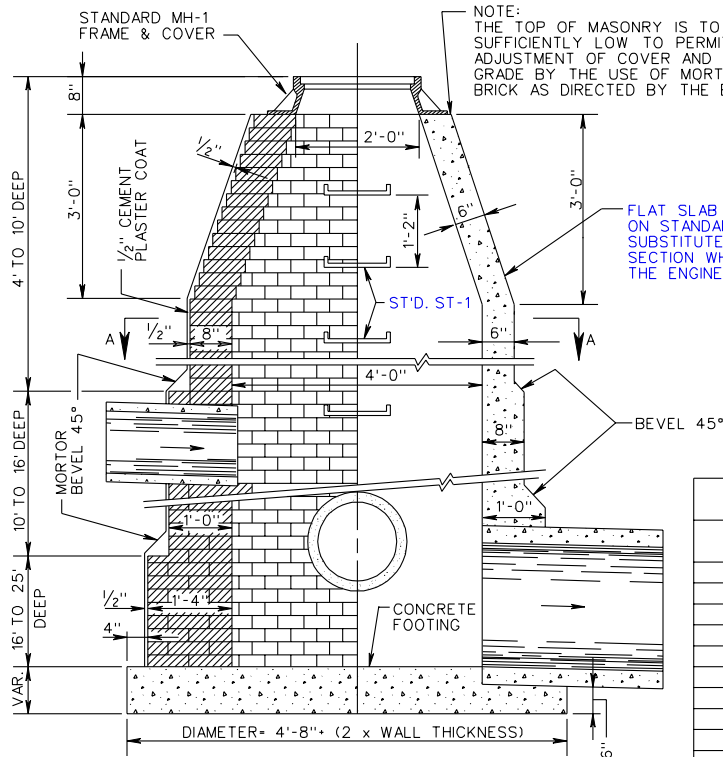


REVISED 7/01

MH-1

SEE STANDARD SL-1 FOR APPLICABILITY OF SAFETY SLABS.

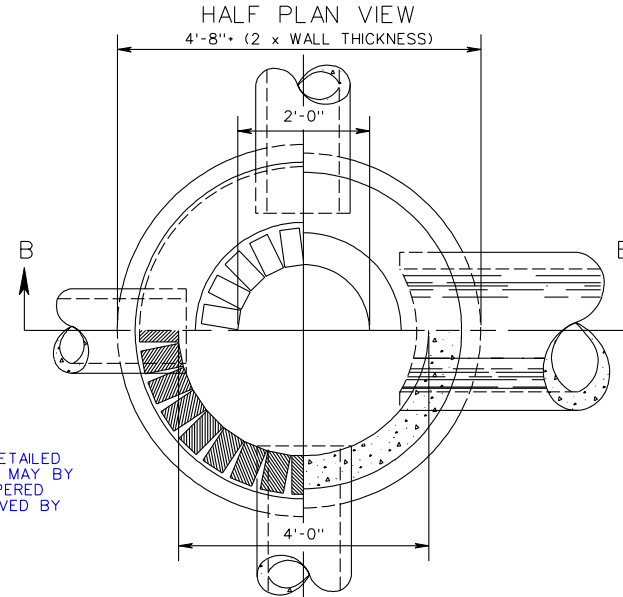


SECTION B-B

BRICK  
CONCRETE  
OR  
CONCRETE BLOCK

NOTE:  
THE TOP OF MASONRY IS TO BE LEFT  
SUFFICIENTLY LOW TO PERMIT PROPER  
ADJUSTMENT OF COVER AND FRAME TO  
GRADE BY THE USE OF MORTAR OR  
BRICK AS DIRECTED BY THE ENGINEER.

FLAT SLAB TOP AS DETAILED  
ON STANDARD T-MH-2 MAY BE  
SUBSTITUTED FOR TAPERED  
SECTION WHEN APPROVED BY  
THE ENGINEER.



HALF SECTION A-A  
(WITH FRAME AND COVER REMOVED)

BRICK  
CONCRETE

TABLE OF QUANTITIES			
DEPTH	BRICK	MANHOLE	CONCRETE
	THOUSANDS	CU. YARDS	CONCRETE CU. YARDS
4	0.5	0.785	1.437
5	0.7	0.785	1.699
6	0.9	0.785	1.961
7	1.0	0.785	2.223
8	1.2	0.785	2.485
9	1.4	0.785	2.747
10	1.6	0.785	3.009
11	1.9	0.970	3.455
12	2.2	0.970	3.817
13	2.5	0.970	4.179
14	2.8	0.970	4.541
15	3.1	0.970	4.903
16	3.4	0.970	5.265
17	4.0	1.173	6.032
INCREMENT	0.45	-	0.582

- NOTES:
1. QUANTITIES SHOWN ARE FOR MANHOLE WITHOUT PIPES. THE AMOUNT DISPLACED BY PIPES MUST BE DEDUCTED TO OBTAIN TRUE QUANTITIES.
  2. A BASE THICKNESS OF 9" WAS USED IN COMPUTING CONCRETE QUANTITIES.
  3. INCREMENTS TO BE ADDED FOR EACH ADDITIONAL FOOT OF DEPTH.
  4. MATERIALS MAY BE BRICK, CONCRETE OR APPROVED CONCRETE MANHOLE BLOCK.
  5. IF BLOCKS ARE USED THE MINIMUM THICKNESS OF SAME IS TO BE 5". OTHER THICKNESSES ARE TO CONFORM TO WALL THICKNESS SHOWN FOR CONCRETE.
  6. ALL CONCRETE TO BE CLASS A3.
  7. WHEN SPECIFIED ON PLANS THE INVERT IS TO BE SHAPED IN ACCORDANCE WITH STANDARD IS-1.

SHEET 1 OF 5

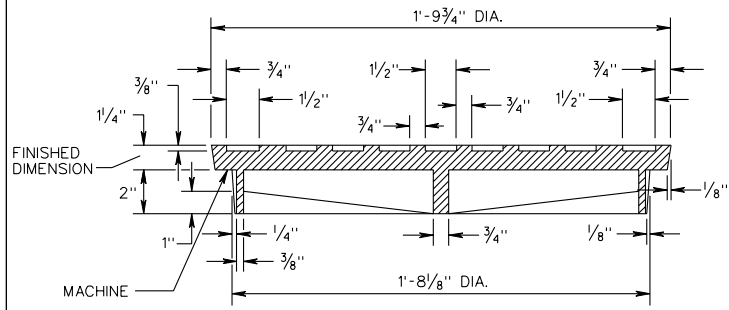
MANHOLE FOR 12" - 48" PIPE CULVERTS

VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION  
REFERENCE

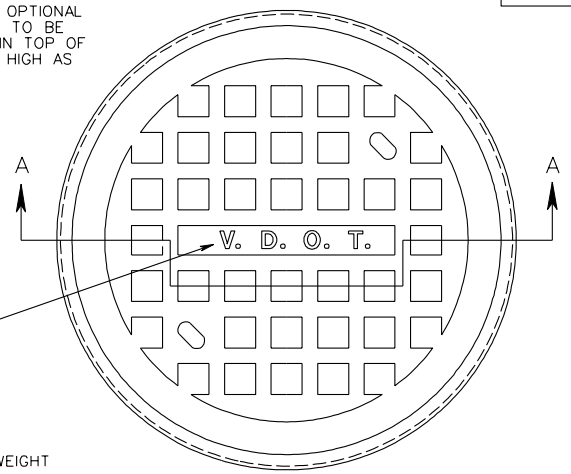
302

106.01



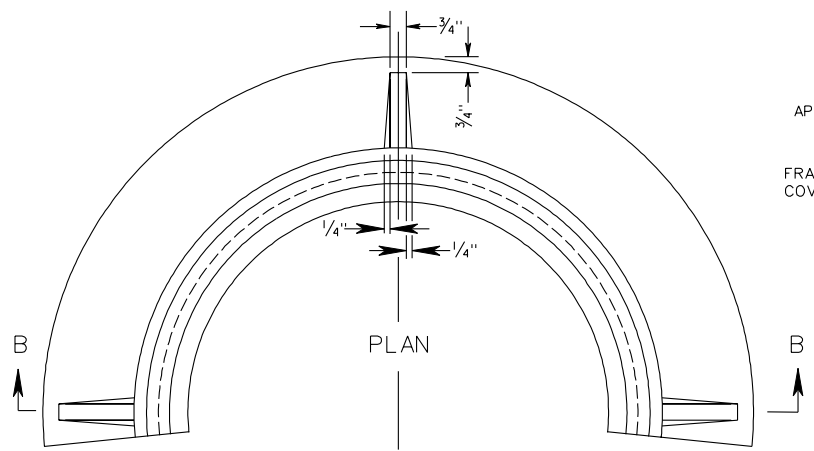
SECTION A-A

THE LETTERS V.D.O.T. ARE OPTIONAL IF USED THE LETTERS ARE TO BE CAST IN THE DEPRESSION IN TOP OF COVER 1\"/>

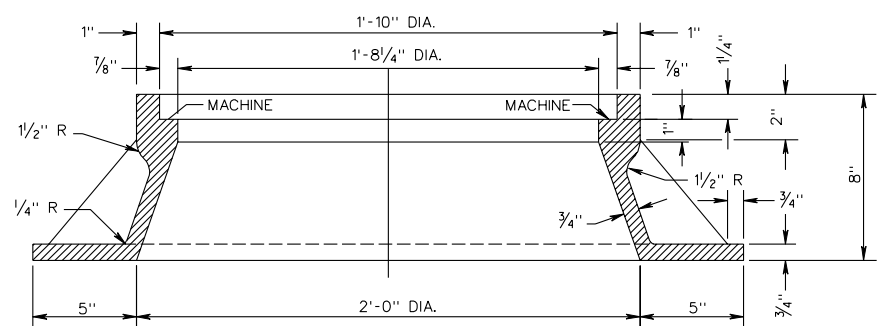


TOP

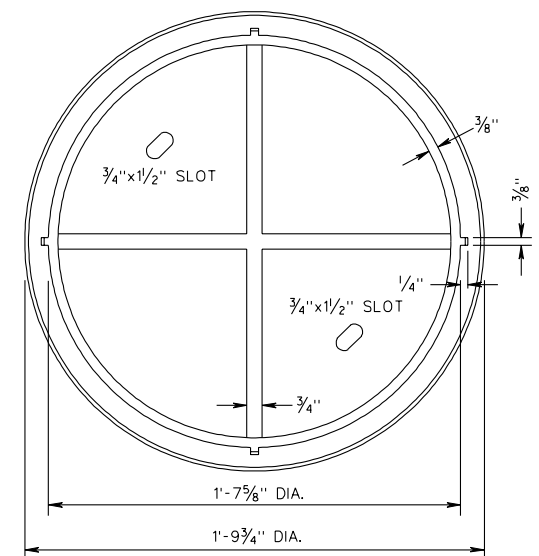
APPROXIMATE WEIGHT  
 CAST IRON  
 FRAME 239 ± 12 LBS.  
 COVER 137 ± 7 LBS.



PLAN



SECTION B-B



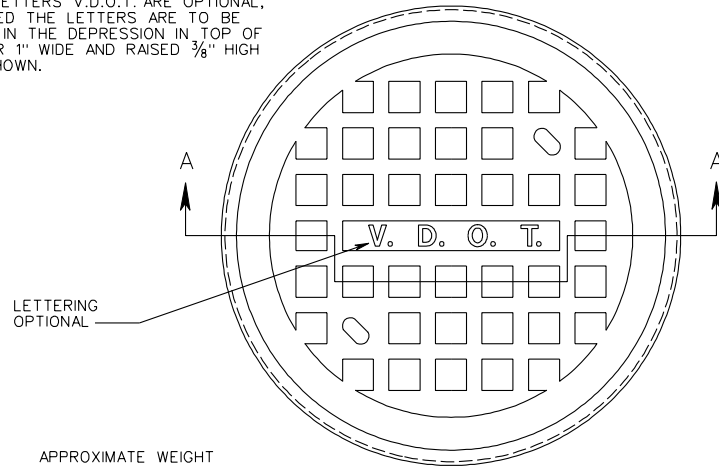
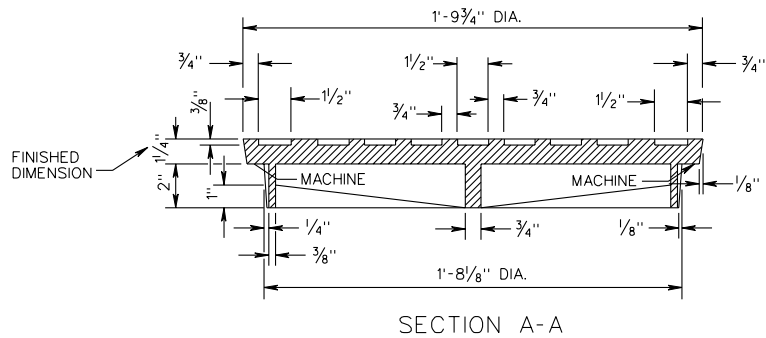
BOTTOM

SPECIFICATION REFERENCE
224 302

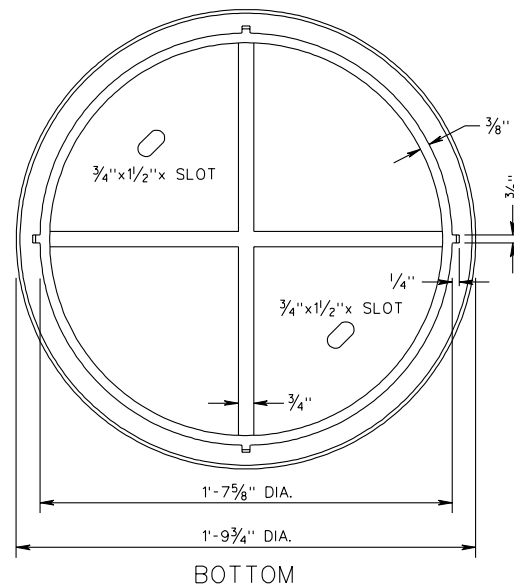
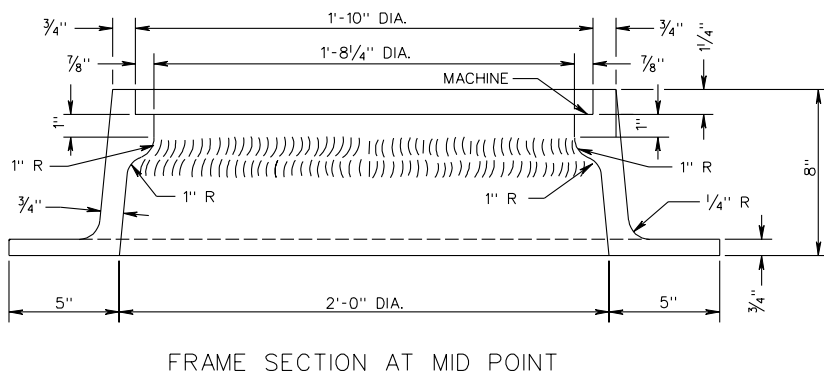
STANDARD MANHOLE FRAME AND COVER  
 VIRGINIA DEPARTMENT OF TRANSPORTATION

MH-1

NOTES:  
THE LETTERS V.D.O.T. ARE OPTIONAL,  
IF USED THE LETTERS ARE TO BE  
CAST IN THE DEPRESSION IN TOP OF  
COVER 1" WIDE AND RAISED  $\frac{3}{8}$ " HIGH  
AS SHOWN.



APPROXIMATE WEIGHT  
CAST IRON  
COVER 137 ± 7 LBS.  
FRAME 235 ± 12 LBS.



SHEET 3 OF 5

# STANDARD MANHOLE FRAME AND COVER

VIRGINIA DEPARTMENT OF TRANSPORTATION

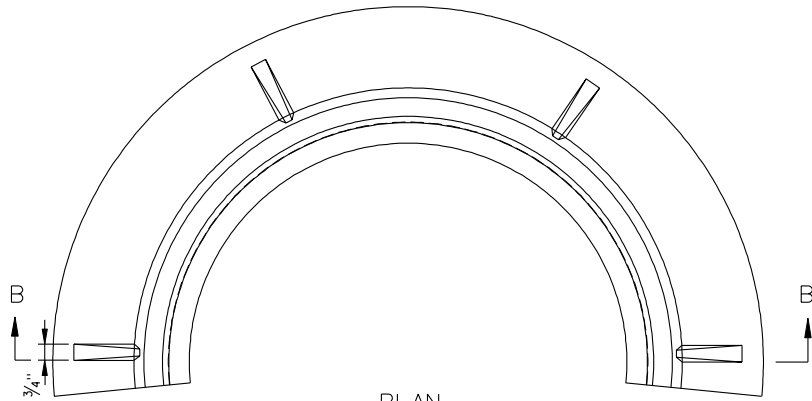
106.03

SPECIFICATION  
REFERENCE

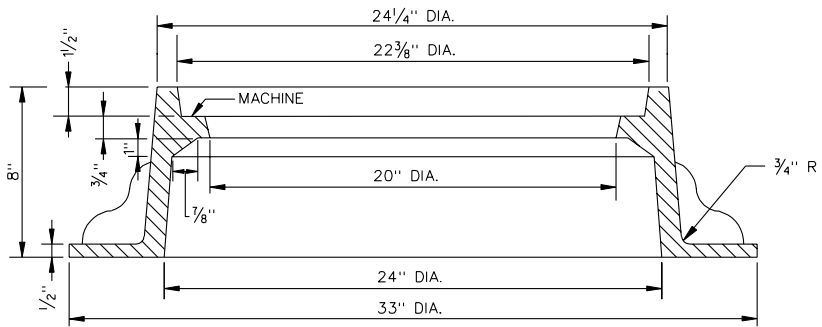
224  
302

REVISED ON 7/02

MH-1



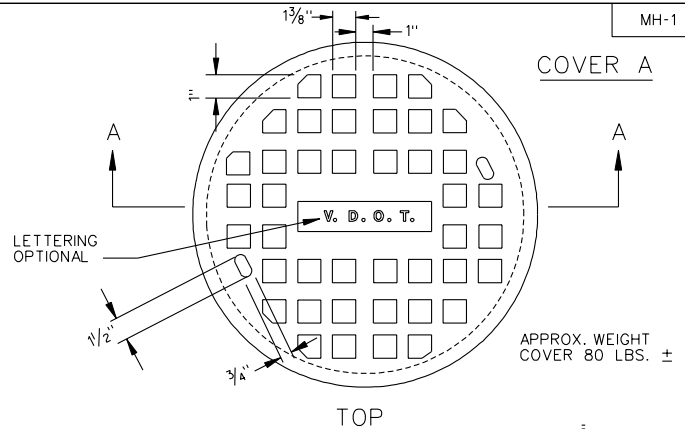
PLAN



FRAME

APPROX. WEIGHT COVER 170 LBS. ±

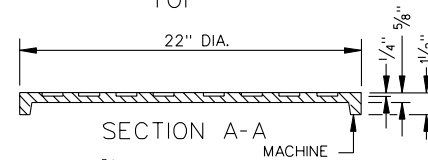
EITHER COVER A OR B MAY BE USED WITH FRAME.



COVER A

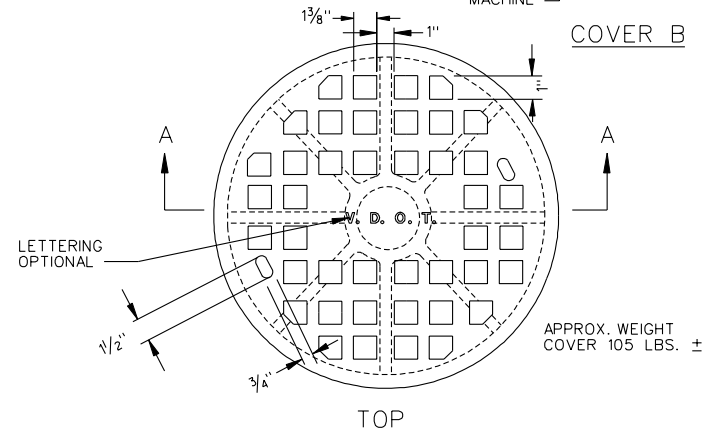
TOP

APPROX. WEIGHT COVER 80 LBS. ±



SECTION A-A

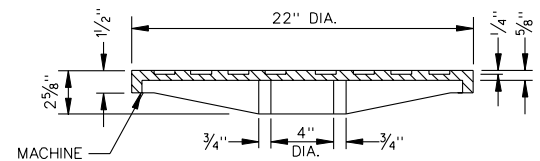
MACHINE



COVER B

TOP

APPROX. WEIGHT COVER 105 LBS. ±



SECTION A-A

SHEET 4 OF 5

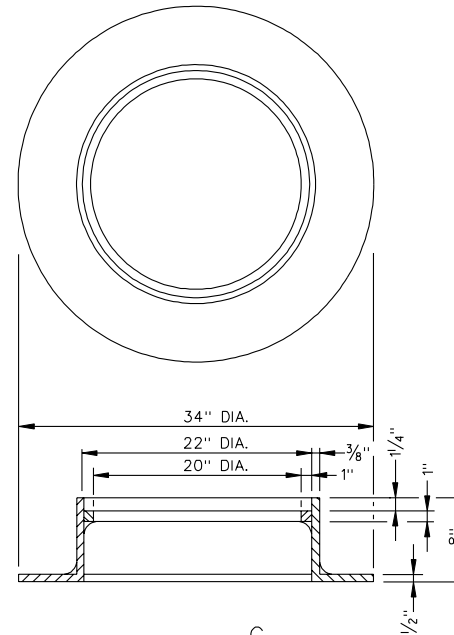
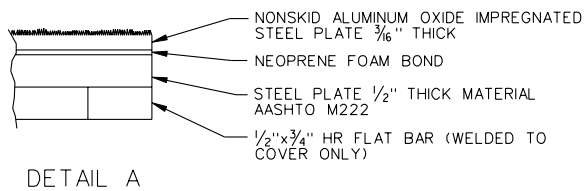
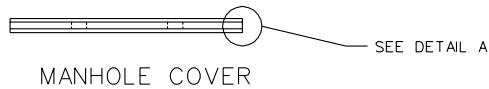
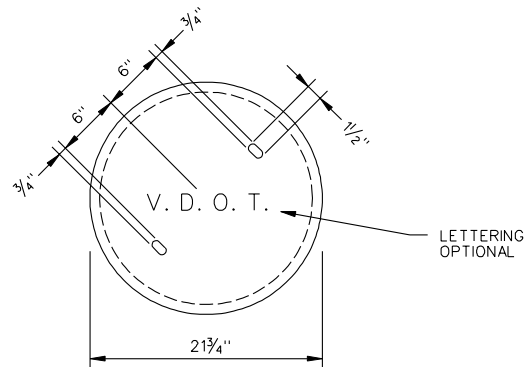
SPECIFICATION REFERENCE

224  
302

STANDARD MANHOLE FRAME AND COVER

VIRGINIA DEPARTMENT OF TRANSPORTATION

106.04



NOTES:  
STRUCTURAL COMPONENTS SHALL CONFORM TO AASHTO M222.

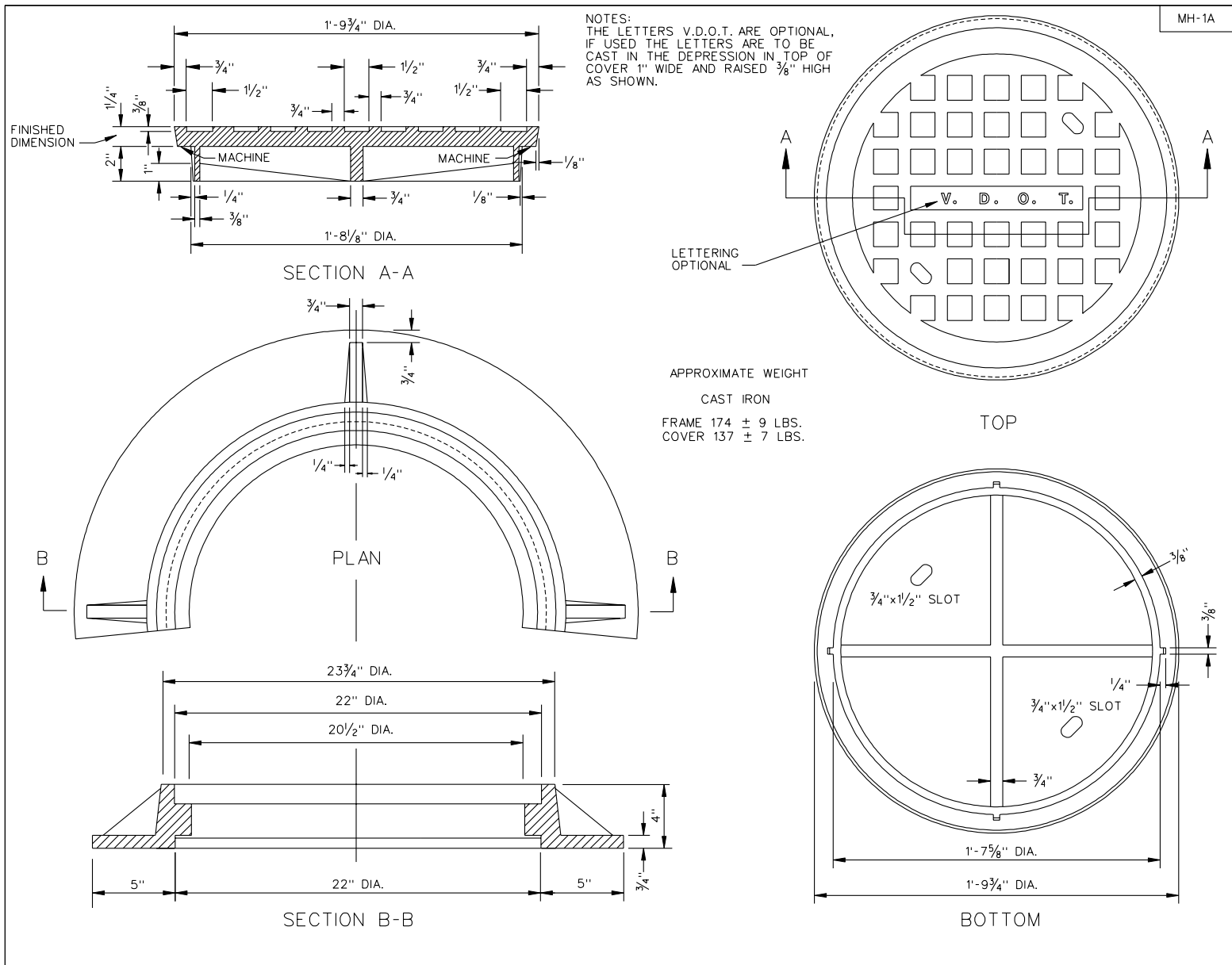
FRAME AND COVER SHALL HAVE A CONTINUOUS FLUSH FIT.

STANDARD MANHOLE FRAME AND COVER

VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION REFERENCE

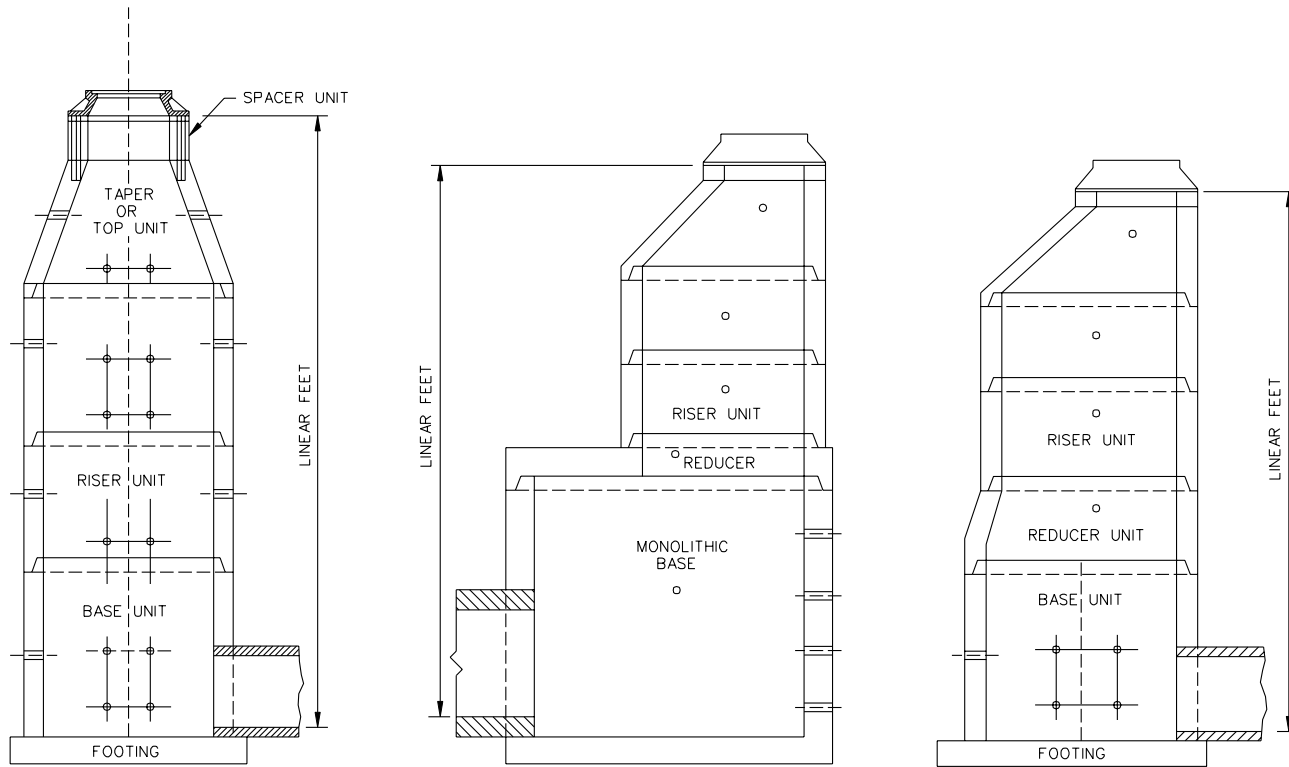
302



SPECIFICATION REFERENCE
224 302

STANDARD MANHOLE FRAME AND COVER  
 VIRGINIA DEPARTMENT OF TRANSPORTATION

FOR DETAILS OF ALL COMPONENT PARTS AND  
"GENERAL NOTES- PRECAST" SEE SHEETS  
103.01-103.11

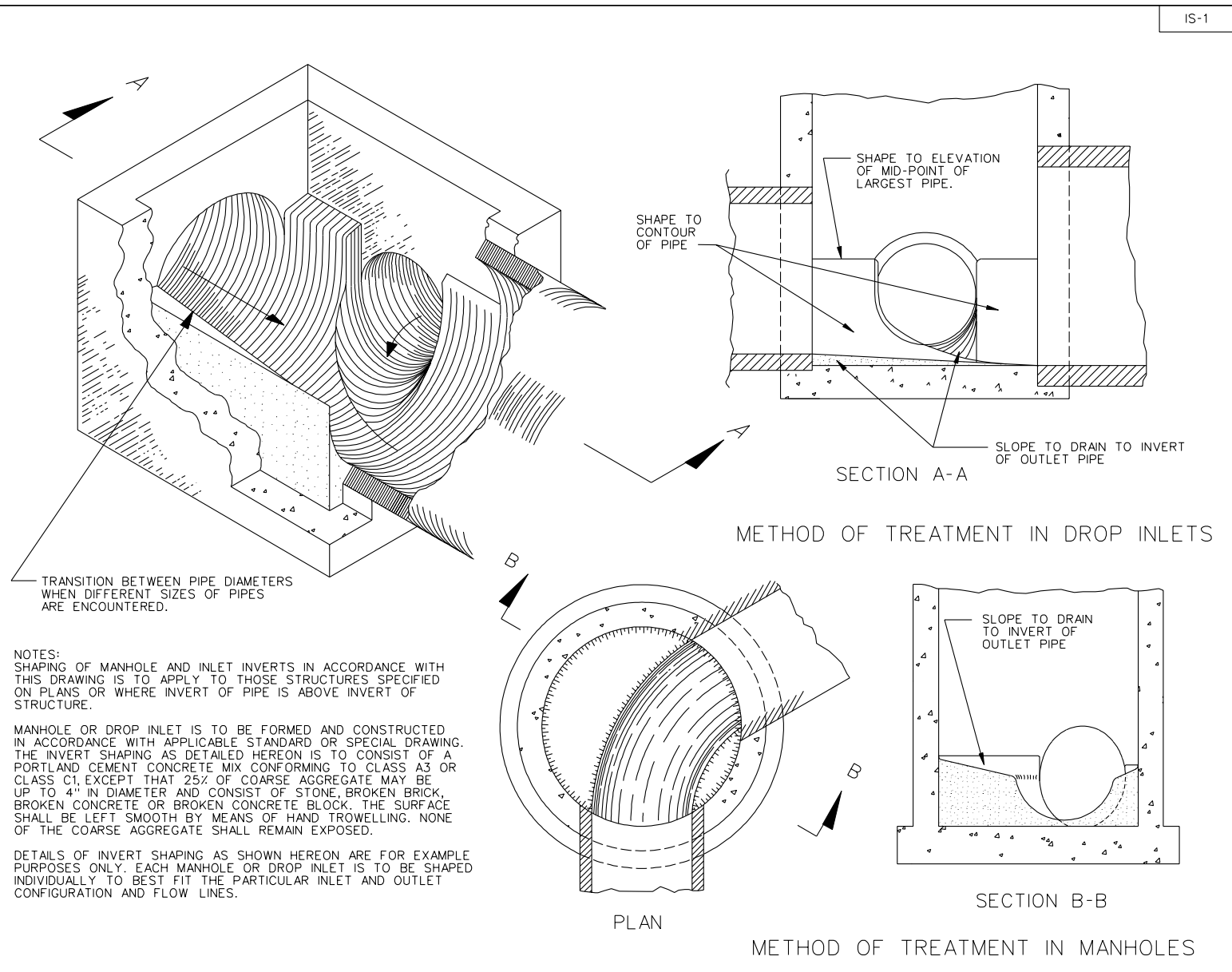


# PRECAST MANHOLE

VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION  
REFERENCE

105  
302



SPECIFICATION REFERENCE
302

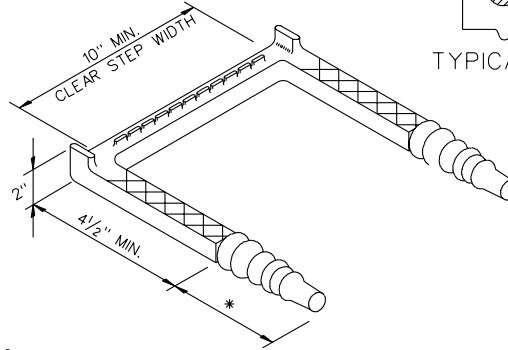
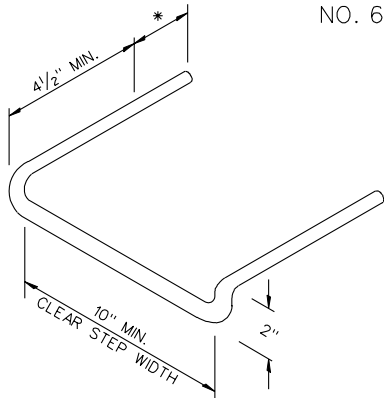
# STANDARD METHOD OF SHAPING MANHOLE & INLET INVERTS

VIRGINIA DEPARTMENT OF TRANSPORTATION

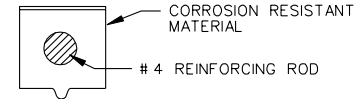


ST-1

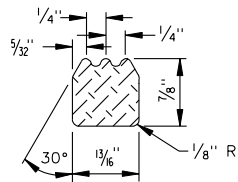
NO. 6 GALVANIZED STEEL STEP



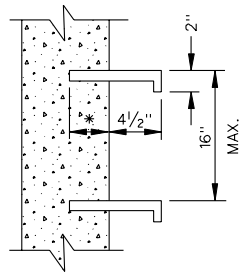
#4, GRADE 60, REINFORCING ROD ENCASED IN A CORROSION RESISTANT RUBBER OR OTHER MATERIAL APPROVED BY THE ENGINEER. (DIMENSION MAY VARY WITH MANUFACTURER'S DESIGN)



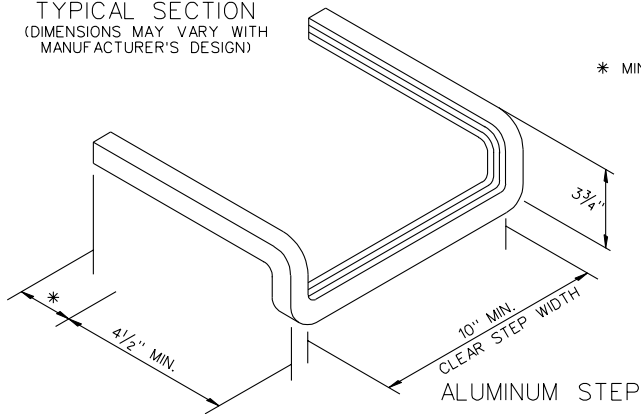
TYPICAL SECTION



TYPICAL SECTION  
(DIMENSIONS MAY VARY WITH MANUFACTURER'S DESIGN)



\* MINIMUM OF 3" EMBEDMENT



ALUMINUM STEP

NOTES:  
STEPS WILL BE REQUIRED IN ALL STRUCTURES WITH A DEPTH OF 4'-0" OR GREATER UNLESS OTHERWISE NOTED ON THE PLANS.

ALL STEPS SHALL PROTRUDE 4 1/2" FROM INSIDE FACE OF STRUCTURE WALL.

MAXIMUM STEP SPACING TO BE 16" C-C.

STEPS SHALL WITHSTAND A MINIMUM FORCE OF 300 POUNDS WHEN EXTENDED 4 1/2" FROM THE FACE OF THE SUPPORT.

STEPS ARE TO BE VERTICALLY ALIGNED AND UNIFORMLY SPACED FOR THE ENTIRE DEPTH OF ANY STRUCTURE.

IN PRECAST UNITS STEPS MAY BE CAST IN PLACE, MORTARED INTO HOLES PROVIDED BY THE FABRICATOR, OR DRIVEN.

STEPS DIFFERING IN DIMENSIONS, CONFIGURATION, OR MATERIALS FROM THOSE SHOWN MAY ALSO BE USED PROVIDED THEY MEET THE MINIMUM REQUIREMENTS SHOWN HEREON AND THE CONTRACTOR HAS FURNISHED THE ENGINEER WITH DETAILS AND CERTIFIED TEST REPORTS OF THE PROPOSED SUBSTITUTE AND HAS RECEIVED WRITTEN APPROVAL FROM THE ENGINEER FOR THE USE OF SUCH STEPS.

ALL STEPS INSTALLED SHALL BE PROVIDED WITH SLIP-RESISTANT SURFACES SUCH AS BUT NOT LIMITED TO, CORRUGATED KNURLED, OR DIMPLED SURFACES.

ALUMINUM STEPS SHALL BE FABRICATED IN ACCORDANCE WITH ASTM B221, ALLOY 6005-T5. THAT PORTION OF THE STEP ENCASED IN MASONRY SHALL BE UNIFORMLY COATED WITH A BITUMINOUS, SOLVENT TYPE, ASBESTOS FILLED ALUMINUM PIGMENTED COATING CONFORMING TO FEDERAL SPECIFICATION TC-C-00498A.

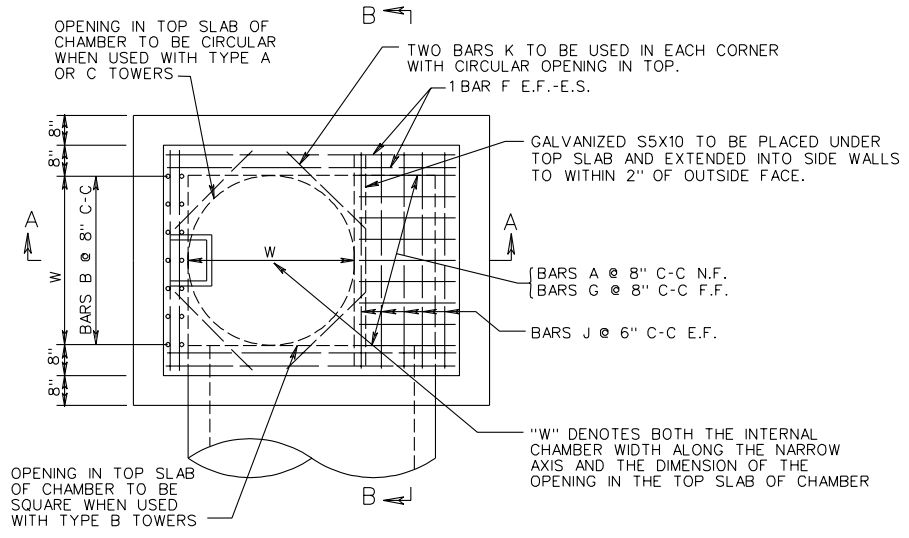
STANDARD STEP

VIRGINIA DEPARTMENT OF TRANSPORTATION

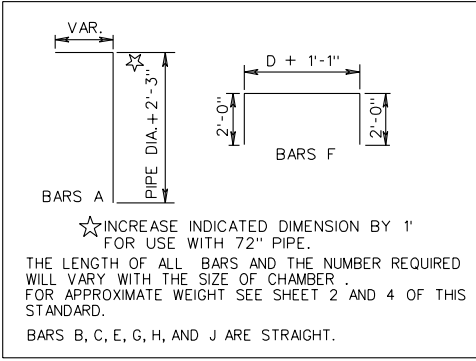
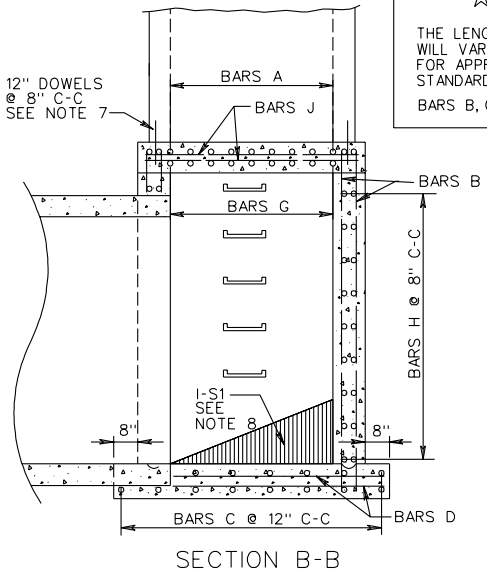
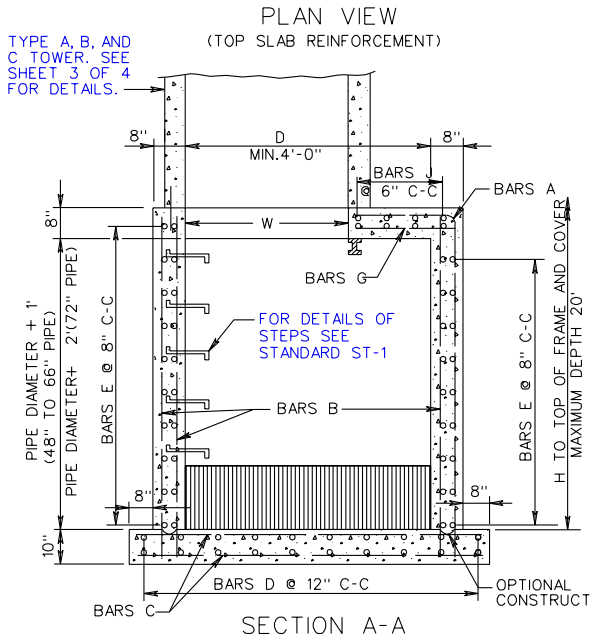
SPECIFICATION REFERENCE

NONE

106.09



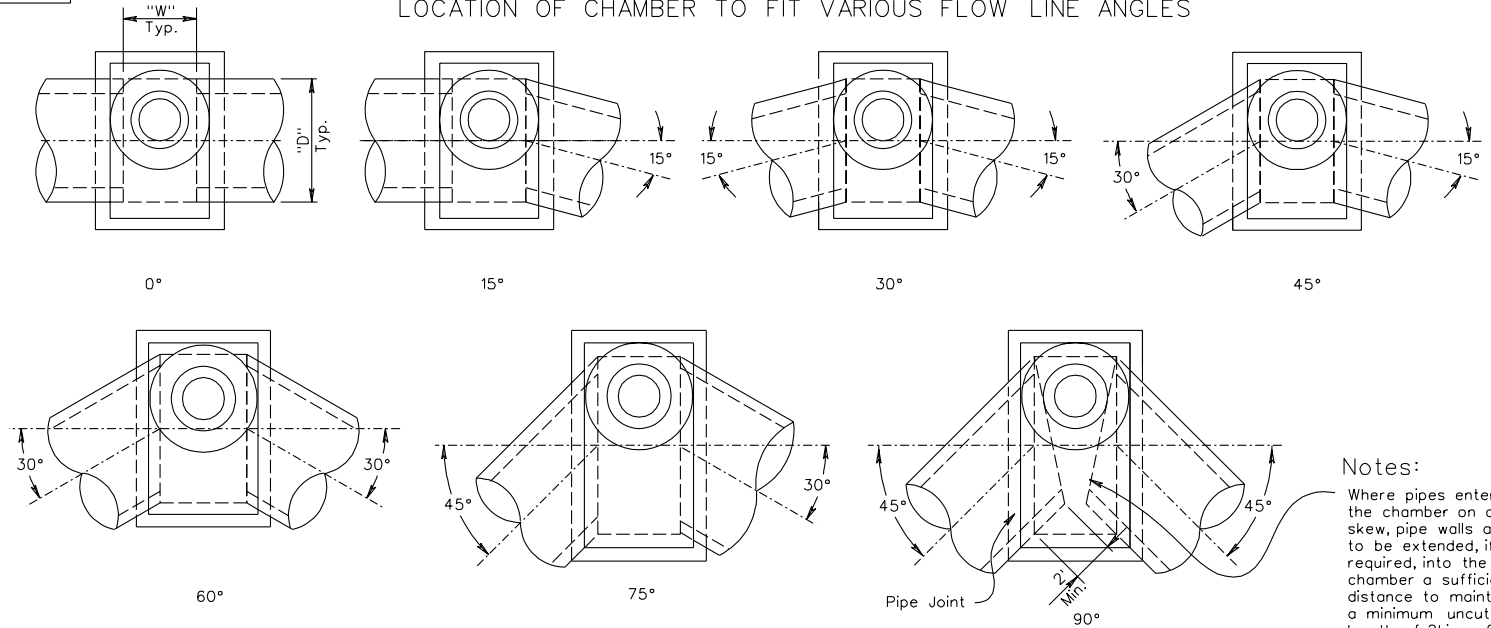
- NOTES:
1. ALL REINFORCING STEEL TO BE #6 BARS WITH A MINIMUM 1/2" CONCRETE COVER.
  2. ANY REINFORCING BARS IN CONFLICT WITH PIPE SHELLS ARE TO BE CUT A MINIMUM OF 1/2" FROM PIPE.
  3. FOR DETAILS METHOD OF TURNING ANGLES AND APPROXIMATE QUANTITIES SEE SHEET 2 OF 4.
  4. PRECAST CHAMBERS OF THE BOLT TOGETHER TYPE MAY BE SUBSTITUTED WHEN APPROVED ON AN INDIVIDUAL BASIS.
  5. ALL CONCRETE TO BE CLASS A3 IF CAST IN PLACE, 4000 PSI IF PRECAST.
  6. THIS ITEM MAY BE PRECAST OR CAST IN PLACE.
  7. ELIMINATE DOWELS WHEN PRECAST TYPE A TOWER ARE ELECTED.
  8. WHEN SPECIFIED ON PLANS INVERT IS TO BE SHAPED IN ACCORDANCE WITH STANDARD IS-1. THE MATERIALS INCIDENTAL TO THE SHAPING ARE NOT TO BE MEASURED OR PAID SEPARATELY BUT THE COST OF SAME IS TO BE INCLUDED IN THE PRICE BID PER CUBIC YARD OF JUNCTION BOX CONCRETE



SPECIFICATION REFERENCE
105
233
302

JUNCTION BOX CHAMBER DETAILS FOR 48" - 72" PIPE CULVERTS  
 MAXIMUM DEPTH (H) = 20'

LOCATION OF CHAMBER TO FIT VARIOUS FLOW LINE ANGLES



Notes:  
Where pipes enter the chamber on a skew, pipe walls are to be extended, if required, into the chamber a sufficient distance to maintain a minimum uncut length of 2' in a 6' pipe section.

QUANTITIES FOR CHAMBER \*

PIPE SIZE	ANGLE OF TURN												
	0°			1° - 30°			31° - 60°			61° - 90°			
	DIM. D	CU. YDS. CONC.	LBS. REINF. STEEL	DIM. D	CU. YDS. CONC.	LBS. REINF. STEEL	DIM. D	CU. YDS. CONC.	LBS. REINF. STEEL	DIM. D	CU. YDS. CONC.	LBS. REINF. STEEL	
TYPE A "W" = 4'-0"	48"	4'-10"	4.56	1293	5'-0"	4.65	1317	5'-7"	4.99	1412	6'-10"	5.72	1602
	54"	5'-5"	5.16	1466	5'-7"	5.26	1558	6'-3"	5.10	1617	7'-8"	6.53	1798
	60"	6'-0"	5.80	1657	6'-3"	5.96	1794	6'-11"	6.38	1831	8'-6"	7.38	2064
	66"	6'-7"	6.46	2028	6'-10"	6.63	2069	7'-7"	7.12	2220	9'-4"	8.27	2510
	72"	7'-2"	7.77	2248	7'-5"	7.95	2306	8'-3"	8.56	2490	10'-2"	9.97	2843
TYPE B "W" = 3'-0"	48"	4'-10"	4.06	1149	5'-0"	4.15	1173	5'-7"	4.46	1274	6'-10"	5.12	1440
	54"	5'-5"	4.61	1308	5'-7"	4.70	1373	6'-3"	5.07	1452	7'-8"	5.85	1619
	60"	6'-0"	5.19	1487	6'-3"	5.33	1531	6'-11"	5.71	1651	8'-6"	6.63	1925
	66"	6'-7"	5.79	1815	6'-10"	5.94	1934	7'-7"	6.40	2058	9'-4"	7.45	2359
	72"	7'-2"	7.00	2020	7'-5"	7.17	2086	8'-3"	7.73	2264	10'-2"	9.03	2585
TYPE C "W" = 2'-0"	48"	4'-10"	3.53	1030	5'-0"	3.61	1052	5'-7"	3.88	1133	6'-10"	4.47	1294
	54"	5'-5"	4.02	1177	5'-7"	4.10	1236	6'-3"	4.43	1305	7'-8"	5.14	1454
	60"	6'-0"	4.54	1337	6'-3"	4.67	1381	6'-11"	5.02	1484	8'-6"	5.85	1710
	66"	6'-7"	5.09	1592	6'-10"	5.22	1674	7'-7"	5.64	1789	9'-4"	6.59	2062
	72"	7'-2"	6.19	1835	7'-5"	6.34	1885	8'-3"	6.86	2050	10'-2"	8.05	2355

\* Quantities shown are for chamber without pipes. Pipe displacement of concrete and steel must be deducted to obtain true quantities. See Sheet 4 of 4.

Chamber and lower quantities for concrete and reinforcing steel must be added to obtain totals.

"W"	STRUCT. STEEL
2'-0"	30 Lbs.
3'-0"	40 Lbs.
4'-0"	50 Lbs.

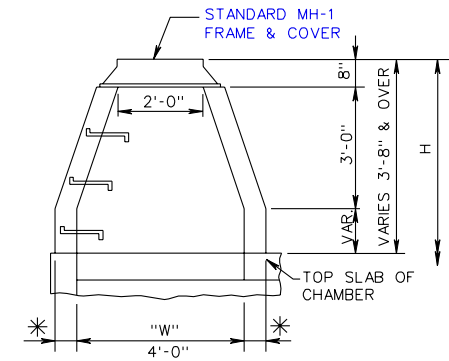
JUNCTION BOX DETAILS FOR ANGULAR CONNECTIONS OF 48" - 72" PIPE CULVERTS

DETAILS OF TOWERS

JB-1

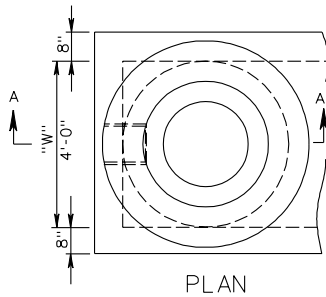
TYPE A

TO BE USED WHEN VERTICAL DISTANCE BETWEEN GRADE AND INVERT OF PIPE IS PIPE DIAMETER PLUS 5'-4" OR GREATER (SEE NOTE 3).



\* WALL THICKNESS TO BE 6" TO A DEPTH OF 10' AND 8" OVER 10'.

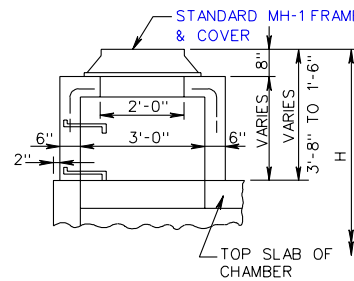
SECTION A-A



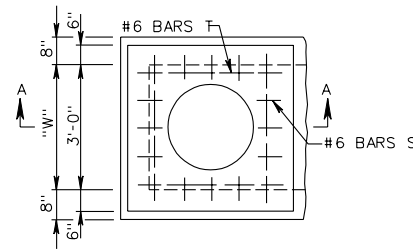
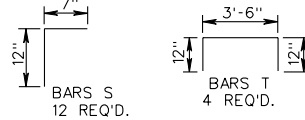
PLAN

TYPE B

TO BE USED WHEN VERTICAL DISTANCE BETWEEN GRADE AND INVERT OF PIPE IS PIPE DIAMETER PLUS 3'-2" TO 5'-4" (SEE NOTE 3).



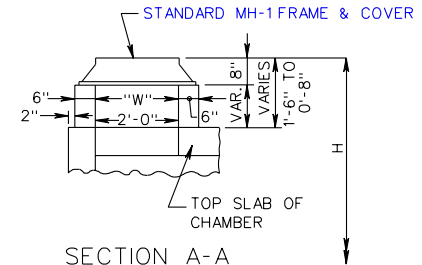
SECTION A-A



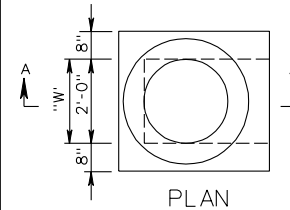
PLAN

TYPE C

TO BE USED WHEN DISTANCE BETWEEN GRADE AND INVERT OF PIPE IS PIPE DIAMETER PLUS 2'-4" TO 3'-2" (SEE NOTE 3).



SECTION A-A



PLAN

NOTES:

1. PRECAST UNITS IN ACCORDANCE WITH STANDARD MH-2 MAY BE SUBSTITUTED FOR TYPE A TOWER SHOWN. IF SUBSTITUTED, PAYMENT WILL BE MADE AT THE CONTRACT UNIT PRICE, FOR CONCRETE AND STEEL BASED ON THE THEORETICAL QUANTITIES THAT WOULD HAVE BEEN REQUIRED TO BUILD THE TYPE A TOWER.
2. SEE STANDARD SL-1 FOR APPLICABILITY OF SAFETY SLABS.
3. INCREASE INDICATED DIMENSION BY ONE FOOT FOR USE WITH 72" DIAMETER PIPE.
4. CHAMBER AND TOWER QUANTITIES FOR CONCRETE AND REINFORCING STEEL MUST BE ADDED TO OBTAIN TOTALS.

QUANTITIES FOR TOWER \*\*

	TYPE A	TYPE B	TYPE C
CONCRETE	0.643 C.Y.	0.325 C.Y.	—
INCREMENT PER FOOT	0.262 TO 10' DEPTH 0.362 OVER 10'	0.259	0.145
REINFORCING STEEL	—	62 LBS.	—

\*\* QUANTITIES SHOWN ARE FOR MINIMUM TOWERS OF EACH TYPE. FOR TOWERS ABOVE MINIMUM HEIGHT INCREMENTS SHOWN PER FOOT MUST BE ADDED.

SHEET 3 OF 4

SPECIFICATION REFERENCE

105  
233  
302

JUNCTION BOX TOWER DETAILS FOR 48" - 72" PIPE CULVERTS  
MAXIMUM DEPTH (H) = 20'

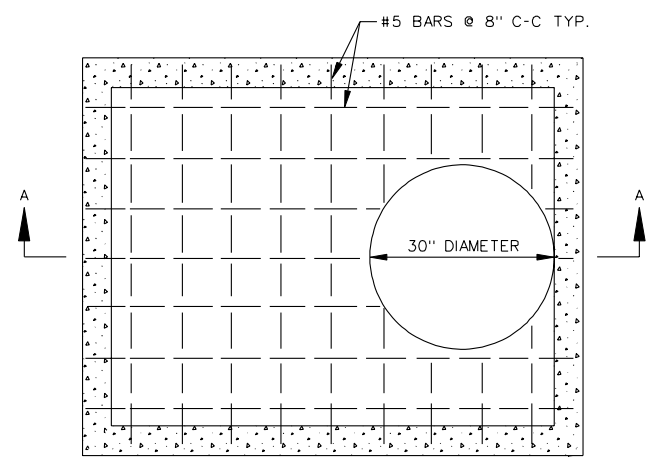
VIRGINIA DEPARTMENT OF TRANSPORTATION

106.12

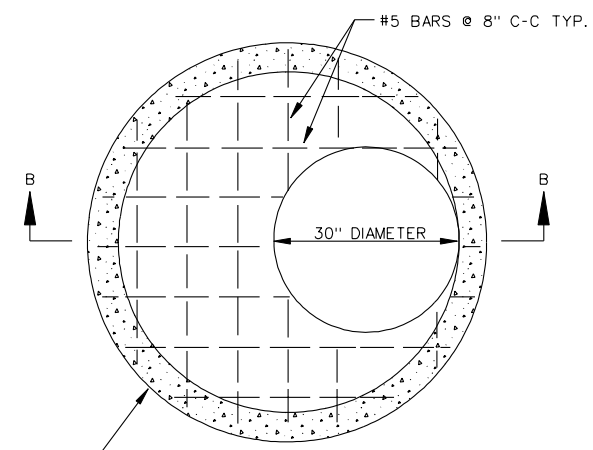
## DISPLACEMENT QUANTITIES FOR PIPE OPENINGS

(To be used with St'd JB-I Junction Box)

PIPE SIZE	PIPE CLASS	CONCRETE				REINF. STEEL Lbs.
		0°	15°	30°	45°	
		Cu. Yards	Cu. Yards	Cu. Yards	Cu. Yards	
12"	III, IV, V	.035	.036	.040	.050	17.67
12"	CM	.019	.020	.022	.027	11.06
15"	III, IV, V	.050	.052	.058	.071	24.88
15"	CM	.030	.031	.034	.042	15.93
18"	III, IV, V	.069	.072	.080	.099	33.23
18"	CM	.043	.044	.049	.061	21.68
24"	III, IV, V	.118	.122	.137	.168	53.53
24"	CM	.076	.078	.087	.108	35.83
30"	III, IV, V	.179	.186	.208	.256	78.64
30"	CM	.118	.122	.137	.168	53.53
36"	III, IV, V	.254	.263	.294	.362	108.76
36"	CM	.170	.176	.197	.242	74.76
42"	III, IV, V	.341	.353	.395	.486	143.33
42"	CM	.231	.240	.268	.330	99.53
48"	III, IV, V	.441	.457	.511	.629	182.90
48"	CM	.302	.313	.350	.431	127.85
54"	III, IV	.554	.574	.642	.789	227.29
54"	V	.580	.600	.672	.826	237.42
54"	CM	.382	.396	.443	.545	159.70
60"	III, IV	.679	.704	.787	.965	276.49
60"	V	.708	.734	.821	1.009	287.65
60"	CM	.472	.481	.551	.673	195.09
66"	III, IV	.818	.847	.948	1.166	330.50
66"	V	.849	.880	.985	1.211	342.70
66"	CM	.571	.591	.662	.814	234.02
72"	III, IV	.969	1.004	1.123	1.382	389.34
72"	V	1.003	1.040	1.163	1.431	402.58
72"	CM	.679	.704	.787	.969	276.49

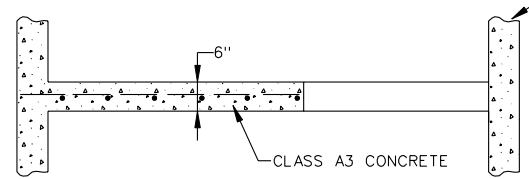


PLAN

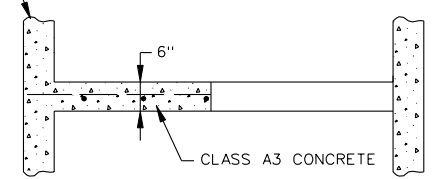


PLAN

STRUCTURE SIZE AND WALL THICKNESS VARIES

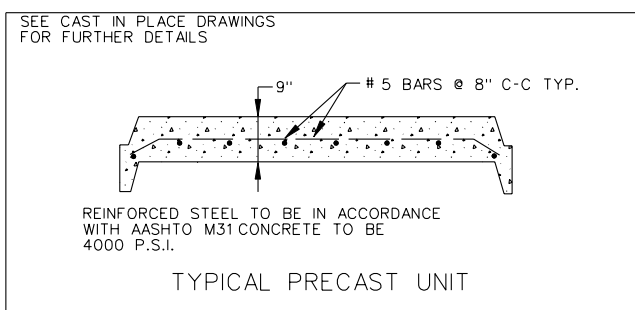


SECTION A-A



SECTION B-B

- NOTES:
1. STANDARD SL-1, MANHOLE SAFETY SLABS, SHOULD BE REQUIRED AS PART OF THE DRAINAGE DESIGN FOR MANHOLES, JUNCTION BOXES AND DROP INLETS WITH HEIGHTS GREATER THAN 10 FEET. THE SPACING OF THE SLABS SHOULD BE 8' TO 12'. THE SLABS SHOULD BE LOCATED SO AS TO NOT TO INTERFERE WITH THE FLOW INTO OR THROUGH THE STRUCTURE. ON TALL STRUCTURES, WHERE PIPES INFLOW AT VARIOUS LOCATIONS VERTICALLY, THE SLABS SHOULD NOT BE PLACED BELOW A 30" OR LARGER PIPE OPENING.
  2. THE COST OF THE SL-1 IS INCLUDED IN THE STRUCTURE. THE DRAINAGE DESCRIPTIONS SHOULD BE USED TO SPECIFY HOW MANY SAFETY SLABS ARE NEEDED FOR EACH STRUCTURE AND THE QUANTITY SHOULD BE NOTED IN THE REMARKS COLUMN ON THE DRAINAGE SUMMARY.
  3. ACCESS HOLES ARE TO BE STAGGERED FROM ONE SIDE OF STRUCTURE TO THE OTHER WHERE APPLICABLE. STEPS ARE TO BE STAGGERED ACCORDINGLY.
  4. MAY BE PRECAST OR CAST IN PLACE.



SPECIFICATION REFERENCE
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## TYPICAL CONCRETE SAFETY SLAB FOR DROP INLETS, MANHOLES AND JUNCTION BOXES