

### 3.9.6 Inservice Testing of Pumps and Valves

Inservice testing of ASME Code, Section III, Class 1, 2, and 3 pumps and valves is performed in accordance with Section XI of the ASME Operations and Maintenance (OM) Code and applicable addenda, as required specified by 10 CFR 50.55a(f), except where specific relief has been granted by the NRC in accordance with 10 CFR 50.55a(f). The Code includes requirements for leak tests and functional tests for active components.

*The requirements for system pressure tests are defined in the ASME Code, Section XI, IWA-5000. These tests verify the pressure boundary integrity and are part of the inservice inspection program, not part of the inservice test program.*

*Testing requirements for components constructed to the ASME Code are in several parts of the ASME OM Code (Reference 2). The ASME OM Code used to develop the inservice testing plan for the AP1000 Design Certification is the 1995 Edition and 1996 Addenda. The edition and addenda to be used for the inservice testing program are administratively controlled as described in subsection 3.9.8. A limited number of valves not constructed to the ASME Code are also included in the inservice testing plan using the requirements of the ASME OM Code. These valves are relied on in some safety analyses.*

*The specific ASME Code requirements for functional testing of pumps are found in the ASME OM Code, Subsection ISTB. The specific ASME Code requirements for functional testing of valves are found in the ASME OM Code, Subsection ISTC. The functional tests are required for pumps and valves that have an active safety-related function. The AP1000 inservice test plan does not include testing of pumps and valves in nonsafety-related systems unless they perform safety-related missions, such as containment isolation. Subsection 16.3.1 describes the evaluation of the importance of nonsafety-related systems, structures and components. Fluid systems with important missions are shown to be available by operation of the system.*

*The AP1000 inservice test plan includes periodic systems level tests and inspections that demonstrate the capability of safety-related features to perform their safety-related functions such as passing flow or transferring heat. The test and inspection frequency is once every 10 years. Staggering of the tests of redundant components is not required. These tests may be performed in conjunction with inservice tests conducted to exercise check valves or to perform power-operated valve operability tests. Alternate means of performing these tests and inspections that provide equivalent demonstration may be developed in the inservice test program as described in subsection 3.9.8. Table 3.9-17 identifies the system inservice tests.*

The AP1000 inservice test plan includes periodic systems level tests and inspections that demonstrate the capability of safety-related features to perform their safety-related functions such as passing flow or transferring heat. The test and inspection frequency is once every 10 years. Each of the inservice test intervals may be extended or decreased by as much as 1 year in accordance with ASME OM, ISTA-3120. Staggering of the tests of redundant components is not required. These tests may be performed in conjunction with inservice tests conducted to exercise check valves or to perform power-operated valve operability tests. Alternate means of performing these tests and inspections that provide equivalent demonstration may be developed in the inservice test program

as described in Subsection 3.9.8. Table 3.9-17 identifies the system inservice tests.

#### **3.9.6.1 Inservice Testing of Pumps**

*Safety-related pumps are subject to operational readiness testing. The only safety-related mission performed by an AP1000 pump is the coast down of the reactor coolant pumps. As a result, the AP1000 inservice test plan does not include any pumps.*

*The AP1000 inservice test plan does not include testing of pumps in nonsafety-related systems unless they perform safety-related missions. Systems containing pumps with important missions have the capability during operation to measure the flow rate, the pump head, and pump vibration to confirm availability of the pumps. These measurements may be made with temporary instruments or test devices. The AP1000 inservice test plan does not include testing of nonsafety-related pumps because they do not perform safety-related missions.*

#### **3.9.6.2 Inservice Testing of Valves**

*Safety-related valves and other selected valves are subject to operational readiness testing. Inservice testing of valves assesses operational readiness including actuating and position indicating systems. The valves that are subject to inservice testing include those valves that perform a specific function in shutting down the reactor to a safe shutdown condition, in maintaining a safe shutdown condition, or in mitigating the consequences of an accident. The AP1000 safe shutdown condition includes conditions other than the cold shutdown mode. Safe shutdown conditions are discussed in subsection 7.4.1. In addition, pressure relief devices used for protecting systems or portions of systems that perform a function in shutting down the reactor to a safe shutdown condition, in maintaining a safe shutdown condition, or in mitigating the consequences of an accident, are subject to inservice testing.*

*The AP1000 inservice test plan does not include testing of nonsafety-related valves except where they perform safety-related missions. Valves that are identified as having important nonsafety-related missions have provisions to allow testing but are not included in the inservice test plan unless inservice testing is identified as part of the regulatory oversight required for investment protection (see Section 16.3). This testing may use temporary instruments or test devices.*

*The valve test program is controlled administratively by the Combined License holder and is based on the plan outlined in this subsection. Valves (including relief valves) subject to inservice testing in accordance with the ASME Code are indicated in Table 3.9-16. This table includes the type of testing to be performed and the frequency at which the testing should be performed. The test program conforms to the requirements of ASME OM, Subsection ISTC, to the extent practical. The guidance in NRC Generic Letters, AEOD reports, and industry and utility guidelines (including NRC Generic Letter 89-04) is also considered in developing the test program. Inservice testing incorporates the use of nonintrusive techniques to periodically assess degradation and performance of selected valves.*

*Safety-related check valves with an active function are exercised in response to flow. Safety-related power-operated valves with an active function are subject to an exercise test and an operability test. The operability test may be either a static or a dynamic (flow and differential pressure) test. Refer to subsection 3.9.6.2.1 for additional information.*

*Relief from the requirements for testing, if required, and the alternative to the tests are justified and documented in DCD Table 3.9-16.*

### **3.9.6.2.1 Valve Functions Tested**

*The AP1000 inservice testing program plan identifies the safety-related missions for safety-related valves for the AP1000 systems. The following safety-related valve missions have been identified in Table 3.9-16.*

- Maintain closed*
- Maintain open*
- Transfer closed (active function)*
- Transfer open (active function)*
- Throttle flow (active function)*

*Based on the safety-related missions identified for each valve, the inservice tests to confirm the capability of the valve to perform these missions are identified. Active valves include valves that transfer open, transfer closed, and/or have throttling missions. Active valves, as defined in the ASME Code, include valves that change obturator (the part of the valve that blocks the flow stream) position to accomplish the safety-related function(s). Valve missions to maintain closed and maintain open are designated as passive and do not include valve exercise inservice testing. If upon removal of the actuation power (electrical power, air or fluid for actuation) an active valve fails to the position associated with performing its safety-related function, it is identified as "active-to-fail" in Table 3.9-16.*

*Valve functions are used in determining the type of inservice testing for the valve. These valve functions include:*

- Active or active-to-fail for fulfillment of the safety-related mission(s)*
- Reactor coolant system pressure boundary isolation function*
- Containment isolation function*
- Seat leakage (in the closed position), is limited to a specific maximum amount when important for fulfillment of the safety-related mission(s)*
- Actuators that fail to a specific position (open/closed) upon loss of actuating power for fulfillment of the safety-related mission(s)*
- Safety-related remote position indication*

*The ASME inservice testing categories are assigned based on the safety-related valve functions and the valve characteristics. The following criteria are used in assigning the ASME inservice testing categories to the AP1000 valves.*

*Category A – safety-related valves with safety-related seat leakage requirements*

*Category B – safety-related valves requiring inservice testing, but without safety-related seat leakage requirements*

*Category C – safety-related, self-actuated valves (such as check valves and pressure relief valves)*

*Category D – safety-related, explosively actuated valves and nonreclosing pressure relief devices*

*Four basic groups of inservice tests have been identified for the AP1000. These testing groups are described below.*

#### **Remote Valve Position Indication Inservice Tests**

*Valves that are included in the inservice testing program that have position indication will be observed locally during valve exercising to verify proper operation of the position indication. The*

*frequency for this position indication test is once every two years. Where local observation is not practicable, other methods will be used for verification of valve position indicator operation. The alternate method and justification are provided in Table 3.9-16.*

#### **Valve Leakage Inservice Tests**

Valves with safety-related seat leakage limits will be tested to verify their seat leakage. These valves include:

– *Containment Isolation - valves that provide isolation of piping/lines that penetrate the containment. Containment isolation valves are tested in accordance with 10 CFR 50, Appendix J. Depending on the function and configuration, some valves are tested during the integrated leak rate testing (Type A) or individually as a part of the Type C testing or both. The leak rate test frequency for containment isolation valves is defined in subsection 6.2.5. The provisions in 10 CFR 50.55a (b) 2. that require leakage limits and corrective actions for individual containment isolation valves by reference to ASME/ANSI OM Part 10 apply to the AP1000 containment isolation valves. Changes to these provisions are discussed in subsection 3.9.8.*

*The ASME Code specifies a test frequency of at least once every 2 years. The ASME Code does not require additional leak testing for valves that demonstrate operability during the course of plant operation. In such cases, the acceptability of the valve performance is recorded during plant operation to satisfy inservice testing requirements. Therefore, a specific inservice test need not be performed on valves that meet this criteria.*

*The AP1000 maximum leakage requirement for pressure isolation valves that provide isolation between high and low pressure systems is included in the surveillance requirements for Technical Specification 3.4.16. The pressure isolation valves that require leakage testing are tabulated in Table 3.9-18.*

*The AP1000 has no temperature isolation valves whose leakage may cause unacceptable thermal loading to piping or supports.*

#### **Manual/Power-Operated Valve Tests**

*Manual/Power-Operated Valve Exercise Tests - Safety-related active valves and other selected active valves, both manual- and power-operated (motor-operated, air-operated, hydraulically operated, solenoid-operated) will be exercised periodically. The ASME code specifies a quarterly valve exercise frequency. The AP1000 test frequencies are identified in Table 3.9-16.*

*In some cases, the valves are tested on a less frequent basis because it is not practicable to exercise the valve during plant operation. If an exception is taken to performing quarterly full-stroke exercise testing of a valve, then full-stroke testing will be performed during cold shutdowns on a frequency not more often than quarterly. If this is not practicable, then the full-stroke testing will be performed each refueling cycle.*

*The inservice testing requirement for measuring stroke time for valves in the AP1000 will be completed in conjunction with a valve exercise inservice test. The stroke time test is not identified as a separate inservice test.*

*Valves that operate during the course of normal plant operation at a frequency that satisfies the*

*exercising requirement need not be additionally exercised, provided that the observations required of inservice testing are made and recorded at intervals no greater than that specified in this section.*

*Safety-related valves that fail to the safety-related actuation position to perform the safety-related missions, are subject to a valve exercise inservice test. The test verifies that the valve repositions to the safety-related position on loss of actuator power. The valve exercise test satisfies this test as long as the test removes actuator power for the valve. The fail-safe test is not identified as a separate test.*

**Power-Operated Valve Operability Tests** - *The inservice operability testing of power-operated valves rely on non-intrusive diagnostic techniques to permit periodic assessment of valve operability at design basis conditions. Table 3.9-16 identifies valves that may require valve operability testing. The specified frequency for operability testing is a maximum of once every 10 years. The initial test frequency is the longer of every 3 refueling cycles or 5 years until sufficient data exists to determine a longer test frequency is appropriate in accordance with Generic Letter 96-05.*

*Static testing with diagnostic measurements will be performed on these valves. The specific frequency for operability testing will be based on the risk ranking and the functional margin of the individual valve with a maximum test frequency of once every 10 years. The factors below are used to determine the risk ranking and functional margin. See subsection 3.9.8.4 for a discussion on developing the inservice test program, which will also include analysis of trends of valve test parameters resulting from the valve operability.*

**– Risk Ranking**

*The risk ranking shall consist of calculating the at-power risk importance, developing component ranking worksheets, and conducting an expert panel review.*

**– Function Margin**

*The functional margin will be determined considering the valve design features, material of construction, operating parameters, actuator capability, and uncertainties. The uncertainties shall consider degradations, and variations of diagnostic measurements and control logic.*

*Valves for which functional margins have not been determined – due to the use of different valve design features, materials of construction, operating parameters, actuator capability, and other uncertainties – may require dynamic testing (differential pressure testing) to determine the appropriate margins.*

A motor-operated valve (MOV) Program will be implemented using a phased approach based on system turnover from the reactor vendor to the Combined License holder. The MOV Program complies with the provisions of the OM Code, ISTC-3500. The general requirements include:

- 1. Design Basis Verification Test:** The OMN-1 Code case considerations and criteria are implemented as part of the program. When practicable valves will be tested in situ under design basis conditions. Justification for testing at conditions other than design basis conditions and for grouping like MOVs shall be

documented by an engineering evaluation, alternate testing techniques, or both.

2. **Preservice Testing:** Each MOV shall be tested during the preservice test period or before implementing inservice testing.

3. Inservice Testing including requirements for establishing test intervals. The maximum inservice test interval does not exceed 10 years.

4. Effect of MOV Replacement, Repair, or Maintenance.

5. Grouping of MOVs for Inservice testing is incorporated as part of the program.

6. MOV exercising requirements.

The MOV Program includes provisions to accommodate the use of Risk-informed inservice testing of MOV.

Pre-installation testing is specified by the reactor vendor, performed by the valve vendor, and documented in a certificate of compliance.

Pre-operational testing will take a phased approach based on system turnover from the reactor. A description of the pre-operational test requirements for the MOV Program is found in Subsection 5.4.8.5.2.

The valve test frequency will be in accordance with Table 3.9-16.

The MOV Program Test Methods, Analysis and Evaluation of Data as well as Records and Reports are in full compliance with that documented in the OMN-1 code case.

#### **Check Valve Tests**

**Check Valve Flow Tests** - Check Valve Flow Tests - Safety-related check valves identified with specific safety-related missions to transfer open or transfer closed are tested periodically.

Exercising a check valve confirms the valve capability to move to the position(s) to fulfill the safety-related mission(s). The exercise test shows that the check valve opens in response to flow and closes when the flow is stopped. Sufficient flow is provided to fully open the check valve unless the maximum accident flows are not sufficient to fully open the check valve. Either permanently or temporarily installed nonintrusive check valve indication is used for this test. Check valves are tested in accordance with ASME OM, ISTC-5220. ASME OM, Appendix II is the basis for the Check Valve Condition Monitoring Program.

**Check Valve Low Differential Pressure Tests** - Safety-related check valves that perform a safety-related mission to transfer open under low differential pressure conditions have periodic inservice testing to verify the capability of the valve to initiate flow.

*The intent of this inservice test is to determine the pressure required to initiate flow. This differential pressure will verify that the valve will initiate flow at low differential pressure. This*

*low pressure differential inservice test is performed in addition to exercise inservice tests. The specified frequency for this inservice test is once each refueling cycle.*

**Other Valve Inservice Tests**

**Explosively Actuated Valves** - Explosively actuated valves are subject to periodic test firing of the explosive actuator charges. The inservice tests for these valves is specified in the ASME code.

*At least 20 percent of the charges installed in the plant in explosively actuated valves are fired and replaced at least once every 2 years. If a charge fails to fire, all charges with the same batch number are removed, discarded, and replaced with charges from a different batch. The firing of the explosive charge may be performed inside of the valve or outside of the valve in a test fixture. The maintenance and review of the service life for charges in explosively actuated valves follow the requirements in the ASME OM Code.*

**Pressure/Vacuum Relief Devices** - Pressure relief devices that provide safety-related functions or that protect equipment in systems that perform API1000 safety-related missions are specified by ASME to have periodic inservice testing. The inservice tests for these valves are identified in ASME IST, Appendix I.

*The periodic inservice testing include visual inspection, seat tightness determination, set pressure determination, and operational determination of balancing devices, alarms, and position indication as appropriate. The frequencies for this inservice test is every 5 years for ASME Class 1 and main steam line safety valve or every 10 years for ASME Classes 2 and 3 devices. Nonreclosing pressure relief devices are inspected when installed and replaced every 5 years unless historical data indicate a requirement for more frequent replacement.*

**3.9.6.2.3 Valve Disassembly and Inspection**

Section 3.9.8 discusses developing a program for periodic valve disassembly and inspection. Evaluation of the factors below will determine which of the valves identified in the inservice testing program in Table 3.9-16 will require disassembly and inspection and the frequency of the inspection.

- API1000 PRA importance measures.
- Design reliability assurance program contained in DCD Section 16.2.
- Historical performance of power-operated valves (identify valve types which experience unacceptable degradation in service.)
- Basic design of valves including the use of components subject to aging and requiring periodic replacement.
- Analysis of trends of valve test parameters during valve inservice tests.
- Results of nonintrusive techniques. Disassembly and inspection may not be needed if nonintrusive techniques are sufficient to detect unacceptable valve degradation.

**3.9.6.2.4 Valve Preservice Tests**

Preservice test for valves are performed in accordance with ASME OM, ISTC-3100.

**3.9.6.2.5 Valve Replacement, Repair, and Maintenance**

Testing in accordance with ASME OM, ISTC-3310 is performed after a valve is replaced, repaired, or has undergone maintenance.

### 3.9.6.3 Relief Requests

*Considerable experience has been used in designing and locating systems and valves to permit preservice and inservice testing required by Section XI of the ASME Code. Deferral of testing to cold shutdown or refueling outages in conformance with the rules of the ASME OM Code when testing during power operation is not practical is not considered a relief request. Relief from the testing requirements of the ASME OM Code will be requested when full compliance with*

*requirements of the ASME OM Code of the Code is not practical. In such cases, specific information will be provided which identifies the applicable code requirements, justification for the relief request, and the testing method to be used as an alternative.*

EXAMPLE

Next is an excerpt from Table 3.9-16, **VALVE  
INSERVICE TEST REQUIREMENTS**. This  
excerpt is only page 1 of 21 pages and notes.

EXAMPLE

Table 3.9-16 (Sheet 1 of 21)

VALVE INSERVICE TEST REQUIREMENTS

Valve Tag Number	Description <sup>(1)</sup>	Valve Type	Safety-Related Missions	Safety Functions <sup>(2)</sup>	ASME IST Category	Inservice Testing Type and Frequency	IST Notes
CAS-PL-V014	Instrument Air Supply Outside Containment Isolation	Remote	Maintain Close Transfer Close	Active-to-Failed Containment Isolation Safety Seat Leakage Remote Position	A	Remote Position Indication, Exercise/2 Years Containment Isolation Leak Test Exercise Full Stroke/Refueling Shutdown Operability Test	18, 27, 31
CAS-PL-V015	Instrument Air Supply Inside Containment Isolation	Check	Maintain Close Transfer Close	Active Containment Isolation Safety Seat Leakage	AC	Containment Isolation Leak Test Check Exercise/Refueling Shutdown	18, 27
CAS-PL-V204	Service Air Supply Outside Containment Isolation	Manual	Maintain Close	Containment Isolation Safety Seat Leakage	A	Containment Isolation Leak Test	27
CAS-PL-V205	Service Air Supply Inside Containment Isolation	Check	Maintain Close	Containment Isolation Safety Seat Leakage	AC	Containment Isolation Leak Test	27
CCS-PL-V200	CCS Containment Isolation Valve - Inlet Line ORC	Remote	Maintain Close Transfer Close	Active Containment Isolation Safety Seat Leakage Remote Position	A	Remote Position Indication, Exercise/2 Years Containment Isolation Leak Test Exercise Full Stroke/Cold Shutdown Operability Test	14, 27, 31
CCS-PL-V201	CCS Containment Isolation Valve - Inlet Line IRC	Check	Maintain Close Transfer Close	Active Containment Isolation Safety Seat Leakage	AC	Containment Isolation Leak Test Check Exercise/Cold Shutdown	14, 27
CCS-PL-V207	CCS Containment Isolation Valve - Outlet Line IRC	Remote	Maintain Close Transfer Close	Active Containment Isolation Safety Seat Leakage Remote Position	A	Remote Position Indication, Exercise/2 Years Containment Isolation Leak Test Exercise Full Stroke/Cold Shutdown Operability Test	14, 27, 31
CCS-PL-V208	CCS Containment Isolation Valve - Outlet Line ORC	Remote	Maintain Close Transfer Close	Active Containment Isolation Safety Seat Leakage Remote Position	A	Remote Position Indication, Exercise/2 Years Containment Isolation Leak Test Exercise Full Stroke/Cold Shutdown Operability Test	14, 27, 31
CVS-PL-V001	RCS Purification Stop	Remote	Maintain Close Transfer Close	Active Safety Seat Leakage Remote Position	A	Remote Position Indication, Exercise/2 Years RCS Isolation Leak Test/Refueling Exercise Full Stroke/Cold Shutdown Operability Test	6, 31, 32
CVS-PL-V002	RCS Purification Stop	Remote	Maintain Close Transfer Close	Active Safety Seat Leakage Remote Position	A	Remote Position Indication, Exercise/2 Years RCS Isolation Leak Test/Refueling Exercise Full Stroke/Cold Shutdown Operability Test	6, 31, 32
CVS-PL-V003	RCS Purification Stop	Remote	Maintain Close Transfer Close	Active Remote Position	B	Remote Position Indication, Exercise/2 Years Exercise Full Stroke/Cold Shutdown Operability Test	6, 31

Table 3.9-16 (Sheet 21 of 21)

VALVE INSERVICE TEST REQUIREMENTS

Valve Tag Number	Description <sup>(1)</sup>	Valve Type	Safety-Related Missions	Safety Functions <sup>(2)</sup>	ASME IST Category	Inservice Testing Type and Frequency	IST Notes
WLS-PL-V057	Sump Discharge Containment Isolation ORC	Remote	Maintain Close Transfer Close	Active-to-Failed Containment Isolation Safety Seat Leakage Remote Position	A	Remote Position Indication, Exercise/2 Years Containment Isolation Leak Test Exercise Full Stroke/Quarterly Operation Operability Test	27, 31
WLS-PL-V067	Reactor Coolant Drain Tank Gas Outlet Containment Isolation IRC	Remote	Maintain Close Transfer Close	Active-to-Failed Containment Isolation Safety Seat Leakage Remote Position	A	Remote Position Indication, Exercise/2 Years Containment Isolation Leak Test Exercise Full Stroke/Quarterly Operation Operability Test	27, 31
WLS-PL-V068	Reactor Coolant Drain Tank Gas Outlet Containment Isolation ORC	Remote	Maintain Close Transfer Close	Active-to-Failed Containment Isolation Safety Seat Leakage Remote Position	A	Remote Position Indication, Exercise/2 Years Containment Isolation Leak Test Exercise Full Stroke/Quarterly Operation Operability Test	27, 31
WLS-PL-V071A	CVS Compartment to Sump	Check	Maintain Close Transfer Close	Active	BC	Check Exercise/Refueling Shutdown	26
WLS-PL-V071B	PXS A Compartment to Sump	Check	Maintain Close Transfer Close	Active	BC	Check Exercise/Refueling Shutdown	26
WLS-PL-V071C	PXS B Compartment to Sump	Check	Maintain Close Transfer Close	Active	BC	Check Exercise/Refueling Shutdown	26
WLS-PL-V072A	CVS Compartment to Sump	Check	Maintain Close Transfer Close	Active	BC	Check Exercise/Refueling Shutdown	26
WLS-PL-V072B	PXS A Compartment to Sump	Check	Maintain Close Transfer Close	Active	BC	Check Exercise/Refueling Shutdown	26
WLS-PL-V072C	PXS B Compartment to Sump	Check	Maintain Close Transfer Close	Active	BC	Check Exercise/Refueling Shutdown	26

Notes:

1. Acronyms:

ADS automatic depressurization system  
 CAS compressed and instrument air system  
 CCS component cooling water system  
 CVS chemical and volume control system  
 DWS demineralized water transfer and storage system  
 FPS fire protection system  
 IRC inside reactor containment  
 IRWST in-containment refueling water storage tank  
 MSS main steam system  
 MTS main turbine system  
 ORC outside reactor containment  
 PCCWST passive containment cooling water storage tank

PCS passive containment cooling system  
 PSS primary sampling system  
 PXS passive core cooling system  
 RCS reactor coolant system  
 RNS normal residual heat removal system  
 SFS spent fuel pool cooling system  
 SGS steam generator system  
 VBS nuclear island nonradioactive ventilation system  
 VES main control room emergency habitability system  
 VFS containment air filtration system  
 VWS central chilled water system  
 WLS liquid radwaste system

2. Valves listed as having an active or an active-to-failed safety-related function provide the safety-related valve transfer capabilities identified in the safety-related mission column. Valves having an active-to-failed function will transfer to the position identified in the safety-related mission column on loss of motive power.
3. This note applies to the ADS stage 1/2/3 valves (RCS-V001A/B, V002A/B, V003A/B, V011A/B, V012A/B, V013A/B). These valves are normally closed to maintain the RCS pressure boundary. These valves have a safety-related function to open following LOCAs to allow safety injection from lower pressure water supplies (accumulators and IRWST). These valves also have beyond design basis functions to depressurize the RCS. These valves have the same design pressure as the RCS and are AP1000 equipment class A. Downstream of the second valve is a lower design pressure and is equipment class C. The discharge of these valves is open to the containment through the IRWST.

Both ADS valves in each line are normally closed during normal reactor operation in accordance with 10 CFR 50.2 and ANS/ANSI 51.1. If one of these valves is opened, for example for testing, the RCS pressure boundary is not maintained in accordance with the criteria contained in these two documents. In addition, the ADS valve configuration is similar to the normal residual heat removal system suction valve configuration. Even though the RNS suction valve configuration includes a third valve in the high pressure portion of the line, and the first two RNS valves have safety related functions to transfer closed, they are not stroke tested during normal reactor operation to avoid a plant configuration where the mispositioning of one valve would cause a LOCA. Note 15 describes the justification for testing the RNS valves during cold shutdown.

These ADS valves are tested during cold shutdowns when the RCS pressure is reduced to atmospheric pressure so that mispositioning of a single valve during this IST will not cause a LOCA. Testing these valves every cold shutdown is consistent with the AP1000 PRA which assumes more than 2 cold or refueling shutdowns per year.

4. This note applies to the reactor vessel head vent solenoid valves (RCS-V150A/B/C/D). Exercise testing of these valves at power represents a risk of loss of reactor coolant and depressurization of the RCS if the proper test sequence is not followed. Such testing may also result in the valves developing through seal leaks. Exercise testing of these valves will be performed at cold shutdown.
5. This note applies to squib valves in the RCS and the PXS. The squib valve charge is removed and test fired outside of valve. Squib valves are not exercised for inservice testing. Their position indication sensors will be tested by local inspection.
6. This note applies to the CVS isolation valves (CVS-V001, V002, V003, V080, V081, V082). Closing these valves at power will result in an undesirable temperature transient on the RCS due to the interruption of purification flow. Therefore, quarterly exercise testing will not be performed. Exercise testing will be performed at cold shutdown.
7. This note applies to the pressurizer safety valves (RCS-V005A/B) and to the main steam safety valves (SGS-V030A/B, V031A/B, V032A/B, V033A/B, V034A/B and V035A/B). Since these valves are not exercised for inservice testing, their position indication sensors are tested by local inspection without valve exercise.
8. This note applies to CVS valve (CVS-V081). The safety functions are satisfied by the check valve function of the valve.
9. This note applies to the PXS accumulator check valves (PXS-V028A/B, V029A/B). To exercise these valves, flow must be provided through these valves to the RCS. These valves are not exercised during power operations because the accumulators cannot provide flow to the RCS since they are at a lower pressure. In addition, providing flow to the RCS during power operation would cause undesirable thermal transients on the RCS. During cold shutdowns, a full flow stroke test is impractical because of the potential of adding significant water to the RCS, and lifting the RNS relief valve. There is also a risk of injecting nitrogen into the RCS. A partial stroke test is practical during longer cold shutdowns ( $\geq 48$  hours in Mode 5). In this test, flow is provided from test connections, through the check valves and into the RCS. Sufficient flow is not available to provide a detectable obturator movement. Full stroke exercise testing of these valves is conducted during refueling shutdowns.
10. This note applies to the PXS CMT check valves (PXS-V016A/B, V017A/B). These check valves are biased open valves and are fully open during normal operation. These valves will be verified to be open quarterly. In order to exercise these check valves, significant reverse flow must be provided from the DVI line to the CMT. These valves are not tested during power operations because the test would cause undesirable thermal transients on the portion of the line at ambient temperatures and change the CMT boron concentration. These valves are not exercised during cold shutdowns because of changes that would result in the CMT boron concentration. Because this parameter is controlled by Technical Specifications, this testing is impractical. These valves are exercised during refueling when the RCS boron concentration is nearly equal to the CMT concentration and the plant is in a mode where the CMTs are not required to be available by the Technical Specifications.
11. This note applies to the PXS containment recirculation check valves (PXS-V119A/B). Squib valves in line with the check valves prevent the use of IRWST water to test the valves. To exercise these check valves an operator must enter the containment, remove a cover from the recirculation screens, and insert a test device into the recirculation pipe to push open the check valve. The test device is made to interface with the valve without causing valve damage. The test device incorporates loads measuring sensors to measure the initial opening and full open force. These valves are not exercised during power operations because of the need to enter highly radioactive areas and because during this test the recirculation screen is bypassed. These valves are not exercised during cold shutdown operations for the same reasons. These valves are exercised during refueling conditions when the recirculation lines are not required to be available by Technical Specifications LCOs 3.5.7 and 3.5.8 and the radiation levels are reduced.
12. This note applies to the PXS IRWST injection check valves (PXS-V122A/B, V124A/B). To exercise these check valves a test cart must be moved into containment and temporary connections made to these check valves. In addition, the IRWST injection line isolation valves must have power restored and be closed. These valves are not exercised during power operations because closing the IRWST injection valve is not permitted by the Technical Specifications and the need to perform significant work inside containment. Testing is not performed during cold shutdown for the same reasons. These valves are exercised during refueling conditions when the IRWST injection lines are not required to be available by Technical Specifications and the radiation levels are reduced.
13. Deleted.
14. Component cooling water system containment isolation motor-operated valves CCS-V200, V207, V208 and check valve CCS-V201 are not exercised during power operation. Exercising these valves would stop cooling water flow to the reactor coolant pumps and letdown heat exchanger. Loss of cooling water may result in damage to equipment or reactor trip. These valves are exercised during cold shutdowns when these components do not require cooling water.
15. Normal residual heat removal system reactor coolant isolation motor-operated valves (RNS-V001A/B, V002A/B) are not exercised during power operation. These valves isolate the high pressure RCS from the low pressure RNS and passive core cooling system (PXS). Opening during normal operation may result in damage to equipment or reactor trip. These valves are exercised during cold shutdowns when the RNS is aligned to remove the core decay heat.
16. Normal residual heat removal system containment isolation motor-operated valves (RNS-V002A/B) are not containment isolation leak tested. The basis for the exception is:
- The valve is submerged during post-accident operations which prevents the release of the containment atmosphere radiogas or aerosol.
  - The RNS is a closed, seismically-designed safety class 3 system outside containment
  - The valves are closed when the plant is in modes above hot shutdown
17. Normal residual heat removal system containment penetration relief valve (RNS-V021) and containment isolation motor-operated valve (RNS-V023) are subjected to containment leak testing by pressurizing the lines in the reverse direction to the flow which accompanies a containment leak in this path.

18. This note applies to the CAS instrument air containment isolation valves (CAS-V014, V015). It is not practical to exercise these valves during power operation or cold shutdowns. Exercising the valves during these conditions may result in some air-operated valves inadvertently opening or closing, resulting in plant or system transients. These valves are exercised during refueling conditions when system and plant transients would not occur.
19. Primary sampling system containment isolation check valve (PSS-V024) is located inside containment and considerable effort is required to install test equipment and cap the discharge line. Exercise testing is not performed during cold shutdown operations for the same reasons. These valves are exercised during refueling conditions when the radiation levels are reduced.
20. This note applies to the main steam isolation valves and main feedwater isolation valves (SGS-V040A/B, V057A/B). The valves are not full stroke tested quarterly at power since full valve stroking will result in a plant transient during normal power operation. Therefore, these valves will be partially stroked on a quarterly basis and will be full stroke tested on a cold shutdown frequency basis. The full stroke testing will be a full "slow" closure operation. The large size and fast stroking nature of the valve makes it advantageous to limit the number of fast closure operations which the valve experiences. The timed slow closure verifies the valves operability status and that the valve is not mechanically bound.
21. Post-72 hour check valves that require temporary connections for inservice-testing are exercised every refueling outage. These valves require transport and installation of temporary test equipment and pressure/fluid supplies. Since the valves are normally used very infrequently, constructed of stainless steel, maintained in controlled environments, and of a simple design, there is little benefit in testing them more frequently. For example, valve PCS-V039 is a simple valve that is opened to provide the addition of water to the PCS post-72 hour from a temporary water supply. To exercise the valve, a temporary pump and water supply is connected using temporary pipe and fittings, and the flow rate is observed using a temporary flow measuring device to confirm valve operation.
22. Exercise testing of the auxiliary spray isolation valve (CVS-V084, V085) will result in an undesirable temperature transient on the pressurizer due to the actuation of auxiliary spray flow. Therefore, quarterly exercise testing will not be performed. Exercise testing will be performed during cold shutdowns.
23. Thermal relief check valves in the normal residual heat removal suction line (RNS-V003A/B) and the Chemical and Volume Control System makeup line (CVS-V100) are located inside containment. To exercise test these valves, entry to the containment is required and temporary connections made to gas supplies. Because of the radiation exposure and effort required, this test is not conducted during power operation or during cold shutdowns. Exercise testing is performed during refueling shutdowns.
24. Normal residual heat removal system reactor coolant isolation check valves (RNS-V015A/B, V017A/B) are not exercise tested quarterly. During normal power operation these valves isolate the high pressure RCS from the low pressure RNS. Opening during normal operation would require a pressure greater than the RCS normal pressure, which is not available. It would also subject the RCS connection to undesirable transients. These valves will be exercised during cold shutdowns.
25. This note applies to the main feedwater control valves (SGS-V250A/B), moisture separator reheater steam control valve (MSS-V016A/B), turbine control valves (MTS-V002A/B, V004A/B). The valves are not quarterly stroke tested since full stroke testing would result in a plant transient during power operation. Normal feedwater and turbine control operation provides a partial stroke confirmation of valve operability. The valves will be full stroke tested during cold shutdowns.
26. This note applies to containment compartment drain line check valves (SFS-V071, SFS-V072, WLS-V071A/B/C, WLS-V072A/B/C). These check valves are located inside containment and require temporary connections for exercise testing. Because of the radiation exposure and effort required, these valves are not exercised during power operation or during cold shutdowns. The valves will be exercised during refuelings.
27. Containment isolation valves leakage test frequency will be conducted in accordance with the "Primary Containment Leakage Rate Test Program" in accordance with 10 CFR 50 Appendix J. Refer to SSAR subsection 6.2.5.
28. This note applies to the chilled water system containment isolation valves (VWS-V058, V062, V082 and V086). Closing any of these valves stops the water flow to the containment fan coolers. This water flow may be necessary to maintain the containment air temperature within Technical Specification limits. As a result, quarterly exercise testing will be deferred when plant operating conditions and site climatic conditions would cause the containment air temperature to exceed this limit during testing.
29. Exercise testing of the turbine bypass control valves (MSS-V001, V002, V003, V004, V005 and V006) will result in an undesirable temperature transient on the turbine, condenser and other portions of the turbine bypass due to the actuation of bypass flow. Therefore, quarterly exercise testing will not be performed. Exercise testing will be performed during cold shutdowns.
30. Deleted.
31. These valves may be subject to operability testing. See subsection 3.9.6.2.2 for the factors to be considered in the evaluation of operability testing and subsection 3.9.8.4 for the Combined License information item. The specified frequency for operability testing is a maximum of once every 10 years. The test frequency is the longer of every 3 refueling cycles or 5 years until sufficient data exists to determine a longer test frequency is appropriate in accordance with Generic Letter 96-05. Some of the valves will be tested the first time after a shorter period to provide for trending information.
32. These valves are subject to leak testing to support the nonsafety-related classification of the CVS purification subsystem inside containment. These valves are not included in the PIV integrity Technical Specification 3.4.16. The leakage through valves CVS-V001, CVS-V002, and CVS-V080 will be tested separately with a leakage limit of 1.5 gpm for each valve. The leakage through valves CVS-V081, V082, V084, and V085 will be tested at the same time as a group with a leakage limit of 1 gpm for the group. The leak tests will be performed at reduced RCS pressures. The observed leakage at lower pressures can be assumed to be the leakage at the maximum pressure as long as the valve leakage is verified to diminish with increasing pressure differential. Verification that the valves have the characteristic of decreasing leakage with pressure may be provided with two tests at different test pressures. The test requirements including the minimum test pressure and the difference between the test pressures will be defined by the Combined License applicant in the inservice test program as discussed in subsection 3.9.8.
33. This note applies to valve FHS-V001. This valve closes one end of the fuel transfer tube. The fuel transfer tube is normally closed by a flange except during refuelings. This valve has an active safety function to close when the fuel transfer tube flange is removed and normal shutdown cooling is lost. Closing this valve, along with other actions, provides containment closure which allows long term core cooling to be provided by the PXS. As a result this valve is only required to be operable during refueling operations. The exercise testing of this valves will be performed during refueling shutdowns prior to removing the fuel transfer tube flange.
34. This note applies to the moisture separator reheater steam control valve (MSS-V016A/B), turbine control valves (MTS-V002A/B, V004A/B), main turbine stop valves (MTS-V001A/B, V003A/B), the turbine bypass control valves (MSS-V001, V002, V003, V004, V005, V006). These valves are not safety-related. These valves are relied on in the safety analyses for those cases in which the rupture of the main steam or feedwater piping inside containment is the postulated initiating event. These valves are credited in single failure analysis to mitigate the event.
35. This note applies to the turbine stop valves (MTS-V001A/B, V003A/B). The valves are not quarterly stroke tested since full stroke testing would result in a plant transient during power operation. The valves will be full stroke tested during cold shutdowns.
36. In each of the four turbine inlet lines, there is a turbine stop valve and turbine control valve. Only one of the valves in each of the four lines is required by Technical Specification 3.7.2 to be operable.