Appendix E8: 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)\(^1\), 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 sending in this form to gads@nerc.net. GADS staff encourages using the software for design entry and updating.

Instructions
Submit the data in this section once during the life of each combined cycle/block unit. If a major change is made to a unit which significantly changes its characteristics, then resubmit this section with updated information.

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

When submitting a copy of the original form, make sure that it is legible.

<table>
<thead>
<tr>
<th>Unit Name</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Location of Unit (State)</td>
<td></td>
</tr>
<tr>
<td>Energy Information Administration (EIA) Number</td>
<td></td>
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<tr>
<td>Regional Entity</td>
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<tr>
<td>Subregion</td>
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<tr>
<td>Date Reporter</td>
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<tr>
<td>Telephone Number</td>
<td></td>
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<td>Date</td>
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</table>

Here are some definitions used to eliminate some of the ambiguity concerning combined-cycle blocks.

- **Combined-Cycle Block (referred to 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 employ electric generating technology that produces electricity 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. Reporters should complete a form for each individual block.

- **Units** – Each gas turbine/jet engine and each steam turbine is considered a “unit.” Each unit contributes to the total electric generation or steam production of the block. Each unit has its own or shares its generator for providing electric power. They should be considered individual parts of the block.

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• Heat Recovery Steam Generator (HRSG) – There may be one or more HRSG or waste heat boilers in a block. Some blocks may have a single HRSG per GT/jet; others may have several GT/jets feeding a single HRSG or any combination thereof. The HRSG does not contribute electricity to the output of the block so is considered a component rather than a “unit.”

• Other Balance of Plant Equipment – There is other equipment in the block used to support the production of electricity/heat energy, but they are not related to any specific generating unit and are also considered 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.

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 a 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 codes 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 specified 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 megavolt amperes (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 loaded with minor load following at night and on weekends  
2 - Periodic startups with daily load-following and reduced load nightly  
3 - Weekly startup with daily load-following and reduced load nightly  
4 - Daily startup with daily load-following and taken off-line nightly  
5 - Startup chiefly to meet daily peaks  
6 – Other, describe: ______________________________________  
7 - Seasonal Operation
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 (megavolt amperes) 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 (in XXXX.X format):

__________________________

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 (GT) or Jet Engine (JE) complete items #12 to #65 (If you have 3 GT, 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 megavolt amperes (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
   The 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 (megavolt amperes) 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) (in XXXX.X format): ______________________

16. Engine manufacturer – (1) Pratt & Whitney; (2) General Electric; (3) Siemens Westinghouse; (4) Alstom (ABB); (5) Rolls Royce; (6) Cooper Bessemer; (7) Worthington; (8) Allison; (9) Other, describe ____________________________________________________________
17. **Engine type** – (1) Gas turbine single shaft; (2) Gas turbine split shaft; (3) Jet engine; (9) Other, describe

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, describe

21. **Start-up system** – (1) Air; (2) Auxiliary motor; (3) Electric motor; (4) Natural gas; (5) Flow turbine; (6) Supercharging fan; (7) Hydraulic; (9) Other, describe

22. **Start-up type** – (1) Automatic, on site; (2) Automatic, remote; (9) Other, describe

23. **Type of Fuel(s) that will be used:** _________________________________

   **Fuel codes:**
   
   BM  Biomass  OO  Oil
   CC  Coal  OS  Other-Solid (Tons)
   DI  Distillate Oil (No. 2)  PC  Petroleum Coke
   GE  Geothermal  PE  Peat
   GG  Gas  PR  Propane
   JP  JP4 or JP5  SL  Sludge Gas
   KE  Kerosene  SO  Solar
   LI  Lignite  WA  Water
   NU  Nuclear  WD  Wood
   OG  Other-Gas (Cu. Ft.)  WH  Waste Heat
   OL  Other-Liquid (BBL)  WM  Wind

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 in seconds for normal cold start to full load:** ________________

28. **Time in seconds for emergency cold start to full load:** ________________

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, describe ______________________________

32. **SNCR injector type** – (1) Wall nozzle; (2) Lance; (9) Other, describe ____________________________

33. **SNCR injection equipment location** – (1) Furnace; (2) Super-heater; (3) Economizer; (9) Other, describe ______________________________

34. **Number of SNCR injectors:** ___________________________

35. **SNCR carrier gas type** – (1) Steam; (2) Air; (9) Other, describe ________________________________

36. **SNCR carrier gas total flow rate** (thousands of lb./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. **SCR reactor** – (1) Separate; (2) In Duct; (3) Other, describe ________________________________

40. **SCR reagent** – (1) Ammonia; (2) Urea; (9) Other, describe ________________________________

41. **SCR ammonia injection grid location** – (1) Furnace; (2) Super-heater; (3) Economizer; (4) Zoned; (5) Other, describe __________________________________________

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

43. **SCR catalyst element type** (1) Plate; (2) Honeycomb; (9) Other, describe ________________________________

44. **SCR catalyst support material** – (1) Stainless steel; (2) Carbon steel; (9) Other, describe ________________________________

45. **SCR catalytic material configuration** – (1) Vertical; (2) Horizontal; (9) Other, describe ________________________________

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 soot blower type** – (1) Air; (2) Steam; (3) Both __________

51. **SCR soot blower manufacturer:** ________________________________________________
Gas Turbine Catalytic Air Heaters (CAH)

52. CAH element type – (1) Laminar surface; (2) Turbulent surface; (9) Other, describe __________________________________________________________

53. CAH catalyst material – (1) Titanium oxide; (2) Vanadium pentoxide; (3) Iron (II) oxide; (4) Molybdenum oxide; (9) Other, describe __________________________________________________________

54. CAH catalyst support material – (1) Stainless steel; (2) Carbon steel; (9) Other, describe __________________________________________________________

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:

<table>
<thead>
<tr>
<th>Design (Nameplate) Item</th>
<th>Main Generator</th>
<th>Second* Shaft</th>
<th>Third* Shaft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage to nearest one-tenth kV</td>
<td>▲</td>
<td>▲</td>
<td></td>
</tr>
<tr>
<td>Megavolt amperes (MVA) Capability</td>
<td></td>
<td>▲</td>
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<tr>
<td>RPM</td>
<td></td>
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</tr>
<tr>
<td>Power Factor (enter as %)</td>
<td></td>
<td>▲</td>
<td>▲</td>
</tr>
</tbody>
</table>

*Cross compound units.
63. Generator – Cooling System
Two types of cooling methods are typically used. First is the “inner cooled” 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 inner cooled and rotor inner cooled.
2 – Stator conventionally cooled and rotor conventionally cooled.
3 – Stator inner cooled 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 (XX.X format): ______________

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 D.C. is obtained by rectifying A.C. from generator terminals and D.C. is fed into rotor by collector rings.
2 – Rotating D.C. generator – exciter supplies D.C. from a commutator into the main rotor by means of collector rings.
3 – Brushless – an A.C. exciter (rotating armature type) 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 A.C. 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 Engine 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: ____________________________________________________________________________
    HRSG model or series name/number: _______________________________________________________________________

68. HRSG – Enclosure
    Is 50% or more of the HRSG outdoors (not enclosed in building framing and siding)? (Y/N):_______

69. HRSG – Nameplate Steam Conditions With Duct Burners
    Enter the following steam conditions at the full load, valves-wide-open design point at the exit of the
    HRSG to the steam turbine when the HRSG is experiencing supplemental firing:

    **HIGH-PRESSURE**
    Steam flow rate (in lbs/hr): ______________________
    Design temperature (ºF): ______________
    Design pressure (psig): ______________________

    **INTERMEDIATE PRESSURE**
    Steam flow rate (in lbs/hr): ______________________
    Design temperature (ºF): ______________
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 Without Duct Burners**
Enter the following steam conditions at the full load, valves-wide-open design point at the exit 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 lb/hr): __________________________
Design temperature (°F): ______________
Design pressure (psig): __________________________

**REHEAT PRESSURE**
Steam flow rate (in lb/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 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 a 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 and 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: _______
Appendix E8 – Unit Design Data – Combined-Cycle Units and Block Design Data (Voluntary Reporting)

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
2  – Motor – two speed
3  – Motor – variable speed
4  – Steam turbine
5  – Shaft
6  – Motor gear
7  – Steam gear
8  – Shaft gear
9  – Other, describe

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

1  – Hydraulic
2  – Mechanical
9  – Other, describe: ____________________________________________________________
82. **Auxiliary Systems – Start-up Feedwater (HRSG Feed) Pumps**

Start-up feedwater pump(s) manufacturer(s):

________________________________________________________

Manufacturer(s) of the motor(s) that drives the start-up feedwater pump(s):

________________________________________________________

PERCENT (%) of the HRSG’s maximum capacity that can be achieved with a single Start-up feedwater pump (XXX.X format): ________________

Indicate the additional capabilities of the start-up 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 – START-UP 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 (ST) Complete items #88 to #104
(If you have 3 ST, then complete items #88-104 once for each ST.)

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 the 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 (megavolt amperes) 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 start-up.
2. *Full arc* – main steam is admitted to all sectors of the turbine’s first stage at start-up.
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:

<table>
<thead>
<tr>
<th>Design (Nameplate) Item</th>
<th>Main Generator</th>
<th>Second* Shaft</th>
<th>Third* Shaft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage to nearest one-tenth kV</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Megavolt amperes (MVA) Capability</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RPM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power Factor (enter as %)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Cross compound units.

102. Generator – Cooling System
Two types of cooling methods are typically used. First is the “inner cooled” 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 inner cooled and rotor inner cooled.
2 – Stator conventionally cooled and rotor conventionally cooled.
3 – Stator inner cooled 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 D.C. is obtained by rectifying A.C. from generator terminals and D.C. is fed into rotor by collector rings.

2  –  Rotating D.C. generator – exciter supplies D.C. from a commutator into the main rotor by means of collector rings.

3  –  Brushless – an A.C. exciter (rotating armature type) 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 A.C. 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 values 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 manufacture:

________________________________________________________

Enter the % of the condensate flow at maximum unit capacity that can be treated (XX.X format):

__________________

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 counter-flow) – 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: __________
Appendix E8 – Unit Design Data – Combined-Cycle Units and Block Design Data (Voluntary Reporting)

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: _________

Megavolt ampere (MVA) size of the main transformer(s): _________

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

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 55 ºF: _________

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 55 ºF: _________

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