

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.16 RCS Pressure Isolation Valve (PIV) Integrity

LCO 3.4.16 Integrity of each RCS PIV shall be maintained.

APPLICABILITY: MODES 1 and 2,
MODE 3 and 4, with pressurizer pressure > 1000 psig.

ACTIONS

-NOTES.....
1. Separate Condition entry is allowed for each flow path.
 2. Enter applicable Conditions and Required Actions for systems made inoperable by an inoperable PIV.
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CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>A. One or more RCS PIVs inoperable.</p>	<p>.....NOTE..... Each valve used to satisfy Required Action A.1 must have been verified to meet SR 3.4.11.1 and be in the reactor coolant pressure boundary or the high pressure portion of the system.</p> <p>A.1 Isolate the high pressure portion of the affected system from the low pressure portion by use of one closed manual, deactivated automatic, or check valve.</p>	<p>8 hours</p> <p>(continued)</p>

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ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. Required Action and associated Completion Time for Condition A not met.	B.1 Be in MODE 3.	6 hours
	<u>AND</u> B.2 Reduce pressurizer pressure \leq 1000 psig.	12 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.4.11.1 Verify OPERABILITY of each RCS PIV in accordance with the Inservice Testing Program.	In accordance with the Inservice Testing Program, and 24 months <u>AND</u> Prior to entering MODE 2 whenever the unit has been in MODE 5 for 7 days or more, if testing has not been performed in the previous 12 months
SR 3.4.11.2 Verify affected RCS PIV is closed.	Within 24 hours following valve actuation due to automatic or manual action or flow through the valve

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.16 RCS Pressure Isolation Valves (PIV) Integrity

BASES

BACKGROUND

10 CFR 50.2, 10 CFR 50.55a(c), and GDC 55 of 10 CFR 50, Appendix A (Refs. 1, 2, and 3), define the RCS pressure boundary as all those pressure containing components such as pressure vessels, piping, pumps, and valves which are connected to the reactor coolant system, up to and including the outermost containment isolation valve in system piping which penetrates primary reactor containment, the second of two valves normally closed during normal reactor operation in system piping which does not penetrate primary reactor containment, and the reactor coolant system safety and relief valves. This includes any two normally closed valves in series within the reactor coolant pressure boundary (RCPB), which separate the high pressure RCS from an attached low pressure system. During their lives, these valves can experience varying amounts of reactor coolant leakage through either normal operational wear or mechanical deterioration. The AP600 RCPB valves are listed in SSAR Table 3.9-16. This specification addresses a subset of the RCPB valves given in SSAR Table 3.9-16. The valves addressed by this specification meet the criteria for PIVs as defined below. The RCS PIV Integrity LCO allows RCS high pressure operation when PIV OPERABILITY has been verified in accordance with the Inservice Test Program (IST).

The purpose of this specification is to prevent overpressure failure or degradation of low pressure portions of connecting systems. The following criteria was used in identifying PIVs for inclusion in the specification. A valve was included in this specification if it's failure may result in:

1. Failure of low pressure portions of connected systems, such as a Loss of Coolant Accident (LOCA) outside of containment, which could place the plant in an unanalyzed condition.

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BASES

BACKGROUND
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2. Degradation of low pressure portions of connected systems, such as damage to a core cooling system, which could degrade a safety related function that mitigates a DBA.

Valves considered for inclusion in this specification are used to isolate the RCS from the following connected systems:

- a. Passive Core Cooling System (PXS) Accumulators;
- b. Normal Residual Heat Removal System (RNS); and
- c. Chemical and Volume Control System (CVS).

None of the valves identified meet the first PIV criteria. The PXS accumulator check valves were determined to meet the second PIV criteria for inclusion in this specification. It is determined that the RNS and CVS PIVs do not meet either criteria for inclusion in this specification.

The accumulator PIVs that are addressed by this specification include the following:

PXS V028A	PXS Accumulator Discharge Check Valve
PXS V029A	PXS Accumulator Discharge Check Valve
PXS V028B	PXS Accumulator Discharge Check Valve
PXS V029B	PXS Accumulator Discharge Check Valve

The PXS accumulator check valves are located on the accumulator discharge lines that interface with the RCS. Each accumulator discharge line contains two check valves (PXS V028A & B and PXS V029A & B) in series that isolate the accumulators from the RCS during normal plant operation. The accumulators are designed to accept some inleakage from

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BASES

BACKGROUND
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the RCS without affecting availability. However, failure of the accumulator check valves could result in overpressurization of the accumulators and degradation of the safety related function of providing low pressure injection for mitigating DBAs.

The CVS and RNS pressure isolation valves were not included in this specification based on the defined criteria. The justification for excluding the CVS and RNS PIVs is discussed in the following paragraphs.

The AP600 RNS incorporates a number of design features which address Intersystem Loss of Coolant Accidents (ISLOCAs).

The RNS contains three connections which are a high pressure / low pressure interface with the RCS. One connection is the RNS suction line which connects to the RCS hot leg. The other two connections are the RNS discharge lines which connect to the RCS direct vessel injection (DVI) line.

The portions of the RNS between the RCS and the RNS containment isolation valves are designed to the operating pressure of the reactor coolant system. The remainder of the RNS is designed so that its ultimate rupture strength is not less than the operating pressure of the RCS.

The RNS suction line contains three normally closed isolation valves in series, all with a design pressure equal to the RCS design pressure. This pathway represents a high pressure / low pressure interface with the RCS. The three RNS suction line valves provide the pressure boundary interface with the RCS. The first two RNS suction line valves are motor operated valves that have power removed at the valve motor control centers and are interlocked such that they cannot be opened unless RCS pressure is reduced to a pressure within the design pressure of the RNS. The third RNS suction line valve is a normally closed containment isolation valve.

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BASES

BACKGROUND
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An RNS relief valve is located inside containment and is connected to the RNS pump suction line. This valve is designed to provide low-temperature overpressure protection of the RCS. It is connected to the high pressure portion of the pump suction line and reduces the risk of overpressurizing the low pressure portions of the system.

The RNS discharge lines have four normally closed isolation valves in series, all the branch lines that interface with the direct vessel injection lines each contain two normally closed check valves that are RCS pressure boundary isolation valves. The branch lines connect to a common header that penetrates containment. This common header contains two containment isolation valves, a check valve inside containment and a motor operated gate valve outside containment. All the valves and piping up to and including the motor operated gate valve are designed to full RCS pressure.

For advanced light water reactors, the NRC has issued design requirements for low pressure systems connected to the high pressure reactor coolant system (Ref. 4). Westinghouse has performed a systematic evaluation of the AP600 design and concludes that it complies with the NRC design requirement(Ref. 5). The AP600 Probabilistic Risk Assessment (Ref. 8) has determined that the probability of Intersystem Loss of Coolant Accidents (ISLOCAs) has been significantly reduced when compared to the plant configurations studied in the referenced studies. This reduction can be attributed to the design features of the AP600 that have been incorporated to meet the ISLOCA requirements, including the design features of the RNS discussed above. Therefore, the RNS PIVs on the suction and discharge branch lines are not included in this specification.

The CVS contains four high pressure / low pressure connections with the RCS. Since the portion of the CVS which is located inside reactor containment is designed to full RCS pressure, the high pressure / low pressure interfaces with the RCS are the lines that penetrate the reactor containment. The CVS lines that penetrate containment include the makeup line, the letdown line to the

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BASES

BACKGROUND
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Liquid Radwaste System, the hydrogen supply line, and the demineralizer resin sluice line used to transfer spent resins from the demineralizers to the Solid Radwaste System. These lines each contain two safety related containment isolation valves which are addressed by the Containment Isolation Specification (LCO 3.6.3). In addition to the containment isolation valves in each of the CVS lines that interface with the RCS, there are additional valves in each line that provide diverse isolation capability. Since more restrictive requirements are imposed by LCO 3.6.3, the CVS isolation valves are not included in this LCO.

Since the purpose of this LCO is to verify that the PIVs (PXS accumulator check valves) have not suffered gross failures, the valve OPERABILITY tests specified in the IST provide an acceptable method of determining valve integrity. The ability of the valves to transition from open to closed provides assurance that the valve can perform its pressure isolation function as required. A small amount leakage through these valves is allowed, provided that the integrity of the valve was demonstrated.

Violation of this LCO could result in continued degradation of a PIV, which could lead to overpressurization of a low pressure system or the failure of a safety related function to mitigate a DBA.

APPLICABLE
SAFETY ANALYSES

Pressure isolation valve integrity is not considered in any design basis accident analyses. This specification provides for monitoring the condition of the reactor coolant pressure boundary to detect degradation which could lead to accidents or which could impair a connected system's ability to mitigate DBAs.

RCS PIV integrity satisfies, Criterion 2 of the NRC Policy Statement.

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BASES (continued)

LCO

RCS PIV integrity of the four accumulator check valves is required to protect the lower pressure portions of the PXS accumulators from overpressure exposure that could potentially result in a loss of a safety related function. Degradation of the accumulators could result in the failure of accumulator injection for mitigation of DBAs. The valve OPERABILITY tests demonstrate the integrity of the RCS PIVs to prevent a degradation of the PXS accumulators.

APPLICABILITY

In MODES 1 and 2, and in 3 and 4, with pressurizer pressure greater than 1000 psig, this LCO applies because the integrity of these valves is required when the RCS is pressurized. When the pressurizer pressure is 1000 psig or below, the accumulator safety function is not assumed. Additionally, the loss of one PXS accumulator as a result of the failure of the PIVs is bounded by the analysis for a DVI LOCA.

In MODES 5 and 6, PIV integrity is not required because the lower reactor coolant pressure is not sufficient to overpressurize the PXS accumulators.

ACTIONS

The Actions are modified by two Notes. Note 1 provides clarification that each flow path allows separate entry into a Condition. This is allowed based upon the functional independence of the flow path. Note 2 requires an evaluation of affected systems if a PIV is inoperable. The pressurization may have affected system operability, or isolation of an affected flow path with an alternate valve may have degraded the ability of the interconnected system to perform its safety function.

A.1

With one or more PIVs inoperable, the affected flow path(s) must be isolated. Required Action A.1 is modified by a Note that the valves used for isolation must meet the same integrity requirements as the PIVs and must be within the RCPB or the high pressure portion of the system.

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BASES

ACTIONS

A.1 (continued)

Required Action A.1 requires that the isolation with one valve must be performed within 8 hours. Eight hours provides time to verify IST compliance for the alternate isolation valve and isolate the flow path. The 8 hour Completion Time allows the actions and restricts the operation with inoperable isolation valves.

B.1 and B.2

If PIV integrity cannot be restored, the system isolated, or the other Required Actions accomplished, the plant must be brought to a MODE in which the requirement does not apply. To achieve this status, the plant must be brought to MODE 3 within 6 hours and pressurizer pressure reduced to ≤ 1000 psig within 12 hours. This Action reduces the potential for degradation of the PXS accumulators and places the plant in a condition in which the accumulator safety function is not required. The allowed Completion Times are reasonable based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE
REQUIREMENTS

SR 3.4.11.1

Performance of IST operability testing on each RCS PIV or isolation valve used to satisfy Required Action A.1 is required to verify valve integrity.

For the two PIVs in series, the valve integrity applies to each valve individually. If the PIVs are not individually tested, one valve may have failed completely and not be detected. In this situation, the protection provided by redundant valves would be lost.

Testing shall be performed every 24 months, a typical refueling cycle, if the plant does not go into MODE 5 for at least 7 days. The 24 month Frequency is consistent with 10 CFR 50.55a(g) (Ref. 6) as contained in the Inservice Testing Program and is within frequency allowed by the American Society of Mechanical Engineers (ASME) Code, Section XI (Ref. 7). The Frequency is also based on the

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BASES

SURVEILLANCE
REQUIREMENTS

SR 3.4.11.1 (continued)

need to perform such surveillances under the conditions that apply during an outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. A full stroke exercise test of the accumulator discharge check valves is required by the IST.

Additionally, the IST require stroke testing of the accumulator discharge check valves prior to entry into MODE 4, whenever the unit has been in MODE 5 for 7 days or more, if testing has not been performed in the previous 12 months. Part stroke exercise testing is acceptable for the cold shutdown test, if a full stroke test is not practicable.

SR 3.4.11.2

This SR requires verification that each RCS PIV is closed, after the valve has been opened by automatic or manual action or by flow. This verification ensures that required PIV isolation is re-established, precluding degradation of the connected system. Closure verification must be performed within 24 hours after the PIV has been opened.

REFERENCES

1. 10 CFR 50.2.
2. 10 CFR 50.55a(c).
3. 10 CFR 50, Appendix A, Section V, GDC 55.
4. SECY-90-016, "Evolutionary light Water Reactor (LWR) Certification Issues and their Relationship to Current Regulatory Requirements," January 12, 1990.
5. WCAP-14425, "Evaluation of the AP600 Conformance to Inter-System Loss-of-Coolant-Accident Acceptance Criteria."
6. 10 CFR 50.55a(g).
7. ASME, Boiler and Pressure Vessel Code, Section XI.
8. AP600 Probabilistic Risk Assessment.

