

VOLUME 3, CHAPTER 2: CONDENSER WATER SYSTEM.

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PART 1. GENERAL DESCRIPTION.

A. A two-cell cooling tower is located at the west end of the Boiler/Generator building (Drawing 3-2-D1 and Photo 3-2-P2).

B. Respective condenser water pumps pump condenser water to chillers as follows (Drawings 3-2-D1, 3-2-D2 and Photo 3-2-P1):

1. Pump P-4: Feeds Chiller No. 1. (Electric driven, heat recovery)

2. Pump P-5: Feeds Chiller No. 2. (Electric driven, heat recovery)

3. Pump P-6: Feeds Chiller No. 3. (Electric driven)

4. Pump P-8: Feeds Chiller No. 4 (solar absorption) and the solar heat exchanger located on the upper level of the Boiler/Generator building.

C. Condenser water pumped to the respective chillers, is drawn from two sump-wells located just west of the two cooling tower cells. One sump well serves for Pumps P-4 and P-5, the other sump well serves for Pumps P-6 and P-8.

D. The cooling tower water is chemically treated by a chemical feed tank, a pump, and an automatic controller. (Refer to Treated Water, Volume 1, Chapter 7.)

E. Condenser water is returned from Chillers No. 1 and 2 through an 8" header pipe to Cell No. 1 of the cooling tower. Condenser water is returned from Chillers No. 3 and 4, and the solar heat exchanger, through a 10" header pipe to Cell No. 2 of the cooling tower.

PART 2. OPERATING NORMS.

A. Condenser water pump will normally run automatically when its respective chiller is energized. The cooling tower fan for each cell will normally run when condenser pumps run, subject to a water temperature thermostat which will select fan speed, high or low, or shut off fan when water temperature is cold. Pumps P4 and P5 serve with Cooling Tower Cell No. 1. Pumps P6 and P8 serve with Cooling Tower Cell No.2 (see Photo 3-2-P1). Water flow rates through each condenser water circuit will be relatively constant. Water rates to the tower will vary depending on the number of condenser pumps running. Condenser water temperatures will vary with chiller load, tower load and, ambient temperatures. Peak values at full load are as given in B and C below.

B. Condenser Water Supply.

1. Pump P-4: 525 GPM at 32.47 psig, 85°/95°F
on/off Chiller.
2. Pump P-5: 525 GPM at 32.47 psig, 85°/95°F
on/off Chiller.
3. Pump P-6: 675 GPM at 28.14 psig, 85°/95°F
on/off Chiller.
4. Pump P-8: 1000 GPM at 30.30 psig, 85°/95°F
on/off Chiller.

C. Cooling Tower.

1. Cell No. 1: Entering water temperature at maximum flow is 95°F; leaving water temperature is 85°F.
2. Cell No. 2: Entering water temperature at maximum flow is 92.5°F; leaving water temperature is 85°F.

PART 3. TROUBLE SHOOTING - EMERGENCY PROCEDURES.

A. Water overflow at cooling tower.

- level.
1. Water level is too high; check the float
 2. Leaking water make-up float valve.
 3. Quick-fill valve in water supply left open.

B. Loss of water capacity at cooling tower.

1. Check the inlet header spray pressure. Pressure should be approximately 5 PSIG. (Low pressure nozzles)
2. Check the fan speed. Fan should be on high speed with high water temperatures.
3. Check the wet deck and eliminators for dirt and debris, and clean if necessary.
4. Clean spray nozzles.

C. Condenser water pumps.

1. If pump will not deliver any water, or delivers less water than normal, check to see that:
 - a. The pump is completely primed. All air must be out of the suction pipe and pump.
 - b. The speed is correct. See that the motor wiring connections are secure and correctly wired.
 - c. The pump is running in the right direction. See the arrow on the pump.
 - d. The impeller passages are not plugged with weeds or debris.
 - e. There are no air leaks in the suction line, or air pockets in the piping.
 - f. The suction line is not clogged with weeds or debris, or the intake is not partially buried in mud or sand.
 - g. The impeller eyes and wear rings are not worn excessively.
 - h. Seals are leaking.

- see that:
 - 2. If the motor draws excessive amps, check to
 - a. The head is not lower than pump is designed for.
 - b. The shaft is not bent.
 - c. The bearings need to be replaced.
 - d. The impeller is not rubbing against the housing.
 - e. Packing glands are not too tight.
 - 3. If the pump loses its prime while running, check to see that:
 - a. The suction line has no air leaks.
 - b. The suction lift is not excessive.
 - c. There is no entrained air or gas in the liquid.
 - 4. Rapid coupling wear, vibration and noises:
 - a. Check alignment of unit; this is practically always a result of misalignment, or a bent shaft. Check to be sure piping is not causing a strain on the pump.

PART 4. START-UP AND SHUT-DOWN.

A. Condenser Pumps:

1. Check to see that all in-the-line gate valves are open.
2. Check to see that cooling tower basin is filled with water.
3. Place condenser pump "Hand-off-Auto" selector switch in the "automatic" position.

B. Cooling Tower:

1. Check all mechanical equipment as called for in Manufacturer's Operating and Maintenance Manual, Volume 10, Chapter 2, page 3A.

PART 5. IMPORTANT AND SPECIAL CONSIDERATIONS.

A. The entire condenser water system must be filled with water, including the condenser, piping, cooling tower and pump casing, prior to any pump restart function after system shut-down for service or trouble shooting.

B. Condenser Water Pump P-4 must interlock with Chiller Pump P-1; Pump P-5 must interlock with chiller pump P-2; and P-6 must interlock with chiller pump P-3, since cooling for air conditioning will always be needed.

C. The cooling tower fans operate continuously unless off-cycled by sump temperature controller.

D. During cleaning, shut down only one tower cell at a time so as to allow cooling to always be available.

E. Excessive moisture on the operating fan is a normal condition.

F. No pump should be started until all air is bled from the system.

G. Never operate a pump against a closed valve.

H. Bearings normally run hot. Unless the bearing housing exceeds 120°F, there is no cause for concern.

I. Tower water treatment and quality should be monitored regularly. See Volume 1, Chapter 7.

817
232
4661
303

PART 6. IDENTIFICATION OF EQUIPMENT.

A. Cooling Tower (Drawing 3-2-D1 and 3-2-D2; Photo 3-2-P2): "Ceramic Cooling Tower", Model No. CT-2-1818L, two cell, complete with two 12'-0" fans with 6 blades and two 25 H.P. motors, 1800/900 R.P.M.; 460V, 3Ø, 60HZ.

B. Condenser Water Pump P-4 (Drawing 3-2-D1 and 3-2-D2; Photo 3-2-P1): Byron Jackson, Model No. 12B5, Serial No. 771-E-0191, 525 GPM @ 32.46 psig, 15 HP, 1750 RPM, 460V, 3Ø, 60 HZ.

C. Condenser Water Pump P-5 (Drawing 3-2-D1 and 3-2-D2; Photo 3-2-P1): Byron Jackson, Model No. 12B5, Serial No. 771-E-0191; 525 GPM @ 32.46 psig, 15 HP, 1750 RPM, 460V, 3Ø, 60 HZ.

D. Condenser Water Pump P-6 (Drawing 3-2-D1 and 3-2-D2; Photo 3-2-P1): Byron Jackson, Model No. 12B5, Serial No. 771-E-0193; 675 GPM at 28.14 psig, 15 HP, 1750 RPM, 460V, 3Ø, 60 HZ.

E. Condenser Water Pump P-8 (Drawing 3-2-D1 and 3-2-D2; Photo 3-2-P1): Byron Jackson, Model No. 21C8, Serial No. 771-E-0194; 1000 GPM at 30.30 psig, 25 HP, 1750 RPM, 460V, 3Ø, 60 HZ.

F. Chemical Feed Unit (Drawing 3-2-D2): Chem-Tech, Model No. 015; 0.0-15 GPD, 0-100 psig, 115V, 1Ø, 60 HZ.

PART 7. TEST PROCEDURES AND SCHEDULING.

A. Test procedures and scheduling shall be conducted as per the Cooling Tower Institute code for cooling towers. See Volume 10, Chapter 2.

PART 8. PREVENTIVE MAINTENANCE.

A. See specific equipment items for equipment preventive maintenance in Volume 10, Chapter 2.

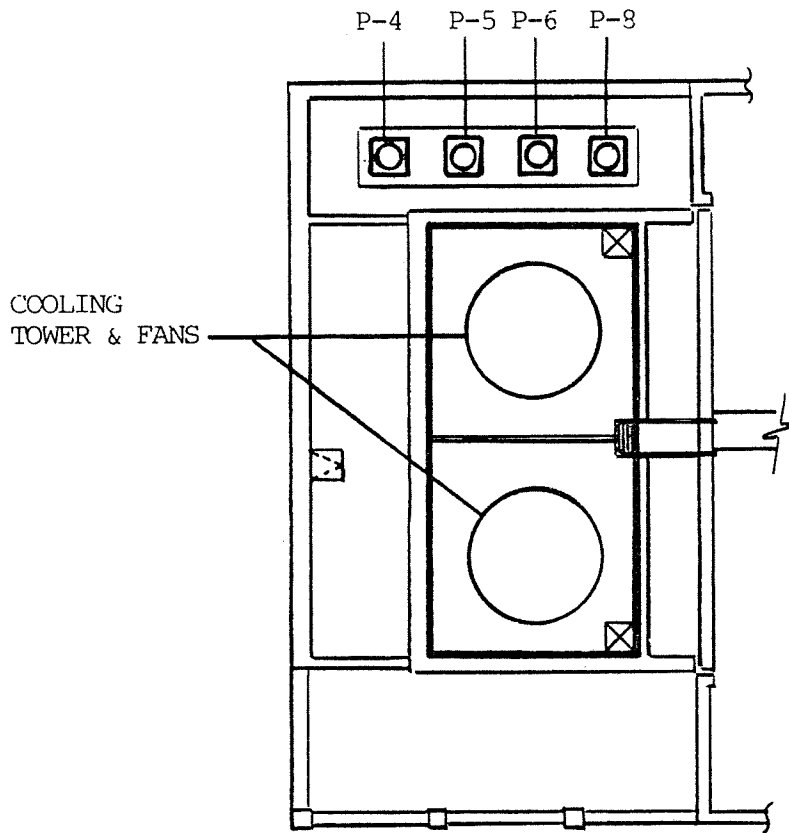
PART 9. BIBLIOGRAPHY.

| MATERIAL AND/OR EQUIPMENT | REFERENCE SPECIFICATIONS SEC. & PAR. | VOLUME VII REF: AS-BUILT DWG. NOS. | MATERIAL USED MANUFACTURER AND VENDOR |
|-----------------------------------|--------------------------------------|------------------------------------|--|
| Piping | Sec. 15652 Par. 2.2 | Dwg. No. | MFR: See Piping, Valves, etc. under Chilled Water Supply & Return System VENDOR: |
| Cooling Towers, Mechanical Draft | Par. 6. | Dwg. No. | MFR: Ceramic Cooling Tower Co. P. O. Box 425 Ft. Worth, TX VENDOR: Ceramic Cooling Tower Co. |
| Pumps: Condenser Water | Par. 7.2 | Dwg. No. | MFR: Byron Jackson Pump Div. Borg-Warner Corp. VENDOR: JAMCO, Inc. P.O. Box 31309 Birmingham, AL 35222 |
| Motor | Par. 7.2.3 | Dwg. No. | MFR: General Electric Co. Vertical Products Div. San Jose, CA 95114 VENDOR: General Electric Co. Vertical Products Div. |
| Water Treatment for Cooling Tower | Par. 13.5 | Dwg. No. | MFR: Water & Waste Specialties P. O. Box 7143 Mobile, AL 36607 VENDOR: Water & Waste Specialties Co. |
| | Par. | Dwg. No. | MFR: VENDOR: |

PART 10. VALVE LIST.

- A. See Bibliography, Part 9.

CONDENSER WATER PUMPS

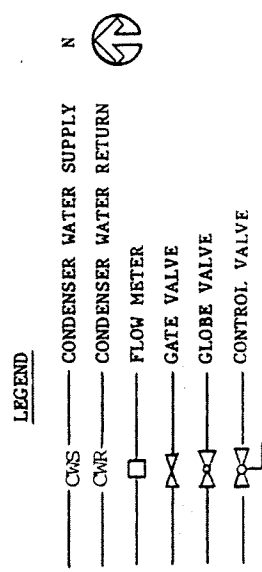
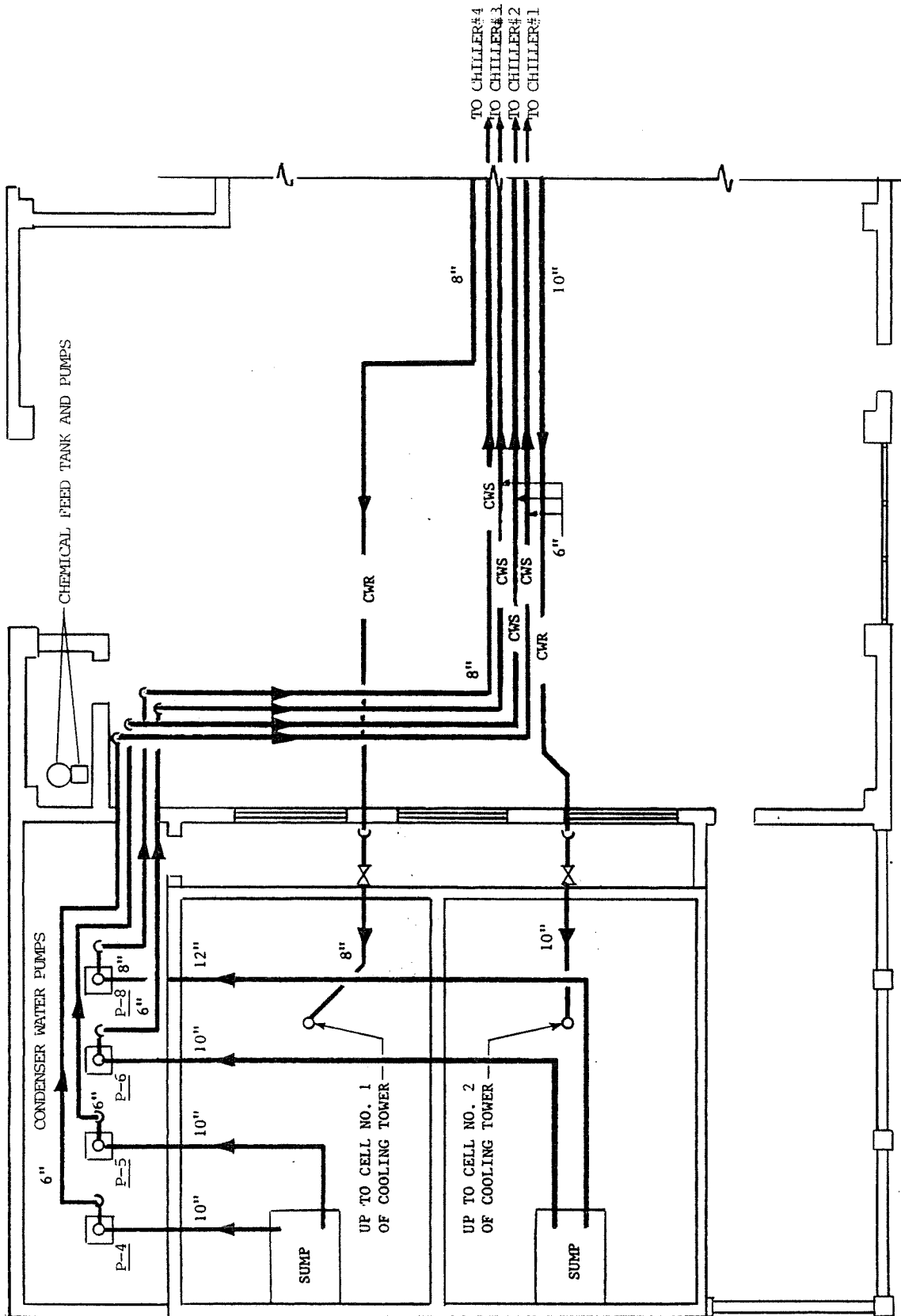


BOILER GENERATOR BUILDING

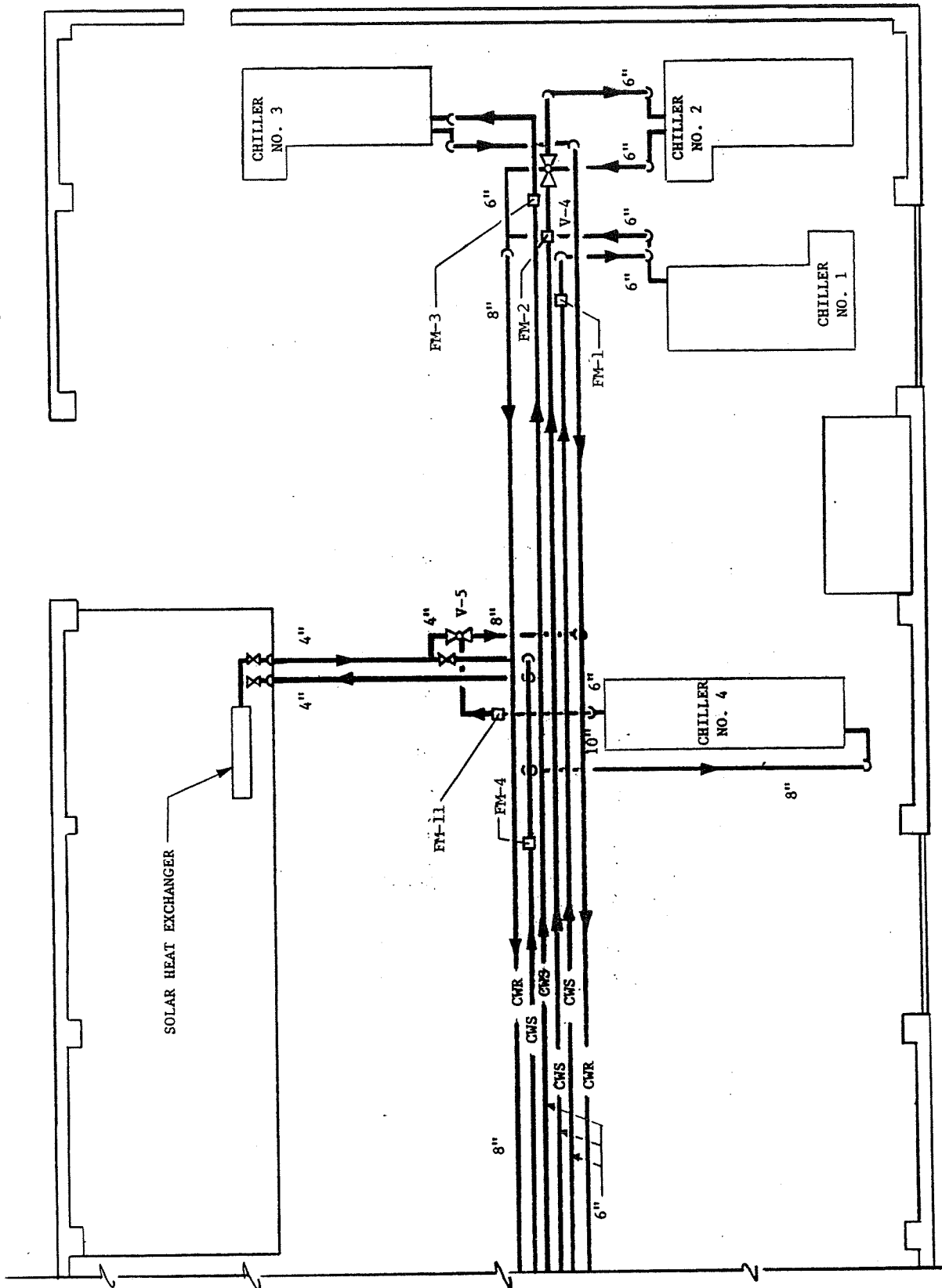
PART PLAN

CONDENSER WATER PIPING





BOILER GENERATOR BUILDING
PART FIRST FLOOR PLAN
CONDENSER WATER PIPING

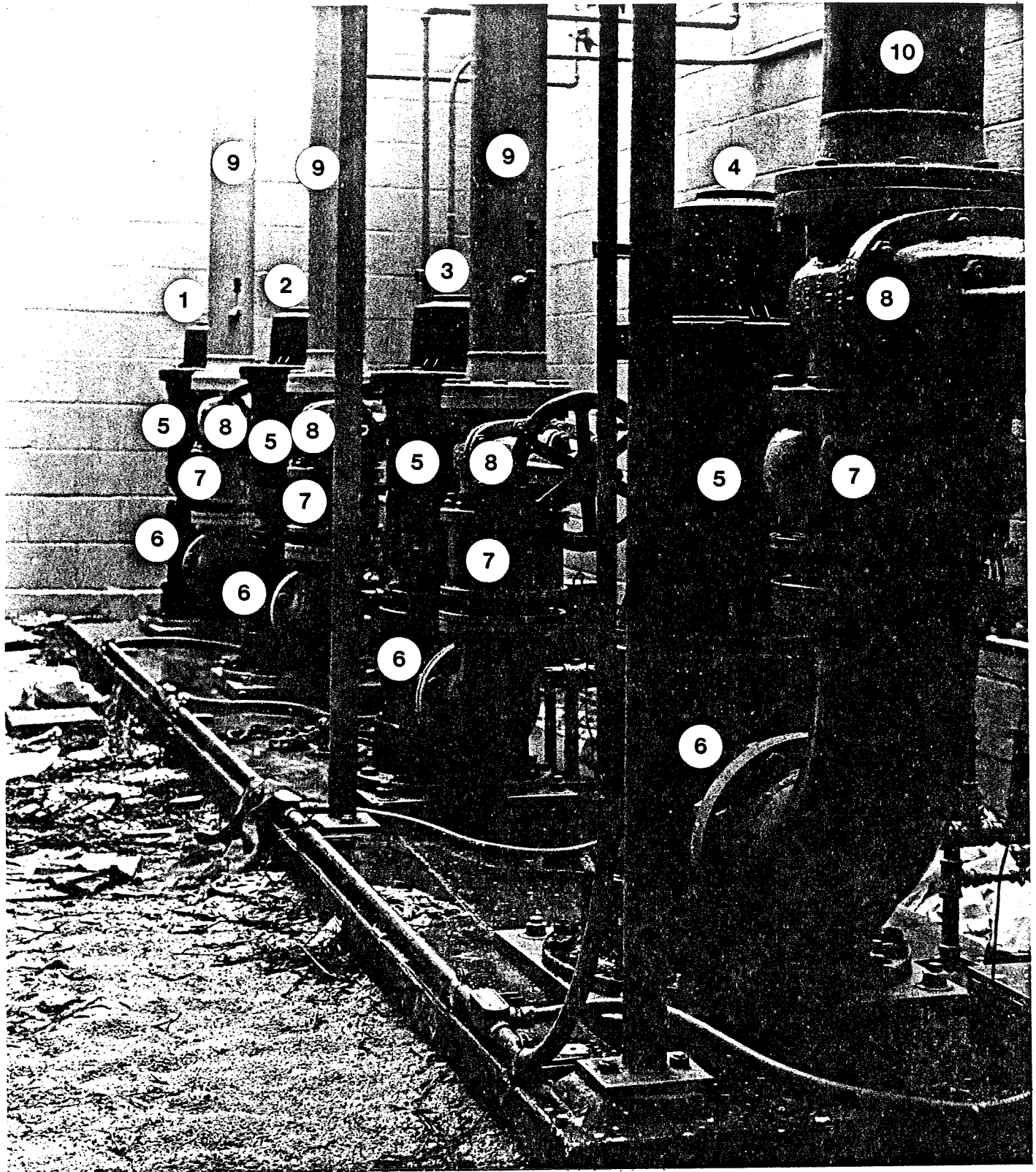


- CWS — CONDENSER WATER SUPPLY
- CWR — CONDENSER WATER RETURN
- FM-1 — FLOW METER (FM-1)
- V — GLOBE VALVE
- V — GLOBE VALVE
- V — CONTROL VALVE

BOILER GENERATOR BUILDING
PART FIRST FLOOR PLAN
CONDENSER WATER PIPING

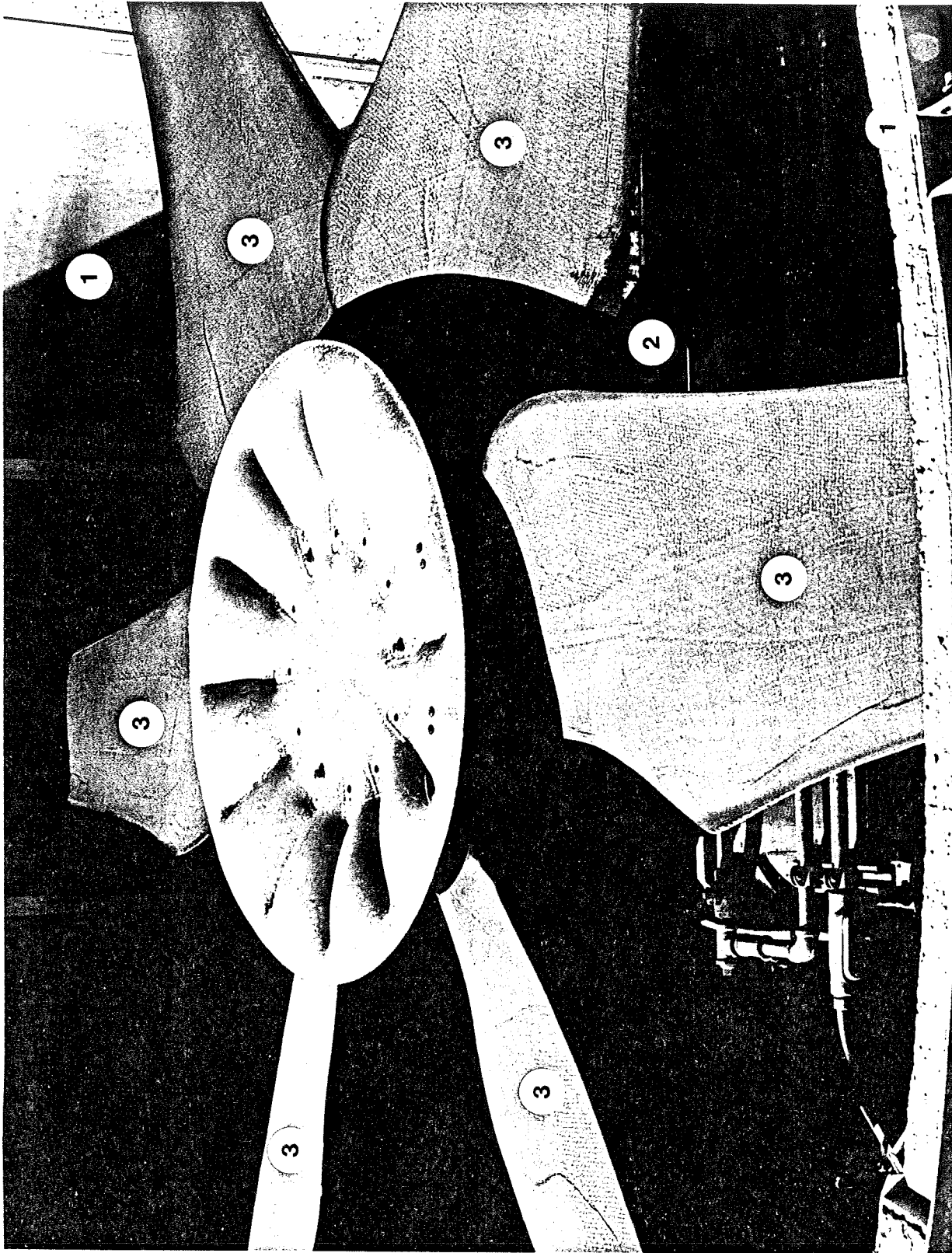
PHOTO

P1, P2



CONDENSER WATER PUMPS

- | | |
|-------------|-------------------------------|
| 1. PUMP P-4 | 6. DISCHARGE HEAD |
| 2. PUMP P-5 | 7. FLEX. CONNECTION |
| 3. PUMP P-6 | 8. GATE VALVE |
| 4. PUMP P-8 | 9. 6" CONDENSER WATER SUPPLY |
| 5. MOTOR | 10. 8" CONDENSER WATER SUPPLY |



COOLING TOWER FAN
1. PRECAST FAN STACK 2. MOTOR DRIVESHAFT 3. FIBERGLASS FAN BLADE