOR CLARITY.

DRAWN BY: <i>WENKHEIMER</i>
CHKD BY: <i>K ROSS/KIR</i>
APPD BY: <i>Stephen C. Ream</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**33150  
THREADED OUTLET  
(STEEL PIPE)**

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SHIELD NOT GROUNDED

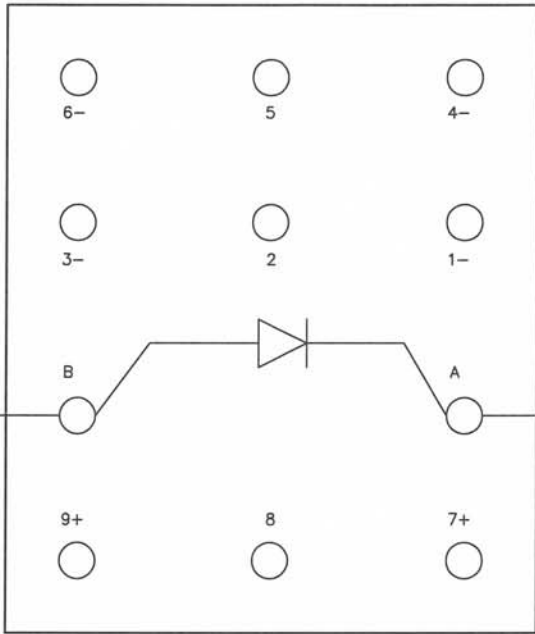
SHIELD GROUNDED

DRAWN BY: ALVARADO
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Rom
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

40901  
SHIELDED CABLE  
TERMINATION

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RELAY SOCKET



NOTE CONTACT POLARITY

(+)

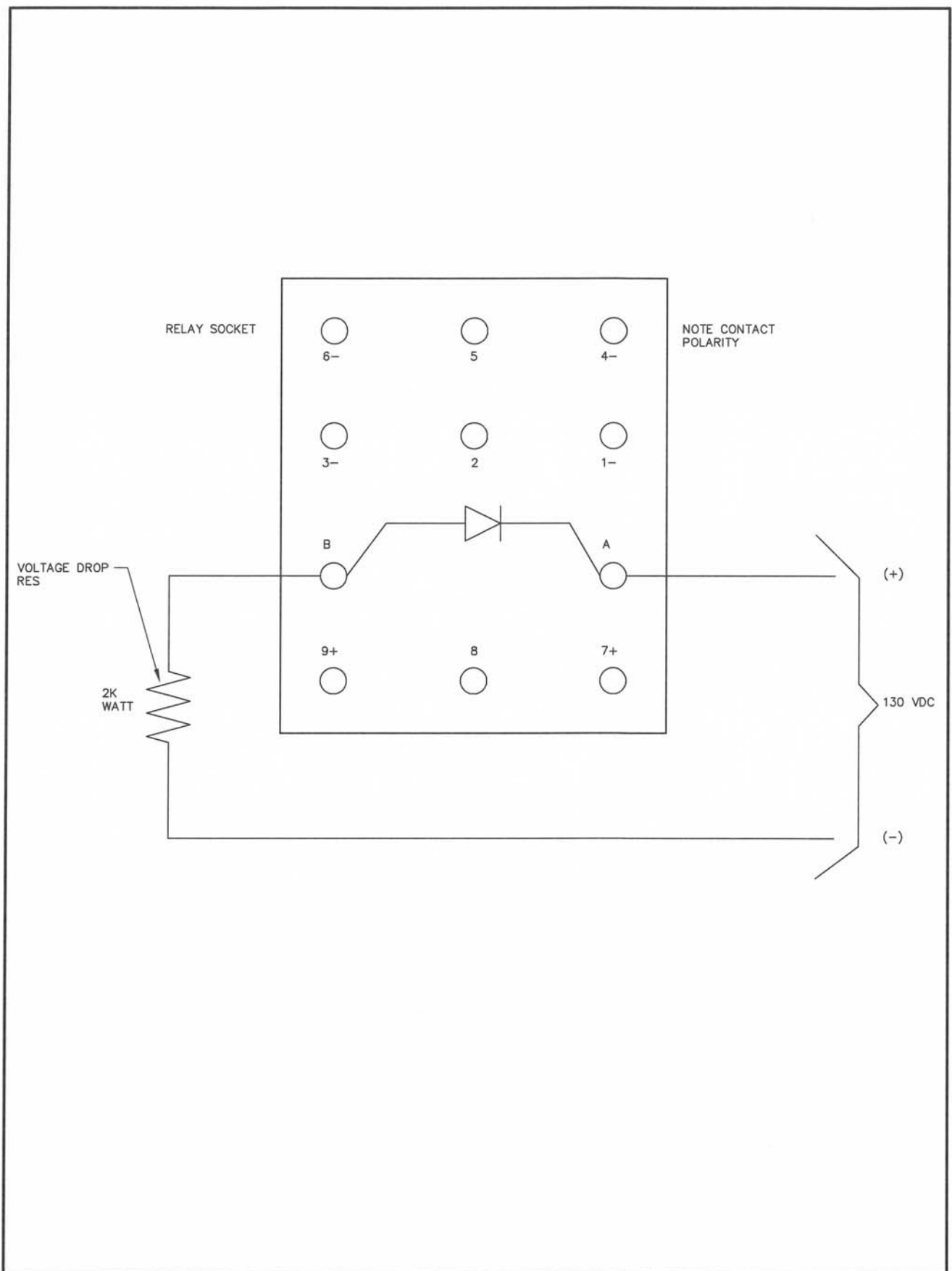
24 VDC

(-)

DRAWN BY: ALVARADO
CHKD BY: K ROSS/VR
APPD BY: Stephen C. Reem
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

40904  
PLC DISCRETE OUTPUT  
RELAY

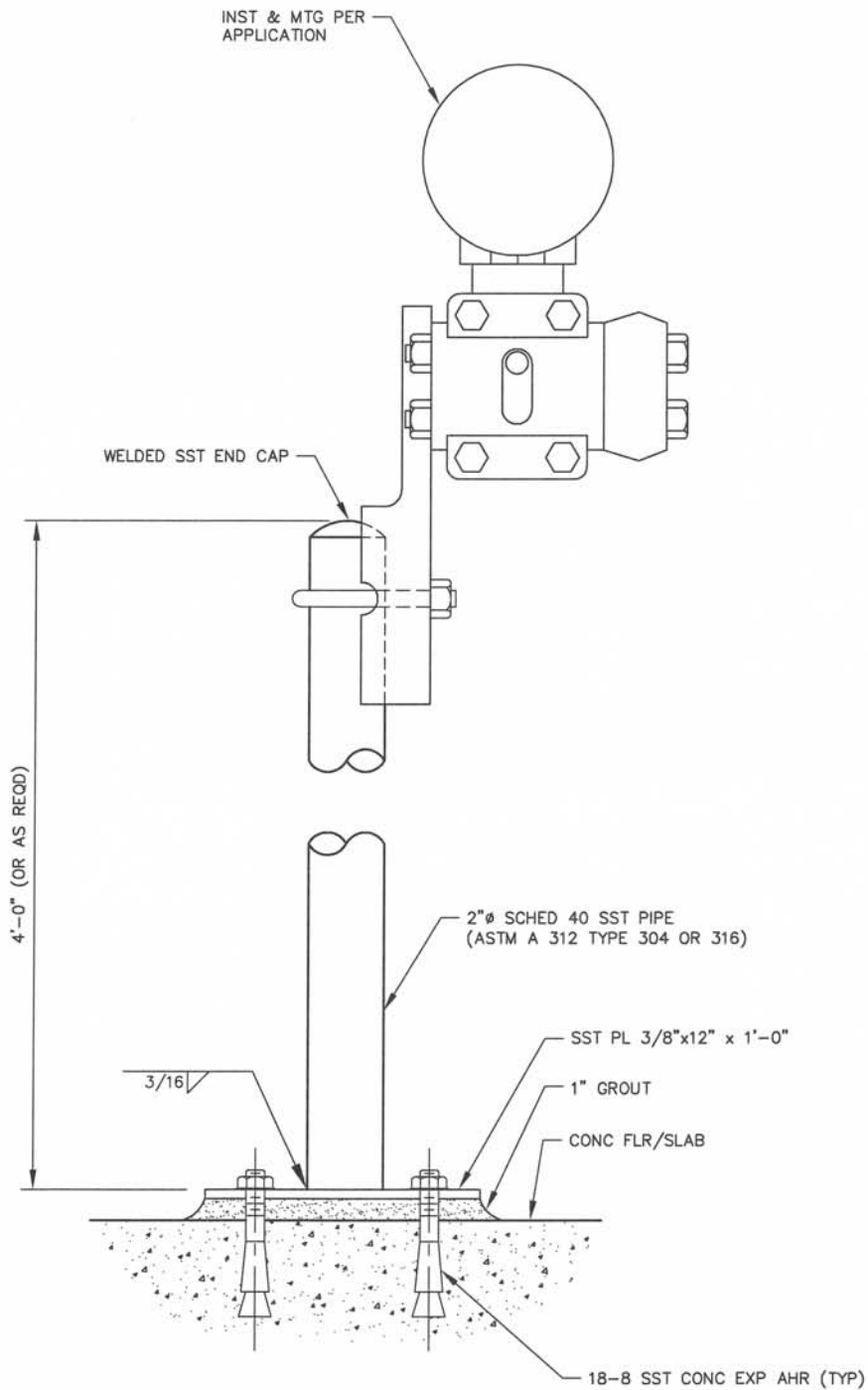
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DRAWN BY: ALVARADO  
 CHKD BY: K ROSS/ *KLR*  
 APPD BY: *Stephen C. B...*  
 ORIGINATION DATE: JANUARY 2017  
 REVISION DATE:

**40905**  
**125VDC CONTROL RELAY**

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**NOTE:**

PLATE AND END CAP MATERIAL: ASTM A 240, TYPE 304 OR 316 (F<sub>y</sub> = 30 KSI MINIMUM).

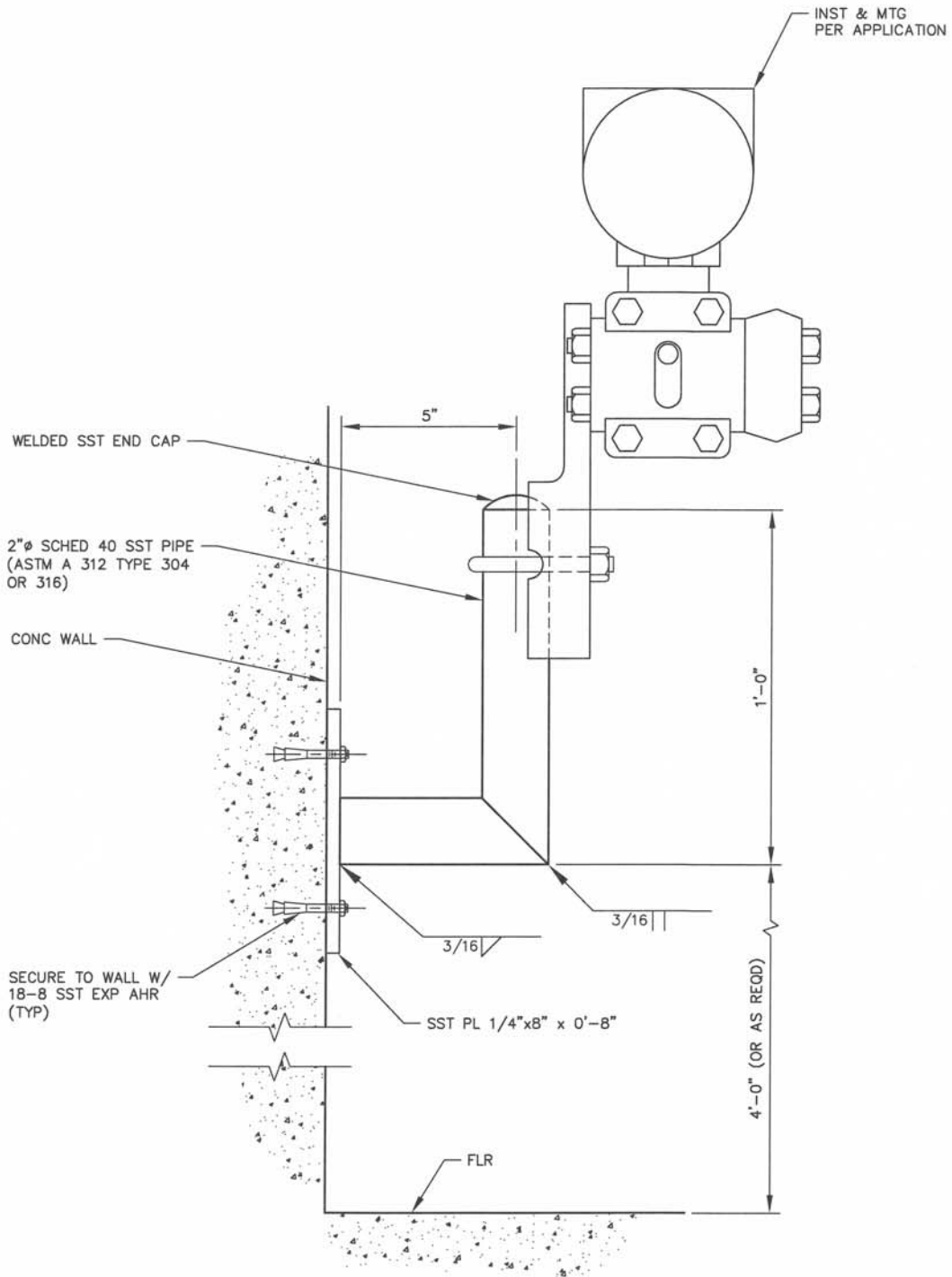
DRAWN BY: ALVARADO
CHKD BY: K ROSS/klr
APPD BY: Stephen C. Ren
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

40910  
INSTRUMENT FLOOR STAND

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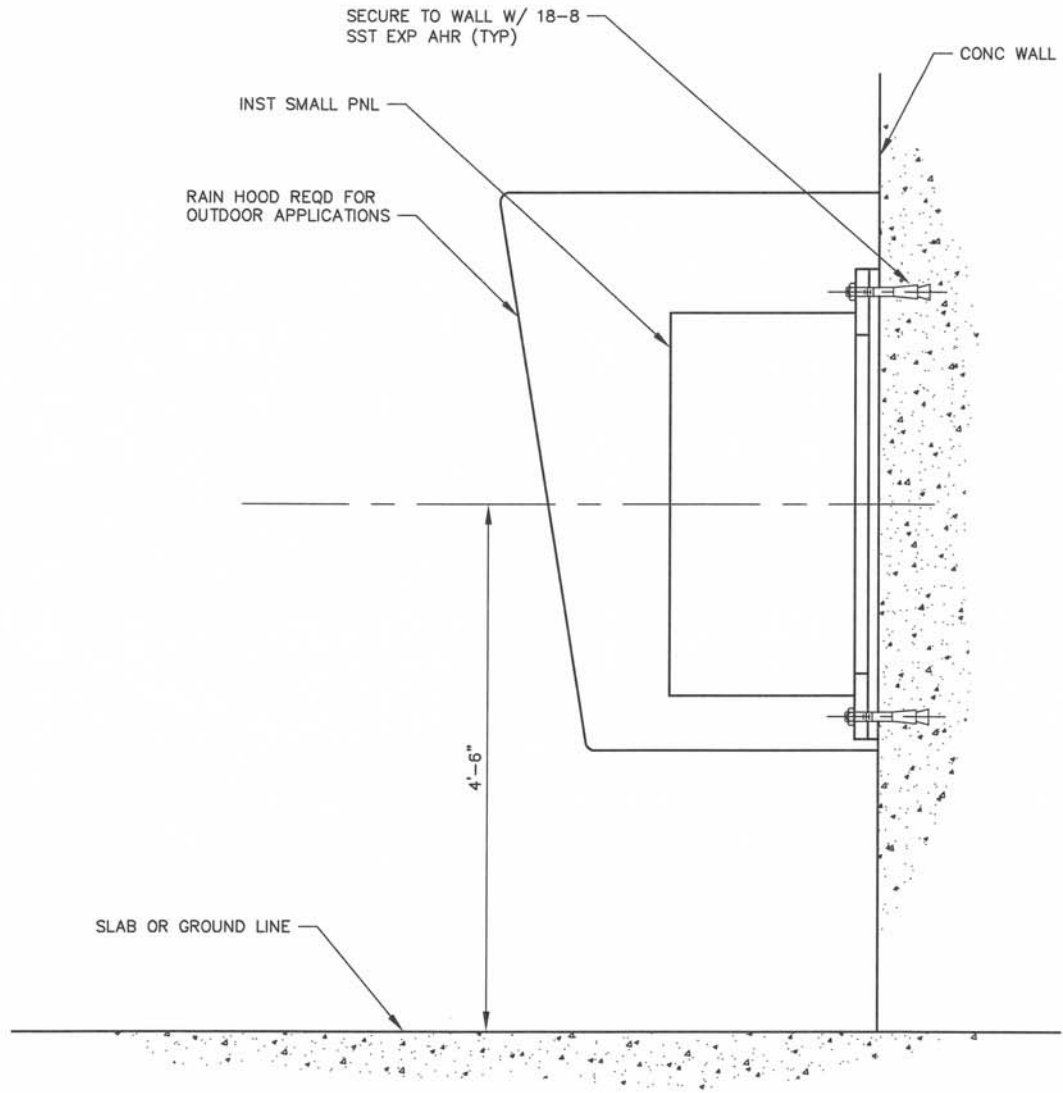
**NOTE:**

PLATE AND END CAP MATERIAL: ASTM A 240, TYPE 304 OR 316 (F<sub>y</sub> = 30 KSI MINIMUM).

DRAWN BY: ALVARADO
CHKD BY: K ROSS/ <i>KLR</i>
APPD BY: <i>Stephen C. Rem</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

40911  
WALL MOUNTED  
INSTRUMENT INSTALLATION

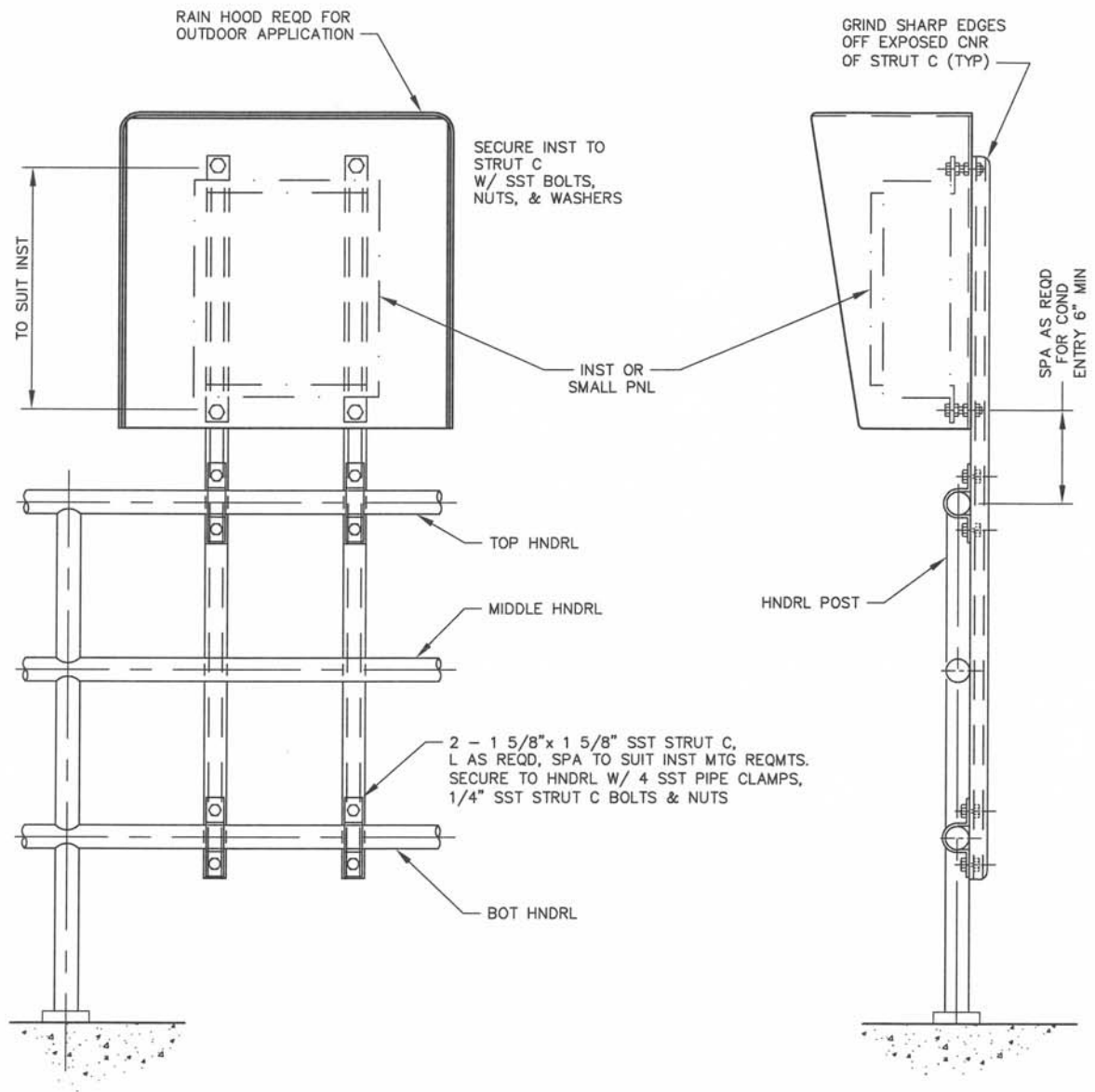
**D DENVER WATER**  
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DRAWN BY: ALVARADO  
 CHKD BY: K ROSS/KUR  
 APPD BY: Stephen C. Penn  
 ORIGINATION DATE: JANUARY 2017  
 REVISION DATE:

40912  
 PANEL OR INSTRUMENT  
 WALL INSTALLATION

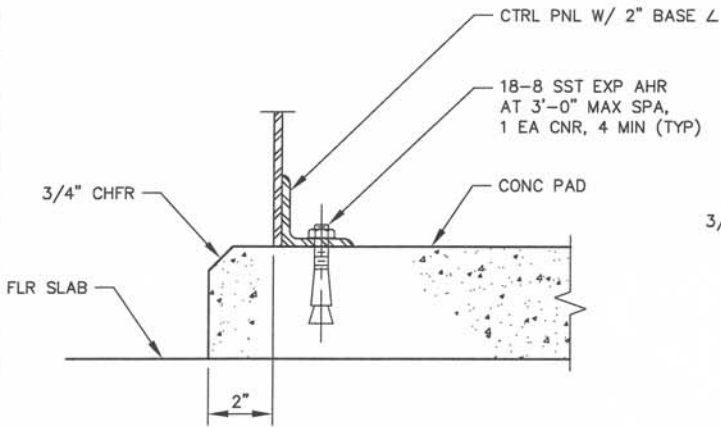
**D DENVER WATER**  
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 F: 303.628.6851  
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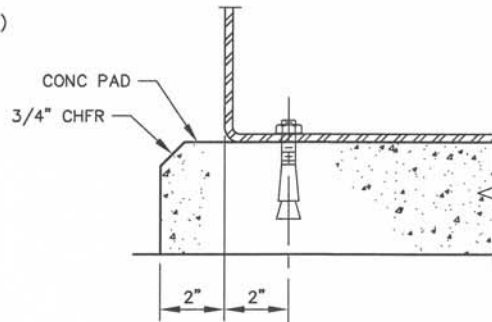
DRAWN BY: ALVARADO
CHKD BY: K ROSS/KJR
APPD BY: Stephen C. Penn
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

40913  
**HANDRAIL MOUNTING FOR  
CASE MOUNTED INSTRUMENTS**

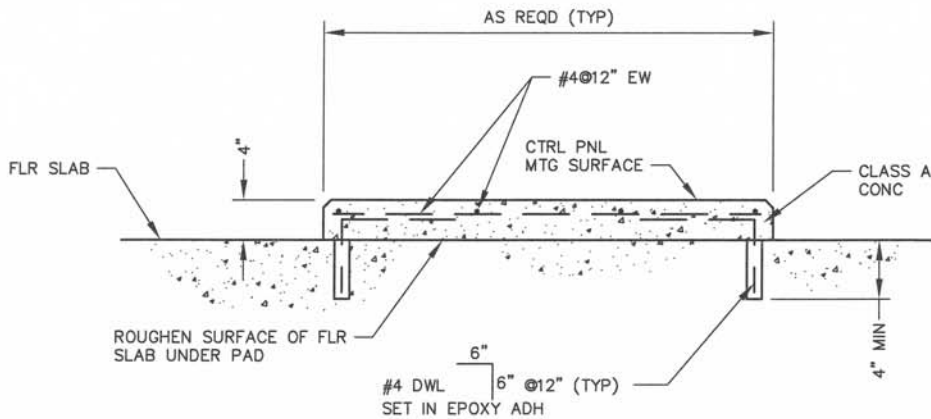
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OPEN BOTTOM PANEL



ENCLOSED BOTTOM PANEL



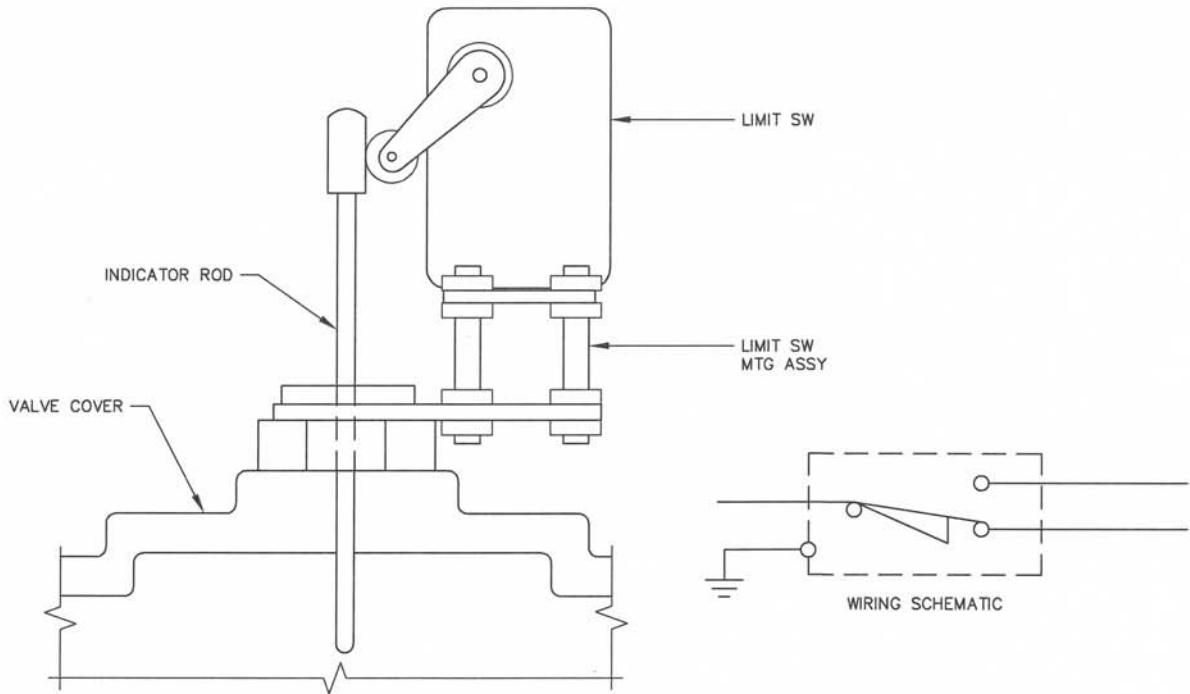
CONCRETE PAD

DRAWN BY: ALVARADO
CHKD BY: K ROSS/ KLR
APPD BY: Stephen C. P...
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

40915  
FREESTANDING PANEL  
MOUNTING ON CONCRETE PAD

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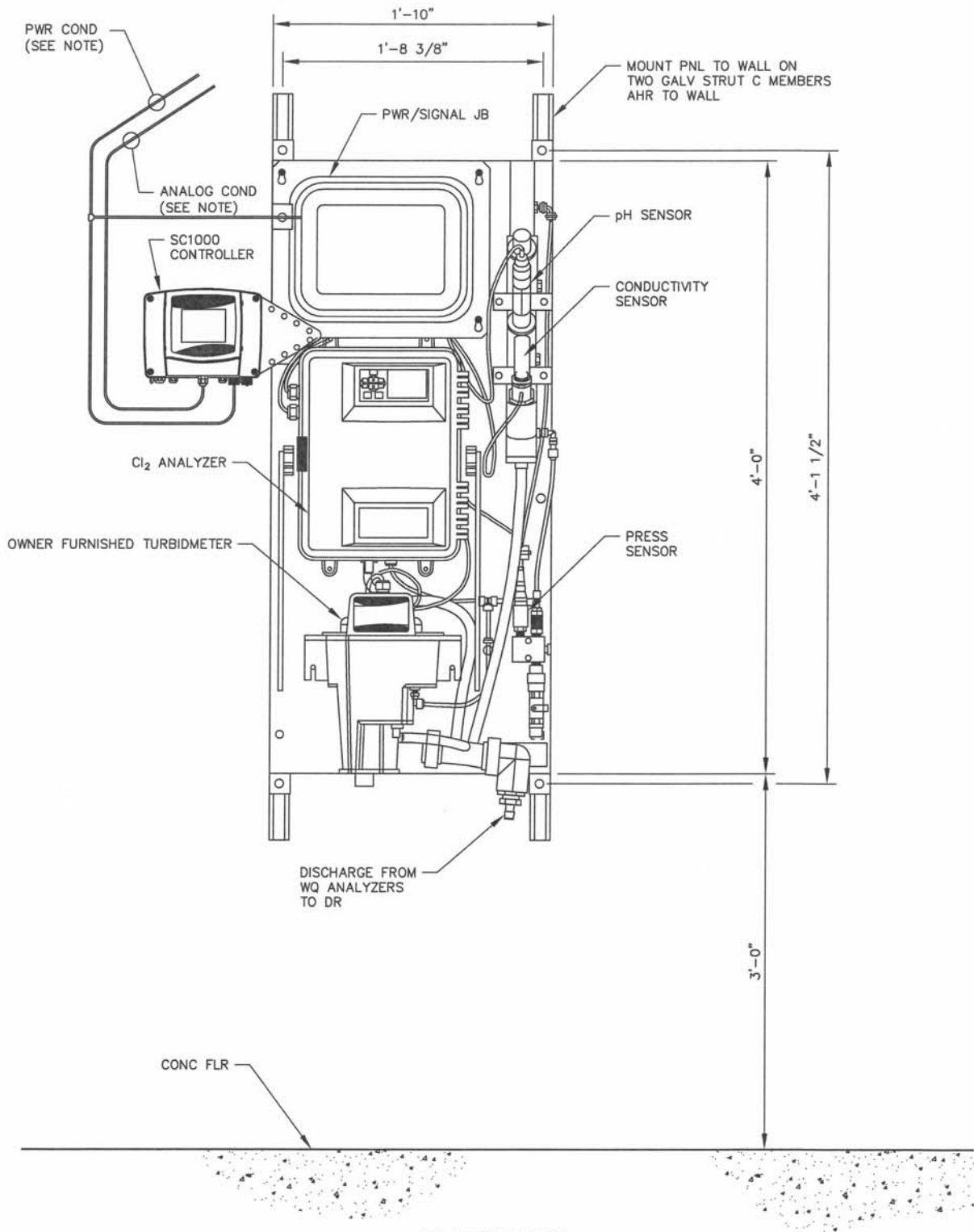
**NOTE:**

SINGLE POLE DOUBLE THROW (SPDT) LIMIT SWITCH RATED 10A, 250V, NEMA 4 ENCLOSURE WITH UL AND CSA LISTINGS.

DRAWN BY: ALVARADO
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Rem
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**40920  
RISING STEM VALVE  
LIMIT SWITCH**

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**ELEVATION**

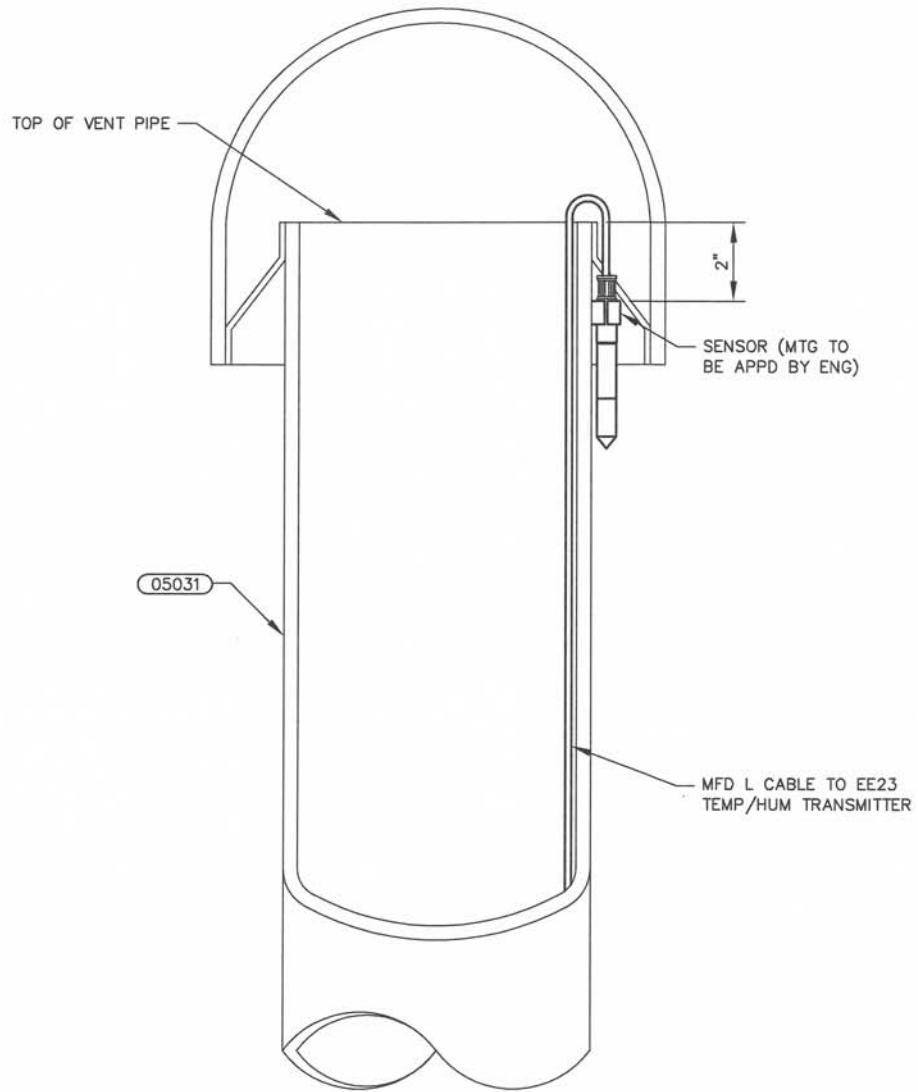
**NOTE:**

SEE CONDUIT AND CONDUCTOR SCHEDULE FOR CONDUIT AND CONDUCTOR SIZE, TYPE AND LABELS.

DRAWN BY: ALVARADO
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Rem
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

40932  
 WATER QUALITY MONITORING  
 STATION PANEL

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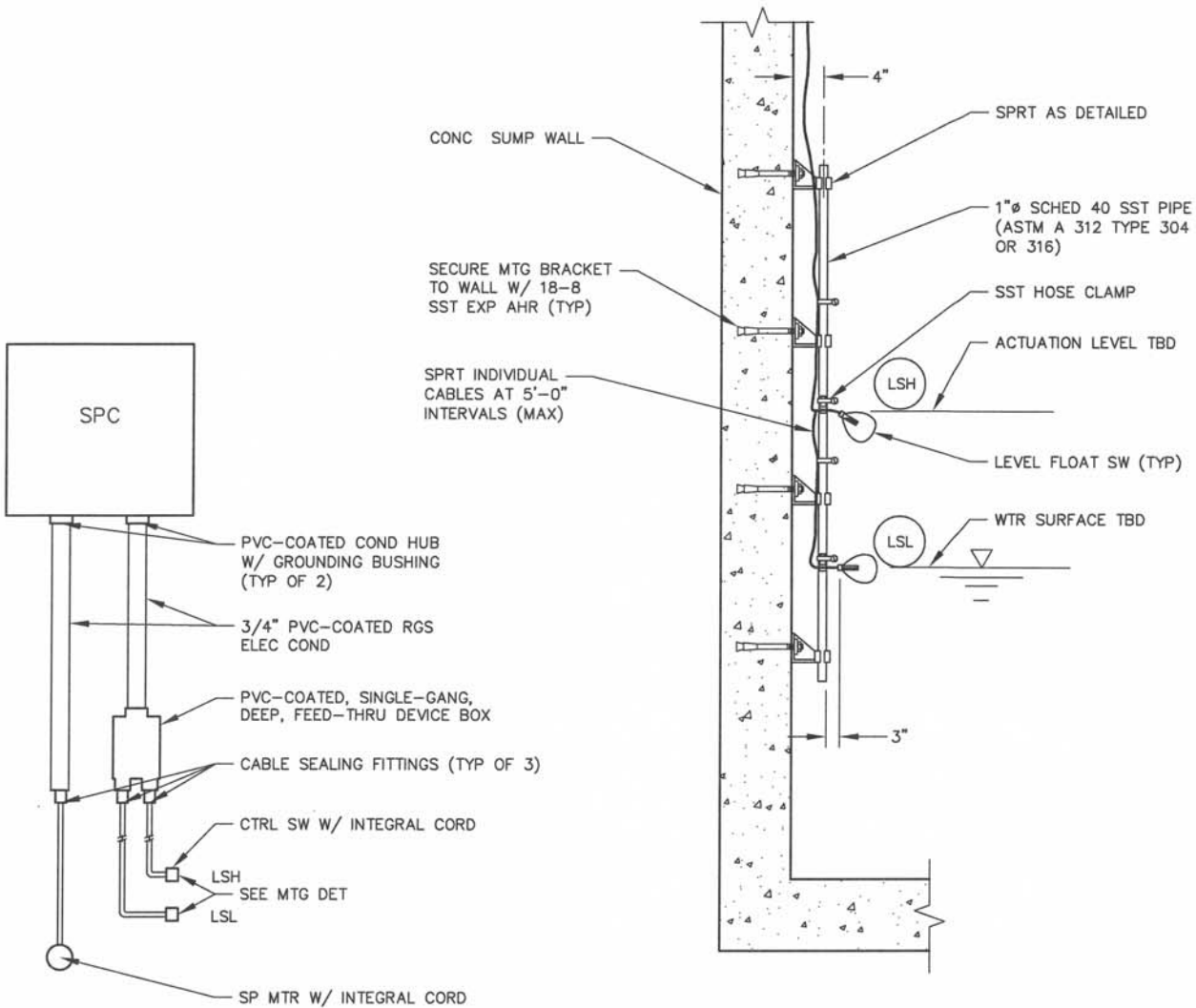
SECTION

DRAWN BY: ALVARADO
CHKD BY: K ROSS/ <i>KUR</i>
APPD BY: <i>Stephen C. Rem</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

40945  
 OUTSIDE TEMPERATURE AND  
 HUMIDITY SENSOR MOUNTING  
 IN VENT PIPE MUSHROOM CAP

**D DENVER WATER**

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MOUNTING DETAIL

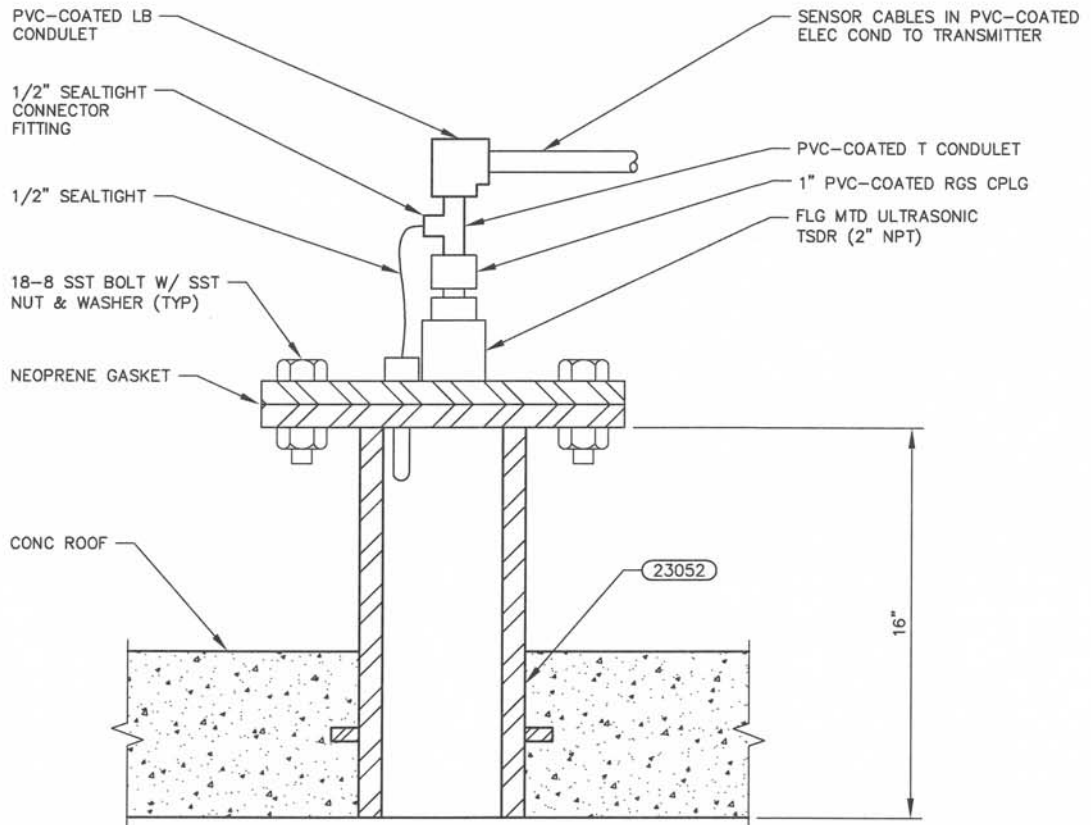
DRAWN BY: ALVARADO
CHKD BY: K ROSS/ <i>KR</i>
APPD BY: <i>Stephen C. Ross</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

40949  
VAULT SUMP PUMP  
CONTROLLER INSTALLATION

**D DENVER WATER**

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**NOTES:**

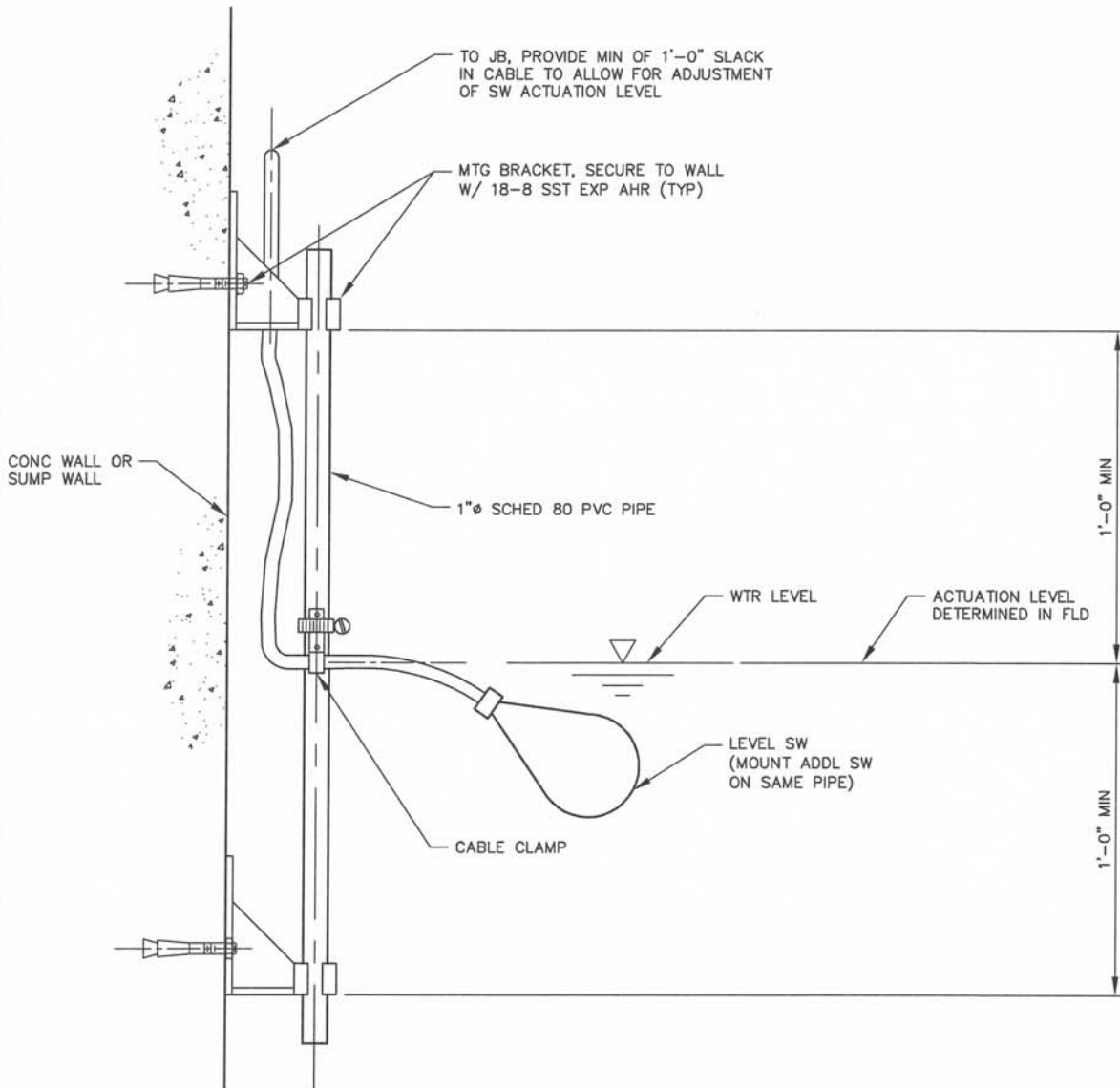
1. COAT PIPE WITH SPECIFIED PAINT SYSTEM PRIOR TO CONCRETE PLACEMENT.
2. INSIDE OF PIPE SHALL BE SEAMLESS AND SMOOTH, COMPLETELY FREE OF BURRS.
3. CENTER LINE OF FLOOR PIPE SHALL BE A MINIMUM OF 2- FEET FROM ANY WALL, EQUIPMENT OR COLUMN.

DRAWN BY: ALVARADO
CHKD BY: K ROSS/KJR
APPD BY: Stephen C. P... (signature)
ORIGINATION DATE: JANUARY 2015
REVISION DATE:

40950  
 ULTRASONIC LEVEL ELEMENT  
 MOUNTING THROUGH  
 BASIN-TANK CONCRETE ROOF

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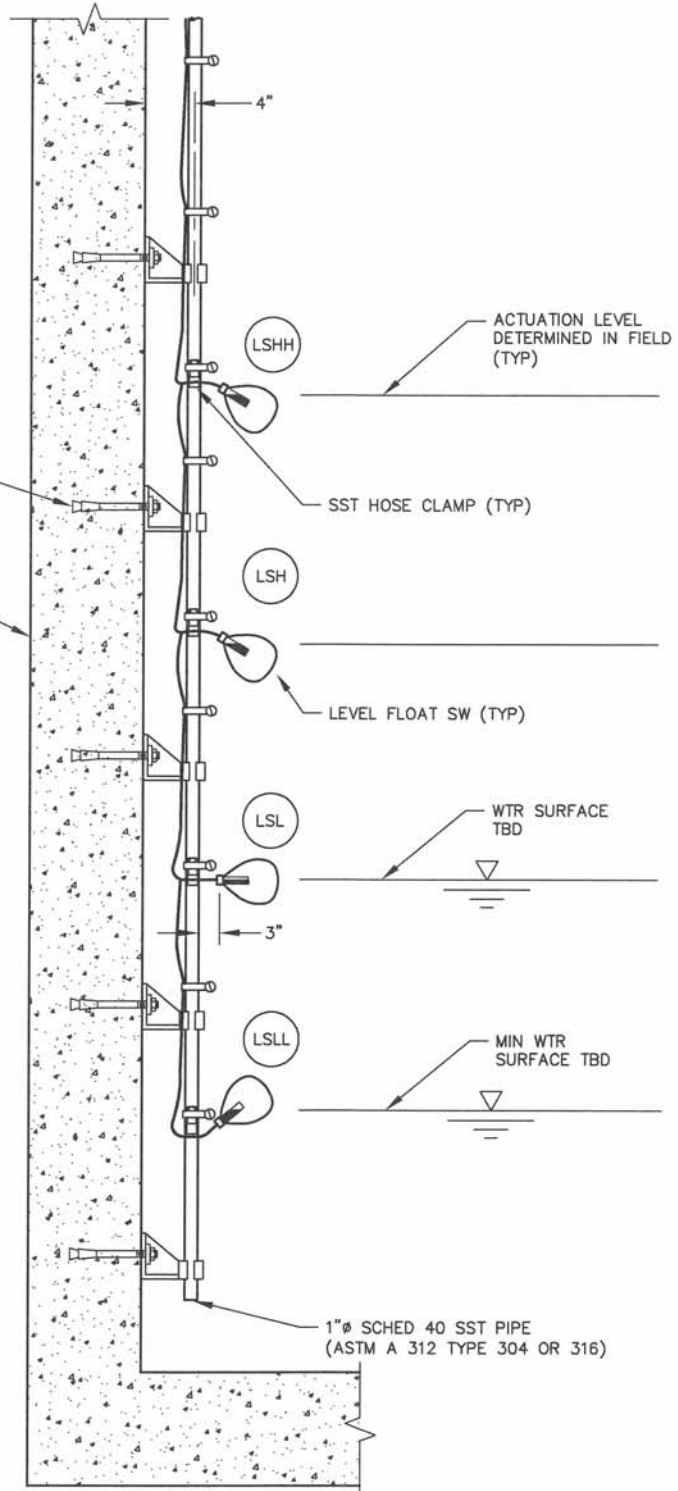
DRAWN BY: ALVARADO  
 CHKD BY: K ROSS/VLR  
 APPD BY: *Steph C. Rom*  
 ORIGINATION DATE: JANUARY 2017  
 REVISION DATE:

40951  
 SINGLE FLOAT LEVEL SWITCH  
 INSTALLATION

**D DENVER WATER**  
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SECURE MTG BRACKET TO WALL  
W/ 18-8 SST EXP AHR (TYP)

CONC WALL OR  
SUMP WALL



DRAWN BY: ALVARADO

CHKD BY: K ROSS/KLR

APPD BY: Stephen C. Ren

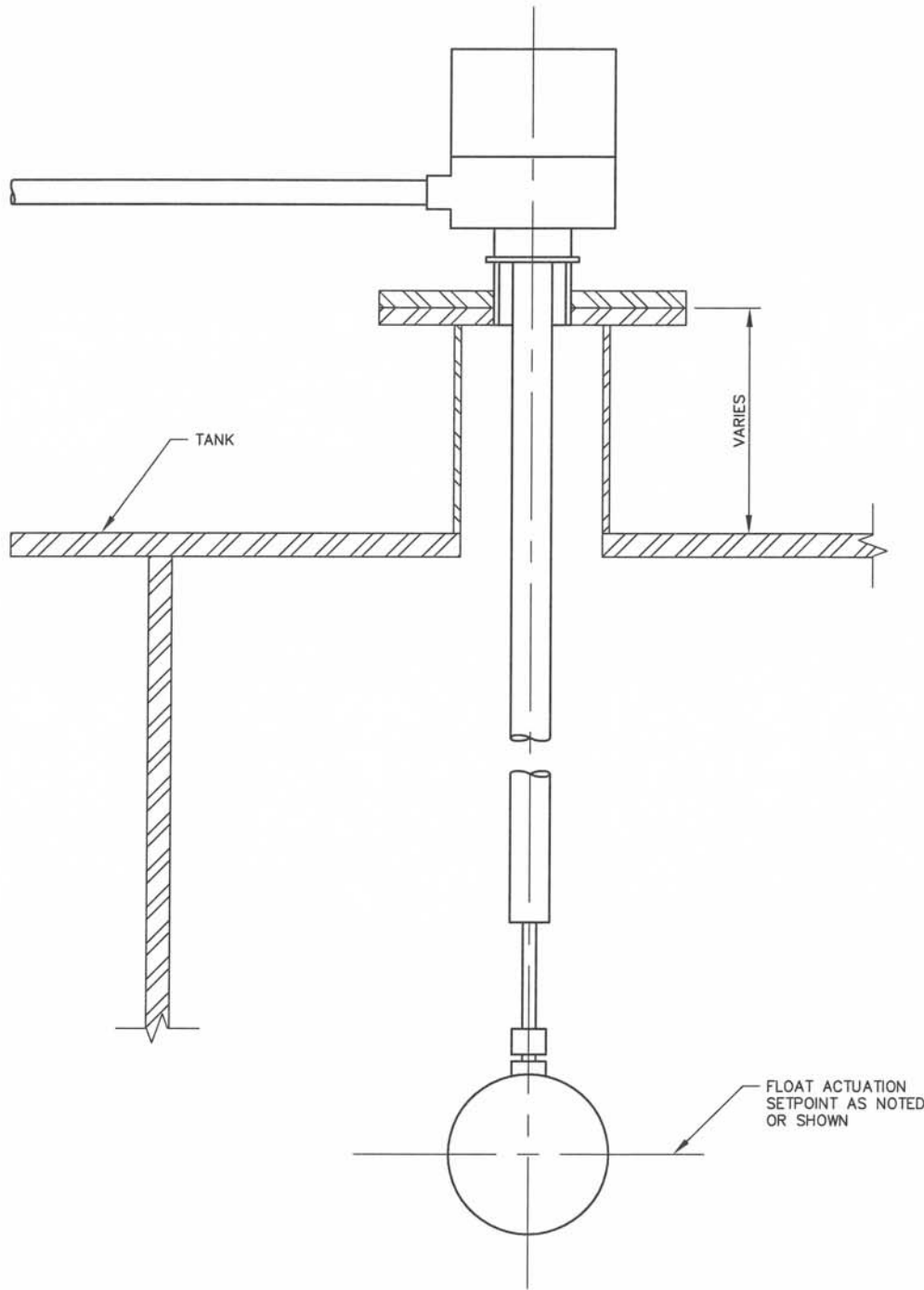
ORIGINATION DATE: JANUARY 2017

REVISION DATE:

40952  
MULTIPLE FLOAT LEVEL  
SWITCH INSTALLATION

**D DENVER WATER**

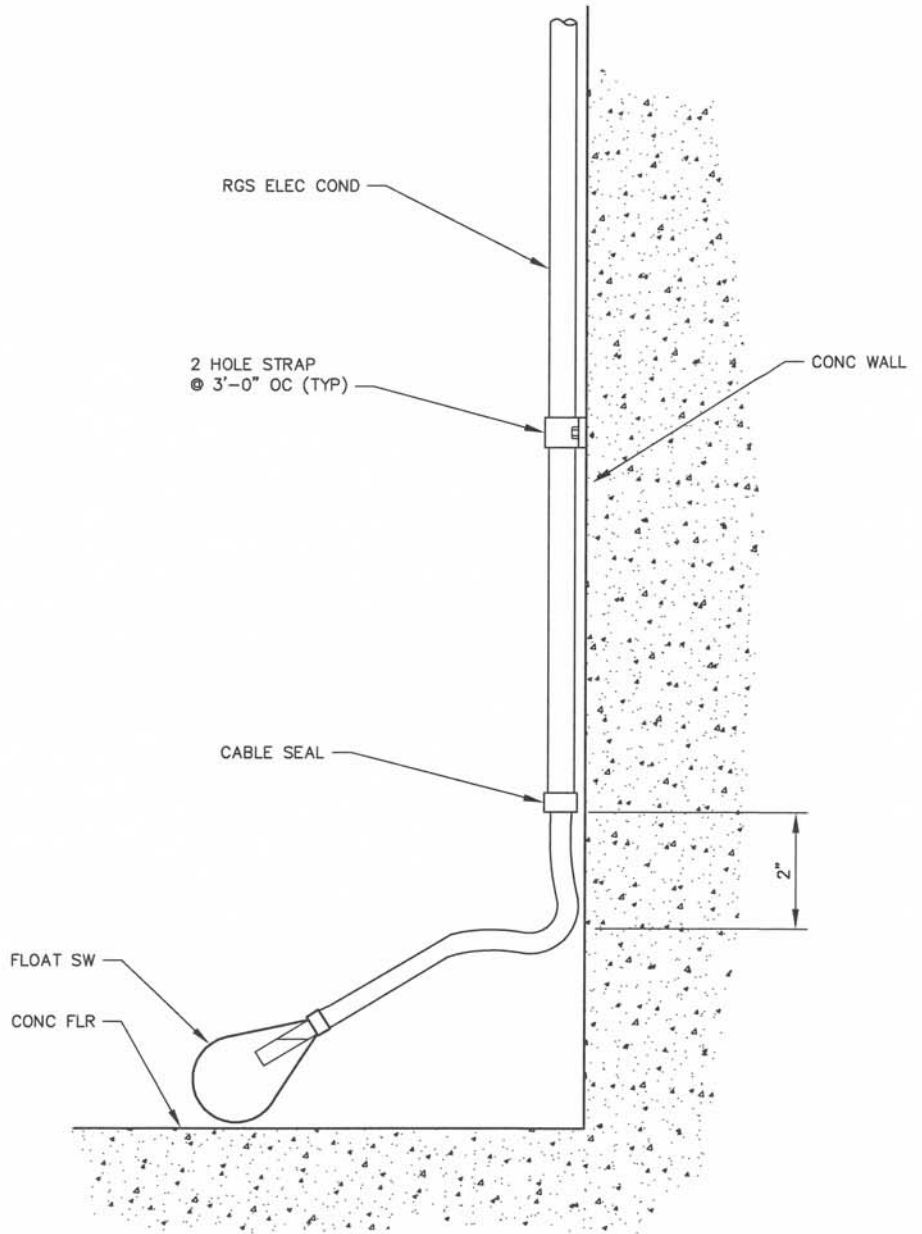
1600 West 12th Ave  
Denver, Colorado 80204-3412  
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F: 303.628.6851  
denverwater.org



DRAWN BY: ALVARADO  
 CHKD BY: K ROSS/KLR  
 APPD BY: Stephen C. Rem  
 ORIGINATION DATE: JANUARY 2017  
 REVISION DATE:

40953  
 TANK FLOAT LEVEL SWITCH  
 INSTALLATION

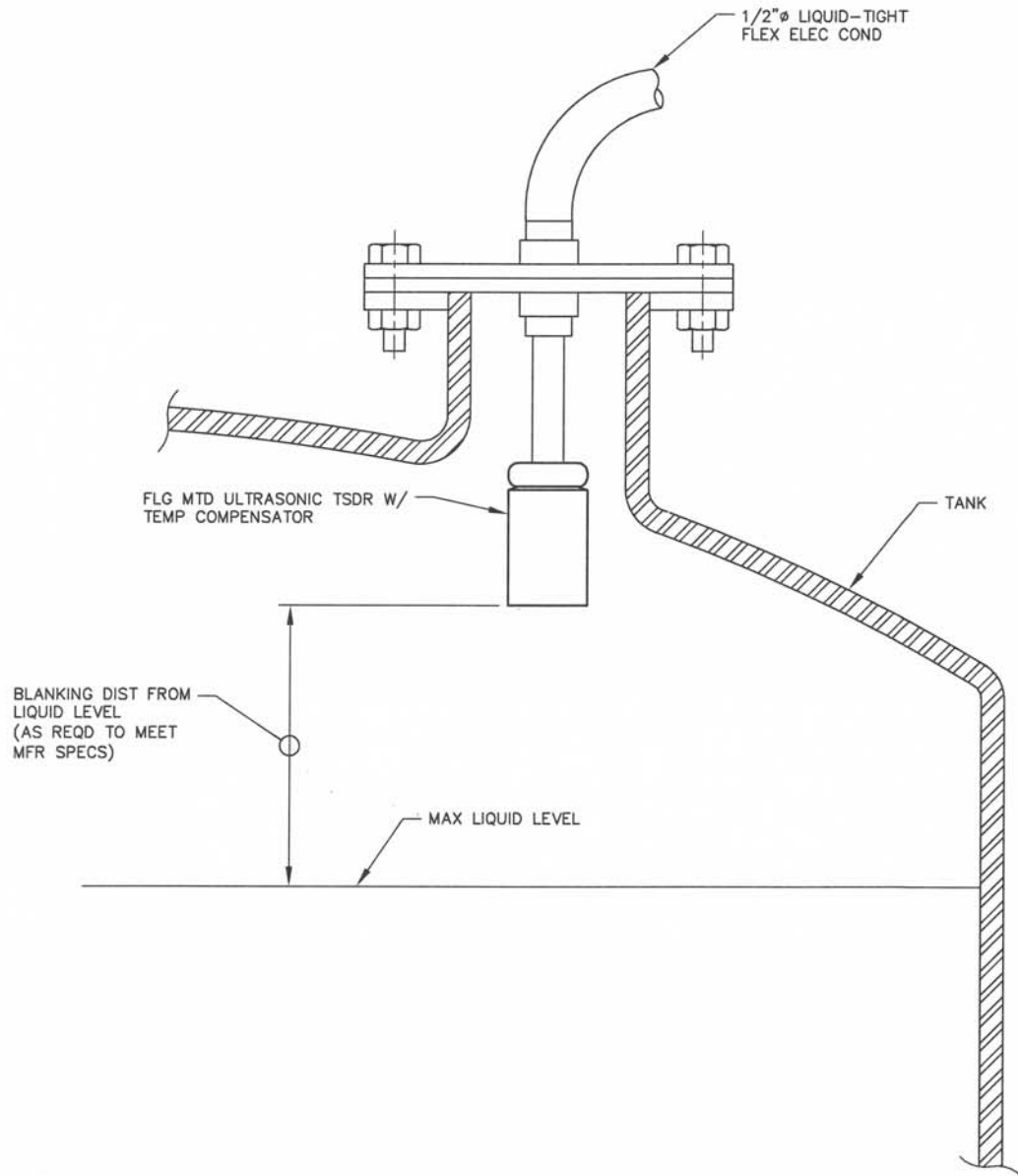
**D DENVER WATER**  
 1600 West 12th Ave  
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DRAWN BY: ALVARADO  
 CHKD BY: K ROSS/KIR  
 APPD BY: Stephen C. Rem  
 ORIGINATION DATE: JANUARY 2017  
 REVISION DATE:

40954  
 WATER ON FLOOR LEVEL  
 SWITCH INSTALLATION

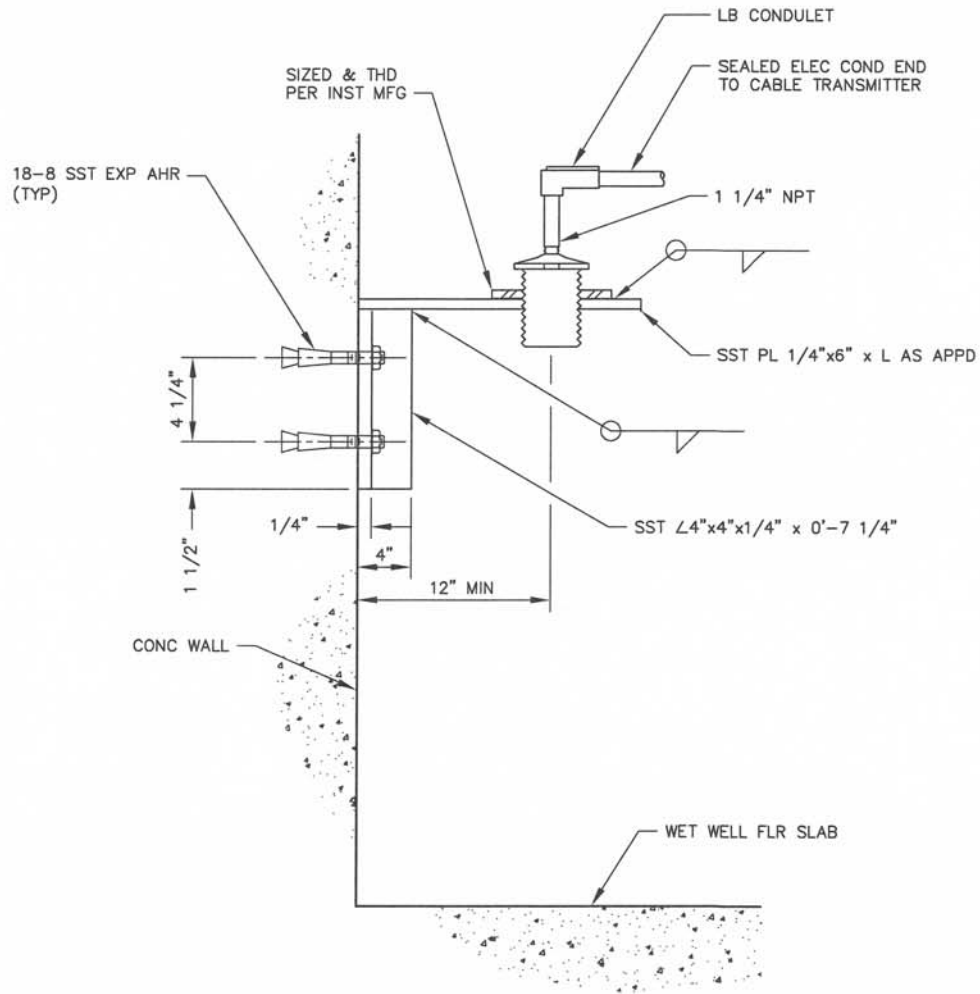
**D DENVER WATER**  
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DRAWN BY: <i>ALVARADO</i>
CHKD BY: <i>K ROSS/KR</i>
APPD BY: <i>Stephen C. Penn</i>
ORIGINATION DATE: <i>JANUARY 2017</i>
REVISION DATE:

**40955**  
**TANK ULTRASONIC LEVEL**  
**ELEMENT INSTALLATION**


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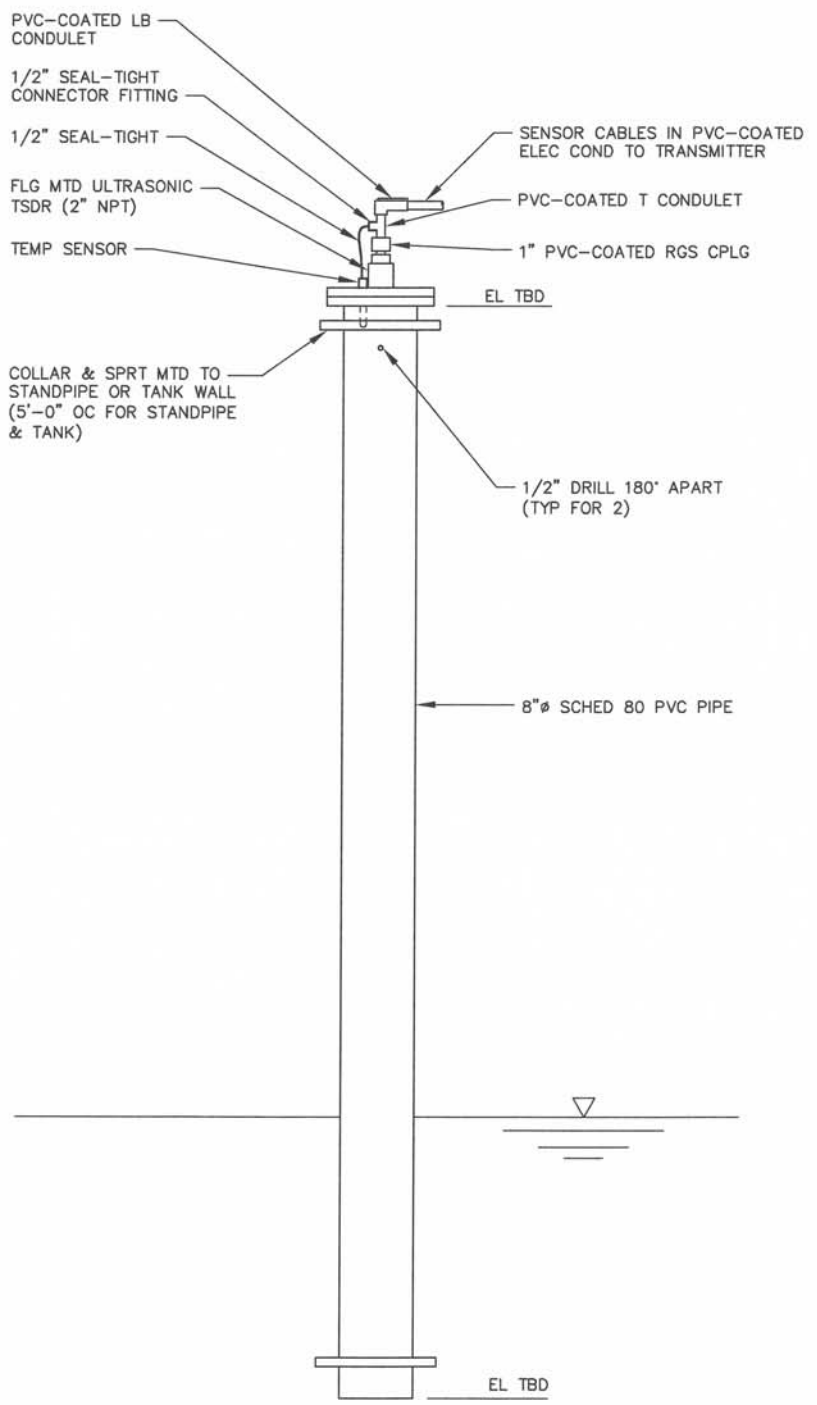
**NOTE:**

ANGLE AND PLATE MATERIAL SHALL BE ASTM A 240 TYPE 304 OR 316 (Fy = 30 KSI MINIMUM).

DRAWN BY: ALVARADO
CHKD BY: K ROSS/KIR
APPD BY: Stephen C. Rem
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

40956  
WALL ULTRASONIC LEVEL  
ELEMENT INSTALLATION

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**NOTE:**

PROVIDE ENGINEER APPROVED SUPPORT SYSTEM.

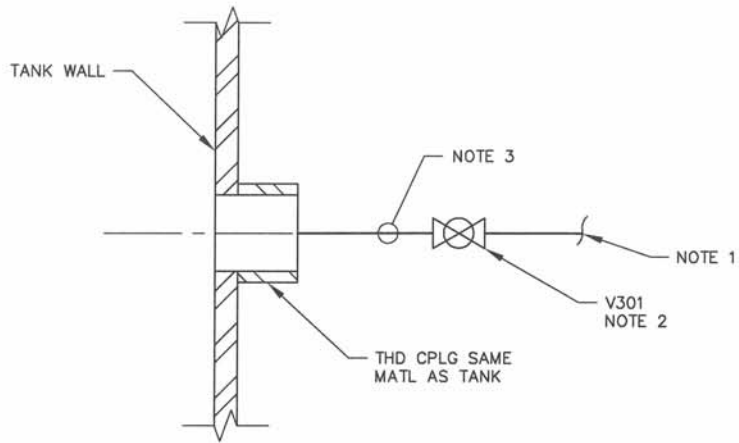
DRAWN BY: ALVARADO
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Rem
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**40959**  
**ULTRASONIC LEVEL**  
**ELEMENT INSTALLATION**  
**(STILLING WELL)**

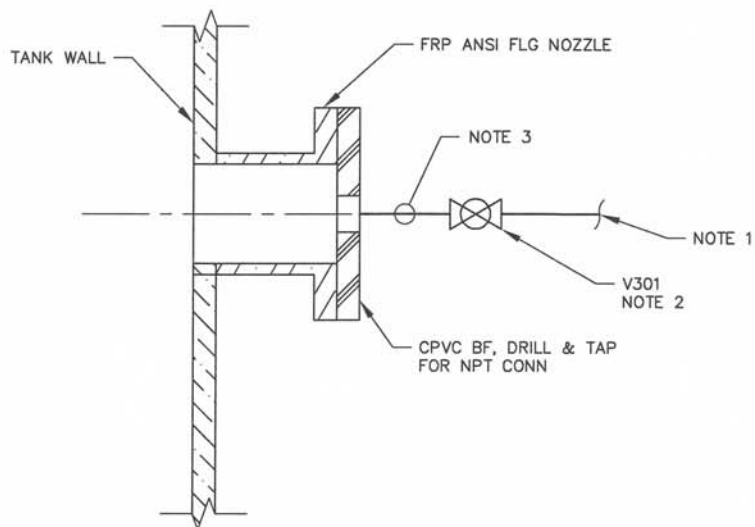
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**STEEL AND STAINLESS STEEL TANK**



**FIBER REINFORCED POLYESTER TANK**

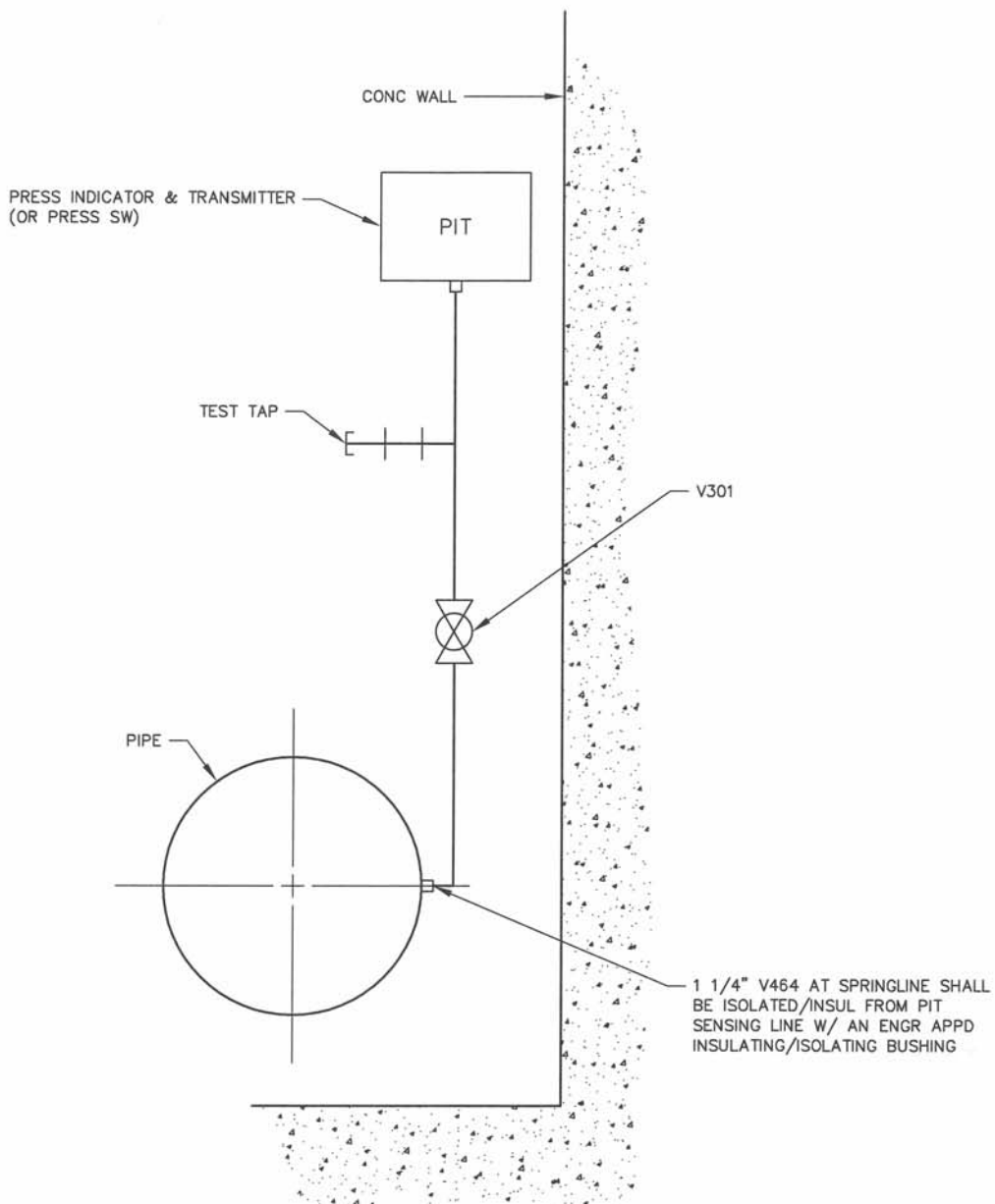
**NOTES:**

1. SENSING LINE TO PRESSURE INSTRUMENT.
2. VALVES: SIZE AND MATERIAL TO MATCH DOWNSTREAM PIPE AND FLOW STREAM REQUIREMENTS FOR MATERIALS.
3. BUSHING (SIZE AS REQUIRED) TO MATCH DOWNSTREAM PIPE SIZE AND CONNECTION TYPE.
4. FOR LIQUID, STEAM OR VAPOR SERVICE INSTALL PROCESS TAP HORIZONTALLY INTO THE SIDE OF THE TANK.
5. FOR AIR OR GAS SERVICE, INSTALL PROCESS TAP VERTICALLY INTO THE TOP OF THE TANK.

DRAWN BY: ALVARADO
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Rem
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

40961  
**PRESSURE MEASUREMENT  
 INSTALLATION (TANKS)**

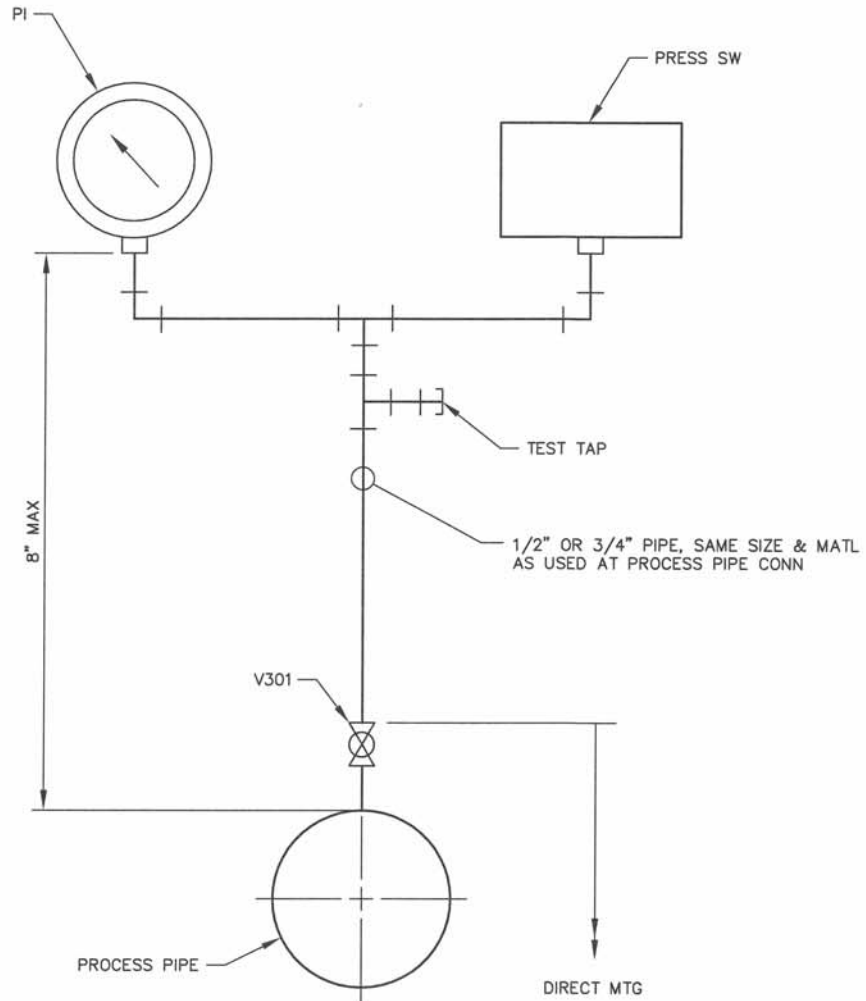
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DRAWN BY: ALVARADO  
 CHKD BY: K ROSS/KLR  
 APPD BY: Stephen C. Rose  
 ORIGINATION DATE: JANUARY 2017  
 REVISION DATE:

40963  
 PRESSURE INSTRUMENT  
 SPRINGLINE INSTALLATION

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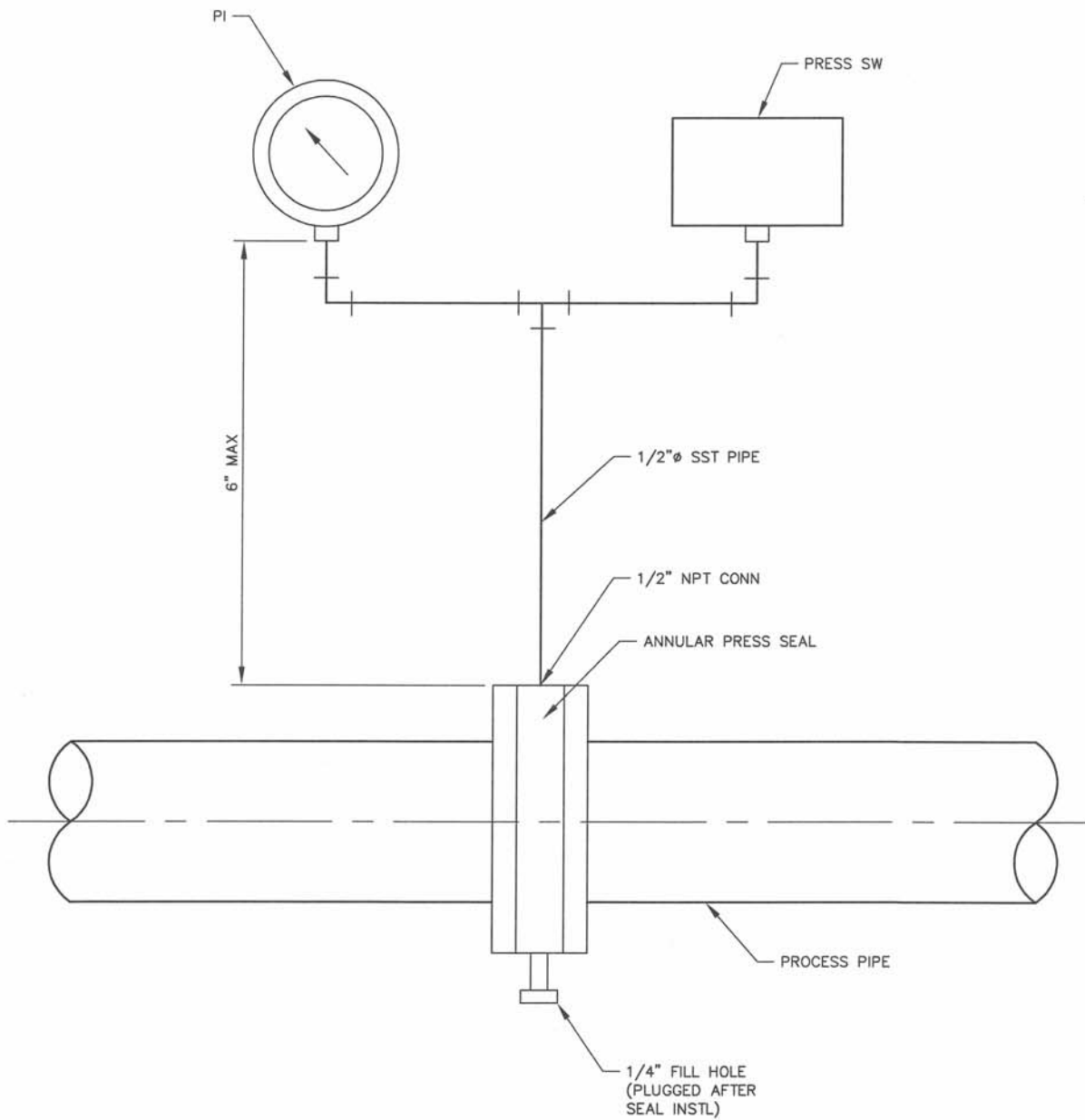
**NOTE:**

INDICATOR AND SWITCH INSTALLATION SHOWN. FOR SINGLE INSTRUMENT INSTALLATIONS, MOUNT DEVICE DIRECTLY ABOVE TEST TAP.

DRAWN BY: ALVARADO
CHKD BY: K ROSS/ <i>KR</i>
APPD BY: <i>Stephen C. Rem</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**40964**  
**PRESSURE INSTRUMENT**  
**INSTALLATION**


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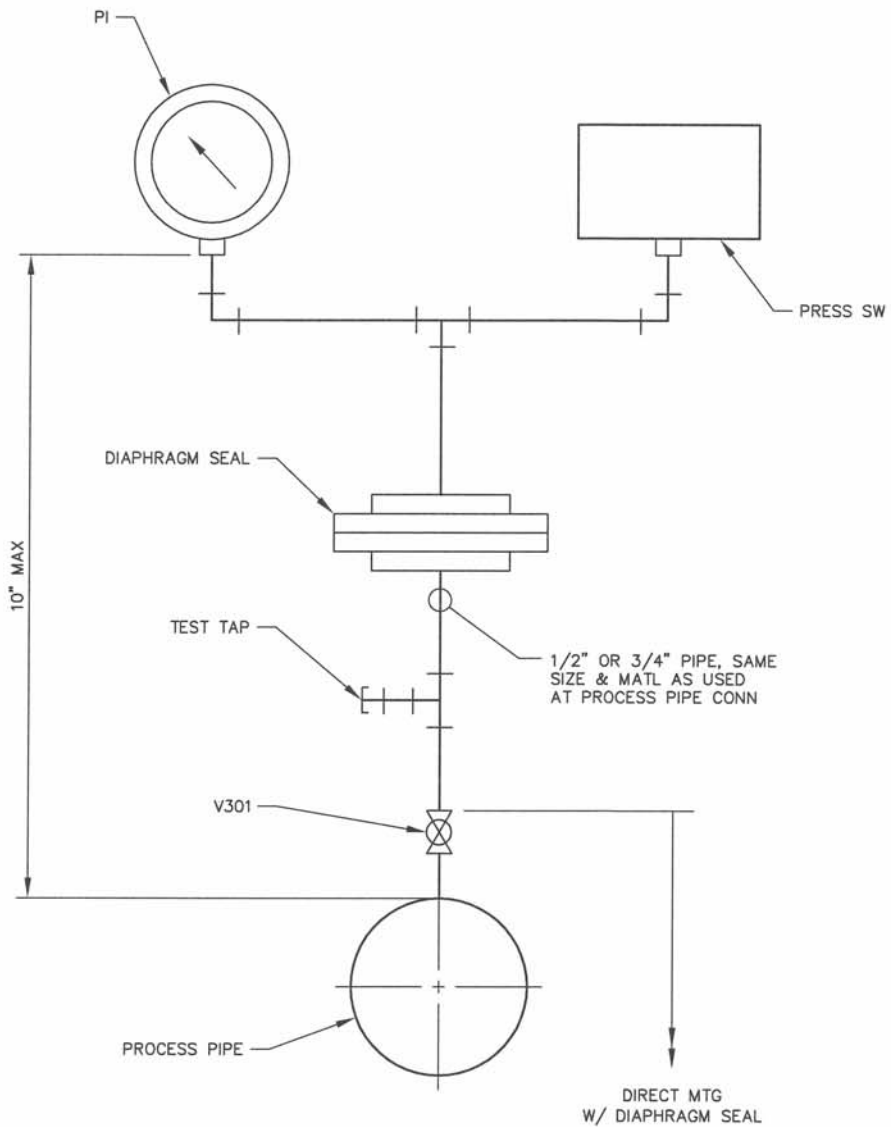
**NOTE:**

INDICATOR AND SWITCH INSTALLATION SHOWN. FOR SINGLE INSTRUMENT INSTALLATIONS, MOUNT DEVICE DIRECTLY TO SEAL.

DRAWN BY: ALVARADO
CHKD BY: K ROSS/ <i>KR</i>
APPD BY: <i>Stephen C. Penn</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**40965**  
**PRESSURE INSTRUMENT**  
**INSTALLATION**  
**(ANNULAR SEAL)**


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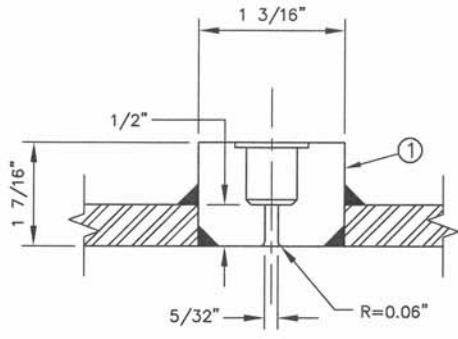
**NOTE:**

INDICATOR AND SWITCH INSTALLATION SHOWN. FOR SINGLE INSTRUMENT INSTALLATIONS, MOUNT DEVICE DIRECTLY ABOVE DIAPHRAGM SEAL.

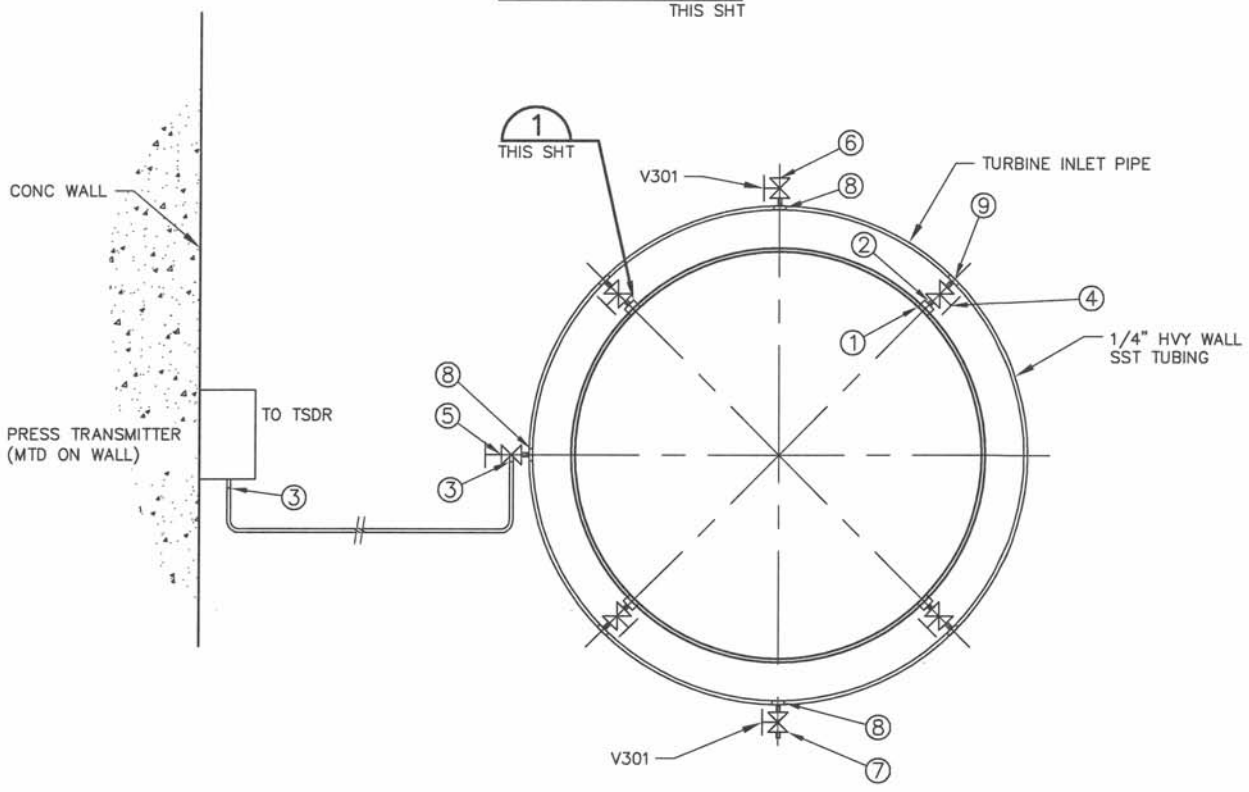
DRAWN BY: ALVARADO
CHKD BY: K ROSS/ <i>KR</i>
APPD BY: <i>Stephen C. Pen</i>
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**40966**  
**PRESSURE INSTRUMENT**  
**INSTALLATION**  
**(DIAPHRAGM SEAL)**


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**DETAIL 1**  
THIS SHT



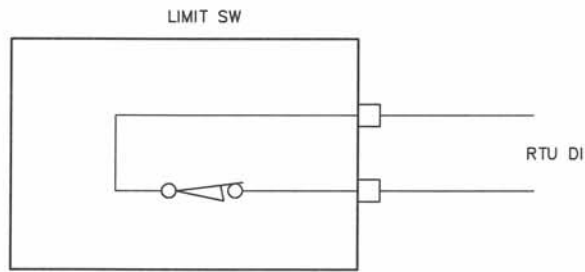
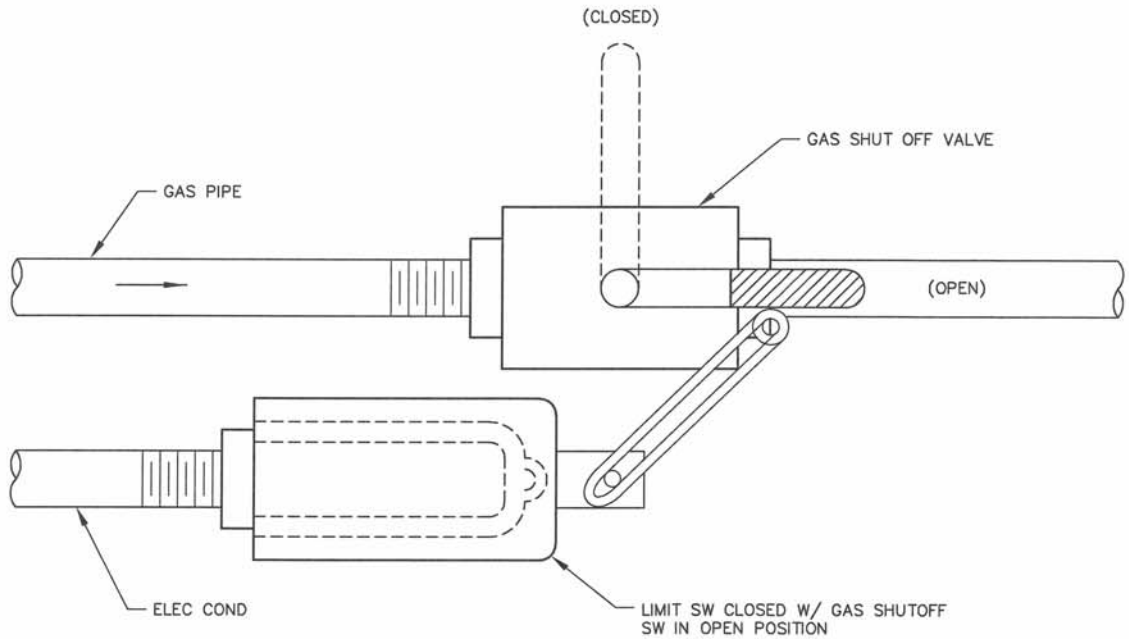
**KEYED NOTES:**

TAG	QTY	DESCRIPTION
①	4	1/4" NPT FEMALE PORT (304 SST)
②	4	SST NIPPLE (BOTH SIDES OF NEEDLE VALVE)
③	2	SST MALE CONNECTOR
④	4	SST NEEDLE VALVE
⑤	1	SST ANGLED NEEDLE VALVE
⑥	1	SST BALL BLEED VALVE
⑦	1	SST BALL DRAIN VALVE
⑧	3	SST BRANCH TEE
⑨	4	SST UNION TEE

DRAWN BY: ALVARADO
CHKD BY: K ROSS/VLR
APPD BY: Stephen C. Ream
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**40969**  
**PENSTOCK PRESSURE RING**

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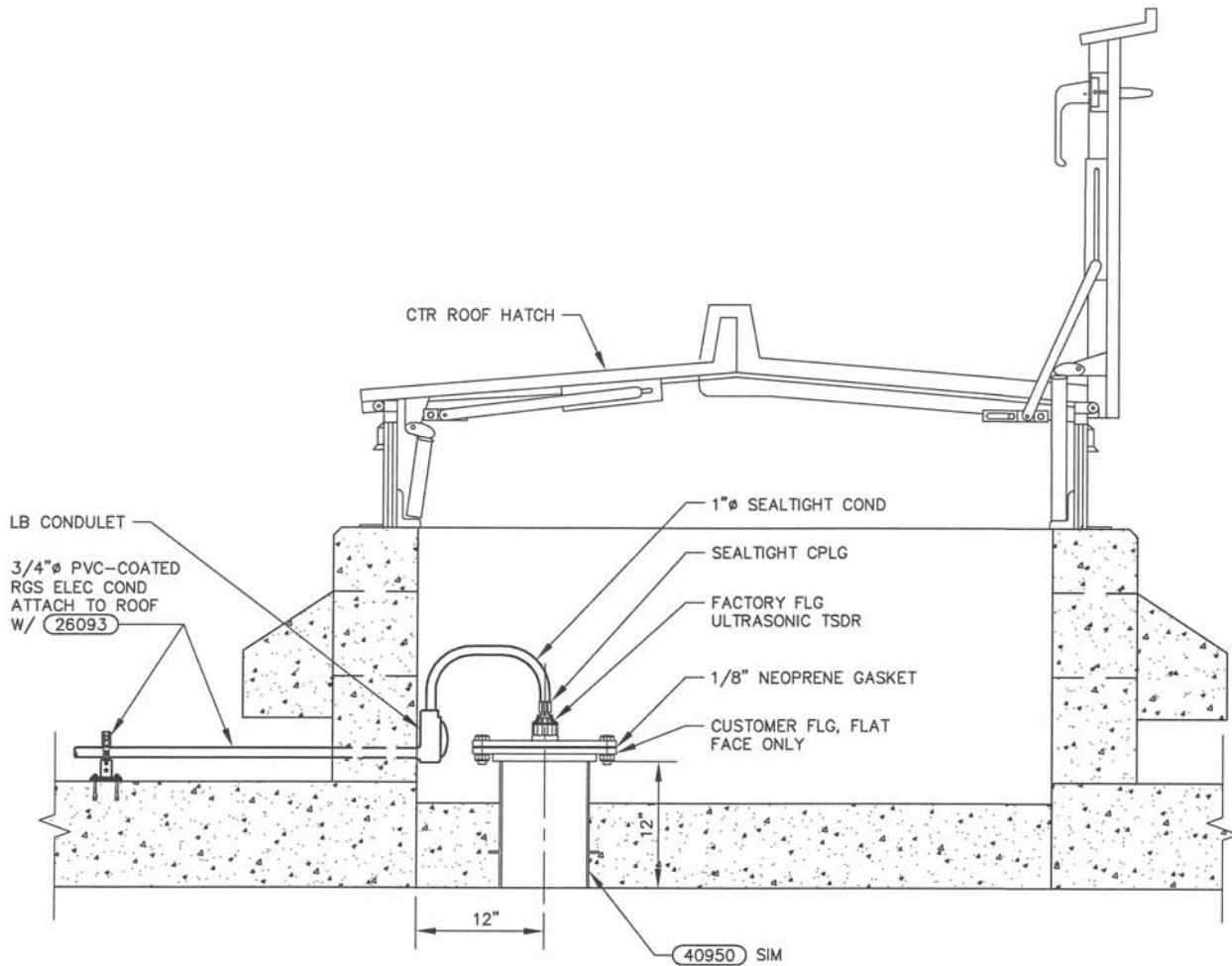


NO SW HELD CLOSED

DRAWN BY: ALVARADO  
 CHKD BY: K ROSS/KJR  
 APPD BY: Stephen C. Pelt  
 ORIGNATION DATE: JANUARY 2017  
 REVISION DATE:

40970  
 NATURAL GAS SUPPLY  
 POSITION SWITCH

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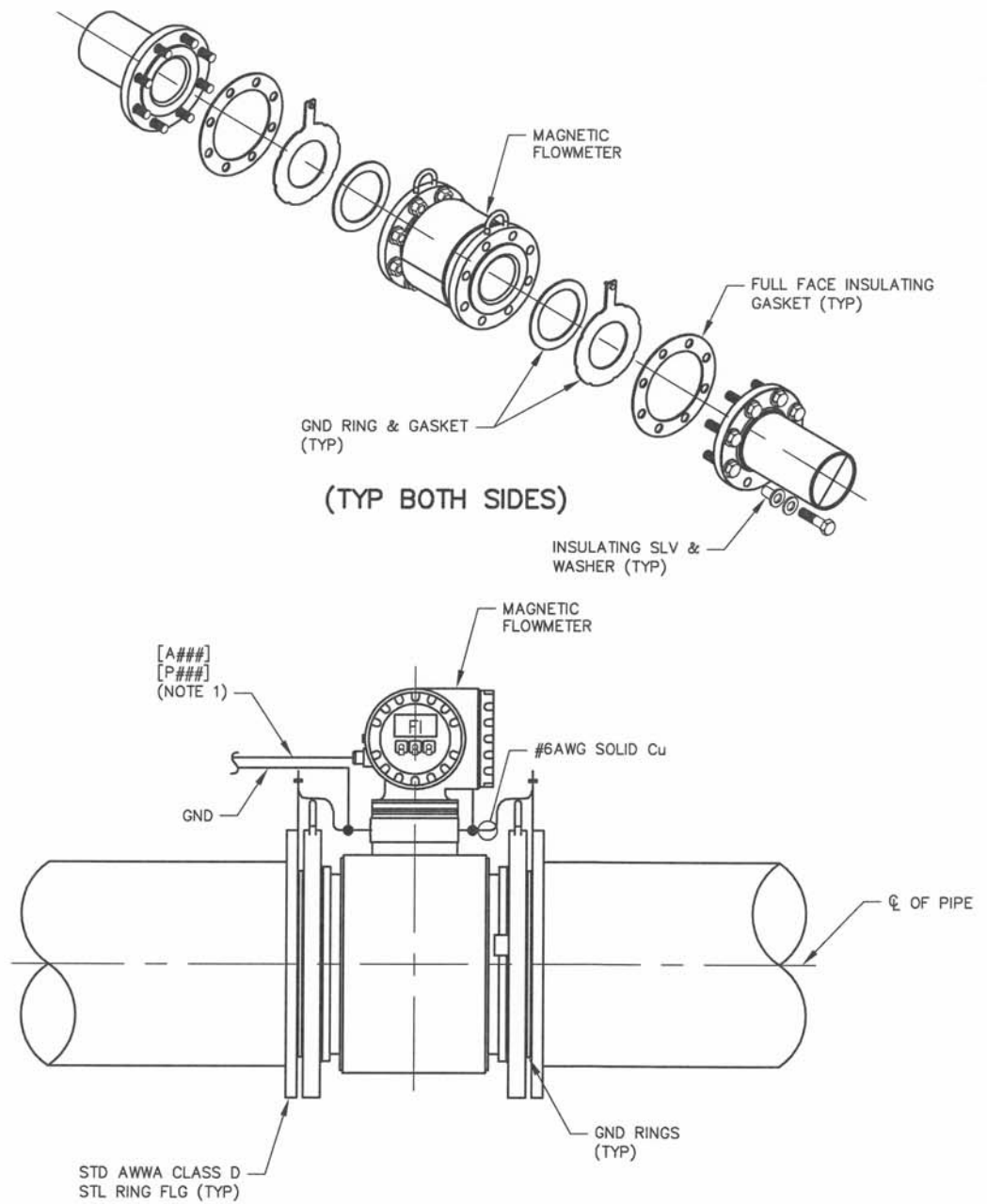


DRAWN BY: BERKNESS  
 CHKD BY: K ROSS/KR  
 APPD BY: Stephen C. Rem  
 ORIGINATION DATE: JANUARY 2017  
 REVISION DATE:

40972  
 ULTRASONIC LEVEL  
 ELEMENT INSTALLATION  
 (RESERVOIR ROOF)

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**NOTES:**

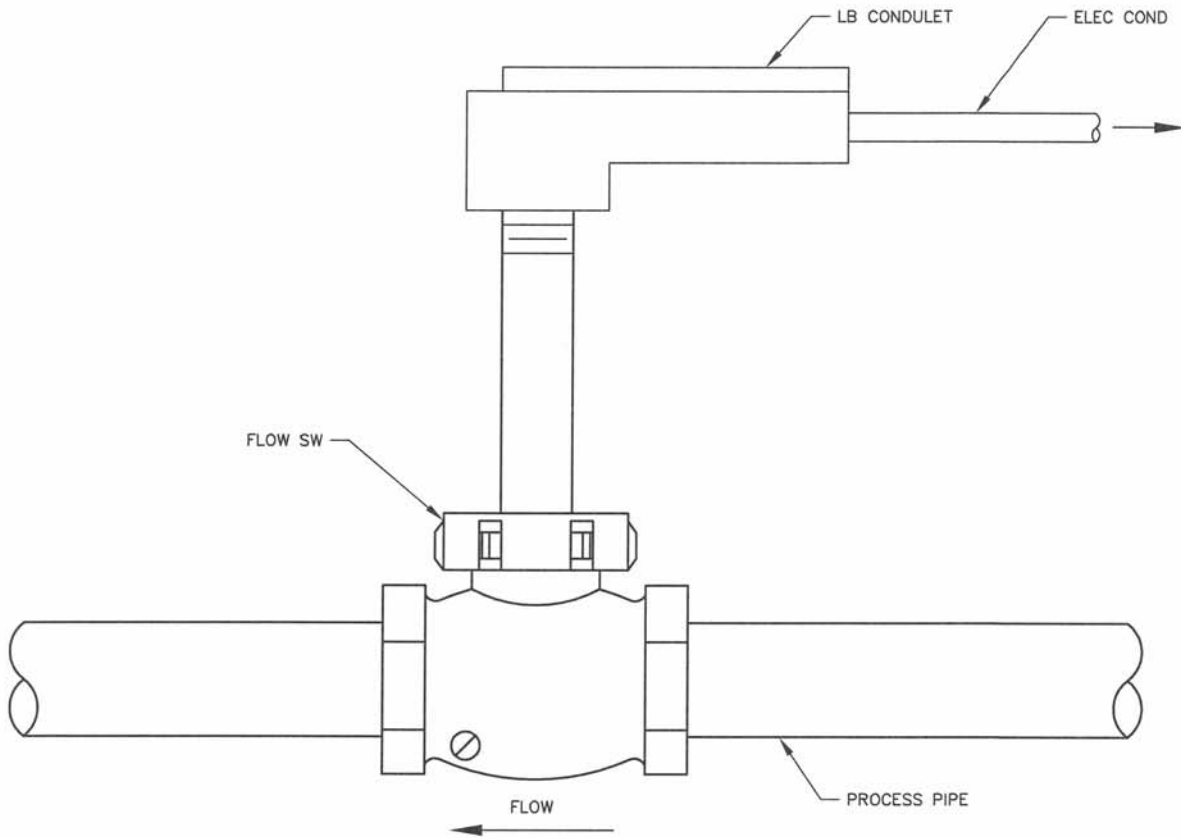
1. SEE CONDUIT AND CONDUCTOR SCHEDULE FOR ELECTRICAL CONDUIT NUMBERS.
2. DETAIL APPLIES TO FLOWMETERS WITH LOCAL OR REMOTE MOUNT TRANSMITTERS.

DRAWN BY: ALVARADO
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Row
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**40981  
MAGNETIC FLOWMETER  
INSTALLATION**

**D DENVER WATER**

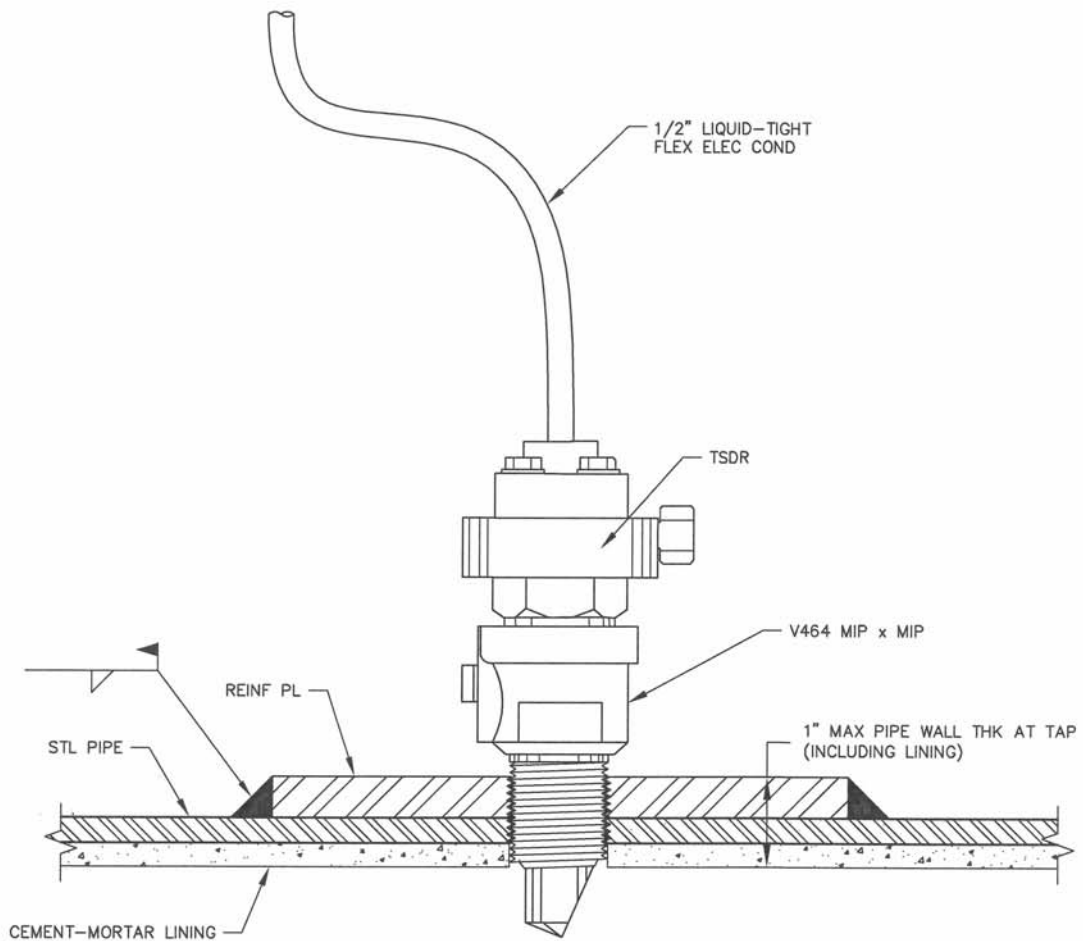
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DRAWN BY: ALVARADO
CHKD BY: K ROSS/ KLR
APPD BY: Stephen C. Ren
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

40983  
FLOW SWITCH

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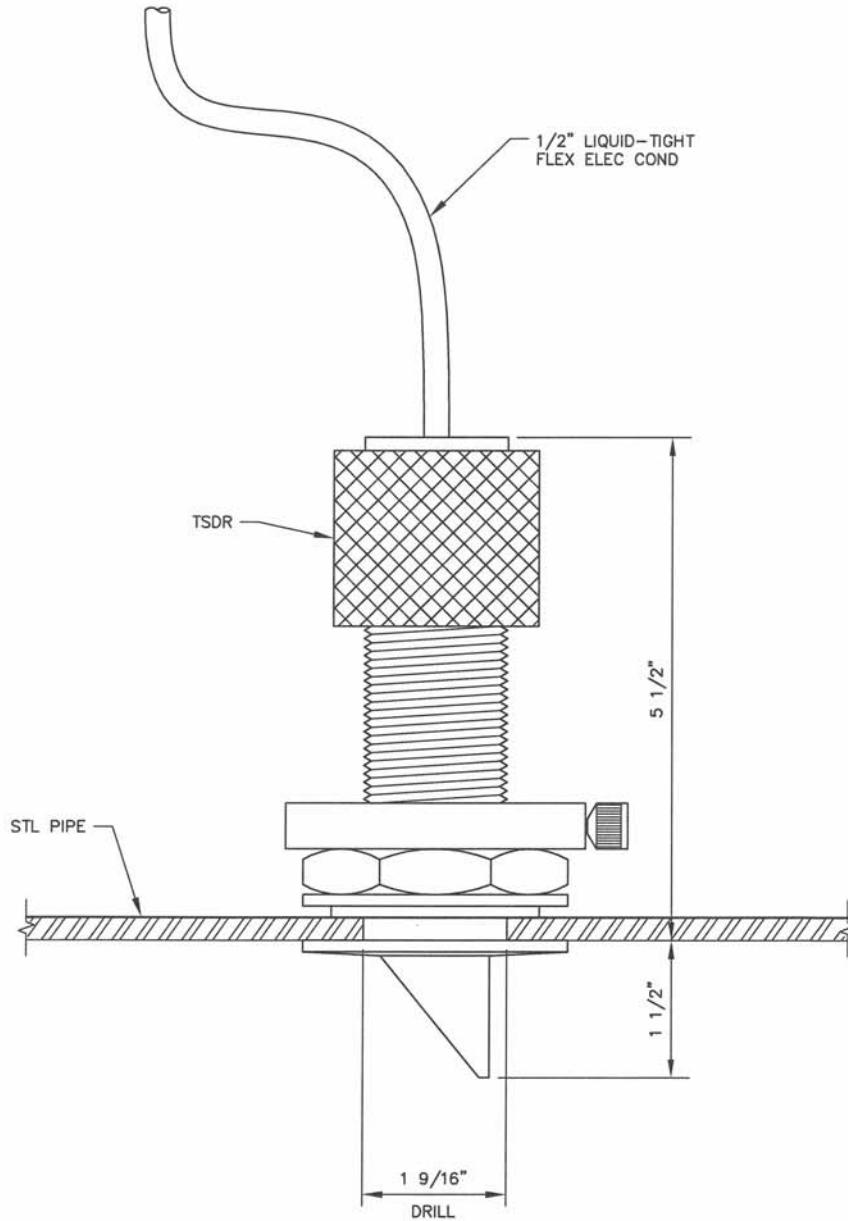
**NOTE:**

PROVIDE TRANSDUCER WITH A BRONZE CORPORATION STOP FEEDTHROUGH WITH BALL VALVE WHICH ALLOWS FOR THE COMPLETE REMOVAL OF THE TRANSDUCER FOR REPAIR, REPLACEMENT OR CLEANING WITHOUT DEWATERING PIPE.

DRAWN BY: ALVARADO
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Pen
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**40985**  
**ULTRASONIC FLOWMETER**  
**TRANSDUCER OUTSIDE**  
**INSTALLATION**


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**NOTES:**

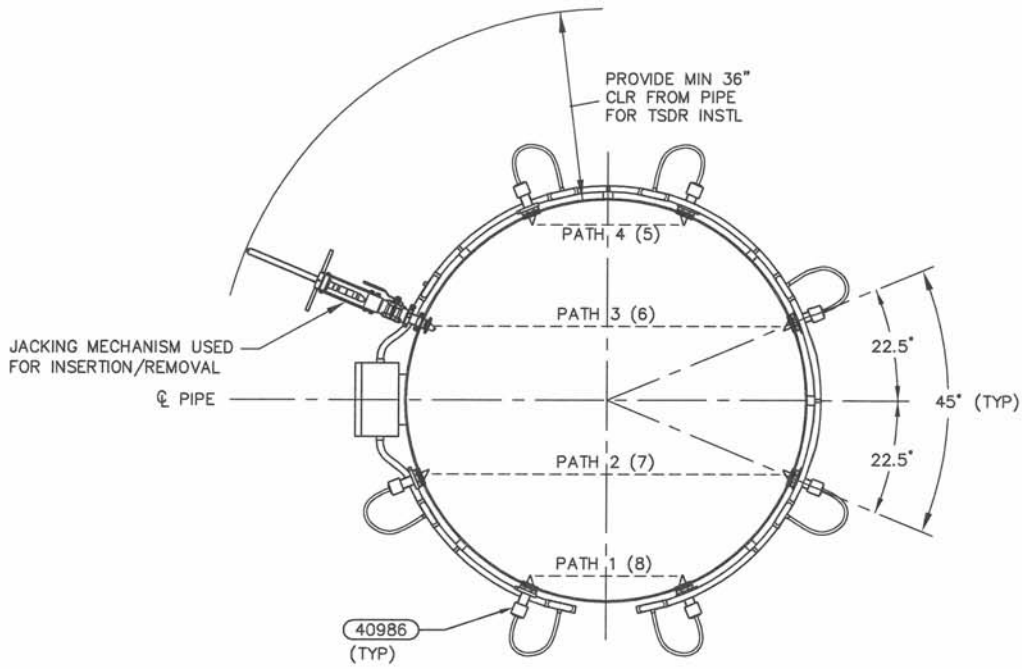
1. THE TRANSDUCER SHALL BE INSTALLED IN A DEWATERED PIPE FROM THE INSIDE OUT. THE TRANSDUCER ASSEMBLY IS SEALED ON THE PIPE USING AN O-RING INNER SEAL AND AN OUTER PACKING.
2. REPAIR LINING AND COATING AFTER DRILLING HOLE AND WELDING.

DRAWN BY: ALVARADO
CHKD BY: K ROSS/KR
APPD BY: Stephen C. Remm
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

40986  
ULTRASONIC FLOWMETER  
TRANSDUCER INSIDE FEED  
THROUGH INSTALLATION

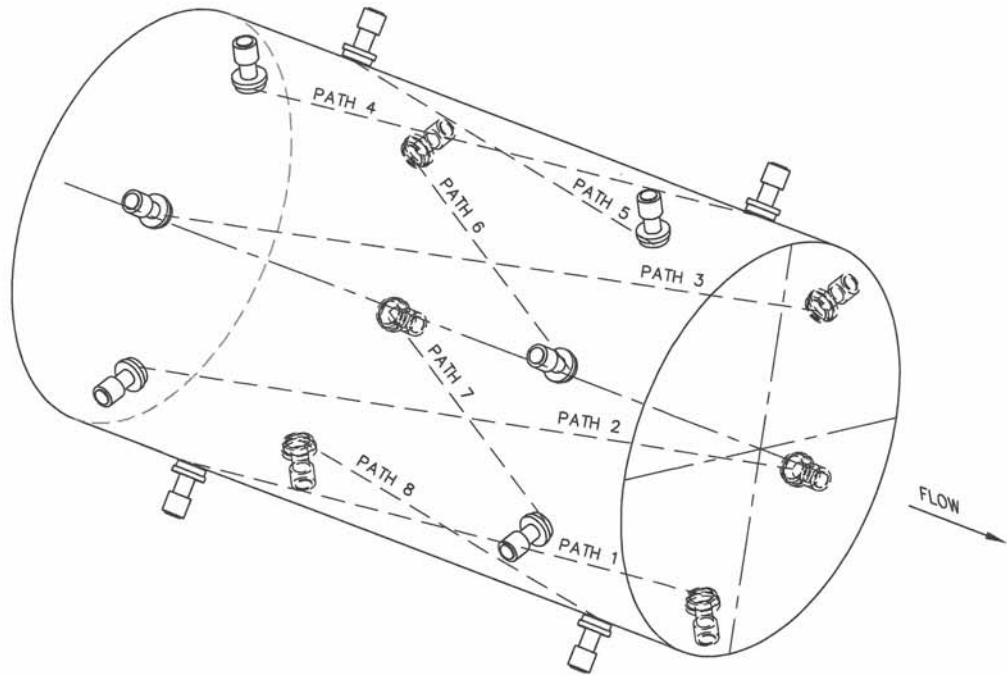
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**PIPE END VIEW**

ANGLES SHOWN FOR REF ONLY  
 -NOT DRILL ANGLES-

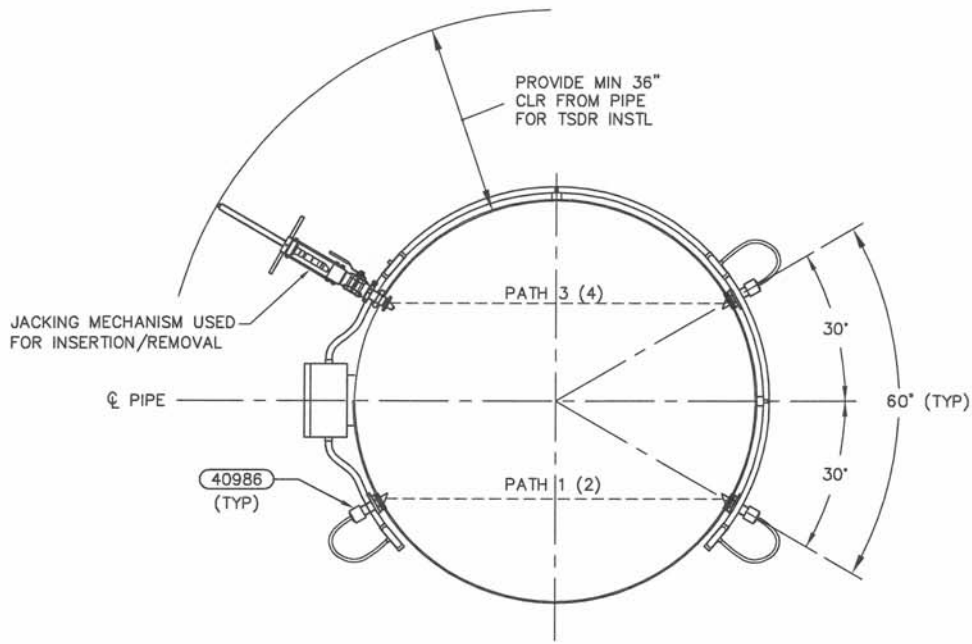


**ISOMETRIC**

DRAWN BY: ALVARADO
CHKD BY: K ROSS/KIR
APPD BY: Stephen C. Reem
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

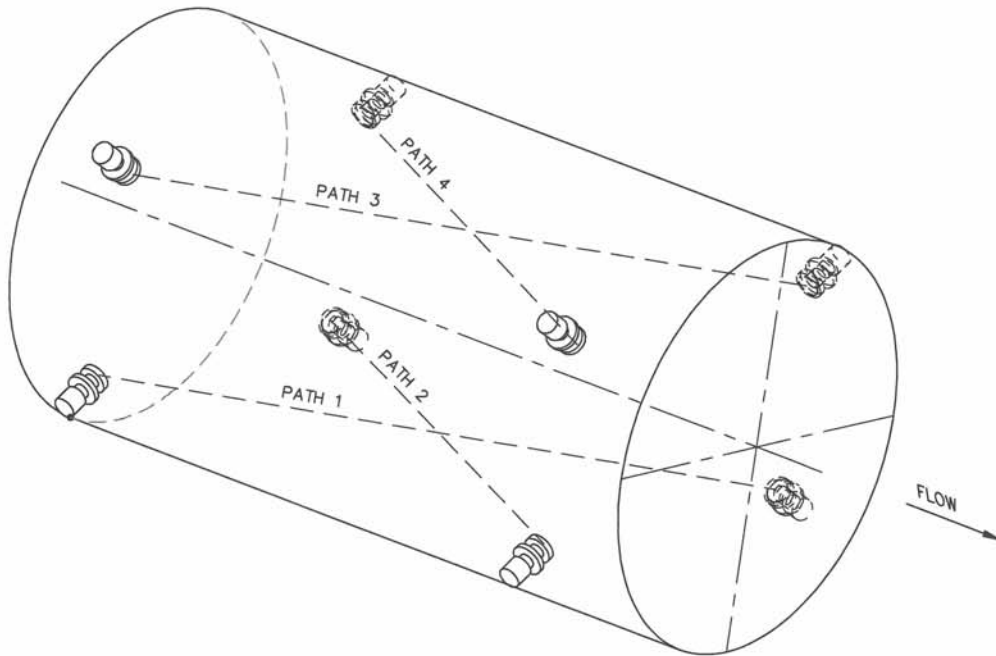
40987  
 ULTRASONIC FLOWMETER  
 (8 PATH)

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**PIPE END VIEW**

ANGLES SHOWN FOR REF ONLY  
 -NOT DRILL ANGLES-

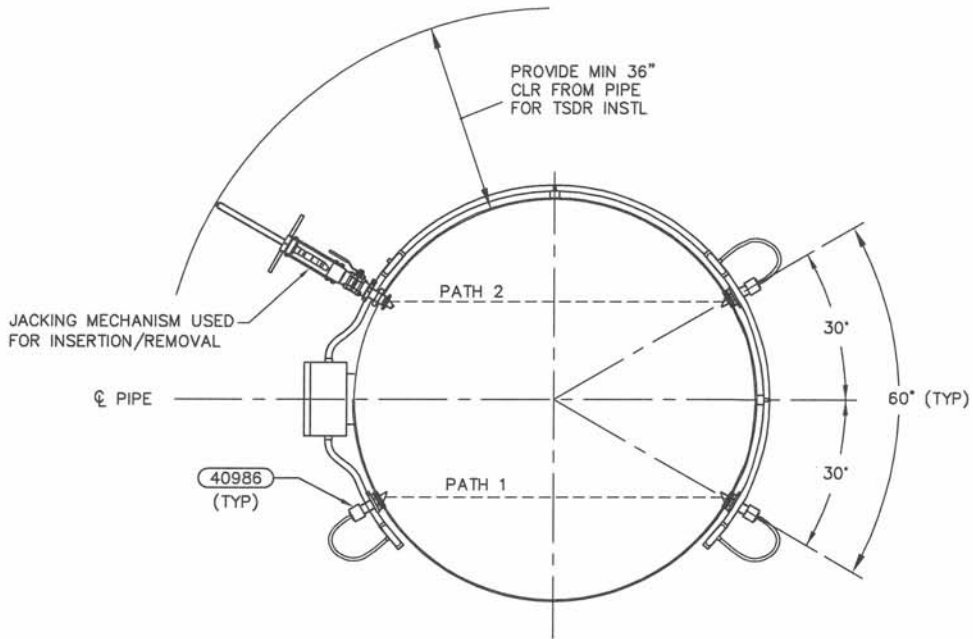


**ISOMETRIC**

DRAWN BY: ALVARADO
CHKD BY: K ROSS/KLR
APPD BY: Stephen C. Ross
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

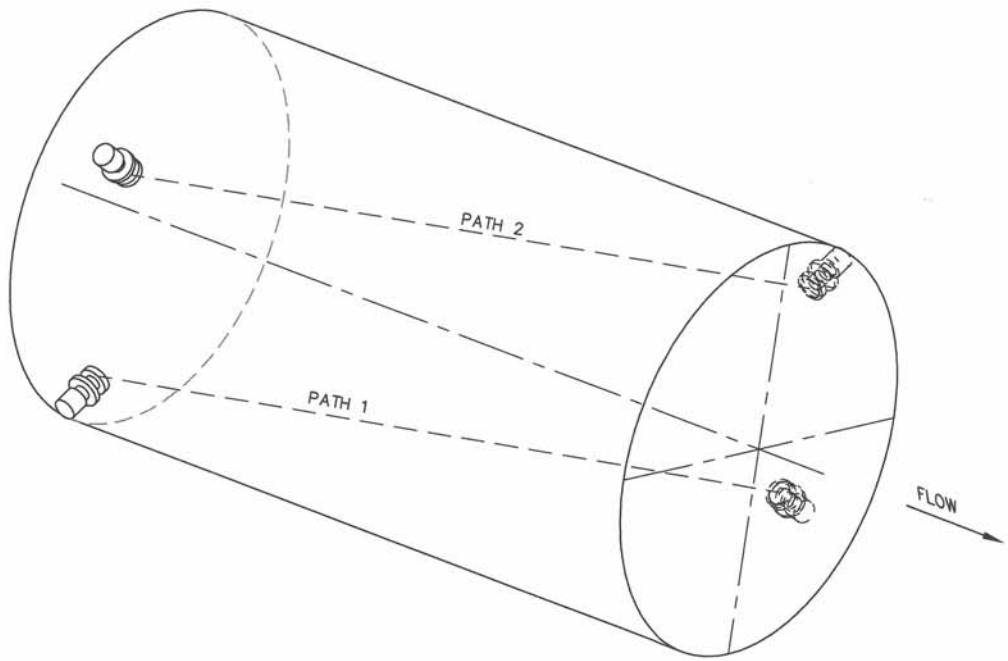
40988  
 ULTRASONIC FLOWMETER  
 (4 PATH)

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**PIPE END VIEW**

ANGLES SHOWN FOR REF ONLY  
 -NOT DRILL ANGLES-



**ISOMETRIC**

DRAWN BY: ALVARADO
CHKD BY: K ROSS/KJR
APPD BY: Stephen C. Rasmussen
ORIGINATION DATE: JANUARY 2017
REVISION DATE:

**40989**  
**ULTRASONIC FLOWMETER**  
**(2 PATH)**

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