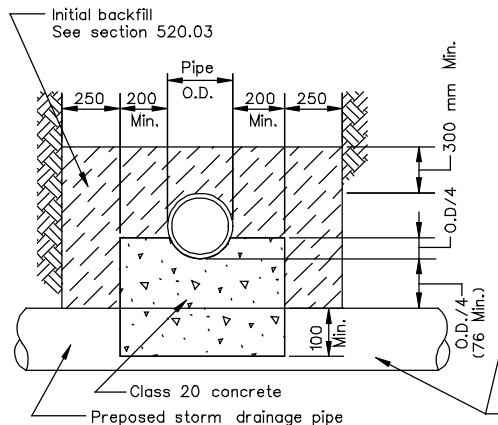
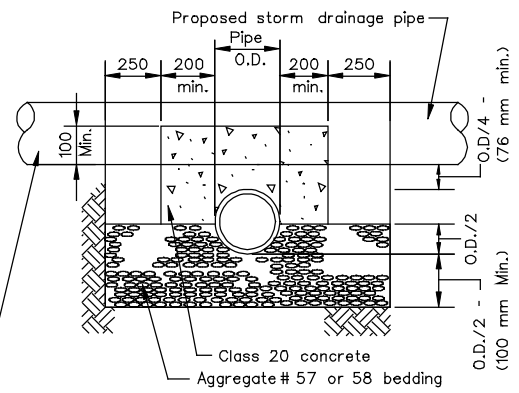


CONCRETE ENCASEMENT



CONCRETE CRADLE



CONCRETE CAP

Notes:

1. Where the trench bottom is in rock, it shall be excavated to a minimum of 200 mm below the bottom of the pipe and backfilled with bedding material.
 2. Where pipe foundations are yielding, pipe shall be bedded on a minimum of 200 mm bedding material.
- * For pipe less than 300 mm the trench width may be 900 mm maximum.

UTILITY BEDDING AND PROTECTION WATER AND SANITARY SEWER FACILITIES

VIRGINIA DEPARTMENT OF TRANSPORTATION

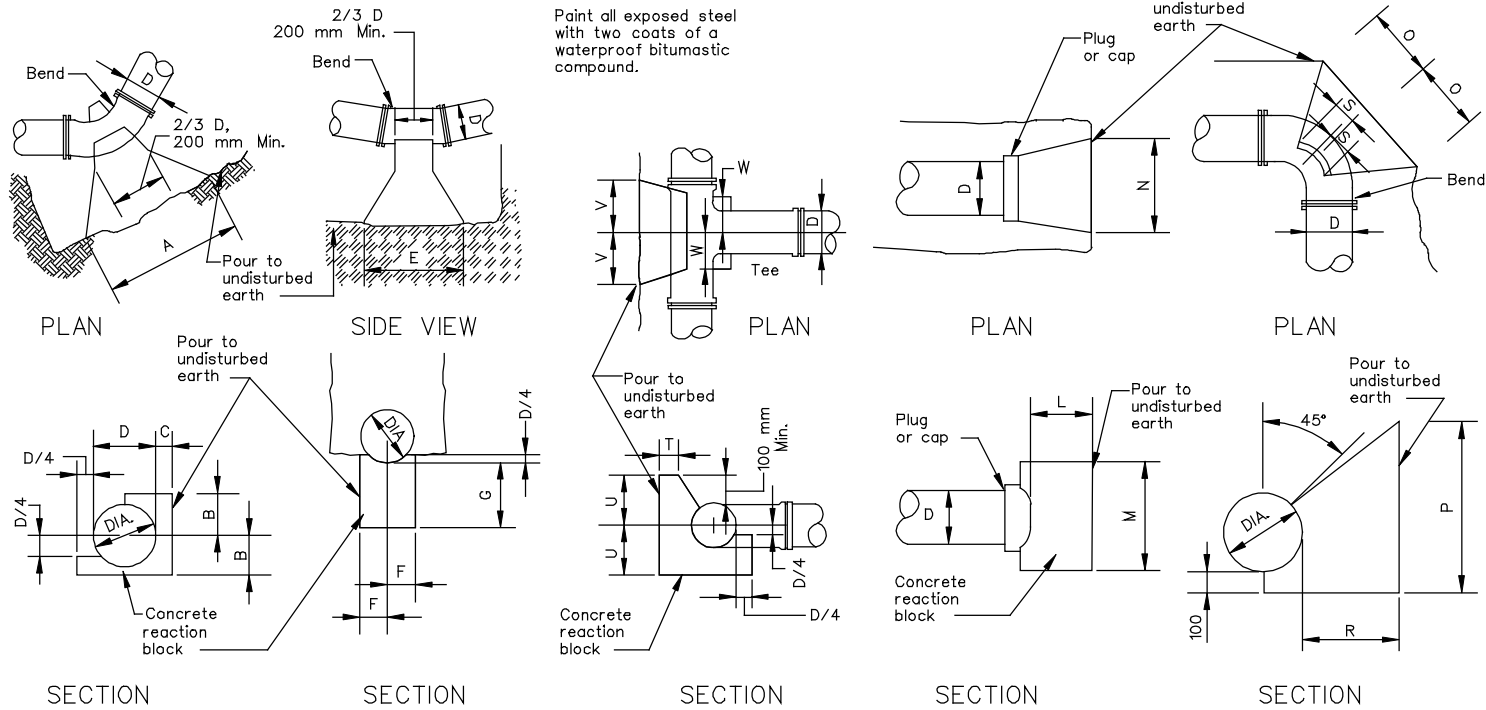
UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS

1401.01

RB-1

Note:

Paint all exposed steel with two coats of a waterproof bitumastic compound.



HORIZONTAL BENDS
11 1/4° - 45°

UPPER VERTICAL
BENDS

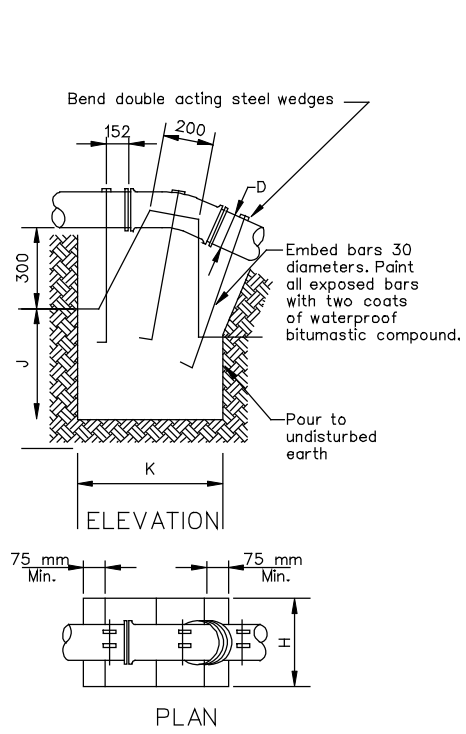
TEES

PLUGS

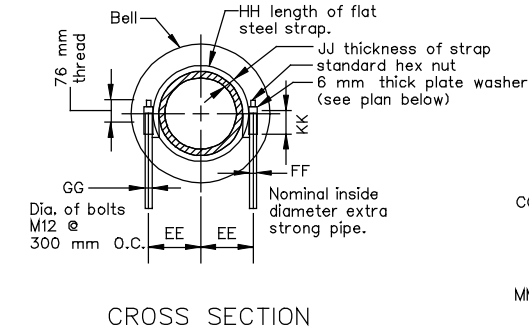
HORIZONTAL BENDS 90

DIA. (mm)	HORIZONTAL BENDS						UPPER VERTICAL BENDS						PLUGS			HORIZONTAL BENDS					TEE BRANCH								
	A	B	C	A	B	C	A	B	C	E	F	G	E	F	G	L	M	N	O	P	R	S	T	U	V	W			
100	150	175	225	225	175	225	380	175	225	150	175	175	225	175	175	380	175	175	150	355	455	355	355	505	125	225	200	225	150
150	150	175	225	225	175	225	380	175	225	150	175	175	225	175	175	380	175	175	150	355	455	355	355	505	125	225	200	225	150
200	200	200	225	300	200	225	605	200	225	200	200	175	300	200	200	630	225	250	200	455	685	480	455	530	150	225	250	300	200
250	250	225	225	455	225	250	760	225	280	250	225	200	455	250	200	630	225	250	200	605	760	505	630	530	150	250	300	380	200
300	300	250	225	530	280	280	890	280	355	300	250	200	530	250	200	760	280	280	250	710	990	605	760	585	175	300	380	430	200
400	405	300	225	710	300	355	1115	380	430	405	300	225	685	250	225	1010	380	380	300	890	1270	630	910	660	250	355	505	555	250
500	505	355	300	965	355	405	1445	455	555	505	355	250	910	355	300	1270	455	455	405	1140	1575	1065	1165	860	300	405	630	685	355
600	605	405	300	1215	405	455	1850	505	585	605	405	300	1065	405	300	1520	530	530	505	1315	1905	1420	1215	910	300	455	760	810	405
750	760	455	325	1520	480	530	2420	605	935	760	480	325	1270	480	325	1905	685	685	605	1650	2260	1750	1520	1165	355	530	935	1190	555
900	910	585	355	1750	605	605	2715	760	1010	910	480	355	1685	605	355	2285	760	810	605	1980	2740	2080	1825	1470	355	605	1140	1190	555

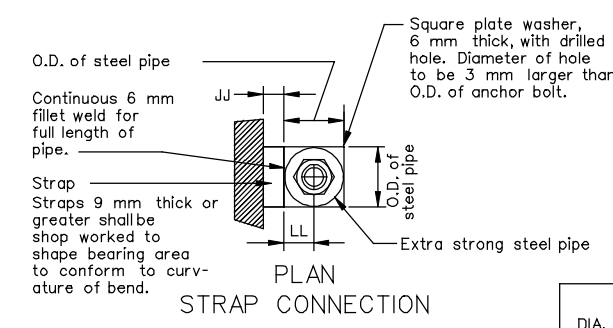
REACTION BLOCKING
WATER AND SANITARY SEWER FACILITIES



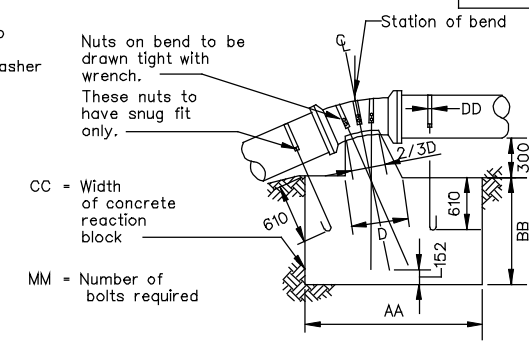
LOWER VERTICAL BENDS
100 mm to 300 mm MAINS



CROSS SECTION



PLAN STRAP CONNECTION



Notes: ELEVATION

1. For 11 1/4° bends use one strap on bend with anchor bolts on center line of bend.
2. Paint all exposed steel with two coats of a waterproof bitumastic compound.

DIA. (mm)	LOWER VERTICAL BENDS								
	11 1/4°			22 1/2°			45°		
	H	J	K	H	J	K	H	J	K
100	455	380	605	605	555	760	760	760	910
150	455	380	605	605	555	760	760	910	910
200	455	530	760	1010	685	990	990	990	1370
250	455	380	835	1115	760	1165	1215	1115	1445
300	910	605	910	1215	760	1215	1370	1115	1520

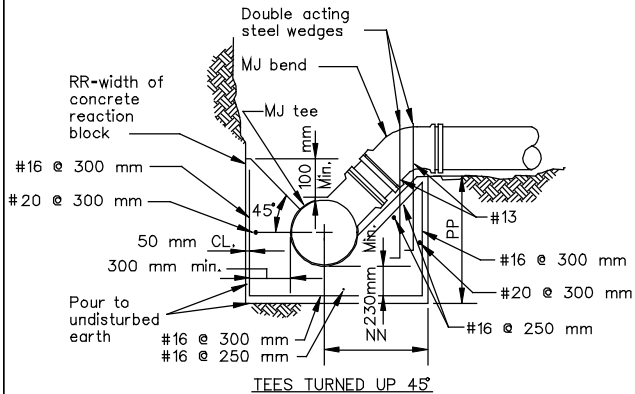
LOWER VERTICAL BENDS																																							
DIA. (mm)	LOWER VERTICAL BENDS			11 1/4°												22 1/2°								45°															
	REINFORCING BARS	AA	BB	CC	DD	EE	FF	GG	HH	JJ	KK	LL	MM	AA	BB	CC	DD	EE	FF	GG	HH	JJ	KK	LL	MM	AA	BB	CC	DD	EE	FF	GG	HH	JJ	KK	LL	MM		
100	3-#13	3-#13	3-#13																																				
150	3-#13	3-#13	3-#13																																				
200	3-#13	3-#13	3-#13																																				
250	3-#13	3-#13	3-#16																																				
300	3-#13	3-#13	3-#16																																				
400				1215	605	1065	50	245	20	15	860	5	55	15	6	1750	760	1370	50	245	20	15	860	5	25	15	10	2030	1215	1675	50	245	20	15	860	5	55	15	10
500				1520	760	1215	50	300	20	15	1075	5	55	15	6	2285	910	1445	50	300	20	15	1090	5	55	15	10	2510	1445	1825	50	300	20	15	1090	5	55	15	10
600				1750	760	1295	50	355	30	20	1345	5	125	20	6	2590	1115	1520	60	50	35	20	1375	5	125	20	10	2895	1675	1980	60	355	35	20	1345	5	125	30	10
750				1980	810	1675	60	435	35	20	1725	10	150	20	6	2740	1370	1750	60	435	35	25	1725	10	150	20	10	3425	1905	2130	60	435	35	25	1725	10	150	20	10
900				2130	1215	1520	60	520	50	30	2285	10	160	20	6	3045	1675	1880	60	520	50	30	2285	10	160	20	10	3655	2130	2590	60	520	50	25	2285	10	160	20	10

REACTION BLOCKING
WATER AND SANITARY SEWER FACILITIES

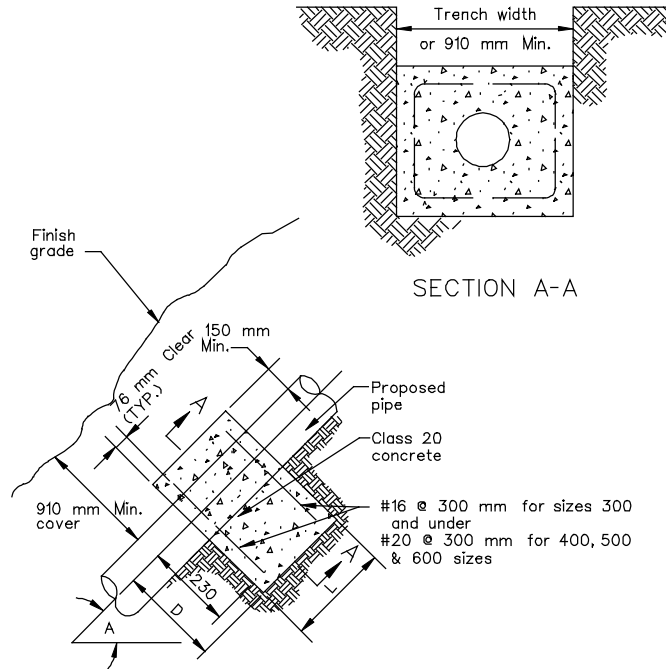
VIRGINIA DEPARTMENT OF TRANSPORTATION

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TEES TURNED UP				
BRANCH SIZE				
D	NN	NN	PP	RR
DIA.	11 1/4° 22 1/2°	45°	11 1/4° 22 1/2° 45°	11 1/4° 22 1/2° 45°
100	310	760	760	760
150	310	760	760	760
200	310	760	760	760
250	310	760	760	810
300	1220	910	760	865



STRAPPING DETAILS FOR TEES TURNED UP



REACTION BLOCK - STRAIGHT SLOPING PIPE							
SIZE	100	152	200	300	400	500	610
D	300	380	380	455	530	610	685
L	455	530	610	685	762	838	910

Note:

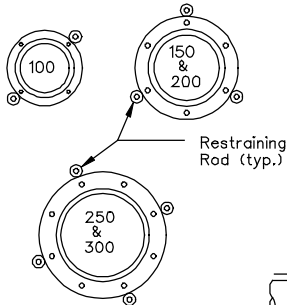
The straight run pipe shall be provided with anchor blocks spaced thus:

ANGLE "A"	ANCHOR BLOCKS NOT NEEDED
0° - 10°	
10° - 16°	SPACING @ 30.5 m
16° - 20°	SPACING @ 18.3 m

STRAIGHT PIPE CONCRETE ANCHOR BLOCK

REACTION BLOCKING WATER AND SANITARY SEWER FACILITIES

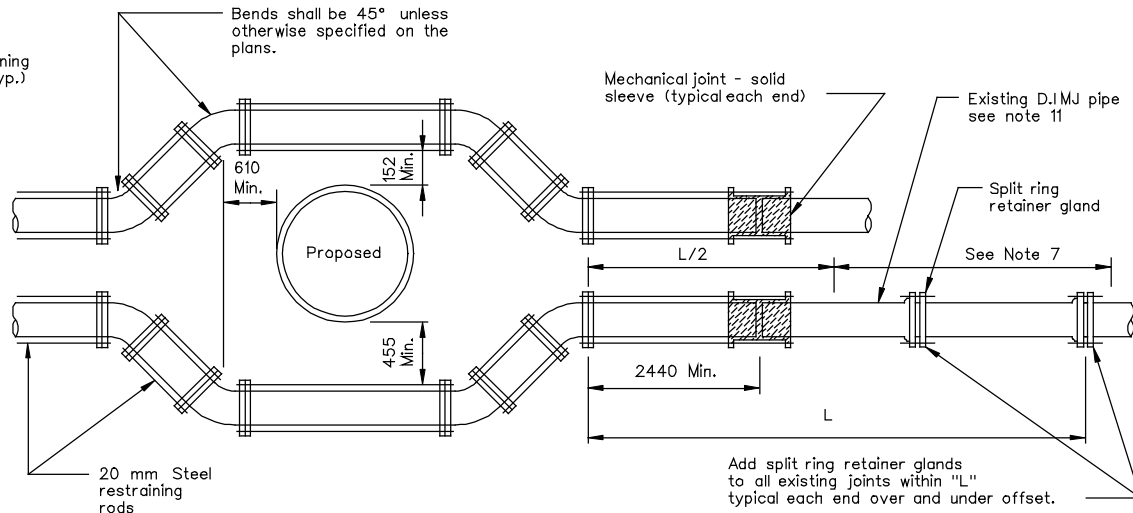
SIZE (DIA. - mm)	100	150	200	250	300	400	455	500	610
LENGTH ("L" - mm)	3660	5180	6710	7920	9450	11890	13110	14330	16760



See Table for 400 - 610 mm

TABLE		
PIPE SIZE	NUMBER OF BOLTS	NUMBER OF RODS
400	12	6
455	12	6
500	14	6
610	16	8

See Note 7 for reduction in number of rods required.



DESIGN CONDITIONS

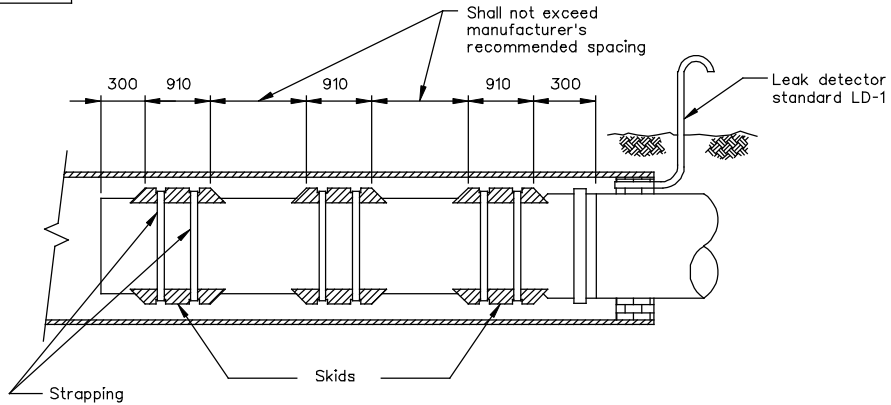
Pressure - 1030 kPa Type Soil - Silt
 Depth of Cover - 910 mm Rod Stress - 172.3 MPa

Notes:

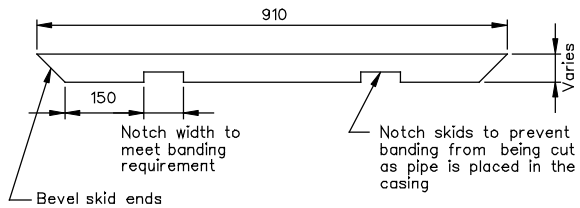
1. Retainer glands are required at each fitting.
2. All pipe and fittings shall be ductile iron, mechanical joint, class 52 (min.). Water main and fittings shall be cement mortar lined.
3. For 300 mm and smaller lines, mechanical joint offset fittings may be used in lieu of the 45° bends shown subject to the approval of the engineer. If used, the offsets must result in the clearances shown being met or exceeded.
4. Rods may be inserted through bolt holes in lieu of using tie-bolts. If used, keeper nut & washer must be installed behind gland.
5. Bolt holes are shown as normally provided in mechanical joint fittings, i.e. straddling the vertical axis when fitting is positioned for a horizontal change of direction. Fittings with bolt holes otherwise oriented should not be used in rodded assemblies.
6. Tie bolts and threaded rods shall be M20 with a minimum yield strength of 33.6 kN each. Space symmetrically around pipe.
7. Number of rods may be reduced to 50% of the number indicated at L/2 from the bend and beyond. Two rods minimum required per joint.
8. All rods and fasteners shall be given two coats of asphaltic paint after assembly.
9. Existing C.I. pipe shall be replaced with an 2440 mm minimum length of D.I. pipe at both ends of the offset and retainer glands installed.
10. The existing piping shall have all joints within the length "L" restrained by adding a split ring retainer gland ("meg-a-lug" or equal) with bolts to the M.J. bell.
11. Length "L" in feet shall conform to the table above.
12. Split ring retainer glands are for use on ductile iron mechanical joint pipe only. If existing pipe is any other material, remove and replace with D.I. mechanical joint pipe for the length "L" specified.

OFFSET WATER AND SANITARY SEWER FACILITIES

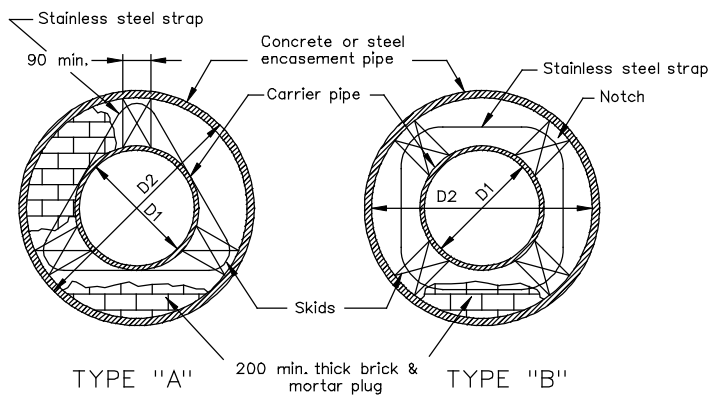
EP-1



SECTION
ENCASEMENT PIPE WITH CARRIER PIPE



SKID



CONCRETE OR STEEL ENCASEMENT PIPE

ENCASEMENT PIPE I.D. (mm)	STEEL ENCASEMENT PIPE MINIMUM THICKNESS
300	6.35
400	6.35
450	7.93
600	9.52
750	12.70
900	12.70
1050	14.28
1200	15.87
1350	15.87
1500	19.05

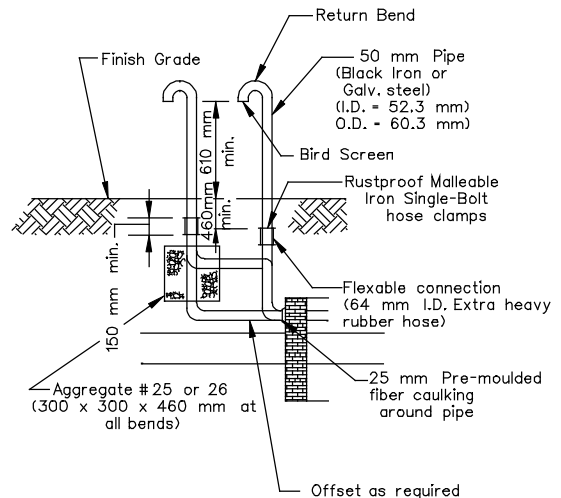
Notes:

1. Skids shall be locust, cypress, preservative treated hardwood, Neoprene, nylon, plastic or other material of high abrasion resistance and a low friction coefficient, approved by the Engineer. Preservative for timber skids shall conform to section 236 of the specifications.
2. Metal straps and clips holding blocking to carrier pipe shall be stainless steel with a minimum cross section of 9.03 mm² strap spacing shall be a minimum of two (2) bands per skid length.
3. Steel encasement pipe shall be grade B and shall conform to section 232.02 (C)7 of the specifications.
4. Carrier pipe shall be pushed or pulled through the encasement pipe so that joints are always being compressed.
5. Carrier pipe shall be wrapped with tar paper at masonry plug.
6. Masonry plug shall be watertight.
7. Concrete pipe for H-18 live load as per standard PC-1.
8. Encasement pipe shall be bedded in accordance with standard PB-1.

1404.01

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VIRGINIA DEPARTMENT OF TRANSPORTATION

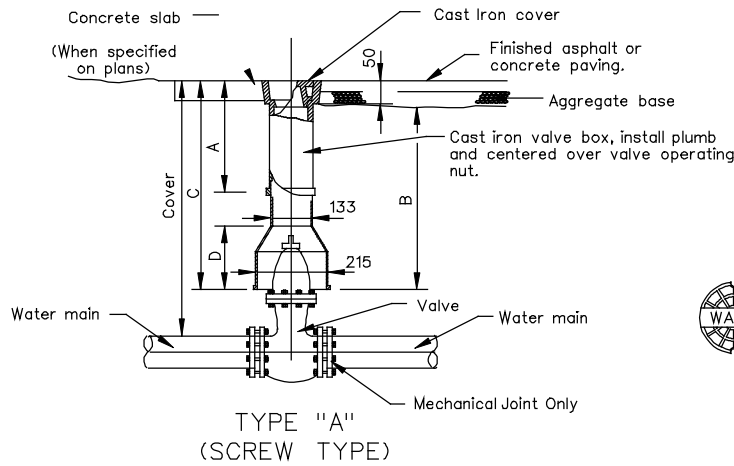


Notes:
Wrap connection in Polyethelene
and Plaster with roofing cement
or Asphaltic material.

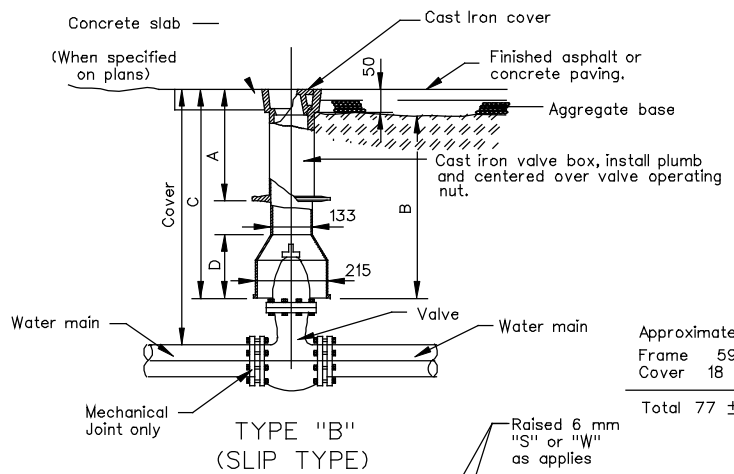
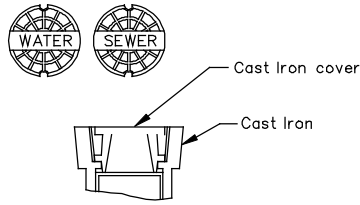
STANDARD LEAK DETECTOR
LD-1

LEAK DETECTOR
VIRGINIA DEPARTMENT OF TRANSPORTATION

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ON THIS SHEET ARE IN MILLIMETERS

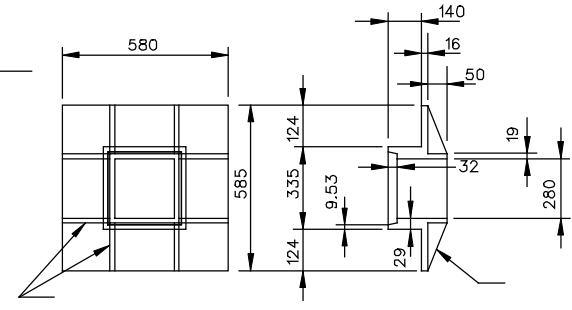
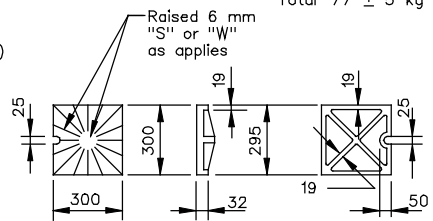


Longer boxes are made by adding extensions.



Longer boxes are made by adding extensions.

Approximate Weights	
Frame	59 ± 4 kg
Cover	18 ± 1 kg
Total	77 ± 5 kg



TYPE "C"

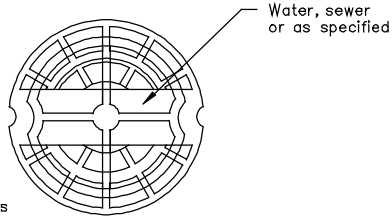
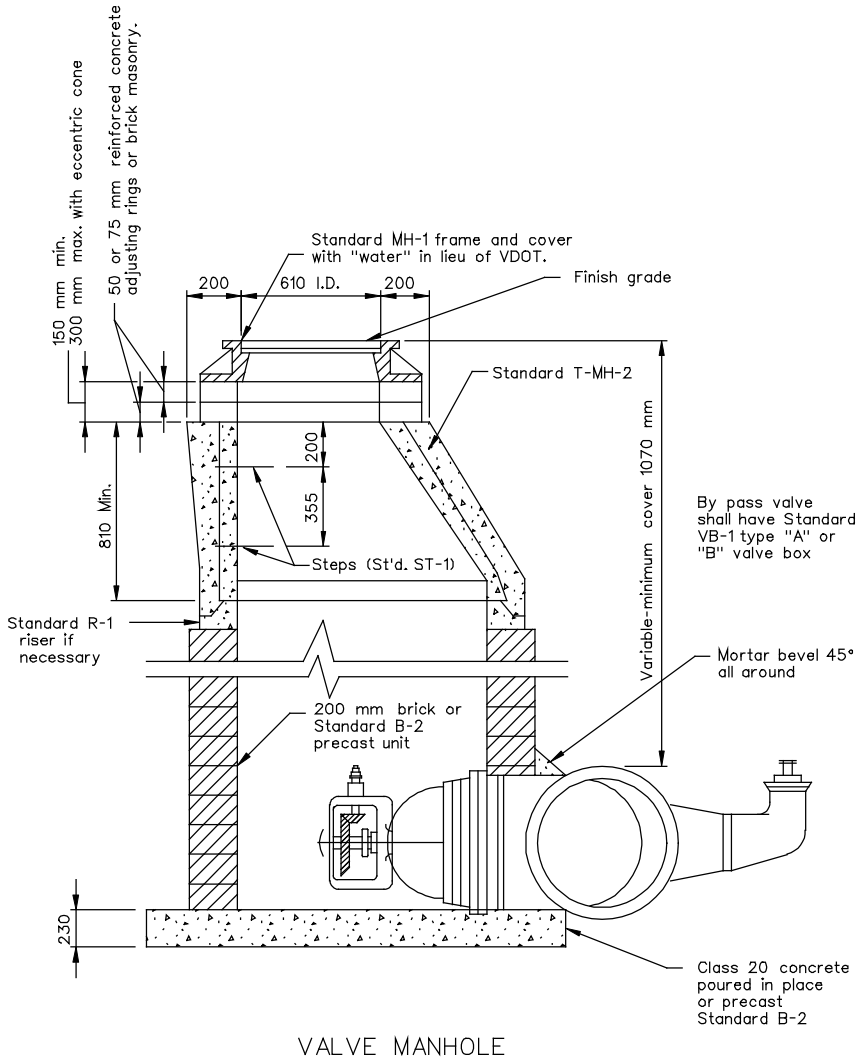
Note:

1. CAST IRON SHALL CONFORM TO ASTM A-48M CLASS 30S.

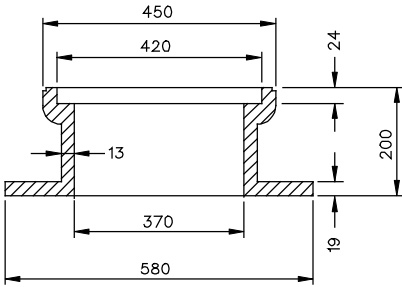
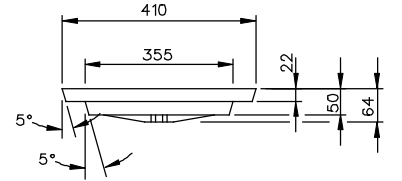
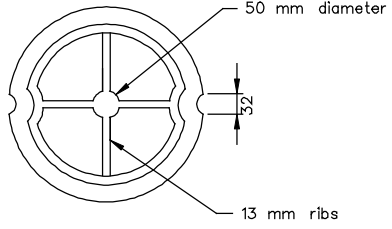
VALVE BOX AND VALVE MANHOLE WATER AND SANITARY SEWER FACILITIES

VM-1

VB-1



Approximate Weights
 Frame 52 ± 6 kg
 Cover 23 ± 1 kg
 Total 75 ± 7 kg

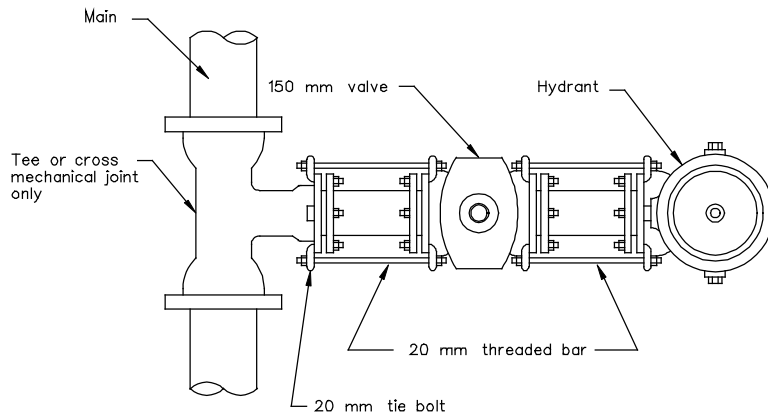


TYPE "D"
 VALVE BOX

Sheet 2 of 2

VALVE BOX AND VALVE MANHOLE
 WATER AND SANITARY SEWER FACILITIES

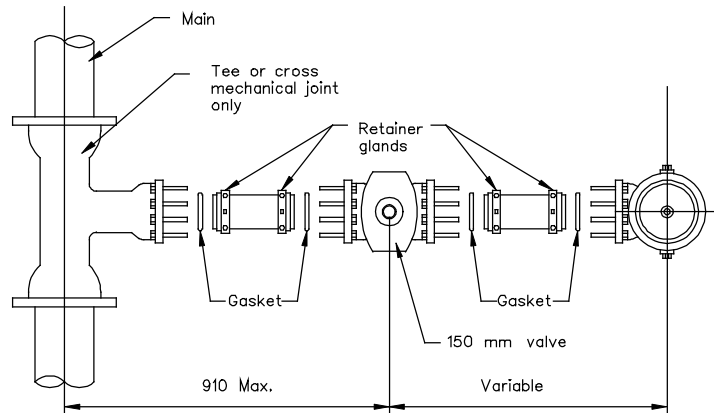
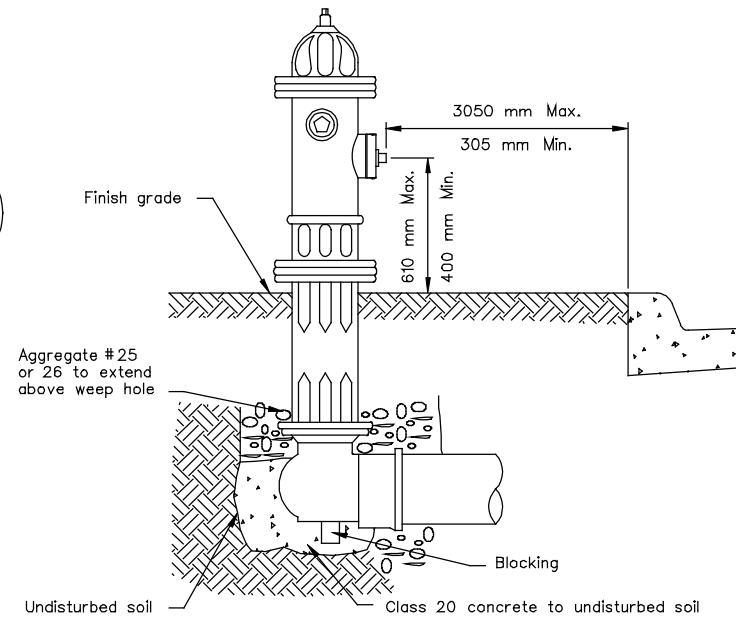
FH-1



TYPE 1 RESTRAINT

Notes:

Rods may be inserted through bolt holes in lieu of using tie-bolts. If used, keeper nut & washer must be installed behind gland.



TYPE 2 RESTRAINT

Notes:

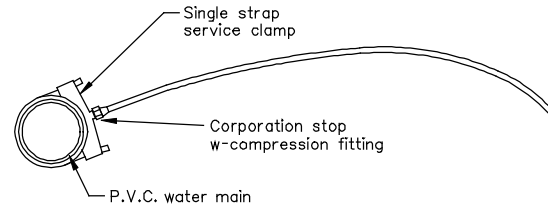
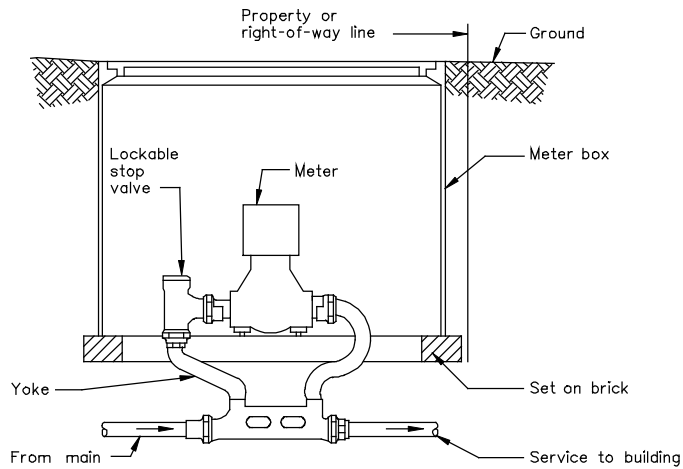
1. Hydrants to be set with bury line positioned at grade with nozzles set as indicated above.
2. When set behind curb the hose nozzles are to be parallel or at right angles to the curb, with the pumper nozzle facing the curb.
3. Bowl of the hydrant to be blocked against undisturbed earth with Class 20 concrete or as directed by the Engineer.
4. Fire hydrants shall have two 63.5 mm hose nozzles and the size of the pumper nozzle & type of operating nut shall be as specified on the plans.

FIRE HYDRANT

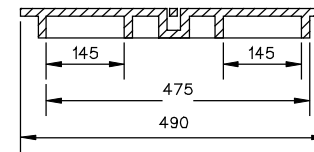
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1407.01

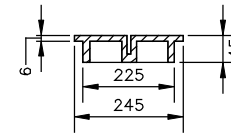
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P.V.C. TAP INSTALLATION



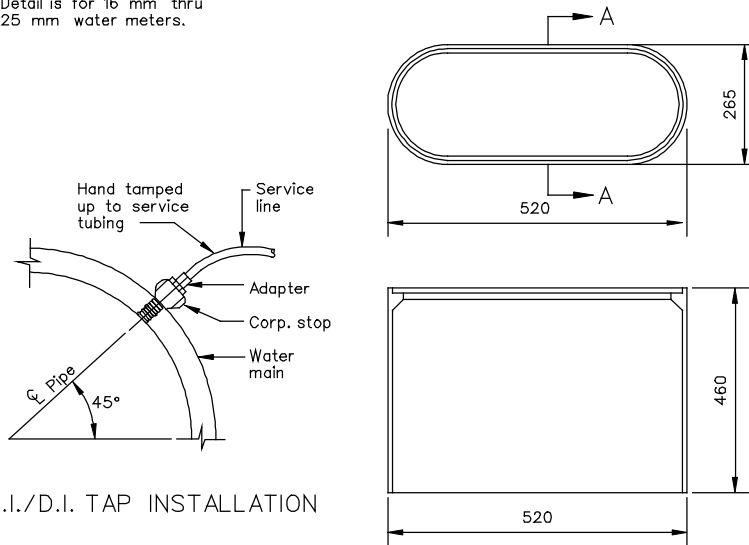
SECTION BB



SECTION CC

Note:

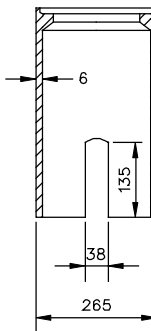
Detail is for 16 mm thru 25 mm water meters.



C.I./D.I. TAP INSTALLATION

WATER METER BOX
FOR 16 mm THRU 25 mm METER

Cast iron shall conform to ASTM A-48M Class 30S
all copper fittings shall be flared type



SECTION AA

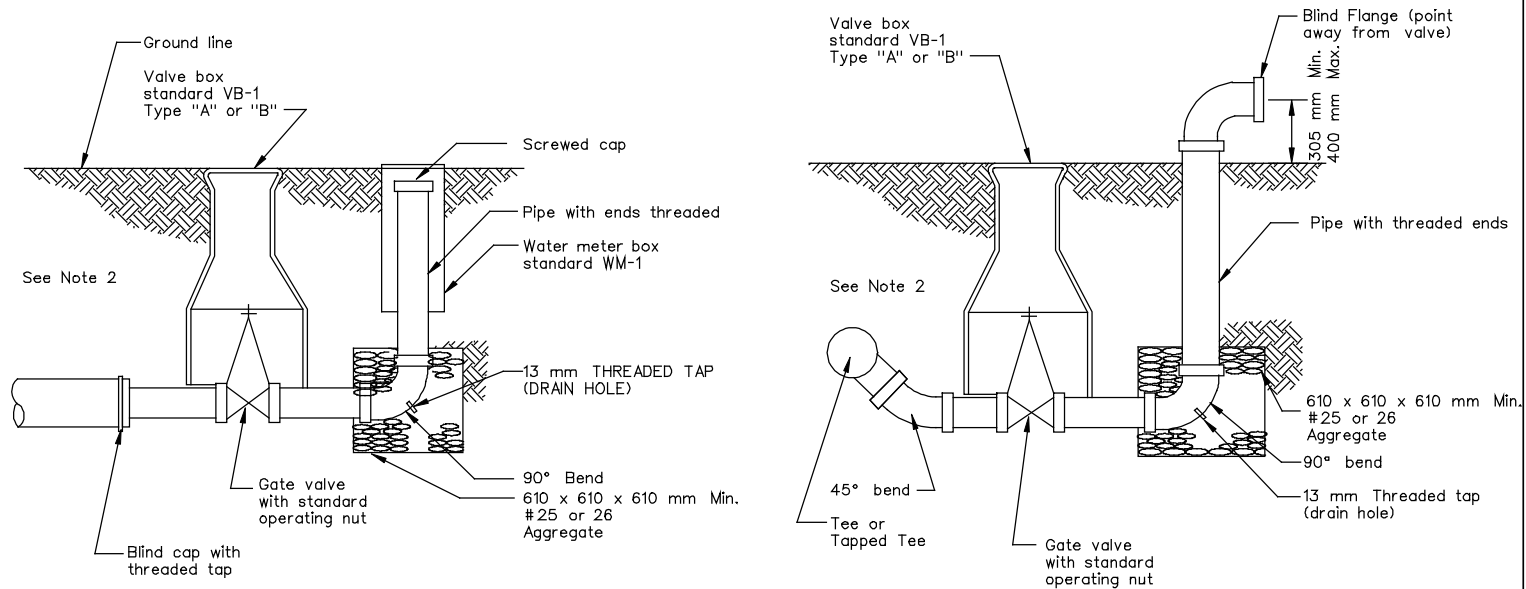
WATER METER AND BOX WATER SERVICE LINES

VIRGINIA DEPARTMENT OF TRANSPORTATION

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ON THIS SHEET ARE IN MILLIMETERS

1408.01

BOV-1



TYPE "A"

TYPE "B"

Notes:

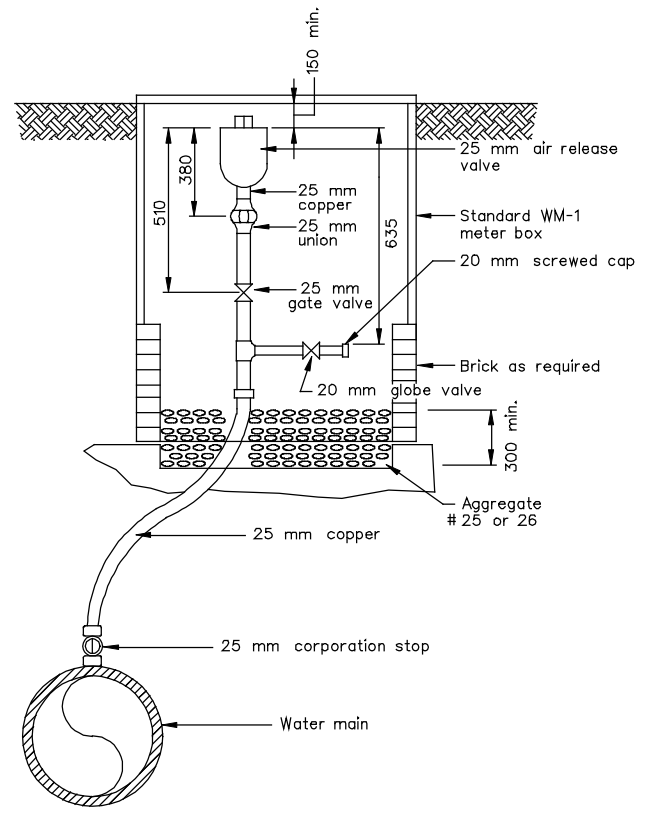
1. All blow-offs should be placed in a position to assure natural drainage.
2. Either type "A" or type "B" blow-off may be used at dead or sag situation.
3. Blow-off pipe shall be threaded black iron or Galvanized steel pipe.
4. Size of blow-off shall be specified on the plans.

BLOW-OFF VALVE AND BOX
WATER AND SANITARY SEWER FACILITIES

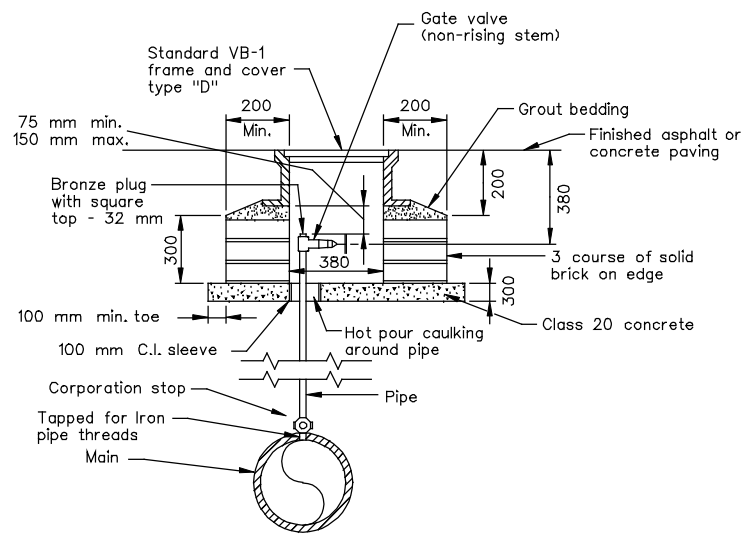
14-09.01

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TYPE "A"



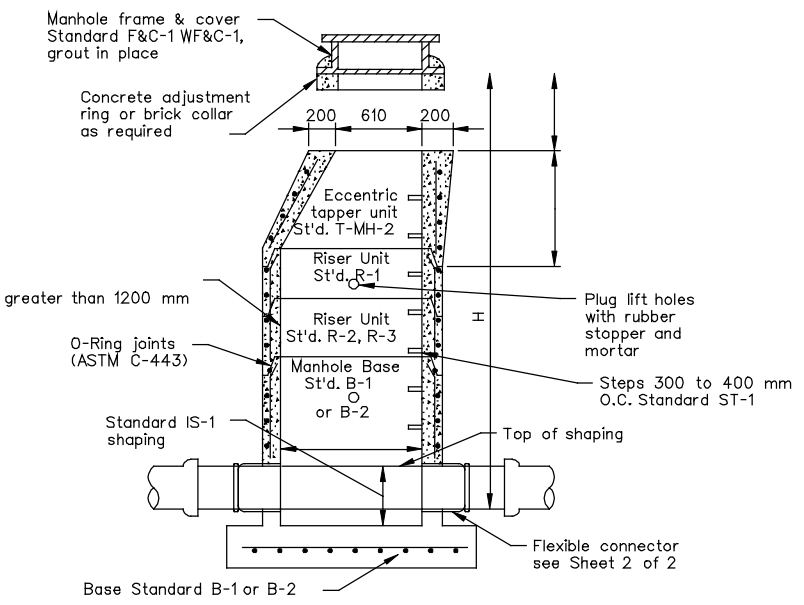
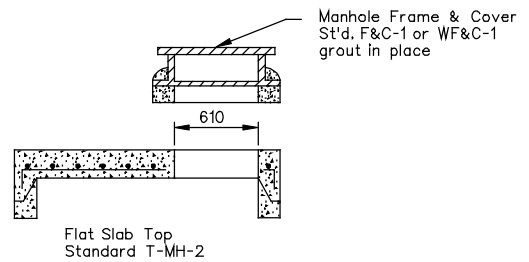
TYPE "B"

Notes:

1. Tap for air release valve shall be standard threaded tap or saddle tap depending on manufacturer's recommendation for type and thickness of pipe encountered.
2. Gravel bedded may be used in place of concrete in non-traffic areas at discretion of Engineer.
3. Pipe shall be Black Iron / Galvanized pipe.
4. If 100 or 150 mm PVC pipe is used, saddle is required for corporation stop.
5. All Copper fittings will be flare type.

AIR RELEASE VALVE AND BOX WATER AND SANITARY SEWER FACILITIES

SMH-1



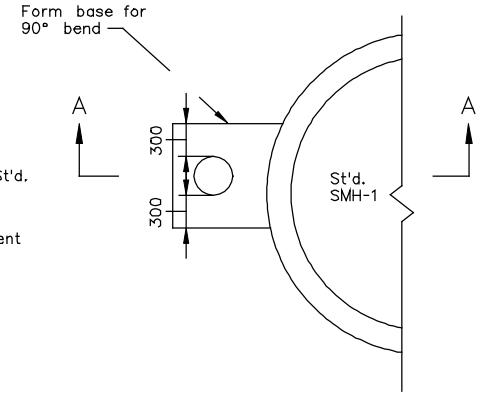
PRECAST CONCRETE MANHOLE

Notes:

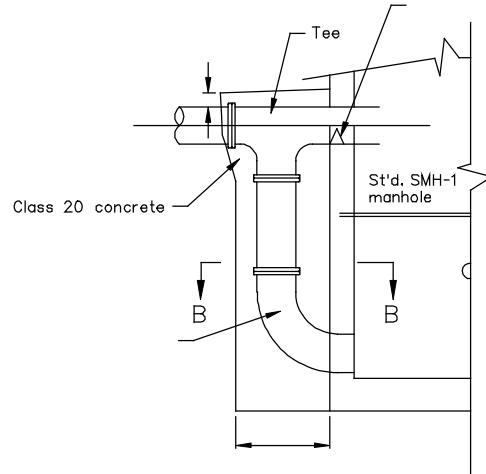
- 1. the base unit shall be 1500 mm with a section height of 1830 mm and a Standard Riser Unit R-2 or R-3 shall be required.
- 2. Flat Slab Top Standard T-MH-2 shall only be allowed on shallow manholes.
- 3. Steps shall be encased in corrosion resistant rubber or other material approved by the Engineer.

Notes:

- For dimensions not shown see VDOT St'd. B-1, B-2 & R-1
- Concrete encasement to extend to limits of excavation



SECTION B-B

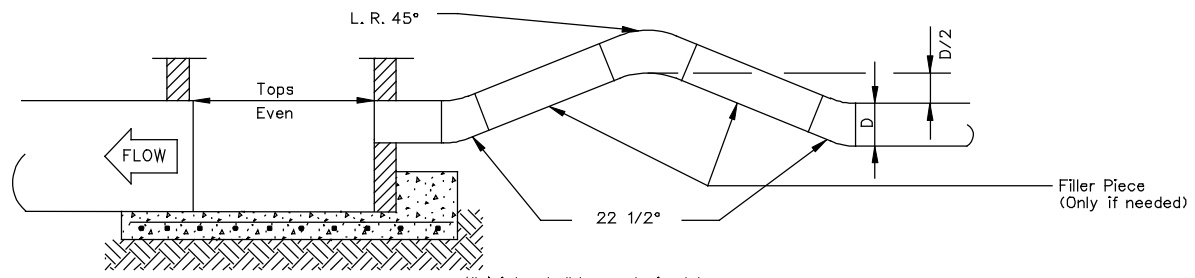


SECTION A-A

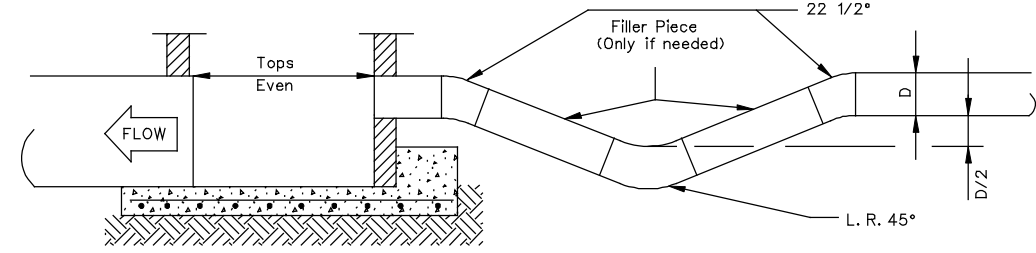
SANITARY DROP CONNECTION

SANITARY SEWER MANHOLE

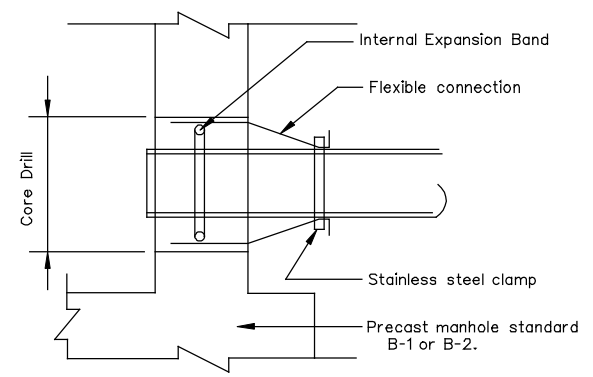
VIRGINIA DEPARTMENT OF TRANSPORTATION



FORCE MAIN DISCHARGE
TYPE 1



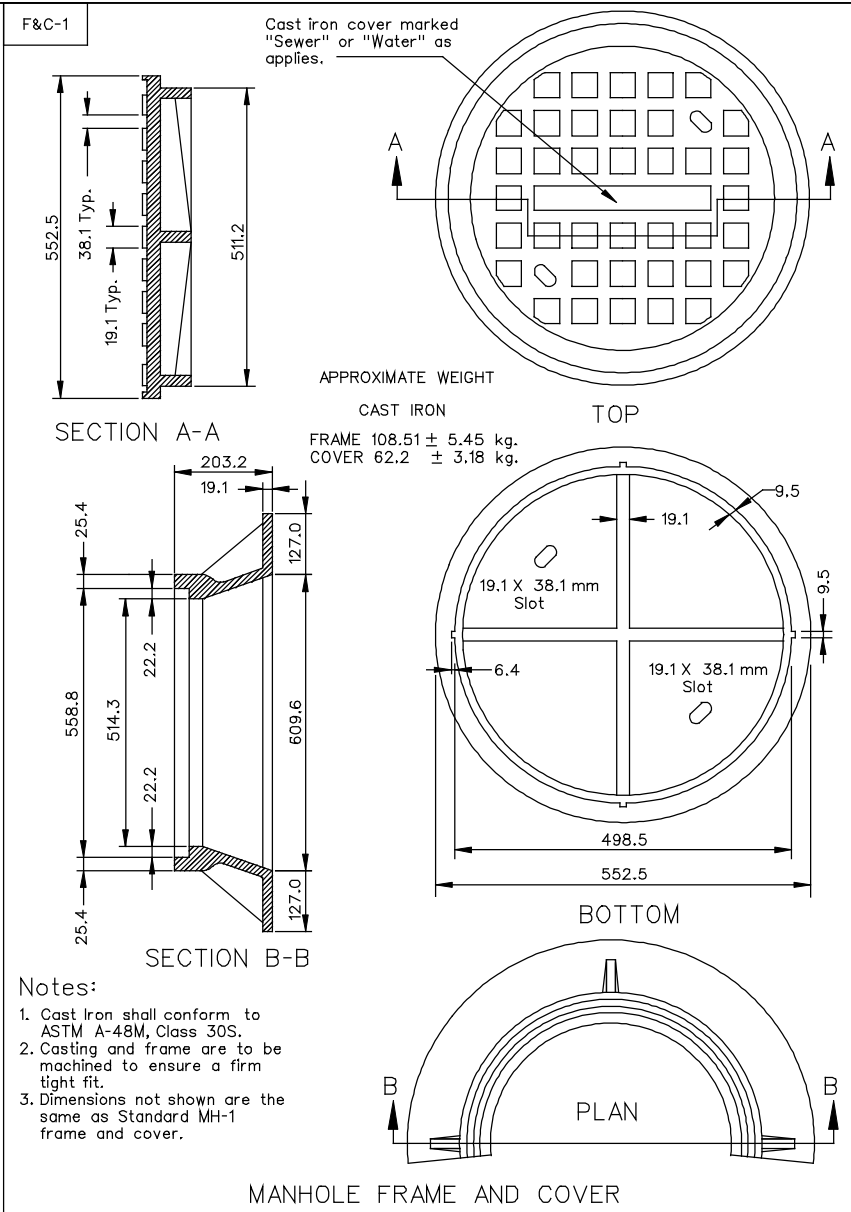
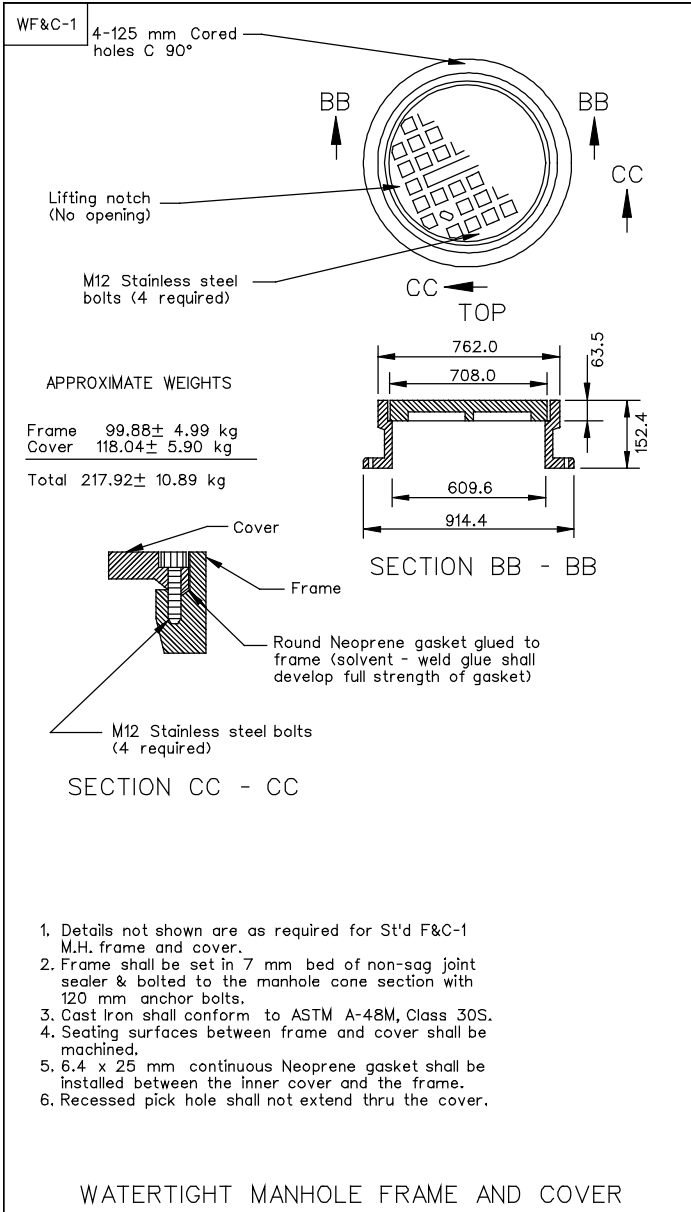
FORCE MAIN DISCHARGE
TYPE 2



FLEXIBLE CONNECTION

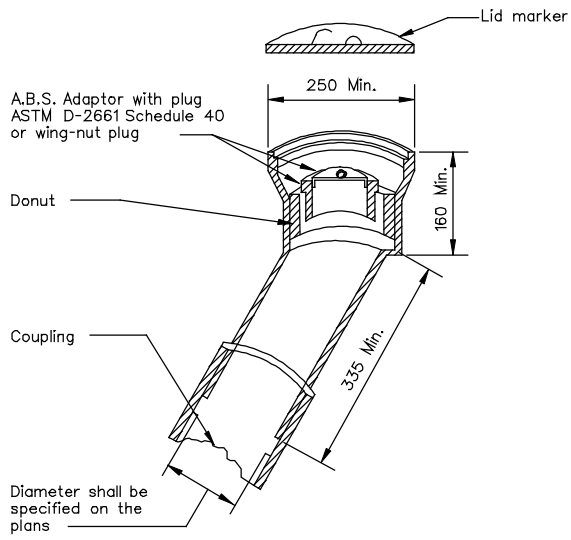
Pipelines connecting directly to precast manholes shall be made with a flexible boot. The boot shall meet ASTM Specification C-923M. Boot shall be made from Neoprene Rubber and have a 10 mm minimum wall thickness throughout. The internal expansion band to secure the boot in place shall conform to aluminum material specification 6061-T6. The external band to clamp and seal the boot to the pipe shall be stainless steel - corrosion resistant conforming to ASTM Specification A-167M. The port to receive the boot shall be core drilled and is to be manufactured as to allow for lateral and vertical movement, as well as angular adjustment thru 20 degrees. All field installation of pipe thru manhole seal shall be done in accordance with the Manufacturer's Recommendations and Specifications.

SANITARY SEWER MANHOLE
WATER AND SANITARY SEWER FACILITIES



WATER AND SANITARY SEWER FACILITIES

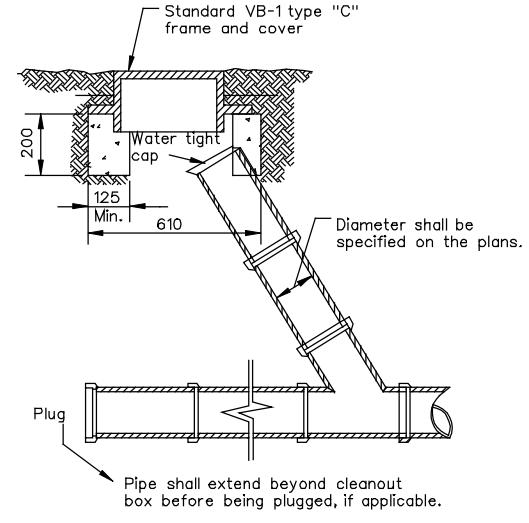
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Notes:

1. Cleanout may also be installed with iron body screw with Brass plug and one inch of lead poured in place & caulked on inside & outside edge.
2. Cleanout shall be suitably braced with 50 x 100 mm cross piece extended over & having solid bearing at least one foot on each side of ditch.
3. Cleanout Wye and Riser shall be constructed of the same material as the main unless otherwise specified.

TYPE "A"



Notes:

1. Cast iron frame and cover shall be sufficiently true to a plane surface, so that tops will not rock.
2. Cleanout Wye and Riser shall be constructed of the same materials as the main unless otherwise specified.

TYPE "B"

SEWER CLEANOUT

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UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS

1413.01