**Type A**

**Plan**

- Tongue end on inlet end sections
- Groove end on outlet end sections

**Section X-X**

- Bar and steel mesh reinforcement

**End View**

**Type B**

**Plan**

- Tongue end on inlet end sections
- Groove end on outlet end sections

**Section X-X**

- Bar and steel mesh reinforcement

**End View**

---

### Table 1: Dimensions

| Dia | Slope | D | E | F *
|-----|-------|---|---|-----*
| 12 | 1:6 | 2'-0" | 15" | 2'-3"
| 15 | 1:6 | 2'-0" | 18" | 2'-3"
| 18 | 1:6 | 2'-0" | 24" | 3'-0"
| 24 | 1:6 | 2'-0" | 36" | 6'-0"

---

### Table 2: Details

- **LARGE DIAMETER PIPE**
- **TIE BOLT CONNECTION**
- **TIE BOLT DETAIL**

---

### Notes

- Tolerances in the adjacent tables may not vary more than ±1.5% for the dimensions shown. Otherwise, they must conform to AASHTO M 170.
- Values are in feet and inches. (See Tie Bolt Detail.)
- The bolts at each end are galvanized.
- Use two tie bolts on all flared end sections, one in each large diameter RCP flared end terminal prefabricated RCP by the Montana Department of Transportation, otherwise they must conform to AASHTO M 170.
### ROAD APPROACH CULVERT END TREATMENT

**QUANTITIES (FOR ESTIMATING ONLY)**

<table>
<thead>
<tr>
<th>DIA.</th>
<th>H PIPE LENGTH</th>
<th>M12 x 105 FERRULE LOOP INSERT (EACH)</th>
<th>LENGTH 63 DIA SCHEDULE 40 GALV. PIPE</th>
<th>DIMENSIONS (mm)</th>
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<tbody>
<tr>
<td>375</td>
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<td>~</td>
<td>~</td>
</tr>
<tr>
<td>450</td>
<td>1981</td>
<td>~</td>
<td>~</td>
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<tr>
<td>600</td>
<td>3048</td>
<td>10</td>
<td>3800</td>
<td>152</td>
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**DIMENSIONS (FT.)**

<table>
<thead>
<tr>
<th>DIA. A RCP</th>
<th>H PIPE LENGTH</th>
<th>F-64 1/2&quot; x 4 1/8&quot; FERRULE LOOP INSERT (EACH)</th>
<th>LENGTH 2 1/2&quot; DIA. SCHEDULE 40 GALV. PIPE</th>
<th>DIMENSIONS</th>
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**METRIC QUANTITIES (FOR ESTIMATING ONLY)**

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<td>10</td>
<td>3800</td>
<td>152</td>
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**PLAN VIEW**

- SCHEDULE 40 GALVANIZED STEEL PIPE (AS REQUIRED)

**SECTION A-A**

- GROOVE END ON OUTLET
- TONGUE END ON INLET
- SCHEDULE 40 GALVANIZED STEEL PIPE (AS REQUIRED)

**NOTE:**
- PAINT ALL NON-GALVANIZED PARTS PER SECTION 710.
- UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.

**DETAILED DRAWING**

- REFERENCE DWG. NO: 603-12
- STANDARD SPEC: MONTANA DEPARTMENT OF TRANSPORTATION 603,710,711

- RCP ROAD APPROACH CULVERT END TREATMENT (RACET)
NOTE:

1. PIPE TO HAVE ANNULAR CORRUGATION OR REROLLED ENDS. USE ONLY APPROVED COUPLING BAND FOR SECTION 384 FOR CMP (RCP) END TREATMENT, SEE DET. DWG. NO. 603-26 FOR CONNECTION.

2. THE TWO 3/4" [19] CHANNELS MAY BE ELIMINATED FROM THE CULVERT END TREATMENT IF:
   a. THE CULVERT IS FABRICATED WITH 12 GAUGE (0.109" [2.8] THICK) MATERIAL.
   b. HALF CIRCLE NOTCHES ARE CUT IN THE CULVERT FOR THE STEEL PIPE WITH CONTINUOUS WELD IN THE PERIPHERY IN CONTACT PROVIDED.
   c. ALL WELDS AND OTHER NON-GALVANIZED PARTS ARE PAINTED PER NOTES:

3. CONNECTIONS MADE PER DET. DWG. NO. 603-26 FOR PIPE SIZES H AND I TO BE INCREASED BY 3" [76].

REFERENCES:

DETAILED DRAWING

REFERENCE DWG. NO. 603-14

SECTION 603.709,710

CRIP ROAD APPROACH

CULVERT END TREATMENT (RACP)

UNIT SHOWN IN BRACKETS [] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.
PER SECTION 711.

**STRUCTURAL TUBING CROSS-PIPE**

- [64 x 64 x 6.4] GALV.
- **2 1/2" x 2 1/2" x 1/4"**

**CSPA**

<table>
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<th>Dimension</th>
<th>Note</th>
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<td>21&quot; x 15&quot;</td>
<td>[530 x 380] CSPA</td>
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<tr>
<td>3'</td>
<td>[914] CONN.</td>
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<tr>
<td>3'-0&quot;</td>
<td>EXISTING OR NEW CSP OR CSPA</td>
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<tr>
<td>1'-0&quot;</td>
<td>CONN.</td>
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**PLAN VIEW**

- 4 SPACES AT 1'-11" [584] PRECAST MEDIAN U-TURN CROSS DRAIN AND CONC. BEVELED END
- 2 1/2" x 2 1/2" x 1/4" [64 x 64 x 6.4] GALV. STRUCTURAL TUBING CROSS-Pipe PER SECTION 711.

**ELEVATION**

- 10:1 SLOPE

**DETAIL A**

- 3/8" DIA. x 1" (M10 x 25) GALV. BOLT (TYP.)
- 3/8" [M10] LOOP FERRULE INSERT (TYP.)

**NOTE:**

- PAINT ALL EXPOSED METAL PARTS WITH ONE COAT OF ZINC RICH PAINT AND TWO COATS OF ALUMINUM PAINT PER SECTION 710.

UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.
1- **STANDARD BEDDING INSTALLATION**

- **EXCAVATE AS NEEDED**
- **SIDE FILL**
- **EXISTING GROUND**
- **EXCAVATION FOR BEDDING**
- **COMPACTED BEDDING MATERIAL**
- **LOSE BEDDING MATERIAL**
- **FOUNDATION MATERIAL** (as specified)
- **EXISTING GROUND**
- **EXCAVATION FOR BEDDING**
- **SIDE FILL**

Depth = \( D + 1/4T + 3" \) (75 mm) 

Dimensions **D, S, and R** are inside pipe diameter.

Metal culverts and smaller.

**NOTES:**
- Do not extend bedding material to the end of the pipe unless otherwise noted in plans.
- Place loose bedding material uniformly in the bottom of the trench and grade to it's bottom before placing the bedding thickness before placing loose bedding material to accommodate bell thickness. After placing the bedding, compact bedding material at hunches and sides of pipe.
- Compact and place side fill per section 603 and 701.
- Furnish bedding and foundation material per section 701.
- **EXCAVATE AS NEEDED**
- **SIDE FILL**
- **EXISTING GROUND**
- **EXCAVATION FOR BEDDING**
- **COMPACTED BEDDING MATERIAL**
- **LOSE BEDDING MATERIAL**
- **FOUNDATION MATERIAL** (as specified)
- **EXISTING GROUND**
- **EXCAVATION FOR BEDDING**
- **SIDE FILL**

Depth = \( R/3 + T + 3" \) (75 mm)

Dimensions **D, S, and R** are inside pipe diameter.

Metal culverts and smaller.

**NOTES:**
- Excavate a sufficient amount to provide a safe working environment and to allow alignment of all culvert installation and compaction.
- Excavation should be made to the level of the culvert and then placed in the very compacted earth. See section 701 for injection well thicknesses. References are typically 1/2" (13 mm) for 12" (300 mm) equipment and smaller.
- Foundation bedding material is shown.
- Bedding for pipes less than 36" (900 mm) in diameter.

**REFERENCE**
- Standard Spec:
- Section 203, 207, 603, 701
- UNITS SHOWN IN BRACKETS [ ] ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.
**NOTES**

1. **TRENCH BACKFILL:** Place per standard specification. Bedding material direct under the pipe should be left uncompacted to facilitate the installation of the pipe.

2. **GRANULAR BEDDING:** Replace per standard specification. Bedding material direct under the pipe should be left uncompacted to facilitate the installation of the pipe.

3. **SAND CUSHION:** Use grade 5 material per Table 701-7 in Standard Specification 701-03.2A. The sand material would be left uncompacted to facilitate the installation of the pipe.

---

**QUANTITIES**

**METRIC QUANTITIES**

<table>
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<tr>
<th>Rigid Pipe 12” to 30” Dia.</th>
<th>Rigid Pipe 36” to 72” Dia.</th>
<th>Flexible Pipe 12” to 48” Dia.</th>
<th>Flexible Pipe 30” to 120” Dia.</th>
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<tr>
<td>DIAMETER (mm)</td>
<td>GRANULAR BEDDING (C.Y. PER FT.)</td>
<td>GRANULAR BEDDING (m³ PER M.)</td>
<td>GRANULAR BEDDING (C.Y. PER FT.)</td>
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</table>

* Based on RCP B wall pipe.

---

**REFERENCE**

Department of Transportation

**STORM DRAIN TRENCH BEDDING DETAIL**

**Dwg. No.**

**Section**

**Standard Spec.**

**Detailed Drawing**

**Units Shown**

METRIC QUANTITIES

- 1' = 300 mm

UNLESS OTHER UNITS ARE SHOWN.
### Dimension Table

<table>
<thead>
<tr>
<th>Dia.</th>
<th>APPROX. O.D. (IN)</th>
<th>LENGTH (IN)</th>
<th>L1 (MM)</th>
<th>L2 (MM)</th>
<th>X1 (WALL A)</th>
<th>X2 (WALL B)</th>
<th>Y1</th>
<th>Y2</th>
<th>Y3</th>
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### Metric Dimension Table (mm)

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<th>APPROX. O.D. (IN)</th>
<th>LENGTH (IN)</th>
<th>L1 (MM)</th>
<th>L2 (MM)</th>
<th>X1 (WALL A)</th>
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### Notes:
- Typical for storm drain and irrigation applications: for heads up to 20 ft. or 6 m.
- Unit number across MAX. meets the requirements of Section 707.
### Metric Dimension Table

<table>
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<tr>
<th>Dia</th>
<th>ASEC WATER AREA</th>
<th>B7 7¢ FOR</th>
<th>T</th>
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### Typical Longitudinal Section

**3 1/4" Diameter Pipes and Larger**

- **Joint Size:** 4 1/2" to 10 1/2"
- **Length:** 8 1/2" to 11 1/2"
- **Wall Thickness:** 3 1/2" to 4 1/2"

**1 1/2" Diameter Pipes and Smaller**

- **Joint Size:** 2 3/4" to 5 1/2"
- **Length:** 1 3/4" to 3 1/2"
- **Wall Thickness:** 1 3/4" to 2 3/4"

---

**DIMENSION TABLE**

| Dia | Water Area | Wall Thickness | Length | Joint | 2 3/4 | 3 1/2 | 4 1/2 | 5 1/2 | 6 1/2 | 7 1/2 | 8 1/2 | 9 1/2 | 10 1/2 | 11 1/2 | 12 1/2 | 13 1/2 | 14 1/2 | 15 1/2 |
|-----|------------|----------------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1'  | 0.078      | 0.078          | 2      | 1.25  | 1.25  | 1.25  | 1.25  | 1.25  | 1.25  | 1.25  | 1.25  | 1.25  | 1.25  | 1.25  | 1.25  | 1.25  | 1.25  |
| 1 1/4 | 0.125      | 0.125          | 2.50  | 2.50  | 2.50  | 2.50  | 2.50  | 2.50  | 2.50  | 2.50  | 2.50  | 2.50  | 2.50  | 2.50  | 2.50  | 2.50  | 2.50  |
| 2    | 0.250      | 0.250          | 4     | 4.76  | 4.76  | 4.76  | 4.76  | 4.76  | 4.76  | 4.76  | 4.76  | 4.76  | 4.76  | 4.76  | 4.76  | 4.76  | 4.76  |
| 2 1/4 | 0.312      | 0.312          | 5     | 6.35  | 6.35  | 6.35  | 6.35  | 6.35  | 6.35  | 6.35  | 6.35  | 6.35  | 6.35  | 6.35  | 6.35  | 6.35  | 6.35  |
| 2 1/2 | 0.375      | 0.375          | 6     | 7.87  | 7.87  | 7.87  | 7.87  | 7.87  | 7.87  | 7.87  | 7.87  | 7.87  | 7.87  | 7.87  | 7.87  | 7.87  | 7.87  |
| 3 1/4 | 0.500      | 0.500          | 8     | 11.11 | 11.11 | 11.11 | 11.11 | 11.11 | 11.11 | 11.11 | 11.11 | 11.11 | 11.11 | 11.11 | 11.11 | 11.11 | 11.11 |

---

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

* Wall "B" Thickness
SECTION A-A

CONNECTION DETAILS

TYPICAL FIELD CAST CONCRETE BEND

UNIT'S SHOWN IN BRACKETS () ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.
NOTE:
DASHED ARROWS DENOTE DIRECTION OF WATER FLOW.

PLAN VIEW OF INLET

OUTLET DETAIL

SECTION A-A

NOTES:
① CORRUGATION MAY BE EITHER ANNULAR OR HELICAL.
BEND ON ELBOW (θ) IS AS SHOWN UNLESS OTHERWISE SPECIFIED IN THE PLANS OR BY THE PROJECT MANAGER.
* INCLUDED WITH ROADWAY QUANTITIES.
NOTES:

1. DESIGNATE THESE STRUCTURES, IN PLANS AND PROPOSAL, AS "VEHICULAR UNDERPASSES" EVEN THOUGH THEY ARE NOT PERMITTED UNDER THE PRESENT HIGHWAY CODE. REGARDLESS OF THE SIZE, OR PURPOSE OF THE STRUCTURE.

2. PROVIDE END TREATMENT FOR ALL VEHICULAR UNDERPASSES INCLUDING CUTOFF WALLS, BACKFILL RETAINING WALLS AND CONCRETE SLOPE COLLARS.

3. PROVIDE SURFACING FOR THE INSIDE OF THE STRUCTURE, CASED-SLOPED TO ALLOW A DRAINAGE COURSE DOWN THE CENTRAL LINE.

4. PROVIDE A PLATE THICKNESS SEE ROAD DESIGN MANUAL, FILL HEIGHT TABLES.

5. USE CLASS GENERAL CONCRETE OR EQUAL.

6. STOP DTL, DNO 552-30 FOR QUANTITIES.

7. SEE DTL, DNO 552-31 FOR ALTERNATIVE "C" PCCP TRANSVERSE JOINT AND BACKFILL RETAINER DETAILS.

SECTION B-B

1279 SEAL BAL.

SECTION C-C

4 ~ #13 BARS CONTINUOUS

SECTION A-A

1200

50 MIN. COVER (TYPICAL)

NOTE:

STEP DTL, DNO 552-30 FOR ANCHOR BOLT DETAILS.

1. PL. MIX SURF.

2. 50 DIAM HOLES ON CENTER 48.

3. #13 STANDS AT 450 O.C.

1. CONCRETE CUTOFF WALL, CARRY AND ELEVATION.

2. DTL, DNO 552-00.

DETAILED DRAWINGS

VEHICULAR UNDERPASSES AND BACKFILL RETAINER & CUTOFF WALL DETAIL (METRIC)

VEHICULAR UNDERPASSES AND BACKFILL RETAINER & CUTOFF WALL DETAIL (METRIC)

VEHICULAR UNDERPASSES AND BACKFILL RETAINER & CUTOFF WALL DETAIL (METRIC)

ALL DIMENSIONS ARE MILLIMETERS UNLESS OTHERWISE NOTED.

REFERENCE DSG. NO. 603-30

SECTION 552-30
TRANSVERSE CONTRACTION JOINT (15' [4.5 m] O.C.)

TRANSVERSE CONTRACTION JOINT (AS NEEDED)

TYPICAL BOTH ENDS

REINFORCING STEEL FOR INLET

BACKFILL RETAINER & GCCP SLAB

See Detail A

DETAIL A

SAWED TRANSVERSE OR LONGITUDINAL JOINT WITH HOT POUR SEALANT

VEHICULAR UNDERPASS
GCCP TRANSVERSE JOINT & BACKFILL RETAINER DETAILS

UNITS SHOWN IN BRACKETS [] ARE
METRIC AND ARE IN MILLIMETERS (mm)
UNLESS OTHER UNITS ARE SHOWN.
### Dimensions

**Diameter**

<table>
<thead>
<tr>
<th>Dia</th>
<th>X(FT.)</th>
<th>Y(FT.)</th>
<th>H(FT.)</th>
<th>AREA &quot;A&quot; (FT²)</th>
<th>AREA &quot;B&quot; (FT²)</th>
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<tr>
<td>8'</td>
<td>1.625</td>
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<td>5.075</td>
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<tr>
<td>10'</td>
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<td>3.750</td>
<td>5.875</td>
<td>15.000</td>
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<tr>
<td>12'</td>
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<td>17.500</td>
<td>12</td>
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<tr>
<td>15'</td>
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<td>5.000</td>
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<td>20.000</td>
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</tr>
<tr>
<td>18'</td>
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<td>8.475</td>
<td>22.500</td>
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</tr>
<tr>
<td>24'</td>
<td>3.750</td>
<td>7.500</td>
<td>10.500</td>
<td>30.000</td>
<td>24</td>
</tr>
<tr>
<td>30'</td>
<td>4.625</td>
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**Notes:**

- AREA "A" is to the middle of the corrugations.
- AREA "B" is to the middle of the corrugations.

### Metric Dimensions

**Diameter**

<table>
<thead>
<tr>
<th>Dia</th>
<th>X(m)</th>
<th>Y(m)</th>
<th>H(m)</th>
<th>AREA &quot;A&quot; (m²)</th>
<th>AREA &quot;B&quot; (m²)</th>
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</thead>
<tbody>
<tr>
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<td>12.815</td>
<td>1.11</td>
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**Notes:**

- AREA "A" is to the middle of the corrugations.
- AREA "B" is to the middle of the corrugations.

### Area W:

- **WS** = 24.000
- **WS** = 19.000
- **WS** = 14.000
- **WS** = 10.000
- **WS** = 6.000

### Notes:

- AREA "A" IS THE MIDDLE OF THE CORRUGATIONS.
- AREA "B" IS THE MIDDLE OF THE CORRUGATIONS.
- AREA "C" IS THE MIDDLE OF THE CORRUGATIONS.

### Units:

**Units shown in brackets ( ) are metric and are in millimeters (mm) unless other units are shown.
SEE DTL. DWG. NO. 552-00, 603-30 AND 603-19.

(SEE FILL HEIGHT TABLES FOR OTHER THAN THE MINIMUM REQUIREMENTS.)

FOR 96" [2400] DIAMETER CORRUGATED STEEL PIPE STOCKPASS IS 0.109" [2.77].
CORRUGATED STEEL PIPE STOCKPASS IS 0.079" [2.01].
THE MINIMUM THICKNESS FOR 84" [2100] DIAMETER AND 90" [2250] DIAMETER
STEP BEVEL PIPE ENDS AT A 2:1 SLOPE.

COURSE ALONG ONE SIDE.  (SEE DTL. DWG. NO. 613-14 AND 613-06.)

ASPHALT SURFACING; CROSS SLOPE ASPHALT SURFACING TO ALLOW DRAINAGE
AT THE INLET END AND OUTLET END, GRANULAR BEDDING AND
CUTOFF WALLS, BACKFILL RETAINERS AT BOTH ENDS, CONCRETE EDGE PROTECTION
WHEN COMBINATION STOCKPASSES AND DRAINS ARE SPECIFIED, INSTALL WITH
BACKFILL RETAINERS AT EACH END, GRAVEL FILL AND GRANULAR BEDDING.
UNLESS OTHERWISE SPECIFIED, INSTALL STOCKPASSES WITH CUTOFF WALLS
NOTES:

* SURFACING QUANTITIES PER LINEAR FOOT FOR DEPTH "D"

** METRIC SURFACING QUANTITIES PER METER FOR DEPTH "D"

W

** DIMENSIONS

<table>
<thead>
<tr>
<th>DIAMETER</th>
<th>X</th>
<th>Z</th>
<th>W</th>
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<tr>
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<td>96&quot;</td>
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<td>0.37</td>
<td>8.0</td>
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</table>

NOTES:

1. UNLESS OTHERWISE SPECIFIED, INSTALL STOCKPASSES WITH CUTOFF WALLS AND
   BACKFILL RETAINERS AT EACH END. GRAVEL FILL AND GRANULAR BEDDING.

2. WHEN COMBINATION STOCKPASSES AND DRAINS ARE SPECIFIED, INSTALL WITH
   CUTOFF WALLS. BACKFILL RETAINERS AT BOTH ENDS. CONCRETE EDGE PROTECTION
   AT THE INLET END AND OUTLET END. GRANULAR BEDDING AND
   CUTOFF WALLS.

3. STEP BEVEL PIPE ENDS AT A 2:1 SLOPE.

4. THE MINIMUM THICKNESS FOR 84" [2100] DIAMETER AND 90" [2250] DIAMETER
   CORRUGATED STEEL PIPE STOCKPASS IS 0.109" [2.77]. THE MINIMUM THICKNESS
   FOR 96" [2400] DIAMETER CORRUGATED STEEL PIPE STOCKPASS IS 0.079" [2.01].
   SEE FILL HEIGHT TABLES FOR OTHER THAN THE MINIMUM REQUIREMENTS.

5. SEE DTL. DWG. NO. 552-30, 603-30 AND 603-19.

UNITS SHOWN ON BRACKETS (i.e., METRIC AND IN MILLIMETERS) SINCE OTHER UNITS ARE SHOWN.