

4 ● What is the effect of train speed upon the cooling requirements of a car?
Requirements are slightly increased because of increased heat transmission.

5 ● What is the capacity of the air conditioning unit in the average car?
2000 to 2500 cfm.

6 ● When is it economical to take all air for car cooling from outdoors?
When the outdoor wet-bulb temperature is lower than that in the car.

7 ● What various arrangements are used for distributing cooled air into cars?
Bulkhead delivery at center or ends of car, center duct, and side duct on one or both sides.

8 ● What types of cooling systems are used?
Ice, steam jet, and mechanical compressor systems.

9 ● What cooling medium is used for condensing the refrigerant in a railroad air conditioning system?
Outdoor air.

10 ● How may adequate cooling of condensers be provided in hot desert regions?
By evaporative cooling with water sprays.

11 ● How is the temperature controlled in railroad cooling systems?
By intermittent operation of the compressor or the steam jet or the ice-water circulating pump.

12 ● How much steam is required for car heating on the coldest days?
Pullmans 250 lb per hour, coaches 150 to 175 lb per hour, baggage cars 150 lb per hour.

13 ● At present costs which is likely to be the greater, fixed charges or operating costs?
The fixed charges for steam and mechanical compression systems, and operating costs for ice systems.

14 ● What would be the annual operating cost for a car cooling system, using ice, if the car travels 150,000 car miles?
\$2,850.

Chapter 23

GRAVITY WARM AIR FURNACE SYSTEMS

Design Procedure, Estimating Heating Requirements, Leader Pipe Sizes, Proportioning Wall Stacks, Register Selections, Recirculating Ducts and Grilles, Furnace Return Connection, Furnace Capacity, Examples, Booster Fans

WARM air heating systems of the gravity type are described in this chapter¹, and those of the mechanical type are described in Chapter 24. In the gravity type, the motive head producing flow depends upon the difference in weight between the heated air leaving the top of the casing and the cooled air entering the bottom of the casing, while in the mechanical type a fan may supply all or part of the motive head. Booster fans are often used in conjunction with gravity-designed systems to increase air circulation.

In general, a warm-air furnace heating plant consists of a fuel-burning furnace or heater, enclosed in a casing of sheet metal or brick, which is placed in the basement of the building. The heated air, taken from the top or sides near the top of the furnace casing, is distributed to the various rooms of the building through sheet metal warm-air pipes. The warm-air pipes in the basement are known as leaders, and the vertical warm-air pipes which are run in the inside partitions of the building are called stacks. The heated air is finally discharged into the rooms through registers which are set in register boxes placed either in the floor or in the side wall, usually at or near the baseboard.

The air supply to the furnace may be taken (1) entirely from inside the building through one or more recirculating ducts, (2) entirely from outside the building, in which case no air is recirculated, or (3) through a combination of the inside and the outside air supply systems.

DESIGN PROCEDURE

The design of a furnace heating system involves the determination of the following items:

1. Heat loss in Btu from each room in the building.
2. Area and diameter in inches of warm-air pipes in basement (known as leaders).
3. Area and dimensions in inches of vertical pipes (known as wall stacks).
4. Free and gross area and dimensions in inches of warm-air registers.
5. Area and dimensions of recirculating or outside air ducts, in inches.
6. Free and gross area and dimensions in inches of recirculating registers.

¹All figures and much of the engineering data which follow are from University of Illinois Engineering Experiment Station Bulletins Nos. 141, 188, 189 and 246, Warm Air Furnaces and Heating Systems, by A. C. Willard, A. P. Kratz, V. S. Day, and S. Konzo.