August 2015

To all holders of standard details:

The attached is an assembly of standard detail drawings to be used for all storm and sanitary sewer construction done under the jurisdiction of the City and County of Denver, Department of Public Works. These standards are to be used in conjunction with the technical specifications and the established ordinances of the City and County of Denver and in case of conflict, the technical specifications which are to be used in conjunction with these standards shall govern.

In general, these drawings are updated from time to time and the user is responsible for obtaining updated or revised standards. The City shall not be held liable for use of outdated standards by the contractor, consultant, developer, or engineer.
STORM CONNECTOR PIPE CLOSURE DETAIL

(To be used where necessary and as authorized by the city engineer.)

GENERAL NOTES

1. A CONCRETE COLLAR IS REQUIRED WHERE THE CHANGE IN GRADE EXCEEDS 0.10 OF A FOOT PER FOOT.

2. GAP LIMITS
   - PIPE DIAMETER
   - COLUMN "A" (SEE A BELOW)
   - COLUMN "B" (SEE B BELOW)

   A. IF THE "EXTREME OUTER ENDS" OF THE PIPE LEAVE A GAP THAT EXCEEDS VALUES IN COLUMN "A" OR COLUMN "B", A CONCRETE COLLAR IS REQUIRED.
   B. IF THE GAP EXCEEDS 6 INCHES, A MANHOLE STRUCTURE IS REQUIRED.

3. CONCRETE COLLAR SHALL NOT BE USED FOR A SIZE CHANGE ON THE MAIN LINE.

4. FOR PIPE SIZE NOT LISTED USE NEXT SIZE LARGER.

5. WHERE REINFORCING IS REQUIRED THE DIAMETER OF THE CIRCULAR TIES SHALL BE D / 2 [where thickness = 1].

6. REINFORCING SHALL BE USED WHERE THE SPACES BETWEEN THE EXTREME OUTER ENDS IS 2 1/2" OR LARGER.

   CIRCULAR TIES
   - PIPE DIAMETER
   - SPACE BETWEEN EXTREME OUTER ENDS
   - NO. OF CIRCULAR TIES

   WHERE THE SPACE BETWEEN PIPE LONGITUDINAL ENDS EXCEEDS 2 1/2", THE NUMBER OF CIRCULAR TIES SHALL BE INCREASED TO MAINTAIN AN APPROXIMATE SPACING OF 6" OC.

7. AN INTERIOR FORM OF UNSEALED SONO-TUBE OR EQUAL SHALL BE USED TO PRODUCE A SMOOTH INTERIOR JOINT. THE PAPER FORM MAY BE LEFT IN PLACE (SEE DETAIL A).

8. THIS DETAIL APPLIES "ONLY" TO PIPE 21" DIAMETER OR LESS, 24" AND LARGER TO BE DESIGNED BY ENGINEER AND APPROVED BY CITY ENGINEER.
SHIPLAP JOINTS FOR REINFORCED CONCRETE M.H. SECTIONS
NO SCALE

NOTES:
1. T = WALL THICKNESS OF PIPE FURNISHED.
2. THE CONTRACTOR SHALL SUBMIT ALL TOLERANCES AND DIMENSIONS, REQUIRED BY THE SPECIFIC PIPE JOINT DETAILS SHOWN, TO THE ENGINEER PRIOR TO FABRICATION.
3. ALL DIMENSIONS SHALL BE GIVEN IN INCHES, UNLESS OTHERWISE NOTED, AND ARE FOR BELL AND SPIGOT IN CONCENTRIC POSITION. REFLECTED PIPE JOINT TOLERANCES & DIMENSIONS SHALL ALSO BE FURNISHED.
4. JOINT CLEARANCE DIMENSION K IS AT CLOSEST POINT WITHIN DISTANCE A.
5. THESE JOINT CONFIGURATIONS ARE IN ACCORDANCE WITH BUREAU OF RECLAMATIONS "TYPE A" JOINT DETAILS.
6. RUBBER "O" RING GASKET SHALL BE IN CONFORMANCE W/ASTM C-443 OR C-361.
7. APPLICABLE CONCRETE PIP/JOINT SPECIFICATIONS:
   A. ASTM C-78
   B. ASTM C-361
8. STEEL REINFORCEMENT SHALL BE IN ACCORDANCE WITH THE APPROPRIATE ASTM SPECIFICATION FOR THE PIPE SIZE AND STRENGTH CLASS AS SPECIFIED ON PLAN/PROFILE DRAWINGS.
9. NO CONNECTION TO GO THROUGH JOINT WITHOUT PRIOR CITY ENGINEER APPROVAL.

SPIGOT GROOVE DETAIL
TYPICAL FOR JOINT R-4
NO SCALE

JOINT TYPE R-2
NO SCALE

JOINT TYPE R-4
NO SCALE
**NOTES:**

1. **Manhole Barrel:** Minimum diameter shall conform to Table 1.
2. Grouted flow channels and inverts may be formed by shaping with lean concrete (f = 2000 psi min).
3. Manhole sides shall conform to Division Standards and Specifications (S-780).
4. Manhole barrel section to be filled with approved flexible plastic sealing compound (type C).
5. Stub-out shall extend 2'-0" max from manhole O.D. and be factory plugged.
6. Reinforcement is required for all manhole bases.
7. Slope manhole bench 1/2" per foot at minimum.
8. Slope manhole invert 2'-0" per foot at maximum.
9. Shaped invert manhole for sanitary sewer, if needed, an outside drop manhole is required (S-593).
10. Shaped invert manhole base shall have full invert at manhole base to conform to Division Standards and Specifications (S-401).
11. Cast-in-place manhole base shall be placed on surface, subgrade material shall be prepared and stabilized with an acceptable granular material, compacted to 80% of maximum dry density in accordance with ASTM D698.
12. All manholes shall be constructed with an approved flexible wedge-type gasket conforming to ASTM C-443 which shall be capable of providing a water tight joint with zero leakage around the installed pipe and concrete pipe without water stop gasket for storm sewer. The use of the gasket is optional as per City Engineer's decision.
13. Precast manhole sections, cones, bases, etc. shall conform to ASTM C-478, latest revision.

**SECTION:**

**CAST-IN-PLACE MANHOLE BASE**

**PLACE CONCRETE FILL AFTER BASE HAS BEEN INSTALLED.

**TABLE 1**

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**SECTION**

**PRECAST MANHOLE BASE**

**BOOT TYPE ALTERNATIVE**

**TABLE 2**

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**SECTION**

**PRECAST MANHOLE BASE NOTES:**

1. The base slab shall be poured monolithically with bottom side section.
2. Precast manhole bases shall be installed in accordance with Division Standards and Specifications (S-101).
3. The base slab shall be compacted and stabilized with an acceptable granular material, compacted to 80% of maximum dry density in accordance with ASTM D698.
4. All manholes shall be constructed with an approved flexible wedge-type gasket conforming to ASTM C-443 which shall be capable of providing a water tight joint with zero leakage around the installed pipe and concrete pipe without water stop gasket for storm sewer. The use of the gasket is optional as per City Engineer's decision.
5. Precast manhole bases are to be seated on an approved granular bedding material as detailed.
NOTES:
1. DETAILS SHOWN ARE TYPICAL ONLY FOR INSTALLATIONS WITH ALL INVERTS AT SAME RELATIVE ELEVATION.
2. FOR EXCESSIVE ELEVATION DIFFERENCE BETWEEN INVERTS, ETC. SPECIAL BASE/CHANNEL DETAILS SHALL BE SHOWN ON PLANS.
3. CHANNELIZATION DETAILS & STEP PLACEMENT TYPICAL FOR BOTH STORM AND SANITARY SEWER HIPS.
4. THE MINIMUM VERTICAL DROP THRU MANHOLE BASE SHALL BE 0.10 FOOT FOR STORM SEwers AND 0.2 FOOT FOR SANITARY SEWER.
5. FOR VERTICAL DROPS IN EXCESS OF 18", AN OUTSIDE DROP MANHOLE IS REQUIRED.
GENERAL NOTES:
1. ALL PIPE AND FITTINGS TO BE ASTM AND CITY APPROVED.
2. FOR PAYMENT PURPOSES, ALL FITTINGS, PIPE, CONCRETE ENCASTEMENT SHALL BE INCLUDED IN THE UNIT PRICE OF THE OUTSIDE DROP.
3. DIAMETER OF THE PIPE SHALL NOT BE LESS THAN MAIN LINE PIPE DIAMETER.
4. FOR 18" DIAMETER AND LARGER, OUTSIDE DROP SHALL BE A STANDARD DESIGN.
5. THE APPROPRIATE MH SEAL ADAPTOR OR CONNECTOR SHALL BE USED FOR THE SPECIFIED PIPE MATERIAL, AND SHALL BE IMPO APPROVED.
6. OUTSIDE DROP SHALL BE ALL OF ONE MATERIAL.
7. CONCRETE ENCASTEMENT SHALL BE A MINIMUM OF 6" THICK ALL AROUND.
8. PIPE DIMENSIONS ARE APPROXIMATE AND MAY VARY FROM ONE MANUFACTURER TO ANOTHER.
9. ALL REQUIRED WALL OPENINGS SHALL BE PRECAST BLOCK-OUTS OR CORE DRILLED. JACK HAMMERING OF OPENINGS IS NOT ALLOWED.

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<th>Dimensions (Nominal)</th>
<th>A (Inches)</th>
<th>B (Inches)</th>
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**PVC:**
- Pipe Diameter (Inches): 42, 47, 50, 51
- \(Y\) (Inches): 31, 37, 39, 50
- \(Z\) (Inches): 18, 16, 22, 20

A MANHOLE OUTSIDE DROP IS NOT FEASIBLE FOR A DROP OF LESS THAN 18". THE ABOVE DIMENSIONS INDICATE ONLY THE MINIMUM DROP OBTAINABLE WITH AVAILABLE FITTINGS AND MATERIAL. GREATER DROPS THAN THIS ARE POSSIBLE BY ADDITION OF THE APPROPRIATE PIPE LENGTH AT DIMENSION E.
MH WATER STOP GASKET

NOTES:
1. PLACE STOP ON PIPE NEAR CENTER OF MANHOLE WALL.
2. TIGHTEN STEEL BAND TO ENSURE POSITIVE SEAL AGAINST PIPE.
   OUTSIDE, A SCREWDRIVER MAY BE USED TO TAKE UP SLACK BUT
   A SOCKET WRENCH (3/16") IS PREFERRED TO ENSURE PROPER
   TIGHTNESS.

CAST-IN-PLACE MANHOLE CONNECTION DETAILS FOR DISSIMILAR PIPE
NO SCALE

DETAIL - FLEXIBLE RUBBER WEDGE TYPE GASKET
(DWMD APPROVED TYPE ONLY)
NO SCALE

NOTE:
1. ALL MATERIAL SPECIFICATIONS AND INSTALLATION REQUIREMENTS SHALL BE IN
   ACCORDANCE WITH THE STANDARD SPECIFICATIONS APPLICABLE TO THE
   PROJECT.

PRECAST MANHOLE CONNECTION DETAILS FOR ANY TYPE OF PIPE
NO SCALE
POLYPROPYLENE REINFORCED PLASTIC STEP

NOTES:

1. ASTM SPECIFICATIONS:
   1.1. ASTM D-4776
   1.2. ASTM A-685 GRADE 60 (STEEL REBAR).
   1.3. ASTM 2166-89, TYPE II, GRADE 16900 (POLYPROPYLENE).

2. STEPS INSTALLED IN MANHOLE BARREL SECTIONS OR SORVALL WALLS OF STRUCTURES SHALL HAVE A 0.197" INCH LEG AND SHALL PROJECT FROM THE WALL 8 INCHES.

3. STEPS INSTALLED IN MANHOLE CONE SECTIONS SHALL HAVE AN 8 1/4 INCH LEG AND SHALL PROJECT FROM THE WALL 5 3/8 INCHES.

4. ALL STEPS SHALL HAVE A PENETRATION DEPTH INTO THE WALL OF 3 3/8 INCHES.

5. STEPS SHALL BE INSTALLED BY THE "PRESS-FIT" METHOD UTILIZING A SPECIAL TAPERED PIN TO FORM THE INSERT HOLE AS SHOWN FOLLOWING MANUFACTURER'S RECOMMENDED PROCEDURE AND SHALL BE GRouted IN PLACE.

6. INSTALLED STEPS SHALL BE CAPABLE OF WITHSTANDING A PULL OUT FORCE OF 2500 LB PER LEG FOR A MINIMUM PERIOD OF TWO MINUTES.

7. PINS MUST BE SMOOTH AND CONTINUOUSLY TAPERED. DIMENSIONS OF THE PIN AND THE INSERTED PORTION OF THE MANHOLE STEP ARE TYPICAL ONLY. IMMEDIATE INSTALLATIONS REQUIRE A MATCHED COMBINATION OF A TAPERED INSERT PIN AND MANHOLE STEP, AS RECOMMENDED OR REQUIRED BY SPECIFIC MANUFACTURER OF THE STEP TO BE USED.

8. THIS STEP CAN ALSO BE USED IN TOE PKET INSTALLATIONS PROVIDED 5" TOE CLEARANCE IS ALLOWED.