

Unit Design Data

COMBINED CYCLE UNITS AND BLOCK DESIGN DATA

(VOLUNTARY REPORTING)

(Note: The NERC Board of Trustees approved the GADS Task Force report (dated July 20, 2011 - <http://www.nerc.com/filez/gadstf.html>) which states that design data collection outside the required nine fields is solely voluntary. However, the GADS staff encourages that reporters report and update GADS design data frequently. This action can be completed by 1) sending in this form or 2) using the design data entry software located at <http://www.nerc.com/page.php?cid=4|43|46>. GADS staff encourages using the software for design entry and updating.)

Company name: _____

Station name: _____

Block name: _____

Data reporter: _____

Telephone number: _____

Date: _____

COMBINED CYCLE UNITS AND BLOCK DESIGN DATA

INSTRUCTIONS

In order to continue this discussion, some terms must be agreed on to eliminate some of the ambiguity concerning combined cycle blocks in general.

- Combined Cycle Block (referred here as a “Block”) –By definition, a combined cycle is a process for generating energy (either electricity or steam) constituted by the marriage of a Brayton Cycle (expand hot gas to turn a gas turbine) with a Rankine Cycle (use heat to boil water to make steam to turn a steam turbine). The combined cycle block employs an electric generating technology in which electricity is produced from otherwise lost waste heat exiting from one or more gas turbines/jet engines, one or more steam turbines, and balance of plant equipment supporting the production of electricity. In the combined cycle block, the exiting heat is routed to a conventional boiler or to a heat recovery steam generator (HRSG) for use by a steam turbine in the production of electricity or steam energy.

There may be more than one block at a plant site. This design form should be completed for each individual block.

- Units – Each gas turbine/jet engine and each steam turbine are considered a “unit.” Each unit contributes to the total electric generation or steam production of the block. Each unit has or shares its generator for providing electric power. They are considered to be individual parts of the block.
- Heat Recovery Steam Generator (HRSG) – There may be one or more HRSG or waste heat boiler in a block. Some blocks may have a single HRSG per GT/jet; others may have several GT/jet feeding a single HRSG or any combination thereof. The HRSG does not contribute electricity to the output of the block and so, is considered a component rather than a “unit”.
- Other Balance of Plant Equipment – There are other equipment in the block used to support the production of electricity/heat energy. They are not related to any specific generating unit and are also considered as components. Submit the data in this section once during the life of each block. If a major change is made to a site that significantly changes its characteristics, then resubmit this section with updated information.

For coded entries, a (9) is entered to indicate an alternative other than those specified. Whenever a (9) is entered, write the column number and the answer on the reverse side of the form.

If a copy of the original form is being submitted, make sure that it is legible.

GENERAL BLOCK IDENTIFICATION

1. Identification

A series of codes uniquely identifies your utility (or company) and the block. NERC assigned a unique code to identify your company. You must assign the unique code that will identify the block being reported. This block code may be any number from 800 to 899. Enter the unique company and block code and the full name of the entire block below:

Utility (Company) Code: _____ Block Code: _____

Name of Block, including site name: _____

2. Date the Block Entered Service

The in-service date establishes the starting point for review of historical performance of the block. Starting dates of each unit may be different. Supply unit dates at the specify location on this form. Using the criteria described below, report the date the block entered service:

Date (Month/day/year) _____

- Criteria: a) The date the block was first declared available for dispatch at some level of its capability, OR
 b) The date the block first operated at 50% of its generator nameplate megawatt capability (product of the megavoltamperes (MVA) and the rated power factor as stamped on the generator nameplate(s)).

3. Block Loading Characteristics at Time of Design

Enter the number from the list below that best describes the mode of operation for the block as it was *originally designed*:

Loading Characteristic: _____

- 1 - Base load with minor load following
- 2 - Periodic start-up, load follow daily, reduced load nightly
- 3 - Weekly start-up, load follow daily, reduced load nightly
- 4 - Daily start-up, load follow daily, off-line nightly
- 5 - Start-up chiefly to meet daily peaks
- 9 - Other, describe _____

4. Design and Construction Contractors

Identify both the architect/engineer and the general construction contractor responsible for the design and construction of the block. If your company was the principal designer or general constructor, enter "SELF"

Architect/Engineer: _____

Constructor: _____

5. Total Nameplate Rating of all units in the block (in MW)

Enter the TOTAL capability (sum of all gas turbines/jet engines and steam turbines) MW nameplate or published MW rating of the block. In cases where the turbine's nameplate rating cannot be determined, approximate the rating by multiplying the MVA (megavoltamperes) by the rated power factor found on the nameplate affixed to each unit's generator (or nameplates in the case of cross compound units).

Total block rating (MW) based on sum of nameplate ratings on all units: _____.

6. **Does the block have co-generation (steam for other than electric generation) capabilities (yes/no)?** _____
7. **What is the number of gas turbines/jet engines per Heat Recovery Steam Generator (HRSG)**
Identify the number of gas turbines/jet engines feeding exhaust gases into a single HRSG. _____
8. **What is the number of gas turbines/jet engines - Heat Recovery Steam Generator (HRSG) Trains**
Identify the number of sets of gas turbines/jet engines and HRSG trains supplying steam to the steam turbine

9. **Total number of gas turbines/jet engines in block**
Identify the number of GT/Jets used for generating power _____
10. **Total number of Heat Recovery Steam Generator (HRSG) in block**
Identify the number of HRSG supplying steam to the steam turbine. _____
11. **Total number of Steam Turbines in block**
Identify the number of steam turbines receiving steam for generating power _____

**FOR EACH GAS TURBINE or JET ENGINE
COMPLETE ITEMS #12 TO #65
(If you have 3 GTs, then complete items #12-65 once for each GT)**

GAS TURBINE OR JET ENGINE DATA

12. Identification

A series of codes uniquely identifies your utility (company), the combined cycle block and its units. NERC assigned a unique code to identify your company. You must assign the unique code that will identify the GAS TURBINE/JET ENGINE unit being reported. This code may be any number from 300 to 399 or 700-799. Enter the unique company, block and unit code and the full name of each gas turbine/jet engine below:

Utility (Company) Code: _____ Unit Code: _____ Block Code: _____

Name of unit: _____

13. Date the gas turbine/jet engine Entered Service

The in-service date establishes the starting point for review of historical performance of each unit. Using the criteria described below, report the date this gas turbine/jet engine entered service:

Date (Month/day/year) _____

- Criteria: a) The date the gas turbine/jet engine was first declared available for dispatch at some level of its capability, OR
b) The date the gas turbine/jet engine first operated at 50% of its generator nameplate megawatt capability (product of the megavoltamperes (MVA) and the rated power factor as stamped on the generator nameplate(s)).

14. Design and Construction Contractors

Identify both the architect/engineer and the general construction contractor responsible for the design and construction of the unit. If your company was the principal designer or general constructor, enter "SELF"

Architect/Engineer: _____

Constructor: _____

15. Gas turbine/jet engine nameplate rating in MW

Nameplate is the design capacity stamped on the gas turbines/jet engines or published on the guarantee flow diagram. In cases where the gas turbine's nameplate rating cannot be determined, approximate the rating by multiplying the MVA (megavoltamperes) by the rated power factor found on the nameplate affixed to each unit's generator (or nameplates in the case of cross compound units).

Gas turbine/jet engine rating (MW): _____

16. **Engine manufacturer** - (1) Pratt & Whitney; (2) General Electric; (3) Seimans Westinghouse; (4) Alstom (ABB); (5) Rolls Royce; (6) Cooper Bessemer; (7) Worthington; (8) Allison; (9) Other. _____

17. **Engine type** - (1) Gas turbine single shaft; (2) Gas turbine split shaft; (3) Jet engine; (9) Other

-
18. **Expander turbines, number per unit if applicable:** _____
19. **Type expander**, if applicable - (1) Single flow; (2) Double flow
20. **Cycle type** - (1) Reheat; (2) Simple; (3) Regenerative; (4) Recuperative; (5) Intercooled; (6) Pre-cooled; (7) Complex; (8) Compound; (9) Other
21. **Startup system** - (1) Air; (2) Auxiliary motor; (3) Electric motor; (4) Natural gas; (5) Flow turbine; (6) Supercharging fan; (7) Hydraulic; (9) Other
22. **Startup type** - (1) Automatic, on site; (2) Automatic, remote; (9) Other
23. **Type of Fuel(s) that will be used:** _____
24. **Enter (1) if sound attenuators located at inlet:** _____
25. **Enter (1) if sound attenuators located at outlet:** _____
26. **Enter (1) if sound attenuators located in building enclosures:** _____
27. **Time for normal cold start to full load in seconds:** _____
28. **Time for emergency cold start to full load in seconds:** _____
29. **Black start capability** - (1) Yes; (2) No _____
30. **Engine Model Number (MS 7001EA, W501AA, FT4A11, etc.)**
-

GAS TURBINE SELECTIVE NON-CATALYTIC REDUCTION SYSTEM (SNCR)

31. **SNCR reagent** - (1) Ammonia; (2) Urea; (9) Other: _____
32. **SNCR injector type** - (1) Wall nozzle; (2) Lance; (9) Other: _____
33. **SNCR injection equipment location** - (1) Furnace; (2) Super-heater; (3) Economizer; (9) Other: _____
34. **Number of SNCR injectors:** _____
35. **SNCR carrier gas type** - (1) Steam; (2) Air; (9) Other: _____

36. **SNCR carrier gas total flow rate** (thousands of lbs./hr.) i.e.
6,000,000 lbs./hr. enter 6000

37. **SNCR carrier gas pressure at nozzle (psi):** _____

38. **SNCR carrier gas nozzle exit velocity (thousands of ft./sec.):** _____

GAS TURBINE SELECTIVE CATALYTIC REDUCTION SYSTEM (SCR)

39. **CR reactor** - (1) Separate; (2) In Duct; (3) Other: _____

40. **40SCR reagent** - (1) Ammonia; (2) Urea; (9) Other: _____

41. **SCR ammonia injection grid location** - (1) Furnace; (2) Super-heater; (3) Economizer;
(4) Zoned; (5) Other: _____

42. **SCR duct configuration** - (1) Flow straighteners; (2) Turning vanes; (3) Dampers

43. **SCR Catalyst Element Type** (1) Plate; (2) Honeycomb; (9) Other: _____

44. **SCR catalyst support material** - (1) Stainless steel; (2) Carbon steel;
(9) Other: _____

45. **SCR catalytic material configuration** - (1) Vertical; (2) Horizontal;
(9) Other: _____

46. **SCR catalyst surface face area** (thousands of square feet): _____

47. **SCR catalyst volume** (thousands of cubic feet): _____

48. **Number of SCR catalytic layers:** _____

49. **SCR catalytic layer thickness (1/1000 inches):** _____

50. **SCR sootblower type** - (1) Air; (2) Steam; (3) Both

51. **SCR sootblower manufacturer:** _____

GAS TURBINE CATALYTIC AIR HEATERS (CAH)

52. **CAH element type** - (1) Laminar surface; (2) Turbulent surface;
(9) Other: _____

53. **CAH catalyst material** - (1) Titanium oxide; (2) Vanadium pentoxide; (3) Iron (II) oxide;
(4) Molybdenum oxide; (9) Other: _____

54. **CAH catalyst support material** - (1) Stainless steel; (2) Carbon steel;
(9) Other: _____

- 55. **CAH catalyst material configuration** - (1) Horizontal air shaft; (2) Vertical air shaft
- 56. **CAH catalyst material total face area** (thousands of square feet): _____
- 57. **CAH catalyst material open face area** (thousands of square feet): _____
- 58. **CAH catalyst material layer thickness** (1/1000 inches): _____

FOR ELECTRIC GENERATOR ON EACH GT/JET ENGINE

59. Generator - Manufacturer

Enter the name of the manufacturer of the electric generator:

Generator manufacturer: _____

60. Number of generators per gas turbine/jet engine: _____

61. Generator - Enclosure

Is 50% or more of the generator outdoors (not enclosed in building framing and siding)? Yes/no: _____

62. Generator - Ratings and Power Factor

Enter the following information about the generator:

Design (Nameplate) Item	Main Generator	Second* Shaft	Third* Shaft
Voltage to nearest one-tenth kV	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> >	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> >	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> >
Megavoltamperes (MVA) Capability	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
RPM	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
Power Factor (enter as %)	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> >	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> >	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> >

*Cross compound units.

63. Generator - Cooling System

Two types of cooling methods are typically used. First is the “innercooled” method, where the cooling medium is in direct contact with the conductor copper or is separated by materials having little thermal resistance. The other is the “conventional” cooling method where the heat generated within the windings must flow through the major ground insulation before reaching the cooling medium.

Enter the type of cooling method used by the generator: _____

- 1 - Stator innercooled and rotor innercooled.
- 2 - Stator conventionally cooled and rotor conventionally cooled.
- 3 - Stator innercooled and rotor conventionally cooled.
- 9 - Other, describe _____

Enter the mediums used to cool the generator’s stator (air, hydrogen, oil, water): _____

Enter the mediums used to cool the generator’s rotor (air, hydrogen, oil, water): _____

64. Generator - Hydrogen Pressure

Enter the generator hydrogen pressure IN PSIG at nameplate MVA: _____

EXCITER ON EACH GT/JET ENGINE GENERATOR**65. Exciter - Configuration**

Enter the following information about the main exciter:

Exciter manufacturer: _____

TOTAL number of exciters; include installed spares: _____

MINIMUM number of exciters required to obtain maximum capacity from the unit: _____

ENTER the type of main exciter used at the unit from the list below: _____

- 1 - *Static* - static excitation where dc is obtained by rectifying ac from generator terminals, and dc is fed into rotor by collector rings.
- 2 - *Rotating dc generator* - exciter supplies dc from a commutator into the main rotor by means of collector rings.
- 3 - *Brushless* - an ac (rotating armature type) exciter whose output is rectified by a semiconductor device to provide excitation to an electric machine. The semiconductor device would be mounted on and rotate with the ac exciter armature.
- 4 - *Alternator rectifier*
- 9 - *Other, describe:* _____

ENTER the type(s) of exciter drive(s) used by the main exciter IF it is rotating: _____

- 1 - Shaft direct
- 2 - Shaft gear
- 3 - Motor
- 9 - Other, describe: _____

**FOR EACH HEAT RECOVERY STEAM GENERATOR (HRSG)
COMPLETE ITEMS #66 TO #87
(If you have 3 HRSGs, then complete items #66-87 once for each HRSG)**

66. Enter the unit code information for each GT/Jet that supplies heat energy to this single HRSG.

Utility (Company) Code: _____ Unit Code "A": _____ Block Code: _____

Name of unit "A", including site name: _____

Utility (Company) Code: _____ Unit Code "B": _____ Block Code: _____

Name of unit "B", including site name: _____

Utility (Company) Code: _____ Unit Code "C": _____ Block Code: _____

Name of unit "C", including site name: _____

Utility (Company) Code: _____ Unit Code "D": _____ Block Code: _____

Name of unit "D", including site name: _____

67. HRSG - Manufacturer

Enter the name of the manufacturer and the model or series name or number of the HRSG:

HRSG manufacturer: _____

68. HRSG - Enclosure

Is 50% or more of the HRSG is outdoors (not enclosed in building framing and siding)? (Y/N): _____

69. HRSG - Nameplate Steam Conditions When fired situation

Enter the following steam conditions at the full load, valves wide open design point at the exist of the HRSG to the steam turbine when the HRSG is experiencing supplemental firing:

HIGH PRESSURE

Steam flow rate (in lbs/hr): _____

Design temperature (°F): _____

Design pressure (psig): _____

INTERMEDIATE PRESSURE

Steam flow rate (in lbs/hr): _____

Design temperature (°F): _____

Design pressure (psig): _____

LOW PRESSURE

Steam flow rate (in lbs/hr): _____

Design temperature (°F): _____

Design pressure (psig): _____

REHEAT PRESSURE

Steam flow rate (in lbs/hr): _____

Design temperature (°F): _____

Design pressure (psig): _____

70. HRSG - Nameplate Steam Conditions When unfired situation

Enter the following steam conditions at the full load, valves wide open design point at the exist of the HRSG to the steam turbine when the HRSG is not experiencing supplemental firing:

HIGH PRESSURE

Steam flow rate (in lbs/hr): _____

Design temperature (°F): _____

Design pressure (psig): _____

INTERMEDIATE PRESSURE

Steam flow rate (in lbs/hr): _____

Design temperature (°F): _____

Design pressure (psig): _____

LOW PRESSURE

Steam flow rate (in lbs/hr): _____

Design temperature (°F): _____

Design pressure (psig): _____

REHEAT PRESSURE

Steam flow rate (in lbs/hr): _____

Design temperature (°F): _____

Design pressure (psig): _____

71. Is the HRSG top-supported (pressure parts hang like in a utility boiler) or bottom-supported? _____

72. Does the HRSG have vertical or horizontal heat exchangers? _____

73. Is the duct insulation is cold-casing (insulation on the inside of the duct) or hot casing (insulation on the outside of the duct)? _____

74. HRSG Supplemental Firing (duct burners)

Does the HRSG have the capability of Supplemental Firing (duct firing) (y/n)? _____

Is the HRSG supplemental used “normally, as-needed” or only in extreme emergency?

75. HRSG bypass capabilities

Does the HRSG have bypass capability? (y/n) _____

76. Does the HRSG have a drum or is it once-through design? _____**77. HRSG - Circulation System**

Enter the following information on the pumps used to recirculate water through the HRSG:

HRSG recirculation pump(s) manufacturer(s): _____

TOTAL number of HRSG recirculation pumps; include installed spares: _____

MINIMUM number of HRSG recirculation pumps required to obtain maximum capacity from this HRSG: _____

Enter the type of HRSG recirculation pump(s) at the block:

- 1 - *Injection* (or injection seal) - controlled-leakage HRSG recirculation pumps mounted vertically with a rigid shaft designed to carry its own thrust.
- 2 - *Leakless* (or canned, canned-motor, or zero-leakage) - pump and its motor are an integral pressurized sealed component.
- 9 - *Other, describe* _____

78. HRSG – Duct Burner System (General)

Enter the following information on the duct burner systems installed for use by this HRSG:

Duct fuel burner(s) manufacturer(s): _____

TOTAL number of duct fuel burners: _____

79. HRSG – Duct Burner Management System

Enter the name of the manufacturer of each of the following burner management systems:

Manufacturer of the combustion control system that coordinates the feedwater, air, and fuel subsystems for continuous HRSG operation: _____

Manufacturer of the burner management system that monitors only the fuel and air mixture during all phases of operation to prevent the formation of an explosive mixture: _____

80. Auxiliary Systems - Feedwater (HRSG Feed) Pumps

The feedwater (HRSG feed) pumps move the feedwater through the feedwater system into the HRSG. Enter the following information on the feedwater pumps installed at this HRSG:

Feedwater (HRSG feed) pump(s) manufacturer(s): _____

Normal operating speed (RPM) of the feedwater pumps: _____

TOTAL number of feedwater pumps; include installed spares: _____

MINIMUM number of feedwater pumps required to obtain maximum capacity from the HRSG: _____

PERCENT (%) of the HRSG's maximum capacity that can be achieved with a single feedwater pump (XXX.X format): _____

81. Auxiliary Systems - Feedwater (HRSG Feed) Pump Drives

Manufacturer(s) of motor(s) or steam turbine(s) that drives the feedwater pump(s). _____

Enter the type of equipment used to drive the feedwater (HRSG feed) pumps: _____

- | | |
|----------------------------|---------------------|
| 1 - Motor - single speed | 6 - Motor gear |
| 2 - Motor - two speed | 7 - Steam gear |
| 3 - Motor - variable speed | 8 - Shaft gear |
| 4 - Steam turbine | 9 - Other, describe |
| 5 - Shaft | |

Specify coupling type used for feedwater (HRSG feed) pump: _____

- | |
|---------------------------|
| 1 - Hydraulic |
| 2 - Mechanical |
| 9 - Other, describe _____ |

82. Auxiliary Systems - Startup Feedwater (HRSG Feed) Pumps

Startup feedwater pump(s) manufacturer(s): _____

Manufacturer(s) of the motor(s) that drives the startup feedwater pump(s): _____

PERCENT (%) of the HRSG's maximum capacity that can be achieved with a single startup feedwater pump: _____

Indicate the additional capabilities of the startup feedwater pump: _____

- | |
|---|
| 1 - ADDITIVE: operated in conjunction with the feedwater (HRSG feed) pumps. |
| 2 - REPLACEMENT: can carry load when the feedwater pumps are inoperative. |
| 3 - STARTUP only: cannot be used in lieu of the feedwater pumps. |
| 9 - Other, describe: _____ |

83. Auxiliary Systems - High Pressure Feedwater Heaters

High-pressure feedwater heaters are those heat exchangers between the feedwater (HRSG feed) pumps discharge and the economizer inlet. Enter the following information for the HIGH pressure feedwater heaters for this HRSG:

High-pressure feedwater heater(s) manufacturer(s): _____

TOTAL number of high-pressure feedwater heaters: _____

Feedwater heater tube materials used in 50% or more of the tubes: _____

Enter the type of HIGH-pressure feedwater heater(s): _____

- 1 - Horizontal - longitudinal axis of the heater shell is horizontal.
- 2 - Vertical - longitudinal axis of the heater shell is vertical.
- 3 - Both
- 9 - Other, describe _____

84. Auxiliary Systems - Intermediate Pressure Feedwater Heaters

Intermediate-pressure feedwater heaters are those heat exchangers between the condensate booster pump discharge and the deaerator. Enter the following information for the INTERMEDIATE pressure feedwater heaters for this HRSG:

Intermediate-pressure feedwater heater(s) manufacturer(s): _____

TOTAL number of intermediate-pressure feedwater heaters: _____

Feedwater heater tube materials used in 50% or more of the tubes: _____

Enter the type of INTERMEDIATE pressure feedwater heater(s): _____

- 1 - Horizontal - longitudinal axis of the heater shell is horizontal.
- 2 - Vertical - longitudinal axis of the heater shell is vertical.
- 3 - Both
- 9 - Other, describe _____

85. Auxiliary Systems - Low Pressure Feedwater Heaters

Low-pressure feedwater heaters are those heat exchangers between the condensate pump discharge and the condensate booster pump inlet. If the HRSG does not have condensate booster pumps, the low pressure feedwater heaters are located between the condensate pumps and the deaerator. Enter the following information for the LOW-pressure feedwater heaters for this HRSG:

Low pressure feedwater heater(s) manufacturer(s): _____

TOTAL number of low pressure feedwater heaters: _____

Feedwater heater tube materials used in 50% or more of the tubes: _____

Enter the type of LOW pressure feedwater heater(s): _____

- 1 - Horizontal - longitudinal axis of the heater shell is horizontal.
- 2 - Vertical - longitudinal axis of the heater shell is vertical.
- 3 - Both
- 9 - Other, describe _____

86. Auxiliary Systems - Deaerator Heater

Deaerator manufacturer(s): _____

Enter the type of deaerator heater(s): _____

- 1 - Spray - high-velocity stream jet atomizes and scrubs the condensate.
- 2 - Tray - series of trays over which the condensate passes and is deaerated.
- 3 - Vacuum - a vacuum condition inside the shell for deaeration.
- 4 - Combination
- 9 - Other, describe _____

87. Auxiliary Systems - Heater Drain Pumps

Heater drain pump(s) manufacturer(s): _____

Manufacturer(s) of the motor(s) that drives the heater drain pump(s): _____

**FOR EACH STEAM TURBINE
COMPLETE ITEMS #88 TO #104
(If you have 3 steam turbines, then complete items #88-104 once
for each steam turbine/generator/exciter set)**

88. Identification

A series of codes uniquely identifies your company and generating-units. NERC assigned a unique code to identify your company. You must assign the unique code that will identify the STEAM TURBINE unit being reported. This code may be any number from 100 to 199 or 600-649. Enter the unique company, block and generating-unit code and the full name of each steam turbine below:

Company Code: _____ Unit Code: _____ Block Code: _____

Name of unit, including site name: _____

89. Does steam turbine have bypass capability? (y/n) _____**90. Steam Turbine - Manufacturer**

Enter the name of the manufacturer of the steam turbine:

Steam turbine manufacturer: _____

91. Steam Turbine - Enclosure

Is 50% or more of the steam turbine outdoors (not enclosed in building framing and siding)? (Y/N) _____

92. Steam Turbine - Nameplate Rating in MW

Nameplate is the design capacity stamped on the steam turbine's nameplate or published on the turbine guarantee flow diagram. In cases where the steam turbine's nameplate rating cannot be determined, approximate the rating by multiplying the MVA (megavoltamperes) by the rated power factor found on the nameplate affixed to the unit's generator (or nameplates in the case of cross compound units).

Steam turbine's nameplate rating (MW) (in XXXX.X format): _____

93. Steam Turbine - Type of Steam Turbine

Identify the steam turbine's casing or shaft arrangement.

Enter the type of steam turbine at the unit: _____

- 1 - *Single casing* - single (simple) turbine having one pressure casing (cylinder).
- 2 - *Tandem compound* - two or more casings coupled together in line.
- 3 - *Cross compound* - two cross-connected single casing or tandem compound turbine sets where the shafts are not in line.
- 4 - *Triple compound* - three cross-connected single casing or tandem compound turbine sets.
- 9 - *Other, describe:* _____

94. Steam Turbine – Manufacturer’s Building Block or Design Codes

Steam turbine building blocks or manufacturer’s design codes are assigned by the manufacturer to designate a series of turbine designs, LM5000 or W501 for example. Enter the following information:

Manufacturer’s code, first shaft: _____

Manufacturer’s code, second shaft (cross or triple compound units): _____

Turbine configuration and number of exhaust flows (e.g., tandem compound, four flow): _____

95. Steam Turbine - Steam Conditions

Enter the following information on the Main, First Reheat, and Second Reheat Steam design conditions:

Main steam: Temperature (°F): _____ Pressure (psig): _____

First reheat steam: Temperature (°F): _____ Pressure (psig): _____

Second reheat steam: Temperature (°F): _____ Pressure (psig): _____

96. Steam Turbine - High, Intermediate, and Low Pressure Sections

Enter the following information describing various sections of the steam turbine:

High Pressure Casings

TOTAL number of high pressure casings, cylinders or shells: _____

Back pressure of the high pressure condenser (if applicable) to the nearest one-tenth inch of mercury at the nameplate capacity and design water temperature. (XX.X format): _____

Combined High Pressure/Intermediate Pressure Casings

TOTAL number of high/intermediate pressure casings, cylinders or shells: _____

Intermediate Pressure Casings

TOTAL number of intermediate pressure casings, cylinders or shells: _____

Combined Intermediate/Low Pressure Casings

TOTAL number of intermediate/low pressure casings, cylinders or shells: _____

Low Pressure Casings

TOTAL number of low pressure casings, cylinders or shells: _____

Back pressure of the low pressure condenser to the nearest one-tenth inch of mercury at nameplate capacity and design water temperature. . (XX.X format): _____

The last stage blade length (inches) of the low pressure turbine, measured from hub to end of top of blade. (XX.X format): _____

97. Steam Turbine - Governing System

Enter the following information for the steam turbine governing system:

Enter the type of governing system used at the unit: _____

- 1 - *Partial arc* - main steam flow is restricted to one sector of the turbine=s first stage at startup.
- 2 - *Full arc* - main steam is admitted to all sectors of the turbine=s first stage at startup.
- 3 - *Either* - capable of admitting steam using either partial or full arc techniques.
- 9 - *Other*, describe

Enter the type of turbine governing system used at the unit: _____

- 1 - *Mechanical hydraulic control (MHC)* - turbine speed monitored and adjusted through mechanical and hydraulic linkages.
- 2 - *Analog electro-hydraulic control (EHC)* - analog signals control electro-hydraulic linkages to monitor and adjust turbine speed.
- 3 - *Digital electro-hydraulic control (DHC)* - same as EHC except signals are digital rather than analog.
- 9 - *Other*, describe

98. Steam Turbine - Lube Oil System

Enter the following information for the steam turbine main lube oil system:

Main lube oil system manufacturer: _____

Main lube oil pump(s) manufacturer: _____

Manufacturer of the motor(s)/steam turbine(s) that drives the main lube oil pump(s): _____

TOTAL number of steam turbine main lube oil pumps; include installed spares: _____

Enter the type of driver on the main lube oil pump: _____

- 1 - Motor
- 2 - Shaft
- 3 - Steam turbine
- 9 - Other, describe

FOR ELECTRIC GENERATOR ON A STEAM TURBINE

99. Generator - Manufacturer

Enter the name of the manufacturer of the electric generator:

Generator manufacturer: _____

100. Generator - Enclosure

Is 50% or more of the generator outdoors (not enclosed in building framing and siding)? (Y/N) _____

101. Generator - Ratings and Power Factor

Enter the following information about the generator:

Design (Nameplate) Item	Main Generator	Second* Shaft	Third* Shaft
Voltage to nearest one-tenth kV	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> >	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> >	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> >
Megavoltamperes (MVA) Capability	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
RPM	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
Power Factor (enter as %)	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> >	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> >	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> >

*Cross compound units.

102. Generator - Cooling System

Two types of cooling methods are typically used. First is the Ainnercooled≅ method, where the cooling medium is in direct contact with the conductor copper or is separated by materials having little thermal resistance. The other is the Aconventional≅ cooling method where the heat generated within the windings must flow through the major ground insulation before reaching the cooling medium.

Enter the type of cooling method used by the generator: _____

- 1 - Stator innercooled and rotor innercooled.
- 2 - Stator conventionally cooled and rotor conventionally cooled.
- 3 - Stator innercooled and rotor conventionally cooled.
- 9 - Other, describe _____

Enter the mediums used to cool the generator’s stator (air, hydrogen, oil, water): _____

Enter the mediums used to cool the generator’s rotor (air, hydrogen, oil, water): _____

103. Generator - Hydrogen Pressure

Enter the generator hydrogen pressure IN PSIG at nameplate MVA (XX.X format): _____

EXCITER FOR EACH STEAM TURBINE GENERATOR**104. Exciter - Configuration**

Enter the following information about the main exciter:

Exciter manufacturer: _____

TOTAL number of exciters; include installed spares: _____

MINIMUM number of exciters required to obtain maximum capacity from the unit: _____

Enter the type of main exciter used at the unit:

- 1 - *Static* - static excitation where dc is obtained by rectifying ac from generator terminals, and dc is fed into rotor by collector rings.
- 2 - *Rotating dc generator* - exciter supplies dc from a commutator into the main rotor by means of collector rings.
- 3 - *Brushless* - an ac (rotating armature type) exciter whose output is rectified by a semiconductor device to provide excitation to an electric machine. The semiconductor device would be mounted on and rotate with the ac exciter armature.
- 4 - *Alternator rectifier*
- 9 - *Other, describe*

Enter the type(s) of exciter drive(s) used by the main exciter IF it is rotating:

- 1 - Shaft direct
- 2 - Shaft gear
- 3 - Motor
- 9 - Other, describe _____

AUXILIARY SYSTEMS

105. Auxiliary Systems - Main Condenser

Enter the following information for the main condenser and its auxiliaries:

Main condenser manufacturer: _____

Type of condenser (water, air): _____

TOTAL number of passes made by the circulating water as it passes through the condenser: _____

TOTAL number of condenser shells: _____

Condenser tube materials used in the majority (50% or more) of the condenser tubes: _____

Air ejector(s) or vacuum pump(s) manufacturer: _____

Enter the type of air removal equipment used on the condenser: _____

- 1 - Vacuum pump
- 2 - Steam jet air ejector
- 3 - Both
- 9 - Other, describe

Enter the type of cooling water used in the condenser: _____

- 1 - *Fresh* - salinity values less than 0.50 parts per thousand.
- 2 - *Brackish* - salinity value ranging from approximately 0.50 to 17 parts per thousand.
- 3 - *Salt* - salinity values greater than 17 parts per thousand.
- 9 - *Other*, describe

Enter the origin of the circulating water used in the condenser: _____

- 1 - River
- 2 - Lake
- 3 - Ocean or Bay
- 4 - Cooling Tower
- 9 - Other, describe _____

106. Auxiliary Systems - Condenser Cleaning System

Enter the following information about the ON-LINE main condenser cleaning system (leave blank if cleaning is manual):

On-line main condenser cleaning system manufacturer: _____

Enter the type of on-line main condenser cleaning system used at the unit: _____

- 1 - Ball sponge rubber
- 2 - Brushes
- 9 - Other, describe _____

107. Auxiliary Systems - Condensate Polishing System

A condensate polisher is an in-line demineralizer located in the condensate water system to treat water coming from the condenser to the HRSG. It is **not** the demineralizer that prepares raw or untreated water for eventual use in the steam production process.

Enter the following information about the condensate polishing system at the unit:

Condensate polishing system manufacturer: _____

Enter the % of the condensate flow at maximum unit capacity that can be treated: _____

108. Auxiliary Systems - Condensate Pumps

Enter the following information for the main condensate pumps (those at the discharge of the condenser):

Condensate pump(s) manufacturer(s): _____

Manufacturer(s) of the motor(s) that drives the condensate pump(s): _____

TOTAL number of condensate pumps; include installed spares: _____

MINIMUM number of condensate pumps required to obtain maximum capacity from the block: _____

109. Auxiliary Systems - Condensate Booster Pumps

Condensate booster pumps increase the pressure of the condensate water between the low pressure and the intermediate or high-pressure feedwater heaters. Enter the following information for the condensate booster pumps:

Condensate booster pump(s) manufacturer(s): _____

Manufacturer(s) of the motor(s) that drives the condensate booster pump(s): _____

TOTAL number of condensate booster pumps; include installed spares: _____

MINIMUM number of condensate booster pumps required for maximum capacity from the block: _____

110. Auxiliary Systems - Circulating Water Pumps

Enter the following information for the circulating water pumps:

Circulating water pump(s) manufacturer(s): _____

Manufacturer(s) of the motor(s) that drives the circulating water pump(s): _____

TOTAL number of circulating water pumps; include installed spares: _____

MINIMUM number of circulating water pumps required to obtain maximum capacity from the block DURING WINTER SEASON. _____

111. Auxiliary Systems - Cooling Tower and Auxiliaries

Enter the following information for the cooling towers and all related auxiliary equipment at the block:

Cooling tower manufacturer(s): _____

Cooling tower fan(s) manufacturer(s): _____

Manufacturer(s) of the motor(s) that drives the cooling tower fan(s): _____

Enter the type of cooling tower(s) used: _____

- 1 - *Mechanical draft* (induced, forced, cross-flow and counterflow) - fan(s) used to move ambient air through the tower.
- 2 - *Atmospheric spray* - air movement is dependent on atmospheric conditions and the aspirating effect of the spray nozzles.
- 3 - *Hyperbolic* (natural draft) - temperature difference between condenser circulating water and ambient air conditions, aided by hyperbolic tower shape, creates natural draft of air through the tower to cool the water.
- 4 - *Deck-filled* - wetted surfaces such as tiers of splash bars or decks aid in the breakup and retention of water drops to increase the evaporation rate.
- 5 - *Coil shed* - a combination structure of a cooling tower installed over a substructure that houses atmospheric coils or sections.
- 9 - *Other, describe* _____

The cooling tower booster pumps increase the pressure of the circulating water and force the water to the top of the cooling tower.

Cooling tower booster pump(s) manufacturer(s): _____

Manufacturer(s) of the motor(s) that drives the cooling tower booster pump(s): _____

TOTAL number of cooling tower booster pumps; include installed spares: _____

MINIMUM number of cooling tower booster pumps required to obtain maximum capacity from the block: _____

BALANCE OF PLANT

112. Balance of Plant - Main Transformer

The main transformer is the block step-up transformer connecting the generator (or multiple generators if block is cross compound) to the transmission system. Enter the following information for the MAIN transformer(s) at the block:

Main transformer(s) manufacturer(s): _____

TOTAL number of main transformers; include installed spares: _____

Megavoltampere (MVA) size of the main transformer(s): _____

HIGH SIDE voltage in kilovolts (kV) of the main transformer(s) at 55E: _____

Enter the type of MAIN transformer at the block: _____

- 1 - Single phase
- 2 - Three phase
- 9 - Other, describe _____

113. Balance of Plant - Block Auxiliary Transformer

The block auxiliary transformer supplies the auxiliaries when the block is synchronized. Enter the following information for this transformer:

Block auxiliary transformer(s) manufacturer(s): _____

TOTAL number of block auxiliary transformer(s): _____

LOW SIDE voltage in kilovolts (kV) of the block auxiliary transformer(s) at 55E: _____

114. Balance of Plant - Station Service Transformer

The station service (start-up) transformer supplies power from a station high voltage bus to the station auxiliaries and also to the block auxiliaries during block start-up and shutdown. It also may be used when the block auxiliary transformer is not available or nonexistent.

Station service transformer(s) manufacturer(s): _____

TOTAL number of station service transformer(s): _____

HIGH SIDE voltage in kilovolts (kV) of the station service transformer(s) at 55E: _____

LOW SIDE voltage in kilovolts (kV) of the station service transformer(s) at 55E: _____