SECTION I

INTRODUCTION

1-1. SCOPE OF INFORMATION.

1-2. This Instruction Manual has been compiled as a guide for the proper operation and maintenance of the Clayton Steam Generator. Recommendations given herein are the result of many years of experience in the manufacture and service of this type of equipment. The efficiency and serviceability of the Clayton Steam Generator will depend entirely upon strict adherance to these recommendations. A comprehensive step-by-step coverage of each phase of operation, maintenance, and repair is given, together with a detailed description of each vital part and its functional operation.

1-3. To simplify procurement of maintenance and replacement parts, a complete parts catalog is included as an appendix to this manual. The catalog contains 'exploded' illustrations which also serve as a valuable aid when it becomes necessary to disassemble or reassemble a particular component.

1-4. GENERAL DESCRIPTION.

1-5. Utilizing the principle of forced recirculation, the Clayton Steam Generator is capable of continuous delivery of its rated horsepower of quality steam (containing less than two per cent moisture) per hour from feedwater at 60°F, under steam pressures ranging from 65 to 150 pounds. Under ordinary conditions, the generator will develop its full rated capacity within five minutes from a cold start. It will automatically recover from sudden peak or overload demands and maintain a minimum thermal efficiency of 75 per cent while operating at partial or full load.

1-6: Design and equipment insure full automatic performance during intermittent or continuous operation. Standard equipment includes safety devices for protection against water failure, burner failure, excessive pressures, electrical overload or low voltage, and excessive heating surface temperature. However, an attendant in charge must give the apparatus the attention outlined in this manual.

1-7. The heating element consists of a continuous coil of steel tubing, arranged in a series of spirally wound, pancake formations, designed to insure counterflow across the heating chamber. It will withstand unusually high heat transfer without burning or blistering and is mounted to allow free expansion and contraction without buckling or rupturing.

1-8. The burner base is of heavy, welded steel construction and is amply reinforced. The combustion chamber is lined with a high grade vermiculite insulation and covered with a layer of 3000°F refractory cement. The centrifugal forced draft burner is highly efficient in blending the air and fuel to produce complete combustion within the combustion chamber. Maximum and minimum fuel controls provide ease of operation and trouble-free performance. A transparent, flame-proof door is provided for burner inspection.

1-9. Water for evaporation is delivered to the heating element by a packless, diaphragm type water pump. The water is heated to steam temperature in the heating coil and discharged into a steam accumulator, where steam is allowed to expand and be used as needed. Water, which separates from the steam in the accumulator, is pumped by the recirculating section of the water pump into a mixing chamber where it combines with the feedwater and is recirculated through the system. Excess water in the system is returned to the condensate receiver through a steam trap.

SECTION II

WATER AND STEAM SYSTEM

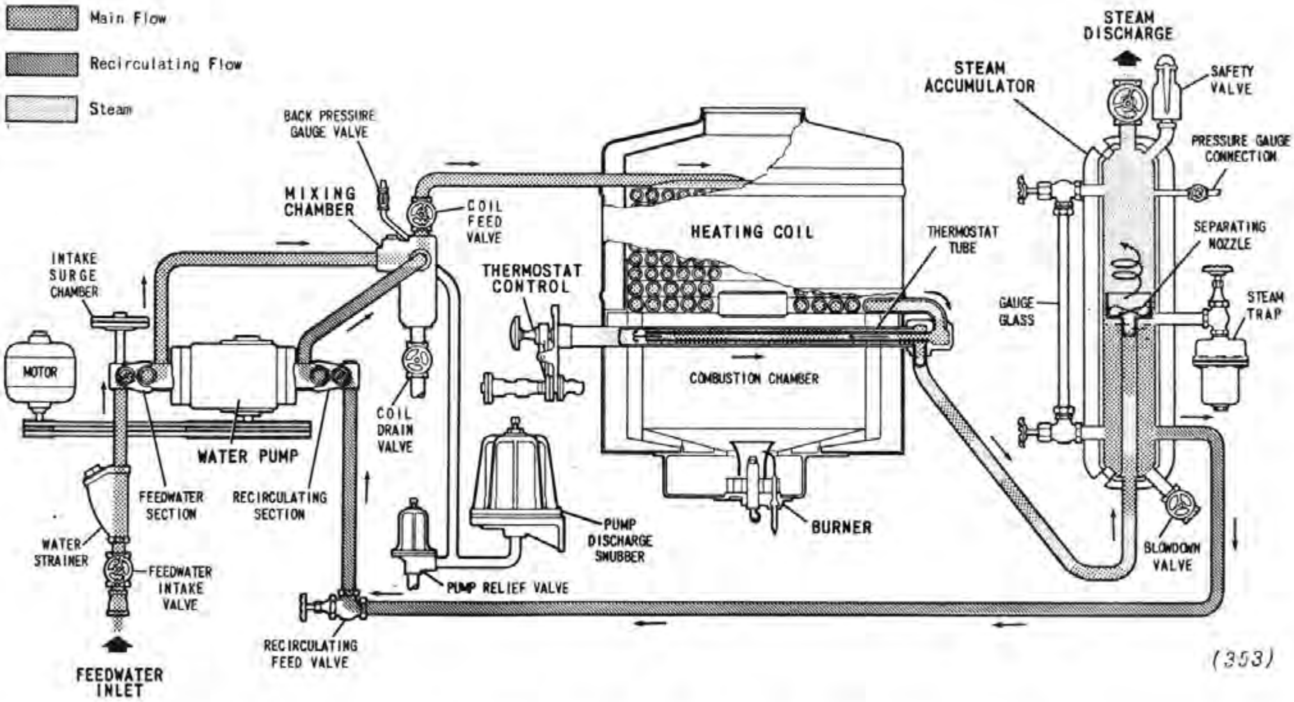


Figure 2-1. Flow Diagram, Water and Steam Circuit

2-1. WATER FLOW AND STEAM CIRCUIT. (See figure 2-1.)

2-2. Make-up water is blended in the hot well with the return condensate from the steam system and enters the steam generator through the feedwater intake valve. Water is then pumped through the mixing chamber and into the heating coil, by the feedwater pump, at a pressure substantially in excess of the steam discharge pressure. In circulating through the continuous, single passage coil, heat is absorbed from the combustion gases flowing upward through the coil assembly.

2-3. After reaching steam temperature, the water is discharged from the coil and enters the thermostat through the inner passage (spill pipe), then counterflows through the thermostat tube back across the combustion chamber. From the thermostat, water is discharged into the steam accumulator where expansion into steam takes place; water and steam are centrifugally separated and dry steam becomes available for use through the steam discharge valve. Water, not expanded, collects in the lower part of the accumulator, where it is picked up by the recirculating section of the water pump. It is then blended with the feedwater in the mixing chamber and recirculated through the heating coil. This process of forced recirculation allows high thermal efficiency, due to high fluid velocities through the heating unit, and also insures against excessive steam generation within the heating coil.

2-4. A steam trap, mounted on the side of the steam accumulator, returns all excess water back to the hot well, where it is blended with the feedwater with negligible heat loss.

WATER SYSTEM

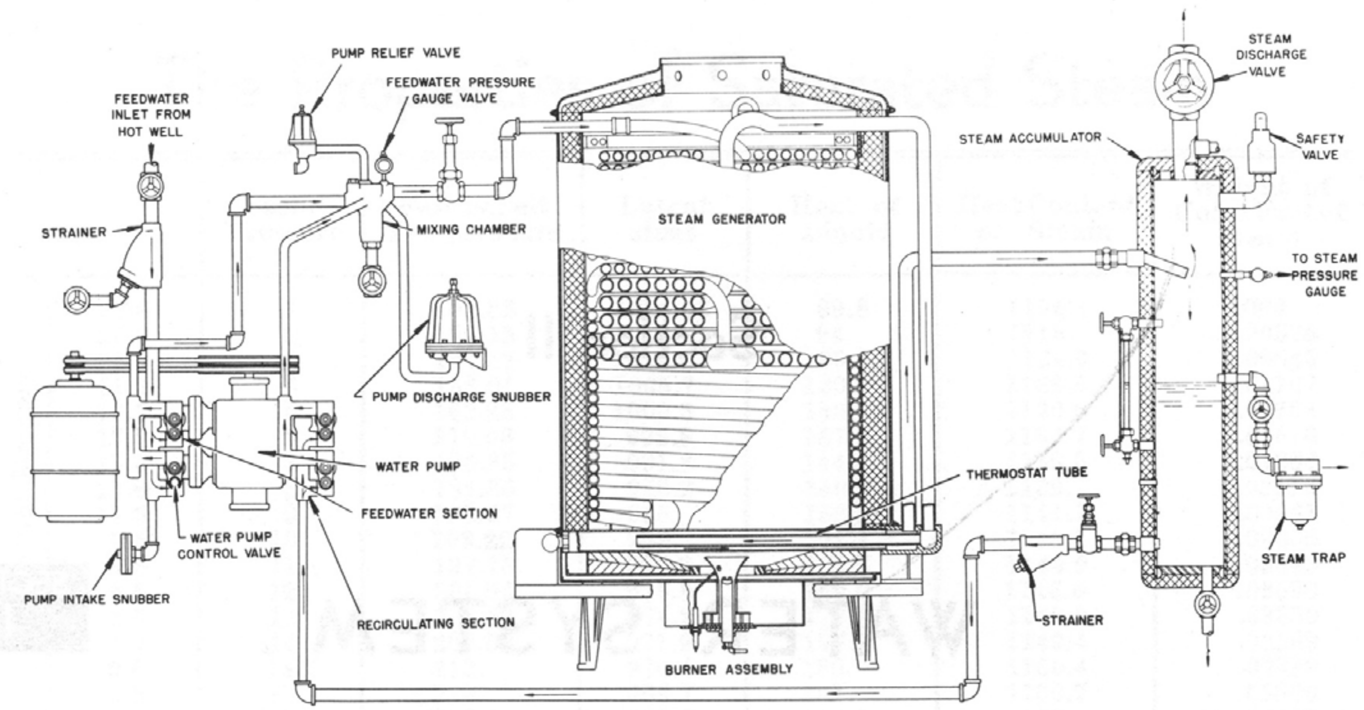


Figure 1 - Water Flow Diagram, 50 HP Steam Generators

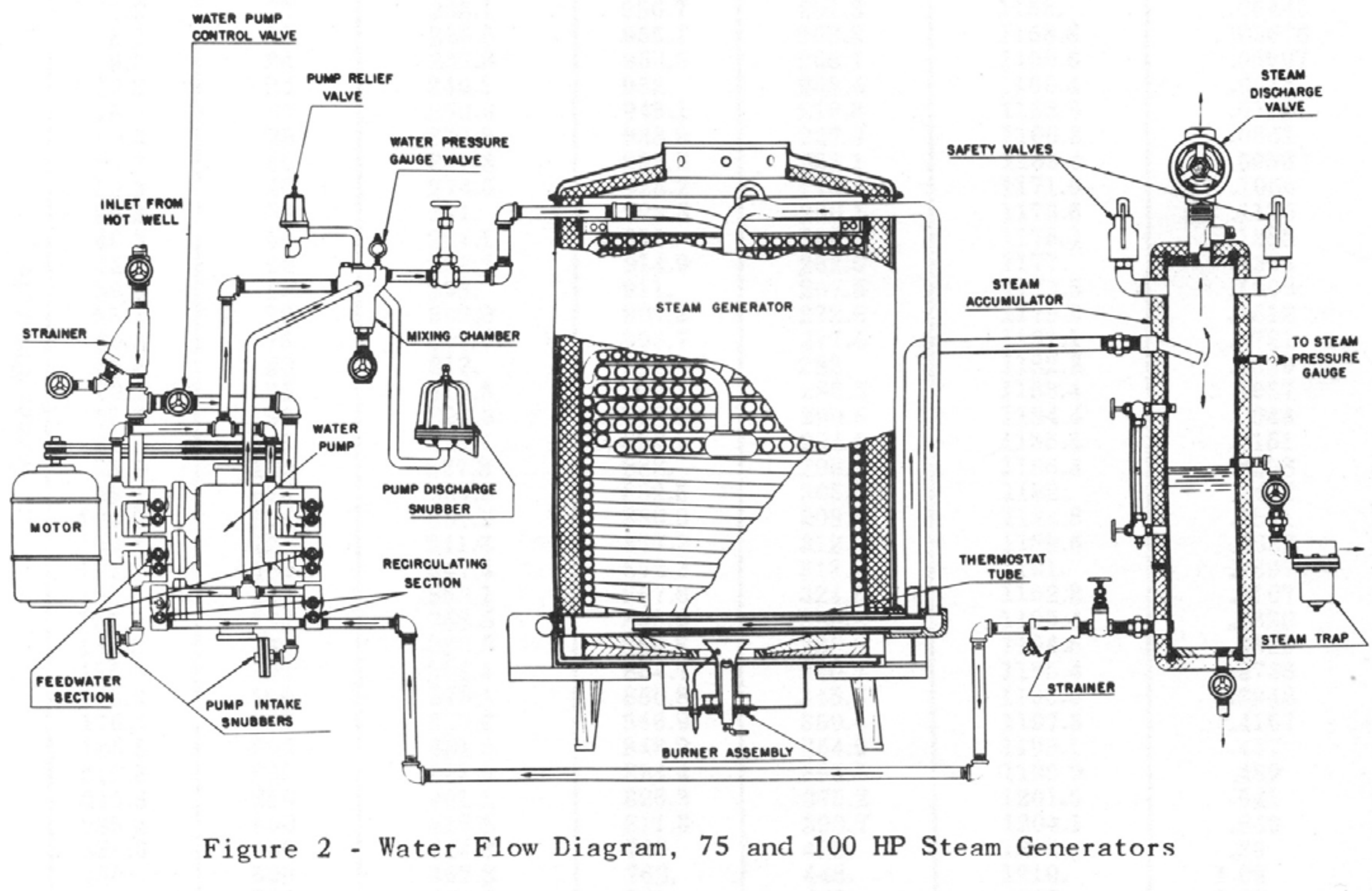


Figure 2 - Water Flow Diagram, 75 and 100 HP Steam Generators

WATER SYSTEM

1. WATER FLOW AND STEAM CIRCUIT.
(See figures 1 and 2.)

Make-up water is blended in the hot well with the return condensate from the steam system and enters the steam generator through the feed water intake valve.

Water is then pumped through the mixing chamber and into the heating coil, by the feed water pump, at a pressure substantially in excess of the steam discharge pressure. In circulating through the continuous, single passage coil, heat is absorbed from the combustion gases flowing upward through the coil assembly.

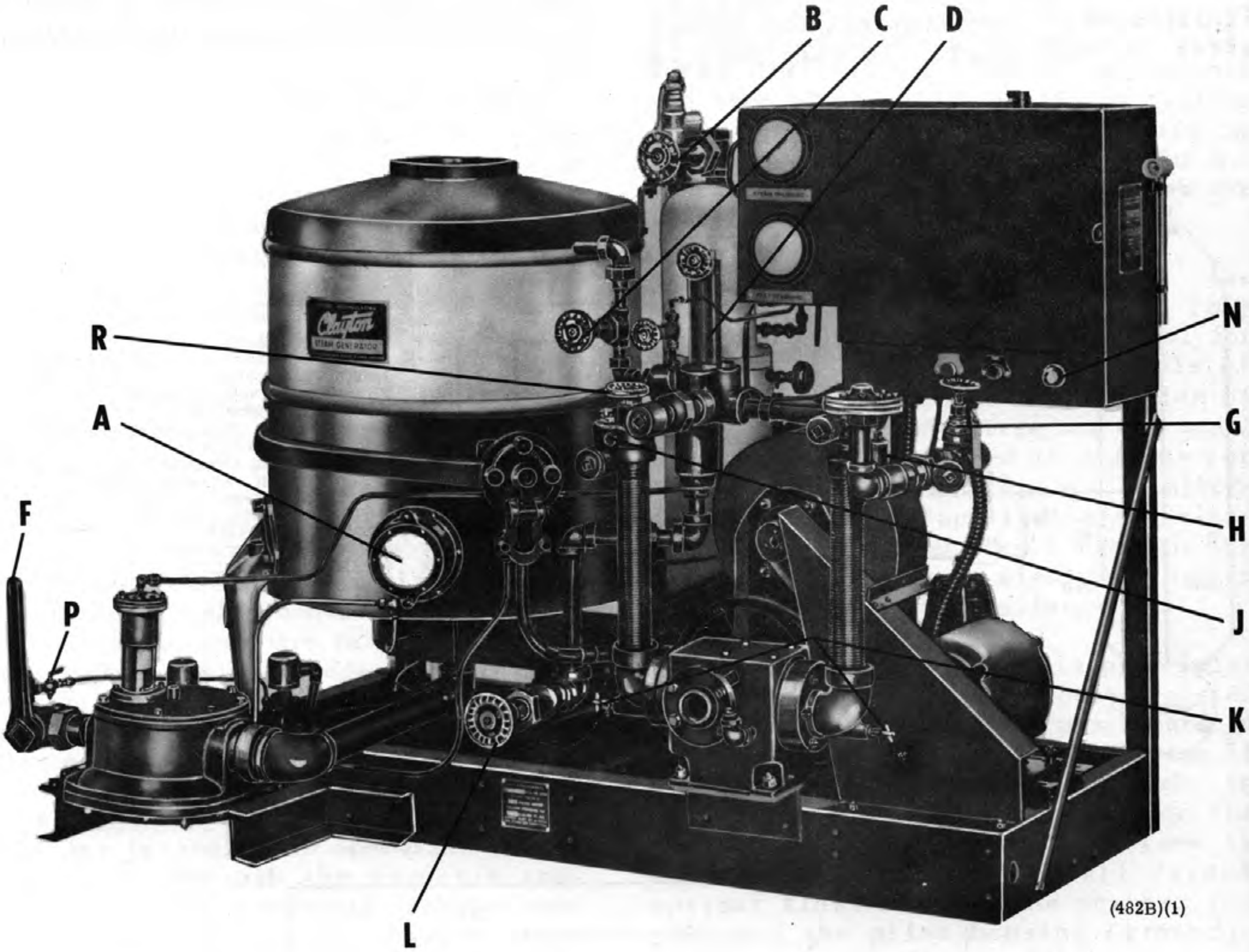
After reaching steam temperature, the water is discharged from the coil and enters the thermostat through the inner passage (spill pipe), then counter-flows through the thermostat tube back across the combustion chamber. From the thermostat, water is discharged into the steam accumulator where expansion into steam takes place; water and steam are centrifugally separated and dry steam becomes available for use through the steam discharge valve. Water, not expanded, collects in the lower part of the accumulator, where it is picked up by the recirculating section of the water pump. It is then blended with the feed water in the mixing chamber and recirculated through the heating coil.

This process of forced recirculation allows high thermal efficiency, due to high fluid velocities through the heating unit, and also insures against excessive steam generation within the heating coil.

A steam trap, mounted on the side of the steam accumulator, returns all excess water back to the hot well, where it is blended with the feed water with negligible heat loss.

Steam output of the generator is governed by the existing pressure in the steam system, which actuates a pressure switch that automatically starts and stops the unit in accordance with the steam demand.

The physical expansion of the thermostat tube is utilized as a positive and automatic control of the fuel supply to the burner. Excessive heat in the generator, due to water failure, will cause the thermostat tube to physically expand and stop the flow of fuel to the burner.



A. Burner Inspection Door
B. Steam Discharge Valve
C. Coil Feed Valve
D. Accumulator Gauge Glass
E. Steam Trap Valve (See Figure 6-2)
F. Main Gas Shut-Off Cock
G. Feedwater Intake Valve
H. Feedwater Pump Check-Valve Housing
J. Recirculating Pump Check-Valve Housing
K. Pump Column Drain Cocks
L. Coil Drain Valve
M. Accumulator Blowdown Valve (See Figure 6-2)
N. Flame Indicator Pilot Light
P. Pilot Gas Cock
R. Recirculating Feed Valve
T. Air Regulator (See Figure 6-2)
U. Snubber Drain Cock (See Figure 6-2)

Figure 5-1. Operating Controls, Front View