Printing History

1st Printing—1974—

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* * *

Copies of **Water Main Standard Details and Corrosion Control Specifications** are available from the Water Department Projects Control Section, Room 1100, Municipal Services Building, Philadelphia, Pennsylvania 19107, (215) MU 6-3835.

STANDARD DETAILS

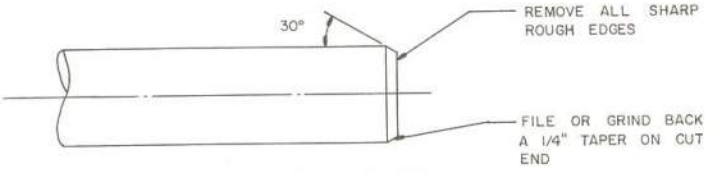
CITY OF PHILADELPHIA

WATER DEPARTMENT

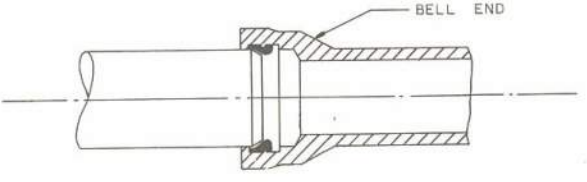
1979

STANDARD DETAILS

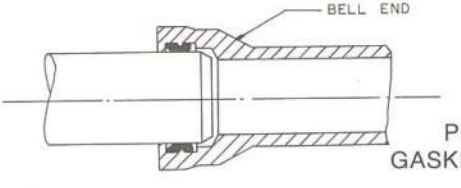
CONTENTS



FIELD CUT PLAIN END PIPE



INITIAL ENTRY
PLAIN END INTO SOCKET



ASSEMBLED JOINT

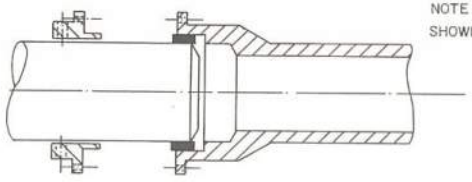
MATERIAL

PIPE: DUCTILE IRON
GASKET: PLAIN RUBBER BASE

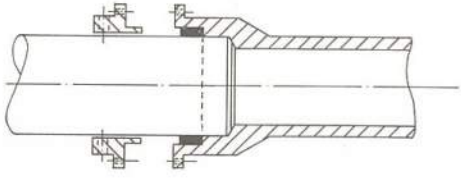
PUSH-ON JOINT ASSEMBLY DETAIL

NOTE: FIELD CUT AS SHOWN ON PAGE NO. 1

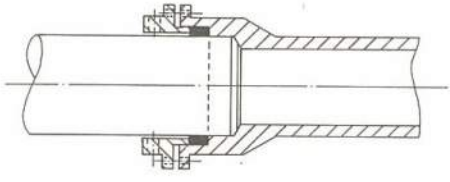
INITIAL ASSEMBLY



PARTIAL ASSEMBLY



FULLY ASSEMBLED

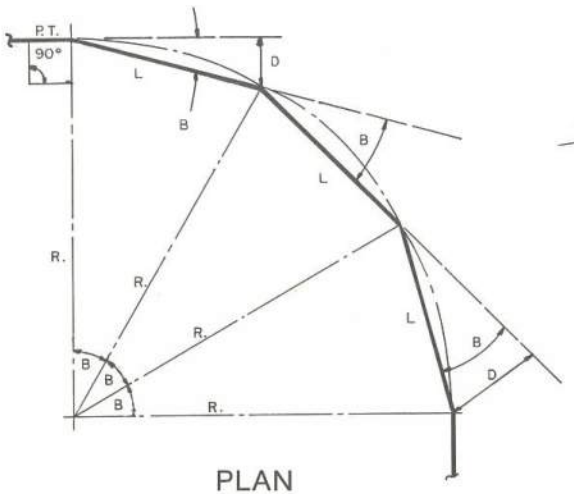


RETAINER GLAND SIZE-INCHES	WORKING PRESSURE-PSI	No. OF SET SCREWS	SET SCREW TORQUE-FT.-LBS.
3	350	4	80
4	250	4	80
6	350	6	80
8	250	9	80
10	250	12	80
12	250	16	80
16	200	24	100
20	200	28	120
24	150	32	120

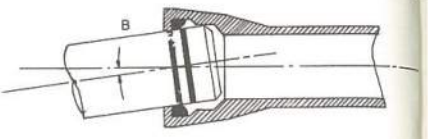
ALL SET SCREWS SHALL BE ⅝" INCH DIAMETER CASE HARDENED STEEL WITH "CUPPED ENDS" AND ⅝" INCH SQUARE HEADS.

ASSEMBLED JOINT SHALL NOT BE DEFLECTED. JOINT DEFLECTION, IF NECESSARY AND WITHIN ALLOWABLE LIMITS, SHALL BE MADE PRIOR TO TIGHTENING OF T-BOLTS AND SET SCREWS.

MECHANICAL JOINT WITH RETAINER GLAND ASSEMBLY DETAIL



PLAN
PIPE DEFLECTION



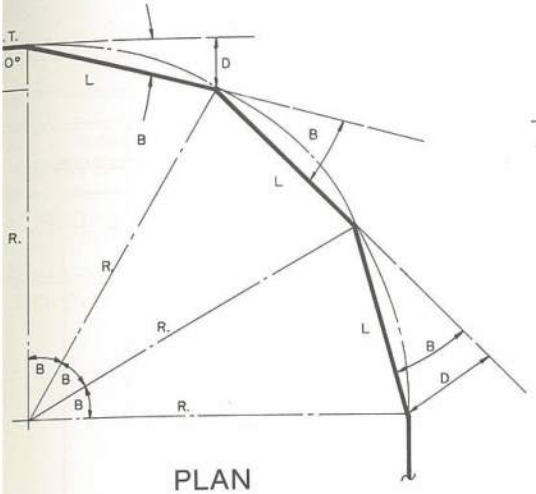
PUSH-ON TYPE JOINT

B—DEFLECTION IN DEGREES
D—DEFLECTION IN INCHES
L—LENGTHS
R—RADIUS IN FEET
P.T.=POINT OF TANGENT

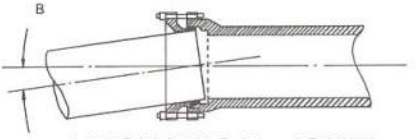
NOTE: DEFLECTIONS SHOWN ARE MAXIMUM ALLOWABLE. WATER DEPT. STANDARD IS 50% MAXIMUM ALLOWABLE UNLESS OTHERWISE AUTHORIZED.

PIPE		L=16 FEET		L=18 FEET		L=20 FEET	
SIZE	B	D	R	D	R	D	R
6"	5°	17	185	19	205	21	230
8"	5°	17	185	19	205	21	230
12"	5°	17	185	19	205	21	230
16"	3°	10	300	11	340	12	380
20"	3°	10	300	11	340	12	380
24"	3°	10	300	11	340	12	380
30"	3°	10	300	11	340	12	380
36"	3°	10	300	11	340	12	380
48"	2°	6	450	7½	510	8	570

PUSH-ON JOINT PIPE
MAXIMUM DEFLECTION & RADIUS



PLAN
PIPE DEFLECTION



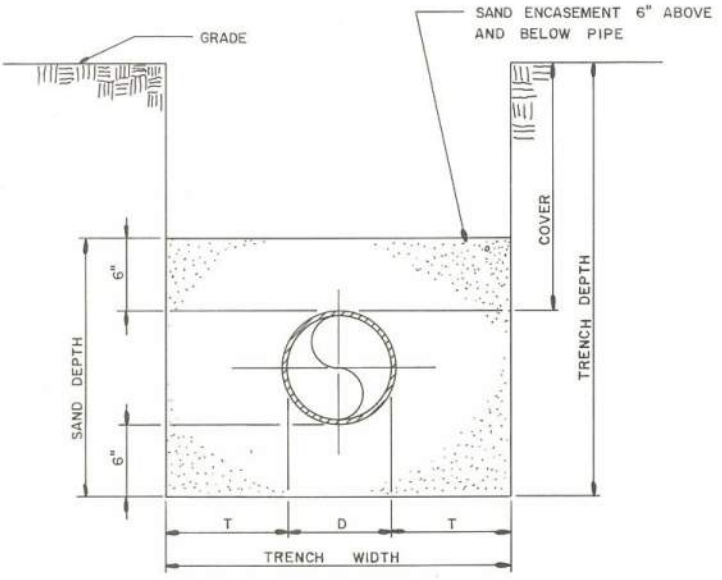
MECHANICAL JOINT

B=DEFLECTION IN DEGREES
D=DEFLECTION IN INCHES
L=LENGTH
R=RADIUS
P.T.=POINT OF TANGENT

NOTE: DEFLECTIONS SHOWN ARE MAXIMUM ALLOWABLE. WATER DEPT. STANDARD IS 50% MAXIMUM ALLOWABLE UNLESS OTHERWISE AUTHORIZED.

PIPE		L=16 FEET		L=18 FEET		L=20 FEET	
SIZE	B	D	R	D	R	D	R
6"	7°7'	24	130	27	145	30	160
8"	5°21'	18	170	20	195	22	213
12"	5°21'	18	170	20	195	22	220
16"	3°35'	12	250	13½	285	15	320
20"	3°	10	300	11	340	12	380
24"	2°23'	8	400	9	450	10	500
30"	2°23'	8	400	9	450	10	500
36"	2°5'	7	440	8	500	9	550
48"	2°	6½	450	7½	510	8	570

MECHANICAL JOINT PIPE MAXIMUM DEFLECTION AND RADIUS



TYPICAL WATER MAIN TRENCH		
D=NOMINAL DIA.	T	TRENCH DEPTH
24" DIA. AND OVER	12"	COVER + DIA. + 8"
8" DIA. TO 20" DIA.	8"	COVER + DIA. + 8"
6" DIA. AND LESS	6"	COVER + DIA. + 8"

TRENCH DEPTH=COVER PLUS NOMINAL PIPE DIA. PLUS 2"PIPE THICKNESS PLUS SAND 6" BELOW PIPE.

TRENCH WIDTH=NOMINAL PIPE DIA. PLUS 2 x T WITH NO PIPE THICKNESS ALLOWANCE.

PAY LIMITS FOR EXCAVATION OF WATER MAIN TRENCHES

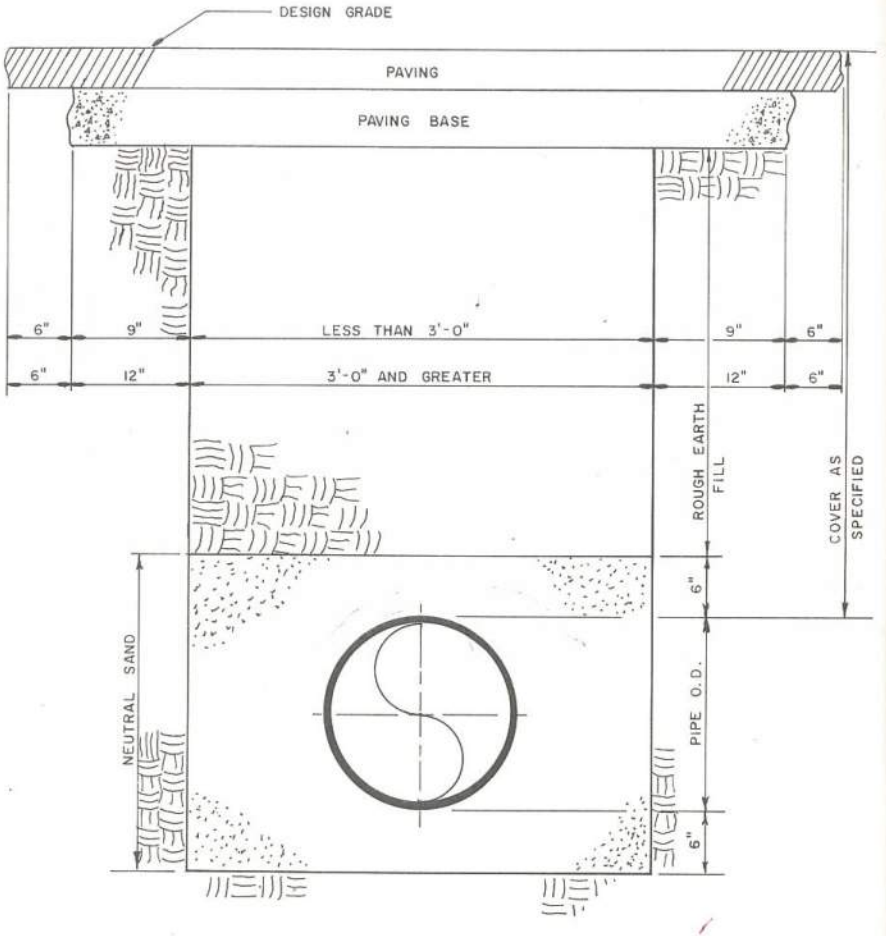
EXCAVATION PAY LIMIT DIMENSIONS

		EXCAVATION QUAN. PER LIN. FT.					SAND ENCASEMENT	
COVER	PIPE SIZE	PIPE AREA (FT²)	TRENCH WIDTH (FT)	TRENCH DEPTH (FT)	CU. FT. PER LIN. FT.	CU. YDS. PER LIN. FT.	DEPTH (FT.)	CU. FT. PER LIN. FT.
4'-0" ‡	6"	0.35	1.50	5.16	7.75	.29	1.67	2.16
	8"	0.54	2.00	5.33	10.66	.39	1.83	3.12
	10"	0.79	2.17	5.50	11.94	.44	2.00	3.55
	12"	1.06	2.33	5.67	13.21	.49	2.17	4.00
	16"	1.77	2.67	6.00	16.02	.59	2.50	4.91
	20"	2.64	3.00	6.33	18.99	.70	2.83	5.85
	24"	3.68	4.00	6.67	26.68	.99	3.17	9.00
	30"	5.57	4.50	7.17	32.27	1.19	3.67	10.94
	36"	7.87	5.00	7.67	38.35	1.42	4.17	12.98
	42"	10.55	5.50	8.17	44.94	1.66	4.67	15.14
	48"	13.62	6.00	8.67	52.02	1.93	5.17	17.40
5'0" ‡	16"			7.00	18.69	.69		
	20"			7.33	21.99	.81		
	24"		SAME AS 4' COV.	7.67	30.68	1.14	SAME AS 4' COV.	
	30"			8.17	36.77	1.36		
	36"			8.67	43.35	1.60		
	42"			9.17	50.44	1.87		
	48"			9.67	58.02	2.15		

PIPE AREA BASED ON NOM. PIPE DIA. PLUS 2" PIPE THICKNESS

SAND DEPTH=NOMINAL PIPE DIA. PLUS 2" PIPE THICKNESS PLUS 6" ABOVE AND BELOW PIPE.

PAY LIMITS FOR EXCAVATION OF WATER MAIN TRENCHES



PAY LIMITS FOR REPAVING
WATER MAIN TRENCHES

ERRATA

PAGE 8—(CHART) UNDER 6" PIPE SIZE the CU. YDS./LIN. FT. for 8" BASE SHOULD BE .074—(not .047).

PAVING RESTORATION NOTES

WHERE THE TRENCH WIDTH IS LESS THAN 3'-0" THE CONCRETE BASE RESTORATION SHALL COVER THE TRENCH AND EXTEND 9" OVER UNDISTURBED OR COMPACTED SOIL ON EACH SIDE OF THE TRENCH.

WHERE THE TRENCH WIDTH IS 3'-0" OR GREATER, THE CONCRETE BASE RESTORATION SHALL COVER THE TRENCH AND EXTEND 12" OVER UNDISTURBED OR COMPACTED SOIL ON EACH SIDE OF THE TRENCH.

SURFACE COURSE PAVING RESTORATION SHALL COVER THE WIDTH OF THE CONCRETE BASE AND EXTEND 6" BEYOND EXCEPT THAT BITUMINOUS CONCRETE SURFACE COURSE RESTORATION SHALL ONLY COVER THE RESTORED CONCRETE BASE.

REMOVAL OF BASE AND PAVING OUTSIDE OF TRENCH LIMITS SHALL BE INCLUDED IN THE COST OF PAVING RESTORATION.

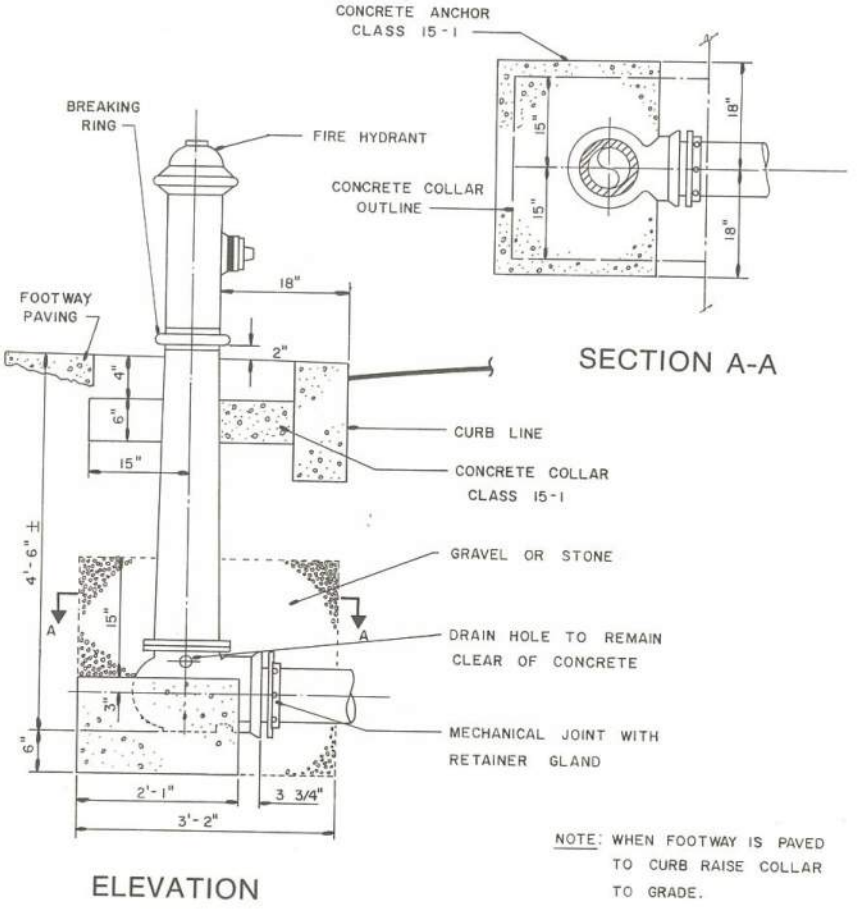
THE EDGES OF THE ASPHALT WEARING COURSE SHALL BE SEALED WITH HOT ASPHALT CEMENT IMMEDIATELY AFTER ROLLING. THE HOT ASPHALT CEMENT SHALL BE SEALED WITH HOT IRONS TO COMPLETELY FILL THE SURFACE VOIDS AND PROVIDE A WATER TIGHT JOINT.

PAVING BASE DIMENSIONS AND REPAVING QUANTITIES

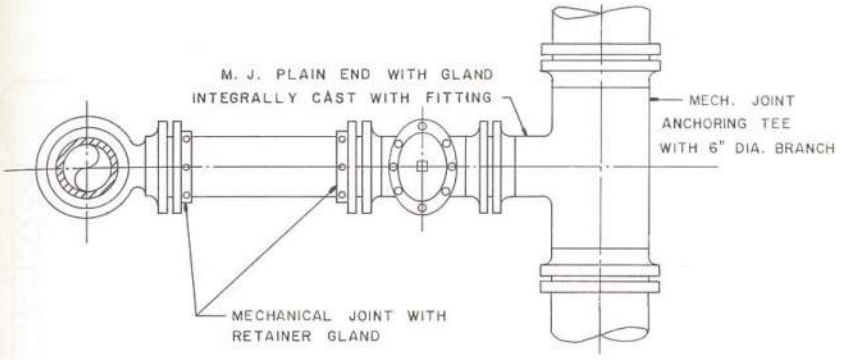
PIPE SIZE	TRENCH WIDTH (FT.)	BASE WIDTH (FT.)	CU. YDS./ LIN. FT. 10" BASE	CU. YDS./ LIN. FT. 8" BASE	CU. YDS./ LIN. FT. 6" BASE	PAVING WIDTH (FT.)	PAVING SQ. YDS./ LIN. FT.
6"*	1.50	3.00	.093	~~.047~~ .074	.056	4.00	.44
8"	2.00	3.50	.108	.086	.065	4.50	.50
10"	2.17	3.67	.113	.091	.068	4.67	.52
12"	2.33	3.83	.118	.094	.071	4.83	.54
16"	2.67	4.17	.129	.103	.077	5.17	.57
20"	3.00	4.50	.139	.111	.083	5.50	.61
24"	4.00	6.00	.185	.148	.111	7.00	.78
30"	4.50	6.50	.201	.160	.120	7.50	.83
36"	5.00	7.00	.216	.173	.130	8.00	.89
42"	5.50	7.50	.231	.185	.139	8.50	.94
48"	6.00	8.00	.247	.197	.148	9.00	1.00

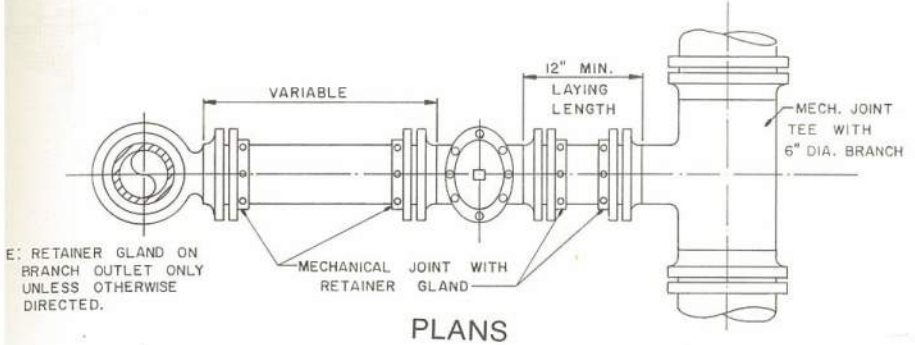
*ALL PIPES 6" AND UNDER

PAY LIMITS FOR REPAVING WATER MAIN TRENCHES

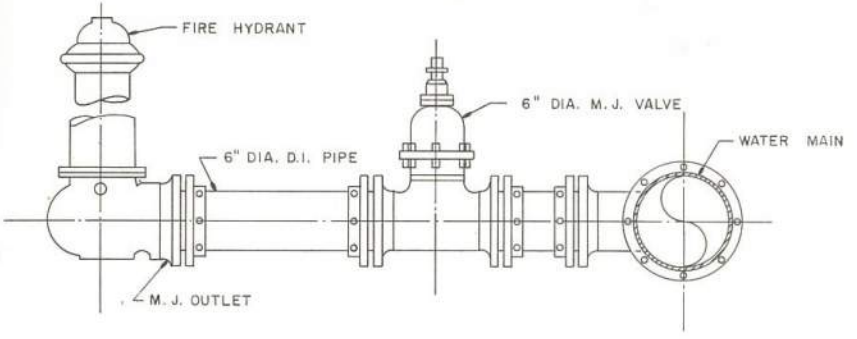


FIRE HYDRANT INSTALLATION



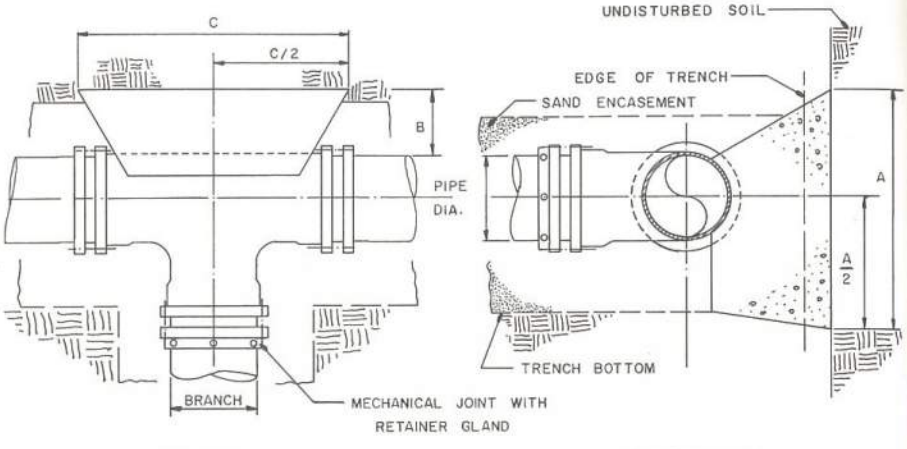


PLANS



ELEVATION

FIRE HYDRANT CONNECTIONS
MECHANICAL JOINT VALVE & FITTINGS



PLAN SECTION

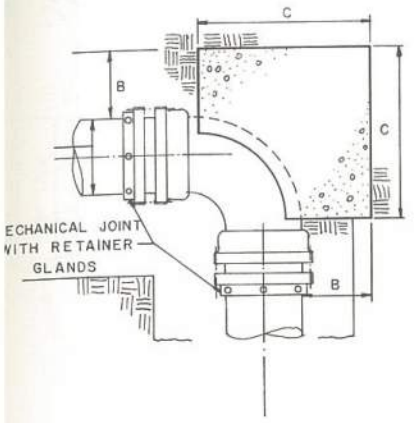
	BRANCH PIPE DIAMETER					
	3", 4" & 6"	8"	12"	16"	20"	24"
A	18"	2'-0"	3'-0"	3'-9"	4'-6"	5'-0"
B	12"	15"	15"	18"	18"	2'-0"
C	18"	2'-0"	3'-0"	4'-0"	5'-6"	6'-0"
D	.1	.2	.4	.8	1.4	2.2

D=APPROXIMATE VOLUME OF CONCRETE IN CUBIC YARDS

NOTES:

1. WRAP FITTING WITH TAR PAPER BEFORE PLACING CONCRETE
2. CONCRETE SHALL BE CLASS 15-1.
3. CONCRETE MUST BEAR AGAINST UNDISTURBED SOIL.
4. SOIL BEARING VALUE—2000 PSF.
5. RETAINER GLAND ON BRANCH OUTLET ONLY UNLESS OTHERWISE DIRECTED.

CONCRETE ANCHORS FOR TEES



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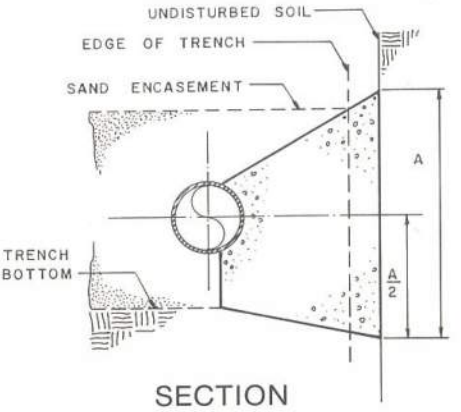


SECTION

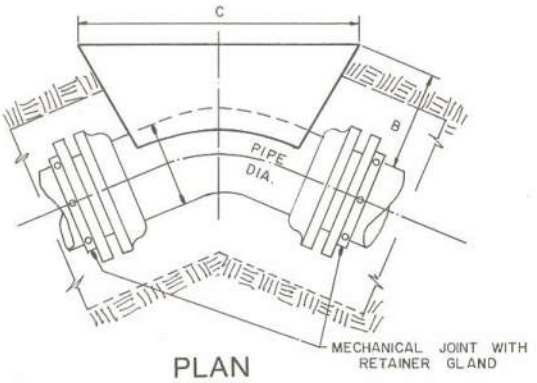
	PIPE DIAMETER					
	3", 4" & 6"	8"	12"	16"	20"	24"
A	18"	24"	3'-0"	3'-0"	4'-6"	5'-0"
B	9"	12"	12"	12"	16"	18"
C	2'-0"	2'-6"	2'-6"	3'-0"	3'-9"	4'-6"
D	.1	.2	.3	.4	1.1"	1.56

D=APPROXIMATE VOLUME OF CONCRETE IN CUBIC YARDS

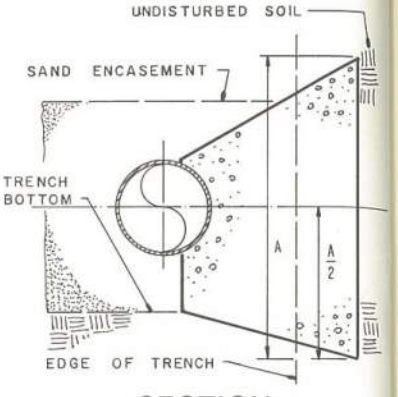
NOTES:

1. WRAP FITTING WITH TAR PAPER BEFORE PLACING CONCRETE
2. CONCRETE SHALL BE CLASS 15-1.
3. CONCRETE MUST BEAR UPON UNDISTURBED SOIL.
4. SOIL BEARING VALUE—2000 PSF.

CONCRETE ANCHOR FOR HORIZONTAL 1/4 BENDS



PLAN



SECTION

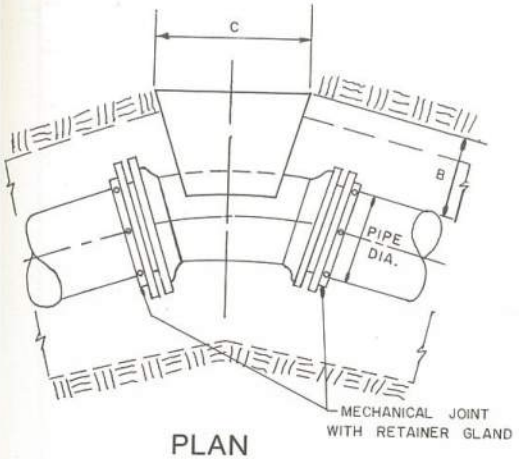
	PIPE DIAMETER					
	3", 4" & 6"	8"	12"	16"	20"	24"
A	18"	21"	2'-6"	3'-6"	4'-0"	5'-0"
B	12"	12"	15"	18"	2'-0"	2'-3"
C	15"	20"	2'-6"	3'-0"	4'-0"	4'-6"
D	.06	.07	.15	.28	.66	1.0

D=APPROXIMATE VOLUME OF CONCRETE IN CUBIC YARDS

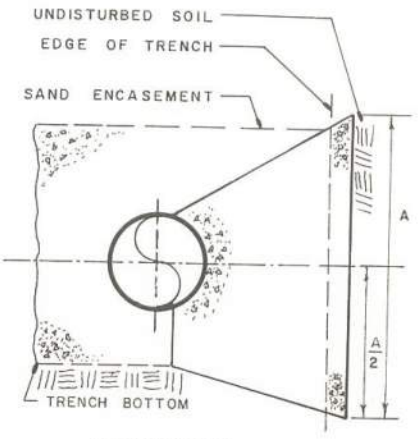
NOTES:

1. WRAP FITTING WITH TAR PAPER BEFORE PLACING CONCRETE.
2. CONCRETE SHALL BE CLASS 15-1.
3. CONCRETE MUST BEAR UPON UNDISTURBED SOIL.
4. SOIL BEARING VALUE—2000 PSF.

CONCRETE ANCHORS FOR HORIZONTAL 1/8 BENDS



PLAN



SECTION

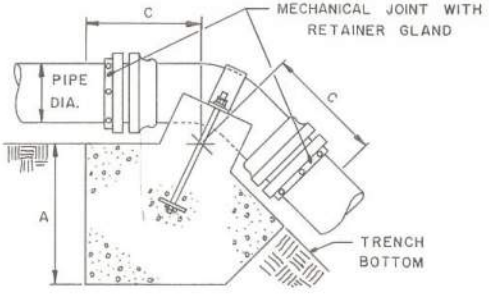
		PIPE DIAMETER				
	3", 4" & 6"	8"	12"	16"	20"	24"
A	20"	22"	2'-2"	2'-6"	3'-0"	3'-6"
B	12"	12"	15"	18"	21"	2'-0"
C	12"	16"	21"	2'-3"	3'-0"	3'-9"
D	.03	.05	.1	.17	.3	.5

D=APPROXIMATE VOLUME OF CONCRETE IN CUBIC YARDS

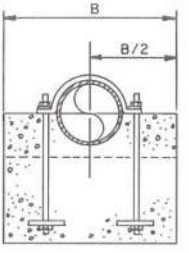
NOTES:

1. WRAP FITTING WITH TAR PAPER BEFORE PLACING CONCRETE.
2. CONCRETE SHALL BE CLASS 15-1.
3. CONCRETE MUST BEAR UPON UNDISTURBED SOIL.
4. SOIL BEARING VALUE—2000 PSF.

CONCRETE ANCHORS FOR HORIZONTAL 1/16 & 1/32 BENDS



ELEVATION



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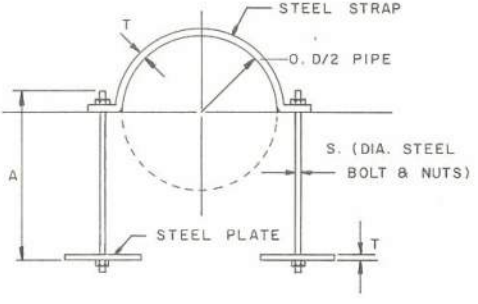
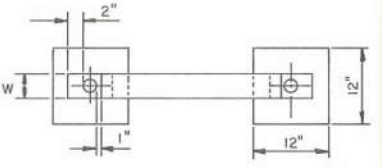




BOLT AND STRAP HARNESS DETAILS

NOTES:

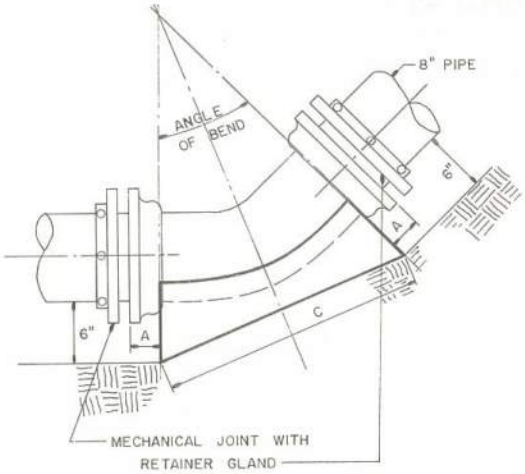
1. WRAP FITTING WITH TAR PAPER BEFORE PLACING CONCRETE.
2. CONCRETE SHALL BE CLASS 15-1.
3. CONCRETE SHALL HAVE A 2" MINIMUM CLEARANCE UNDER BELLS & GLANDS.
4. APPLY COLD BITUMEN COATING AS SPECIFIED.
5. NUTS TO BE HEAVY HEXAGON.

CONCRETE ANCHORS FOR VERTICAL 1/8, 1/16 & 1/32 BENDS (TOP)

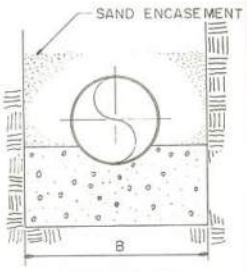
PIPE DIA.	1/8 BEND 45 °							
	A	B	C	D	S	T	W	P
6"	2'-10"	2'-6"	2'-0"	.65	¾"	½"	4"	60
8"	4'-0"	2'-6"	3'-0"	1.47	¾"	½"	4"	65
12"	4'-9"	3'-6"	3'-6"	2.8	1"	½"	5"	86
16"	5'-8"	4'-6"	4'-0"	4.7	1"	¾"	5"	127
20"	7'-0"	5'-0"	5'-0"	8.15	1¼"	¾"	6"	172
24"	7'-9"	5'-6"	5'-6"	10.89	1½"	¾"	6"	219
	1/16 BEND 22 1/2 °							
6"	2'-0"	2'-6"	2'-0"	.4	¾"	½"	3"	55
8"	2'-0"	2'-6"	2'-6"	.55	¾"	½"	4"	59
12"	4'-0"	2'-6"	3'-0"	1.38	¾"	½"	4"	68
16"	4'-6"	3'-0"	4'-0"	2.5	¾"	½"	5"	78
20"	5'-0"	4'-0"	4'-6"	4.15	1"	¾"	5"	130
24"	5'-0"	4'-0"	5'-0"	6.0	1¼"	¾"	5"	154
	1/32 BEND 11 1/4 °							
6"	18"	18"	18"	.2	¾"	½"	3"	53
8"	2'-0"	2'-0"	2'-0"	.4	¾"	½"	3"	56
12"	2'-6"	2'-6"	2'-6"	.75	¾"	½"	4"	64
16"	3'-0"	3'-0"	2'-6"	1.4	¾"	½"	4"	69
20"	3'-3"	3'-0"	3'-6"	2.1	1"	¾"	4"	113
24"	3'-6"	4'-0"	3'-6"	3.0	1"	¾"	5"	129

D=APPROXIMATE VOLUME OF CONCRETE IN CUBIC YARDS
P=WEIGHT IN POUNDS OF STEEL STRAPS, PLATES, AND BOLTS

CONCRETE ANCHORS FOR VERTICAL BENDS (TOP)



ELEVATION



SECTION

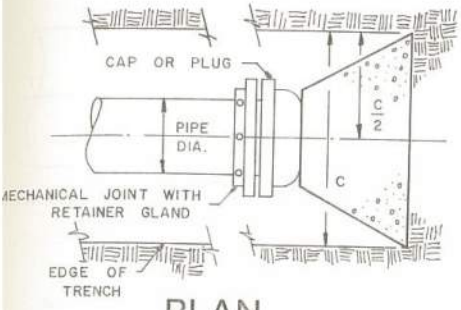
ANGLE OF BEND			PIPE DIAMETER (INCHES)					
			3", 4" & 6"	8	12	16	20	24
		A	2.5"	2.5"	2.5"	3.5"	3.5"	3.5"
	1/8 45°	B	18"	24"	28"	42"	48"	66"
		C	12"	14"	19"	21"	25"	28"
		D	.02	.04	.07	.13	.19	.31
	1/16 22½°	B	18"	24"	28"	32"	36"	48"
		C	9	11"	16"	16"	20"	22"
		D	.02	.04	.07	.09	.13	.21
	1/32 11¼°	B	18"	24"	28"	32"	36"	48"
		C	7"	9"	13"	14"	17"	18"
		D	.02	.03	.06	.08	.12	.19

D=APPROXIMATE VOLUME OF CONCRETE IN CUBIC YARDS

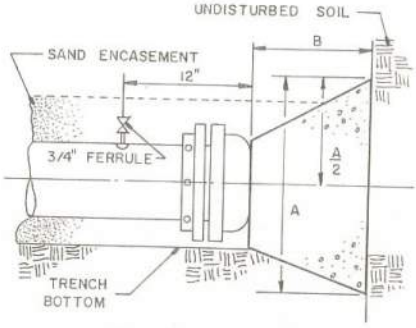
NOTES:

1. WRAP FITTING WITH TAR PAPER BEFORE PLACING CONCRETE.
2. CONCRETE SHALL BE CLASS 15-1.
3. CONCRETE MUST BEAR UPON UNDISTRUBED SOIL.
4. SOIL BEARING VALUE-2000 PSF.

CONCRETE ANCHORS FOR VERTICAL BENDS (BOTTOM)



PLAN



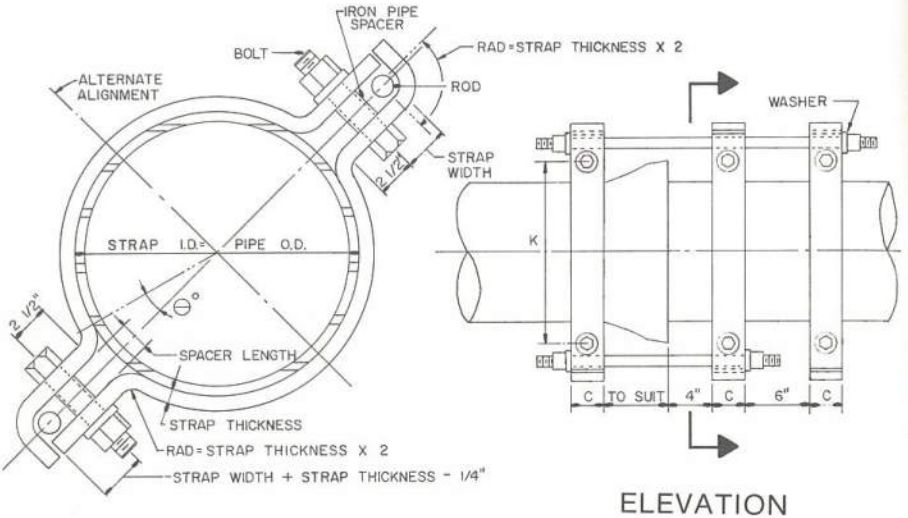
ELEVATION

	PIPE DIAMETER					
	3", 4" & 6"	8"	12"	16"	20"	24"
A	18"	2'-0"	2'-6"	3'-9"	4'-6"	5'-0"
B	12"	12"	18"	2'-0"	2'-0"	2'-0"
C	18"	2'-0"	3'-6"	4'-0"	5'-0"	6'-0"
D	.06	.15	.4	.8	1.3	1.7

D=APPROXIMATE VOLUME OF CONCRETE IN CUBIC YARDS

NOTES:
1. WRAP FITTING WITH TAR PAPER BEFORE PLACING CONCRETE.
2. CONCRETE MUST BEAR AGAINST UNDISTURBED SOIL.
3. SOIL BEARING VALUE-2000 PSF.
4. CONCRETE SHALL BE CLASS 15-1.

CONCRETE ANCHORS FOR DEAD ENDS

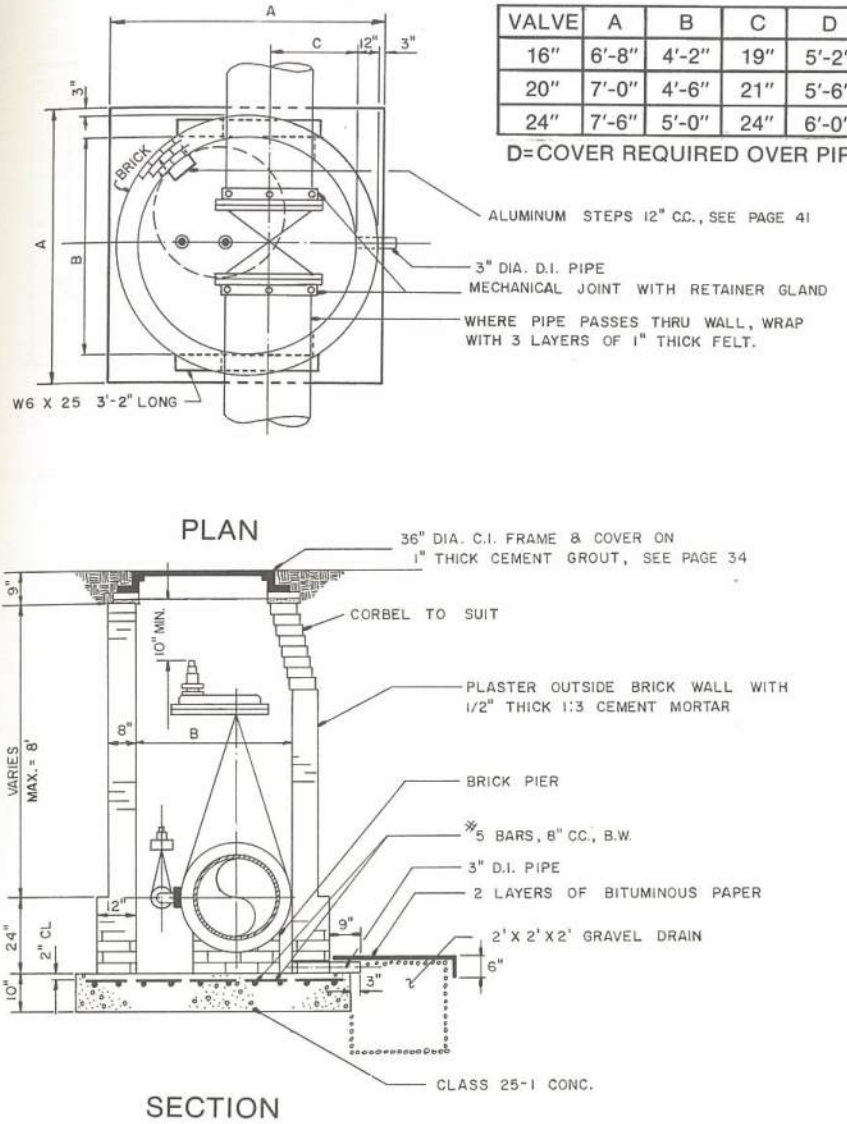


Pipe Size	A Strap I.D.	B Strap Thick-ness	C Strap Width	D Rod Dia-meter	E Bolt Size	F Spacer Size	G Spacer Length	H θ°	K Bolt Center	W Weight (Ap-prox)
3	—	½	2	⅝	⅝	¾	1	—	—	—
4	4.80	½	2	⅝	⅝	¾	1	26.179	11.10	72
6	6.90	½	2	¾	⅝	¾	1¼	21.418	13.29	98
8	9.05	½	2	¾	⅝	¾	1¼	17.105	15.56	100
12	13.20	¾	3	1	⅞	1	1½	16.128	20.56	218
16	17.40	¾	3	1	⅞	1	1½	12.744	24.90	228
20	21.60	¾	3	1¼	⅞	1	1¾	11.133	29.14	331
24	25.80	¾	4	1½	⅞	1	2	10.000	33.36	520

WASHER THICKNESS=STRAP THICKNESS +¼"

$\theta = \text{SIN}^{-1}\left(\frac{\text{SPACER LENGTH} + 4 \times \text{STRAP THICKNESS}}{\text{STRAP I.D.} + 4 \times \text{STRAP THICKNESS}}\right)$

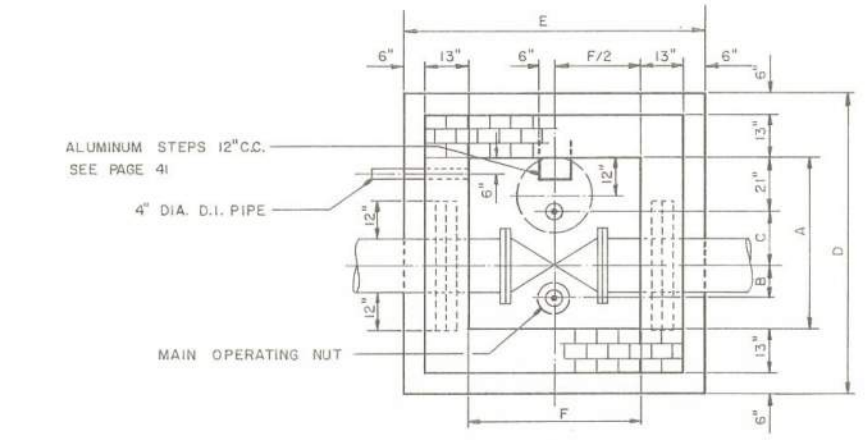
PUSH-ON JOINT HARNESSING



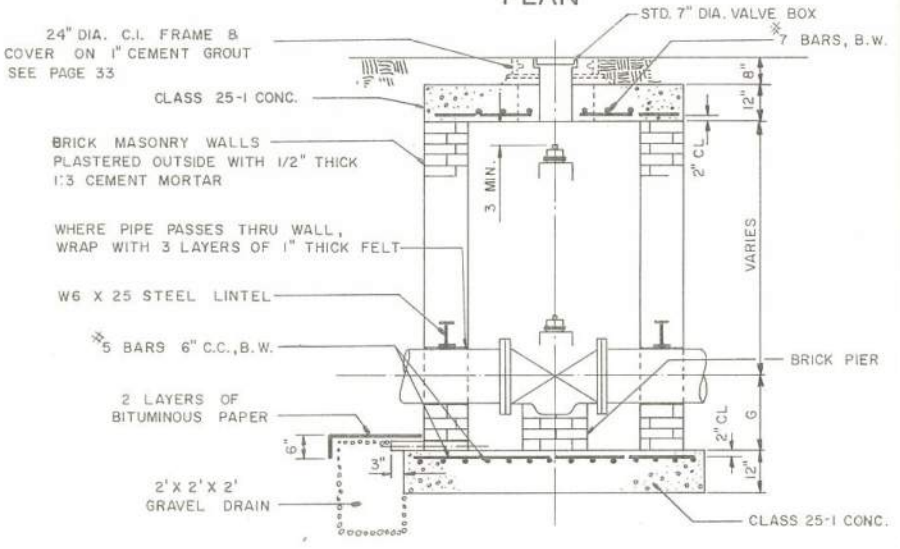
VALVE	A	B	C	D
16"	6'-8"	4'-2"	19"	5'-2"
20"	7'-0"	4'-6"	21"	5'-6"
24"	7'-6"	5'-0"	24"	6'-0"

D=COVER REQUIRED OVER PIPE

16", 20" & 24" VERTICAL VALVE CHAMBER

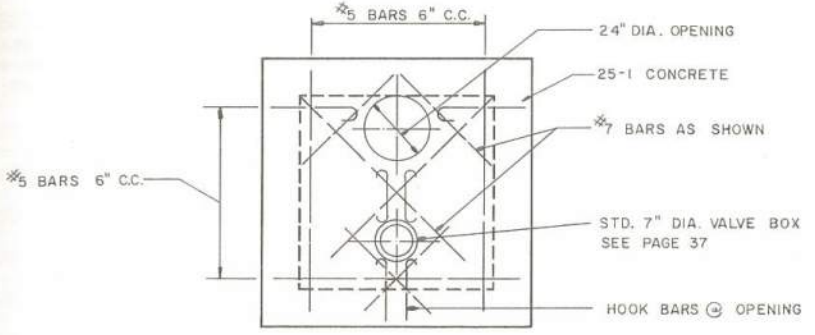


PLAN



SECTION

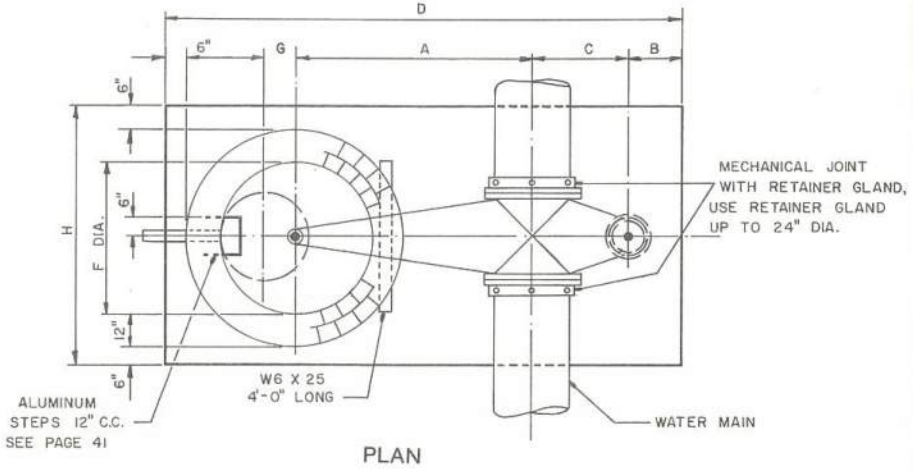
30" THRU 60" VERTICAL VALVE CHAMBERS



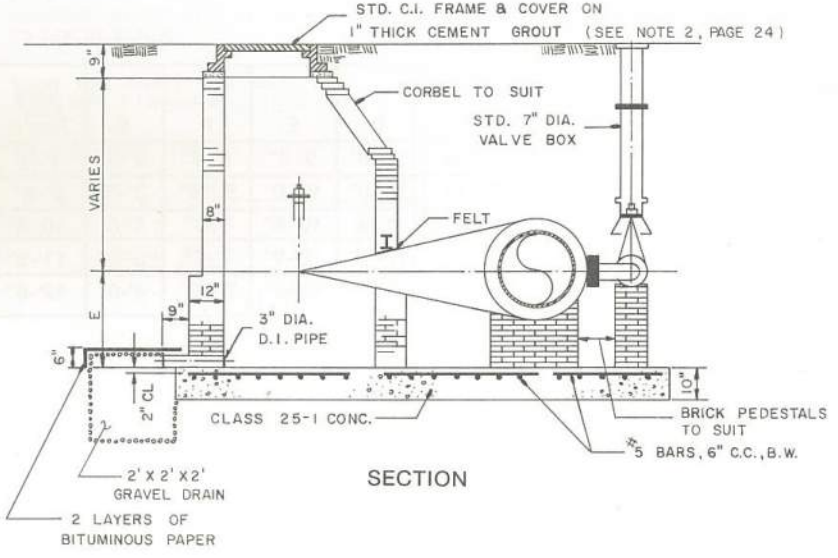
TOP SLAB DETAIL

SIZE	A	B	C	D	E	F	G	Pipe Cov. Req'd.
30"	6'-10"	10"	2'-4 3/8"	10'-0"	9'-6"	6'-4"	2'-6"	7'-0"
36"	7'-7"	10"	2'-7 1/8"	10'-9"	10'-0"	6'-10"	3'-0"	7'-8"
42"	8'-4"	13"	2'-11 11/16"	11'-6"	10'-6"	7'-4"	3'-3"	10'-6"
48"	9"-7"	13"	3'-10"	12'-9"	10'-9"	7'-7"	3'-6"	11'-6"
60"	11'-10"	16 3/8"	4'-6 5/8"	15'-0"	11'-0"	7'-10"	4'-0"	12'-6"

30" THRU 60" VERTICAL VALVE CHAMBERS



PLAN



SECTION

16" THRU 60" HORIZONTAL VALVE CHAMBERS

HORIZONTAL VALVE CHAMBER DIMENSIONS

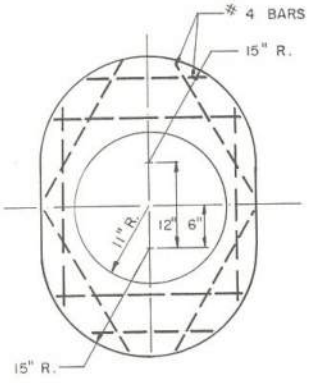
SIZE	A	B	C	D	E	F	G	H
16"	3'3-5/8"	9-1/2"	18-3/4"	8'9"	2'0"	3'0"	6"	6'0"
20"	3'10-3/8"	9-3/4"	20-3/4"	9'9"	2'3"	3'6"	9"	6'6"
24"	4'6-1/16"	13"	2'0-7/8"	11'0"	2'6"	3'6"	9"	6'6"
30"	5'5"	13-1/2"	2'4-3/8"	12'3"	3'0"	3'6"	9"	6'6"
36"	6'4-1/4"	12-3/8"	2'7-1/8"	13'4"	3'0"	3'6"	9"	6'6"
42"	7'7-1/2"	12-3/4"	2'11-11/16"	15'3"	3'6"	4'-0"	6"	7'-0"
48"	8'5-7/8"	13-5/16"	3'10"	17'3"	4'0"	4'0"	6"	7'0"
60"	10'6-1/4"	16-1/8"	4'6-5/8"	20'6"	5'0"	4'6"	9"	7'6"

NOTE:

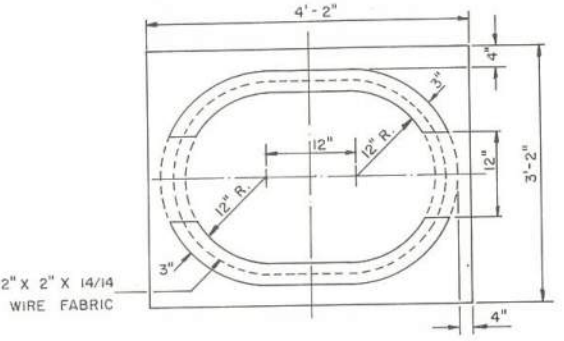
1. PLASTER OUTSIDE BRICK WALL WITH ½" THICK 1: 3 CEMENT MORTAR.
2. 24" DIA. C.I. FRAME & COVER FOR 16" TO 36" VALVE CHAMBER.

   36" DIA. C.I. FRAME & COVER FOR 42" TO 60" VALVE CHAMBER.
3. WHERE VALVE PASSES THRU WALL OF MANHOLE WRAP WITH 3 LAYERS OF 1" THICK FELT.

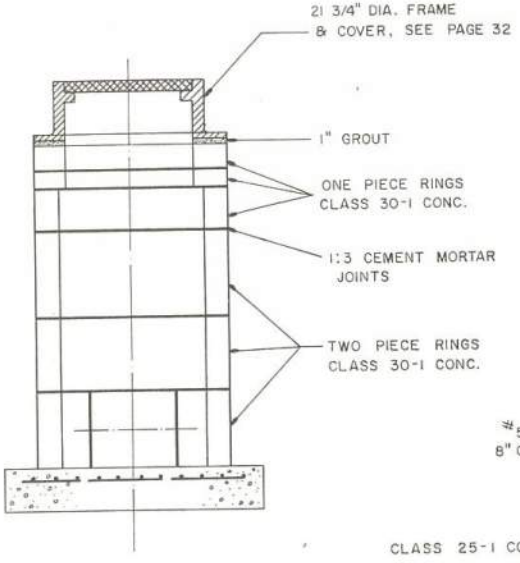
16" THRU 60" HORIZONTAL VALVE CHAMBER



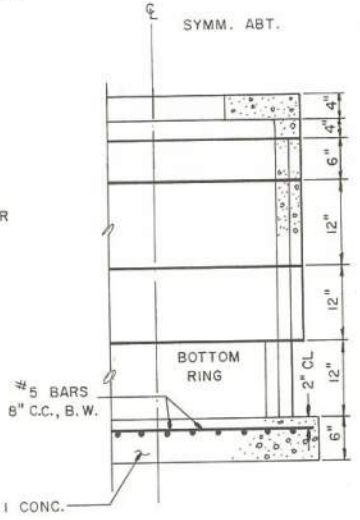
TOP RING



PLAN



SECTION

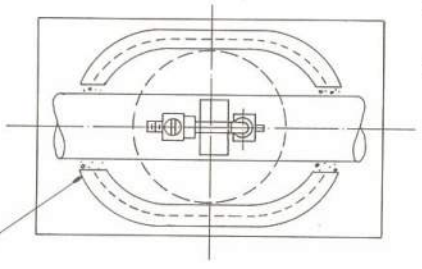


SECTION

CONCRETE VALVE BOX

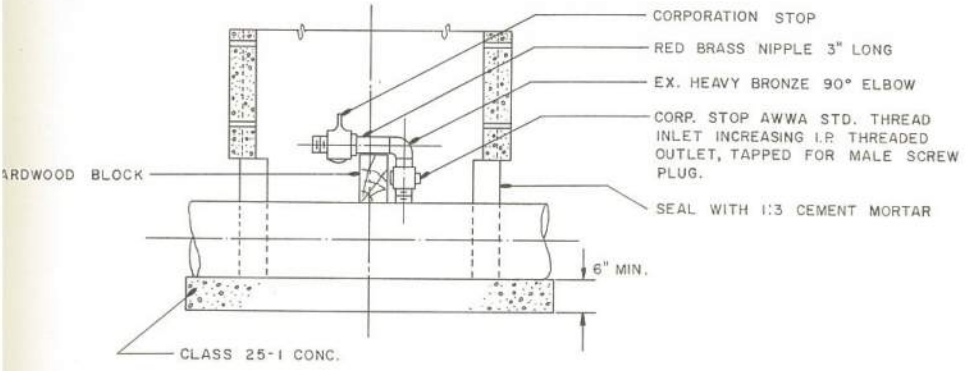
TYPICAL MANUAL AIR VALVE MANHOLE FOR 6" TO 12" MAINS

FOR 16" DIA. & LARGER MAINS
A. ROTATE VALVE BOX 90°
B. ELIMINATE BOTTOM RING, BRING CONCRETE FLUSH WITH TOP OF MAIN.
C. BASE WIDTH SHALL BE THE GREATER, 4'-2" OR FULL TRENCH WIDTH.



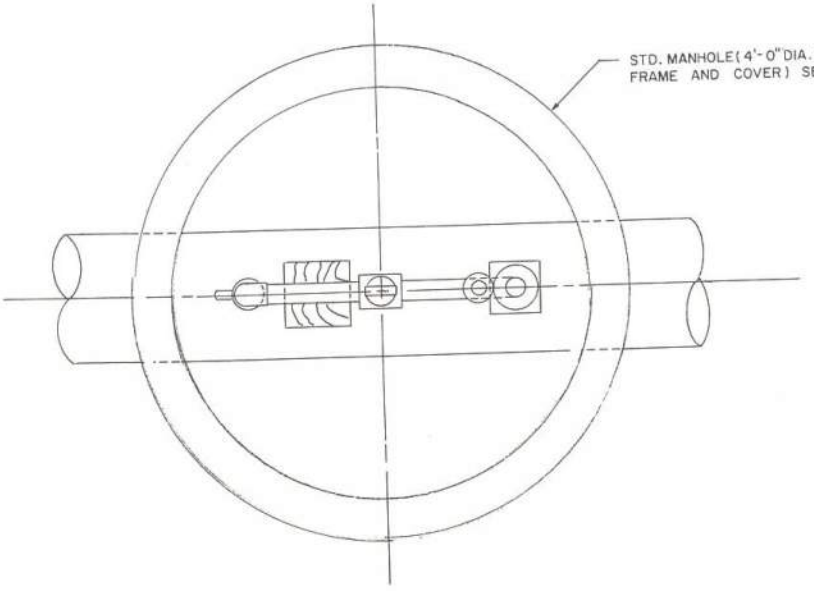
STANDARD CONCRETE VALVE BOX SEE PAGE 25

PLAN

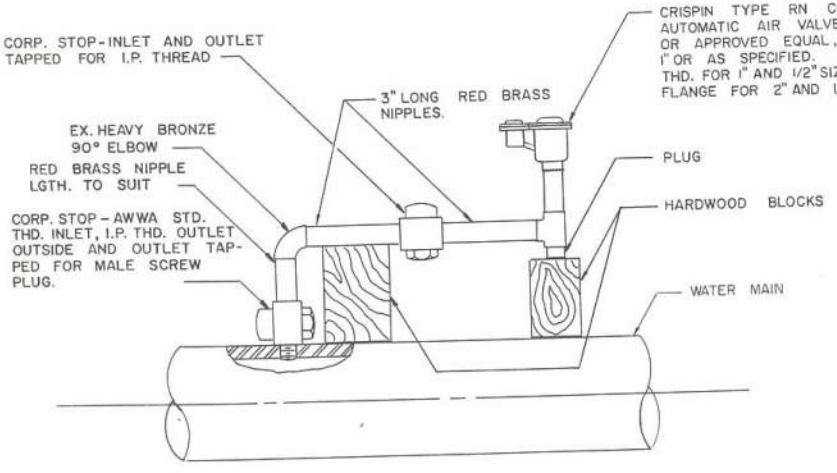


SECTION

MANUAL AIR VALVE

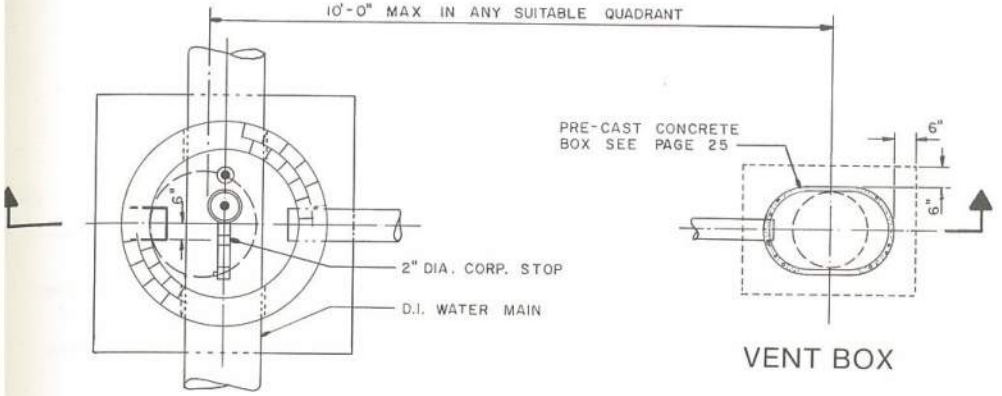


PLAN



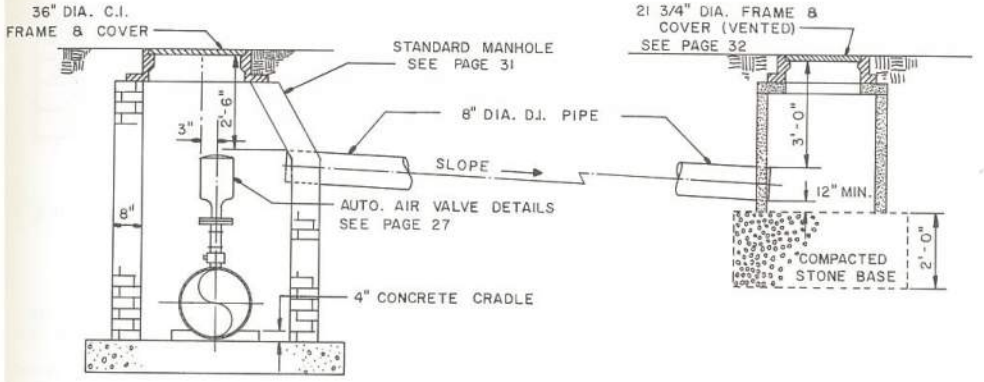
SECTION

AUTOMATIC AIR/VACUUM VALVE ARRANGEMENT



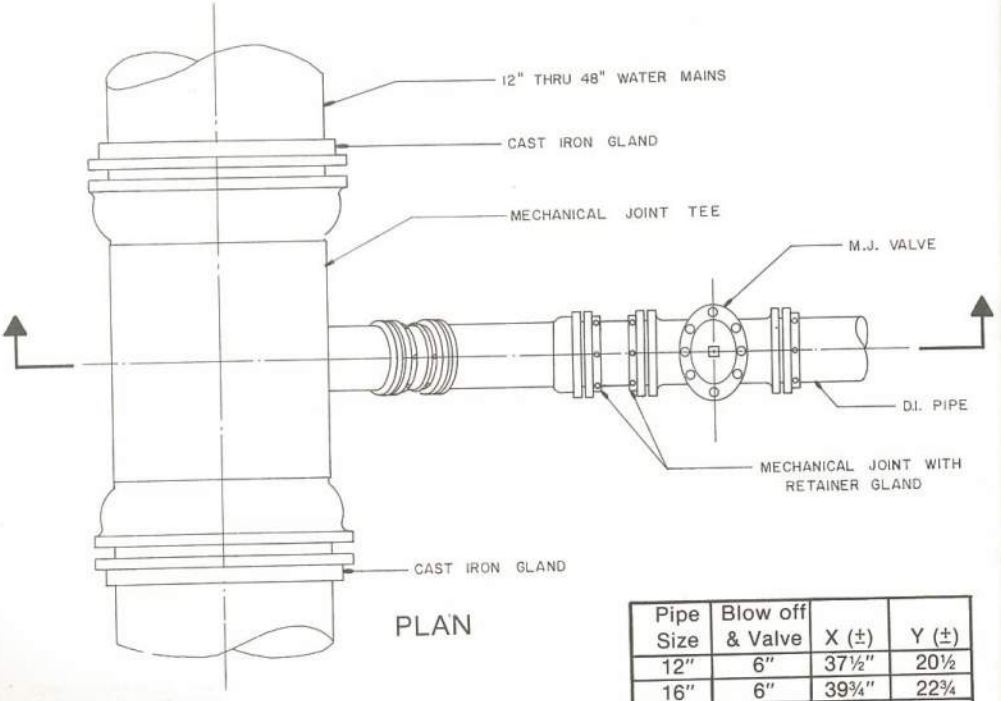
AUTOMATIC AIR VALVE CHAMBER

PLAN

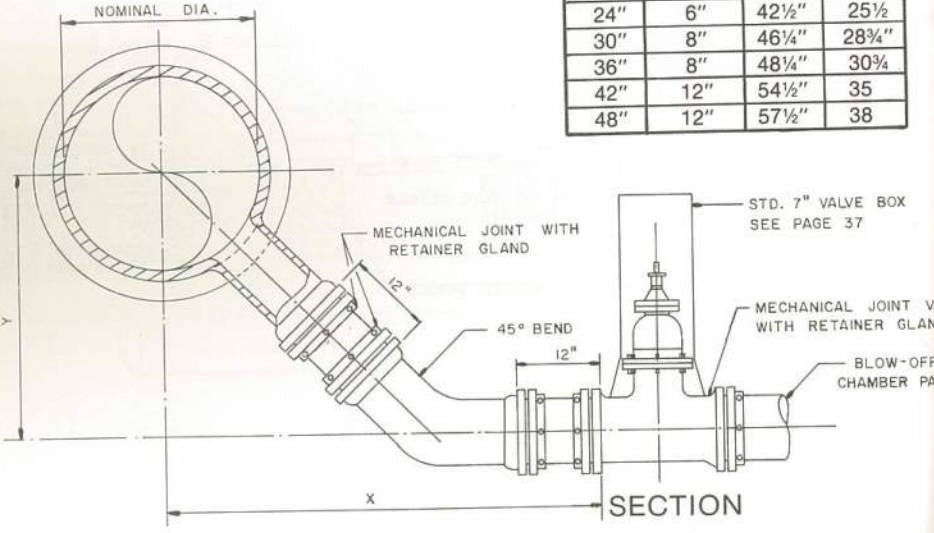


SECTION

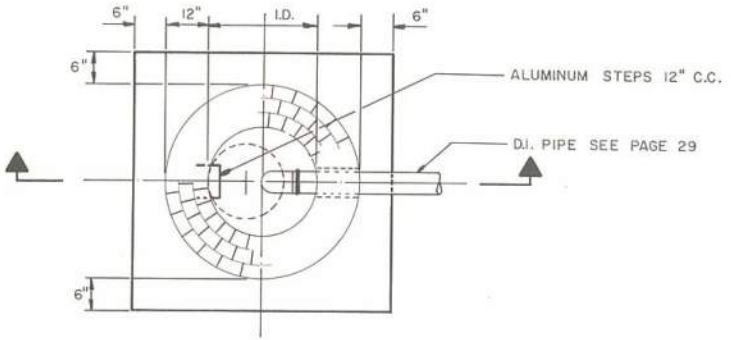
AUTOMATIC AIR VALVE CHAMBER AND VENT BOX



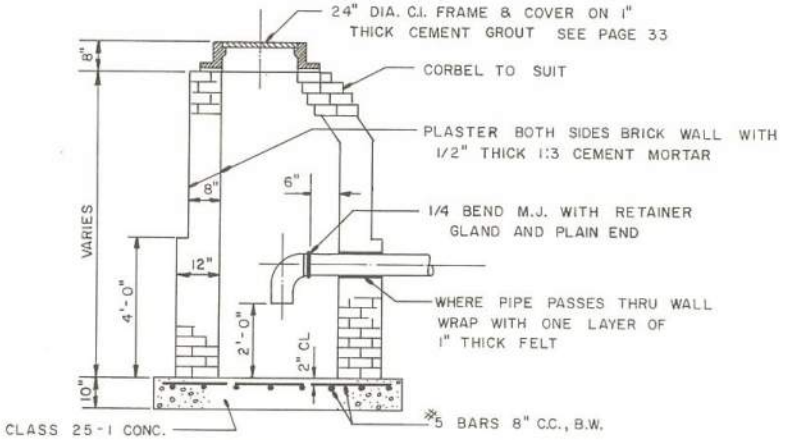
Pipe Size	Blow off & Valve	X (±)	Y (±)
12"	6"	37½"	20½
16"	6"	39¾"	22¾
20"	6"	41"	24
24"	6"	42½"	25½
30"	8"	46¼"	28¾"
36"	8"	48¼"	30¾
42"	12"	54½"	35
48"	12"	57½"	38



BLOW-OFF BRANCH WITH OUTLET VALVE



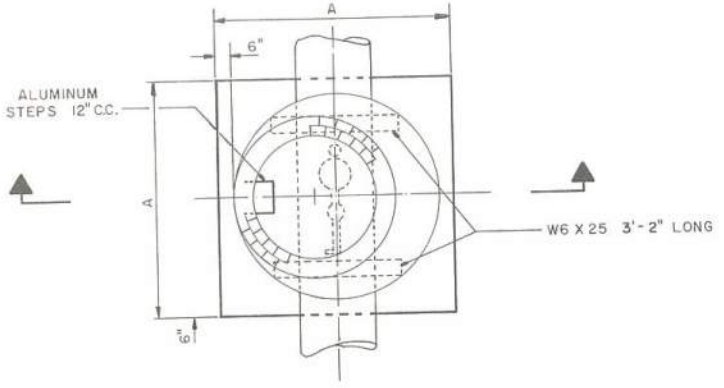
PLAN



SECTION

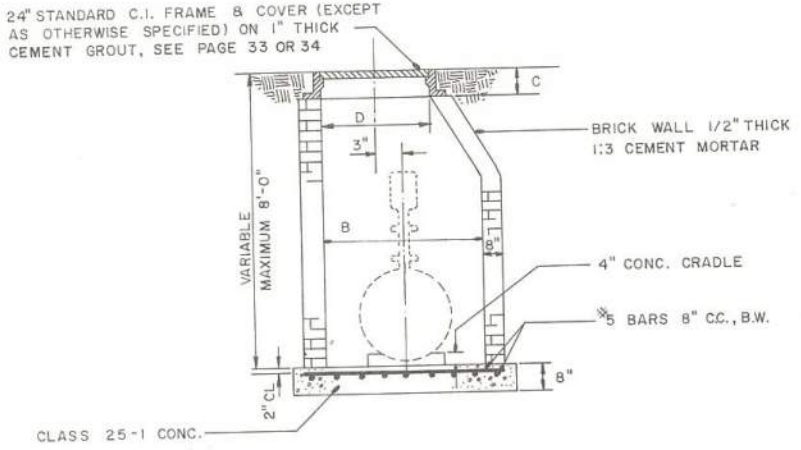
I.D. = INSIDE DIAMETER 3'-0" FOR 6" OR SMALLER BLOW-OFF, 4'-0" FOR 8" AND LARGER BLOW-OFF, OR AS SPECIFIED

BLOW-OFF CHAMBER



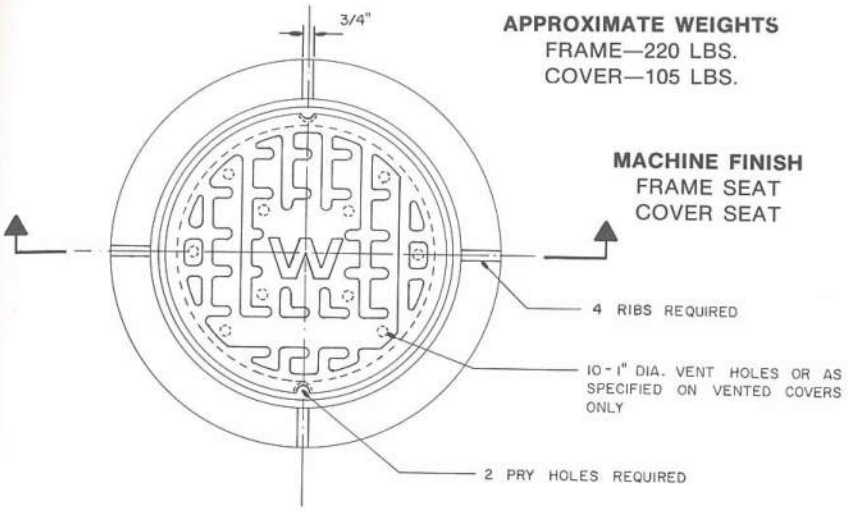
PLAN

Pipe Dia.	A	B	C	D
6"-12"	5'-4"	3'-0"	7"	24"
16"-24"	6'-4"	4'-0"	8"	36"



SECTION

STANDARD MANHOLE

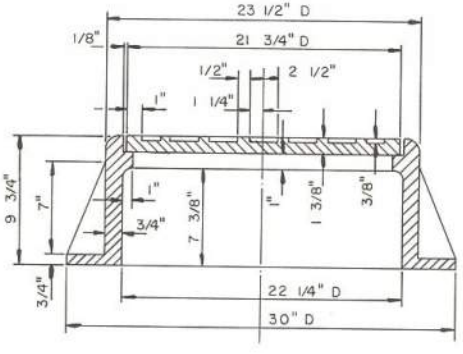


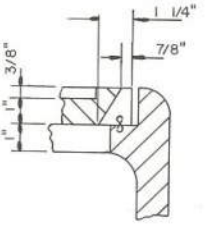
APPROXIMATE WEIGHTS
FRAME—220 LBS.
COVER—105 LBS.

MACHINE FINISH
FRAME SEAT
COVER SEAT

PLAN

MATERIAL
CAST IRON ASTM A-48
CLASS 30 B



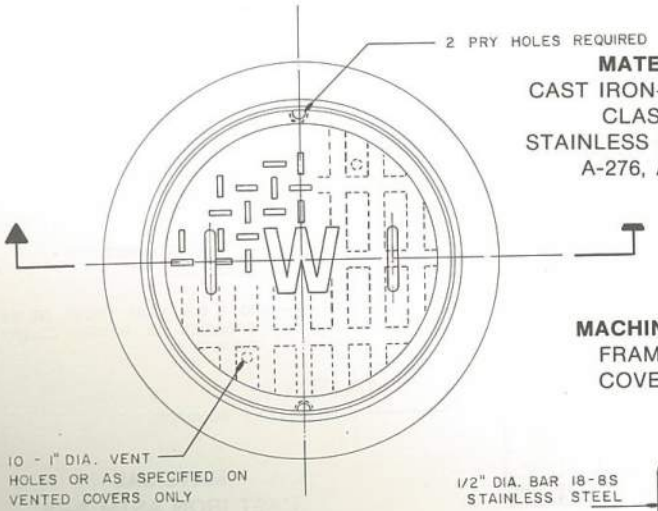


PRY HOLE DETAIL

SECTION

FRAME AND COVER—21¾" DIAMETER

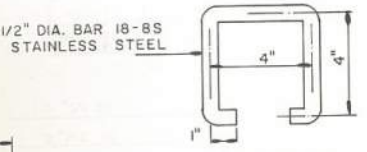
APPROXIMATE WEIGHTS
FRAME—200 LBS.
COVER—175 LBS



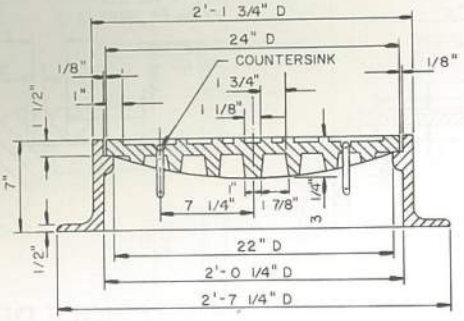
PLAN

MATERIALS
CAST IRON—ASTM A-48
CLASS 30B
STAINLESS STEEL-ASTM
A-276, AISI 304

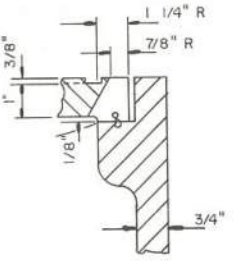
MACHINE FINISH
FRAME SEAT
COVER SEAT



HANDLE

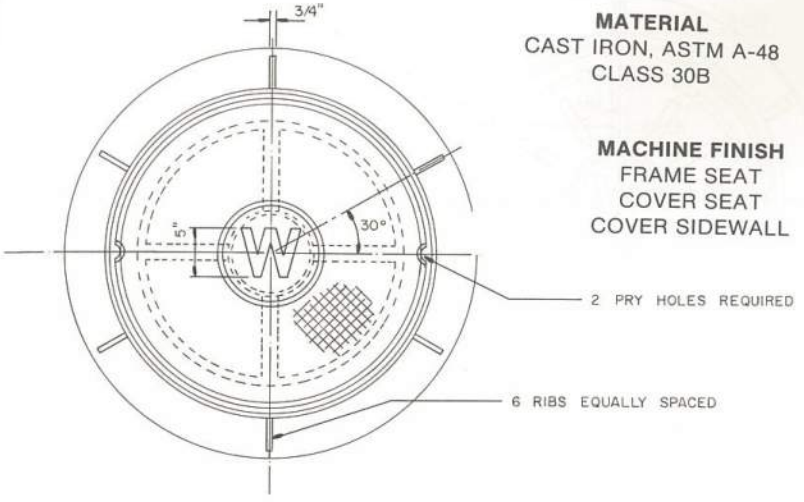


SECTION



PRY HOLE DETAIL

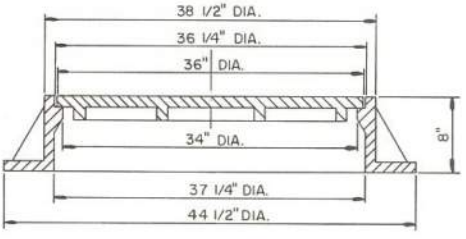
FRAME AND COVER—24" DIAMETER



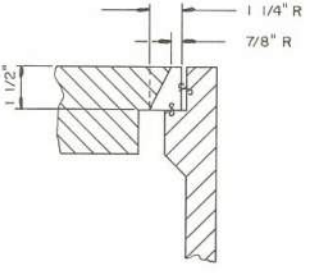
MATERIAL
CAST IRON, ASTM A-48
CLASS 30B

MACHINE FINISH
FRAME SEAT
COVER SEAT
COVER SIDEWALL

PLAN

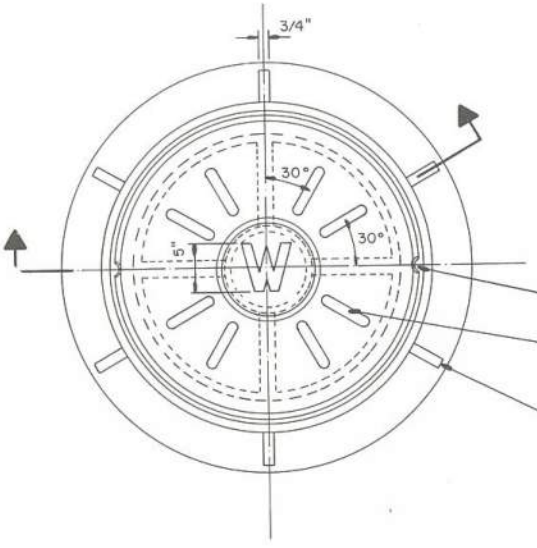


SECTION



PRY HOLE DETAIL

FRAME AND COVER—36" DIAMETER



MATERIAL
CAST IRON, ASTM A-48
CLASS 30B

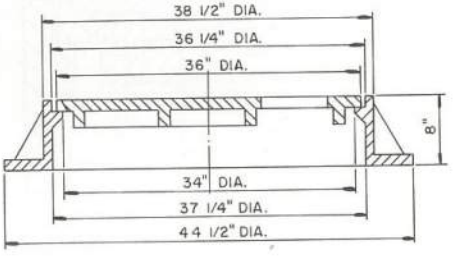
MACHINE FINISH
FRAME SEAT
COVER SEAT
COVER SIDEWALL

2 PRY HOLES REQUIRED

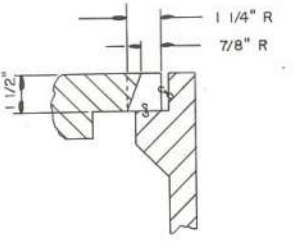
8 VENT SLOTS
1" WIDE X 8" LONG

6 RIBS EQUALLY SPACED

PLAN

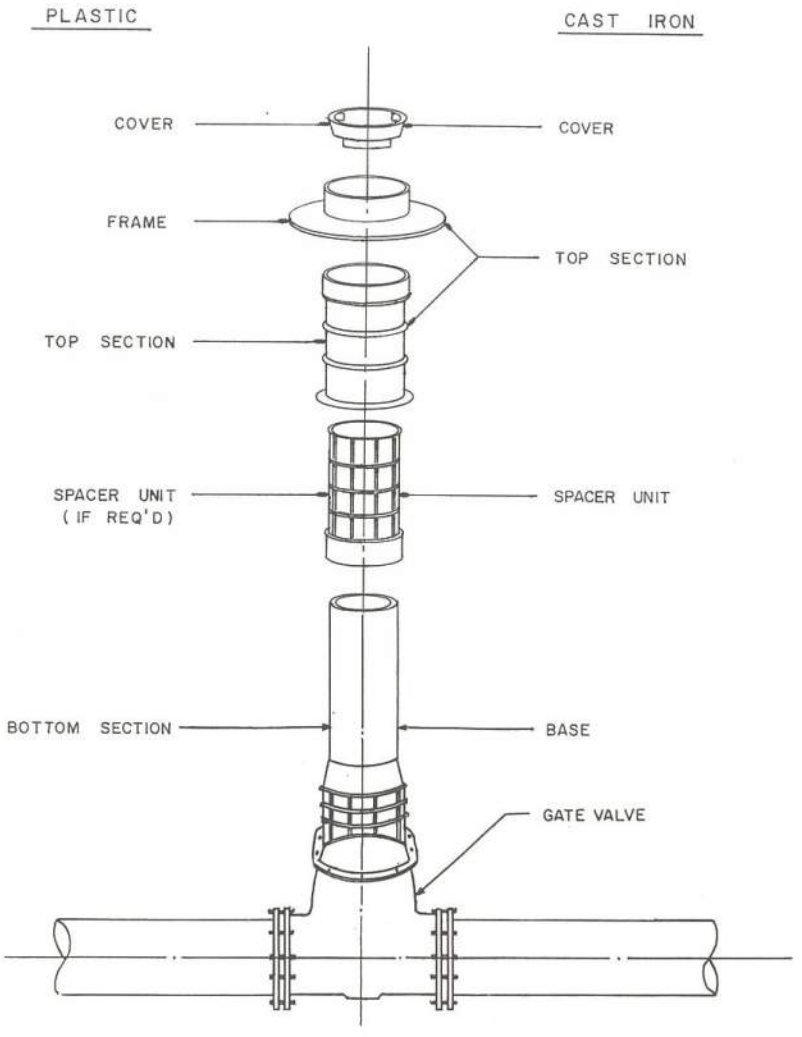


SECTION

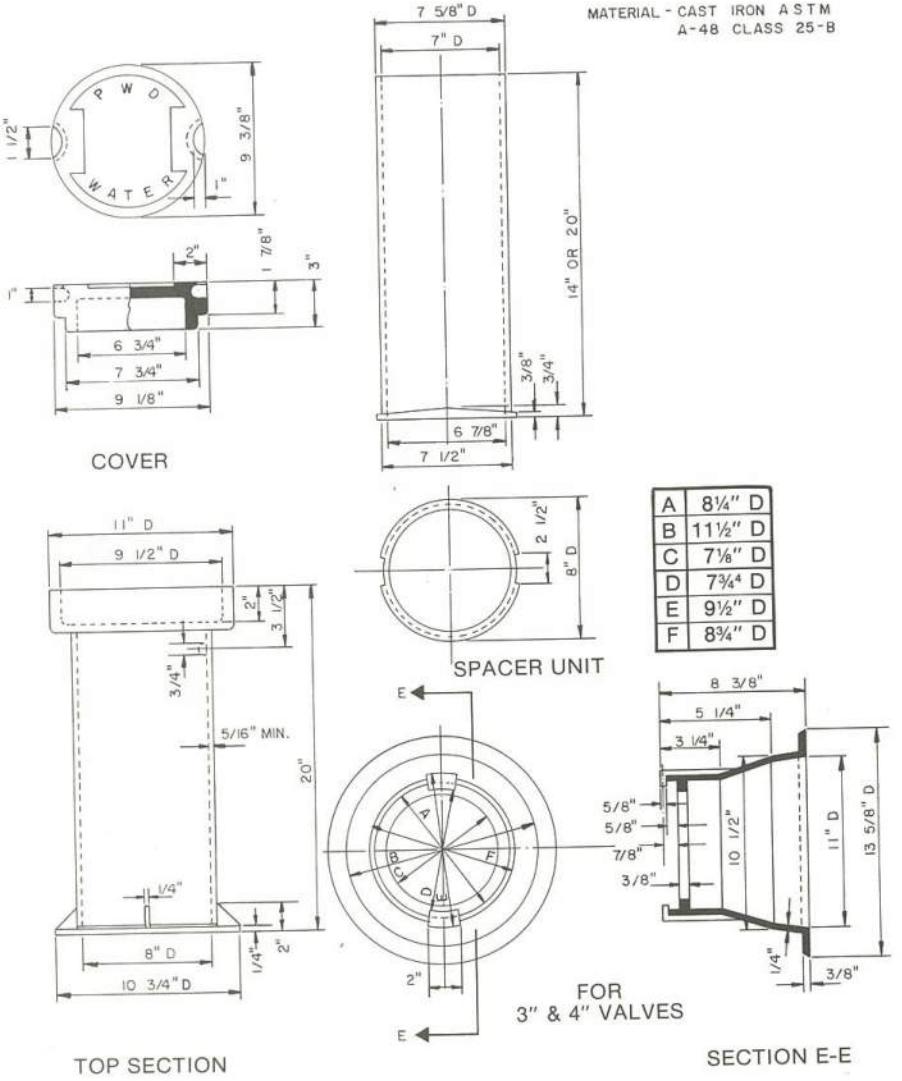


PRY HOLE DETAIL

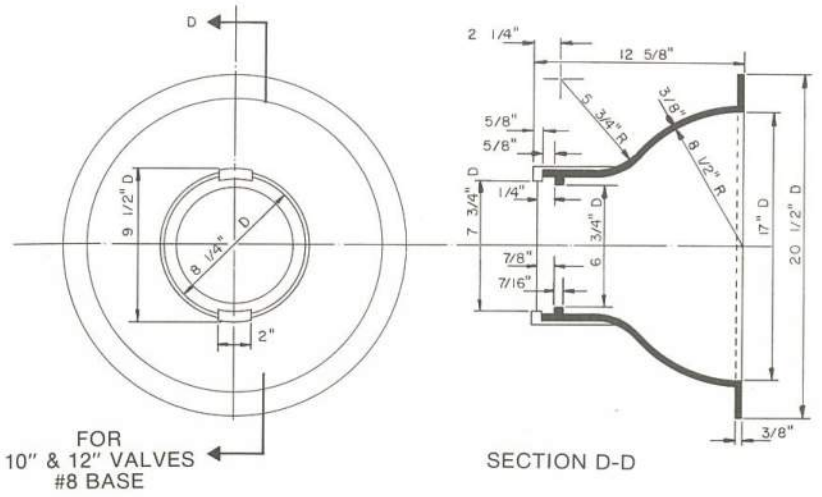
FRAME AND VENTED COVER—36" DIAMETER



STANDARD 7" VALVE BOX ASSEMBLY

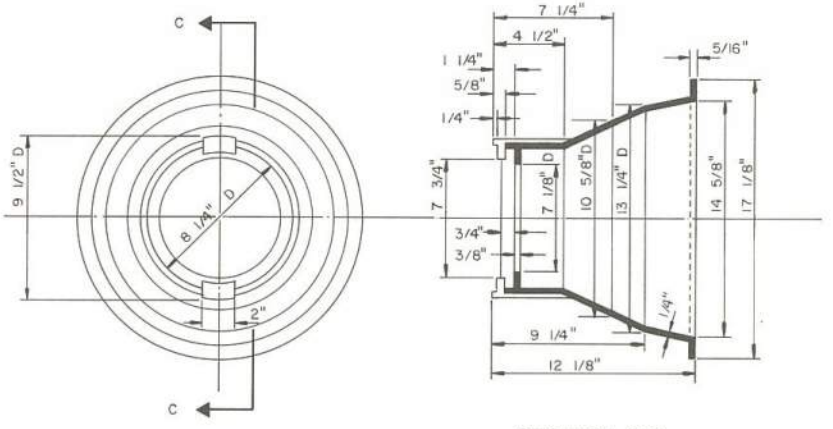


STANDARD 7" CAST IRON VALVE BOX



FOR
10" & 12" VALVES
#8 BASE

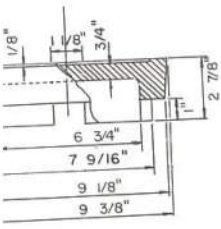
SECTION D-D



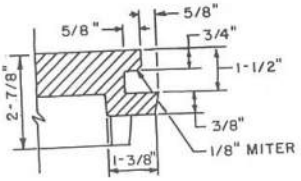
SECTION C-C

FOR
6" & 8" VALVES
#6 BASE

STANDARD 7" CAST IRON VALVE BOX-BASE SECTIONS

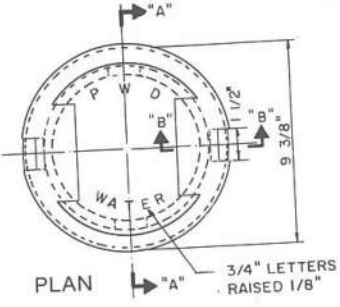


SECTION A-A

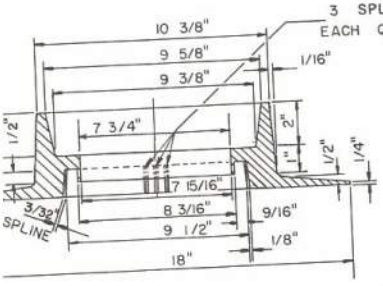


SECTION B-B

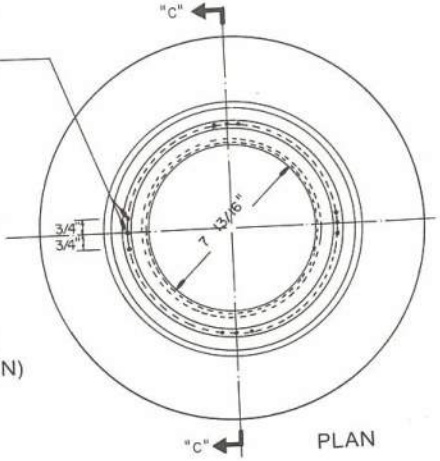
COVER
(CAST IRON)



PLAN

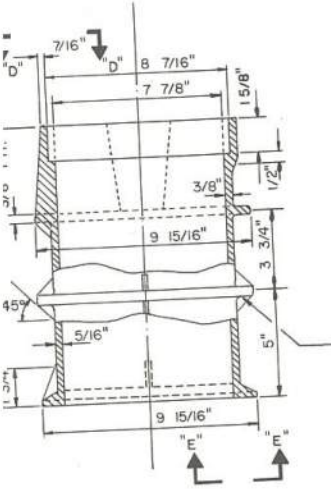


SECTION C-C



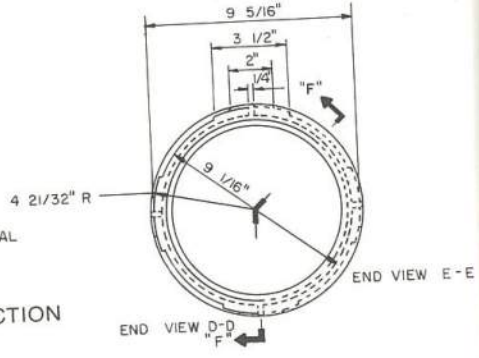
FRAME
(CAST IRON)

PLAN

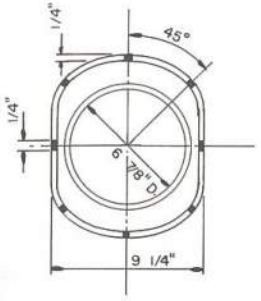


SECTION F-F

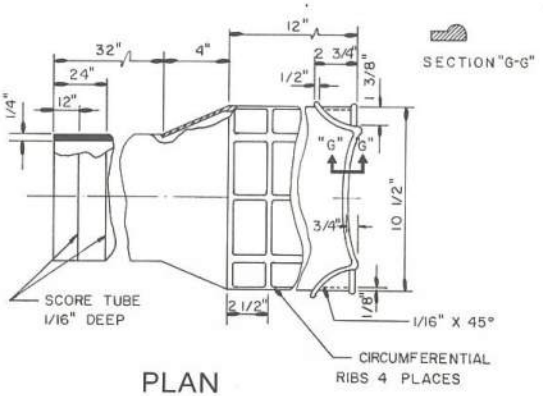
TOP SECTION



STANDARD 7" PLASTIC VALVE BOX
CAST IRON COVER & FRAME-TOP SECTION



SECTION



PLAN

MATERIALS SPECIFICATIONS

PLASTIC: ALL PLASTIC PARTS SHALL BE INJECTION MOLDED. PLASTIC SHALL BE A REINFORCED **OLEFIC** POLYMER IN ACCORDANCE WITH THE REQUIREMENTS OF A.S.T.M. D2853-70, CLASS 1212, REINFORCED WITH A FIBROUS INORGANIC COMPONENT AND STABILIZED WITH CARBON BLACK TO PREVENT MATERIAL DEGRADATION FROM ULTRA-VIOLET LIGHT.

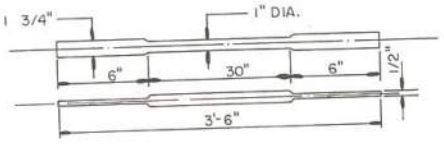
PHYSICAL PROPERTIES

	TEST METHOD-ASTM	MIN TEST VALUES
Tensile Strength (2.0" Min.)	D-638	3400 PSI
Impact Strength I 20 D	D-256	0.6 Ft. Lb./In.
Durometer Hardness, Type D	D-2250	60
Deflection Temperature-66 PSI Stress	D-648	230° F
Specific Gravity	D-792	1.15

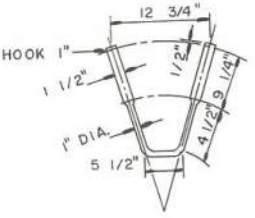
NOTE—SPECIAL ALLOWANCES SHALL BE MADE IF TEST SECTION IS CUT FROM FINISHED PRODUCT

CAST IRON—CAST IRON SHALL CONFORM TO A.S.T.M. A-48, CLASS 30B.

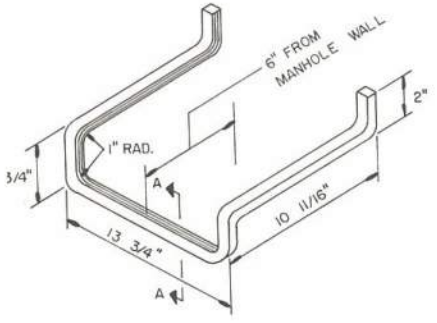
STANDARD 7" PLASTIC VALVE BOX BOTTOM SECTION & SPECIFICATION

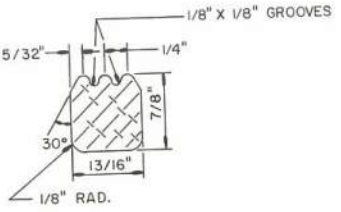


DUCTILE IRON LADDER BAR



DUCTILE IRON STEP



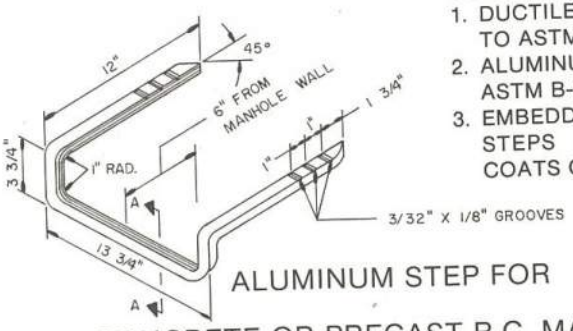


SECTION A-A

MINUM STEP FOR BRICK MANHOLE

NOTES:

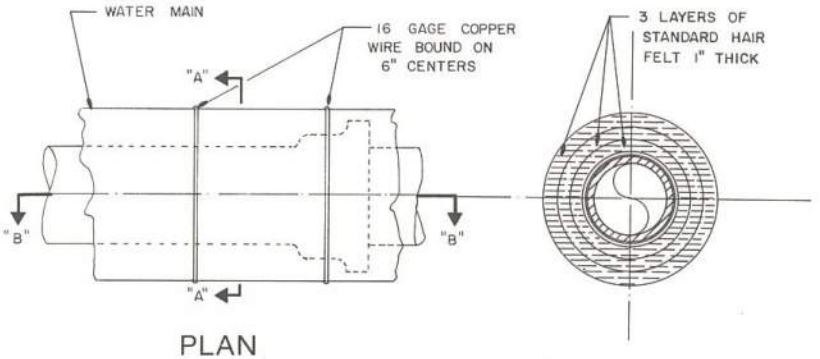
1. DUCTILE IRON SHALL CONFORM TO ASTM A536, GRADE 60-40-18
2. ALUMINUM SHALL CONFORM TO ASTM B-221 ALLOY 6061 T-6
3. EMBEDDED ENDS OF ALUMINUM STEPS SHALL HAVE TWO (2) COATS OF BITUMASTIC.



ALUMINUM STEP FOR

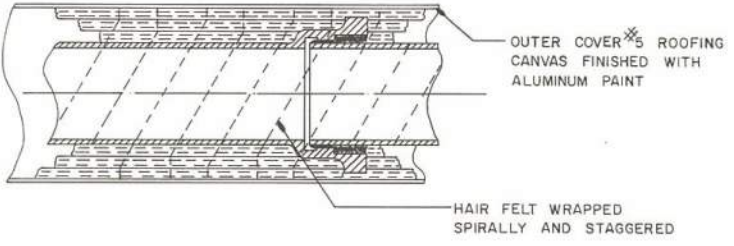
CONCRETE OR PRECAST R.C. MANHOLE

MANHOLE STEPS AND LADDER BARS



PLAN

SECTION A-A

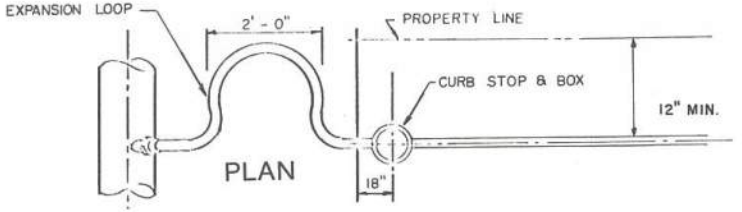


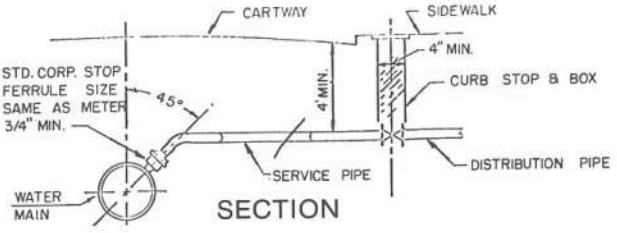
SECTION B-B

NOTES:

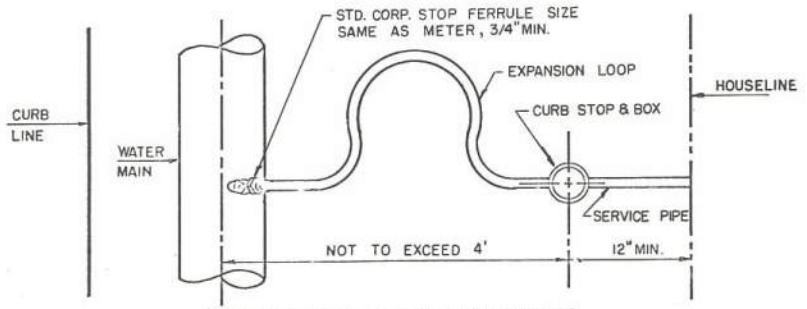
1. EACH LAYER OF FELT SHALL BE WRAPPED WITH TWINE.
2. ALUMINUM PAINT SHALL CONFORM TO PHILA. PROCUREMENT SPEC. No. TT-P-38d.

EXPOSED WATER MAIN FROST PROTECTIVE COVERING

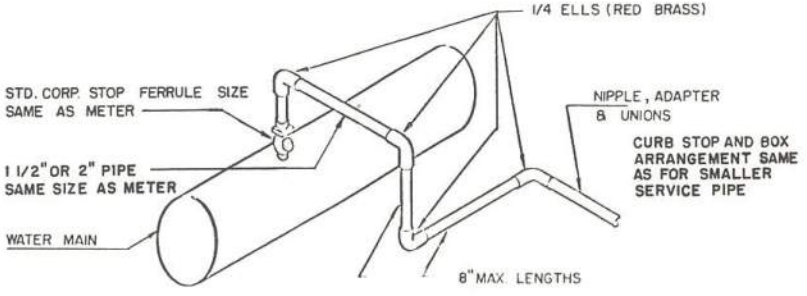




WATER MAIN IN CARTWAY OR OPPOSITE SIDEWALK



WATER MAIN IN SIDEWALK



SWING JOINT FOR 1½ or 2" SERVICE PIPE

SERVICE CONNECTIONS 2" AND SMALLER

NOTES

NOTES

CORROSION CONTROL SPECIFICATIONS

CITY OF PHILADELPHIA
WATER DEPARTMENT

STANDARD SPECIFICATIONS—W-23
FOR
FURNISHING AND INSTALLING
CORROSION CONTROL FOR DUCTILE IRON
WATER MAINS
1979

W-23.1—SCOPE OF SPECIFICATIONS

This specification is a standard part of the Contract Documents and covers furnishing and installing corrosion control for ductile iron water mains.

Both standard corrosion control requirements (W-23.2) which apply to all new ductile iron water mains and special corrosion control requirements (W-23.3 thru W-23.11) which will be used only when specifically required by contract plans and/or specifications are included.

W-23.2—PROTECTIVE COATING OF MECHANICAL JOINTS, HARNESSES, IRON AND STEEL ANCHORS, BOLTING AND MISCELLANEOUS FORMS

A protective coating shall be applied to all mechanical joints, harnesses, iron and steel anchors, and miscellaneous forms wherever used in the construction of ductile iron water mains.

W-23.2.1—COATING MATERIALS

The coating material shall be a cold-applied fast drying black mastic consisting of a bituminous resin and solvents. Coating shall be furnished in one gallon sealed containers. Only fresh material shall be used during construction. All opened containers shall be properly sealed when not in use. Partially hardened or contaminated coating may be rejected by the City inspector.

Acceptable coatings are manufactured by Royston Company (Roskote A-938), by Utility Products Company (Thick-N-Quick Mastic), and by Koppers Company (Bitumastic 50). The use of other coatings, such as roofing coating or cement will not be permitted.

W-23.2.2—APPLICATION OF PROTECTIVE COATING

The following procedures shall be followed in applying the protective coating:

a. Assure the area to be coated is completely dry.
b. Thoroughly clean the area to be coated by wire brushing.
c. Apply the coating material strictly in accordance with manufacturers recommendations.
d. Allow sufficient time for coating to dry prior to backfilling. Under normal conditions, the coating should be sufficiently dry to permit backfilling in not more than one hour.

W-23.2.3—PAYMENT

Unless otherwise specified, separate payment will not be made for the protective coating. The cost of such work shall be included in the price bid for the applicable items.

W-23.3—ATTACHMENT OF WIRES TO DUCTILE IRON PIPE AND CAST/DUCTILE IRON FITTINGS

This specification shall apply to the attachment of all wires to ductile iron pipes and cast or ductile iron fittings for corrosion control purposes, including test stations, bonding and anodes.

W-23.3.1—WIRE ATTACHMENT EQUIPMENT

Equipment suitable for making attachment of copper wire to ductile iron pipe shall be as shown in Table 23.3.1.

W-23.3.2—PREPARATION OF PIPE AND/OR FITTINGS

The pipe and/or fittings shall be prepared as follows:

a. Assure that area where attachment is to be made is absolutely dry.
b. Remove all mill coating, dirt, grime and grease from pipe or fitting surface at weld location by wire brushing and/or the use of suitable safety solvents.
c. Clean pipe or fitting surface at weld location to a bright shiny surface, free of all serious pits and flaws by use of a mechanical grinder or file.

W-23.3.3—PREPARATION OF WIRE

Wire shall be stranded or solid copper wire of the AWG size required by this specification for the indicated use, unless otherwise required by the contract specifications or drawings. All wire shall have 600 V, type TW or THW insulation.

The wire shall be prepared as follows:

a. Assure that cable is absolutely dry. If necessary a fast drying safety solvent may be used to dry cable.
b. Cable must be free of all dirt, grease, corrosion products and all other foreign matter. this may be accomplished by use of a stiff wire brush.
c. Cable is to be cut in such a way as to avoid flattening or forcing out of round. Out of round cable will not permit the mold to sit properly and will cause the molten metal to leak from the mold. To prevent deforming cable, it must be cut with cable cutters or a hacksaw. When using a hacksaw on insulated wire, it is necessary to remove the insulation first in order to avoid coating wire ends with insulating material.

TABLE 23.3.1
EQUIPMENT FOR ATTACHMENT OF COPPER WIRE TO DUCTILE IRON PIPE

PIPE SIZE	AWG WIRE SIZE/STRAND	CADWELD MOLD No.	CADWELD ALLOY CHARGE	CADWELD ADAPTER SLEEVE	THERMOWELD MOLD No.	THERMOWELD PCI CHARGE	THERMOWELD ADAPTER SLEEVE
4"	8/7	CAHBA-1L-4	CA-25-XF-19	CAS421	M-159-4	25	A-201
4"	4/7	CAHBA-1L-4	CA-45-XF-19	———	M-159-4	45	———
6"	12/Solid	CAHBA-1G-6	CA-25-XF-19	CA26180	M-156-6	25	A-200
6"	8/7	CAHBA-1L-6	CA-25-XF-19	CAS421	M-159-6	25	A-201
6"	6/7	CAHBA-1H-6	CA-25-XF-19	———	M-157-6	25	———
6"	4/7	CAHBA-1L-6	CA-45-XF-19	———	M-159-6	45	———
8"	12/Solid	CAHBA-1G-8	CA-25-XF-19	CA26180	M-156-8	25	A-200
8"	8/7	CAHBA-1L-8	CA-25-XF-19	CAS421	M-159-8	25	A-201
8"	6/7	CAHBA-1H-8	CA-25-XF-19	———	M-157-8	25	———
8"	4/7	CAHBA-1L-8	CA-45-XF-19	———	M-159-8	45	———
10"	12/Solid	CAHBA-1G-10	CA-25-XF-19	CA26180	M-156-10	25	A-200
10"	8/7	CAHBA-1L-10	CA-25-XF-19	CAS421	M-159-10	25	A-201
10"	6/7	CAHBA-1H-10	CA-25-XF-19	———	M-157-10	25	———
10"	4/7	CHABA-1L-10	CA-45-XF-19	———	M-159-10	45	———
12"	12/Solid	CAHBA-1G-12	CA-25-XF-19	CA26180	M-156-12	25	A-200
12"	8/7	CAHBA-1L-12	CA-25-XF-19	CAS421	M-159-12	25	A-201
12"	6/7	CAHBA-1H-12	CA-25-XF-19	———	M-157-12	25	———
12"	4/7	CAHBA-1L-12	CA-45-XF-19	———	M-159-12	45	———
16"	12/Solid	CAHBA-1G-16	CA-25-XF-19	CA26180	M-156-16	25	A-200
16"	8/7	CAHBA-1L-16	CA-25-XF-19	CAS421	M-159-16	25	A-201
16"	6/7	CAHBA-1H-16	CA-25-XF-19	———	M-157-16	25	———
16"	4/7	CAHBA-1L-16	CA-45-XF-19	———	M-159-16	45	———
20"	12/Solid	CAHBA-1G-20	CA-25-XF-19	CA26180	M-156-20	25	A-200
20"	8/7	CAHBA-1L-20	CA-25-XF-19	CAS421	M-159-20	25	A-201
20"	6/7	CAHBA-1H-20	CA-25-XF-19	———	M-157-20	25	———
20"	4/7	CAHBA-1L-20	CA-45-XF-19	———	M-159-20	45	———
24"	8/7	CAHBA-1L-24	CA-25-XF-19	CAS421	M-159-24	25	A-201
24"	6/7	CAHBA-1H-24	CA-25-XF-19	———	M-157-24	25	———
24"	4/7	CAHBA-1L-24	CA-45-XF-19	———	M-159-24	45	———

. Insulation shall be removed in a manner to avoid damage to strands.
. Cable is to be held at 30° to 45° angle to the pipe surface when welding.
. When using adapter sleeves, wire is to extend ¼-inch beyond the end of the sleeve.

/-23.3.4—ATTACHMENT OF WIRE TO PIPE OR FITTINGS

The attachment of the copper wire shall be made as shown in igure 23.3.4.

/-23.3.5—TESTING OF ALL COMPLETED WELDS

As soon as the weld has cooled, all weld slag shall be removed and ıe weldment tested for strength by striking a sharp blow with a two ound hammer while pulling firmly on the wire. All unsound welds hall be rewelded and retested at the Contractor's expense.

Mold and mold covers shall be thoroughly cleaned after ompletion of each weld to assure that no slag will penetrate into the ext weld.

/-23.3.6—COATING OF ALL COMPLETED WELDS

All sound welds shall be coated as specified in W-23.2.

V-23.4—STANDARD TEST STATIONS

Five types of standard test stations are included in this Standard ;pecifications. The specific type and location of the test station shall ıe as shown on the contract drawings. Types I, II and III are :lectrolysis test stations and shall be as shown in Figures W-23.4 Type , W-23.4 Type II and W-23.4 Type III, respectively. Type IV is an :lectrolysis bonding test station and shall be as shown in Figure V-23.4 Type IV. Type V is a magnesium anode test station and shall be nstalled in accordance with Figure W-23.4 Type V, and with the anode n accordance with Section W-23.5 of these specifications.

V-23.4.1—STANDARD ELECTROLYSIS TEST BOX

Where the contract drawings or standard test station drawings call or the use of a 5-inch roadway box, upper section only, it shall be as ;hown in Figure W-23.4.1 of cast iron construction and marked as ;hown. Payment for this item will include upper section only with ;over and will not include extensions or valve seats unless otherwise ıoted.

V-23.4.2—12-INCH ROADWAY BOX TEST STATION HOUSING

Where the contract drawings or standard test station drawings call or the use of a 12-inch roadway box, heavy highway type, it shall be as ;hown in Figure W-23.4.2 of cast iron construction.

W-23.4.3—ELECTRODES

Electrodes shall be provided where required for all standard test stations. The electrodes shall be made from scrap iron or reinforcing bar approximately 6 inches long by one half inch diameter, and be installed twelve inches below the pipe or as indicated on the applicable drawings. AWG No. 8 stranded copper wire shall be brazed or thermite welded to the electrode. The weld area shall be coated in accordance with W-23.2.

W-23.4.4—WIRES

Test station wires shall be attached to the main in accordance with W-23.3, and be of the type required. Where two wires are attached to the same section of pipe, they shall be installed twelve inches apart. Sufficient slack wire shall be left in all test station boxes so that all wires can be extended twelve inches above grade. Where wire tags are called for, they shall be one inch diameter brass stamped with the indicated symbol.

W-23.5—MAGNESIUM ANODES

Magnesium anodes shall be installed only within the limits shown on the contract drawings. Unless otherwise specified, pipe joints shall not be bonded unless a number of fittings are grouped, and then only as hereinafter specified. One 32 pound magnesium anode shall be installed on each ductile iron pipe length and/or grouping of cast or ductile iron pipe and fittings.

W-23.5.1—ANODE COMPOSITION AND ASSEMBLY

The anode shall have a nominal weight of 32 pounds, excluding backfill, of which there shall be 6% aluminum, 3% zinc alloy, 1% manganese and the remainder magnesium. The backfill shall have a nominal weight of 38 pounds, with 20% bentonite, 5% sodium sulphate (NA_2SO_4) and the remainder gypsum.

The anode and backfill shall be prepackaged into a single unit, usually a cloth bag, a minimum of ten feet of AWG No. 12 solid copper wire with TW insulation shall be attached to the anode. Wire to anode attachment shall be sealed to prevent any moisture penetration.

W-23.5.2—INDIVIDUAL ANODE INSTALLATION

Anode wires shall be attached to ductile iron pipe and cast or ductile iron fittings in accordance with W-23.3. Anodes shall be installed in holes dug in existing earth, not in the sand backfill, as shown in Figure W-23.5.2A. Anode holes shall be backfilled with soil from the excavation. Paper shipping bags should be removed before installation. The cloth bag containing a special chemical mix shall not be disturbed. Where the anode hole is dry, the anode shall be presoaked in a bucket of water. One anode is required for each full length of ductile iron pipe.

Where a single fitting, such as a bend, reducer, or valve is involved, the fitting shall be bonded to one of the connecting pipes with two No. 4 AWG stranded copper wires in accordance with Figure W-23.6A. Anode shall not be attached to the fitting.

Where several fittings and/or short sections of pipe are in close proximity they shall be bonded together with No. 4 AWG stranded copper wire in groupings not greater than 25 feet from unbonded joint to unbonded joint. Each grouping shall have one anode installed. Bonding shall be in accordance with Section W-23.6. Figure No. W-23.5.2B shows a typical arrangement of a grouping of fittings.

W-23.5.3—GROUND BED ANODE INSTALLATION

This classification covers the installation of sacrificial magnesium anodes spliced to a common bus wire at the location specified on the contract drawings. The final arrangement shall be as shown in Figure W-23.5.3a.

Magnesium anodes used for this item shall be in accordance with paragraph W-23.5.1 of the standard specifications. Nominal anode weight shall be 32 lbs.

Anodes shall be installed in a horizontal position three feet below the bottom of the pipe and approximately two feet off the centerline of the main in the corner of the pipe trench, spaced ten feet apart. Under no circumstances shall the anodes be installed in clean sand fill.

The AWG No. 12 solid wire supplied with the anode shall be spliced to an AWG No. 8 stranded copper wire through the use of a compression connector. The resulting splice shall be taped with a layer of splicing compounds (50% overlap) followed by a layer of vinyl electrical tape (50% overlap) as shown on Figure W-23.5.3b.

Anode bus wire and two AWG No. 8 wires thermite welded to the main are to be terminated in a 5-inch roadway box as shown on the contract drawings. Anode bus wire will be connected to the main wires at a later date.

W-23.5.4—RECORDS

The Contractor shall keep a record of the location of each anode. Dimensions shall be referenced from line valves. This record shall be transmitted to the Water Department with other records of the job.

W-23.6—BONDING

Joints shall be bonded only when specifically required by the contract drawings, specifications or applicable Standards. When required, all joints within the limits shown on the contract drawings, including tie-ins, fire hydrants and fire hydrant laterals shall be bonded by attachment of two AWG No. 4, stranded copper wires. Bonding across joints of straight pipe shall be in accordance with Figure No. W-23.6A. Bonding across joints of fittings shall be in accordance with Figure No. W-23.6B. The attachments of wires shall be in accordance with W-23.3. Bond wire length shall be kept at a minimum.

W-23.7—ELECTRICAL INSULATION OF LINE PIPING

Polyvinyl Chloride (P.V.C.) pipe inserts and insulator test stations, when called for in the contract drawings, shall be furnished and installed in accordance with this section of the Corrosion Control Standard (W-23).

W-23.7.1—POLYVINYL CHLORIDE PIPE INSERTS

P.V.C. pipe shall be in complete accordance with AWWA C900 for Polyvinyl Chloride (P.V.C.) Pressure Pipe, 4 in. through 12 in., for Water. P.V.C. pipe shall be 200 psi pressure class with cast iron pipe outside diameter. Inserts shall be the same nominal size as the adjacent line pipe and shall be supplied in 18 inch plain ended segments.

The exact location of the insert shall be determined in the field to avoid the installation of ferrules in the insert. The pipe insert shall be installed in accordance with Water Department Standards and manufacturers recommendations.

P.V.C. pipe inserts should be installed directly into push-on or mechanical joint pipe including mechanical joint gate valves providing the resulting pipe joints can remain unharnessed. Under no circumstances shall bond wires be installed across the P.V.C. insert.

W-23.7.2—COATING REQUIREMENTS AT INSULATORS

The push-on joint and/or mechanical joint at each end of the P.V.C. insert shall be coated with a cold-applied bituminous coating in accordance with Section W-23.2.1 of these specifications for a distance of 8-inches from the face of the joint including all bolting components. Coating requirements other than this standard procedure will be as specified on the contract drawings, or in accordance with Section W-23.9 as they apply.

W-23.7.3—ELECTROLYSIS TEST STATION AT INSULATORS

Where the contract drawings specify installation of P.V.C. pipe nserts, an electrolysis test station as shown in Figure W-23.7A or 7B hall be installed with the insert. All wires, attachment procedures, and velding equipment shall be in accordance with Section W-23.3 of hese specifications.

W-23.8—SUPPLEMENTAL GROUNDING REQUIREMENTS

Where the contract drawings specify the installation of supplemental ground rods at specific water services, they shall be nstalled in accordance with the arrangement shown in Figure W-23.8 using the following materials and procedures, and in accordance with applicable electrical codes.

W-23.8.1—GROUND RODS

Ground rods shall be ⅝-inch diameter 8-foot long steel core copper clad rods specifically manufactured for use as a grounding device. Rods shall be driven into the earth at the service valve. Non-copper rods will not be permitted.

W-23.8.2—INSTALLATION OF GROUND RODS

Ground rods will be attached to service pipe on the house side of the water service valve (curb cock) through the use of an AWG No. 4 stranded copper wire mechanically attached to both the ground rod and the water service. Ground rods shall be positioned no more than 6-inches away from the service valve and shall extend 1 foot above the top of the valve after driving.

W-23.8.3—GROUND ROD CLAMPS

Clamps used for attachment of wires to ground rods and service pipes shall be of all copper or copper alloy (brass or bronze) construction, including bolts, washers, and nuts. Under no circumstances will non-copper alloy or copper clad components be permitted for use as clamps and connectors.

Connectors used for attachment of wires to ground rods shall consist of a single slip-on unit that houses both wire and rod and secured with a single bolt or set screw.

W-23.8.4—SERVICE PIPE CLAMPS

Clamps used for attachment of wires to service pipe shall consist of a U-bolt arrangement for the pipe and integral clamp arrangement for the wire. Single point of contact connectors will not be permitted as they may damage thin wall service pipe. Care must be exercised during installation of service pipe clamps so as not to damage service piping.

W-23.9—EXTRUDED POLYETHYLENE COATING

All ductile iron pipe lengths as specified on the contract drawings are to be coated with an extruded-polyethylene-hot butyl rubber protective coating system in accordance with these specifications.

W-23.9.1—LINE PIPE EXTERNAL COATING—SHOP APPLIED

This specification covers the general procedures for the shop applied spiral application of hot butyl rubber adhesive and virgin black polyethylene for protection against external corrosion. Coating shall be H. C. Price Company Pritec or approved equal.

a. Preparation of Surfaces—Pipe should, if possible, be ordered bare, free of mill preservatives.

The exterior of the pipe shall be free of all rust, rust preventatives, or other foreign matter. This shall be accomplished by thoroughly blasting the pipe's surface with a sand, grit, or shot to a NACE No. 3 Commercial blast cleaned surface finish. "A NACE No. 3 is a surface from which all oil, grease, dirt, rust scale, and foreign matter have been completely removed and all rust, mill scale, and old paint have been removed except for slight shadows, streaks, or discolorations caused by rust stain or mill scale oxide binder. At least two-thirds of the surface area shall be free of all visible residues, and the remainder shall be limited to light discoloration, slight staining, or light residues mentioned above. If the surface is pitted, slight residues of rust or paint are found in the bottom of pits."

b. Adhesive—The adhesive shall consist of a compound of pure gum butyl rubber, a tackifier, polybutylene, vinyl acetate copolymer, and the necessary stabilizers for thermal and ultraviolet protection. The adhesive shall be permanently tacky and shall adhere to the pipe and the polyethylene coating.

c. Plastic Resin—The resin shall be a virgin, medium density copolymer of ethylene and butene—1. Carbon black (N-550) shall be dispersed in the resin at the rate of 2½ percent by weight. The resin shall meet the requirements of ASTM D 1248-70a, Type II, Class C, Category 5. The PPI designation is PE-2306.

d. Application—The exterior surface of the pipe shall be prepared as in paragraph W-23.9.1a. The specified thickness of hot butyl rubber adhesive shall be extruded spirally around the pipe in two layers. Immediately after the adhesive, three layers of virgin black polyethylene shall be applied from a second extruder producing a bonded, seamless coating 40 to 60 mils thick (nominal thickness less 10% tolerance). Nominal total coating system thickness shall be 50 mils.

e. Coating application shall provide a coating cutback on the pigot end of each pipe length in accordance with the following table or each pipe diameter. The distances shown apply to where the ctual cut should be made. Allowance for coating shrinkage is ncluded in the cutbacks listed.

Nominal Diameter	Cutback—Spigot End
4"	2.75" + .03 (1/32")
6"	3.00" + .03 (1/32")
8"	3.25" + .03 (1/32")
10"	3.25" + .03 (1/32")
12"	3.25" + .03 (1/32")
16"	4.37" + .03 (1/32")

Coating shall extend to the face of the bell end as shown in Figure W-23.9.1. All disbonded coating shall be repaired prior to nstallation of the pipe in the trench. Repairs shall be in accordance with paragraphs W-23.9.2.

f. Pipe coating shall be 100% inspected for pinholes and holidays mmediately after application with a holiday detector adjusted to provide sufficient voltage to produce a spark through a pinhole in the coating (at least 15 KV ac).

g. Defective external coating shall be recoated to meet all equirements of this specification.

W-23.9.2—IRREGULAR PIECES EXTERNAL COATING—FIELD APPLIED

This classification shall include all fittings such as tees, bends, sleeves and hydrants excluding valves. All items in this classification shall be primed and coated with a cold-applied polyethylene backed tape and cold-applied bitumen coating in accordance with the following procedures and as shown in Figures W-23.9.2a and W-23.9.2b.

The composite tape system shall consist of a polyethylene outer ayer no less than 5 mils thick and an inner synthetic elastomer layer not less than 40 mils thick. This tape shall be of the type which equires a primer prior to application. Tapes with an adhesive as part of the tape structure are not acceptable. Cold-applied bitumen coating shall be as set forth in W-23.2.1 of the Standard Specification.

W-23.9.2.1—INSTALLATION REQUIREMENTS

a. Remove all dirt, grime, grease, rust and loosely adhering mill scale from the assembled joint or fitting to be coated by power wire brushing and/or use of suitable safety solvents.

b. Apply the primer specified by the tape manufacturer to the pipe surface to be coated. The primer should cover the pipe and the 2-inch wide bands of roughened mill coating. Allow the primer to dry as specified.

c. Apply the tape, maximum 2-inches wide to the primed pipe in accordance with the manufacturer's instructions so as to provide a 50% overlap of tape. Care should be taken to form tape tightly around irregular surfaces. Tape shall extend up to the fitting side of mechanical joint flanges.

d. The face of all bell joints on straight pipe shall be coated with a cold-applied bitumastic coating per W-23.2.1 of the standard specifications, both prior to installation into the pipe trench, and after push-on joint assembly. The assembled pipe joint shall be such that there are no uncoated areas remaining on the spigot or bell ends. All such areas shall be coated in accordance with paragraphs "a" through "d" above.

e. All exposed metal at mechanical joints, including bolts shall be coated with a cold-applied bitumastic coating per W-23.3.1 of the standard specifications and as shown in Figure W-23.9.2b.

f. Where bond wires are required, thermite welding should be done on exposed bare pipe surfaces if possible, and thoroughly coated with cold-applied bitumastic coating. If this is not possible, a minimum amount of mill applied coating or tape coating should be removed from the pipe surface by cutting away an area of 4 square inches. All butyl adhesive and/or primer should be removed, the weld made, and then recoated with a cold-applied bituminous coating as shown in Figure W-23.9.2c.

Line valves are not to be taped but coated with a cold-applied bituminous coating per W-23.2.1 of the standard specifications.

W.23.9.3—TRANSPORTING COATED PIPE

Protected pipe shall be handled at all times with equipment such as stout, wide belt slings and wide padded skids designed to prevent damage to the coating. Bare cables, chains, hooks, metal bars, or narrow skids shall not be permitted to come in contact with the coating.

When shipped by rail, all pipe shall be carefully loaded on properly padded saddles or bolsters. All bearing surfaces and loading stakes shall be properly padded with approved materials. Pipe sections shall be separated so that they do not bear against each other, and the whole load shall be securely fastened together to prevent movement in transit. The pipe shall be loaded and tied into a unit load in strict accordance with the current loading rules of the American Railway Association, whenever they are applicable.

In truck shipments, the pipe shall be supported in wide cradles of suitably padded timbers hollowed out on the supporting surface to fit the curvature of pipe, and all chains, cables, or other equipment used for fastening the load shall be carefully padded. For smaller-diameter pipe, sand or sawdust-filled bags may be used instead of hollowed-out timbers.

The purchaser shall inspect the pipe and pipe protection on cars or trucks at destination, and if the pipe or pipe protection was damaged during shipment, claim shall be made against the carrier.

W-23.9.4—HANDLING COATED PIPE IN FIELD OR AT TRENCH

Pipe shall be stored along the trench side, suitably supported off the ground to avoid damage to the coating.

Pipe shall be hoisted from the trench side to the trench by means of wide belt slings. Chains, cables, tongs, or other equipment likely to cause damage to the coating will not be permitted, nor will dragging or skidding of the pipe. The contractor shall allow inspection of the coating on the underside of the pipe while it is suspended from the slings. Any damage shall be repaired before the pipe is lowered into the trench.

At all times during construction of the pipe line, the contractor shall use every precaution to prevent damage to protective coating on the pipe. No metal tools or heavy objects shall be permitted to come into contact unnecessarily with the finished coating. Workmen will be permitted to walk upon the coating only when necessary, in which case they shall wear shoes with rubber or composition soles and heels. This rule shall apply to all surfaces, whether bare, primed, or coated. Any damage to the pipe or the protective coating from any cause during the installation of the pipeline and before final acceptance by the purchaser shall be repaired as directed by the inspectors, by and at the expense of the laying contractor.

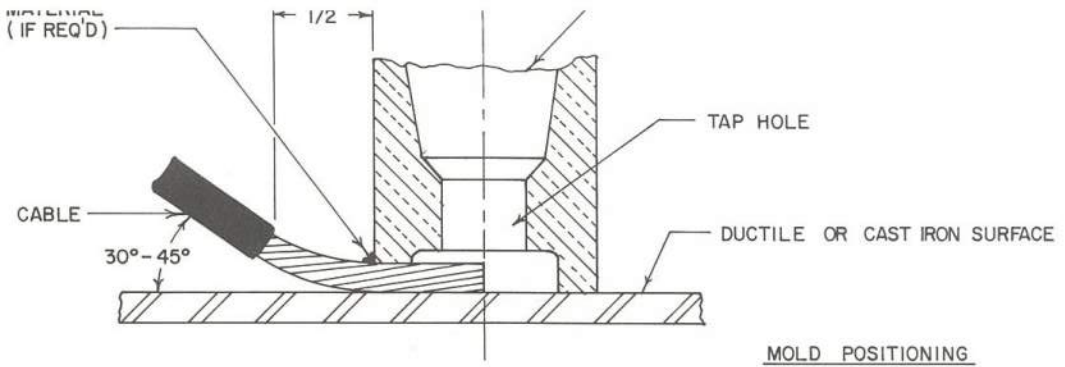
W-23.10—RESERVED FOR FUTURE USE

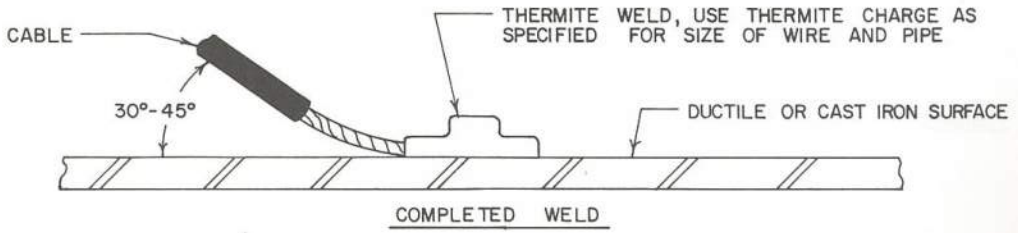
W-23.11—TESTING

In all cases in which wires are attached to the main for corrosion control purposes or where test stations are installed, the electrical continuity of the water main will be tested by the Water Department after backfilling but prior to paving at no cost to the Contractor.

In the event electrical measurements or visual inspection indicate defective or omitted work, the Contractor shall provide all labor, materials and equipment to locate, repair, and/or replace such defective or omitted work, to the satisfaction of the Engineer.

The Contractor shall bear all costs associated with this repair including the cost of all further testing necessary to bring the work into conformance with the specifications.





THERMITE WELD
FIGURE W-23.3.4

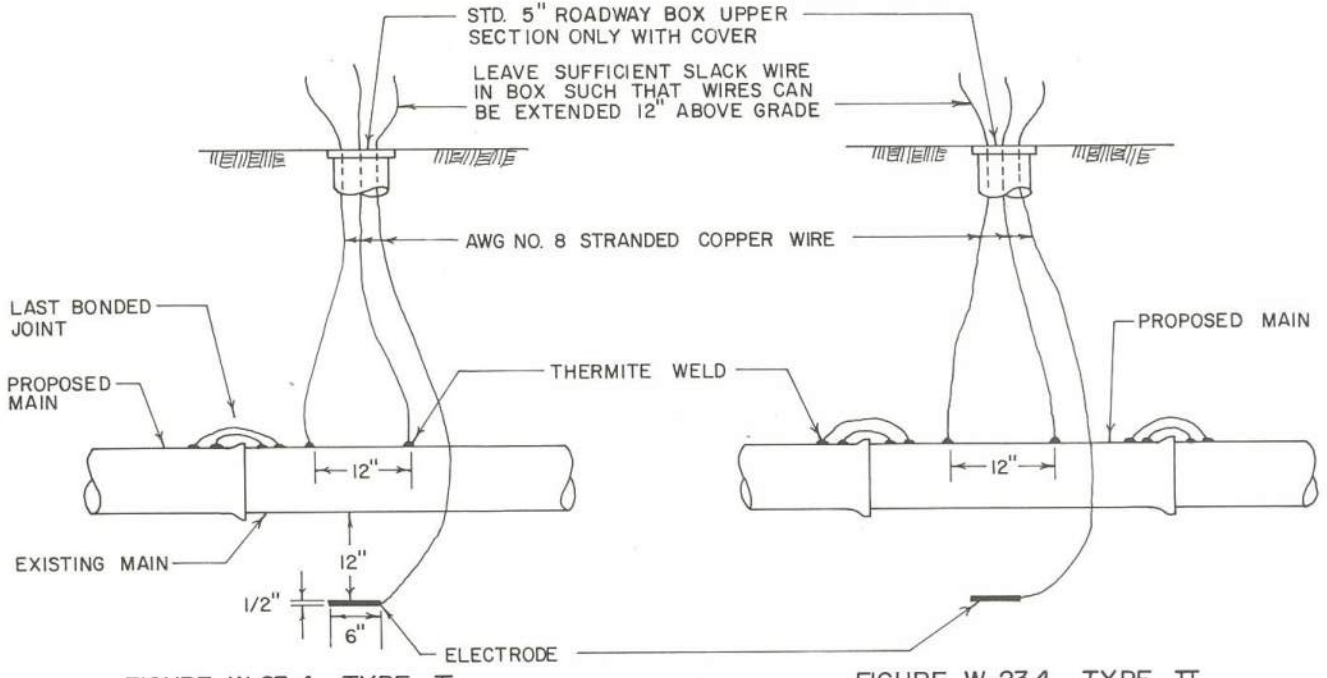
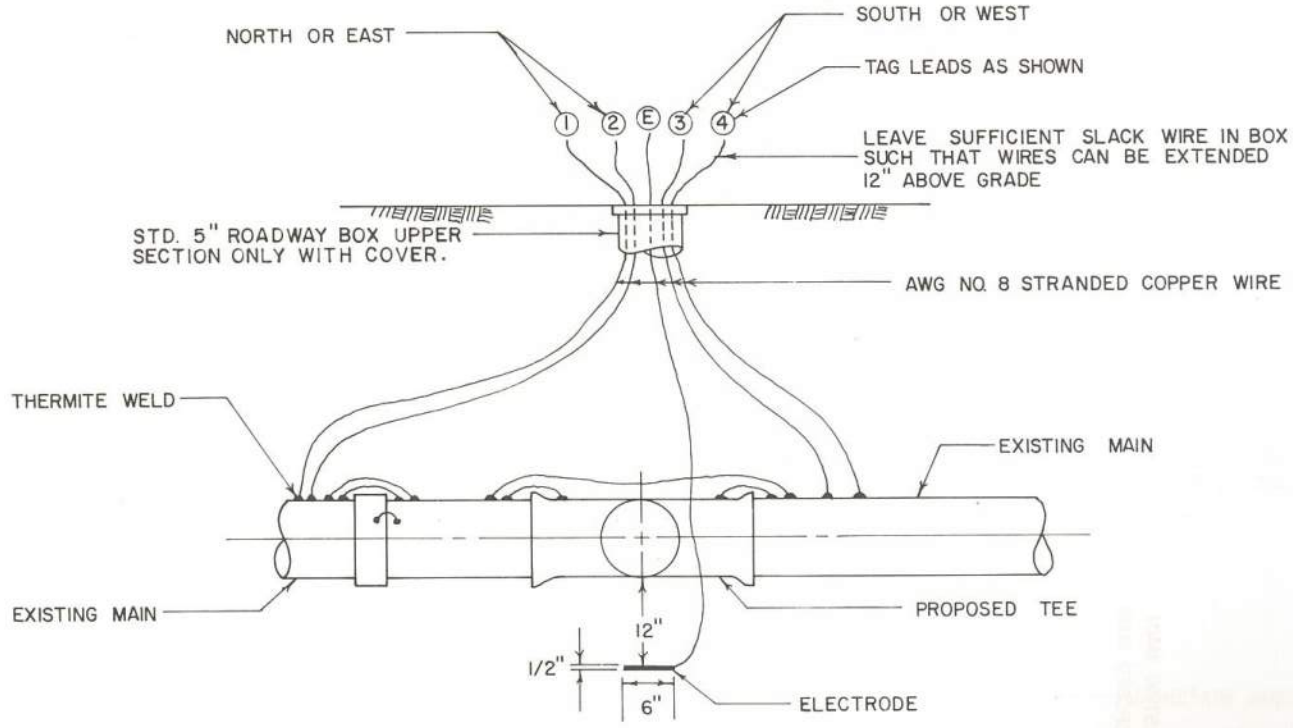


FIGURE W-23.4 TYPE I

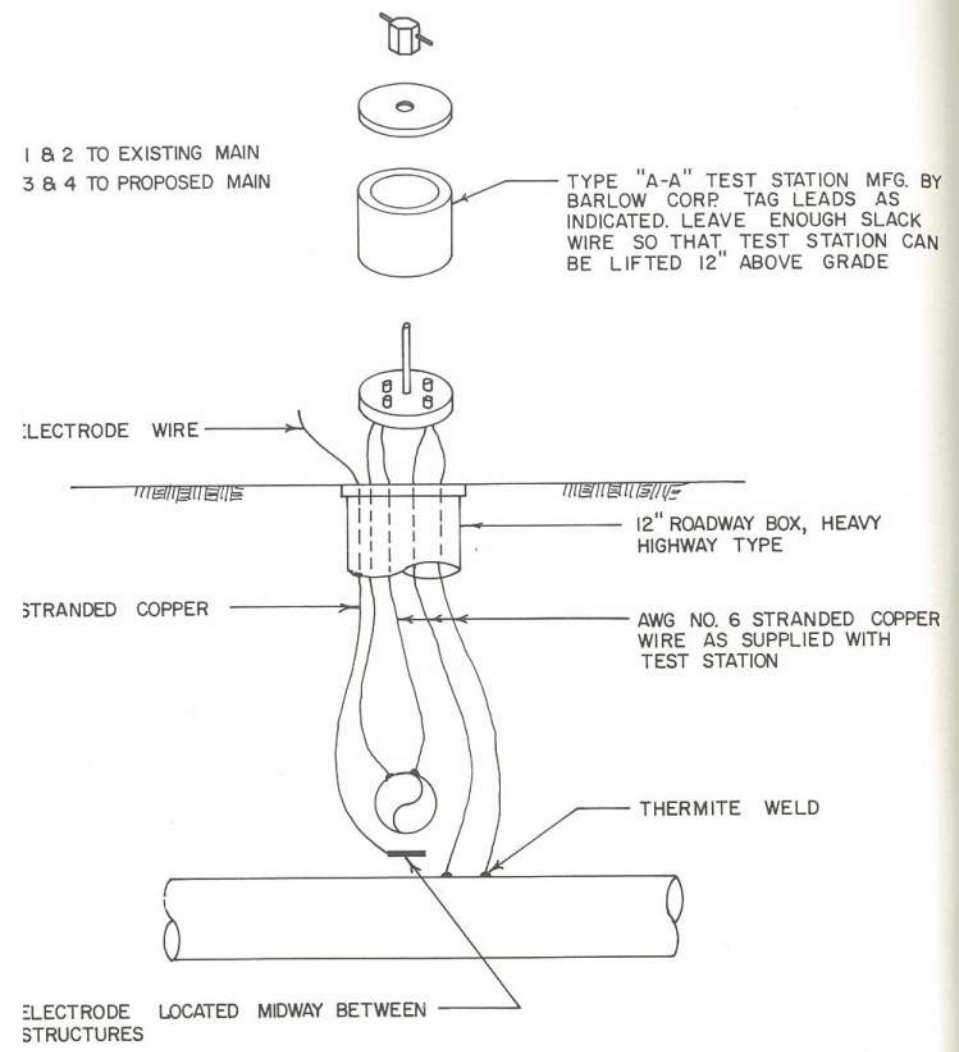
FIGURE W-23.4 TYPE II

ELECTROLYSIS TEST STATION

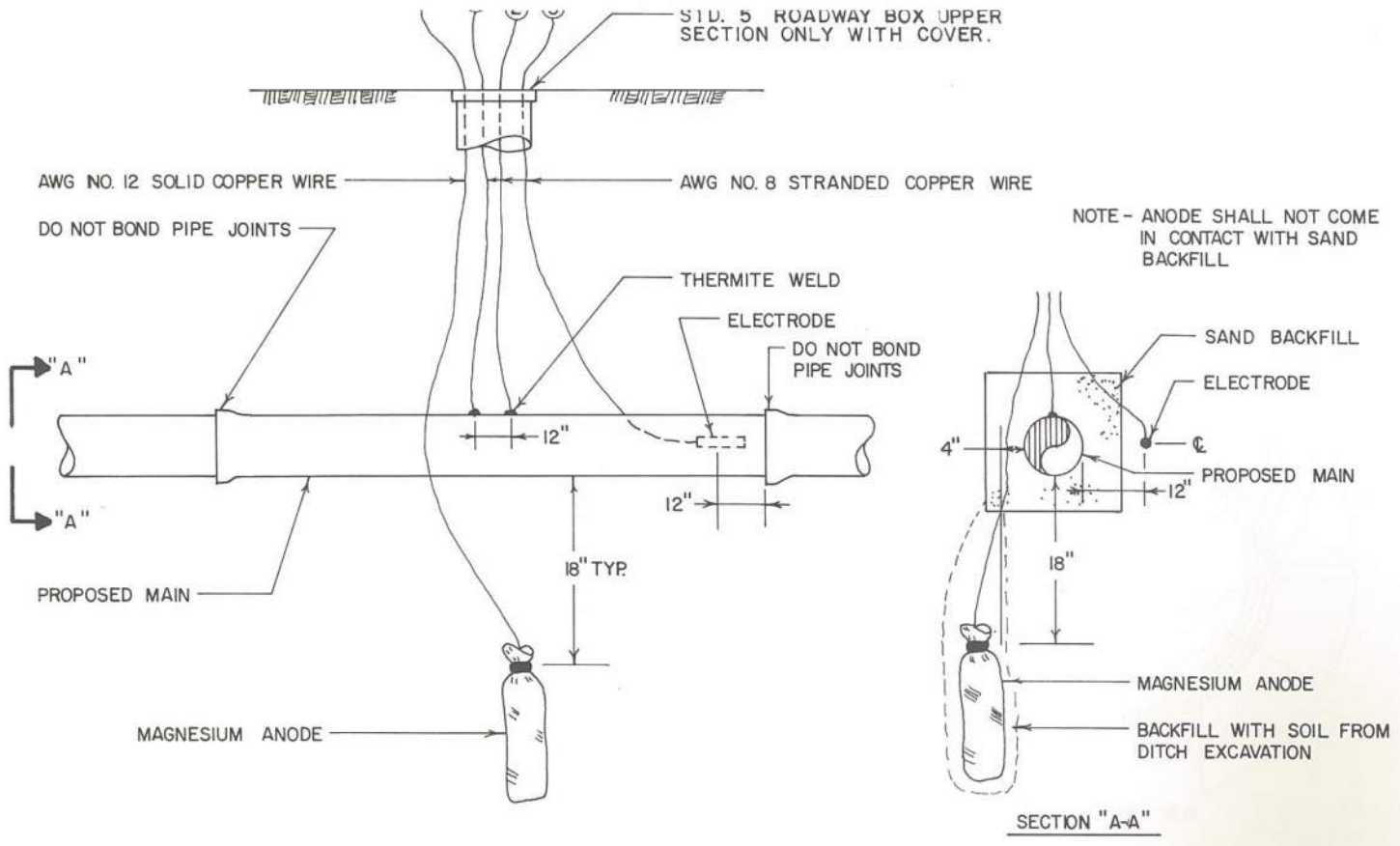


ELECTROLYSIS TEST STATION

FIGURE W-23.4 TYPE III

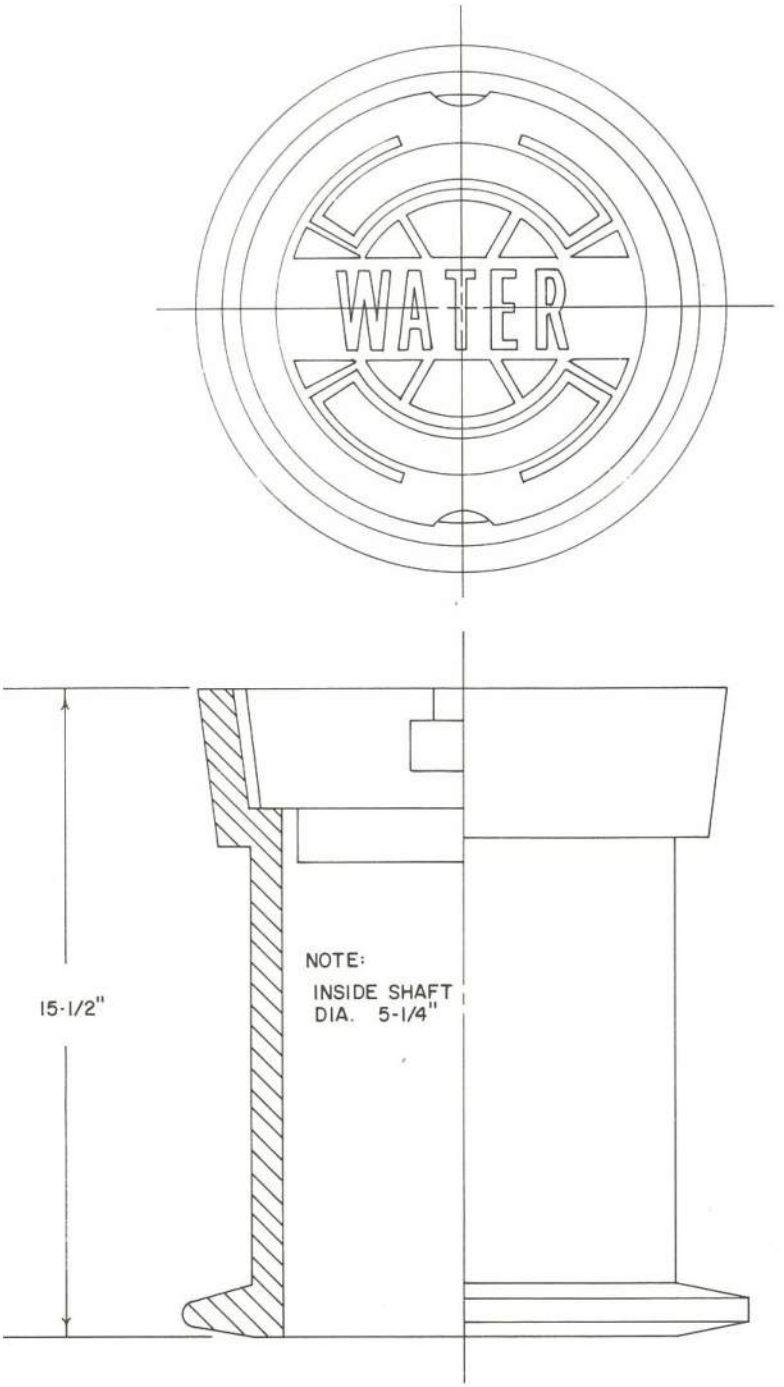


ELECTROLYSIS BONDING STATION
TYPE IV
FIGURE W-23.4



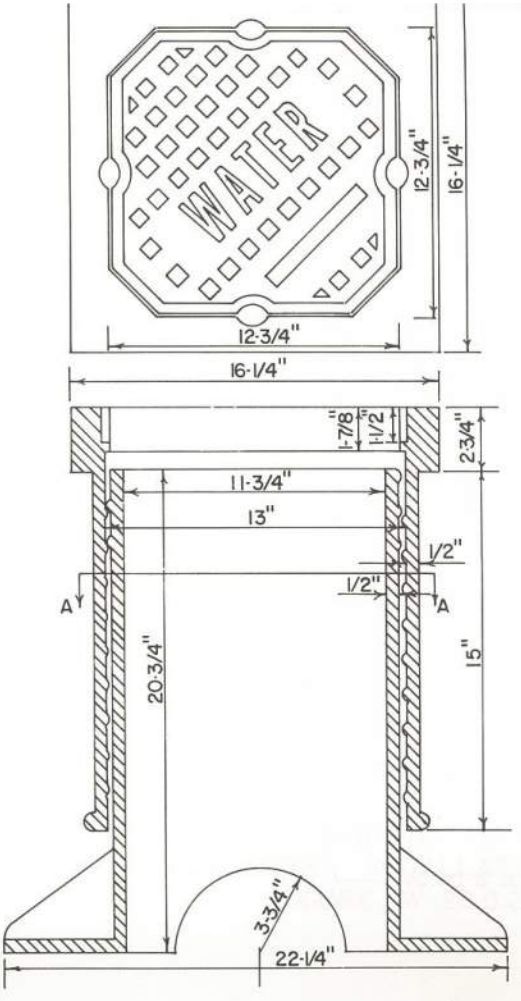
MAGNESIUM ANODE TEST STATION

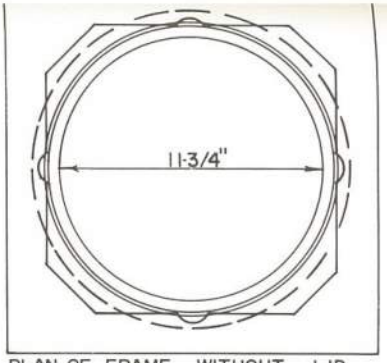
FIGURE W-23.4 TYPE V



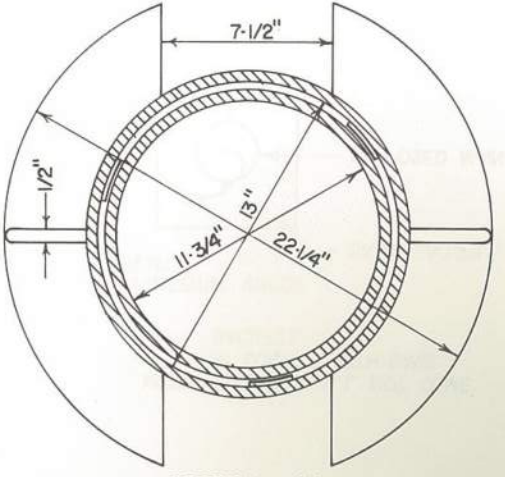
5" ROADWAY BOX

FIGURE W-23.4.1



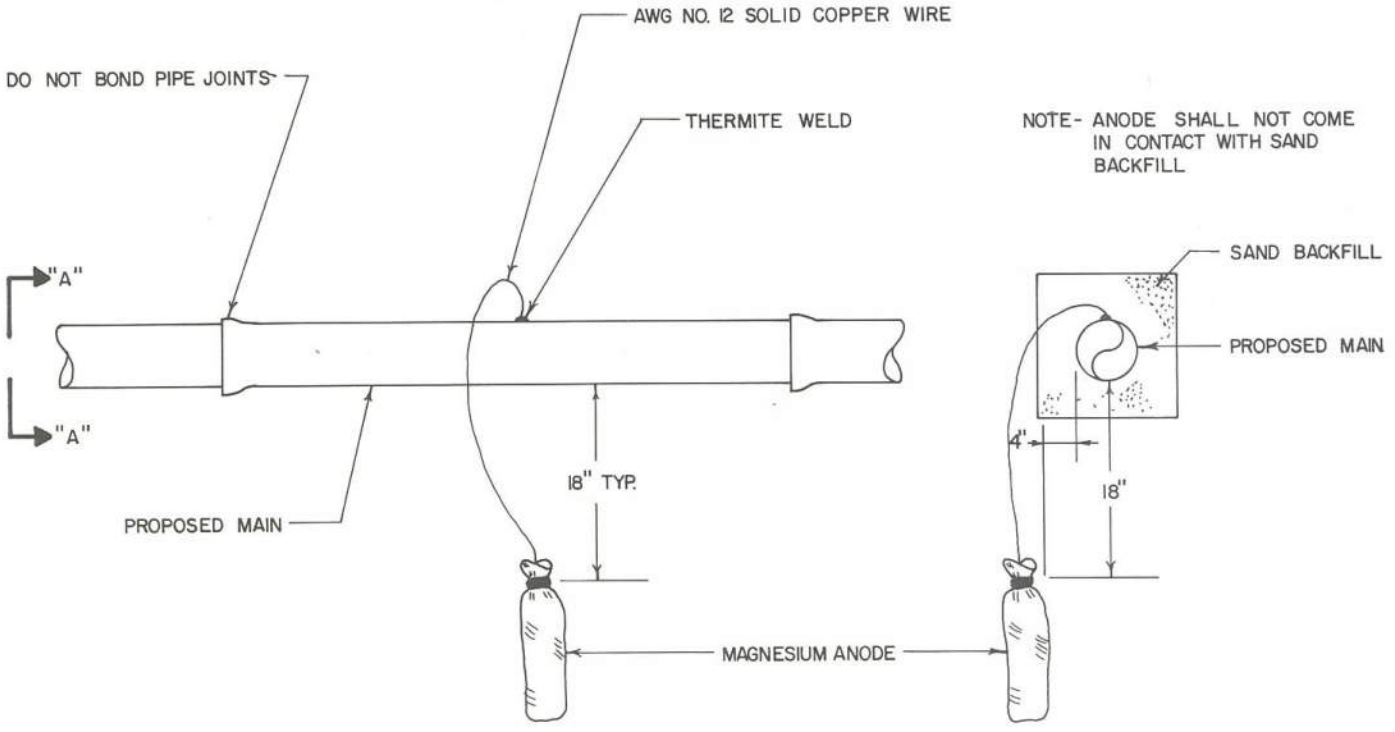


PLAN OF FRAME WITHOUT LID

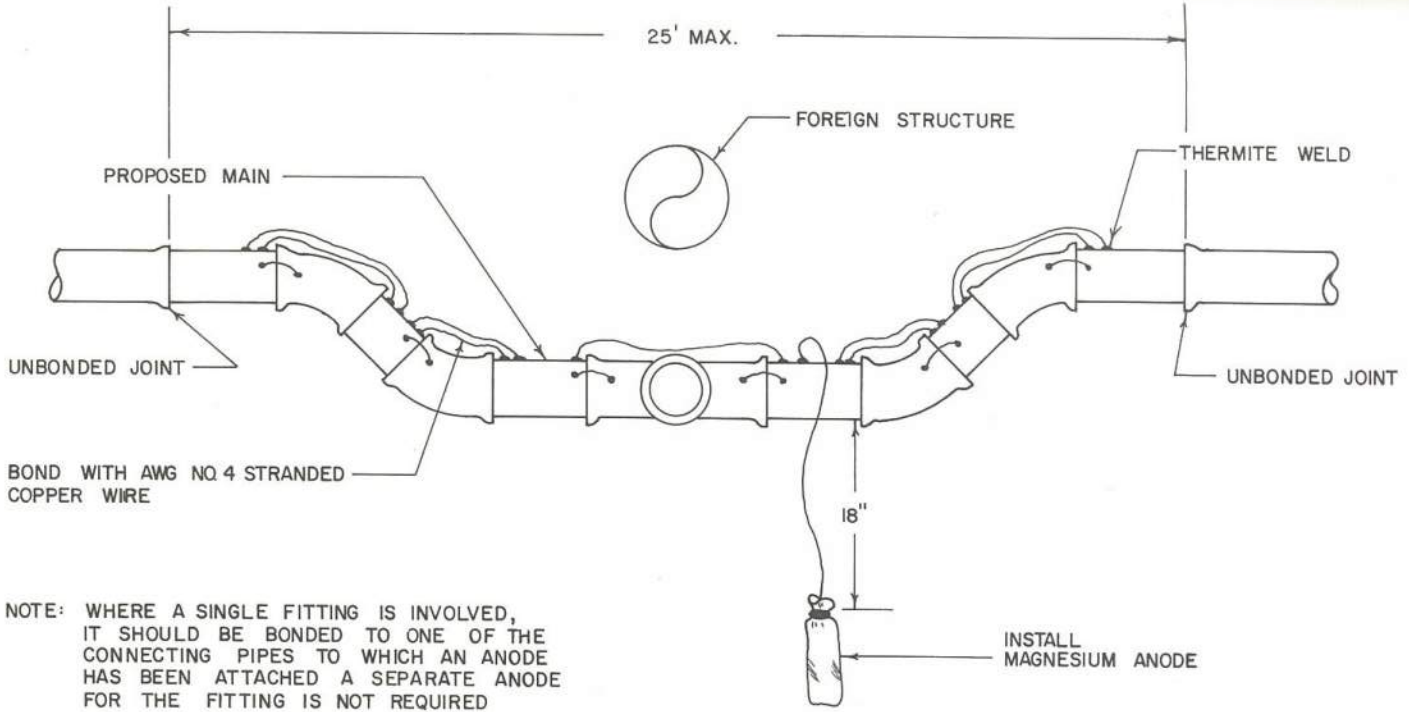


SECTION AA

12" ROADWAY BOX
FIGURE W-23.4.2

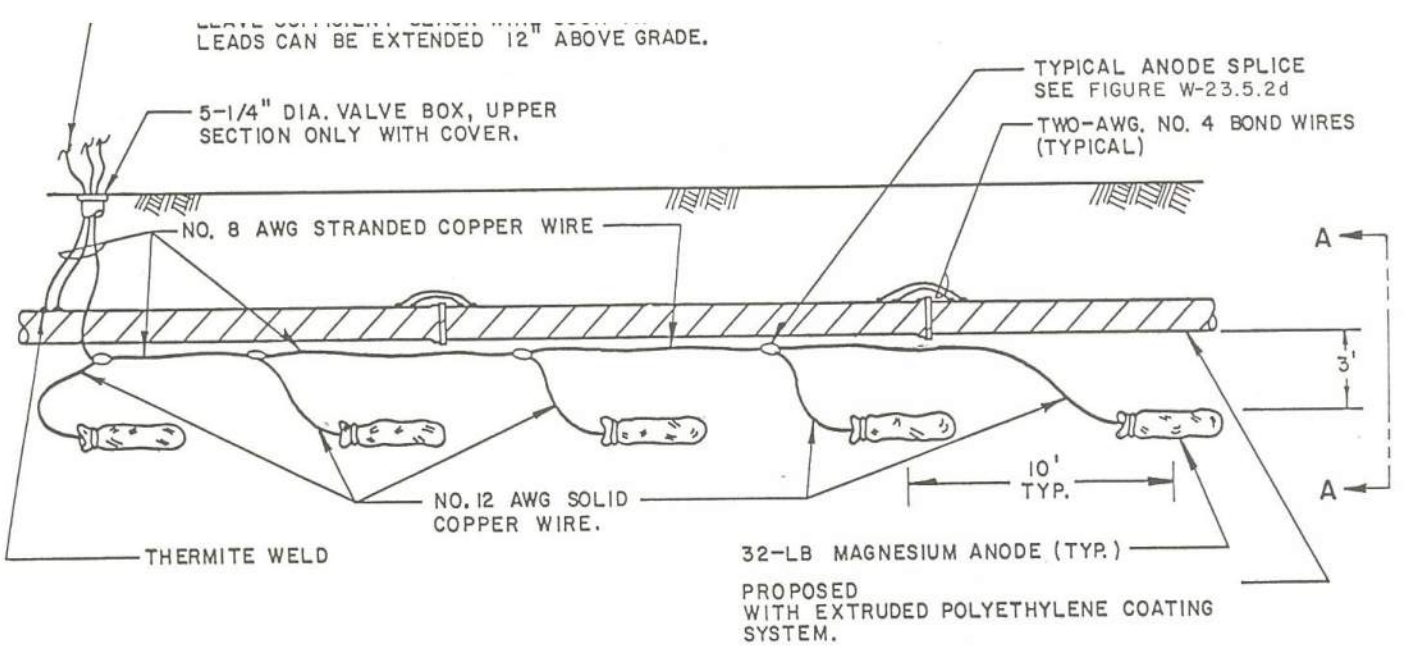


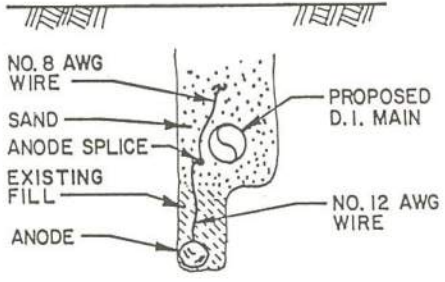
MAGNESIUM ANODE INSTALLATION
FIGURE W-23.5.2A



NOTE: WHERE A SINGLE FITTING IS INVOLVED, IT SHOULD BE BONDED TO ONE OF THE CONNECTING PIPES TO WHICH AN ANODE HAS BEEN ATTACHED A SEPARATE ANODE FOR THE FITTING IS NOT REQUIRED

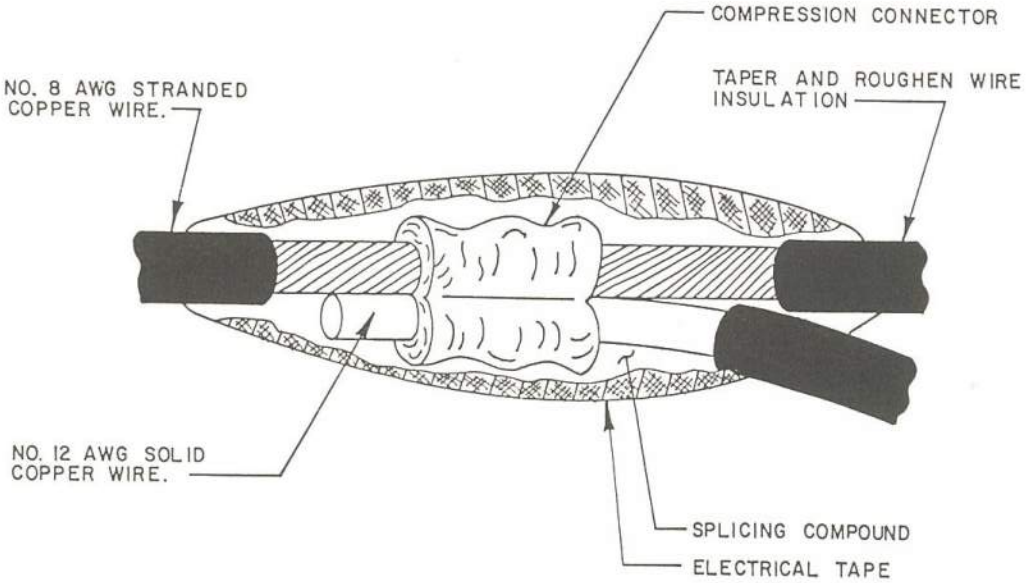
TYPICAL GROUPING OF FITTINGS
FOR ANODE INSTALLATION
FIGURE W-23.5.2 B





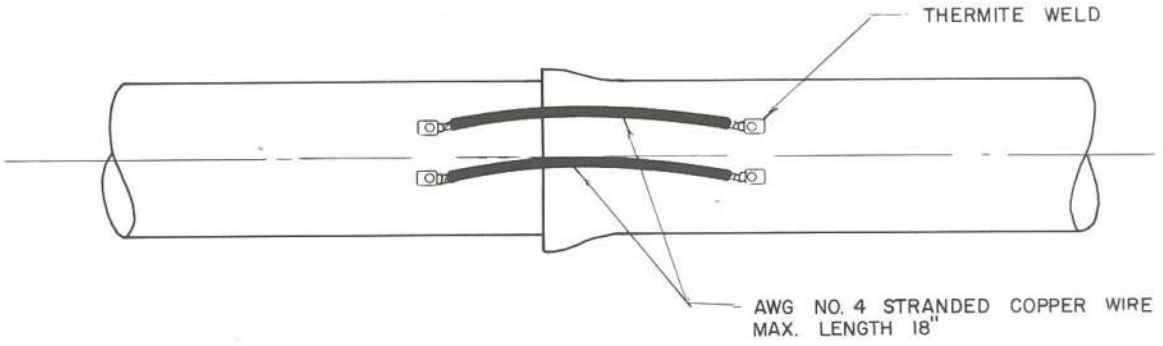
SECTION A-A

FIGURE W-23.5.3A

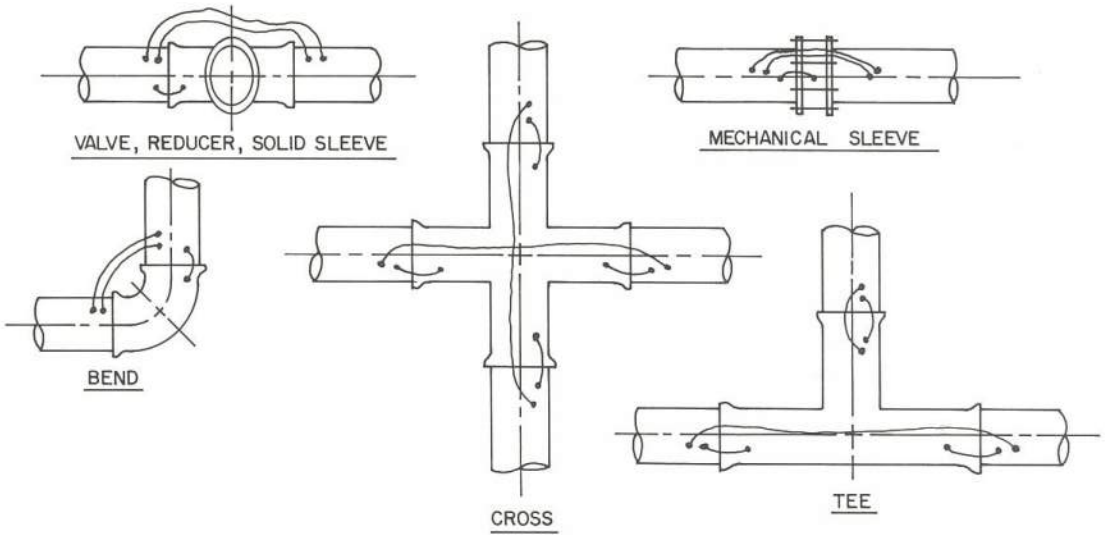


TYPICAL ANODE SPLICE

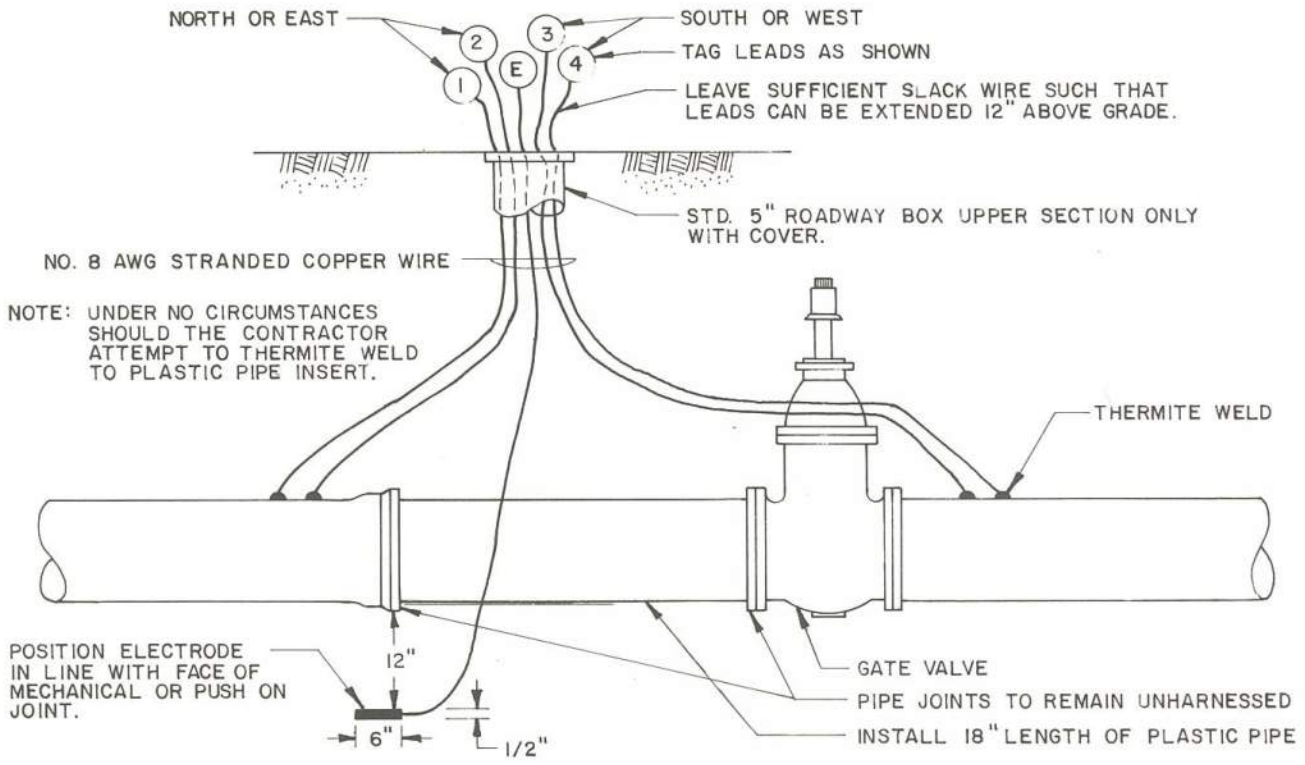
FIGURE W-23.5.3B



TYPICAL PIPE JOINT BOND
(STRAIGHT PIPE)
FIGURE W-23.6A

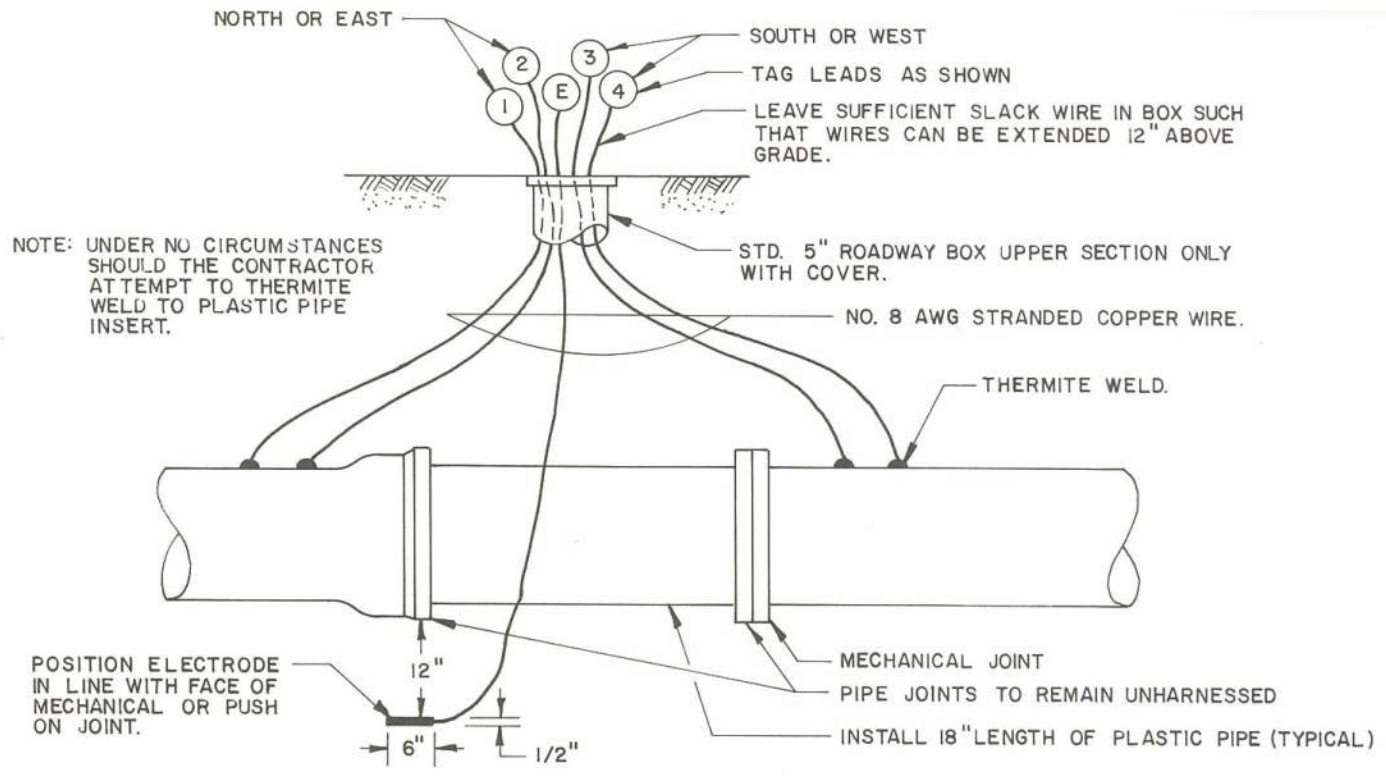


TYPICAL BONDING OF FITTINGS
FIGURE W-23.6B

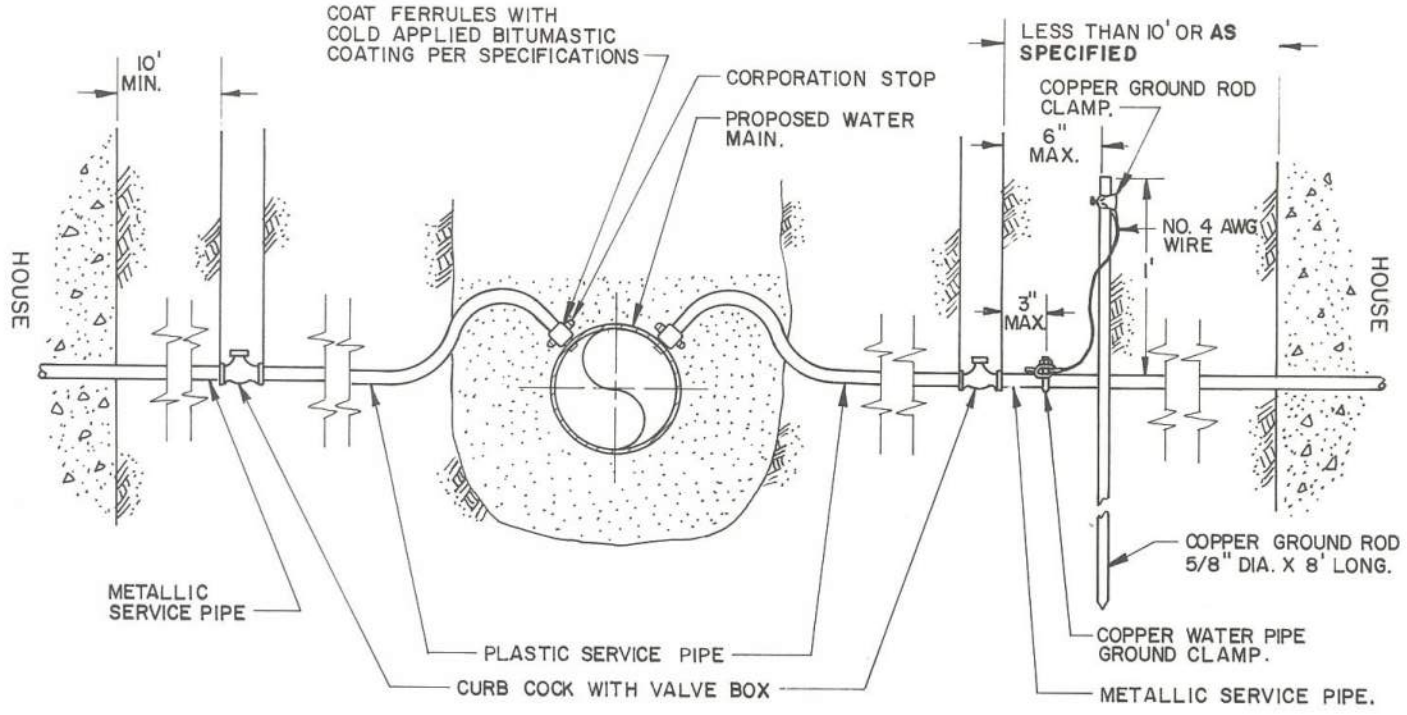


ELECTROLYSIS TEST STATION—ELECTRICAL INSULATOR

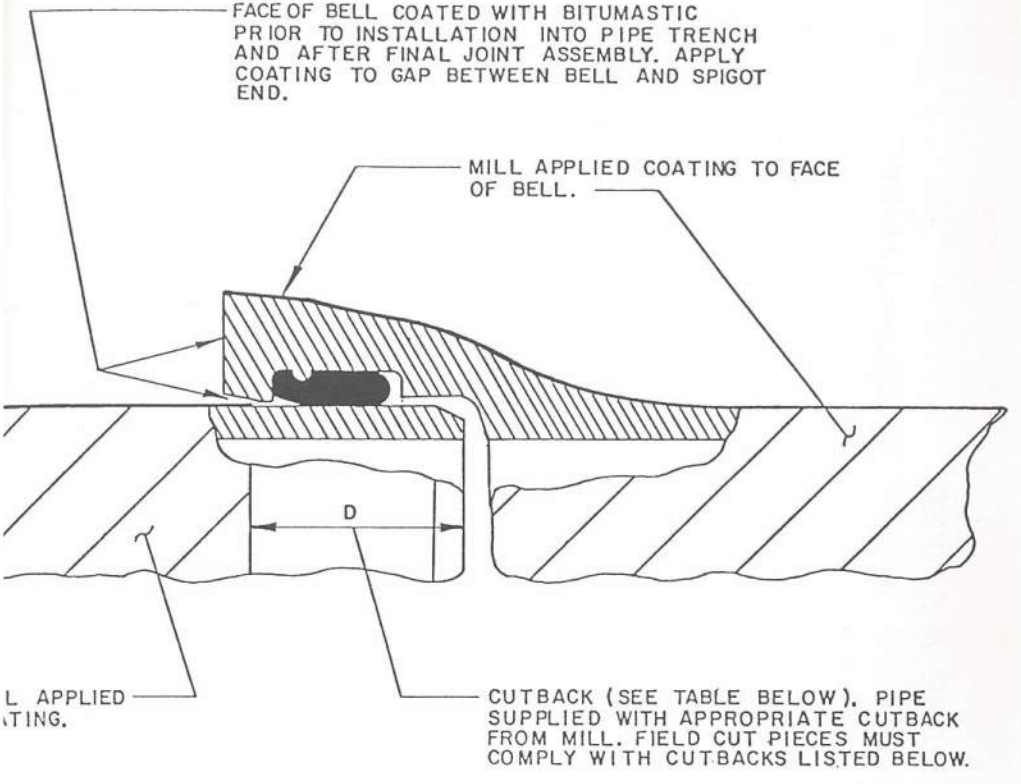
FIGURE W-23.7 A



ELECTROLYSIS TEST STATION-ELECTRICAL INSULATOR
FIGURE W-23.7 B

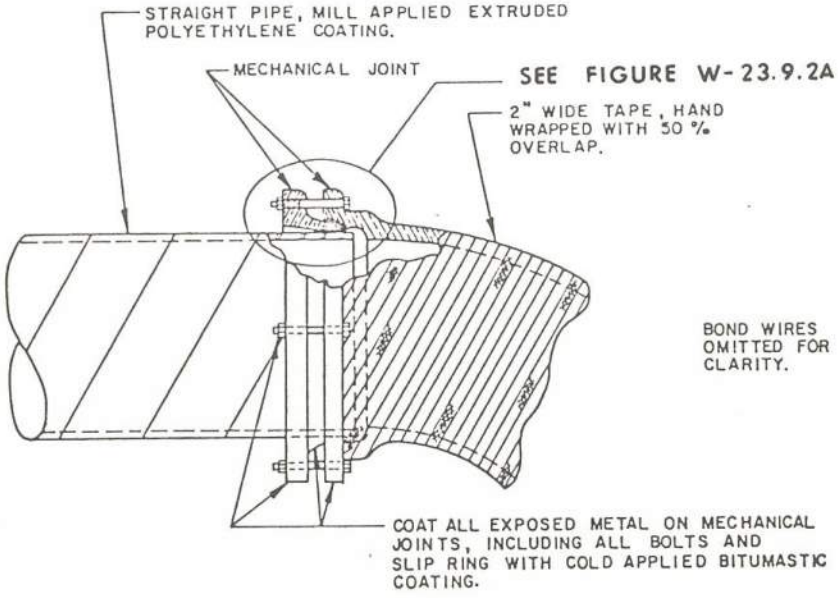


GROUND ROD INSTALLATION
FIGURE W-23.8



COATING CUTBACK	
PIPE SIZE	D
4"	2.75" ± 1/32
6"	3.00" ± 1/32
8"	3.25" ± 1/32
10"	3.25" ± 1/32
12"	3.25" ± 1/32
16"	4.77" ± 1/32

PUSH-ON JOINT COATING ARRANGEMENT—TYPICAL
FIGURE W-23.9.1



TAPE INSTALLATION PROCEDURE

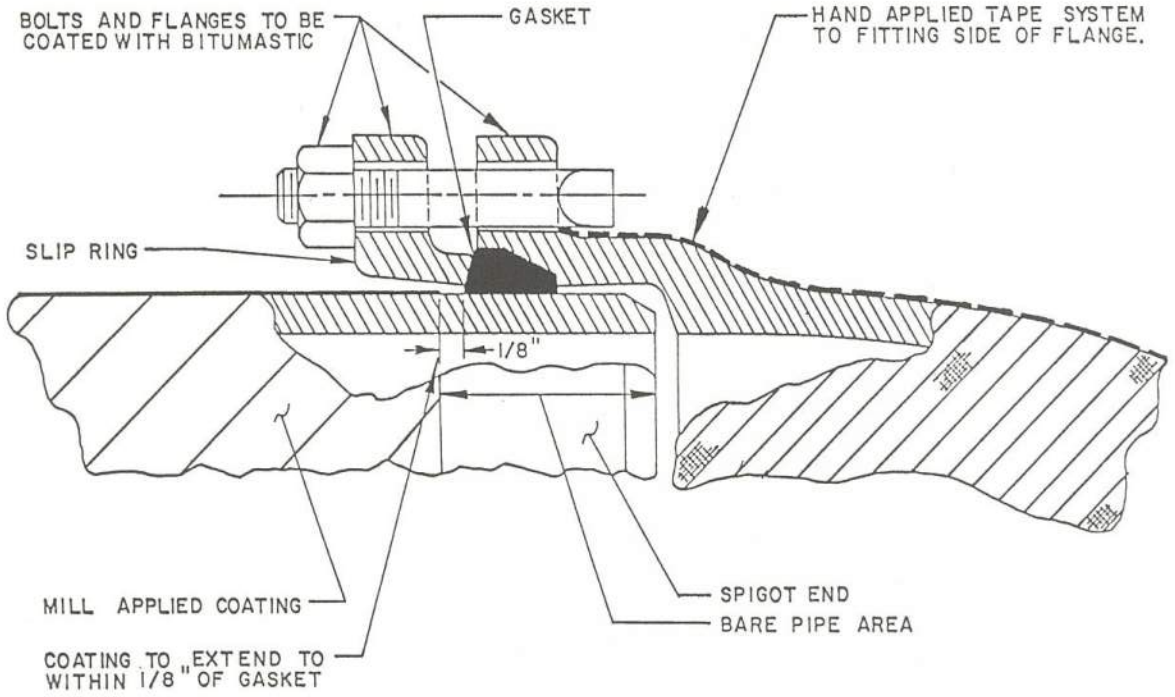
A) REMOVE ALL DIRT, GRIME, GREASE, RUST AND LOOSELY ADHERING MILL SCALE FROM THE ASSEMBLED JOINT OR FITTING TO BE COATED BY POWER WIRE BRUSHING AND/OR USE OF SUITABLE SAFETY SOLVENTS.

B) WHERE BOND WIRES ARE PRESENT THEY SHOULD BE NEATLY DRESSED OVER THE PIPE JOINT OR FITTING SO AS NOT TO EXTEND ABOVE THE JOINT MORE THAN IS PRACTICAL.

C) APPLY THE TAPE, MAXIMUM 2-INCHES WIDE, TO THE PRIMED PIPE IN ACCORDANCE WITH THE MANUFACTURERS INSTRUCTIONS SO AS TO PROVIDE A 50 PERCENT OVERLAP OF TAPE. CARE SHOULD BE TAKEN TO FORM TAPE TIGHTLY AROUND BOND WIRES.

D) THE FACE OF ALL BELL JOINTS IS NOT TO BE TAPED, BUT LEFT EXPOSED AND COATED WITH A COLD-APPLIED BITUMINOUS FAST DRYING COATING. DO NOT EXTEND THE TAPE SYSTEM OVER THE FACE OF THE BELL.

TAPING OF MECHANICAL JOINTS AND IRREGULAR FITTINGS FIGURE W-23.9.2A



MECHANICAL JOINT COATING ARRANGEMENT – TYPICAL
FIGURE W-23.9.2B

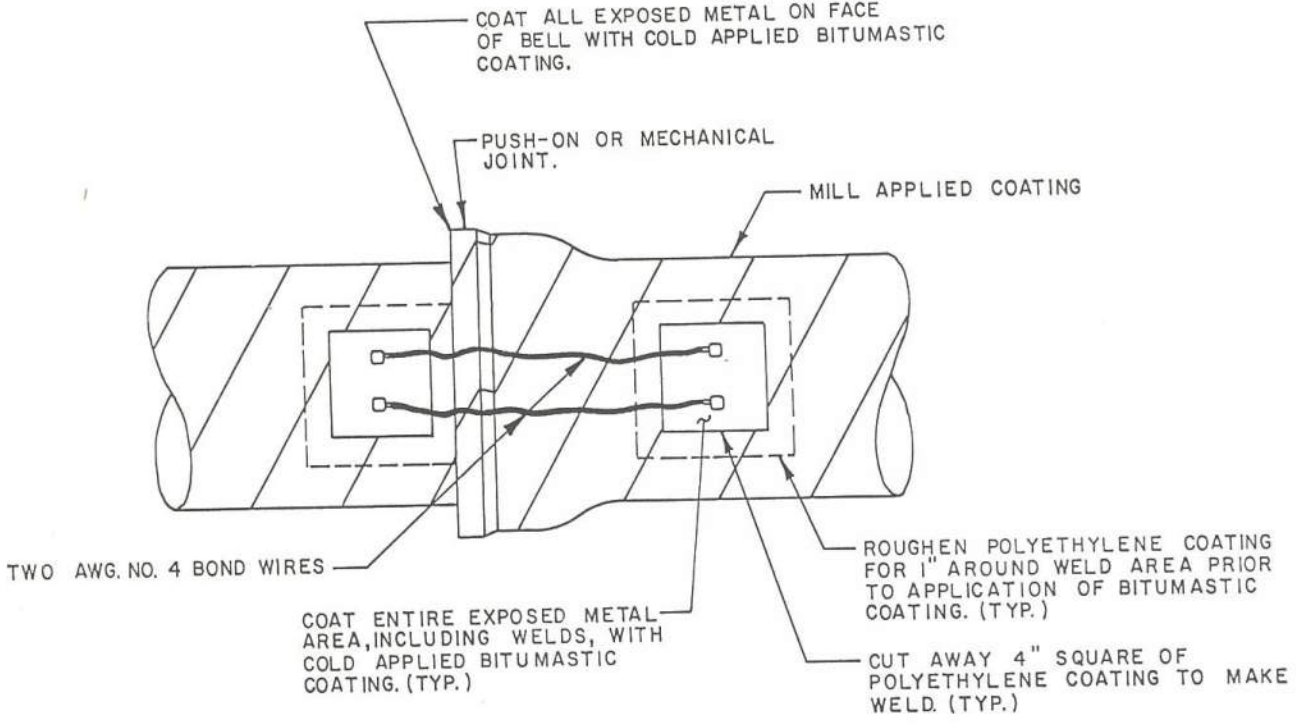


FIGURE W-23.9.1.2C