

Design Procedure, the carrying capacities of leader pipes have been expressed directly in terms of Btu per hour.

In residences requiring a total leader pipe area of less than about 650 sq in., it is advisable to use two or more leader pipes to rooms requiring more than the capacity of a 12 in. round pipe. The tops of all sizes of leader pipes should be cut into the furnace bonnet at the same elevation, and from this point there should be a uniform upgrade of at least 1 in. per foot of run. Leaders over 12 ft in length, or having a large number of elbow fittings should be avoided if possible. In cases where such leaders are necessary, it is recommended that smooth transition fittings be used, and that duct insulation be applied. Asbestos paper, unless of the corrugated type, should not be considered as insulation. To assist in balancing the air distribution of the system, a damper should be placed

TABLE 1. FORMER METHOD OF EXPRESSING LEADER PIPE CARRYING CAPACITIES

REGISTER LOCATION	CARRYING CAPACITY OF EACH SQUARE INCH OF LEADER PIPE FOR 175 F REGISTER TEMPERATURE, IN BTU PER HOUR	
First Story.....	105 ^a	111 ^b
Second Story.....	170 ^a	166 ^b
Third Story.....	208 ^a	200 ^b

^aActual capacity. ^bUsed for average calculations.

in each leader pipe except one, this latter leader preferably being connected to a room heated at all times, such as a living room.

In a gravity circulating system, the ratio of stack to leader area is quite important, although little is gained by providing wall stacks with areas in excess of 75 per cent of their connected leader pipe area. In most cases a 3¼ in. X 12 in. stack is the largest which can be installed in normal wall construction. Hence, any room having a heat loss much in excess of 9000 Btu per hour, will require two or more stacks, or one oversized stack built into a 6 in. studding space, providing the design register temperature is to be retained at the value of 175 F as recommended.

Registers used for discharging warm air into rooms should have a net area not less than the area of the leader pipe to which the register is attached. First story registers should be connected through boot and register box extensions having areas at least equal to leader areas. Upper story registers should be of the same width as the wall stack, and should be placed either in the baseboard or sidewall, preferably without offsets. First story registers may be of the baseboard or floor type, with the former location preferred. High sidewall locations for warm-air registers in gravity systems deliver a greater quantity of warm air into the room than do baseboard registers, but most of the additional air merely results in high temperatures at the ceiling.

RETURN AIR DUCTS, GRILLES, AND SHOE CONNECTIONS

The ducts through which air is returned to the furnace should be designed to minimize resistance to air flow. They should be of ample

area, in excess of the total area of warm-air pipes, and should be streamlined. Horizontal ducts should pitch at least ½ in. per foot downward toward the furnace, avoiding fittings which would require lifting of the return air after the duct has passed under some obstacle.

The return air grilles should have free areas at least equal to the ducts to which they connect. These return air grilles should be installed in the floor, or in the baseboard with the top edge of the grille not more than about 8 in. above the floor line. Frictional resistance in the return air system is as detrimental to proper performance as is resistance in the warm-air system, so that care should be exercised in locating return air grilles which require long return ducts.

The placement and number of return grilles will depend upon the size, details, and exposure of the house. Small compactly built houses may be adequately served by a single return grille effectively placed in the central hall. It is usually desirable to have two or more returns, provided that

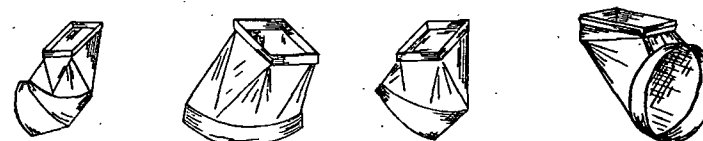


FIG. 2. TYPICAL BOOTS

in two-story residences one return is placed to effectively receive the return air at the foot of the stairs. A return air connection must be carried to any heated room whose floor level is below that of adjacent rooms.

Where a divided system of two or more returns is used, the grilles must be placed to serve the maximum area of cold wall or windows. Thus, in rooms having only small windows the grille can be brought as close to the furnace as possible, but if the room has large window exposure the grille should be located near the exposure. If long ducts are used in parallel with short return ducts, the frictional resistance of the long ducts must be reduced to compensate for the length. Return ducts from upstairs rooms may be necessary in spaces which are closed off from the rest of the house or which have much outdoor exposure. Return grilles on different floor levels should not be connected to the same vertical return duct.

Ducts returning air to the furnace should avoid heat sources which tend to reheat the return air. If the duct must be run over the top of the furnace, or above the vent pipe from the furnace, insulation should be interposed between the heat source and the duct.

Circulation of air is facilitated if the air can slide down a pipe inclined at approximately 45 degrees and into a furnace shoe connection having a cross-sectional area equal to that of the pipe. The top of the return shoe should enter the casing below the level of the grate in the case of a coal