PART 4

DRAIN HARDWARE & ACCESSORIES (DH)

PART 4
DRAIN HARDWARE & ACCESSORIES (DH)
DESIGN CONSIDERATIONS

The selection of inlets and grates by the designer should be based on consideration of the following factors:

1. Hydraulic efficiency. This information will normally be obtained from the manufacturer or current literature.

2. Clogging characteristics.

3. Structural requirements will be dictated by location of placement.

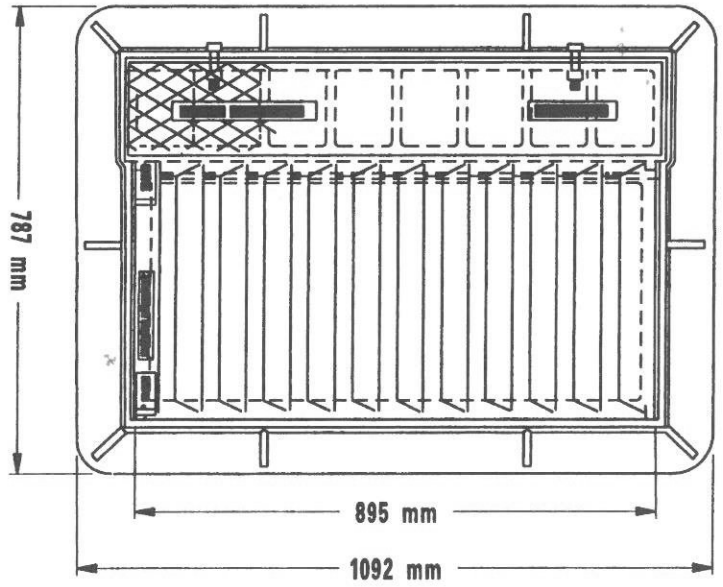
4. Safety requirements for bicycle and pedestrian traffic including the use of vane grates, transverse bars or ribs, if necessary.

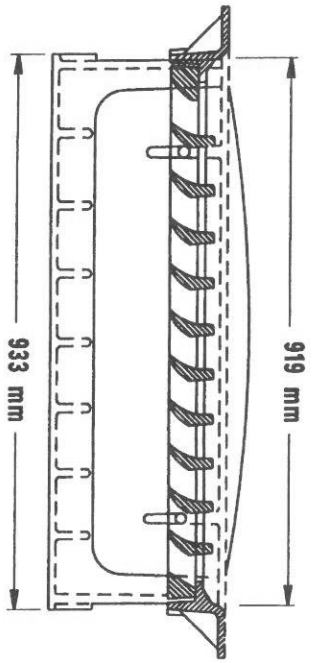
5. Esthetics and maintenance.

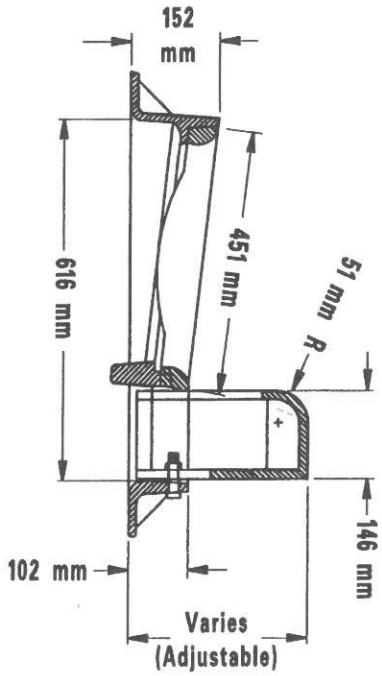
The designer can help ensure proper drainage hardware components are used by writing specifications which relate the extent to which testing and certification of materials should be done. It is expected such specifications would include tolerances which would be in accordance with industry standards and marking of items with visible and permanent identification for testing and certification procedures. Including as an appendix to this section is a "Specification for Cast Frames, Covers, Gratings, Steps and Catch Basin, Manhole." It is intended to be a suggested specification which will ensure adequate tensile strength of materials, be representative of the current practice and trends, and further contribute to drainage hardware standardization.

The dimensions shown in this section are nominal only and may not reflect the detail dimensions required for proper foundry practice.

SECTION DHD—DRAINS







SPECIFICATIONS

Cast Gray Iron: ASTM A 48 (AASHTO M 105 & M 306) Class 35B

BASIS OF SPECIFYING

Item description and grate configuration.
(See DHD-6 for possible configurations.)

Base metal (i.e. Gray Iron)

Size.

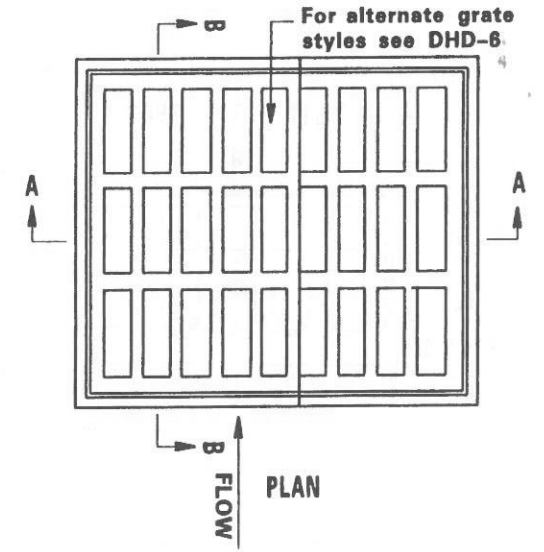
USE

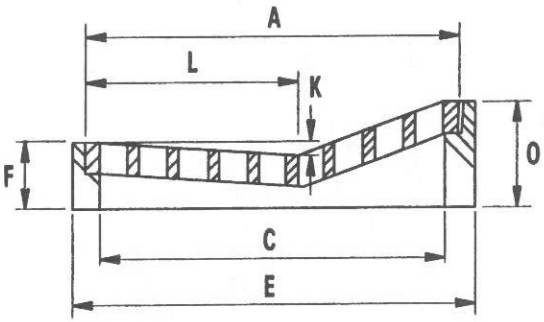
For Pavement drop inlet.

CAST CURB INLET, FRAME AND GRATE

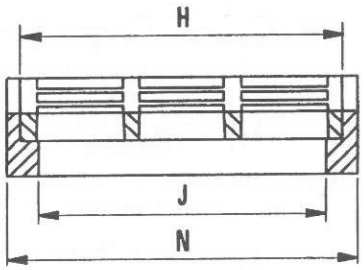
AASHTO-AGC-ARTBA
TF-13 DRAWING

DHD-1-96





SECTION AA



SECTION BB

FRAME AND GRATE

SPECIFICATIONS

Cast Gray Iron: ASTM A 48 (AASHTO M 105 & M 306) Class 30B or 35B

BASIS OF SPECIFYING

Item description and grate configuration.
(See DHD-6 for possible configurations.)

Base metal (i.e. Gray Iron)

Size.

Use Standard Sizes

For Pavement drop inlet.

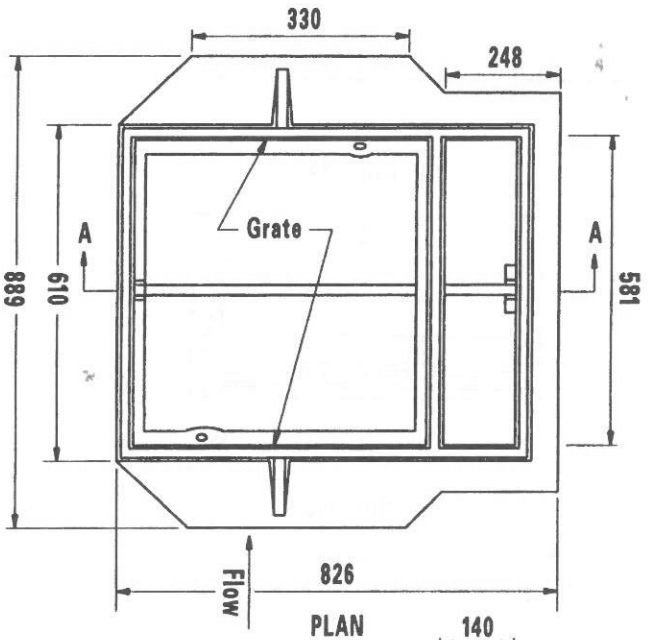
A	H	C	J	K	L	E	N	F	O
670	572	597	495	13	375	733	619	114	178
670	572	597	495	13	375	714	1219*	114	178

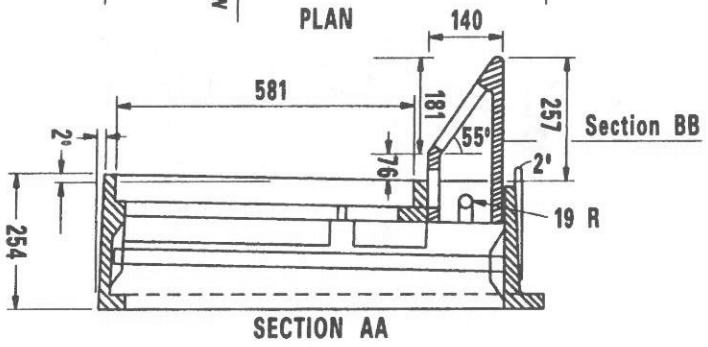
*Size of frame: Double Grates (End-to-End)
NOTE: All dimensions shown are in millimeters

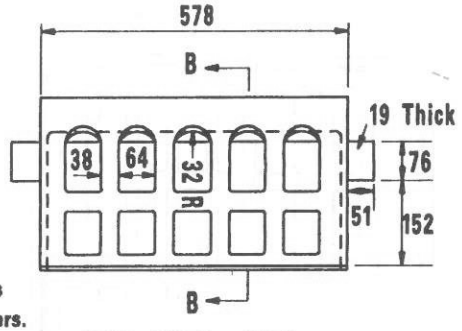
CAST CURB INLET, FRAME AND GRATE

AASHTO-AGC-ARTBA TF-13 DRAWING

DHD-2-96







NOTE: All dimensions shown are in millimeters.

CURB INLET - ELEV.

SPECIFICATIONS

Cast Gray Iron: ASTM A 48 (AASHTO M 105 & M 306) Class 30B or 35B

BASIS OF SPECIFYING

Item description and grate configuration.
Use type 6 grate configuration only (See DHD–6)

Base metal (i.e. Gray Iron) and class.

For pairs remove mating flanges.

Size.

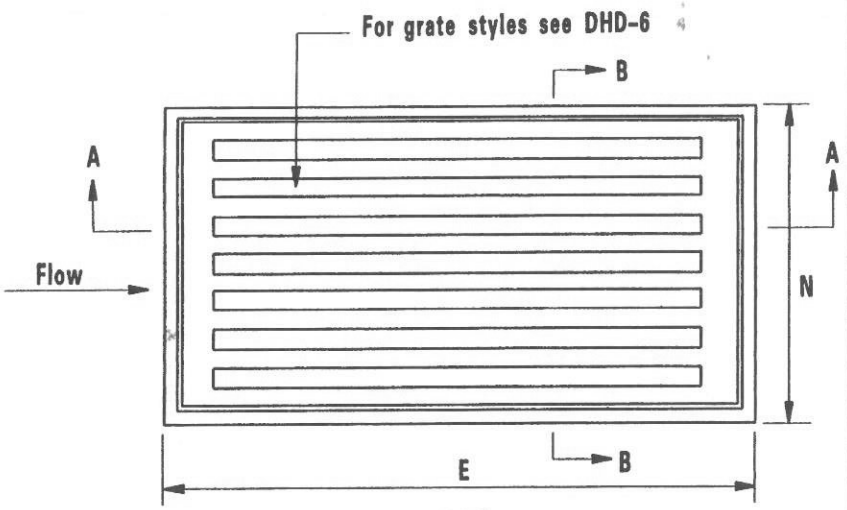
Use

For Pavement drop inlet in conjunction with concrete barrier. (MB–5)

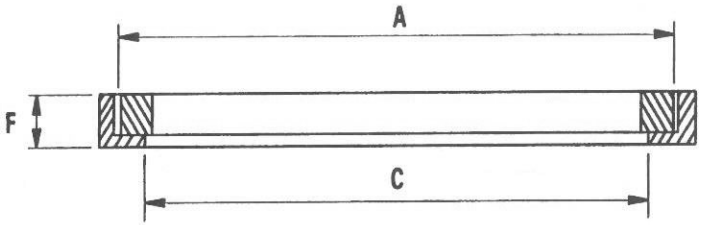
CAST CURB INLET, FRAME AND GRATE

AASHTO–AGC–ARTBA TF–13 DRAWING

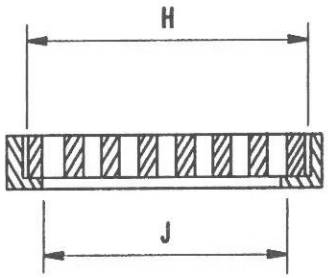
DHD–3–96



PLAN



SECTION AA



SECTION BB

FRAME AND GRATE

SPECIFICATIONS

Cast Gray Iron: ASTM A 48 (AASHTO M 105 & M 306) Class 30B or 35B

BASIS OF SPECIFYING

Item description and grate configuration.
(See DHD-6 for possible configuration.)

Base metal (i.e. Gray Iron) and class

Size.

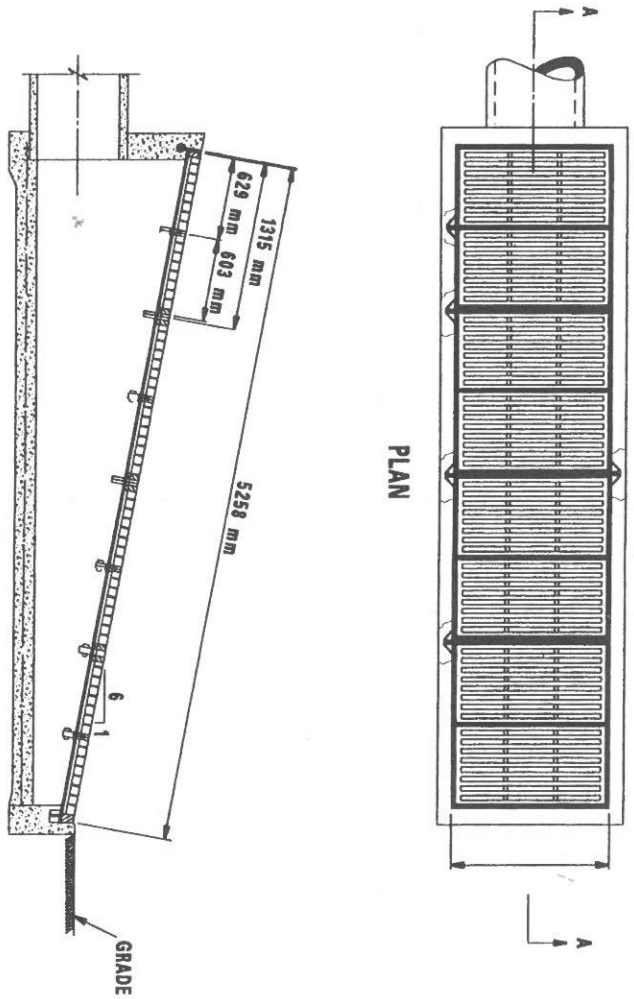
A	H	C	J	E	N	F
457	305	406	254	495	343	64
610	305	559	254	648	343	64
914	610	864	559	953	648	64

NOTE: All dimensions shown are in millimeters.

CAST FRAME AND GRATE

AASHTO–AGC–ARTBA
TF–13 DRAWING

DHD–4–96



SPECIFICATIONS

Cast Gray Iron: ASTM A 48 (AASHTO M 105 & M 306) Class 35B

BASIS OF SPECIFYING

Item description and grate configuration.
(See DHD-6 for possible configuration.)

Base metal (i.e. Gray Iron, Ductile Iron) and class, grade or alloy.

Size.

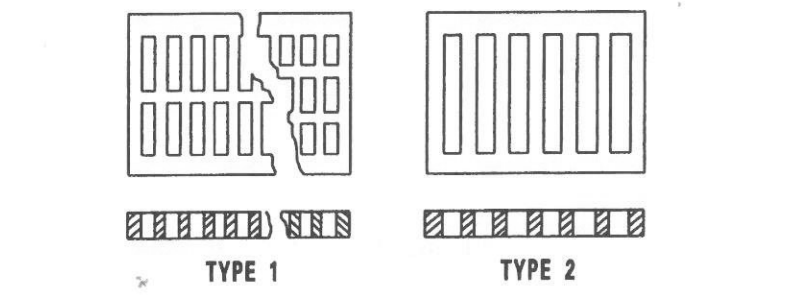
USE

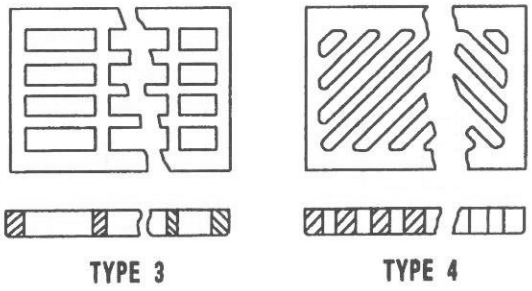
For safety section and 1 V. to 6 H. side slopes

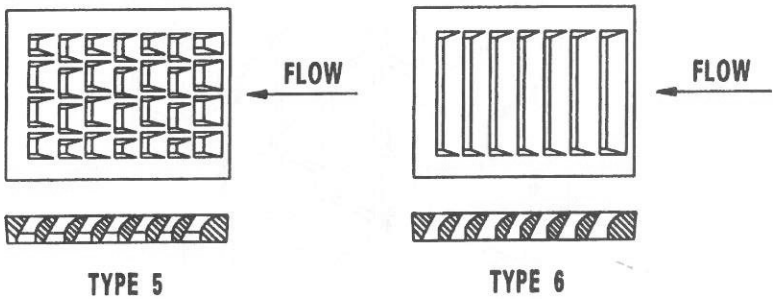
CAST FRAME AND GRATE

AASHTO-AGC-ARTBA TF-13 DRAWING

DHD-5-96







FOR RETANGULAR AND SQUARE FRAMES

SPECIFICATIONS

Cast Gray Iron: ASTM A 48 (AASHTO M 105 & M 306) Class 30B or 35B

BASIS OF SPECIFYING

Grate configuration.

Base metal (i.e. Gray Iron) and class

Size in accordance with frame.

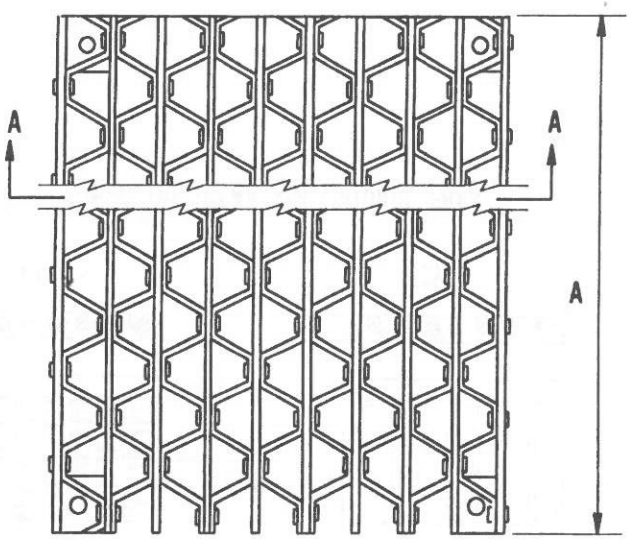
USES

For inlets.

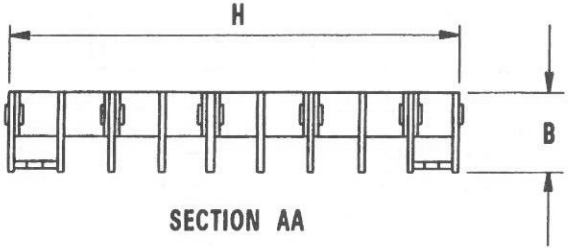
GRATE CONFIGURATIONS
RECTANGULAR AND SQUARE FRAMES

AASHTO–AGC–ARTBA
TF–13 DRAWING

DHD–6–96



PLAN



SECTION AA

RETICULINE CONFIGURATION

SPECIFICATIONS

1. Steel for grate shall conform to AASTO M 183M, ASTM A 36M or AISI Grade 1020 or 1025
2. Rivets shall conform to AASHTO M 228, Grade 1.
3. Steel grate shall be galvanized in accordance with AASHTO M111.

BASIS OF SPECIFYING

Item description.

Size.

USES

For structure, pavement and sidewalk drainage.

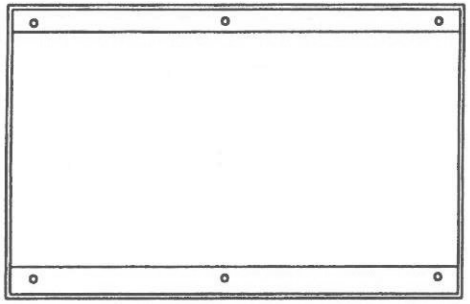
A	H	B
457	305	51
610	305	51
914	610	51

NOTE: All dimensions shown are in millimeters.

STEEL GRATE
RETICULINE CONFIGURATION

AASHTO–AGC–ARTBA
TF–13 DRAWING

DHD–7–96



PLAN
FRAME

Flow

B

A

A

H

B

PLAN
GRATE

A

B

SECTION AA

SECTION BB

FRAME AND GRATE

SPECIFICATIONS

Steel for frame and grate shall conform to ASSHTO M 183M.

Steel frame and grate shall be galvanized in accordance with ASSHTO M 111.

BASIS OF SPECIFYING

Item description.

Size.

USES

For pavement drop inlet.

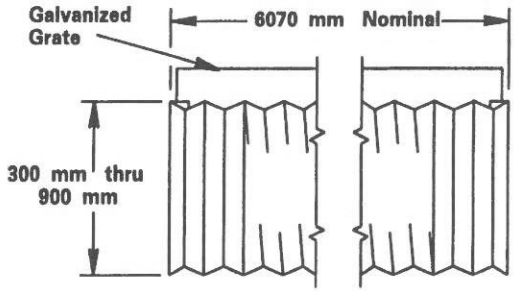
A	H	B
457	305	51
610	305	51
914	610	51

NOTE: Dimensions shown are in millimeters.

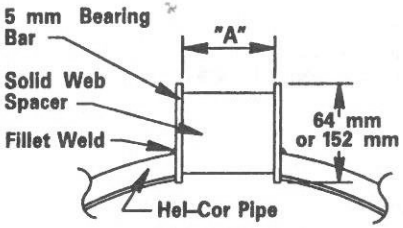
STEEL FRAME AND GRATE

AASHTO–AGC–ARTBA
TF–13 DRAWING

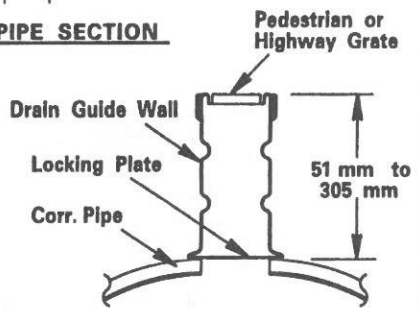
DHD–8–96



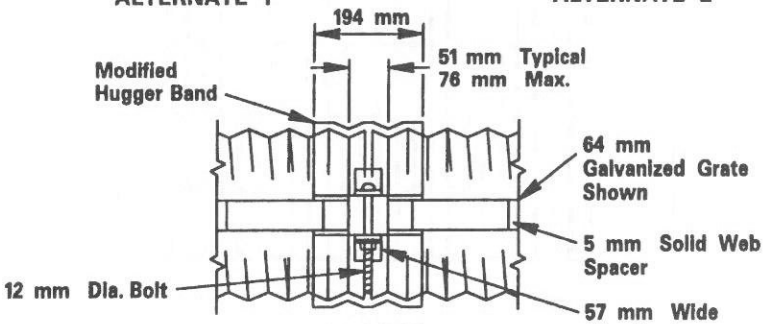
TYPICAL PIPE SECTION



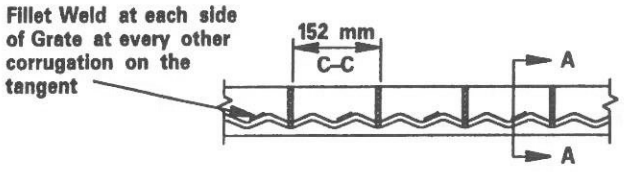
SECTION A-A
STANDARD DETAIL
ALTERNATE 1



SLOT DETAIL
ALTERNATE 2



TOP VIEW
MODIFIED HUGGER BAND



GRATE WELDING DETAIL

SPECIFICATIONS

1. Corrugated steel pipe shall meet applicable portions of AASHTO M 36M, AASHTO M 274 or AASHTO M 218 or AASHTO M 245M, AASHTO M 246M and ASTM A 825.

   PLATE GRATE – ALTERNATE 1
   Grate assemblies shall be a weldable grate of steel complying to the mechanical requirements of AASHTO M 183M. They shall be hot-dipped galvanized in accordance with AASHTO M 111.

   FORMED SHEET – ALTERNATE 2 STEEL
   Components formed from 2.01 mm material meeting the requirements of AASHTO M 218.

   FORMED SHEET – ALTERNATE 2A ALUMINUM
   Components formed from 1.91 mm material meeting the requirements of AASHTO M 196M.

2. Asphalt coated pipe shall conform to AASHTO M 190, Type A or C.

BASIS OF SPECIFYING

Item description.

Size and thickness.

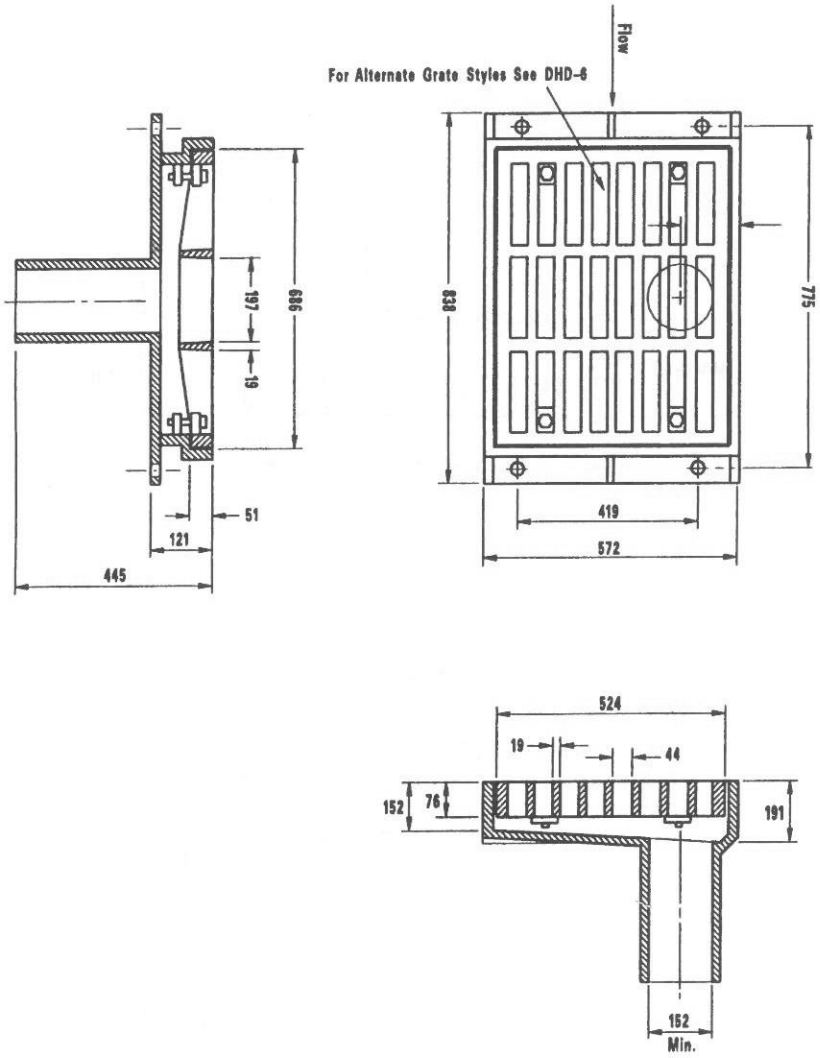
USES

Collect and remove surface water from roadways, parking lots and other paved areas.

CORRUGATED METAL SLOTTED DRAIN
ALUMINUM OR STEEL

AASHTO-AGC-ARTBA
TF-13 DRAWING

DHD-9-96



NOTE: All dimensions shown are in millimeters

SPECIFICATIONS

Cast Gray Iron:

ASTM A 48 (AASHTO M 105 & M 306)
Class 30B or 35B

BASIS OF SPECIFYING

Item description.
Base metal (i.e. Gray Iron) and class.

Size.
Grate type (See DHD-6-96 for grates that may be available).

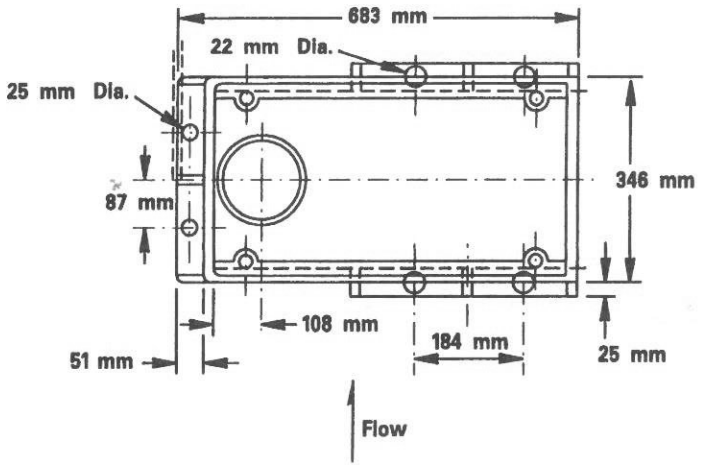
USES

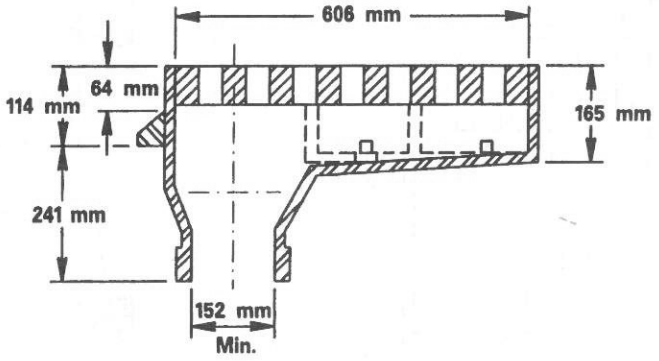
For bridge deck.

CAST IRON BRIDGE DRAIN

AASHTO-AGC-ARTBA
TF-13 DRAWING

DHD-10-96





SPECIFICATIONS

Cast Gray Iron:

ASTM A 48 (AASHTO M 105 & M 306)
Class 30B or 35B

BASIS OF SPECIFYING

Item description.
Base metal (i.e. Gray Iron) and class.

Size.
Grate type (See DHD-6-96 for grates that may be available).

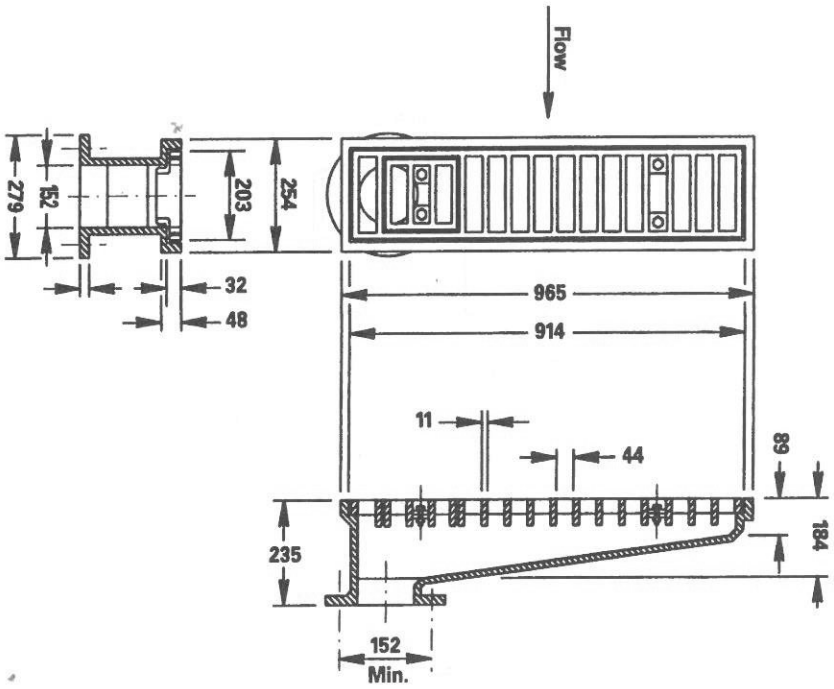
USES

For bridge deck.

CAST IRON BRIDGE DRAIN

AASHTO-AGC-ARTBA
TF-13 DRAWING

DHD-11-96



NOTE: All dimensions shown are in millimeters

SPECIFICATIONS

Cast Gray Iron:

ASTM A 48 (AASHTO M 105 & M 306)
Class 30B or 35B

BASIS OF SPECIFYING

Item description.
Base metal (i.e. Gray Iron) and class.

Size.

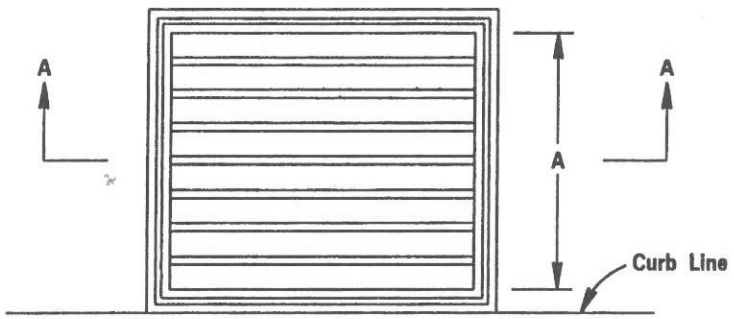
USES

For bridge deck.

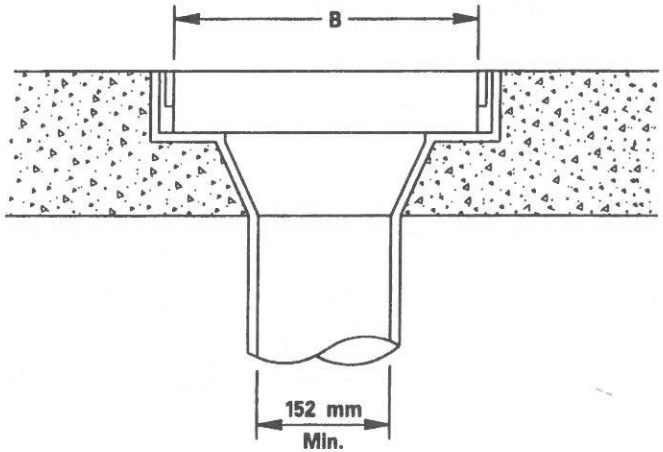
CAST IRON BRIDGE DRAIN

AASHTO–AGC–ARTBA
TF–13 DRAWING

DHD–12–96



PLAN



SECTION A-A

SPECIFICATIONS

Cast Gray Iron:

ASTM A 48 (AASHTO M 105 & M 306)
Class 30B or 35B

BASIS OF SPECIFYING

Item description.
Base metal (i.e. Gray Iron) and class.

Size.

Grate type. (See DHD-6-96 for grates that may be available).

USES

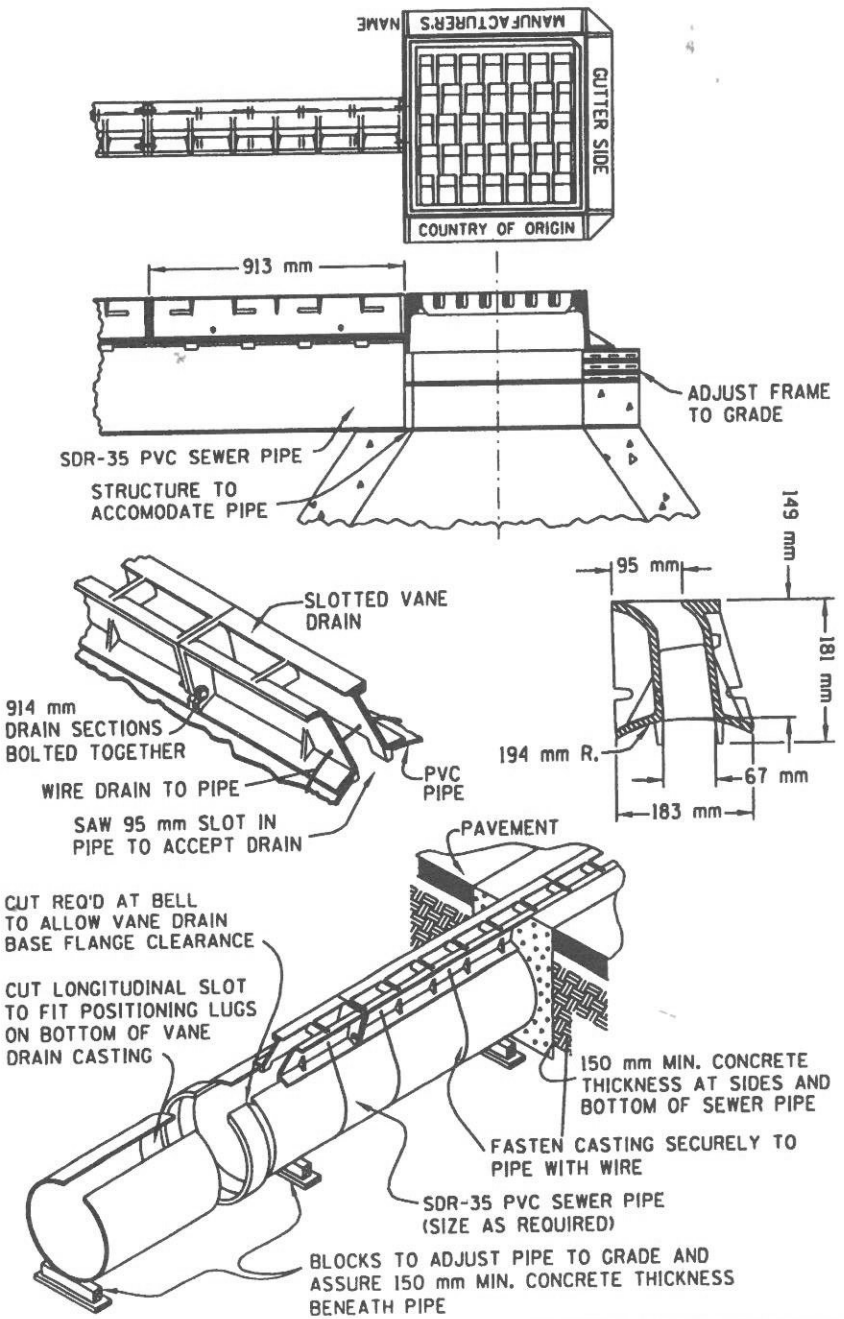
For bridge deck.

A	B
229 mm	305 mm
330 mm	330 mm
381 mm	406 mm
406 mm	610 mm

CAST IRON BRIDGE DRAIN

AASHTO-AGC-ARTBA
TF-13 DRAWING

DHD-13-96



SPECIFICATIONS

Cast Gray Iron:

ASTM A 48 (AASHTO M 105 & M 306)
Class 35B

EFFICIENCY

The slotted vane drain removes sheet flow at a rate of 46.45 L /sec per lineal meter of drain for longitudinal slopes of 0% to 6%.

USES

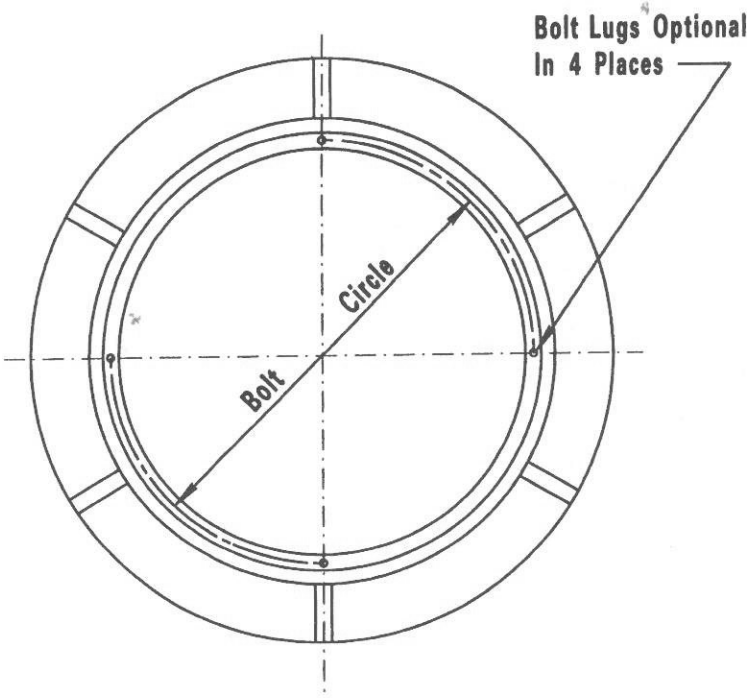
The slotted vane drain is installed perpendicular to the flow either as a free-standing unit or ideally extending from a gutter inlet frame and grate into the street. It is intended to maximize flow capture at specific inlet locations, thereby increasing efficiency of individual inlets and reducing the number of structures required downstream.

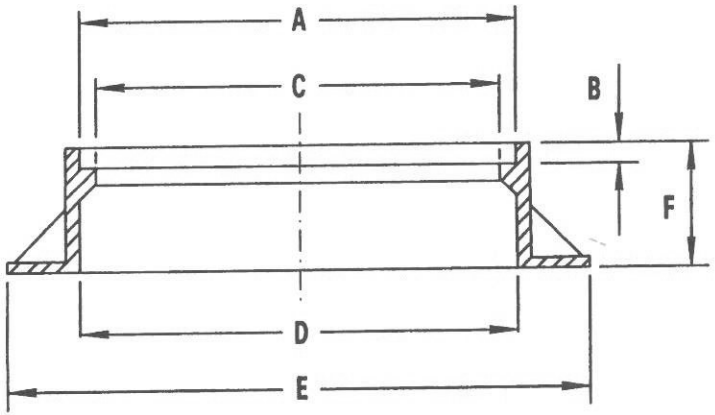
SLOTTED VANE DRAIN

AASHTO-AGC-ARTBA TF-13 DRAWING

DHD-14-96

SECTION DHMF—MANHOLE FRAMES





SPECIFICATIONS

CAST GRAY IRON: ASTM A 48 (AASHTO M 105 & M 306)

CLASS 30 B
CLASS 35 B

BASIS OF SPECIFYING

Item description
Style or type
Size
Base Metal (i.e. Gray Iron) and Class.
Machined bearing surface

USE

Use with Style 1 & 2 lids (DHML-1, DHML-2)
Sanitary and storm drain manhole access.

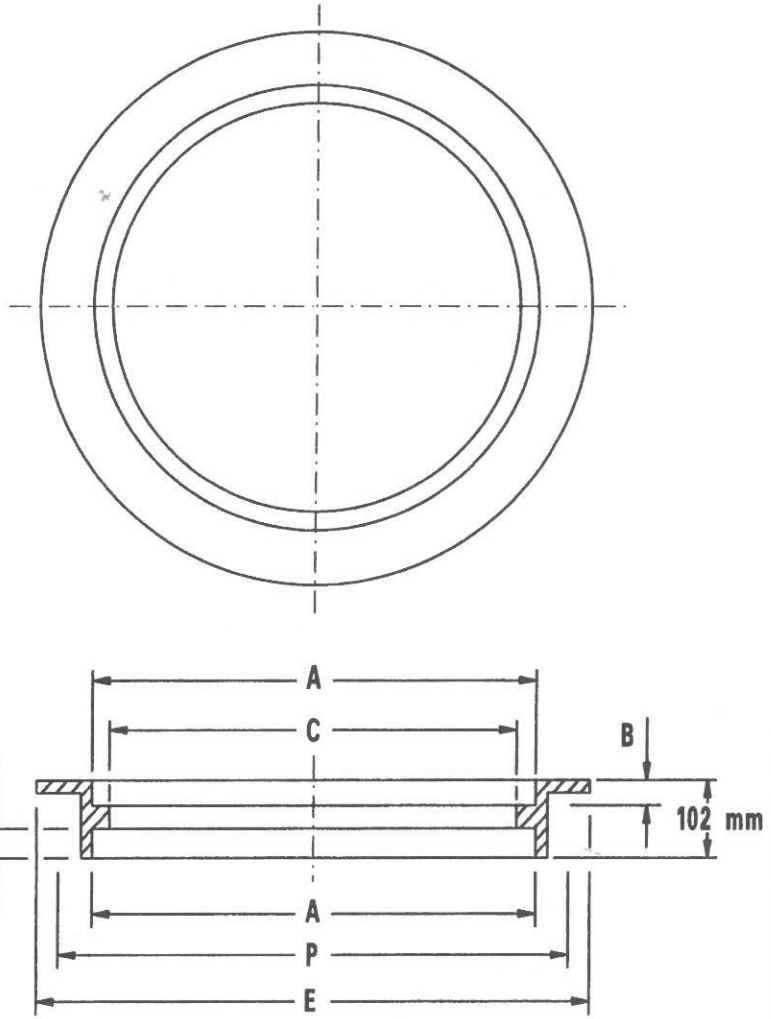
A	B	C	D	E	F
610	38 to 44	533		864	152 to 229
670	38 to 44	610		914	152 to 229
813	38 to 44	762		991	152 to 229

NOTE: All dimensions shown are in millimeters.

STYLE "A" FRAME

AASHTO-AGC-ARTBA
TF-13 DRAWING

DHMF-1-96



SPECIFICATIONS

CAST GRAY IRON: ASTM A 48 (AASHTO M 105 & M 306)

CLASS 30 B
CLASS 35 B

BASIS OF SPECIFYING

Item description
Style or type
Size
Base Metal (i.e. Gray Iron) and Class.
May be ordered reversible – Bearing surface(s) to be machined as specified.

USE

Use with Style 1 & 2 lids (DHML–1, DHML–2)
Sanitary and storm drain drain manhole access.
May be used for access to pipe sections of precast manholes.

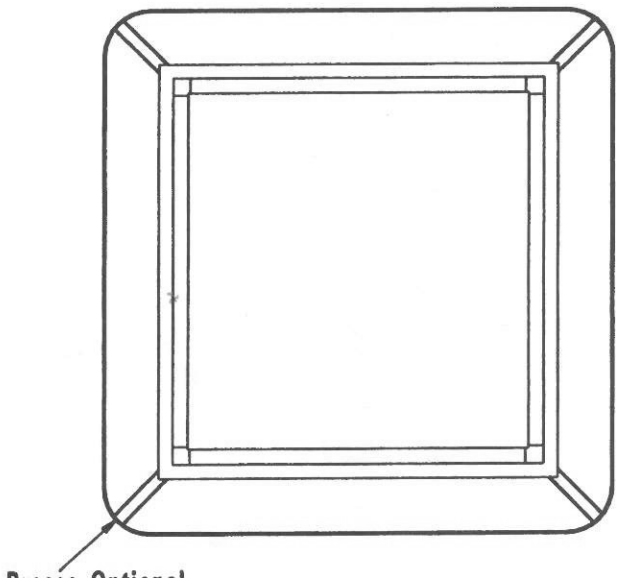
A	B	C	E	P*
419	38	368	521	457
473	38	419	572	508
575	38	521	673	610
651	38	597	749	686
727	38	673	823	762
879	38	826	978	914
1026	38	978	1130	1067
1175	38	1130	1283	1219
*P dimension is pipe size				

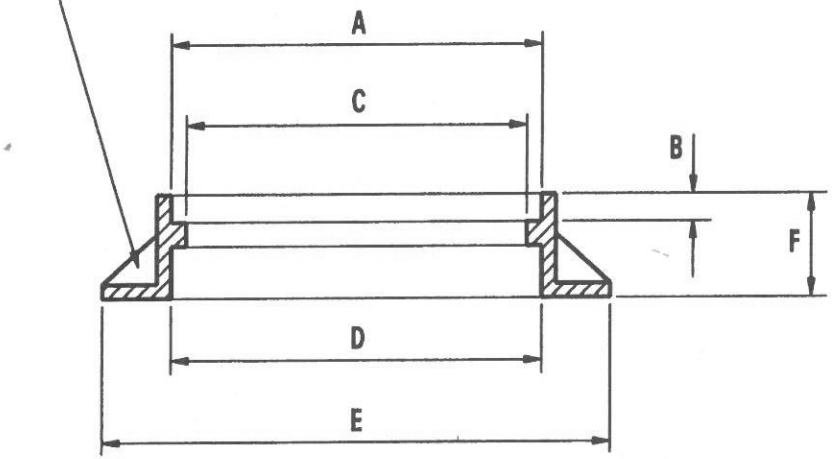
NOTE: All dimensions shown are in millimeters.

STYLE "B" FRAME

AASHTO–AGC–ARTBA
TF–13 DRAWING

DHMF–2–96





NOTE: All dimensions shown are in millimeters unless otherwise noted.

SPECIFICATIONS

CAST GRAY IRON: ASTM A 48 (AASHTO M 105 & M 306)

CLASS 30 B
CLASS 35 B

BASIS OF SPECIFYING

Item description
Style or type
Size
Base Metal (i.e. Gray Iron) and Class.

USE

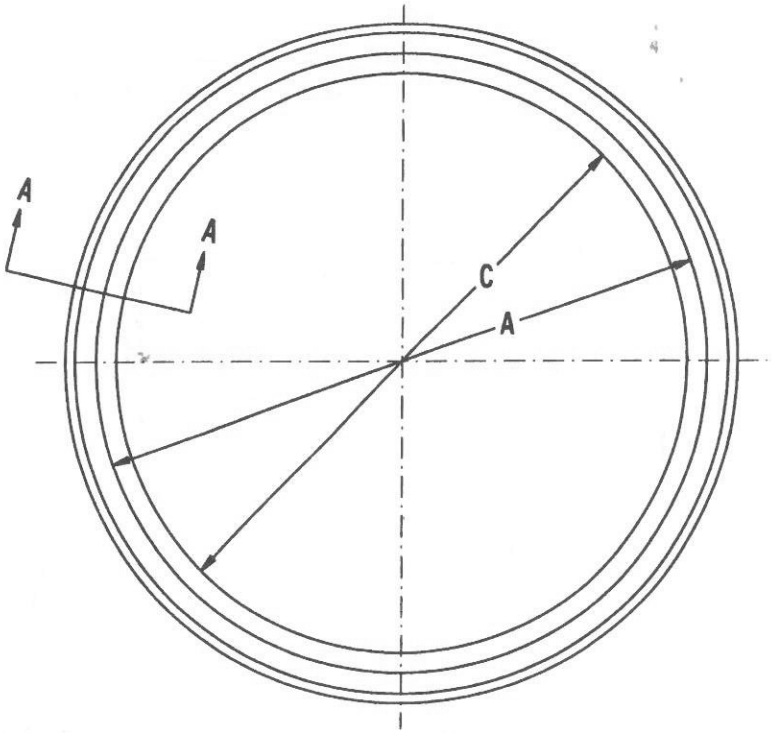
Electrical and drainage manhole access.

A	B	C	D	E	F
359 Sq.	38	305 Sq.	359 Sq.	457 Sq.	102
518 Sq.	38	457 Sq.	518 Sq.	610 Sq.	102
613 Sq.	38	559 Sq.	613 Sq.	711 Sq.	102
708 Sq.	38	660 Sq.	708 Sq.	813 Sq.	102
816 Sq.	38	762 Sq.	816 Sq.	914 Sq.	102
949 Sq.	38	914 Sq.	949 Sq.	1067 Sq.	102

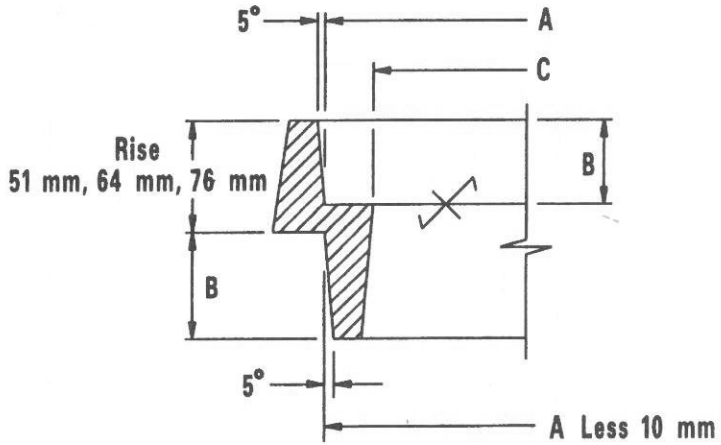
STYLE "D" FRAME

AASHTO–AGC–ARTBA
TF–13 DRAWING

DHMF–3–96



PLAN VIEW



SECTION A-A

SPECIFICATIONS

CAST GRAY IRON: ASTM A 48 (AASHTO M 105 & M 306)

CLASS 30 B
CLASS 35 B

BASIS OF SPECIFYING

Item description
Style or type
Size
Base Metal (i.e. Gray Iron) and Class.
Machined bearing surface

USE

To raise top of manhole frame. (DHMF-1, DHMF-2)
Use with styles A & B Frames

Propriety products available for adjusting diameter and height. Consult manufacturers catalogs.

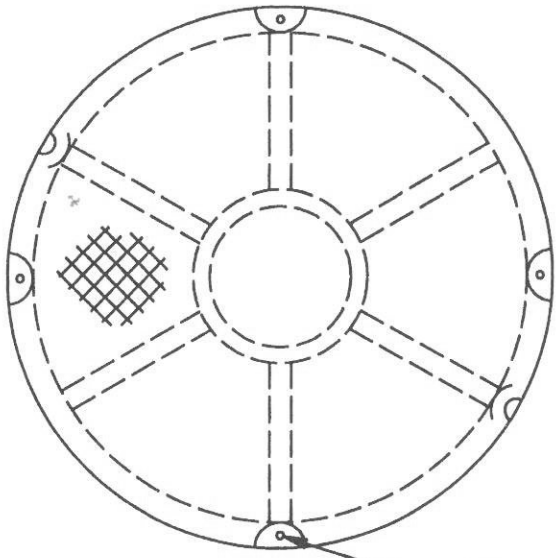
FRAME ADJUSTING RING

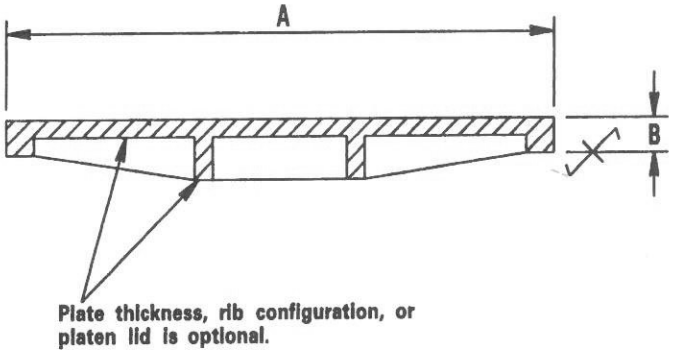
AASHTO-AGC-ARTBA
TF-13 DRAWING

DHMF-4-96

SECTION DHML—MANHOLE LIDS

ROADWAY TYPE





SPECIFICATIONS

CAST GRAY IRON: ASTM A 48 (AASHO M 105 & M 306)

CLASS 30 B
CLASS 35 B

BASIS OF SPECIFYING

Item description
Style or type
Size
Base Metal (i.e., Gray Iron) and class,
Lid surface design DHML-7
Lifting method DHML-5
Locking device DHML-6
Gasket if necessary
Machined bearing surface

Sanitary or storm manhole cover (DHMF–1, DHMF–2)
Use with Style A & B Frames,
Heavy duty for roadway traffic.

A	B
578	38 to 44
660	38 to 44
806	38 to 44

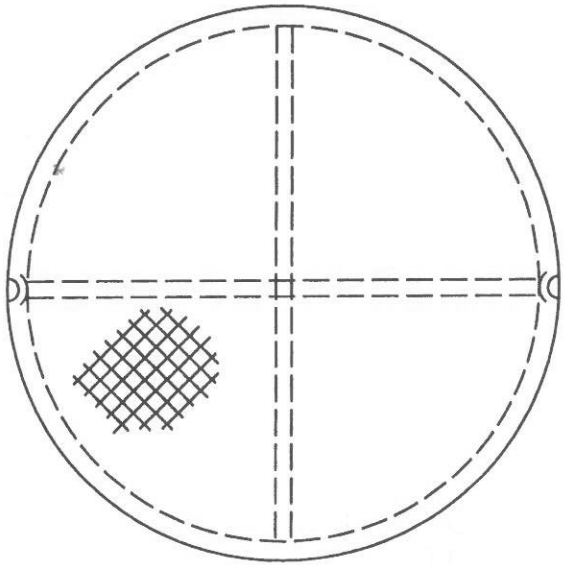
NOTE: All dimensions shown are in millimeters.

STYLE 1 LID

AASHTO–AGC–ARTBA
TF–13 DRAWING

DHML–1–96

SIDEWALK TYPE



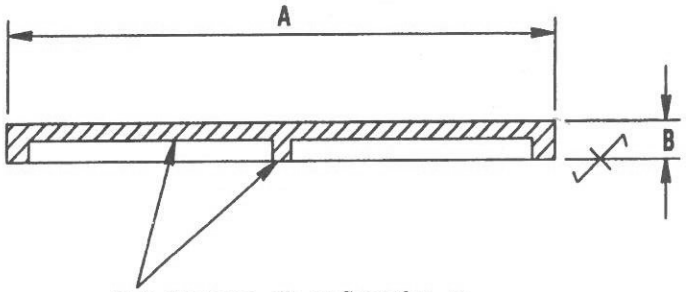


Plate thickness, rib configuration, or platen lid is optional.

SPECIFICATIONS

CAST GRAY IRON: ASTM A 48 (AASHO M 105 & M 306)

CLASS 30 B
CLASS 35 B

BASIS OF SPECIFYING

Item description
Style or type
Size
Base Metal (i.e., Gray Iron) and class,
Lid surface design DHML-7
Lifting method DHML-5
Locking device DHML-6
Gasket if necessary
Machined bearing surface

Pull box or clean-out lid

Use with Style A & B Frames. (DHMF-1, DHMF-2)

Lightweight for pedestrian traffic only,

A	B
406	38
457	38
559	38
635	38
711	38
863	38
1016	38
1165	38

NOTE: All dimensions shown are in millimeters.

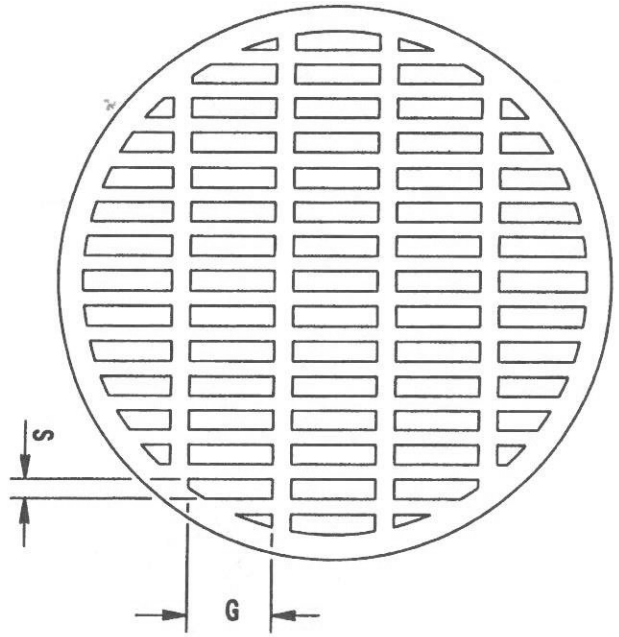
STYLE 2 LID

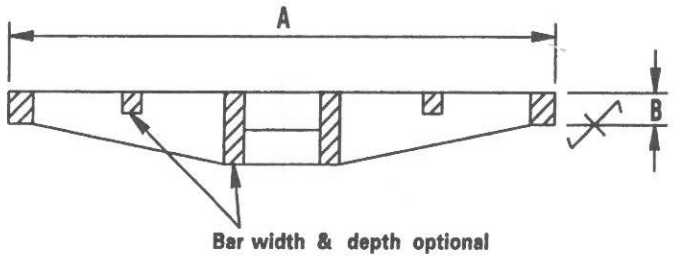
AASHTO-AGC-ARTBA
TF-13 DRAWING

DHML-2-96

STYLE 4 OPEN LID
ROADWAY TYPE

STYLE 5 OPEN LID
SIDEWALK TYPE





Bar width & depth optional

SPECIFICATIONS

CAST GRAY IRON: ASTM A 48 (AASHO M 105 & M 306)

CLASS 30 B
CLASS 35 B

BASIS OF SPECIFYING

Item description
Style or type
Size
Base Metal (i.e., Gray Iron) and class,
Surface configuration
Machined bearing surface
Lid surface design DHML-8

USE

Style 4 Lid – Roadway Type : Area drainage, Parking lots.
Style 5 Lid – Sidewalk Type : Mail and Alley drainage.

Use with Styles A & B Frames DHMF–1, DHMF–2

A	B	S	G
559	38	25 Max	229 Max
584	38	25 Max	229 Max
610	38	25 Max	229 Max
660	38	25 Max	229 Max
737	35		
813	38		
1016	38		
1165	38		

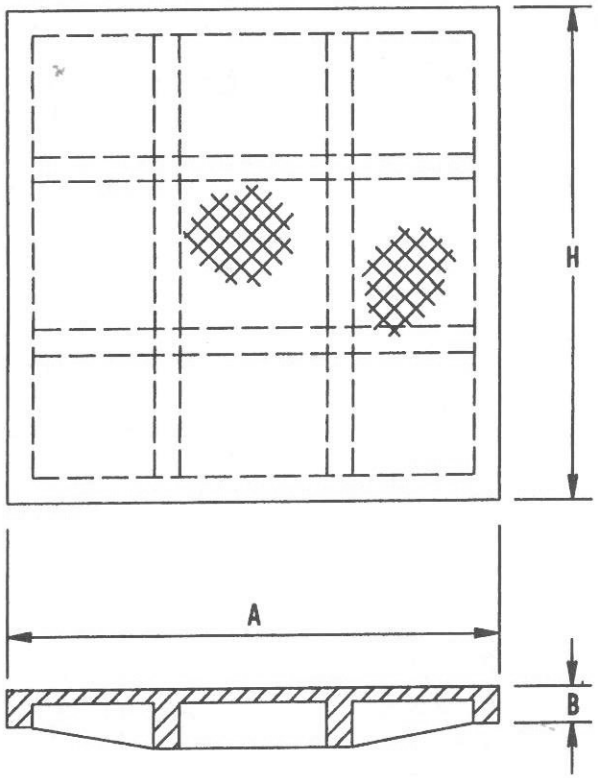
NOTE: All dimensions shown are in millimeters.

STYLE 4 & 5 LIDS

AASHTO–AGC–ARTBA
TF–13 DRAWING

DHML–3–96

ROADWAY TYPE



SPECIFICATIONS

CAST GRAY IRON: ASTM A 48 (AASHO M 105 & M 306)

CLASS 30 B
CLASS 35 B

BASIS OF SPECIFYING

Item description
Style or type
Size
Base Metal (i.e., Gray Iron) and class,
Lid surface design DHML-7
Lifting method DHML-5
Locking device DHML-6
Gasket if necessary

USE

Electrical and drainage manhole lid.

Use with Style D Frame DHMF–4

A	H	B
349	349	38
508	508	38
603	603	38
699	699	38
806	806	38
940	940	38

NOTE: All dimensions shown are in millimeters.

STYLE 6 LID

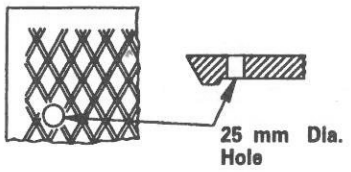
AASHTO–AGC–ARTBA TF–13 DRAWING

DHML–4–96

THROUGH THE LID

ROUND HOLE

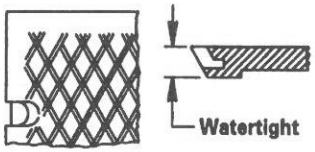
TOP SECTION



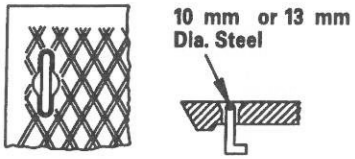
IN THE LID

CONCEALED

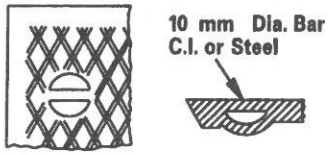
TOP SECTION



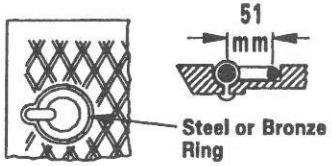
TOP SECTION



TOP SECTION



TOP SECTION



TOP SECTION

SPECIFICATIONS

As required or furnished with the lid.

BASIS OF SPECIFYING

Specify type as required.
Consult manufacturer catalogs for availability of each type for specific lids.

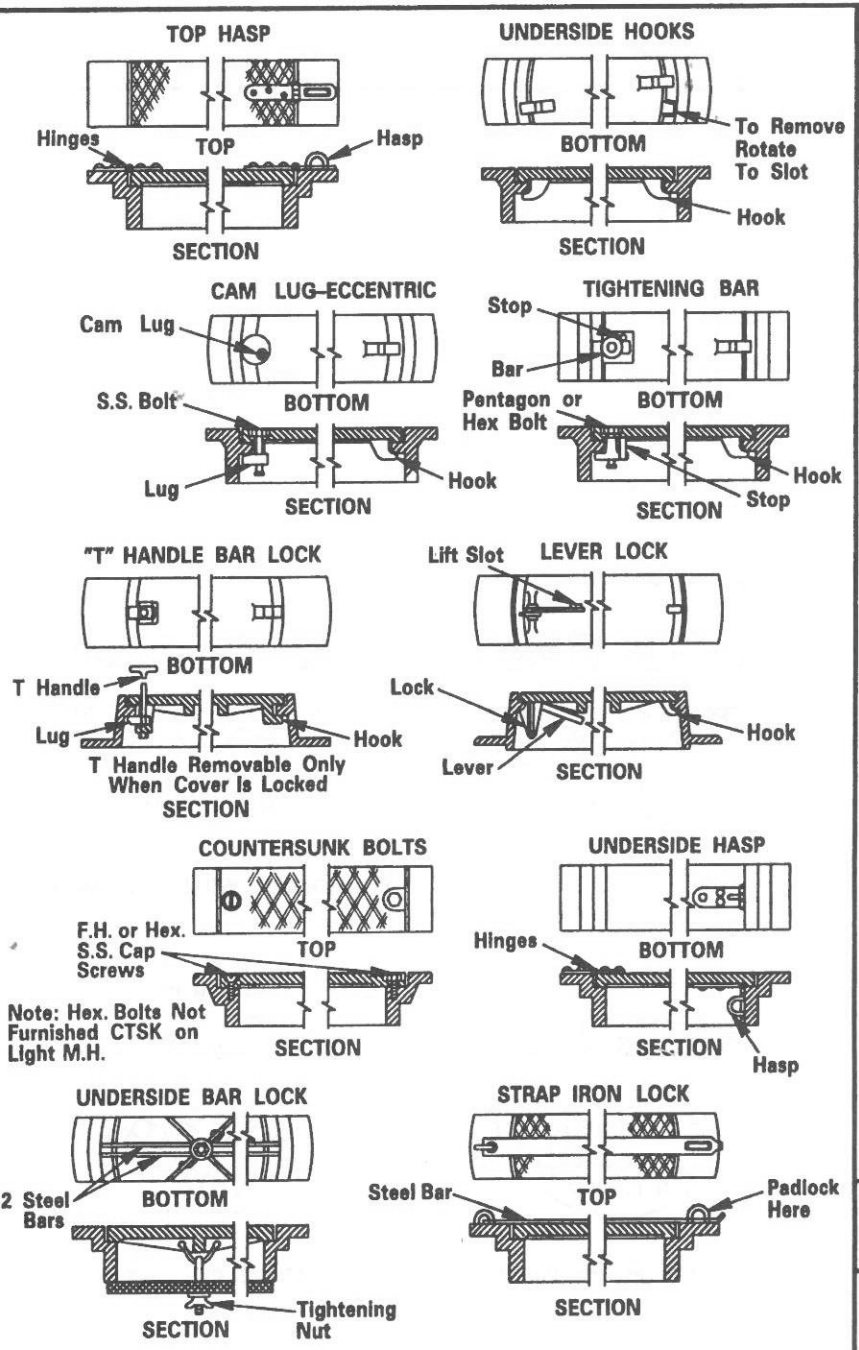
USE

Lifting of lids from frames.

LID LIFTING DEVICES

AASHTO–AGC–ARTBA
TF–13 DRAWING

DHML–5–96



SPECIFICATIONS

As required or furnished with the lid and frame.

BASIS OF SPECIFYING

Specify type as required.
Consult manufacturers catalogs for availability of each type for specific lids and frames.

USE

Prevent lids from being removed by unauthorized personnel.

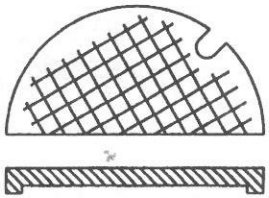
To provide anchorage under traffic.

LID LOCKING DEVICES

AASHTO-AGC-ARTBA TF-13 DRAWING

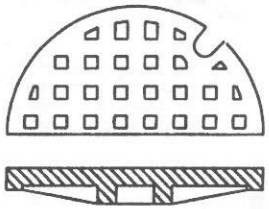
DHML-6-96

PLATEN LID DESIGN

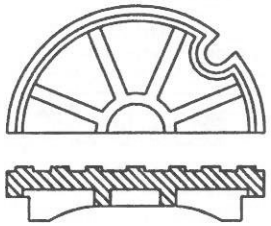


No Ribbing

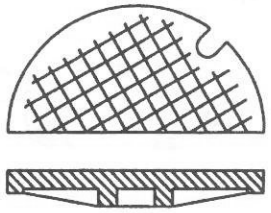
INDENTED TOP DESIGN



SHOWING BOTTOM REINFORCING



CHECKERED TOP DESIGN



SPECIFICATIONS

CAST GRAY IRON: ASTM A 48 (AASHTO M 105 & M 306)

CLASS 30 B
CLASS 35 B

BASIS OF SPECIFYING

Lid style required.
May also include custom names and designs.
Consult manufacturer catalogs for availability of styles.

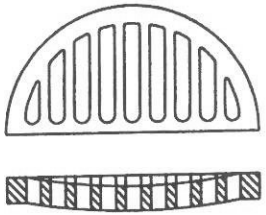
USE

Lids for manhole access frames.

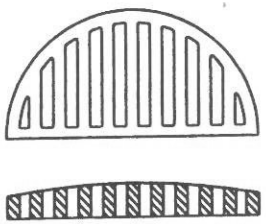
SELECTED SOLID LID STYLES

AASHTO-AGC-ARTBA
TF-13 DRAWING

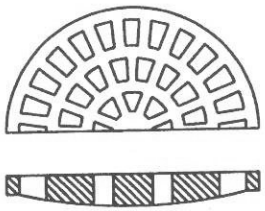
DHML-7-96



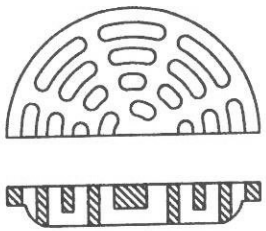
STANDARD CONCAVE



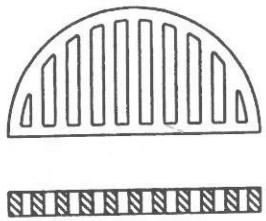
STANDARD CONVEX



STANDARD RADIAL



STANDARD FLAT



STANDARD FLAT

SPECIFICATIONS

CAST GRAY IRON: ASTM A 48 (AASHTO M 105 & M 306)

CLASS 30 B
CLASS 35 B

BASIS OF SPECIFYING

Lid style required.
Consult manufacturers catalogs for availability of styles.

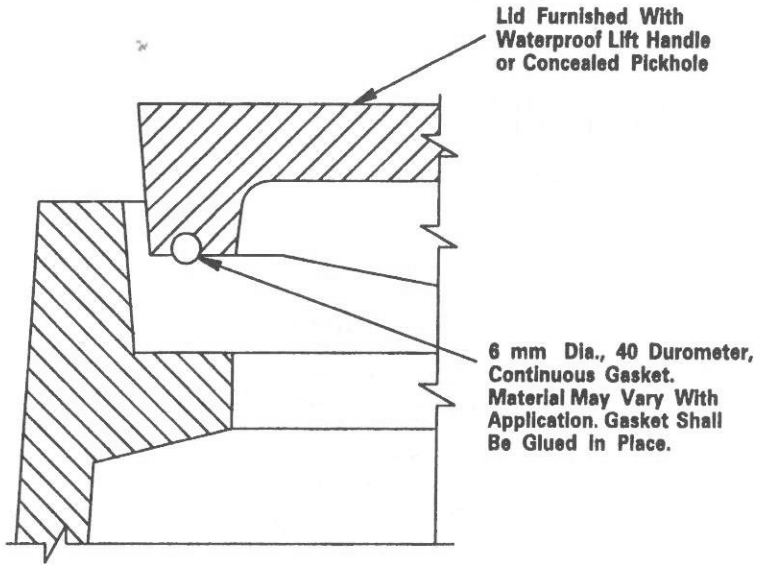
USE

Lids for manhole access frames.
Catch Basin lid.

SELECTED GRATE LID STYLES

AASHTO–AGC–ARTBA
TF–13 DRAWING

DHML–8–96



SPECIFICATIONS

Sealing system gasket to be 6.22 mm diameter, 40 durometer continuous gasket. Material may vary with application, consult with manufacturer.

BASIS OF SPECIFYING

Specify Gasket sealed lid.

USE

Gasket sealing system is used for sealing lid to prevent surface water inflow without bolting.

Gasket sealing system used on Style 1 and 2 lids DHML-1, DHML-2.

GASKET SEALING SYSTEM FOR LIDS

AASHTO-AGC-ARTBA
TF-13 DRAWING

DHML-9-96

SECTION DHMS—MANHOLE STEPS

Guidelines for Specifying:

1. Steps may be cast iron, aluminum alloy or polypropylene-coated reinforcing steel. A specific type may be specified if desired.

2. The minimum width of rungs or cleats shall be 254 mm, and rungs of cleats shall be shaped to prevent the foot from slipping off the side. A slip-resistant surface shall be provided on the rung by a means of grooves, scores, grit, etc.

3. Steps shall project a minimum of 102 mm from the wall at the point of embedment. Steps shall be embedded a minimum of 76 mm. The portion embedded in the wall shall have a configuration such that it will prevent pull out.

4. Steps shall be spaced vertically a maximum distance of 400 mm.

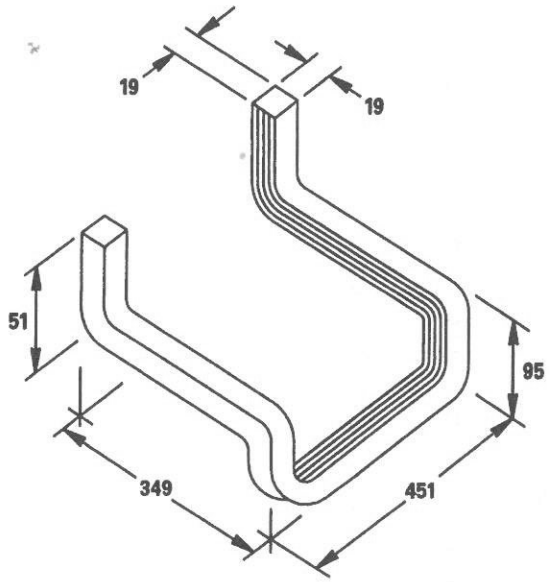
5. Steps shall have properties such that they will withstand a single concentrated load of 136 kg without distortion.

6. Metal steps shall be coated with asphalt or an approved mastic when subjected to chlorides or other detrimental environments.

7. Dimensional tolerances are intended to be consistent with the function of the part, appearance and accepted manufacturing practices.

8. Dimension lines are shown to indicate those dimensions which may be secured from the manufacturer of the specific item.

9. Aluminum steps must be coated when in contact with concrete.



NOTE: All dimensions shown are in millimeters.

SPECIFICATIONS

Extruded Aluminum: ASTM B 221M, Alloy 6005–T5 or 6061–T6.

The manhole steps shall be extruded and cold–formed to the required shape. They must be coated when in contact with concrete.

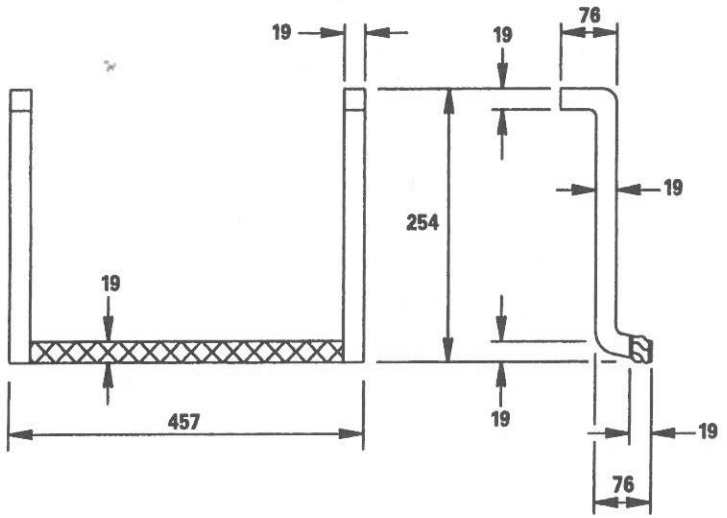
USE

Steps for manhole and drop inlet access. Rungs can be set into precast concrete, mortared into brick structures or cemented in place wherever needed.

EXTRUDED ALUMINUM MANHOLE STEP

AASHTO–AGC–ARTBA
TF–13 DRAWING

DHMS–1–96



NOTE: All dimensions shown are in millimeters.

SPECIFICATIONS

Cast Aluminum: ASTM B 26M, Alloy 356.0–T6

Cast Gray Iron: ASTM A 48
ASHTO M 105
Class 30B or 35B

Cast Ductile Iron: Grade 65–45–12

USES

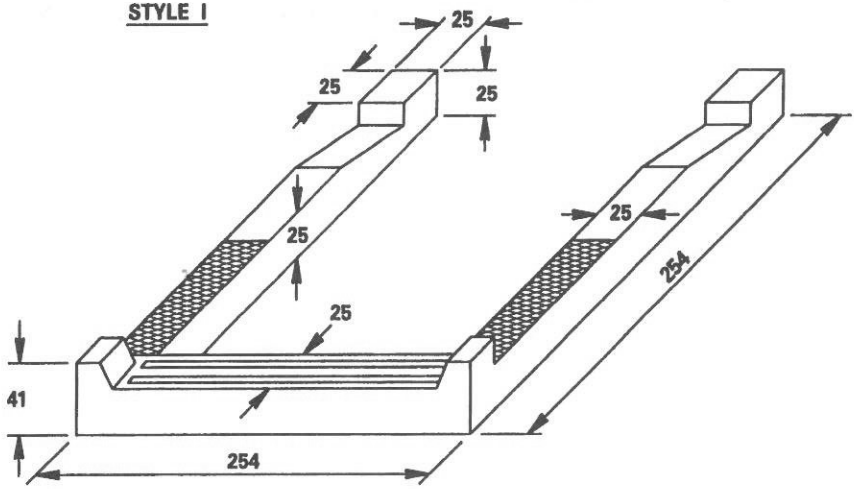
Steps for manhole and drop inlet access. Rungs can be set into precast concrete, mortared into brick structures or cemented in place wherever needed.

CAST METAL MANHOLE STEP

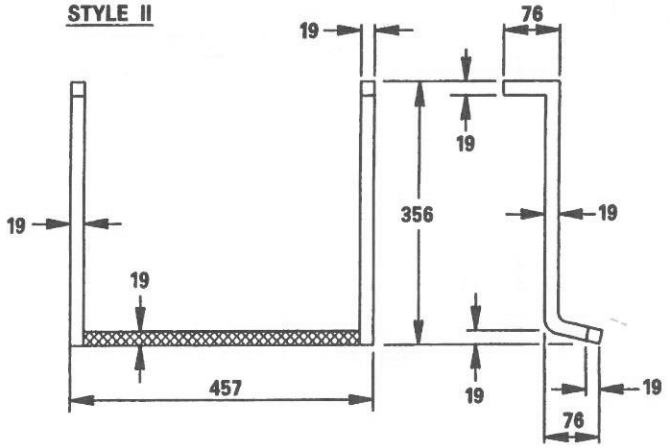
AASHTO–AGC–ARTBA
TF–13 DRAWING

DHMS–2–96

STYLE I



STYLE II



NOTE: All dimensions shown are in millimeters.

SPECIFICATIONS

STYLE I

Cast Ductile Iron: ASTM A 536, Grade 65–45–12

Cast Gray Iron: ASTM A 48, Class 35B

STYLE II

Cast Ductile Iron: ASTM A 536, Grade 65–45–12

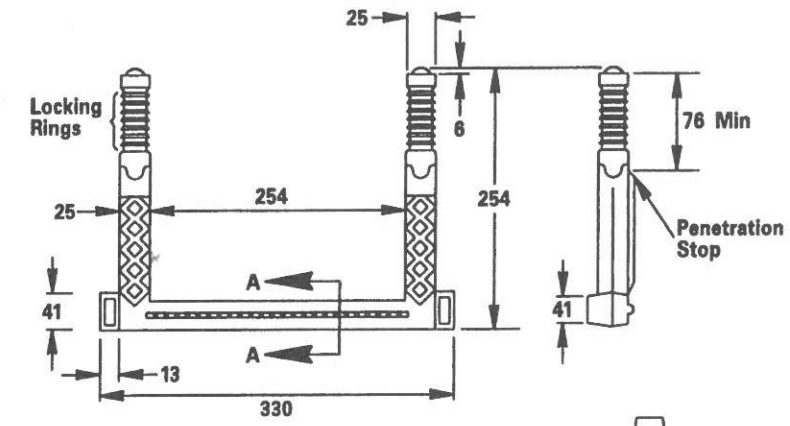
USE

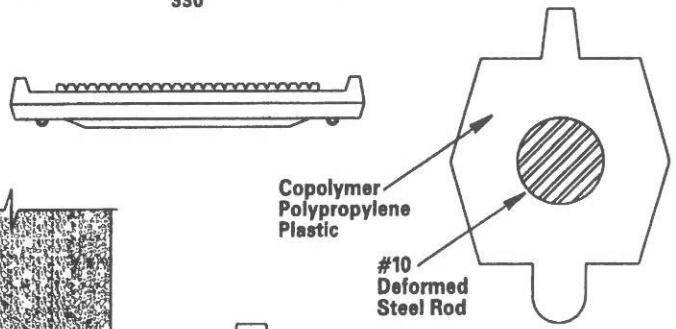
Steps for manhole and drop inlet access. Rungs can be set into precast concrete, mortared into brick structures or cemented in place wherever needed.

CAST IRON MANHOLE STEP

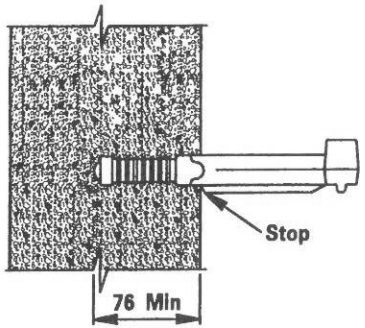
AASHTO–AGC–ARTBA
TF–13 DRAWING

DHMS–3–96





SECTION A-A



PENETRATION

NOTE: All dimensions shown are in millimeters.

SPECIFICATIONS

Plastic:

ASTM D 2146, Type II,
Grade 16906

Steel Reinforcing Bar:

ASTM D 615M, Grade 60

In cold climates Plastics meeting ASTM D4101 is recommended.

USE

Steps for manhole and drop inlet access. Rungs can be set into precast concrete, mortared into brick structures or cemented in place wherever needed.

Plastic coated steel steps may be proprietary.

PLASTIC – STEEL REINFORCED MANHOLE STEP

AASHTO–AGC–ARTBA
TF–13 DRAWING

DHMS–4–96