

UK ABWR

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UK ABWR Generic Design Assessment

Generic PCSR Sub-chapter 15.5 : Electrical Protection



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15.5.1 Electrical Protection

This section explains the protection philosophy, protection coordination and protection devices including smart protection devices.

15.5.1.1 Circuit Protection

15.5.1.1.1 Philosophy of Protection

Simplicity of load grouping facilitates the use of conventional, protective relaying practices for the isolation of faults. Emphasis has been placed on preserving function and limiting loss of equipment function in situations of power loss or equipment failure.

Protection coordination analysis will be performed.

Circuit protection of buses is interfaced with the design of the overall protection system.

15.5.1.1.2 Earthing Methods

Station earthing and surge protection is discussed in Section 15.5.2 & 15.5.3. The medium voltage system is resistance earthed.

15.5.1.1.3 Bus Protection

Bus protection is as follows:

- (1) Medium-voltage bus incoming circuits have instantaneous, inverse time over-current, ground fault, and under-voltage protection.
- (2) Medium-voltage feeders for power centers have instantaneous, inverse time over-current and ground fault protection.
- (3) Medium-voltage feeders used for motor have instantaneous, inverse time over-current, ground fault protection and thermal.
- (4) Low-voltage bus incoming line and feeder circuits have inverse time over-current and ground fault protection.

15.5.1.1.4 Protection Requirements for Diesel Generators

When the diesel generators supply power during loss of coolant accident (LOCA) conditions, the only electrical protective devices which shut down the diesel are the generators differential relays. These protection devices are retained under fault conditions to protect against the possibility of significant damage. Other protective relays, such as loss of excitation, anti-motoring (reverse power), over-current voltage restraint, are used to protect the diesel generators when operating in parallel with the off-site power system, during periodic test. The relays excepting the generator differential relays are automatically isolated from the tripping circuits during LOCA conditions when there is a concurrent loss of off-site power (LOOP) signal.

Synchronizing interlocks are provided to prevent incorrect synchronization whenever the diesel generator is required to operate in parallel with the off-site power supply. Such interlocks are capable of being tested, and shall be periodically tested.

15.5.2 Lightning Protection

This section describes the items to be considered for the lightning protection design so that lightning does not severely affect the operation of the nuclear power plant.

(1) Prevention of lightning strike

Appropriate measures for lightning protection design and earthing design shall be implemented for buildings, electrical equipment, and equipment important to safety to minimise damage from lightning strike.

Equipment and circuits important to safety shall be installed inside buildings, in principle.

(2) Measures to suppress lightning strike

In order to reduce the impact of lightning surge, measures to suppress the propagation of lightning surge shall be implemented considering propagation of lightning surge into electrical equipment and instrumentation and control equipment and cable raceway.

(3) Suppression of lightning surge propagating to instrumentation and control equipment

Instrumentation and control equipment shall be classified according to its safety role whether it is related to safety of the nuclear power plant or operation continuance and important monitoring, and be divided according to the existence of outdoor cable.

Appropriate measures shall be implemented for earthing design and shielding design of important systems in order to suppress the induced voltage raised by lightning surge.

(4) Prevention of impact of lightning surge

If a nuclear power plant is struck by lightning, lightning surge is propagated into the main buildings from cables installed outdoors. Appropriate measures shall be implemented so that instrumentation and control equipment related to the safety of the nuclear power plant, operation continuance and important monitoring does not lose its functions.

15.5.3 Earthing

The earthing system is designed to prevent physical injuries and equipment damages, and to minimize electromagnetic effect from earth fault currents. Also, the system is designed to prevent interference and to protect equipment from lightning strikes.

Earthing systems are established as multiplex (mesh) earthing conductors in building and in the ground.

Earthing systems are classified as Class 1, 2 and 3 and non-class according to classification of equipment and panels.

Equipment is earthed by earthing conductors installed in each building. The detail specifications of earthing system are described in the supporting document ([Ref-1]).

15.5.4 References

[Ref-1] "Earthing Specification" (GA33-1009-0001-00001, Rev.0)

[Ref-2] "Electrical protection and earthing system"

(GA33-1001-0007-00001, Rev.0)

[Ref-3] "Lightning Protection Specification"

(GA33-1001-0002-00001, Rev.0)