

2.4.26 Rod Position Measurement System

1.0 Description

The rod position measurement system (RPMS) measures the position of a rod cluster control assembly (RCCA) located within the reactor vessel and provides the measurement to the distributed control systems.

The RPMS provides the following safety-related functions:

- Receives safety-related RCCA position signals and signals from the control rod drive mechanisms.
- Sends safety-related temperature compensated analog RCCA position signals to the signal conditioning and distribution system (SCDS).

2.0 Arrangement

2.1 RPMS equipment is located as listed in Table 2.4.26-1—Rod Position Measurement System Equipment.

2.2 Physical separation exists between the four divisions of the RPMS.

2.3 Physical separation exists between Class 1E RPMS equipment and non-Class 1E equipment.

3.0 Mechanical Design Features

3.1 Equipment identified as Seismic Category I in Table 2.4.26-1 can withstand seismic design basis loads without loss of safety function.

4.0 I&C Design Features, Displays and Controls

4.1 The RPMS receives input signals from the sources listed in Table 2.4.26-2—Rod Position Measurement System Input Signals.

4.2 The RPMS provides the output signals listed in Table 2.4.26-3—Rod Position Measurement System Output Signals.

4.3 The RPMS design and application software are developed using a process composed of six lifecycle phases with each phase having outputs which must conform to the requirements of that phase. The six lifecycle phases are the following:

1. Basic Design Phase.
2. Detailed Design Phase.
3. Manufacturing Phase.
4. System Integration and Testing Phase.

5. Installation and Commissioning Phase.

6. Final Documentation Phase.

4.4 The RPMS equipment listed as Class 1E in Table 2.4.26-1 can perform its safety function when subjected to electromagnetic interference (EMI), radio-frequency interference (RFI), electrostatic discharges (ESD), and power surges.

4.5 Hardwired disconnects exist between the service unit and each divisional monitoring and service interface (MSI) of the RPMS. The hardwired disconnects prevent the connection of the service unit to more than a single division of the RPMS.

5.0 Electrical Power Design Features

5.1 Class 1E RPMS components are powered from a Class 1E division in a normal or alternate feed condition.

6.0 Inspections, Tests, Analyses, and Acceptance Criteria

Table 2.4.26-4 lists the RPMS ITAAC.

Table 2.4.26-1—Rod Position Measurement System Equipment

Description	Tag Number(1)	Location	Seismic Category	IEEE Class 1E(2)
RPMS Cabinets, Division 1	30CLE11	Safeguard Building 1	I	1 ^N 2 ^A
RPMS Cabinets, Division 2	30CLF11	Safeguard Building 2	I	2 ^N 1 ^A
RPMS Cabinets, Division 3	30CLG11	Safeguard Building 3	I	3 ^N 4 ^A
RPMS Cabinets, Division 4	30CLH11	Safeguard Building 4	I	4 ^N 3 ^A

- 1) Equipment Tag numbers are provided for information and are not part of the design certification.
- 2) ^N denotes the division the component is normally powered from. ^A denotes the division the component is powered from when alternate feed is implemented.

Table 2.4.26-2—Rod Position Measurement System Input Signals

Item #	Signal	Source	# Divisions
1	RCCA positions Division 1 (22 RCCA positions) Division 2 (22 RCCA positions) Division 3 (22 RCCA positions) Division 4 (23 RCCA positions)	Control Rod Drive Mechanisms	4
2	Temperature measurement signal for compensation	Control Rod Drive Mechanisms	4

Table 2.4.26-3—Rod Position Measurement System Output Signals

Item #	Signal	Destination	# Divisions
1	RCCA positions Division 1 (22 RCCA positions) Division 2 (22 RCCA positions) Division 3 (22 RCCA positions) Division 4 (23 RCCA positions)	SCDS	4

**Table 2.4.26-4—Rod Position Measurement System ITAAC
(4 Sheets)**

Commitment Wording		Inspection, Tests, Analyses	Acceptance Criteria
2.1	RPMS equipment is located as listed in Table 2.4.26-1.	Inspections will be performed for the location of the RPMS equipment.	The RPMS equipment listed in Table 2.4.26-1 is located as listed in Table 2.4.26-1.
2.2	Physical separation exists between the four divisions of the RPMS.	Inspections will be performed to verify that the divisions of the RPMS are located in separate Safeguard Buildings.	The four divisions of the RPMS are located in separate Safeguard Buildings as listed in Table 2.4.26-1.
2.3	Physical separation exists between Class 1E RPMS equipment and non-Class 1E equipment.	<p>a. Design analyses will be performed to determine the required safety-related structures, separation distance, barriers, or any combination thereof to achieve adequate physical separation between Class 1E RPMS equipment and non-Class 1E equipment.</p> <p>b. Inspections will be performed to verify that the required safety-related structures, separation distance, barriers, or any combination thereof exist between the Class 1E RPMS equipment and non-Class 1E equipment.</p>	<p>a. A report exists and defines the required safety-related structures, separation distance, barriers, or any combination thereof to achieve adequate physical separation between Class 1E RPMS equipment and non-Class 1E equipment.</p> <p>b. The required safety-related structures, separation distance, barriers, or any combination thereof exist between Class 1E RPMS equipment and non-Class 1E equipment. Reconciliation is performed of any deviations to the design.</p>

**Table 2.4.26-4—Rod Position Measurement System ITAAC
(4 Sheets)**

Commitment Wording		Inspection, Tests, Analyses	Acceptance Criteria
3.1	Equipment identified as Seismic Category I in Table 2.4.26-1 can withstand seismic design basis loads without loss of safety function.	<p>a. Type tests, analyses or a combination of type tests and analyses will be performed on the equipment listed as Seismic Category I in Table 2.4.26-1 using analytical assumptions, or under conditions, which bound the Seismic Category I design requirements.</p> <p>b. Inspections will be performed of the Seismic Category I equipment listed in Table 2.4.1-1 to verify that the equipment including anchorage is installed as specified on the construction drawings.</p>	<p>a. Test/analysis reports exist and conclude that the as designed equipment listed in Table 2.4.26-1 can withstand seismic design basis loads without loss of safety function.</p> <p>b. Inspection reports exist and conclude that the Seismic Category I equipment listed in Table 2.4.26-1 including anchorage is installed as specified on the construction drawings.</p>
4.1	The RPMS receives input signals from the sources listed in Table 2.4.26-2.	Tests will be performed to verify the existence of input signals.	The RPMS receives the input signals listed in Table 2.4.26-2.
4.2	The RPMS provides the output signals listed in Table 2.4.26-3.	Tests will be performed to verify the existence of output signals.	The RPMS provides output signals to the recipients listed in Table 2.4.26-3.

**Table 2.4.26-4—Rod Position Measurement System ITAAC
(4 Sheets)**

	Commitment Wording	Inspection, Tests, Analyses	Acceptance Criteria
4.3	<p>The RPMS system design and application software are developed using a process composed of six lifecycle phases, with each phase having outputs which must conform to the requirements of that phase. The six lifecycle phases are the following:</p> <ol style="list-style-type: none"> 1) Basic Design Phase. 2) Detailed Design Phase. 3) Manufacturing Phase. 4) System Integration and Testing Phase. 5) Installation and Commissioning Phase. 6) Final Documentation Phase. 	<ol style="list-style-type: none"> a. Analyses will be performed to verify that the outputs for the RPMS basic design phase conform to the requirements of that phase. b. Analyses will be performed to verify that the outputs for the RPMS detailed design phase conform to the requirements of that phase. c. Analyses will be performed to verify that the outputs for the RPMS manufacturing phase conform to the requirements of that phase. d. Analyses will be performed to verify that the outputs for the RPMS system integration and testing phase conform to the requirements of that phase. e. Analyses will be performed to verify that the outputs for the RPMS installation and commissioning phase conform to the requirements of that phase. f. Analyses will be performed to verify that the outputs for the RPMS final documentation phase conform to the requirements of that phase. 	<ol style="list-style-type: none"> a. A report exists and concludes that the outputs conform to the requirements of the basic design phase of the RPMS. b. A report exists and concludes that the outputs conform to the requirements of the detailed design phase of the RPMS. c. A report exists and concludes that the outputs conform to the requirements of the manufacturing phase of the RPMS. d. A report exists and concludes that the outputs conform to the requirements of the system integration and testing phase of the RPMS. e. A report exists and concludes that the outputs conform to the requirements of the installation and commissioning phase of the RPMS. f. A report exists and concludes that the outputs conform to the requirements of the final documentation phase of the RPMS.
4.4	<p>The RPMS equipment listed as Class 1E in Table 2.4.26-1 can perform its safety function when subjected to EMI, RFI, ESD, and power surges.</p>	<p>Type tests, tests, analyses or a combination of these will be performed on the Class 1E equipment listed in Table 2.4.26-1.</p>	<p>A report exists and concludes that the equipment listed as Class 1E in Table 2.4.26-1 can perform its safety function when subjected to EMI, RFI, ESD, and power surges.</p>

**Table 2.4.26-4—Rod Position Measurement System ITAAC
(4 Sheets)**

Commitment Wording		Inspection, Tests, Analyses	Acceptance Criteria
4.5	Hardwired disconnects exist between the Service Unit and each divisional Monitoring and Service Interface (MSI) of the RPMS. The hardwired disconnects prevent the connection of the Service Unit to more than a single division of the RPMS.	<ul style="list-style-type: none"> a. Inspections will be performed on the RPMS to verify the existence of a hardwired disconnects between the Service Unit and each divisional MSI of RPMS. b. Tests will be performed on the RPMS to verify that the hardwired disconnects prevent the connection of the Service Unit to more than a single division of the RPMS. 	<ul style="list-style-type: none"> a. Hardwired disconnects exist between the Service Unit and each divisional (MSI) of the RPMS. b. The hardwired disconnects prevent the connection of the Service Unit to more than a single division of the RPMS.
5.1	Class 1E RPMS components are powered from a Class 1E division in a normal or alternate feed condition.	<ul style="list-style-type: none"> a. Testing will be performed for components identified as Class 1E in Table 2.4.26-1 by providing a test signal in each normally aligned division. b. Testing will be performed for components identified as Class 1E in Table 2.4.26-1 by providing a test signal in each division with the alternate feed aligned to the divisional pair. 	<ul style="list-style-type: none"> a. The test signal provided in the normally aligned division is present at the respective Class 1E component identified in Table 2.4.26-1. b. The test signal provided in each division with the alternate feed aligned to the divisional pair is present at the respective Class 1E components identified in Table 2.4.26-1.

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