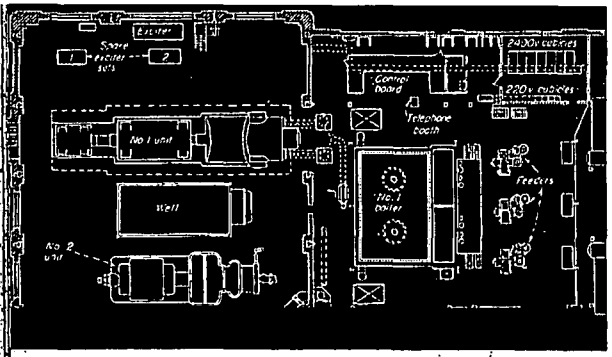
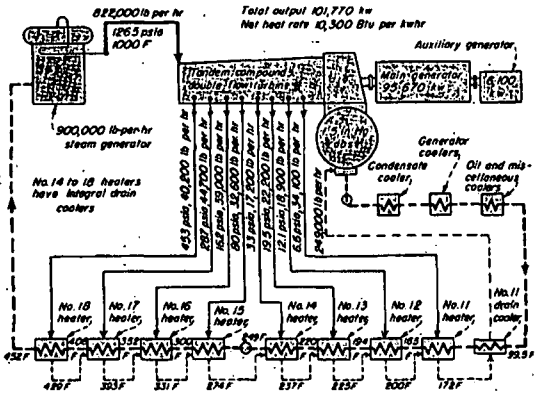


TURBINE-GENERATOR STANDS in existing turbine-room building, but new building was needed for steam generator; control board centralizes supervision for unit



EIGHT FEEDWATER HEATERS feature unit heat balance with all deaeration performed in main condenser only; all heater drains cascade back to condenser hotwell

halves and prevent creating any pressure differential. A spray-type attemperator between the two sections of the pendant superheater controls the outlet steam temperature. Heating surfaces of the steam generator are: boiler and waterwalls, 21,391 sq ft; superheater, 31,643 sq ft; economizer, 16,400 sq ft; regenerative air heaters, 211,800 sq ft.

Air for soot blowing also functions as the medium for power and control of the soot-blowing system. The blowers, automatically controlled from the board, are in boiler walls, superheater, economizer and air heaters.

The forced-draft and induced-draft fans, Ljungstrom heaters and precipitators are outdoors on the boiler-house roof. Air-cooled bearings provided on these units eliminate the need of cooling water, which would be subject to freezing troubles in winter. The totally enclosed induced-draft fan drive motors of 1000-hp capacity are insulated with silicone and, incidentally, are the largest of their type built to date.

A single short steam main between superheater outlet and turbine stop valves connect steam generator and turbine. There are no intermediate valves or branch steam lines in the high-pressure main. This simple design was achieved by eliminating all need for auxiliary steam. This has several advantages, such as avoiding the need for supervising and maintaining reducing valves, reduction in makeup water needs, minimizing water-treating costs, avoiding handling low-pressure [illegible] etc.

Auxiliaries. All station auxiliaries must obviously be provided electrically under this scheme. Air for soot blowing avoids demand for low-pressure steam and the practically "standard" steam-jet air ejector for the main condenser is replaced in this installation by two rotary vacuum pumps, operating in parallel. One pump can handle ordinary air leakage into the condenser, but the two pumps together do the service ordinarily provided by steam hogging jets. A secondary advantage of two pumps is that they serve as standby for each other.

The turbine has eight bleed points feeding eight closed feedwater heaters. Three l-p heaters are located in the main condenser steam inlet to keep the l-p bleed connections short and to save space. No heater condensate pumps are used, the condensate cascading through all heaters to the main condenser. All deaeration of condensate takes place in the main condenser and hence no deaerating heater appears in the heat-balance cycle of the unit. The cycle uses three 1750-hp 3600-rpm boiler feed pumps driven by totally enclosed motors through hydraulic couplings. The coupling speed rating corresponds to changes in steam flow to the boiler and drum-water level. The boiler feed valve, located in the supply line, will be used for emergency purposes only.

Coolers. The main unit condenser cools lubricating oil, hydrogen, bearings motors, couplings, etc. This helps to keep to a minimum salt-water piping which is used only for compressor and other minor needs. During the summer when condensate temperatures tend to run too high for cooling service, special condensate coolers are placed in the ice.

Station Features. A feature of the installation is the central control board which supervises the turbine, generator, steam generator and feed pumps. The board is located so the operator can readily reach all main equipment.

The auxiliary generator on the main unit shaft supplies all the auxiliary drives. No normal interconnection between the unit auxiliary buses and the station bus exists, but in emergency auxiliary supply can be drawn from the station bus. Normally the two buses are not kept synchronized.

The new unit has been installed at a unit cost of $93 per rated kw. This includes the cost of the new boiler and superstructure, but not that of the foundations and existing turbine building as shown in station cross

PRINCIPAL POWER-PLANT EQUIPMENT

No. 1 Unit, Essex Generating Station

Public Service Electric & Gas Co, Newark, N. J.

TURBINE-GENERATOR and AUXILIARIES:

Turbine-generator.....General Electric Co
100,000-kw 3600-rpm 24-stage tandem-compound double-flow turbine, 1250 psig, 1000 F, 1.5-in. Hg abs, 8 bleed points. Main generator, 125,000 kw, 85% pf, 13.8 kv, 3 phase, 60 cycle, hydrogen cooler, 25 psig. Auxiliary generator, direct connected, 7500 kw, 80% pf, 2400 v, 3 phase 60 cycle, air cooled. Separate exciter, 300 kw for main generator; 60-kw exciter for auxiliary generator
Surface condenser.....Westinghouse Electric Corp
53,000 sq ft, 2-pass, radial flow, deaerating hotwell, welded shell, divided cast-iron waterboxes, waterbox division valve
Condenser tubes.....Phelps Dodge Copper Products Co
Circulating water pumps, 2.....Westinghouse Electric Corp
37,000 gpm, 318 rpm, 31-ft head, 549 hp
Circulating-water-pump drives, 2.....Westinghouse Electric Corp
Constant speed, 300 hp, 318 rpm, 2300 v
Vacuum pumps, 2.....Kinney Manufacturing Co
600 cfm at 400 rpm, 1-in. Hg abs pressure
Vacuum-pump drives, two, 40 hp.....General Electric Co

STEAM-GENERATING EQUIPMENT:

Boiler and waterwalls, 1.....Babcock & Wilcox Co
Radiant boiler, heating surface including walls, floor and division wall, 21,391 sq ft; max continuous capacity, 900,000 lb per hr; 1500 psig, 1000 F; 47,800-cu-ft furnace volume
Superheater, attemperator, 31,643 sq ft.....Babcock & Wilcox Co
Economizer, 16,400 sq ft.....Babcock & Wilcox Co
Air heaters, 2.....Air Preheater Corp
105,900 sq ft, Ljungstrom, outdoor installation
Burners, 12, coal and oil.....Babcock & Wilcox Co
Boiler insulation.....H W Porter & Co
Boiler refractory and brickwork.....George Allen & Son
Ash hoppers and pump.....Allen-Sherman-Hoff Co
Coal pulverizers, 3.....Foster Wheeler Corp
Ball mills, double classifier and feed, 37,400 lb per hr each
Pulverizer drive motors, three, 350 hp.....Westinghouse Elec Corp
Coal feeders, 3, table type.....Foster Wheeler Corp
Coal-feeder drive motors, 3.....Westinghouse Electric Corp
Mill exhausters, 3, 19,400 cfm.....Foster Wheeler Corp
Mill-exhauster drive motors, 3.....Allis-Chalmers Mfg Co
Forced-draft fans, 2.....American Blower Corp
150,000 cfm at 125 F, 18.8 in. H_2O
Forced-draft-fan hydraulic couplings, 2.....American Blower Corp
Forced-draft-fan drive motors.....Allis-Chalmers Mfg Co
Constant speed, 600 hp, 1200 rpm, 2300 v
Induced-draft fans, 2.....American Blower Corp
Louver control, 263,000 cfm at 286 F, 15.4 in. H_2O
Induced-draft-fan drive motors, 2.....Westinghouse Elec Corp
Constant speed, 1000 hp, 600 rpm, 2300 v
Ducts and breeching.....Connery Construction Co
Duct and breeching insulation.....H W Porter & Co
Wall and superheater soot blowers.....Vulcan Soot Blower Corp
Economizer soot blowers.....Diamond Power Specialty Corp
Air-heater soot blowers.....Air Preheater Corp
Boiler gage glasses.....Diamond Power Specialty Corp
Bowers level indicator.....Yarnall-Waring Co
Chemical feed pumps, low pressure.....Milton Roy Co
Automatic combustion control.....Bailey Meter Co
Fuel-oil pressure control.....Bailey Meter Co

COAL-HANDLING and DUST-COLLECTING EQUIPMENT:

Coal tower and barge puller.....McKiernan-Terry Corp
Coal conveyors.....Robins Conveyors, Inc
Coal scale, weightometer.....Merrick Scale Manufacturing Co
Conveyor drives.....Westinghouse Electric Corp
Boiler conveyors, two, 110 t per hr.....Stephens-Adamson Mfg Co
Magnetic separators.....Ding's Magnetic Separator Co
Coal hoppers.....Hellman Boiler Works
Tractors and scrapers.....Caterpillar Tractor Co
Flash collectors, 2.....Research Corp
Ash-handling equipment.....United Conveyor Corp

FEEDWATER SYSTEM:

High-pressure heaters, 4.....Foster Wheeler Corp
Vertical, internal drain coolers, 45-20 cupro-nickel tubes.
2200-psig working water pressure, 2410-sq-ft 350-psig steam press, 1118-sq-ft 340-psig steam press, 1890-sq-ft 227-psig steam press, 1955-sq-ft 111-psig steam press
Low-pressure heater, 1.....Foster Wheeler Corp
Horizontal, 2040 sq ft, 100 psig steam press, 250 psig water press, internal drain cooler, arsenical copper tubes
Low-pressure heaters, 2.....Westinghouse Electric Corp
1800 sq ft, 100 psig steam press, 300 psig water press. Admiralty tubes, horizontal. Heaters located in turbine exhaust connection
Low-pressure heater.....Westinghouse Electric Corp
2700 sq ft, 100 psig, steam press, 300 psig water press. Admiralty tubes, horizontal, in turbine exhaust connection
Low-pressure drain cooler, 3000 sq ft.....Westinghouse Electric Corp
Heater-drainage controllers.....Fisher Governor Co
Condensate coolers, two, 1935 sq ft.....Condenser Service & Engrg Co
Condensate and pumps, 2.....Worthington Pump Mach Corp
Condensate-pump motors.....Westinghouse Electric Corp
Boiler-feed pumps, 3.....Worthington Pump & Machinery Corp
1174 gpm, 4050-ft head
Boiler-feed pump hydraulic couplings.....American Blower Corp
Boiler-feed pump motors, 3.....Westinghouse Electric Corp
1750 hp, 2300 v, 3600 rpm
Boiler-water recirculating pump, 1, 70 gpm.....Hankison Co
Feedwater control, 3-element.....Bailey Meter Co
Feedwater storage-tank pumps, two, 600 gpm.....Ingersoll-Rand Co

PIPING:

High-pressure fabricated piping.....M W Kellogg Co
Intermediate and low-pressure piping.....Midwest Piping & Supply Co; Cornell & Underhill, Inc
Circulating-water piping.....Warren Foundry & Pipe Co
Blowdown valves, 3.....Yarnall-Waring Co
H-p steel gate, globe and check valves.....Lunkenheimer Co
L-p steel gate, globe and check valves.....Wm Powell Co
Small high-pressure valves.....Edward Valves Inc; Lunkenheimer Co
Small l-p valves.....Hancock Div, Manning, Maxwell & Moore, Inc
Iron gate, globe and check valves.....Crane Co
Large iron butterfly valves, circulating water.....Henry Pratt Co
Bleed-steam check nonreturn valves.....Schutte & Koerting Co
Small bronze valves.....Lunkenheimer Co
Constant-load spring hanger.....Grinnell Co
Inspection.....Hartford Steam Boiler Inspection & Insurance Co
Pipe insulation.....Philip Carey Co
Relief valves, heaters.....Parris Engineering Co; Consolidated Div, Manning Maxwell & Moore
Soot-blower air relief valves.....Consolidated Division, Manning, Maxwell & Moore
Boiler drum and superheater relief valves.....Consolidated Division, Manning, Maxwell & Moore

MISCELLANEOUS EQUIPMENT:

Surge tank, 10,000 gal.....Hellman Boiler Works
Compressed air receivers, 3.....M W Kellogg Co; Buffalo Tank Corp
Gland seal tank, 485 gal.....McCarter Iron Works
Drain tank.....Hellman Boiler Works
Acid cleaning tanks, two, 10,000 gal.....McCarter Iron Works
Lubricating-oil storage tank, 4500 gal.....Hellman Boiler Works
Boiler meters and recorders.....Bailey Meter Co
Draft gages.....Ellison Draft Gage Co
Feedwater flow indicator.....Republic Flow Meter Co
Pressure gages.....Ashcroft Div, Manning, Maxwell & Moore, Inc
Speed and cam-shaft position recorder.....General Electric Co
Shaft differential expansion recorder.....General Electric Co
Bearing vibration amplitude recorder.....General Electric Co
Hotwell level and makeup control.....Hagan Corp
H_2 and CO_2 control and indication.....General Electric Co
Industrial thermometers, vacuum column.....Taylor Instrument Co's
Temperature and conductivity recorders.....Leeds & Northrup Co
Fuel-oil meters.....Neptune Meter Co
Limitorque valve operators.....Philadelphia Gear Works
CO_2 recorder.....Leeds & Northrup Co
High and low coal level indicators for hoppers.....Fuller Co
Sample cooling coils.....Parker Appliance Co
Service water pumps, two, 2500 gpm.....De Laval Steam Turbine Co
Boiler-room elevator.....Otis Elevator Co
Fire-protection equipment.....Acme Rubber Manufacturing Co; American-LaFrance Foamite Corp; Blaw-Knox Co; C-O-Two Fire Equipment Co; Davis Emergency Equipment Co; Mine Safety Appliance Co; Walter Kidde & Co; Wirt & Knox Manufacturing Co
Air compressor, 1, 1000 cfm.....Worthington Pump & Mach Corp
Air compressor, control air.....Ingersoll-Rand Co
Acid cleaning pumps, 2.....Worthington Pump & Machinery Corp
Hoists and trolleys.....Ingersoll-Rand Co; Philadelphia Chain Block & Mfg Co, Inc; Wright Mfg Div, American Chain and Cable Co
Ventilating equipment.....American Blower Corp; Da Bothezat Div, Amer Machine & Metals Co; H H Robertson Co