

BELL SYSTEM PRACTICES
Outside Plant Construction
and Maintenance

SECTION G43.140.1
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AT&T Co Standard

MANHOLES
EQUIPPING

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1. CABLE RACKS AND CABLE RACK SUPPORTS

1.01 At the time the manhole is constructed, concrete inserts should be placed in the walls for the attachment of the ultimate number of cable racks or cable rack supports which will be needed in the manhole. Generally, however, only the racks and rack supports required for immediately planned cable installations should be provided initially.

Spacing of Cable Racks

1.02 Unless otherwise specified on the detail plans, the cable racks shall be spaced as shown on the manhole diagrams in G43.110.1. Where lack of space in the street restricts the length of the manhole, consideration should be given to reducing the width of the splicing bays from 30 inches to 27 inches.

Number of Racks

1.03 The number of cable racks as determined by the headroom of line manholes or by the height of the splicing chamber in loading manholes, is indicated below:

NUMBER OF CABLE RACKS PER VERTICAL STRIP OF RACKS

* Headroom	Number of Racks		
	14 Hole Racks	18 Hole Racks	37 Hole Racks
5 ft.-0 in.	1	1 or	1
5 ft.-6 in.		2 or	1
6 ft.-0 in.		2 or	1
6 ft.-6 in.	3		
7 ft.-0 in.	2	1	
7 ft.-6 in.	1	2	
8 ft.-0 in.		3	
8 ft.-6 in.	4		
9 ft.-0 in.	3	1	
9 ft.-6 in.	2	2	
10 ft.-0 in.	1	3	
10 ft.-6 in.		4	
11 ft.-0 in.	4	1	

* In loading manholes - headroom of splicing chamber

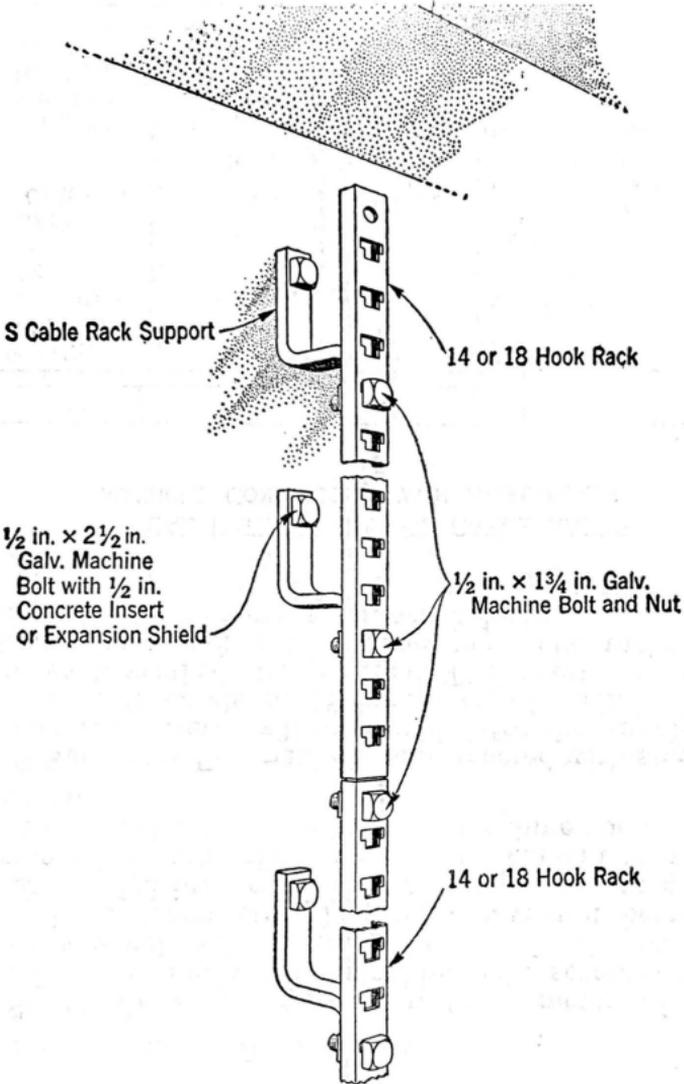
Size of Rack	Distance Between Bolt Holes
8 Hook holes	13½ inches
14 Hook holes	22½ inches
18 Hook holes	28½ inches
37 Hook holes	Not equipped with bolt holes

Note: The 8-hole cable rack will be found useful in filling in side wall space above or below existing racks and also for providing rack space on the end walls for the accommodation of stubs or subsidiary cables. The 37-hole rack, 4 feet 7-1/4 inches long, has no bolt holes, the attachment being made through the hook holes.

Cable Rack Supports

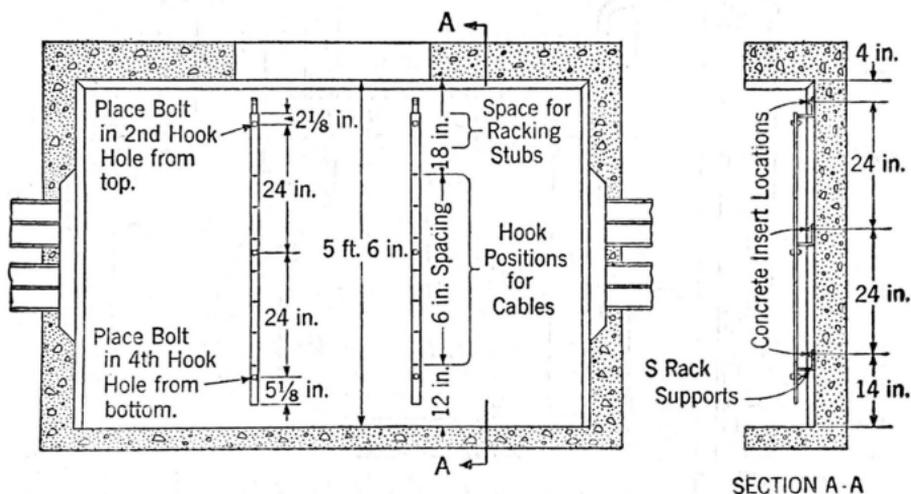
1.04 Unless otherwise specified, the cable racks shall be attached to cable rack supports which support the racks at a distance out from the surface of the manhole wall. There are two types of cable rack supports. The shorter, or S Cable Rack Support, is used in line manholes. The longer support

Where 14 and 18-hook racks are used, it will be necessary to bolt the ends of the racks together between the S rack supports, as shown below:

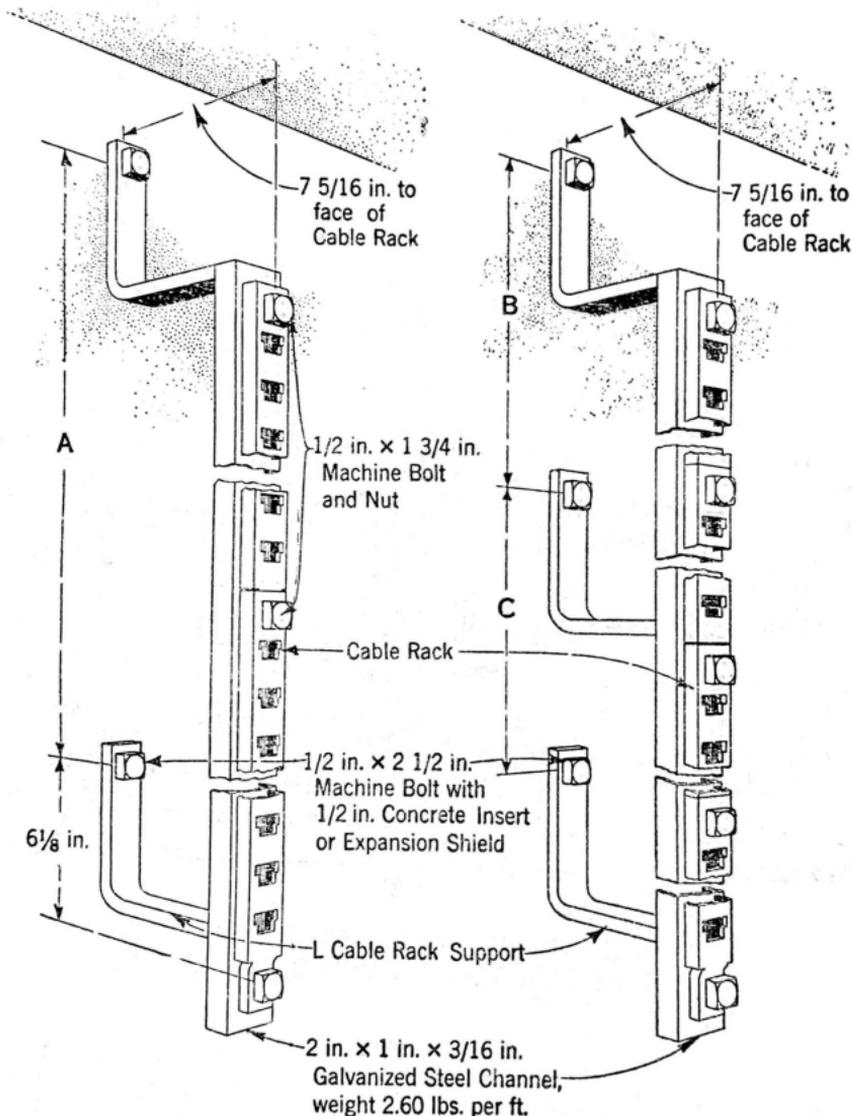


1.07 For manholes constructed with wooden forms, the inserts should be spaced about 24 inches apart vertically, as shown below, when 37-hook racks are to be used. The inserts should be spaced to fit the end bolt holes when 8, 14 or 18-hook racks are to be used.

TYPICAL INSTALLATION OF CABLE RACKS
MANHOLE CONSTRUCTED WITH WOODEN FORMS



1.08 **L Supports:** In loading manholes, the number and position of the L cable rack supports required and the length of 2-inch x 1-inch x 3/16-inch galvanized channel is as indicated in the following figure. See Paragraph 1.03 for number and types of cable racks required.



Headroom of Splicing Chamber	Distance between Cable Rack Supports			Length of Channel
	A	B	C	
* 5 ft. 0 in.	4 ft. 0 in.			4 ft. 8 in.
* 5 ft. 6 in.	4 ft. 0 in.			4 ft. 8 in.
* 6 ft. 0 in.	4 ft. 0 in.			4 ft. 8 in.
6 ft. 6 in.	5 ft. 7 1/2 in.			5 ft. 10 1/2 in.
7 ft. 0 in.		2 ft. 4 1/2 in.	3 ft. 9 in.	6 ft. 4 1/2 in.
7 ft. 6 in.		2 ft. 4 1/2 in.	4 ft. 3 in.	6 ft. 10 1/2 in.
8 ft. 0 in.		2 ft. 4 1/2 in.	4 ft. 9 in.	7 ft. 4 1/2 in.
8 ft. 6 in.		3 ft. 9 in.	3 ft. 9 in.	7 ft. 9 in.
9 ft. 0 in.		3 ft. 9 in.	4 ft. 3 in.	8 ft. 3 in.
9 ft. 6 in.		3 ft. 9 in.	4 ft. 9 in.	8 ft. 9 in.
10 ft. 0 in.		4 ft. 3 in.	4 ft. 9 in.	9 ft. 3 in.
10 ft. 6 in.		4 ft. 9 in.	4 ft. 9 in.	9 ft. 9 in.
11 ft. 0 in.		4 ft. 3 in.	5 ft. 7 1/2 in.	10 ft. 1 1/2 in.

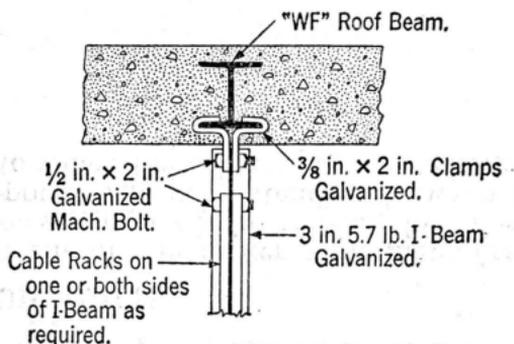
* Use 37 hole racks. Attach rack to channel at mid-point of rack in addition to attachments at top and bottom.

1.09 Before mounting the cable rack supports on the wall, chip away any projections on the wall which might prevent even bearing of the support against the wall. Attach the supports at the proper points and complete the assembly of racks or channel and racks as indicated above. During the assembly, tighten the bolts only part way, so that any adjustments between the parts may be made as the work progresses. After all racks are in place, tighten all bolts securely.

2. I-BEAM UPRIGHTS

2.01 In certain of the center rack manholes and V-type manholes a part of the racking facilities is furnished by 3-inch 5.7-pound I-beams extending between the floor and the roof and to which the cable racks are bolted.

2.02 The I-beam uprights are usually attached to the reinforcing beam of the roof by means of clamps which are placed at the time of construction of the roof. The design of the clamps and the method of attachment are illustrated below.



2.03 If the location of the roof beam will not coincide with the desired location of the center rack, concrete inserts should be placed in the roof for the attachment of angle sections to which the uprights can be bolted. Otherwise, it will be necessary later to place expansion shields in the roof.

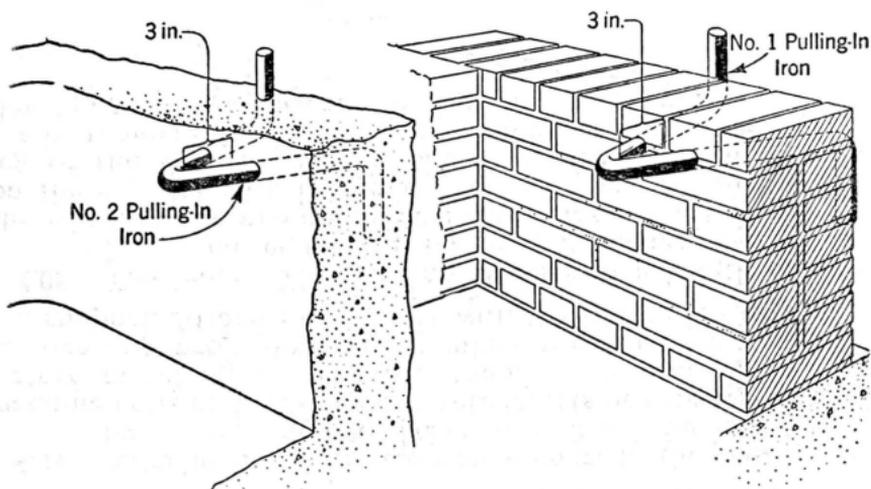
2.04 The lower end of the uprights may be grouted into recesses left in the floor of the manhole or, if it is desired that they be detachable at the bottom, bolted to angle sections cast or anchored in the floor.

3. PULLING-IN IRONS

3.01 Pulling-in irons are installed for the purpose of providing a point of attachment for blocks, sheaves and other tackle employed in the installation and maintenance of cable.

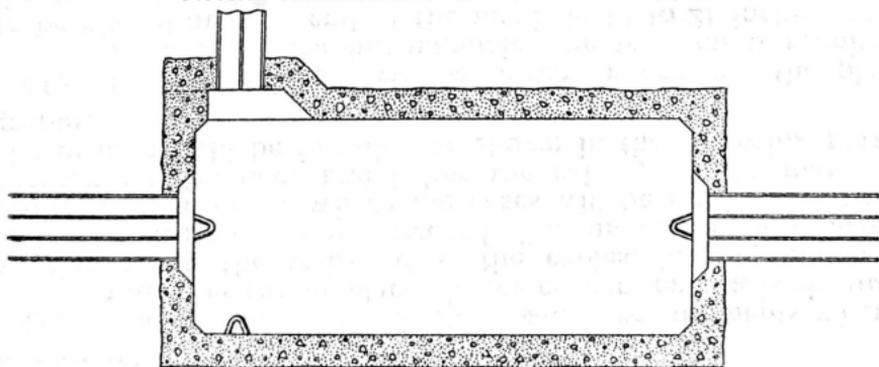
3.02 Two types of pulling-in irons are available, the No. 1 for brick walls and the No. 2 for walls constructed of concrete. Both pulling-in irons are designed to extend into the manhole far enough to permit a clear opening of approximately 3 inches in the eye, as shown below. This work must, of course, be done in conjunction with the wall construction, as explained in the respective sections.

3.03 With a 6-inch concrete wall or 8-inch brick wall, the vertical legs of the irons will bear against the outside face of the wall. For heavier walls the legs will be embedded in the concrete or mortar of the wall.



3.04 In general, one pulling-in iron is to be placed in the wall opposite each duct entrance, usually at a point from 6 to 12 inches below the ducts with which they are associated and in line with the center line of the duct or bank of ducts. On occasion, it may be desirable to place additional irons above the duct banks, depending upon the cable pulling requirements of the particular entrance.

TYPICAL ARRANGEMENT OF PULLING - IN IRONS



4. LOADING MANHOLE PLATFORMS

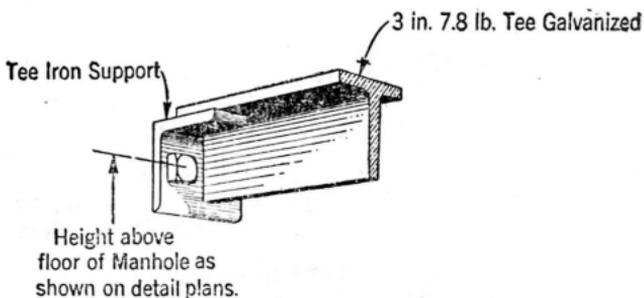
4.01 For manholes with limited loading requirements where the cases can be placed in the corners or in a horizontal position along the walls below the cables, loading manhole platforms are usually not needed. For manholes with heavy loading requirements where the cases will be set in a vertical position on the floor and below the cables, loading manhole platforms should be installed as shown in the following paragraphs.

4.02 **Spacing of Platform Supports:** In erecting the platform for a loading manhole, one tee iron is required to be placed at each end of the manhole 18 to 21 inches from the end wall. In addition, extra tee irons should be provided so that the span between adjacent tee irons shall in no case exceed 6 feet. Space the supports at equal intervals so that the planks may be used at various locations in the manhole, if desired. The height of the tee irons above the floor of the manhole will be shown on the detail plans.

4.03 **Tee Iron Supports:** For each tee iron, two tee iron supports are required to be attached to the manhole wall. The tee iron support consists of a 4-inch length of 3-inch x 3-inch x 3/8-inch galvanized angle. One leg contains two holes for the purpose of attaching the support to the wall, and the second leg is slotted to receive the stem of the tee iron.

4.04 Attachment of the tee iron support to the wall is made by means of two 1/2-inch x 2-1/2 inch galvanized machine bolts and 1/2-inch concrete inserts or expansion shields. Before attaching the support, examine the wall surface and remove any projections which might prevent even bearing of the support. Attach the support with the slotted leg uppermost.

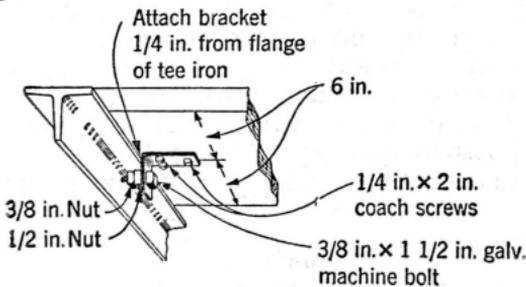
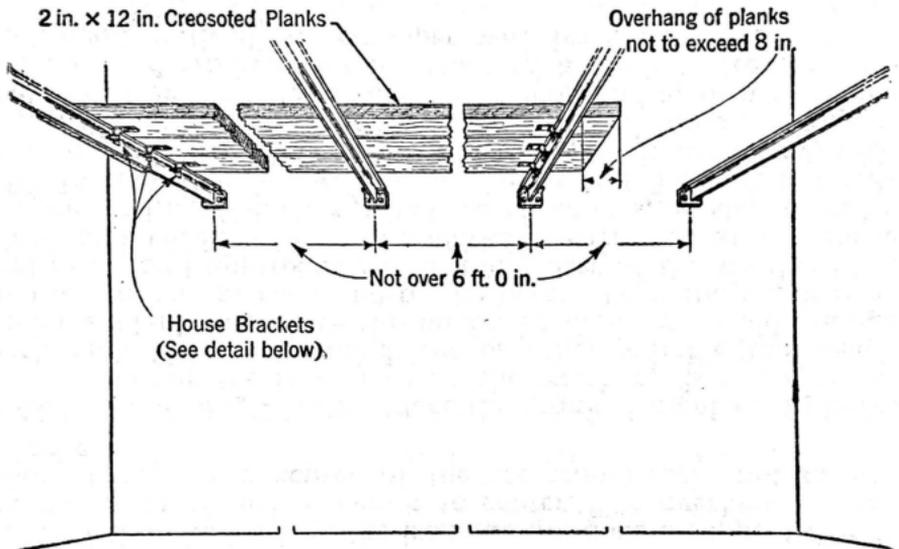
4.05 **Tee Irons:** The tee iron consists of a length of 3-inch 7.8-pound equal leg tee bar, 2 inches shorter than the width of the manhole. When in position, the tee iron rests on the support with its stem secured by the slot in the upper leg of the support. The fit should be free enough to permit ready removal of the tee iron should occasion arise, and yet develop maximum bearing surface on the support.



4.06 Planking: Where a permanent platform is to be provided, 2-inch x 12-inch dressed creosoted plank should be used. Only sufficient plank need be placed to provide working space or, if desired, complete flooring may be installed. In the latter case, it will be advisable, in manholes over 14 feet in length to place two tee irons for the intermediate supports in order to provide adequate bearing surface for the abutting ends of the planks. The tee irons at the double support should be spaced at 12 inches, center to center. The overhang of any plank beyond the center of the tee iron should not exceed 8 inches.

4.07 Equipping Planks: Place the required number of planks on the tee irons so that the overhang is the same at each end. Using a screw-driver or other suitable tool reach under a plank and score the underside along the inside flange of the tee iron at each end of the plank. Turn the plank over and at a point approximately in the center of the width of the plank and 1/4-inch inside the marks at each end, attach house brackets with 1/4-inch x 2-inch coach screws, as shown under 4.08. In the other legs of the brackets insert 3/8-inch x 1-1/2-inch galvanized machine bolts, cut to length if necessary, with the threaded ends toward the ends of the plank. Place a 1/2-inch nut over the bolt to act as a bushing and against this turn the standard 3/8-inch nut furnished with the bolt. Repeat with each plank until all are equipped with brackets.

4.08 To install the planks, set one end on a tee iron so that the bracket bears against the flange and the bolt end projects under the flange. Holding this end of the plank, slide the opposite end along the tee iron toward either side wall until the end of the bolt clears the flange and the plank drops into position. Then slide the plank back until it occupies its normal position parallel with the walls. Remove planks by reversing this operation.



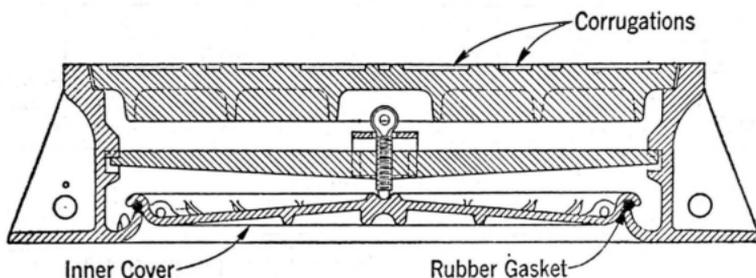
Method of attaching bracket to underside of plank

5. FRAMES AND COVERS

Types and Uses

5.01 The following figures illustrate the types of standard frames and covers and the associated tables give data relative to the different sizes of each type.

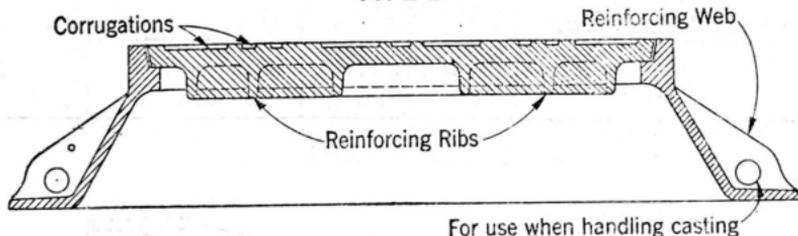
TYPE A



TYPE A FRAMES

Nominal Diameter of Opening (Inches)	Diameter of Base of Frame (Inches)		Height of Frame (Inches)	Outside Diameter of Cover (Inches)	Approximate Weights (Pounds)		
	Outside	Inside			Frame	Cover	Inner Cover
27	43 1/2	30 1/2	11	33 1/4	520	385	95
30	46 1/2	33 1/2	11	36 1/4	580	465	145

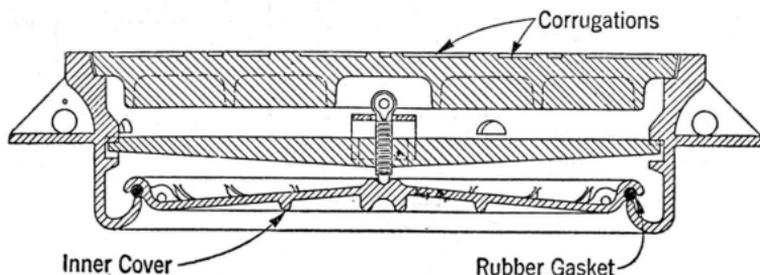
TYPE B



TYPE B FRAMES

Nominal Diameter of Opening (Inches)	Diameter of Base of Frame (Inches)		Height of Frame (Inches)	Outside Diameter of Cover (Inches)	Approximate Weights (Pounds)	
	Outside	Inside			Frame	Cover
24	43	35	10	25 3/4	355	195
27	46	38	10	28 3/4	385	245
30	49	41	10	31 3/4	440	305

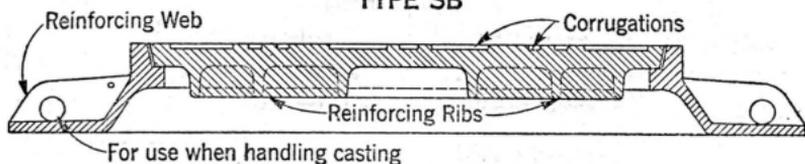
TYPE SA



TYPE SA FRAMES

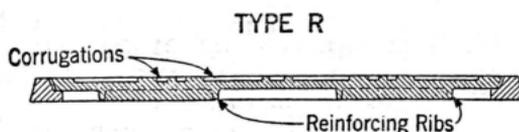
Nominal Diameter of Opening (Inches)	Diameter of Base of Frame (Inches)		Height of Frame (Inches)	Outside Diameter of Cover (Inches)	Approximate Weights (Pounds)		
	Outside	Inside			Frame	Cover	Inner Cover
27	43 1/2	32 3/4	5 5/8	33 1/4	500	385	95
30	46 1/2	35 3/4	5 5/8	36 1/4	560	465	145

TYPE SB



TYPE SB FRAMES

Nominal Diameter of Opening (Inches)	Diameter of Base of Frame (Inches)		Height of Frame (Inches)	Outside Diameter of Cover (Inches)	Approximate Weights (Pounds)	
	Outside	Inside			Frame	Cover
27	46	34	5 5/8	28 3/4	305	245
30	49	37	5 5/8	31 3/4	335	305



TYPE R FRAMES

Nominal Diameter of Opening (Inches)	Diameter of Base of Frame (Inches)		Height of Frame (Inches)	Outside Diameter of Cover (Inches)	Approximate Weights (Pounds)	
	Outside	Inside			Frame	Cover
27	32	27 $\frac{3}{4}$	1 $\frac{1}{2}$	29 $\frac{1}{4}$	60	140
30	35	30 $\frac{3}{4}$	1 $\frac{1}{2}$	32 $\frac{1}{4}$	70	165

5.02 The Types A and B frames are the types most commonly employed on new work. The former is equipped with an inner cover and a locking bar and is intended for use where it may be necessary to seal the manhole. The Types SA and SB are shallower modifications of the above types and are employed in connection with roadway regrading operations or in other instances where advantage may be taken of their shallower depth. Where the type of highway surfacing will permit, the Type SB frame can also be used on new construction as an alternative to the Type B frame. The Type R frames are to be used for manholes in sidewalks, parking strips and other locations not subject to the loads imposed by vehicular traffic.

5.03 The frames may be obtained with either solid or perforated covers, but unless otherwise specified by local regulations, solid covers should be installed.

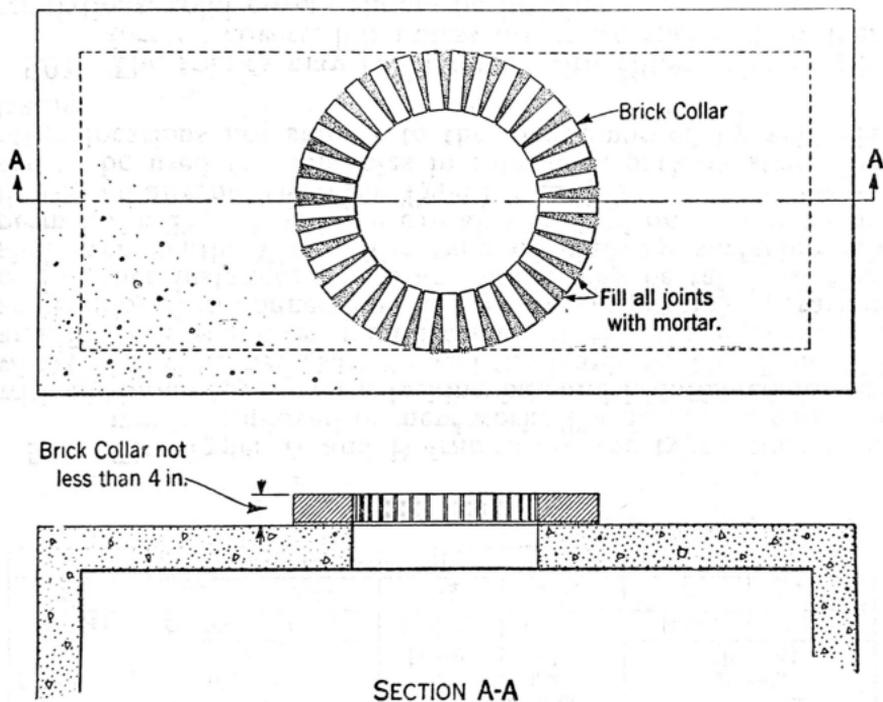
5.04 The three sizes of frames are to be used for the following purposes:

- (a) The 30-inch frame is for use on Types A, J, L, T and V manholes on heavy runs or in districts where required for light and ventilation. In addition, the 30-inch frame should be used on all manholes in which it may be necessary to place loading coil cases having a maximum cross-sectional dimension in excess of 26-1/2 inches.
- (b) The 27-inch frame is for use in general construction on all types of manholes, except as stated in (a) and (c).
- (c) The 24-inch frame is for use on Types X and Y manholes.

Placing Frame

5.05 Each frame with which the manhole is equipped is to be supported on a brick collar constructed as shown below. The collar should be of sufficient height to bring the cover flush with the grade of the street. (See G43.118.1 relating to depth of excavation for manholes.)

5.06 In highway locations the height of the brick collar should be not less than 4 inches, and when there is any probability that the grade of the street will be lowered subsequently, the height of the collar should be increased so that courses of brick may later be removed and the frame lowered to conform to the new grade.



5.07 Where the manhole is constructed in a grass plot and the Type R frame is employed, the roof should be located not less than 12 inches below the ground surface in order to afford sufficient cover of soil to permit the sod to reestablish itself. This will require that a collar at least 2 bricks high be constructed to support the ring type frame at the proper level.

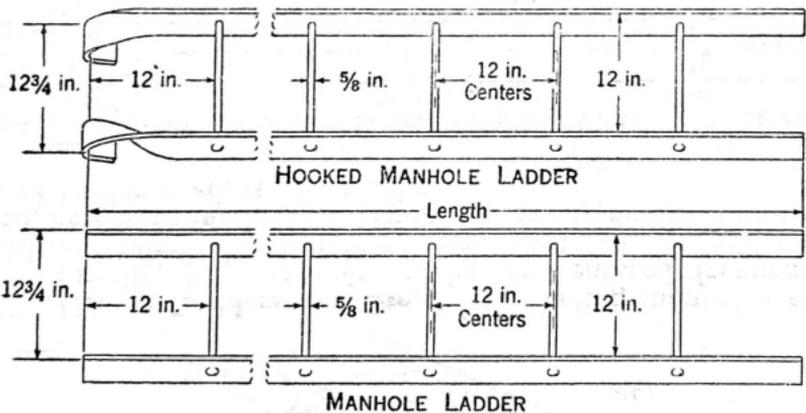
5.08 Lay the brick in mortar of the grade specified for brickwork and top the upper course with a layer of mortar in which to bed the manhole frame. The mortar bed should be of a thickness adequate to ensure even bearing all around the base of the frame and to bring the frame up to the desired grade. Do not use broken brick or other devices as a means of adjusting the frame to grade as this may result in uneven support for the frame.

5.09 Place the manhole frame, centering the opening with the opening in the manhole roof. In handling the frame, a tripod chain hoist or truck mounted derrick should be employed. Thoroughly fill all joints with mortar both inside and outside the collar.

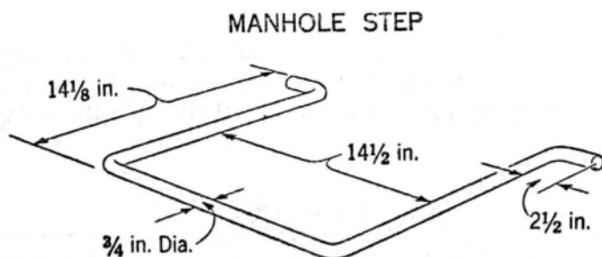
5.10 If required, the excavation may be backfilled as soon as the frame is in position.

6. LADDERS AND STEPS

6.01 **Description of Ladders and Steps:** Standard manhole ladders are of steel construction, hot dip galvanized and are furnished with plain ends or with the side rails of one end formed into hooks to engage a manhole step at the upper end of the ladder. Each type is furnished in seven lengths as follows: 6-1/2, 8, 10, 12, 14, 16 and 18 feet.



6.02 The manhole step is made of 3/4-inch round steel bar formed in the shape of a U with hooked ends and is furnished hot dip galvanized.



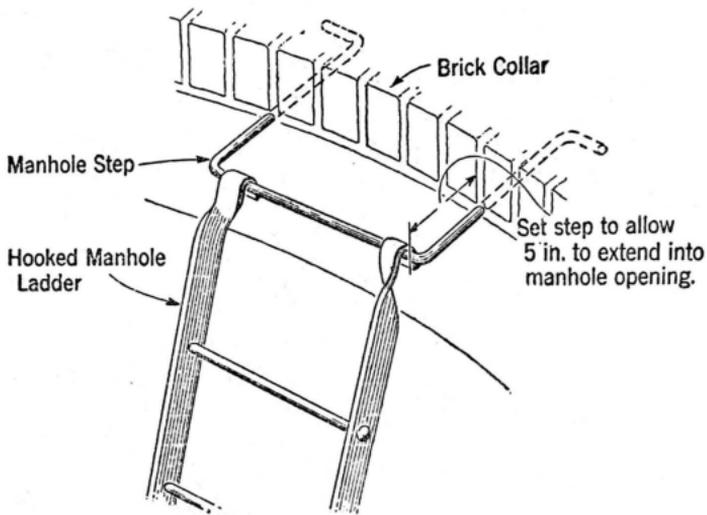
6.03 Use of Ladders and Steps: All loading manholes and, usually, line manholes which are entered frequently, should be equipped with ladders. The length of the ladder required, as determined by the headroom of the manhole and the type of ladder used, is given below.

*Headroom in Manhole (Feet)	Length of Straight End Ladder (Feet)	Length of Hooked Ladder (Feet)
5 to 5½	6½	6½
6	6½	8
6½ to 7	8	8
7½ to 9	10	10
9½ to 11	12	12
11½ to 13	14	14
13½ to 15	16	16
15½ to 16½	18	18

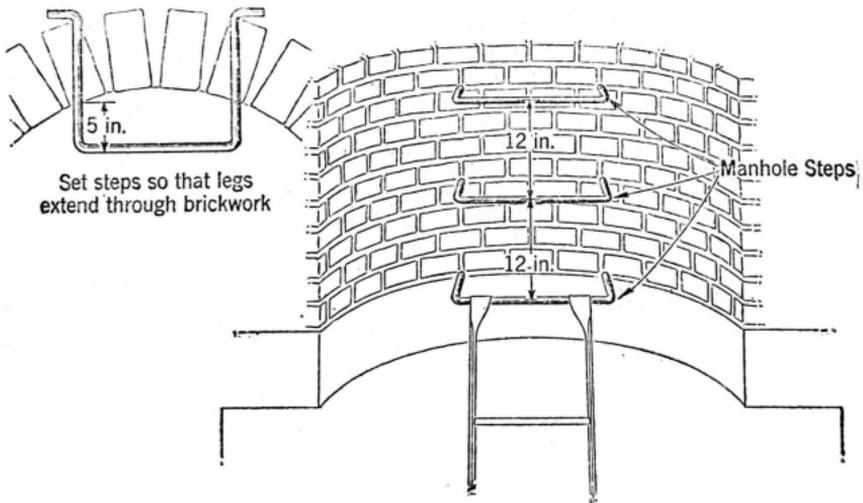
***Note:** In loading manholes which are permanently equipped with platforms, the length of the ladder required will usually be determined by the headroom of the splicing chamber.

6.04 Ladders for use in loading manholes, and in some cases for the deeper line manholes, should be of the hooked type in order to provide greater security for the ladder. A manhole step should be set in the roof opening of the manhole to provide a support for the ladder, as shown.

6.05 In order to be of maximum value as a step, it is desirable that the manhole step extend into the roof opening or chimney approximately 5 inches, as indicated. However, in loading manholes the space required for lowering loading coil cases is the controlling factor and the step should be set so as not to interfere with this operation. To avoid interference in loading manholes, the amount by which the step extends into the opening should not exceed 1/2 the difference between the minimum diameter of the frame opening and the diameter of the roof opening.



6.06 In situations where the brick chimney of the manhole may be so deep that the step or top rung of the ladder cannot easily and safely be reached by a workman entering the manhole, place additional manhole steps at intervals of one foot, as shown. Make certain that the legs of the steps are solidly embedded in the mortar of the brickwork.



6.07 Install steps in existing manholes by cutting away the brick at the point where the step is to be placed. Insert the legs of the step to the required depth and anchor them securely with brick and cement mortar.