

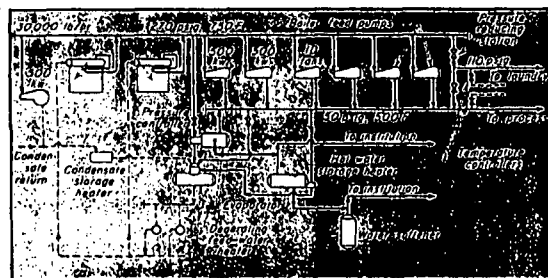


1 Electrical-energy requirements run heavier, relatively, than steam during summer and fall but, nevertheless, reach their peak in winter. As a result, plant needs both condensing and noncondensing turbine generators for best economy

Reliability, Continuity Mark Institutional Plant

Complete gamut of power services—electrical energy, steam, compressed air, hot and cold softened water—features the modern institutional power plant so that failure of power-house equipment proves costly and dangerous

By L. J. NEUBAUER, Ellerbe & Co., St. Paul, Minn.



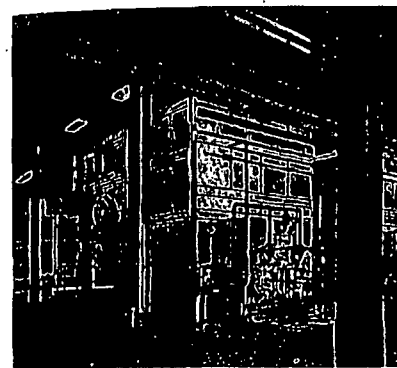
6 Flow diagram pictures the distribution of steam at the various pressure levels, indicates flexibility, balance that turbine exhaust and reducing stations give

► SERVICES, OPERATION, economy, reliability and equipment layout, almost in that order, dictate institutional power-plant design. When the Rochester, Minn. State Hospital came in for expansion to serve an eventual 3000 patients, the first phase included a new power plant. Besides straightforward planning for final conditions, the new operating features had to permit economical interim power services.

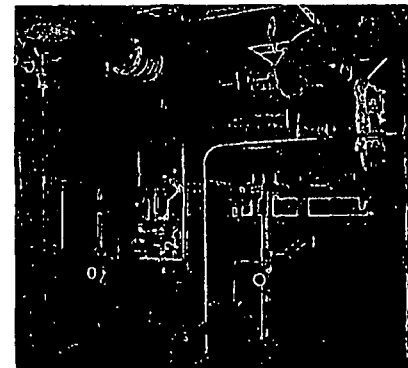
These services include steam at different pressures, Fig. 6, electrical energy, cold and hot softened water, compressed air. There was immediate need for 40-psig steam for sterilizers and at lower pressure for heating nearly all buildings, including those in the first expansion. So we chose 50-psig steam for distribution to buildings, then specified local reducing stations to drop this pressure for heating systems. On top of this general steam demand was a special 100 psig for laundry mangles, presses, other equipment.

Electrical-energy needs include ac and dc. Dc in laundry and kitchen is only temporary, slated for eventual ac operation. To generate this energy we needed steam at considerably higher pressure than our 100-psig top process need. So we selected 270 psig for our generating level, and hence our steam-boiler output.

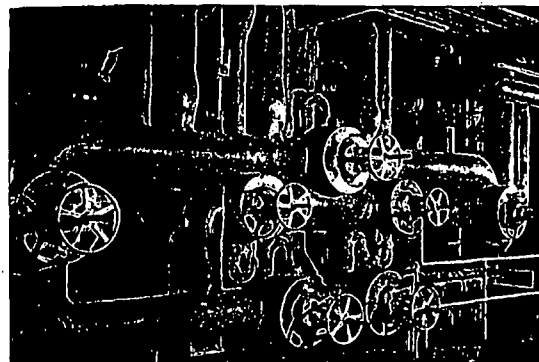
Boiler Selection. We picked two 30,000-lb-per-hr 270-psig 750-F steam generators, Fig. 2, to meet above steam needs. These units of 2-drum, bent-tube design now firing natural gas (and oil if needed) have their water-



2 Two selected boilers, 30,000 lb per hr, 270 psig, 750 F, have hung up 79.5% efficiency burning natural-gas fuel



3 High-pressure steam from boilers enters a manifold for distribution to power generators, pressure-reducing units



4 Single, condensing turbine unit, among three picked, employs a 2-pass non-divided waterbox surface condenser suspended from the turbine exhaust nozzles



5 Cooling tower, induced-draft fan type, cools water for condensing unit, left

well furnaces, forced- and induced-draft fans suitable for coal-firing on a traveling-grate spreader stoker should this equipment ever be needed.

Three combination oil-and-gas burners mount in a triangle on front wall of each boiler furnace. Natural gas from mid-continent fields reaches the plant at 25-40 psig, drops to 12 psig at gas-regulating house. Then as gas reaches each boiler its pressure drops still more through a regulating valve operated by combustion-control equipment. Boilers develop full-rated capacity with gas-burner pressure of 7 psig. Only fuel is natural gas except in winter when the outdoors stays under 5 below zero.

During this cold weather, fuel is No.

6 oil, stored in four 15,000-gal underground tanks some 75 ft from the boiler room. One motor- and one steam-driven pump, an oil heater, piping and accessories are all assembled on a common bedplate to deliver this oil from storage to the combination burners. These burners each carry a gas pilot fed from the domestic gas, making them safe from any service interruption. Oil-burner elements employ a wide-range mechanical stonizing design, handle oil at 275 psig, 210 F.

Tubular air preheaters furnish combustion air to the burners at top temperature of 335 F and corresponding minimum flue-gas temperature of 305 F. We have to use an auxiliary duct to

bypass some combustion air to the air preheater outlet at low steam-generator loads so flue-gas temperatures do not get below the acceptable 305 F. A temperature regulator operates a damper to give an automatic control over the amount of bypassed combustion air. A motor-driven forced-draft fan with inlet vane dampers controls combustion air.

The induced-draft fan ties into a venturi stack that projects 12 ft above boiler-room roof. A steam turbine drives this fan through a reduction gear. A diaphragm valve in the steam-supply line picks up swings in steaming rates, sets off the proper accompanying changes in i-d fan speed.

Turbine-Generators. The 270-psig 750-