# Oak Creek Power Station:

## OAK-401 Steam Turbine and Generator Unit
### Sargent & Lundy Engineers

**Mfr**: General Electric
**Number**: One Unit
**Contract No.**: T-1550
**Turbine Type & Rating**: 75,000 KW, Tandem Compound, Double Flow, Condensing Reheat Steam Turbine
**Speed**: 3,600 RPM
**No. of Extraction Points**: 5

**Turbine Data:**
**Speed**: 3,600 RPM
**No. of Stages**: 23
**Length of Longest Blades:** 20”
**Tip Diameter of Largest wheel:** 80”
**Max. Peripheral Velocity of Largest Wheel**: 1260 FT/SEC.
**Turbine Critical Speed**:
**HP**- 2400 RPM
**LP**- 3200 RPM
**Generator Critical Speed**:
1700 RPM

### Steam Turbine/Generator – General Operating Data:

**Generator Output at Terminals:**
KW: 37,500 / 56,250 / 75,000 / 77,256
**Throttle Steam Pressure**:
PSIG: 1450 / 1450 / 1450 / 1450
**Throttle Steam Temperature** –
DEG F: 1000 / 1000 / 1000 / 1000
**Throttle Steam**:
BTU/LB: 1491.2 / 1491.2 / 1491.2 / 1491.2
**Exhaust Pressure**:
IN HG: 2.0 / 2.0 / 2.0 / 2.0
**Condenser Flow** –
LBS/HR: 189,497 / 275,082 / 365,576 / 392,077
**Throttle Flow** – LBS/HR: 248,137 / 372,649 / 510,705 / 547,620

**OAK-401 (Cont.)**

## IN/Oiling System:

**Capacity of Oil Reservoir:** 3100 gallons

**Quantity of Oil Contained in the entire oil system,**
**Including oil reservoir:** 3625 gallons
**Pumps Service:**
**Auxiliary Oil Pump –**
**Capacity GPM:** 450
**Dischg. Press. PSIG:** 160
**Type Pump Drive:** AC Motor
**IN/**
**Generator Data:**
**Rating at 30 PSIG H2:**
**KW:** 81,600
**KVA:** 96,000
**Power Factor:** 0.85
**Voltage:** 13,800
**Voltage Regulation at 1.0 PF:** 23%
**Voltage Regulation at .85 PF:** 28%

**Rating of Motors HP:** 100
**Turning Gear Oil Pump –**
**Capacity GPM:** 225
**Dischg. Press. PSIG:** 40
**Type Pump Drive:** AC Motor
**Rating of Motors HP:** 10

**Oil Cooler Data:**
**(Operating data for one cooler at full load conditions)**
**Make of Cooler:** General Electric
**Inlet water Temperature:** 95 F. Max
**Outlet water Temperature:** 100 F.
**Quantity of Cooling Water:** 450 GPM
**Inlet Temperature of Oil:** 135 F.
**Outlet Temperature of Oil:** 115 F.
**Quantity of Oil:** 270 GPM
**Type of Cooler:** Externally mounted through type
**Type of Material:** Admiralty

**Diameter and Thickness of Tubes:** 5/8" OD x #16 BWG

**<u>OAK-401</u> (Cont.)**

**Turning Gear:**

**Speed at which it turns Unit:** 3 RPM
**Size of Main Motor Drive:** 7.5 HP
**Exciter Data –**
**Main Exciter Rating:** 240 KW – 250 Volts
**Type: Shaft Driven Exciter**
**Full Load Speed:** 1778 RPM
**Ceiling Voltage:** 300 Volts
**Exciter Nominal Speed of Response:** 0.5 SEC

**Net Weights –**

**Generator:**

**Complete Equipment:** 395,000 lbs.
**Heaviest Piece During Erection:** 225,000 lbs.
**Heaviest Piece After Erection:** 53,000 lbs. (Rotor)

**Turbine:**

**Complete Equipment:** 461,000 lbs.
**Heaviest Piece During Erection:** 225,000 lbs.
**Heaviest Piece After Erection:** 45,000 lbs. (upper exhaust hood)

**Turbine Oil Transfer Pump –**

**Mfr:** Worthington Corp.
**Number and Type:** One Model 5GAV
**Type:** Rotary Positive Displacement type with built in relief valve
**Performance Data:**
Oil Viscosity: 100 SSU
Capacity: 33.2 GPM
Total Head: 45 FT
BHP Required: 1.83 BHP

W/

**Motor, Electric** –

2 HP 1800 RPM, 440 Volt, Open Drip-Proof Type

**Overall Dimensions-**

**Length:** 67’ – 5-3/4”
**Width:** 17’- 5”
**Width at Floorline:** 17’- 5”
**Height:** 12’ – 1-1/2”

**OAK-401 (Cont.)**

**Auxiliary Equipment** –

**Turbine Oil Purifier**:
**Mfr**: Delaval Separator Company
**Number and Type**:
One Model 55-23 Unimatic with Corrosion resistant bowl with two internal gear type oil pumps; one for suction, one for discharge, both pumps operate from same shaft. Unit equipped with 18 KW electric heater with automatic temperature control.
**Motor**:
2 HP, 440 Volt explosion proof type purifier capacity: 225 GPM

**Tag Data:**

**Turbine –** major O/H in 2000
Steam Turbine – Generator Unit
**Mfr**: General Electric
**Turbine** –

Rating: 75000 KW
RPM: 3600
Stages: 23
Steam Conditions:

Pressure: 1450 PSIG
Temperature: 1000° F
Exhaust Pressure: 3.5" HG ABS
Reheat Temperature: 1000°F

**Serial Number**: 128942
**Generator** –

ATB 2 Poles 60 Cycle
Hydrogen Cooled
Y Connected for 13800 Volts
**Excitation**: 250 Volts
**Gas Pressure**: 30 PSIG Rating
**KVA**: 96000 Rating
**Stater Amperes**: 4016 Rating
**Field Amperes**: 866 Rating
**Power Factor**: 0.85 Rating
**Temperature Rise at rated load not to exceed**:

45°C on Stator Winding by Dectector
74° C on Field by Resistance

**Serial Number**: 8287090

**OAK-401D & 401E**

**Exciter** –
**Mfr**: GE Motors & Industrial Systems
GE Drive Systems
**Req. No.**: 417E3157
**Item No.**: ED001
**LINEUP:** #001
**Power In:** Volts 350 (V)
Amps 990 (A)
Hertz 60 (Hz)
Phase 3 (PH)
**Power Out**: Volts 250 (V)
Amps 918 (A)
Power 229 (KW)
Freq. DC to HZ
1 Phase Rotation
**Max. System S.C.C. 65000 Amps**
Hema enclosure type 1
**Exciter Bridge** – No. 1 (#0001)
**Mfr**: GE Drive Systems
**Power In**: Volts 350
Amps 990
Hertz 60
Phase 3
**Power Out**: Volts 250
Amps 918
229 KW Power
**Max. System S.C.C. 65000 Amps**
Hema enclosure type 1

Dimensions:
20" Wide x 7'6" Long x 8'0" High
Steel Clad enclosure
Double Door Opening
3 Section/Compartments
W/Ground Fault Detection Panel
No.: DS3820NGDB
NP. No.: 323 A1606P1

**OAK-402**

**Boiler – Steam Generating Unit**:
Contract No. T-1551
**Mfr**: Babcock and Wilson Co.
**Type**: Pressurized furnace outdoor reheat type fired by natural gas and in emergency by fuel oil
**Steam Capacity**: (normal) 525,000 LB/HR
**Steam Pressure at Superheater Outlet**: 1510 PSIG
**Steam Temperature at Superheater Outlet**: 1005° F
**Steam Temperature at Reheat Outlet**: 1005° F
**Feed Water Temperature**: 445° F

**Heating Surface**:
Boiler: 6475 Sq. Ft.
Furnace (projected area): 5208 Sq. Ft.
Primary Superheater: 9817 Sq. Ft.
Secondary Superheater: 3610 Sq. Ft.
Reheater: 5266 Sq. Ft.
Economizer: 15,362 Sq. Ft.
Air Heater (total): 77,200 Sq. Ft.
**Design Pressure** –
Boiler: 1725 PSIG
Superheater: 1725 PSIG
Reheater: 550 PSIG
Economizer: 1775 PSIG
**Furnace Volume (Total):** 26,600 CU FT
**Heat Liberation in furnace (from fuel only) @ 525,000 LB Steam/HR**:
**W/ Gas Fuel**: 28,400 BTU/CU. FT/ HR
**W/ Oil Fuel**: 27,300 BTU/CU FT/HR
**Heat Absorption in Furnace (from fuel only) @ 525,000 LB Steam/HR**:
**W/ Gas Fuel**: 134,500 BTU/SQ FT
**W/Oil Fuel**: 129,500 BTU/SQ FT
**Water Walls** –
**Type**: Radiant
**Tube Size**: 2- 31/32" OD
**Supply and Riser Tubes**: 4 ½" OD
**Headers (all):** 14" OD + 18 ¼" OD
**Valves**: 2- ½" Lower water wall and side wall header drains 2- 1 ½" lower front and rear header drains

**<u>OAK-402</u> (Cont.)**

**Superheater** –

**Type**:
**Primary Superheater**: Continuous Tube, Drainable
**Secondary Superheater**: Convection Tube, Drainable
**Tube Size**:
**Primary Superheater**: 2 ½" OD
**Secondary Superheater**: 2 ½" OD
**Headers:**
**Primary Superheater Inlet:**
**Primary Superheater Outlet:**
**Secondary Superheater Inlet:**
**Secondary Superheater Outlet:**

**Primary Superheater Outlet –** link to attemperator**:** (2) 11 ½" OD
**Secondary Superheater Inlet** – link to attemperator: (2) 11 ¾" OD

**Reheater** –

**Type**: Continuous Tube, Drainable
**Tube Size**: 2" OD

**Headers**:

**Reheater Inlet Header**: 18 ½" OD
**Reheater Oulet Header**: 19" OD

**Valves** –

(2) 4" Safety Valves
(1) 3" Safety Valve
(1) 1" Vent Valve

**Economizer** –

**Type**: Continuous Tube, drainable
**Tube Size**: 2" OD
**Headers**:
Inlet Header (1) 11 ½" OD
Outlet Header (1) 11 ½" OD
**Valves**:
(1) 8" Feed Water Stop-Check
(2) 1 ½" Drain Valves

**<u>OAK-402</u> (Cont.)**

**Boiler Wall Construction** –

**Type**: Tubes on tangential Centers, Kaocrete refractory, #10 GA skin casing, intermediate temperature block insulation and #18 GA galvanized outer lagging (in that order)

**w/Superheat Attmperator –**

**Type:** (2) Water Spray Type

**Reheat Attemperator –**

**Type:** (1) Water Spray Type

**Gas Burners** –

**Number**: 12

**Type**: "Laredo" type circular multispeed with 8 speeds per burner arranged 4 burners high and 3 wide

**Maximum Rating per burner**: 43,750 LB Steam/HR

**W/Automatic Burner Ignition and Flame Failure Equipment** –

**Mfr**: Bailey Meter Co.

**Tag Data**:

Contract No.: RB350
Capacity LB/HR: 525,000
Design Pressure: 1725 PSI
Steam Temperature: 1005° F
Boiler HS Sq. Ft.: 11,683
Preheater Pressure: 400 PSI
Preheater Temperature: 1005° F
Economizer Pressure: 1775 PSI
Built: 1961

**Boiler Corrected Tag**:

Babcock and Wilcox Company
Date: 12/4/2000
MAINP: 550 PSI @ 1005° F
Capacity: 315,000 LB/HR

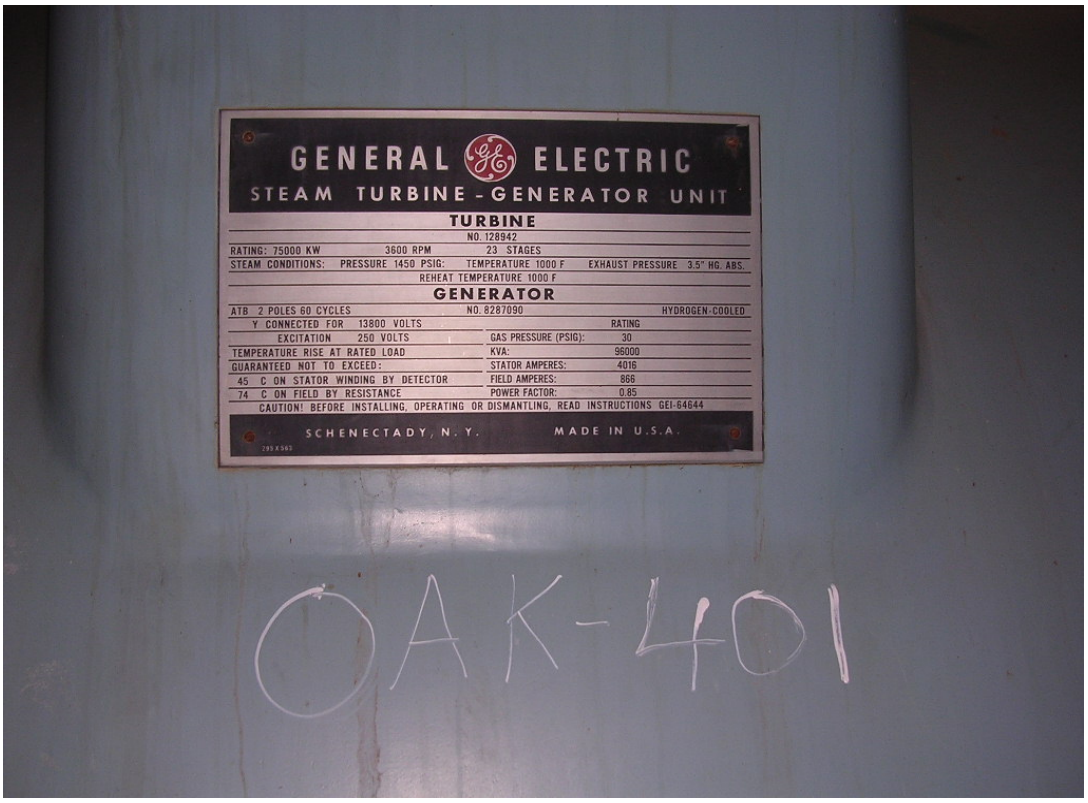
**OAK-403**

**Condenser – Steam Turbine – Generator Unit:**

**Contract No.:** T-1553
**Mfr**: Worthington Corporation
**Type**: Horizontal Surface Condenser of Multisteam pass, two water passes, rectangular section and divided water box design.
**Surface**: 45,000 Sq. Ft.
**Tube Size**: 1" OD #18 BWG x 30'-0" Inhibited Admiralty
**Number of Tubes**: 5800
**Cooling Water**: 40,400 GPM
**Full Load Condensing Capacity**: 387,500 LB/HR
**Water Box Design Pressure**: 30 PSIG

**Tag Data**:

Surface Condenser
Unit No. 1
45,000 Sq. Ft.
**Serial Number**: 1586697

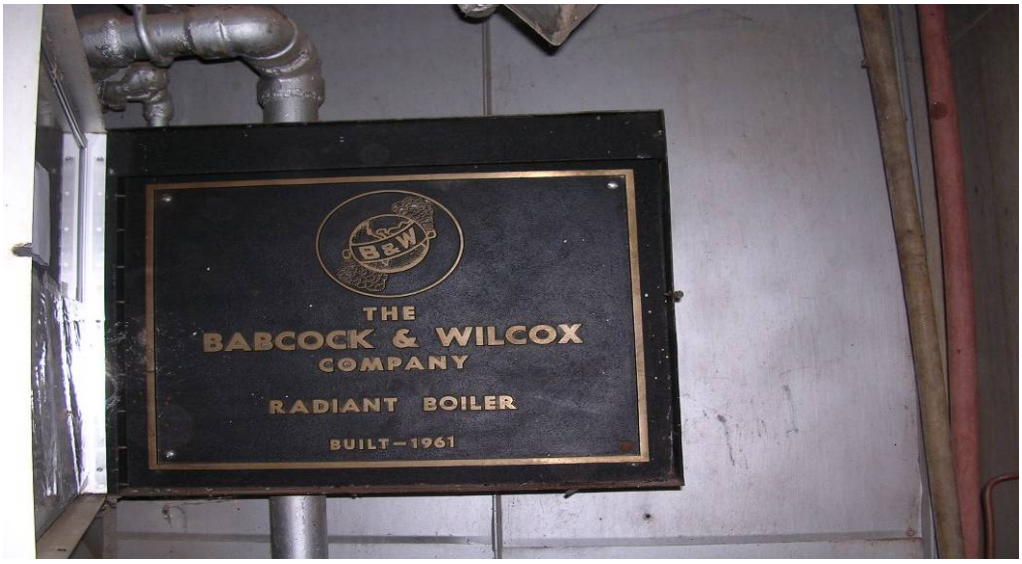



GENERAL ELECTRIC


DANGER


OAK-401A


OAK-402
THE
BABCOCK & WILCOX
COMPANY


B&W
THE
BABCOCK & WILCOX
COMPANY
RADIANT BOILER
BUILT—1961


OAK-403
DANGER
FOLLOW CONFINED SPACE
ENTRY PROCEDURE
BEFORE ENTERING
WORTHINGTON
CORPORATION
SURFACE CONDENSER
SQ.FT. SERIAL NO.
MADE IN U.S.A.