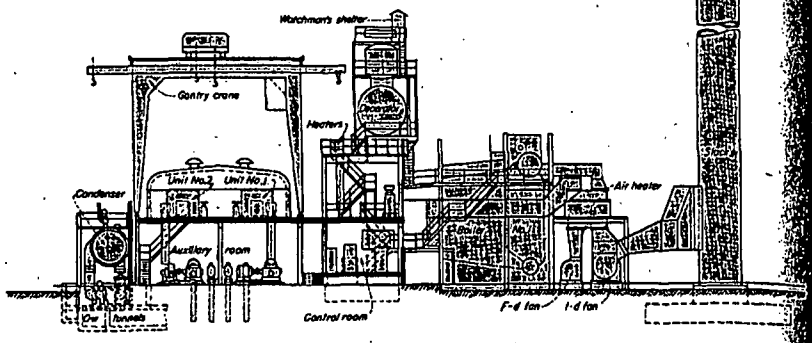


OUTDOOR STATION HAS THREE ENCLOSED AREAS, turbine-generator units, auxiliary room and control room; all other apparatus outdoors has suitable weatherproof casing. Absence of architectural treatment makes plant appear very different

PERMIAN BASIN

Texas Electric Service Co installs outdoor station near Monahans, Texas. Cooling towers serve condensers of four units. Two units forming heat balance group have one common deaerating heater

► THE WESTERN DIVISION of Texas Electric Service Co serves a portion of the rich Texas oil and gas fields. Their extensive development during and since World War II has created a demand for additional electric power, and predictions indicate a substantial increase in the future. Average load factor in this area reaches 65% annually and the monthly maximum is 74%. To meet rising power demand Texas Electric Service is adding new capacity, representing an increase in system capability of over 170,000 kw, at (1) Handley, near Fort Worth (2) Permian Basin (3) Wichita Falls.

Permian Basin will be rated at 50,000 kw when completed in 1949. Two 12,500-kw turbine-generators and two boilers have just been installed, with two more similar units scheduled for next year.

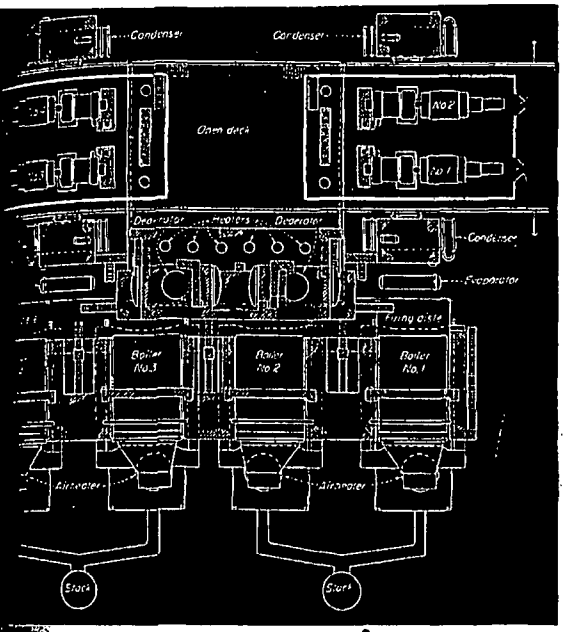
The plant stands in a sparsely settled region of the plains country near Monahans in west Texas on the Texas & Pacific RR. A full section of land was purchased, partly to have adequate area for spacing wells that supply makeup water. Considering the station as a "kilowatt-hour factory" no architectural embellishments are necessary. Company engineers and executives have taken the broad view in accepting advanced practice in outdoor design. Climate generally favors outdoor construction, rainfall averaging only about 15 in. annually. Design precautions guard against effects of moisture and low temperatures. With enclosures provided only for control room, auxiliary room and turbine-generators, large station-construction savings are realized, the main objective in outdoor designs.

Providing a water supply for cooling-tower and general plant makeup poses a real problem in west Texas. Water at Permian Basin comes from a considerable number of wells drilled at widely spaced intervals to minimize the effect of one well on others. Cooling towers provide the only means of meeting circulating-water needs in this location.

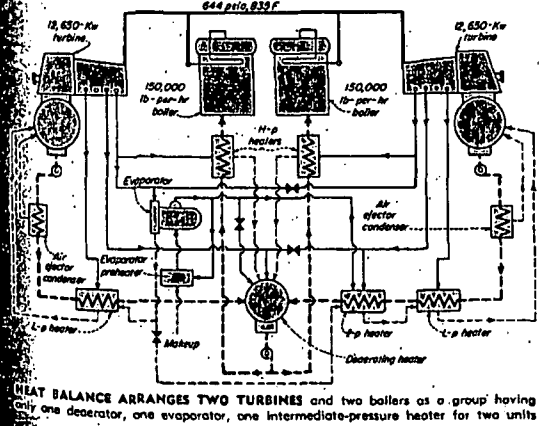
The two present and two future steam generators are of outdoor design, the boilers being completely enclosed by an insulated steel casing with removable-panel side walls and roof and welded-casing rear wall. Each unit delivers rated output of 150,000-lb-per-hr steam at 650 psig and 835 F. Full-load heat release equals 33,000 Btu per hr per cu ft, or 132,500 Btu per hr per sq ft of projected watercooling surface. Natural-gas fuel permits this relatively high unit heat release in the four boiler furnaces.

Natural gas provides the chief fuel with oil as standby. Both are available in the vicinity. Each boiler has four combination gas-and-oil burners in two rows. Oil burners are wide-range mechanical type. A 55,000-bbl storage tank and 2000-bbl day tank hold the oil supply. A Ljungstrom air heater with vertical shaft forms part of each steam-generating unit. Constant-speed motor-driven forced-draft and induced-draft fans, one for each boiler, are mounted on outdoor concrete pedestals between boiler and stack. Each f-d fan, driven by a 150-hp motor, delivers 55,500 cfm. An i-d fan, driven by a 250-hp motor, handles 90,500 cfm. The brick-lined steel stacks, 10 ft 8 in. inside diam, stand 150 ft above grade. One stack serves two boilers.

A somewhat unusual system of steam and water connection serves these four relatively small units. Boilers 1 and 2 feed steam to a header supplying turbines 1 and 2. A single deaerating heater and intermediate-pressure closed feedwater heater, fed by 8th-stage extraction steam, are provided for each pair of turbines to avoid unbalancing steam extracted from two units. Each boiler pair has one common motor-driven boiler-feed pump with a turbine-driven feed pump for standby service for the first pair and a motor-driven standby pump for the second pair.



MAIN CONDENSERS STAND OUTDOORS to one side of turbines, reducing turbine-pedestal height. Heaters and deaerators are located outdoors above control room



HEAT BALANCE ARRANGES TWO TURBINES and two boilers as a group having only one deaerator, one evaporator, one intermediate-pressure heater for two units

The automatic combustion-control system, consisting of master controller, furnace-draft regulator, steamflow-air-flow ratio regulator, operates the boilers in accordance with steam load without assistance from the operators. Each control mechanism may be operated manually without disturbing any automatic linkage or other connections. In case of boiler-fan power-supply failure, solenoid-operated shutoff valves cut fuel supply to the boilers.

The 3-element feedwater control system responds to (1) water level in boiler drum (2) steam flow leaving boiler (3) feedwater flow into boiler. The piston-actuated control valves have valve position indicators. An integrally mounted regulator operates each control valve, being loaded from the elements measured. Manual adjustments are provided.

Turbine-Generators. The impulse-type turbine with three bleed points has a rating of 11,500/12,650 kw with throttle steam at 600 psig, 825 F. Rather than the standard 13,529-kva machine, an oversized generator rated 15,625 kva was specified. This operates at 13,200 v, 3-phase, 60 cycles. The air-cooled generator uses a fin-type cooler.

Steel and concrete enclosures protect the turbines on an open deck. Turbine units 1 and 2 are in one enclosure, 3 and 4 in another. A 25-ton gantry crane runs overhead, for general use in handling the turbine and other machinery parts. Sliding steel hatches in the turbine-enclosure roof permit access for maintenance.

Condensers are of 2-pass non-divided waterbox construction with ⅞-in. tubes, 20 ft long. The 11,000-sq-ft condensers are rated 106 million Btu per hr each when provided with 29.8 cfs cooling water at 80 F. Condensers are not directly under the turbine exhaust, but well to one side, and connected by an elbow. This arrangement permits reducing height of pedestal above base slab; this reduces construction costs.

Two cooling towers, capable of handling about 65 cfs each, cool the condensing water. Six 184-in. 3-blade adjustable-pitch axial-flow fans serve six 2-cell cooling towers. Each fan delivers 375,000 cfm. Guaranteed approach to a 74-F wet bulb is 14 F. Cooling water flows by gravity from cooling tower through concrete tunnels, provided with screens at the entrance, to the circulating-pump suctions adjacent to the condensers. One 13,350-gpm circulator serves each condenser. Makeup water from the wells passes through settling basins and various coolers before going to cooling-tower basin.

An air-to-air heat pump air-conditions the control room because of dust and high temperatures. The pump, with a 10-hp compressor, handles a heat gain of 106,000 Btu per hr and a heat loss of 165,000 Btu per hr with two changes of air per hr from a volume of 14,000 cu ft. Unit coefficient of performance equals 3.5. The unit is not