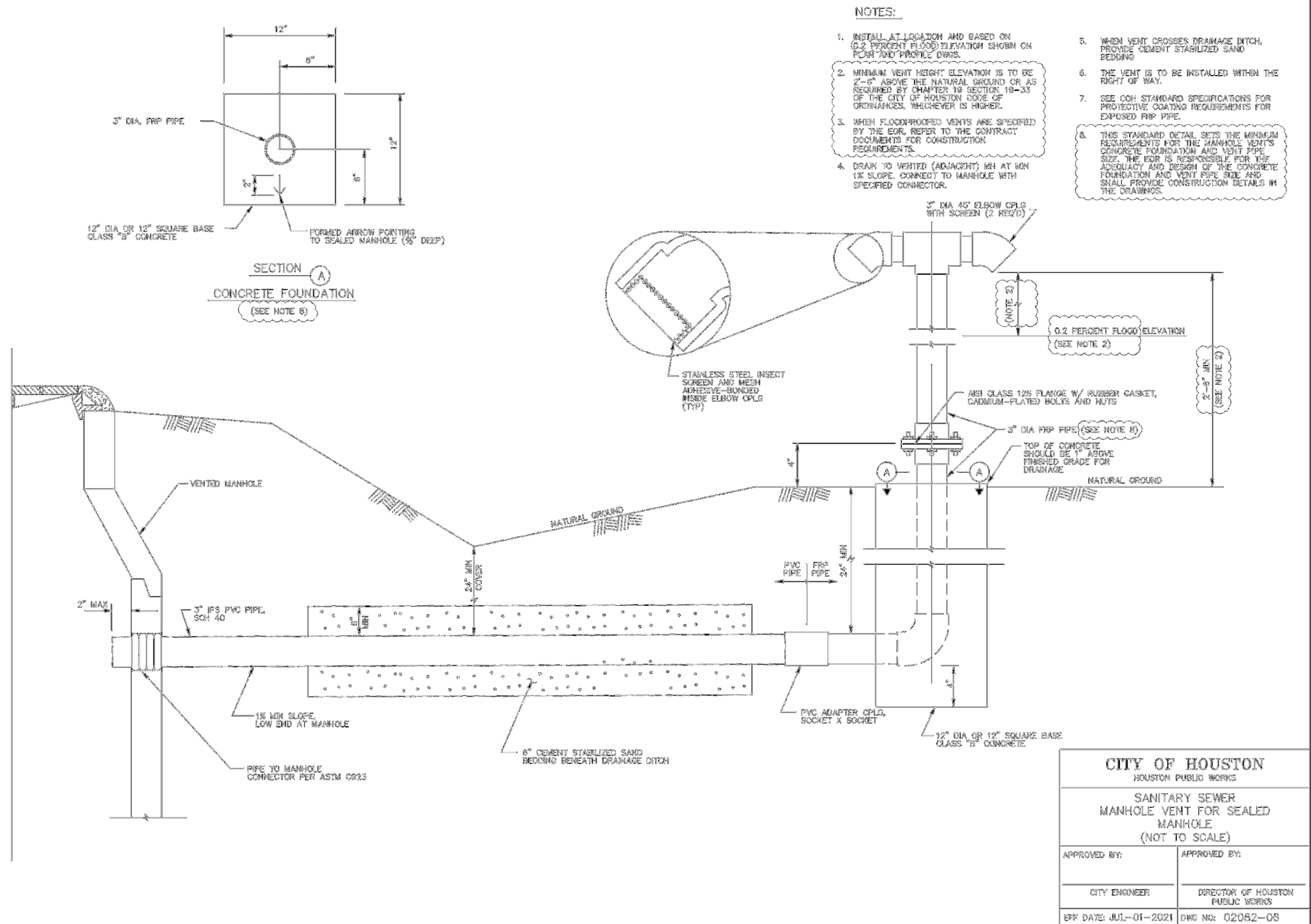
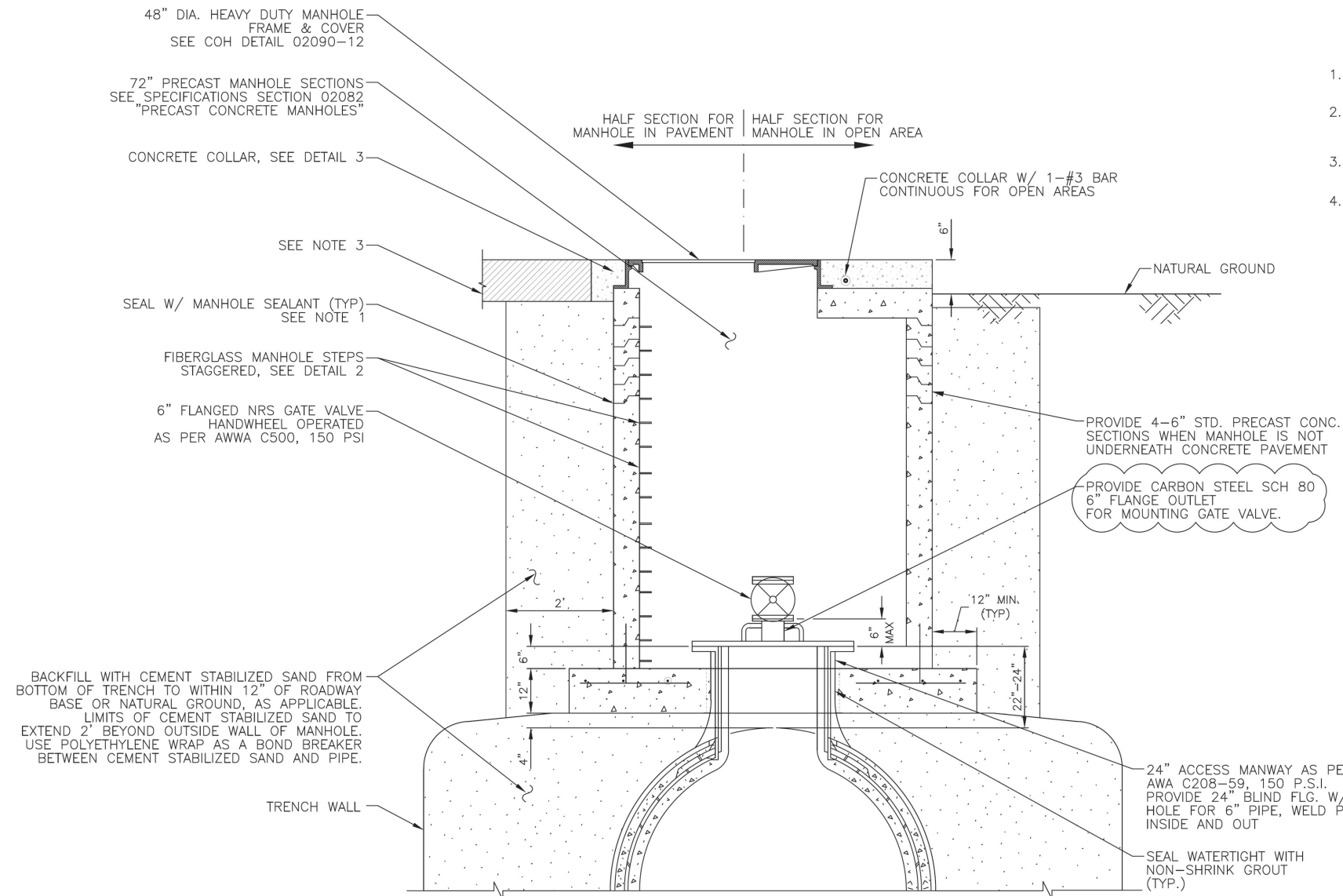


City of Houston
Standard Details
2020-2021 Review Cycle

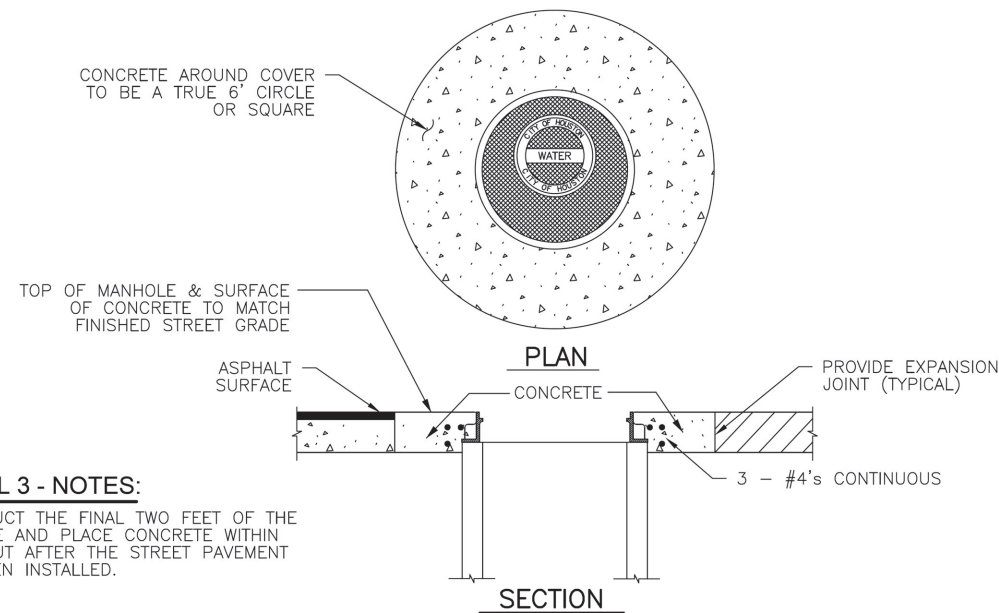
REDLINES

Updates in these details are shown by denoted revision clouds.





1 ACCESS MANWAY IN ACCESS MANHOLE
(FOR WATER LINES 36-INCH TO 96-INCH DIAMETER)



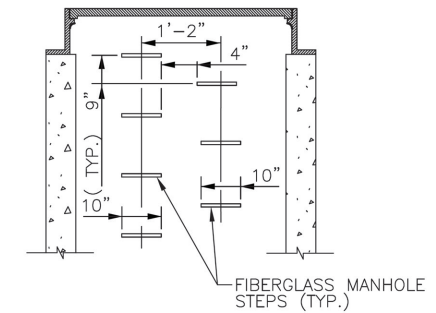
DETAIL 3 - NOTES:

1. CONSTRUCT THE FINAL TWO FEET OF THE MANHOLE AND PLACE CONCRETE WITHIN BLOCKOUT AFTER THE STREET PAVEMENT HAS BEEN INSTALLED.

3 MANHOLE CONCRETE COLLAR DETAIL

DETAIL 1 - NOTES:

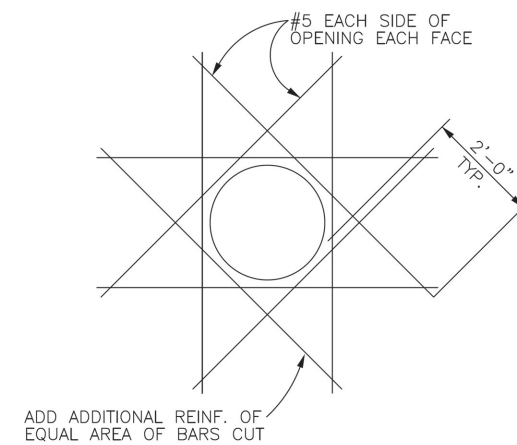
1. PROVIDE RAM-NEK OR APPROVED EQUAL BETWEEN PRECAST SEGMENTS OF THE MANHOLE.
2. FOR MANHOLES DEEPER THAN 20 FEET, SAFETY CLIMBING RAIL MUST BE PROVIDED (SAF-T-CLIMB OR APPROVED EQUAL).
3. FOR PAVEMENT REPAIR, SEE COH STANDARD DETAILS 02902-01 & 02902-02.
4. PROVIDE AN APPROVED PETROLATUM BASED TAPE ENCAPSULATING ALL BOLTS IN ACCESS MANHOLE.



DETAIL 2 - NOTES:

1. PROVIDE MODEL PS1-PF STEPS AS MANUFACTURED BY M.A. INDUSTRIES INC. OR APPROVED EQUAL.
2. BOTTOM MANHOLE STEP SHALL BE NO HIGHER THAN 12\"/>

2 MANHOLE STEP DETAIL

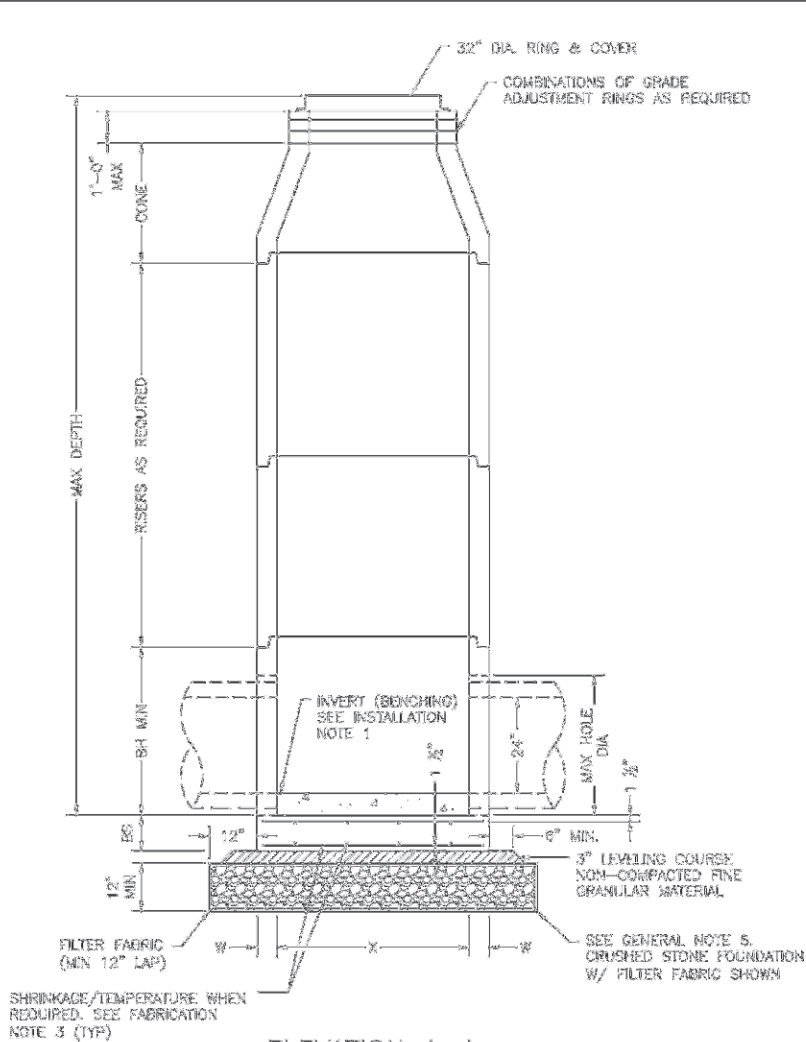


ADD ADDITIONAL REINF. OF EQUAL AREA OF BARS CUT

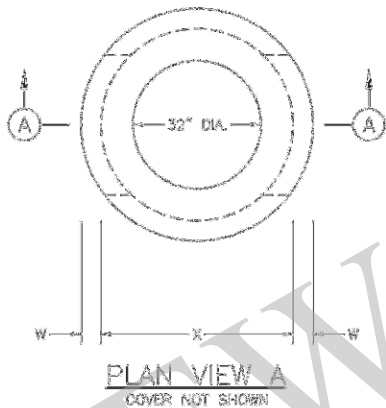
SERVICE MANHOLE REINFORCEMENT DETAIL

CITY OF HOUSTON HOUSTON PUBLIC WORKS	
STANDARD LDWL ACCESS MANHOLE DETAILS	
(NOT TO SCALE)	
APPROVED BY:	APPROVED BY:
CITY ENGINEER	DIRECTOR OF HOUSTON PUBLIC WORKS
EFF DATE: JULY - 01 - 2021	DWG NO: 02082-10

DISCLAIMER: THE USE OF THIS STANDARD IS GOVERNED BY THE TEXAS ENGINEERING PRACTICE ACT. THE DESIGN REQUIREMENTS ON THIS STANDARD DO NOT PURPORT TO ADDRESS ALL OF THE SAFETY CONCERNS ASSOCIATED WITH THEIR USE. THE ENGINEER OF RECORD (EOR) IS TO REVIEW THESE DESIGN REQUIREMENTS AND BY AUTHORIZING THEIR USE, ACCEPTS RESPONSIBILITY FOR THEIR ADEQUACY AND SAFETY. NO WARRANTY OF ANY KIND IS MADE BY THE CITY OF HOUSTON FOR ANY PURPOSES WHATSOEVER. THE CITY OF HOUSTON ASSUMES NO RESPONSIBILITY FOR INCORRECT RESULTS OR DAMAGES RESULTING FROM ITS USE.

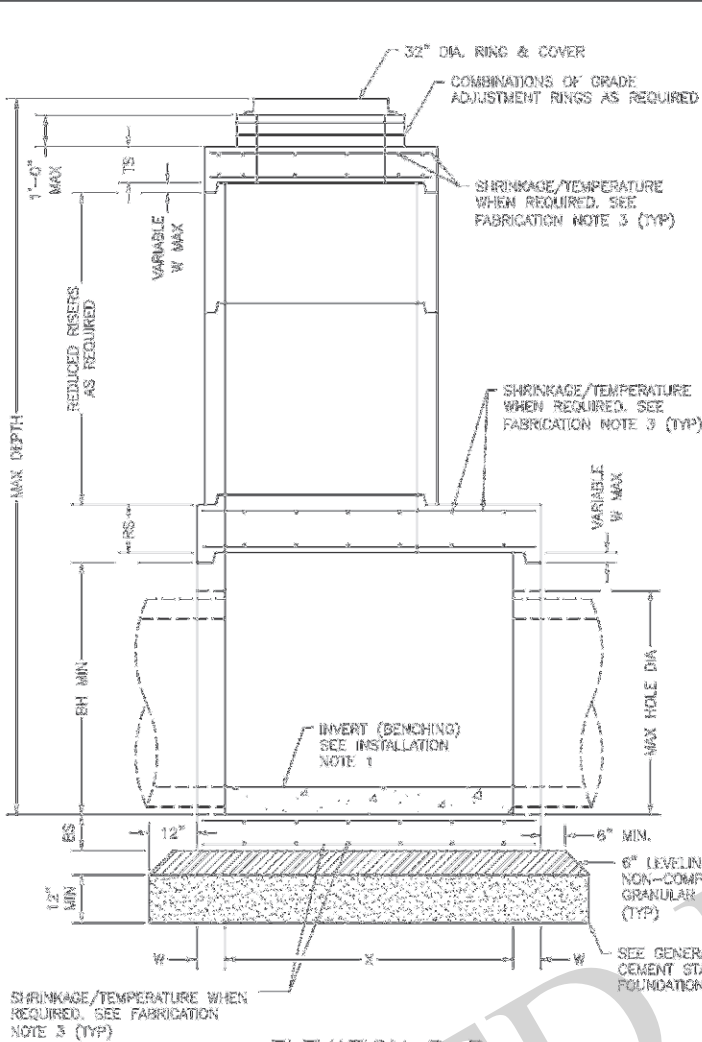


ELEVATION A-A
CONE TOP WITH SHIP LOOSE
RING & COVER OPTION

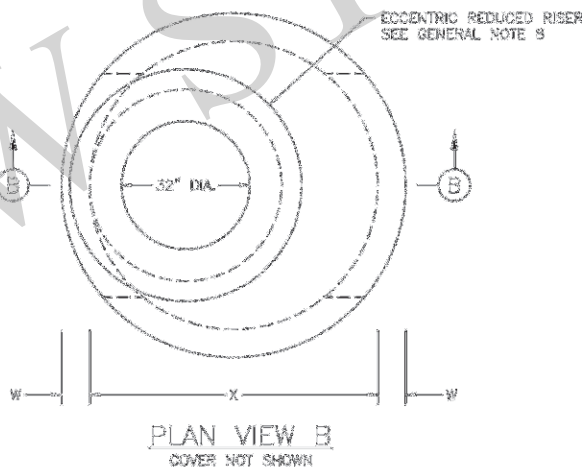


PLAN VIEW A
COVER NOT SHOWN

4-FT DIA MANHOLE

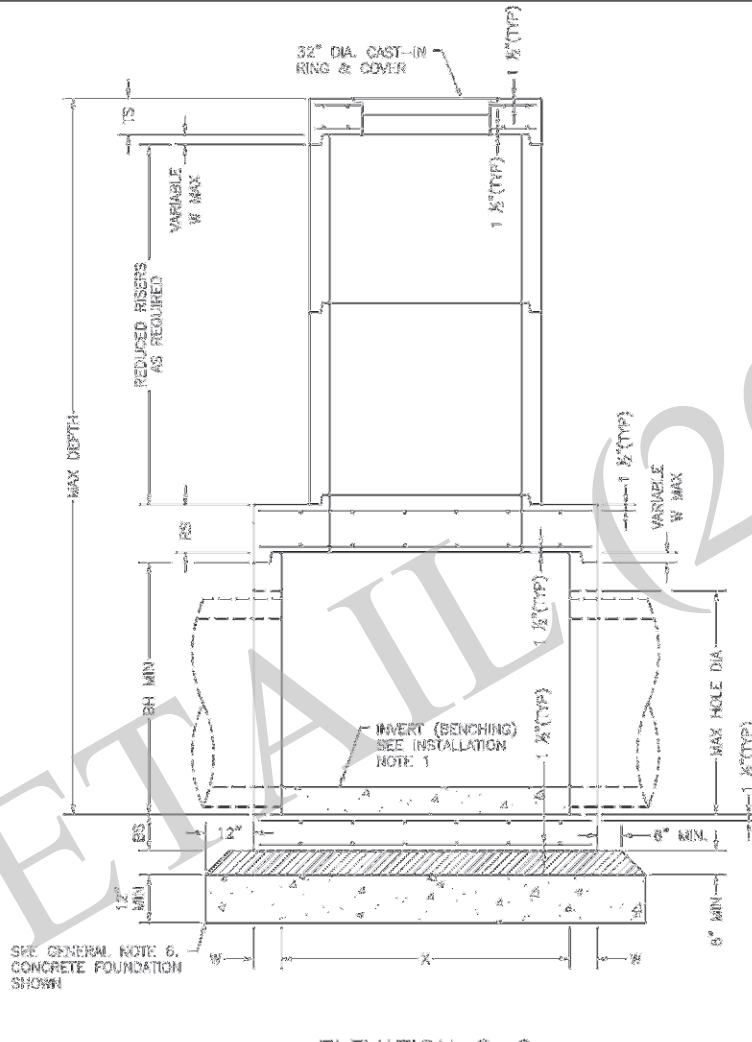


ELEVATION B-B
FLAT SLAB TOP WITH SHIP LOOSE
RING & COVER OPTION

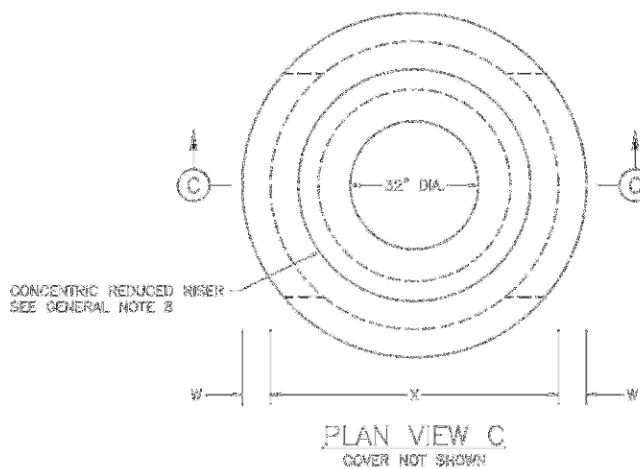


PLAN VIEW B
COVER NOT SHOWN

5-FT & 6-FT DIA MANHOLE
ECCENTRIC MANHOLE
(PREFERRED CONFIGURATION)



ELEVATION C-C
FLAT SLAB TOP WITH INVERTED
RING & COVER OPTION



PLAN VIEW C
COVER NOT SHOWN

5-FT & 6-FT DIA MANHOLE
CONCENTRIC MANHOLE
(ALTERNATE CONFIGURATION)

FABRICATION NOTES:

1. PROVIDE CLASS "II" CONCRETE IN ACCORDANCE WITH TEXAS DEPARTMENT OF TRANSPORTATION ITEM 421 AND HAVING A MINIMUM COMPRESSIVE STRENGTH OF 5,000 PSI.
2. PROVIDE GRADE 60 REINFORCING STEEL OR EQUIVALENT AREA OF WHR. PROVIDE CIRCUMFERENTIAL REINFORCING STEEL IN VERTICAL WALLS OF BASE, RISER AND CONE IN ACCORDANCE WITH ASTM C478.
3. SLABS WITH A THICKNESS OF 8" OR GREATER REQUIRE SHRINKAGE AND TEMPERATURE REINFORCING STEEL. PROVIDE STEEL AREA = 0.11 IN²/FT EACH WAY.
4. MANUFACTURE BASE AND RISERS TO NEAREST 3" INCREMENT.
5. DESIGN TONGUE AND GROOVE JOINTS FOR FULL CLOSURE ON BOTH SHOULDERS. MINIMUM SPIGOT DEPTH IS 3/4".
6. PROVIDE LIFTING DEVICES IN CONFORMANCE WITH MANUFACTURER'S RECOMMENDATIONS.
7. PROVIDE CAST IRON SOLID COVER, UNLESS NOTED OTHERWISE ELSEWHERE IN THE PLANS.
8. THREE DIFFERENT OPTIONS FOR CAPPING THE MANHOLE RISER NEAR THE FINISHED GRADE ARE SHOWN. CONES CAN BE USED WHEN COVER IS SUFFICIENT TO ALLOW FOR PROPER PLACEMENT. FLAT LIDS ARE TO BE USED WHERE COVER IS LIMITED.

INSTALLATION NOTES:

1. IF REQUIRED ELSEWHERE, INVERTS (BENCHING) TO BE PROVIDED BY CONTRACTOR. CONCRETE OR MORTAR USED FOR INVERT IS SUBSIDIARY TO THIS ITEM. REFER TO CITY OF HOUSTON SPECIFICATION SECTION 02082 FOR INVERT (BENCHING) REQUIREMENTS.
2. SEAL TONGUE AND GROOVE JOINTS WITH PREFORMED OR BULK WASTIC IN CONFORMANCE WITH MANUFACTURER'S RECOMMENDATIONS. TONGUE AND GROOVE JOINTS MAY BE GROUTED NO MORE THAN 1" BETWEEN EACH SECTION, OR 1/2 THE JOINT DEPTH, WHICHEVER IS GREATER.
3. DO NOT GROUT RUBBER GASKET JOINTS WITHOUT MANUFACTURER'S RECOMMENDATION.
4. INITIAL INSTALLATION OF GRADE ADJUSTMENT RINGS IS LIMITED TO 1'-0" MAX AS SHOWN.
5. GRADE ADJUSTMENT RINGS MAY BE INCREASED TO 1'-6" MAX WHEN FUTURE CONSTRUCTION AFFECTS FINAL GRADE OF STRUCTURE. MAKE ADJUSTMENTS GREATER THAN 1'-6" WITH ADDITIONAL RISERS. ADJUSTMENTS MAY BE MADE UP TO THE MAX DEPTH OF 25'-0". STRUCTURE MUST BE EVALUATED IF MAX DEPTH WILL BE EXCEEDED.

GENERAL NOTES:

1. SEE TABLE 1 FOR MINIMUM DESIGN REQUIREMENTS. CONCENTRIC RISER WITH RESPECT TO BASE (ALTERNATIVE CONFIGURATION) FALLS OUTSIDE THE SCOPE OF REQUIREMENTS PROVIDED. ENGINEER OF RECORD ACCEPTS RESPONSIBILITY FOR SAFETY AND ADEQUACY OF MANHOLE IF THE ALTERNATIVE CONFIGURATION IS USED.
2. DESIGNED ACCORDING TO ASTM C478.
3. PAYMENT FOR PRECAST MANHOLE PER SECTION 02082 "PRECAST CONCRETE MANHOLES".
4. PIPE OD + PLACEMENT TOLERANCE MUST BE EQUAL OR LESS THAN MAX HOLE DIA. FOR RIGID PIPE, PLACEMENT TOLERANCE IS 4" MAX, 2" MIN. FOR FLEXIBLE PIPE, CONSULT BIDD/SEAL MANUFACTURER'S SPECIFICATION FOR PLACEMENT TOLERANCE.
5. STORM WATER SEWER PIPE INTERNAL DIA SHALL NOT BE LESS THAN 24".
6. FOUNDATION/SUBGRADE TO BE DESIGNED BY ENGINEER AND MEET MINIMUM REQUIREMENTS ACCORDING TO SECTION 02082.
7. ALL STORM WATER MANHOLES ARE TO BE PRECAST CONCRETE, UNLESS OTHERWISE NOTED ELSEWHERE IN THE PLANS.
8. ECCENTRIC REDUCED RISER WITH RESPECT TO BASE IS THE PREFERRED MANHOLE CONFIGURATION. CONCENTRIC REDUCED RISER WITH RESPECT TO BASE MANHOLE CONFIGURATION IS AN ALTERNATIVE DESIGN THAT WILL BE ACCEPTED BASED ON THE NEEDS OF THE CITY OF HOUSTON.
9. CONES MAY BE CONCENTRIC OR ECCENTRIC. REDUCTION CONES ARE ACCEPTABLE. REFER TO MANUFACTURER FOR CONE DIMENSIONS.
10. MANHOLE SIZE SHALL CONSIDER ENGINEERING ECONOMY. THIS DETAIL IS NOT APPLICABLE TO ROUND MANHOLES LARGER THAN 6-FOOT DIA.

CITY OF HOUSTON

HOUSTON PUBLIC WORKS

STORM SEWER TYPE 'C' PRECAST ROUND MANHOLE

(NOT TO SCALE)

APPROVED BY:

CITY ENGINEER

APPROVED BY:

DIRECTOR OF
HOUSTON PUBLIC WORKS

EFF DATE: JUL-01-2021

DWG NO: 02082-12

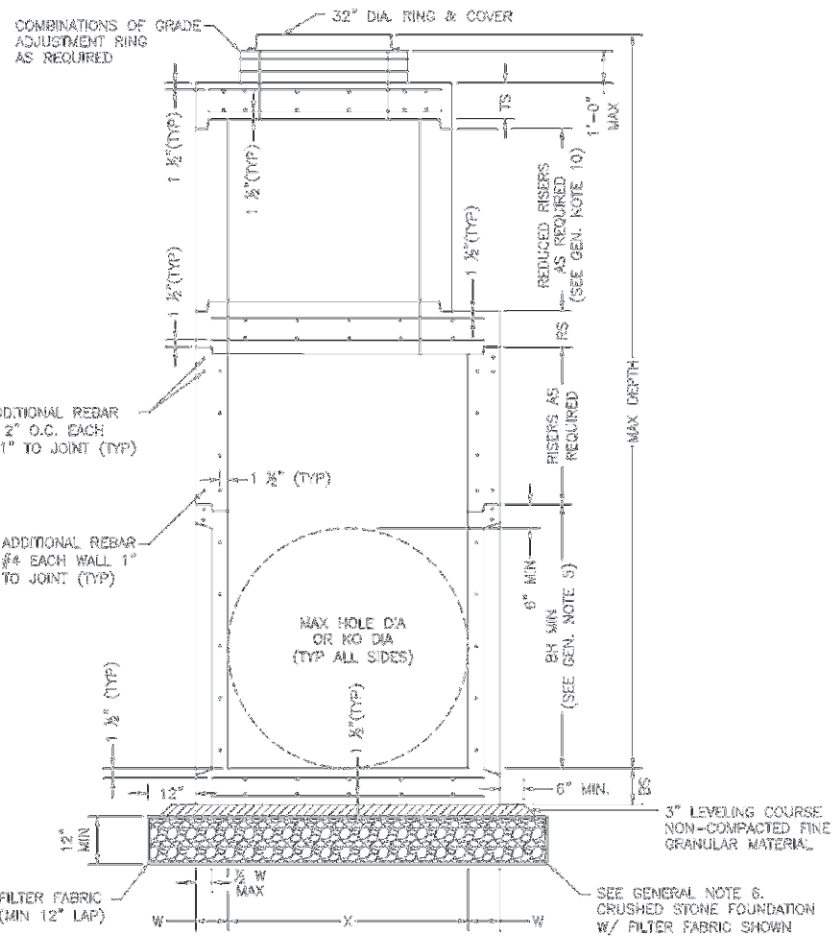
TABLE 1

PRECAST ROUND MANHOLE (PRM) MINIMUM REQUIREMENTS FOR 24 IN. TO 42 IN. INTERNAL DIA STORM SEWER PIPES

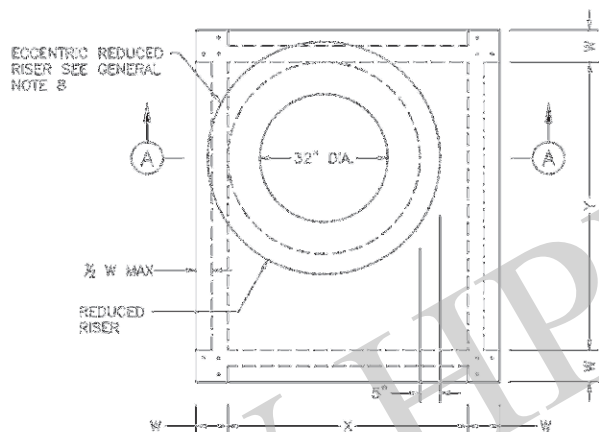
	24 IN.	30 IN.	36 IN.	42 IN.	48 IN.	54 IN.	60 IN.	66 IN.	72 IN.
PRM	4	5	6	7	8	9	10	11	12
	4	5	6	7	8	9	10	11	12
	4	5	6	7	8	9	10	11	12
	4	5	6	7	8	9	10	11	12
	4	5	6	7	8	9	10	11	12
	4	5	6	7	8	9	10	11	12
	4	5	6	7	8	9	10	11	12
	4	5	6	7	8	9	10	11	12
	4	5	6	7	8	9	10	11	12

(*) 60-IN REDUCED RISER IS TO BE USED WHEN DEEMED NECESSARY TO SATISFY WALL PENETRATION SPACING REQUIREMENTS.

DISCLAIMER: THE USE OF THIS STANDARD IS COVERED BY THE TEXAS ENGINEERING PRACTICE ACT. THE DESIGN REQUIREMENTS ON THIS STANDARD DO NOT PURPORT TO ADDRESS ALL OF THE SAFETY CONCERNS ASSOCIATED WITH THEIR USE. THE ENGINEER OF RECORD (EOR) IS TO REVIEW THESE DESIGN REQUIREMENTS AND BY AUTHORIZING THEIR USE, ACCEPTS RESPONSIBILITY FOR THEIR APPLICATION, ADEQUACY AND SAFETY. NO WARRANTY OF ANY KIND IS MADE BY THE CITY OF HOUSTON FOR ANY PURPOSES WHATSOEVER. THE CITY OF HOUSTON ASSUMES NO RESPONSIBILITY FOR INCORRECT RESULTS OR DAMAGES RESULTING FROM ITS USE.

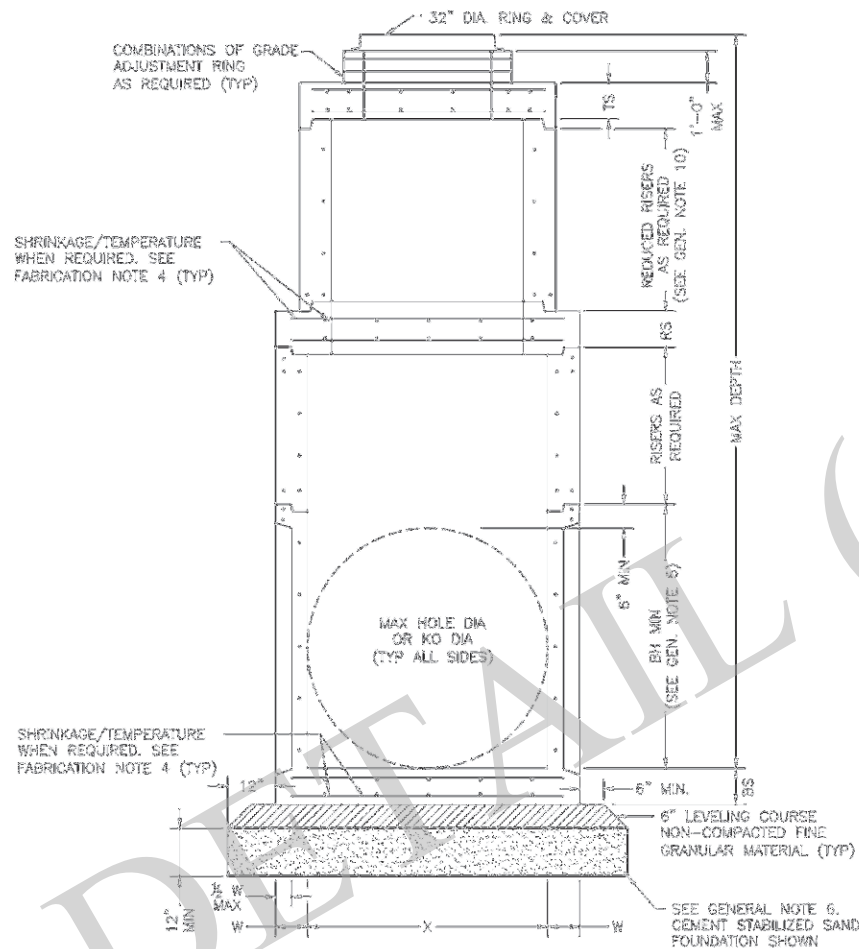
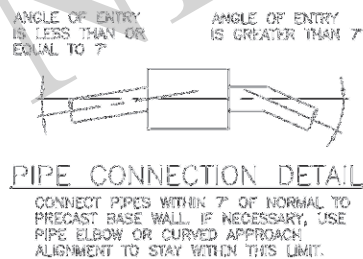


ELEVATION A-A
FLAT SLAB TOP WITH SHIP
LOOSE RING & COVER OPTION

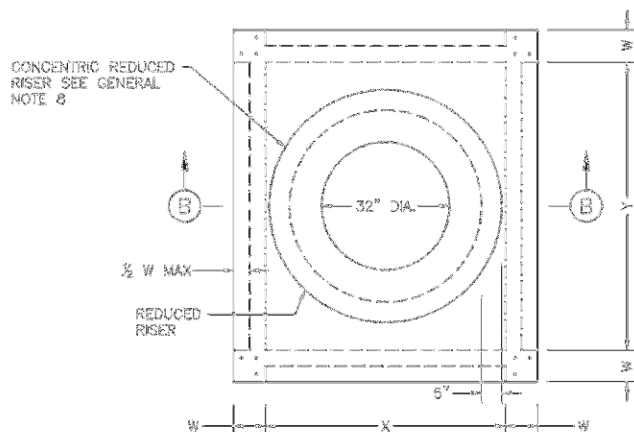


PLAN VIEW A
COVER NOT SHOWN

ECCENTRIC MANHOLE (PREFERRED CONFIGURATION)



ELEVATION B-B
FLAT SLAB TOP WITH SHIP
LOOSE RING & COVER OPTION



PLAN VIEW B
COVER NOT SHOWN

CONCENTRIC MANHOLE (ALTERNATE CONFIGURATION)

TABLE 1

PRECAST BOX MANHOLE (PBM) MINIMUM REQUIREMENTS FOR 24 IN. TO 78 IN. INTERNAL DIA STORM SEWER PIPES										
SIZE	BASE UNIT THICKNESS	BASE UNIT DIA. RISE	REDUCED RISER DIA.	REDUCED RISER THICKNESS	TOP RING THICKNESS	MAX. DEPTH TO TOP OF BASE SLAB	MIN. HEIGHT FOR THE RING (IN.)	MAX. RING DIA. (IN.)	MAX. RING DIA. (IN.)	MAX. RING DIA. (IN.)
X & Y	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
30X30	6	6	N/A	N/A	9	25	3.50	36	36	36
36X36	6	6	N/A	N/A	9	25	4.50	42	42	42
42X42	6	6	N/A	N/A	9	25	5.50	48	48	48
48X48	6	6	42 IN.	9	9	25	6.50	54	54	54
54X54	6	6	48 IN.	9	9	25	7.50	60	60	60
60X60	6	6	54 IN.	9	9	25	8.50	66	66	66
66X66	6	6	60 IN.	9	9	25	9.50	72	72	72
72X72	6	6	66 IN.	9	9	25	10.50	78	78	78

TABLE 1 NOTES:
1. () ROUND MANHOLES ARE PREFERRED FOR THESE SIZES.
2. () UNLESS OTHERWISE INDICATED.
3. TABLE IS VALID FOR UP TO 25 FT OF INSTALLATION DEPTH.

FABRICATION NOTES:

1. PROVIDE CLASS "H" CONCRETE IN ACCORDANCE WITH TEXAS DEPARTMENT OF TRANSPORTATION ITEM 421 AND HAVING A MINIMUM COMPRESSIVE STRENGTH OF 5,000 PSI.
2. PROVIDE GRADE 60 REINFORCING STEEL OR EQUIVALENT AREA OF WWR. PROVIDE CIRCUMFERENTIAL REINFORCING STEEL IN VERTICAL WALLS OF RISER AND CONE IN ACCORDANCE WITH ASTM C478.
3. PROVIDE TYPICAL MINIMUM CONCRETE CLEAR COVER OF 1 1/2" TO REINFORCING STEEL AT INTERIOR OR EXTERIOR WALLS.
4. SLABS WITH A THICKNESS OF 8" OR GREATER REQUIRE SHRINKAGE AND TEMPERATURE REINFORCING STEEL. PROVIDE STEEL AREA = 0.11 IN²/FT EACH WAY.
5. MANUFACTURE BASE AND RISERS TO NEAREST 3" INCREMENT.
6. DESIGN TONGUE AND GROOVE JOINTS FOR FULL CLOSURE ON BOTH SHOULDERS. MINIMUM SPIGOT DEPTH IS 3/4".
7. PROVIDE LIFTING DEVICES IN CONFORMANCE WITH MANUFACTURER'S RECOMMENDATIONS.
8. PROVIDE CAST IRON SOLID COVER, UNLESS NOTED OTHERWISE ELSEWHERE IN THE PLANS.
9. MAXIMUM SPACING OF REINFORCEMENT IS 8".
10. AT MANUFACTURER'S OPTION, PROVIDE CAST OR CORED HOLES OR THIN WALL PANELS (KO) TO THE MAXIMUM DIA SHOWN FOR EACH. WHEN NO PENETRATION IS REQUIRED, IT IS ACCEPTABLE TO PROVIDE A WALL WITH NO SECTIONAL REDUCTION.
11. THREE DIFFERENT OPTIONS FOR CAPPING THE MANHOLE RISER NEAR THE FINISHED GRADE ARE ALLOWED. CONES CAN BE USED WHEN COVER IS SUFFICIENT TO ALLOW FOR PROPER PLACEMENT. FLAT LIDS ARE TO BE USED WHERE COVER IS LIMITED. REFER TO 02082-12 FOR OPTIONS.
12. BASES AND RISERS MAY HAVE CAST, CUT OR THIN WALL PANEL (KO) THAT ARE ROUND AND DO NOT EXTEND INTO THE FLOOR, INTO WALLS, OR WITHIN 8" OF THE JOINT ABOVE OR BELOW.

INSTALLATION NOTES:

1. IF REQUIRED ELSEWHERE, INVERTS (BENCHING) TO BE PROVIDED BY CONTRACTOR. CONCRETE OR MORTAR USED FOR INVERT IS SUBSIDIARY TO MANHOLE. REFER TO CITY OF HOUSTON SPECIFICATION SECTION 02082 FOR INVERT (BENCHING) REQUIREMENTS.
2. SEAL TONGUE AND GROOVE JOINTS WITH PREFORMED OR BULK MASTIC IN CONFORMANCE WITH MANUFACTURER'S RECOMMENDATIONS. TONGUE AND GROOVE JOINTS MAY BE GROUTED NO MORE THAN 1" BETWEEN EACH SECTION, OR 1/2 THE JOINT DEPTH, WHICHEVER IS GREATER.
3. DO NOT GROUT RUBBER GASKET JOINTS WITHOUT MANUFACTURER'S RECOMMENDATION.
4. FOR RIGID PIPE, CUT HOLE IN THIN WALL PANEL (KO) 4" MAX, 2" MIN LARGER THAN PIPE OD.
5. FOR FLEXIBLE PIPE, CONSULT BOOT/SEAL MANUFACTURER'S SPECIFICATION FOR PLACEMENT TOLERANCE AND HOLE SIZE. CENTER PIPE IN HOLE AND INSTALL BOOT/SEAL PER MANUFACTURER'S SPECIFICATION.
6. INITIAL INSTALLATION OF GRADE ADJUSTMENT RINGS IS LIMITED TO 1'-6" MAX AS SHOWN.
7. GRADE ADJUSTMENT RINGS MAY BE INCREASED TO 1'-6" MAX WHEN FUTURE CONSTRUCTION AFFECTS FINAL GRADE OF STRUCTURE. MAKE ADJUSTMENTS GREATER THAN 1'-6" WITH ADDITIONAL RISERS. ADJUSTMENTS MAY BE MADE UP TO THE MAX DEPTH OF 25'-0". STRUCTURE MUST BE EVALUATED IF MAX DEPTH WILL BE EXCEEDED.

GENERAL NOTES:

1. SEE TABLE 1 FOR MINIMUM DESIGN REQUIREMENTS. CONCENTRIC RISER WITH RESPECT TO BASE (ALTERNATE CONFIGURATION) FALLS OUTSIDE THE SCOPE OF REQUIREMENTS PROVIDED. ENGINEER OF RECORD ACCEPTS RESPONSIBILITY FOR SAFETY AND ADEQUACY OF MANHOLE IF THE ALTERNATE CONFIGURATION IS USED.
2. DESIGNED ACCORDING TO ASTM C478 AND/OR ASTM C813.
3. PAYMENT FOR PRECAST MANHOLE PER SECTION 02082 "PRECAST CONCRETE MANHOLES."
4. PRECAST BASE CONSISTS OF BASE SLAB, BASE UNIT, RISERS (AS REQUIRED), REDUCING SLAB (AS REQUIRED), AND REDUCED RISERS (AS REQUIRED).
5. MIN HEIGHT SHOWN FOR STOCK BASE UNITS. USE STOCK BASE UNITS WHENEVER PRACTICAL. SMALLER HEIGHT BASE UNITS CAN BE USED IN SPECIAL INSTALLATION CIRCUMSTANCES, WHEN NOTED ELSEWHERE IN THE PLANS. ABSOLUTE MINIMUM HEIGHT OF BASE UNITS IS 2'-6".
6. FOUNDATION/SUBGRADE TO BE DESIGNED BY ENGINEER AND MEET MINIMUM REQUIREMENTS ACCORDING TO SECTION 02082.
7. ALL STORM WATER MANHOLES ARE TO BE PRECAST CONCRETE, UNLESS OTHERWISE NOTED ELSEWHERE IN THE PLANS.
8. ECCENTRIC REDUCED RISER WITH RESPECT TO BASE IS THE PREFERRED MANHOLE CONFIGURATION. CONCENTRIC REDUCED RISER WITH RESPECT TO BASE MANHOLE CONFIGURATION IS AN ALTERNATE DESIGN THAT WILL BE ACCEPTED BASED ON THE NEEDS OF THE CITY OF HOUSTON.
9. MANHOLE SIZE SHALL CONSIDER ENGINEERING ECONOMY. THIS DETAIL IS NOT APPLICABLE TO BOX MANHOLES LARGER THAN 8-FOOT BY 8-FOOT.
10. REFER TO STORM SEWER TYPE 'C' PRECAST ROUND MANHOLE DETAIL (02082-12) FOR REDUCED RISER DESIGN REQUIREMENTS.

CITY OF HOUSTON HOUSTON PUBLIC WORKS

STORM SEWER PRECAST BOX MANHOLE

(NOT TO SCALE)

APPROVED BY:

APPROVED BY:

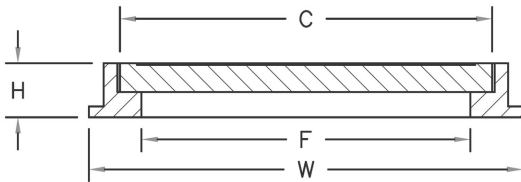
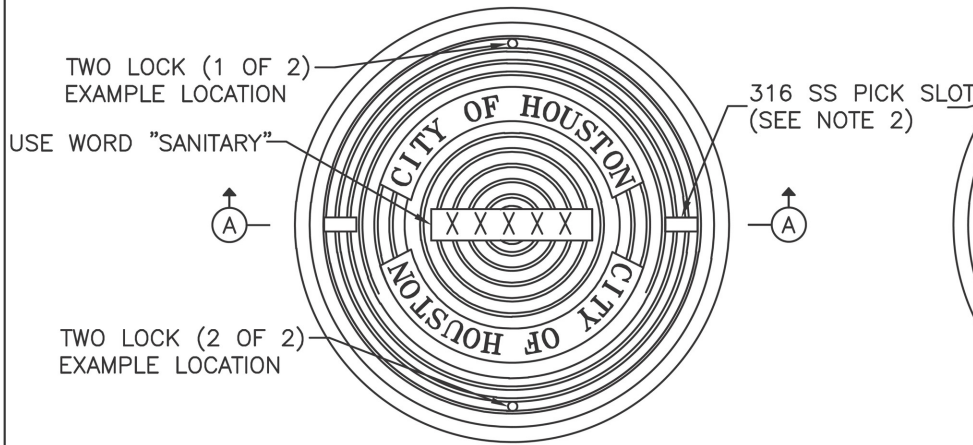
CITY ENGINEER

DIRECTOR OF
HOUSTON PUBLIC WORKS

EFF DATE: JUL-01-2021

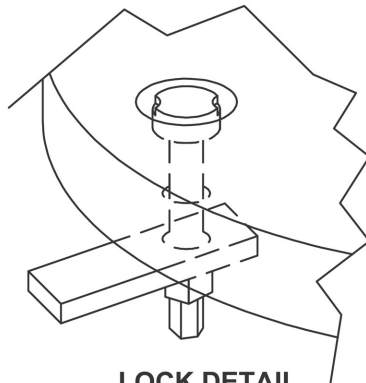
DWG NO: 02082-13

ASSEMBLY VIEW

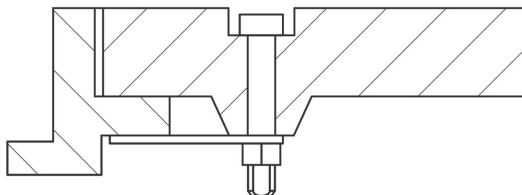


SECTION A-A

COVER SIZE	C	F	H	W
	IN (MAX)	IN (EXACT)	IN (MAX)	IN (MAX)
32"	35.75	30.00	5.00	41.00

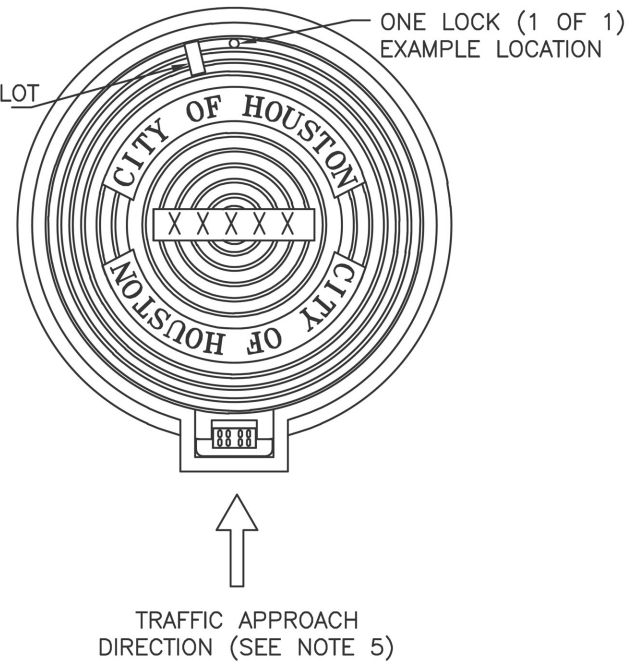


LOCK DETAIL



LOCK CUT AWAY SECTION DETAIL

ASSEMBLY VIEW - W/ HINGE



NOTES:

1. FRAME AND COVER MEETS OR EXCEEDS REQUIREMENTS FOR CITY OF HOUSTON SPECIFICATION 02091 – NON METALLIC FRAMES, GRATES, RINGS, AND COVERS.
2. COVER SHALL HAVE A MINIMUM OF ONE (1) 316 STAINLESS STEEL PICK BAR SLOT MOLDED IN THE COMPOSITE MATRIX.
3. LOCK AND BOLT SHALL BE 316 STAINLESS STEEL AND BE $\frac{1}{4}$ " TURN CAM/PADDLE TYPE.
4. MANHOLE DESIGNS WITHOUT HINGES MUST INCLUDE A MINIMUM OF TWO (2) LOCKS LOCATED ON OPPOSITE EDGES. DESIGNS WITH A HINGE MUST INCLUDE A MINIMUM OF ONE (1) LOCK LOCATED OPPOSITE EDGE OF THE HINGE MECHANISM.
5. MANHOLE INSTALLATIONS WITH HINGES SHALL ORIENT HINGES PARALLEL TO TRAFFIC FLOW DIRECTION. THE HINGE WILL BE LOCATED ON THE APPROACHING DIRECTION OF TRAFFIC.

CITY OF HOUSTON HOUSTON PUBLIC WORKS

NON-METALLIC MANHOLE FRAME AND COVER (NOT TO SCALE)

APPROVED BY:

CITY ENGINEER

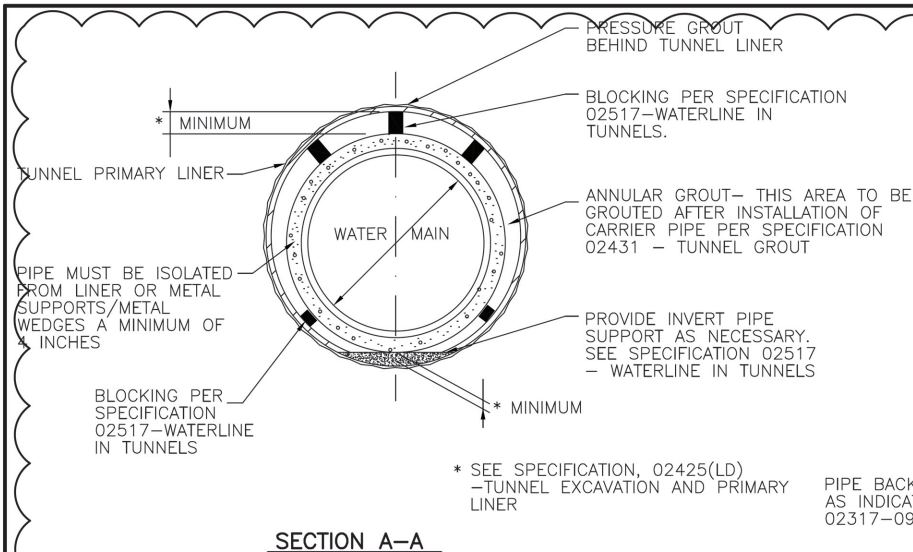
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APPROVED BY:

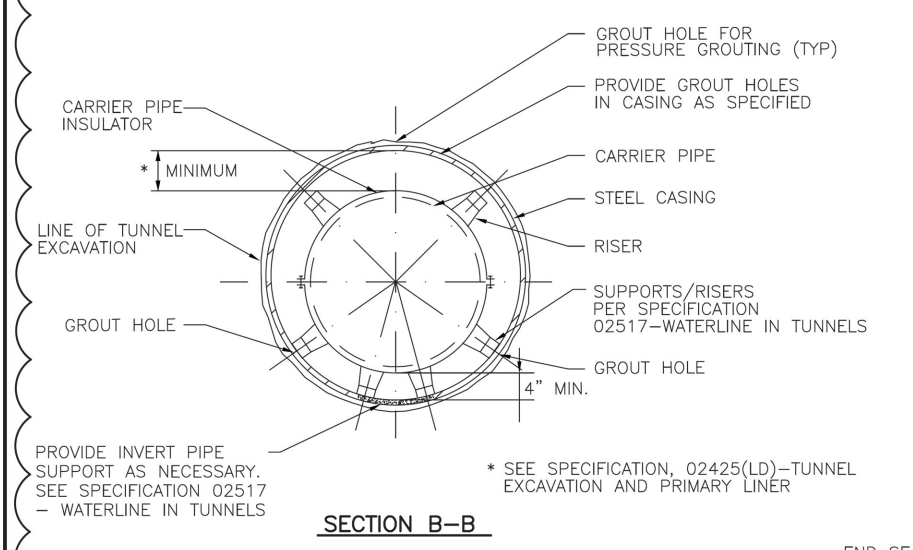
DIRECTOR OF
HOUSTON PUBLIC WORKS

DWG NO: 02091-01

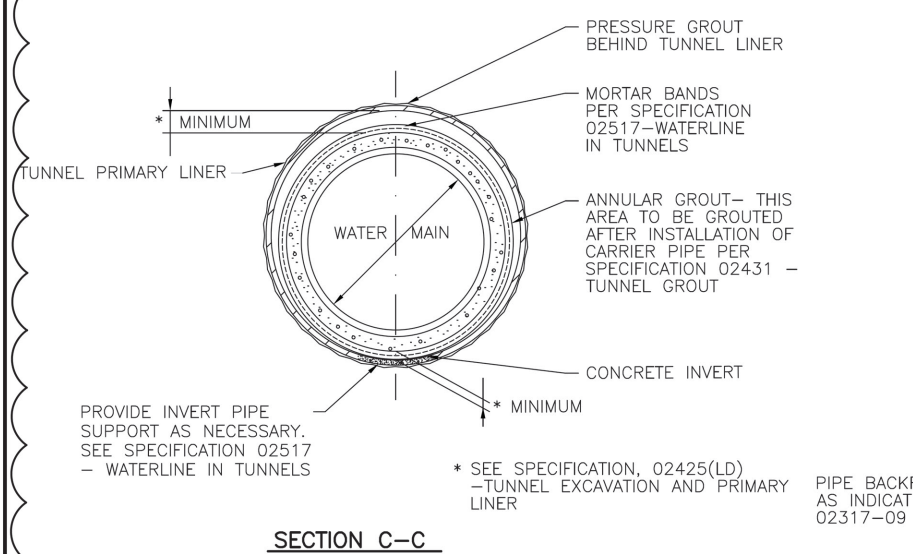




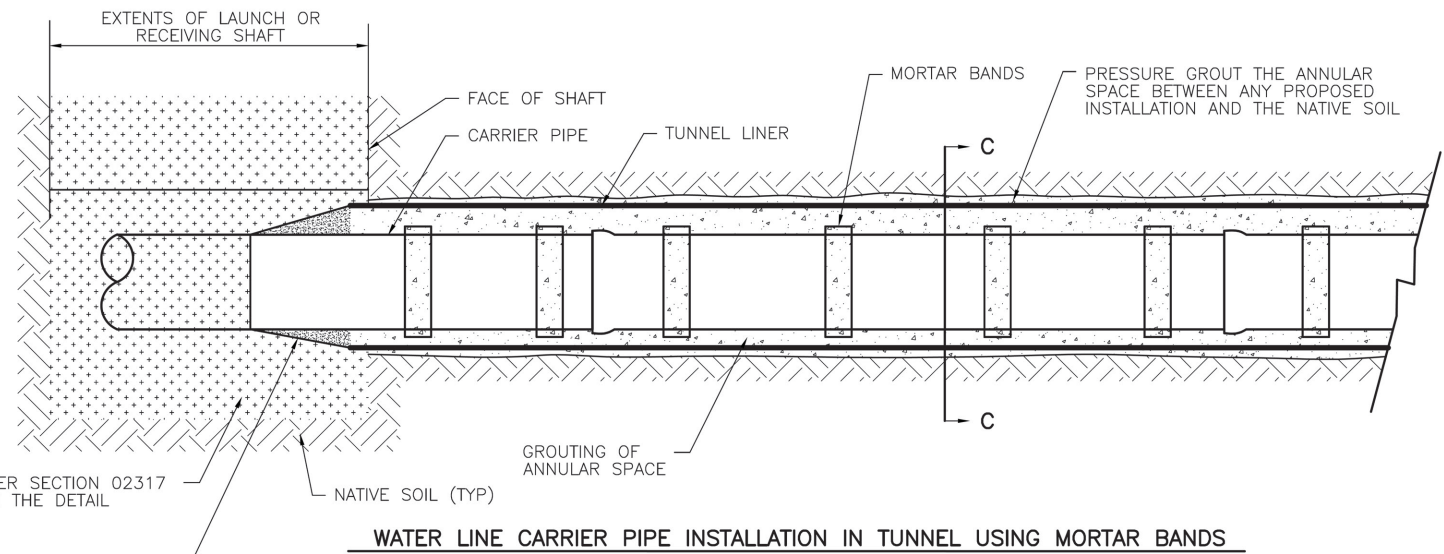
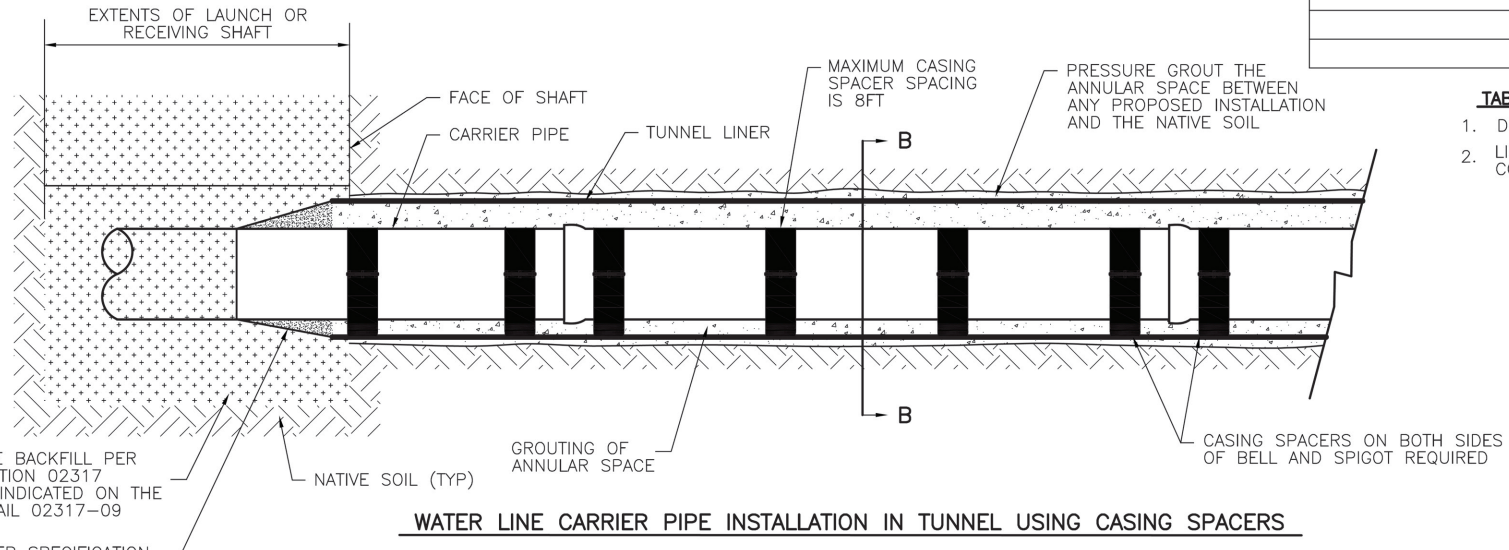
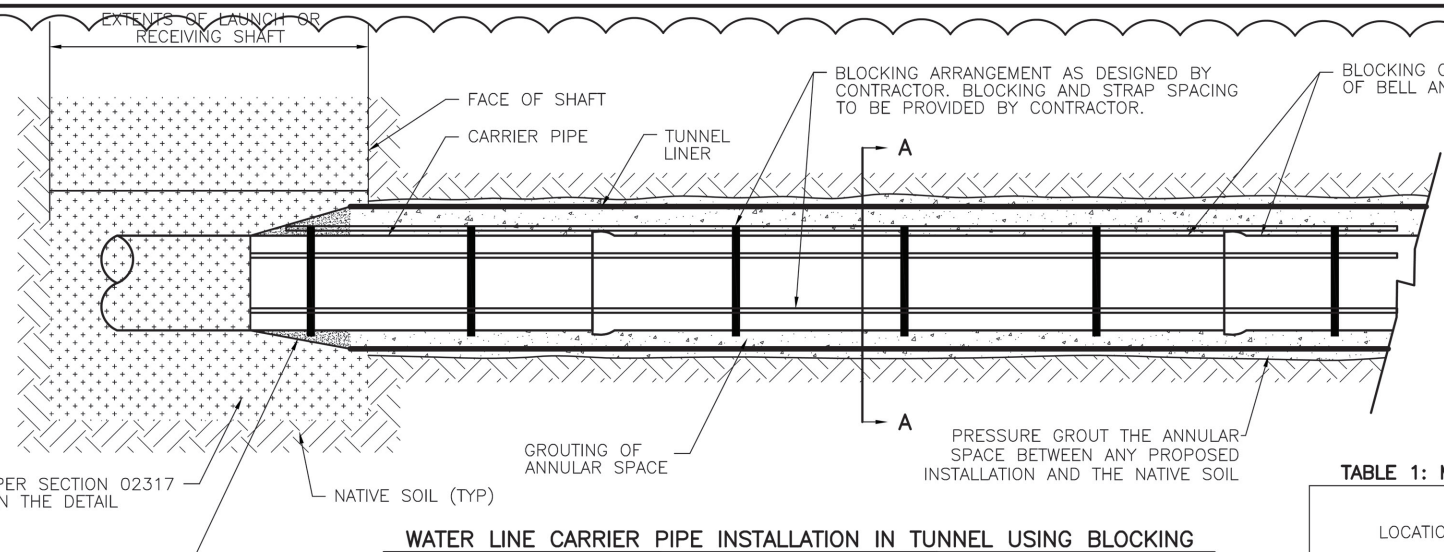
1 **WATER LINE CARRIER PIPE INSTALLATION IN TUNNEL USING BLOCKING**



2 **WATER LINE CARRIER PIPE INSTALLATION IN TUNNEL USING CASING SPACERS**



3 **WATER LINE CARRIER PIPE INSTALLATION IN TUNNEL USING MORTAR BANDS**



GENERAL NOTES:

1. DETAIL IS FOR PRESTRESSED CONCRETE CYLINDER PIPE (BAR WRAPPED STEEL CYLINDER PIPE, STEEL PIPE AND D.I.P. ALTERNATE SIMILAR).
2. MINIMUM CLEARANCES SHOWN ON THE PLAN & PROFILE DRAWINGS ARE TO THE O.D. OF TUNNEL LINER. ADJUST PROFILE AS REQUIRED TO MAINTAIN CLEARANCES IDENTIFIED. NO SEPARATE PAY.
3. DIAMETERS INDICATED ON PLANS ARE NOMINAL DIAMETERS.

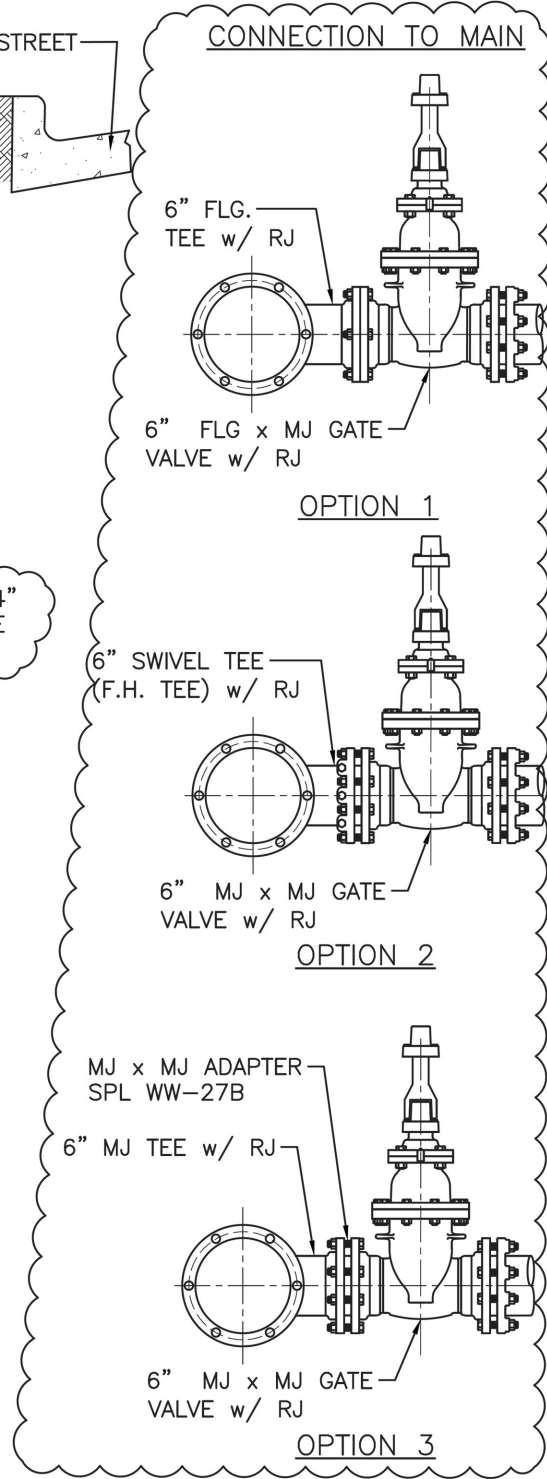
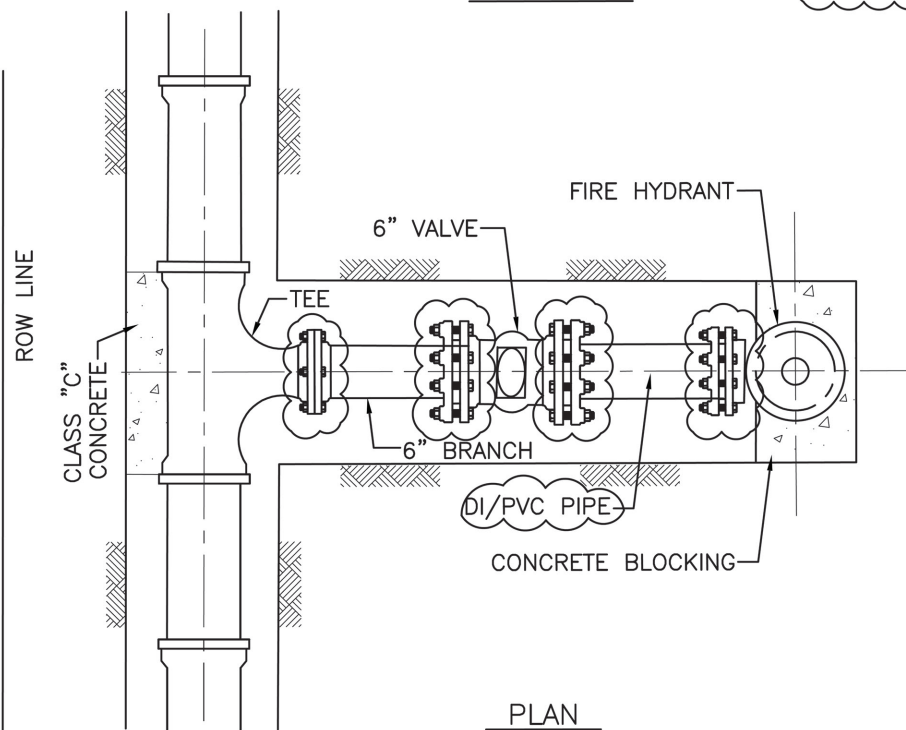
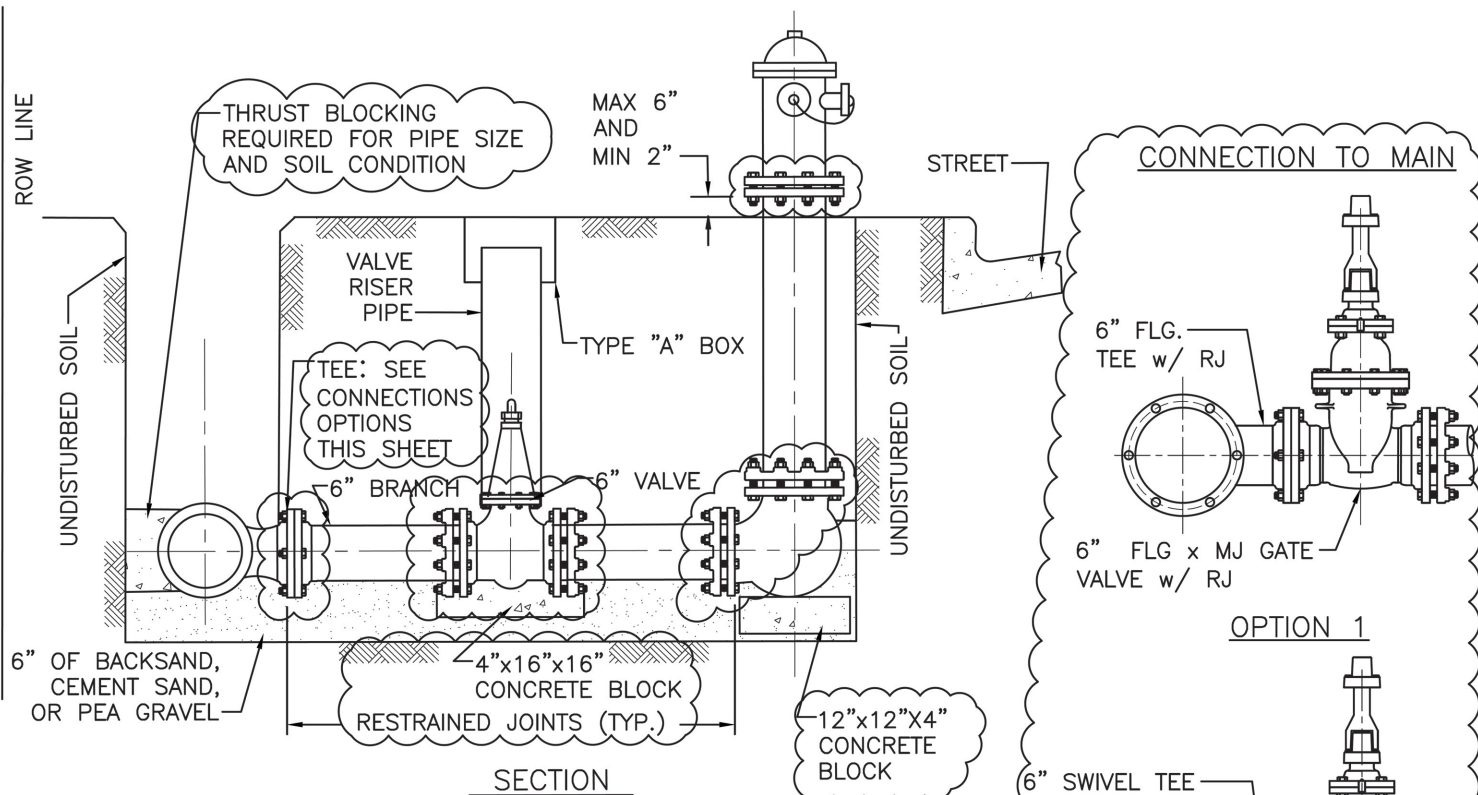
TABLE 1: MINIMUM TUNNEL LINER / CASING SIZES AND THICKNESS

LOCATION	WATER MAIN DIA.	PIPE MATERIAL	NOMINAL DIA ⁽¹⁾ (.IN)/(CASING O.D.)/WALL THICKNESS (IN.)		
			2-FLANGE ⁽²⁾ LINER PLATE	4-FLANGE LINER PLATE	STEEL CASING

TABLE 1 - NOTES:

1. DIAMETER OF LINER PLATE IS AT NEUTRAL AXIS.
2. LINER PLATE IS TWO FLANGE AND NOMINALLY 2-INCH CORRUGATION BY 6-INCH PROFILE.

CITY OF HOUSTON HOUSTON PUBLIC WORKS	
LDWL TUNNEL AND CASING DETAILS FOR WATER LINES 24-INCH AND LARGER	
(NOT TO SCALE)	
APPROVED BY:	APPROVED BY:
CITY ENGINEER	DIRECTOR OF HOUSTON PUBLIC WORKS
EFF DATE: JUL - 01 - 2021	DWG NO: 02517-01



NOTES:

1. LOCATE FIRE HYDRANTS AT POINT OF CURVATURE (PC) OR POINT OF TANGENCY (PT) OF THE INTERSECTION CURB RADIUS, 3 FEET BEHIND CURB OR PROJECTED FUTURE CURB.
2. ON OPEN-DITCH ROADWAYS, SET THE FIRE HYDRANTS WITH IN 5 FEET OF RIGHT-OF-WAY LINES.
3. FIRE HYDRANT STEAMER NOZZLE SHALL FACE THE STREET.
4. LOCATE HYDRANT VALVE IMMEDIATELY ADJACENT TO WATER LINE.
5. ALL PIPING TO BE RESTRAINED JOINTS.

CITY OF HOUSTON
HOUSTON PUBLIC WORKS

**STANDARD
FIRE HYDRANT DETAIL**

(NOT TO SCALE)

APPROVED BY:

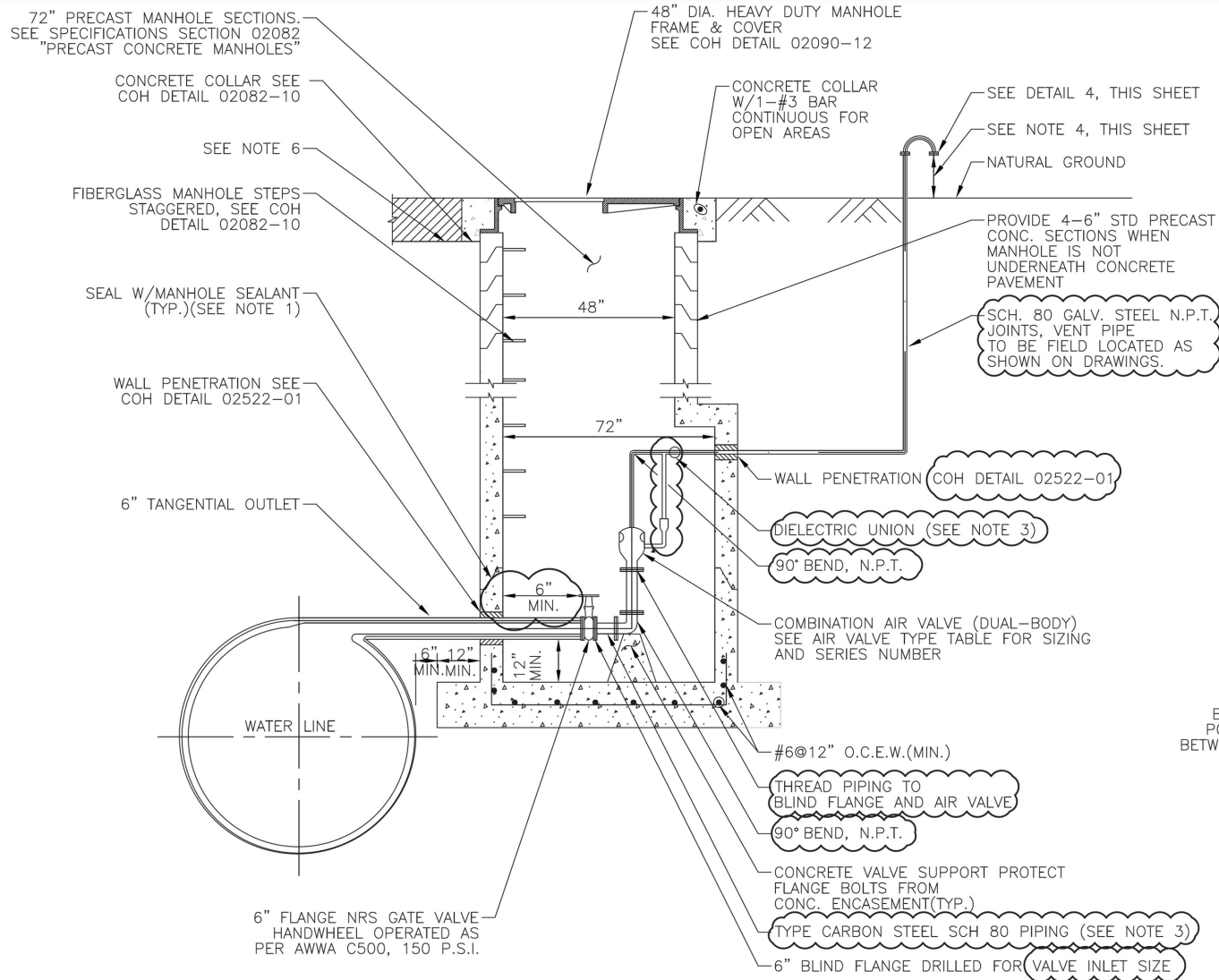
CITY ENGINEER

EFF DATE: JUL - 01 - 2021

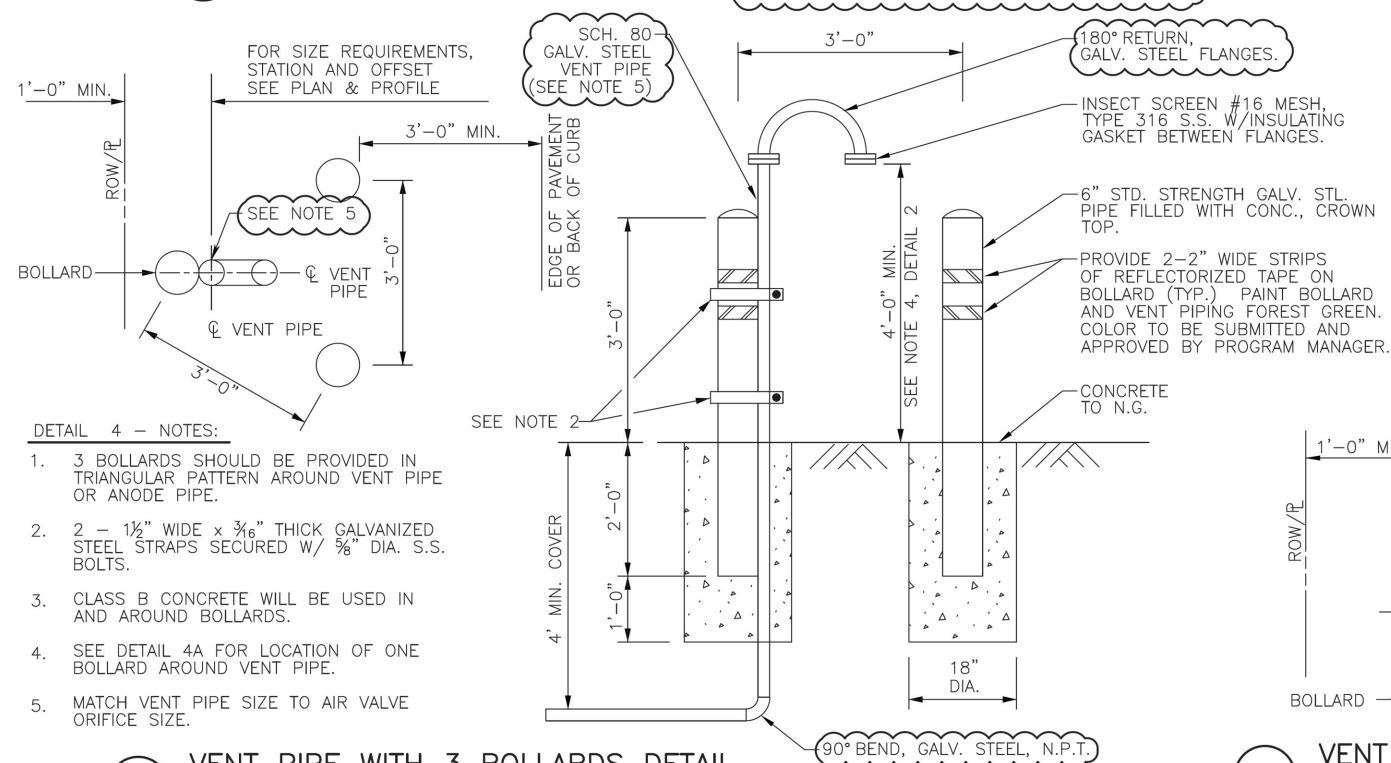
APPROVED BY:

DIRECTOR OF
HOUSTON PUBLIC WORKS

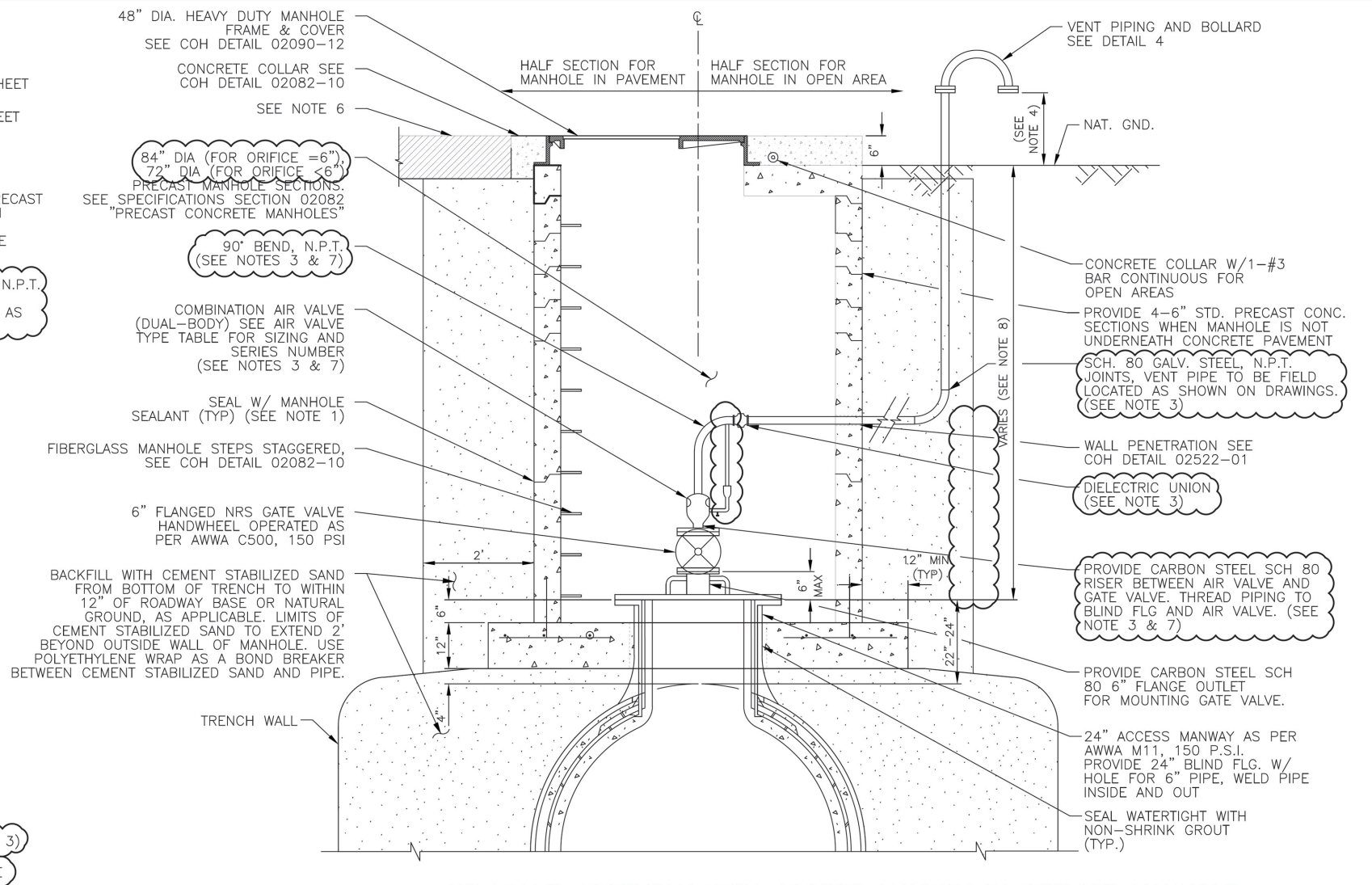
DWG NO: 02520-01



1 LOW PROFILE AIR VALVE ASSEMBLY
(FOR WATER LINES 36-INCH TO 96-INCH DIAMETER, ONLY IF SPECIFIED IN PLAN AND PROFILE SHEETS)



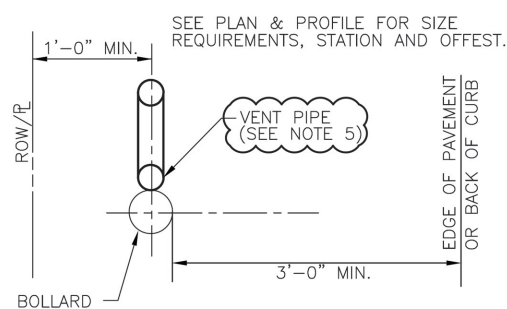
4 VENT PIPE WITH 3 BOLLARDS DETAIL



2 AIR VALVE ASSEMBLY WITH ACCESS MANWAY IN SERVICE MANHOLE
(FOR WATER LINES 36-INCH TO 96-INCH DIAMETER)

WATER MAIN DIAMETER	MANUFACTURER (1)	VACUUM (AI/VR)		AIR RELEASE		
		SERIES	ORIFICE SIZE	SERIES	INLET SIZE (NPT)	ORIFICE SIZE (2)
>=36" <=96"	APCO	1500C		200A	1"	
	CLAVAL	38VB		34AR-C	1"	
	PRATT	WAVB		WAR 02	1"	

3 AIR VALVE & TYPE TABLE
(FOR WATER LINES 36" TO 96" DIAMETER)



4A VENT PIPE WITH 1 BOLLARD DETAIL

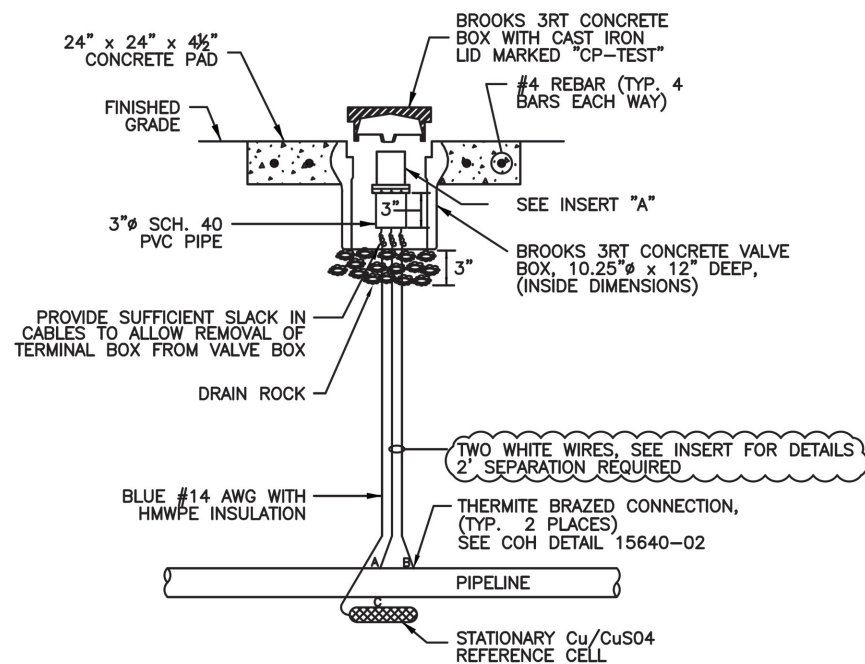
DETAILS 1 & 2 - NOTES:

1. PROVIDE RAM-NEK OR APPROVED EQUAL BETWEEN PRECAST SEGMENTS OF THE MANHOLE.
2. FOR MANHOLES DEEPER THAN 20 FEET, SAFETY CLIMBING RAIL MUST BE PROVIDED (SAF-T-CLIMB OR APPROVED EQUAL). SEE COH DETAIL 02082-11.
3. PIPING AND APPURTENANCES OF THE SAME DIAMETER AND CONSTRUCTED OF THE SAME MATERIAL AND CLASS.
4. VERIFY THAT LOCATION OF VENT PIPE SCREEN IS 1 FOOT ABOVE 100-YEAR FLOOD PLAIN ELEVATION OR 4 FEET ABOVE NATURAL GROUND WHICHEVER IS HIGHER.
5. REFER TO PLAN AND PROFILE SHEETS FOR LOCATIONS OF AIR VALVES.
6. FOR PAVEMENT REPAIR, SEE COH DETAILS 02902-01 & 02902-02.
7. PROVIDE AN APPROVED PETROLATUM BASED TAPE ENCAPSULATING ALL BOLTS IN ACCESS MANHOLE.
8. USE "LOW PROFILE AIR VALVE ASSEMBLY DETAIL" ONLY IF SPECIFIED IN PLAN AND PROFILE SHEETS.
9. NATIONAL PIPE THREAD IS ABBREVIATED AS N.P.T. ON THIS DRAWING

DETAILS 3 - NOTES:

- (1) OR APPROVED EQUAL.
- (2) MINIMUM ORIFICE SIZE REQUIRED. TO BE UPDATED FOR EACH PROJECT BASED ON TRANSIENT ANALYSIS.

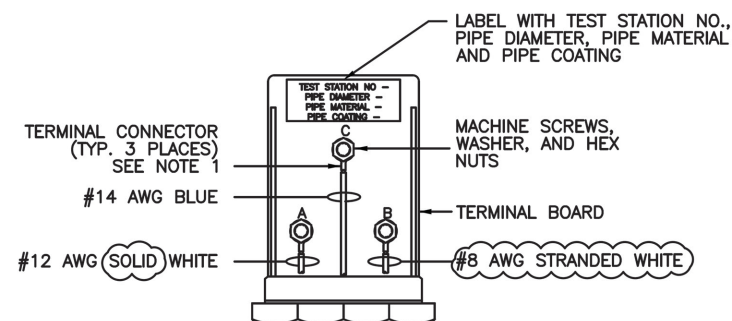
CITY OF HOUSTON HOUSTON PUBLIC WORKS	
LDWL AIR VALVE ASSEMBLY IN SERVICE MANHOLE DETAIL (NOT TO SCALE)	
APPROVED BY: CITY ENGINEER	APPROVED BY: DIRECTOR OF HOUSTON PUBLIC WORKS
EFF DATE: JUL - 01 - 2021	DWG NO: 02524-03



1 FLUSH MOUNTED POTENTIAL TEST STATION

WIRE CODING:

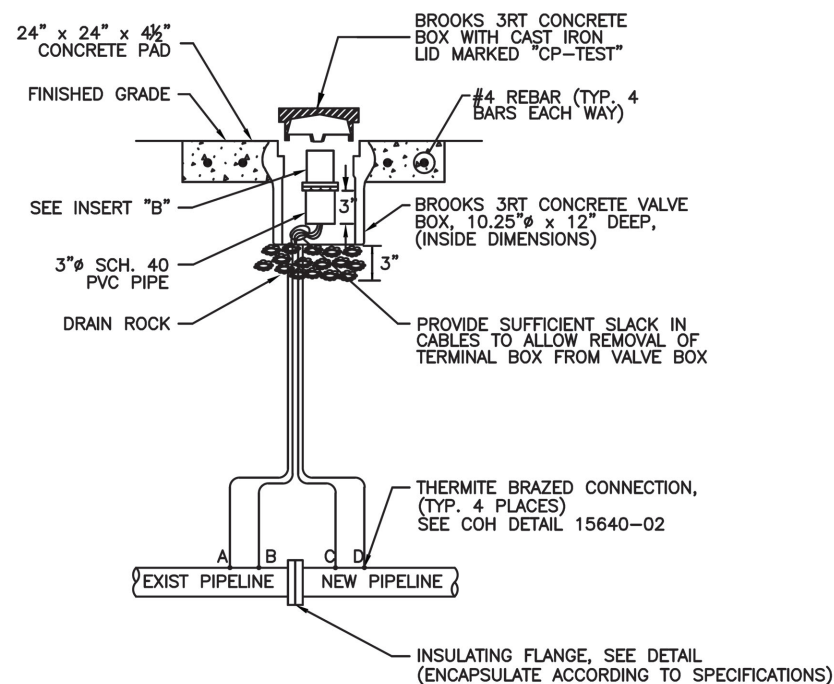
- * WIRES A & B ARE WHITE, WIRE C IS BLUE
- * WIRE A IS #12 AWG TW SOLID SINGLE CONDUCTOR WIRE
- * WIRE B IS #8 AWG TW STRANDED SINGLE CONDUCTOR
- * WIRES C IS #14 AWG WITH HMWPE INSULATION



INSERT A - NOTES:

1. TERMINAL CONNECTORS SHALL BE RING TONGUE, BRAZED, COPPER, NON-INSULATED WITH " 1/4" STUD SIZE

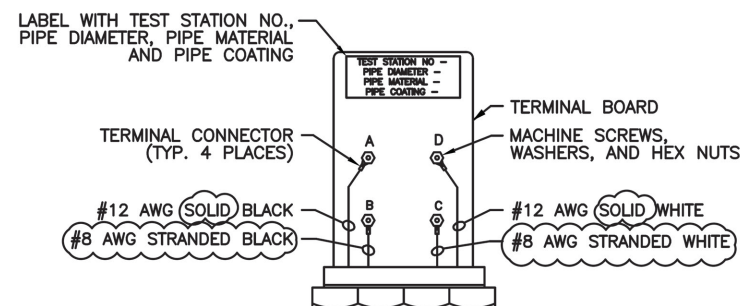
INSERT "A"



2 FLUSH MOUNTED FLANGE ISOLATION TEST STATION

WIRE CODING:

- * WIRES A & B ARE BLACK, WIRES C & D ARE WHITE
- * WIRES A & D ARE #12 AWG TW SOLID SINGLE CONDUCTOR WIRE
- * WIRES B & C ARE #8 AWG TW STRANDED SINGLE CONDUCTOR
- * BLACK WIRES ATTACHED TO UNPROTECTED OR EXISTING PIPE
- * WHITE WIRES ATTACHED TO PROTECTED OR NEW PIPE



INSERT B - NOTES:

1. TERMINAL CONNECTORS SHALL BE RING TONGUE, BRAZED, COPPER, NON-INSULATED WITH " 1/4" STUD SIZE

INSERT "B"

APPROVED BY:

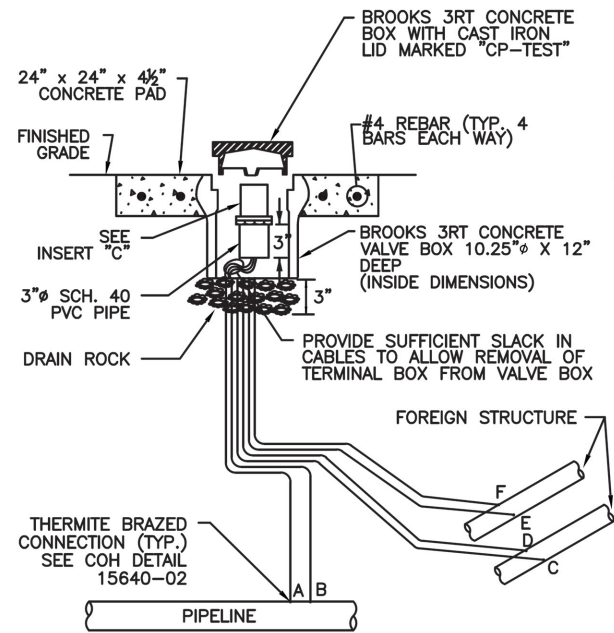
CITY ENGINEER

APPROVED BY:

DIRECTOR OF
HOUSTON PUBLIC WORKS

EFF DATE: JUL - 01 - 2021

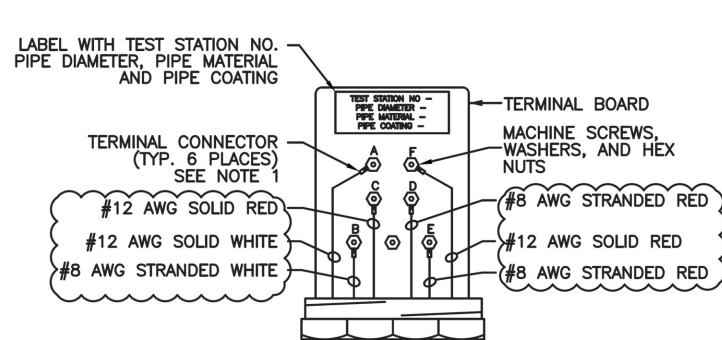
DWG NO: 15641-01



- DETAIL 3 - NOTES:
1. TEST STATION SHALL BE MOUNTED DIRECTLY ABOVE THE NEW WATER LINE.
 2. FOR MORE THAN TWO (2) FOREIGN LINES, INSTALL A COTTBOX TYPE TEST STATION. (UP TO 20 TERMINALS)

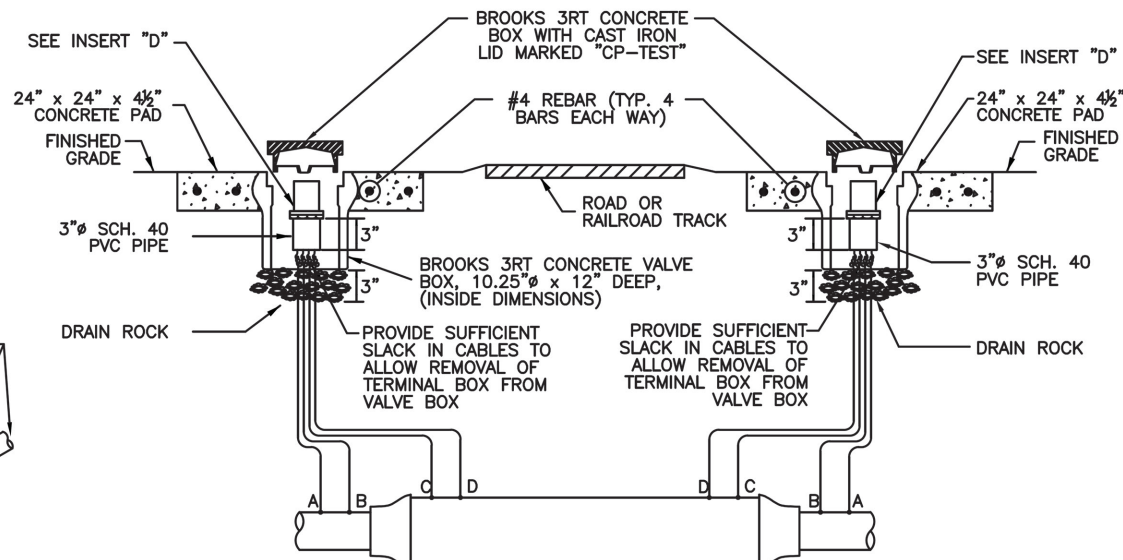
3 FLUSH MOUNTED FOREIGN LINE TEST STATION

- WIRING CODE:
- * WIRES A & B ARE WHITE
 - * WIRES C, D, E & F ARE RED
 - * WIRES A, C, F ARE #12 AWG TW SOLID COPPER WIRE
 - * WIRES B, D, E ARE #8 AWG TW STRANDED COPPER WIRE
 - * RED WIRES ATTACHED TO FOREIGN OWNED PIPE
 - * WHITE WIRES ATTACHED TO NEW PIPE



- INSERT C - NOTES:
1. TERMINAL CONNECTORS SHALL BE RING TONGUE, BRAZED, COPPER, NON-INSULATED WITH 1/4" STUD SIZE.

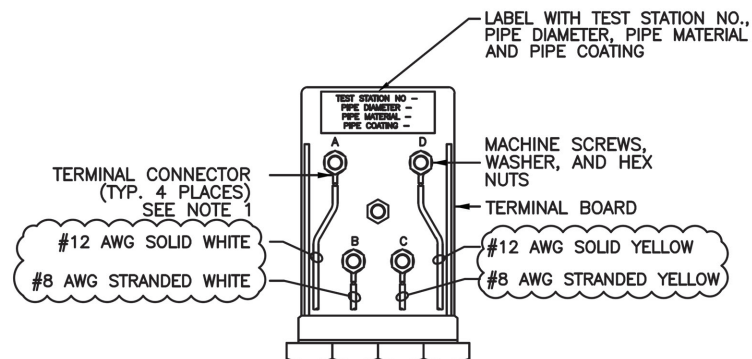
INSERT "C"



- DETAIL 4 - NOTES:
1. FOR PARALLEL CASED CROSSINGS, INSTALL A COTTBOX TYPE TEST STATION. (UP TO 20 TERMINALS)

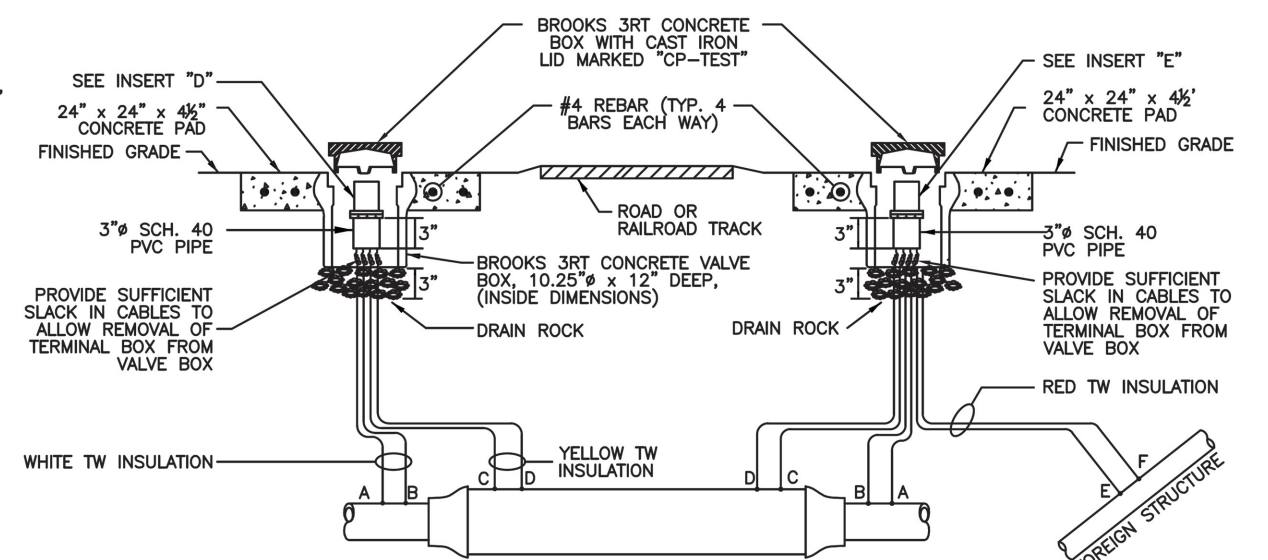
4 FLUSH MOUNTED CASED CROSSING TEST STATION

- WIRE CODING:
- * WIRES A & B ARE WHITE, WIRES C & D ARE YELLOW
 - * WIRES A & D ARE #12 AWG TW SOLID SINGLE CONDUCTOR WIRE
 - * WIRES B & C ARE #8 AWG TW STRANDED SINGLE CONDUCTOR
 - * YELLOW WIRES ATTACHED TO CASING
 - * WHITE WIRES ATTACHED TO PROTECTED OR NEW PIPE



- INSERT D - NOTES:
1. TERMINAL CONNECTORS SHALL BE RING TONGUE, BRAZED, COPPER, NON-INSULATED WITH 1/4" STUD SIZE.

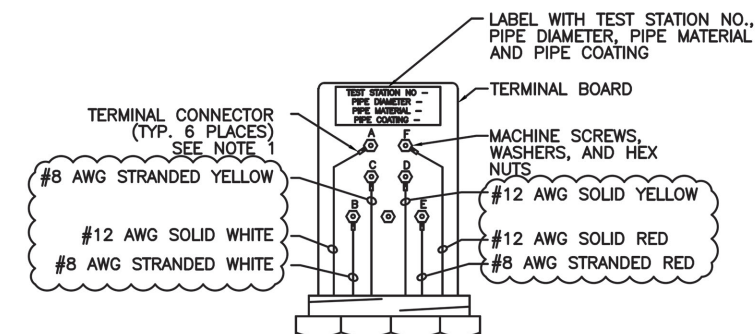
INSERT "D"



- DETAIL 5 - NOTES:
1. TEST STATION SHALL BE MOUNTED DIRECTLY ABOVE THE NEW WATER LINE.
 2. FOR MORE THAN ONE (1) FOREIGN LINE, INSTALL A COTTBOX TYPE TEST STATION. (UP TO 20 TERMINALS)

5 FLUSH MOUNTED CASED CROSSING AND FOREIGN LINE TEST STATION

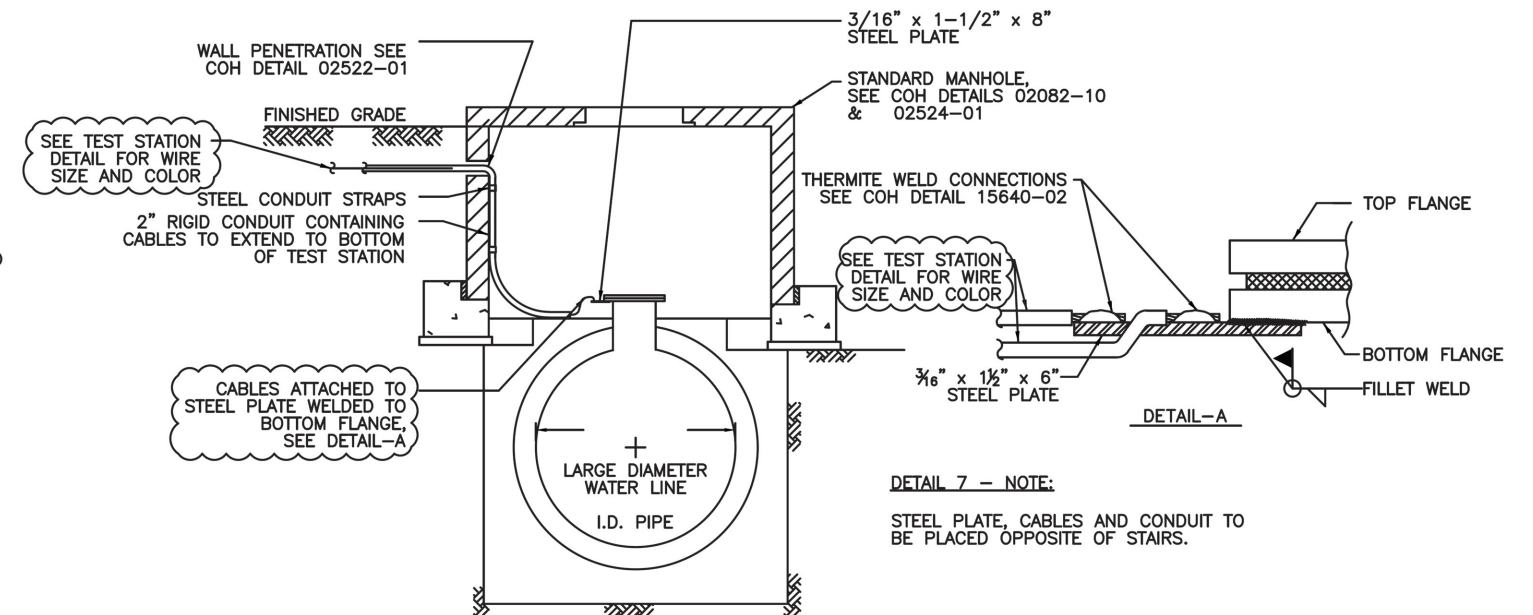
- WIRE CODING:
- * WIRES A & B ARE WHITE, WIRES C & D ARE YELLOW
 - * WIRES E & F ARE RED
 - * WIRES A, D & F ARE #12 AWG TW SOLID SINGLE CONDUCTOR WIRE
 - * WIRES B, C & E ARE #8 AWG TW STRANDED SINGLE CONDUCTOR
 - * WHITE WIRES ATTACHED TO PROTECTED OR NEW PIPE
 - * YELLOW WIRES ATTACHED TO CASING
 - * RED WIRES ATTACHED TO FOREIGN OWNED PIPE



- INSERT E - NOTES:
1. TERMINAL CONNECTORS SHALL BE RING TONGUE, BRAZED, COPPER, NON-INSULATED WITH 1/4" STUD SIZE.

INSERT "E"

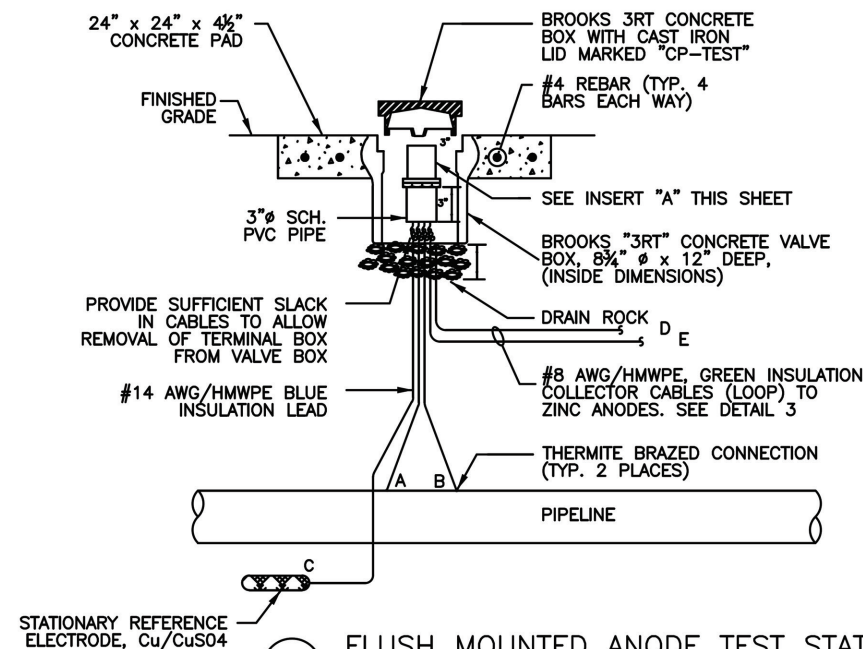
CITY OF HOUSTON HOUSTON PUBLIC WORKS	
STANDARD LDWL CATHODIC PROTECTION DETAILS FOR TEST STATIONS (SHEET 2 OF 3) (NOT TO SCALE)	
APPROVED BY:	APPROVED BY:
CITY ENGINEER	DIRECTOR OF HOUSTON PUBLIC WORKS
EFF DATE: JUL - 01 - 2021	DWG NO: 15641-02



7 TEST STATION INSTALLATION IN MANHOLE

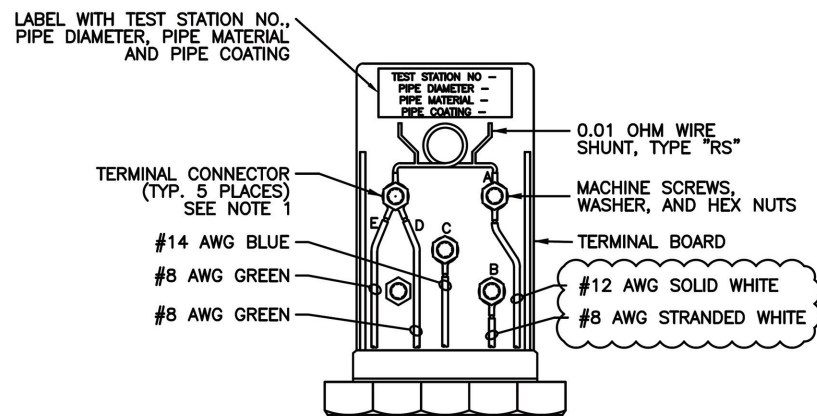
— LABEL WITH TEST STATION NO.,
PIPE DIAMETER, PIPE MATERIAL
AND PIPE COATING





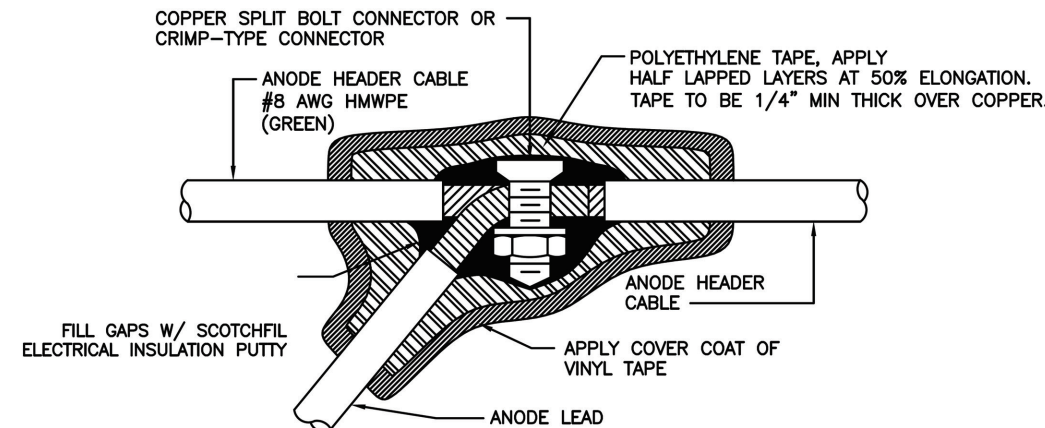
1 FLUSH MOUNTED ANODE TEST STATION

WIRE CODING:
 * WIRES A & B ARE WHITE
 * WIRE A IS #12 AWG TW SOLID SINGLE CONDUCTOR WIRE
 * WIRE B IS #8 AWG TW STRANDED SINGLE CONDUCTOR WIRE
 * WIRE C IS BLUE #14 AWG/HMWPE LEAD WIRE TO REFERENCE ELECTRODE
 * WIRES D & E ARE GREEN #8 AWG ANODE LEAD WIRE TO ANODE GROUND BED

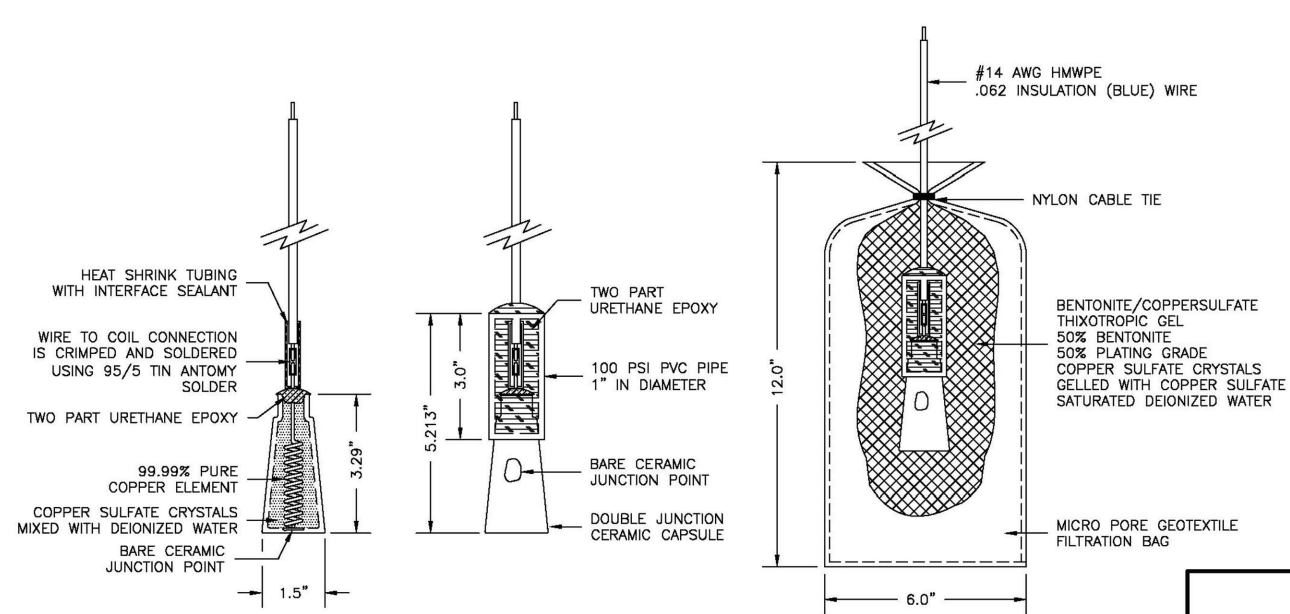


INSERT A - NOTES:
 1. TERMINAL CONNECTORS SHALL BE RING TONGUE, BRAZED, COPPER, NON-INSULATED WITH 1/4" STUD SIZE

INSERT "A"



3 ANODE TEST STATION PLAN
 ANODE SIZE AND SPACING REQUIREMENT PER DESIGN DRAWINGS

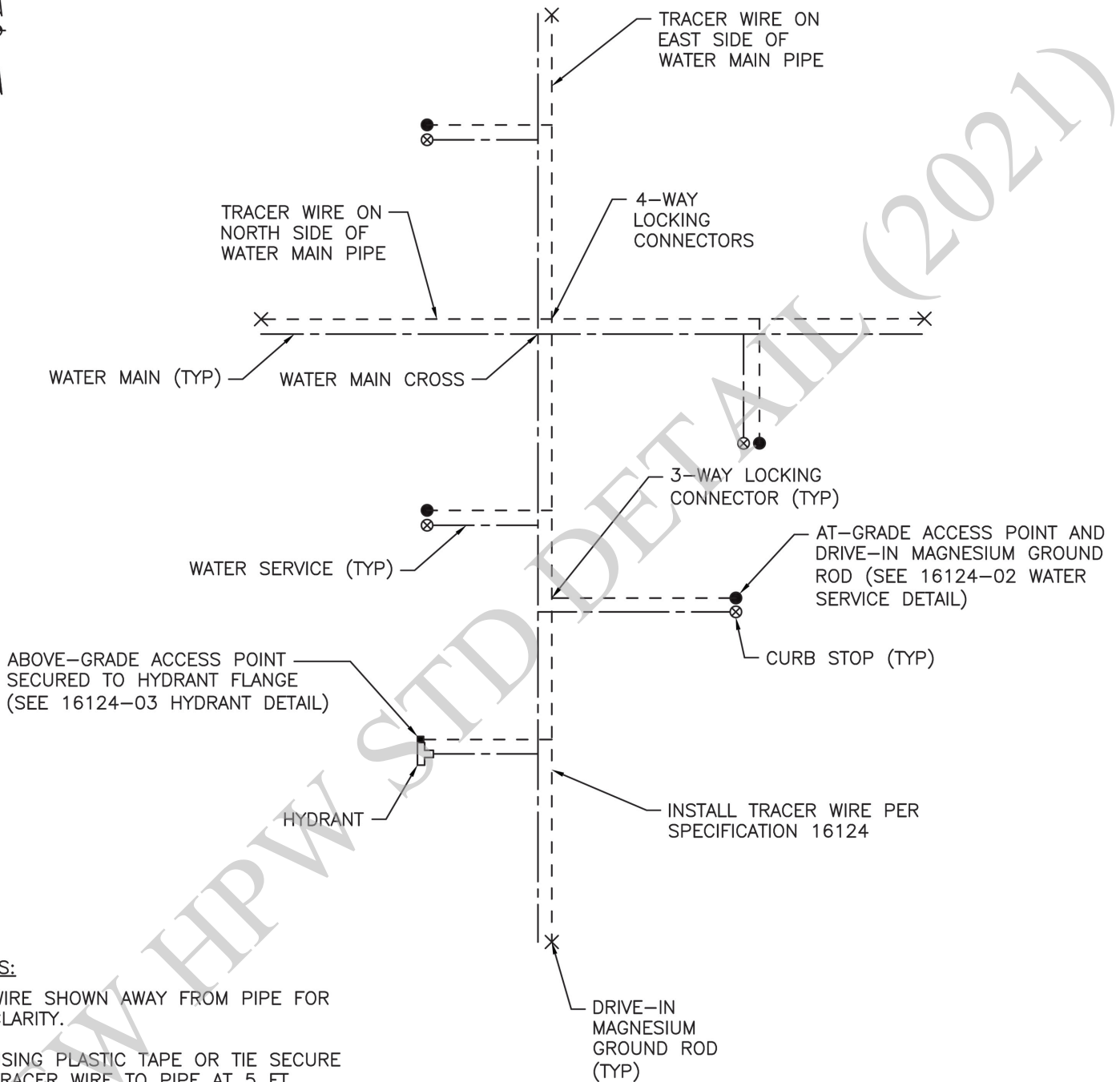


4 Cu/CuSO4 PERMACELL PLUS
 STATIONARY REFERENCE CELL

DETAIL 2 - NOTES:
 1. MAKE SPLICE WATERPROOF
 A. SMOOTH ALL IRREGULAR SURFACES WITH ELECTRICAL INSULATION PUTTY.
 B. APPLY 2 LAYERS OF HALF LAPPED RUBBER SPLICING TAPE.
 C. APPLY 2 LAYERS OF HALF LAPPED VINYL ELECTRICAL TAPE.
 2. NUMBER OF WIRES MAY VARY PER SPLICE

2 SPLICE DETAIL

CITY OF HOUSTON HOUSTON PUBLIC WORKS	
STANDARD LDWL CATHODIC PROTECTION DETAILS FOR TEST STATIONS & ANODES (NOT TO SCALE)	
APPROVED BY:	APPROVED BY:
CITY ENGINEER	DIRECTOR OF HOUSTON PUBLIC WORKS
EFF DATE: JUL - 01 - 2021	DWG NO: 16640-01



NOTES:

1. WIRE SHOWN AWAY FROM PIPE FOR CLARITY.
2. USING PLASTIC TAPE OR TIE SECURE TRACER WIRE TO PIPE AT 5 FT INTERVALS IN THE 3 O' CLOCK POSITION.

SAMPLE PLAN (WATER)
NOT TO SCALE

CITY OF HOUSTON
HOUSTON PUBLIC WORKS

**COMPLETE UTILITY LOCATING
SYSTEM SAMPLE PLAN (WATER)**

(NOT TO SCALE)

APPROVED BY:

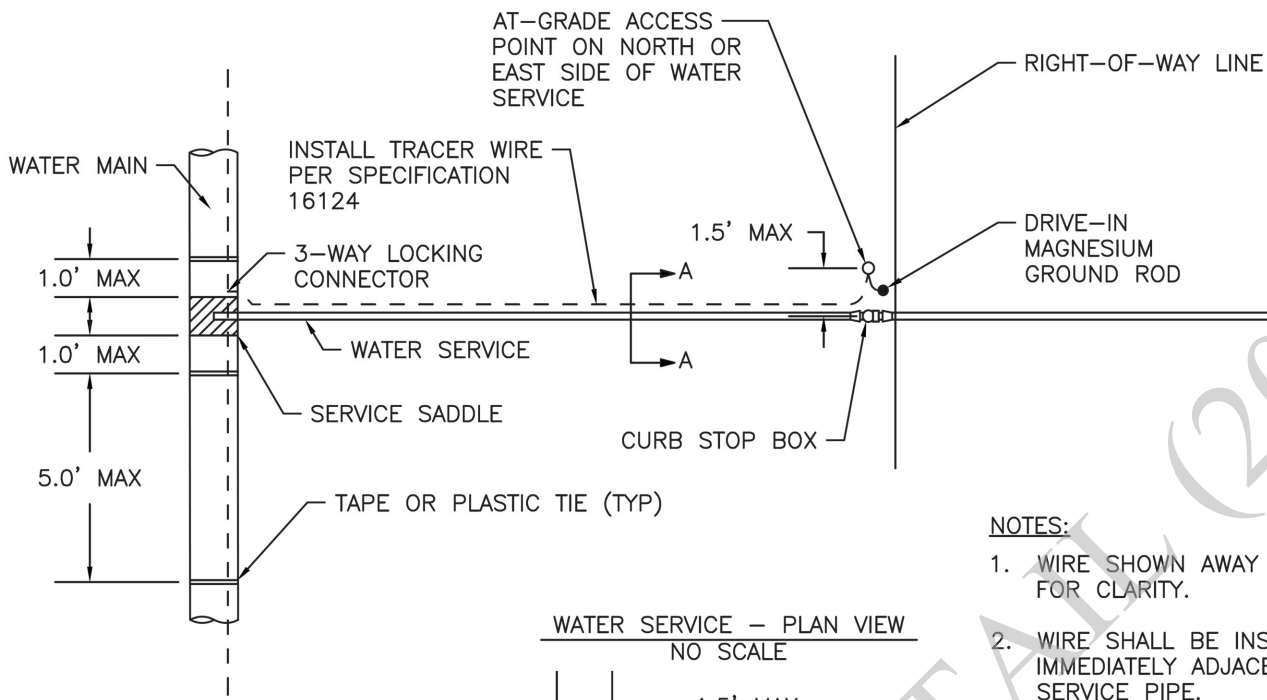
CITY ENGINEER

EFF DATE: JUL-01-2021

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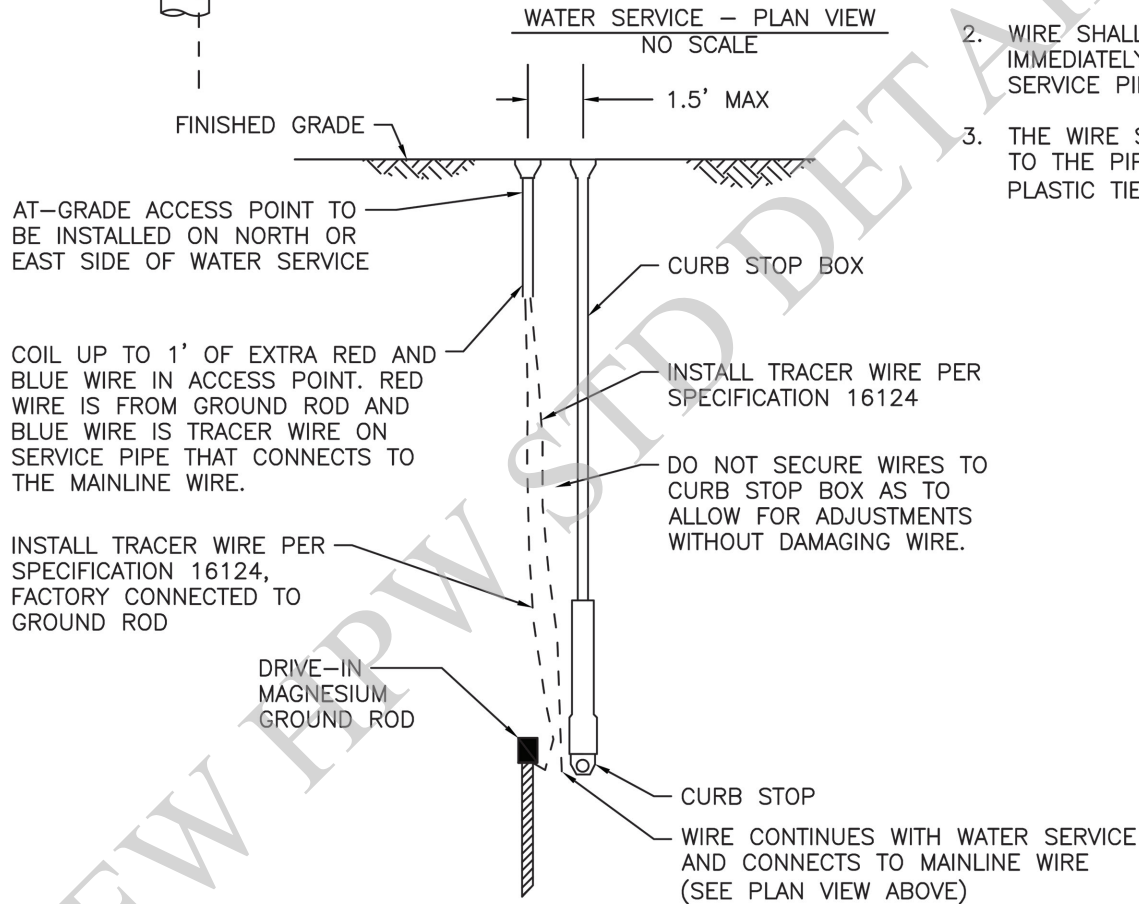
DIRECTOR OF
HOUSTON PUBLIC WORKS

DWG NO: 16124-01



NOTES:

1. WIRE SHOWN AWAY FROM PIPE FOR CLARITY.
2. WIRE SHALL BE INSTALLED IMMEDIATELY ADJACENT TO THE SERVICE PIPE.
3. THE WIRE SHALL BE FASTENED TO THE PIPE WITH TAPE OR PLASTIC TIES AT 5' INTERVALS.



WATER SERVICE - SECTION VIEW A-A
NOT TO SCALE

CITY OF HOUSTON
HOUSTON PUBLIC WORKS

**COMPLETE UTILITY LOCATING
SYSTEM WATER SERVICE DETAIL**

(NOT TO SCALE)

APPROVED BY:

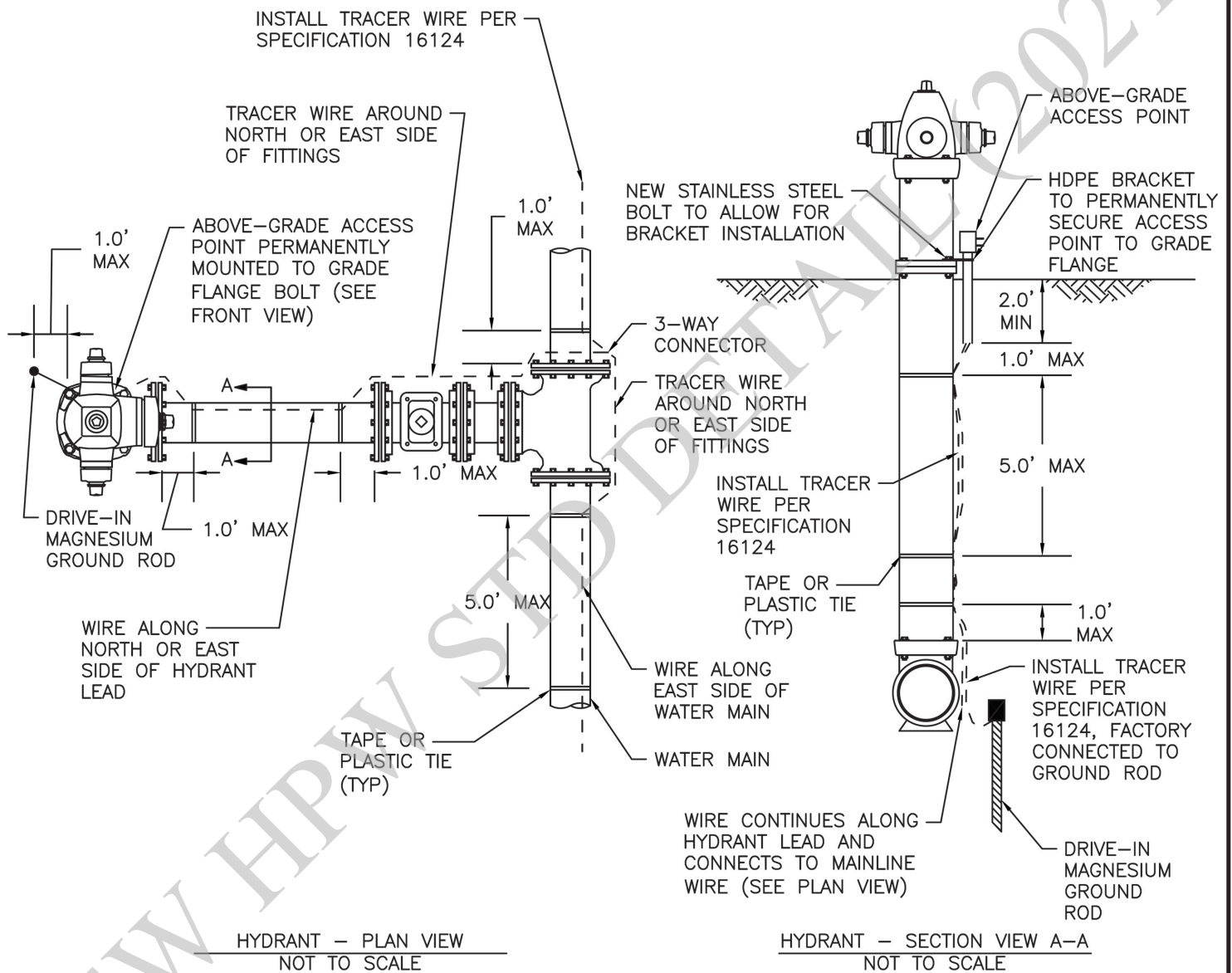
CITY ENGINEER

EFF DATE: JUL-01-2021

APPROVED BY:

DIRECTOR OF
HOUSTON PUBLIC WORKS

DWG NO: 16124-02



CITY OF HOUSTON
HOUSTON PUBLIC WORKS

**COMPLETE UTILITY LOCATING
SYSTEM HYDRANT DETAIL**

(NOT TO SCALE)

APPROVED BY:

CITY ENGINEER

EFF DATE: JUL-01-2021

APPROVED BY:

DIRECTOR OF
HOUSTON PUBLIC WORKS

DWG NO: 16124-03