

CITY OF PHILADELPHIA
WATER DEPARTMENT
1985



WATER MAIN

STANDARD DETAILS

&

CORROSION CONTROL SPECIFICATIONS

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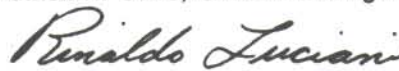
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CORROSION CONTROL SPECIFICATIONS




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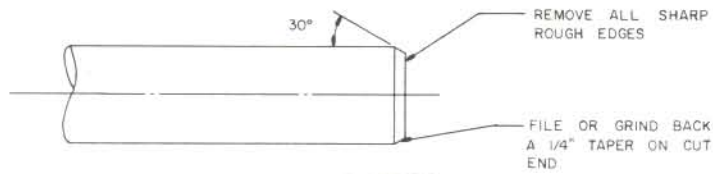
STANDARD DETAILS

Copies of Water Main Standard Details and Corrosion Control Specifications are available from the Water Department Projects Control Section, 1101 Market St., One Reading Center—2nd Floor, Philadelphia, Pa. 19107—(215) 592-6337.

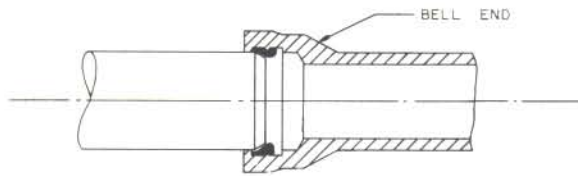
CITY OF PHILADELPHIA
WATER DEPARTMENT
1 9 8 5
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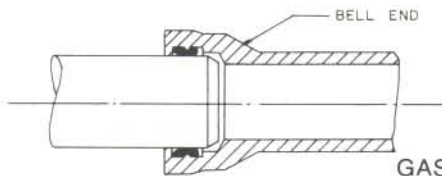
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FIELD CUT PLAIN END PIPE



**INITIAL ENTRY
PLAIN END INTO SOCKET**

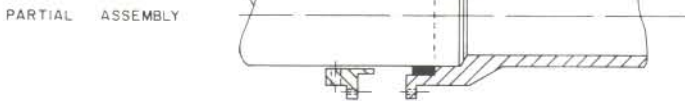
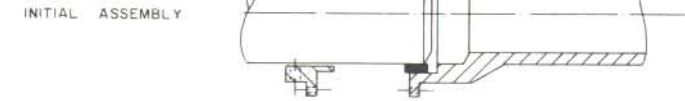


ASSEMBLED JOINT

MATERIAL
PIPE: DUCTILE IRON
GASKET: PLAIN RUBBER BASE

PUSH-ON JOINT ASSEMBLY DETAIL

NOTE: FIELD CUT AS SHOWN ON PAGE NO 1

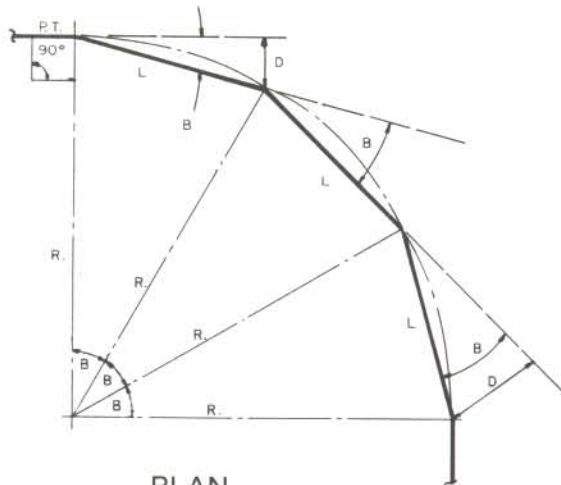


RETAINER GLAND SIZE-INCHES	WORKING PRESSURE-PSI	No. OF SET SCREWS	SET SCREW TORQUE-FT.-LBS.
3	350	4	80
4	250	4	80
6	350	6	80
8	250	9	80
10	250	12	80
12	250	16	80
16	200	24	100
20	200	28	120
24	150	32	120

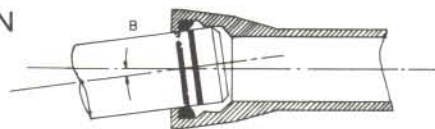
ALL SET SCREWS SHALL BE 3/8" INCH DIAMETER CASE HARDENED STEEL WITH "CUPPED ENDS" AND 3/8" INCH SQUARE HEADS.

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

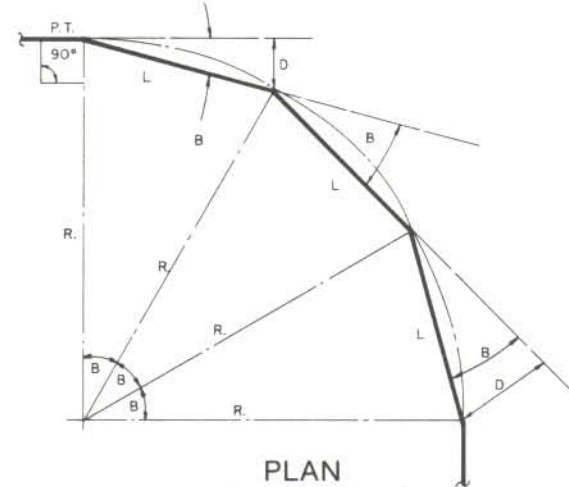


PUSH-ON TYPE JOINT

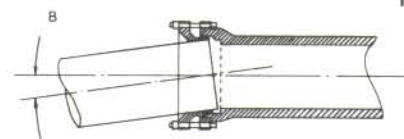
B—DEFLECTION IN DEGREES
D—DEFLECTION IN INCHES
L—LENGTHS
R—RADIUS IN FEET
P.T.—POINT OF TANGENT

PIPE SIZE	B	L=16 FEET		L=18 FEET		L=20 FEET	
		D	R	D	R	D	R
6"	3°	10"	306'	11"	344'	13"	382'
8"	3°	10"	306'	11"	344'	13"	382'
12"	3°	10"	306'	11"	344'	13"	382'
16"	2°	7"	458'	8"	516'	8"	573'
20"	2°	7"	458'	8"	516'	8"	573'
24"	2°	7"	458'	8"	516'	8"	573'
30"	2°	7"	458'	8"	516'	8"	573'
36"	2°	7"	458'	8"	516'	8"	573'
48"	1°	3"	917'	4"	1031'	4"	1146'

PUSH-ON JOINT PIPE
MAXIMUM DEFLECTION & RADIUS



PLAN
PIPE DEFLECTION

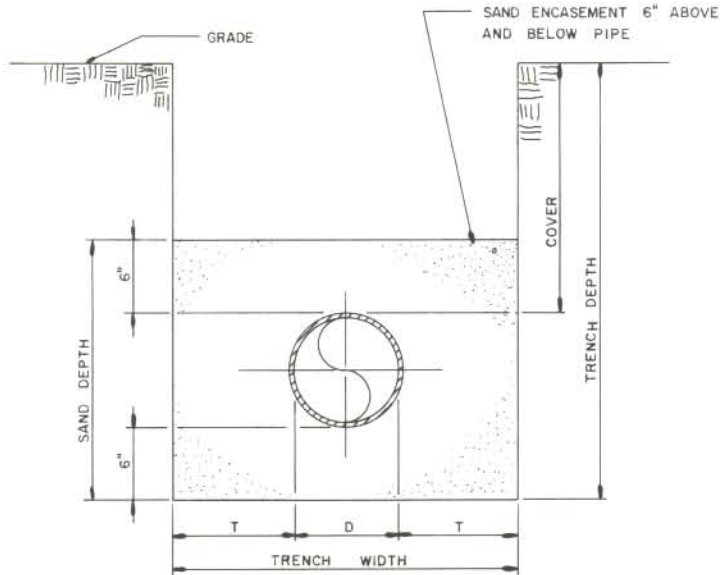


MECHANICAL JOINT

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

PIPE SIZE	B	L=16 FEET		L=18 FEET		L=20 FEET	
		D	R	D	R	D	R
6"	4°	13"	229'	15"	258'	17"	286'
8"	3°	10"	306'	11"	344'	13"	382'
12"	3°	10"	306'	11"	344'	13"	382'
16"	2°	7"	458'	8"	516'	8"	573'
20"	2°	7"	458'	8"	516'	8"	573'
24"	1°	3"	917'	4"	1031'	4"	1146'
30"	1°	3"	917'	4"	1031'	4"	1146'
36"	1°	3"	917'	4"	1031'	4"	1146'
48"	1°	3"	917'	4"	1031'	4"	1146'

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.

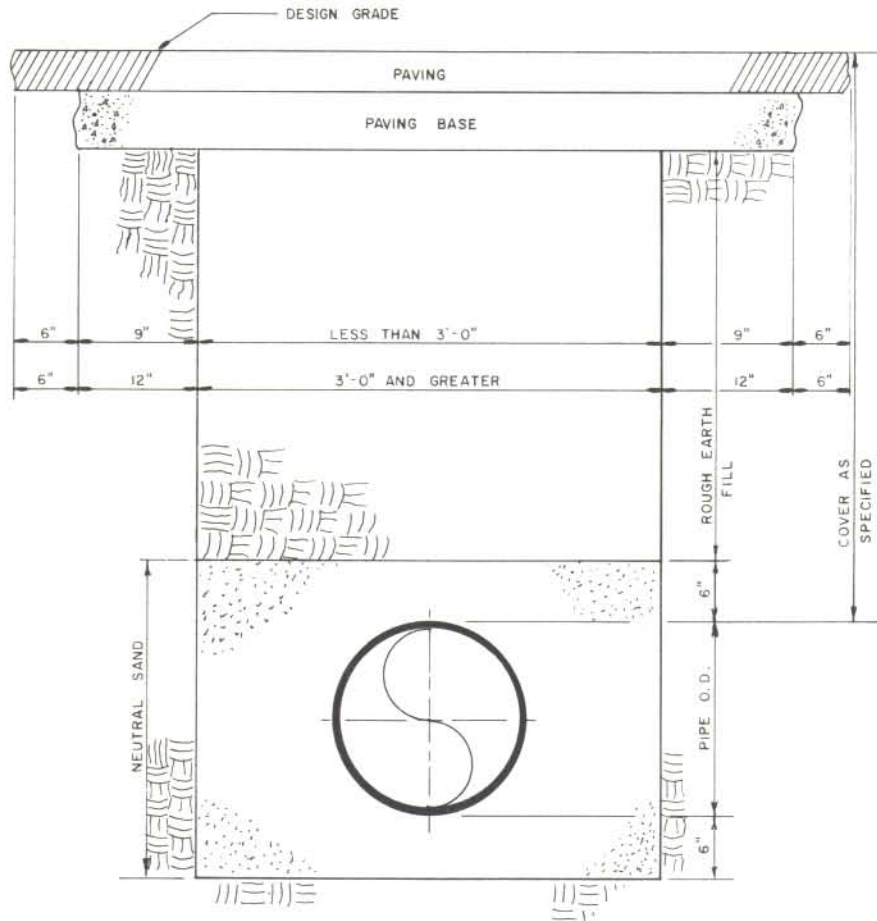
PAY LIMITS FOR EXCAVATION OF WATER MAIN TRENCHES

EXCAVATION PAY LIMIT DIMENSIONS

COVER	EXCAVATION QUAN. PER LIN. FT.						SAND ENCASEMENT	
	PIPE SIZE	PIPE AREA (FT.)	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
5'0" ±	48"	13.62	6.00	8.67	52.02	1.93	5.17	17.40
	16"			7.00	18.69	.69		
	20"			7.33	21.99	.81		
	24"			7.67	30.68	1.14		
	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**

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.

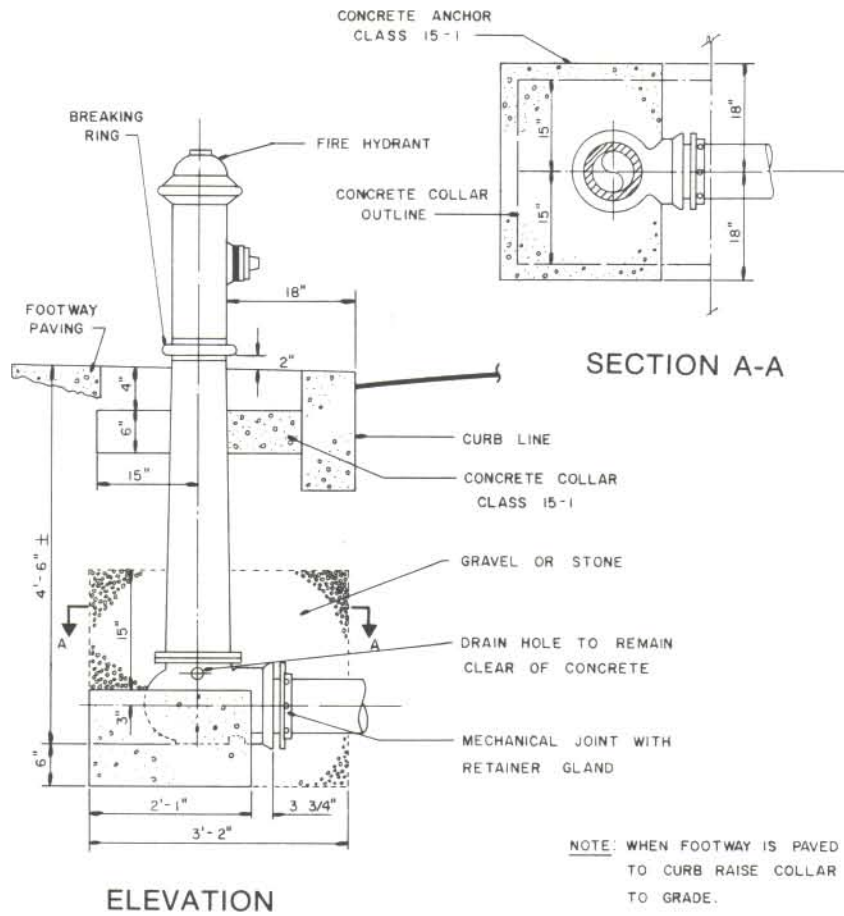
REMOVAL OF BASE AND PAVING OUTSIDE OF TRENCH LIMITS SHALL BE INCLUDED IN THE COST OF PAVING RESTORATION.

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.

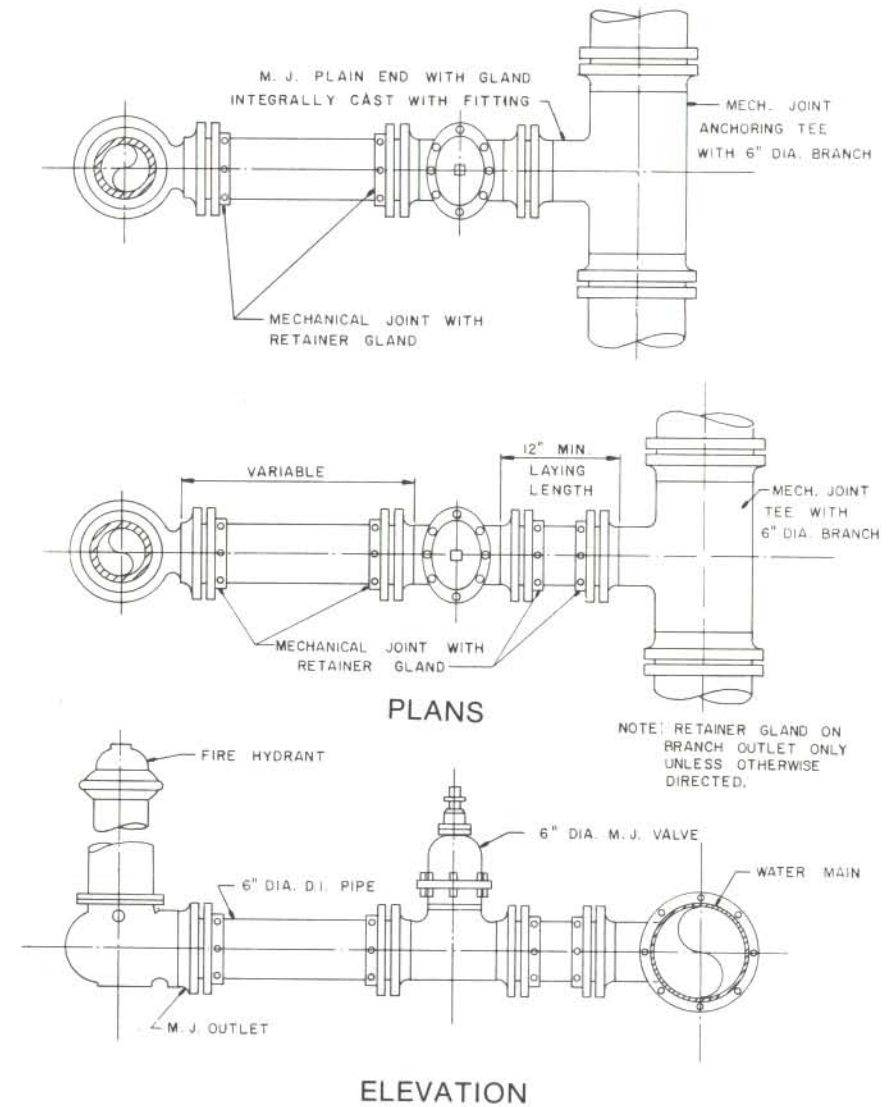
PAVING BASE DIMENSIONS AND REPAVING QUANTITIES							
PIPE SIZE	TRENCH WIDTH (FT)	BASE WIDTH (FT)	CU YDS / LIN FT 10" BASE	CU YDS / LIN FT 8" BASE	CU YDS / LIN FT 6" BASE	PAVING WIDTH (FT)	PAVING SQ YDS. / LIN FT.
6"	1.50	3.00	.093	.074	.056	4.00	.44
8"	2.00	3.50	.108	.086	.065	4.50	.50
10"	2.17	3.67	.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

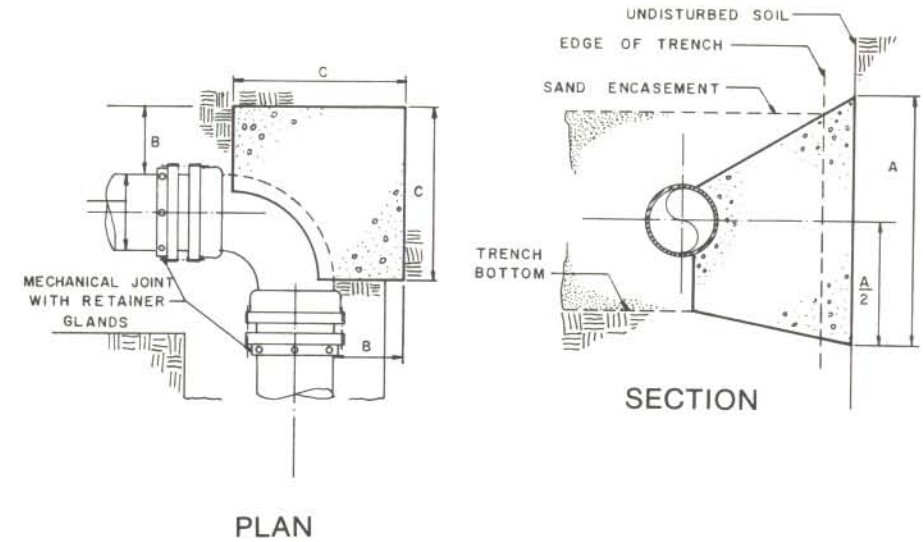
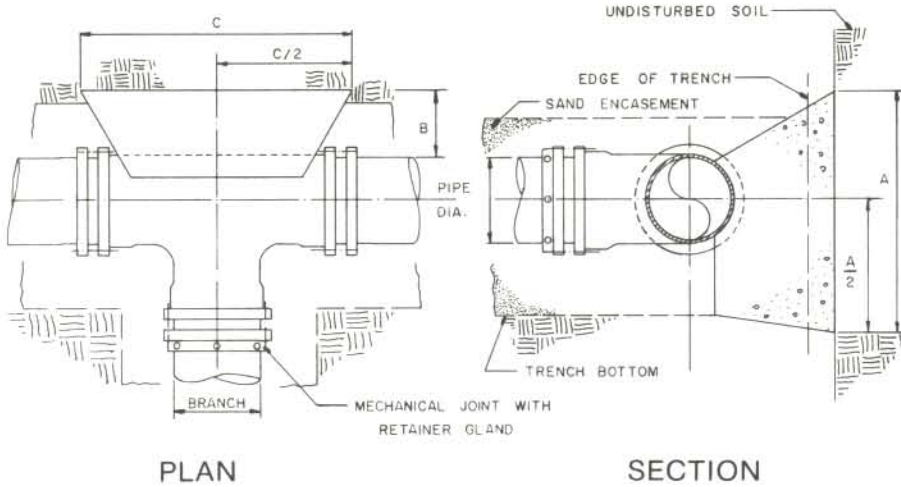
**PAY LIMITS FOR REPAVING
WATER MAIN TRENCHES**



FIRE HYDRANT INSTALLATION



**FIRE HYDRANT CONNECTIONS
MECHANICAL JOINT VALVE & FITTINGS**



	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

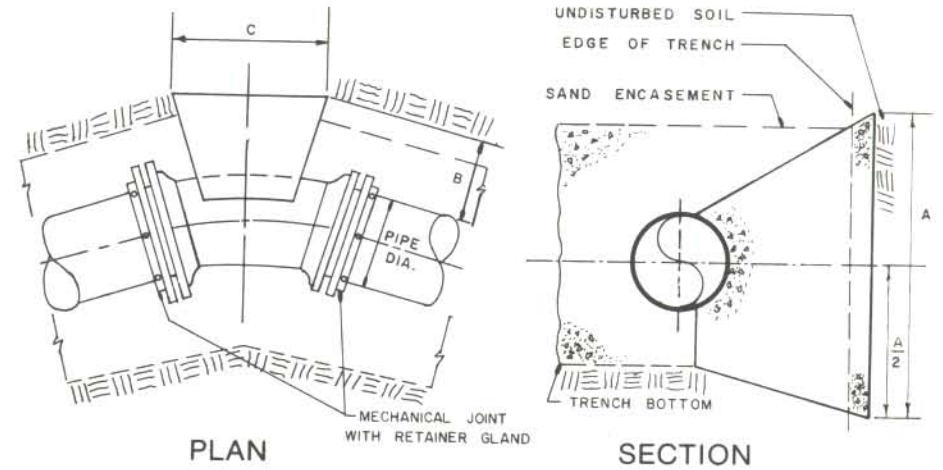
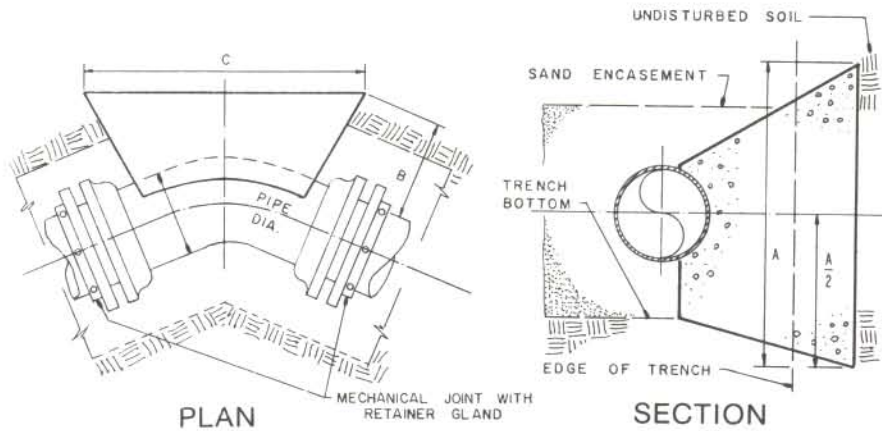
	PIPE DIAMETER					
	3", 4" & 6"	8"	12"	16"	20"	24"
A	18"	24"	3'-0"	3'-0"	4'-6"	5'-0"
B	9"	12"	12"	12"	16"	18"
C	2'-0"	2'-6"	2'-6"	3'-0"	3'-9"	4'-6"
D	.1	.2	.3	.4	1.1"	1.56

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



	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**

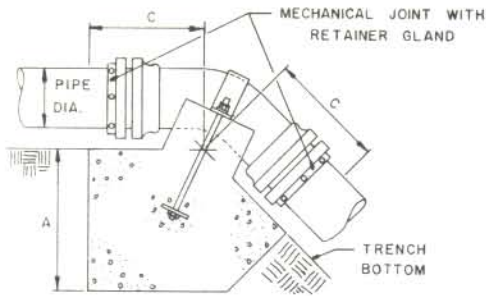
	PIPE DIAMETER					
	3", 4" & 6"	8"	12"	16"	20"	24"
A	20"	22"	2'-2"	2'-6"	3'-0"	3'-6"
B	12"	12"	15"	18"	21"	2'-0"
C	12"	16"	21"	2'-3"	3'-0"	3'-9"
D	.03	.05	.1	.17	.3	.5

D=APPROXIMATE VOLUME OF CONCRETE IN CUBIC YARDS

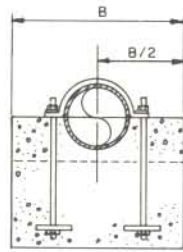
NOTES:

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.

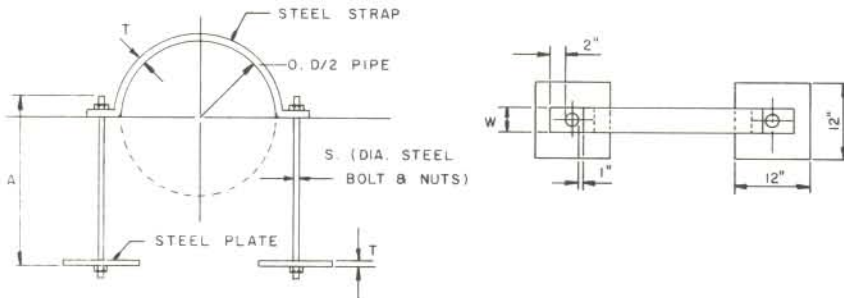
**CONCRETE ANCHORS FOR
HORIZONTAL 1/16 & 1/32 BENDS**



ELEVATION



SECTION



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 HAV A 2" MINIMUM CLEARANCE UNDER BELLS & GLANES.
4. APPLY COLD BITUMEN COATING AS SPECIFIED.
5. HARNESS TO BE MADE OF A-36 STEEL.
6. RODS TO BE A-193-GRADE B7.
7. NUTS TO BE A-194-GRADE 4-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	3/4"	1/2"	4"	60
8"	4'-0"	2'-6"	3'-0"	1.47	3/4"	1/2"	4"	65
12"	4'-9"	3'-6"	3'-6"	2.8	1"	1/2"	5"	86
16"	5'-8"	4'-6"	4'-0"	4.7	1"	3/4"	5"	127
20"	7'-0"	5'-0"	5'-0"	8.15	1 1/4"	3/4"	6"	172
24"	7'-9"	5'-6"	5'-6"	10.89	1 1/2"	3/4"	6"	219

1/16 BEND 22 1/2 °

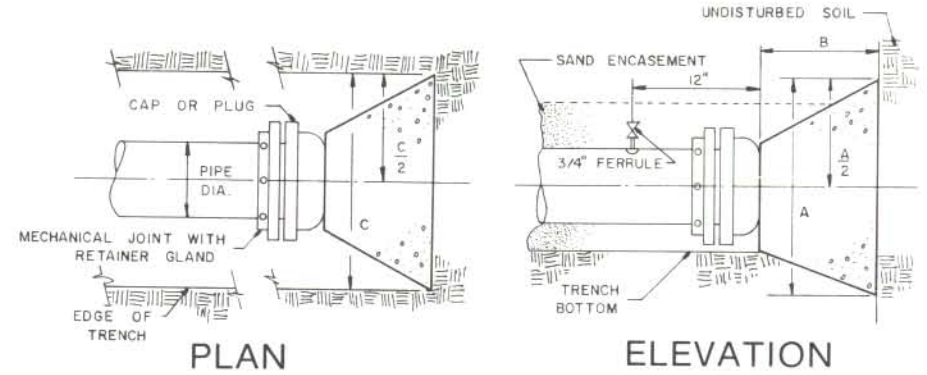
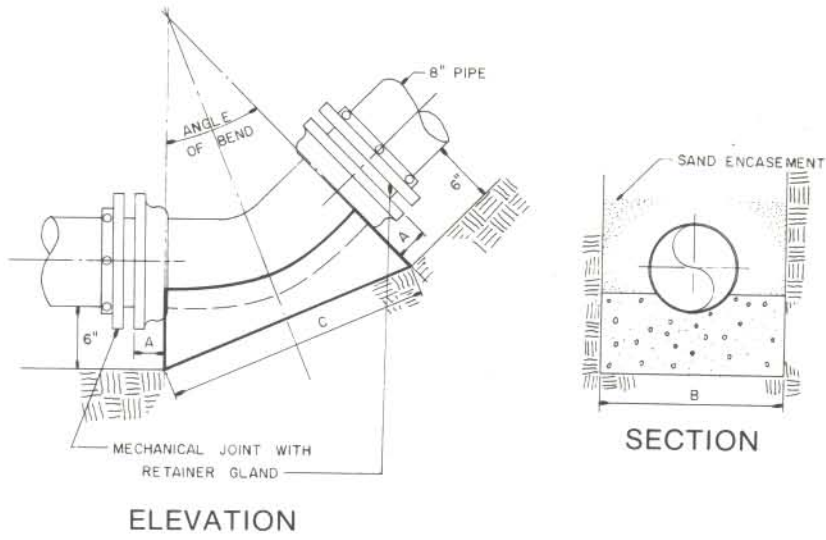
6"	2'-0"	2'-6"	2'-0"	.4	3/4"	1/2"	3"	55
8"	2'-0"	2'-6"	2'-6"	.55	3/4"	1/2"	4"	59
12"	4'-0"	2'-6"	3'-0"	1.38	3/4"	1/2"	4"	68
16"	4'-6"	3'-0"	4'-0"	2.5	3/4"	1/2"	5"	78
20"	5'-0"	4'-0"	4'-6"	4.15	1"	3/4"	5"	130
24"	5'-0"	4'-0"	5'-0"	6.0	1 1/4"	3/4"	5"	154

1/32 BEND 11 1/4 °

6"	18"	18"	18"	.2	3/4"	1/2"	3"	53
8"	2'-0"	2'-0"	2'-0"	.4	3/4"	1/2"	3"	56
12"	2'-6"	2'-6"	2'-6"	.75	3/4"	1/2"	4"	64
16"	3'-0"	3'-0"	2'-6"	1.4	3/4"	1/2"	4"	69
20"	3'-3"	3'-0"	3'-6"	2.1	1"	3/4"	4"	113
24"	3'-5"	4'-0"	3'-6"	3.0	1"	3/4"	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)



		PIPE DIAMETER (INCHES)						
		3", 4" & 6"	8	12	16	20	24	
ANGLE OF BEND	45°	A	2.5"	2.5"	2.5"	3.5"	3.5"	3.5"
		B	18"	24"	28"	42"	48"	66"
		C	12"	14"	19"	21"	25"	28"
		D	.02	.04	.07	.13	.19	.31
	22½°	B	18"	24"	28"	32"	36"	48"
		C	9	11"	16"	16"	20"	22"
		D	.02	.04	.07	.09	.13	.21
		11¼°	B	18"	24"	28"	32"	36"
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 UNDISTURBED SOIL.
4. SOIL BEARING VALUE-2000 PSF.

CONCRETE ANCHORS FOR VERTICAL BENDS (BOTTOM)

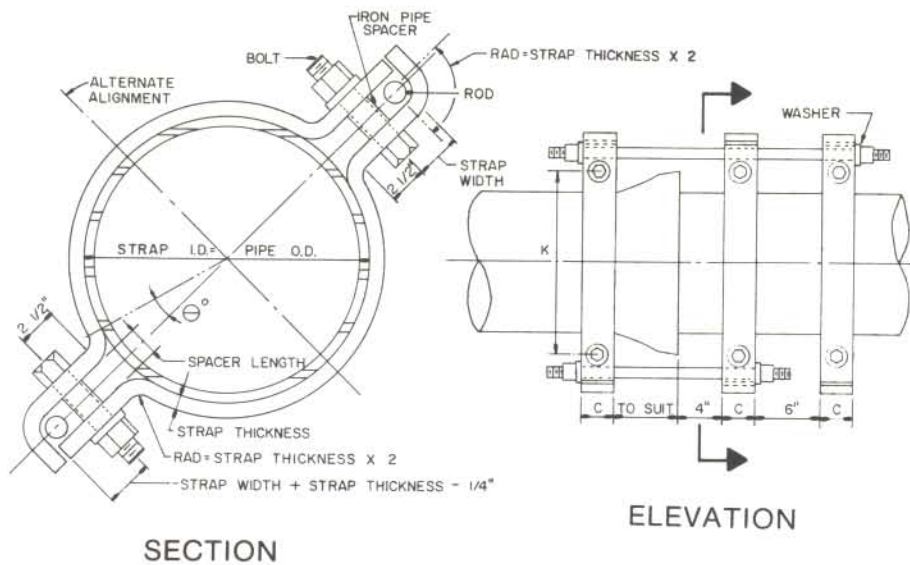
	PIPE DIAMETER					
	3", 4" & 6"	8"	12"	16"	20"	24"
A	18"	2'-0"	2'-6"	3'-9"	4'-6"	5'-0"
B	12"	12"	18"	2'-0"	2'-0"	2'-0"
C	18"	2'-0"	3'-6"	4'-0"	5'-0"	6'-0"
D	.06	.15	.4	.8	1.3	1.7

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



SECTION

ELEVATION

Pipe Size	A	B	C	D	E	F	G	H	K	W
	Strap I.D.	Strap Thick-ness	Strap Width	Rod Dia- meter	Bolt Size	Spacer Size	Spacer Length	θ°	Bolt Center	Weight (Ap- prox)
3	—	1/2	2	5/8	5/8	3/4	1	—	—	—
4	4.80	1/2	2	5/8	5/8	3/4	1	26.179	11.10	72
6	6.90	1/2	2	3/4	5/8	3/4	1 1/4	21.418	13.29	98
8	9.05	1/2	2	3/4	5/8	3/4	1 1/4	17.105	15.56	100
12	13.20	3/4	3	1	7/8	1	1 1/2	16.128	20.56	218
16	17.40	3/4	3	1	7/8	1	1 1/2	12.744	24.90	228
20	21.60	3/4	3	1 1/4	7/8	1	1 3/4	11.133	29.14	331
24	25.80	3/4	4	1 1/2	7/8	1	2	10.000	33.36	520

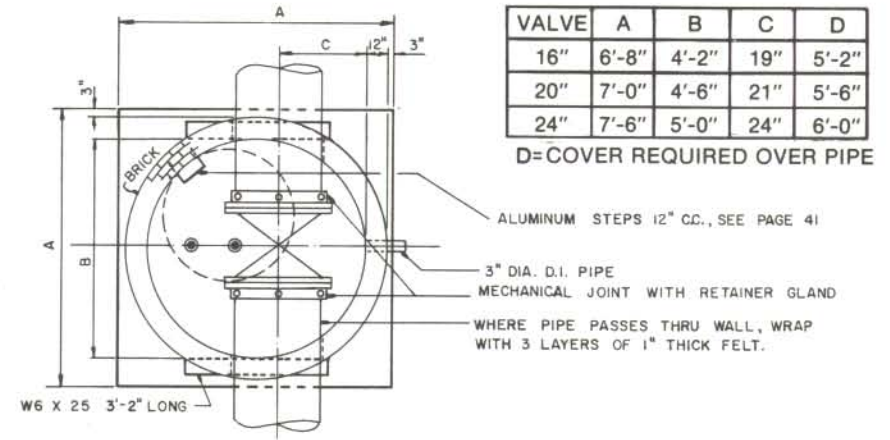
WASHER THICKNESS=STRAP THICKNESS + 1/4"

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

NOTES:

1. BOLTS TO BE A-193-GRADE B7.
2. NUTS TO BE A-194-GRADE 4 HEAVY HEX.
3. STRAPS TO BE A-36 STEEL.
4. ALL JOINTS WITHIN 12 FEET OF A BEND SHALL BE HARNESSSED.

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"

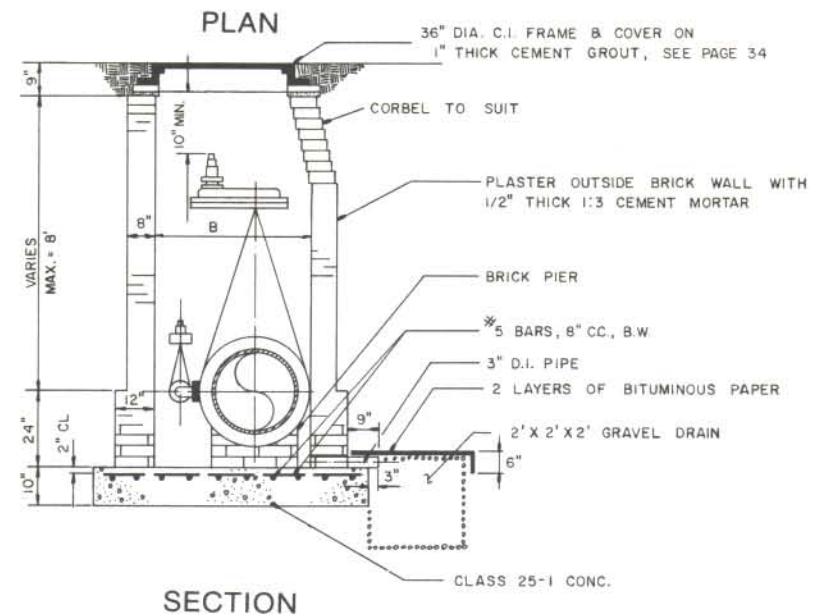
D=COVER REQUIRED OVER PIPE

ALUMINUM STEPS 12" CC., SEE PAGE 41

3" DIA. D.I. PIPE
MECHANICAL JOINT WITH RETAINER GLAND

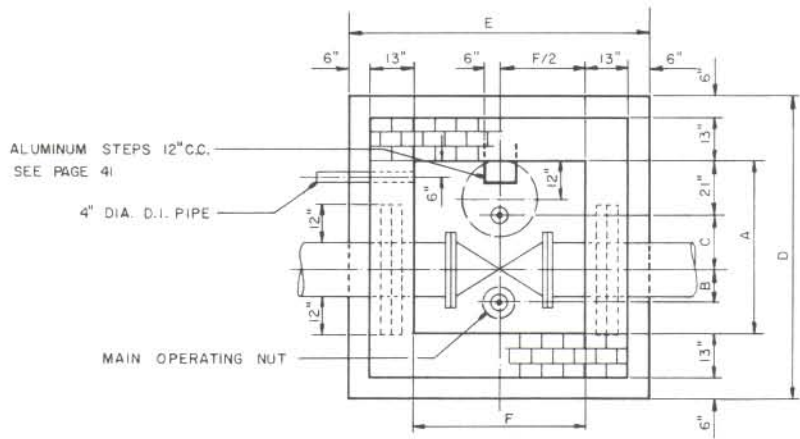
WHERE PIPE PASSES THRU WALL, WRAP
WITH 3 LAYERS OF 1" THICK FELT.

W6 X 25 3'-2" LONG

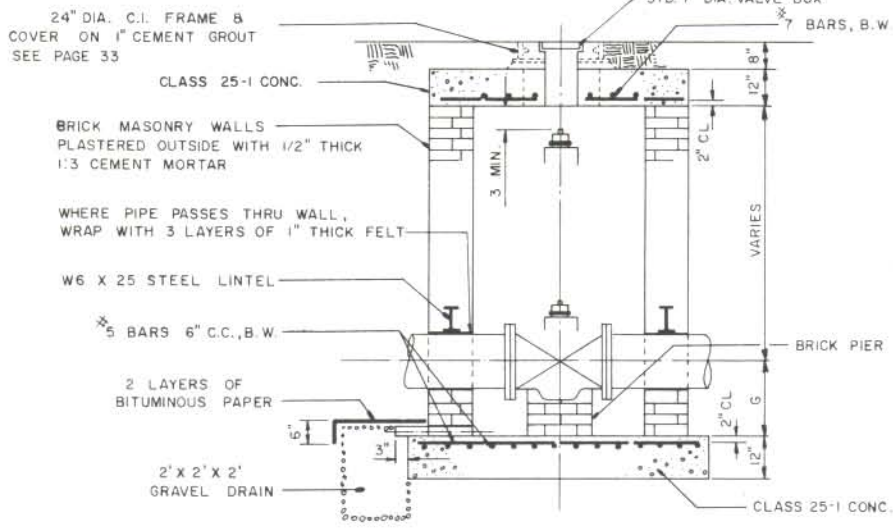


SECTION

16", 20" & 24" VERTICAL VALVE CHAMBER

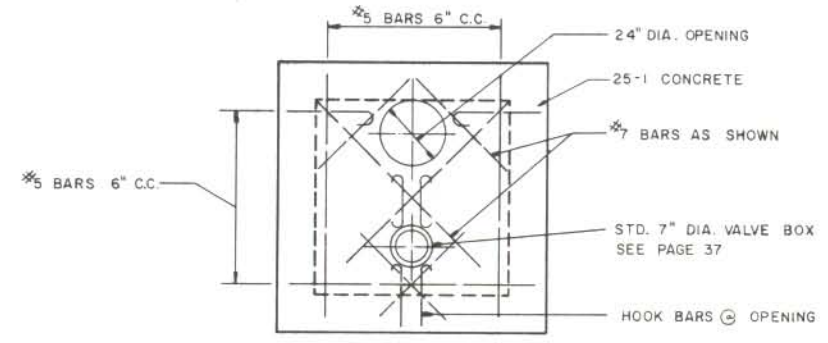


PLAN



SECTION

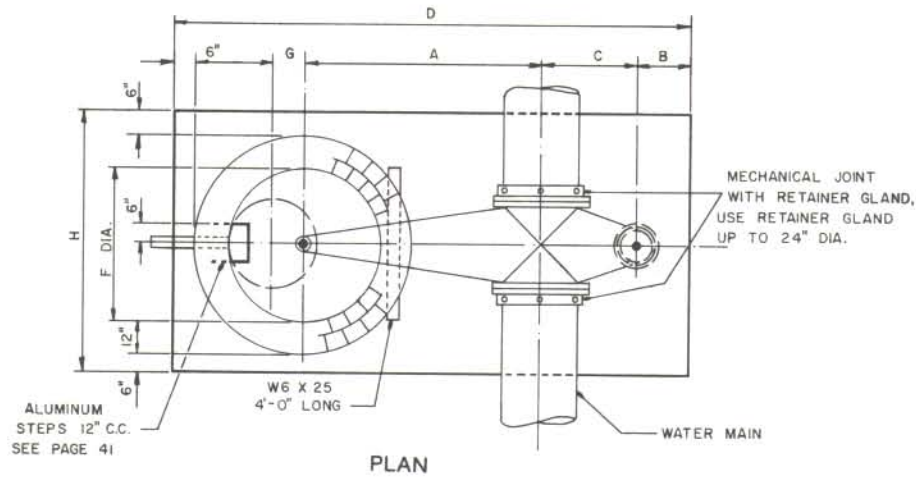
30" THRU 60" VERTICAL VALVE CHAMBERS



TOP SLAB DETAIL

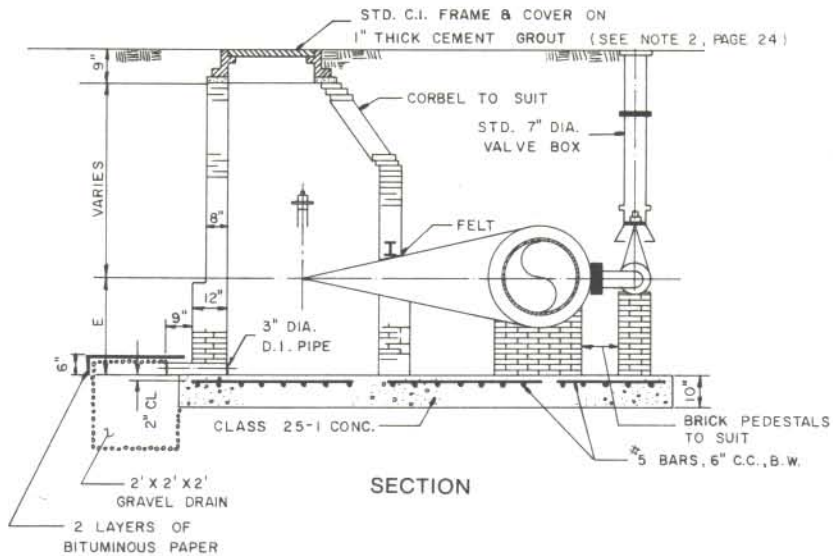
SIZE	A	B	C	D	E	F	G	Pipe Cov. Req'd.
30"	6'-10"	10"	2'-4 3/8"	10'-0"	9'-6"	6'-4"	2'-6"	7'-0"
36"	7'-7"	10"	2'-7 1/8"	10'-9"	10'-0"	6'-10"	3'-0"	7'-8"
42"	8'-4"	13"	2'-11 11/16"	11'-6"	10'-6"	7'-4"	3'-3"	10'-6"
48"	9'-7"	13"	3'-10"	12'-9"	10'-9"	7'-7"	3'-6"	11'-6"
60"	11'-10"	16 3/8"	4'-6 5/8"	15'-0"	11'-0"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

30" THRU 60" VERTICAL VALVE CHAMBERS



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"

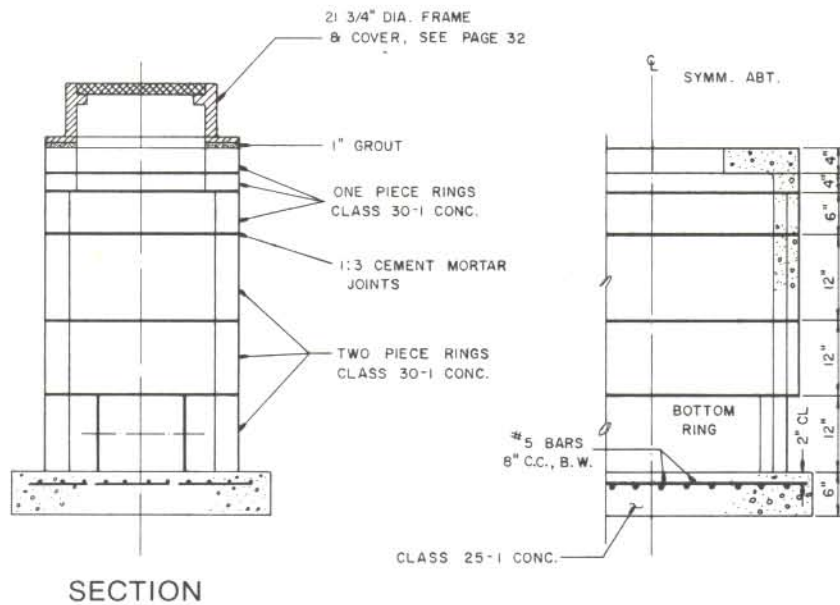
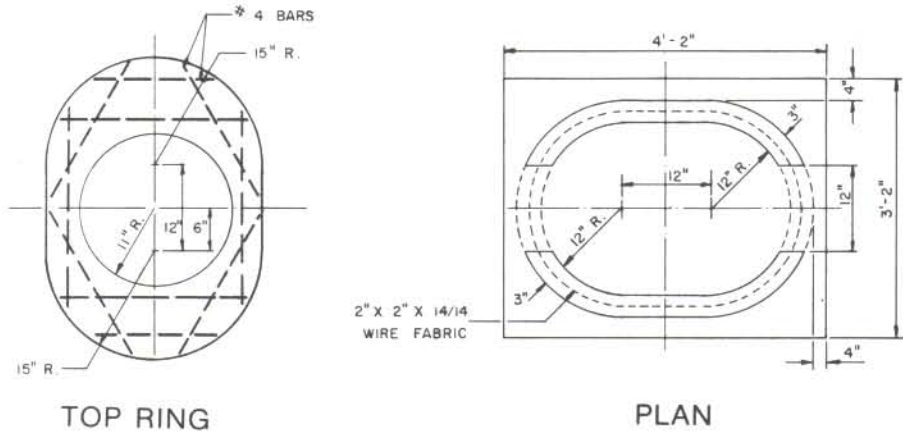


NOTE:

1. PLASTER OUTSIDE BRICK WALL WITH 1/2" 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

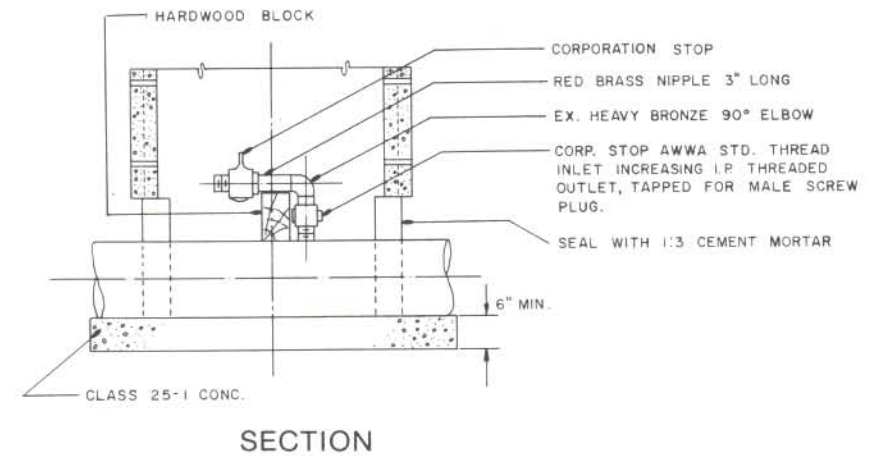
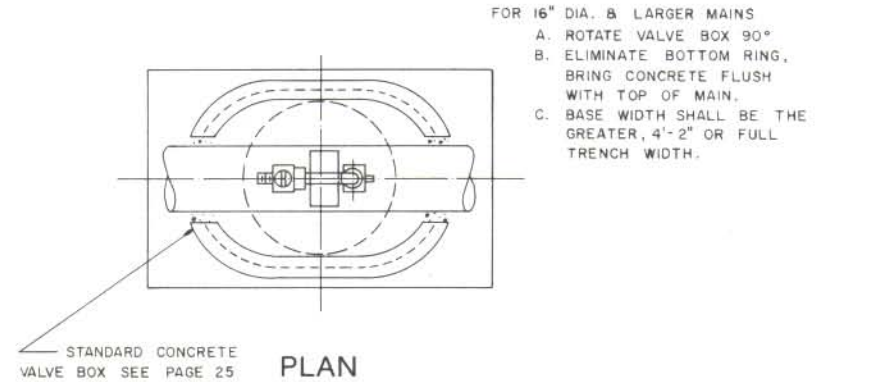
16" THRU 60" HORIZONTAL VALVE CHAMBERS



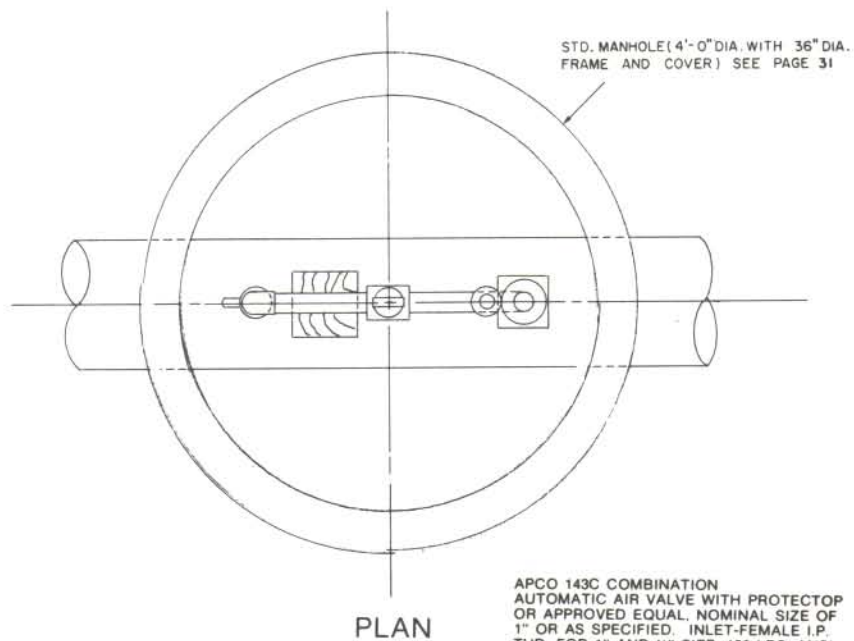
NOTE:
1. SHALL CONFORM TO ASTM C-858 AND THE CITY STANDARD FOR CONCRETE MASONRY

CONCRETE VALVE BOX

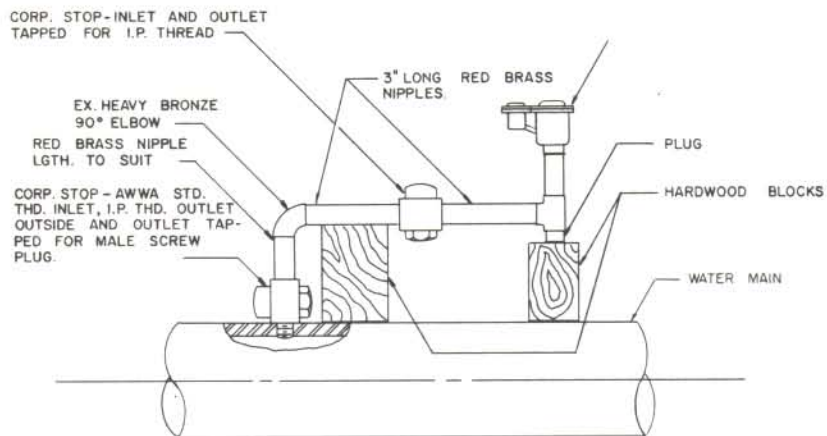
TYPICAL MANUAL AIR VALVE MANHOLE FOR 6" TO 12" MAINS



MANUAL AIR VALVE

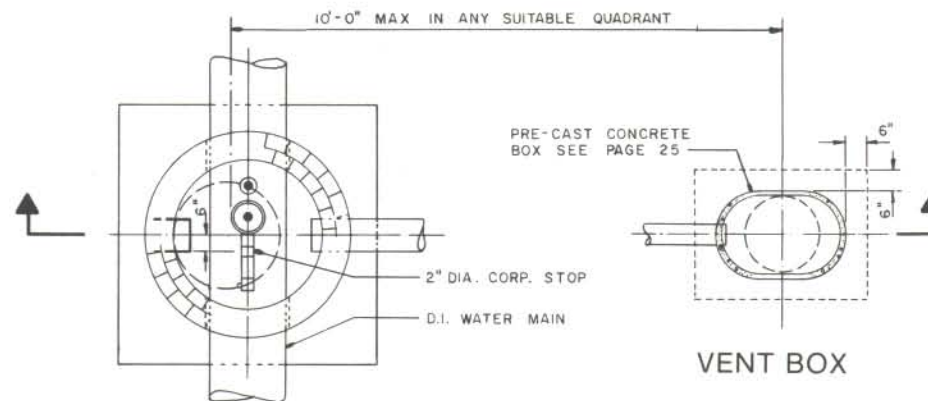


APCO 143C COMBINATION AUTOMATIC AIR VALVE WITH PROTECTOP OR APPROVED EQUAL, NOMINAL SIZE OF 1" OR AS SPECIFIED. INLET-FEMALE I.P. THD. FOR 1" AND 1/2" SIZE, 150 LBS. ANSI. FLANGE FOR 2" AND LARGER SIZE.



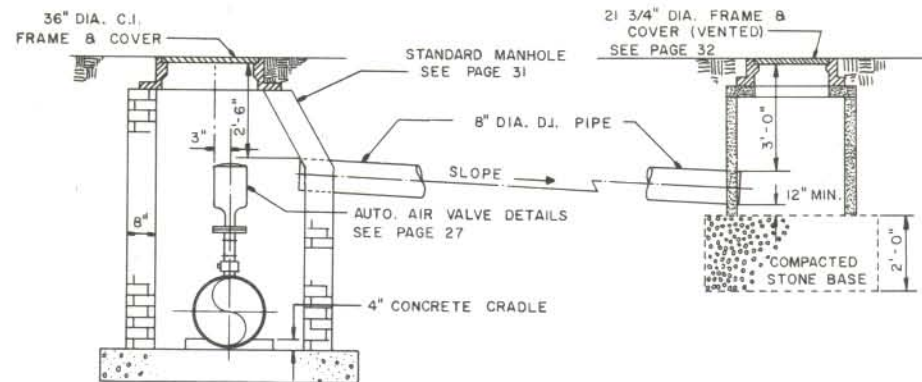
SECTION

AUTOMATIC AIR/VACUUM VALVE ARRANGEMENT



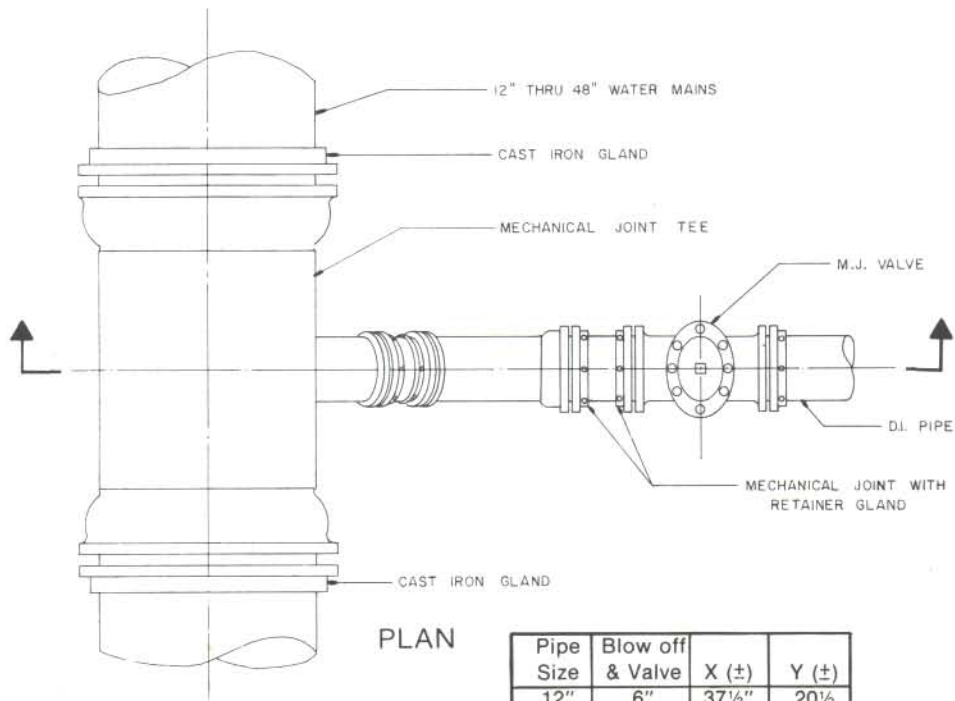
AUTOMATIC AIR VALVE CHAMBER

PLAN



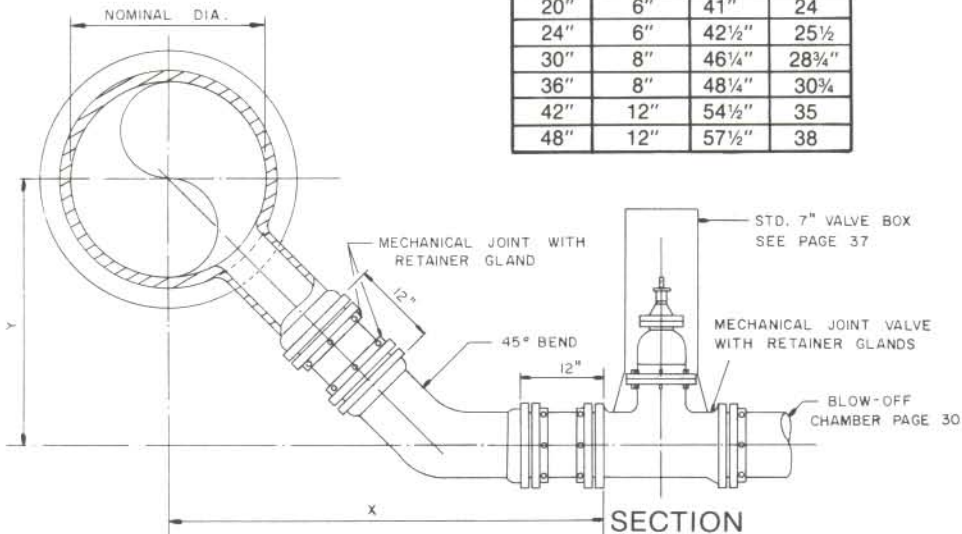
SECTION

AUTOMATIC AIR VALVE CHAMBER AND VENT BOX

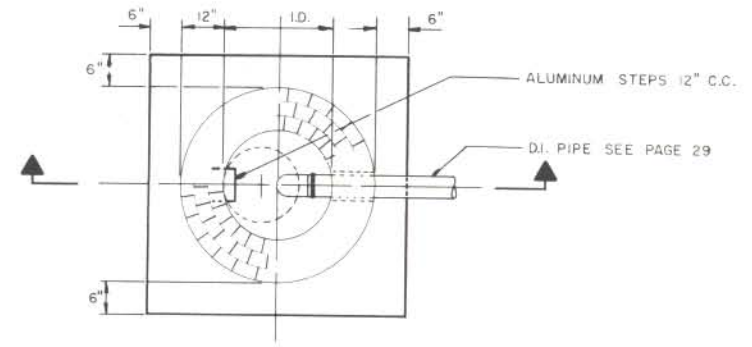


PLAN

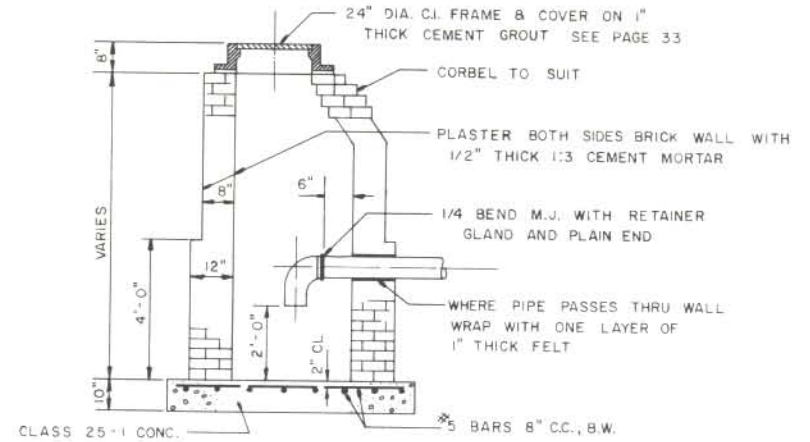
Pipe Size	Blow off & Valve	X (±)	Y (±)
12"	6"	37½"	20½"
16"	6"	39¾"	22¾"
20"	6"	41"	24"
24"	6"	42½"	25½"
30"	8"	46¼"	28¾"
36"	8"	48¼"	30¾"
42"	12"	54½"	35"
48"	12"	57½"	38"



BLOW-OFF BRANCH WITH OUTLET VALVE



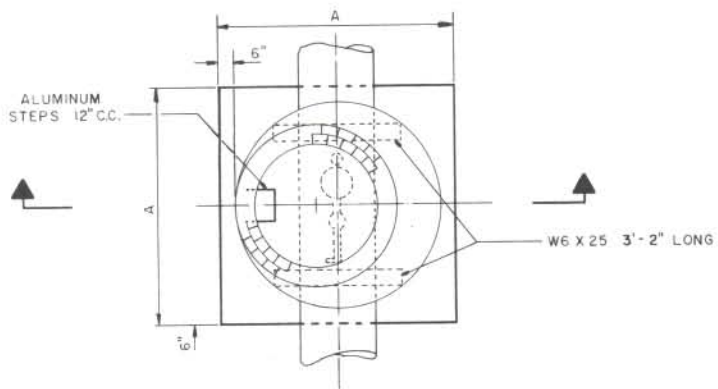
PLAN



SECTION

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

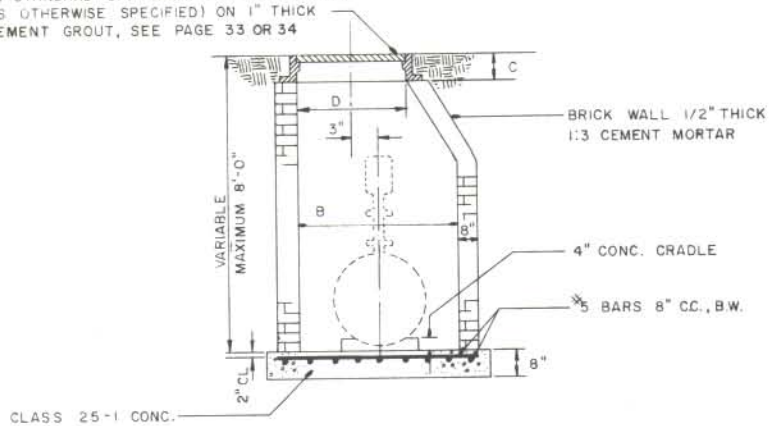
BLOW-OFF CHAMBER



PLAN

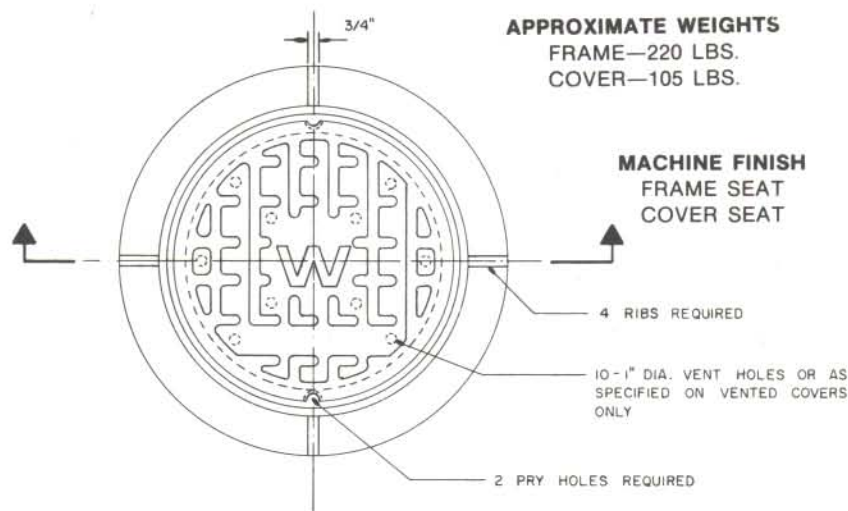
Pipe Dia.	A	B	C	D
6"-12"	5'-4"	3'-0"	7"	24"
16"-24"	6'-4"	4'-0"	8"	36"

24" STANDARD C.I. FRAME & COVER (EXCEPT AS OTHERWISE SPECIFIED) ON 1" THICK CEMENT GROUT, SEE PAGE 33 OR 34



SECTION

STANDARD MANHOLE

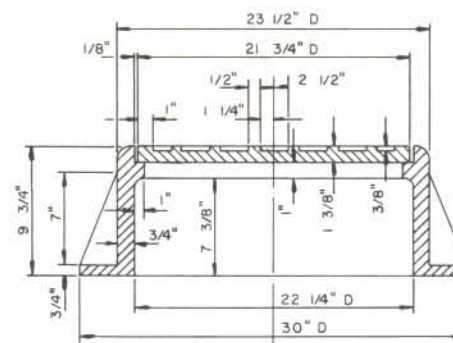


APPROXIMATE WEIGHTS
 FRAME—220 LBS.
 COVER—105 LBS.

MACHINE FINISH
 FRAME SEAT
 COVER SEAT

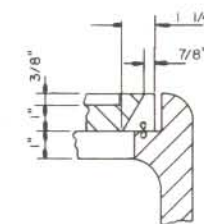
PLAN

MATERIAL
 CAST IRON ASTM A-48
 CLASS 30 B



SECTION

FRAME AND COVER—21³/₄" DIAMETER



PRY HOLE DETAIL

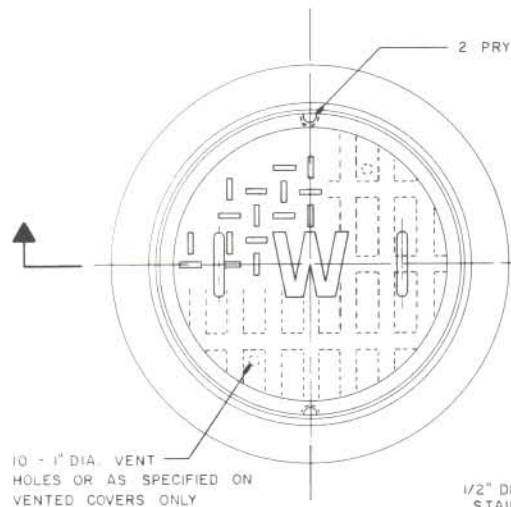
APPROXIMATE WEIGHTS

FRAME—200 LBS.
COVER—175 LBS

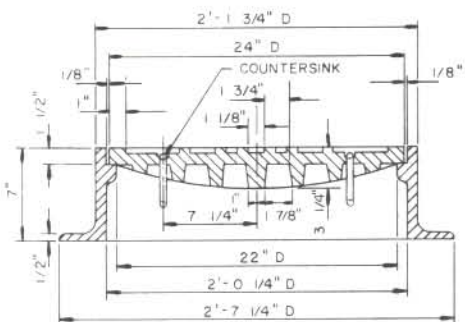
MATERIALS

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

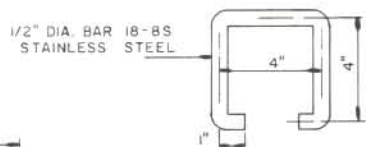
MACHINE FINISH
FRAME SEAT
COVER SEAT



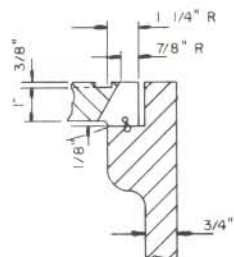
PLAN



SECTION



HANDLE

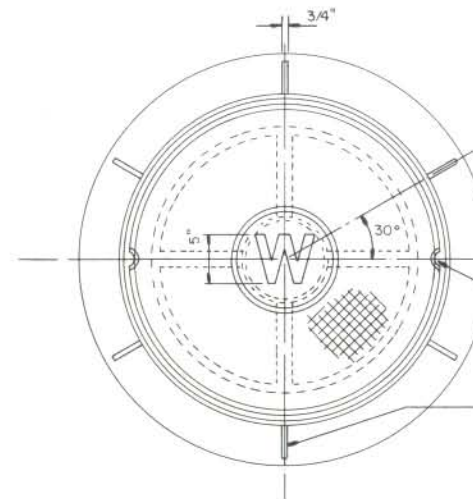


PRY HOLE DETAIL

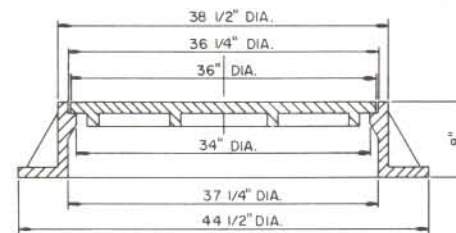
FRAME AND COVER—24\"/>

MATERIAL
CAST IRON, ASTM A-48
CLASS 30B

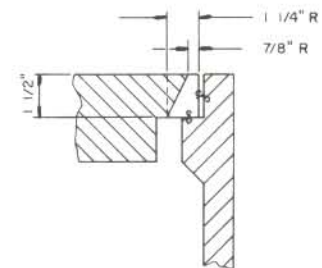
MACHINE FINISH
FRAME SEAT
COVER SEAT
COVER SIDEWALL



PLAN

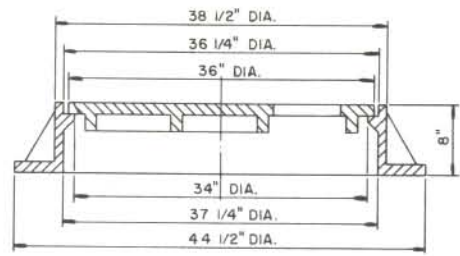
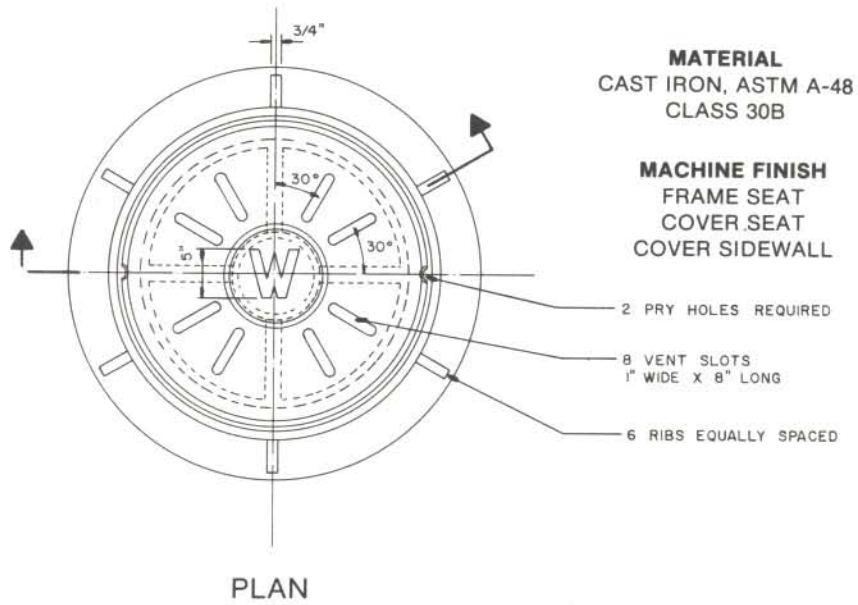


SECTION

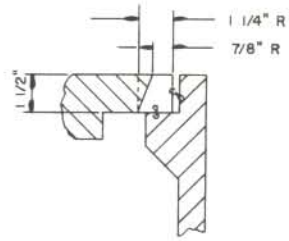


PRY HOLE DETAIL

FRAME AND COVER—36\"/>

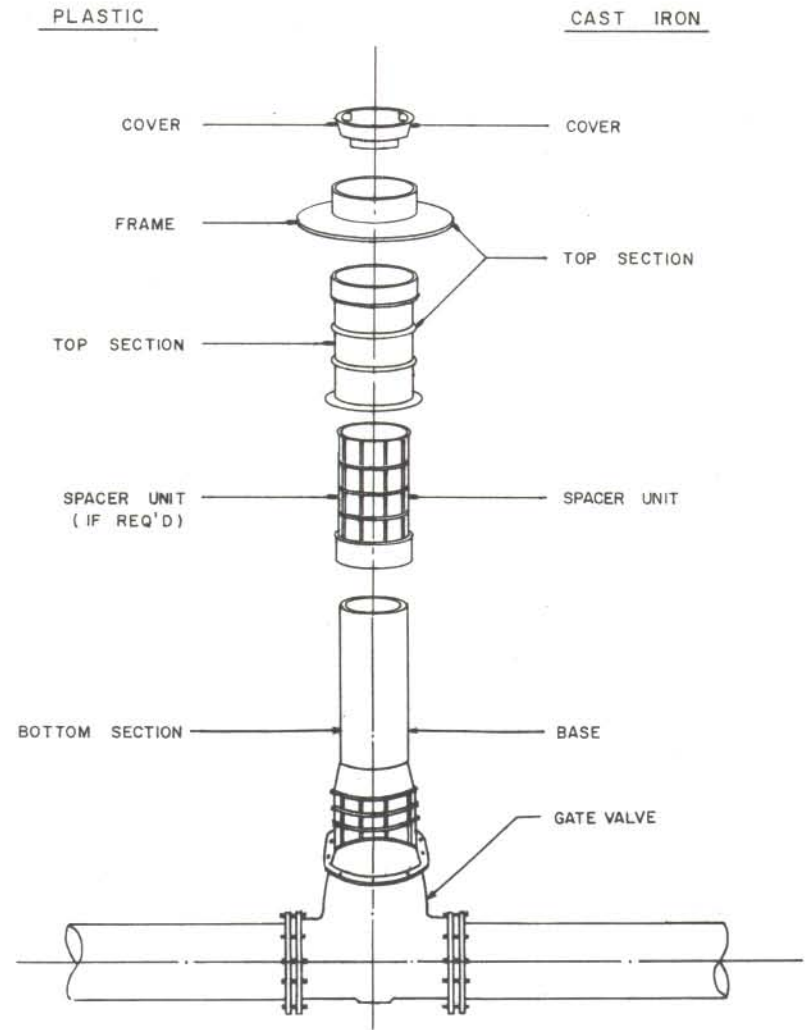


SECTION

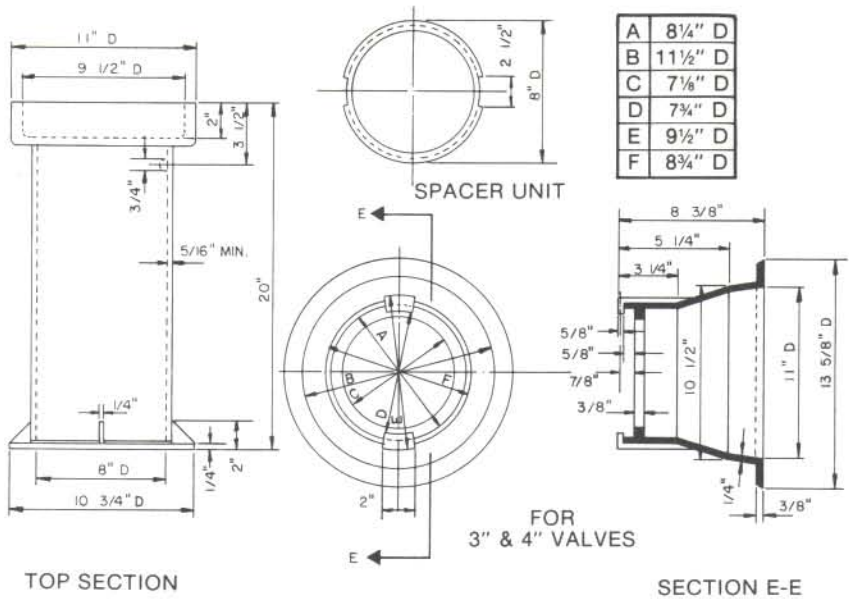
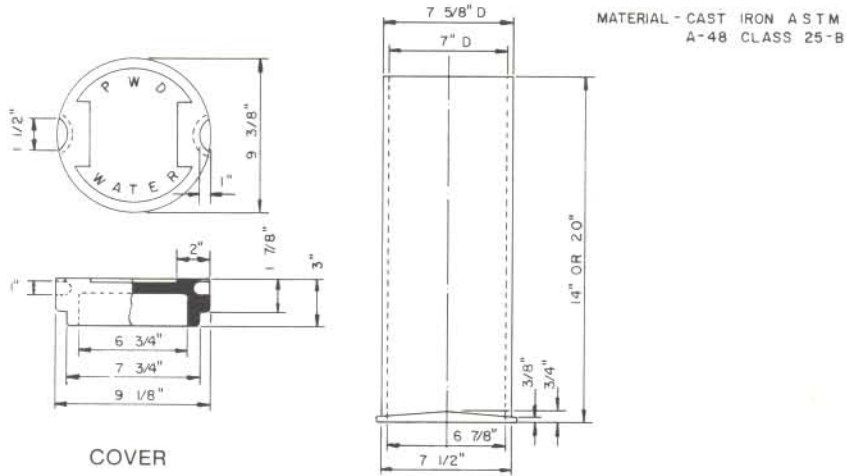


PRY HOLE DETAIL

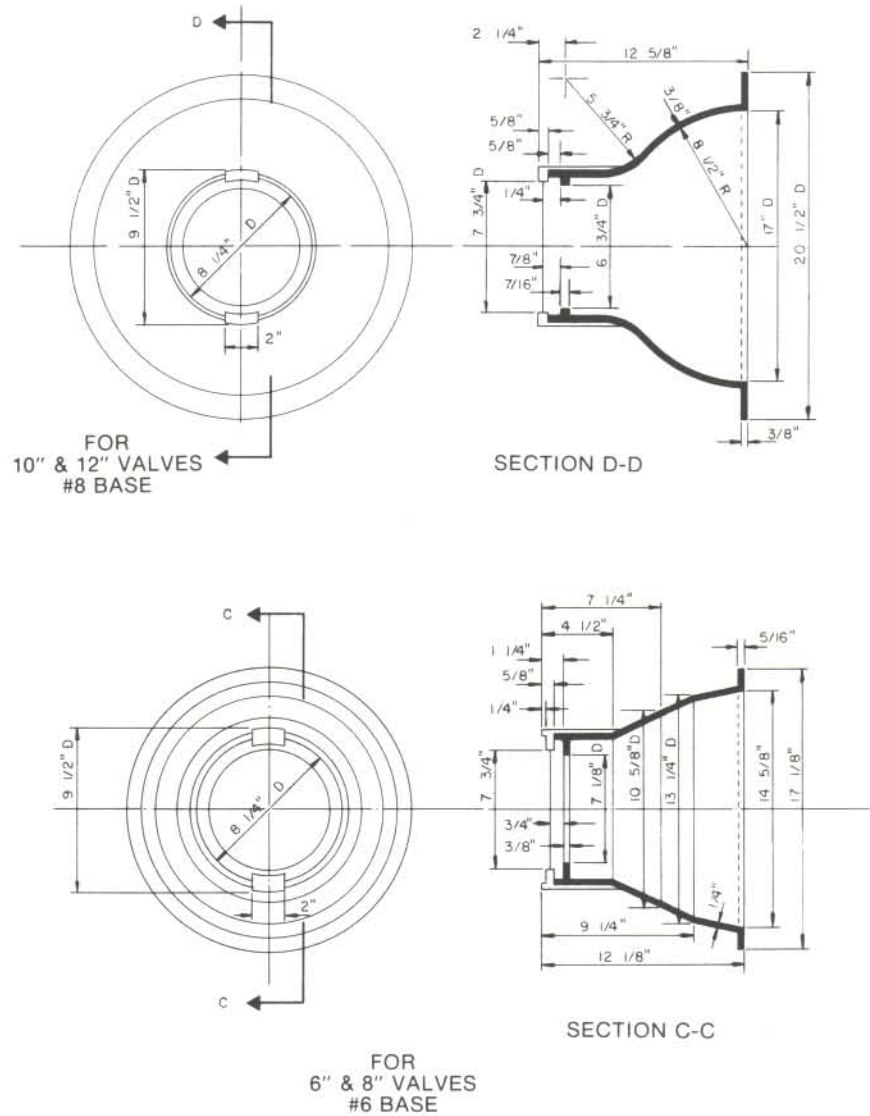
FRAME AND VENTED COVER—36" DIAMETER



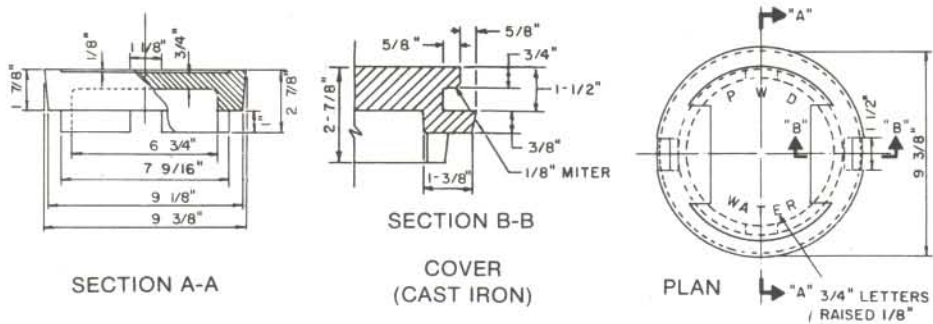
STANDARD 7" VALVE BOX ASSEMBLY



STANDARD 7" CAST IRON VALVE BOX



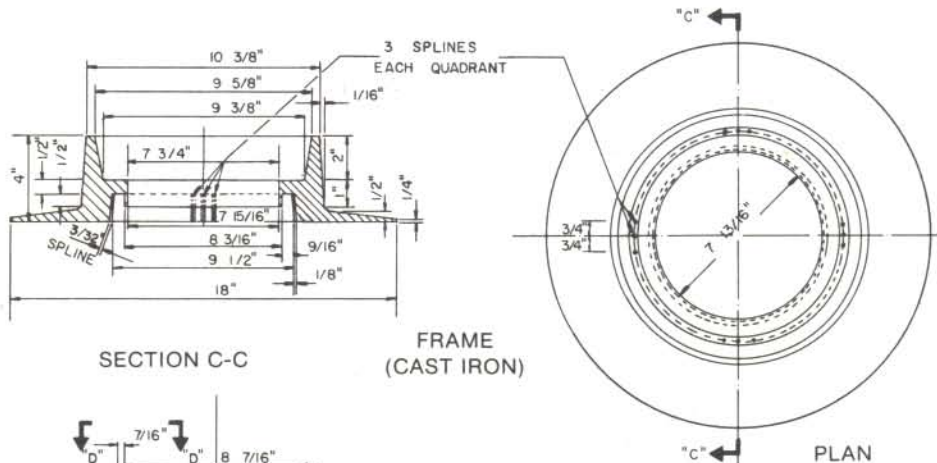
STANDARD 7" CAST IRON
VALVE BOX-BASE SECTIONS



SECTION A-A

SECTION B-B
COVER
(CAST IRON)

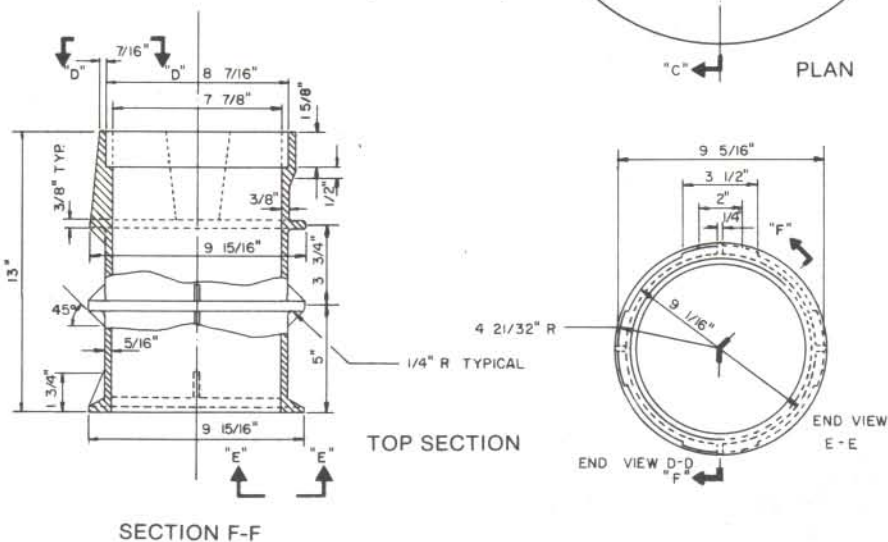
PLAN
"A" 3/4" LETTERS
/ RAISED 1/8"



SECTION C-C

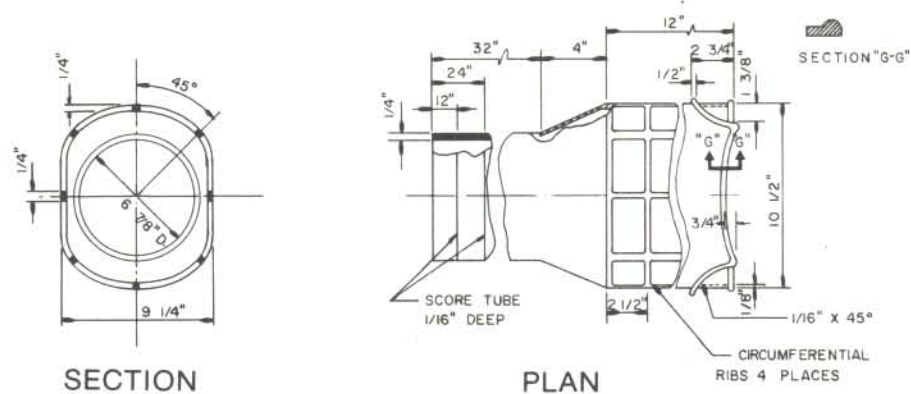
FRAME
(CAST IRON)

PLAN



SECTION F-F

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



SECTION

PLAN

SECTION "G-G"

MATERIALS SPECIFICATIONS

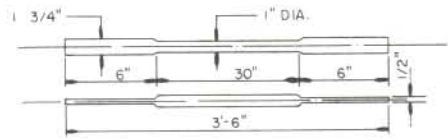
PLASTIC: ALL PLASTIC PARTS SHALL BE INJECTION MOLDED. PLASTIC SHALL BE A REINFORCED OLEFIC POLYMER IN ACCORDANCE WITH THE REQUIREMENTS OF A.S.T.M. D2853-70, CLASS 1212, REINFORCED WITH A FIBROUS INORGANIC COMPONENT AND STABILIZED WITH CARBON BLACK TO PREVENT MATERIAL DEGRADATION FROM ULTRA-VIOLET LIGHT.

PHYSICAL PROPERTIES

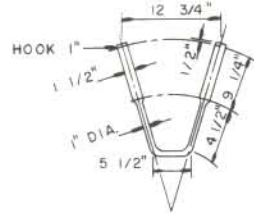
	TEST METHOD-ASTM	MIN TEST VALUES
Tensile Strength (2.0" Min.)	D-638	3400 PSI
Impact Strength I 20 D	D-256	0.6 Ft. Lb./in.
Durometer Hardness, Type D	D-2250	60
Deflection		
Temperature-66 PSI Stress	D-648	230° F
Specific Gravity	D-792	1.15

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.

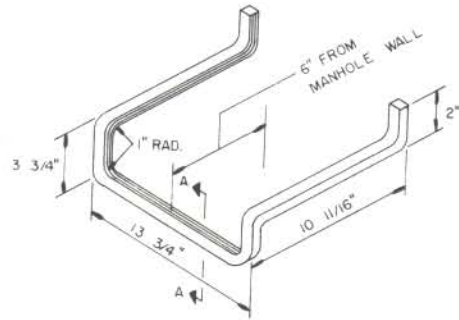
STANDARD 7" PLASTIC VALVE BOX BOTTOM SECTION & SPECIFICATION



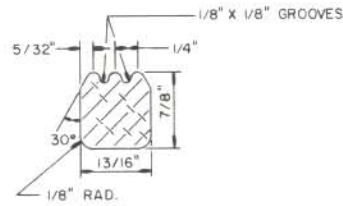
DUCTILE IRON LADDER BAR



DUCTILE IRON STEP



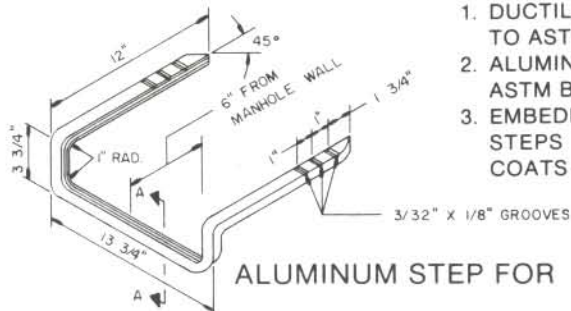
ALUMINUM STEP FOR BRICK MANHOLE



SECTION A-A

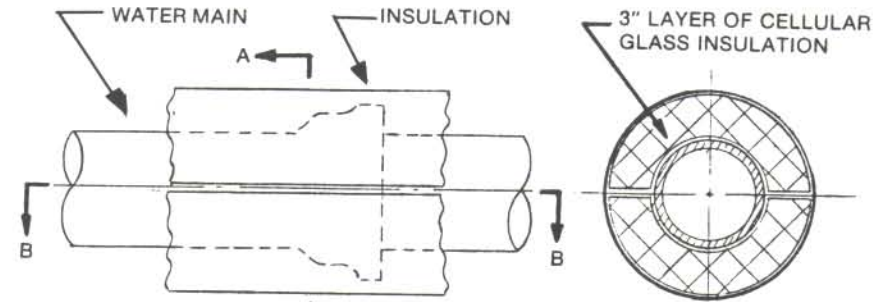
NOTES:

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.

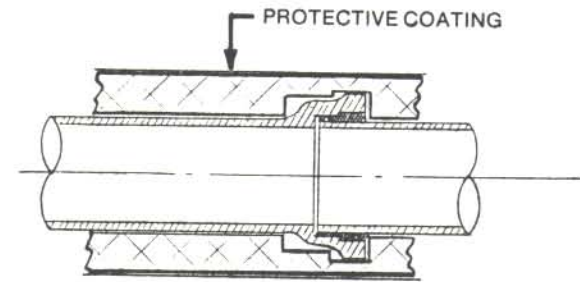


ALUMINUM STEP FOR CONCRETE OR PRECAST R.C. MANHOLE

MANHOLE STEPS AND LADDER BARS



SECTION A-A



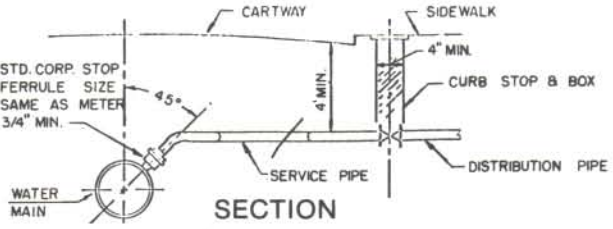
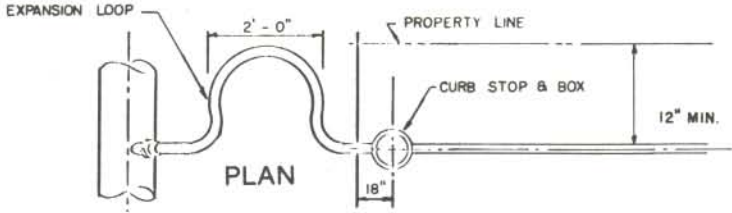
SECTION B-B

NOTES:

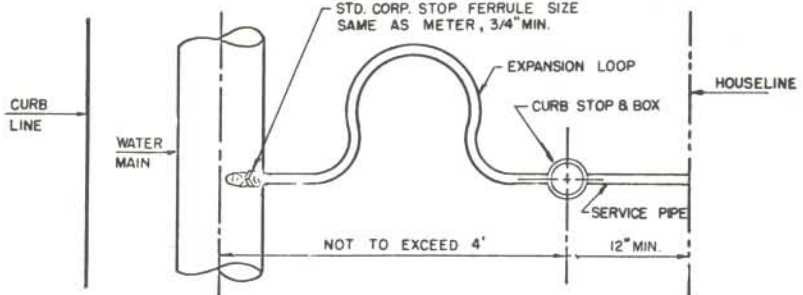
1. INSULATION SHALL BE A CELLULAR GLASS CONFORMING TO ASTM C-552-73. INSTALLED ACCORDING TO MANUFACTURERS RECOMMENDATIONS.
2. THE PROTECTIVE COATING SHALL BE A 125 MIL PREFABRICATED LAMINATE CONTAINING A 10X10 ASPHALT IMPREGNATED GLASS FABRIC AND A 1 MIL ALUMINUM FOIL, SANDWICHED BETWEEN 3 LAYERS OF BITUMINOUS MASTIC. THE EXPOSED SURFACE IS COATED WITH A PROTECTIVE PLASTIC FILM.

EXPOSED WATER MAIN FROST PROTECTIVE COVERING

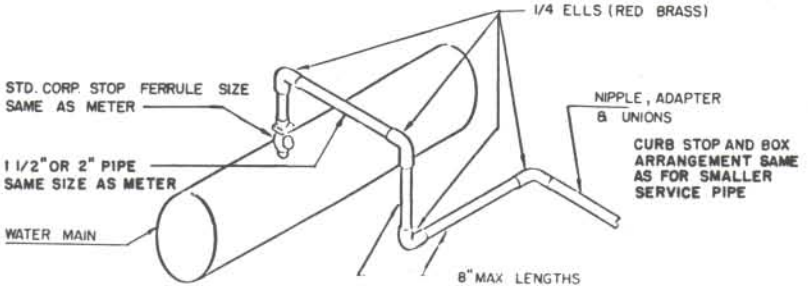
CORROSION CONTROL SPECIFICATIONS



WATER MAIN IN CARTWAY OR OPPOSITE SIDEWALK



WATER MAIN IN SIDEWALK



SWING JOINT FOR 1 1/2 or 2" SERVICE PIPE

SERVICE CONNECTIONS 2" AND SMALLER

**CITY OF PHILADELPHIA
WATER DEPARTMENT
STANDARD SPECIFICATIONS—W-23
FOR
FURNISHING AND INSTALLING
CORROSION CONTROL FOR DUCTILE IRON
WATER MAINS
1 9 8 5**

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W-23.1—SCOPE OF SPECIFICATIONS

This specification is a standard part of the contract documents and covers furnishing and installing corrosion control for standard pressure ductile iron water distribution 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, HARNESES, 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. Where concrete anchor blocks are used, the pipe shall be coated for an area extending six (6) inches each side of the anchor block.

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 shall not be used.

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. Remove rust, mill scale, dirt, grease and any mill applied coating or finishes.
- c. Apply a single coat of the material strictly in accordance with manufacturers recommendations. Airless spray is preferred, however brush application is acceptable.

- d. Allow sufficient time for coating to dry prior to backfilling. Drying time will vary with coating thickness, temperature and manufacturer. Coating shall be allowed to dry for a minimum of two hours or until dry to the touch, whichever is sooner. In the event that backfilling operations must be initiated prior to complete drying of the coating, the non-cured coated areas shall be protected with a loose polyethylene wrap, nominal thickness 3 to 4 mils. The wrap shall be installed such that it generally conforms to the shape of the coated area. Backfilling operations shall be initiated only after approval by the PWD inspector/engineer.

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:

- Assure the area is absolutely dry. If necessary, a fast drying safety solvent may be used to dry cable.
- 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.
- 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.
- 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.

TABLE 23.3.1

PIPE SIZE	AWG WIRE SIZE/STRAND	MOLD NO.	ALLOY CHARGE	CADWELD		THERMOWELD	
				ADAPTER SLEEVE	ADAPTER SLEEVE	MOLD NO.	PCI CHARGE
4"	8/7	CAHBA-1L-4	CA-25-XF-19	CAB-133-1L	M-159-4	25	A-201
4"	4/7	CAHBA-1L-4	CA-45-XF-19	None	M-159-4	45	None
6"	12/Solid	CAHBA-1G-6	CA-25-XF-19	CAB-133-1H	M-156-6	25	A-200
6"	8/7	CAHBA-1L-6	CA-25-XF-19	CAB-133-1L	M-159-6	25	A-201
6"	6/7	CAHBA-1H-6	CA-25-XF-19	None	M-157-6	25	None
6"	4/7	CAHBA-1L-6	CA-45-XF-19	None	M-159-6	45	None
8"	12/Solid	CAHBA-1G-8	CA-25-XF-19	CAB-133-1H	M-156-8	25	A-200
8"	8/7	CAHBA-1L-8	CA-25-XF-19	CAB-133-1L	M-159-8	25	A-201
8"	6/7	CAHBA-1H-8	CA-25-XF-19	None	M-157-8	25	None
8"	4/7	CAHBA-1L-8	CA-45-XF-19	None	M-159-8	45	None
10"	12/Solid	CAHBA-1G-10	CA-25-XF-19	CAB-133-1H	M-156-10	25	A-200
10"	8/7	CAHBA-1L-10	CA-25-XF-19	CAB-133-1L	M-159-10	25	A-201
10"	6/7	CAHBA-1H-10	CA-25-XF-19	None	M-157-10	25	None
10"	4/7	CAHBA-1L-10	CA-45-XF-19	None	M-159-10	45	None
12"	12/Solid	CAHBA-1G-12	CA-25-XF-19	CAB-133-1H	M-156-12	25	A-200
12"	8/7	CAHBA-1L-12	CA-25-XF-19	CAB-133-1L	M-159-12	25	A-201
12"	6/7	CAHBA-1H-12	CA-25-XF-19	None	M-157-12	25	None
12"	4/7	CAHBA-1L-12	CA-45-XF-19	None	M-159-12	45	None
16"	12/Solid	CAHBA-1G-16	CA-25-XF-19	CAB-133-1H	M-156-16	25	A-200
16"	8/7	CAHBA-1L-16	CA-25-XF-19	CAB-133-1L	M-159-16	25	A-201
16"	6/7	CAHBA-1H-16	CA-25-XF-19	None	M-157-16	25	None
16"	4/7	CAHBA-1L-16	CA-45-XF-19	None	M-159-16	45	None
20"	12/Solid	CAHBA-1G-20	CA-25-XF-19	CAB-133-1H	M-156-20	25	A-200
20"	8/7	CAHBA-1L-20	CA-25-XF-19	CAB-133-1L	M-159-20	25	A-201
20"	6/7	CAHBA-1H-20	CA-25-XF-19	None	M-157-20	25	None
20"	4/7	CAHBA-1L-20	CA-45-XF-19	None	M-159-20	45	None
24"	8/7	CAHBA-1L-24	CA-25-XF-19	None	M-157-24	25	A-201
24"	6/7	CAHBA-1H-24	CA-25-XF-19	None	M-157-24	25	None
24"	4/7	CAHBA-1L-24	CA-45-XF-19	None	M-159-24	45	None

W-23.3.4—ATTACHMENT OF WIRE TO PIPE OR FITTINGS

The attachment of the copper wire shall be made as shown in Figure W-23.3.4.

W-23.3.5—TESTING OF ALL COMPLETED WELDS

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

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

W-23.3.6—COATING OF ALL COMPLETED WELDS

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

W-23.4—STANDARD TEST STATIONS

Five types of standard test stations are included in this Standard Specification. Test stations are identified and shall be installed in accordance with the following:

Electrolysis—Types I thru III	—Figures W-23.4 Types I, II and III
Bonding—Type IV	—Figure W-23.4 Type IV
Anode—Type V	—Figure W-23.4 Type V

W-23.4.1—STANDARD ELECTROLYSIS TEST BOX

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

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

Where the contract drawings or standard test station drawings call for the use of a 12-inch roadway box, heavy highway type, it shall be as shown 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 steel or reinforcing bar approximately 6-inches long by one-half inch diameter, and be installed twelve inches below the pipe in line with the outside diameter or as indicated on the applicable drawings. The electrode shall not be installed in the sand backfill. AWG No. 8 stranded copper wire shall be brazed or thermite welded to the electrode. The weld area shall be coated in accordance with Section W-23.2.

W-23.4.4—WIRES

Test station wires and installation shall be in accordance with Section W-23.3. 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 a minimum of twelve inches above grade. Where wire tags are called for, they shall be one inch diameter brass, stamped with the indicated symbol and attached to the test wire with a copper wire of appropriate size.

W-23.5—MAGNESIUM ANODES

Magnesium anodes shall be installed at the locations shown on the contract drawings. Magnesium anodes will be installed on ductile iron pipe lengths; groupings of cast or ductile iron pipe and fittings; or as a groundbed connected to a common bus wire. The arrangement shall be as shown on the contract drawings.

W-23.5.1—ANODE COMPOSITION AND ASSEMBLY

The anode shall have a nominal weight of 32 pounds, excluding backfill. Composition 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 sulfate (NA₂SO₄) 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 Section W-23.3. Anodes shall be installed in holes dug in existing earth, not in the sand backfill, as shown in Figures W-23.5.2A and 2B. Anode holes shall be backfilled with soil from the excavation. Paper shipping bags shall be removed before installation. The cloth bag containing a special chemical mix shall not be disturbed. The prepackaged anode shall be presoaked in a bucket of water. Number and location of anodes shall be as shown on the contract drawings.

W-23.5.3—GROUNDBED 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 Figures W-23.5.3A and 3B.

- a. 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.
- b. Anodes shall be installed in a horizontal position three feet below the bottom of the pipe and approximately one foot off the center line 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.
- c. The AWG No. 12 solid wire supplied with anode shall be spliced to an AWG No. 8 stranded copper wire through the use of a compression/crimp type connector requiring the use of a crimping tool for installation. Solderless lugs, split-bolts or other connectors that utilize threaded connections or set screws shall not be permitted. The resulting splice shall be taped with a layer of splicing compound (50% overlap) followed by a layer of vinyl electrical tape (50% overlap) as shown in Figure W-23.5.3C. The outer layer of tape shall extend a minimum of 2-inches over the wire installation.
- d. Anode bus wire and two AWG No. 8 wires, thermite welded to the main, shall be terminated in a 5-inch roadway box as shown in Figure W-23.5.3A. Anode bus wire shall not be connected to the main wires by the Contractor.

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 hydrant 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 W-23.6A. Bonding across joints of fittings shall be in accordance with Figure W-23.6B. The attachment of wires shall be in accordance with Section W-23.3. Bond wire length shall be kept a minimum.

W-23.7—ELECTRICAL INSULATION OF LINE PIPING

This section specifies the installation of polyvinyl chloride (P.V.C.) pipe inserts and insulator test stations, when called for on the contract drawings. Installation of polyethylene domestic water services, when called for on the contract drawings, shall be in strict accordance with City of Philadelphia Water Department Standard Specification W-21.

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 shall be installed directly into push-on or standard mechanical joint pipe including mechanical joint gate valves, providing the resulting pipe joints can remain unharnessed. P.V.C. pipe inserts shall not be installed with retainer glands or other devices that utilize set-screws to secure slip rings to the pipe. Under no circumstances shall bond wires be installed across the P.V.C. insert.

W-23.7.2—COATING REQUIREMENTS AT INSULATORS

W-23.7.2.1

When the contract drawings do not specify installation of an extruded mill-applied coating system, the pipe, push-on joint and/or mechanical joint on each side of a P.V.C. insert shall be coated as follows:

- a. Install a cold-applied polyethylene backed elastomer based tape system in accordance with paragraph W-23.9.2 to the pipe for a distance of ten feet from the face of the pipe joint on each side of the insert.
- b. Coat the face of the pipe joints, valves and other irregular surfaces within ten feet of each end of the insert with a cold-applied bitumen coating in accordance with Section W-23.2.

When the contract drawings specify installation of an extruded polyethylene coating system, the piping on each side of an insert shall be coated in accordance with Section W-23.9. No additional coating, beyond those specified in Section W-23.9 shall be required.

W-23.7.3—ELECTROLYSIS TEST STATION AT INSULATORS

Where the contract drawings specify installation of P.V.C. pipe inserts, an electrolysis test station, as shown in Figure W-23.7.3A or 3B, shall be installed with the insert. All wires, attachment procedures, and welding equipment shall be in accordance with Section W-23.3 of these 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 installed 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 5/8-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 shall not be permitted.

W-23.8.2—INSTALLATION OF GROUND RODS

Ground rods shall 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 shall 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 within the limits shown 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 performed spiral application of hot-butyl rubber adhesive and virgin black polyethylene for protection against external corrosion. Coating shall be Bredero Price, Inc.—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. Carbron 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. a 10 mil 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 mils thick (nominal thickness $\pm 10\%$ tolerance). Nominal total coating system thickness shall be 50 mils $\pm 10\%$.
- e. Coating application shall provide a coating cutback on the spigot end of each pipe length in accordance with the following table for each pipe diameter. The distances shown apply to where the actual cut should be made. Allowance for coating shrinkage is included in the cutbacks listed.

NOMINAL DIAMETER	CUTBACK-SPIGOT END
4"	2.75" \pm 0.25"
6"	3.00" \pm 0.25"
8"	3.25" \pm 0.25"
10"	3.25" \pm 0.25"
12"	3.25" \pm 0.25"
16"	4.37" \pm 0.25"

The final coating cutbacks shall be achieved by either of two methods:

1. Application of extruded mill coating in accordance with the cutbacks listed (preferred method).
2. Use of a cold-applied polyethylene tape overlapping the mill coating for a distance of 1-inch and extending to the spigot end a sufficient distance to establish the cutback stated. Total longitudinal distance covered by the tape shall not exceed three (3) inches. Material application requirements shall be as set forth in paragraph W-23.9.2 (Acceptable alternative).

It shall be the Contractor's responsibility to establish the coating cutbacks required, either through arrangement with the mill applicator, or through the use of his own personnel. The final arrangement shall be as shown in Figure W-23.9.1

- f. Mill extruded coating shall extend to the face of the bell during the application process. A hand held, smooth faced roller or similar device shall be used to insure that the coating bonds to the curved portion of the bell. The roller shall be used to press the coating against the pipe prior to completion of the application process. After shrinkage has occurred (approx. 1 to 1.5-inches), the bare area on the bell shall be coated with a cold-applied polyethylene tape installed in accordance with paragraph W-23.9.2. The final arrangement shall be as shown in Figure W-23.9.1.
- g. After shrinkage has occurred, air pockets may form at the slope of the bell. The Contractor shall inspect each pipe length for air pockets and repair all pockets by slicing the mill applied coating and installing polyethylene tape wrap in accordance with paragraph W-23.9.2.
- h. Mill applied coating shall be 100% inspected for pinholes and holidays immediately after application, with a holiday detector adjusted to provide sufficient voltage to produce a spark through a pinhole in the coating (at least 15KV). Defective external coating shall be repaired to meet all requirements of these specifications. Repairs shall be made in accordance with paragraph W-23.9.2.

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 layer 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 requires a primer prior to application. Tapes with an adhesive as part of the tape structure are not acceptable. Tape shall conform to the following general requirements.

- a. Maximum Moisture Transmission Rate:
0.06 grams/100 square inches/24 hours
- b. Maximum Moisture Absorption: .05%
- c. Operating Temperature Range: -40°F to 180°F
- d. Application Temperature Range: -30°F to 120°F
- e. Dielectric Strength: 15,000 volts minimum
- f. Volume Resistivity: 10¹¹ ohm-centimeters minimum
- g. Primer: As specifically compounded for tape used

W-23.9.2.1—INSTALLATION REQUIREMENTS

- a. Remove all dirt, grime, 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 stright pipe shall be coated with a cold-applied butumastic coating in accordance with paragrph W-23.2.1 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 in according with paragraph W-23.2.1 and as shown in Figure W-23.9.2B.
- f. Where bond wires are required, thermite welds should be made on exposed bare pipe surfaces, if possible, and thoroughly coated with a 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.

- g. Line valves are not to be taped but coated with a cold-applied bituminous coating in accordance with paragraph 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 entire 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 the 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 pipeline, 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 inspector, by and at the expense of the laying contractor.

W-23.9.5—ATTACHMENT OF SERVICE FERRULES TO COATED PIPE

Tapping machines used for ferrule installation shall be secured to the pipe using wide belt slings, padded chains, or by inserting several layers of asphalt mastic board between the coated pipe and chains. Under no circumstances shall the chains or other metallic securing devices come into direct contact with the coated pipe.

After ferrules and polyethylene service pipes are installed, all ferrules shall be coated with cold-applied bitumastic coating in accordance with Section W-23.2 and the following:

- a. Remove all loose mill coating, caused by tapping operations, from the base of the ferrule.
- b. Thoroughly degrease or otherwise remove all oils or other lubricants, on the ferrule and pipe area around the ferrule, that may have been used for tapping operations.
- c. Roughen the mill applied coating with a medium grit sandpaper on the pipe around the base of the ferrule for an area of four (4) square inches.
- d. apply the bitumastic coating to the ferrule and the roughened area on the coated pipe in accordance with Section W-23.2.

W-23.9.6—CONCRETE THRUST BLOCKS ON COATED PIPE

Coated pipe shall be wrapped with two layers of pipeline felt in the area where concrete thrust blocks will be installed. Felt shall be secured in place with non-metallic tape. The final arrangement shall be as shown in Figure No. W-23.9.6 such that there is no concrete in direct contact with the coated pipe.

W-23.9.7—ACCEPTANCE CRITERIA FOR POLYETHYLENE COATED PIPE (EXTRUDED AND TAPE SYSTEMS)

Electrical tests shall be made on coated pipe prior to paving but after all phases of pipe installation, including service attachments, have been completed. These tests shall be conducted by the City of Philadelphia Water Department or its representative. The total coating system shall be considered as acceptable provided the measured coating resistance (between P.V.C. inserts) is not less than 4,000 ohm-square feet.

If testing shows a resistance less than the minimum acceptable value, the Contractor, at his expense, will be required to locate and repair the defective coating. Repairs will be made in accordance with Section W-23.9.2 and be subject to retesting after all work is completed. Final acceptance of the coating and associated repair work will be determined by the City of Philadelphia Water Department or its representative.

W-23.10—RESERVED FOR FUTURE USE

W-23.11—TESTING

In all cases where corrosion control measures, as set forth in these specifications, are installed with a water main, such measures and devices will be tested by the Water Department after backfilling, but prior to paving, at no cost to the Contractor. The Water Department will bear the cost only for the initial testing of corrosion control measures. Initial testing is defined as those tests required to determine whether or not the measures meet acceptance criteria as set forth in standard **Philadelphia Water Department Corrosion Control Test Guidelines and Acceptance Criteria**, which by reference becomes a part of this specification and is available through the Philadelphia Water Department as needed.

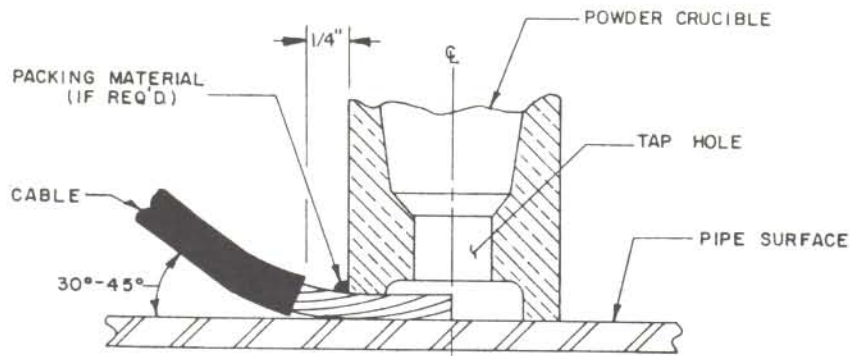
The testing will include, but not be limited to, the following basic measurements as they apply and are required for a specific main installation project.

- a. Electrical evaluation of electrolysis test stations in accordance with Section 2 of the test guidelines. These items shall be considered acceptable provided measured values do not exceed theoretical values by more than 20 percent.
- b. Electrical continuity of piping in accordance with section 3 of the test guidelines. This item shall be considered acceptable provided measured values do not exceed theoretical values by more than 10 percent.
- c. Resistance characteristics of insulating devices in accordance with section 4.1 of the test guidelines. These items shall be considered acceptable provided they meet the criteria set forth in section 4.1 and 4.2 for the specific insulating device tested.
- d. Resistance characteristics of magnesium anode installations in accordance with section 2.4 of the test guidelines. These items shall be considered as acceptable provided measured values do not exceed theoretical values by more than 50 percent.
- e. Resistance characteristics of protective coatings in accordance with section 4.3 of the test guidelines. This item shall be considered as acceptable provided measured values are 4000 ohm-square feet or greater.
- f. Evaluation of cathodic protection levels in accordance with section 6 of the test guidelines. Cathodic protection shall be considered as established provided at least two of the criteria set forth in section 6.3 are met.

In the event that initial testing or visual examination indicate failure to meet acceptance criteria or otherwise show the presence of defective or omitted work, the Contractor, at no expense to the Water Department, shall provide all labor, materials and equipment to locate, repair, and/or replace such defective or omitted work, to the satisfaction of the Engineer. Should additional testing be required to more precisely locate defective or omitted items, the Contractor shall complete such tests through either of the following options:

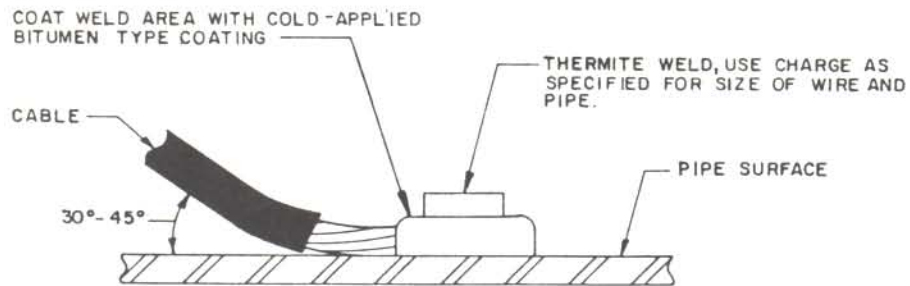
- a. Contractor may conduct tests in accordance with the Water Department Corrosion Control Test Guidelines, utilizing his own personnel or the service of a qualified corrosion control engineering firm, at no expense to the Water Department.
- b. Contractor may utilize the services of the Water Department or its Consultant to conduct the additional tests with the understanding that the costs for these tests will be the responsibility of the Contractor and will be withheld from the contract payment. The amount of backcharge will be based upon the prevailing rates between the Water Department and its Consultant and the time (manhours required for the tests).

Subsequent to the repair or replacement of defective or omitted corrosion control measures, the Water Department or its representatives will retest the repaired areas to insure that all work is in accordance with these specifications. The Contractor shall bear all cost associated with the repair work, including the cost of retesting, necessary to bring the work into conformance with the specifications. The cost of retesting will be based upon the prevailing rates between the Water Department and its Consultant and the time (manhours) required to complete the retesting. These costs will be withheld from the contract payment.



NOTE: END OF CABLE SHOULD NOT PASS CENTER LINE OF MOLD.

MOLD POSITIONING



COMPLETED WELD

**THERMITE WELD
FIGURE W-23.3.4**

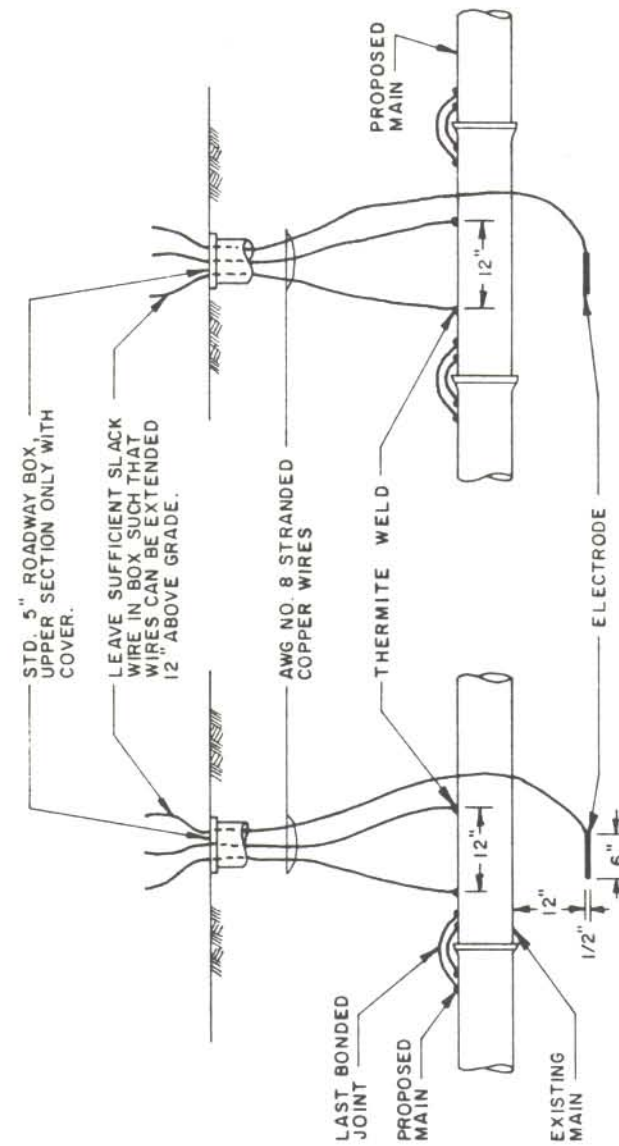
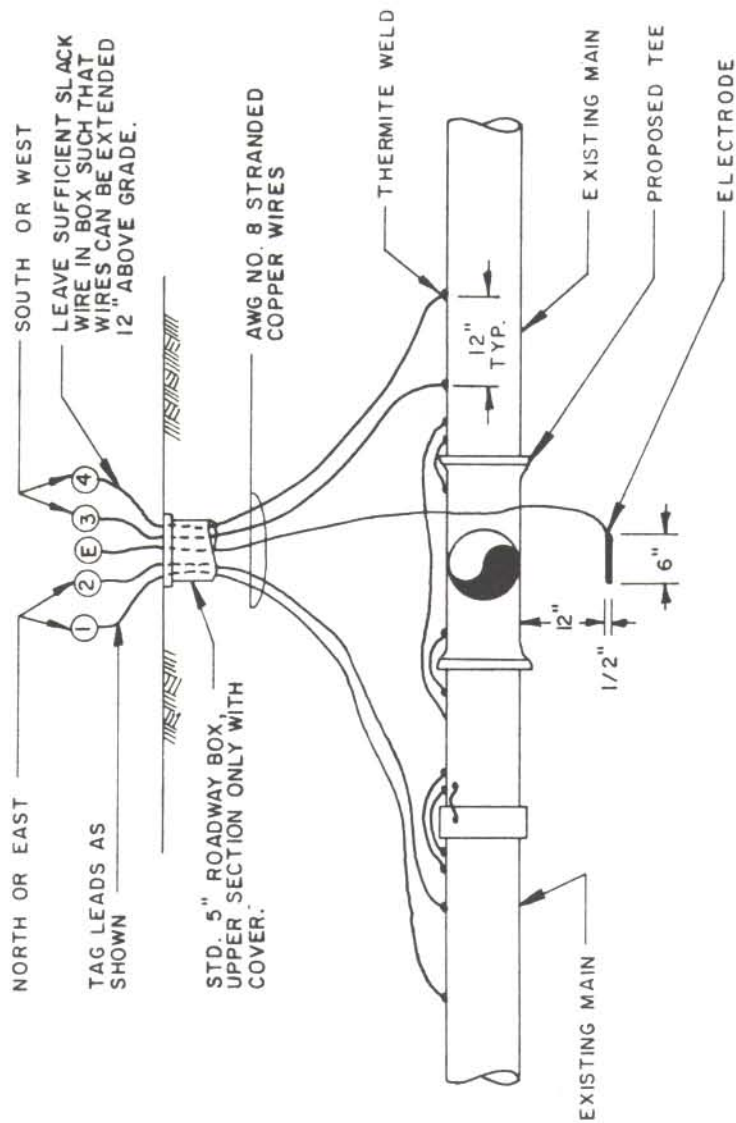


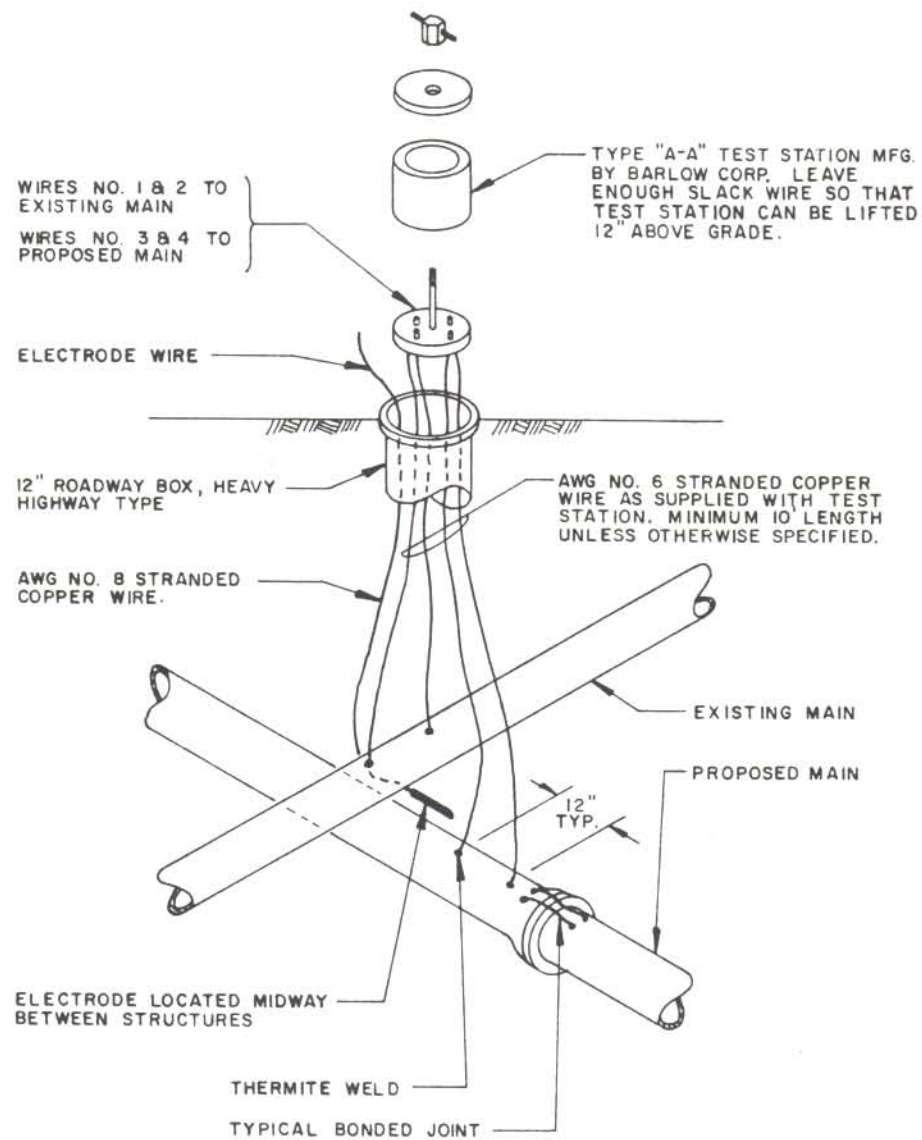
FIGURE W-23.4 TYPE I

FIGURE W-23.4 TYPE II

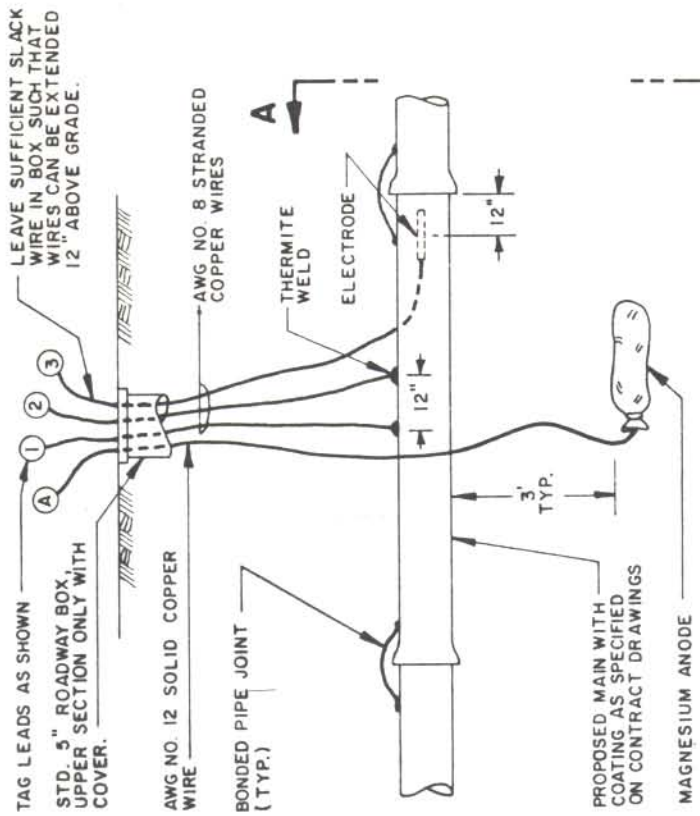
ELECTROLYSIS TEST STATION



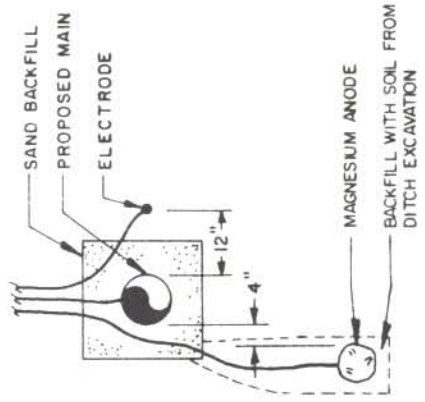
**ELECTROLYSIS TEST STATION
FIGURE W-23.4 TYPE III**



**ELECTROLYSIS BONDING STATION
FIGURE W-23.4 TYPE IV**

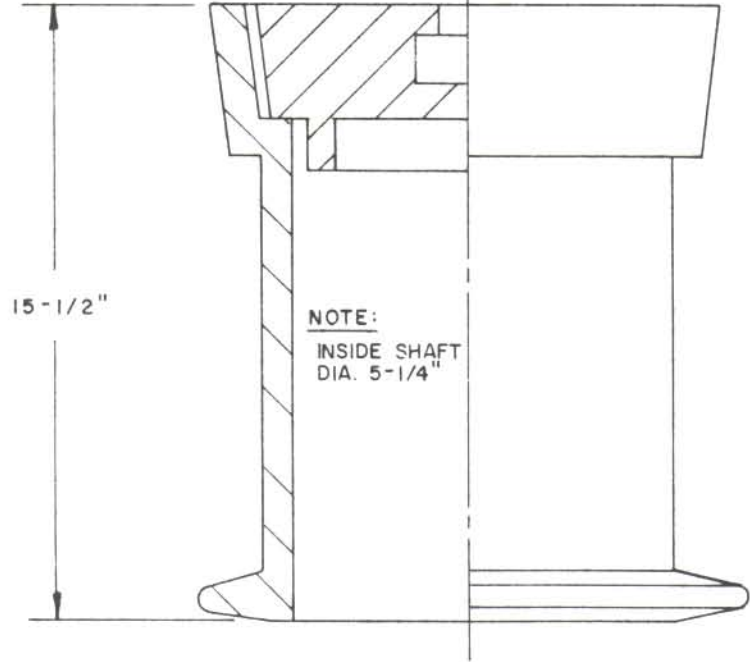


NOTE: ANODE SHALL NOT COME IN CONTACT WITH SAND BACKFILL

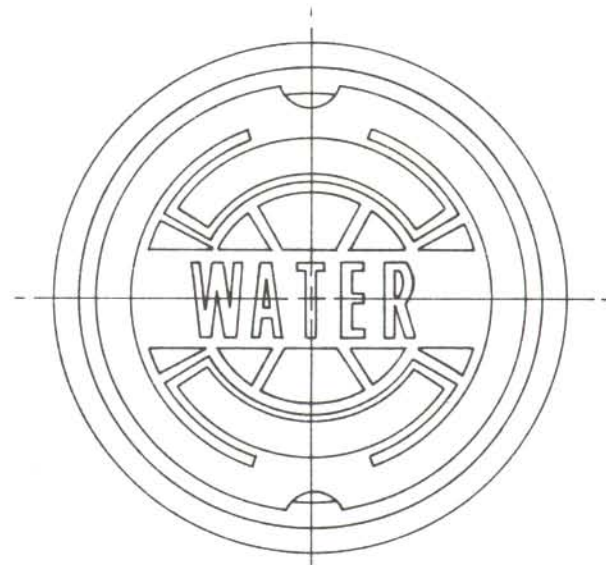


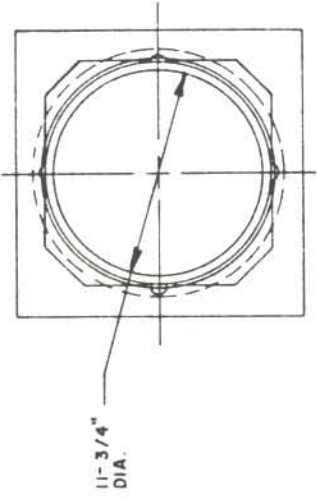
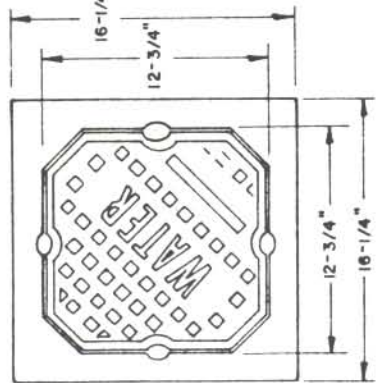
SECTION A-A

MAGNESIUM ANODE TEST STATION
 FIGURE W-23.4 TYPE V



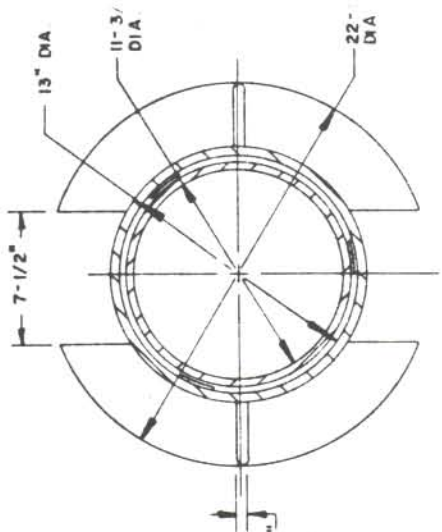
5" ROADWAY BOX
 FIGURE W-23.4.1



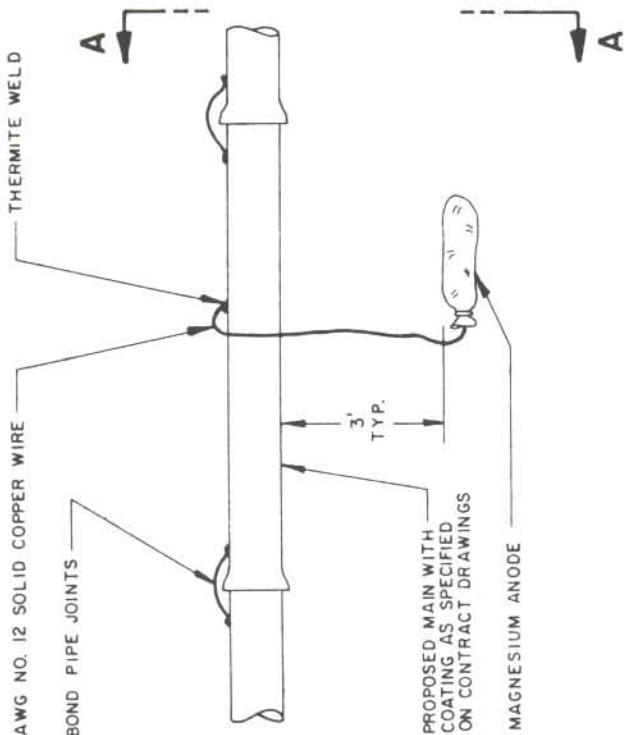
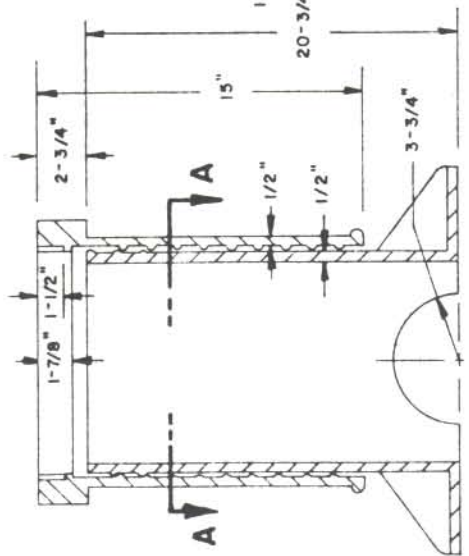


12" ROADWAY BOX
FIGURE W-23.4.2

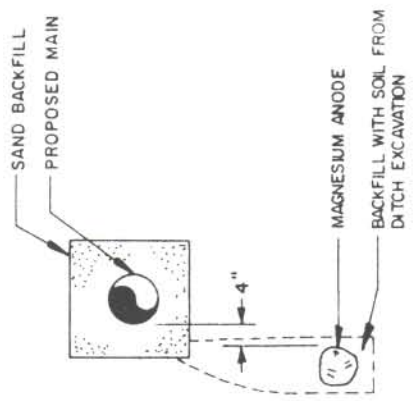
PLAN OF FRAME WITHOUT LID



SECTION A-A

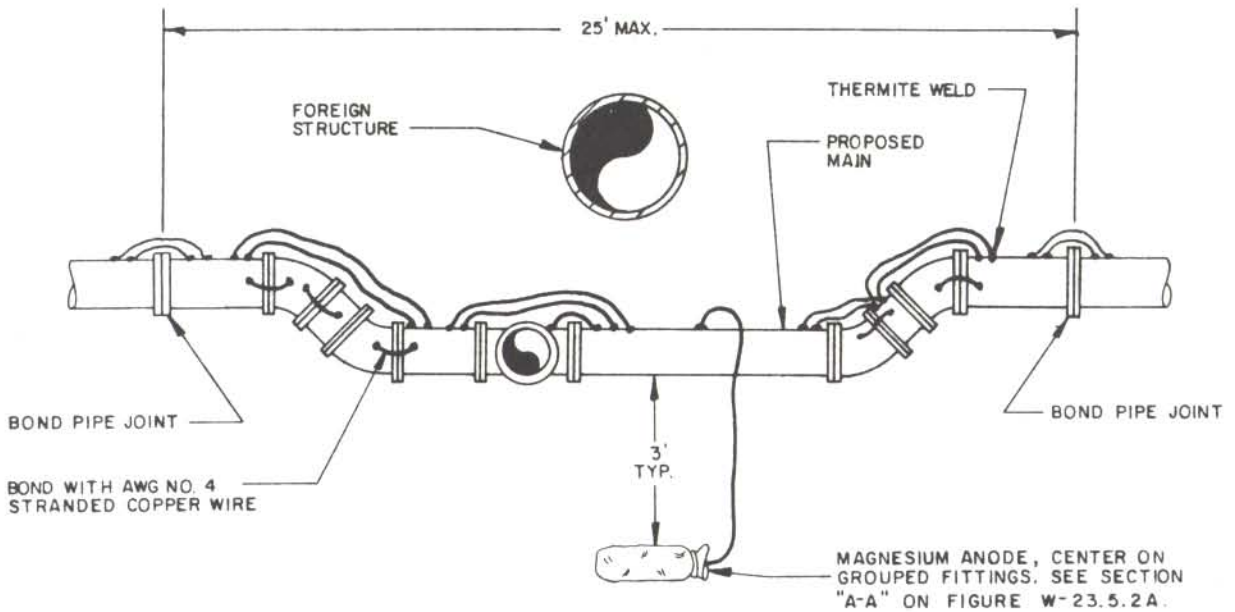


NOTE: ANODE SHALL NOT COME IN CONTACT WITH SAND BACKFILL



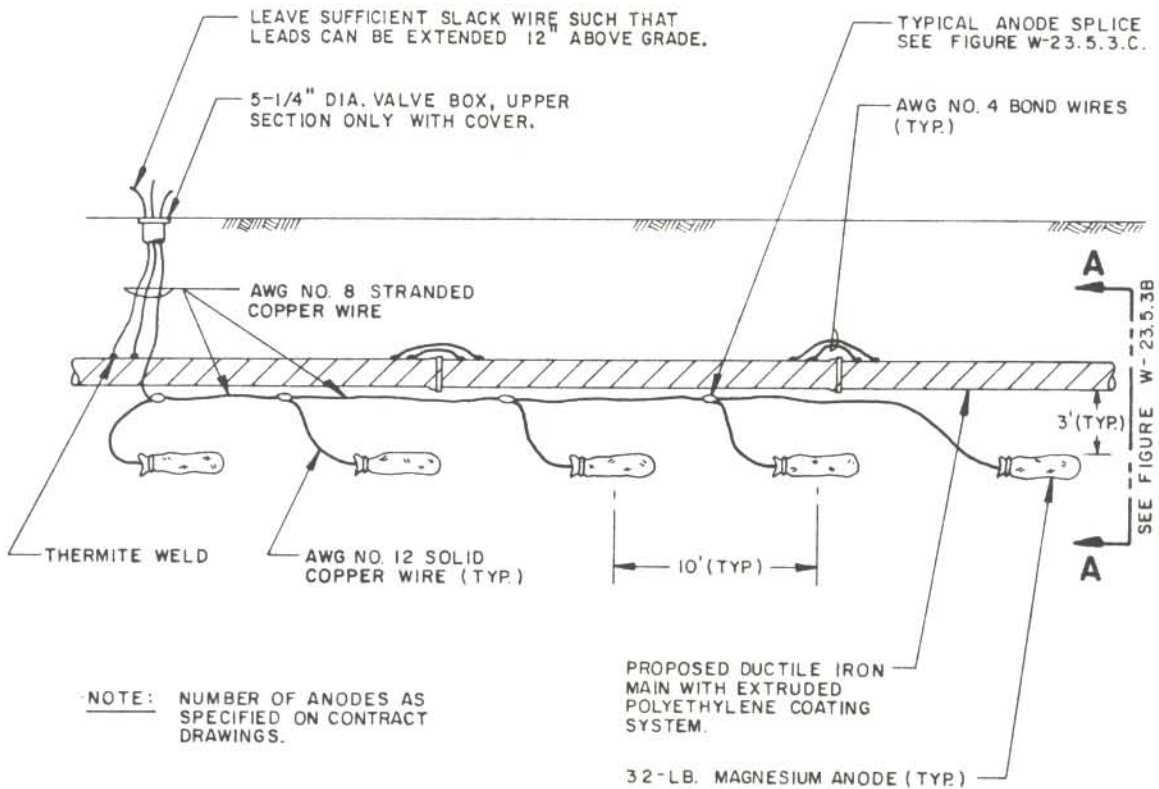
SECTION A-A

MAGNESIUM ANODE INSTALLATION
FIGURE W-23.5.2A



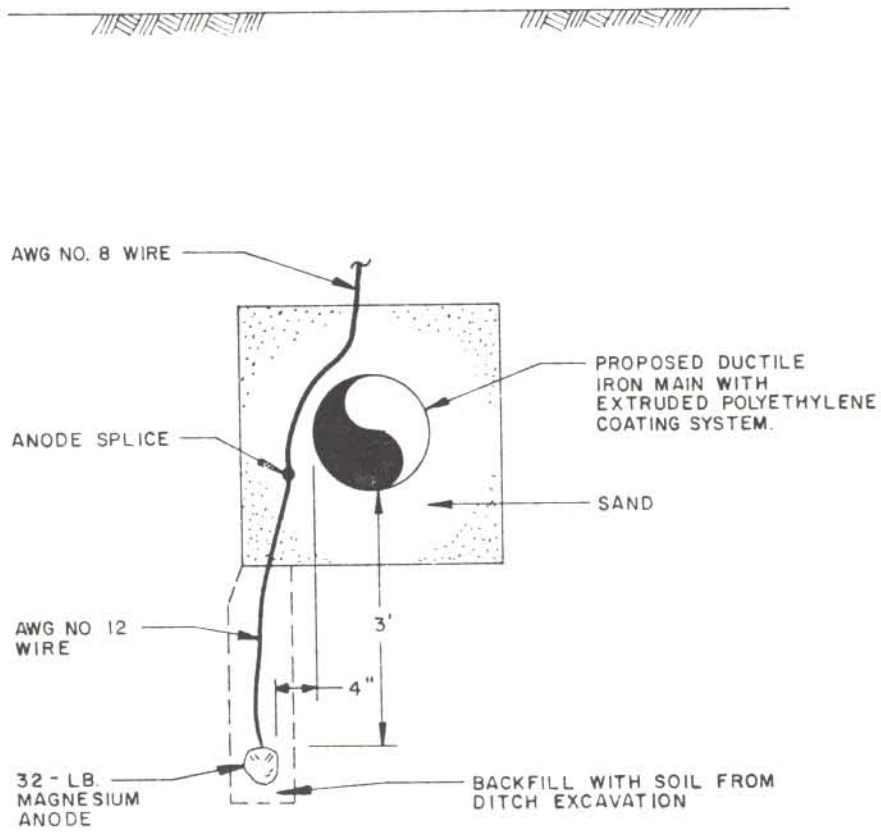
NOTE: WHERE A SINGLE FITTING IS INVOLVED, IT SHOULD BE BONDED TO ONE OF THE CONNECTING PIPES TO WHICH AN ANODE HAS BEEN ATTACHED. A SEPARATE ANODE FOR THE FITTING IS NOT REQUIRED.

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

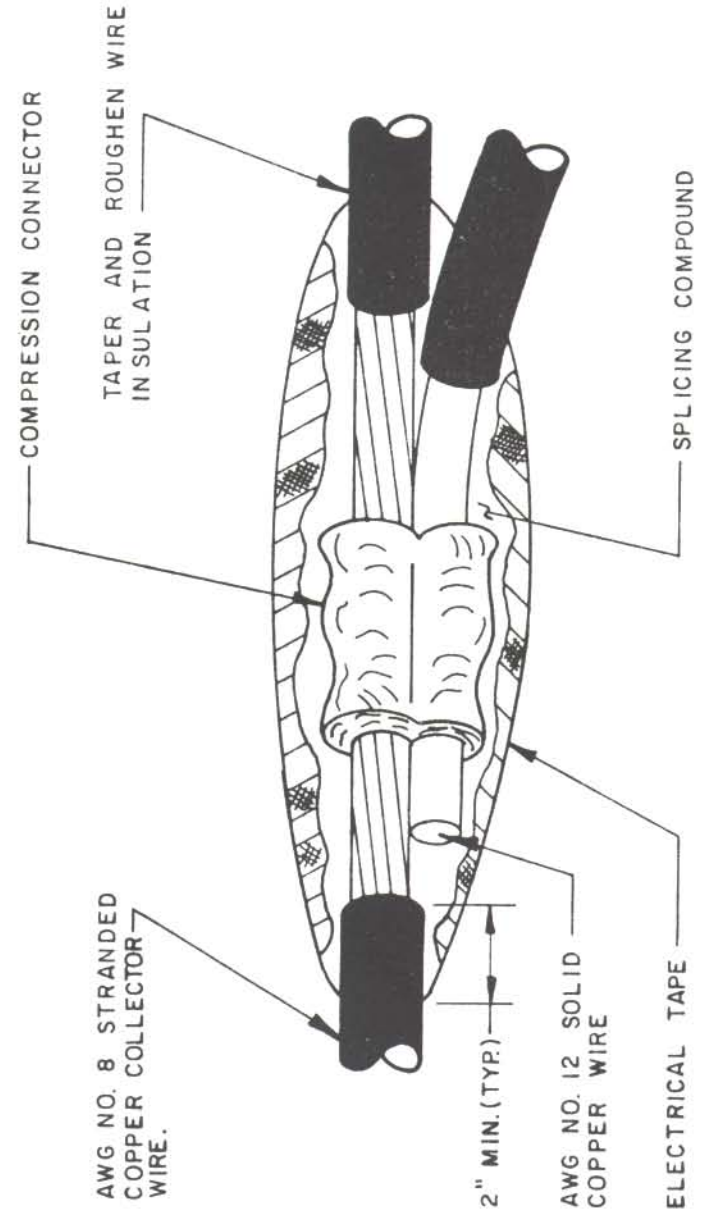


NOTE: NUMBER OF ANODES AS SPECIFIED ON CONTRACT DRAWINGS.

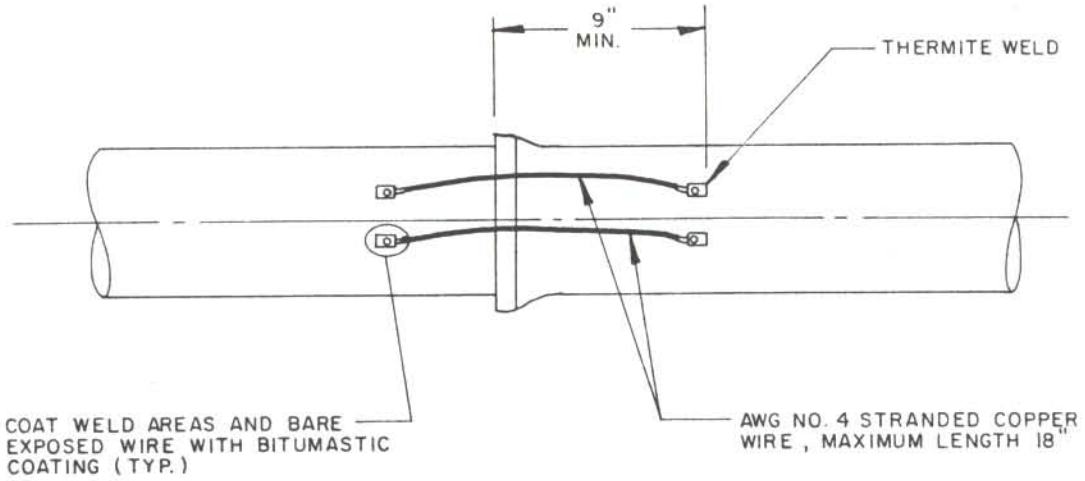
**GROUND BED INSTALLATION
FIGURE W-23.5.3A**



SECTION A-A
FIGURE W-23.5.3B



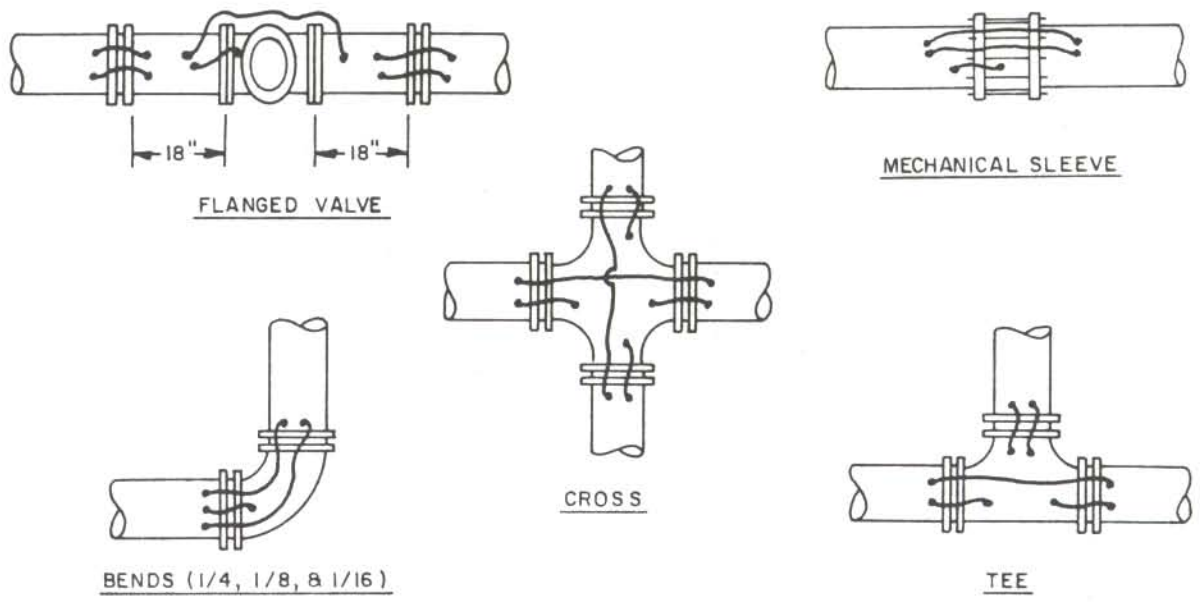
TYPICAL ANODE SPLICE
FIGURE W-23.5.3C



COAT WELD AREAS AND BARE EXPOSED WIRE WITH BITUMASTIC COATING (TYP.)

AWG NO. 4 STRANDED COPPER WIRE , MAXIMUM LENGTH 18"

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

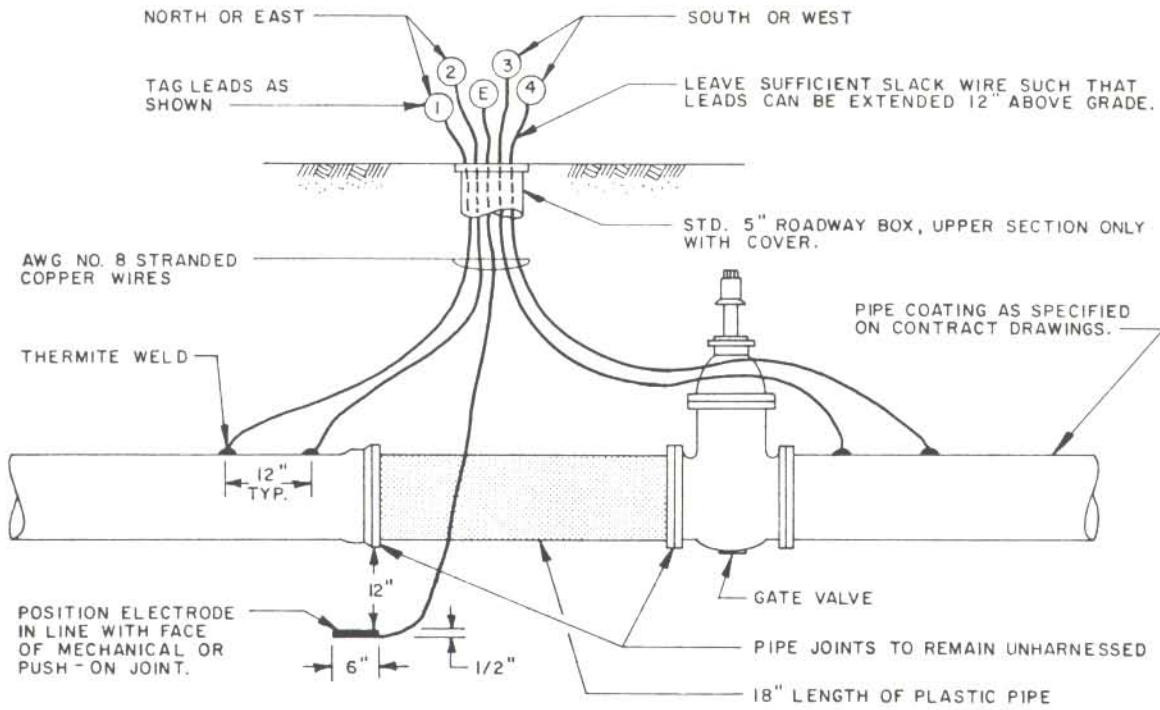


BENDS (1/4, 1/8, & 1/16)

NOTES:

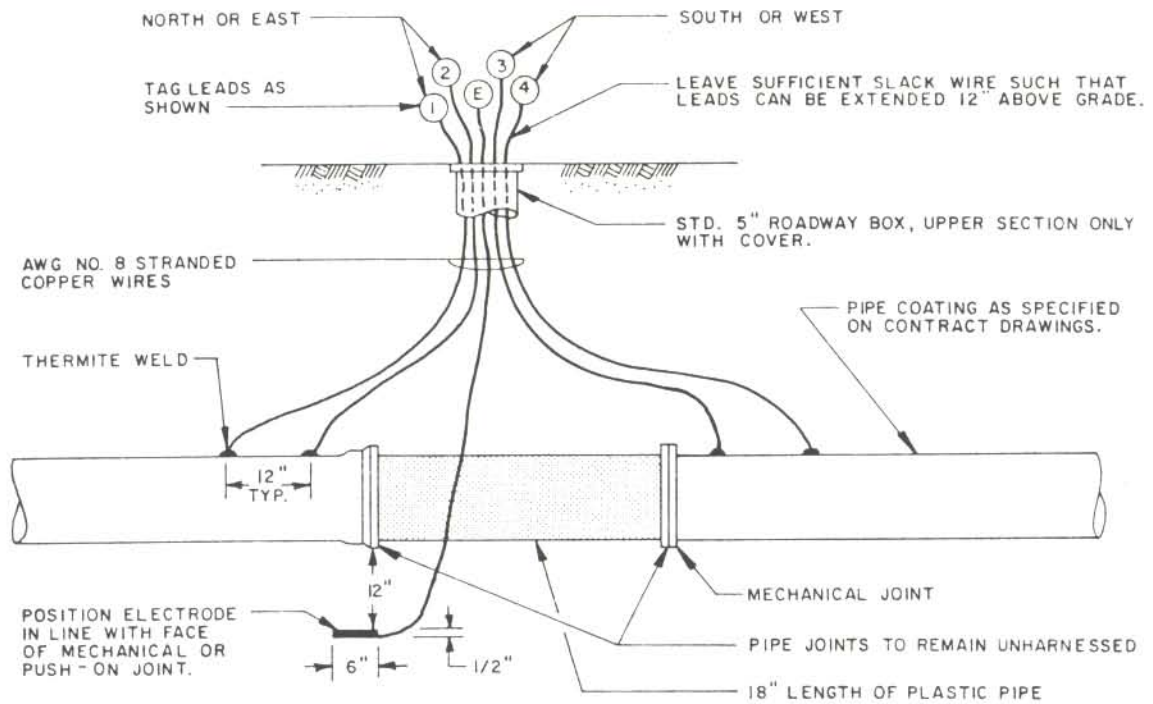
1. ALL WIRE IS AWG NO. 4 COPPER WITH THW INSULATION.
2. LENGTH OF BOND WIRES SPANNING MORE THAN ONE PIPE JOINT SHALL BE KEPT TO A MINIMUM

**TYPICAL BONDING OF FITTINGS
FIGURE W-23.6B**



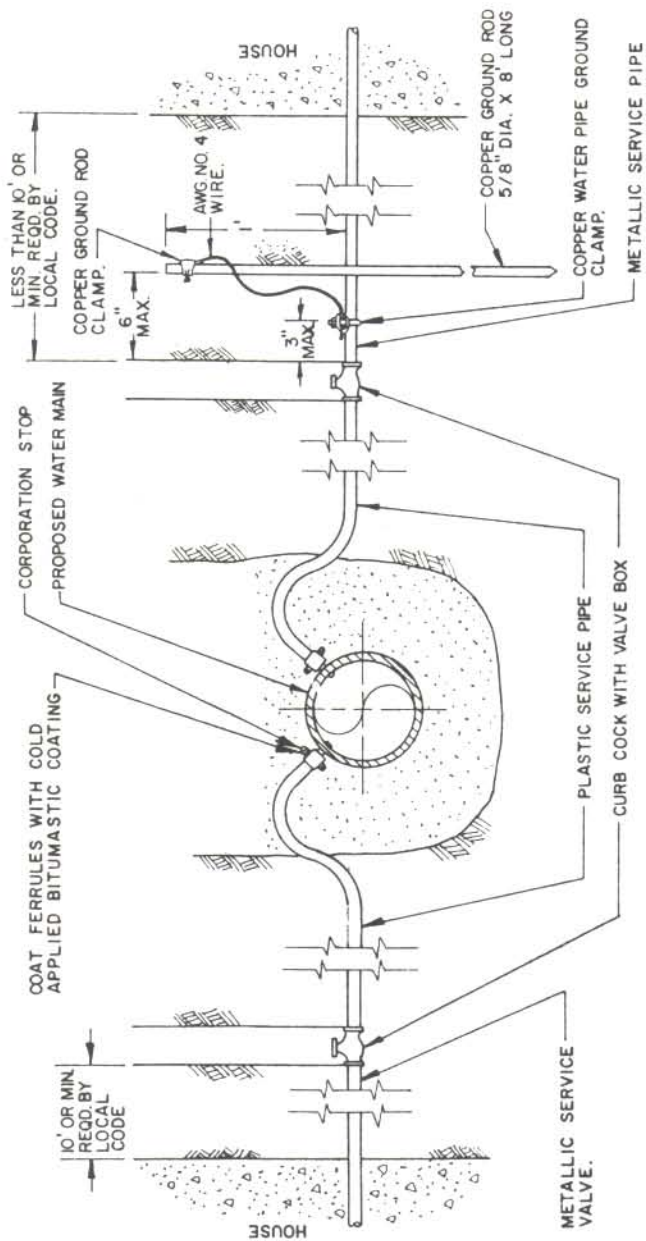
NOTE: UNDER NO CIRCUMSTANCES SHOULD THE CONTRACTOR ATTEMPT TO THERMITE WELD TO PLASTIC PIPE INSERT.

**ELECTROLYSIS TEST STATION - ELECTRICAL INSULATOR
FIGURE W-23.7.3A**

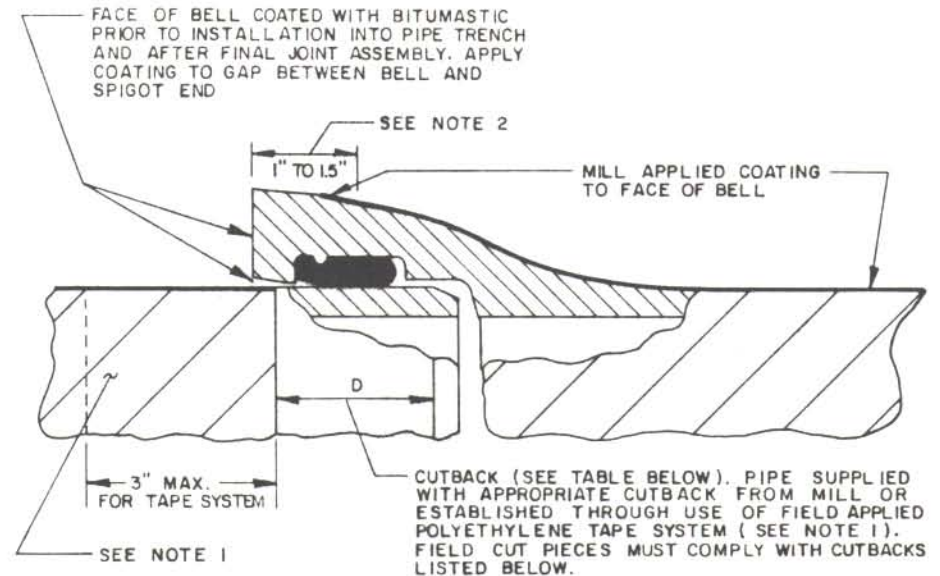


NOTE: UNDER NO CIRCUMSTANCES SHOULD THE CONTRACTOR ATTEMPT TO THERMITE WELD TO PLASTIC PIPE INSERT.

**ELECTROLYSIS TEST STATION - ELECTRICAL INSULATOR
FIGURE W-23.7.3B**



**GROUND ROD INSTALLATION
FIGURE W-23.8**

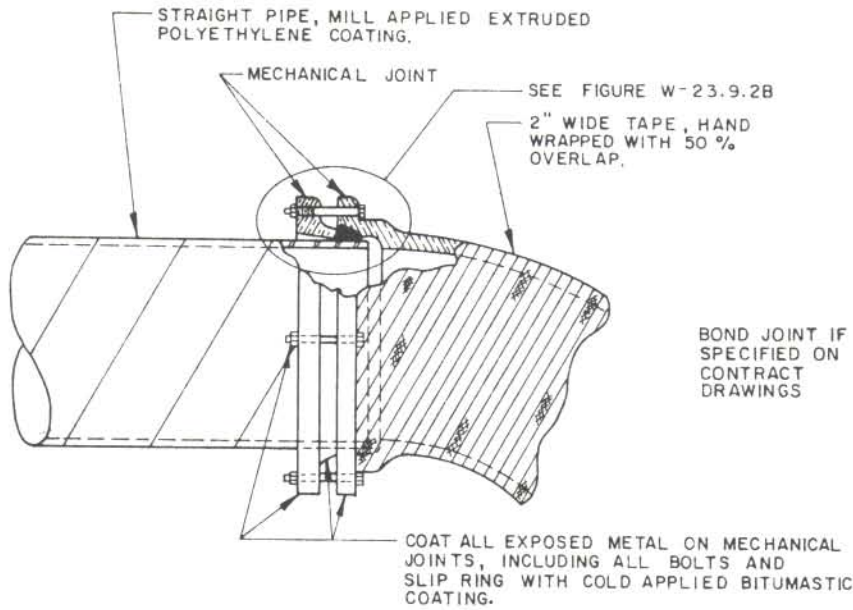


COATING CUTBACK	
PIPE SIZE	D
4"	2.75" ± .25
6"	3.00" ± .25
8"	3.25" ± .25
10"	3.25" ± .25
12"	3.25" ± .25
16"	4.37" ± .25

NOTES:

1. COATING WITHIN AREA SHOWN TO BE EXTRUDED MILL APPLIED COATING OR POLYETHYLENE TAPE SYSTEM AS REQUIRED TO MEET CUTBACKS LISTED IN TABLE ABOVE. IF TAPE SYSTEM IS USED, IT MUST OVERLAP MILL COATING FOR 1-INCH AND NOT EXTEND MORE THAN 3-INCHES TO MEET CUTBACK REQUIREMENTS.
2. BARE AREAS AT BELL, CAUSED BY MILL COATING SHRINKAGE TO BE COATED WITH POLYETHYLENE TAPE SYSTEM.

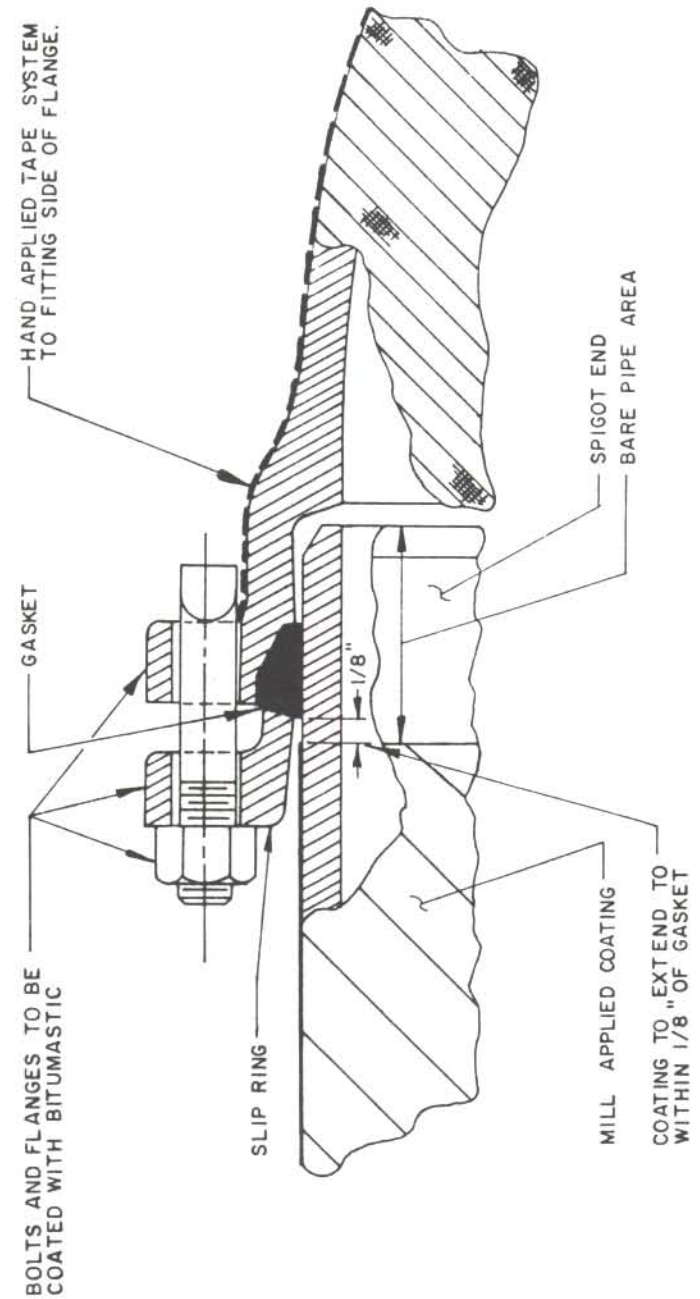
**PUSH-ON JOINT COATING ARRANGEMENT - TYPICAL
FIGURE W-23.9.1**



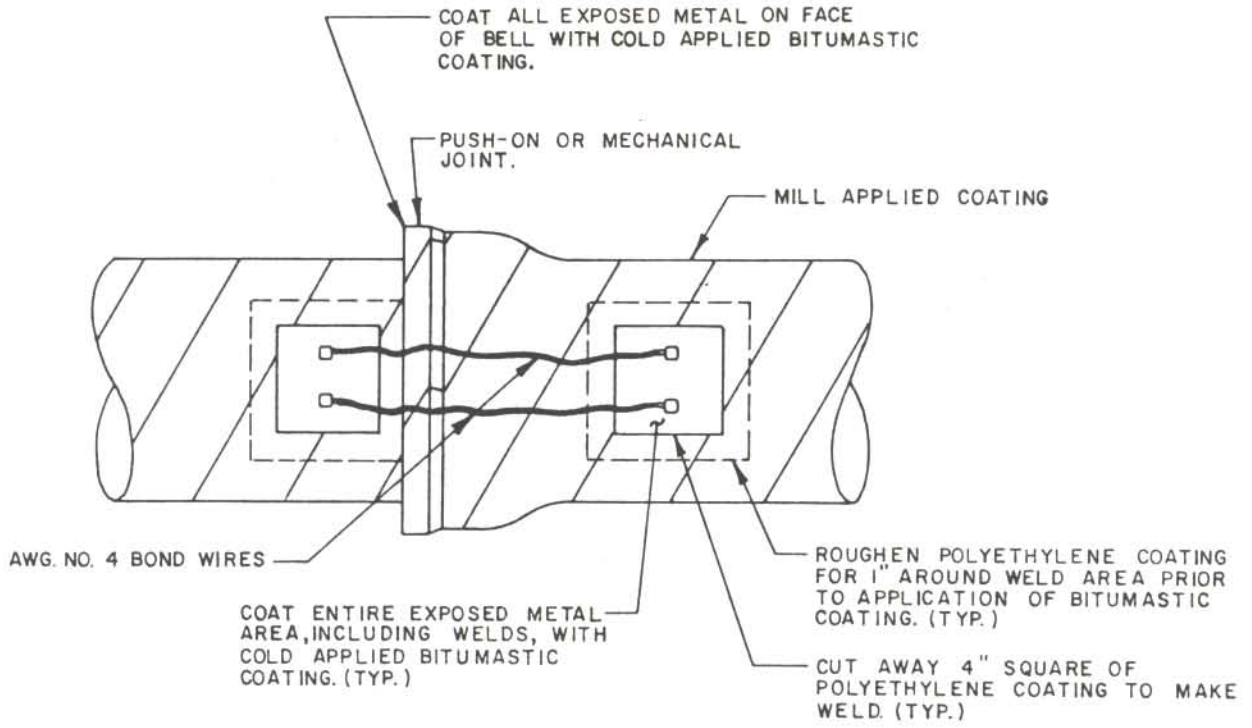
TAPE INSTALLATION PROCEDURE

- 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.

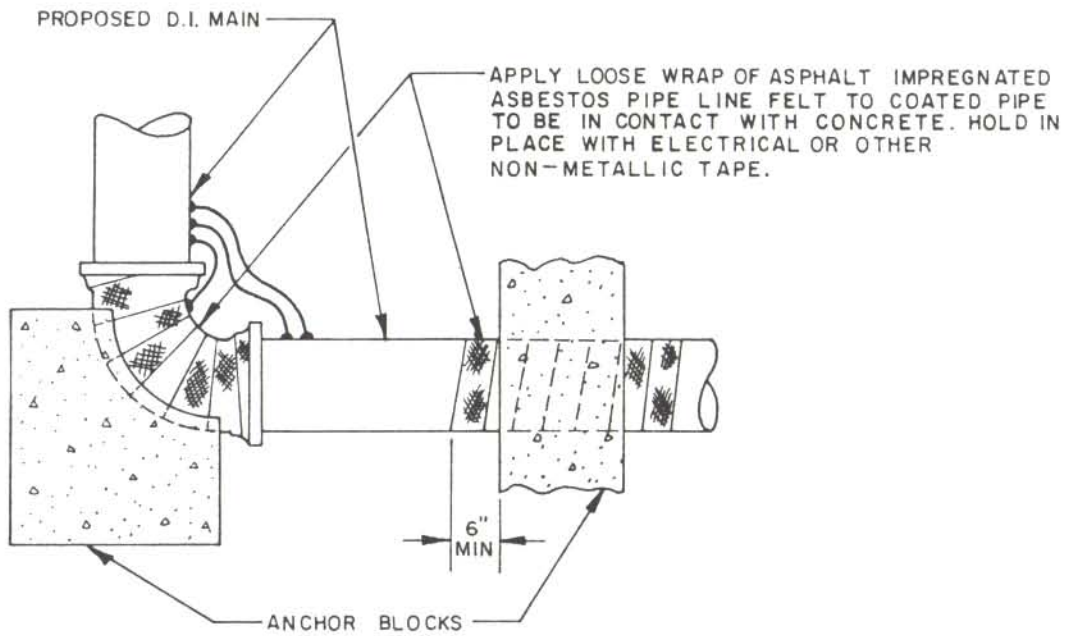
**TAPING OF MECHANICAL JOINTS
AND IRREGULAR FITTINGS
FIGURE W-23.9.2A**



**MECHANICAL JOINT COATING ARRANGEMENT - TYPICAL
FIGURE W-23.9.2B**



BONDING OF MILL - COATED PIPE
FIGURE W-23.9.2C



PROTECTION AT CONCRETE ANCHOR BLOCKS
FIGURE W-23.9.6