

# Nuclear Reactor Error Code Manual

This manual provides a clear guide to the nuclear reactor's error codes, their meanings, and the exact **error letter** to enter to initiate the correct fix action for each specific error message. Errors are grouped by system component, and special attention is given to components like `VENTILATION_AIRFLOW` that have multiple error letters to ensure clarity in selecting the appropriate action.

## How to Use This Manual

1. **Identify the Error Message:** When an error occurs, note the full error message (e.g., "[WARN] VentilationSystem: Airflow in Sector B1 reduced by 12% – inspect ducting for blockages.") and its **error letter** (e.g., `Q`).
2. **Find the Error Letter:** Use the **Error Messages and Corrective Actions** section to locate the specific error message and its corresponding error letter.
3. **Confirm the System Component:** Check the **Error Codes by System Component** section to understand the system affected (e.g., `VENTILATION_AIRFLOW`).
4. **Enter the Error Letter:** Input the exact error letter into the reactor's control system to trigger the associated **fix message** (e.g., `CLEANING VENTILATION`).
5. **Follow the Corrective Action:** Execute the action described in the fix message and monitor the system to ensure resolution.

## Error Codes by System Component

This table lists all error codes, their associated system components, and the error letters linked to each. For systems with multiple error letters (e.g., `VENTILATION_AIRFLOW`), refer to the **Error Messages and Corrective Actions** section for the specific letter to use.

| Error Code | System Component      | Error Letters     | Description  |
|------------|-----------------------|-------------------|--|
| AA01       | Core Temperature      | A, BG, BY         | Issues with core temperature, such as inaccurate readings or critical overheating. |
| AB02       | Coolant Flow          | B, BW             | Problems with coolant flow rate or pressure in coolant lines.                      |
| AC03       | Control Rod           | C, J, AL, BL      | Control rod issues, including unresponsiveness, delays, or misalignment.           |
| AD04       | Radiation Leak        | D, CB, AY, BJ     | Radiation issues, including leaks, gamma spikes, or high beta/alpha radiation.     |
| AE05       | Emergency Power       | E                 | Emergency power system offline.  |
| AF06       | Signal Interference   | F                 | Signal interference in command relay.  |
| AG07       | Generator Oscillation | G                 | Backup generator oscillation abnormality.  |
| AH08       | Pressure Sensor       | H                 | Core pressure sensor mismatch.   |
| AI09       | Neutron Flux          | I                 | Upward trend in neutron flux requiring damping.                                    |
| AJ10       | Containment Seal      | K, AX             | Pressure deviations or minor breaches in containment seals.                        |
| AK11       | SCRAM Overdue         | L                 | Emergency SCRAM system test overdue.   |
| AL12       | Radiation Monitor     | M                 | Gamma levels approaching alert threshold in service tunnel.                        |
| AM13       | Power Grid            | N, O, BI          | Voltage fluctuations, phase drift, or minor voltage dips in power grid.            |
| AN14       | Water Level           | P                 | Low coolant reservoir levels.  |
| AO15       | Ventilation Airflow   | Q, AS, AV, BN, AG | Issues with airflow, turbine vibration, or sensors in ventilation system.          |
| AP16       | Operator Console      | R                 | Button lag on operator console terminal.   |
| AQ17       | Fire Suppression      | S                 | Low suppression agent reservoir.   |
| AR18       | Heat Exchanger        | T                 | High differential temperature in heat exchanger.                                   |
| AS19       | Data Logger           | U, BU             | Telemetry backlog or error log nearing capacity.                                   |
| AT20       | System Diagnostics    | V                 | Non-critical hardware fault in sensor node.  |
| AU21       | Air Intake            | Y                 | Dust buildup in air intake filters.  |
|            |                       |                   |  |

|                               |                                    |                                       |   |
|-------------------------------|------------------------------------|---------------------------------------|---|
| AV22<br>Error<br>Code<br>AW23 | Coolant Pump                       | AA, BM, CC<br>Error Letters<br>AB, BO | Vibration anomalies or failure in coolant pumps.            |
|                               | System Component<br>Thermal Shield |                                       | Description<br>Wear or erosion in thermal shielding layers. |
| AX24                          | Airflow Regulator                  | AC                                    | Control valve stuck, causing airflow issues.                |
| AY25                          | Reactor Core                       | AD                                    | Micro-fissure in core lining.                               |
| AZ26                          | Exhaust System                     | AE                                    | Backpressure in exhaust system.                             |
| BA27                          | Turbine Speed                      | AF                                    | Turbine overspeed detected.                                 |
| BB28                          | Coolant Filter                     | AH                                    | Clogging in coolant filter.                                 |
| BC29                          | Radiation Shield                   | AI                                    | Breach in secondary radiation shield.                       |
| BD30                          | Hydraulic System                   | AK                                    | Low fluid pressure in hydraulic system.                     |
| BE31                          | Ventilation Motor                  | AM                                    | Overheating in ventilation motor.                           |
| BF32                          | Pressure Valve                     | AN                                    | Minor sticking in pressure valve.                           |
| BG33                          | Coolant Leak                       | AP, BP                                | Trace coolant leaks or rapid pressure drops in containment. |
| BH34                          | Sensor Array                       | AQ                                    | Intermittent signal loss from sensor nodes.                 |
| BI35                          | Overpressure Event                 | AR, BD                                | Pressure spikes or surges in core chamber.                  |
| BJ36                          | Backup System                      | AT                                    | Minor latency in redundant circuit test.                    |
| BK37                          | Thermal Runaway                    | AU                                    | Early signs of thermal runaway reaction.                    |
| BL38                          | Control Panel                      | AW                                    | Display flicker on control panel terminal.                  |
| BM39                          | Maintenance Log                    | AZ                                    | Routine maintenance check overdue.                          |
| BN40                          | Fuel Rod                           | BB                                    | Wear in fuel rod.   |
| BO41                          | Coolant<br>Temperature             | BC                                    | Secondary loop temperature above nominal.                   |
| BP42                          | Core Instability                   | BS                                    | Neutron flux instability in reactor core.                   |
| BQ43                          | Heat Sink                          | BQ                                    | Reduced efficiency in heat sink.                            |
| BR44                          | Log System                         | BU                                    | Error log nearing capacity.                                 |
| BS45                          | Sensor Calibration                 | BX                                    | Temperature sensor miscalibration.                          |
| BT46                          | System Clock                       | BF                                    | Time synchronization drift.                                 |

## Error Messages and Corrective Actions

This section lists each error message, the exact **error letter** to enter, the associated **error code**, and the **fix message** with its corrective action. For systems with multiple error letters (e.g., `VENTILATION_AIRFLOW`), each message is clearly mapped to its specific letter to eliminate confusion.

| Error Letter | Error Code | Error Message   | Fix Message       | Corrective Action                                   |
|--------------|------------|---|-------------------|---|
| A            | AA01       | [WARN] CoreTempMonitor: Temperature Monitor readings are inaccurate - recalibration required. | RECALIBRATING     | Recalibrate core temperature monitor.               |
| AA           | AV22       | [WARN] CoolantPump: Backup pump vibration anomaly – inspect bearings.                         | REPAIRING PUMP    | Inspect and repair bearings in backup coolant pump. |
| AB           | AW23       | [INFO] ThermalShield: Minor wear detected in shielding layer – monitor for degradation.       | INSPECTING SHIELD | Monitor thermal shield for further degradation.     |
|              |            |   |                   |   |

| AC Error Letter | AX24 Error Code | [ERR] AirflowRegulator: Control valve stuck at 20% — immediate repair needed.            | ADJUSTING VALVE<br>Fix Message | Repair stuck control valve to correct airflow.      |
|-----------------|-----------------|--|--------------------------------|---|
| AD              | AY25            | [WARN] ReactorCore: Micro-fissure detected in core lining — assess structural integrity. | SEALING FISSURE                | Assess and seal micro-fissure in core lining.       |
| AE              | AZ26            | [INFO] ExhaustSystem: Backpressure 8% above normal — check exhaust ports.                | CLEARING EXHAUST               | Clear exhaust ports to reduce backpressure.         |
| AF              | BA27            | [ERR] TurbineSpeed: Turbine overspeed detected — reduce load immediately.                | SLOWING TURBINE                | Reduce turbine load to correct overspeed.           |
| AG              | AO15            | [INFO] ExhaustSystem: Backpressure 8% above normal — check exhaust ports.                | CLEARING EXHAUST               | Clear exhaust system to address ventilation issues. |
| AH              | BB28            | [INFO] CoolantFilter: Clogging detected at 15% — replace filter soon.                    | REPLACING FILTER               | Replace clogged coolant filter.                     |
| AI              | BC29            | [ERR] RadiationShield: Breach in secondary shield — initiate lockdown.                   | REINFORCING SHIELD             | Lockdown and reinforce secondary radiation shield.  |
| AK              | BD30            | [INFO] HydraulicSystem: Fluid pressure 5% below optimal — check for leaks.               | INSPECTING LINES               | Check hydraulic system for leaks.                   |
| AL              | AC03            | [ERR] CoreAlignment: Misalignment of fuel rods detected — realign urgently.              | REALIGNING RODS                | Realign misaligned fuel rods urgently.              |
| AM              | BE31            | [WARN] VentilationMotor: Overheating in motor #2 — reduce load or cool.                  | COOLING MOTOR                  | Reduce load or cool ventilation motor.              |
| AN              | BF32            | [INFO] PressureValve: Minor sticking detected in valve #5 — lubricate or replace.        | LUBRICATING VALVE              | Lubricate or replace sticking pressure valve.       |
| AP              | BG33            | [WARN] CoolantLeak: Trace coolant detected in containment — locate source.               | SEALING LEAK                   | Locate and seal trace coolant leak.                 |
| AQ              | BH34            | [INFO] SensorArray: Intermittent signal loss from Node 7B — check connections.           | RECONNECTING                   | Reconnect sensor array node.                        |
| AR              | BI35            | [ERR] OverpressureEvent: Pressure spike in core chamber — vent excess now.               | VENTING PRESSURE               | Vent excess pressure in core chamber.               |
| AS              | AO15            | [WARN] AirflowImbalance: Uneven flow between Sectors A and B — balance dampers.          | BALANCING DAMPERS              | Balance dampers to correct uneven airflow.          |
| AT              | BJ36            | [INFO] BackupSystem: Redundant circuit test passed with minor latency — log for review.  | LOGGING DATA                   | Log redundant circuit test data for review.         |
| AU              | BK37            | [ERR] ThermalRunaway: Early signs of runaway reaction — reduce heat input.               | COOLING CORE                   | Reduce heat input to mitigate thermal runaway.      |
| AV              | AO15            | [WARN] AirflowTurbine: Ventilation turbine vibration anomaly — inspect blades.           | INSPECTING TURBINE             | Inspect ventilation turbine blades.                 |
| AW              | BL38            | [INFO] ControlPanel: Display flicker on Terminal B-1 — check power supply.               | STABILIZING POWER              | Stabilize power supply to control panel.            |
| AX              | AJ10            | [ERR] ContainmentBreach: Minor breach in outer containment — seal and monitor.           | SEALING BREACH                 | Seal and monitor minor containment breach.          |
| AY              | AD04            | [WARN] RadiationSpike: Sudden gamma spike in Sector C3 — evacuate and assess.            | MONITORING RADIATION           | Evacuate and assess gamma radiation spike.          |
| AZ              | BM39            | [INFO] MaintenanceLog: Routine check overdue for pump array — schedule soon.             | SCHEDULING                     | Schedule overdue maintenance check.                 |
| B               | AB02            | [INFO] CoolantFlowRate: Detected 68% of nominal flow — check secondary pump performance. | RESTARTING                     | Restart secondary pump to restore coolant flow.     |
| BB              | BN40            | [WARN] FuelRod: Wear detected in fuel rod #7 — replace within 48h.                       | REPLACING ROD                  | Replace worn fuel rod within 48 hours.              |

| Error BC Letter | Error Code | Error Message   | Fix Message                      | Corrective Action                                    |
|-----------------|------------|---|----------------------------------|--|
|                 |            | [INFO] CoolantTemp: Secondary loop temp 5°C above nominal – monitor trend.    |                                  | Monitor secondary coolant loop temperature.          |
| BD              | BI35       | [ERR] PressureSurge: Uncontrolled surge in core – initiate emergency vent.    | VENTING                          | Initiate emergency vent for pressure surge.          |
| BF              | BT46       | [INFO] SystemClock: Time sync drift detected – resynchronize clocks.          | SYNCHRONIZING                    | Resynchronize system clocks.                         |
| BG              | AA01       | [ERR] CoreOverheat: Core temp critical at 950°C – activate emergency cooling. | COOLING CORE                     | Activate emergency cooling for core overheat.        |
| BI              | AM13       | [INFO] PowerSupply: Minor voltage dip in backup grid – check regulators.      | STABILIZING                      | Stabilize voltage dip in backup grid.                |
| BJ              | AD04       | [ERR] RadiationAlarm: High beta radiation in exhaust – isolate and scrub.     | SCRUBBING EXHAUST                | Isolate and scrub exhaust for beta radiation.        |
| BL              | AC03       | [INFO] ControlRod: Minor wear in rod #6 mechanism – inspect at next shutdown. | INSPECTING                       | Inspect control rod mechanism at next shutdown.      |
| BM              | AV22       | [ERR] CoolantFailure: Primary coolant pump offline – switch to backup.        | SWITCHING PUMPS                  | Switch to backup coolant pump.                       |
| BN              | AO15       | [WARN] AirflowSensor: Tertiary sensor offline – verify connections.           | RECONNECTING                     | Verify connections for tertiary airflow sensor.      |
| BO              | AW23       | [INFO] ShieldIntegrity: Minor erosion in thermal shield – monitor closely.    | MONITORING                       | Monitor thermal shield for further erosion.          |
| BP              | BG33       | [ERR] PressureLeak: Rapid pressure drop in Sector A3 – locate leak.           | SEALING LEAK                     | Locate and seal rapid pressure drop.                 |
| BQ              | BQ43       | [WARN] HeatSink: Efficiency down 9% – clean or replace heat sink.             | CLEANING                         | Clean or replace heat sink to restore efficiency.    |
| BS              | BP42       | [ERR] CoreInstability: Flux instability detected – stabilize reaction.        | STABILIZING                      | Stabilize reactor core for neutron flux instability. |
| BU              | BR44       | [INFO] LogSystem: Error log nearing capacity – archive old entries.           | ARCHIVING                        | Archive old entries in error log.                    |
| BW              | AB02       | [WARN] CoolantPressure: Low pressure in coolant line – check for blockages.   | CLEARING LINE                    | Clear blockages in coolant line.                     |
| BX              | BS45       | [INFO] SensorCalib: Temp sensor #9 slightly off – recalibrate soon.           | RECALIBRATING                    | Recalibrate temperature sensor.                      |
| BY              | AA01       | [ERR] OverheatAlert: Core temp at 980°C – emergency shutdown imminent.        | COOLING CORE                     | Activate emergency cooling for critical overheat.    |
| C               | AC03       | [WARN] Primary control rod unresponsive.                                      | CHECKING HYDRAULICS              | Check hydraulic system for control rod.              |
| CB              | AD04       | [ERR] RadiationSurge: Critical alpha radiation spike – seal Sector H1.        | SEALING SECTOR                   | Seal Sector H1 for alpha radiation surge.            |
| CC              | AV22       | [WARN] PumpVibration: Excessive vibration in coolant pump #3 – inspect now.   | REPAIRING PUMP                   | Inspect and repair coolant pump #3 vibration.        |
| D               | AD04       | [WARN] Radiation leak detected!   | INITIATING CONTAINMENT PROTOCOLS | Initiate containment protocols for radiation leak.   |
| E               | AE05       | [WARN] Emergency power offline.   | REBOOTING                        | Reboot emergency power system.                       |
| F               | AF06       | [INFO] Signal interference in command relay.                                  | RECONNECTING                     | Reconnect command relay for signal interference.     |
|                 |            |   |                                  |  |

| G Error Letter | AG07 Error Code | [INFO] Backup generator oscillation abnormality.<br>Error Message                              | RESTARTING<br>Fix Message | Restart backup generator for<br>Corrective Action  |
|----------------|-----------------|--|---------------------------|--|
| H              | AH08            | [ERR] Core pressure sensor mismatch.   | RECALIBRATING             | Recalibrate core pressure sensor.                  |
| I              | AI09            | [INFO] NeutronFluxSensor: Flux trending upward — initiate damping procedures.                  | DAMPING                   | Initiate damping for neutron flux trend.           |
| J              | AC03            | [ERR] ControlRodArray: Rod #4 insertion delay (2.7s) — verify hydraulic response.              | CHECKING HYDRAULICS       | Verify hydraulic response for rod insertion delay. |
| K              | AJ10            | [INFO] ContainmentSealChk: Slight pressure deviation in Sector A2 — inspect for micro-leaks.   | CORRECTING                | Inspect and correct micro-leaks in containment.    |
| L              | AK11            | [WARN] EmergencySCRAM: System test overdue by 96 hours — perform routine validation.           | VERIFYING INTEGRITY       | Validate overdue SCRAM system test.                |
| M              | AL12            | [INFO] RadiationMonitor: Gamma levels in service tunnel approaching alert threshold.           | MONITORING                | Monitor gamma levels in service tunnel.            |
| N              | AM13            | [ERR] PowerGridSync: Voltage fluctuation detected in Sector 3 — immediate attention required.  | STABILIZING               | Stabilize voltage fluctuation in power grid.       |
| O              | AM13            | [INFO] PowerGridSync: Phase drift within acceptable range — monitor closely.                   | MONITORING                | Monitor phase drift in power grid.                 |
| P              | AN14            | [WARN] WaterLevelSensor: Primary coolant reservoir down 6.2% — consider top-off.               | PUMPING COOLANT           | Pump coolant to top off reservoir.                 |
| Q              | AO15            | [WARN] VentilationSystem: Airflow in Sector B1 reduced by 12% — inspect ducting for blockages. | CLEANING VENTILATION      | Inspect and clean ventilation ducting.             |
| R              | AP16            | [ERR] OperatorConsole: Button lag detected on Terminal A-2 — recalibration recommended.        | RECALIBRATING             | Recalibrate operator console for button lag.       |
| S              | AQ17            | [INFO] FireSuppressSys: Suppression agent reservoir at 28% — refill soon.                      | REFILLING                 | Refill fire suppression agent reservoir.           |
| T              | AR18            | [WARN] HeatExchanger: Differential temp 14°C above optimal — increase secondary loop flow.     | INCREASING FLOW           | Increase secondary loop flow for heat exchanger.   |
| U              | AS19            | [INFO] DataLogger: Telemetry backlog detected — compress logs and resume transmission.         | TRANSMITTING              | Compress and transmit telemetry backlog.           |
| V              | AT20            | [INFO] SystemDiagnostics: Non-critical hardware fault in Sensor Node 14A — replace within 24h. | REPLACING SENSOR          | Replace faulty sensor node.                        |
| Y              | AU21            | [INFO] AirIntake: Dust buildup detected in intake filters — schedule cleaning.                 | CLEANING FILTERS          | Schedule cleaning of air intake filters.           |

## Quick Reference for Systems with Multiple Error Letters

For systems with multiple error letters (e.g., `VENTILATION_AIRFLOW`, `CONTROL_ROD`, `RADIATION_LEAK`), this section clarifies which letter to enter based on the specific error message.

### Ventilation Airflow (Error Code: AO15)

- **Q:** Use for "[WARN] VentilationSystem: Airflow in Sector B1 reduced by 12% — inspect ducting for blockages."  
**Action:** Enter `Q` to trigger `CLEANING VENTILATION` (clean ventilation ducting).
- **AS:** Use for "[WARN] AirflowImbalance: Uneven flow between Sectors A and B — balance dampers."  
**Action:** Enter `AS` to trigger `BALANCING DAMPERS` (balance dampers for even airflow).
- **AV:** Use for "[WARN] AirflowTurbine: Ventilation turbine vibration anomaly — inspect blades."  
**Action:** Enter `AV` to trigger `INSPECTING TURBINE` (inspect turbine blades).
- **BN:** Use for "[WARN] AirflowSensor: Tertiary sensor offline — verify connections."  
**Action:** Enter `BN` to trigger `RECONNECTING` (verify sensor connections).
- **AG:** Use for "[INFO] ExhaustSystem: Backpressure 8% above normal — check exhaust ports."  
**Action:** Enter `AG` to trigger `CLEARING EXHAUST` (clear exhaust system).

### Control Rod (Error Code: AC03)

- **C:** Use for "[WARN] Primary control rod unresponsive."  
**Action:** Enter **C** to trigger **CHECKING HYDRAULICS** (check hydraulic system).
- **J:** Use for "[ERR] ControlRodArray: Rod #4 insertion delay (2.7s) – verify hydraulic response."  
**Action:** Enter **J** to trigger **CHECKING HYDRAULICS** (verify hydraulic response).
- **AL:** Use for "[ERR] CoreAlignment: Misalignment of fuel rods detected – realign urgently."  
**Action:** Enter **AL** to trigger **REALIGNING RODS** (realign fuel rods).
- **BL:** Use for "[INFO] ControlRod: Minor wear in rod #6 mechanism – inspect at next shutdown."  
**Action:** Enter **BL** to trigger **INSPECTING** (inspect rod mechanism).

### Radiation Leak (Error Code: AD04)

- **D:** Use for "[WARN] Radiation leak detected!"  
**Action:** Enter **D** to trigger **INITIATING CONTAINMENT PROTOCOLS** (initiate containment protocols).
- **CB:** Use for "[ERR] RadiationSurge: Critical alpha radiation spike – seal Sector H1."  
**Action:** Enter **CB** to trigger **SEALING SECTOR** (seal Sector H1).
- **AY:** Use for "[WARN] RadiationSpike: Sudden gamma spike in Sector C3 – evacuate and assess."  
**Action:** Enter **AY** to trigger **MONITORING RADIATION** (evacuate and assess gamma spike).
- **BJ:** Use for "[ERR] RadiationAlarm: High beta radiation in exhaust – isolate and scrub."  
**Action:** Enter **BJ** to trigger **SCRUBBING EXHAUST** (isolate and scrub exhaust).

### Other Systems with Multiple Letters

- **Core Temperature (AA01):** Use **A** for inaccurate readings, **BG** for 950°C overheat, **BY** for 980°C overheat.
- **Coolant Flow (AB02):** Use **B** for low flow rate, **BW** for low coolant pressure.
- **Power Grid (AM13):** Use **N** for voltage fluctuation, **O** for phase drift, **BI** for voltage dip.
- **Coolant Pump (AV22):** Use **AA** for backup pump vibration, **BM** for primary pump failure, **CC** for pump #3 vibration.
- **Thermal Shield (AW23):** Use **AB** for minor wear, **BO** for minor erosion.
- **Containment Seal (AJ10):** Use **K** for pressure deviation, **AX** for minor breach.
- **Coolant Leak (BG33):** Use **AP** for trace coolant leak, **BP** for rapid pressure drop.
- **Overpressure Event (BI35):** Use **AR** for pressure spike, **BD** for uncontrolled surge.
- **Data Logger (AS19):** Use **U** for telemetry backlog, **BU** for log capacity issue.

### Notes

- **Critical Errors ([ERR]):** Errors like **BY** (core overheat), **CB** (radiation surge), or **AR** (overpressure) require immediate action to prevent safety hazards.
- **Warnings ([WARN]):** Errors like **A** (core temp), **P** (water level), or **Q** (ventilation) should be addressed promptly but are not immediately critical.
- **Information ([INFO]):** Errors like **F** (signal interference), **O** (phase drift), or **BC** (coolant temp) suggest monitoring or routine maintenance.
- **Unknown Codes:** If an error letter is not listed (e.g., **CA**), the system defaults to **UNKN00**. Investigate manually and report to maintenance.
- **Ventilation Airflow Clarity:** Always match the error message to the specific letter (**Q**, **AS**, **AV**, **BN**, or **AG**) as outlined above to ensure the correct fix action.

### Example Scenario

**Error Message:** "[WARN] VentilationSystem: Airflow in Sector B1 reduced by 12% – inspect ducting for blockages. CODE: A015"

1. **Error Letter:** **Q** (from the **Ventilation Airflow** quick-reference section).
2. **Error Code:** **A015** (Ventilation Airflow).
3. **Fix Message:** **CLEANING VENTILATION**.
4. **Action:** Enter **Q** to trigger cleaning of ventilation ducting. Monitor airflow to confirm resolution.

For further assistance, contact the reactor maintenance team or refer to the reactor's operational handbook.