## ADVANTAGES OF STEAM AS A HEATING MEDIUM

Probably the greatest single advantage offered by steam as a heating medium is the superior ability to carry heat. But steam has many other virtues. It offers freedom from freeze-up and assures absence of damage from water leakage. Steam requires low power to circulate through the system. Especially, steam offers the advantage of rapid response.

Rapid response, or the ability of the heating system to heat-up or cool-down radiation units quickly, is not only convenient but contributes directly to economical operation characteristic of steam. With steam, the heating system of a school or other building may be shut down and left unattended over a night or weekend without danger of freezing or damage from water leakage. Rapid response assures fast warm-up when heat is again required.

Steam, when used for space heating, does away with secondary steam boilers and related equipment required for utility water heating, ventilating fan coils, and kitchen equipment.

## STEAM HEAT MAY BE PERFECTLY CONTROLLED

The Nash Synchronized Heating Control is a new primary control which, for the first time, successfully regulates steam to the heating system in proportion to the heat loss of the building. It operates on a unique principle by which the steam supply pressure or vacuum is controlled by and synchronized to conditions in the return side of the heating system.

In the return side of the heating system, conditions are controlled directly by outside temperature and, in turn, the steam supply is varied from approximately 2 lbs. pressure and corresponding temperature of 218°F., or higher in the coldest weather, to 20" Hg. vacuum and corresponding temperature of 161°F. in mild weather.

The control provides a wide differential in cold weather and a decreasing differential as weather moderates, assuring complete distribution and system balancing at all times.

Individual room temperature controls can provide closely regulated heat output without "hunting" and without overruns when Nash Synchronized Heating Control is employed. This is particularly important in the moderate weather which constitutes the major part of the heating season. During this season the control supplies low temperature expanded steam. This permits individual valves to accurately supply steam to heating elements, requiring only minor adjustments by individual room control.

In comparison with low vacuum steam heating systems, fuel savings of greater than 20 percent are obtained. These savings can be confirmed to the satisfaction of any consulting engineer or building owner by examination of a Nash Control in operation.

When the Nash Control is employed, specification is flexible and convenient because any type or make of radiation, valve, or trap, suitable for high vacuum operation, can be used.

Operation of a heating system with Nash Control is quiet with a complete absence of orifice hiss and water hammer.

In moderate weather, the Nash Control eliminates drafts and variations in room temperature due to its ability to supply expanded low temperature steam and evenly distribute it throughout the heating surfaces, thus eliminating overheating of a portion of the radiation. This is especially important with fin-tube radiation.

When unit ventilators are employed, troublesome and fuel consuming overruns and underruns are eliminated. Because the Nash Control expands the steam and delivers it to the unit ventilators at lower temperature, the unit ventilator is not overheated and, therefore, is not caused to introduce outside cooling air in excess of that required for ventilation.

## HOW THE NASH SYNCHRONIZED HEATING CONTROL OPERATES

This advanced Nash Heating Control automatically and accurately regulates the vacuum in the return side of the heating system as shown on Chart 1. In the coldest weather only a low vacuum is maintained and as the weather moderates the vacuum is increased until it reaches 20″ Hg. vacuum or greater. Simultaneously, admission of steam to the supply side of the system is closely regulated so as to maintain a correct differential at all times between the supply and return side. Chart 1 shows typical operation of the control and indicates how the supply side steam conditions vary with return side vacuum. The control produces a wide differential in cold weather and a decreasing differential as the weather moderates. To match the requirements of any installation, the Nash Control is readily adjusted when the system is put into initial operation. This is accomplished by changing, if necessary, the slope of the average steam main pressure curve or changing the differential between this curve and the average vacuum in the return main.

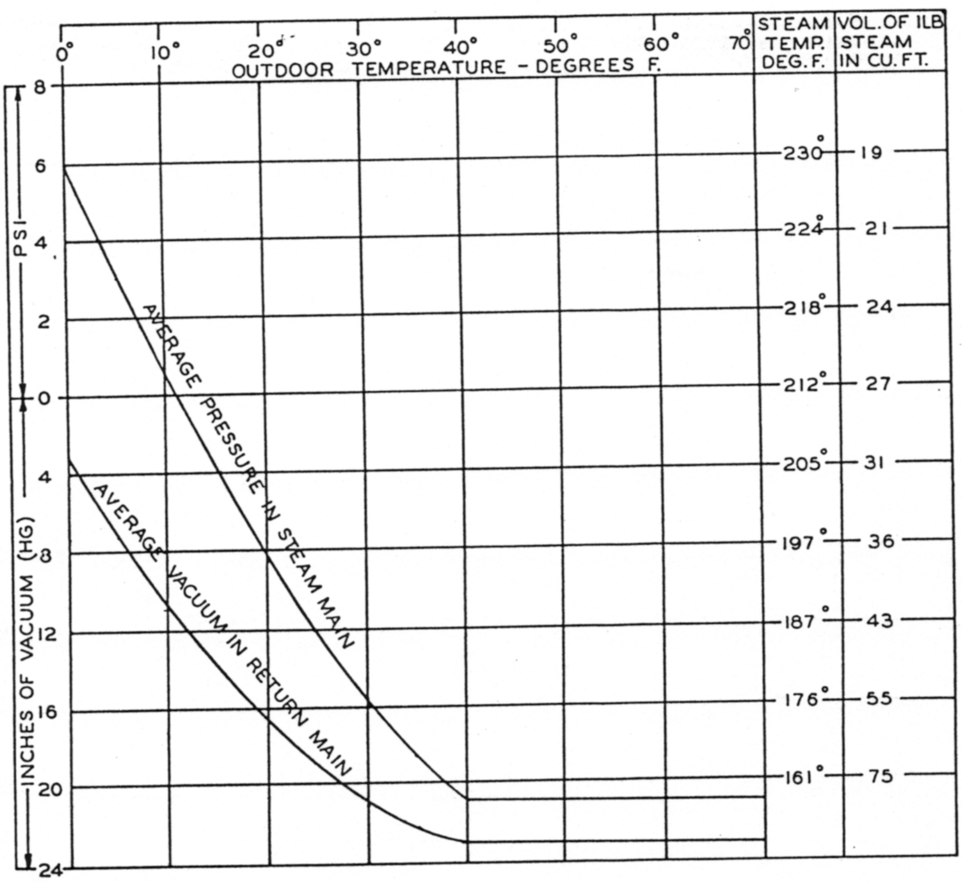



CHART NO. 1

TYPICAL PERFORMANCE WITH 6 LBS. MAXIMUM SUPPLY PRESSURE AT 0° F. DESIGN TEMPERATURE

The Nash Synchronized Heating Control assures balanced distribution of steam to all parts of the heating system over the entire outside temperature range by a new process of regulated expansion. This is accomplished by automatically reducing the flow of steam to the supply side, at proper intervals.

## APPLICATION OF NASH SYNCHRONIZED HEATING CONTROL

Figure 1 shows the general arrangement of a system employing a Nash Synchronized Heating Control. This may be varied to meet individual conditions, but in no case is it necessary to depart from established practice with any low vacuum return system.

In Figure 1 is shown a variety of radiation units such as are frequently present on a single installation. The Nash Synchronized Heating Control functions equally well with any type of direct heating unit.

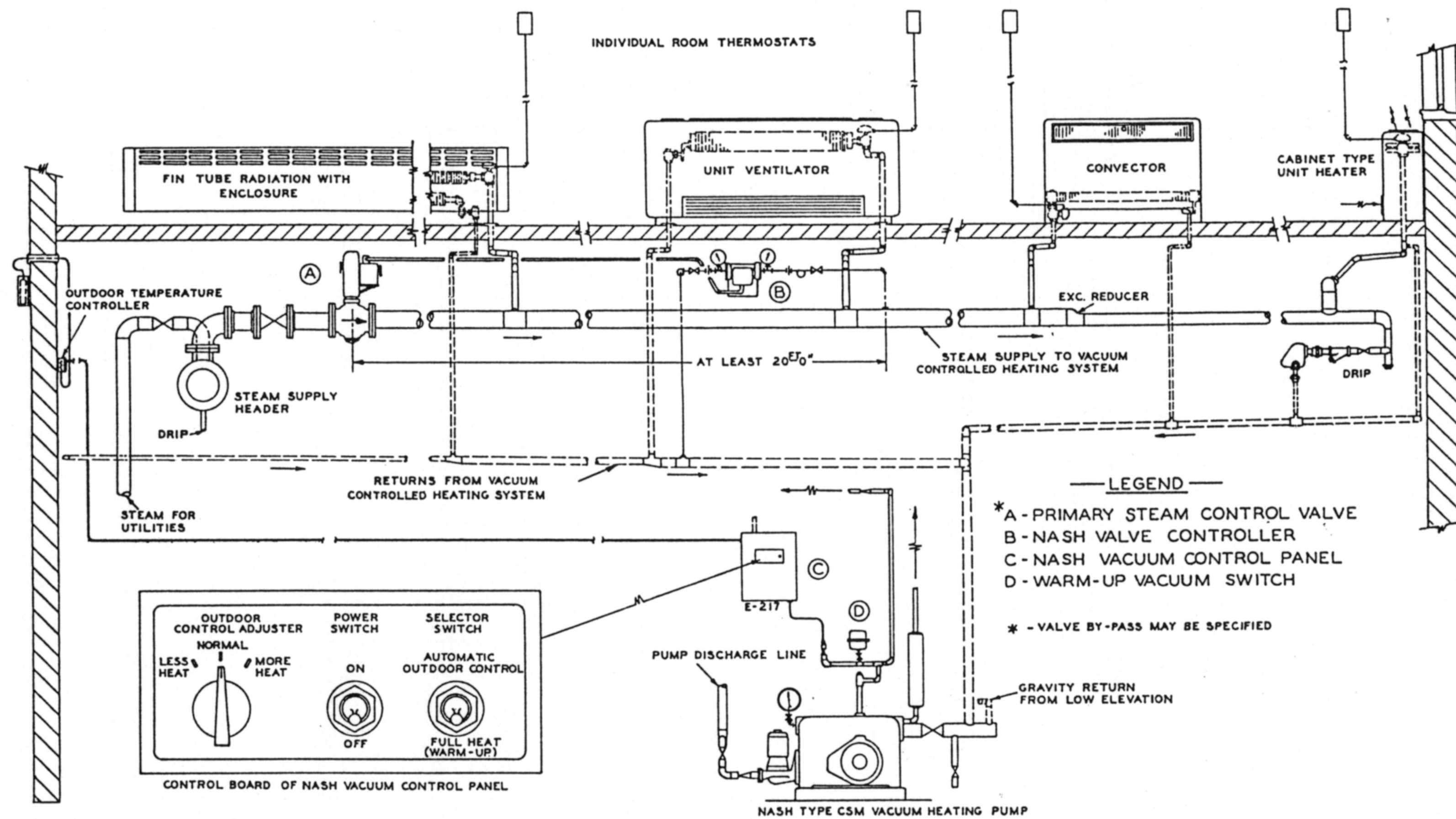
## SPECIFICATION OF A NASH SYNCHRONIZED HEATING CONTROL

Furnish and install, as shown on plans and in accordance with manufacturer's instructions, a Nash Synchronized Heating Control which shall include the following components:

One (1) size______ Nash Primary Control Valve of the modulating motor-operated type, capable of passing_____lbs. of steam per hour from an average supply pressure of____lbs. to____lbs. average pressure in the heating main. (NOTE: Pneumatic Type Primary Control Valve may be specified if desired when a source of 15 lb. control air is available.)

One (1) variable differential type Nash Valve Controller for primary valve. This controller shall cause the valve to operate so as to maintain a pressure differential between the supply side and return side of the heating system sufficient for complete circulation at all times. The differential shall be variable, such that the greatest differential is provided at outside design temperature with this differential reduced as outdoor temperature moderates. The maximum differential shall be approximately______and reduced to approximately_____ in moderate weather.

One (1) Nash Vacuum Pump Controller with outdoor sensing element and temperature switch for controlling operation of the vacuum heating pump directly from outside temperature. This controller shall cause pump operation to maintain an average vacuum in the return side of the heating system from 5½″ Hg. vacuum at design temperature to approximately 20″ Hg. vacuum or greater as outside temperature moderates. At design temperature, the pump operating range shall be varied from approximately 5″ Hg. between start and stop to approximately 2″ Hg. between start and stop in mild weather.




SCHEMATIC DRAWING SHOWING BASIC LAYOUT

FIGURE 1

The Nash Vacuum Pump Controller shall be installed in the pump room, and the temperature switch shall be mounted on an outside wall of the building, with its outdoor sensing element located out of the sun and out of the path of air discharged from the building. The temperature switch shall be furnished with 5 feet of capillary tubing and a shield for the outdoor sensing element.

One (1) Nash Type CSM, Series____ (Modified Duplex) Duplex Vacuum Heating Pump complete with all standard accessories. (Modified duplex unit shall be three motor construction with two bronze fitted centrifugal pumps and one bronze fitted rotary water sealed positive displacement type vacuum pump.) Duplex unit shall be four motor construction with two bronze fitted centrifugal pumps and two bronze fitted rotary water sealed positive displacement type vacuum pumps.

(Each) centrifugal pump shall be direct connected to a____hp motor, and (each) shall have a capacity of_____ gpm from 20″ Hg. vacuum to ____lbs. discharge pressure at the pump. (Each) vacuum pump shall be direct connected to a____hp motor, and (each) shall have a capacity of ____cfm dry air at 20″ Hg. vacuum and 70°F. and shall be capable of maintaining this vacuum through a____diameter sharp edged orifice plate ⅛″ thick when taking air from atmosphere. Condensate and air shall be separated under vacuum, with all pumping units capable of delivering their rated capacity separately or simultaneously.

All pumping units shall be mounted on one cast iron receiver with inlet strainer, gauge glass, and built-in air discharge separator(s). Standard accessories shall include condensate discharge check valves, air inlet check valve(s), vacuum gauge, and thermometer. The receiver shall be equipped with two float switches to provide sequence water pump control. The vacuum pump(s) shall be controlled by the Nash Vacuum Pump Controller.

Motors shall be drip-proof, suitable for operation on____phase,____ cycle, ____volts, and each shall be furnished with across-the-line type magnetic starter for wall mounting. Nash Primary Valve Motors and Nash Vacuum Pump Controller shall operate at 24 volts with primary supply at 120 volts, single phase.

The electric wiring for the motors, starters, and control equipment is included in the electrical specification and will not be a part of this contract.

## HEATING SYSTEM REQUIREMENTS

Return piping shall be pitched, without pockets or seals, so that all condensate will flow by gravity into the receiver of the vacuum heating pump.

Accumulator tanks shall not be used nor shall lift fittings be used in any part of the return side of the heating system.

Only condensate from steam that has passed through the Nash Primary Steam Control Valve, or which has been properly flashed, shall be drained to the return side of the heating system.

All return piping shall be left uncovered wherever practicable.

All steam mains and branches shall be properly dripped at least once in every 200 feet of run.

All steam specialties shall be suitable for high vacuum operation.

After completion, the system shall be tested for tightness when cold. To do this, close the valve in the steam main at the boiler. Using the air pump, a vacuum of 20″ Hg. shall then be established in the entire system. The pump shall then be stopped, whereupon the vacuum shall not drop more than 2″ Hg. in twenty minutes.

The CSM vacuum heating pump should be selected from the tables appearing on Page 12 based on the following:

(a) For heating units equipped with fin-tube heating elements, the water capacity of each centrifugal pump should not be less than 1 gpm per 1000 square feet EDR, and the air capacity of (each) vacuum pump not less than 1 cfm per 1000 square feet EDR.

(b) For cast iron radiators, the water capacity remains the same, but the air capacity should be 2 cfm per 1000 square feet EDR.

When necessary, the specifications may be modified to provide the following:

(a) More than one Nash Primary Control Valve.

(b) Water capacity of 1½ gpm per 1000 square feet EDR for a single CSM unit with one centrifugal pump only.

(c) Totally enclosed motors or combination starters.

The electrical specifications should include the wiring for:

(a) Nash Valve Controller and Primary Supply Valve in accordance with wiring diagram appearing on Page 13. (NOTE: Pneumatic Primary Supply Valve must be provided with a source of control air.)

(b) Nash Vacuum Pump Controller and temperature switch in accordance with wiring diagram appearing on Page 14.

(c) The vacuum heating pump unit in accordance with the wiring diagram supplied with the unit.

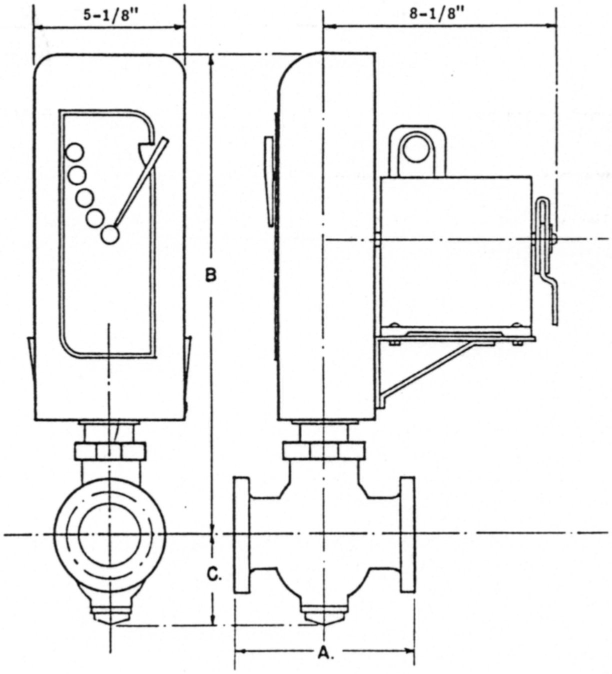
A pressure relief valve should be specified for installation in the heating main beyond the Nash Primary Control Valve if the steam pressure ahead of the primary valve exceeds 15 psi.

The standard practice of rising at each drip in the steam main and branches should be followed where headroom permits.

## NASH MOTOR OPERATED TYPE PRIMARY CONTROL VALVES

1" to 3", inclusive — Bronze body, bronze trim, with screwed connections.

4" to 6", inclusive — High tensile iron body, bronze trim, with flanged connections.

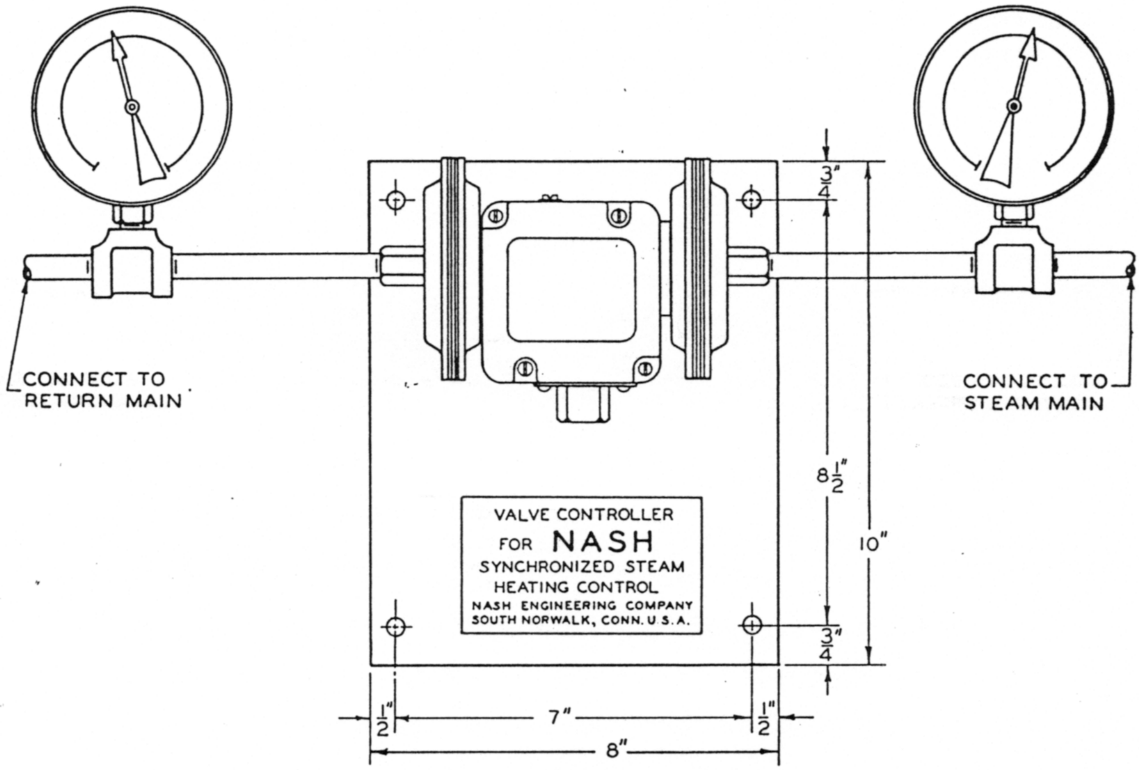



DIMENSIONS

| VALVE SIZE (inches) | TYPE AND BODY | DIMENSIONS (inches) | | |
|---|---|---|---|---|
| | | A | B | C |
| 1 | Single Seated Bronze Screwed | 4-3/8 | 15-1/8 | 1-5/8 |
| 1-1/4 | Single Seated Bronze Screwed | 5 | 15-3/8 | 1-1/2 |
| 1-1/2 | Single Seated Bronze Screwed | 5-3/4 | 15-1/2 | 1-3/8 |
| 2 | Single Seated Bronze Screwed | 5-3/4 | 15-3/4 | 2 |
| 2-1/2 | Single Seated Bronze Screwed | 7-1/2 | 16 | 2-3/8 |
| 3 | Single Seated Bronze Screwed | 8-7/8 | 16-3/8 | 2-3/8 |
| 4 | Double Seated Iron Flanged | 10-7/8 | 19 | 6 |
| 5 | Double Seated Iron Flanged | 12-1/8 | 19-7/8 | 5-1/2 |
| 6 | Double Seated Iron Flanged | 13-3/4 | 20-7/8 | 6-1/2 |

Approximately 4" clearance is required for removal of linkage. The linkage may be installed horizontally provided the motor remains in a horizontal position.

VARIABLE DIFFERENTIAL TYPE NASH VALVE CONTROLLER

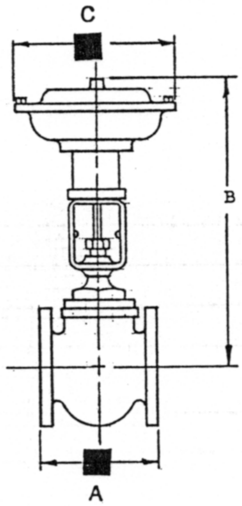



## Table 1M
### SELECTION OF NASH MOTOR OPERATED TYPE PRIMARY CONTROL VALVE
### For 2 psi Pressure in the Heating Main

| CAPACITY IN POUNDS OF STEAM PER HOUR | INLET STEAM PRESSURE TO VALVE IN POUNDS PER SQUARE INCH | | | | | |
|---|---|---|---|---|---|---|
| | 3 | 4 | 5 | 7½ | 10 | 15 |
| 250 | 1¼" | 1" | 1" | 1" | 1" | 1" |
| 500 | 2" | 1½" | 1¼" | 1¼" | 1" | 1" |
| 750 | 2½" | 2" | 1½" | 1¼" | 1¼" | 1" |
| 1,000 | 2½" | 2" | 2" | 1½" | 1½" | 1¼" |
| 1,250 | 3" | 2½" | 2" | 2" | 1½" | 1½" |
| 1,500 | 4" | 2½" | 2½" | 2" | 2" | 1½" |
| 1,750 | 4" | 3" | 2½" | 2" | 2" | 2" |
| 2,000 | 4" | 3" | 3" | 2½" | 2" | 2" |
| 2,500 | 5" | 4" | 3" | 2½" | 2½" | 2" |
| 3,000 | 5" | 4" | 4" | 3" | 2½" | 2½" |
| 3,500 | 6" | 4" | 4" | 3" | 3" | 2½" |
| 4,000 | 6" | 5" | 4" | 4" | 3" | 3" |
| 5,000 | * | 5" | 5" | 4" | 4" | 3" |
| 6,000 | * | 6" | 5" | 5" | 4" | 4" |
| 7,000 | * | 6" | 6" | 5" | 4" | 4" |
| 8,000 | * | * | 6" | 5" | 5" | 4" |
| 9,000 | — | * | * | 6" | 5" | 4" |
| 10,000 | — | * | * | 6" | 6" | 5" |
| 12,000 | — | * | * | 6" | 6" | 5" |

(*Use two valves of suitable size in parallel. Only one valve controller is required for both valves.)

## NASH PNEUMATIC TYPE PRIMARY CONTROL VALVES
## 1½" to 2" Bronze Body with Screwed Connections
## 2½" to 6" Iron Body with Flanged Connections



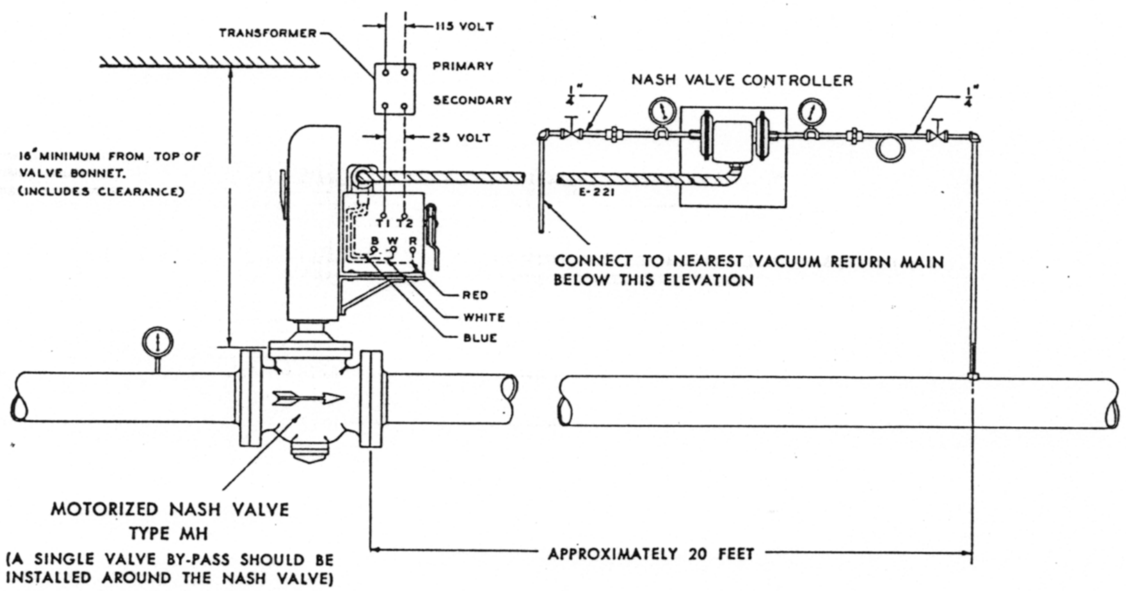

| VALVE SIZE (INCHES) | BODY | TOP SIZE | DIMENSIONS (INCHES) | | |
|---|---|---|---|---|---|
| | | | A | B | C |
| 1½ | BRONZE SCREWED | 3-R | 4⅞ | 10¼ | 6 |
| 2 | BRONZE SCREWED | 3-R | 5⅛ | 10¾ | 6 |
| 2½ | IRON FLANGED | 4-R | 7¼ | 14 | 8⅛ |
| 3 | IRON FLANGED | 5-R | 8⅝ | 20 3/16 | 11⅞ |
| 4 | IRON FLANGED | 5-R | 10½ | 21 13/16 | 11⅞ |
| 5 | IRON FLANGED | 5-R | 12½ | 22 9/16 | 11⅞ |
| | | 8-R | 12½ | 26 7/16 | 16½ |
| 6 | IRON FLANGED | 8-R | 14½ | 28 | 16½ |

## Table 1P
## SELECTION OF NASH PNEUMATIC TYPE PRIMARY CONTROL VALVE
## For 2 psi Pressure in the Heating Main

| CAPACITY IN POUNDS OF STEAM PER HOUR | INLET STEAM PRESSURE TO VALVE IN POUNDS PER SQUARE INCH | | | | | |
|---|---|---|---|---|---|---|
| | 3 | 4 | 5 | 7½ | 10 | 15 |
| 250 | 1½" | 1½" | 1¼" | 1¼" | 1" | 1" |
| 500 | 2½" | 2" | 2" | 1½" | 1½" | 1¼" |
| 750 | 3" | 2½" | 2" | 2" | 1½" | 1½" |
| 1,000 | 3" | 3" | 2½" | 2" | 2" | 1½" |
| 1,250 | 4" | 3" | 3" | 2½" | 2" | 1½" |
| 1,500 | 4" | 4" | 3" | 2½" | 2½" | 2" |
| 1,750 | 4" | 4" | 3" | 3" | 2½" | 2" |
| 2,000 | 5" | 4" | 4" | 3" | 3" | 2½" |
| 2,500 | 5" | 4" | 4" | 3" | 3" | 2½" |
| 3,000 | 5" | 5" | 4" | 4" | 3" | 3" |
| 3,500 | 6" | 5" | 5" | 4" | 4" | 3" |
| 4,000 | 6" | 5" | 5" | 4" | 4" | 3" |
| 5,000 | * | 6" | 5" | 5" | 4" | 4" |
| 6,000 | * | 6" | 6" | 5" | 5" | 4" |
| 7,000 | * | * | 6" | 5" | 5" | 4" |
| 8,000 | * | * | * | 6" | 5" | 5" |
| 9,000 | — | * | * | 6" | 5" | 5" |
| 10,000 | — | * | * | 6" | 6" | 5" |
| 12,000 | — | * | * | * | 6" | 5" |

(*Use two valves of suitable size in parallel. A valve controller is required for each valve.)

## PIPING AND WIRING DIAGRAM FOR NASH MOTOR OPERATED TYPE PRIMARY CONTROL VALVE AND VALVE CONTROLLER

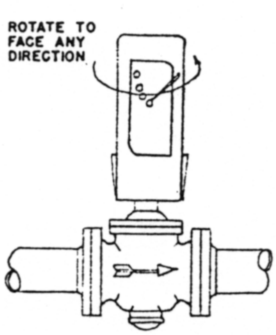



NOTE: The valve body should not be installed directly above a boiler or in any location where the ambient temperature may exceed 110 deg. F. It may be located any distance from the boiler or steam supply header ahead of the initial radiation.

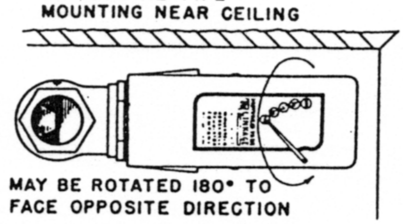
It is improper to install the valve with the motor below the valve body, because an objectionable drippage of condensate may occur under certain conditions of operation. Proper arrangements are shown below.

Valves are furnished with one minute motors. The valve is not in continuous motion.

Installation of valve controller should be arranged so that there can be no accumulation of water in control piping leading to it. All devices indicated are furnished by Nash Engineering Company. Piping, gate valves and wiring are not included.

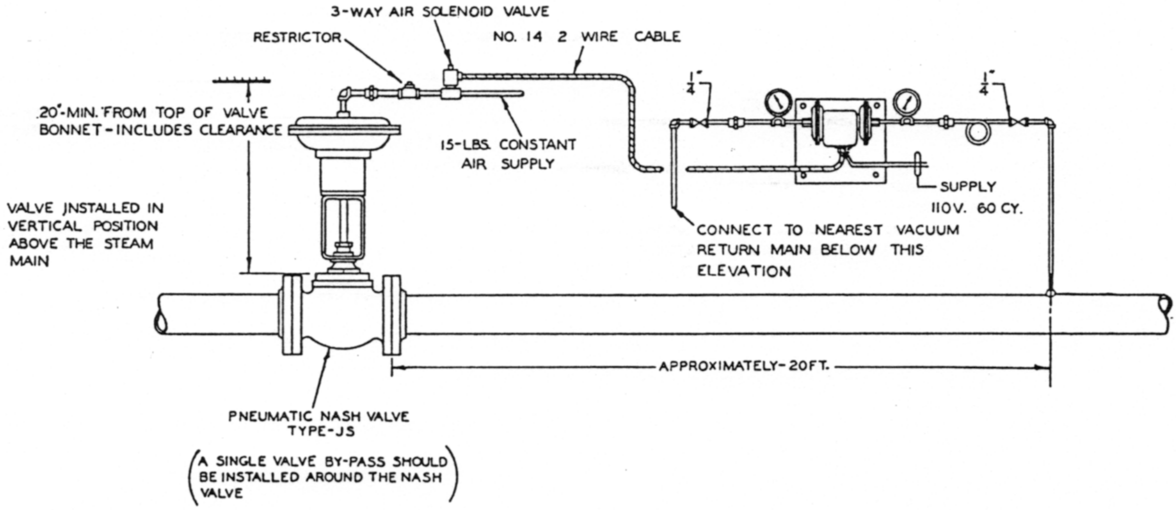



Preferred Arrangement



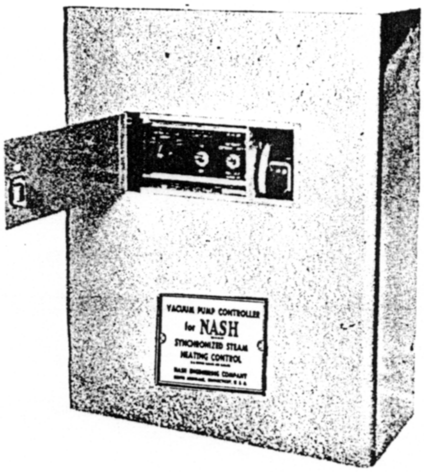

Optional Arrangement
(for limited headroom)

## PIPING AND WIRING DIAGRAM FOR NASH PNEUMATIC TYPE PRIMARY CONTROL VALVE WITH ELECTRIC VALVE CONTROLLER

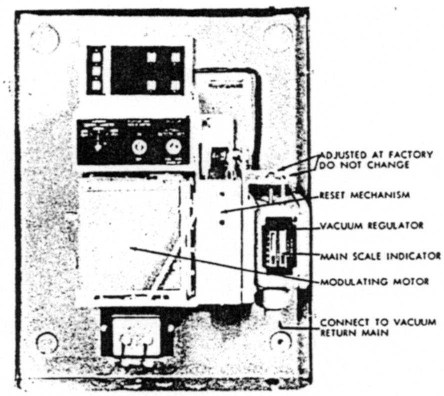



NOTE: Unlike the motor operated valve, the pneumatic valve may be adjusted for any opening or closing speed by adjustment of the restrictor. Adjustment of the restrictor should be such that shaft motion is barely perceptible. The valve remains in continuous motion except when fully open or fully closed.

Installation of valve controller should be arranged so that there can be no accumulation of water in control pipe leading to it. All devices indicated are furnished by Nash Engineering Company. Piping, gate valves and wiring are not included.

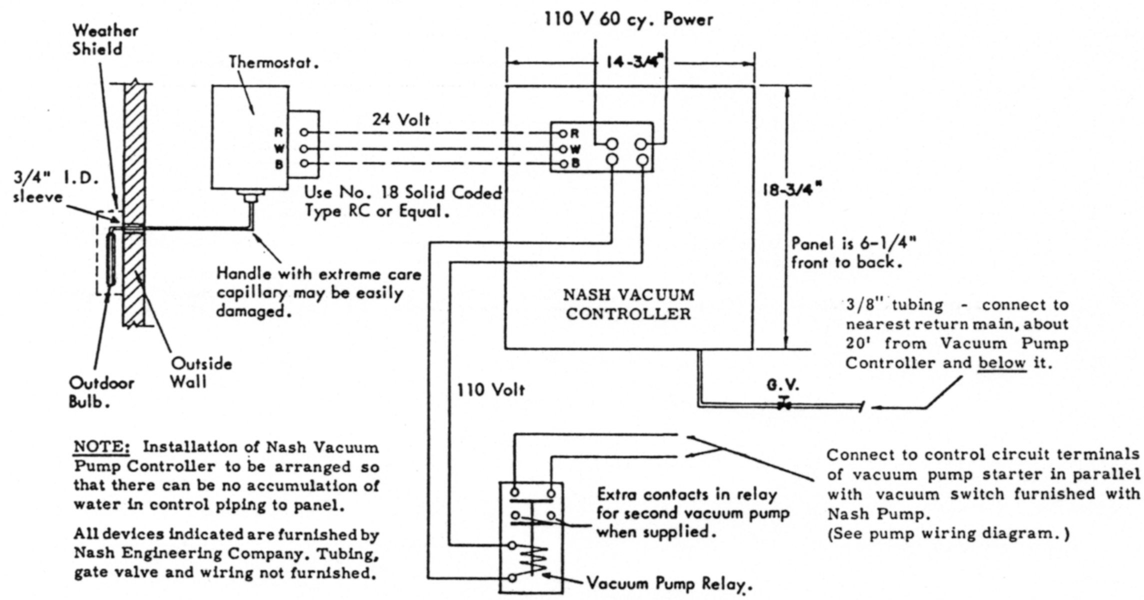



NASH VACUUM PUMP CONTROLLER




NASH VACUUM PUMP CONTROLLER
WITH COVER REMOVED

CONNECTION AND WIRING DIAGRAM.
FOR NASH VACUUM PUMP CONTROLLER AND ACCESSORIES.




NOTE: Installation of Nash Vacuum Pump Controller to be arranged so that there can be no accumulation of water in control piping to panel.

All devices indicated are furnished by Nash Engineering Company. Tubing, gate valve and wiring not furnished.

## NASH TYPE CSM VACUUM HEATING PUMPS

Tables 2 and 3 may be used for selecting the correct size CSM unit to meet the water and air capacity requirements of the system. Water pump capacities are in U.S. gallons per minute at 70°F. temperature from 20″ Hg. vacuum against discharge pressure specified. Air pump capacities are in cubic feet per minute of dry air at 70°F. measured at 20″ Hg. vacuum.

### Table 2

| SERIES | WATER PUMP DISCHARGE PRESSURE FROM 20″ HG. VACUUM | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 10 LBS. | | 15 LBS. | | 20 LBS. | | 25 LBS. | | 30 LBS. | | 40 LBS. | | 50 LBS. | |
| | GPM | HP | GPM | HP | GPM | HP | GPM | HP | GPM | HP | GPM | HP | GPM | HP |
| 10 | 7 | ⅓ | — | — | 10 | ½ | 4 | ¾ | — | — | — | — | — | — |
| | 12 | ½ | 12 | ½ | 12 | ¾ | 12 | 1 | 12 | 1 | 12 | 1½ | 12 | 2 |
| 20 | — | — | 16 | ½ | 20 | ¾ | — | — | — | — | 15 | 1½ | 14 | 2 |
| | 23 | ½ | 23 | ¾ | 23 | 1 | 23 | 1 | 23 | 1½ | 23 | 2 | 23 | 3 |
| 40 | 23 | ½ | 16 | ½ | 20 | ¾ | 23 | 1 | 12 | 1 | 15 | 1½ | 14 | 2 |
| | 38 | ¾ | 30 | ¾ | 36 | 1 | 36 | 1½ | 30 | 1½ | 30 | 2 | — | — |
| | — | — | — | — | 42 | 1½ | — | — | — | — | — | — | — | — |
| | 45 | 1 | 45 | 1 | 45 | 2 | 45 | 2 | 45 | 2 | 45 | 3 | 45 | 3 |
| 60 | 50 | 1 | 50 | 1½ | 50 | 2 | 50 | 2 | 50 | 3 | 50 | 5 | | |
| | 60 | 1½ | 60 | 2 | 60 | 2 | 60 | 3 | 60 | 3 | 60 | 5 | | |
| | 80 | 2 | 80 | 3 | 80 | 3 | 80 | 5 | 80 | 5 | 80 | 5 | | |
| | 100 | 2 | 100 | 3 | 100 | 5 | 100 | 5 | 100 | 5 | 100 | 7½ | | |
| 100 | 120 | 3 | 120 | 5 | 120 | 5 | 120 | 5 | 120 | 7½ | 120 | 7½ | | |
| | 150 | 5 | 150 | 5 | 150 | 5 | 150 | 7½ | 150 | 7½ | 150 | 10 | | |

### Table 3

**AIR PUMP PERFORMANCE AT 20″ HG. VACUUM**

| CFM | SERIES 10 | SERIES 20 | SERIES 40 | SERIES 60 | SERIES 100 |
|---|---|---|---|---|---|
| | MOTOR HP | MOTOR HP | MOTOR HP | MOTOR HP | MOTOR HP |
| 4 | ½ | | | | |
| 10 | 1 | | | | |
| 15 | 1½ | 1½ | | | |
| 20 | 2 | 2 | | | |
| 28 | | | 2 | | |
| 38 | | | 3 | | |
| 55 | | | 5 | 5 | |
| 70 | | | | 5 | 5 |
| 105 | | | | 10 | 10 |
| 150 | | | | 15 | 15 |

## REVISED PIPING STANDARDS CUT INSTALLATION COSTS

Use of smaller established pipe size standards results in significant savings in piping steam heating systems. These cost reducing methods can be used to great advantage when designing a heating system.

With smaller established pipe size standards and the Nash Synchronized Heating Control, the heating system may be designed for a total pressure drop of 7.5 pounds at 100 percent of heating plant capacity. This total pressure drop consists of the individual pressure drops as shown in Table 4, below. The 7.5 psi design pressure drop is overcome by an average boiler pressure of 4¾ pounds and an average return line vacuum at outside design temperature of 5½″ Hg. or minus 2¾ pounds. The recommended boiler pressure range is 4 to 8 psi.

For complete information on pipe sizing and piping connections for steam heating systems refer to the Nash booklet entitled "Advanced Practice in Design of Economical Steam Heating Systems." For additional copies of this booklet write your Nash Representative or write directly to Nash Engineering Co., So. Norwalk, Conn.

Table 5, Page 18 should be used for selection of the Nash Motor Operated Type Primary Control Valve when the smaller established pipe size standards are employed. This Table allows for 2 psi pressure drop through the valve.

### Table 4

| PRESSURE DROP P.S.I. AT DESIGN CONDITIONS | SYSTEM |
|---|---|
| 2.0 | Nash Primary Control Valve |
| 2.5 | Steam Mains |
| 1.0 | Steam Branches |
| 1.0 | Individual Room Control Valves |
| 1.0 | Radiation Units |
| 7.5 | TOTAL |

## Table 5

### SELECTION OF NASH PRIMARY CONTROL VALVE

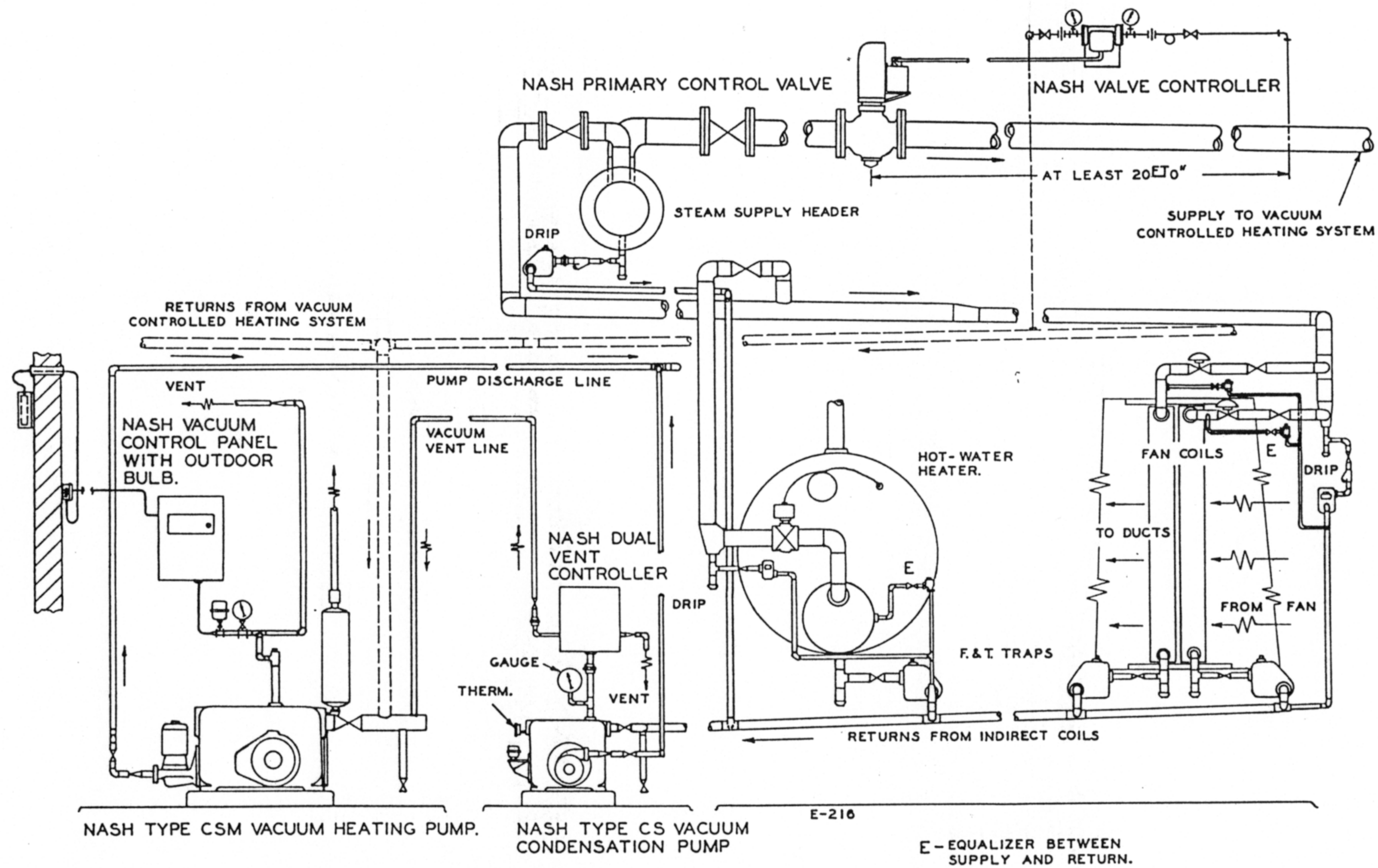
| CAPACITY IN POUNDS OF STEAM PER HOUR | VALVE SIZE | | CAPACITY IN POUNDS OF STEAM PER HOUR | VALVE SIZE | |
|---|---|---|---|---|---|
| | MOTOR OPERATED | PNEUMATIC | | MOTOR OPERATED | PNEUMATIC |
| 250 | 1" | 1½" | 3,500 | 4" | 5" |
| 500 | 1½" | 2" | 4,000 | 5" | 5" |
| 750 | 2" | 2½" | 5,000 | 5" | 6" |
| 1,000 | 2" | 3" | 6,000 | 6" | 6" |
| 1,250 | 2½" | 3" | 7,000 | 6" | ** |
| 1,500 | 2½" | 4" | 8,000 | * | ** |
| 1,750 | 3" | 4" | 9,000 | * | ** |
| 2,000 | 3" | 4" | 10,000 | * | ** |
| 2,500 | 4" | 4" | 12,000 | * | ** |
| 3,000 | 4" | 5" | | | |

( *Use two valves of suitable size in parallel. Only one valve controller is required for both valves.)
(**Use two valves of suitable size in parallel. A valve controller is required for each valve.)

### NASH SYNCHRONIZED HEATING CONTROL WITH DIVIDED HEATING SYSTEM

When ventilating fan units and water heaters constitute a large part of the total heating load, it is possible with the Nash Control to divide or split the heating system as shown in Figure 2, thus eliminating the possibility of requiring a separate boiler for this load. Coils of ventilating fans and water heaters are supplied with low pressure steam taken from the steam main ahead of the Nash Primary Control Valve and are regulated by their own thermostatically controlled valves. The condensate from these indirect coils is drained by gravity into the separate Nash vacuum condensation pump which returns the condensate separately to the boilers or boiler feed system. Thus the relatively hot returns from the ventilating fans and water heaters do not interfere with the vacuum operation of the Nash Synchronized Heating Control.

When the total condensate load from the ventilating fan coils and water heaters does not exceed 20 percent of the total heating load, these units may be drained directly into the return side of the direct heating system as shown in Figure 3. This arrangement flashes sufficient condensate

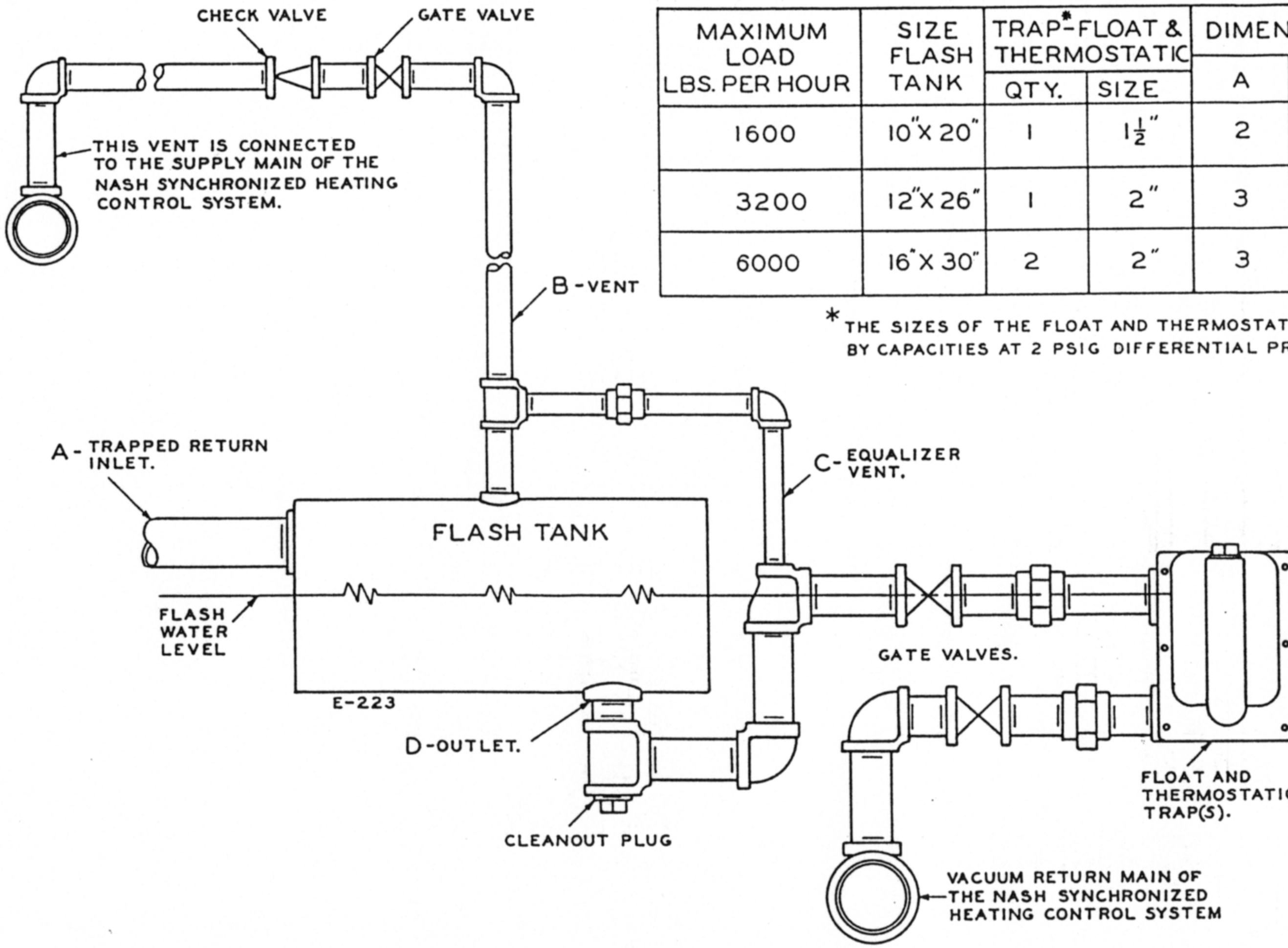



SCHEMATIC DRAWING SHOWING DIVIDED SYSTEM LAYOUT

FIGURE 2

| MAXIMUM LOAD LBS. PER HOUR | SIZE FLASH TANK | TRAP*-FLOAT & THERMOSTATIC | | DIMENSIONS IN INCHES | | | |
|---|---|---|---|---|---|---|---|
| | | QTY. | SIZE | A | B | C | D |
| 1600 | 10" X 20" | 1 | $1\frac{1}{2}$" | 2 | 1 | $\frac{3}{4}$ | $1\frac{1}{2}$ |
| 3200 | 12" X 26" | 1 | 2" | 3 | $1\frac{1}{4}$ | 1 | 2 |
| 6000 | 16" X 30" | 2 | 2" | 3 | $1\frac{1}{2}$ | $1\frac{1}{4}$ | $2\frac{1}{2}$ |

* THE SIZES OF THE FLOAT AND THERMOSTATIC TRAPS ARE DETERMINED BY CAPACITIES AT 2 PSIG DIFFERENTIAL PRESSURE.




FLASH TANKS FOR THE NASH SYNCHRONIZED HEATING CONTROL SYSTEM

FIGURE 3

into the supply side of the direct system to reduce the remaining condensate of the indirect system to a temperature corresponding to that existing in the return side of the direct heating system.

With the divided system arrangement, it is possible to provide vacuum drainage to the coils of the ventilating fan units and water heaters. This is accomplished by using the vacuum available in the return side of the Nash Synchronized Heating Control regulated by the Nash Dual-Vent Controller as shown in Figure 2.

The Dual-Vent Controller maintains the maximum vacuum possible without flashing in the vacuum condensate unit and the indirect return lines draining to it. This vacuum is regulated by the temperature of the returns and varies inversely with it. The vacuum condensate unit is vented to atmosphere by the Dual-Vent Controller whenever the temperature is too high to carry any vacuum without flashing.

With the Dual-Vent Controller the efficiency of ventilating fan units and hot water heaters is increased by assured drainage of condensate. Condensate is not held in the coils by the induced vacuum created by condensing steam. Also the conventional drop-leg of 12″ to 18″ from the coils to the traps is not required.

Longer coils may be used with assurance that steam will be evenly distributed throughout the coils by expansion due to the vacuum. Multi-zone fan units, in particular, will produce more uniform temperatures at all outlets.

Vacuum condensate drainage provided by operation of the Dual-Vent Controller greatly reduces the possibility of water hammer and coil freezing.

## SPECIFICATION FOR DIVIDED SYSTEM

The basic specification on Pages 6 and 8 covering a Nash Synchronized Heating Control should be used. The air capacity of the vacuum pump of the Nash CSM vacuum heating unit should be increased 1/3 cfm per 1000 square feet EDR for the load of the ventilating fan coils and water heaters.

The following specifications should be added:

The coils of the ventilating fans, water heaters, and hot drips from sources other than the Nash Synchronized Heating Control shall drain by gravity into a Nash duplex vacuum condensation pump equipped with a Dual-Vent Controller. This Controller shall maintain the maximum vacuum possible without flashing in the vacuum condensate unit and the indirect return lines draining to it. This vacuum shall be regulated by the temperature of the returns and shall vary inversely with it. The vacuum condensate unit shall be vented to atmosphere by the Dual-Vent Controller whenever the temperature is too high to carry any vacuum without flashing. Connect a ¾″ vacuum vent line to the top of the nearest Nash Synchronized Heating Control return main and a ¾″ atmospheric vent line to a floor drain. The Controller is connected to the vacuum condensation pump tank by a 1¼″ connection.

The vacuum condensation pump shall be a Nash size______ duplex unit designed for high vacuum operation. Each pump shall have a capacity of _____ gpm from 20″ Hg. vacuum to ____ lbs. discharge pressure at the pump when the condensing load is lowest, and at least 50 percent more capacity at full load when no vacuum exists in the unit. Each pump shall be direct connected to a ____hp, ______ phase, ____cycle, _____volt drip-proof motor. The pumps shall be mounted on a cast iron receiver, which shall be complete with two float switches, compound gauge, gauge glass and cocks. The unit shall also include two magnetic starters for wall mounting and one Nash Dual-Vent Controller for mounting on the receiver and connected to a single phase, 60 cycle, 230 volt circuit.

All automatic steam coil-valves and traps shall function satisfactorily with 20″ Hg. vacuum in the fan coils; all returns shall flow by gravity to inlet of pump receiver without lifts or pockets, and the vacuum vent line shall be properly graded to eliminate pockets.

The above specifications may be modified for a single unit instead of a duplex unit or for units with totally enclosed motors or combination starters. Wiring for the Nash vacuum condensation unit should be included in the electrical specifications as well as wiring from a 230 volt, 60 cycle, single phase circuit to the Dual-Vent Controller.

## Table 6

### SELECTION TABLE FOR NASH TYPE CS VACUUM CONDENSATION PUMPS

| SERIES | CAPACITIES | | DISCHARGE PRESSURE IN POUNDS PER SQUARE INCH (WITH 20" HG. VACUUM IN RECEIVER) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | SQ. FT. EDR | *GPM FROM 20" HG. VAC. | 10 | | 20 | | 30 | | 40 | |
| | | | PUMP | HP | PUMP | HP | PUMP | HP | PUMP | HP |
| 10 | 2,000 | 2 | D220V | ⅓ | D230V | ½ | D240V | 1 | D250V | 1½ |
| | 4,000 | 4 | D420V | ⅓ | D430V | ½ | D440V | 1 | D450V | 1½ |
| | 6,000 | 6 | D620V | ⅓ | D630V | ½ | D640V | 1 | D650V | 1½ |
| 20 | 8,000 | 8 | D820V | ½ | D830V | ½ | D840V | 1 | D850V | 1½ |
| | 10,000 | 10 | D1020V | ½ | D1030V | ¾ | D1040V | 1 | D1050V | 1½ |
| 40 | 15,000 | 15 | D1520V | ½ | D1530V | ¾ | D1540V | 1½ | D1550V | 1½ |
| | 20,000 | 20 | D2020V | ½ | D2030V | 1 | D2040V | 1½ | D2050V | 2 |
| | 25,000 | 25 | D2520V | ¾ | D2530V | 1 | D2540V | 1½ | D2550V | 2 |
| 50 | 30,000 | 30 | D3020V | 1 | D3030V | 1 | D3040V | 2 | D3050V | 3 |
| | 40,000 | 40 | D4020V | 1 | D4030V | 1½ | D4040V | 2 | D4050V | 3 |

*Pump Capacities listed in table are for lowest condensing loads.

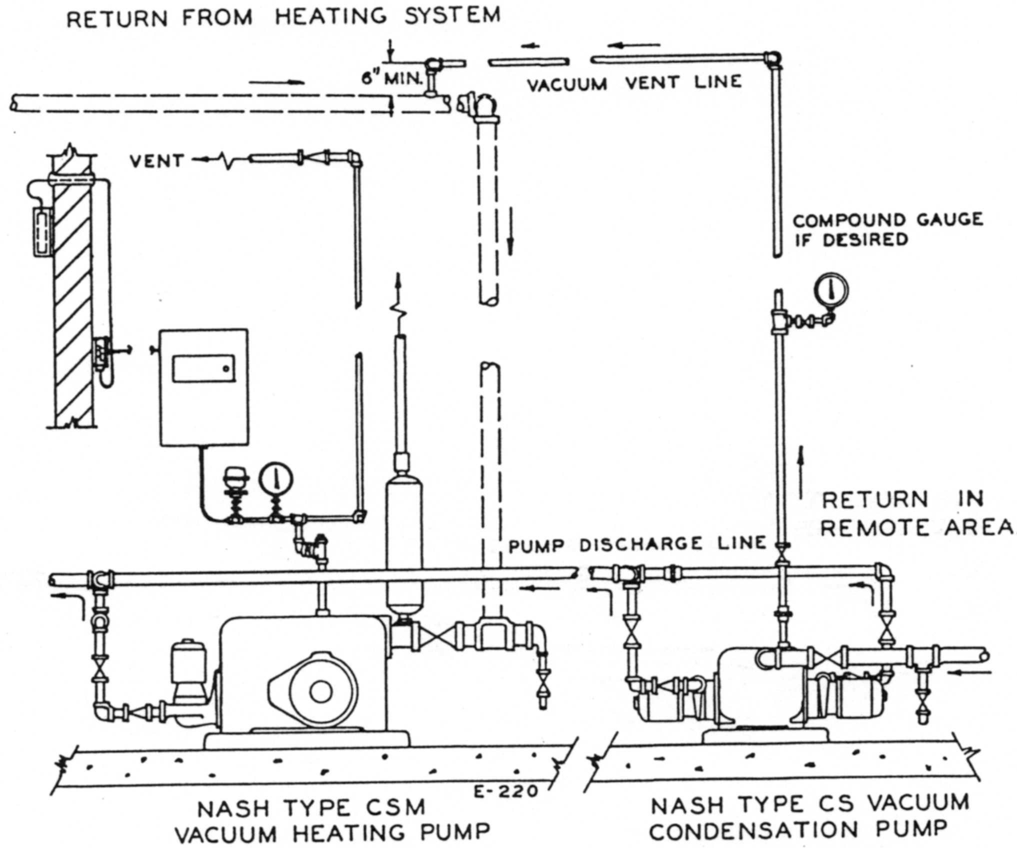
Each pump has approximately 50 percent more capacity when there is no vacuum in the receiver. This occurs when the load is maximum. Units for larger capacities and higher pressures can be furnished. Single unit size designation starts with the letter S instead of D.

### NASH SYNCHRONIZED HEATING CONTROL WITH REMOTE AREA DRAINAGE

With the Nash Synchronized Heating Control, it is easy to provide for returns from remote sections of buildings or separate buildings where gravity returns are not possible. A Nash vacuum condensation pump is located in the remote section or building into which the returns are drained. This arrangement is shown in Figure 4.

One or more vacuum condensation pumps may be used. Each unit discharges its condensate to the pumped condensate return line and thence to the boilers or boiler feed system. Each vacuum condensation pump and the return lines draining to it are maintained under the same vacuum conditions as the rest of the Nash Synchronized Heating Control by connecting the vacuum condensation pump tank to the top of the nearest Nash Synchronized Heating Control return main.

Selection of the Nash vacuum condensation pump can be made from the pump table in the preceding section. The water capacity of the unit is




DRAINING REMOTE SECTION

FIGURE 4

determined on the basis of 1 gpm per 1000 square feet EDR. The air capacity required by the remote radiation should be included in the air capacity calculated for the Nash CSM vacuum heating unit, since the CSM unit is handling the air requirements for the entire system.

The vacuum vent line between the vacuum condensation pump and the return main is sized as indicated in Table 7. For runs over 100 feet, the line should be increased one pipe size over that shown.

**Table 7**

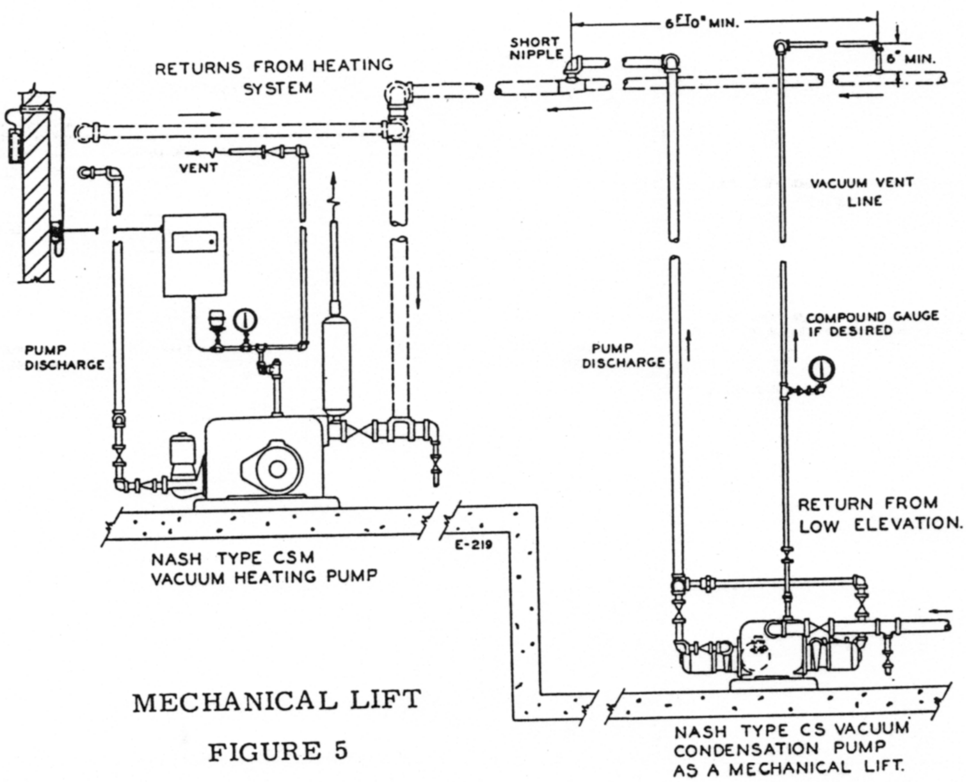
| SQ. FT. EDR | SIZE OF VACUUM VENT LINE | SQ. FT. EDR | SIZE OF VACUUM VENT LINE |
|---|---|---|---|
| 2,000 | ¾" | 15,000 | 1" |
| 4,000 | ¾" | 20,000 | 1¼" |
| 6,000 | ¾" | 25,000 | 1¼" |
| 8,000 | 1" | 30,000 | 1½" |
| 10,000 | 1" | 40,000 | 1½" |

## NASH SYNCHRONIZED HEATING CONTROL WITH MECHANICAL LIFT

When it is necessary to raise small amounts of condensate from low returns that are below the gravity return level, a Nash vacuum condensation pump is used as a mechanical lift as shown in Figure 5. This eliminates the necessity of lowering the entire return main and the Nash vacuum heating pump as well, to meet required gravity drainage. The Nash vacuum condensation pump is vacuum vented to the nearest Nash Synchronized Heating Control return main, and discharges its condensate into the top of the same return main. The return main is sized to accommodate this added load.

The discharge head of the Nash vacuum condensation pump, used as a mechanical lift, is only the static head plus the friction in the discharge line, because the same vacuum exists in both the mechanical lift and in the vacuum return line into which it discharges.

It is not recommended that the mechanical lift be for over 5000 square feet EDR. For larger amounts of radiation, it is advisable to discharge the condensate from the Nash vacuum condensation pump directly into the Nash CSM vacuum heating pump or into the pumped condensate discharge line of the CSM pump.




MECHANICAL LIFT

FIGURE 5