

14. Pipe to Manhole Geometry.

a. General.

- 1) Design manholes with sufficient inside dimensions to perform inspection and cleaning operations, allow for proper channel construction without difficulty and minimize hydraulic losses through the manhole. Determine the appropriate size and shape of each manhole. For types and diameters of manholes, see Part Two, Section 12 (Types of Manholes).
- 2) Design the channel to conform to Standard Detail S/3.3 and provide adequate space within the manhole for removal of existing pipe, design the channel to suit the existing channel flow and adequate width at the top of the bench within the manhole for worker safety and maintenance, see requirements in Part Two, Section 18 (Manhole Channel Design).

b. Minimum Diameter Precast Manholes for Maximum Sewer Sizes.

- 1) Minimum inside diameter of new precast manholes for maximum sewer pipe size, see Table "14". See additional requirements under Part Two, Section 17 (Manhole Channel Design) for 12-inch and smaller sewer pipelines.

TABLE "14"

Minimum Diameter Precast Manholes for Maximum Sewer Sizes

Manhole Diameter	45° Deflection Maximum Size of Pipe ^A	90° Deflection Maximum Size of Pipe ^B
48-inch ^C	24-inch	18-inch
60-inch	36-inch	27-inch
72-inch	42-inch	30-inch
84-inch	48-inch	36-inch
96-inch	60-inch	42-inch

^A Maximum pipe size for a given manhole diameter is based on straight through pipe alignment to forty five (45°) degree deflection through the manhole.

^B Maximum pipe size for a given manhole diameter is based on forty five (45°) to ninety (90°) degree deflection through the manhole, without any other pipe connection to the manhole.

^C Maximum depth of 48-inch diameter manhole is twenty (20) feet. Over twenty (20) feet requires a five (5) foot diameter manhole, see Part Two, Section 19 (Manhole Depth Design).

c. Minimum Diameter of Existing Brick Manholes for Maximum Sewer Sizes.

- 1) Design brick manholes, only if an existing brick manhole has to be modified, see Part Two, Section 12 (Types of Manholes). Minimum inside diameter of existing brick manholes for the maximum sewer pipe size, see Table "15".

TABLE "15"

Minimum Diameter Existing Brick Manholes for Maximum Sewer Sizes

Manhole Diameter	No Deflection – Straight Run ^D
48-inch	Up to 24-inch
60-inch	27-inch to 36-inch
72-inch	42-inch to 48-inch
84-inch	54-inch to 60-inch

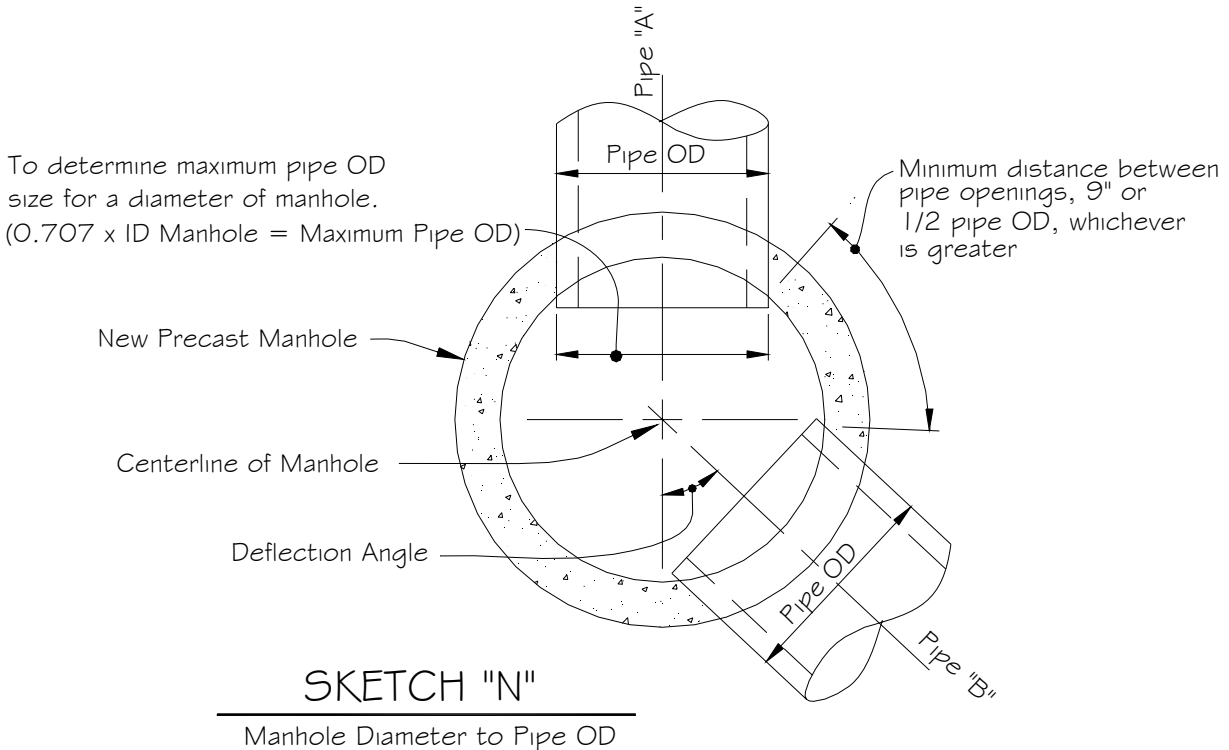
^D When the sewer requires deflection at the manhole, determine the deflection angle and the required manhole diameter from Table "14". Provide a new precast manhole if size must be increased.



d. Determining Manhole Diameter.

- 1) New precast manholes. To determine the inside diameter and/or deflection angle, see Table "14", or provide calculations using the following:
 - (a) Determine the type of material to be used for the sewer pipeline, (PVC, RCP [use ASTM C76, Wall C] or DIP) and determine maximum pipe size for diameter of the manhole using the following formula for pipes flowing straight through a manhole:

$$\text{Maximum pipe outside diameter} = 0.707 \times \text{ID of the manhole.}$$
 - (b) Check the distance between pipe openings, see Sketch "N". Provide a minimum of 9 inches or 1/2 the pipe OD, whichever is greater, between the manhole pipe hole openings of both pipes. When the adjacent pipes are different sizes, use 1/2 the pipe OD of the smaller pipe or 9 inches, whichever is greater.
 - (c) When the minimum clearances between pipe openings cannot be met, see Offset Manholes, in this section.

**Example:**

For a 48-inch ID manhole:

Determine the maximum OD of the sewer connections at a 48-inch ID manhole.

$$0.707 \times 48" = 33.94"$$

Determine the size of pipe ID; see the chart in ASTM C76 for Wall C.

$$27\text{-inch RCP (OD)} = 35" \text{ and } 24\text{-inch RCP (OD)} = 31.5",$$

Therefore, for a 48-inch ID manhole

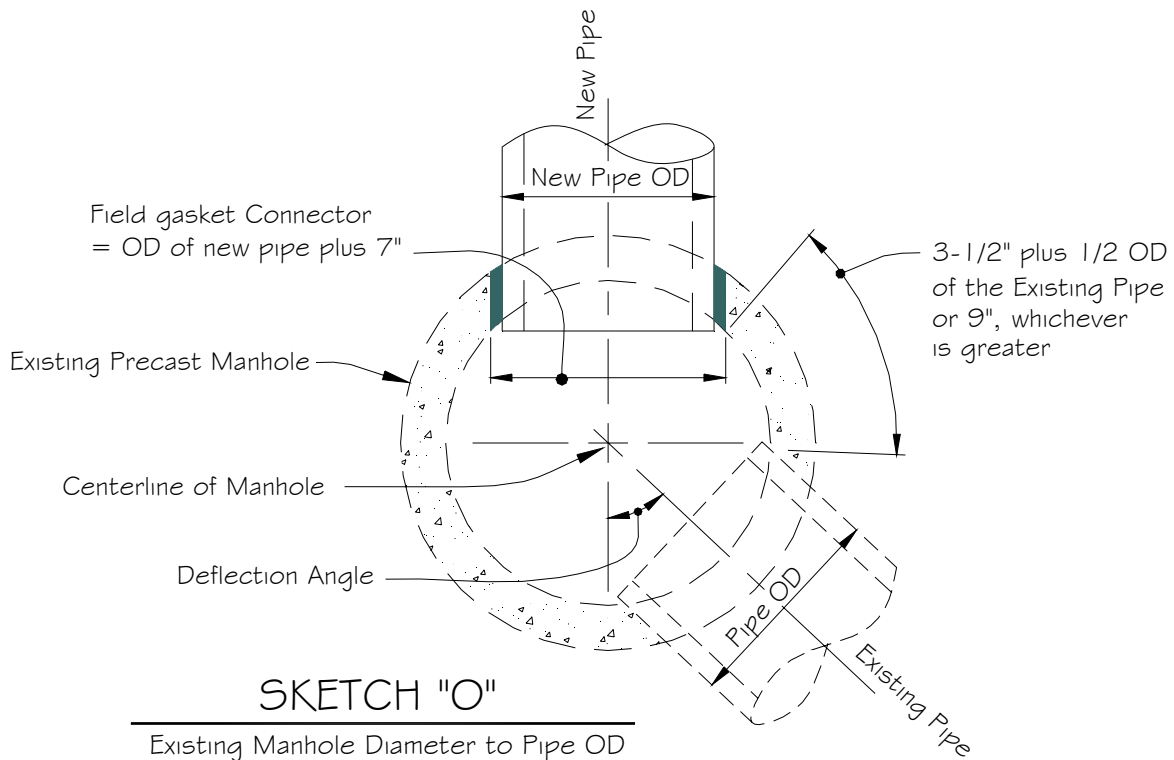
Maximum size of sewer pipeline using RCP is 24-inch diameter.

Next, verify the angles between the sewer pipelines, see Tables "14" and "15" or Sketch "N".



2) Existing precast manholes.

- a) If the existing manhole has an existing connection (stub), match the existing pipe material or remove the connection if the pipe material is not one of the approved pipe materials in accordance with Specifications.
- b) If the manhole has no existing connections, the manhole will require a field connection to be installed. This connection is called "Field Gasket Connector", see Specifications.
 - (1) Determine the maximum pipe size allowed at the existing manhole. The field gasket connector requires an opening equal to the OD of the sewer pipe plus 7" (or 3-1/2" on each side of the pipe OD).
 - (2) Determine the minimum clearances between two pipe openings at the manhole, one being existing and the other using a field gasket connector. The field gasket opening requirement must be added to the new pipe diameter for this calculation. See Sketch "O".
- c) When the minimum clearances between pipe openings cannot be met, see Offset Manholes in this section.

3) Existing brick manholes.

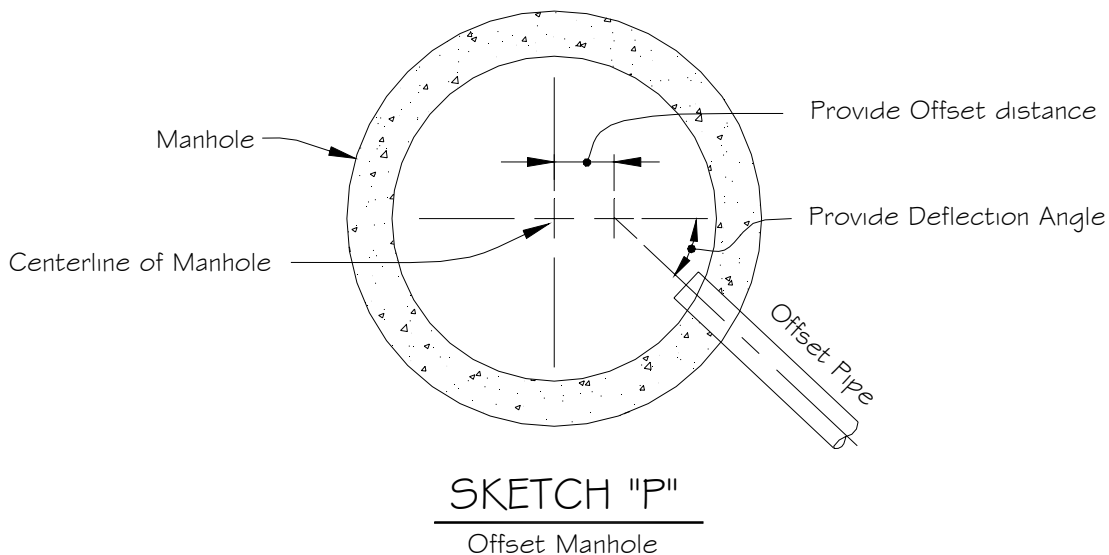
- a) If the existing manhole has an existing connection (stub), match the existing pipe material or remove the connection if the pipe material is not one of the approved pipe materials in accordance with Specifications.



- b) If the manhole has no connections, the manhole will require a connection to be constructed in accordance with Standard Detail S/3.0a and Specifications. New sewer pipe connecting to the existing brick manhole can only be DIP or RCP. Provide nine (9") inches minimum clearance between sewer pipe OD's at the inside of the manhole wall following Sketch "N".
- c) When the minimum clearances between pipe openings cannot be met, see Offset Manholes, in this section.

e. Offset Manholes.

- 1) When the clearance between the pipe openings is not in accordance with Sketch "N" and "O" or if the sewer pipe leaving the manhole has a problem with clearances, provide a design for the sewer to be offset or askew at the manhole. The design will require details, dimensions, etc., to be shown on the drawings, see Sketch "P".



f. Mechanical Flow Control Devices in Manholes.

- 1) For special manholes that require mechanical flow control devices (slide gates, weirs, etc.), provide detailed drawings showing locations, manufacturer's recommendation, required clearances, etc., with sufficient inside dimensions for installation and removal of these devices.
- 2) These devices will require the manhole or vault to have an opening large enough for their removal. In some cases, additional access equipment hatches may be required.

g. Non-Circular Manholes.

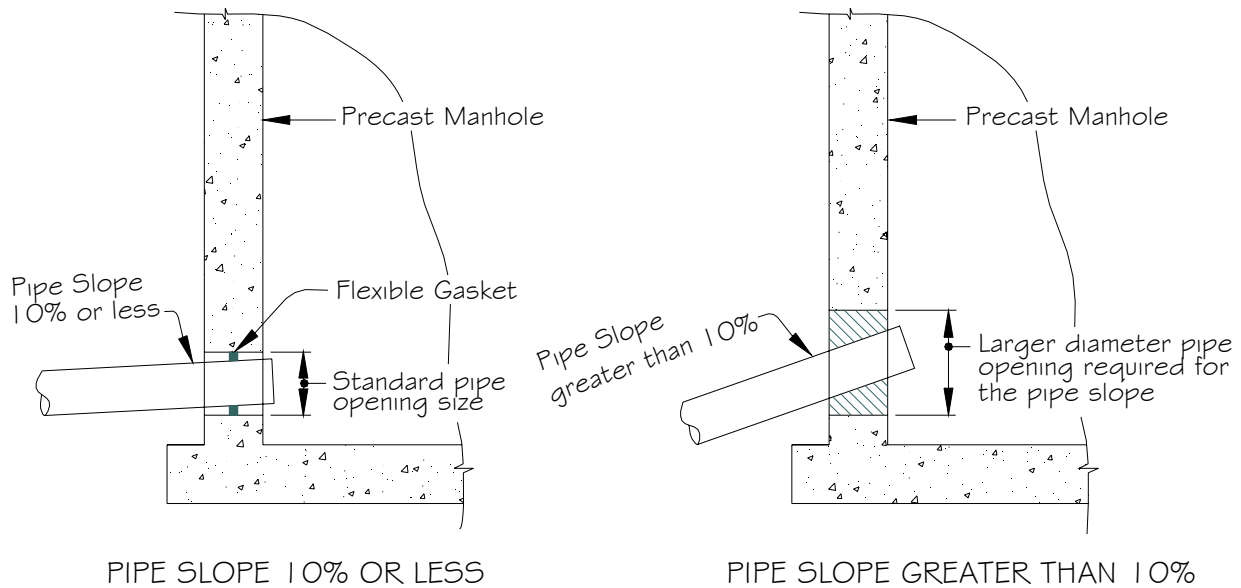
- 1) If the design requires a manhole to be non-circular, provide all necessary details required to construct this type of manhole.

h. Special Pipe Openings in Manholes.

- 1) Manhole connections for steep pipe grades.
 - a) Pipe connections to precast concrete manholes are typically installed with a flexible type gasket



per the Specifications. When the pipe slope is greater than ten (10%) percent for sewer pipeline materials other than PVC (AWWA C900) pipe, the flexible gasket cannot be used and the pipe opening at the manhole wall requires the diameter of the opening to be larger in diameter or oblong, see Standard Detail S/3.03. Provide all necessary details required, see requirements below and Sketch "R". For PVC AWWA C900 pipe requirements on pipe slopes ten (10%) percent or greater, see Part Two, Section 16 (Pipe Slope and Manhole Distance).



SKETCH "R"

Pipe Manhole Connection for Steep Grades

b) Sewers 12-inch and smaller.

- (1) Pipe slopes ten (10%) percent or greater and sewers 12-inch or smaller, see Standard Detail S/3.03 and use PVC (AWWA C-900) pipe only, see Part Two, Section 15 (Pipe Slope and Manhole Distance).
 - (2) Pipe slope greater than sixty (60%) percent. Indicate the size of the pipe opening on the drawings and coordinate with the manhole manufacturer to assure the proposed opening dimensions are compatible with the precaster's capabilities.
 - (3) Review the design of the pipe slope, to determine if the slope could be changed so that the pipe slope is under ten (10%) percent, see Part Two, Section 15 (Pipe Slope and Manhole Distance) and Sketch "T".
- c) Sewers greater than 12-inch diameter. Indicate the size of the pipe opening on the drawings, specify DIP, PVC AWWA C-905 or RCP and coordinate with the manhole manufacturer to assure the proposed opening dimensions are compatible with the precaster's capabilities.

