Geometric limits for pipe penetration holes:

1. A minimum of 12 (300) of monolithic reinforced concrete shall be maintained above pipe penetration holes > 4'-0" (1.22 m).
2. A minimum 12 (300) inside arc length of reinforced concrete shall be maintained between pipe penetration holes > 15 (380).
3. A maximum of 60 percent of the inside perimeter of the reinforced concrete manhole walls may be removed.
4. Horizontal joints that intersect pipe penetration holes > 15 (380) shall have one joint space for every location around the perimeter of the joint where the inside arc length between pipe penetration holes is < 24 (600). See joint splice detail.
5. The recommended pipe penetration hole is equal to the D.D. of the pipe plus 4 (100).
6. Any pipe penetration holes ≤ 15 (380) are allowed in riser sections.

Precaution notes:

- Pipe holes shall be formed to facilitate proper placement of hole reinforcement.
- The manufacturer shall ensure that all precast manhole sections are additionally reinforced where required to resist damage from handling, shipping and installation stresses.
- Lifting holes shall be located in the sections as per the manufacturer’s recommendations.
- See Standard 602701 for details of manhole steps.
- All dimensions are in inches (millimeters) unless otherwise noted.

General notes:

- The recommended pipe penetration hole is equal to the D.D. of the pipe plus 4 (100).
- Horizontal joints that intersect pipe penetration holes > 15 (380) shall have one joint space for every location around the perimeter of the joint where the inside arc length between pipe penetration holes is < 24 (600). See joint splice detail.
- The recommended pipe penetration hole is equal to the D.D. of the pipe plus 4 (100).
- Any pipe penetration holes ≤ 15 (380) are allowed in riser sections.

Section perpendicular to pipe (With conical top riser):

- See base slab joint configurations.
- See geometric limits for pipe penetration holes.
- Length shall be sufficient to intersect the horizontal #3 (#10) bars as shown.
- See Standard 602701 for details of manhole steps.

General notes:

- The recommended pipe penetration hole is equal to the D.D. of the pipe plus 4 (100).
- Horizontal joints that intersect pipe penetration holes > 15 (380) shall have one joint space for every location around the perimeter of the joint where the inside arc length between pipe penetration holes is < 24 (600). See joint splice detail.
- The recommended pipe penetration hole is equal to the D.D. of the pipe plus 4 (100).
- Any pipe penetration holes ≤ 15 (380) are allowed in riser sections.

Section parallel to pipe (Without conical top riser):

- See flat slab top joint configurations.
- See geometric limits for pipe penetration holes.
- Length shall be sufficient to intersect the vertical #3 (#10) bars as shown.
- See Standard 602701 for details of manhole steps.

General notes:

- The recommended pipe penetration hole is equal to the D.D. of the pipe plus 4 (100).
- Horizontal joints that intersect pipe penetration holes > 15 (380) shall have one joint space for every location around the perimeter of the joint where the inside arc length between pipe penetration holes is < 24 (600). See joint splice detail.
- The recommended pipe penetration hole is equal to the D.D. of the pipe plus 4 (100).
- Any pipe penetration holes ≤ 15 (380) are allowed in riser sections.
Bar c #5 (#18), 4'-6" (1.37 m) length, 5'-2" (1.57 m) radius top and bottom

Bar c #5 (#18), 10'-1" (3.07 m) length, 5'-2" (1.57 m) radius top and bottom

Bar c #5 (#18), 10'-1" (3.07 m) length, 5'-2" (1.57 m) radius top and bottom

* #6 (19) bars bottom. Bundle first bar with closest WWR bar to the opening and place second bar ±3 (75) away.
### Flat Slab Top Reinforcement

<table>
<thead>
<tr>
<th>Location</th>
<th>Riser Height (RH)</th>
<th>WWR or Rebar (each direction)</th>
<th>A_s (min.)</th>
<th>Spacing (max.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top</td>
<td>All</td>
<td></td>
<td>0.11 sq. in./ft.</td>
<td>18</td>
</tr>
<tr>
<td>Bottom</td>
<td>RH ≤ 10 ft. (3.05 m)</td>
<td><strong>0.086 sq. in./ft.</strong></td>
<td>6</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>RH &gt; 10 ft. (3.05 m)</td>
<td>WWR not permitted</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Only one layer of WWRR permitted to avoid congestion.**

### Wall Reinforcement

<table>
<thead>
<tr>
<th>Location</th>
<th>Orientation</th>
<th>A_s (min.)</th>
<th>Spacing (max.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 ft. (1.22 m) Ø Riser</td>
<td>Circumferential: 0.12 sq. in./ft.</td>
<td>6</td>
<td>(30)</td>
</tr>
<tr>
<td></td>
<td>Vertical: 0.065 sq. in./ft.</td>
<td>8</td>
<td>(200)</td>
</tr>
<tr>
<td>6 ft. (3.05 m) Ø Barrel</td>
<td>Circumferential: 0.30 sq. in./ft.</td>
<td>6</td>
<td>(150)</td>
</tr>
<tr>
<td>Inside Mat</td>
<td>Vertical: 0.065 sq. in./ft.</td>
<td>8</td>
<td>(200)</td>
</tr>
<tr>
<td>10 ft. (3.05 m) Ø Barrel</td>
<td>Circumferential: 0.11 sq. in./ft.</td>
<td>6</td>
<td>(150)</td>
</tr>
<tr>
<td>Outside Mat</td>
<td>Vertical: 0.065 sq. in./ft.</td>
<td>8</td>
<td>(200)</td>
</tr>
</tbody>
</table>

### Base Slab Reinforcement

<table>
<thead>
<tr>
<th>Location</th>
<th>Riser Height (RH)/ Total Height (TH)</th>
<th>WWR or Rebar (each direction)</th>
<th>A_s (min.)</th>
<th>Spacing (max.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top</td>
<td>RH ≥ 10 ft. (3.05 m) or TH &gt; 20 ft. (6.10 m)</td>
<td>0.48 sq. in./ft.</td>
<td>6</td>
<td>(150)</td>
</tr>
<tr>
<td>Bottom</td>
<td>All</td>
<td>0.12 sq. in./ft.</td>
<td>6</td>
<td>(150)</td>
</tr>
</tbody>
</table>

**Only one layer of WWR permitted to avoid congestion.**

### Drawings

- **Joint Splice**
- **Connection Angle**
- **Tie Plate**