

# Appendix B10 Concentrated Solar Power Cause Codes

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(Unit Codes 800–899)

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**SOLAR ENERGY GATHERING EQUIPMENT**

**Solar Field**

- 6500 - Cold Header piping
- 6501 - Cold Header valves
- 6505 - Hot Header piping
- 6506 - Hot Header valves
- 6510 – Heat Transfer Fluid (HTF) Expansion Vessel
- 6521 - Heat Transfer Fluid (HTF) Pumping
- 6522 - Flow Control (Valves, orifices, etc)
- 6523 - Heat Transfer Fluid (HTF) Piping

6524 - Solar Collector Assemblies (SCA)  
6540 - Parabolic trough mirrors  
6541 - Parabolic trough mirror alignment equipment  
6545 - Reflective Panels  
6546 - Heat Collector Element (HCE)  
6547 - Flexible Connections  
6548 - Tracking assembly (drive motor, hydraulics, etc)  
6559 – Other solar field problems

### **Thermal Storage**

6570 – Expansion vessel  
6571 - Hot tank  
6572 - Hot tank piping and valves  
6575 - Cold tank  
6576 - Cold tank piping and valves  
6580 - Heat Transfer Fluid (HTF) pump  
6581 - Heat Transfer Fluid (HTF) pump motor  
6582 - Heat Transfer Fluid (HTF) pump piping and valves  
6589 – Other thermal storage problems

### **Operational Problems**

6590 - No heat due to sunset  
6591 - Not sufficient heat due to weather  
6599 – Other operational problems

## **STEAM TURBINE**

Besides the turbine, this set includes the steam stop/control valves, turbine control system, and the turbine auxiliaries. The extraction steam codes are contained in the Balance of Plant set.

### **High Pressure Turbine**

4000 Outer casing  
4001 Inner casing  
4009 Nozzle bolting  
4010 Nozzles and nozzle blocks  
4011 Diaphragms  
4012 Buckets or blades  
4013 Diaphragms unit and shroud type  
4014 Bucket or blade fouling  
4015 Wheels or spindles  
4020 Shaft seals  
4021 Dummy rings  
4022 Gland rings

- 4030 Rotor shaft
- 4040 Bearings
- 4041 Thrust bearings
- 4099 Other high-pressure turbine problems

### **Intermediate Pressure Turbine**

- 4100 Outer casing
- 4101 Inner casing
- 4109 Nozzle bolting
- 4110 Nozzles and nozzle blocks
- 4111 Diaphragms
- 4112 Buckets or blades
- 4113 Bucket or blade fouling
- 4115 Wheels or spindles
- 4120 Shaft seals
- 4121 Dummy rings
- 4122 Gland rings
- 4130 Rotor shaft
- 4140 Bearings
- 4141 Thrust bearings
- 4199 Other intermediate pressure turbine problems

### **Low Pressure Turbine**

- 4200 Outer casing
- 4201 Inner casing
- 4209 Nozzle bolting
- 4210 Nozzles and nozzle blocks
- 4211 Diaphragms
- 4212 Buckets or blades
- 4213 Bucket or blade fouling
- 4215 Wheels or spindles
- 4220 Shaft seals
- 4221 Dummy rings
- 4222 Gland rings
- 4230 Rotor shaft
- 4240 Bearings
- 4241 Thrust bearings
- 4250 Other low pressure turbine problems

### **Valves**

- 4260 Main stop valves
- 4261 Control valves
- 4262 Intercept valves
- 4263 Reheat stop valves
- 4264 Combined intercept valves
- 4265 Miscellaneous drain and vent valves

- 4266 Main stop valve testing
- 4267 Control valve testing
- 4268 Reheat/intercept valve testing
- 4269 Other turbine valves

### **Piping**

- 4270 Crossover or under piping
- 4279 Miscellaneous turbine piping

### **Lube Oil**

(do not include bearing failures due to lube oil)

- 4280 Lube oil pumps
- 4281 Lube oil coolers
- 4282 Lube oil conditioners
- 4283 Lube oil system valves and piping
- 4284 Lube oil pump drive
- 4289 Other lube oil system problems

### **Controls**

- 4290 Hydraulic system pumps
- 4291 Hydraulic system coolers
- 4292 Hydraulic system filters
- 4293 Hydraulic system pipes and valves
- 4299 Other hydraulic system problems
- 4300 Turbine supervisory system (use codes 4290 to 4299 for hydraulic oil)
- 4301 Turbine governing system
- 4302 Turbine trip devices (including instruments)
- 4303 Exhaust hood and spray controls
- 4304 Automatic turbine control systems - mechanical
- 4305 Automatic turbine control systems - mechanical - hydraulic
- 4306 Automatic turbine control systems - electro-hydraulic - analog
- 4307 Automatic turbine control systems - electro-hydraulic - digital
- 4308 Automatic turbine control systems - digital control and monitoring
- 4309 Other turbine instrument and control problems
- 4310 Steam Turbine Control System - data highway
- 4311 Steam Turbine Control System - hardware problems (including card failure)
- 4312 Steam Turbine Control System - internal and termination wiring
- 4313 Steam Turbine Control System - logic problems
- 4314 Steam Turbine Control System - upgrades

### **Miscellaneous (Steam Turbine)**

- 4400 Major turbine overhaul (720 hours or longer) (use for non-specific overhaul only; see page B-FS-2)
- 4401 Inspection
- 4402 Minor turbine overhaul (less than 720 hours) (use for non-specific overhaul only; see page B-FS-2)
- 4410 Turning gear and motor
- 4411 Steam turbine gear box (single shaft configuration)
- 4412 Steam turbine clutch (single shaft configuration)
- 4415 Shaft coupling mechanism
- 4420 Vibration of the turbine generator unit that cannot be attributed to a specific cause such as bearings or blades (use this code for balance moves)
- 4430 Gland seal system
- 4450 Water induction
- 4460 Turbine overspeed trip test
- 4470 Differential expansion
- 4490 Turbine performance testing (use code 9999 for total unit performance testing)
- 4499 Other miscellaneous steam turbine problems

## **GENERATOR**

This set of codes contains the generator, exciter, generator cooling systems, and generator controls. Note the main leads up to and includes the generator output breaker in this set of codes.

### **Generator**

- 4500 Rotor windings
- 4510 Rotor collector rings
- 4511 Rotor, General
- 4520 Stator windings, bushings, and terminals
- 4530 Stator core iron
- 4535 Stator, General
- 4540 Brushes and brush rigging
- 4550 Generator bearings and lube oil system
- 4551 Generator bearings
- 4552 Generator lube oil system
- 4555 Bearing cooling system
- 4560 Generator vibration (excluding vibration due to failed bearing and other components)
- 4570 Generator casing
- 4580 Generator end bells and bolting

### **Exciter**

- 4600 Exciter drive - motor
- 4601 Exciter field rheostat
- 4602 Exciter commutator and brushes

- 4603 Solid state exciter element
- 4604 Exciter drive - shaft
- 4605 Exciter transformer
- 4609 Other exciter problems

### **Cooling System**

(report failures caused by water leaks into generator as codes 4500, 4510, etc.)

- 4610 Hydrogen cooling system piping and valves
- 4611 Hydrogen coolers
- 4612 Hydrogen storage system
- 4613 Hydrogen seals
- 4619 Other hydrogen system problems
- 4620 Air cooling system
- 4630 Liquid cooling system
- 4640 Seal oil system and seals
- 4650 Other cooling system problems

### **Controls**

- 4700 Generator voltage control
- 4710 Generator metering devices
- 4720 Generator synchronization equipment
- 4730 Generator current and potential transformers
- 4740 Emergency generator trip devices
- 4750 Other generator controls and metering problems

### **Miscellaneous (Generator)**

- 4800 Generator main leads
- 4805 Generator Bus Duct Cooling System
- 4810 Generator output breaker
- 4830 Major generator overhaul (720 hours or longer) (use for non-specific overhaul only; see Page B- [FS-2](#))
- 4831 Minor generator overhaul (less than 720 hours) (use for non-specific overhaul only; see Page B- [FS-2](#))
- 4840 Inspection
- 4841 Generator dole testing
- 4842 Reactive and capability testing
- 4850 Core monitor alarm
- 4860 Generator neutral grounding equipment
- 4899 Other miscellaneous generator problems

## HEAT RECOVERY STEAM GENERATOR (HRSG) (Waste Heat Boiler)

### Burners (Duct Burners)

- 0358 Oil burner piping and valves
- 0359 Gas burner piping and valves
- 0360 Duct burners
- 0361 Duct burner orifices
- 0370 Duct burner instruments and controls (except light-off)
- 0380 Light-off (igniter) systems (including fuel supply)
- 0385 Igniters
- 0410 Other duct burner problems

### Oil and Gas Systems (except light-off)

- 0440 Fuel oil pumps (general)
- 0441 Fuel oil pumps (burner supply)
- 0442 Fuel oil pumps (forwarding/transfer)
- 0443 Fuel oil (burner supply) pump drives
- 0444 Fuel oil (forwarding/transfer) pump drives
- 0450 Fuel oil heaters
- 0460 Fuel oil atomizers
- 0470 Oil and gas fires
- 0480 Other oil and gas fuel supply problems (see codes 0360-0410 for burner problems)

### Steam System Desuperheaters/Attemperators

See cause codes 6140 to 6154

### HRSG Boiler Piping System

#### HRSG Startup Bypass

See cause codes 6160 to 6183

#### HRSG Main Steam

- 6110 HP steam piping up to turbine stop valves – Greater than 600 PSIG  
(see 0790 for piping supports)
- 6111 HP steam relief/safety valves
- 6112 Other HP steam valves (including vent and drain valves but not including the turbine stop valves)
- 6113 Other HP steam system problems
- 6120 IP steam piping up to turbine stop valves – Between 200 & 600 PSIG  
(see 0790 for piping supports)
- 6121 IP steam relief/safety valves
- 6122 Other IP steam valves (including vent and drain valves but not including the turbine stop valves)
- 6123 Other IP steam system problems



- 6130 LP steam piping up to turbine stop valves – Less than 200 PSIG (see 0790 for piping supports)
- 6131 LP steam relief/safety valves
- 6132 Other LP steam valves (including vent and drain valves but not including the turbine stop valves)
- 6133 Other LP steam system problems
- 6134 Other main steam valves (including vent and drain valves but not including the turbine stop valves)

#### **HRSO Cold and Hot Reheat Steam**

- 0540 Reheat steam piping up to turbine stop valves
- 0541 Cold reheat steam piping up to boiler
- 0550 Reheat steam relief/safety valves
- 0560 Other reheat steam valves (not including turbine stop or intercept valves)
- 0561 Other cold reheat steam valves (not including turbine stop or intercept valves)
- 0570 Other reheat steam problems

#### **HRSO Desuperheaters/Attemperators**

- 6140 HP Desuperheater/attemperator piping – Greater than 600 PSIG.
- 6141 HP Desuperheater/attemperator valves
- 6142 HP Desuperheater/attemperator spray nozzles
- 6143 HP Desuperheater/attemperator drums
- 6144 Other HP desuperheater/attemperator problems
- 6145 IP Desuperheater/attemperator piping – Between 200-600 PSIG
- 6146 IP Desuperheater/attemperator valves
- 6147 IP Desuperheater/attemperator spray nozzles
- 6148 IP Desuperheater/attemperator drums
- 6149 Other IP desuperheater/attemperator problems
- 6150 LP Desuperheater/attemperator piping – Less than 200 PSIG
- 6151 LP Desuperheater/attemperator valves
- 6152 LP Desuperheater/attemperator spray nozzles
- 6153 LP Desuperheater/attemperator drums
- 6154 Other LP desuperheater/attemperator problems

#### **HRSO Startup Bypass**

- 6160 HP Startup bypass system piping (including drain lines up to heaters or condenser)- Greater than 600 PSIG
- 6161 HP Startup bypass system valves
- 6162 HP Startup bypass tanks or flash tanks
- 6163 Other HP startup bypass system problems
- 6170 IP Startup bypass system piping (including drain lines up to heaters or condenser) – Between 200-600 PSIG
- 6171 IP Startup bypass system valves
- 6172 IP Startup bypass tanks or flash tanks
- 6173 Other IP startup bypass system problems
- 6180 LP Startup bypass system piping (including drain lines up to heaters or condenser) – Less than 200 PSIG
- 6181 LP Startup bypass system valves
- 6182 LP Startup bypass tanks or flash tanks
- 6183 Other LP startup bypass system problems

### Feedwater and Blowdown

- 0670 Feedwater piping downstream of feedwater regulating valve
- 0680 Feedwater valves (not feedwater regulating valve)
- 0690 Other feedwater problems downstream of feedwater regulating valve (use codes 3401 to 3499 for remainder of feedwater system)
- 0700 Blowdown system valves
- 0710 Blowdown system piping
- 0720 Blowdown system controls / instrumentation
- 0730 Other blowdown system problems

### Boiler Recirculation

- 0740 Boiler recirculation pumps
- 0741 Boiler recirculation pumps - motors
- 0750 Boiler recirculation piping including downcomers
- 0760 Boiler recirculation valves
- 0770 Other boiler recirculation problems

### Miscellaneous (Piping)

- 0775 Economizer piping
- 0780 Headers between tube bundles
- 0782 Headers and caps
- 0790 Pipe hangers, brackets, supports (general)
- 0799 Other miscellaneous piping system problems

### HRSG Boiler Internals and Structures

- 0800 Drums and drum internals (single drum only)
- 0801 HP Drum (including drum level trips not attributable to other causes)
- 0802 IP Drum (including drum level trips not attributable to other causes)
- 0803 LP Drum (including drum level trips not attributable to other causes)
- 0810 Boiler supports and structures (use code 1320 for tube supports)
- 0820 Casing
- 0830 Doors
- 0840 Refractory and insulation
- 0845 Windbox expansion joints
- 0847 Other expansion joints
- 0848 Inlet panel
- 0850 Other internal or structural problems
- 0855 Drum relief/safety valves (Single drum only)
- 0856 HP Drum relief/safety valves
- 0857 IP Drum relief/safety valves
- 0858 LP Drum relief/safety valves
- 0859 Tube external fins/membranes

### **HRSB Boiler Tube Leaks**

(use code 0859 for tube/membrane failures)

6005	HP Evaporator tubes
6006	IP Evaporator tubes
6007	LP Evaporator tubes
6010	HP superheater
6011	HP reheater
6012	HP economizer
6020	IP superheater
6021	IP reheater
6022	IP economizer
6030	LP reheater
6031	LP superheater
6032	LP economizer
6090	Other HRSB tube Problems

### **Miscellaneous HRSB Boiler Tube Problems**

1300	Water side fouling
1305	Fireside cleaning (which requires a full outage)
1310	Water side cleaning (acid cleaning)
1320	Tube supports/attachments
1330	Slag fall damage
1340	Tube modifications (including addition and removal of tubes)
1350	Other miscellaneous boiler tube problems

### **Air Supply**

1400	Forced draft fans
1407	Forced draft fan lubrication system
1410	Forced draft fan motors
1411	Forced draft fan motors – variable speed
1412	Forced draft fan drives (other than motor)
1415	Forced draft fan controls
1420	Other forced draft fan problems
1430	Air supply ducts
1431	Air supply dampers from FD fan
1432	Air supply duct expansion joints
1440	Air supply dampers
1450	Other air supply problems

### **Miscellaneous (Boiler Air and Gas Systems)**

1590	Stacks
1591	Stack damper and linkage
1592	Stack damper linkage motors
1599	Other miscellaneous boiler air and gas system problems

### **HRSG Boiler Control Systems**

(including instruments which input to the controls)

- 1700 Feedwater controls (report local controls – feedwater pump, feedwater regulator valve, etc., – with component or system)
- 1710 Combustion/steam condition controls (report local controls with component or system)
- 1720 Desuperheater/attenuator controls (not local controls)
- 1730 Boiler explosion or implosion
- 1740 Gage glasses
- 1750 Burner management system
- 1760 Feedwater instrumentation (not local controls)
- 1761 Combustion /Steam condition instrumentation (not local controls)
- 1762 Desuperheater/attenuator instrumentation (not local controls)
- 1799 Other boiler instrumentation and control problems

### **HRSG Boiler Overhaul and Inspections**

- 1800 Major boiler overhaul (720 hours or more) (use for non-specific overhaul only; see page B- FS-2)
- 1801 Minor boiler overhaul (less than 720 hours) (use for non-specific overhaul only; see page B- FS-2)
- 1810 Other boiler inspections
- 1811 Boiler Inspections – problem identification/investigative
- 1812 Boiler Inspections – scheduled or routine
- 1820 Chemical cleaning/steam blows

### **HRSG Boiler Water Condition**

- 1850 Boiler water condition (not feedwater water quality)

### **HRSG Boiler Design Limitations**

- 1900 Improper balance between tube sections not due to fouling or plugging
- 1910 Inadequate air not due to equipment problems

### **Miscellaneous (Boiler)**

(use more specific codes - other slagging and fouling problems, other control problems, etc. X whenever possible. Describe miscellaneous problems in the verbal description.)

- 1980 Boiler safety valve test
- 6000 HRSG Boiler to gas turbine connecting equipment.
- 6100 Steam turbine to gas turbine coupling
- 1990 Boiler performance testing (use code 9999 for total unit performance testing)
- 1999 Boiler, miscellaneous

## BALANCE OF PLANT

### Condensing System

#### Condenser Tubes

- 3110 Condenser tube leaks
- 3111 Condenser tube fouling shell side
- 3112 Condenser tube fouling tube side
- 3113 Condenser tube and water box cleaning (including circulating water flow reversal)
- 3114 Air-cooled condenser tubes
- 3115 Air-cooled condenser pumps
- 3116 Air-cooled condenser fans
- 3117 Air-cooled condenser fan motors
- 3118 Other Air-cooled condenser problems
- 3119 Other air-cooled condenser tube casing or shell and internal problems

#### Condenser Casing or Shell and Internals

- 3120 Tube sheets
- 3121 Expansion joint
- 3122 Gaskets and seals
- 3123 Hot well
- 3124 Tube sheet fouling
- 3129 Other condenser casing or shell and internal problems

#### Vacuum Equipment

- 3130 Air ejectors
- 3131 Air ejector piping and valves
- 3132 Inter and after condensers
- 3133 Vacuum pumps
- 3134 Vacuum pump piping and valves
- 3135 Vacuum pump motor and auxiliaries
- 3139 Other air extraction system problems - general
- 3149 Loss of vacuum not attributable to a particular component such as air ejectors or valves; or, high back pressure not attributable to high circulating water temperature, or vacuum losses from a known cause.

#### Condenser Controls

- 3150 Hot well level controls
- 3151 Vacuum pump and air ejector controls
- 3152 Air-cooled condenser controls
- 3159 Other condensing system controls and instruments

#### Miscellaneous (Condensing System)

- 3170 Condenser inspection (use code 3110 to report looking for tube leaks)
- 3171 Air-cooled condenser inspections
- 3180 Major condenser overhaul
- 3185 Water side cathodic protection
- 3186 Auxiliary condenser and associated equipment

- 3190 Air leakage (for losses not attributable to previously noted equipment related codes)
- 3199 Other miscellaneous condensing system problems

### **Circulating Water Systems**

- 3210 Circulating water pumps
- 3211 Circulating water pump motors
- 3220 Circulating water piping
- 3221 Circulating water piping fouling
- 3230 Circulating water valves
- 3233 Circulating water priming system
- 3235 Cooling tower booster pump
- 3236 Cooling tower booster motor
- 3238 Cooling tower fan motors
- 3239 Cooling tower fan motors - variable speed
- 3240 Cooling tower fans
- 3241 Cooling tower efficiency below design
- 3242 Cooling tower fill damage
- 3243 Cooling tower icing
- 3244 Cooling tower fires
- 3245 Other cooling tower problems
- 3246 Cooling tower fouling
- 3247 Cooling tower instrumentation
- 3250 Circulating water system instruments and controls
- 3260 Traveling screens
- 3261 Traveling screen fouling
- 3269 Circulating water biological conditions (ie, zebra mussels)
- 3270 Intake system problems other than traveling screens
- 3271 Intake grating fouling
- 3272 Circulating water screenwash system
- 3273 Debris in circulating water from outside sources (leaves, mud, etc.)
- 3280 High circulating water temperature (not due to season, tower efficiency below design, or other listed equipment problem)
- 3281 Circulating water tempering system
- 3282 Circulating water cooling ponds
- 3285 Circulating water chemistry
- 3299 Other circulating water system problems

### **Waste Water (zero discharge) Systems**

- 3290 Waste water (zero discharge) tanks, pumps and motors
- 3291 Waste water (zero discharge) system fouling
- 3292 Waste water (zero discharge) piping
- 3293 Waste water (zero discharge) valves
- 3294 Waste water (zero discharge) controls and instrumentation
- 3295 Other waste water (zero discharge) problems

## Condensate System

### **Pumps, Piping, and Valves**

- 3300 Condensate water pre-treatment
- 3310 Condensate/hotwell pumps
- 3311 Condensate/hotwell pump motor
- 3312 Condensate booster pump
- 3313 Condensate booster pump motor
- 3314 Condensate booster pump motor - variable speed
- 3315 Condensate booster pump drive (other than 3313 and 3314)
- 3320 Condensate piping
- 3330 Condensate valves

### **Low/Intermediate Pressure Heater and Deaerators**

- 3339 LP heater head leaks
- 3340 LP heater tube leaks
- 3341 Other LP heater – general
- 3342 IP heater tube leaks
- 3343 Other IP heater – general
- 3344 Deaerator (including level control)
- 3345 IP heater head leaks

### **Polishers/Chemical Addition**

- 3350 Condensate polishing and filtering systems
- 3351 Chemical addition systems
- 3352 Feedwater chemistry (not specific to condenser, polishers, or chemical addition)

### **Miscellaneous (Condensate System)**

- 3360 Condensate makeup and return (including storage tanks)
- 3370 Condensate system controls and instrumentation (not hotwell level, heater level, or deaerator level controls: see codes 3150-3159, 3344, 3502.
- 3380 Condensate coolers
- 3399 Other miscellaneous condensate system problems

## Feedwater System

(excluding extraction or drain systems)

- 3401 Startup feedwater pump
- 3402 Startup feedwater pump drives - all types
- 3407 Feedwater pump suction screens
- 3408 Feedwater pump drive – local controls
- 3409 Feedwater pump drive motor - variable speed
- 3410 Feedwater pump
- 3411 Feedwater pump drive - motor
- 3412 Feedwater pump drive - steam turbine
- 3413 Feedwater pump coupling and drive shaft
- 3414 Feedwater pump local controls

- 3415 Feedwater pump/drive lube oil system
- 3416 Other feedwater pump problems
- 3417 Feedwater pump drive - main shaft
- 3418 Feedwater pump drive - other
- 3419 Feedwater pump drive - gear
- 3420 Feedwater piping and supports
- 3430 Feedwater regulating (boiler level control) valve
- 3431 Other feedwater valves
- 3439 HP heater head leaks
- 3440 High pressure heater tube leaks
- 3441 Other high pressure heater problems (see condensate system for LP and IP heater codes)
- 3451 Feedwater booster pump suction screens
- 3452 Feedwater booster pump drive - local controls
- 3453 Feedwater booster pump drive motor - variable speed
- 3454 Feedwater booster pump
- 3455 Feedwater booster pump drive - motor
- 3456 Feedwater booster pump drive - steam turbine
- 3457 Feedwater booster pump coupling and drive shaft
- 3458 Feedwater booster pump local controls
- 3459 Feedwater booster pump/drive lube oil system
- 3460 Other feedwater booster pump problems
- 3461 Feedwater booster pump drive - main shaft
- 3462 Feedwater booster pump drive - other
- 3463 Feedwater booster pump drive - gear
- 3499 Other feedwater system problems

### **Heater Drain Systems**

- 3501 Heater drain pumps
- 3502 Heater level control
- 3503 Heater drain piping
- 3504 Heater drain valves
- 3505 Heater drain pump drive
- 3509 Other heater drain system problems

### **Extraction Steam**

- 3520 HP Extraction steam piping
- 3521 HP Extraction steam valves
- 3522 HP Extraction steam instruments and controls
- 3529 Other HP extraction steam system problems
- 3530 IP Extraction steam piping
- 3531 IP Extraction steam valves
- 3532 IP Extraction steam instruments and controls
- 3539 Other IP extraction steam system problems
- 3540 LP Extraction steam piping
- 3541 LP Extraction steam valves
- 3542 LP Extraction steam instruments and controls



3549 Other LP extraction steam system problems

**Electrical**

3600 Switchyard transformers and associated cooling systems – external (OMC)  
3601 Switchyard transformers and associated cooling systems – external (not OMC)  
3610 Switchyard circuit breakers – external (not OMC)  
3611 Switchyard circuit breakers – external (OMC)  
3612 Switchyard system protection devices – external (OMC)  
3613 Switchyard system protection devices – external (not OMC)  
3618 Other switchyard equipment – external (not OMC)  
3619 Other switchyard equipment – external (OMC)  
3620 Main transformer  
3621 Unit auxiliaries transformer  
3622 Station service startup transformer  
3623 Auxiliary generators  
3624 Auxiliary generator voltage supply system  
3629 Other switchyard or high voltage system problems  
3630 400-700-volt transformers  
3631 400-700-volt circuit breakers  
3632 400-700-volt conductors and buses  
3633 400-700-volt insulators  
3634 400-700-volt protection devices  
3639 Other 400-700-volt problems  
3640 AC instrument power transformers  
3641 AC Circuit breakers  
3642 AC Conductors and buses  
3643 AC Inverters  
3644 AC Protection devices  
3649 Other AC instrument power problems  
3650 DC instrument power battery chargers  
3651 DC circuit breakers  
3652 DC conductors and buses  
3653 DC protection devices  
3659 Other DC power problems  
3660 4000-6000-volt transformers  
3661 4000-6000-volt circuit breakers  
3662 4000-6000-volt conductors and buses  
3663 4000-6000-volt insulators  
3664 4000-6000-volt protection devices  
3669 Other 4000-6000-volt problems  
3670 12-15kV transformers  
3671 12-15kV circuit breakers  
3672 12-15kV conductors and buses  
3673 12-15kV insulators  
3674 12-15kV protection devices  
3679 Other 12-15kV problems  
3680 Other voltage transformers  
3681 Other voltage circuit breakers

- 3682 Other voltage conductors and buses
- 3683 Other voltage insulators
- 3684 Other voltage protection devices
- 3689 Other voltage problems
- 3690 Station Service Power Distribution System, General

### **Power Station Switchyard**

- 3700 Powerhouse switchyard (non generating unit equipment)
- 3710 Transmission line (connected to powerhouse switchyard to 1st Substation)
- 3720 Transmission equipment at the 1st substation) (see code 9300 if applicable)
- 3730 Transmission equipment beyond the 1st substation (see code 9300 if applicable)

### **Auxiliary Systems**

#### **Open Cooling Water System**

- 3800 Open cooling water pumps and motors
- 3801 Open cooling water piping
- 3802 Open cooling water valves
- 3803 Open cooling water heat exchangers
- 3804 Open cooling water system fouling
- 3805 Open cooling water system instrumentation
- 3806 Open cooling water strainer
- 3809 Other open cooling water problems

#### **Service Water (Open System)**

- 3810 Service water pumps and motors
- 3811 Service water piping
- 3812 Service water valves
- 3813 Service water heat exchangers
- 3814 Service water system fouling
- 3815 Service water strainer
- 3819 Other service water problems

#### **Closed Cooling Water Systems**

- 3820 Closed cooling water pumps
- 3821 Closed cooling water piping
- 3822 Closed cooling water valves
- 3823 Closed cooling water heat exchangers
- 3824 Closed cooling water system fouling
- 3825 Closed cooling water instrumentation
- 3826 Closed cooling water strainer
- 3829 Other closed cooling water system problems

#### **Auxiliary Steam**

- 3830 Auxiliary boiler
- 3831 Auxiliary steam piping
- 3832 Auxiliary steam valves
- 3833 Auxiliary steam controls and instruments
- 3834 Auxiliary boiler tube leaks
- 3835 Auxiliary boiler burner management system
- 3836 Steam transfer to other unit
- 3839 Other auxiliary steam problems (also see extraction steam codes 3520 to 3529; startup bypass codes 0630 to 0660; and soot blower steam code 0870)

**Service Air**

- 3840 Service air compressors
- 3841 Service air piping
- 3842 Service air valves
- 3843 Service air dryers
- 3844 Soot blowing air compressor and system
- 3849 Other service air problems

**Instrument Air**

- 3850 Instrument air compressors
- 3851 Instrument air piping
- 3852 Instrument air valves
- 3853 Instrument air dryers
- 3854 N<sub>2</sub> backup to instrument air
- 3859 Other instrument air problems

**Fire Protection System**

- 3860 Fire protection system pumps
- 3861 Fire protection system piping
- 3862 Fire protection system valves
- 3863 Fire protection system fouling
- 3864 Fire protection system instrumentation and controls
- 3869 Other fire protection system problems

**Low-pressure Gas Compression System**

- 3870 Fuel Gas Compressor and Motors
- 3871 Fuel Gas Compressor Piping
- 3872 Fuel Gas Compressor Valves
- 3873 Fuel Gas Compressor Heat Exchangers
- 3874 Fuel Gas Compressor Controls and Instrumentation
- 3875 Fuel Gas Compressor Filters
- 3876 Fuel Gas Compressor Fire System
- 3879 Fuel Gas Compressor – Other

**Seal Air Fans**

- 3880 Seal air fan
- 3881 Seal air fan drive - motor

- 3882 Seal air control dampers and drives
- 3883 Seal air filters
- 3389 Other seal air problems

**Miscellaneous (Auxiliary Systems)**

- 3898 Miscellaneous plant auxiliary process and services instrumentation and controls
- 3899 Other miscellaneous auxiliary system problems
- 6299 Other combined cycle block problems (Use other gas turbine problem codes, other steam turbine codes, etc., whenever appropriate.)
- 6399 Other coal gasification equipment problems

**Miscellaneous (Balance of Plant)**

- 3950 Process computer
- 3960 Thermal derating (thermal efficiency losses in balance of plant when specific cause(s) unknown)
- 3970 Distributive Control System (DCS) – process computer
- 3971 DCS – data highway
- 3972 DCS – hardware problems (including card failure)
- 3973 DCS – internal and termination wiring
- 3974 DCS – logic problems
- 3975 DCS – upgrades
- 3979 Other DCS problems
- 3980 Programmable Logic Controller (PLC)
- 3981 PLC – data highway
- 3982 PLC – hardware problems (including card failure)
- 3983 PLC – internal and termination wiring
- 3984 PLC – logic problems
- 3985 PLC – upgrades
- 3989 Other PLC problems
- 3995 Powerhouse heating and ventilating systems
- 3996 Air conditioning systems – rooms and areas
- 3999 Other miscellaneous balance of plant problems

**EXTERNAL**

Use this set of codes to report events caused by external factors (flood, lightning, etc); economic factors (lack of fuel, labor strikes, etc.); operator training; and, transmission system problems external to the plant.

**Catastrophe**

- 9000 Flood
- 9001 Drought
- 9010 Fire, not related to a specific component
- 9020 Lightning
- 9025 Geomagnetic disturbance
- 9030 Earthquake
- 9031 Tornado
- 9035 Hurricane

- 9036 Storms (ice, snow, etc)
- 9040 Other catastrophe

**Economic**

- 0000 Reserve shutdown
- 9130 Lack of fuel (water from rivers or lakes, coal mines, gas lines, etc) where the operator is not in control of contracts, supply lines, or delivery of fuels
- 9131 Lack of fuel (interruptible supply of fuel part of fuel contract)
- 9134 Fuel conservation
- 9136 Problems with Primary Fuel for Units with Secondary Fuel Operation
- 9137 Ground water or other water supply problems.
- 9140 Plant modifications to burn different fuel that are not regulatory mandated
- 9150 Labor strikes company-wide problems or strikes outside the company’s jurisdiction such as manufacturers (delaying repairs) or transportation (fuel supply) problems.
- 9151 Labor strikes direct plant management grievances that result in a walkout or strike are under plant management control.
- 9160 Other economic problems
- 9180 Economic (for internal use at plants only)
- 9181 Economic (for internal use at plants only)
- 9182 Economic (for internal use at plants only)
- 9183 Economic (for internal use at plants only)
- 9184 Economic (for internal use at plants only)
- 9185 Economic (for internal use at plants only)
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- 9196 Economic (for internal use at plants only)
- 9197 Economic (for internal use at plants only)
- 9198 Economic (for internal use at plants only)
- 9199 Economic (for internal use at plants only)

**Fuel Quality**

(Use code 9600 to 9650 if the fuel quality results in excess stack emissions through no fault in the pollution control equipment. Use the appropriate equipment code to report fouling and slagging.)

- 9200 High ash content (OMC)
- 9201 High ash content (not OMC)
- 9205 Poor quality natural gas fuel, low heat content
- 9210 Low grindability (OMC)
- 9211 Low grindability (not OMC)

9220	High sulfur content (OMC)
9221	High sulfur content (not OMC)
9230	High vanadium content (OMC)
9231	High vanadium content (not OMC)
9240	High sodium content (OMC)
9241	High sodium content (not OMC)
9250	Low BTU coal (OMC)
9251	Low BTU coal (not OMC)
9260	Low BTU oil (OMC)
9261	Low BTU oil (not OMC)
9270	Wet coal (OMC)
9271	Wet coal (not OMC)
9280	Frozen coal (OMC)
9281	Frozen coal (not OMC)
9290	Other fuel quality problems (OMC)
9291	Other fuel quality problems (not OMC)

### **Miscellaneous (External)**

9300	Transmission system problems other than catastrophes (do not include switchyard problems in this category; see codes 3600 to 3629, 3720 to 3730)
9305	Ash disposal problem
9310	Operator training
9320	Other miscellaneous external problems
9340	Synchronous Condenser Operation

## **REGULATORY, SAFETY, ENVIRONMENTAL**

Use these codes only for events not directly attributable to equipment failures. Inspections or testing of certain equipment due to regulation are reported using the appropriate equipment cause codes, and the fact that it was a regulatory requirement noted in the verbal description section.

### **Regulatory**

9504	Regulatory (environmental) proceedings and hearings regulatory agency initiated
9506	Regulatory (environmental) proceedings and hearings intervener initiated
9510	Plant modifications strictly for compliance with new or changed regulatory requirements (scrubbers, cooling towers, etc.)
9520	Oil spill in Gulf of Mexico (OMC)
9590	Miscellaneous regulatory (this code is primarily intended for use with event contribution code 2 to indicate that a regulatory-related factor contributed to the primary cause of the event)

**Stack Emission**

(include exhaust emissions)

- 9600 SO2 stack emissions – Fossil
- 9603 SO2 stack emissions – Gas Turbine
- 9604 SO2 stack emissions – Jet Engines
- 9610 NOx stack emissions – Fossil
- 9613 NOx stack emissions – Gas Turbine
- 9614 NOx stack emissions – Jet Engines
- 9620 Particulate stack emissions – Fossil
- 9623 Particulate stack emissions – Gas Turbine
- 9624 Particulate stack emissions – Jet Engines
- 9630 Opacity – Fossil
- 9633 Opacity – Gas Turbine
- 9634 Opacity – Jet Engines
- 9650 Other stack or exhaust emissions – Fossil  
(use codes 9200 to 9290 if fuel quality causes pollution control equipment problems that result in excess stack emissions)
- 9653 Other stack or exhaust emissions – Gas Turbine  
(use codes 9200 to 9290 if fuel quality causes pollution control equipment problems that result in excess stack emissions)
- 9654 Other stack or exhaust emissions – Jet Engines  
(use codes 9200 to 9290 if fuel quality causes pollution control equipment problems that result in excess stack emissions)
- 9656 Other stack or exhaust emissions testing - Fossil
- 9657 Other stack or exhaust emissions testing – Gas Turbine
- 9658 Other stack or exhaust emissions testing – Jet Engines

**Other Operating Environmental Limitations**

- 9660 Thermal discharge limits – Fossil
- 9663 Thermal discharge limits – Gas Turbines
- 9664 Thermal discharge limits – Jet Engines
- 9670 Noise limits (not for personnel safety) – Fossil
- 9673 Noise limits (not for personnel safety) – Gas Turbines
- 9674 Noise limits (not for personnel safety) – Jet Engines
- 9677 Noise limits testing - Fossil
- 9678 Noise limits testing - Gas Turbine
- 9679 Noise limits testing - Jet Engines
- 9680 Fish kill
- 9690 Other miscellaneous operational environmental limits – Fossil
- 9693 Other miscellaneous operational environmental limits – Gas Turbines
- 9694 Other miscellaneous operational environmental limits – Jet Engines

### Safety

- 9700 OSHA-related retrofit or inspection
- 9720 Other safety problems

### **PERSONNEL OR PROCEDURE ERRORS**

- 9900 Operator error
- 9910 Maintenance personnel error
- 9920 Contractor error
- 9930 Operating procedure error
- 9940 Maintenance procedure error
- 9950 Contractor procedure error
- 9960 Staff shortage

### **INACTIVE STATES**

- 0002 Inactive Reserve Shutdown
- 9990 Retired unit
- 9991 Mothballed unit

### **PERFORMANCE**

- 9997 NERC Reliability Standard Requirement
- 9998 Black start testing
- 9999 Total unit performance testing (use appropriate codes for individual component testing)