OM CODE CASES

A Code Case is the official method of handling a reply to an inquiry when study indicates that the Code wording needs clarification, or when the reply modifies the existing requirements of the Code, or grants permission to use alternative methods.

ASME has agreed to publish Cases issued by the Operation and Maintenance Committee concerning the OM Code as part of the update service to the OM Code. A notice appears in *Mechanical Engineering* when new and revised Cases are approved, as well as announcements of approval of reaffirmed Cases and annulments. All Code Case actions then appear in the next update. Cases currently in effect at the time of publication of a new edition of the Code are included with it as a supplement.

The Cases affected by this supplement (OMb Code-2003) are as follows:

Page	*Location*	*Change*
C-24	OMN-8	New expiration date: November 20, 2006
C-25	OMN-9	New expiration date: November 25, 2006
C-28	OMN-10	New expiration date: January 26, 2006
C-35	OMN-11	New expiration date: March 3, 2006
C-44	OMN-14	Added

Replace or insert the pages listed. Changes given above are identified on the pages by a margin note, **(b)**, placed next to the affected area. The pages not listed are the reverse sides of the listed pages and contain no changes.

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(b) Feedback and corrective actions shall be taken in accordance with Code Case OMN-3, para 4.7.

(c) If the maximum test interval as determined from the aggregate risk assessment of Code Case OMN-3, para. 4.5.2, for a specific component is more limiting than the test frequency of para. 2.2 or 2.3 above (as applicable), the most limiting test interval shall be used for that component. A Group A or Group B test, as applicable, shall be performed to satisfy the increased test frequency requirements.

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CODE CASE OMN-8
Alternative Rules for Preservice and Inservice Testing of Power-Operated Valves That Are Used for System Control and Have a Safety Function per OM-10

This Case shall expire on November 20, 2006 unless previously annulled or reaffirmed.

Inquiry: What alternative requirements to those of ASME/ANSI OMa-1988, Part 10, para. 4.2 through OM Code-1995, ISTC 4.2 may be used for power-operated control valves that have only a fail safe safety function?

Reply: It is the opinion of the Committee that the requirements of ASME/ANSI OMa-1988, Part 10, para. 4.2.1.4, Power-Operated Valve Stroke Testing; para. 4.2.1.8, Stroke Time Acceptance Criteria; and para. 4.2.1.9(b) need not be met. All other applicable requirements of para. 4.2 shall be met for ASME/ANSI OMa-1988, Part 10.

Further, the requirements of OM Code-1995, ISTC 4.2.4, Power-Operated Valve Stroke Testing; ISTC 4.2.8, Stroke Time Acceptance Criteria; and ISTC 4.2.9(b) need not be met. All other applicable requirements of the paragraph shall be met.

Any abnormality or erratic action experienced during valve exercising shall be recorded in the record of tests, and an evaluation shall be made regarding need for corrective action.

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CODE CASE OMN-9
Use of a Pump Curve for Testing

(b)

This Case shall expire on November 25, 2006 unless previously annulled or reaffirmed.

Inquiry: What alternative rules to those of ISTB 4.3, 4.4, 4.5, 5.2, and 6.1 may be used when it is impractical to adjust a centrifugal or vertical line shaft pump to a specific reference value as required by ISTB 5.2(b)?

Reply: It is the opinion of the Committee that the following rules may be used for testing of centrifugal or vertical line shaft pumps where adjustment to a specific reference value is impractical, in lieu of the requirements of ISTB 4.3, 4.4, 4.5, 5.2, and 6.1.

Applicability: ASME OM Code-1990 through ASME OMb Code-1992.

1 ADDITIONAL DEFINITIONS

maximum pump curve range: the maximum potential flow or differential pressure range for the pump curve, from shutoff conditions to maximum required flow rate.

reference curve: a range of values of a test parameter versus flow or differential pressure, for a centrifugal or vertical line shaft pump, measured or determined when the pump is known to be operating acceptably.

2 REFERENCE VALUES

Reference values shall be determined from the results of preservice testing or from the results of the first inservice test. Reference values shall be at points of operation readily duplicated during subsequent tests. All subsequent test results shall be compared to these initial reference values or to new reference values established in accordance with sections 4 and 5 below. Reference values shall only be established when the pump is known to be operating acceptably. If the particular parameter being measured or determined can be significantly influenced by other related conditions, then these conditions shall be analyzed.[1]

3 REFERENCE CURVES

If the establishment of specific reference values is impractical for a centrifugal or vertical line shaft pump, the Owner may establish reference curves. Reference curves shall be determined from data measured during preservice testing or from the first inservice test. A reference curve shall be established from a minimum of three data points and shall have at least one data point for each 20% of the maximum pump curve range. The range of the reference curve shall be sufficient to bound the points of operation expected during subsequent tests. All subsequent test results shall be compared to the initial reference curves or to new reference curves established in accordance with section 4 or 5 below. Reference curves shall only be established when the pump is known to be operating acceptably. If vibration is relatively unaffected by changing differential pressure or flow over the reference curve range, a single reference value may be used for that test quantity, provided it is at the minimum of the measured data. If reference curves are used, the reasons for doing so and the suitability of the methods used to develop the reference curves and acceptance criteria shall be justified and documented in the record of tests (see ISTB 7).

[1] Vibration of pumps may be foundation, driver, and piping dependent. Therefore, if initial vibration readings are high and have no obvious relationship to the pump, the vibration measurements should be taken at the driver, at the foundation, and on the piping, and analyzed to ensure that the reference vibration measurements are representative of the pump and that the mesured vibration levels will not prevent the pump from fulfilling its function.

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4 EFFECT OF PUMP REPLACEMENT, REPAIR, AND MAINTENANCE ON REFERENCE VALUES OR REFERENCE CURVES

When a reference value, set of reference values, or reference curve may have been affected by repair, replacement, or routine servicing of a pump, a new reference value, set of reference values, or reference curve shall be determined or the previous value, or curve, reconfirmed by an inservice test run before declaring the pump operable. Deviations between the previous and new set of reference values or reference curves shall be identified, and verification that the new values or curves represent acceptable pump operations shall be placed in the record of tests (see ISTB 7).

5 ESTABLISHMENT OF ADDITIONAL SET OF REFERENCE VALUES OR REFERENCE CURVES

If it is necessary or desirable, for some reason other than stated in section 4 above, to establish an additional set of reference values or reference curves, an inservice test shall be run at the conditions of an existing set of reference values, or within the range of existing reference curves, and the results analyzed. If operation is acceptable per section 7 below, a second test run at the new reference conditions shall follow as soon as practicable. The results of this test shall establish the additional set of reference values or reference curves. Whenever an additional set of reference values or reference curves is established, the reasons for so doing shall be justified and documented in the record of tests (see ISTB 7). The requirements of section 2 or 3 above apply.

6 TEST PROCEDURE

An inservice test shall be conducted with the pump operating at the specified test conditions. The test parameters shown in Table ISTB 5.2-1 shall be determined and recorded as directed in this paragraph. The test shall be conducted as follows.

(a) The pump shall be operated at nominal motor speed for constant speed drives and at a speed adjusted to the reference speed for variable speed drives.

(b) The resistance of the system shall be varied until the flow rate equals the reference value. The pressure shall then be determined and compared to its reference value. Alternatively, the flow rate can be varied until the pressure equals the reference value, and the flow rate shall be determined and compared to the reference flow rate value.

(c) Where system resistance cannot be varied or if reference curves are used, flow rate and pressure shall be determined and compared to their respective reference values or the associated reference values from the reference curves.

(d) Pressure, flow rate, and vibration (displacement or velocity) shall be determined and compared with corresponding reference values or associated reference values from the reference curves. All deviations from the reference values shall be compared with the limits given in Table ISTB 5.2-2 and Fig. ISTB 5.2-1, and corrective action taken as specified in section 7 below. If the reference curve test method is used, the comparison may be done graphically as shown in Examples 1 and 2 of Fig. 1.

Vibration measurements are to be broad band (unfiltered). If velocity measurements are used, they shall be peak. If displacement amplitudes are used, they shall be peak-to-peak.

7 ACCEPTANCE CRITERIA

If deviations fall within the alert range of Fig. ISTB 5.2-1 and Table ISTB 5.2-2, the frequency of testing specified in ISTB 5.1 shall be doubled until the cause of the deviation is determined and the condition corrected. If deviations fall within the required action range of Table ISTB 5.2-2, the pump shall be declared inoperable until the cause of the deviation has been determined and the condition corrected. If using reference curves, evaluations for deviations in the alert or required action range may be done graphically as demonstrated in Examples 1 and 2 of Fig. 1. When a test shows deviations outside of the acceptable range of Table ISTB 5.2-2, the instruments involved may be recalibrated and the test rerun.

8 RECORDS AND REPORTS

Use of this Code Case shall be documented in the inservice test plans per ISTB 7.2.

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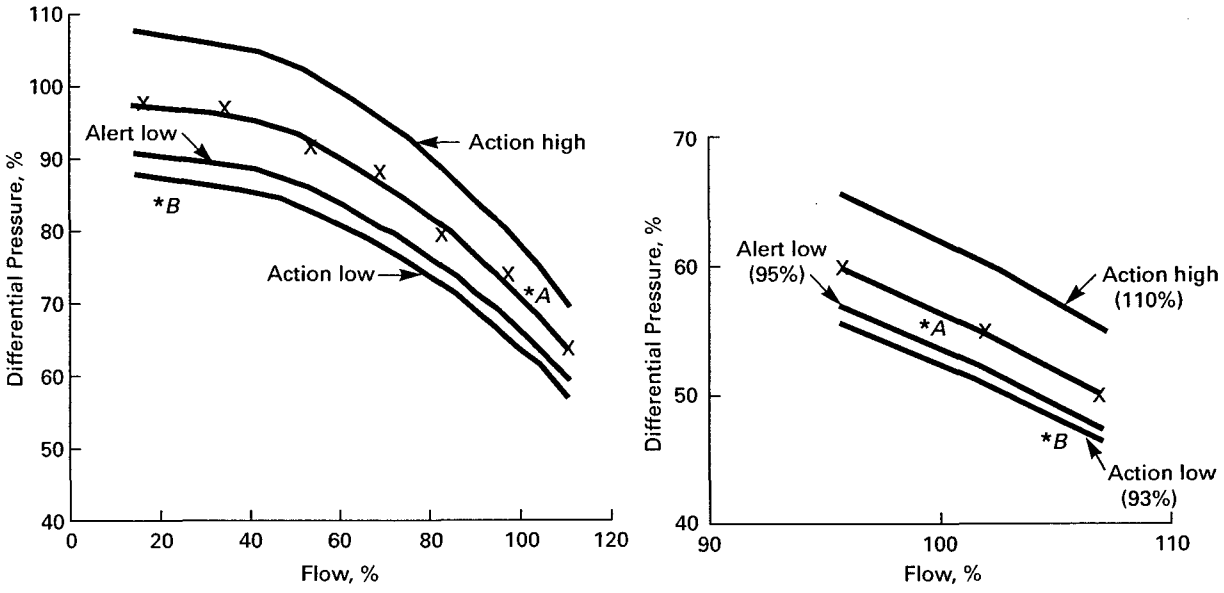

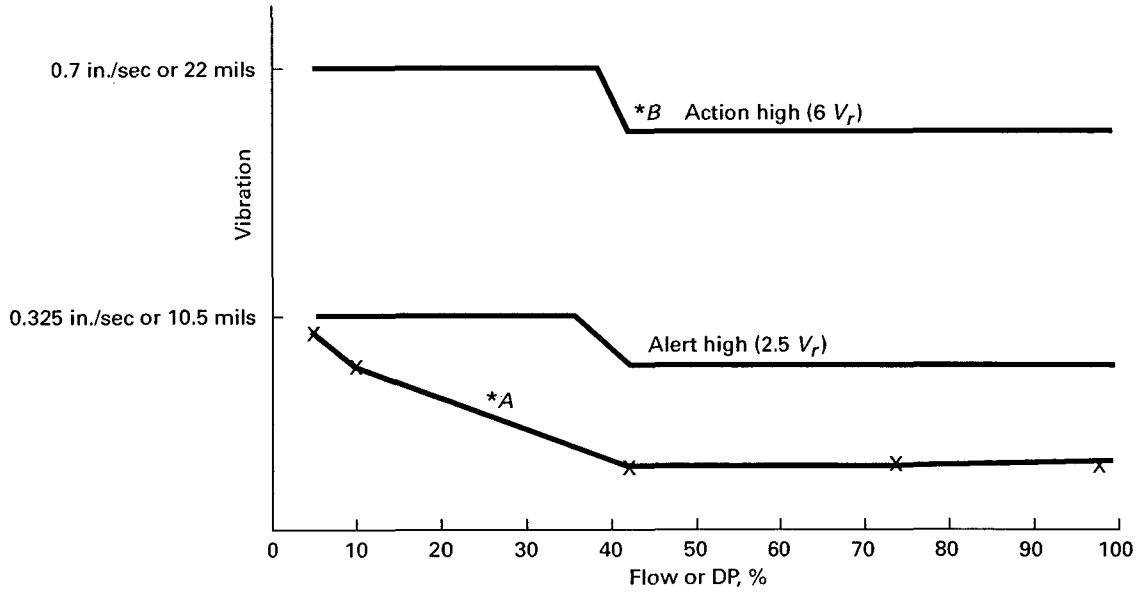

A = acceptable operation
B = required action
X = data points used to establish reference curve

FIG. 1 EXAMPLES OF GRAPHICAL EVALUATION OF TESTS USING REFERENCE CURVES

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(b)

CODE CASE OMN-10
Requirements for Safety Significance Categorization of Snubbers Using Risk Insights and Testing Strategies for Inservice Testing of LWR Power Plants

This Case shall expire on January 26, 2006 unless previously annulled or reaffirmed.

Inquiry: Is it acceptable to categorize those snubbers under the scope of the ASME OM Code into two categories based on their significance for the purpose of applying different examination and testing strategies to those described in ISTD 6 and ISTD 7?

Reply: Yes, provided the following requirements are met.

1 APPLICABILITY

This Code Case establishes the safety categorization methodology and process for dividing the population of snubbers, as identified in the Owner's Snubber Program Plan, into high safety significant component (HSSC) and low safety significant component (LSSC) categories, and provides acceptable testing strategies for each category.

2 SUPPLEMENTAL DEFINITIONS

2.1 PRA Definitions

common cause failure (CCF): a single event that adversely affects two or more components at the same time.

core damage frequency (CDF): the calculated frequency (per year) that core damage will occur due to failure of a critical safety function (i.e., reactivity control, core cooling, or containment heat removal).

Fussell-Vesely (F-V) importance: the fractional decrease in total risk level (usually CDF) when the plant feature is assumed to be perfectly reliable (failure rate = 0.0).

importance measure: a mathematical expression that defines a quantity of interest. The most common importance measures are F-V and RAW.

large early release frequency (LERF): the calculated frequency (per year) that radioactivity release from containment is both large and early. Large means involving the rapid, unscrubbed release of airborne fission products to the environment. Early means occurring before the effective implementation of offsite emergency and protective actions.

Level 1 PRA: a PRA that identifies accident sequences that can lead to core damage, calculates the frequency of each sequence, and sums those frequencies to obtain CDF.

Level 2 PRA: a PRA that identifies accident sequences that can lead to radioactivity release, calculates the frequency of each sequence, and sums up those frequencies to obtain LERF.

living PRA: a plant specific PRA that is maintained up to date, such that plant modifications, plant operation changes (including procedure changes), component performance, and other technical information significantly affecting the model are reflected in the model.

probabilistic risk assessment (PRA): a quantitative assessment of the risk associated with plant operation and maintenance. Risk is measured in terms of the frequency of occurrence of different events, including core damage. In general, the scope of a PRA is divided into three categories: Level 1, Level 2, and Level 3. A Level 1 maps from initiating events to plant damage states, including their aggregate, core damage. Level 2 includes Level 1 mapping from initiating events to release categories (source term).

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CODE CASE OMN-11
Risk-Informed Testing for Motor-Operated Valves (b)

This Code Case shall expire on March 3, 2006 unless previously annulled or reaffirmed.

Inquiry: What alternatives may be used for a risk-informed program in lieu of the testing frequency requirements of Code Case OMN-1, para. 3.3 for Inservice Testing of Motor-Operated Valves?

Reply: It is the opinion of the Committee that the following test frequency alternative requirements are an acceptable method of meeting the requirements of OMN-1, paras. 3.3 and 3.7 and may be applied.

1 SAFETY SIGNIFICANCE CATEGORIZATION

Motor-operated valves (MOVs) shall be evaluated and categorized as High Safety Significant Components (HSSCs) or Low Safety Significant Components (LSSCs), in accordance with the safety significance categorization methodology prescribed in Code Case OMN-3. The risk evaluation process may identify MOVs that were not previously included within the scope of OMN-1 but are applicable under a risk-informed program.

2 HSSC INSERVICE TESTING

HSSC MOVs shall be tested in accordance with OMN-1, para. 3.3, using established test frequencies and utilizing a mix of static and dynamic MOV performance testing.

3 LSSC INSERVICE TESTING

(a) LSSC grouping shall be technically justified, but need not comply with all the requirements of OMN-1, para. 3.5.

(b) LSSC MOVs shall be associated with an established group of other MOVs wherever possible. When a member of that group is tested, the test results shall be analyzed and evaluated in accordance with OMN-1, section 6, and applied to all LSSCs associated with that group.

(c) LSSC MOVs that are not able to be associated with an established group, shall be inservice tested in accordance with OMN-1, para. 3.3, using an initial test frequency of three refueling cycles or 5 years (whichever is longer) until sufficient data exist to determine a more appropriate test frequency.

(d) LSSC MOVs shall be inservice tested at least every 10 years in accordance with OMN-1, para. 3.3.1(c).

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CODE CASE OMN-12
Alternate Requirements for Inservice Testing Using Risk Insights for Pneumatically and Hydraulically Operated Valve Assemblies in Light-Water Reactor Power Plants (OM-Code 1998, Subsection ISTC)

This Code Case shall expire on February 15, 2004 unless previously annulled or reaffirmed.

Inquiry: What alternative to the requirements of ISTC-5130 and ISTC-5140 may be used for risk-informed inservice testing of pneumatically and hydraulically operated valve assemblies?

Reply: It is the opinion of the Committee that the following alternative requirements may be used in lieu of ISTC-5130 and ISTC-5140 for risk-informed inservice testing of pneumatically and hydraulically operated valve assemblies.

1 INTRODUCTION

This Code Case establishes alternative requirements for implementing and maintaining a risk-informed inservice testing program for active pneumatically and hydraulically operated valve assemblies in light-water reactor power plants.

2 TERMS AND DEFINITIONS

The following are provided to ensure a uniform understanding of select terms used in this Code Case.

baseline data: one or more values of test parameters measured or determined when the equipment is known to be operating acceptably at conditions including design basis conditions.

baseline test: a performance test to establish baseline data.

bench set: calibration of the actuator spring range to account for the in-service process forces.

critical parameters: one or more specific parameters that must be met for a valve assembly to meet its design function.

design basis conditions: conditions associated with design basis events, as specified in the final safety analysis report or design basis document(s).

dynamic test: a test conducted with system pressure and/or flow.

hydraulic actuator: a device that provides energy to open, close, or position a valve via hydraulic pressure.

hydraulically operated valve assembly (or valve assembly): a valve and its associated hydraulic actuator, including all subcomponents required for the valve assembly to perform its intended safety function.

maximum available pneumatic pressure: the maximum pressure available to the actuator.

performance test: a test to determine whether a system, structure, or component meets specified acceptance criteria.

periodic valve assembly exercising: periodic stroking of the valve assembly to ensure that the valve assembly is not binding and the valve actuator is functional.

pneumatic actuator: a device that provides energy to open, close, or position a valve via pneumatic pressure.

pneumatically operated valve assembly (or valve assembly): a valve and its associated pneumatic actuator, including all subcomponents required for the valve assembly to perform its intended safety function(s).

seat load: the total net contact force between the obturator and the seat under static conditions.

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for continued service to the next examination interval.

3.4 Review of Operational Readiness Test Data

All inservice test data acquired since implementation of the requirements of this Code Case shall be evaluated for indications of snubber degradation or other anomalies. This includes a review of test traces, where available. The results of this evaluation shall be used:

(a) to identify snubbers that are subject to progressive degradation; and

(b) to identify severe operating environments not previously identified.

Where applicable, data gathered prior to implementation of this Code Case shall also be evaluated.

3.5 Examination During Disassembly

Snubbers and snubber parts shall be examined for indications of degradation and severe operating environments during disassembly (e.g., during failure evaluation, refurbishment).

CORRELATION TABLE

1995 Edition and 1996 Addenda	1998 Edition
ISTD 1.13	ISTD-1750
ISTD 6	ISTD-4200
ISTD 6.1, 6.2, 6.3, 6.4	ISTD-4210, 4220, 4230, 4240
IST 6.5.1	ISTD-4251
ISTD 6.5.2(a)	ISTD-4252(a)
ISTD 6.5.2(b)	ISTD-4252(b)
ISTD 6.5.2(c)	ISTD-4252(c)
ISTD 8	ISTD-6000
ISTD 8.5	ISTD-6500
Table ISTD 6.5.2-1	Table ISTD-4252-1

3.6 Transient Dynamic Event

The service life evaluation required by para. 2.1 of this Code Case shall include any transient dynamic event and actions taken under ISTD 1.13.

3.7 Frequency of Examinations

All snubbers within the scope of ISTD shall be examined and evaluated per ISTD 6.1, ISTD 6.3, and ISTD 6.4 at least once every 10 years.

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CODE CASE OMN-14
Alternative Rules for Valve Testing Operations and Maintenance, Appendix I: BWR CRD Rupture Disk Exclusion

(Applicability: ASME OMc Code-1994 through ASME OMb Code-1997)

This Case shall expire on February 10, 2006 unless previously annulled or reaffirmed.

Inquiry: What alternative to the requirements of the OM Code Appendix I, I-1.3.4 and I-1.3.6 may be used for rupture disks located in the Scram Accumulators of BWRs?

Reply: It is the opinion of the Committee that in lieu of the requirements of the OM Code Appendix I, I-1.3.4 and I-1.3.6 for rupture disks in the Scram Accumulators of BWRs, testing and replacement may be performed in accordance with the Owner's inspection procedures.

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OM CODE CASES

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The Cases affected by this supplement (OMa Code-2002) are as follows:

Page	*Location*	*Change*
C-1	OMN-1	Revised
C-11–C-18.3	OMN-3	(1) Revised (2) Appendix A revised (3) Appendix B added
C-22	OMN-7	New expiration date: January 30, 2005

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CODE CASE OMN-1
Alternative Rules for Preservice and Inservice Testing of Certain Electric Motor-Operated Valve Assemblies in Light-Water Reactor Power Plants OM Code-1995, Subsection ISTC

(a)

This Case shall expire on March 30, 2004 unless previously annulled or reaffirmed.

Inquiry: What alternative rules, to those of OM Code, Subsection ISTC, may be used for preservice and inservice testing to assess the operational readiness of certain electric motor-operated valve assemblies in light-water reactor power plants?

Reply: It is the opinion of the Committee that, in lieu of the rules for preservice and inservice testing to assess the operational readiness of certain electric motor-operated valve assemblies in light-water reactor power plants in OM Code, Subsection ISTC, except for ISTC 4.3 (1995 Edition with the 1996 and 1997 Addenda) or ISTC-3600 (1998 Edition with the 1999 and 2000 Addenda) as applicable, the following alternative requirements may be applied. Electric motor-operated valves for which seat leakage is limited to a specific maximum amount in the closed position for fulfillment of their required function (Category A) must also be seat leakage rate tested in accordance with the requirements of ISTC 4.3 (1995 Edition with the 1996 and 1997 Addenda) or ISTC-3600 (1998 Edition with the 1999 and 2000 Addenda) as applicable.

NOTE: The terms "shall consider" and "shall be considered" are used in paras. 3.5, 3.6.2, and 3.7.1 of this Code Case. The Code Case does not dictate how the considerations in the paragraphs are implemented or documented. Users of the Code Case will determine the best methods based on their programs, which may include procedures, checklists, training, or other methods.

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1 INTRODUCTION

1.1 Scope

This Code Case establishes the requirements for preservice and inservice testing to assess the operational readiness of certain motor-operated valves (MOVs) in light-water reactor (LWR) power plants.

The MOVs covered are those required to perform a specific function in shutting down a reactor to the safe shutdown condition, in maintaining the safe shut-down condition, or in mitigating the consequences of an accident.

This Code Case establishes test methods, test intervals, parameters to be measured and evaluated, acceptance criteria, corrective actions, and records requirements.

1.2 Exclusions

MOVs in the following categories are excluded from this Code Case, if they are not specifically required to perform a function described in para. 1.1:

(a) MOVs used only for operating convenience, such as vent, drain, instrument, and test valves;

(b) MOVs used only for system control, such as pressure regulating valves;

(c) MOVs used only for system or component maintenance;

(d) MOVs not required to change position.

External control and protection systems that sense plant conditions and provide signals for MOV operation are also excluded from the requirements of this Code Case.

2 SUPPLEMENTAL DEFINITIONS

motor-operated valve (MOV): a valve and its associated electric motor-driven mechanism for positioning the valve, including components that control valve action and provide position output signals.

MOV functional margin: the increment by which an MOV's available capability exceeds the capability required to operate the MOV under design basis conditions.

stem factor: the ratio of stem torque to stem thrust in rising-stem valves.

design basis stem factor: the greatest value for stem factor expected during design basis operation of an MOV.

3 GENERAL REQUIREMENTS

3.1 Design Basis Verification Test

A one-time test shall be conducted to verify the capability of each MOV to meet its safety-related design basis requirements. This test shall be conducted at conditions as close to design basis conditions as practicable. Requirements for a design basis verification test are specified in applicable regulatory documents. Testing that meets the requirements of this Code Case but conducted before implementation of this Code Case may be used.

(a) Design basis verification test data shall be used in conjunction with preservice test data as the basis for inservice test criteria.

(b) Design basis verification testing shall be conducted in situ or in a prototype test facility that duplicates applicable design basis conditions. If a test facility is used, an engineering analysis shall be documented that supports applicability to the in situ conditions.

(c) 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.

(d) The design basis verification test shall be repeated if an MOV application is changed, the MOV is physically modified, or the system is modified in a manner that invalidates its current design basis verification test results or data. A determination that a design basis verification test is still valid shall be justified by an engineering evaluation, alternative testing techniques, or both.

3.2 Preservice Test

Each MOV shall be tested during the preservice test period or before implementing inservice testing. These tests shall be conducted under conditions as near as practicable to those expected during subsequent inservice testing. Testing that meets the requirements of this Code Case but conducted before implementation of this Code Case may be used. Only one preservice test of each MOV is required unless, as described in para. 3.4, the MOV has undergone maintenance that could affect its performance.

3.3 Inservice Test

Inservice testing shall commence when the MOV is required to be operable to fulfill its required

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CODE CASE OMN-3 (a)
Requirements for Safety Significance Categorization of Components Using Risk Insights for Inservice Testing of LWR Power Plants

This Case shall expire on March 30, 2004 unless previously annulled or reaffirmed.

Inquiry: Is it acceptable to categorize those components under the scope of the ASME OM Code Section IST into two categories based on their safety significance?

Reply: Yes, provided the following requirements are met.

1 APPLICABILITY

This Code Case establishes the component safety categorization methodology and process for dividing the population of pumps and valves, as identified in the IST Program Plan, into "high safety significant component" (HSSC) and "low safety significant component" (LSSC) categories.

2 SUPPLEMENTAL DEFINITIONS

aggregate risk: the risk due to programmatic changes in the IST program (test method effectiveness and/or testing interval) as measured by CDF or LERF.

basic event: basic fault event in a fault-free model that requires no further development, because appropriate limit of resolution has been reached.

common cause failure (CCF): a single event that adversely affects two or more components at the same time.

core damage frequency (CDF): the calculated frequency (per year) that core damage will occur due to failure of a critical safety function (i.e., reactivity control, core cooling, or containment heat removal). (A Level 1 PRA identifies accident sequences that can lead to core damage, calculates the frequency of each sequence, and sums those frequencies to obtain CDF.)

decision criteria: the quantitative and qualitative factors that influence a decision. These include both quantitative screening criteria (for PRA model) and the evaluation of other qualitative (or deterministic) factors that influence the results of an application.

figures-of-merit: the quantitative value, obtained from a PRA analysis, used to evaluate the results of an application (e.g., CDF, LERF).

Fussell-Vesely (F-V) importance measure: for a specified basic event, Fussell-Vesely importance is the fractional contribution to the total of a selected figure of merit for all accident sequences containing that basic event.

high safety significant components (HSSCs): components that have been designated as more important to plant safety by a blended process of PRA risk ranking and Plant Expert Panel evaluation.

importance measure: a mathematical expression that defines a quantity of interest. The most common importance measures are F-V and RAW.

inservice test (IST): a test to determine the operational readiness of a component/system.

initiating event: any event that perturbs the steady state operation of the plant, if operating, or the steady state operation of the decay heat removal system during shutdown operations, thereby initiating a transient within the plant. (Initiating events trigger sequences of events that challenge plant control and safety systems.)

large early release frequency (LERF): the calculated frequency (per year) that radioactivity release from the containment is both large and early. "Large" means involving the rapid, unscrubbed release of

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airborne fission products to the environment. "Early" means occurring before the effective implementation of off-site emergency and protective actions. (A Level 2 PRA identifies accident sequences that can lead to radioactivity release, calculates the frequency of each sequence, and sums these frequencies to obtain LERF.)

living PRA: a plant specific PRA that is maintained up to date, such that plant modifications, plant operation changes (including procedure changes), component performance, and other technical information significantly affecting the model are reflected in the model.

low safety significant components (LSSCs): components that have been designated as less important to plant safety by a blended process of PRA risk ranking and Plant Expert Panel evaluation.

operational readiness: the ability of a component to perform its intended system function when required.

PRA failure rate: the conditional probability of failure of a component on the next demand (for standby component) or in the next hour of operation (for operating component), given that it has not already failed.

probabilistic risk assessment (PRA): a quantitative assessment of the risk associated with plant operation and maintenance. Risk is measured in terms of the frequency of occurrence of different events, including core damage. In general the scope of a PRA is divided into three categories: Level 1, Level 2, and Level 3. A Level 1 maps from initiating events to plant damage states, including their aggregate, core damage. Level 2 includes Level 1 mapping from initiating events to release categories (source term). A Level 3 includes Level 2 and uses the source term of Level 2 to quantify consequences, the most common of which are health effects and property damage in terms of cost.

risk achievement worth (RAW) importance measure: for a specified basic event, risk achievement worth importance reflects the increase in a selected figure of merit when an SSC is assumed to be unable to perform its function due to testing, maintenance, or failure. It is the ratio or interval of the figure of merit, evaluated with the SSC's basic event probability set to one, to the base case figure of merit.

testing strategy: the IST strategy to measure component degradation or to monitor a component for operational readiness at some interval by operating or inspecting the component (e.g., valve stroking, pump vibration test, motor circuit evaluation, motor current signature analysis, component bearing lube oil analysis).

truncation limits: the cutoff value of probability or frequency of individual accident sequences below which they are no longer retained in quantitative PRA model results.

3 GENERAL REQUIREMENTS

3.1 Implementation

The requirements of the risk-informed IST component code cases shall be implemented for all IST components of the same type. Component types are specified in the risk informed component code cases.

3.2 Plant Specific PRA

The plant specific PRA (Level 1 with internal initiating events, as a minimum) shall be available and used to perform component risk ranking.

3.3 Living PRA

The PRA shall be maintained up to date. (Reference 1 provides guidance.)

3.4 Integrated Effects

Components may be affected by more than one risk informed application. Integrated effects of multiple risk informed applications (including risk informed applications outside of the ASME scope) shall be evaluated.

3.5 Plant Expert Panel

A Plant Expert Panel shall be designated to perform the blended safety evaluation of probabilistic and deterministic engineering information for each component.

3.6 Determination of HSSC and LSSC

The Plant Expert Panel shall evaluate each component and categorize it as HSSC or LSSC, using PRA quantitative information (if component is modeled) and engineering qualitative information (for both modeled and not modeled components).

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3.7 Inservice Testing Strategy for HSSCs and LSSCs

Testing strategies will be developed by other risk informed component code cases:

(a) Test strategies for the HSSCs shall have the objective of identifying and trending degradation that could lead to the occurrence of the failure mode(s) that resulted in the HSSC categorization.

(b) Test strategies for LSSCs shall have the objective of providing confidence for operational readiness.

3.8 Evaluation of Aggregate Risk

The aggregate risk impact of changes to the IST program shall be evaluated by the Owner (e.g., plant expert panel). Decision criteria, quantitative evaluations, and qualitative assessments are a part of this aggregate risk impact evaluation. Reference 1 provides guidance on evaluating aggregate risk.

3.9 Feedback and Corrective Actions

Feedback and corrective action processes are required elements of this Code Case.

4 SPECIFIC REQUIREMENTS

In addition to section 3 above, the following requirements apply to component classification into HSSC and LSSC categories, and to a risk-informed IST program based on those categories.

4.1 Component Risk Categorization

This paragraph establishes requirements for separating components into HSSC or LSSC categories, performing PRA sensitivity studies to ensure that quantitative ranking is correct, and determining how to treat components not modeled.

4.1.1 Appropriate Failure Modes. Component risk categorization shall be based on basic events that include failure modes representing functions addressed by inservice testing (e.g., pump failure to run, valve failure to open, common cause failure).

4.1.2 Importance Measures

(a) As a minimum, two importance measures, F-V and RAW, shall be calculated for those components modeled in the PRA.

(b) Importance measures should be evaluated for both CDF and LERF, if available.

4.1.3 Screening Criteria. For those components modeled in the PRA:

(a) a threshold value of F-V>0.005 or lower based on either CDF or LERF should be initially considered as HSSC;

(b) a threshold value of RAW>2 based on either CDF or LERF shall be initially considered as HSSC.

4.1.4 Sensitivity Studies

(a) The following sensitivity studies shall be performed:

(1) Data and Uncertainties. Failure probabilities of components within the PRA models for those IST components that have initially very high or very low safety significance shall be selectively increased and/or decreased to determine if the results are sensitive to changes in the failure data. If sensitivities are indicated, steps shall be taken to determine if uncertainty ranges can be reduced and to validate the failure probabilities included in the models.

(2) Human Recovery Actions. The PRA shall be requantified, and the F-V and RAW importance measures recalculated, after human actions modeled in the PRA to recover from specific component failures are adjusted in the models (i.e., the probability of successful recovery due to human intervention is adjusted by factor of ten).

(3) Test and Maintenance Unavailabilities. The PRA models shall be requantified with test and maintenance unavailabilities adjusted, and the importance measures recalculated.

(4) LSSC Failure Rates. Failure rates for initially ranked LSSC components shall be increased by a factor representing the upper bound (95%) of the failure rate and the PRA models requantified. The importance measures shall then be recalculated.

(5) Truncation Limits. If the PRA has not been quantified with a truncation limit in accordance with Ref. 1, the PRA model shall be requantified with the truncation limit lowered to this value. The importance measures shall then be recalculated.

(6) Common Cause. Sensitivity analyses shall determine the impact of increased or decreased common cause failure rates. Importance measures shall then be recalculated.

(b) The results of these sensitivity studies and any others that are performed, shall be documented. In addition to the magnitude of the changes to the CDF or LERF, all insights obtained from the results shall be described.

(c) The results and insights of these sensitivity studies shall be provided to the Plant Expert Panel

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for their consideration in the final categorization of the components.

4.1.5 Qualitative Assessments. Qualitative assessments shall be performed for all IST components, modeled and not modeled in the PRA to determine whether there are other bases for categorizing IST components.

(a) The following qualitative assessments shall be performed:

(1) impact of initiating events (i.e., the impact of failure or degradation as it might result in an initiator, component contribution to initiating events represented by point estimates);

(2) potential consequences of shutdown (outage) conditions;

(3) response to external initiating events (e.g., seismic, fire, high winds/tornadoes, flooding, etc.);

(4) impact of LERF, if not used in para. 4.1.2(b).

(b) Qualitative assessments shall be performed for plant-specific design bases conditions and events not modeled in a PRA.

(c) Qualitative assessments shall consider the impacts upon the plant to:

(1) prevent or mitigate accident conditions;

(2) reach and/or maintain safe shutdown conditions;

(3) preserve the reactor primary coolant pressure boundary integrity; and

(4) maintain containment integrity.

(d) Qualitative assessments shall also consider:

(1) safety function being satisfied by the component's operation;

(2) level of redundancy existing at the plant to fulfill the component's function;

(3) ability to recover from a failure of the component;

(4) performance history of the component;

(5) plant technical specifications requirements applicable to the component;

(6) emergency operating procedure instructions that use the component(s); and

(7) design and current licensing basis information relevant to IST component function.

(e) The cumulative impacts of combinations of component unavailability, which could impact an entire system (e.g., multitrain impacts) or critical safety function (e.g., multisystem impacts), shall also be considered.

(f) These qualitative assessments shall be available to the Plant Expert Panel for their decision of component safety categorization.

(g) These qualitative assessments and the Plant Expert Panel's disposition of them shall be documented.

4.1.6 Components Not Modeled. If IST components not modeled in the PRA are subsequently determined by the Plant Expert Panel to have an impact upon the ability of the facility to respond to analyzed events, consideration should be given to updating the PRA model to incorporate the effects of the component(s), then using the updated model to provide a quantified basis for categorization (either HSSC or LSSC).

4.2 Component Safety Categorization

This paragraph provides requirements for the Plant Expert Panel's review and evaluation process for categorizing IST components relative to their safety significance, using both deterministic and probabilistic insights.

4.2.1 Plant Expert Panel Utilization. The Plant Expert Panel shall blend deterministic and probabilistic information to classify IST components into HSSC or LSSC categories.

(a) PRA Insights. The results of PRA analyses shall be used by the Plant Expert Panel to determine the safety significance of components within the scope of IST and PRA programs. Information contained in PRAs relative to the role of components in mitigating or preventing core damaging events or radiological release events shall be considered. The scope of the PRA and depth of probabilistic analyses shall be assessed, evaluated, and documented. As a minimum, the following shall be documented:

(1) The level of plant specific PRA analysis available for assessing the applicability of PRA information relative to IST programs. For example, written documentation describing the level of plant specific PRA analysis such as Level 1 PRA (assessment of core damage frequency) and/or Level 2 PRA (assessment of core damage frequency plus containment performance).

(2) Scope of initiating events considered (internal events, external events, both).

(3) Typical failure modes considered (e.g., hardware failures, testing/maintenance failures, common cause failures, human errors).

(4) PRA scope for plant configurations (e.g., low power risk, shutdown risk, transition mode risk,

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at-power risk) reviewed relative to the applicability of PRA information and IST component function(s).

(b) Deterministic Insights. The Plant Expert Panel shall also consider deterministic factors when assessing the safety significance of components within the scope of IST programs (See Appendix A of this Code Case for a sample list of deterministic questions).

4.2.2 Plant Expert Panel Requirements

(a) Plant Procedure. A procedure approved by the Owner shall describe the process, including:

(1) designated members and alternates;

(2) designated chairman and alternate;

(3) quorum;

(4) attendance records;

(5) agendas;

(6) motions for approval;

(7) process for decision making;

(8) documentation and resolution of differing opinions;

(9) minutes;

(10) implementation of feedback/corrective actions;

(11) feedback to the PRA; and

(12) required training.

(b) Training. The Plant Expert Panel shall be trained and indoctrinated by the Owner in the specific requirements to be used for this Code Case. Training and indoctrination shall include the application of risk analysis methods and techniques used for this Code Case. At a minimum, the risk methods and techniques include:

(1) PRA fundamentals (e.g., PRA technical approach, PRA assumptions and limitations, failure probability, truncation limits, uncertainty);

(2) use of risk importance measures;

(3) assessment of failure modes;

(4) reliability versus availability;

(5) risk thresholds; and

(6) expert judgment elicitation.

Each of the aforementioned topics shall be covered in the indoctrination to the extent necessary to provide the Plant Expert Panel with a level of knowledge needed to adequately evaluate and approve the scope of the IST selections, using both probabilistic and deterministic information.

(c) Expertise. Requirements for ensuring adequate expertise levels of Plant Expert Panel members. Member expertise levels shall be documented and maintained.

(d) Membership

(1) There shall be at least five experts designated as members of the Plant Expert Panel. Members may be experts in more than one field; however, excessive reliance on any one member's judgment shall be avoided.

(2) The chairperson shall be familiar with this Code Case and shall facilitate Plant Expert Panel activities, to ensure that the requirements of this Code Case are satisfied.

(3) Expertise in the following functions shall be represented on the Plant Expert Panel:

(a) operation

(b) safety analysis engineering

(c) probabilistic risk assessment

(4) Additional members of the Plant Expert Panel who have the following plant expertise may be selected:

(a) systems performance

(b) maintenance

(c) licensing

(d) component performance

(e) ASME inservice testing

(f) quality assurance

(g) design engineering

(5) Alternate members may be designated to the Plant Expert Panel on a temporary basis; however, vacancies in the Plant Expert Panel membership should be filled by qualified individuals within a reasonable period of time.

(6) Other plant or nuclear industry experts may be invited to attend some or all of the sessions of the Plant Expert Panel as visitors to provide observations, opinions, or recommendations.

4.2.3 Plant Expert Panel Decision Criteria. Plant Expert Panel decision criteria for categorizing components as HSSC and LSSC shall be documented.

4.2.4 Reconciliation. Decisions of the Plant Expert Panel shall be arrived at by consensus. Differing opinions shall be documented and resolved, if possible.

(a) If a resolution cannot be achieved concerning the safety significance classification of a component, then the component shall be classified HSSC.

(b) If components have a high initial ranking from the PRA (i.e., RAW>2 or F-V>0.005) but are ultimately ranked as LSSCs, the Plant Expert Panel decisions shall be documented.

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4.3 Testing Strategy Formulation

(a) Testing strategies for HSSCs and LSSCs shall be developed following the requirements provided in the risk informed component code cases.

(b) After testing strategies are developed, the Owner shall provide the planned changes (e.g., test frequency, testing effectiveness, and test duration) for input to the evaluation of aggregate risk.

4.4 Evaluation of Aggregate Risk

4.4.1 Decision Criteria

(a) Appropriate decision criteria for aggregate risk effects shall be established and documented.

(1) Decision criteria shall be based on thresholds for aggregate risk limits using standard figures-of-merit (e.g., CDF, LERF). (Appendix B provides guidance.)

(2) Performance criteria used for other regulatory requirements may be taken into consideration when developing decision criteria for aggregate risk effects.

(b) Decision criteria may be determined both qualitatively and quantitatively.

4.4.2 Quantitative Assessment

(a) An aggregate risk evaluation shall be performed prior to implementation, as applicable, using the PRA.

(1) Quantitative attributes associated with this Code Case shall be considered and included in the quantitative evaluation, as appropriate, and within the scope of the PRA.

(2) Each applicable quantitative IST attribute shall be incorporated into the quantitative evaluation, as appropriate, until all proposed changes have been dispositioned (i.e., incorporated or not incorporated).

(3) Once all appropriate inputs have been incorporated, the PRA shall be rerun to assess the overall risk impact.

(4) Proposed IST program change shall be assessed to determine compliance with approved decision criteria and to quantitatively determine if any adjustments or compensatory measures are warranted.

(b) Types of quantitative attributes that should be considered in the quantitative evaluation include changes in:

(1) testing frequency;

(2) out of service duration;

(3) failure rates;

(4) failure modes;

(5) common cause failure susceptibility;

(6) compensatory measures; and

(7) testing scheme (staggered or simultaneous testing)

Compensatory measures include both those specifically incorporated into plant programs and those developed by the Owner for specific situations. Management directed compensatory measures should also be included in the quantitative assessment, as appropriate. Verifiable values of failure rates shall be used in the quantification process for IST component.

(c) Testing effectiveness shall be evaluated by periodic assessments or when new failure modes are identified that impact risk quantification.

(1) New failure modes shall be incorporated in accordance with the Owner's risk management and corrective action programs into the quantitative evaluation, as appropriate.

(2) Changes resulting from programs that significantly affect the reliability or availability of components that perform important safety functions shall be assessed, and, if appropriate, incorporated into the PRA for requantification.

Such assessments may be performed in conjunction with the plant specific Maintenance Rule (10 CFR 50.65) requirements.

4.4.3 Qualitative Evaluation

(a) Aggregate risk effects shall be qualitatively evaluated (i.e., risk decreases as well as risk increases) for IST program changes (e.g., testing effectiveness).

(b) Pertinent performance indicators, industry programs, or other scrutable methods for establishing aggregate risk effects shall be identified and monitored.

(c) Feedback processes and corrective action programs shall be considered in the evaluation of aggregate risk.

4.4.4 Defense in Depth. The IST aspects of Defense in Depth shall be maintained.

4.4.5 Safety Margins. The IST aspects of Safety Margin shall be maintained.

4.5 Inservice Testing Program

4.5.1 Maximum Testing Interval. The maximum testing interval shall be based on the more limiting of the following:

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(a) the results of the aggregate risk; and
(b) performance history of the component.

4.5.2 Implementation Schedule. A schedule shall be developed for implementing the testing strategies as specified in the risk informed component code cases.

4.5.3 Assessment of Aggregate Risk. Once the test schedule has been developed, the schedule shall be assessed against the assumptions of the aggregate risk evaluation.

4.5.4 Transition Plan. A transition plan shall be developed for each component type to ensure adequate information is collected to support justification of stepwise test interval extension up to and including the maximum allowable interval. Staggered test intervals are acceptable for implementing a stepwise test interval extension.

4.6 Performance Monitoring

4.6.1 HSSC Attribute Trending. For HSSCs, a set of attributes to be tested, shall be established in accordance with the requirements of risk-informed component code cases and a trending program shall be implemented for those attributes selected for monitoring.

4.6.2 LSSC Performance Trending. For LSSCs, testing strategies shall be identified in accordance with the requirements of risk-informed component code cases and shall trend component performance.

4.7 Feedback and Corrective Actions

4.7.1 Feedback

(a) A feedback process incorporating elements of both conditional and periodic feedback shall be established such that component performance information is directed to both the IST and PRA programs. Conditional feedback shall occur in a timely fashion following component failure. Periodic feedback shall be considered for maintenance of the PRA.

(b) Each program shall assimilate performance information to ensure the appropriate unavailability information is reflected in decision making.

(c) A feedback process shall be established so IST programmatic changes are directed to the PRA program.

4.7.2 Corrective Action. In addition to the requirements in the IST Code of Record with respect to Corrective Actions, a Corrective Action Program shall be established that identifies and tracks to resolution all failures of similar types of components within an IST Program incorporating risk insights, including evaluation of generic implications.

4.7.3 Component Safety Recategorization. The component's operational readiness is not changed by recategorization.

5 RESERVED

6 RESERVED

7 RESERVED

8 RECORDS AND REPORTS

In addition to the requirements in the Code of Record with respect to Records, the following records of the Plant Expert Panel and the component shall be maintained.

8.1 Plant Expert Panel Records

(a) Membership and attendance
(b) Member expertise representation and training records per para. 4.2.2(b)
(c) Member experience (years of experience in each of the expertise categories)
(d) Meeting agendas
(e) Meeting minutes
(f) Plant procedure

8.2 Component Records

(a) Risk significance based on PRA importance measures
(b) Additional PRA quantitative information
(c) Deterministic information
(d) Plant Expert Panel categorization decisions of HSSC or LSSC
(e) Basis for the HSSC/LSSC decision

9 REFERENCES

EPRI TR. 105396, PSA Applications Guide, August 1995

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APPENDIX A
Sample List of Component Deterministic Questions

This nonmandatory Appendix provides guidance to the Plant Expert Panel for categorizing components as HSSC or LSSC.

A1 DESIGN BASIS ANALYSIS

(a) Is component considered in design basis analysis?

(b) Is component function considered important in the Safety Analysis Report?

(c) Are there any Tech Spec considerations for this component?

A2 RADIOACTIVE MATERIAL RELEASE LIMIT

(a) Could the failure of this component be considered a breach in an engineered safety barrier?

(b) Could the failure of this component result in an uncontained release of radioactive material in excess of that allowed?

A3 MAINTENANCE RELIABILITY

(a) Is component important to maintaining system reliability?

(b) What type of component failures have been experienced for this and similar style components?

(c) What does the maintenance history indicate about the reliability of this component?

(d) Does the component receive preventive maintenance and is it effective for preventing identified failures?

(e) How are component failures detected?

A4 EFFECT OF COMPONENT FAILURE ON SYSTEM OPERATIONAL READINESS

(a) Is component important to maintaining system availability?

(b) How does component failure affect system performance?

(c) Does component failure cause other system component failures?

(d) What is the system component level of defense in depth?

(e) Does the system or component perform other functions outside the scope of the PRA?

(f) Can system or component failure modes affect redundant trains or other similar component?

A5 OTHER DETERMINISTIC CONSIDERATIONS

(a) Should other component failure modes be considered in the PRA model?

(b) Is this component used to mitigate the consequences of an accident caused by external events?

(c) Is this component important for safe shutdown?

(d) Is this component required to maintain the safe shutdown condition?

(e) Should other component failure modes which may not be included in the PRA be considered (e.g., aging effects, structural supports, human performance failures).

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APPENDIX B
Acceptance Guidelines

This nonmandatory Appendix provides guidance on the decision criteria for aggregate risk limits using CDF and LERF.

The risk acceptance guidelines presented in this Appendix are structured as follows. Regions are established in the two planes generated by a measure of the baseline risk metric (CDF or LERF) along the *x*-axis, and the change in those metrics (CDF or LERF) along the *y*-axis (Figs. B-1 and B-2), and acceptance guidelines are established for each region as discussed below. These guidelines are intended for comparison with a full PRA scope (including internal events, external events, full power, low power, and shutdown) assessment of the change in risk metric, and, when necessary, as discussed below, the baseline value of the risk metric (CDF or LERF). However, it is recognized that many PRAs are not full scope and the use of less than full-scope PRA information is acceptable as discussed in this Code Case.

There are two acceptance guidelines, one for CDF and one for LERF, both of which should be used.

(a) The acceptance guidelines for CDF are as follows:

(1) If the change can be clearly shown to result in a decrease in CDF, then the change is satisfactory.

(2) When the calculated increase in CDF is very small, which is taken as being less than 1E-06 per reactor year, the change should be considered, regardless of whether there is a calculation of the total CDF (Region III). While there is no requirement to calculate the total CDF, should there be an indication that the CDF may be considerably higher than 1E-04 per reactor year, then the focus should be on finding ways to decrease CDF. Such an indication would result, for example, if:

(a) the contribution to CDF calculated from a limited scope analysis, such as the PRA, and, if appropriate the PRA with external initiating events, significantly exceeds 1E-04;

(b) there has been an identification of a potential vulnerability from a margin-type analysis; or

(c) historical experience at the plant in question has indicated a potential safety concern.

(3) When the calculated increase in CDF is in the range of 1E-06 per reactor year to 1E-05 per reactor year, changes should only be considered if it can be reasonably shown that the total CDF is less than 1E-04 per reactor year (Region II).

(4) Applications that result in increases to CDF above 1E-05 per reactor year (Region I) should not normally be considered.

(b) The acceptance guidelines for LERF are as follows:

(1) If the change can be clearly shown to result in a decrease in LERF, then the change is satisfactory.

(2) When the calculated increase in LERF is very small, which is taken as being less than 1E-07 per reactor year, the change should be considered, regardless of whether there is a calculation of the total LERF (Region III). While there is no requirement to calculate the total LERF, should there be an indication that the LERF may be considerably higher than 1E-05 per reactor year, then the focus should be on finding ways to decrease rather than increase it. Such an indication would result, for example, if:

(a) the contribution to LERF calculated from a limited scope analysis, such as that the IPE, and, if appropriate the IPEEE, significantly exceeds 1E-05;

(b) there has been an identification of a potential vulnerability from a margin-type analysis; or

(c) historical experience at the plant in question has indicated a potential safety concern.

(3) When the calculated increase in LERF is in the range of 1E-07 per reactor year to 1E-06 per reactor year, changes should only be considered if it can be reasonably shown that the total LERF is less than 1E-05 per reactor year (Region II).

(4) Changes that result in increases to LERF above 1E-06 per reactor year (Region I) should not normally be considered.

These acceptance criteria are intended to provide assurance that proposed increases in CDF and LERF are small.

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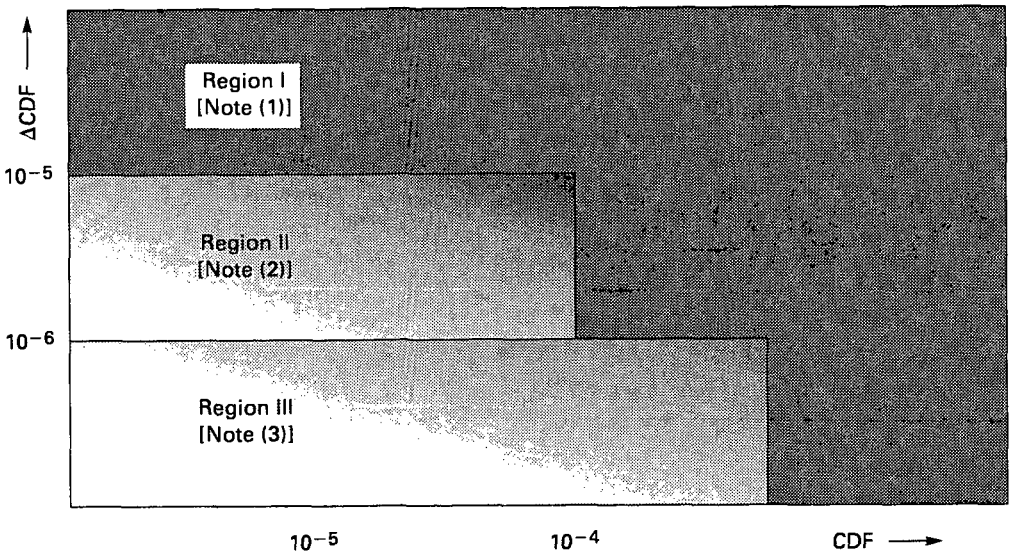

NOTES:
(1) Region I: No changes allowed.
(2) Region II:
  (a) Small changes
  (b) Track cumulative impacts
(3) Region III:
  (a) Very small changes
  (b) More flexibility with respect to baseline CDF
  (c) Track cumulative impacts

FIG. B1 ACCEPTANCE GUIDELINES FOR CDF (FROM RG 1.174)

The analysis may be subject to a more detailed technical and management review depending upon the degree to which a change resides in a given region. In the context of the integrated decision making by the Plant Expert Panel, the boundaries between regions should not be interpreted as being definitive; the numerical values associated with defining the regions in the figure are to be interpreted as being absolute.

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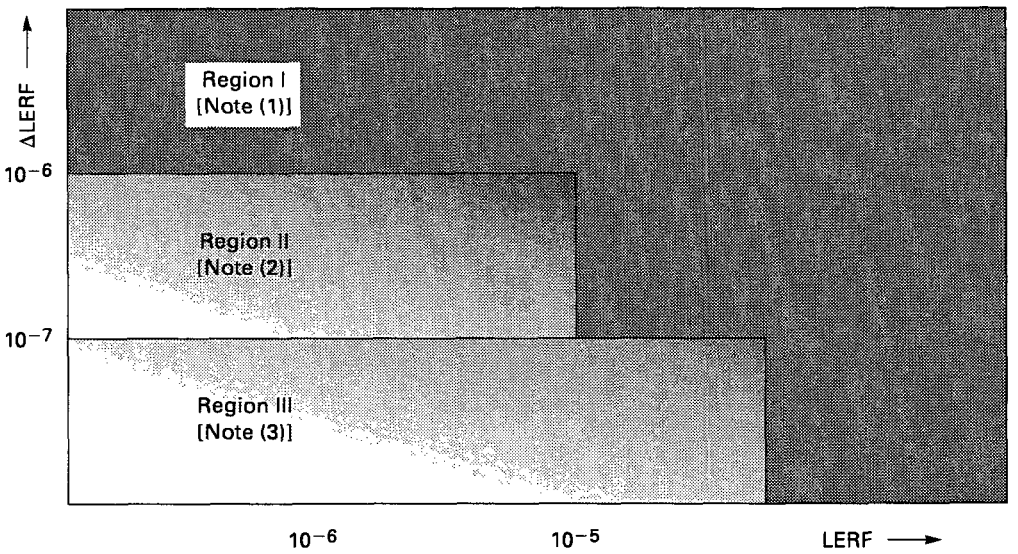

NOTES:
(1) Region I: No changes allowed.
(2) Region II:
    (a) Small changes
    (b) Track cumulative impacts
(3) Region III:
    (a) Very small changes
    (b) More flexibility with respect to baseline LERF
    (c) Track cumulative impacts

FIG. B2 ACCEPTANCE GUIDELINES FOR LERF (FROM RG 1.174)

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CODE CASE OMN-6
Alternate Rules for Digital Instruments

This Case shall expire on March 30, 2004 unless previously annulled or reaffirmed.

Inquiry: What alternative requirements to those specified in OM Code, ISTB 4.6.1(b)(2) [ISTB 4.7.1(b)(2) in 1994 addenda and later] may be used for digital instruments used in the performance of inservice testing?

Reply: It is the opinion of the Committee that digital instruments may be selected such that the reference value does not exceed 90% of the calibrated range of the instrument.

Applicability: ASME OM Code-1990 Edition through ASME OMb Code-1997 Addenda.

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(a)

CODE CASE OMN-7
Alternative Requirements for Pump Testing

This Case shall expire on January 30, 2005 unless previously annulled or reaffirmed.

Inquiry: What alternative to the requirements of ASME OM Code, Subarticle ISTB-5.1 may be used in conjunction with Code Case OMN-3, Requirements for Safety Significance Categorization of Components Using Risk Insights for Inservice Testing of LWR Power Plants, for inservice testing to assess the operational readiness of pumps in light water reactor power plants?

Reply: It is the opinion of the Committee that, in lieu of the rules of ASME OM Code, Subsection ISTB, Subarticle ISTB-5.1, the following alternative requirements may be applied.

1 APPLICABILITY

The pumps covered by this Code Case are all those pumps determined to be within the scope of the risk-informed IST Program in accordance with Code Case OMN-3, Requirements for Safety Significance Categorization of Components Using Risk Insights for Inservice Testing of LWR Power Plants.

2 REQUIREMENTS

2.1 Related Requirements

Use of this Code Case also requires compliance with the requirements of ASME Code Case OMN-3 (risk ranking). Code Case OMN-3 groups components into one of two categories:

(a) high safety significant component (HSSC); or

(b) low safety significant component (LSSC).

Trending of parameters according to OM Code-1995 with OMa Code-1996 meets the performance monitoring requirements of Code Case OMN-3, para. 4.6.

2.2 HSSC Testing Requirements

Group A and Group B pumps categorized as HSSCs shall meet all the requirements of OM Code-1995 with OMa Code-1996.

2.3 LSSC Testing Requirements

Group A and Group B pumps categorized as LSSCs shall meet all the requirements of OM Code-1995 with OMa Code-1996, except that the testing requirements identified in this paragraph and in the table below may be substituted for those in ISTB 5.1 (Table ISTB 5.1-1). All Group A and Group B LSSC pumps shall receive an initial Group A test conducted within ±20% of pump design flow rate as soon as practical and no later than the first refueling outage following implementation of this Code Case. Thereafter, all Group A and Group B LSSC pumps shall be Group A tested within ±20% of pump design flow rate at least once every 5 years or three refueling outages, whichever is longer.

Pump Group	Group A Test	Group B Test	Comprehensive Test
Group A (routinely or continuously operated pumps)	6 months [Note (1)]	Not required	Not required
Group B (standby pumps)	2 years	6 months [Note (1)]	Not required

NOTE:
(1) To meet vendor recommendations, pump operation may be required more frequently than the specified test frequency.

3 ADDITIONAL REQUIREMENTS

(a) The Owner shall develop a transition plan and implementation schedule for this Code Case.

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OM CODE CASES

A Code Case is the official method of handling a reply to an inquiry when study indicates that the Code wording needs clarification, or when the reply modifies the existing requirements of the Code, or grants permission to use alternative methods.

ASME has agreed to publish Cases issued by the Operation and Maintenance Committee concerning the OM Code as part of the update service to the OM Code. A notice appears in *Mechanical Engineering* when new and revised Cases are approved, as well as announcements of approval of reaffirmed Cases and annulments. All Code Case actions then appear in the next update. Cases currently in effect at the time of publication of a new edition of the Code are included with it as a supplement.

The Cases affected by this supplement are as follows:

Page	*Location*	*Change*
C-1	OMN-1	New expiration date: March 30, 2004
C-10	OMN-2	New expiration date: March 30, 2004
C-11	OMN-3	New expiration date: March 30, 2004
C-19	OMN-4	New expiration date: March 30, 2004
C-20	OMN-5	New expiration date: March 30, 2004
C-21	OMN-6	New expiration date: March 30, 2004
C-35	OMN-11	Added
C-36	OMN-12	Added
C-42	OMN-13	Added

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CODE CASE OMN-1
Alternative Rules for Preservice and Inservice Testing of Certain Electric Motor-Operated Valve Assemblies in Light-Water Reactor Power Plants OM Code-1995, Subsection ISTC

This Case shall expire on March 30, 2004 unless previously annulled or reaffirmed.

Inquiry: What alternative rules, to those of OM Code, Subsection ISTC, may be used for preservice and inservice testing to assess the operational readiness of certain electric motor-operated valve assemblies in light-water reactor power plants?

Reply: It is the opinion of the Committee that, in lieu of the rules for preservice and inservice testing to assess the operational readiness of certain electric motor-operated valve assemblies in light-water reactor power plants in OM Code-1995, Subsection ISTC, except for ISTC 4.3, the following alternative requirements may be applied. Electric motor-operated valves for which seat leakage is limited to a specific maximum amount in the closed position for fulfillment of their required function (Category A) must also be seat leakage rate tested in accordance with the requirements of ISTC 4.3.

NOTE: The terms "shall consider" and "shall be considered" are used in paras. 3.5, 3.6.2, and 3.7.1 of this Code Case. The Code Case does not dictate how the considerations in the paragraphs are implemented or documented. Users of the Code Case will determine the best methods based on their programs, which may include procedures, checklists, training, or other methods.

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1 INTRODUCTION

1.1 Scope

This Code Case establishes the requirements for preservice and inservice testing to assess the operational readiness of certain motor-operated valves (MOVs) in light-water reactor (LWR) power plants.

The MOVs covered are those required to perform a specific function in shutting down a reactor to the safe shutdown condition, in maintaining the safe shut-down condition, or in mitigating the consequences of an accident.

This Code Case establishes test methods, test intervals, parameters to be measured and evaluated, acceptance criteria, corrective actions, and records requirements.

1.2 Exclusions

MOVs in the following categories are excluded from this Code Case, if they are not specifically required to perform a function described in para. 1.1:

(a) MOVs used only for operating convenience, such as vent, drain, instrument, and test valves;

(b) MOVs used only for system control, such as pressure regulating valves;

(c) MOVs used only for system or component maintenance;

(d) MOVs not required to change position.

External control and protection systems that sense plant conditions and provide signals for MOV operation are also excluded from the requirements of this Code Case.

2 SUPPLEMENTAL DEFINITIONS

motor-operated valve (MOV): a valve and its associated electric motor-driven mechanism for positioning the valve, including components that control valve action and provide position output signals.

MOV functional margin: the increment by which an MOV's available capability exceeds the capability required to operate the MOV under design basis conditions.

stem factor: the ratio of stem torque to stem thrust in rising-stem valves.

design basis stem factor: the greatest value for stem factor expected during design basis operation of an MOV.

3 GENERAL REQUIREMENTS

3.1 Design Basis Verification Test

A one-time test shall be conducted to verify the capability of each MOV to meet its safety-related design basis requirements. This test shall be conducted at conditions as close to design basis conditions as practicable. Requirements for a design basis verification test are specified in applicable regulatory documents. Testing that meets the requirements of this Code Case but conducted before implementation of this Code Case may be used.

(a) Design basis verification test data shall be used in conjunction with preservice test data as the basis for inservice test criteria.

(b) Design basis verification testing shall be conducted in situ or in a prototype test facility that duplicates applicable design basis conditions. If a test facility is used, an engineering analysis shall be documented that supports applicability to the in situ conditions.

(c) 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.

(d) The design basis verification test shall be repeated if an MOV application is changed, the MOV is physically modified, or the system is modified in a manner that invalidates its current design basis verification test results or data. A determination that a design basis verification test is still valid shall be justified by an engineering evaluation, alternative testing techniques, or both.

3.2 Preservice Test

Each MOV shall be tested during the preservice test period or before implementing inservice testing. These tests shall be conducted under conditions as near as practicable to those expected during subsequent inservice testing. Testing that meets the requirements of this Code Case but conducted before implementation of this Code Case may be used. Only one preservice test of each MOV is required unless, as described in para. 3.4, the MOV has undergone maintenance that could affect its performance.

3.3 Inservice Test

Inservice testing shall commence when the MOV is required to be operable to fulfill its required

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function(s), as described in para. 1.1, and shall be sufficient to assess changes in MOV functional margin consistent with section 6.

(a) MOVs may be grouped for inservice testing as described in para. 3.5.

(b) Inservice tests shall be conducted in the as-found condition. Maintenance activities, such as stem lubrication, shall not be conducted if they might invalidate the as-found condition for inservice testing.

(c) The inservice testing program will include a mix of static and dynamic MOV performance testing. The mix of MOV performance testing may be altered when justified by an engineering evaluation of test data.

3.3.1 Inservice Test Frequency

(a) The inservice test frequency shall be determined in accordance with para. 6.4.4.

(b) If insufficient data exist to determine the inservice test frequency in accordance with para. 6.4.4, then MOV inservice testing shall be conducted every 2 refueling cycles or 3 years (whichever is longer) until sufficient data exist to determine a more appropriate test frequency.

(c) The maximum inservice test frequency shall not exceed 10 years. MOV inservice tests conducted per para. 3.4 may qualify for this requirement.

3.4 Effect of MOV Replacement, Repair, or Maintenance

When an MOV or its control system is replaced, repaired, or undergoes maintenance that could affect the valve's performance, new inservice test values shall be determined or the previously established inservice test values shall be confirmed before the MOV is returned to service. If the MOV was not removed from service, inservice test values shall be immediately determined or confirmed. This testing is intended to demonstrate that performance parameters, which could be affected by the replacement, repair, or maintenance, are within acceptable limits. The Owner's program shall define the level of testing required after replacement, repair, or maintenance. Deviations between the previous and new inservice test values shall be identified and analyzed. Verification that the new values represent acceptable operation shall be documented as described in section 9, Records and Reports.

3.5 Grouping of MOVs for Inservice Testing

Grouping MOVs for inservice testing is permissible. Grouping MOVs shall be justified by an engineering evaluation, alternative testing techniques, or both. The following shall be considered when grouping MOVs:

(a) MOVs with identical or similar motor operators and valves and with similar plant service conditions may be grouped together based on the results of design basis verification and preservice tests. Functionality of all groups of MOVs shall be validated by appropriate inservice testing of one or more representative valves;

(b) test results shall be evaluated and justified for all MOVs in the group;

(c) a single representative MOV shall not be selected consecutively. All testable MOVs in a group shall be inservice tested before a previously tested representative MOV can be reselected. In addition to this requirement, the Owner may elect to consecutively test a certain MOV to monitor changes in its functional margin over time;

(d) the number of MOVs tested from each group shall be determined using appropriate statistical methodology. For groups with ten or more MOVs, at least two representative MOVs shall be tested; and

(e) test results for a representative MOV shall be analyzed and evaluated per Section 6 for each MOV in the group.

3.6 MOV Exercising Requirements

3.6.1 All MOVs, within the scope of this Code Case shall be exercised on an interval not to exceed one year or one refueling cycle (whichever is longer). Full-stroke operation of an MOV, as a result of normal plant operations or Code requirements, may be considered an exercise of the MOV, if documented. Alternatively, longer exercise intervals may be used if justified by successful operating experience.

3.6.2 The Owner shall consider more frequent exercising requirements for MOVs in any of the following categories:

(a) MOVs with high risk significance;

(b) infrequently operated MOVs with risk significance;

(c) MOVs with adverse or harsh environmental conditions; or

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(d) MOVs with any abnormal characteristics (operational, design, or maintenance conditions).

3.6.3 MOVs shall be exercised as follows:

(a) full-stroke exercising during plant operation to the position(s) required to fulfill its function(s);

(b) if full-stroke exercising of an MOV is not practicable during plant operation, then full-stroke exercising shall be done during cold shutdowns; or

(c) if full-stroke exercising of an MOV is not practicable during plant operation or cold shutdown, then full-stroke exercising shall be done during the plant's refueling outages.

3.7 Risk-Based Criteria for MOV Testing

3.7.1 Risk-based criteria for MOV testing are permissible. If establishing risk based criteria for performance testing, the Owner shall consider the following:

(a) develop an acceptable basis for MOV risk determination;

(b) develop MOV screening criteria to determine each MOV's contribution to risk; and

(c) establish applicability by a documented evaluation from a plant expert panel.

3.7.2 Risk-based criteria, when applied to MOV performance testing, shall be used in conjunction with the MOV's margin to establish MOV grouping, acceptance criteria, exercising requirements, and testing frequency.

4 RESERVED

5 TEST METHODS

5.1 Test Prerequisites

All testing shall be conducted in accordance with plant-specific technical specifications, installation details, acceptance criteria, and maintenance, surveillance, operation, or other applicable procedures.

5.2 Test Conditions

Inservice test conditions shall be sufficient to determine the MOV's functional margin per para. 6.4. Test conditions shall be recorded for each test per section 9.

5.3 Limits and Precautions

(a) MOV exposure to dust, moisture, or other adverse conditions shall be minimized while performing tests.

(b) Manufacturer or vendor limits and precautions associated with the MOV and with the test equipment shall be considered, including the structural thrust and torque limits of the MOV.

(c) Plant-specific operational and design precautions and limits shall be followed. Items to be considered shall include, but are not limited to, water hammer and intersystem relationships.

5.4 Test Procedures

Procedures shall be established for all tests specified in this Code Case and shall provide for:

(a) methodical, repeatable, and consistent performance testing; and

(b) collection of data required to analyze and evaluate the MOV functional margin in accordance with section 6.

5.5 Test Parameters

Sufficient test parameters shall be selected for measurement to meet the requirements of section 6 in determining the MOV functional margin.

6 ANALYSIS AND EVALUATION OF DATA

6.1 Acceptance Criteria

The Owner shall establish methods to determine acceptance criteria for each MOV within the scope of this Code Case. Acceptance criteria shall be based upon the minimum amount by which available stem torque must exceed the required design basis stem torque. When determining the acceptance criteria, consider the following sources of uncertainty:

(a) test measurement uncertainty and equipment uncertainty (e.g., torque switch repeatability);

(b) analysis, evaluation, and extrapolation method uncertainty; and

(c) grouping method uncertainty.

6.1.1 MOV margins may be expressed in terms of other parameters, such as stem force, if those parameters are consistent with paras. 6.1 through 6.5.

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6.2 Analysis of Data

Data obtained from a test required by this Code Case shall be analyzed to determine if the MOV performance is acceptable. The Owner shall determine which methods are suitable for analyzing necessary parameters for each MOV and application.

Whenever data are analyzed, all relevant operating and test conditions shall be considered.

The Owner shall compare performance test data to the acceptance criteria. If the functional margin, determined per para. 6.4.3, does not meet the acceptance criteria, the MOV shall be declared inoperable, in accordance with the Owner's requirements.

Data analysis shall include a qualitative review to identify anomalous behavior. If indications of anomalous behavior are identified, the cause of the behavior shall be analyzed and corrective actions completed, if required.

6.3 Evaluation of Data

The Owner shall determine which methods are suitable for evaluating test data for each MOV and application.

The Owner shall have procedural guidelines to establish the methods and timing for evaluating MOV test data. Evaluations shall determine the amount of degradation in functional margin that occurred over time. Evaluations shall consider the influence of past maintenance and test activities to establish appropriate time intervals for future test activities.

If grouping is used, the evaluations shall apply changes in functional margin to all members of the group to establish appropriate time intervals for future test activities.

6.4 Determination of MOV Functional Margin

The Owner shall demonstrate that adequate margin exists between the required torque and the available torque. Also, adequate margin shall exist to ensure that changes in MOV operating characteristics over time do not result in reaching a point of insufficient margin before the next scheduled test activity.

Figure 6.4-1 is a flow diagram that outlines the important steps for determining MOV functional margin. This figure is provided for information only. The figure shows separate paths for quarter-turn and rising-stem MOVs. For rotating-rising-stem MOVs, follow the path for rising-stem MOVs.

6.4.1 Determination of Required Torque

6.4.1.1 Rising-Stem MOVs. Design basis required torque shall be determined from measurements taken during testing at design basis conditions.

If not measured directly during testing at design basis conditions, design basis required torque for rising-stem MOVs shall be determined from the evaluation of the design basis required stem thrust and the design basis stem factor (torque equals thrust multiplied by stem factor).

(a) Design Basis Stem Thrust. Design basis stem thrust shall be determined from measurements taken during testing at design basis conditions. Alternatively, design basis stem thrust can, with justification, be estimated by analytical methods using valve parameters determined from testing at conditions other than design basis conditions.

(b) Design Basis Stem Factor. Design basis stem factor shall be calculated from measurements taken during testing at design basis conditions. Alternatively, the stem factor can, with justification, be estimated by analytical methods using valve parameters determined from testing at conditions other than design basis conditions.

6.4.1.2 Quarter-Turn MOVs. The design basis stem torque shall be determined from measurements taken during testing at design basis conditions. Alternatively, the design basis stem torque can, with justification, be estimated by analytical methods, using valve parameters determined from testing at conditions other than design basis conditions.

6.4.2 Determination of Available Stem Torque

6.4.2.1 Available Stem Torque Based on Motor Capabilities. Available stem torque shall be determined based on motor capabilities at the motor's design basis conditions. Considerations shall include:

(a) rated motor start torque;
(b) minimun voltage conditions;
(c) elevated ambient temperature conditions;
(d) operator efficiency; and
(e) other appropriate factors.

6.4.2.2 Available Torque Based on Torque Switch Setting. Where used, the available stem torque, based on the current torque switch setting, shall be determined from the stem torque measurement taken at torque switch trip.

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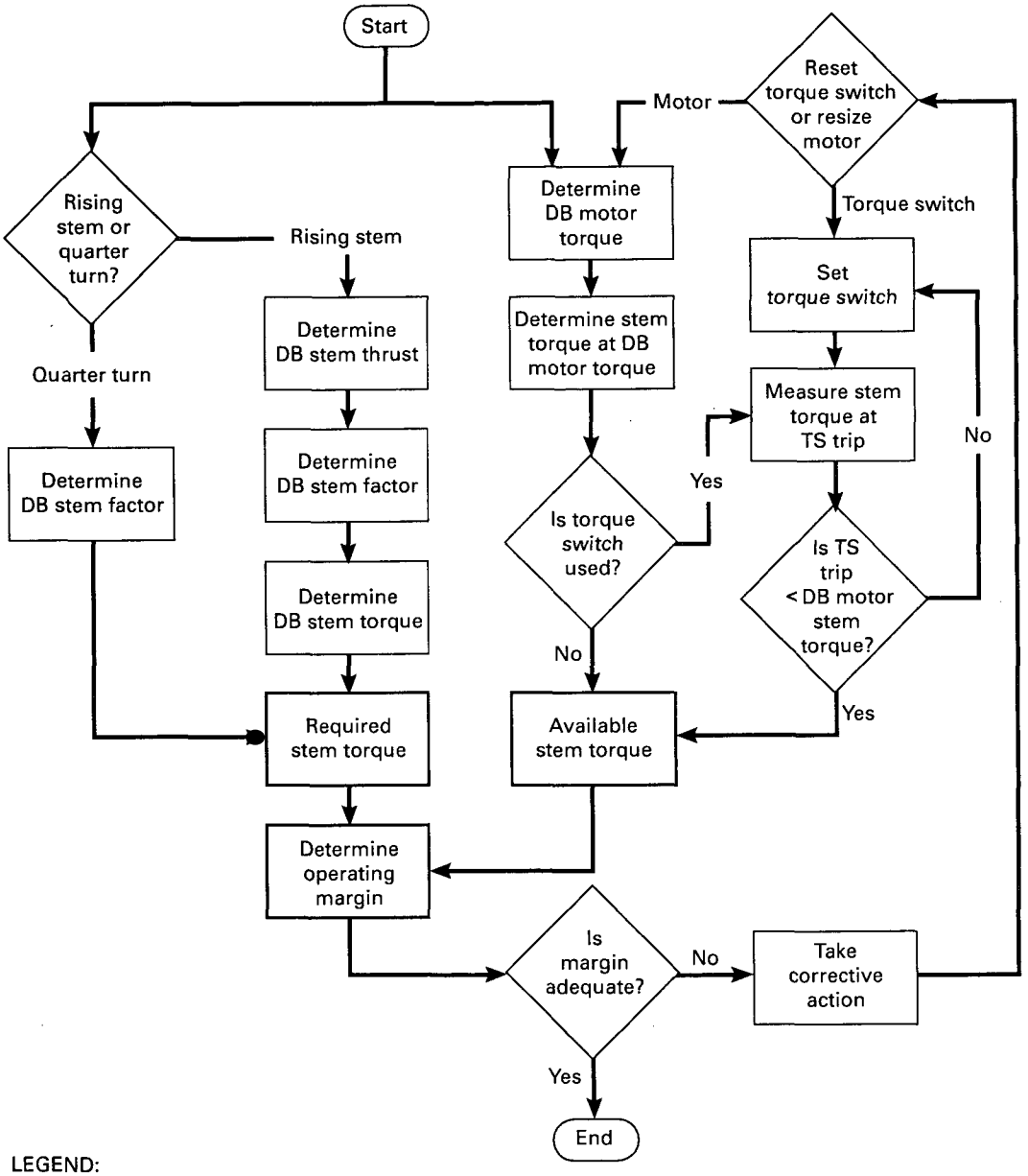

LEGEND:
DB = design basis
TS = torque switch

NOTE:
(1) Or alternate corrective action

FIG. 6.4-1 MOV FUNCTIONAL MARGIN DETERMINATION FLOWCHART

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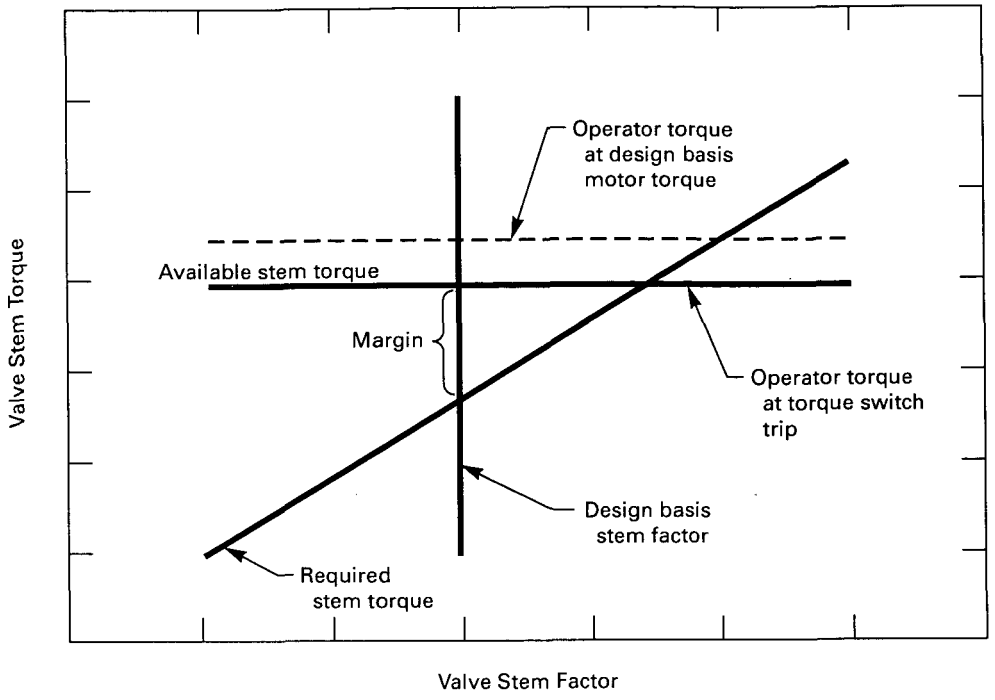

FIG. 6.4-2 DETERMINING FUNCTIONAL MARGIN FOR RISING-STEM MOVs

For MOVs where inservice testing does not sufficiently load the MOV to cause torque switch trip (e.g., butterfly and ball valves), available stem torque based on the current torque switch setting shall be determined analytically from test data. Considerations shall include:

(a) calibration of the torque switch spring pack;

(b) the current torque switch setting; and

(c) repeatability of torque switch operation.

6.4.3 Calculation of MOV Functional Margin. MOV functional margin shall be calculated as the difference between the available stem torque and the required stem torque (available torque minus required torque equals margin).

Figure 6.4-2 illustrates this calculation for a rising-stem MOV where torque is expressed as a function of stem factor. The figure shows available stem torque based on two values:

(a) the stem torque based on the motor operating at its design basis conditions; and

(b) the stem torque based on the current torque switch setting.

When calculating MOV functional margin, the available stem torque is the lesser of the two.

For rising-stem valves, required stem torque appears as a diagonal line representing the torque needed to provide a given amount of stem thrust (required stem thrust) at various values for the stem factor. MOV functional margin is the difference between available stem torque and required stem torque at the design basis stem factor.

6.4.4 Determination of MOV Test Interval. Calculations for determining MOV functional margin shall also be evaluated to account for anticipated time-related changes in performance. Figure 6.4-3 provides an example of how the measured functional margin might change over time. Figure 6.4-4 provides an example of how changes in the functional margin over time can be evaluated to determine test intervals. Maintenance activities and intervals can affect test intervals and shall be considered.

The interval between tests shall be less than the anticipated time for the functional margin to decrease to the acceptance criteria.

6.5 Corrective Action

If the MOV performance is unacceptable, as established in para. 6.4, corrective action shall be taken

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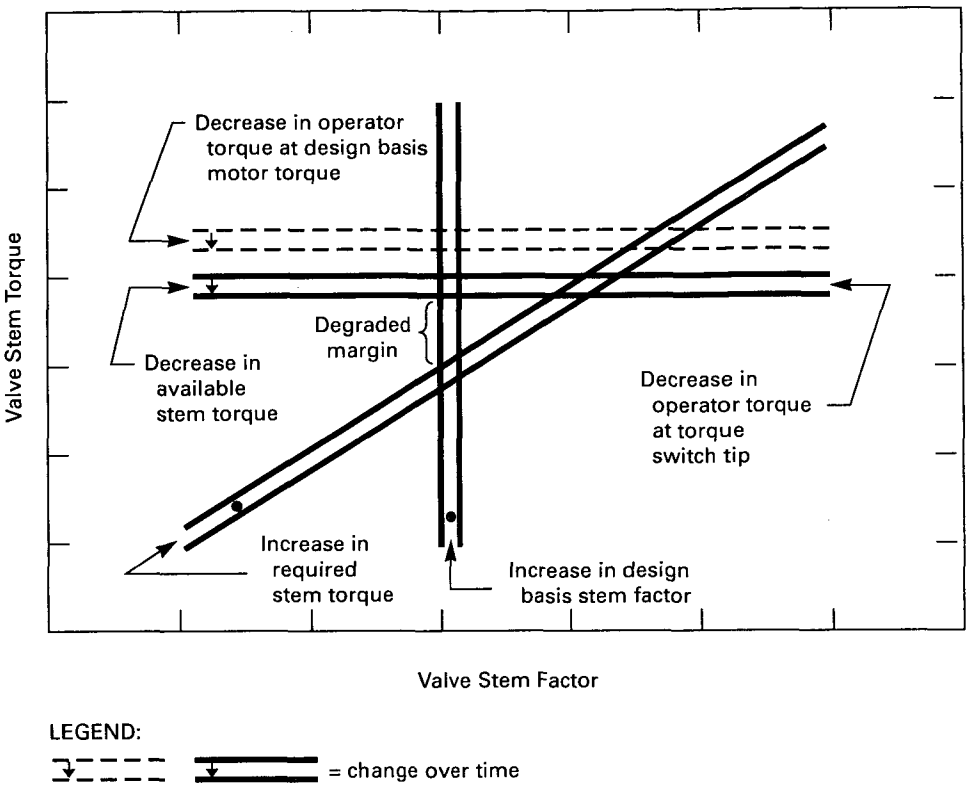

FIG. 6.4-3 DECREASE IN FUNCTIONAL MARGIN OVER TIME FOR RISING-STEM MOVs

in accordance with Owner's corrective action requirements.

6.5.1 Record of Corrective Action. The Owner shall maintain records of corrective action that shall include a summary of the corrections made, the subsequent inservice tests, confirmation of operational adequacy, and the signature of the individual responsible for corrective action and verification of results.

7 RESERVED

8 RESERVED

9 RECORDS AND REPORTS

9.1 Test Information

Pertinent test information shall be recorded or verified for MOV testing, described in section 3. The following information shall be considered:

(a) MOV plant-specific unique identification number;

(b) motor, valve, actuator nameplate data;

(c) test equipment unique identification numbers and equipment calibration dates;

(d) test method and conditions, described in section 5, including description of valve lineups, process equipment, and type of test. Descriptions shall include valve body, valve stem, electric motor-operator orientation, and piping configuration near the MOV;

(e) breaker setting/fuse size and motor starter thermal overload size, if used;

(f) MOV torque and limit switch configuration and settings;

(g) MOV performance test procedure and other approved plant documents containing acceptance criteria;

(h) name of test performer and date of test;

(i) system flow, system pressure, differential pressure, system fluid temperature, system fluid phase, and ambient temperature; and

(j) significant observations — any comments pertinent to the test results which otherwise may not be readily identified by other recorded test data shall be recorded. Observations shall include any remarks regarding abnormal or erratic MOV action

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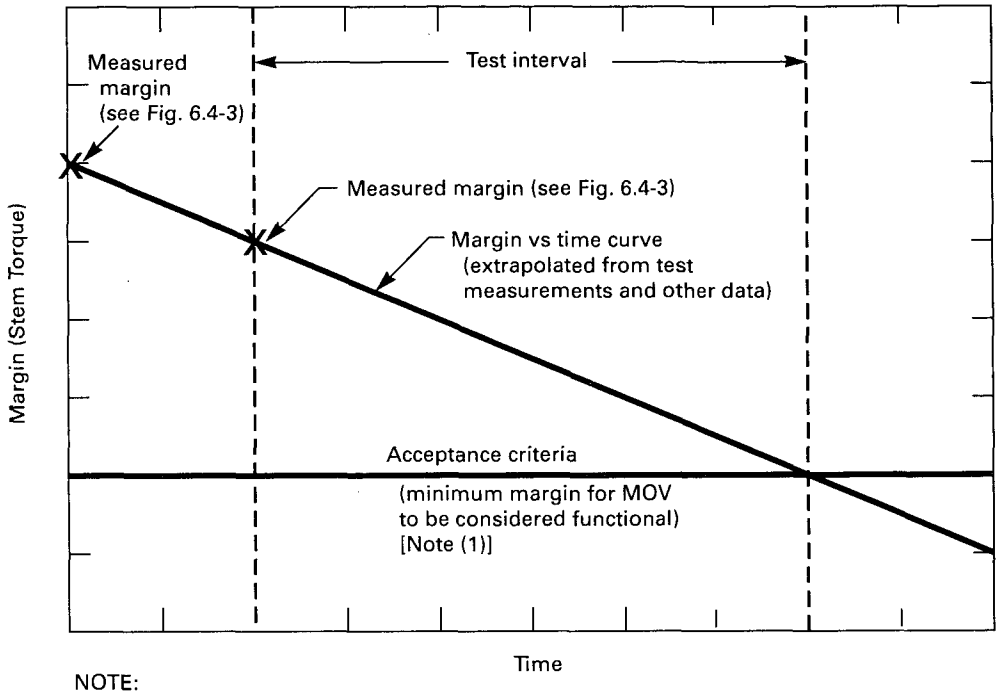

NOTE:
(1) Calculated value plus uncertainty.

FIG. 6.4-4 DETERMINING THE TEST INTERVALS FOR MAINTAINING MOV FUNCTIONAL MARGIN

noted either during or preceding performance testing and any other pertinent design information which can be verified at the MOV.

9.2 Documentation of Analysis and Evaluation of Data

The documentation of acceptable MOV performance, which has been analyzed and evaluated in accordance with section 6, shall include, as a minimum:

(a) values of test data, test parameters, and test information established by paras. 5.5 and 9.1;

(b) summary of analysis and evaluation required per paras. 6.2 and 6.3;

(c) statement(s), by an individual qualified to make such a statement through the Owner's qualification requirements, confirming that the MOV is capable of performing its intended safety function; and

(d) signature and date of verification of the results of the analysis and evaluation by qualified individuals. Independent verification shall be by individuals qualified to verify those specific analyses and evaluations through the Owner's qualification requirements.

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CODE CASE OMN-2
Thermal Relief Valve Code Case, OM Code-1995, Appendix I

This Case shall expire on March 30, 2004, unless previously annulled or reaffirmed.

Inquiry: What alternative to ASME OM Code-1995, Appendix I, paras. 1.3.5(a), (b), and (c) may be used for Class 2 and Class 3 pressure relief valves, which are required to be tested per ASME OM Code-1995, Appendix I, para. I 1.1, whose only overpressure protection function is to protect isolated components from fluid expansion caused by changes in fluid temperature?

Reply: It is the opinion of the Committee that in lieu of the requirements specified in ASME OM Code-1995, paras. I 1.3.5(a), (b), and (c) testing for Class 2 and Class 3 pressure relief devices whose only overpressure protection function is to protect isolated components from fluid expansion caused by changes in fluid temperature shall be performed once every ten years on each device unless performance data indicates that more frequent testing is needed to assure device function. In lieu of test, the Owner may replace these devices every ten years unless performance data indicates more frequent replacement is needed to assure device function.

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CODE CASE OMN-3
Requirements for Safety Significance Categorization of Components Using Risk Insights for Inservice Testing of LWR Power Plants

This Case shall expire on March 30, 2004 unless previously annulled or reaffirmed.

Inquiry: Is it acceptable to categorize those components under the scope of the ASME OM Code Section IST into two categories based on their safety significance?
Reply: Yes, provided the following requirements are met.

1 APPLICABILITY

This Code Case establishes the component safety categorization methodology and process for dividing the population of components, as identified in the IST Program Plan, into "high safety significant component" (HSSC) and "low safety significant component" (LSSC) categories.

2 SUPPLEMENTAL DEFINITIONS

aggregate risk: the risk due to programmatic changes in the IST program (test method effectiveness and/or testing interval) as measured by CDF or LERF.

common cause failure (CCF): a single event that adversely affects two or more components at the same time.

core damage frequency (CDF): the calculated frequency (per year) that core damage will occur due to failure of a critical safety function (i.e., reactivity control, core cooling, or containment heat removal). (A Level 1 PRA identifies accident sequences that can lead to core damage, calculates the frequency of each sequence, and sums those frequencies to obtain CDF.)

decision criteria: the quantitative and qualitative factors that influence a decision. These include both quantitative screening criteria (for PRA model) and the evaluation of other qualitative (or deterministic) factors that influence the results of an application.

PRA failure rate: the conditional probability of failure of a component on the next demand (for standby component) or in the next hour of operation (for operating component), given that it has not already failed.

figures-of-merit: the quantitative value, obtained from a PRA analysis, used to evaluate the results of an application (e.g., CDF, LERF).

Fussell-Vesely (F-V) importance: the fractional decrease in total risk level (usually CDF) when the plant feature is assumed to be perfectly reliable (failure rate = 0.0).

high safety significant components (HSSCs): components that have been designated as more important to plant safety by a blended process of PRA risk ranking and Plant Expert Panel evaluation.

importance measure: a mathematical expression that defines a quantity of interest. The most common importance measures are F-V and RAW.

inservice test (IST): a test to determine the operational readiness of a component/system.

initiating event: any event that perturbs the steady state operation of the plant, if operating, or the steady state operation of the decay heat removal system during shutdown operations, thereby initiating a transient within the plant. (Initiating events trigger sequences of events that challenge plant control and safety systems.)

large early release frequency (LERF): the calculated frequency (per year) that radioactivity release from

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the containment is both large and early. "Large" means involving the rapid, unscrubbed release of airborne fission products to the environment. "Early" means occurring before the effective implementation of off-site emergency and protective actions. (A Level 2 PRA identifies accident sequences that can lead to radioactivity release, calculates the frequency of each sequence, and sums these frequencies to obtain LERF.)

living PRA: a plant specific PRA that is maintained up to date, such that plant modifications, plant operation changes (including procedure changes), component performance, and other technical information significantly affecting the model are reflected in the model.

low safety significant components (LSSCs): components that have been designated as less important to plant safety by a blended process of PRA risk ranking and Plant Expert Panel evaluation.

operational readiness: the ability of a component to perform its intended system function when required.

probabilistic risk assessment (PRA): a quantitative assessment of the risk associated with plant operation and maintenance. Risk is measured in terms of the frequency of occurrence of different events, including core damage. In general the scope of a PRA is divided into three categories: Level 1, Level 2, and Level 3. A Level 1 maps from initiating events to plant damage states, including their aggregate, core damage. Level 2 includes Level 1 mapping from initiating events to release categories (source term). A Level 3 includes Level 2 and uses the source term of Level 2 to quantify consequences, the most common of which are health effects and property damage in terms of cost. Full scope PRA includes internal and external events.

risk achievement worth (RAW): the increase in risk of a modeled plant feature (usually a component, train, or system) when the feature is assumed to be out of service (failed). RAW is expressed in terms of the ratio of the risk with the event failed to the baseline risk level.

testing strategy: the IST strategy to measure component degradation or to monitor a component for operational readiness at some interval by operating or inspecting the component (e.g., valve stroking, pump vibration test, motor circuit evaluation, motor current signature analysis, component bearing lube oil analysis).

truncation limits: the cutoff value of probability or frequency of individual accident sequences below which they are no longer retained in quantitative PRA model results.

3 GENERAL REQUIREMENTS

3.1 Implementation

The requirements of the risk informed component code cases shall be implemented for all IST components of the same type. Component types are specified in the risk informed component code cases.

3.2 Plant Specific PRA

The plant specific PRA (Level 1 with internal initiating events, as a minimum) shall be available and used to perform component risk ranking.

3.3 Living PRA

The PRA shall be maintained up to date. (Reference 1 provides guidance.)

3.4 Integrated Effects

Components may be affected by more than one risk informed application. Integrated effects of multiple risk informed applications (including risk informed applications outside of the ASME scope) shall be evaluated.

3.5 Plant Expert Panel

A Plant Expert Panel shall be designated to perform the blended safety evaluation of probabilistic and deterministic engineering information for each component.

3.6 Determination of HSSC and LSSC

The Plant Expert Panel shall evaluate each component and categorize it as HSSC or LSSC, using PRA quantitative information (if component is modeled) and engineering qualitative information (for both modeled and not modeled components).

3.7 Inservice Testing Strategy for HSSCs and LSSCs

Testing strategies will be developed by other risk informed component code cases:

(a) Test strategies for the HSSCs shall have the objective of identifying and trending degradation

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that could lead to the occurrence of the failure mode(s) that resulted in the HSSC categorization.

(b) Test strategies for LSSCs shall have the objective of providing confidence for operational readiness.

3.8 Evaluation of Aggregate Risk

The aggregate risk impact of changes to the IST program shall be evaluated by the Owner (e.g., plant expert panel). Decision criteria, quantitative evaluations, and qualitative assessments are a part of this aggregate risk impact evaluation. Reference 1 provides guidance on evaluating aggregate risk.

3.9 Feedback and Corrective Actions

Feedback and corrective action processes are required elements of this Code Case.

4 SPECIFIC REQUIREMENTS

In addition to section 3 above, the following requirements apply to component classification into HSSC and LSSC categories, and to a risk-informed IST program based on those categories.

4.1 Component Risk Categorization

This paragraph establishes requirements for separating components into HSSC or LSSC categories, performing PRA sensitivity studies to ensure that quantitative ranking is correct, and determining how to treat components not modeled.

4.1.1 Importance Measures

(a) As a minimum, two importance measures, F-V and RAW, shall be calculated for those components modeled in the PRA.

(b) Both the impact upon CDF and upon LERF, if available, shall be determined.

4.1.2 Screening Criteria. For those components modeled in the PRA:

(a) a threshold value of F-V>0.005 based on either CDF or LERF shall be initially considered as HSSC;

(b) a threshold value of RAW>2 based on either CDF or LERF shall be initially considered as HSSC.

4.1.3 Sensitivity Studies

(a) The following sensitivity studies shall be performed:

(1) Data and Uncertainties. Failure rates of components within the PRA models for those IST components that have initially very high or very low safety significance shall be selectively increased and/or decreased to determine if the results are sensitive to changes in the failure data. If sensitivities are indicated, steps shall be taken to determine if uncertainty ranges can be reduced and to validate the failure probabilities included in the models.

(2) Human Factors. The PRA shall be requantified, and the F-V and RAW importance measures recalculated, after human actions modeled in the PRA to recover from specific component failures are removed from the models (i.e., the probability of successful recovery due to human intervention is set to zero).

(3) Test and Maintenance Unavailabilities. The PRA models shall be requantified with test and maintenance unavailabilities minimized or removed, and the importance measures recalculated.

(4) LSSC Failure Rates. Failure rates for initially ranked LSSC components shall be increased by a factor representing the upper bound (95%) of the failure rate and the PRA models requantified. The importance measures shall then be recalculated.

(5) Truncation Limits. If the PRA has not been quantified with a truncation limit in accordance with Ref. 1, the PRA model shall be requantified with the truncation limit lowered to this value. The importance measures shall then be recalculated.

(6) Common Cause. Sensitivity analyses shall determine the impact of increased or decreased common cause failure rates. Importance measures shall then be recalculated.

(b) The results of these sensitivity studies and any others that are performed, shall be documented. In addition to the magnitude of the changes to the CDF or LERF, all insights obtained from the results shall be described.

(c) The results and insights of these sensitivity studies shall be provided to the Plant Expert Panel for their consideration in the final categorization of the components.

4.1.4 Qualitative Assessments. Qualitative assessments shall be performed for all IST components, modeled and not modeled.

(a) The following qualitative assessments shall be performed:

(1) impact of initiating events (i.e., the impact of failure or degradation as it might result in an initiator);

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(2) potential consequences of shutdown (outage) conditions; and

(3) response to external events (e.g., seismic, fire, high winds/tornadoes, flooding, etc.).

(b) Qualitative assessments shall be performed for plant-specific design bases conditions and events not modeled in a PRA.

(c) Qualitative assessments shall consider the impacts upon the plant to:

(1) prevent or mitigate accident conditions;

(2) reach and/or maintain safe shutdown conditions;

(3) preserve the reactor primary coolant pressure boundary integrity; and

(4) maintain containment integrity.

(d) Qualitative assessments shall also consider:

(1) safety function being satisfied by the component's operation;

(2) level of redundancy existing at the plant to fulfill the component's function;

(3) ability to recover from a failure of the component;

(4) performance history of the component;

(5) plant technical specifications requirements applicable to the component;

(6) emergency operating procedure instructions that use the component(s); and

(7) design and current licensing basis information relevant to IST component function.

(e) The cumulative impacts of combinations of component unavailability, which could impact an entire system (e.g., multitrain impacts) or critical safety function (e.g., multisystem impacts), shall also be considered.

(f) These qualitative assessments and the plant expert panel's disposition of them shall be documented so independent parties can review and cognizant analysts who did not take part in the original assessment can confirm the result.

(g) These qualitative assessments shall be available to the Plant Expert Panel for their decision of component safety categorization.

4.1.5 Components Not Modeled

(a) If IST components not modeled in the original at-power PRA are subsequently determined to have an impact upon the ability of the facility to respond to events initiated while the plant is at power, consideration should be given to updating the PRA model to incorporate the effects of the component(s), then using the updated model to provide a quantified basis for categorization (either HSSC or LSSC).

(b) If IST components not modeled in the original shutdown PRA (for facilities with a shutdown PRA) are subsequently determined to have an impact upon the ability of the facility to respond to events initiated while the plant is shutdown, consideration should be given to updating the shutdown PRA model to incorporate the effects of the component(s), then using the updated model to provide a quantified basis for categorization (either HSSC or LSSC).

4.2 Component Safety Categorization

This paragraph provides requirements for the Plant Expert Panel's review and evaluation process for categorizing IST components relative to their safety significance, using both deterministic and probabilistic insights.

4.2.1 Plant Expert Panel Utilization. The Plant Expert Panel shall blend deterministic and probabilistic information to classify IST components into HSSC or LSSC categories.

(a) *PRA Insights.* The results of PRA analyses shall be used by the Plant Expert Panel to determine the safety significance of components within the scope of IST and PRA programs. Information contained in PRAs relative to the role of components in mitigating or preventing core damaging events or radiological release events shall be considered. The scope of the PRA and depth of probabilistic analyses shall be assessed, evaluated, and documented. As a minimum, the following shall be documented:

(1) The level of plant specific PRA analysis available for assessing the applicability of PRA information relative to IST programs. For example, written documentation describing the level of plant specific PRA analysis such as Level 1 PRA (assessment of core damage frequency) and/or Level 2 PRA (assessment of core damage frequency plus containment performance).

(2) Scope of initiating events considered (internal events, external events, both).

(3) Typical failure modes considered (e.g., hardware failures, testing/maintenance failures, common cause failures, human errors).

(4) PRA scope for plant configurations (e.g., low power risk, shutdown risk, transition mode risk, at-power risk) reviewed relative to the applicability of PRA information and IST component function(s).

(b) *Deterministic Insights.* The Plant Expert Panel

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shall also consider deterministic factors when assessing the safety significance of components within the scope of IST programs (See Appendix A of this Code Case for a sample list of deterministic questions).

4.2.2 Plant Expert Panel Requirements

(a) Plant Procedure. A procedure approved by the Owner shall describe the process, including:

(1) designated members and alternates;

(2) designated chairman and alternate;

(3) quorum;

(4) attendance records;

(5) agendas;

(6) motions for approval;

(7) process for decision making;

(8) documentation and resolution of differing opinions;

(9) minutes;

(10) implementation of feedback/corrective actions;

(11) feedback to the PRA; and

(12) required training.

(b) Training. The Plant Expert Panel shall be trained and indoctrinated by the Owner in the specific requirements to be used for this Code Case. Training and indoctrination shall include the application of risk analysis methods and techniques used for this Code Case. At a minimum, the risk methods and techniques include:

(1) PRA fundamentals (e.g., PRA technical approach, PRA assumptions and limitations, failure probability, truncation limits, uncertainty);

(2) use of risk importance measures;

(3) assessment of failure modes;

(4) reliability versus availability;

(5) risk thresholds; and

(6) expert judgment elicitation.

Each of the aforementioned topics shall be covered in the indoctrination to the extent necessary to provide the Plant Expert Panel with a level of knowledge needed to adequately evaluate and approve the scope of the IST selections, using both probabilistic and deterministic information.

(c) Experience. The Owner shall establish requirements for ensuring adequate experience levels of Plant Expert Panel members. Member experience levels shall be documented and maintained by the Owner.

(d) Requirements. The Owner shall ensure:

(1) there are at least five experts designated as members of the Plant Expert Panel. Members may be experts in more than one field; however, excessive reliance on any one member's judgment shall be avoided.

(2) the chairperson is familiar with this Code Case and facilitates Plant Expert Panel activities, to ensure that the requirements of this Code Case are satisfied.

(3) expertise in the following functions is represented on the Plant Expert Panel:

(a) operation

(b) safety analysis engineering

(c) probabilistic risk assessment

(e) Recommendations. The Owner:

(1) should select additional members of the Plant Expert Panel who have the following plant expertise:

(a) systems performance

(b) maintenance

(c) licensing

(d) component performance

(e) ASME inservice testing

(f) quality assurance

(2) may designate alternate members to the Plant Expert Panel on a temporary basis; however, vacancies in the Plant Expert Panel membership should be filled by qualified individuals within a reasonable period of time;

(3) may invite other plant or nuclear industry experts to attend some or all of the sessions of the Plant Expert Panel as visitors to provide observations, opinions, or recommendations.

4.2.3 Plant Expert Panel Decision Criteria. Plant Expert Panel decision criteria for categorizing components as HSSC and LSSC shall be documented.

4.2.4 Reconciliation. Decisions of the Plant Expert Panel shall be arrived at by consensus. Differing opinions shall be documented and resolved, if possible.

(a) If a resolution cannot be achieved concerning the safety significance classification of a component, then the component shall be classified HSSC.

(b) If components have a high initial ranking from the PRA (i.e., RAW>2 or F-V>0.005) but are ultimately ranked as LSSCs, the Plant Expert Panel shall provide written justification of their decision.

4.3 Testing Strategy Formulation

(a) The Owner shall develop testing strategies

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for HSSCs and LSSCs following the requirements provided in the risk informed component code cases.

(b) After testing strategies are developed, the Owner shall provide the planned changes (e.g., test frequency, testing effectiveness, and test duration) for input to the evaluation of aggregate risk.

4.4 Evaluation of Aggregate Risk

4.4.1 Decision Criteria

(a) Appropriate decision criteria for aggregate risk effects shall be established and documented by the Owner.

(1) Decision criteria shall be based on thresholds for aggregate risk limits using standard figures-of-merit (e.g., CDF, LERF). (Reference 1 provides guidance.)

(2) Performance criteria used for other regulatory requirements, such as the Maintenance Rule (10 CFR 50.65) or other formal industry programs, may be taken into consideration when developing decision criteria for aggregate risk effects.

(b) Decision criteria may be determined both qualitatively and quantitatively.

4.4.2 Quantitative Assessment

(a) An aggregate risk evaluation shall be performed prior to implementation, as applicable, using the PRA.

(1) Quantitative attributes associated with this Code Case shall be considered and included in the quantitative evaluation, as appropriate, and within the scope of the PRA.

(2) Each applicable quantitative IST attribute shall be incorporated into the quantitative evaluation, as appropriate, until all proposed changes have been dispositioned (i.e., incorporated or not incorporated).

(3) Attributes not included in the quantitative evaluation shall be documented.

(4) Once all appropriate inputs have been incorporated, the PRA shall be rerun to assess the overall risk impact.

(5) Proposed IST program change shall be assessed to determine compliance with approved decision criteria and to quantitatively determine if any adjustments or compensatory measures are warranted.

(b) Types of quantitative attributes that should be considered in the quantitative evaluation include changes in:

(1) testing frequency;

(2) test duration;

(3) failure rates;

(4) failure modes;

(5) common cause failure susceptibility; and

(6) compensatory measures.

Compensatory measures include both those specifically incorporated into plant programs and those developed by the Owner for specific situations. Management directed compensatory measures should also be included in the quantitative assessment, as appropriate. Verifiable values of failure rates shall be used in the quantification process for IST component.

(c) Testing effectiveness shall be evaluated by periodic assessments or when new failure modes are identified that impact risk quantification.

(1) New failure modes shall be incorporated in accordance with the Owner's risk management and corrective action programs into the quantitative evaluation, as appropriate.

(2) Changes resulting from programs that significantly affect the reliability or availability of components that perform important safety functions shall be assessed, and, if appropriate, incorporated into the PRA for requantification.

Such assessments may be performed in conjunction with the plant specific Maintenance Rule (10 CFR 50.65) requirements.

4.4.3 Qualitative Evaluation

(a) Aggregate risk effects shall be qualitatively evaluated (i.e., risk decreases as well as risk increases) for IST program changes (e.g., testing effectiveness).

(b) Pertinent performance indicators, industry programs, or other scrutable methods for establishing aggregate risk effects shall be identified and monitored.

(c) Owner feedback processes and corrective action programs shall be considered in the evaluation of aggregate risk.

4.4.4 Defense in Depth. The Owner shall ensure that the IST aspects of Defense in Depth are maintained.

4.5 Inservice Testing Program

4.5.1 Maximum Testing Interval

(a) The results of the aggregate risk evaluation shall determine the maximum test interval based on safety significance.

(b) Within the maximum test interval set by the

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aggregate risk evaluation, the Owner shall establish a testing strategy for each individual component as specified in the applicable risk informed component code cases.

4.5.2 Implementation Schedule. A schedule shall be developed for implementing the testing strategies as specified in the risk informed component code cases.

4.5.3 Feedback to Aggregate Risk. Once the test schedule has been developed, the schedule shall be reviewed against the assumptions of the aggregate risk evaluation.

4.5.4 Transition Plan. A transition plan shall be developed for each component type to ensure adequate information is collected to support justification of stepwise test interval extension up to and including the maximum allowable interval.

4.6 Performance Monitoring

4.6.1 HSSC Attribute Trending. For HSSCs, the Owner shall establish a set of attributes to be tested in accordance with the requirements of risk informed component code cases and will implement a trending program for those attributes selected for monitoring.

4.6.2 LSSC Performance Trending. For LSSCs, the Owner shall identify testing strategies in accordance with the requirements of risk informed component code cases and shall trend component performance.

4.7 Feedback and Corrective Actions

4.7.1 Feedback

(a) The Owner shall establish a feedback process incorporating elements of both conditional and periodic feedback such that component performance information is directed to both the IST and PRA programs. Conditional feedback shall occur on a timely fashion following component failure. Periodic feedback shall be considered for maintenance of the PRA.

(b) Each program shall assimilate performance information to ensure the appropriate unavailability information is reflected in decision making.

(c) The Owner shall establish a feedback process so IST programmatic changes are directed to the PRA program.

4.7.2 Corrective Action. In addition to the requirements in the IST Code of Record with respect to Corrective Actions, the Owner shall establish a Corrective Action Program that identifies and tracks to resolution all failures of similar types of components within an IST Program incorporating risk insights, including transportability evaluation.

4.7.3 Component Safety Recategorization. The component's operational readiness is not changed by recategorization.

5 RESERVED

6 RESERVED

7 RESERVED

8 RECORDS AND REPORTS

In addition to the requirements in the Code of Record with respect to Records, the Owner shall maintain the following records of the Plant Expert Panel and the component.

8.1 Plant Expert Panel Records

(a) Membership and attendance

(b) Member expertise representation and training records

(c) Member experience (years of experience in each of the expertise categories)

(d) Meeting agendas

(e) Meeting minutes

(f) Plant procedure

8.2 Component Records

(a) Risk significance based on PRA importance measures

(b) Additional PRA quantitative information

(c) Deterministic information

(d) Plant Expert Panel categorization decisions of HSSC or LSSC (e) Basis for the HSSC/LSSC decision

9 REFERENCES

EPRI TR. 105396, PSA Applications Guide, August 1995

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APPENDIX A
Sample List of Component Deterministic Questions

This nonmandatory Appendix provides guidance to the Plant Expert Panel for including additional components into the IST program and categorizing them as HSSC or LSSC.

A1 DESIGN BASIS ANALYSIS

(a) Is component considered in design basis analysis?

(b) Is component function considered important in the Safety Analysis Report?

(c) Are there any Tech Spec considerations for this component?

A2 10 CFR 100 RELEASE LIMIT

(a) Could the failure of this component be considered a breach in an engineered safety barrier?

(b) Could the failure of this valve result in an uncontained release of radioactive material in excess of that allowed in 10 CFR 100?

A3 MAINTENANCE RELIABILITY

(a) Is component important to maintaining system reliability?

(b) What type of component failures have been experienced for this and similar style components?

(c) What does the maintenance history indicate about the reliability of this component?

(d) Does the component receive preventive maintenance and is it effective for preventing identified failures?

(e) How are component failures detected?

A4 EFFECT OF COMPONENT FAILURE ON SYSTEM OPERATIONAL READINESS

(a) Is component important to maintaining system availability?

(b) How does component failure affect system performance?

(c) Does component failure cause other system component failures?

(d) What is the system component level of defense in depth?

(e) Does the system or component perform other functions outside the scope of the PRA?

(f) Can system or component failure modes affect redundant trains or other similar component?

A5 OTHER DETERMINISTIC CONSIDERATIONS

(a) Should other component failure modes be considered in the PRA model?

(b) Is this component used to mitigate the consequences of an accident caused by external events?

(c) Is this component important for safe shutdown?

(d) Is this component required to maintain the safe shutdown condition?

(e) Should other component failure modes which may not be included in the PRA be considered (e.g., aging effects, structural supports, human performance failures).

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CODE CASE OMN-4
Requirements for Risk Insights for Inservice Testing of Check Valves at LWR Power Plants

This Case shall expire on March 30, 2004 unless previously annulled or reaffirmed.

Inquiry: What alternative requirements may be used in lieu of the requirements of the ASME OM Code for inservice exercising tests for Category C check valves?

Reply: It is the opinion of the Committee that the following requirements may be applied.

1 SAFETY SIGNIFICANCE CATEGORIZATION

Check valves shall be evaluated and categorized as High Safety Significant Components (HSSCs) or Low Safety Significant Components (LSSCs) in accord- ance with the Code Case on Requirements for safety significance categorization of components using Risk Insights for Inservice Testing of LWR Power Plants.

2 HSSC TESTING

HSSC check valves shall be placed in a Condition Monitoring Program and tested in accordance with ASME OMa Code-1996, Appendix II. The Condition Monitoring program shall include identification and trending of attributes indicative of degradation that could lead to the occurrence of the failure mode(s) that resulted in HSSC categorization.

3 LSSC TESTING

LSSC check valves shall be tested in accordance with OMa Code-1996, Subsection ISTC, or placed in a Condition Monitoring Program and tested in accordance with the ASME OMa Code-1996, Appendix II.

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CODE CASE OMN-5
Testing of Liquid Service Relief Valves Without Insulation

This Case shall expire on March 30, 2004 unless previously annulled or reaffirmed.

Inquiry: What alternative requirements to those of ANSI/ASME OM Code, Appendix I, paras. I 4.1.1(d), I 4.1.2(d), I 4.1.3(d), I 8.1.1(d), I 8.1.2(d), and I 8.1.3(d) may be used for valves which are insulated in service and removed for testing?

Reply: It is the opinion of the Committee that valves which are insulated in service and removed for testing at ambient temperature using a test media at ambient temperature need not be insulated during testing, provided the requirements of ANSI/ASME OM Code, Appendix I, paras. I 4.3 and I 8.3 are met.

Applicability: ASME OM Code-1990 Edition and later editions and addenda through 1995.

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CODE CASE OMN-6
Alternate Rules for Digital Instruments

This Case shall expire on March 30, 2004 unless previously annulled or reaffirmed.

Inquiry: What alternative requirements to those specified in OM Code, ISTB 4.6.1(b)(2) [ISTB 4.7.1(b)(2) in 1994 addenda and later] may be used for digital instruments used in the performance of inservice testing?

Reply: It is the opinion of the Committee that digital instruments may be selected such that the reference value does not exceed 90% of the calibrated range of the instrument.

Applicability: ASME OM Code-1990 Edition through ASME OMb Code-1997 Addenda.

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CODE CASE OMN-7
Alternative Requirements for Pump Testing

This Case shall expire on January 30, 2002 unless previously annulled or reaffirmed.

Inquiry: What alternative to the requirements of ASME OM Code, Subarticle ISTB-5.1 may be used in conjunction with Code Case OMN-3, Requirements for Safety Significance Categorization of Components Using Risk Insights for Inservice Testing of LWR Power Plants, for inservice testing to assess the operational readiness of pumps in light water reactor power plants?

Reply: It is the opinion of the Committee that, in lieu of the rules of ASME OM Code, Subsection ISTB, Subarticle ISTB-5.1, the following alternative requirements may be applied.

1 APPLICABILITY

The pumps covered by this Code Case are all those pumps determined to be within the scope of the risk-informed IST Program in accordance with Code Case OMN-3, Requirements for Safety Significance Categorization of Components Using Risk Insights for Inservice Testing of LWR Power Plants.

2 REQUIREMENTS

2.1 Related Requirements

Use of this Code Case also requires compliance with the requirements of ASME Code Case OMN-3 (risk ranking). Code Case OMN-3 groups components into one of two categories:

(a) high safety significant component (HSSC); or

(b) low safety significant component (LSSC).

Trending of parameters according to OM Code-1995 with OMa Code-1996 meets the performance monitoring requirements of Code Case OMN-3, para. 4.6.

2.2 HSSC Testing Requirements

Group A and Group B pumps categorized as HSSCs shall meet all the requirements of OM Code-1995 with OMa Code-1996.

2.3 LSSC Testing Requirements

Group A and Group B pumps categorized as LSSCs shall meet all the requirements of OM Code-1995 with OMa Code-1996, except that the testing requirements identified in this paragraph and in the table below may be substituted for those in ISTB 5.1 (Table ISTB 5.1-1). All Group A and Group B LSSC pumps shall receive an initial Group A test conducted within ±20% of pump design flow rate as soon as practical and no later than the first refueling outage following implementation of this Code Case. Thereafter, all Group A and Group B LSSC pumps shall be Group A tested within ±20% of pump design flow rate at least once every 5 years or three refueling outages, whichever is longer.

Pump Group	Group A Test	Group B Test	Comprehensive Test
Group A (routinely or continuously operated pumps)	6 months [Note (1)]	Not required	Not required
Group B (standby pumps)	2 years	6 months [Note (1)]	Not required

NOTE:
(1) To meet vendor recommendations, pump operation may be required more frequently than the specified test frequency.

3 ADDITIONAL REQUIREMENTS

(a) The Owner shall develop a transition plan and implementation schedule for this Code Case.

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(b) Feedback and corrective actions shall be taken in accordance with Code Case OMN-3, para 4.7.

(c) If the maximum test interval as determined from the aggregate risk assessment of Code Case OMN-3, para. 4.5.2, for a specific component is more limiting than the test frequency of para. 2.2 or 2.3 above (as applicable), the most limiting test interval shall be used for that component. A Group A or Group B test, as applicable, shall be performed to satisfy the increased test frequency requirements.

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CODE CASE OMN-8
Alternative Rules for Preservice and Inservice Testing of Power-Operated Valves That Are Used for System Control and Have a Safety Function per OM-10

This Case shall expire on November 20, 2001 unless previously annulled or reaffirmed.

Inquiry: What alternative requirements to those of ASME/ANSI OMa-1988, Part 10, para. 4.2 through OM Code-1995, ISTC 4.2 may be used for power-operated control valves that have only a fail safe safety function?

Reply: It is the opinion of the Committee that the requirements of ASME/ANSI OMa-1988, Part 10, para. 4.2.1.4, Power-Operated Valve Stroke Testing; para. 4.2.1.8, Stroke Time Acceptance Criteria; and para. 4.2.1.9(b) need not be met. All other applicable requirements of para. 4.2 shall be met for ASME/ANSI OMa-1988, Part 10.

Further, the requirements of OM Code-1995, ISTC 4.2.4, Power-Operated Valve Stroke Testing; ISTC 4.2.8, Stroke Time Acceptance Criteria; and ISTC 4.2.9(b) need not be met. All other applicable requirements of the paragraph shall be met.

Any abnormality or erratic action experienced during valve exercising shall be recorded in the record of tests, and an evaluation shall be made regarding need for corrective action.

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CODE CASE OMN-9
Use of a Pump Curve for Testing

This Case shall expire on November 25, 2001 unless previously annulled or reaffirmed.

Inquiry: What alternative rules to those of ISTB 4.3, 4.4, 4.5, 5.2, and 6.1 may be used when it is impractical to adjust a centrifugal or vertical line shaft pump to a specific reference value as required by ISTB 5.2(b)?

Reply: It is the opinion of the Committee that the following rules may be used for testing of centrifugal or vertical line shaft pumps where adjustment to a specific reference value is impractical, in lieu of the requirements of ISTB 4.3, 4.4, 4.5, 5.2, and 6.1.

Applicability: ASME OM Code-1990 through ASME OMb Code-1992.

1 ADDITIONAL DEFINITIONS

maximum pump curve range: the maximum potential flow or differential pressure range for the pump curve, from shutoff conditions to maximum required flow rate.

reference curve: a range of values of a test parameter versus flow or differential pressure, for a centrifugal or vertical line shaft pump, measured or determined when the pump is known to be operating acceptably.

2 REFERENCE VALUES

Reference values shall be determined from the results of preservice testing or from the results of the first inservice test. Reference values shall be at points of operation readily duplicated during subsequent tests. All subsequent test results shall be compared to these initial reference values or to new reference values established in accordance with sections 4 and 5 below. Reference values shall only be established when the pump is known to be operating acceptably. If the particular parameter being measured or determined can be significantly influenced by other related conditions, then these conditions shall be analyzed.[1]

3 REFERENCE CURVES

If the establishment of specific reference values is impractical for a centrifugal or vertical line shaft pump, the Owner may establish reference curves. Reference curves shall be determined from data measured during preservice testing or from the first inservice test. A reference curve shall be established from a minimum of three data points and shall have at least one data point for each 20% of the maximum pump curve range. The range of the reference curve shall be sufficient to bound the points of operation expected during subsequent tests. All subsequent test results shall be compared to the initial reference curves or to new reference curves established in accordance with section 4 or 5 below. Reference curves shall only be established when the pump is known to be operating acceptably. If vibration is relatively unaffected by changing differential pressure or flow over the reference curve range, a single reference value may be used for that test quantity, provided it is at the minimum of the measured data. If reference curves are used, the reasons for doing so and the suitability of the methods used to develop the reference curves and acceptance criteria shall be justified and documented in the record of tests (see ISTB 7).

[1] Vibration of pumps may be foundation, driver, and piping dependent. Therefore, if initial vibration readings are high and have no obvious relationship to the pump, the vibration measurements should be taken at the driver, at the foundation, and on the piping, and analyzed to ensure that the reference vibration measurements are representative of the pump and that the mesured vibration levels will not prevent the pump from fulfilling its function.

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4 EFFECT OF PUMP REPLACEMENT, REPAIR, AND MAINTENANCE ON REFERENCE VALUES OR REFERENCE CURVES

When a reference value, set of reference values, or reference curve may have been affected by repair, replacement, or routine servicing of a pump, a new reference value, set of reference values, or reference curve shall be determined or the previous value, or curve, reconfirmed by an inservice test run before declaring the pump operable. Deviations between the previous and new set of reference values or reference curves shall be identified, and verification that the new values or curves represent acceptable pump operations shall be placed in the record of tests (see ISTB 7).

5 ESTABLISHMENT OF ADDITIONAL SET OF REFERENCE VALUES OR REFERENCE CURVES

If it is necessary or desirable, for some reason other than stated in section 4 above, to establish an additional set of reference values or reference curves, an inservice test shall be run at the conditions of an existing set of reference values, or within the range of existing reference curves, and the results analyzed. If operation is acceptable per section 7 below, a second test run at the new reference conditions shall follow as soon as practicable. The results of this test shall establish the additional set of reference values or reference curves. Whenever an additional set of reference values or reference curves is established, the reasons for so doing shall be justified and documented in the record of tests (see ISTB 7). The requirements of section 2 or 3 above apply.

6 TEST PROCEDURE

An inservice test shall be conducted with the pump operating at the specified test conditions. The test parameters shown in Table ISTB 5.2-1 shall be determined and recorded as directed in this paragraph. The test shall be conducted as follows.

(a) The pump shall be operated at nominal motor speed for constant speed drives and at a speed adjusted to the reference speed for variable speed drives.

(b) The resistance of the system shall be varied until the flow rate equals the reference value. The pressure shall then be determined and compared to its reference value. Alternatively, the flow rate can be varied until the pressure equals the reference value, and the flow rate shall be determined and compared to the reference flow rate value.

(c) Where system resistance cannot be varied or if reference curves are used, flow rate and pressure shall be determined and compared to their respective reference values or the associated reference values from the reference curves.

(d) Pressure, flow rate, and vibration (displacement or velocity) shall be determined and compared with corresponding reference values or associated reference values from the reference curves. All deviations from the reference values shall be compared with the limits given in Table ISTB 5.2-2 and Fig. ISTB 5.2-1, and corrective action taken as specified in section 7 below. If the reference curve test method is used, the comparison may be done graphically as shown in Examples 1 and 2 of Fig. 1.

Vibration measurements are to be broad band (unfiltered). If velocity measurements are used, they shall be peak. If displacement amplitudes are used, they shall be peak-to-peak.

7 ACCEPTANCE CRITERIA

If deviations fall within the alert range of Fig. ISTB 5.2-1 and Table ISTB 5.2-2, the frequency of testing specified in ISTB 5.1 shall be doubled until the cause of the deviation is determined and the condition corrected. If deviations fall within the required action range of Table ISTB 5.2-2, the pump shall be declared inoperable until the cause of the deviation has been determined and the condition corrected. If using reference curves, evaluations for deviations in the alert or required action range may be done graphically as demonstrated in Examples 1 and 2 of Fig. 1. When a test shows deviations outside of the acceptable range of Table ISTB 5.2-2, the instruments involved may be recalibrated and the test rerun.

8 RECORDS AND REPORTS

Use of this Code Case shall be documented in the inservice test plans per ISTB 7.2.

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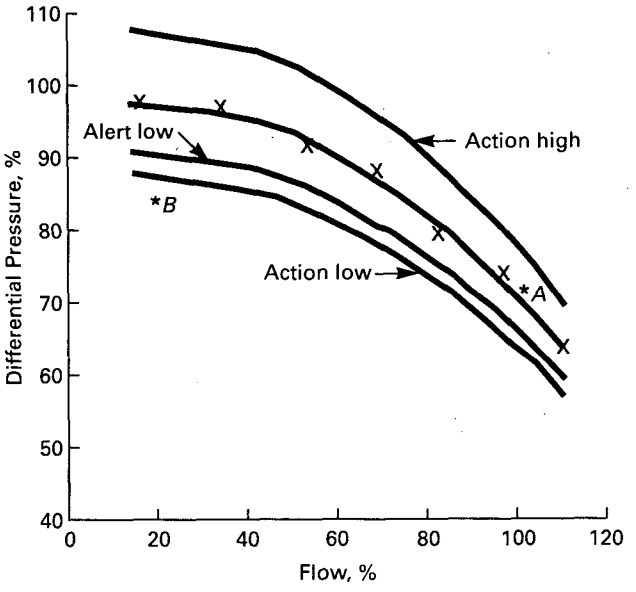
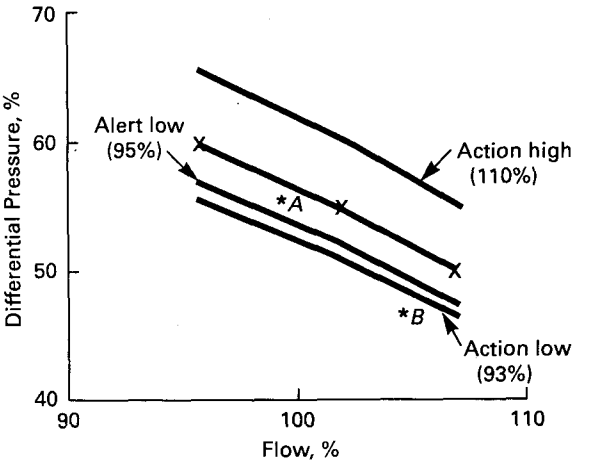
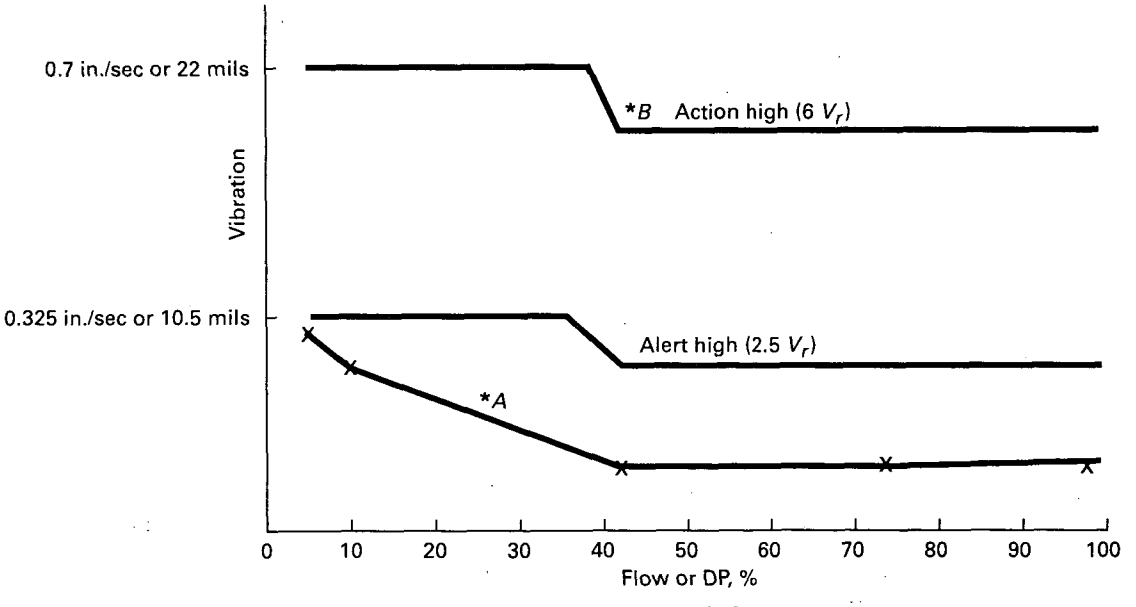


Example 1A



Example 1B



Example 2

A = acceptable operation
B = required action
X = data points used to establish reference curve

FIG. 1 EXAMPLES OF GRAPHICAL EVALUATION OF TESTS USING REFERENCE CURVES

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CODE CASE OMN-10
Requirements for Safety Significance Categorization of Snubbers Using Risk Insights and Testing Strategies for Inservice Testing of LWR Power Plants

This Case shall expire on January 26, 2003 unless previously annulled or reaffirmed.

Inquiry: Is it acceptable to categorize those snubbers under the scope of the ASME OM Code into two categories based on their significance for the purpose of applying different examination and testing strategies to those described in ISTD 6 and ISTD 7?

Reply: Yes, provided the following requirements are met.

1 APPLICABILITY

This Code Case establishes the safety categorization methodology and process for dividing the population of snubbers, as identified in the Owner's Snubber Program Plan, into high safety significant component (HSSC) and low safety significant component (LSSC) categories, and provides acceptable testing strategies for each category.

2 SUPPLEMENTAL DEFINITIONS

2.1 PRA Definitions

common cause failure (CCF): a single event that adversely affects two or more components at the same time.

core damage frequency (CDF): the calculated frequency (per year) that core damage will occur due to failure of a critical safety function (i.e., reactivity control, core cooling, or containment heat removal).

Fussell-Vesely (F-V) importance: the fractional decrease in total risk level (usually CDF) when the plant feature is assumed to be perfectly reliable (failure rate = 0.0).

importance measure: a mathematical expression that defines a quantity of interest. The most common importance measures are F-V and RAW.

large early release frequency (LERF): the calculated frequency (per year) that radioactivity release from containment is both large and early. Large means involving the rapid, unscrubbed release of airborne fission products to the environment. Early means occurring before the effective implementation of offsite emergency and protective actions.

Level 1 PRA: a PRA that identifies accident sequences that can lead to core damage, calculates the frequency of each sequence, and sums those frequencies to obtain CDF.

Level 2 PRA: a PRA that identifies accident sequences that can lead to radioactivity release, calculates the frequency of each sequence, and sums up those frequencies to obtain LERF.

living PRA: a plant specific PRA that is maintained up to date, such that plant modifications, plant operation changes (including procedure changes), component performance, and other technical information significantly affecting the model are reflected in the model.

probabilistic risk assessment (PRA): a quantitative assessment of the risk associated with plant operation and maintenance. Risk is measured in terms of the frequency of occurrence of different events, including core damage. In general, the scope of a PRA is divided into three categories: Level 1, Level 2, and Level 3. A Level 1 maps from initiating events to plant damage states, including their aggregate, core damage. Level 2 includes Level 1 mapping from initiating events to release categories (source term).

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Level 3 includes Level 2 and uses the source term of Level 2 to quantify consequences, the most common of which are health effects and property damage in terms of cost.

risk achievement worth (RAW): the increase in risk of a modeled plant feature (usually a component, train, or system) when the feature is assumed to be out of service (failed). RAW is expressed in terms of the ratio of the risk with the event failed to the baseline risk level.

2.2 Safety Definitions

decision criteria: the quantitative and qualitative factors that affect a decision. These include both quantitative screening criteria (for PRA model) and the evaluation of other qualitative (or deterministic) factors that influence the results of an application.

Expert Panel: a multidisciplined group of experienced plant experts who evaluate specific information, discuss this information amongst themselves (and others as appropriate), and make HSSC and LSSC determinations.

high safety significant components (HSSCs): components that have been designated as more important to plant safety by a blended process of PRA risk ranking and Expert Panel evaluation.

low safety significant components (LSSCs): components that have been designated as less important to plant safety by a blended process of PRA risk ranking and Expert Panel evaluation.

technical specification: the plant technical specifications that are a condition of the plant operating license granted to the Owner by the regulator.

2.3 IST Definitions

active valve: valve that is required to change obturator position to accomplish the required design functions.

inservice test (IST): a test to determine the operational readiness of a component/system (snubber).

operational readiness: ability of a component (snubber) to perform its intended system function when required.

testing strategy: the IST strategy to measure component (snubber) degradation or to monitor a component (snubber) for operational readiness at some interval by operating, examining, or testing the component (snubber).

2.4 Snubber Definitions

component's snubber: snubbers required to protect a component (e.g., pump, valve) during a dynamic event.

equipment dynamic restraint (snubber): a device that provides restraint to a component or system during the sudden application of forces, but allows essentially free motion during thermal movement.

hydraulic snubbers: devices in which the load is transmitted through a hydraulic fluid.

mechanical snubbers: devices in which the load is transmitted entirely through mechanical components.

replacement snubber: any snubber other than the snubber immediately previously installed at a given location.

service conditions: the operating environment for the snubber (e.g., temperature, vibration, weather) at its installed plant location, categorized as harsh or benign.

service life: period of time an item is expected to meet the operational readiness requirements without maintenance.

3 GENERAL REQUIREMENTS

3.1 Implementation

The requirements of this Code Case shall be implemented for all snubbers identified in the Snubber Program Plan, after the Owner has transferred the plant snubber examination and testing requirements from the plant technical specification to an Owner-controlled document and adopted the OM Code.

3.2 Plant Specific PRA

The plant specific PRA (Level 1 with internal initiating events, as a minimum) shall be available and used to perform system risk ranking.

3.3 Living PRA

The PRA shall be maintained up to date [reference (b) in section 9 below provides guidance].

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3.4 Expert Panel

An Expert Panel shall be designated to perform the blended safety evaluation of probabilistic and deterministic engineering information for snubbers.

3.5 Determination of HSSC and LSSC

The Expert Panel shall evaluate each snubber and categorize it as HSSC or LSSC.

3.6 Inservice Testing Strategies for HSSCs and LSSCs

Testing strategies shall be implemented for HSSC snubbers and for LSSC snubbers.

3.7 Other Requirements

Subsection ISTD of reference (a) in section 9 below provides examination and testing requirements for snubbers. Any requirements not specifically addressed by alternative requirements in this Code Case shall stand.

4 SPECIFIC REQUIREMENTS FOR SAFETY CATEGORIZATION

In addition to section 3 above, the following requirements apply to snubber classification into HSSC and LSSC categories.

4.1 System Risk Categorization

This paragraph establishes requirements for separating systems with snubbers into high and low risk categories.

4.1.1 Importance Measures

(a) As a minimum, two importance measures, F-V and RAW, shall be calculated for those systems modeled in the PRA.

(b) The impact upon CDF, and upon LERF if available, shall be determined.

4.1.2 Screening Criteria. For those systems modeled in the PRA, a threshold value of F-V>0.05 (system level) or F-V>0.005 (component or train level) based on CDF (and LERF if available) or RAW>2 (component or train level) shall be initially considered as high risk components, trains, or systems.

4.1.3 Sensitivity Studies

(a) The following sensitivity studies shall be performed for each system containing snubbers.

(1) For Level 1 PRA (CDF end state), determine system and component importance rankings (F-V and RAW) from internal and external initiating events. If external/seismic initiating event PRA is not available, then use alternative deterministic evaluation (i.e., seismic margins).

(2) If available for Level 2 PRA (LERF end state), determine system and component importance rankings as appropriate from internal and external initiating events. If Level 2 PRA is not available, then use alternative deterministic evaluation (i.e., containment bypass).

(3) Identify the major components and their contribution to system risk (F-V and RAW), using internal (and external if available) initiating events.

(4) If available for shutdown PRA (CDF end state), determine system and component importance rankings as appropriate from internal and external initiating events. If shutdown PRA is not available, then use alternative deterministic evaluation (i.e., shutdown cooling paths).

(b) The results of these sensitivity studies, and any others that are performed, shall be documented.

(c) The results and insights of these sensitivity studies shall be provided to the Expert Panel for their consideration in the final categorization of the snubbers.

4.1.4 Qualitative Assessments. Qualitative assessments shall be performed for all active IST components (e.g., pumps and valves) protected by snubbers, unless those snubbers are categorized as HSSC.

(a) The following qualitative assessments shall be performed:

(1) impact of initiating events (i.e., the impact of failure or degradation as it might result in an initiator);

(2) potential consequences of shutdown (outage) conditions; and

(3) response to external initiating events (e.g., seismic, fire, high winds/tornadoes, flooding, etc.).

(b) Qualitative assessments shall be performed for plant-specific design basis conditions and events not modeled in a PRA.

(c) Qualitative assessments shall consider the impacts upon the plant to:

(1) prevent or mitigate accident conditions;

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(2) reach and/or maintain safe shutdown conditions;

(3) preserve the reactor primary coolant pressure boundary integrity; and

(4) maintain containment integrity.

(d) Qualitative assessments shall also consider:

(1) safety function being satisfied by the component's operation;

(2) level of redundancy existing at the plant to fulfill the component's function;

(3) ability to recover from a failure of the component;

(4) performance history of the component;

(5) plant technical specifications requirements applicable to the component;

(6) emergency operating procedure instructions that use the component(s); and

(7) design and licensing basis information relevant to IST component function.

(e) The cumulative impacts of combinations of component unavailability, which could impact an entire system (e.g., multitrain impacts) or critical safety function (e.g., multisystem impacts), shall also be considered.

(f) These qualitative assessments and the Expert Panel's disposition of them shall be documented so independent parties can review and cognizant analysts who did not take part in the original assessment can confirm the result.

(g) These qualitative assessments shall be available to the Expert Panel for their decision of component safety categorization.

4.2 Snubber Safety Categorization

This paragraph provides requirements for the Expert Panel's review and evaluation process for categorizing snubbers relative to their safety significance, using both deterministic and probabilistic insights.

4.2.1 Expert Panel Utilization. The Expert Panel shall blend deterministic and probabilistic information to classify snubbers into HSSC or LSSC categories using both PRA insights and deterministic insights.

(a) *PRA Insights.* The results of PRA analyses shall be used by the Expert Panel to determine the safety significance of components (e.g., pumps and valves) within HSSC systems. Information contained in PRAs relative to the role of components in mitigating or preventing core damaging events or large early radiological release events shall be considered.

(b) *Quality of PRA.* The scope of the PRA and depth of probabilistic analyses shall be assessed, evaluated, and documented. As a minimum, the following shall be documented:

(1) the level of plant specific PRA analysis available for assessing the applicability of PRA information relative to IST programs; for example, written documentation describing the level of plant specific PRA analysis such as Level 1 PRA (assessment of core damage frequency) and/or Level 2 PRA (assessment of core damage frequency plus containment performance);

(2) scope of initiating events considered (internal events, external events, both);

(3) typical failure modes considered (e.g., hardware failures, testing/maintenance failures, common cause failures, human errors);

(4) PRA scope for plant configurations (e.g., low power risk, shutdown risk, transition mode risk, at-power risk) reviewed relative to the applicability of PRA information and IST component function(s).

(c) *Deterministic Insights.* The Expert Panel shall also consider deterministic factors when assessing the safety significance of components within the scope of IST programs (see Appendix A for a sample list of deterministic considerations).

4.2.2 Expert Panel Requirements

(a) *Plant Procedure.* An approved plant procedure shall describe the process, including:

(1) designated members and alternates;

(2) designated chair and alternate;

(3) quorum;

(4) attendance records;

(5) agendas;

(6) motions for approval;

(7) process for decision making;

(8) documentation and resolution of differing opinions;

(9) minutes; and

(10) required training.

(b) *Training.* The Expert Panel shall be trained and indoctrinated in the specific requirements to be used for this Code Case. Training and indoctrination shall include the application of risk analysis methods and techniques used for this Code Case. At a minimum, the risk methods and techniques include:

(1) PRA fundamentals (e.g., PRA technical approach, PRA assumptions and limitations, failure probability, truncation limits, uncertainty);

(2) use of risk importance measures;

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(3) assessment of failure modes for snubbers and components being supported by snubbers;

(4) reliability versus availability;

(5) risk thresholds; and

(6) expert judgment elicitation.

Each of the aforementioned topics shall be covered in the indoctrination to the extent necessary to provide the Expert Panel with a level of knowledge needed to adequately evaluate and approve the scope of the snubber selections, using both probabilistic and deterministic information.

(c) *Experience.* Requirements shall be established for ensuring adequate experience levels of Expert Panel members. Member experience levels shall be documented and maintained.

(d) *Membership*

(1) There shall be at least five experts designated as members of the Expert Panel. Members may be experts in more than one field; however, excessive reliance on any one member's judgment shall be avoided.

(2) The chairperson shall be familiar with this Code Case and shall facilitate Expert Panel activities, to ensure that the requirements of this Code Case are satisfied.

(3) Expertise in the following functions shall be represented on the Expert Panel:

(a) operation

(b) safety analysis engineering

(c) probabilistic risk assessment

(4) Additional members of the Expert Panel should be selected who have the following plant expertise:

(a) systems performance

(b) maintenance

(c) licensing

(d) component performance

(e) ASME inservice examination and testing for snubbers

(f) ASME inservice testing for pumps and valves

(g) quality assurance

(5) Alternate members to the Expert Panel may be designated on a temporary basis; however, vacancies in the Expert Panel membership should be filled by qualified individuals within a reasonable period of time.

(6) Other plant or nuclear industry experts may be invited to attend some or all of the sessions of the Expert Panel as visitors to provide observations, opinions, or recommendations.

4.2.3 Expert Panel Decision Criteria

(a) Level A Inclusion Criteria. Any of the following contributors to snubber importance above stated threshold will potentially make the snubber HSSC:

(1) *Level A-1.* All snubbers protecting the following components:

(a) PWRs: steam generators, reactor coolant pumps

(b) BWRs: recirculation pumps

(2) *Level A-2.* All snubbers protecting components in systems with PRA importance ranking F-V>0.05 or, if evaluated on a component/train level, all snubbers supporting the components in trains with PRA importance ranking F-V>0.005 or RAW>2.

(b) *Level B Exclusion Criteria.* The following conditions allow a snubber to potentially be classified as LSSC:

(1) *Level B-1.* All snubbers that support the component with an importance ranking F-V≤0.005 and a RAW≤2.

(2) *Level B-2.* All snubbers associated with unmodeled components and associated with components that would likely be unmodeled in Level 1, 2, 3, and shutdown PRAs, including both internal and external events.

4.2.4 Reconciliation. Decisions of the Expert Panel shall be arrived at by consensus. Differing opinions shall be documented and resolved, if possible. If a resolution cannot be achieved concerning the safety significance classification of a snubber, then the snubber shall be classified HSSC.

5 SPECIFIC REQUIREMENTS FOR SNUBBER SERVICE CONDITION DETERMINATION

All snubbers shall be placed in one of two service conditions, *harsh* or *benign.*

5.1 Harsh

The *harsh* service condition shall be considered for those operating environments where the snubber is exposed to higher temperatures, vibration, or other service condition variables (see ISTD 8, Appendix F) that would result in a predicted service life of ≤10 years.

5.2 Benign

The *benign* service condition shall be considered for those operating environments where the snubber is exposed to lower temperatures, minimal vibration,

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or other service condition variables (see ISTD 8, Appendix F) that would result in a predicted service life of >10 years.

6 SPECIFIC REQUIREMENTS FOR HSSC TESTING STRATEGIES

NOTE: These are alternate examination and testing strategies in lieu of ISTD 6 and ISTD 7 requirements in reference (a) in section 9 below.

6.1 Examination and Testing Strategies for HSSC Snubbers in Harsh Environment

(a) All snubbers (size, manufacturer, type) in this category shall be considered as one population for examination and testing.

(b) Perform visual examination per ISTD 6.

(c) Test per 37 or 10% plan each refueling cycle or 24 months. If a failure occurs, follow the applicable requirements of the selected plan.

(d) Test and/or replace all snubbers within this DTPG once every 6 years.

(e) The snubbers may be selected for testing on a rotational basis.

6.2 Examination and Testing Strategies for HSSC Snubbers in Benign Environment

(a) All snubbers (size, manufacturer, type) in this category shall be considered as one population for examination and testing.

(b) Perform visual examination per ISTD 6.

(c) Test per 37 or 10% plan each refueling cycle or 24 months. If a failure occurs, follow the applicable requirements of the selected plan.

(d) Test and/or replace all snubbers within this DTPG once every 10 years.

(e) The snubbers may be selected for testing on a rotational basis.

7 SPECIFIC REQUIREMENTS FOR LSSC TESTING STRATEGIES

NOTE: These are alternate examination and testing strategies in lieu of ISTD 6 and ISTD 7 requirements in reference (a) in section 9 below.

7.1 Examination and Testing Strategies for LSSC Snubbers in Harsh Environment

(a) All snubbers (size, manufacturer, type) in this category shall be considered as one population for examination and testing.

(b) Perform visual examination per ISTD 6.

(c) Test per 37 or 10% plan each refueling cycle or 24 months. If a failure occurs, follow the applicable requirements of the selected plan.

(d) Test and/or replace all snubbers within this DTPG once every 10 years.

(e) The snubbers may be selected for testing on a rotational basis.

7.2 Examination and Testing Strategies for LSSC Snubbers in Benign Environment

(a) Determine and monitor service life of each snubber per ISTD 8.

(b) Perform visual examination of all hydraulic snubbers in this category per ISTD 6.

(c) Perform visual examination of all mechanical snubbers in this category to satisfy visual examination requirements of ISTD 6.3 and verify freedom of motion by manual stroking, measuring incremental thermal movement, or functional testing. Perform visual examination of all mechanical snubbers once every 10 years, staggered on minimum 10% to 20% every refuel cycle or 24 months. If degradation is found, test the snubber. If the snubber fails, then verify freedom of motion or test all snubbers susceptible to the same failure mode.

8 RECORDS AND REPORTS

In addition to the requirements of reference (a) in section 9 below with respect to records, the following records of the Expert Panel and the component shall be maintained.

8.1 Expert Panel Records

(a) Membership and attendance

(b) Member expertise representation and training records

(c) Member experience (years of experience in each of the expertise categories)

(d) Meeting agendas

(e) Meeting minutes

(f) Plant procedure

8.2 Component Records

(a) Risk significance based on PRA importance measures

(b) Additional PRA quantitative information

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(c) Deterministic information

(d) Expert Panel categorization decisions of HSSC or LSSC

(e) Basis for the HSSC/LSSC decision

9 REFERENCES

(a) ASME OM Code, Subsection ISTD, Preservice and Inservice Examination and Testing of Dynamic Restraints (Snubbers) in Light-Water Reactor Power Plants, 1995 edition and later addenda

(b) EPRI PSA Applications Guide, TR-105396, August 1995

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CODE CASE OMN-11
Risk-Informed Testing for Motor-Operated Valves

This Code Case shall expire on March 3, 2003 unless previously annulled or reaffirmed.

Inquiry: What alternatives may be used for a risk-informed program in lieu of the testing frequency requirements of Code Case OMN-1, para. 3.3 for Inservice Testing of Motor-Operated Valves?

Reply: It is the opinion of the Committee that the following test frequency alternative requirements are an acceptable method of meeting the requirements of OMN-1, paras. 3.3 and 3.7 and may be applied.

1 SAFETY SIGNIFICANCE CATEGORIZATION

Motor-operated valves (MOVs) shall be evaluated and categorized as High Safety Significant Components (HSSCs) or Low Safety Significant Components (LSSCs), in accordance with the safety significance categorization methodology prescribed in Code Case OMN-3. The risk evaluation process may identify MOVs that were not previously included within the scope of OMN-1 but are applicable under a risk-informed program.

2 HSSC INSERVICE TESTING

HSSC MOVs shall be tested in accordance with OMN-1, para. 3.3, using established test frequencies and utilizing a mix of static and dynamic MOV performance testing.

3 LSSC INSERVICE TESTING

(a) LSSC grouping shall be technically justified, but need not comply with all the requirements of OMN-1, para. 3.5.

(b) LSSC MOVs shall be associated with an established group of other MOVs wherever possible. When a member of that group is tested, the test results shall be analyzed and evaluated in accordance with OMN-1, section 6, and applied to all LSSCs associated with that group.

(c) LSSC MOVs that are not able to be associated with an established group, shall be inservice tested in accordance with OMN-1, para. 3.3, using an initial test frequency of three refueling cycles or 5 years (whichever is longer) until sufficient data exist to determine a more appropriate test frequency.

(d) LSSC MOVs shall be inservice tested at least every 10 years in accordance with OMN-1, para. 3.3.1(c).

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CODE CASE OMN-12
Alternate Requirements for Inservice Testing Using Risk Insights for Pneumatically and Hydraulically Operated Valve Assemblies in Light-Water Reactor Power Plants (OM-Code 1998, Subsection ISTC)

This Code Case shall expire on February 15, 2004 unless previously annulled or reaffirmed.

Inquiry: What alternative to the requirements of ISTC-5130 and ISTC-5140 may be used for risk-informed inservice testing of pneumatically and hydraulically operated valve assemblies?

Reply: It is the opinion of the Committee that the following alternative requirements may be used in lieu of ISTC-5130 and ISTC-5140 for risk-informed inservice testing of pneumatically and hydraulically operated valve assemblies.

1 INTRODUCTION

This Code Case establishes alternative requirements for implementing and maintaining a risk-informed inservice testing program for active pneumatically and hydraulically operated valve assemblies in light-water reactor power plants.

2 TERMS AND DEFINITIONS

The following are provided to ensure a uniform understanding of select terms used in this Code Case.

baseline data: one or more values of test parameters measured or determined when the equipment is known to be operating acceptably at conditions including design basis conditions.

baseline test: a performance test to establish baseline data.

bench set: calibration of the actuator spring range to account for the in-service process forces.

critical parameters: one or more specific parameters that must be met for a valve assembly to meet its design function.

design basis conditions: conditions associated with design basis events, as specified in the final safety analysis report or design basis document(s).

dynamic test: a test conducted with system pressure and/or flow.

hydraulic actuator: a device that provides energy to open, close, or position a valve via hydraulic pressure.

hydraulically operated valve assembly (or valve assembly): a valve and its associated hydraulic actuator, including all subcomponents required for the valve assembly to perform its intended safety function.

maximum available pneumatic pressure: the maximum pressure available to the actuator.

performance test: a test to determine whether a system, structure, or component meets specified acceptance criteria.

periodic valve assembly exercising: periodic stroking of the valve assembly to ensure that the valve assembly is not binding and the valve actuator is functional.

pneumatic actuator: a device that provides energy to open, close, or position a valve via pneumatic pressure.

pneumatically operated valve assembly (or valve assembly): a valve and its associated pneumatic actuator, including all subcomponents required for the valve assembly to perform its intended safety function(s).

seat load: the total net contact force between the obturator and the seat under static conditions.

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set points: a point or set of points that are set so that a valve assembly would meet its design function. Examples of set point would be bench set values, or pressure regulator values.

setup: the establishment and adjustment (i.e., bench set, seat load, regulator set point) of valve subcomponents so that a valve will perform its function(s).

spring rate: the force change per unit change in length, usually expressed as pounds per inch (lb/in.) or Newtons per millimeter (N/mm).

total friction: the sum of packing friction, valve internal friction and actuator friction.

valve assembly group: a collection of valve assemblies having similar design characteristics, applications, and service conditions so that test results, design evaluations, and operating experiences from one member may be applied to other members of the group.

3 PREREQUISITES

3.1 Classification

Valve assemblies shall be classified as either high safety significant or low safety significant in accordance with Code Case OMN-3.

3.2 Grouping of Valve Assemblies

Grouping of valve assemblies is permissible. Valve assemblies with identical or similar designs and with similar plant service conditions may be grouped together. The following shall be performed if grouping of valve assemblies is used:

(a) grouping valve assemblies shall be justified by a documented engineering evaluation;

(b) the functionality of all valve assembly groups shall be validated by the appropriate inservice testing of one or more representative valve assemblies;

(c) test results shall be evaluated and justified for all valve assemblies in a group;

(d) a single representative valve assembly shall not be selected for inservice testing consecutively. All testable valve assemblies in a group shall be inservice tested before a previously tested representative valve assembly can be selected. In addition to this requirement, the owner may elect to consecutively test a certain valve assembly to monitor changes in its functional margin over time;

(e) the number of valve assemblies tested from each group shall be determined using appropriate statistical methodology; and

(f) test results for the representative valve assembly shall be analyzed and evaluated for each valve assembly in the group.

3.3 Testing Basis

An analysis of the test, maintenance, and operating history of a valve assembly, or valve assembly group, shall be performed and documented in order to establish the basis for specifying testing requirements and frequency.

4 HIGH SAFETY SIGNIFICANT VALVE ASSEMBLIES

The purpose of the combination of testing and/or analysis is to ensure the capability of the valve assembly to perform its intended safety function. Testing of valve assemblies classified as high safety significant shall meet the requirements of paras. 4.1 through 4.5.

4.1 Design Verification

4.1.1 The design basis capability for existing valve assemblies shall be verified prior to implementing this Code Case for those valve assemblies.

4.1.2 The design basis capability for new valve assemblies shall be verified prior to initially being placed in service.

4.1.3 A baseline test in combination with at least one of the following shall be performed to demonstrate design basis capability of the valve assembly:

(a) dynamic test at design basis conditions;

(b) correlation with a similar valve assembly that has been dynamically tested at similar or bounding conditions;

(c) extrapolation of results of dynamic tests at highest practicable test conditions;

(d) calculation methods.

4.2 Inservice Test Requirements

4.2.1 Baseline Test Requirements

4.2.1.1 Valve assemblies shall have a baseline test to establish reference values for comparison to subsequent periodic performance test data.

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4.2.1.2 The preservice test results may be used as the baseline test, provided the test conditions in para. 4.3.1 are satisfied. Testing in accordance with ISTC-3100 may be used as the baseline test.

4.2.2 Periodic Test Requirements

4.2.2.1 Periodic test frequency shall be determined based on analysis of data. Data analysis shall be in accordance with para. 4.4.

4.2.2.2 If insufficient data exist to determine the inservice test frequency in accordance with para. 4.4, the valve assembly inservice testing shall be conducted every two refueling cycles or 3 years (whichever is longer) until sufficient data exist to determine a more appropriate test frequency.

4.2.2.3 The maximum interval between inservice tests shall not exceed 10 years.

4.2.2.4 Periodic test methods shall be in accordance with para. 4.3.

4.2.3 Periodic Valve Assembly Exercising

4.2.3.1 Once during each fuel cycle of operation, each valve assembly subject to this Code Case shall be operated to move the obturator through one full stroke (open and close). If a valve assembly experiences a full stroke during the fuel cycle of operation, and the Owner elects to document such operation, no additional valve operation is required to satisfy this requirement.

4.2.3.2 More frequent exercise requirements for valve assemblies with higher risk significance, adverse or harsh environmental conditions, or with abnormal performance history shall be considered. Alternatively, longer exercise intervals may be used if justified by successful operating experience.

4.2.3.3 Paragraph 4.2.3 does not limit the plant operating mode under which periodic valve assembly exercising may be performed.

4.3 Test Methods

The following test methods shall be applied to valve assemblies determined to be subject to this Code Case. The Owner is responsible for establishing conformance with the test methods, including offsite testing.

4.3.1 Test Conditions. Tests shall be performed without any changes, modifications, or adjustments to the valve assembly during testing. Test conditions that apply to valve assemblies based on the selection of the test parameters in accordance with para. 4.3.3 shall be determined. The baseline test shall be performed at specific repeatable conditions. The periodic performance tests shall be performed at the conditions used to establish baseline values.

4.3.2 Test Procedures. Procedures shall be established, as appropriate, to provide for the following:

(a) methodical, repeatable, and consistent performance testing;

(b) valid test data that are not influenced by any preconditioning associated with performance testing procedural steps;

(c) data that reflects, or can be correlated with, the design basis conditions;

(d) adequate data for analysis and evaluation per para. 4.4.

4.3.3 Test Parameters

4.3.3.1 Test parameters shall be monitored to ensure that the valve assembly performs its intended safety function(s). The safety function(s) may include one or more of the following:

(a) open within a specified minimum or maximum time period, or both;

(b) close within a specified minimum or maximum time period, or both;

(c) stroke open to obtain specified flow or pressure;

(d) stroke open or closed against flow or pressure, including maximum differential pressure for the valve assembly to fulfill its safety function, across the valve;

(e) travel to a predetermined intermediate position;

(f) remain in operating position for specified period of time;

(g) operate a specified number of cycles.

4.3.3.2 Determine which of the following parameters, or combination of parameters, which may be determined from data obtained during testing, are important to monitor to ensure the safety function(s) capability of the valve assembly.

(a) bench set;

(b) seat load;

(c) spring rate;

(d) full-stroke time;

(e) actual travel;

(f) total friction;

(g) maximum available pneumatic pressure;

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(h) minimum pneumatic pressure required to accomplish the safety function(s) of the valve assembly;

(i) hydraulic pressure at an appropriate point in operation;

(j) pneumatic and hydraulic fluid condition and cleanliness;

(k) set point of pressure switch, relief valve, regulator, etc.;

(l) torque;

(m) others as applicable.

4.3.4 Test Information. Test information shall be recorded in accordance with ISTC-9000. In addition, the following information shall be recorded:

(a) test conditions per para. 4.3.1, including system fluid and ambient conditions;

(b) remarks concerning abnormal or erratic action, either during or preceding performance testing;

(c) date of test;

(d) valve assembly identification;

(e) nameplate data;

(f) test equipment identification and date of calibration;

(g) parameters measured in accordance with para. 4.3.3.2; and

(h) name of tester.

4.4 Analysis and Evaluation of Data

The following analysis and evaluation of data shall be applied to valve assemblies determined to be subject to this Code Case.

4.4.1 Acceptance Criteria. Acceptance criteria shall be established by which test data shall be analyzed. The criteria shall specify the acceptable limits or range of test parameters based on design criteria necessary for the valve assembly to perform its intended safety function(s) until the next test.

4.4.2 Analysis of Data. Data obtained from a test performed under this Code Case shall be analyzed to determine acceptable valve assembly performance.

Performance test data shall be compared to parameter limits or ranges established in accordance with para. 4.4.1. Test history (such as degradation) shall be considered on a particular valve assembly. Performance test data trends (including allowance for uncertainties) shall be established to predict when data points may approach the parameter limits. If a datum being compared falls within the acceptable range of established parameters, the valve assembly may be considered acceptable. If the test data is unacceptable, corrective actions shall be taken in accordance with para. 4.5.

4.4.3 Evaluation of Data

4.4.3.1 Criteria for data evaluation shall be established that ensures:

(a) the valve assembly meets its established acceptance criteria;

(b) corrective action is taken as described in para. 4.5 if a valve assembly does not meet its established acceptance criteria; and

(c) validation of the test frequency.

4.4.3.2 Where grouping is used, the results of data evaluation shall be applied to all valve assemblies in the group.

4.4.4 Documentation of Analysis and Evaluation of Data. Results of test data evaluation and analysis shall be documented. Documentation shall include:

(a) assumptions made;

(b) values of test parameters and test information established in accordance with paras. 4.3.4 and 4.4.1.

(c) a statement that test data are within acceptable limits or that corrective actions have been initiated and that independent verification of the test data evaluation and analysis has been completed; and

(d) a summary of data analysis and evaluation in accordance with paras. 4.4.2 and 4.4.3.

4.5 Corrective Action

If the monitored parameters are outside acceptable limits, then corrective action shall be initiated. If acceptance criteria (established in para. 4.4.1) limiting values are exceeded, the valve shall immediately be declared inoperable. Valve assemblies declared inoperable may be repaired or replaced, or the data may be analyzed to determine the cause of the deviation and to show the valve assembly to be operating acceptably.

The corrective action shall bring the valve assembly back into compliance with the acceptance criteria. When the corrective action consists of evaluating the acceptability of the valve assembly at the degraded conditions, new baseline data and acceptance criteria shall be established. The valve assembly shall be retested in accordance with para. 4.3 following the corrective action and prior to return to service. The cause of the failure or degradation shall be evaluated for identification of corrective actions to prevent recurrence in similar components or grouped

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valve assemblies. Documentation of corrective actions shall include:

(a) valve assembly identification;

(b) summary of corrective action and results;

(c) subsequent test data or analysis, including analysis for valve assembly operability;

(d) identification of the cause of the anomaly and technical justification for corrective action taken; and

(e) description of actions taken to restore operational readiness of the valve assembly.

5 LOW SAFETY SIGNIFICANT VALVE ASSEMBLIES

The purpose of this section is to provide a high degree of confidence that the LSSC valve assemblies will perform their intended safety function if called upon. Valve assemblies classified as LSSC shall meet the requirements of paras. 5.1 through 5.6.

5.1 Set Points and/or Critical Parameters

5.1.1 Set points and/or critical parameters for existing valve assemblies shall be established prior to implementing this Code Case for those valve assemblies.

5.1.2 Set points and/or critical parameters for new valve assemblies shall be established prior to initially being placed in service.

5.1.3 Establishment of set points and/or critical parameters should consider the following:

(a) walk down of the valve assembly to establish that the installed assembly agrees with the plant's information or database;

(b) original manufacturer's set points;

(c) changes to the original plant system design parameters or the operation of the valve assembly;

(d) industry experience;

(e) maximum expected packing and other valve assembly friction; and

(f) manufacturer's or industry calculations may be used to establish set points and/or critical parameters.

5.1.4 All information and methods used to establish the set points and/or critical parameters shall be documented.

5.2 Evaluation Requirements

Procedures shall be established, as appropriate, and should consider the following:

(a) consistent and verifiable evaluation of the valve assembly;

(b) application of diagnostic test equipment;

(c) documentation of parameters necessary to evaluate the valve assembly's ability to perform its intended safety function(s).

(d) system or plant conditions, at which the valve assembly is tested, shall be evaluated; and

(e) which of the parameters, or combination of parameters, listed in para. 4.3.3.2 are important to monitor to provide a high degree of confidence in the capability of the valve assembly to perform its safety function.

5.3 Periodic Evaluation

5.3.1 Periodic Evaluation Frequency. Periodic evaluation frequency shall be established based on the requirements of paras. 5.3.1.1 through 5.3.1.3.

5.3.1.1 No valve assembly shall exceed 10 years between evaluations.

5.3.1.2 The initial evaluation period shall be established based on one or more of the following:

(a) plant-specific maintenance and operating history;

(b) evaluation of nonmetallic materials required for safety function(s) of the valve assembly;

(c) manufacturer's recommendations; and

(d) if a subcomponent has no effect on the setup of the valve's safety function, it need not be considered in the evaluation period of the overall valve assembly.

5.3.1.3 All information and methods used to establish the evaluation period shall be documented.

5.3.2 Extending or Decreasing Periodic Evaluation Periods

5.3.2.1 The initial evaluation period and subsequent periods may be extended 1 year or one refueling cycle at a time if the evaluation of valve assembly test data has determined that there is no unacceptable degradation of components in the valve assembly.

5.3.2.2 The periodic evaluation period shall be decreased if it is determined that a component failure was due to degradation during the existing evaluation period.

5.3.3 Group Evaluation Period. Where grouping of valve assemblies is used, all valves in a group shall be assigned the same periodic evaluation period.

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5.4 Evaluations

5.4.1 Initial or As-Left Evaluation

5.4.1.1 The initial or as-left evaluation shall be performed after the valve assembly is initially put in service, postmaintenance, or refurbished and has been set up per the established criteria. The purpose of this evaluation is to:

(a) validate the assumptions used to establish the valve assembly's set-up criteria used in para. 5.1; and

(b) confirm the integrity and operation of all the valve assembly's subcomponents.

5.4.1.2 If a valve assembly's evaluation does not meet the parameters established in para. 5.1, corrective action shall be initiated.

5.4.2 As-Found Evaluation. Maintenance and operational activities shall be conducted in order to prevent or minimize preconditioning of the valve assembly prior to as-found evaluation.

5.4.2.1 An as-found evaluation shall be performed to:

(a) validate any assumptions used in para. 5.1; and

(b) confirm the integrity of the valve assembly's subcomponents.

5.4.2.2 As-found evaluations shall be performed on a valve assembly prior to any refurbishment at the end of a periodic evaluation period.

5.4.2.3 If a valve assembly's evaluation does not meet the parameters established in para. 5.1, corrective action shall be initiated.

5.5 Periodic Valve Assembly Exercising

5.5.1 Once during each fuel cycle of operation, each valve assembly subject to this Code Case shall be operated to move the obturator through one full stroke (open and close).

5.5.2 If a valve assembly experiences a full stroke during the plant's cycle of operation and the Owner elects to document such operation, no additional operation is required for the cycle.

5.5.3 Paragraph 5.3 does not limit the plant's operating mode under which periodic valve assembly exercising may be performed.

5.6 Corrective Action

5.6.1 If the parameters monitored and evaluated do not meet the established criteria, then corrective action shall be initiated.

5.6.2 If a valve assembly being evaluated for corrective action is part of a group of valve assemblies, the group must also be evaluated for corrective action.

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CODE CASE OMN-13
Requirements for Extending Snubber Inservice Visual Examination Interval at LWR Power Plants

This Code Case shall expire on February 12, 2004 unless previously annulled or reaffirmed.

Inquiry: With the low rate of problem identification through the visual examination process, can the visual examination interval allowed in Table ISTD 6.5.2-1 of the OM Code, Subsection ISTD, 1995 Edition 1996 Addenda be extended?

Reply: Yes, provided that the following additional service life monitoring requirements are met.

Applicability: ASME OM Code 1995 Edition with 1996 Addenda and later editions and addenda.

1 APPLICABILITY

This Code Case establishes specific requirements that must be met in order to allow extension of the visual examination interval beyond the maximum interval allowed in Table ISTD 6.5.2-1 for mechanical and hydraulic snubbers. Paragraphs referenced in this Code Case denote the 1995 Edition and 1996 Addenda. A correlation Table 1 is provided for 1998 Edition.

2 GENERAL REQUIREMENTS

The following requirements shall be implemented in order to extend the visual examination interval beyond the maximum interval allowed in Table ISTD 6.5.2-1.

(a) These requirements are in addition to the service life monitoring requirements in ISTD 8.

(b) The requirements of this Code Case shall be implemented after the requirements of ISTD 6.5.1, ISTD 6.5.2(a), ISTD 6.5.2(b), and ISTD 6.5.2(c) have been satisfied and the previous examination per Table ISTD 6.5.2-1 was performed at a maximum interval of two fuel cycles.

(c) Demonstrate that the requirements of paras. 3.1, 3.2, 3.3, 3.4, 3.5, and 3.6 of this Code Case have been met for one interval prior to extending the examination interval.

2.1 Service Life Evaluations

The data and information gathered under this Code Case shall be utilized to reevaluate service life as described in ISTD 8.

2.2 Testing for This Code Case

Snubbers tested specifically for this Code Case shall be dispositioned per ISTD 8.5.

3 SPECIFIC REQUIREMENTS

3.1 Examination for Indications of Degradation or Severe Operating Environments

Examinations per ISTD 6.1, ISTD 6.2, ISTD 6.3, and ISTD 6.4 shall include examination for indications of degradation and severe operating environments.

3.2 Examination Prior to Maintenance or Testing

All snubbers shall be examined in accordance with the requirements of ISTD 6.1, ISTD 6.2, ISTD 6.3, and ISTD 6.4 and para. 3.1 of this Code Case prior to conducting any maintenance, stroking, or testing, and prior to removal, for any reason, from their installed location.

3.3 Monitoring of Reservoir Fluid Level

Fluid level in hydraulic snubber reservoirs shall be sufficient to ensure that the snubber is acceptable

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for continued service to the next examination interval.

3.4 Review of Operational Readiness Test Data

All inservice test data acquired since implementation of the requirements of this Code Case shall be evaluated for indications of snubber degradation or other anomalies. This includes a review of test traces, where available. The results of this evaluation shall be used:

(a) to identify snubbers that are subject to progressive degradation; and

(b) to identify severe operating environments not previously identified.

Where applicable, data gathered prior to implementation of this Code Case shall also be evaluated.

3.5 Examination During Disassembly

Snubbers and snubber parts shall be examined for indications of degradation and severe operating environments during disassembly (e.g., during failure evaluation, refurbishment).

CORRELATION TABLE

1995 Edition and 1996 Addenda	1998 Edition
ISTD 1.13	ISTD-1750
ISTD 6	ISTD-4200
ISTD 6.1, 6.2, 6.3, 6.4	ISTD-4210, 4220, 4230, 4240
IST 6.5.1	ISTD-4251
ISTD 6.5.2(a)	ISTD-4252(a)
ISTD 6.5.2(b)	ISTD-4252(b)
ISTD 6.5.2(c)	ISTD-4252(c)
ISTD 8	ISTD-6000
ISTD 8.5	ISTD-6500
Table ISTD 6.5.2-1	Table ISTD-4252-1

3.6 Transient Dynamic Event

The service life evaluation required by para. 2.1 of this Code Case shall include any transient dynamic event and actions taken under ISTD 1.13.

3.7 Frequency of Examinations

All snubbers within the scope of ISTD shall be examined and evaluated per ISTD 6.1, ISTD 6.3, and ISTD 6.4 at least once every 10 years.

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OM CODE CASES

A Code Case is the official method of handling a reply to an inquiry when study indicates that the Code wording needs clarification, or when the reply modifies the existing requirements of the Code, or grants permission to use alternative methods.

ASME has agreed to publish Cases issued by the Operation and Maintenance Committee concerning the OM Code as part of the update service to the OM Code. A notice appears in *Mechanical Engineering* when new and revised Cases are approved, as well as announcements of approval of reaffirmed Cases and annulments. All Code Case actions then appear in the next update. Cases currently in effect at the time of publication of a new edition of the Code are included with it as a supplement.

The Cases affected by this supplement are as follows:

Page	*Location*	*Change*
C-1	OMN-1	New expiration date: March 30, 2004
C-10	OMN-2	New expiration date: March 30, 2004
C-11	OMN-3	New expiration date: March 30, 2004
C-19	OMN-4	New expiration date: March 30, 2004
C-20	OMN-5	New expiration date: March 30, 2004
C-21	OMN-6	New expiration date: March 30, 2004
C-35	OMN-11	Added
C-36	OMN-12	Added
C-42	OMN-13	Added

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CODE CASE OMN-1
Alternative Rules for Preservice and Inservice Testing of Certain Electric Motor-Operated Valve Assemblies in Light-Water Reactor Power Plants OM Code-1995, Subsection ISTC

This Case shall expire on March 30, 2004 unless previously annulled or reaffirmed.

Inquiry: What alternative rules, to those of OM Code, Subsection ISTC, may be used for preservice and inservice testing to assess the operational readiness of certain electric motor-operated valve assemblies in light-water reactor power plants?

Reply: It is the opinion of the Committee that, in lieu of the rules for preservice and inservice testing to assess the operational readiness of certain electric motor-operated valve assemblies in light-water reactor power plants in OM Code-1995, Subsection ISTC, except for ISTC 4.3, the following alternative requirements may be applied. Electric motor-operated valves for which seat leakage is limited to a specific maximum amount in the closed position for fulfillment of their required function (Category A) must also be seat leakage rate tested in accordance with the requirements of ISTC 4.3.

NOTE: The terms "shall consider" and "shall be considered" are used in paras. 3.5, 3.6.2, and 3.7.1 of this Code Case. The Code Case does not dictate how the considerations in the paragraphs are implemented or documented. Users of the Code Case will determine the best methods based on their programs, which may include procedures, checklists, training, or other methods.

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1 INTRODUCTION

1.1 Scope

This Code Case establishes the requirements for preservice and inservice testing to assess the operational readiness of certain motor-operated valves (MOVs) in light-water reactor (LWR) power plants.

The MOVs covered are those required to perform a specific function in shutting down a reactor to the safe shutdown condition, in maintaining the safe shut-down condition, or in mitigating the consequences of an accident.

This Code Case establishes test methods, test intervals, parameters to be measured and evaluated, acceptance criteria, corrective actions, and records requirements.

1.2 Exclusions

MOVs in the following categories are excluded from this Code Case, if they are not specifically required to perform a function described in para. 1.1:

(a) MOVs used only for operating convenience, such as vent, drain, instrument, and test valves;

(b) MOVs used only for system control, such as pressure regulating valves;

(c) MOVs used only for system or component maintenance;

(d) MOVs not required to change position.

External control and protection systems that sense plant conditions and provide signals for MOV operation are also excluded from the requirements of this Code Case.

2 SUPPLEMENTAL DEFINITIONS

motor-operated valve (MOV): a valve and its associated electric motor-driven mechanism for positioning the valve, including components that control valve action and provide position output signals.

MOV functional margin: the increment by which an MOV's available capability exceeds the capability required to operate the MOV under design basis conditions.

stem factor: the ratio of stem torque to stem thrust in rising-stem valves.

design basis stem factor: the greatest value for stem factor expected during design basis operation of an MOV.

3 GENERAL REQUIREMENTS

3.1 Design Basis Verification Test

A one-time test shall be conducted to verify the capability of each MOV to meet its safety-related design basis requirements. This test shall be conducted at conditions as close to design basis conditions as practicable. Requirements for a design basis verification test are specified in applicable regulatory documents. Testing that meets the requirements of this Code Case but conducted before implementation of this Code Case may be used.

(a) Design basis verification test data shall be used in conjunction with preservice test data as the basis for inservice test criteria.

(b) Design basis verification testing shall be conducted in situ or in a prototype test facility that duplicates applicable design basis conditions. If a test facility is used, an engineering analysis shall be documented that supports applicability to the in situ conditions.

(c) 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.

(d) The design basis verification test shall be repeated if an MOV application is changed, the MOV is physically modified, or the system is modified in a manner that invalidates its current design basis verification test results or data. A determination that a design basis verification test is still valid shall be justified by an engineering evaluation, alternative testing techniques, or both.

3.2 Preservice Test

Each MOV shall be tested during the preservice test period or before implementing inservice testing. These tests shall be conducted under conditions as near as practicable to those expected during subsequent inservice testing. Testing that meets the requirements of this Code Case but conducted before implementation of this Code Case may be used. Only one preservice test of each MOV is required unless, as described in para. 3.4, the MOV has undergone maintenance that could affect its performance.

3.3 Inservice Test

Inservice testing shall commence when the MOV is required to be operable to fulfill its required

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function(s), as described in para. 1.1, and shall be sufficient to assess changes in MOV functional margin consistent with section 6.

(a) MOVs may be grouped for inservice testing as described in para. 3.5.

(b) Inservice tests shall be conducted in the as-found condition. Maintenance activities, such as stem lubrication, shall not be conducted if they might invalidate the as-found condition for inservice testing.

(c) The inservice testing program will include a mix of static and dynamic MOV performance testing. The mix of MOV performance testing may be altered when justified by an engineering evaluation of test data.

3.3.1 Inservice Test Frequency

(a) The inservice test frequency shall be determined in accordance with para. 6.4.4.

(b) If insufficient data exist to determine the inservice test frequency in accordance with para. 6.4.4, then MOV inservice testing shall be conducted every 2 refueling cycles or 3 years (whichever is longer) until sufficient data exist to determine a more appropriate test frequency.

(c) The maximum inservice test frequency shall not exceed 10 years. MOV inservice tests conducted per para. 3.4 may qualify for this requirement.

3.4 Effect of MOV Replacement, Repair, or Maintenance

When an MOV or its control system is replaced, repaired, or undergoes maintenance that could affect the valve's performance, new inservice test values shall be determined or the previously established inservice test values shall be confirmed before the MOV is returned to service. If the MOV was not removed from service, inservice test values shall be immediately determined or confirmed. This testing is intended to demonstrate that performance parameters, which could be affected by the replacement, repair, or maintenance, are within acceptable limits. The Owner's program shall define the level of testing required after replacement, repair, or maintenance. Deviations between the previous and new inservice test values shall be identified and analyzed. Verification that the new values represent acceptable operation shall be documented as described in section 9, Records and Reports.

3.5 Grouping of MOVs for Inservice Testing

Grouping MOVs for inservice testing is permissible. Grouping MOVs shall be justified by an engineering evaluation, alternative testing techniques, or both. The following shall be considered when grouping MOVs:

(a) MOVs with identical or similar motor operators and valves and with similar plant service conditions may be grouped together based on the results of design basis verification and preservice tests. Functionality of all groups of MOVs shall be validated by appropriate inservice testing of one or more representative valves;

(b) test results shall be evaluated and justified for all MOVs in the group;

(c) a single representative MOV shall not be selected consecutively. All testable MOVs in a group shall be inservice tested before a previously tested representative MOV can be reselected. In addition to this requirement, the Owner may elect to consecutively test a certain MOV to monitor changes in its functional margin over time;

(d) the number of MOVs tested from each group shall be determined using appropriate statistical methodology. For groups with ten or more MOVs, at least two representative MOVs shall be tested; and

(e) test results for a representative MOV shall be analyzed and evaluated per Section 6 for each MOV in the group.

3.6 MOV Exercising Requirements

3.6.1 All MOVs, within the scope of this Code Case shall be exercised on an interval not to exceed one year or one refueling cycle (whichever is longer). Full-stroke operation of an MOV, as a result of normal plant operations or Code requirements, may be considered an exercise of the MOV, if documented. Alternatively, longer exercise intervals may be used if justified by successful operating experience.

3.6.2 The Owner shall consider more frequent exercising requirements for MOVs in any of the following categories:

(a) MOVs with high risk significance;

(b) infrequently operated MOVs with risk significance;

(c) MOVs with adverse or harsh environmental conditions; or

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(d) MOVs with any abnormal characteristics (operational, design, or maintenance conditions).

3.6.3 MOVs shall be exercised as follows:

(a) full-stroke exercising during plant operation to the position(s) required to fulfill its function(s);

(b) if full-stroke exercising of an MOV is not practicable during plant operation, then full-stroke exercising shall be done during cold shutdowns; or

(c) if full-stroke exercising of an MOV is not practicable during plant operation or cold shutdown, then full-stroke exercising shall be done during the plant's refueling outages.

3.7 Risk-Based Criteria for MOV Testing

3.7.1 Risk-based criteria for MOV testing are permissible. If establishing risk based criteria for performance testing, the Owner shall consider the following:

(a) develop an acceptable basis for MOV risk determination;

(b) develop MOV screening criteria to determine each MOV's contribution to risk; and

(c) establish applicability by a documented evaluation from a plant expert panel.

3.7.2 Risk-based criteria, when applied to MOV performance testing, shall be used in conjunction with the MOV's margin to establish MOV grouping, acceptance criteria, exercising requirements, and testing frequency.

4 RESERVED

5 TEST METHODS

5.1 Test Prerequisites

All testing shall be conducted in accordance with plant-specific technical specifications, installation details, acceptance criteria, and maintenance, surveillance, operation, or other applicable procedures.

5.2 Test Conditions

Inservice test conditions shall be sufficient to determine the MOV's functional margin per para. 6.4. Test conditions shall be recorded for each test per section 9.

5.3 Limits and Precautions

(a) MOV exposure to dust, moisture, or other adverse conditions shall be minimized while performing tests.

(b) Manufacturer or vendor limits and precautions associated with the MOV and with the test equipment shall be considered, including the structural thrust and torque limits of the MOV.

(c) Plant-specific operational and design precautions and limits shall be followed. Items to be considered shall include, but are not limited to, water hammer and intersystem relationships.

5.4 Test Procedures

Procedures shall be established for all tests specified in this Code Case and shall provide for:

(a) methodical, repeatable, and consistent performance testing; and

(b) collection of data required to analyze and evaluate the MOV functional margin in accordance with section 6.

5.5 Test Parameters

Sufficient test parameters shall be selected for measurement to meet the requirements of section 6 in determining the MOV functional margin.

6 ANALYSIS AND EVALUATION OF DATA

6.1 Acceptance Criteria

The Owner shall establish methods to determine acceptance criteria for each MOV within the scope of this Code Case. Acceptance criteria shall be based upon the minimum amount by which available stem torque must exceed the required design basis stem torque. When determining the acceptance criteria, consider the following sources of uncertainty:

(a) test measurement uncertainty and equipment uncertainty (e.g., torque switch repeatability);

(b) analysis, evaluation, and extrapolation method uncertainty; and

(c) grouping method uncertainty.

6.1.1 MOV margins may be expressed in terms of other parameters, such as stem force, if those parameters are consistent with paras. 6.1 through 6.5.

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6.2 Analysis of Data

Data obtained from a test required by this Code Case shall be analyzed to determine if the MOV performance is acceptable. The Owner shall determine which methods are suitable for analyzing necessary parameters for each MOV and application.

Whenever data are analyzed, all relevant operating and test conditions shall be considered.

The Owner shall compare performance test data to the acceptance criteria. If the functional margin, determined per para. 6.4.3, does not meet the acceptance criteria, the MOV shall be declared inoperable, in accordance with the Owner's requirements.

Data analysis shall include a qualitative review to identify anomalous behavior. If indications of anomalous behavior are identified, the cause of the behavior shall be analyzed and corrective actions completed, if required.

6.3 Evaluation of Data

The Owner shall determine which methods are suitable for evaluating test data for each MOV and application.

The Owner shall have procedural guidelines to establish the methods and timing for evaluating MOV test data. Evaluations shall determine the amount of degradation in functional margin that occurred over time. Evaluations shall consider the influence of past maintenance and test activities to establish appropriate time intervals for future test activities.

If grouping is used, the evaluations shall apply changes in functional margin to all members of the group to establish appropriate time intervals for future test activities.

6.4 Determination of MOV Functional Margin

The Owner shall demonstrate that adequate margin exists between the required torque and the available torque. Also, adequate margin shall exist to ensure that changes in MOV operating characteristics over time do not result in reaching a point of insufficient margin before the next scheduled test activity.

Figure 6.4-1 is a flow diagram that outlines the important steps for determining MOV functional margin. This figure is provided for information only. The figure shows separate paths for quarter-turn and rising-stem MOVs. For rotating-rising-stem MOVs, follow the path for rising-stem MOVs.

6.4.1 Determination of Required Torque

6.4.1.1 Rising-Stem MOVs. Design basis required torque shall be determined from measurements taken during testing at design basis conditions.

If not measured directly during testing at design basis conditions, design basis required torque for rising-stem MOVs shall be determined from the evaluation of the design basis required stem thrust and the design basis stem factor (torque equals thrust multiplied by stem factor).

(a) Design Basis Stem Thrust. Design basis stem thrust shall be determined from measurements taken during testing at design basis conditions. Alternatively, design basis stem thrust can, with justification, be estimated by analytical methods using valve parameters determined from testing at conditions other than design basis conditions.

(b) Design Basis Stem Factor. Design basis stem factor shall be calculated from measurements taken during testing at design basis conditions. Alternatively, the stem factor can, with justification, be estimated by analytical methods using valve parameters determined from testing at conditions other than design basis conditions.

6.4.1.2 Quarter-Turn MOVs. The design basis stem torque shall be determined from measurements taken during testing at design basis conditions. Alternatively, the design basis stem torque can, with justification, be estimated by analytical methods, using valve parameters determined from testing at conditions other than design basis conditions.

6.4.2 Determination of Available Stem Torque

6.4.2.1 Available Stem Torque Based on Motor Capabilities. Available stem torque shall be determined based on motor capabilities at the motor's design basis conditions. Considerations shall include:

(a) rated motor start torque;
(b) minimun voltage conditions;
(c) elevated ambient temperature conditions;
(d) operator efficiency; and
(e) other appropriate factors.

6.4.2.2 Available Torque Based on Torque Switch Setting. Where used, the available stem torque, based on the current torque switch setting, shall be determined from the stem torque measurement taken at torque switch trip.

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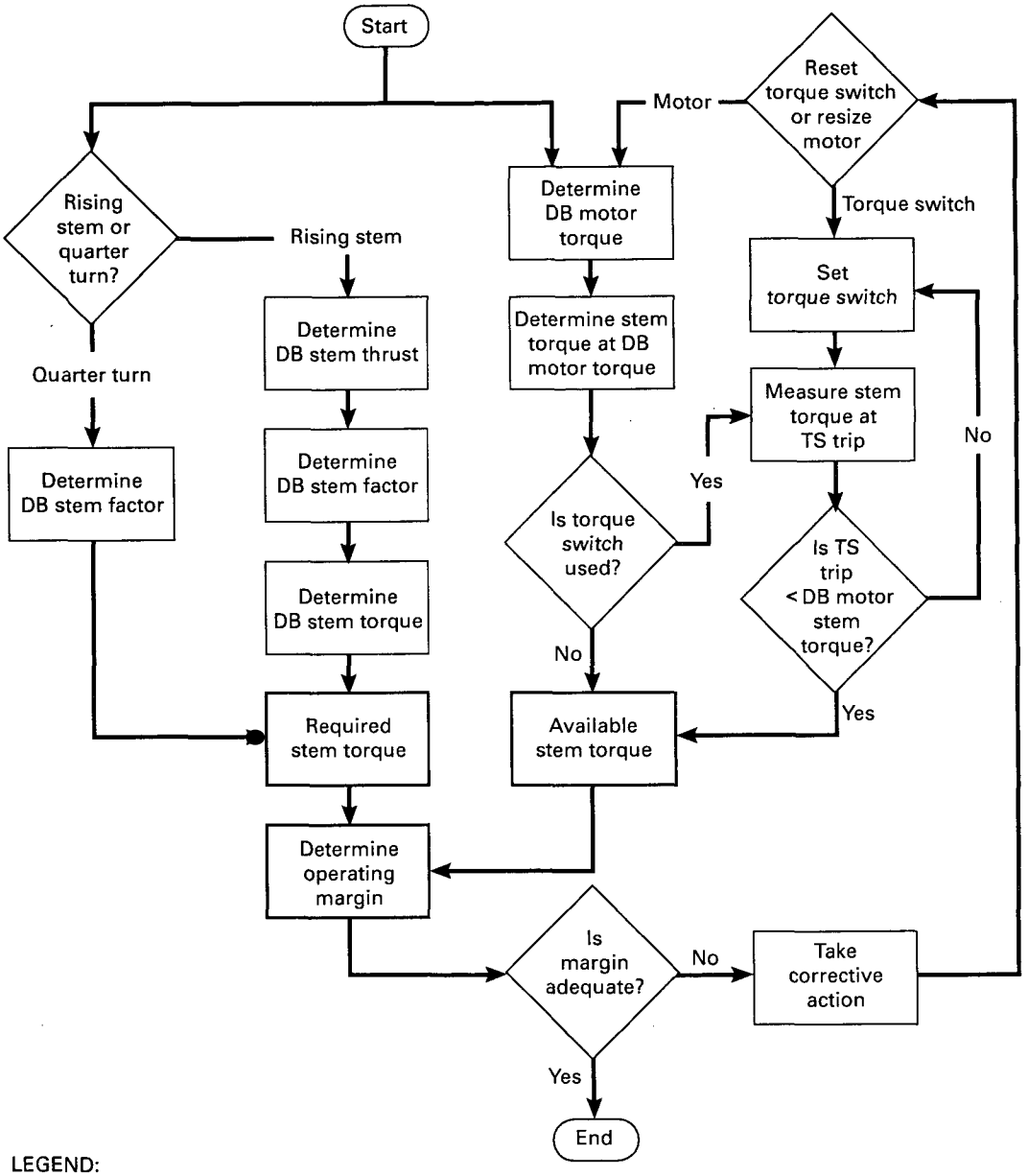

LEGEND:
DB = design basis
TS = torque switch

NOTE:
(1) Or alternate corrective action

FIG. 6.4-1 MOV FUNCTIONAL MARGIN DETERMINATION FLOWCHART

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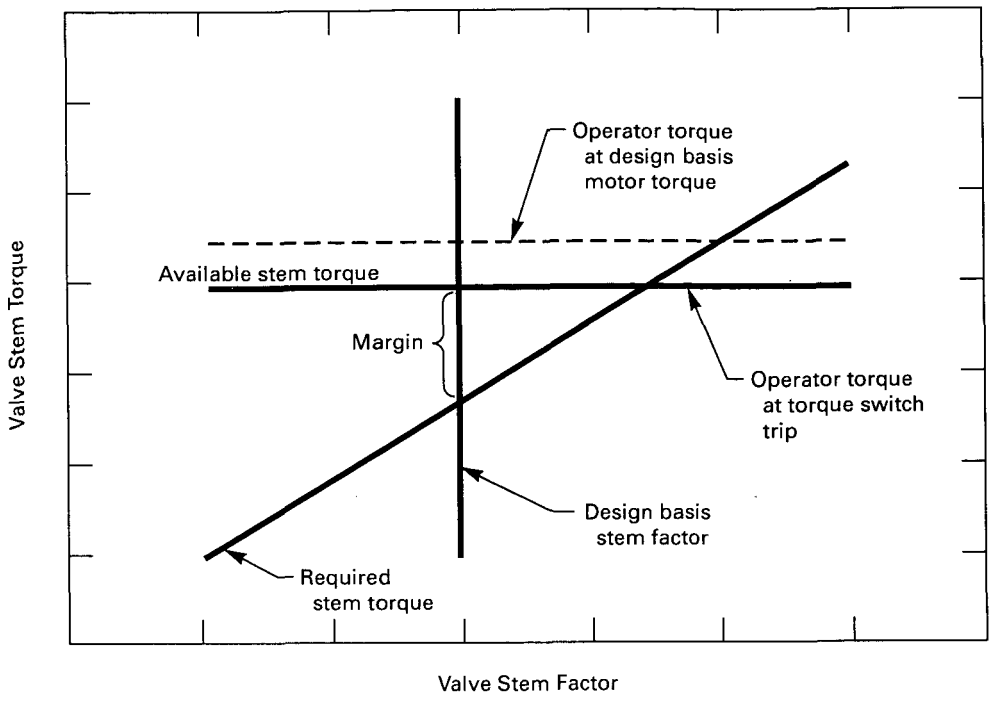

FIG. 6.4-2 DETERMINING FUNCTIONAL MARGIN FOR RISING-STEM MOVs

For MOVs where inservice testing does not sufficiently load the MOV to cause torque switch trip (e.g., butterfly and ball valves), available stem torque based on the current torque switch setting shall be determined analytically from test data. Considerations shall include:

(a) calibration of the torque switch spring pack;

(b) the current torque switch setting; and

(c) repeatability of torque switch operation.

6.4.3 Calculation of MOV Functional Margin. MOV functional margin shall be calculated as the difference between the available stem torque and the required stem torque (available torque minus required torque equals margin).

Figure 6.4-2 illustrates this calculation for a rising-stem MOV where torque is expressed as a function of stem factor. The figure shows available stem torque based on two values:

(a) the stem torque based on the motor operating at its design basis conditions; and

(b) the stem torque based on the current torque switch setting.

When calculating MOV functional margin, the available stem torque is the lesser of the two.

For rising-stem valves, required stem torque appears as a diagonal line representing the torque needed to provide a given amount of stem thrust (required stem thrust) at various values for the stem factor. MOV functional margin is the difference between available stem torque and required stem torque at the design basis stem factor.

6.4.4 Determination of MOV Test Interval. Calculations for determining MOV functional margin shall also be evaluated to account for anticipated time-related changes in performance. Figure 6.4-3 provides an example of how the measured functional margin might change over time. Figure 6.4-4 provides an example of how changes in the functional margin over time can be evaluated to determine test intervals. Maintenance activities and intervals can affect test intervals and shall be considered.

The interval between tests shall be less than the anticipated time for the functional margin to decrease to the acceptance criteria.

6.5 Corrective Action

If the MOV performance is unacceptable, as established in para. 6.4, corrective action shall be taken

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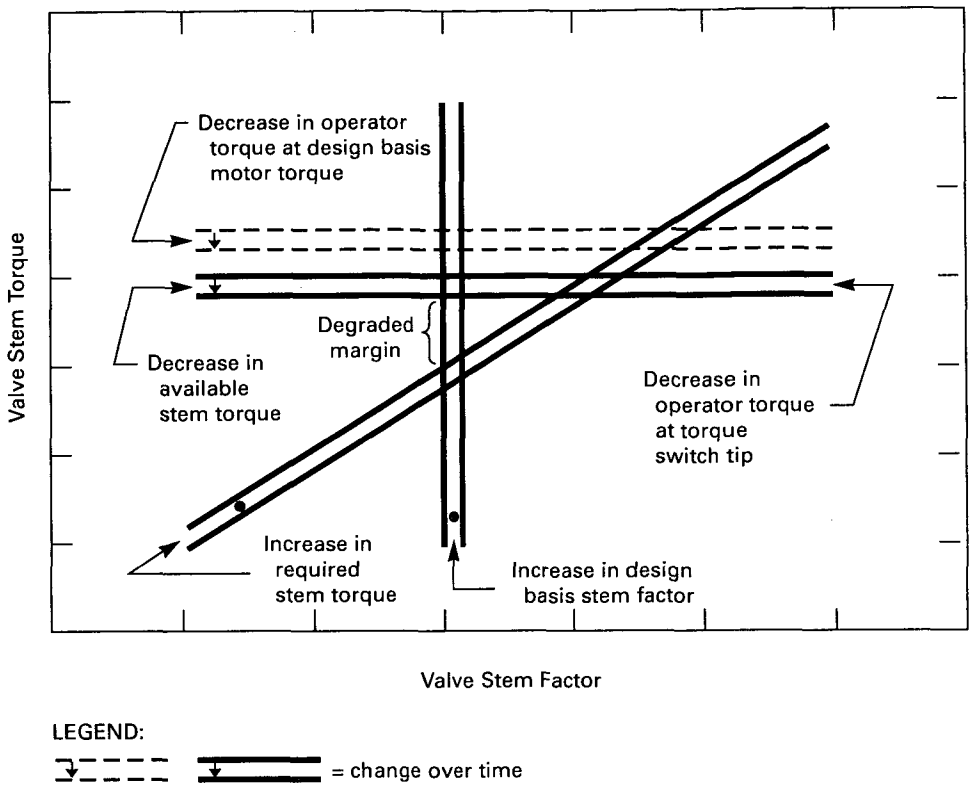

FIG. 6.4-3 DECREASE IN FUNCTIONAL MARGIN OVER TIME FOR RISING-STEM MOVs

in accordance with Owner's corrective action requirements.

6.5.1 Record of Corrective Action. The Owner shall maintain records of corrective action that shall include a summary of the corrections made, the subsequent inservice tests, confirmation of operational adequacy, and the signature of the individual responsible for corrective action and verification of results.

7 RESERVED

8 RESERVED

9 RECORDS AND REPORTS

9.1 Test Information

Pertinent test information shall be recorded or verified for MOV testing, described in section 3. The following information shall be considered:

(a) MOV plant-specific unique identification number;

(b) motor, valve, actuator nameplate data;

(c) test equipment unique identification numbers and equipment calibration dates;

(d) test method and conditions, described in section 5, including description of valve lineups, process equipment, and type of test. Descriptions shall include valve body, valve stem, electric motor-operator orientation, and piping configuration near the MOV;

(e) breaker setting/fuse size and motor starter thermal overload size, if used;

(f) MOV torque and limit switch configuration and settings;

(g) MOV performance test procedure and other approved plant documents containing acceptance criteria;

(h) name of test performer and date of test;

(i) system flow, system pressure, differential pressure, system fluid temperature, system fluid phase, and ambient temperature; and

(j) significant observations — any comments pertinent to the test results which otherwise may not be readily identified by other recorded test data shall be recorded. Observations shall include any remarks regarding abnormal or erratic MOV action

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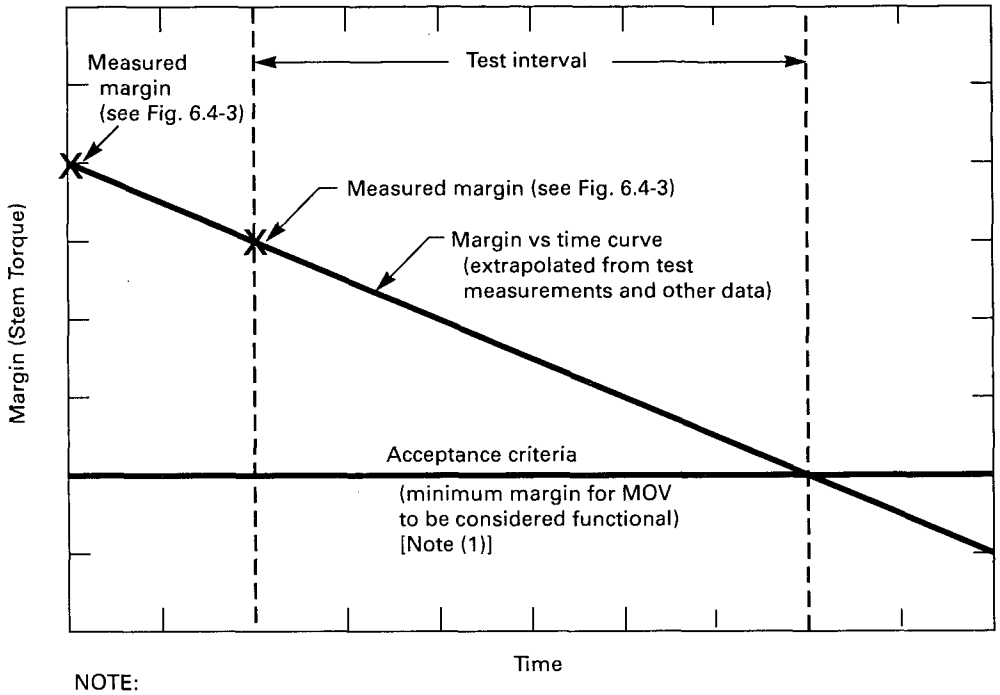

NOTE:
(1) Calculated value plus uncertainty.

FIG. 6.4-4 DETERMINING THE TEST INTERVALS FOR MAINTAINING MOV FUNCTIONAL MARGIN

noted either during or preceding performance testing and any other pertinent design information which can be verified at the MOV.

9.2 Documentation of Analysis and Evaluation of Data

The documentation of acceptable MOV performance, which has been analyzed and evaluated in accordance with section 6, shall include, as a minimum:

(a) values of test data, test parameters, and test information established by paras. 5.5 and 9.1;

(b) summary of analysis and evaluation required per paras. 6.2 and 6.3;

(c) statement(s), by an individual qualified to make such a statement through the Owner's qualification requirements, confirming that the MOV is capable of performing its intended safety function; and

(d) signature and date of verification of the results of the analysis and evaluation by qualified individuals. Independent verification shall be by individuals qualified to verify those specific analyses and evaluations through the Owner's qualification requirements.

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CODE CASE OMN-2
Thermal Relief Valve Code Case, OM Code-1995, Appendix I

This Case shall expire on March 30, 2004, unless previously annulled or reaffirmed.

Inquiry: What alternative to ASME OM Code-1995, Appendix I, paras. 1.3.5(a), (b), and (c) may be used for Class 2 and Class 3 pressure relief valves, which are required to be tested per ASME OM Code-1995, Appendix I, para. I 1.1, whose only overpressure protection function is to protect isolated components from fluid expansion caused by changes in fluid temperature?

Reply: It is the opinion of the Committee that in lieu of the requirements specified in ASME OM Code-1995, paras. I 1.3.5(a), (b), and (c) testing for Class 2 and Class 3 pressure relief devices whose only overpressure protection function is to protect isolated components from fluid expansion caused by changes in fluid temperature shall be performed once every ten years on each device unless performance data indicates that more frequent testing is needed to assure device function. In lieu of test, the Owner may replace these devices every ten years unless performance data indicates more frequent replacement is needed to assure device function.

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CODE CASE OMN-3
Requirements for Safety Significance Categorization of Components Using Risk Insights for Inservice Testing of LWR Power Plants

This Case shall expire on March 30, 2004 unless previously annulled or reaffirmed.

Inquiry: Is it acceptable to categorize those components under the scope of the ASME OM Code Section IST into two categories based on their safety significance?
Reply: Yes, provided the following requirements are met.

1 APPLICABILITY

This Code Case establishes the component safety categorization methodology and process for dividing the population of components, as identified in the IST Program Plan, into "high safety significant component" (HSSC) and "low safety significant component" (LSSC) categories.

2 SUPPLEMENTAL DEFINITIONS

aggregate risk: the risk due to programmatic changes in the IST program (test method effectiveness and/or testing interval) as measured by CDF or LERF.

common cause failure (CCF): a single event that adversely affects two or more components at the same time.

core damage frequency (CDF): the calculated frequency (per year) that core damage will occur due to failure of a critical safety function (i.e., reactivity control, core cooling, or containment heat removal). (A Level 1 PRA identifies accident sequences that can lead to core damage, calculates the frequency of each sequence, and sums those frequencies to obtain CDF.)

decision criteria: the quantitative and qualitative factors that influence a decision. These include both quantitative screening criteria (for PRA model) and the evaluation of other qualitative (or deterministic) factors that influence the results of an application.

PRA failure rate: the conditional probability of failure of a component on the next demand (for standby component) or in the next hour of operation (for operating component), given that it has not already failed.

figures-of-merit: the quantitative value, obtained from a PRA analysis, used to evaluate the results of an application (e.g., CDF, LERF).

Fussell-Vesely (F-V) importance: the fractional decrease in total risk level (usually CDF) when the plant feature is assumed to be perfectly reliable (failure rate = 0.0).

high safety significant components (HSSCs): components that have been designated as more important to plant safety by a blended process of PRA risk ranking and Plant Expert Panel evaluation.

importance measure: a mathematical expression that defines a quantity of interest. The most common importance measures are F-V and RAW.

inservice test (IST): a test to determine the operational readiness of a component/system.

initiating event: any event that perturbs the steady state operation of the plant, if operating, or the steady state operation of the decay heat removal system during shutdown operations, thereby initiating a transient within the plant. (Initiating events trigger sequences of events that challenge plant control and safety systems.)

large early release frequency (LERF): the calculated frequency (per year) that radioactivity release from

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the containment is both large and early. "Large" means involving the rapid, unscrubbed release of airborne fission products to the environment. "Early" means occurring before the effective implementation of off-site emergency and protective actions. (A Level 2 PRA identifies accident sequences that can lead to radioactivity release, calculates the frequency of each sequence, and sums these frequencies to obtain LERF.)

living PRA: a plant specific PRA that is maintained up to date, such that plant modifications, plant operation changes (including procedure changes), component performance, and other technical information significantly affecting the model are reflected in the model.

low safety significant components (LSSCs): components that have been designated as less important to plant safety by a blended process of PRA risk ranking and Plant Expert Panel evaluation.

operational readiness: the ability of a component to perform its intended system function when required.

probabilistic risk assessment (PRA): a quantitative assessment of the risk associated with plant operation and maintenance. Risk is measured in terms of the frequency of occurrence of different events, including core damage. In general the scope of a PRA is divided into three categories: Level 1, Level 2, and Level 3. A Level 1 maps from initiating events to plant damage states, including their aggregate, core damage. Level 2 includes Level 1 mapping from initiating events to release categories (source term). A Level 3 includes Level 2 and uses the source term of Level 2 to quantify consequences, the most common of which are health effects and property damage in terms of cost. Full scope PRA includes internal and external events.

risk achievement worth (RAW): the increase in risk of a modeled plant feature (usually a component, train, or system) when the feature is assumed to be out of service (failed). RAW is expressed in terms of the ratio of the risk with the event failed to the baseline risk level.

testing strategy: the IST strategy to measure component degradation or to monitor a component for operational readiness at some interval by operating or inspecting the component (e.g., valve stroking, pump vibration test, motor circuit evaluation, motor current signature analysis, component bearing lube oil analysis).

truncation limits: the cutoff value of probability or frequency of individual accident sequences below which they are no longer retained in quantitative PRA model results.

3 GENERAL REQUIREMENTS

3.1 Implementation

The requirements of the risk informed component code cases shall be implemented for all IST components of the same type. Component types are specified in the risk informed component code cases.

3.2 Plant Specific PRA

The plant specific PRA (Level 1 with internal initiating events, as a minimum) shall be available and used to perform component risk ranking.

3.3 Living PRA

The PRA shall be maintained up to date. (Reference 1 provides guidance.)

3.4 Integrated Effects

Components may be affected by more than one risk informed application. Integrated effects of multiple risk informed applications (including risk informed applications outside of the ASME scope) shall be evaluated.

3.5 Plant Expert Panel

A Plant Expert Panel shall be designated to perform the blended safety evaluation of probabilistic and deterministic engineering information for each component.

3.6 Determination of HSSC and LSSC

The Plant Expert Panel shall evaluate each component and categorize it as HSSC or LSSC, using PRA quantitative information (if component is modeled) and engineering qualitative information (for both modeled and not modeled components).

3.7 Inservice Testing Strategy for HSSCs and LSSCs

Testing strategies will be developed by other risk informed component code cases:

(a) Test strategies for the HSSCs shall have the objective of identifying and trending degradation

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that could lead to the occurrence of the failure mode(s) that resulted in the HSSC categorization.

(b) Test strategies for LSSCs shall have the objective of providing confidence for operational readiness.

3.8 Evaluation of Aggregate Risk

The aggregate risk impact of changes to the IST program shall be evaluated by the Owner (e.g., plant expert panel). Decision criteria, quantitative evaluations, and qualitative assessments are a part of this aggregate risk impact evaluation. Reference 1 provides guidance on evaluating aggregate risk.

3.9 Feedback and Corrective Actions

Feedback and corrective action processes are required elements of this Code Case.

4 SPECIFIC REQUIREMENTS

In addition to section 3 above, the following requirements apply to component classification into HSSC and LSSC categories, and to a risk-informed IST program based on those categories.

4.1 Component Risk Categorization

This paragraph establishes requirements for separating components into HSSC or LSSC categories, performing PRA sensitivity studies to ensure that quantitative ranking is correct, and determining how to treat components not modeled.

4.1.1 Importance Measures

(a) As a minimum, two importance measures, F-V and RAW, shall be calculated for those components modeled in the PRA.

(b) Both the impact upon CDF and upon LERF, if available, shall be determined.

4.1.2 Screening Criteria. For those components modeled in the PRA:

(a) a threshold value of F-V>0.005 based on either CDF or LERF shall be initially considered as HSSC;

(b) a threshold value of RAW>2 based on either CDF or LERF shall be initially considered as HSSC.

4.1.3 Sensitivity Studies

(a) The following sensitivity studies shall be performed:

(1) Data and Uncertainties. Failure rates of components within the PRA models for those IST components that have initially very high or very low safety significance shall be selectively increased and/or decreased to determine if the results are sensitive to changes in the failure data. If sensitivities are indicated, steps shall be taken to determine if uncertainty ranges can be reduced and to validate the failure probabilities included in the models.

(2) Human Factors. The PRA shall be requantified, and the F-V and RAW importance measures recalculated, after human actions modeled in the PRA to recover from specific component failures are removed from the models (i.e., the probability of successful recovery due to human intervention is set to zero).

(3) Test and Maintenance Unavailabilities. The PRA models shall be requantified with test and maintenance unavailabilities minimized or removed, and the importance measures recalculated.

(4) LSSC Failure Rates. Failure rates for initially ranked LSSC components shall be increased by a factor representing the upper bound (95%) of the failure rate and the PRA models requantified. The importance measures shall then be recalculated.

(5) Truncation Limits. If the PRA has not been quantified with a truncation limit in accordance with Ref. 1, the PRA model shall be requantified with the truncation limit lowered to this value. The importance measures shall then be recalculated.

(6) Common Cause. Sensitivity analyses shall determine the impact of increased or decreased common cause failure rates. Importance measures shall then be recalculated.

(b) The results of these sensitivity studies and any others that are performed, shall be documented. In addition to the magnitude of the changes to the CDF or LERF, all insights obtained from the results shall be described.

(c) The results and insights of these sensitivity studies shall be provided to the Plant Expert Panel for their consideration in the final categorization of the components.

4.1.4 Qualitative Assessments. Qualitative assessments shall be performed for all IST components, modeled and not modeled.

(a) The following qualitative assessments shall be performed:

(1) impact of initiating events (i.e., the impact of failure or degradation as it might result in an initiator);

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(2) potential consequences of shutdown (outage) conditions; and

(3) response to external events (e.g., seismic, fire, high winds/tornadoes, flooding, etc.).

(b) Qualitative assessments shall be performed for plant-specific design bases conditions and events not modeled in a PRA.

(c) Qualitative assessments shall consider the impacts upon the plant to:

(1) prevent or mitigate accident conditions;

(2) reach and/or maintain safe shutdown conditions;

(3) preserve the reactor primary coolant pressure boundary integrity; and

(4) maintain containment integrity.

(d) Qualitative assessments shall also consider:

(1) safety function being satisfied by the component's operation;

(2) level of redundancy existing at the plant to fulfill the component's function;

(3) ability to recover from a failure of the component;

(4) performance history of the component;

(5) plant technical specifications requirements applicable to the component;

(6) emergency operating procedure instructions that use the component(s); and

(7) design and current licensing basis information relevant to IST component function.

(e) The cumulative impacts of combinations of component unavailability, which could impact an entire system (e.g., multitrain impacts) or critical safety function (e.g., multisystem impacts), shall also be considered.

(f) These qualitative assessments and the plant expert panel's disposition of them shall be documented so independent parties can review and cognizant analysts who did not take part in the original assessment can confirm the result.

(g) These qualitative assessments shall be available to the Plant Expert Panel for their decision of component safety categorization.

4.1.5 Components Not Modeled

(a) If IST components not modeled in the original at-power PRA are subsequently determined to have an impact upon the ability of the facility to respond to events initiated while the plant is at power, consideration should be given to updating the PRA model to incorporate the effects of the component(s), then using the updated model to provide a quantified basis for categorization (either HSSC or LSSC).

(b) If IST components not modeled in the original shutdown PRA (for facilities with a shutdown PRA) are subsequently determined to have an impact upon the ability of the facility to respond to events initiated while the plant is shutdown, consideration should be given to updating the shutdown PRA model to incorporate the effects of the component(s), then using the updated model to provide a quantified basis for categorization (either HSSC or LSSC).

4.2 Component Safety Categorization

This paragraph provides requirements for the Plant Expert Panel's review and evaluation process for categorizing IST components relative to their safety significance, using both deterministic and probabilistic insights.

4.2.1 Plant Expert Panel Utilization. The Plant Expert Panel shall blend deterministic and probabilistic information to classify IST components into HSSC or LSSC categories.

(a) *PRA Insights.* The results of PRA analyses shall be used by the Plant Expert Panel to determine the safety significance of components within the scope of IST and PRA programs. Information contained in PRAs relative to the role of components in mitigating or preventing core damaging events or radiological release events shall be considered. The scope of the PRA and depth of probabilistic analyses shall be assessed, evaluated, and documented. As a minimum, the following shall be documented:

(1) The level of plant specific PRA analysis available for assessing the applicability of PRA information relative to IST programs. For example, written documentation describing the level of plant specific PRA analysis such as Level 1 PRA (assessment of core damage frequency) and/or Level 2 PRA (assessment of core damage frequency plus containment performance).

(2) Scope of initiating events considered (internal events, external events, both).

(3) Typical failure modes considered (e.g., hardware failures, testing/maintenance failures, common cause failures, human errors).

(4) PRA scope for plant configurations (e.g., low power risk, shutdown risk, transition mode risk, at-power risk) reviewed relative to the applicability of PRA information and IST component function(s).

(b) *Deterministic Insights.* The Plant Expert Panel

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shall also consider deterministic factors when assessing the safety significance of components within the scope of IST programs (See Appendix A of this Code Case for a sample list of deterministic questions).

4.2.2 Plant Expert Panel Requirements

(a) Plant Procedure. A procedure approved by the Owner shall describe the process, including:

(1) designated members and alternates;

(2) designated chairman and alternate;

(3) quorum;

(4) attendance records;

(5) agendas;

(6) motions for approval;

(7) process for decision making;

(8) documentation and resolution of differing opinions;

(9) minutes;

(10) implementation of feedback/corrective actions;

(11) feedback to the PRA; and

(12) required training.

(b) Training. The Plant Expert Panel shall be trained and indoctrinated by the Owner in the specific requirements to be used for this Code Case. Training and indoctrination shall include the application of risk analysis methods and techniques used for this Code Case. At a minimum, the risk methods and techniques include:

(1) PRA fundamentals (e.g., PRA technical approach, PRA assumptions and limitations, failure probability, truncation limits, uncertainty);

(2) use of risk importance measures;

(3) assessment of failure modes;

(4) reliability versus availability;

(5) risk thresholds; and

(6) expert judgment elicitation.

Each of the aforementioned topics shall be covered in the indoctrination to the extent necessary to provide the Plant Expert Panel with a level of knowledge needed to adequately evaluate and approve the scope of the IST selections, using both probabilistic and deterministic information.

(c) Experience. The Owner shall establish requirements for ensuring adequate experience levels of Plant Expert Panel members. Member experience levels shall be documented and maintained by the Owner.

(d) Requirements. The Owner shall ensure:

(1) there are at least five experts designated as members of the Plant Expert Panel. Members may be experts in more than one field; however, excessive reliance on any one member's judgment shall be avoided.

(2) the chairperson is familiar with this Code Case and facilitates Plant Expert Panel activities, to ensure that the requirements of this Code Case are satisfied.

(3) expertise in the following functions is represented on the Plant Expert Panel:

(a) operation

(b) safety analysis engineering

(c) probabilistic risk assessment

(e) Recommendations. The Owner:

(1) should select additional members of the Plant Expert Panel who have the following plant expertise:

(a) systems performance

(b) maintenance

(c) licensing

(d) component performance

(e) ASME inservice testing

(f) quality assurance

(2) may designate alternate members to the Plant Expert Panel on a temporary basis; however, vacancies in the Plant Expert Panel membership should be filled by qualified individuals within a reasonable period of time;

(3) may invite other plant or nuclear industry experts to attend some or all of the sessions of the Plant Expert Panel as visitors to provide observations, opinions, or recommendations.

4.2.3 Plant Expert Panel Decision Criteria. Plant Expert Panel decision criteria for categorizing components as HSSC and LSSC shall be documented.

4.2.4 Reconciliation. Decisions of the Plant Expert Panel shall be arrived at by consensus. Differing opinions shall be documented and resolved, if possible.

(a) If a resolution cannot be achieved concerning the safety significance classification of a component, then the component shall be classified HSSC.

(b) If components have a high initial ranking from the PRA (i.e., RAW>2 or F-V>0.005) but are ultimately ranked as LSSCs, the Plant Expert Panel shall provide written justification of their decision.

4.3 Testing Strategy Formulation

(a) The Owner shall develop testing strategies

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for HSSCs and LSSCs following the requirements provided in the risk informed component code cases.

(b) After testing strategies are developed, the Owner shall provide the planned changes (e.g., test frequency, testing effectiveness, and test duration) for input to the evaluation of aggregate risk.

4.4 Evaluation of Aggregate Risk

4.4.1 Decision Criteria

(a) Appropriate decision criteria for aggregate risk effects shall be established and documented by the Owner.

(1) Decision criteria shall be based on thresholds for aggregate risk limits using standard figures-of-merit (e.g., CDF, LERF). (Reference 1 provides guidance.)

(2) Performance criteria used for other regulatory requirements, such as the Maintenance Rule (10 CFR 50.65) or other formal industry programs, may be taken into consideration when developing decision criteria for aggregate risk effects.

(b) Decision criteria may be determined both qualitatively and quantitatively.

4.4.2 Quantitative Assessment

(a) An aggregate risk evaluation shall be performed prior to implementation, as applicable, using the PRA.

(1) Quantitative attributes associated with this Code Case shall be considered and included in the quantitative evaluation, as appropriate, and within the scope of the PRA.

(2) Each applicable quantitative IST attribute shall be incorporated into the quantitative evaluation, as appropriate, until all proposed changes have been dispositioned (i.e., incorporated or not incorporated).

(3) Attributes not included in the quantitative evaluation shall be documented.

(4) Once all appropriate inputs have been incorporated, the PRA shall be rerun to assess the overall risk impact.

(5) Proposed IST program change shall be assessed to determine compliance with approved decision criteria and to quantitatively determine if any adjustments or compensatory measures are warranted.

(b) Types of quantitative attributes that should be considered in the quantitative evaluation include changes in:

(1) testing frequency;

(2) test duration;

(3) failure rates;

(4) failure modes;

(5) common cause failure susceptibility; and

(6) compensatory measures.

Compensatory measures include both those specifically incorporated into plant programs and those developed by the Owner for specific situations. Management directed compensatory measures should also be included in the quantitative assessment, as appropriate. Verifiable values of failure rates shall be used in the quantification process for IST component.

(c) Testing effectiveness shall be evaluated by periodic assessments or when new failure modes are identified that impact risk quantification.

(1) New failure modes shall be incorporated in accordance with the Owner's risk management and corrective action programs into the quantitative evaluation, as appropriate.

(2) Changes resulting from programs that significantly affect the reliability or availability of components that perform important safety functions shall be assessed, and, if appropriate, incorporated into the PRA for requantification.

Such assessments may be performed in conjunction with the plant specific Maintenance Rule (10 CFR 50.65) requirements.

4.4.3 Qualitative Evaluation

(a) Aggregate risk effects shall be qualitatively evaluated (i.e., risk decreases as well as risk increases) for IST program changes (e.g., testing effectiveness).

(b) Pertinent performance indicators, industry programs, or other scrutable methods for establishing aggregate risk effects shall be identified and monitored.

(c) Owner feedback processes and corrective action programs shall be considered in the evaluation of aggregate risk.

4.4.4 Defense in Depth. The Owner shall ensure that the IST aspects of Defense in Depth are maintained.

4.5 Inservice Testing Program

4.5.1 Maximum Testing Interval

(a) The results of the aggregate risk evaluation shall determine the maximum test interval based on safety significance.

(b) Within the maximum test interval set by the

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aggregate risk evaluation, the Owner shall establish a testing strategy for each individual component as specified in the applicable risk informed component code cases.

4.5.2 Implementation Schedule. A schedule shall be developed for implementing the testing strategies as specified in the risk informed component code cases.

4.5.3 Feedback to Aggregate Risk. Once the test schedule has been developed, the schedule shall be reviewed against the assumptions of the aggregate risk evaluation.

4.5.4 Transition Plan. A transition plan shall be developed for each component type to ensure adequate information is collected to support justification of stepwise test interval extension up to and including the maximum allowable interval.

4.6 Performance Monitoring

4.6.1 HSSC Attribute Trending. For HSSCs, the Owner shall establish a set of attributes to be tested in accordance with the requirements of risk informed component code cases and will implement a trending program for those attributes selected for monitoring.

4.6.2 LSSC Performance Trending. For LSSCs, the Owner shall identify testing strategies in accordance with the requirements of risk informed component code cases and shall trend component performance.

4.7 Feedback and Corrective Actions

4.7.1 Feedback

(a) The Owner shall establish a feedback process incorporating elements of both conditional and periodic feedback such that component performance information is directed to both the IST and PRA programs. Conditional feedback shall occur on a timely fashion following component failure. Periodic feedback shall be considered for maintenance of the PRA.

(b) Each program shall assimilate performance information to ensure the appropriate unavailability information is reflected in decision making.

(c) The Owner shall establish a feedback process so IST programmatic changes are directed to the PRA program.

4.7.2 Corrective Action. In addition to the requirements in the IST Code of Record with respect to Corrective Actions, the Owner shall establish a Corrective Action Program that identifies and tracks to resolution all failures of similar types of components within an IST Program incorporating risk insights, including transportability evaluation.

4.7.3 Component Safety Recategorization. The component's operational readiness is not changed by recategorization.

5 RESERVED

6 RESERVED

7 RESERVED

8 RECORDS AND REPORTS

In addition to the requirements in the Code of Record with respect to Records, the Owner shall maintain the following records of the Plant Expert Panel and the component.

8.1 Plant Expert Panel Records

(a) Membership and attendance

(b) Member expertise representation and training records

(c) Member experience (years of experience in each of the expertise categories)

(d) Meeting agendas

(e) Meeting minutes

(f) Plant procedure

8.2 Component Records

(a) Risk significance based on PRA importance measures

(b) Additional PRA quantitative information

(c) Deterministic information

(d) Plant Expert Panel categorization decisions of HSSC or LSSC (e) Basis for the HSSC/LSSC decision

9 REFERENCES

EPRI TR. 105396, PSA Applications Guide, August 1995

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APPENDIX A
Sample List of Component Deterministic Questions

This nonmandatory Appendix provides guidance to the Plant Expert Panel for including additional components into the IST program and categorizing them as HSSC or LSSC.

A1 DESIGN BASIS ANALYSIS

(a) Is component considered in design basis analysis?

(b) Is component function considered important in the Safety Analysis Report?

(c) Are there any Tech Spec considerations for this component?

A2 10 CFR 100 RELEASE LIMIT

(a) Could the failure of this component be considered a breach in an engineered safety barrier?

(b) Could the failure of this valve result in an uncontained release of radioactive material in excess of that allowed in 10 CFR 100?

A3 MAINTENANCE RELIABILITY

(a) Is component important to maintaining system reliability?

(b) What type of component failures have been experienced for this and similar style components?

(c) What does the maintenance history indicate about the reliability of this component?

(d) Does the component receive preventive maintenance and is it effective for preventing identified failures?

(e) How are component failures detected?

A4 EFFECT OF COMPONENT FAILURE ON SYSTEM OPERATIONAL READINESS

(a) Is component important to maintaining system availability?

(b) How does component failure affect system performance?

(c) Does component failure cause other system component failures?

(d) What is the system component level of defense in depth?

(e) Does the system or component perform other functions outside the scope of the PRA?

(f) Can system or component failure modes affect redundant trains or other similar component?

A5 OTHER DETERMINISTIC CONSIDERATIONS

(a) Should other component failure modes be considered in the PRA model?

(b) Is this component used to mitigate the consequences of an accident caused by external events?

(c) Is this component important for safe shutdown?

(d) Is this component required to maintain the safe shutdown condition?

(e) Should other component failure modes which may not be included in the PRA be considered (e.g., aging effects, structural supports, human performance failures).

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CODE CASE OMN-4
Requirements for Risk Insights for Inservice Testing of Check Valves at LWR Power Plants

This Case shall expire on March 30, 2004 unless previously annulled or reaffirmed.

Inquiry: What alternative requirements may be used in lieu of the requirements of the ASME OM Code for inservice exercising tests for Category C check valves?

Reply: It is the opinion of the Committee that the following requirements may be applied.

1 SAFETY SIGNIFICANCE CATEGORIZATION

Check valves shall be evaluated and categorized as High Safety Significant Components (HSSCs) or Low Safety Significant Components (LSSCs) in accord- ance with the Code Case on Requirements for safety significance categorization of components using Risk Insights for Inservice Testing of LWR Power Plants.

2 HSSC TESTING

HSSC check valves shall be placed in a Condition Monitoring Program and tested in accordance with ASME OMa Code-1996, Appendix II. The Condition Monitoring program shall include identification and trending of attributes indicative of degradation that could lead to the occurrence of the failure mode(s) that resulted in HSSC categorization.

3 LSSC TESTING

LSSC check valves shall be tested in accordance with OMa Code-1996, Subsection ISTC, or placed in a Condition Monitoring Program and tested in accordance with the ASME OMa Code-1996, Appendix II.

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CODE CASE OMN-5
Testing of Liquid Service Relief Valves Without Insulation

This Case shall expire on March 30, 2004 unless previously annulled or reaffirmed.

Inquiry: What alternative requirements to those of ANSI/ASME OM Code, Appendix I, paras. I 4.1.1(d), I 4.1.2(d), I 4.1.3(d), I 8.1.1(d), I 8.1.2(d), and I 8.1.3(d) may be used for valves which are insulated in service and removed for testing?

Reply: It is the opinion of the Committee that valves which are insulated in service and removed for testing at ambient temperature using a test media at ambient temperature need not be insulated during testing, provided the requirements of ANSI/ASME OM Code, Appendix I, paras. I 4.3 and I 8.3 are met.

Applicability: ASME OM Code-1990 Edition and later editions and addenda through 1995.

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CODE CASE OMN-6
Alternate Rules for Digital Instruments

This Case shall expire on March 30, 2004 unless previously annulled or reaffirmed.

Inquiry: What alternative requirements to those specified in OM Code, ISTB 4.6.1(b)(2) [ISTB 4.7.1(b)(2) in 1994 addenda and later] may be used for digital instruments used in the performance of inservice testing?

Reply: It is the opinion of the Committee that digital instruments may be selected such that the reference value does not exceed 90% of the calibrated range of the instrument.

Applicability: ASME OM Code-1990 Edition through ASME OMb Code-1997 Addenda.

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CODE CASE OMN-7
Alternative Requirements for Pump Testing

This Case shall expire on January 30, 2002 unless previously annulled or reaffirmed.

Inquiry: What alternative to the requirements of ASME OM Code, Subarticle ISTB-5.1 may be used in conjunction with Code Case OMN-3, Requirements for Safety Significance Categorization of Components Using Risk Insights for Inservice Testing of LWR Power Plants, for inservice testing to assess the operational readiness of pumps in light water reactor power plants?

Reply: It is the opinion of the Committee that, in lieu of the rules of ASME OM Code, Subsection ISTB, Subarticle ISTB-5.1, the following alternative requirements may be applied.

1 APPLICABILITY

The pumps covered by this Code Case are all those pumps determined to be within the scope of the risk-informed IST Program in accordance with Code Case OMN-3, Requirements for Safety Significance Categorization of Components Using Risk Insights for Inservice Testing of LWR Power Plants.

2 REQUIREMENTS

2.1 Related Requirements

Use of this Code Case also requires compliance with the requirements of ASME Code Case OMN-3 (risk ranking). Code Case OMN-3 groups components into one of two categories:

(a) high safety significant component (HSSC); or

(b) low safety significant component (LSSC).

Trending of parameters according to OM Code-1995 with OMa Code-1996 meets the performance monitoring requirements of Code Case OMN-3, para. 4.6.

2.2 HSSC Testing Requirements

Group A and Group B pumps categorized as HSSCs shall meet all the requirements of OM Code-1995 with OMa Code-1996.

2.3 LSSC Testing Requirements

Group A and Group B pumps categorized as LSSCs shall meet all the requirements of OM Code-1995 with OMa Code-1996, except that the testing requirements identified in this paragraph and in the table below may be substituted for those in ISTB 5.1 (Table ISTB 5.1-1). All Group A and Group B LSSC pumps shall receive an initial Group A test conducted within ±20% of pump design flow rate as soon as practical and no later than the first refueling outage following implementation of this Code Case. Thereafter, all Group A and Group B LSSC pumps shall be Group A tested within ±20% of pump design flow rate at least once every 5 years or three refueling outages, whichever is longer.

Pump Group	Group A Test	Group B Test	Comprehensive Test
Group A (routinely or continuously operated pumps)	6 months [Note (1)]	Not required	Not required
Group B (standby pumps)	2 years	6 months [Note (1)]	Not required

NOTE:
(1) To meet vendor recommendations, pump operation may be required more frequently than the specified test frequency.

3 ADDITIONAL REQUIREMENTS

(a) The Owner shall develop a transition plan and implementation schedule for this Code Case.

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(b) Feedback and corrective actions shall be taken in accordance with Code Case OMN-3, para 4.7.

(c) If the maximum test interval as determined from the aggregate risk assessment of Code Case OMN-3, para. 4.5.2, for a specific component is more limiting than the test frequency of para. 2.2 or 2.3 above (as applicable), the most limiting test interval shall be used for that component. A Group A or Group B test, as applicable, shall be performed to satisfy the increased test frequency requirements.

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CODE CASE OMN-8
Alternative Rules for Preservice and Inservice Testing of Power-Operated Valves That Are Used for System Control and Have a Safety Function per OM-10

This Case shall expire on November 20, 2001 unless previously annulled or reaffirmed.

Inquiry: What alternative requirements to those of ASME/ANSI OMa-1988, Part 10, para. 4.2 through OM Code-1995, ISTC 4.2 may be used for power-operated control valves that have only a fail safe safety function?

Reply: It is the opinion of the Committee that the requirements of ASME/ANSI OMa-1988, Part 10, para. 4.2.1.4, Power-Operated Valve Stroke Testing; para. 4.2.1.8, Stroke Time Acceptance Criteria; and para. 4.2.1.9(b) need not be met. All other applicable requirements of para. 4.2 shall be met for ASME/ANSI OMa-1988, Part 10.

Further, the requirements of OM Code-1995, ISTC 4.2.4, Power-Operated Valve Stroke Testing; ISTC 4.2.8, Stroke Time Acceptance Criteria; and ISTC 4.2.9(b) need not be met. All other applicable requirements of the paragraph shall be met.

Any abnormality or erratic action experienced during valve exercising shall be recorded in the record of tests, and an evaluation shall be made regarding need for corrective action.

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CODE CASE OMN-9
Use of a Pump Curve for Testing

This Case shall expire on November 25, 2001 unless previously annulled or reaffirmed.

Inquiry: What alternative rules to those of ISTB 4.3, 4.4, 4.5, 5.2, and 6.1 may be used when it is impractical to adjust a centrifugal or vertical line shaft pump to a specific reference value as required by ISTB 5.2(b)?

Reply: It is the opinion of the Committee that the following rules may be used for testing of centrifugal or vertical line shaft pumps where adjustment to a specific reference value is impractical, in lieu of the requirements of ISTB 4.3, 4.4, 4.5, 5.2, and 6.1.

Applicability: ASME OM Code-1990 through ASME OMb Code-1992.

1 ADDITIONAL DEFINITIONS

maximum pump curve range: the maximum potential flow or differential pressure range for the pump curve, from shutoff conditions to maximum required flow rate.

reference curve: a range of values of a test parameter versus flow or differential pressure, for a centrifugal or vertical line shaft pump, measured or determined when the pump is known to be operating acceptably.

2 REFERENCE VALUES

Reference values shall be determined from the results of preservice testing or from the results of the first inservice test. Reference values shall be at points of operation readily duplicated during subsequent tests. All subsequent test results shall be compared to these initial reference values or to new reference values established in accordance with sections 4 and 5 below. Reference values shall only be established when the pump is known to be operating acceptably. If the particular parameter being measured or determined can be significantly influenced by other related conditions, then these conditions shall be analyzed.[1]

3 REFERENCE CURVES

If the establishment of specific reference values is impractical for a centrifugal or vertical line shaft pump, the Owner may establish reference curves. Reference curves shall be determined from data measured during preservice testing or from the first inservice test. A reference curve shall be established from a minimum of three data points and shall have at least one data point for each 20% of the maximum pump curve range. The range of the reference curve shall be sufficient to bound the points of operation expected during subsequent tests. All subsequent test results shall be compared to the initial reference curves or to new reference curves established in accordance with section 4 or 5 below. Reference curves shall only be established when the pump is known to be operating acceptably. If vibration is relatively unaffected by changing differential pressure or flow over the reference curve range, a single reference value may be used for that test quantity, provided it is at the minimum of the measured data. If reference curves are used, the reasons for doing so and the suitability of the methods used to develop the reference curves and acceptance criteria shall be justified and documented in the record of tests (see ISTB 7).

[1] Vibration of pumps may be foundation, driver, and piping dependent. Therefore, if initial vibration readings are high and have no obvious relationship to the pump, the vibration measurements should be taken at the driver, at the foundation, and on the piping, and analyzed to ensure that the reference vibration measurements are representative of the pump and that the mesured vibration levels will not prevent the pump from fulfilling its function.

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4 EFFECT OF PUMP REPLACEMENT, REPAIR, AND MAINTENANCE ON REFERENCE VALUES OR REFERENCE CURVES

When a reference value, set of reference values, or reference curve may have been affected by repair, replacement, or routine servicing of a pump, a new reference value, set of reference values, or reference curve shall be determined or the previous value, or curve, reconfirmed by an inservice test run before declaring the pump operable. Deviations between the previous and new set of reference values or reference curves shall be identified, and verification that the new values or curves represent acceptable pump operations shall be placed in the record of tests (see ISTB 7).

5 ESTABLISHMENT OF ADDITIONAL SET OF REFERENCE VALUES OR REFERENCE CURVES

If it is necessary or desirable, for some reason other than stated in section 4 above, to establish an additional set of reference values or reference curves, an inservice test shall be run at the conditions of an existing set of reference values, or within the range of existing reference curves, and the results analyzed. If operation is acceptable per section 7 below, a second test run at the new reference conditions shall follow as soon as practicable. The results of this test shall establish the additional set of reference values or reference curves. Whenever an additional set of reference values or reference curves is established, the reasons for so doing shall be justified and documented in the record of tests (see ISTB 7). The requirements of section 2 or 3 above apply.

6 TEST PROCEDURE

An inservice test shall be conducted with the pump operating at the specified test conditions. The test parameters shown in Table ISTB 5.2-1 shall be determined and recorded as directed in this paragraph. The test shall be conducted as follows.

(a) The pump shall be operated at nominal motor speed for constant speed drives and at a speed adjusted to the reference speed for variable speed drives.

(b) The resistance of the system shall be varied until the flow rate equals the reference value. The pressure shall then be determined and compared to its reference value. Alternatively, the flow rate can be varied until the pressure equals the reference value, and the flow rate shall be determined and compared to the reference flow rate value.

(c) Where system resistance cannot be varied or if reference curves are used, flow rate and pressure shall be determined and compared to their respective reference values or the associated reference values from the reference curves.

(d) Pressure, flow rate, and vibration (displacement or velocity) shall be determined and compared with corresponding reference values or associated reference values from the reference curves. All deviations from the reference values shall be compared with the limits given in Table ISTB 5.2-2 and Fig. ISTB 5.2-1, and corrective action taken as specified in section 7 below. If the reference curve test method is used, the comparison may be done graphically as shown in Examples 1 and 2 of Fig. 1.

Vibration measurements are to be broad band (unfiltered). If velocity measurements are used, they shall be peak. If displacement amplitudes are used, they shall be peak-to-peak.

7 ACCEPTANCE CRITERIA

If deviations fall within the alert range of Fig. ISTB 5.2-1 and Table ISTB 5.2-2, the frequency of testing specified in ISTB 5.1 shall be doubled until the cause of the deviation is determined and the condition corrected. If deviations fall within the required action range of Table ISTB 5.2-2, the pump shall be declared inoperable until the cause of the deviation has been determined and the condition corrected. If using reference curves, evaluations for deviations in the alert or required action range may be done graphically as demonstrated in Examples 1 and 2 of Fig. 1. When a test shows deviations outside of the acceptable range of Table ISTB 5.2-2, the instruments involved may be recalibrated and the test rerun.

8 RECORDS AND REPORTS

Use of this Code Case shall be documented in the inservice test plans per ISTB 7.2.

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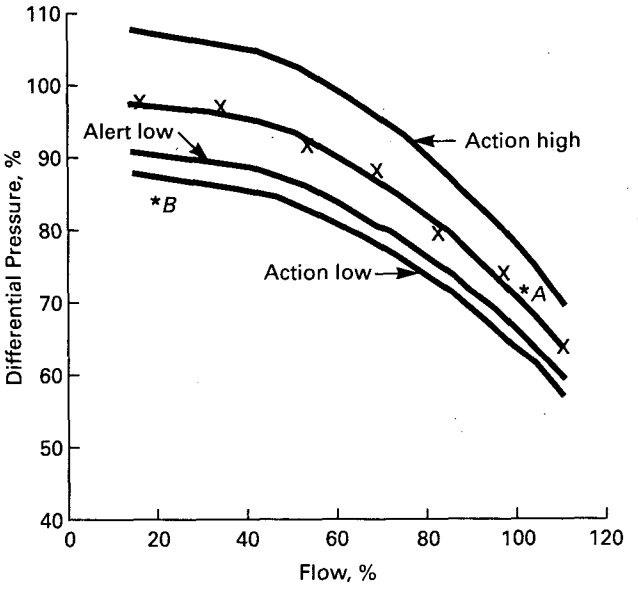
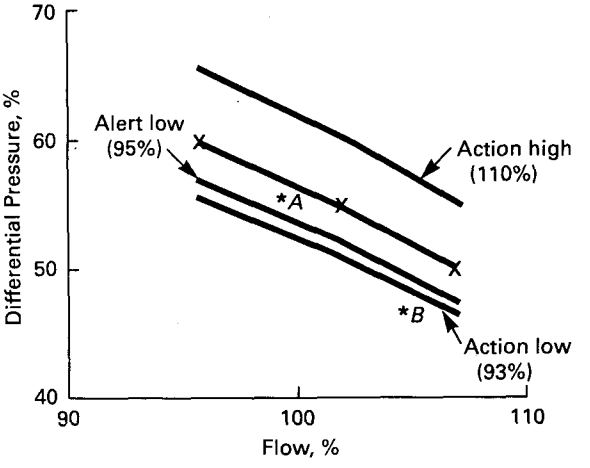
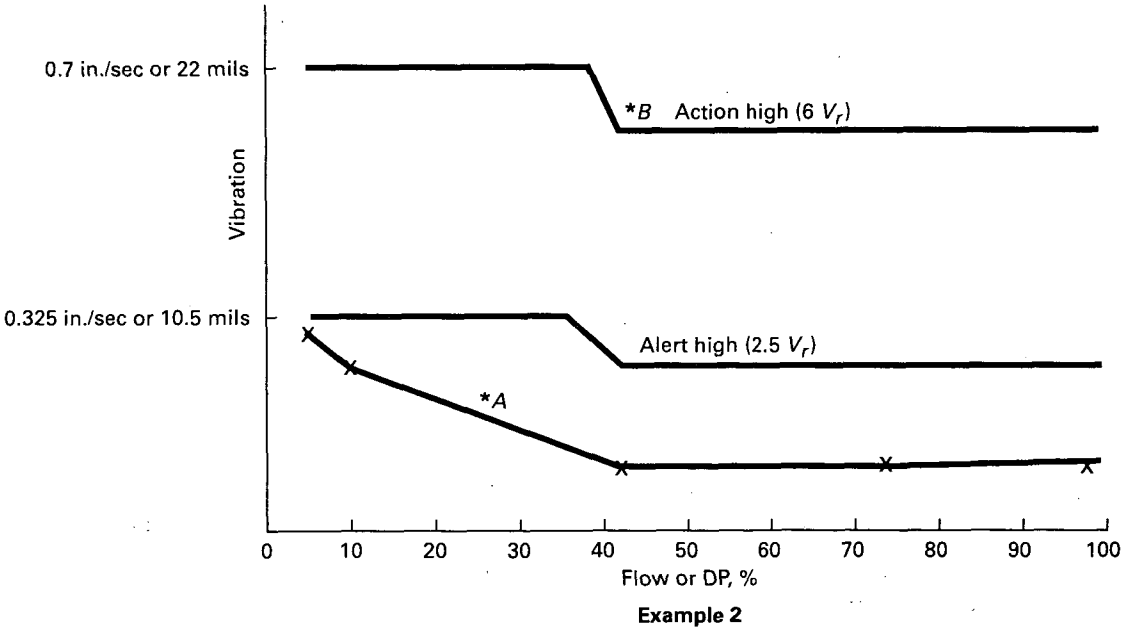


Example 1A



Example 1B



Example 2

A = acceptable operation
B = required action
X = data points used to establish reference curve

FIG. 1 EXAMPLES OF GRAPHICAL EVALUATION OF TESTS USING REFERENCE CURVES

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CODE CASE OMN-10
Requirements for Safety Significance Categorization of Snubbers Using Risk Insights and Testing Strategies for Inservice Testing of LWR Power Plants

This Case shall expire on January 26, 2003 unless previously annulled or reaffirmed.

Inquiry: Is it acceptable to categorize those snubbers under the scope of the ASME OM Code into two categories based on their significance for the purpose of applying different examination and testing strategies to those described in ISTD 6 and ISTD 7?

Reply: Yes, provided the following requirements are met.

1 APPLICABILITY

This Code Case establishes the safety categorization methodology and process for dividing the population of snubbers, as identified in the Owner's Snubber Program Plan, into high safety significant component (HSSC) and low safety significant component (LSSC) categories, and provides acceptable testing strategies for each category.

2 SUPPLEMENTAL DEFINITIONS

2.1 PRA Definitions

common cause failure (CCF): a single event that adversely affects two or more components at the same time.

core damage frequency (CDF): the calculated frequency (per year) that core damage will occur due to failure of a critical safety function (i.e., reactivity control, core cooling, or containment heat removal).

Fussell-Vesely (F-V) importance: the fractional decrease in total risk level (usually CDF) when the plant feature is assumed to be perfectly reliable (failure rate = 0.0).

importance measure: a mathematical expression that defines a quantity of interest. The most common importance measures are F-V and RAW.

large early release frequency (LERF): the calculated frequency (per year) that radioactivity release from containment is both large and early. Large means involving the rapid, unscrubbed release of airborne fission products to the environment. Early means occurring before the effective implementation of offsite emergency and protective actions.

Level 1 PRA: a PRA that identifies accident sequences that can lead to core damage, calculates the frequency of each sequence, and sums those frequencies to obtain CDF.

Level 2 PRA: a PRA that identifies accident sequences that can lead to radioactivity release, calculates the frequency of each sequence, and sums up those frequencies to obtain LERF.

living PRA: a plant specific PRA that is maintained up to date, such that plant modifications, plant operation changes (including procedure changes), component performance, and other technical information significantly affecting the model are reflected in the model.

probabilistic risk assessment (PRA): a quantitative assessment of the risk associated with plant operation and maintenance. Risk is measured in terms of the frequency of occurrence of different events, including core damage. In general, the scope of a PRA is divided into three categories: Level 1, Level 2, and Level 3. A Level 1 maps from initiating events to plant damage states, including their aggregate, core damage. Level 2 includes Level 1 mapping from initiating events to release categories (source term).

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Level 3 includes Level 2 and uses the source term of Level 2 to quantify consequences, the most common of which are health effects and property damage in terms of cost.

risk achievement worth (RAW): the increase in risk of a modeled plant feature (usually a component, train, or system) when the feature is assumed to be out of service (failed). RAW is expressed in terms of the ratio of the risk with the event failed to the baseline risk level.

2.2 Safety Definitions

decision criteria: the quantitative and qualitative factors that affect a decision. These include both quantitative screening criteria (for PRA model) and the evaluation of other qualitative (or deterministic) factors that influence the results of an application.

Expert Panel: a multidisciplined group of experienced plant experts who evaluate specific information, discuss this information amongst themselves (and others as appropriate), and make HSSC and LSSC determinations.

high safety significant components (HSSCs): components that have been designated as more important to plant safety by a blended process of PRA risk ranking and Expert Panel evaluation.

low safety significant components (LSSCs): components that have been designated as less important to plant safety by a blended process of PRA risk ranking and Expert Panel evaluation.

technical specification: the plant technical specifications that are a condition of the plant operating license granted to the Owner by the regulator.

2.3 IST Definitions

active valve: valve that is required to change obturator position to accomplish the required design functions.

inservice test (IST): a test to determine the operational readiness of a component/system (snubber).

operational readiness: ability of a component (snubber) to perform its intended system function when required.

testing strategy: the IST strategy to measure component (snubber) degradation or to monitor a component (snubber) for operational readiness at some interval by operating, examining, or testing the component (snubber).

2.4 Snubber Definitions

component's snubber: snubbers required to protect a component (e.g., pump, valve) during a dynamic event.

equipment dynamic restraint (snubber): a device that provides restraint to a component or system during the sudden application of forces, but allows essentially free motion during thermal movement.

hydraulic snubbers: devices in which the load is transmitted through a hydraulic fluid.

mechanical snubbers: devices in which the load is transmitted entirely through mechanical components.

replacement snubber: any snubber other than the snubber immediately previously installed at a given location.

service conditions: the operating environment for the snubber (e.g., temperature, vibration, weather) at its installed plant location, categorized as harsh or benign.

service life: period of time an item is expected to meet the operational readiness requirements without maintenance.

3 GENERAL REQUIREMENTS

3.1 Implementation

The requirements of this Code Case shall be implemented for all snubbers identified in the Snubber Program Plan, after the Owner has transferred the plant snubber examination and testing requirements from the plant technical specification to an Owner-controlled document and adopted the OM Code.

3.2 Plant Specific PRA

The plant specific PRA (Level 1 with internal initiating events, as a minimum) shall be available and used to perform system risk ranking.

3.3 Living PRA

The PRA shall be maintained up to date [reference (b) in section 9 below provides guidance].

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3.4 Expert Panel

An Expert Panel shall be designated to perform the blended safety evaluation of probabilistic and deterministic engineering information for snubbers.

3.5 Determination of HSSC and LSSC

The Expert Panel shall evaluate each snubber and categorize it as HSSC or LSSC.

3.6 Inservice Testing Strategies for HSSCs and LSSCs

Testing strategies shall be implemented for HSSC snubbers and for LSSC snubbers.

3.7 Other Requirements

Subsection ISTD of reference (a) in section 9 below provides examination and testing requirements for snubbers. Any requirements not specifically addressed by alternative requirements in this Code Case shall stand.

4 SPECIFIC REQUIREMENTS FOR SAFETY CATEGORIZATION

In addition to section 3 above, the following requirements apply to snubber classification into HSSC and LSSC categories.

4.1 System Risk Categorization

This paragraph establishes requirements for separating systems with snubbers into high and low risk categories.

4.1.1 Importance Measures

(a) As a minimum, two importance measures, F-V and RAW, shall be calculated for those systems modeled in the PRA.

(b) The impact upon CDF, and upon LERF if available, shall be determined.

4.1.2 Screening Criteria. For those systems modeled in the PRA, a threshold value of F-V>0.05 (system level) or F-V>0.005 (component or train level) based on CDF (and LERF if available) or RAW>2 (component or train level) shall be initially considered as high risk components, trains, or systems.

4.1.3 Sensitivity Studies

(a) The following sensitivity studies shall be performed for each system containing snubbers.

(1) For Level 1 PRA (CDF end state), determine system and component importance rankings (F-V and RAW) from internal and external initiating events. If external/seismic initiating event PRA is not available, then use alternative deterministic evaluation (i.e., seismic margins).

(2) If available for Level 2 PRA (LERF end state), determine system and component importance rankings as appropriate from internal and external initiating events. If Level 2 PRA is not available, then use alternative deterministic evaluation (i.e., containment bypass).

(3) Identify the major components and their contribution to system risk (F-V and RAW), using internal (and external if available) initiating events.

(4) If available for shutdown PRA (CDF end state), determine system and component importance rankings as appropriate from internal and external initiating events. If shutdown PRA is not available, then use alternative deterministic evaluation (i.e., shutdown cooling paths).

(b) The results of these sensitivity studies, and any others that are performed, shall be documented.

(c) The results and insights of these sensitivity studies shall be provided to the Expert Panel for their consideration in the final categorization of the snubbers.

4.1.4 Qualitative Assessments. Qualitative assessments shall be performed for all active IST components (e.g., pumps and valves) protected by snubbers, unless those snubbers are categorized as HSSC.

(a) The following qualitative assessments shall be performed:

(1) impact of initiating events (i.e., the impact of failure or degradation as it might result in an initiator);

(2) potential consequences of shutdown (outage) conditions; and

(3) response to external initiating events (e.g., seismic, fire, high winds/tornadoes, flooding, etc.).

(b) Qualitative assessments shall be performed for plant-specific design basis conditions and events not modeled in a PRA.

(c) Qualitative assessments shall consider the impacts upon the plant to:

(1) prevent or mitigate accident conditions;

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(2) reach and/or maintain safe shutdown conditions;

(3) preserve the reactor primary coolant pressure boundary integrity; and

(4) maintain containment integrity.

(d) Qualitative assessments shall also consider:

(1) safety function being satisfied by the component's operation;

(2) level of redundancy existing at the plant to fulfill the component's function;

(3) ability to recover from a failure of the component;

(4) performance history of the component;

(5) plant technical specifications requirements applicable to the component;

(6) emergency operating procedure instructions that use the component(s); and

(7) design and licensing basis information relevant to IST component function.

(e) The cumulative impacts of combinations of component unavailability, which could impact an entire system (e.g., multitrain impacts) or critical safety function (e.g., multisystem impacts), shall also be considered.

(f) These qualitative assessments and the Expert Panel's disposition of them shall be documented so independent parties can review and cognizant analysts who did not take part in the original assessment can confirm the result.

(g) These qualitative assessments shall be available to the Expert Panel for their decision of component safety categorization.

4.2 Snubber Safety Categorization

This paragraph provides requirements for the Expert Panel's review and evaluation process for categorizing snubbers relative to their safety significance, using both deterministic and probabilistic insights.

4.2.1 Expert Panel Utilization. The Expert Panel shall blend deterministic and probabilistic information to classify snubbers into HSSC or LSSC categories using both PRA insights and deterministic insights.

(a) *PRA Insights.* The results of PRA analyses shall be used by the Expert Panel to determine the safety significance of components (e.g., pumps and valves) within HSSC systems. Information contained in PRAs relative to the role of components in mitigating or preventing core damaging events or large early radiological release events shall be considered.

(b) *Quality of PRA.* The scope of the PRA and depth of probabilistic analyses shall be assessed, evaluated, and documented. As a minimum, the following shall be documented:

(1) the level of plant specific PRA analysis available for assessing the applicability of PRA information relative to IST programs; for example, written documentation describing the level of plant specific PRA analysis such as Level 1 PRA (assessment of core damage frequency) and/or Level 2 PRA (assessment of core damage frequency plus containment performance);

(2) scope of initiating events considered (internal events, external events, both);

(3) typical failure modes considered (e.g., hardware failures, testing/maintenance failures, common cause failures, human errors);

(4) PRA scope for plant configurations (e.g., low power risk, shutdown risk, transition mode risk, at-power risk) reviewed relative to the applicability of PRA information and IST component function(s).

(c) *Deterministic Insights.* The Expert Panel shall also consider deterministic factors when assessing the safety significance of components within the scope of IST programs (see Appendix A for a sample list of deterministic considerations).

4.2.2 Expert Panel Requirements

(a) *Plant Procedure.* An approved plant procedure shall describe the process, including:

(1) designated members and alternates;

(2) designated chair and alternate;

(3) quorum;

(4) attendance records;

(5) agendas;

(6) motions for approval;

(7) process for decision making;

(8) documentation and resolution of differing opinions;

(9) minutes; and

(10) required training.

(b) *Training.* The Expert Panel shall be trained and indoctrinated in the specific requirements to be used for this Code Case. Training and indoctrination shall include the application of risk analysis methods and techniques used for this Code Case. At a minimum, the risk methods and techniques include:

(1) PRA fundamentals (e.g., PRA technical approach, PRA assumptions and limitations, failure probability, truncation limits, uncertainty);

(2) use of risk importance measures;

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(3) assessment of failure modes for snubbers and components being supported by snubbers;

(4) reliability versus availability;

(5) risk thresholds; and

(6) expert judgment elicitation.

Each of the aforementioned topics shall be covered in the indoctrination to the extent necessary to provide the Expert Panel with a level of knowledge needed to adequately evaluate and approve the scope of the snubber selections, using both probabilistic and deterministic information.

(c) *Experience.* Requirements shall be established for ensuring adequate experience levels of Expert Panel members. Member experience levels shall be documented and maintained.

(d) *Membership*

(1) There shall be at least five experts designated as members of the Expert Panel. Members may be experts in more than one field; however, excessive reliance on any one member's judgment shall be avoided.

(2) The chairperson shall be familiar with this Code Case and shall facilitate Expert Panel activities, to ensure that the requirements of this Code Case are satisfied.

(3) Expertise in the following functions shall be represented on the Expert Panel:

(a) operation

(b) safety analysis engineering

(c) probabilistic risk assessment

(4) Additional members of the Expert Panel should be selected who have the following plant expertise:

(a) systems performance

(b) maintenance

(c) licensing

(d) component performance

(e) ASME inservice examination and testing for snubbers

(f) ASME inservice testing for pumps and valves

(g) quality assurance

(5) Alternate members to the Expert Panel may be designated on a temporary basis; however, vacancies in the Expert Panel membership should be filled by qualified individuals within a reasonable period of time.

(6) Other plant or nuclear industry experts may be invited to attend some or all of the sessions of the Expert Panel as visitors to provide observations, opinions, or recommendations.

4.2.3 Expert Panel Decision Criteria

(a) Level A Inclusion Criteria. Any of the following contributors to snubber importance above stated threshold will potentially make the snubber HSSC:

(1) *Level A-1.* All snubbers protecting the following components:

(a) PWRs: steam generators, reactor coolant pumps

(b) BWRs: recirculation pumps

(2) *Level A-2.* All snubbers protecting components in systems with PRA importance ranking F-V>0.05 or, if evaluated on a component/train level, all snubbers supporting the components in trains with PRA importance ranking F-V>0.005 or RAW>2.

(b) *Level B Exclusion Criteria.* The following conditions allow a snubber to potentially be classified as LSSC:

(1) *Level B-1.* All snubbers that support the component with an importance ranking F-V≤0.005 and a RAW≤2.

(2) *Level B-2.* All snubbers associated with unmodeled components and associated with components that would likely be unmodeled in Level 1, 2, 3, and shutdown PRAs, including both internal and external events.

4.2.4 Reconciliation. Decisions of the Expert Panel shall be arrived at by consensus. Differing opinions shall be documented and resolved, if possible. If a resolution cannot be achieved concerning the safety significance classification of a snubber, then the snubber shall be classified HSSC.

5 SPECIFIC REQUIREMENTS FOR SNUBBER SERVICE CONDITION DETERMINATION

All snubbers shall be placed in one of two service conditions, *harsh* or *benign.*

5.1 Harsh

The *harsh* service condition shall be considered for those operating environments where the snubber is exposed to higher temperatures, vibration, or other service condition variables (see ISTD 8, Appendix F) that would result in a predicted service life of ≤10 years.

5.2 Benign

The *benign* service condition shall be considered for those operating environments where the snubber is exposed to lower temperatures, minimal vibration,

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or other service condition variables (see ISTD 8, Appendix F) that would result in a predicted service life of >10 years.

6 SPECIFIC REQUIREMENTS FOR HSSC TESTING STRATEGIES

NOTE: These are alternate examination and testing strategies in lieu of ISTD 6 and ISTD 7 requirements in reference (a) in section 9 below.

6.1 Examination and Testing Strategies for HSSC Snubbers in Harsh Environment

(a) All snubbers (size, manufacturer, type) in this category shall be considered as one population for examination and testing.

(b) Perform visual examination per ISTD 6.

(c) Test per 37 or 10% plan each refueling cycle or 24 months. If a failure occurs, follow the applicable requirements of the selected plan.

(d) Test and/or replace all snubbers within this DTPG once every 6 years.

(e) The snubbers may be selected for testing on a rotational basis.

6.2 Examination and Testing Strategies for HSSC Snubbers in Benign Environment

(a) All snubbers (size, manufacturer, type) in this category shall be considered as one population for examination and testing.

(b) Perform visual examination per ISTD 6.

(c) Test per 37 or 10% plan each refueling cycle or 24 months. If a failure occurs, follow the applicable requirements of the selected plan.

(d) Test and/or replace all snubbers within this DTPG once every 10 years.

(e) The snubbers may be selected for testing on a rotational basis.

7 SPECIFIC REQUIREMENTS FOR LSSC TESTING STRATEGIES

NOTE: These are alternate examination and testing strategies in lieu of ISTD 6 and ISTD 7 requirements in reference (a) in section 9 below.

7.1 Examination and Testing Strategies for LSSC Snubbers in Harsh Environment

(a) All snubbers (size, manufacturer, type) in this category shall be considered as one population for examination and testing.

(b) Perform visual examination per ISTD 6.

(c) Test per 37 or 10% plan each refueling cycle or 24 months. If a failure occurs, follow the applicable requirements of the selected plan.

(d) Test and/or replace all snubbers within this DTPG once every 10 years.

(e) The snubbers may be selected for testing on a rotational basis.

7.2 Examination and Testing Strategies for LSSC Snubbers in Benign Environment

(a) Determine and monitor service life of each snubber per ISTD 8.

(b) Perform visual examination of all hydraulic snubbers in this category per ISTD 6.

(c) Perform visual examination of all mechanical snubbers in this category to satisfy visual examination requirements of ISTD 6.3 and verify freedom of motion by manual stroking, measuring incremental thermal movement, or functional testing. Perform visual examination of all mechanical snubbers once every 10 years, staggered on minimum 10% to 20% every refuel cycle or 24 months. If degradation is found, test the snubber. If the snubber fails, then verify freedom of motion or test all snubbers susceptible to the same failure mode.

8 RECORDS AND REPORTS

In addition to the requirements of reference (a) in section 9 below with respect to records, the following records of the Expert Panel and the component shall be maintained.

8.1 Expert Panel Records

(a) Membership and attendance

(b) Member expertise representation and training records

(c) Member experience (years of experience in each of the expertise categories)

(d) Meeting agendas

(e) Meeting minutes

(f) Plant procedure

8.2 Component Records

(a) Risk significance based on PRA importance measures

(b) Additional PRA quantitative information

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(c) Deterministic information

(d) Expert Panel categorization decisions of HSSC or LSSC

(e) Basis for the HSSC/LSSC decision

9 REFERENCES

(a) ASME OM Code, Subsection ISTD, Preservice and Inservice Examination and Testing of Dynamic Restraints (Snubbers) in Light-Water Reactor Power Plants, 1995 edition and later addenda

(b) EPRI PSA Applications Guide, TR-105396, August 1995

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CODE CASE OMN-11
Risk-Informed Testing for Motor-Operated Valves

This Code Case shall expire on March 3, 2003 unless previously annulled or reaffirmed.

Inquiry: What alternatives may be used for a risk-informed program in lieu of the testing frequency requirements of Code Case OMN-1, para. 3.3 for Inservice Testing of Motor-Operated Valves?

Reply: It is the opinion of the Committee that the following test frequency alternative requirements are an acceptable method of meeting the requirements of OMN-1, paras. 3.3 and 3.7 and may be applied.

1 SAFETY SIGNIFICANCE CATEGORIZATION

Motor-operated valves (MOVs) shall be evaluated and categorized as High Safety Significant Components (HSSCs) or Low Safety Significant Components (LSSCs), in accordance with the safety significance categorization methodology prescribed in Code Case OMN-3. The risk evaluation process may identify MOVs that were not previously included within the scope of OMN-1 but are applicable under a risk-informed program.

2 HSSC INSERVICE TESTING

HSSC MOVs shall be tested in accordance with OMN-1, para. 3.3, using established test frequencies and utilizing a mix of static and dynamic MOV performance testing.

3 LSSC INSERVICE TESTING

(a) LSSC grouping shall be technically justified, but need not comply with all the requirements of OMN-1, para. 3.5.

(b) LSSC MOVs shall be associated with an established group of other MOVs wherever possible. When a member of that group is tested, the test results shall be analyzed and evaluated in accordance with OMN-1, section 6, and applied to all LSSCs associated with that group.

(c) LSSC MOVs that are not able to be associated with an established group, shall be inservice tested in accordance with OMN-1, para. 3.3, using an initial test frequency of three refueling cycles or 5 years (whichever is longer) until sufficient data exist to determine a more appropriate test frequency.

(d) LSSC MOVs shall be inservice tested at least every 10 years in accordance with OMN-1, para. 3.3.1(c).

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CODE CASE OMN-12
Alternate Requirements for Inservice Testing Using Risk Insights for Pneumatically and Hydraulically Operated Valve Assemblies in Light-Water Reactor Power Plants (OM-Code 1998, Subsection ISTC)

This Code Case shall expire on February 15, 2004 unless previously annulled or reaffirmed.

Inquiry: What alternative to the requirements of ISTC-5130 and ISTC-5140 may be used for risk-informed inservice testing of pneumatically and hydraulically operated valve assemblies?

Reply: It is the opinion of the Committee that the following alternative requirements may be used in lieu of ISTC-5130 and ISTC-5140 for risk-informed inservice testing of pneumatically and hydraulically operated valve assemblies.

1 INTRODUCTION

This Code Case establishes alternative requirements for implementing and maintaining a risk-informed inservice testing program for active pneumatically and hydraulically operated valve assemblies in light-water reactor power plants.

2 TERMS AND DEFINITIONS

The following are provided to ensure a uniform understanding of select terms used in this Code Case.

baseline data: one or more values of test parameters measured or determined when the equipment is known to be operating acceptably at conditions including design basis conditions.

baseline test: a performance test to establish baseline data.

bench set: calibration of the actuator spring range to account for the in-service process forces.

critical parameters: one or more specific parameters that must be met for a valve assembly to meet its design function.

design basis conditions: conditions associated with design basis events, as specified in the final safety analysis report or design basis document(s).

dynamic test: a test conducted with system pressure and/or flow.

hydraulic actuator: a device that provides energy to open, close, or position a valve via hydraulic pressure.

hydraulically operated valve assembly (or valve assembly): a valve and its associated hydraulic actuator, including all subcomponents required for the valve assembly to perform its intended safety function.

maximum available pneumatic pressure: the maximum pressure available to the actuator.

performance test: a test to determine whether a system, structure, or component meets specified acceptance criteria.

periodic valve assembly exercising: periodic stroking of the valve assembly to ensure that the valve assembly is not binding and the valve actuator is functional.

pneumatic actuator: a device that provides energy to open, close, or position a valve via pneumatic pressure.

pneumatically operated valve assembly (or valve assembly): a valve and its associated pneumatic actuator, including all subcomponents required for the valve assembly to perform its intended safety function(s).

seat load: the total net contact force between the obturator and the seat under static conditions.

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set points: a point or set of points that are set so that a valve assembly would meet its design function. Examples of set point would be bench set values, or pressure regulator values.

setup: the establishment and adjustment (i.e., bench set, seat load, regulator set point) of valve subcomponents so that a valve will perform its function(s).

spring rate: the force change per unit change in length, usually expressed as pounds per inch (lb/in.) or Newtons per millimeter (N/mm).

total friction: the sum of packing friction, valve internal friction and actuator friction.

valve assembly group: a collection of valve assemblies having similar design characteristics, applications, and service conditions so that test results, design evaluations, and operating experiences from one member may be applied to other members of the group.

3 PREREQUISITES

3.1 Classification

Valve assemblies shall be classified as either high safety significant or low safety significant in accordance with Code Case OMN-3.

3.2 Grouping of Valve Assemblies

Grouping of valve assemblies is permissible. Valve assemblies with identical or similar designs and with similar plant service conditions may be grouped together. The following shall be performed if grouping of valve assemblies is used:

(a) grouping valve assemblies shall be justified by a documented engineering evaluation;

(b) the functionality of all valve assembly groups shall be validated by the appropriate inservice testing of one or more representative valve assemblies;

(c) test results shall be evaluated and justified for all valve assemblies in a group;

(d) a single representative valve assembly shall not be selected for inservice testing consecutively. All testable valve assemblies in a group shall be inservice tested before a previously tested representative valve assembly can be selected. In addition to this requirement, the owner may elect to consecutively test a certain valve assembly to monitor changes in its functional margin over time;

(e) the number of valve assemblies tested from each group shall be determined using appropriate statistical methodology; and

(f) test results for the representative valve assembly shall be analyzed and evaluated for each valve assembly in the group.

3.3 Testing Basis

An analysis of the test, maintenance, and operating history of a valve assembly, or valve assembly group, shall be performed and documented in order to establish the basis for specifying testing requirements and frequency.

4 HIGH SAFETY SIGNIFICANT VALVE ASSEMBLIES

The purpose of the combination of testing and/or analysis is to ensure the capability of the valve assembly to perform its intended safety function. Testing of valve assemblies classified as high safety significant shall meet the requirements of paras. 4.1 through 4.5.

4.1 Design Verification

4.1.1 The design basis capability for existing valve assemblies shall be verified prior to implementing this Code Case for those valve assemblies.

4.1.2 The design basis capability for new valve assemblies shall be verified prior to initially being placed in service.

4.1.3 A baseline test in combination with at least one of the following shall be performed to demonstrate design basis capability of the valve assembly:

(a) dynamic test at design basis conditions;

(b) correlation with a similar valve assembly that has been dynamically tested at similar or bounding conditions;

(c) extrapolation of results of dynamic tests at highest practicable test conditions;

(d) calculation methods.

4.2 Inservice Test Requirements

4.2.1 Baseline Test Requirements

4.2.1.1 Valve assemblies shall have a baseline test to establish reference values for comparison to subsequent periodic performance test data.

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4.2.1.2 The preservice test results may be used as the baseline test, provided the test conditions in para. 4.3.1 are satisfied. Testing in accordance with ISTC-3100 may be used as the baseline test.

4.2.2 Periodic Test Requirements

4.2.2.1 Periodic test frequency shall be determined based on analysis of data. Data analysis shall be in accordance with para. 4.4.

4.2.2.2 If insufficient data exist to determine the inservice test frequency in accordance with para. 4.4, the valve assembly inservice testing shall be conducted every two refueling cycles or 3 years (whichever is longer) until sufficient data exist to determine a more appropriate test frequency.

4.2.2.3 The maximum interval between inservice tests shall not exceed 10 years.

4.2.2.4 Periodic test methods shall be in accordance with para. 4.3.

4.2.3 Periodic Valve Assembly Exercising

4.2.3.1 Once during each fuel cycle of operation, each valve assembly subject to this Code Case shall be operated to move the obturator through one full stroke (open and close). If a valve assembly experiences a full stroke during the fuel cycle of operation, and the Owner elects to document such operation, no additional valve operation is required to satisfy this requirement.

4.2.3.2 More frequent exercise requirements for valve assemblies with higher risk significance, adverse or harsh environmental conditions, or with abnormal performance history shall be considered. Alternatively, longer exercise intervals may be used if justified by successful operating experience.

4.2.3.3 Paragraph 4.2.3 does not limit the plant operating mode under which periodic valve assembly exercising may be performed.

4.3 Test Methods

The following test methods shall be applied to valve assemblies determined to be subject to this Code Case. The Owner is responsible for establishing conformance with the test methods, including offsite testing.

4.3.1 Test Conditions. Tests shall be performed without any changes, modifications, or adjustments to the valve assembly during testing. Test conditions that apply to valve assemblies based on the selection of the test parameters in accordance with para. 4.3.3 shall be determined. The baseline test shall be performed at specific repeatable conditions. The periodic performance tests shall be performed at the conditions used to establish baseline values.

4.3.2 Test Procedures. Procedures shall be established, as appropriate, to provide for the following:

(a) methodical, repeatable, and consistent performance testing;

(b) valid test data that are not influenced by any preconditioning associated with performance testing procedural steps;

(c) data that reflects, or can be correlated with, the design basis conditions;

(d) adequate data for analysis and evaluation per para. 4.4.

4.3.3 Test Parameters

4.3.3.1 Test parameters shall be monitored to ensure that the valve assembly performs its intended safety function(s). The safety function(s) may include one or more of the following:

(a) open within a specified minimum or maximum time period, or both;

(b) close within a specified minimum or maximum time period, or both;

(c) stroke open to obtain specified flow or pressure;

(d) stroke open or closed against flow or pressure, including maximum differential pressure for the valve assembly to fulfill its safety function, across the valve;

(e) travel to a predetermined intermediate position;

(f) remain in operating position for specified period of time;

(g) operate a specified number of cycles.

4.3.3.2 Determine which of the following parameters, or combination of parameters, which may be determined from data obtained during testing, are important to monitor to ensure the safety function(s) capability of the valve assembly.

(a) bench set;

(b) seat load;

(c) spring rate;

(d) full-stroke time;

(e) actual travel;

(f) total friction;

(g) maximum available pneumatic pressure;

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(h) minimum pneumatic pressure required to accomplish the safety function(s) of the valve assembly;

(i) hydraulic pressure at an appropriate point in operation;

(j) pneumatic and hydraulic fluid condition and cleanliness;

(k) set point of pressure switch, relief valve, regulator, etc.;

(l) torque;

(m) others as applicable.

4.3.4 Test Information. Test information shall be recorded in accordance with ISTC-9000. In addition, the following information shall be recorded:

(a) test conditions per para. 4.3.1, including system fluid and ambient conditions;

(b) remarks concerning abnormal or erratic action, either during or preceding performance testing;

(c) date of test;

(d) valve assembly identification;

(e) nameplate data;

(f) test equipment identification and date of calibration;

(g) parameters measured in accordance with para. 4.3.3.2; and

(h) name of tester.

4.4 Analysis and Evaluation of Data

The following analysis and evaluation of data shall be applied to valve assemblies determined to be subject to this Code Case.

4.4.1 Acceptance Criteria. Acceptance criteria shall be established by which test data shall be analyzed. The criteria shall specify the acceptable limits or range of test parameters based on design criteria necessary for the valve assembly to perform its intended safety function(s) until the next test.

4.4.2 Analysis of Data. Data obtained from a test performed under this Code Case shall be analyzed to determine acceptable valve assembly performance.

Performance test data shall be compared to parameter limits or ranges established in accordance with para. 4.4.1. Test history (such as degradation) shall be considered on a particular valve assembly. Performance test data trends (including allowance for uncertainties) shall be established to predict when data points may approach the parameter limits. If a datum being compared falls within the acceptable range of established parameters, the valve assembly may be considered acceptable. If the test data is unacceptable, corrective actions shall be taken in accordance with para. 4.5.

4.4.3 Evaluation of Data

4.4.3.1 Criteria for data evaluation shall be established that ensures:

(a) the valve assembly meets its established acceptance criteria;

(b) corrective action is taken as described in para. 4.5 if a valve assembly does not meet its established acceptance criteria; and

(c) validation of the test frequency.

4.4.3.2 Where grouping is used, the results of data evaluation shall be applied to all valve assemblies in the group.

4.4.4 Documentation of Analysis and Evaluation of Data. Results of test data evaluation and analysis shall be documented. Documentation shall include:

(a) assumptions made;

(b) values of test parameters and test information established in accordance with paras. 4.3.4 and 4.4.1.

(c) a statement that test data are within acceptable limits or that corrective actions have been initiated and that independent verification of the test data evaluation and analysis has been completed; and

(d) a summary of data analysis and evaluation in accordance with paras. 4.4.2 and 4.4.3.

4.5 Corrective Action

If the monitored parameters are outside acceptable limits, then corrective action shall be initiated. If acceptance criteria (established in para. 4.4.1) limiting values are exceeded, the valve shall immediately be declared inoperable. Valve assemblies declared inoperable may be repaired or replaced, or the data may be analyzed to determine the cause of the deviation and to show the valve assembly to be operating acceptably.

The corrective action shall bring the valve assembly back into compliance with the acceptance criteria. When the corrective action consists of evaluating the acceptability of the valve assembly at the degraded conditions, new baseline data and acceptance criteria shall be established. The valve assembly shall be retested in accordance with para. 4.3 following the corrective action and prior to return to service. The cause of the failure or degradation shall be evaluated for identification of corrective actions to prevent recurrence in similar components or grouped

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valve assemblies. Documentation of corrective actions shall include:

(a) valve assembly identification;

(b) summary of corrective action and results;

(c) subsequent test data or analysis, including analysis for valve assembly operability;

(d) identification of the cause of the anomaly and technical justification for corrective action taken; and

(e) description of actions taken to restore operational readiness of the valve assembly.

5 LOW SAFETY SIGNIFICANT VALVE ASSEMBLIES

The purpose of this section is to provide a high degree of confidence that the LSSC valve assemblies will perform their intended safety function if called upon. Valve assemblies classified as LSSC shall meet the requirements of paras. 5.1 through 5.6.

5.1 Set Points and/or Critical Parameters

5.1.1 Set points and/or critical parameters for existing valve assemblies shall be established prior to implementing this Code Case for those valve assemblies.

5.1.2 Set points and/or critical parameters for new valve assemblies shall be established prior to initially being placed in service.

5.1.3 Establishment of set points and/or critical parameters should consider the following:

(a) walk down of the valve assembly to establish that the installed assembly agrees with the plant's information or database;

(b) original manufacturer's set points;

(c) changes to the original plant system design parameters or the operation of the valve assembly;

(d) industry experience;

(e) maximum expected packing and other valve assembly friction; and

(f) manufacturer's or industry calculations may be used to establish set points and/or critical parameters.

5.1.4 All information and methods used to establish the set points and/or critical parameters shall be documented.

5.2 Evaluation Requirements

Procedures shall be established, as appropriate, and should consider the following:

(a) consistent and verifiable evaluation of the valve assembly;

(b) application of diagnostic test equipment;

(c) documentation of parameters necessary to evaluate the valve assembly's ability to perform its intended safety function(s).

(d) system or plant conditions, at which the valve assembly is tested, shall be evaluated; and

(e) which of the parameters, or combination of parameters, listed in para. 4.3.3.2 are important to monitor to provide a high degree of confidence in the capability of the valve assembly to perform its safety function.

5.3 Periodic Evaluation

5.3.1 Periodic Evaluation Frequency. Periodic evaluation frequency shall be established based on the requirements of paras. 5.3.1.1 through 5.3.1.3.

5.3.1.1 No valve assembly shall exceed 10 years between evaluations.

5.3.1.2 The initial evaluation period shall be established based on one or more of the following:

(a) plant-specific maintenance and operating history;

(b) evaluation of nonmetallic materials required for safety function(s) of the valve assembly;

(c) manufacturer's recommendations; and

(d) if a subcomponent has no effect on the setup of the valve's safety function, it need not be considered in the evaluation period of the overall valve assembly.

5.3.1.3 All information and methods used to establish the evaluation period shall be documented.

5.3.2 Extending or Decreasing Periodic Evaluation Periods

5.3.2.1 The initial evaluation period and subsequent periods may be extended 1 year or one refueling cycle at a time if the evaluation of valve assembly test data has determined that there is no unacceptable degradation of components in the valve assembly.

5.3.2.2 The periodic evaluation period shall be decreased if it is determined that a component failure was due to degradation during the existing evaluation period.

5.3.3 Group Evaluation Period. Where grouping of valve assemblies is used, all valves in a group shall be assigned the same periodic evaluation period.

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5.4 Evaluations

5.4.1 Initial or As-Left Evaluation

5.4.1.1 The initial or as-left evaluation shall be performed after the valve assembly is initially put in service, postmaintenance, or refurbished and has been set up per the established criteria. The purpose of this evaluation is to:

(a) validate the assumptions used to establish the valve assembly's set-up criteria used in para. 5.1; and

(b) confirm the integrity and operation of all the valve assembly's subcomponents.

5.4.1.2 If a valve assembly's evaluation does not meet the parameters established in para. 5.1, corrective action shall be initiated.

5.4.2 As-Found Evaluation. Maintenance and operational activities shall be conducted in order to prevent or minimize preconditioning of the valve assembly prior to as-found evaluation.

5.4.2.1 An as-found evaluation shall be performed to:

(a) validate any assumptions used in para. 5.1; and

(b) confirm the integrity of the valve assembly's subcomponents.

5.4.2.2 As-found evaluations shall be performed on a valve assembly prior to any refurbishment at the end of a periodic evaluation period.

5.4.2.3 If a valve assembly's evaluation does not meet the parameters established in para. 5.1, corrective action shall be initiated.

5.5 Periodic Valve Assembly Exercising

5.5.1 Once during each fuel cycle of operation, each valve assembly subject to this Code Case shall be operated to move the obturator through one full stroke (open and close).

5.5.2 If a valve assembly experiences a full stroke during the plant's cycle of operation and the Owner elects to document such operation, no additional operation is required for the cycle.

5.5.3 Paragraph 5.3 does not limit the plant's operating mode under which periodic valve assembly exercising may be performed.

5.6 Corrective Action

5.6.1 If the parameters monitored and evaluated do not meet the established criteria, then corrective action shall be initiated.

5.6.2 If a valve assembly being evaluated for corrective action is part of a group of valve assemblies, the group must also be evaluated for corrective action.

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CODE CASE OMN-13
Requirements for Extending Snubber Inservice Visual Examination Interval at LWR Power Plants

This Code Case shall expire on February 12, 2004 unless previously annulled or reaffirmed.

Inquiry: With the low rate of problem identification through the visual examination process, can the visual examination interval allowed in Table ISTD 6.5.2-1 of the OM Code, Subsection ISTD, 1995 Edition 1996 Addenda be extended?

Reply: Yes, provided that the following additional service life monitoring requirements are met.

Applicability: ASME OM Code 1995 Edition with 1996 Addenda and later editions and addenda.

1 APPLICABILITY

This Code Case establishes specific requirements that must be met in order to allow extension of the visual examination interval beyond the maximum interval allowed in Table ISTD 6.5.2-1 for mechanical and hydraulic snubbers. Paragraphs referenced in this Code Case denote the 1995 Edition and 1996 Addenda. A correlation Table 1 is provided for 1998 Edition.

2 GENERAL REQUIREMENTS

The following requirements shall be implemented in order to extend the visual examination interval beyond the maximum interval allowed in Table ISTD 6.5.2-1.

(a) These requirements are in addition to the service life monitoring requirements in ISTD 8.

(b) The requirements of this Code Case shall be implemented after the requirements of ISTD 6.5.1, ISTD 6.5.2(a), ISTD 6.5.2(b), and ISTD 6.5.2(c) have been satisfied and the previous examination per Table ISTD 6.5.2-1 was performed at a maximum interval of two fuel cycles.

(c) Demonstrate that the requirements of paras. 3.1, 3.2, 3.3, 3.4, 3.5, and 3.6 of this Code Case have been met for one interval prior to extending the examination interval.

2.1 Service Life Evaluations

The data and information gathered under this Code Case shall be utilized to reevaluate service life as described in ISTD 8.

2.2 Testing for This Code Case

Snubbers tested specifically for this Code Case shall be dispositioned per ISTD 8.5.

3 SPECIFIC REQUIREMENTS

3.1 Examination for Indications of Degradation or Severe Operating Environments

Examinations per ISTD 6.1, ISTD 6.2, ISTD 6.3, and ISTD 6.4 shall include examination for indications of degradation and severe operating environments.

3.2 Examination Prior to Maintenance or Testing

All snubbers shall be examined in accordance with the requirements of ISTD 6.1, ISTD 6.2, ISTD 6.3, and ISTD 6.4 and para. 3.1 of this Code Case prior to conducting any maintenance, stroking, or testing, and prior to removal, for any reason, from their installed location.

3.3 Monitoring of Reservoir Fluid Level

Fluid level in hydraulic snubber reservoirs shall be sufficient to ensure that the snubber is acceptable

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for continued service to the next examination interval.

3.4 Review of Operational Readiness Test Data

All inservice test data acquired since implementation of the requirements of this Code Case shall be evaluated for indications of snubber degradation or other anomalies. This includes a review of test traces, where available. The results of this evaluation shall be used:

(a) to identify snubbers that are subject to progressive degradation; and

(b) to identify severe operating environments not previously identified.

Where applicable, data gathered prior to implementation of this Code Case shall also be evaluated.

3.5 Examination During Disassembly

Snubbers and snubber parts shall be examined for indications of degradation and severe operating environments during disassembly (e.g., during failure evaluation, refurbishment).

CORRELATION TABLE

1995 Edition and 1996 Addenda	1998 Edition
ISTD 1.13	ISTD-1750
ISTD 6	ISTD-4200
ISTD 6.1, 6.2, 6.3, 6.4	ISTD-4210, 4220, 4230, 4240
IST 6.5.1	ISTD-4251
ISTD 6.5.2(a)	ISTD-4252(a)
ISTD 6.5.2(b)	ISTD-4252(b)
ISTD 6.5.2(c)	ISTD-4252(c)
ISTD 8	ISTD-6000
ISTD 8.5	ISTD-6500
Table ISTD 6.5.2-1	Table ISTD-4252-1

3.6 Transient Dynamic Event

The service life evaluation required by para. 2.1 of this Code Case shall include any transient dynamic event and actions taken under ISTD 1.13.

3.7 Frequency of Examinations

All snubbers within the scope of ISTD shall be examined and evaluated per ISTD 6.1, ISTD 6.3, and ISTD 6.4 at least once every 10 years.

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ASME OMb CODE–2000

Following approval by the ASME OM Committee and ASME, and after public review, ASME OMb Code–2000 was approved by the American National Standards Institute on May 3, 2000.

Addenda to the 1998 edition of ASME OM Code are issued in the form of replacement pages. Revisions, additions, and deletions are incorporated directly into the affected pages. It is advisable, however, that this page, the Addenda title and copyright pages, and all replaced pages be retained for reference.

SUMMARY OF CHANGES

This is the second Addenda to be published to ASME OM Code–1998. A previous Addenda was published in 1999.

Replace or insert the pages listed. Changes given below are identified on the pages by a margin note, **(b)**, placed next to the affected area. Previous Addenda changes are indicated by **(a)**. The pages not listed are the reverse sides of the listed pages and contain no changes.

Page	*Location*	*Change*
vii–ix	Committee Roster	Revised
12	ISTB-3550	Revised
23–25	ISTC-2000	(1) Definition of *power-operated relief valve* added (2) Entries arranged in alphabetical order
	ISTC-3510	Last sentence added
27, 27.1	ISTC-5111	Added
	ISTC-5112	Added
	ISTC-5113	Added
	ISTC-5114	Added
	ISTC-5115	Added
28	Table ISTC-3500-1	(1) Under Category, fifth and sixth entries revised (2) Note (4) added
35	Footnote 1	Second line corrected by errata
37	ISTD-3230	ISTD-3240 redesignated as ISTD-3230
	ISTD-4110(e)	Last line corrected by errata
40, 41	ISTD-5225	Last cross-reference corrected by errata

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Page	*Location*	*Change*
51	I-1360(c)	In subparagraphs (2) and (3), cross-references corrected by errata
52	I-3100	(1) I-3120 through I-3170 redesignated as I-3130 through I-3180, correspondingly (2) New I-3120 added
57	I-4220	Revised
58	I-6000	In last line, first cross-reference corrected by errata to read I-7100
64	I-8220	Revised
84	Fig. E-1000-1	Cross-reference in top right box corrected by errata

SPECIAL NOTE:

The Interpretations to ASME OM Code issued between January 1, 1999 and November 30, 1999 follow the last page of this Addenda as a separate section.

After the Interpretations, Code Cases OMN-7 through OMN-10 follow as a separate supplement.

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This Case shall expire on January 30, 2002 unless previously annulled or reaffirmed.

CODE CASE OMN-7
Alternative Requirements for Pump Testing

Inquiry: What alternative to the requirements of ASME OM Code, Subarticle ISTB-5.1 may be used in conjunction with Code Case OMN-3, Requirements for Safety Significance Categorization of Components Using Risk Insights for Inservice Testing of LWR Power Plants, for inservice testing to assess the operational readiness of pumps in light water reactor power plants?

Reply: It is the opinion of the Committee that, in lieu of the rules of ASME OM Code, Subsection ISTB, Subarticle ISTB-5.1, the following alternative requirements may be applied.

1 APPLICABILITY

The pumps covered by this Code Case are all those pumps determined to be within the scope of the risk-informed IST Program in accordance with Code Case OMN-3, Requirements for Safety Significance Categorization of Components Using Risk Insights for Inservice Testing of LWR Power Plants.

2 REQUIREMENTS

2.1 Related Requirements

Use of this Code Case also requires compliance with the requirements of ASME Code Case OMN-3 (risk ranking). Code Case OMN-3 groups components into one of two categories: (a) high safety significant component (HSSC) or (b) low safety significant component (LSSC). Trending of parameters according to OM Code-1995 with OMa Code-1996 meets the performance monitoring requirements of Code Case OMN-3, para. 4.6.

2.2 HSSC Testing Requirements

Group A and Group B pumps categorized as HSSCs shall meet all the requirements of OM Code-1995 with OMa Code-1996.

2.3 LSSC Testing Requirements

Group A and Group B pumps categorized as LSSCs shall meet all the requirements of OM Code-1995 with OMa Code-1996, except that the testing requirements identified in this paragraph and in the table below may be substituted for those in ISTB 5.1 (Table ISTB 5.1-1). All Group A and Group B LSSC pumps shall receive an initial Group A test conducted within ±20% of pump design flow rate as soon as practical and no later than the first refueling outage following implementation of this Code Case. Thereafter, all Group A and Group B LSSC pumps shall be Group A tested within ±20% of pump design flow rate at least once every 5 years or three refueling outages, whichever is longer.

Pump Group	Group A Test	Group B Test	Comprehensive Test
Group A (routinely or continuously operated pumps)	6 months [Note (1)]	Not required	Not required
Group B (standby pumps)	2 years	6 months [Note (1)]	Not required

NOTE:
(1) To meet vendor recommendations, pump operation may be required more frequently than the specified test frequency.

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3 ADDITIONAL REQUIREMENTS

(a) The Owner shall develop a transition plan and implementation schedule for this Code Case.

(b) Feedback and corrective actions shall be taken in accordance with Code Case OMN-3, para 4.7.

(c) If the maximum test interval as determined from the aggregate risk assessment of Code Case OMN-3, para. 4.5.2, for a specific component is more limiting than the test frequency of para. 2.2 or 2.3 above (as applicable), the most limiting test interval shall be used for that component. A Group A or Group B test, as applicable, shall be performed to satisfy the increased test frequency requirements.

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This Case shall expire on November 20, 2001 unless previously annulled or reaffirmed.

CODE CASE OMN-8
Alternative Rules for Preservice and Inservice Testing of Power-Operated Valves That Are Used for System Control and Have a Safety Function per OM-10

Inquiry: What alternative requirements to those of ASME/ANSI OMa-1988, Part 10, para. 4.2 through OM Code-1995, ISTC 4.2 may be used for power-operated control valves that have only a fail safe safety function?

Reply: It is the opinion of the Committee that the requirements of ASME/ANSI OMa-1988, Part 10, para. 4.2.1.4, Power-Operated Valve Stroke Testing; para. 4.2.1.8, Stroke Time Acceptance Criteria; and para. 4.2.1.9(b) need not be met. All other applicable requirements of para. 4.2 shall be met for ASME/ANSI OMa-1988, Part 10.

Further, the requirements of OM Code-1995, ISTC 4.2.4, Power-Operated Valve Stroke Testing; ISTC 4.2.8, Stroke Time Acceptance Criteria; and ISTC 4.2.9(b) need not be met. All other applicable requirements of the paragraph shall be met.

Any abnormality or erratic action experienced during valve exercising shall be recorded in the record of tests, and an evaluation shall be made regarding need for corrective action.

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This Case shall expire on November 25, 2001 unless previously annulled or reaffirmed.

CODE CASE OMN-9
Use of a Pump Curve for Testing

Inquiry: What alternative rules to those of ISTB 4.3, 4.4, 4.5, 5.2, and 6.1 may be used when it is impractical to adjust a centrifugal or vertical line shaft pump to a specific reference value as required by ISTB 5.2(b)?

Reply: It is the opinion of the Committee that the following rules may be used for testing of centrifugal or vertical line shaft pumps where adjustment to a specific reference value is impractical, in lieu of the requirements of ISTB 4.3, 4.4, 4.5, 5.2, and 6.1.

Applicability: ASME OM Code-1990 through ASME OMb Code-1992.

1 ADDITIONAL DEFINITIONS

maximum pump curve range: the maximum potential flow or differential pressure range for the pump curve, from shutoff conditions to maximum required flow rate.

reference curve: a range of values of a test parameter versus flow or differential pressure, for a centrifugal or vertical line shaft pump, measured or determined when the pump is known to be operating acceptably.

2 REFERENCE VALUES

Reference values shall be determined from the results of preservice testing or from the results of the first inservice test. Reference values shall be at points of operation readily duplicated during subsequent tests. All subsequent test results shall be compared to these initial reference values or to new reference values established in accordance with sections 4 and 5 below. Reference values shall only be established when the pump is known to be operating acceptably. If the particular parameter being measured or determined can be significantly influenced by other related conditions, then these conditions shall be analyzed.[1]

3 REFERENCE CURVES

If the establishment of specific reference values is impractical for a centrifugal or vertical line shaft pump, the Owner may establish reference curves. Reference curves shall be determined from data measured during preservice testing or from the first inservice test. A reference curve shall be established from a minimum of three data points and shall have at least one data point for each 20% of the maximum pump curve range. The range of the reference curve

[1] Vibration of pumps may be foundation, driver, and piping dependent. Therefore, if initial vibration readings are high and have no obvious relationship to the pump, the vibration measurements should be taken at the driver, at the foundation, and on the piping, and analyzed to ensure that the reference vibration measurements are representative of the pump and that the measured vibration levels will not prevent the pump from fulfilling its function.

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shall be sufficient to bound the points of operation expected during subsequent tests. All subsequent test results shall be compared to the initial reference curves or to new reference curves established in accordance with section 4 or 5 below. Reference curves shall only be established when the pump is known to be operating acceptably. If vibration is relatively unaffected by changing differential pressure or flow over the reference curve range, a single reference value may be used for that test quantity, provided it is at the minimum of the measured data. If reference curves are used, the reasons for doing so and the suitability of the methods used to develop the reference curves and acceptance criteria shall be justified and documented in the record of tests (see ISTB 7).

4 EFFECT OF PUMP REPLACEMENT, REPAIR, AND MAINTENANCE ON REFERENCE VALUES OR REFERENCE CURVES

When a reference value, set of reference values, or reference curve may have been affected by repair, replacement, or routine servicing of a pump, a new reference value, set of reference values, or reference curve shall be determined or the previous value, or curve, reconfirmed by an inservice test run before declaring the pump operable. Deviations between the previous and new set of reference values or reference curves shall be identified, and verification that the new values or curves represent acceptable pump operations shall be placed in the record of tests (see ISTB 7).

5 ESTABLISHMENT OF ADDITIONAL SET OF REFERENCE VALUES OR REFERENCE CURVES

If it is necessary or desirable, for some reason other than stated in section 4 above, to establish an additional set of reference values or reference curves, an inservice test shall be run at the conditions of an existing set of reference values, or within the range of existing reference curves, and the results analyzed. If operation is acceptable per section 7 below, a second test run at the new reference conditions shall follow as soon as practicable. The results of this test shall establish the additional set of reference values or reference curves. Whenever an additional set of reference values or reference curves is established, the reasons for so doing shall be justified and documented in the record of tests (see ISTB 7). The requirements of section 2 or 3 above apply.

6 TEST PROCEDURE

An inservice test shall be conducted with the pump operating at the specified test conditions. The test parameters shown in Table ISTB 5.2-1 shall be determined and recorded as directed in this paragraph. The test shall be conducted as follows.

(a) The pump shall be operated at nominal motor speed for constant speed drives and at a speed adjusted to the reference speed for variable speed drives.

(b) The resistance of the system shall be varied until the flow rate equals the reference value. The pressure shall then be determined and compared to its reference value. Alternatively, the flow rate can be varied until the pressure equals the reference value, and the flow rate shall be determined and compared to the reference flow rate value.

(c) Where system resistance cannot be varied or if reference curves are used, flow rate and pressure shall be determined and compared to their respective reference values or the associated reference values from the reference curves.

(d) Pressure, flow rate, and vibration (displacement or velocity) shall be determined and compared with corresponding reference values or associated reference values from the reference curves. All deviations from the reference values shall be compared with the limits given in Table ISTB 5.2-2 and Fig. ISTB 5.2-1, and corrective action taken as specified in section 7 below. If the reference curve test method is used, the comparison may be done graphically as shown in Examples 1 and 2 of Fig. 1.

Vibration measurements are to be broad band (unfiltered). If velocity measurements are used, they shall be peak. If displacement amplitudes are used, they shall be peak-to-peak.

7 ACCEPTANCE CRITERIA

If deviations fall within the alert range of Fig. ISTB 5.2-1 and Table ISTB 5.2-2, the frequency of testing specified in ISTB 5.1 shall be doubled until the cause of the deviation is determined and the condition corrected. If deviations fall within the required action range of Table ISTB 5.2-2, the pump shall be declared inoperable until the cause of the deviation has been determined and the condition corrected. If using reference curves, evaluations for deviations in the alert or required action range may be done graphically as demonstrated in Examples 1 and 2 of Fig. 1. When

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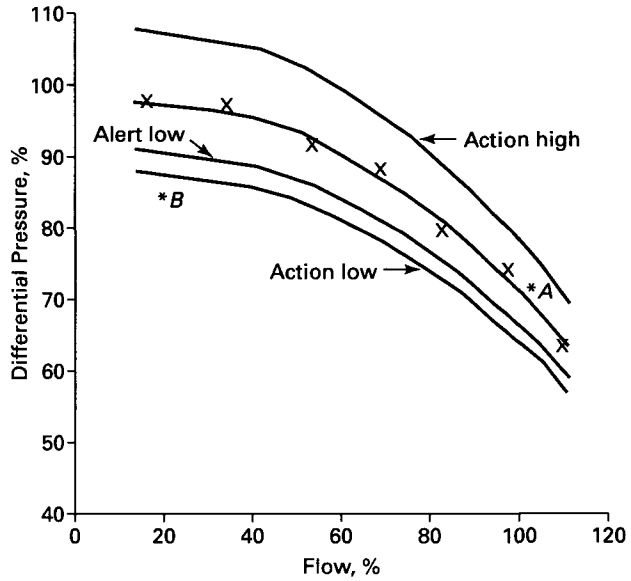
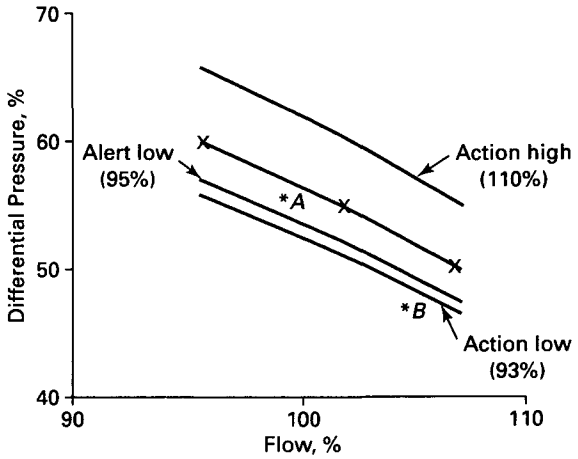
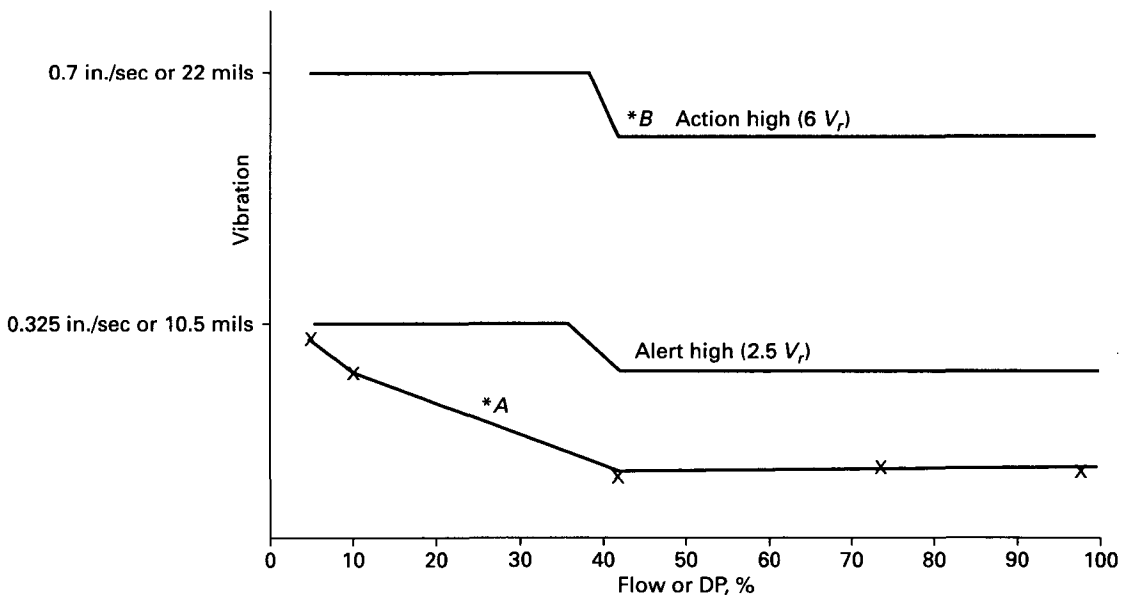


Example 1A



Example 1B



Example 2

A = acceptable operation
B = required action
X = data points used to establish reference curve

FIG. 1 EXAMPLES OF GRAPHICAL EVALUATION OF TESTS USING REFERENCE CURVES

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a test shows deviations outside of the acceptable range of Table ISTB 5.2-2, the instruments involved may be recalibrated and the test rerun.

8 RECORDS AND REPORTS

Use of this Code Case shall be documented in the inservice test plans per ISTB 7.2.

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This Case shall expire on January 26, 2003 unless previously annulled or reaffirmed.

CODE CASE OMN-10
Requirements for Safety Significance Categorization of Snubbers Using Risk Insights and Testing Strategies for Inservice Testing of LWR Power Plants

Inquiry: Is it acceptable to categorize those snubbers under the scope of the ASME OM Code into two categories based on their significance for the purpose of applying different examination and testing strategies to those described in ISTD 6 and ISTD 7?

Reply: Yes, provided the following requirements are met.

1 APPLICABILITY

This Code Case establishes the safety categorization methodology and process for dividing the population of snubbers, as identified in the Owner's Snubber Program Plan, into high safety significant component (HSSC) and low safety significant component (LSSC) categories, and provides acceptable testing strategies for each category.

2 SUPPLEMENTAL DEFINITIONS

2.1 PRA Definitions

common cause failure (CCF): a single event that adversely affects two or more components at the same time.

core damage frequency (CDF): the calculated frequency (per year) that core damage will occur due to failure of a critical safety function (i.e., reactivity control, core cooling, or containment heat removal).

Fussell–Vesely (F–V) importance: the fractional decrease in total risk level (usually CDF) when the plant feature is assumed to be perfectly reliable (failure rate = 0.0).

importance measure: a mathematical expression that defines a quantity of interest. The most common importance measures are F–V and RAW.

large early release frequency (LERF): the calculated frequency (per year) that radioactivity release from containment is both large and early. *Large* means involving the rapid, unscrubbed release of airborne fission products to the environment. *Early* means occurring before the effective implementation of off-site emergency and protective actions.

Level 1 PRA: a PRA that identifies accident sequences that can lead to core damage, calculates the frequency of each sequence, and sums those frequencies to obtain CDF.

Level 2 PRA: a PRA that identifies accident sequences that can lead to radioactivity release, calculates the frequency of each sequence, and sums up those frequencies to obtain LERF.

living PRA: a plant specific PRA that is maintained up to date, such that plant modifications, plant operation changes (including procedure changes), component performance, and other technical information significantly affecting the model are reflected in the model.

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probabilistic risk assessment (PRA): a quantitative assessment of the risk associated with plant operation and maintenance. Risk is measured in terms of the frequency of occurrence of different events, including core damage. In general, the scope of a PRA is divided into three categories: Level 1, Level 2, and Level 3. A Level 1 maps from initiating events to plant damage states, including their aggregate, core damage. Level 2 includes Level 1 mapping from initiating events to release categories (source term). Level 3 includes Level 2 and uses the source term of Level 2 to quantify consequences, the most common of which are health effects and property damage in terms of cost.

risk achievement worth (RAW): the increase in risk of a modeled plant feature (usually a component, train, or system) when the feature is assumed to be out of service (failed). RAW is expressed in terms of the ratio of the risk with the event failed to the baseline risk level.

2.2 Safety Definitions

decision criteria: the quantitative and qualitative factors that affect a decision. These include both quantitative screening criteria (for PRA model) and the evaluation of other qualitative (or deterministic) factors that influence the results of an application.

Expert Panel: a multidisciplined group of experienced plant experts who evaluate specific information, discuss this information amongst themselves (and others as appropriate), and make HSSC and LSSC determinations.

high safety significant components (HSSCs): components that have been designated as more important to plant safety by a blended process of PRA risk ranking and Expert Panel evaluation.

low safety significant components (LSSCs): components that have been designated as less important to plant safety by a blended process of PRA risk ranking and Expert Panel evaluation.

technical specification: the plant technical specifications that are a condition of the plant operating license granted to the Owner by the regulator.

2.3 IST Definitions

active valve: valve that is required to change obturator position to accomplish the required design functions.

inservice test (IST): a test to determine the operational readiness of a component/system (snubber).

operational readiness: ability of a component (snubber) to perform its intended system function when required.

testing strategy: the IST strategy to measure component (snubber) degradation or to monitor a component (snubber) for operational readiness at some interval by operating, examining, or testing the component (snubber).

2.4 Snubber Definitions

component's snubber: snubbers required to protect a component (e.g., pump, valve) during a dynamic event.

equipment dynamic restraint (snubber): a device that provides restraint to a component or system during the sudden application of forces, but allows essentially free motion during thermal movement.

hydraulic snubbers: devices in which the load is transmitted through a hydraulic fluid.

mechanical snubbers: devices in which the load is transmitted entirely through mechanical components.

replacement snubber: any snubber other than the snubber immediately previously installed at a given location.

service conditions: the operating environment for the snubber (e.g., temperature, vibration, weather) at its installed plant location, categorized as harsh or benign.

service life: period of time an item is expected to meet the operational readiness requirements without maintenance.

3 GENERAL REQUIREMENTS

3.1 Implementation

The requirements of this Code Case shall be implemented for all snubbers identified in the Snubber Program Plan, after the Owner has transferred the plant snubber examination and testing requirements from the plant technical specification to an Owner-controlled document and adopted the OM Code.

3.2 Plant Specific PRA

The plant specific PRA (Level 1 with internal initiating events, as a minimum) shall be available and used to perform system risk ranking.

3.3 Living PRA

The PRA shall be maintained up to date [reference (b) in section 9 below provides guidance].

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3.4 Expert Panel

An Expert Panel shall be designated to perform the blended safety evaluation of probabilistic and deterministic engineering information for snubbers.

3.5 Determination of HSSC and LSSC

The Expert Panel shall evaluate each snubber and categorize it as HSSC or LSSC.

3.6 Inservice Testing Strategies for HSSCs and LSSCs

Testing strategies shall be implemented for HSSC snubbers and for LSSC snubbers.

3.7 Other Requirements

Subsection ISTD of reference (a) in section 9 below provides examination and testing requirements for snubbers. Any requirements not specifically addressed by alternative requirements in this Code Case shall stand.

4 SPECIFIC REQUIREMENTS FOR SAFETY CATEGORIZATION

In addition to section 3 above, the following requirements apply to snubber classification into HSSC and LSSC categories.

4.1 System Risk Categorization

This paragraph establishes requirements for separating systems with snubbers into high and low risk categories.

4.1.1 Importance Measures

(a) As a minimum, two importance measures, F–V and RAW, shall be calculated for those systems modeled in the PRA.

(b) The impact upon CDF, and upon LERF if available, shall be determined.

4.1.2 Screening Criteria. For those systems modeled in the PRA, a threshold value of F–V > 0.05 (system level) or F–V > 0.005 (component or train level) based on CDF (and LERF if available) or RAW > 2 (component or train level) shall be initially considered as high risk components, trains, or systems.

4.1.3 Sensitivity Studies

(a) The following sensitivity studies shall be performed for each system containing snubbers.

(1) For Level 1 PRA (CDF end state), determine system and component importance rankings (F–V and RAW) from internal and external initiating events. If external/seismic initiating event PRA is not available, then use alternative deterministic evaluation (i.e., seismic margins).

(2) If available for Level 2 PRA (LERF end state), determine system and component importance rankings as appropriate from internal and external initiating events. If Level 2 PRA is not available, then use alternative deterministic evaluation (i.e., containment bypass).

(3) Identify the major components and their contribution to system risk (F–V and RAW), using internal (and external if available) initiating events.

(4) If available for shutdown PRA (CDF end state), determine system and component importance rankings as appropriate from internal and external initiating events. If shutdown PRA is not available, then use alternative deterministic evaluation (i.e., shutdown cooling paths).

(b) The results of these sensitivity studies, and any others that are performed, shall be documented.

(c) The results and insights of these sensitivity studies shall be provided to the Expert Panel for their consideration in the final categorization of the snubbers.

4.1.4 Qualitative Assessments. Qualitative assessments shall be performed for all active IST components (e.g., pumps and valves) protected by snubbers, unless those snubbers are categorized as HSSC.

(a) The following qualitative assessments shall be performed:

(1) impact of initiating events (i.e., the impact of failure or degradation as it might result in an initiator);

(2) potential consequences of shutdown (outage) conditions; and

(3) response to external initiating events (e.g., seismic, fire, high winds/tornadoes, flooding, etc.).

(b) Qualitative assessments shall be performed for plant-specific design basis conditions and events not modeled in a PRA.

(c) Qualitative assessments shall consider the impacts upon the plant to:

(1) prevent or mitigate accident conditions;

(2) reach and/or maintain safe shutdown conditions;

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(3) preserve the reactor primary coolant pressure boundary integrity; and

(4) maintain containment integrity.

(d) Qualitative assessments shall also consider:

(1) safety function being satisfied by the component's operation;

(2) level of redundancy existing at the plant to fulfill the component's function;

(3) ability to recover from a failure of the component;

(4) performance history of the component;

(5) plant technical specifications requirements applicable to the component;

(6) emergency operating procedure instructions that use the component(s); and

(7) design and licensing basis information relevant to IST component function.

(e) The cumulative impacts of combinations of component unavailability, which could impact an entire system (e.g., multitrain impacts) or critical safety function (e.g., multisystem impacts), shall also be considered.

(f) These qualitative assessments and the Expert Panel's disposition of them shall be documented so independent parties can review and cognizant analysts who did not take part in the original assessment can confirm the result.

(g) These qualitative assessments shall be available to the Expert Panel for their decision of component safety categorization.

4.2 Snubber Safety Categorization

This paragraph provides requirements for the Expert Panel's review and evaluation process for categorizing snubbers relative to their safety significance, using both deterministic and probabilistic insights.

4.2.1 Expert Panel Utilization. The Expert Panel shall blend deterministic and probabilistic information to classify snubbers into HSSC or LSSC categories using both PRA insights and deterministic insights.

(a) *PRA Insights.* The results of PRA analyses shall be used by the Expert Panel to determine the safety significance of components (e.g., pumps and valves) within HSSC systems. Information contained in PRAs relative to the role of components in mitigating or preventing core damaging events or large early radiological release events shall be considered.

(b) *Quality of PRA.* The scope of the PRA and depth of probabilistic analyses shall be assessed, evaluated, and documented. As a minimum, the following shall be documented:

(1) the level of plant specific PRA analysis available for assessing the applicability of PRA information relative to IST programs; for example, written documentation describing the level of plant specific PRA analysis such as Level 1 PRA (assessment of core damage frequency) and/or Level 2 PRA (assessment of core damage frequency plus containment performance);

(2) scope of initiating events considered (internal events, external events, both);

(3) typical failure modes considered (e.g., hardware failures, testing/maintenance failures, common cause failures, human errors);

(4) PRA scope for plant configurations (e.g., low power risk, shutdown risk, transition mode risk, at-power risk) reviewed relative to the applicability of PRA information and IST component function(s).

(c) *Deterministic Insights.* The Expert Panel shall also consider deterministic factors when assessing the safety significance of components within the scope of IST programs (see Appendix A for a sample list of deterministic considerations).

4.2.2 Expert Panel Requirements

(a) *Plant Procedure.* An approved plant procedure shall describe the process, including:

(1) designated members and alternates;

(2) designated chair and alternate;

(3) quorum;

(4) attendance records;

(5) agendas;

(6) motions for approval;

(7) process for decision making;

(8) documentation and resolution of differing opinions;

(9) minutes; and

(10) required training.

(b) Training. The Expert Panel shall be trained and indoctrinated in the specific requirements to be used for this Code Case. Training and indoctrination shall include the application of risk analysis methods and techniques used for this Code Case. At a minimum, the risk methods and techniques include:

(1) PRA fundamentals (e.g., PRA technical approach, PRA assumptions and limitations, failure probability, truncation limits, uncertainty);

(2) use of risk importance measures;

(3) assessment of failure modes for snubbers and components being supported by snubbers;

(4) reliability versus availability;

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(5) risk thresholds; and

(6) expert judgment elicitation.

Each of the aforementioned topics shall be covered in the indoctrination to the extent necessary to provide the Expert Panel with a level of knowledge needed to adequately evaluate and approve the scope of the snubber selections, using both probabilistic and deterministic information.

(c) Experience. Requirements shall be established for ensuring adequate experience levels of Expert Panel members. Member experience levels shall be documented and maintained.

(d) Membership

(1) There shall be at least five experts designated as members of the Expert Panel. Members may be experts in more than one field; however, excessive reliance on any one member's judgment shall be avoided.

(2) The chairperson shall be familiar with this Code Case and shall facilitate Expert Panel activities, to ensure that the requirements of this Code Case are satisfied.

(3) Expertise in the following functions shall be represented on the Expert Panel:

(a) operation

(b) safety analysis engineering

(c) probabilistic risk assessment

(4) Additional members of the Expert Panel should be selected who have the following plant expertise:

(a) systems performance

(b) maintenance

(c) licensing

(d) component performance

(e) ASME inservice examination and testing for snubbers

(f) ASME inservice testing for pumps and valves

(g) quality assurance

(5) Alternate members to the Expert Panel may be designated on a temporary basis; however, vacancies in the Expert Panel membership should be filled by qualified individuals within a reasonable period of time.

(6) Other plant or nuclear industry experts may be invited to attend some or all of the sessions of the Expert Panel as visitors to provide observations, opinions, or recommendations.

4.2.3 Expert Panel Decision Criteria

(a) *Level A Inclusion Criteria.* Any of the following contributors to snubber importance above stated threshold will potentially make the snubber HSSC:

(1) *Level A-1.* All snubbers protecting the following components:

(a) PWRs: steam generators, reactor coolant pumps

(b) BWRs: recirculation pumps

(2) *Level A-2.* All snubbers protecting components in systems with PRA importance ranking F–V > 0.05 or, if evaluated on a component/train level, all snubbers supporting the components in trains with PRA importance ranking F–V > 0.005 or RAW > 2.

(b) *Level B Exclusion Criteria.* The following conditions allow a snubber to potentially be classified as LSSC:

(1) *Level B-1.* All snubbers that support the component with an importance ranking F–V ≤ 0.005 and a RAW ≤ 2.

(2) *Level B-2.* All snubbers associated with unmodeled components and associated with components that would likely be unmodeled in Level 1, 2, 3, and shutdown PRAs, including both internal and external events.

4.2.4 Reconciliation. Decisions of the Expert Panel shall be arrived at by consensus. Differing opinions shall be documented and resolved, if possible. If a resolution cannot be achieved concerning the safety significance classification of a snubber, then the snubber shall be classified HSSC.

5 SPECIFIC REQUIREMENTS FOR SNUBBER SERVICE CONDITION DETERMINATION

All snubbers shall be placed in one of two service conditions, *harsh* or *benign.*

5.1 Harsh

The *harsh* service condition shall be considered for those operating environments where the snubber is exposed to higher temperatures, vibration, or other service condition variables (see ISTD 8, Appendix F) that would result in a predicted service life of ≤ 10 years.

5.2 Benign

The *benign* service condition shall be considered for those operating environments where the snubber is exposed to lower temperatures, minimal vibration, or other service condition variables (see ISTD 8, Appendix F) that would result in a predicted service life of > 10 years.

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6 SPECIFIC REQUIREMENTS FOR HSSC TESTING STRATEGIES

NOTE:
These are alternate examination and testing strategies in lieu of ISTD 6 and ISTD 7 requirements in reference (a) in section 9 below.

6.1 Examination and Testing Strategies for HSSC Snubbers in Harsh Environment

(a) All snubbers (size, manufacturer, type) in this category shall be considered as one population for examination and testing.

(b) Perform visual examination per ISTD 6.

(c) Test per 37 or 10% plan each refueling cycle or 24 months. If a failure occurs, follow the applicable requirements of the selected plan.

(d) Test and/or replace all snubbers within this DTPG once every 6 years.

(e) The snubbers may be selected for testing on a rotational basis.

6.2 Examination and Testing Strategies for HSSC Snubbers in Benign Environment

(a) All snubbers (size, manufacturer, type) in this category shall be considered as one population for examination and testing.

(b) Perform visual examination per ISTD 6.

(c) Test per 37 or 10% plan each refueling cycle or 24 months. If a failure occurs, follow the applicable requirements of the selected plan.

(d) Test and/or replace all snubbers within this DTPG once every 10 years.

(e) The snubbers may be selected for testing on a rotational basis.

7 SPECIFIC REQUIREMENTS FOR LSSC TESTING STRATEGIES

NOTE:
These are alternate examination and testing strategies in lieu of ISTD 6 and ISTD 7 requirements in reference (a) in section 9 below.

7.1 Examination and Testing Strategies for LSSC Snubbers in Harsh Environment

(a) All snubbers (size, manufacturer, type) in this category shall be considered as one population for examination and testing.

(b) Perform visual examination per ISTD 6.

(c) Test per 37 or 10% plan each refueling cycle or 24 months. If a failure occurs, follow the applicable requirements of the selected plan.

(d) Test and/or replace all snubbers within this DTPG once every 10 years.

(e) The snubbers may be selected for testing on a rotational basis.

7.2 Examination and Testing Strategies for LSSC Snubbers in Benign Environment

(a) Determine and monitor service life of each snubber per ISTD 8.

(b) Perform visual examination of all hydraulic snubbers in this category per ISTD 6.

(c) Perform visual examination of all mechanical snubbers in this category to satisfy visual examination requirements of ISTD 6.3 and verify freedom of motion by manual stroking, measuring incremental thermal movement, or functional testing. Perform visual examination of all mechanical snubbers once every 10 years, staggered on minimum 10% to 20% every refuel cycle or 24 months. If degradation is found, test the snubber. If the snubber fails, then verify freedom of motion or test all snubbers susceptible to the same failure mode.

8 RECORDS AND REPORTS

In addition to the requirements of reference (a) in section 9 below with respect to records, the following records of the Expert Panel and the component shall be maintained.

8.1 Expert Panel Records

(a) Membership and attendance

(b) Member expertise representation and training records

(c) Member experience (years of experience in each of the expertise categories)

(d) Meeting agendas

(e) Meeting minutes

(f) Plant procedure

8.2 Component Records

(a) Risk significance based on PRA importance measures

(b) Additional PRA quantitative information

(c) Deterministic information

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(d) Expert Panel categorization decisions of HSSC or LSSC

(e) Basis for the HSSC/LSSC decision

9 REFERENCES

(a) ASME OM Code, Subsection ISTD, Preservice and Inservice Examination and Testing of Dynamic Restraints (Snubbers) in Light-Water Reactor Power Plants, 1995 edition and later addenda

(b) EPRI PSA Applications Guide, TR-105396, August 1995

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OM CODE CASES

(Cases are not part of ASME OM Code-1998 or its Addenda.)

A Case is the official method of handling a reply to an inquiry when study indicates that the Code wording needs clarification, or when the reply modifies the existing requirements of the Code, or grants permission to use alternative methods.

ASME has agreed to publish Cases issued by the Operation and Maintenance Committee concerning the OM Code as part of the update service to the OM Code. The text of proposed new and revised Cases and reaffirmations of current Cases appear in *Mechanical Engineering* for public review. A notice also appears in *Mechanical Engineering* when new and revised Cases are approved.

New and revised Cases, as well as announcements of reaffirmed Cases and annulments, then appear in the next update. Cases currently in effect at the time of publication of a new edition of the Code are included with it as a supplement.

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This Case shall expire on November 30, 2001 unless previously annulled or reaffirmed.

CODE CASE OMN-1
Alternative Rules for Preservice and Inservice Testing of Certain Electric Motor-Operated Valve Assemblies in Light-Water Reactor Power Plants OM Code-1995, Subsection ISTC

Inquiry: What alternative rules, to those of OM Code, Subsection ISTC, may be used for preservice and inservice testing to assess the operational readiness of certain electric motor-operated valve assemblies in light-water reactor power plants?

Reply: It is the opinion of the Committee that, in lieu of the rules for preservice and inservice testing to assess the operational readiness of certain electric motor-operated valve assemblies in light-water reactor power plants in OM Code-1995, Subsection ISTC, except for ISTC 4.3, the following alternative requirements may be applied. Electric motor-operated valves for which seat leakage is limited to a specific maximum amount in the closed position for fulfillment of their required function (Category A) must also be seat leakage rate tested in accordance with the requirements of ISTC 4.3.

NOTE: The terms "shall consider" and "shall be considered" are utilized in paras. 3.5, 3.6.2, and 3.7.1. The Code Case does not dictate how the considerations in the paragraphs are implemented or documented. Users of the Code Case will determine the best methods based on their programs, which may include procedures, checklists, training, or other methods.

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1 INTRODUCTION

1.1 Scope

This Code Case establishes the requirements for preservice and inservice testing to assess the operational readiness of certain motor-operated valves (MOVs) in light-water reactor (LWR) power plants.

The MOVs covered are those required to perform a specific function in shutting down a reactor to the safe shutdown condition, in maintaining the safe shutdown condition, or in mitigating the consequences of an accident.

This Code Case establishes test methods, test intervals, parameters to be measured and evaluated, acceptance criteria, corrective actions, and records requirements.

1.2 Exclusions

MOVs in the following categories are excluded from this Code Case, if they are not specifically required to perform a function described in para. 1.1:

(a) MOVs used only for operating convenience, such as vent, drain, instrument, and test valves;

(b) MOVs used only for system control, such as pressure regulating valves;

(c) MOVs used only for system or component maintenance;

(d) MOVs not required to change position.

External control and protection systems that sense plant conditions and provide signals for MOV operation are also excluded from the requirements of this Code Case.

2 SUPPLEMENTAL DEFINITIONS

motor-operated valve (MOV): a valve and its associated electric motor-driven mechanism for positioning the valve, including components that control valve action and provide position output signals

MOV functional margin: the increment by which an MOV's available capability exceeds the capability required to operate the MOV under design basis conditions

stem factor: the ratio of stem torque to stem thrust in rising-stem valves

design basis stem factor: the greatest value for stem factor expected during design basis operation of an MOV

3 GENERAL REQUIREMENTS

3.1 Design Basis Verification Test

A one-time test shall be conducted to verify the capability of each MOV to meet its safety-related design basis requirements. This test shall be conducted at conditions as close to design basis conditions as practicable. Requirements for a design basis verification test are specified in applicable regulatory documents. Testing that meets the requirements of this Code Case but conducted before implementation of this Code Case may be used.

(a) Design basis verification test data shall be used in conjunction with preservice test data as the basis for inservice test criteria.

(b) Design basis verification testing shall be conducted in situ or in a prototype test facility that duplicates applicable design basis conditions. If a test facility is used, an engineering analysis shall be documented that supports applicability to the in situ conditions.

(c) 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.

(d) The design basis verification test shall be repeated if an MOV application is changed, the MOV is physically modified, or the system is modified in a manner that invalidates its current design basis verification test results or data. A determination that a design basis verification test is still valid shall be justified by an engineering evaluation, alternative testing techniques, or both.

3.2 Preservice Test

Each MOV shall be tested during the preservice test period or before implementing inservice testing. These tests shall be conducted under conditions as near as practicable to those expected during subsequent inservice testing. Testing that meets the requirements of this Code Case but conducted before implementation of this Code Case may be used. Only one preservice test of each MOV is required unless, as described in para. 3.4, the MOV has undergone maintenance that could affect its performance.

3.3 Inservice Test

Inservice testing shall commence when the MOV is required to be operable to fulfill its required function(s), as described in para. 1.1 and shall be suffi-

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cient to assess changes in MOV functional margin consistent with Section 6.

(a) MOVs may be grouped for inservice testing as described in para. 3.5.

(b) Inservice tests shall be conducted in the as-found condition. Maintenance activities, such as stem lubrication, shall not be conducted if they might invalidate the as-found condition for inservice testing.

(c) The inservice testing program will include a mix of static and dynamic MOV performance testing. The mix of MOV performance testing may be altered when justified by an engineering evaluation of test data.

3.3.1 Inservice Test Frequency

(a) The inservice test frequency shall be determined in accordance with para. 6.4.4.

(b) If insufficient data exist to determine the inservice test frequency in accordance with para. 6.4.4, then MOV inservice testing shall be conducted every 2 refueling cycles or 3 years (whichever is longer) until sufficient data exist to determine a more appropriate test frequency.

(c) The maximum inservice test frequency shall not exceed 10 years. MOV inservice tests conducted per para. 3.4 may qualify for this requirement.

3.4 Effect of MOV Replacement, Repair, or Maintenance

When an MOV or its control system is replaced, repaired, or undergoes maintenance that could affect the valve's performance, new inservice test values shall be determined or the previously established inservice test values shall be confirmed before the MOV is returned to service. If the MOV was not removed from service, inservice test values shall be immediately determined or confirmed. This testing is intended to demonstrate that performance parameters, which could be affected by the replacement, repair, or maintenance, are within acceptable limits. The Owner's program shall define the level of testing required after replacement, repair, or maintenance. Deviations between the previous and new inservice test values shall be identified and analyzed. Verification that the new values represent acceptable operation shall be documented as described in Section 9, Records and Reports.

3.5 Grouping of MOVs for Inservice Testing

Grouping MOVs for inservice testing is permissible. Grouping MOVs shall be justified by an engineering evaluation, alternative testing techniques, or both. The following shall be considered when grouping MOVs:

(a) MOVs with identical or similar motor operators and valves and with similar plant service conditions may be grouped together based on the results of design basis verification and preservice tests. Functionality of all groups of MOVs shall be validated by appropriate inservice testing of one or more representative valves;

(b) test results shall be evaluated and justified for all MOVs in the group;

(c) a single representative MOV shall not be selected consecutively. All testable MOVs in a group shall be inservice tested before a previously tested representative MOV can be reselected. In addition to this requirement, the Owner may elect to consecutively test a certain MOV to monitor changes in its functional margin over time;

(d) the number of MOVs tested from each group shall be determined using appropriate statistical methodology. For groups with 10 or more MOVs, at least two representative MOVs shall be tested; and

(e) test results for a representative MOV shall be analyzed and evaluated per Section 6 for each MOV in the group.

3.6 MOV Exercising Requirements

3.6.1 All MOVs, within the scope of this Code Case shall be exercised on an interval not to exceed one year or one refueling cycle (whichever is longer). Full-stroke operation of an MOV, as a result of normal plant operations or Code requirements, may be considered an exercise of the MOV, if documented. Alternatively, longer exercise intervals may be used if justified by successful operating experience.

3.6.2 The Owner shall consider more frequent exercising requirements for MOVs in any of the following categories:

(a) MOVs with high risk significance;

(b) infrequently operated MOVs with risk significance;

(c) MOVs with adverse or harsh environmental conditions; or

(d) MOVs with any abnormal characteristics (operational, design, or maintenance conditions).

3.6.3 MOVs shall be exercised as follows:

(a) full-stroke exercising during plant operation to the position(s) required to fulfill its function(s);

(b) if full-stroke exercising of an MOV is not practicable during plant operation, then full-stroke exercising shall be done during cold shutdowns; or

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(c) if full-stroke exercising of an MOV is not practicable during plant operation or cold shutdown, then full-stroke exercising shall be done during the plant's refueling outages.

3.7 Risk Based Criteria for MOV Testing

3.7.1 Risk based criteria for MOV testing are permissible. If establishing risk based criteria for performance testing, the Owner shall consider the following:

(a) develop an acceptable basis for MOV risk determination;

(b) develop MOV screening criteria to determine each MOV's contribution to risk; and

(c) establish applicability by a documented evaluation from a plant expert panel.

3.7.2 Risk based criteria, when applied to MOV performance testing, shall be used in conjunction with the MOV's margin to establish MOV grouping, acceptance criteria, exercising requirements, and testing frequency.

4 RESERVED

5 TEST METHODS

5.1 Test Prerequisites

All testing shall be conducted in accordance with plant-specific technical specifications, installation details, acceptance criteria, and maintenance, surveillance, operation, or other applicable procedures.

5.2 Test Conditions

Inservice test conditions shall be sufficient to determine the MOV's functional margin per para. 6.4. Test conditions shall be recorded for each test per Section 9.

5.3 Limits and Precautions

(a) MOV exposure to dust, moisture, or other adverse conditions shall be minimized while performing tests.

(b) Manufacturer or vendor limits and precautions associated with the MOV and with the test equipment shall be considered, including the structural thrust and torque limits of the MOV.

(c) Plant-specific operational and design precautions and limits shall be followed. Items to be considered shall include, but are not limited to, water hammer and intersystem relationships.

5.4 Test Procedures

Procedures shall be established for all tests specified in this Code Case and shall provide for:

(a) methodical, repeatable, and consistent performance testing; and

(b) collection of data required to analyze and evaluate the MOV functional margin in accordance with Section 6.

5.5 Test Parameters

Sufficient test parameters shall be selected for measurement to meet the requirements of Section 6 in determining the MOV functional margin.

6 ANALYSIS AND EVALUATION OF DATA

6.1 Acceptance Criteria

The Owner shall establish methods to determine acceptance criteria for each MOV within the scope of this Code Case. Acceptance criteria shall be based upon the minimum amount by which available stem torque must exceed the required design basis stem torque. When determining the acceptance criteria, consider the following sources of uncertainty:

(a) test measurement uncertainty and equipment uncertainty (e.g., torque switch repeatability);

(b) analysis, evaluation, and extrapolation method uncertainty; and

(c) grouping method uncertainty.

6.1.1 MOV margins may be expressed in terms of other parameters, such as stem force, if those parameters are consistent with paras. 6.1 through 6.5.

6.2 Analysis of Data

Data obtained from a test required by this Code Case shall be analyzed to determine if the MOV performance is acceptable. The Owner shall determine which methods are suitable for analyzing necessary parameters for each MOV and application.

Whenever data are analyzed, all relevant operating and test conditions shall be considered.

The Owner shall compare performance test data to the acceptance criteria. If the functional margin, determined per para. 6.4.3, does not meet the acceptance criteria, the MOV shall be declared inoperable, in accordance with the Owner's requirements.

Data analysis shall include a qualitative review to identify anomalous behavior. If indications of anom-

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alous behavior are identified, the cause of the behavior shall be analyzed and corrective actions completed, if required.

6.3 Evaluation of Data

The Owner shall determine which methods are suitable for evaluating test data for each MOV and application.

The Owner shall have procedural guidelines to establish the methods and timing for evaluating MOV test data. Evaluations shall determine the amount of degradation in functional margin that occurred over time. Evaluations shall consider the influence of past maintenance and test activities to establish appropriate time intervals for future test activities.

If grouping is used, the evaluations shall apply changes in functional margin to all members of the group to establish appropriate time intervals for future test activities.

6.4 Determination of MOV Functional Margin

The Owner shall demonstrate that adequate margin exists between the required torque and the available torque. Also, adequate margin shall exist to ensure that changes in MOV operating characteristics over time do not result in reaching a point of insufficient margin before the next scheduled test activity.

Figure 6.4-1 is a flow diagram that outlines the important steps for determining MOV functional margin. This figure is provided for information only. The figure shows separate paths for quarter-turn and rising-stem MOVs. For rotating-rising-stem MOVs, follow the path for rising-stem MOVs.

6.4.1 Determination of Required Torque

6.4.1.1 Rising-Stem MOVs. Design basis required torque shall be determined from measurements taken during testing at design basis conditions.

If not measured directly during testing at design basis conditions, design basis required torque for rising-stem MOVs shall be determined from the evaluation of the design basis required stem thrust and the design basis stem factor (torque equals thrust multiplied by stem factor).

(a) Design Basis Stem Thrust. Design basis stem thrust shall be determined from measurements taken during testing at design basis conditions. Alternatively, design basis stem thrust can, with justification, be estimated by analytical methods using valve parameters determined from testing at conditions other than design basis conditions.

(b) Design Basis Stem Factor. Design basis stem factor shall be calculated from measurements taken during testing at design basis conditions. Alternatively, the stem factor can, with justification, be estimated by analytical methods using valve parameters determined from testing at conditions other than design basis conditions.

6.4.1.2 Quarter-Turn MOVs. The design basis stem torque shall be determined from measurements taken during testing at design basis conditions. Alternatively, the design basis stem torque can, with justification, be estimated by analytical methods, using valve parameters determined from testing at conditions other than design basis conditions.

6.4.2 Determination of Available Stem Torque

6.4.2.1 Available Stem Torque Based on Motor Capabilities. Available stem torque shall be determined based on motor capabilities at the motor's design basis conditions. Considerations shall include:

(a) rated motor start torque;
(b) minimun voltage conditions;
(c) elevated ambient temperature conditions;
(d) operator efficiency; and
(e) other appropriate factors.

6.4.2.2 Available Torque Based on Torque Switch Setting. Where used, the available stem torque, based on the current torque switch setting, shall be determined from the stem torque measurement taken at torque switch trip.

For MOVs where inservice testing does not sufficiently load the MOV to cause torque switch trip (e.g., butterfly and ball valves), available stem torque based on the current torque switch setting shall be determined analytically from test data. Considerations shall include:

(a) calibration of the torque switch spring pack;
(b) the current torque switch setting; and
(c) repeatability of torque switch operation.

6.4.3 Calculation of MOV Functional Margin. MOV functional margin shall be calculated as the difference between the available stem torque and the required stem torque (available torque minus required torque equals margin).

Figure 6.4-2 illustrates this calculation for a rising-stem MOV where torque is expressed as a function of stem factor. The figure shows available stem torque based on two values:

(a) the stem torque based on the motor operating at its design basis conditions; and

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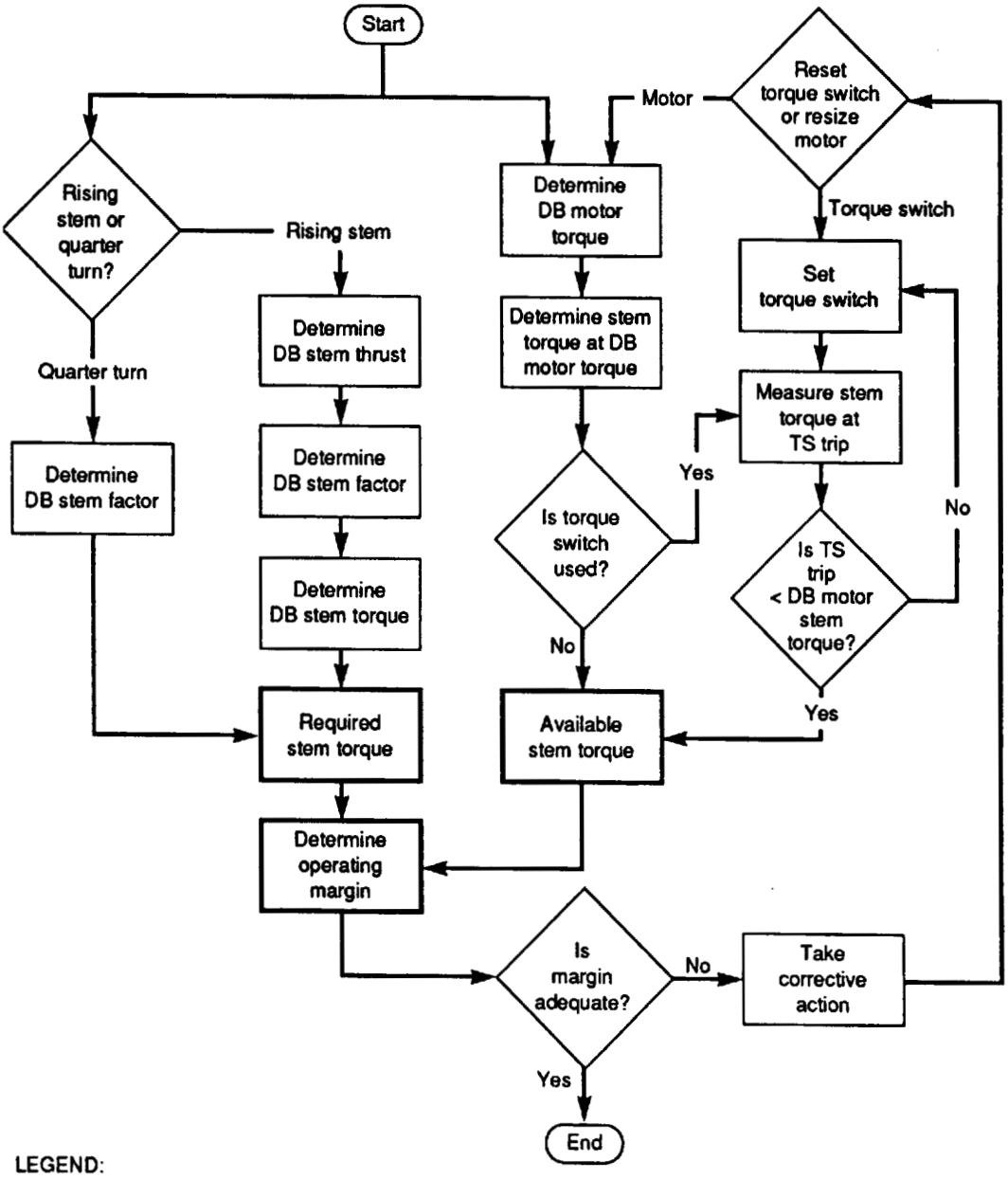

LEGEND:
DB = design basis
TS = torque switch

NOTE:
(1) Or alternate corrective action

FIG. 6.4-1 MOV FUNCTIONAL MARGIN DETERMINATION FLOWCHART

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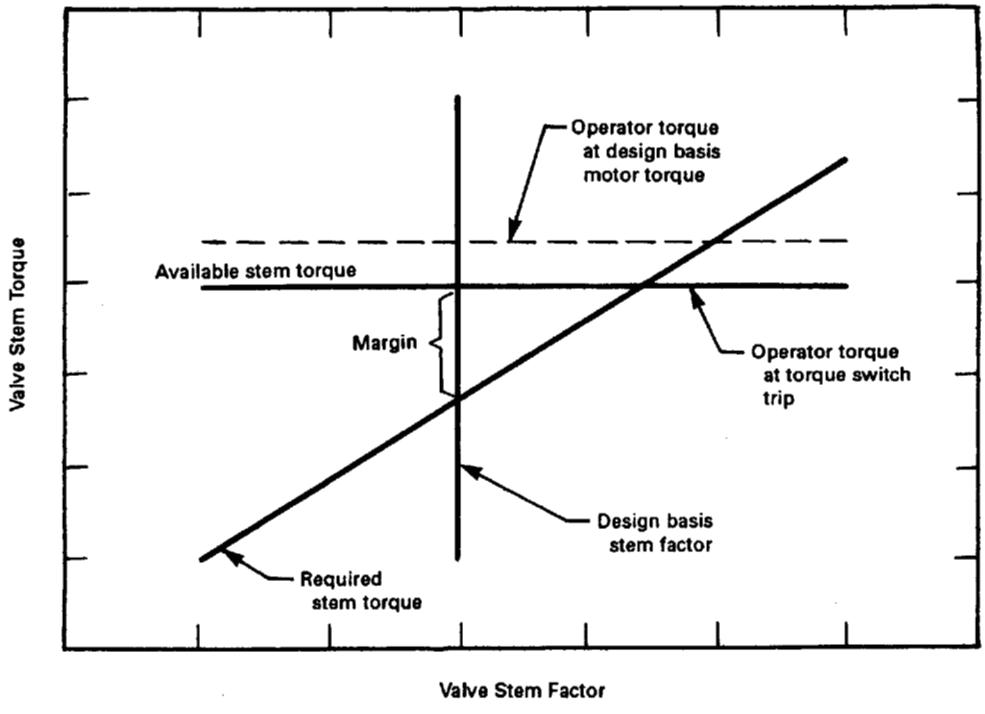

FIG. 6.4-2 DETERMINING FUNCTIONAL MARGIN FOR RISING-STEM MOVs

(b) the stem torque based on the current torque switch setting.

When calculating MOV functional margin, the available stem torque is the lesser of the two.

For rising-stem valves, required stem torque appears as a diagonal line representing the torque needed to provide a given amount of stem thrust (required stem thrust) at various values for the stem factor. MOV functional margin is the difference between available stem torque and required stem torque at the design basis stem factor.

6.4.4 Determination of MOV Test Interval. Calculations for determining MOV functional margin shall also be evaluated to account for anticipated time-related changes in performance. Figure 6.4-3 provides an example of how the measured functional margin might change over time. Figure 6.4-4 provides an example of how changes in the functional margin over time can be evaluated to determine test intervals. Maintenance activities and intervals can affect test intervals and shall be considered.

The interval between tests shall be less than the anticipated time for the functional margin to decrease to the acceptance criteria.

6.5 Corrective Action

If the MOV performance is unacceptable, as established in para. 6.4, corrective action shall be taken in accordance with Owner's corrective action requirements.

6.5.1 Record of Corrective Action. The Owner shall maintain records of corrective action that shall include a summary of the corrections made, the subsequent in-service tests, confirmation of operational adequacy, and the signature of the individual responsible for corrective action and verification of results.

7 RESERVED

8 RESERVED

9 RECORDS AND REPORTS

9.1 Test Information

Pertinent test information shall be recorded or verified for MOV testing, described in Section 3. The following information shall be considered:

(a) MOV plant-specific unique identification number;

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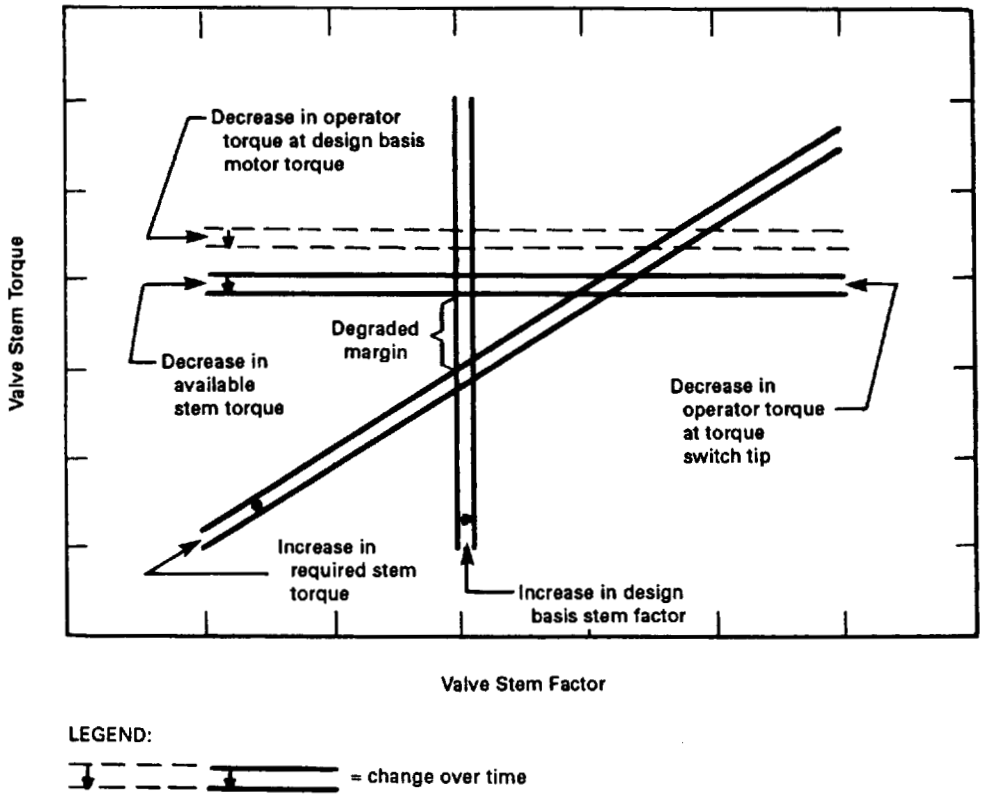
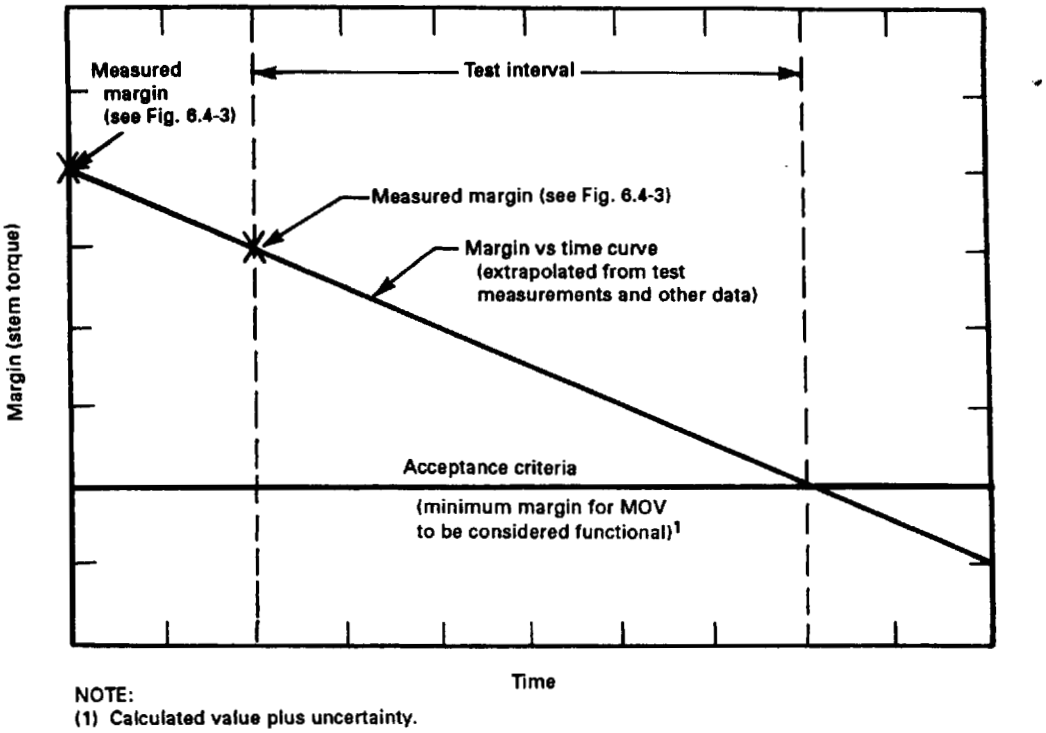


FIG. 6.4-3 DECREASE IN FUNCTIONAL MARGIN OVER TIME FOR RISING-STEM MOVs



NOTE:
(1) Calculated value plus uncertainty.

FIG. 6.4-4 DETERMINING THE TEST INTERVALS FOR MAINTAINING MOV FUNCTIONAL MARGIN

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(b) motor, valve, actuator nameplate data;

(c) test equipment unique identification numbers and equipment calibration dates;

(d) test method and conditions, described in Section 5, including description of valve lineups, process equipment, and type of test. Descriptions shall include valve body, valve stem, electric motor-operator orientation, and piping configuration near the MOV;

(e) breaker setting/fuse size and motor starter thermal overload size, if used;

(f) MOV torque and limit switch configuration and settings;

(g) MOV performance test procedure and other approved plant documents containing acceptance criteria;

(h) name of test performer and date of test;

(i) system flow, system pressure, differential pressure, system fluid temperature, system fluid phase, and ambient temperature; and

(j) significant observations — any comments pertinent to the test results which otherwise may not be readily identified by other recorded test data shall be recorded. Observations shall include any remarks regarding abnormal or erratic MOV action noted either during or preceding performance testing and any other pertinent design information which can be verified at the MOV.

9.2 Documentation of Analysis and Evaluation of Data

The documentation of acceptable MOV performance, which has been analyzed and evaluated in accordance with Section 6, shall include, as a minimum:

(a) values of test data, test parameters, and test information established by paras. 5.5 and 9.1;

(b) summary of analysis and evaluation required per paras. 6.2 and 6.3;

(c) statement(s), by an individual qualified to make such a statement through the Owner's qualification requirements, confirming that the MOV is capable of performing its intended safety function; and

(d) signature and date of verification of the results of the analysis and evaluation by qualified individuals. Independent verification shall be by individuals qualified to verify those specific analyses and evaluations through the Owner's qualification requirements.

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This Case shall expire on June 5, 2001 unless previously annulled or reaffirmed.

CODE CASE OMN-4
Requirements for Risk Insights for Inservice Testing of Check Valves at LWR Power Plants

Inquiry: What alternative requirements may be used in lieu of the requirements of the ASME OM Code for inservice exercising tests for Category C check valves?

Reply: It is the opinion of the Committee that the following requirements may be applied.

1 SAFETY SIGNIFICANCE CATEGORIZATION

Check valves shall be evaluated and categorized as High Safety Significant Components (HSSCs) or Low Safety Significant Components (LSSCs) in accordance with the Code Case on Requirements for safety significance categorization of components using Risk Insights for Inservice Testing of LWR Power Plants.

2 HSSC TESTING

HSSC check valves shall be placed in a Condition Monitoring Program and tested in accordance with ASME OMa Code-1996, Appendix II. The Condition Monitoring program shall include identification and trending of attributes indicative of degradation that could lead to the occurrence of the failure mode(s) that resulted in HSSC categorization.

3 LSSC TESTING

LSSC check valves shall be tested in accordance with OMa Code-1996, Subsection ISTC, or placed in a Condition Monitoring Program and tested in accordance with the ASME OMa Code-1996, Appendix II.

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CODE CASE OMN-5
Testing of Liquid Service Relief Valves Without Insulation

Inquiry: What alternative requirements to those of ANSI/ASME OM Code, Appendix I, paras. I 4.1.1(d), I 4.1.2(d), I 4.1.3(d), I 8.1.1(d), I 8.1.2(d), and I 8.1.3(d) may be used for valves which are insulated in service and removed for testing?

Reply: It is the opinion of the Committee that valves which are insulated in service and removed for testing at ambient temperature using a test media at ambient temperature need not be insulated during testing, provided the requirements of ANSI/ASME OM Code, Appendix I, paras. I 4.3 and I 8.3 are met.

Applicability: ASME OM Code-1990 Edition and later editions and addenda through 1995.

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This Case shall expire on September 28, 2001 unless previously annulled or reaffirmed.

CODE CASE OMN-6
Alternate Rules for Digital Instruments

Inquiry: What alternative requirements to those specified in OM Code, ISTB 4.6.1(b)(2) [ISTB 4.7.1(b)(2) in 1994 addenda and later] may be used for digital instruments used in the performance of inservice testing?

Reply: It is the opinion of the Committee that digital instruments may be selected such that the reference value does not exceed 90% of the calibrated range of the instrument.

Applicability: ASME OM Code-1990 Edition through ASME OMb Code-1997 Addenda.

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OM CODE CASES

(This Case is not part of ASME OM Code-1998 or its Addenda.)

A Case is the official method of handling a reply to an inquiry when study indicates that the Code wording needs clarification, or when the reply modifies the existing requirements of the Code, or grants permission to use alternative methods.

ASME has agreed to publish Cases issued by the Operation and Maintenance Committee concerning the OM Code as part of the update service to the OM Code. The text of proposed new and revised Cases and reaffirmations of current Cases appear in *Mechanical Engineering* for public review. A notice also appears in *Mechanical Engineering* when new and revised Cases are approved.

New and revised Cases, as well as announcements of reaffirmed Cases and annulments, then appear in the next update. Cases currently in effect at the time of publication of a new edition of the Code are included with it as a supplement.

The Cases included in this supplement are as follows.

Page	*Case*	*Change*
C-3	OMN-2	Added
C-5	OMN-3	Added

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CODE CASE OMN-2
Thermal Relief Valve Code Case, OM Code-1995, Appendix I

Inquiry: What alternative to ASME OM Code-1995, Appendix I, paras. 1.3.5(a), (b), and (c) may be used for Class 2 and Class 3 pressure relief valves, which are required to be tested per ASME OM Code-1995, Appendix I, para. I 1.1, whose only overpressure protection function is to protect isolated components from fluid expansion caused by changes in fluid temperature?

Reply: It is the opinion of the Committee that in lieu of the requirements specified in ASME OM Code-1995, paras. I 1.3.5(a), (b), and (c) testing for Class 2 and Class 3 pressure relief devices whose only overpressure protection function is to protect isolated components from fluid expansion caused by changes in fluid temperature shall be performed once every ten years on each device unless performance data indicates that more frequent testing is needed to assure device function. In lieu of test, the Owner may replace these devices every ten years unless performance data indicates more frequent replacement is needed to assure device function.

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This Case shall expire on July 31, 2001 unless previously annulled or reaffirmed.

CODE CASE OMN-3
Requirements for Safety Significance Categorization of Components Using Risk Insights for Inservice Testing of LWR Power Plants

Inquiry: Is it acceptable to categorize those components under the scope of the ASME OM Code Section IST into two categories based on their safety significance?

Reply: Yes, provided the following requirements are met.

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Appendix
A Sample List of Component Deterministic Questions C-17

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1 APPLICABILITY

This Code Case establishes the component safety categorization methodology and process for dividing the population of components, as identified in the IST Program Plan, into "high safety significant component" (HSSC) and "low safety significant component" (LSSC) categories.

2 SUPPLEMENTAL DEFINITIONS

aggregate risk: the risk due to programmatic changes in the IST program (test method effectiveness and/or testing interval) as measured by CDF or LERF

common cause failure (CCF): a single event that adversely affects two or more components at the same time

core damage frequency (CDF): the calculated frequency (per year) that core damage will occur due to failure of a critical safety function (i.e., reactivity control, core cooling, or containment heat removal). (A Level 1 PRA identifies accident sequences that can lead to core damage, calculates the frequency of each sequence, and sums those frequencies to obtain CDF.)

decision criteria: the quantitative and qualitative factors that influence a decision. These include both quantitative screening criteria (for PRA model) and the evaluation of other qualitative (or deterministic) factors that influence the results of an application.

PRA failure rate: the conditional probability of failure of a component on the next demand (for standby component) or in the next hour of operation (for operating component), given that it has not already failed

figures-of-merit: the quantitative value, obtained from a PRA analysis, used to evaluate the results of an application (e.g., CDF, LERF)

Fussell-Vesely (F-V) importance: the fractional decrease in total risk level (usually CDF) when the plant feature is assumed to be perfectly reliable (failure rate = 0.0)

high safety significant components (HSSCs): components that have been designated as more important to plant safety by a blended process of PRA risk ranking and Plant Expert Panel evaluation

importance measure: a mathematical expression that defines a quantity of interest. The most common importance measures are F-V and RAW.

inservice test (IST): a test to determine the operational readiness of a component/system

initiating event: any event that perturbs the steady state operation of the plant, if operating, or the steady state operation of the decay heat removal system during shutdown operations, thereby initiating a transient within the plant. (Initiating events trigger sequences of events that challenge plant control and safety systems.)

large early release frequency (LERF): the calculated frequency (per year) that radioactivity release from the containment is both large and early. "Large" means involving the rapid, unscrubbed release of airborne fission products to the environment. "Early" means occurring before the effective implementation of off-site emergency and protective actions. (A Level 2 PRA identifies accident sequences that can lead to radioactivity release, calculates the frequency of each sequence, and sums these frequencies to obtain LERF.)

living PRA: a plant specific PRA that is maintained up to date, such that plant modifications, plant operation changes (including procedure changes), component performance, and other technical information significantly affecting the model are reflected in the model

low safety significant components (LSSCs): components that have been designated as less important to plant safety by a blended process of PRA risk ranking and Plant Expert Panel evaluation

operational readiness: the ability of a component to perform its intended system function when required

probabilistic risk assessment (PRA): a quantitative assessment of the risk associated with plant operation and maintenance. Risk is measured in terms of the frequency of occurrence of different events, including core damage. In general the scope of a PRA is divided into three categories: Level 1, Level 2, and Level 3. A Level 1 maps from initiating events to plant damage states, including their aggregate, core damage. Level 2 includes Level 1 mapping from initiating events to release categories (source term). A Level 3 includes Level 2 and uses the source term of Level 2 to quantify consequences, the most common of which are health effects and property damage in terms of cost. Full scope PRA includes internal and external events.

risk achievement worth (RAW): the increase in risk of a modeled plant feature (usually a component, train, or system) when the feature is assumed to be out of service (failed). RAW is expressed in terms of the ratio of the risk with the event failed to the baseline risk level.

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testing strategy: the IST strategy to measure component degradation or to monitor a component for operational readiness at some interval by operating or inspecting the component (e.g., valve stroking, pump vibration test, motor circuit evaluation, motor current signature analysis, component bearing lube oil analysis).

truncation limits: the cutoff value of probability or frequency of individual accident sequences below which they are no longer retained in quantitative PRA model results.

3 GENERAL REQUIREMENTS

3.1 Implementation

The requirements of the risk informed component code cases shall be implemented for all IST components of the same type. Component types are specified in the risk informed component code cases.

3.2 Plant Specific PRA

The plant specific PRA (Level 1 with internal initiating events, as a minimum) shall be available and used to perform component risk ranking.

3.3 Living PRA

The PRA shall be maintained up to date. (Reference 1 provides guidance.)

3.4 Integrated Effects

Components may be affected by more than one risk informed application. Integrated effects of multiple risk informed applications (including risk informed applications outside of the ASME scope) shall be evaluated.

3.5 Plant Expert Panel

A Plant Expert Panel shall be designated to perform the blended safety evaluation of probabilistic and deterministic engineering information for each component.

3.6 Determination of HSSC and LSSC

The Plant Expert Panel shall evaluate each component and categorize it as HSSC or LSSC, using PRA quantitative information (if component is modeled) and engineering qualitative information (for both modeled and not modeled components).

3.7 Inservice Testing Strategy for HSSCs and LSSCs

Testing strategies will be developed by other risk informed component code cases:

(a) Test strategies for the HSSCs shall have the objective of identifying and trending degradation that could lead to the occurrence of the failure mode(s) that resulted in the HSSC categorization.

(b) Test strategies for LSSCs shall have the objective of providing confidence for operational readiness.

3.8 Evaluation of Aggregate Risk

The aggregate risk impact of changes to the IST program shall be evaluated by the Owner (e.g., plant expert panel). Decision criteria, quantitative evaluations, and qualitative assessments are a part of this aggregate risk impact evaluation. Reference 1 provides guidance on evaluating aggregate risk.

3.9 Feedback and Corrective Actions

Feedback and corrective action processes are required elements of this Code Case.

4 SPECIFIC REQUIREMENTS

In addition to Section 3 above, the following requirements apply to component classification into HSSC and LSSC categories, and to a risk-informed IST program based on those categories.

4.1 Component Risk Categorization

This paragraph establishes requirements for separating components into HSSC or LSSC categories, performing PRA sensitivity studies to ensure that quantitative ranking is correct, and determining how to treat components not modeled.

4.1.1 Importance Measures

(a) As a minimum, two importance measures, F-V and RAW, shall be calculated for those components modeled in the PRA.

(b) Both the impact upon CDF and upon LERF, if available, shall be determined.

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4.1.2 Screening Criteria. For those components modeled in the PRA:

(a) a threshold value of F-V > 0.005 based on either CDF or LERF shall be initially considered as HSSC;

(b) a threshold value of RAW > 2 based on either CDF or LERF shall be initially considered as HSSC.

4.1.3 Sensitivity Studies

(a) The following sensitivity studies shall be performed:

(1) Data and Uncertainties. Failure rates of components within the PRA models for those IST components that have initially very high or very low safety significance shall be selectively increased and/or decreased to determine if the results are sensitive to changes in the failure data. If sensitivities are indicated, steps shall be taken to determine if uncertainty ranges can be reduced and to validate the failure probabilities included in the models.

(2) Human Factors. The PRA shall be requantified, and the F-V and RAW importance measures recalculated, after human actions modeled in the PRA to recover from specific component failures are removed from the models (i.e., the probability of successful recovery due to human intervention is set to zero).

(3) Test and Maintenance Unavailabilities. The PRA models shall be requantified with test and maintenance unavailabilities minimized or removed, and the importance measures recalculated.

(4) LSSC Failure Rates. Failure rates for initially ranked LSSC components shall be increased by a factor representing the upper bound (95%) of the failure rate and the PRA models requantified. The importance measures shall then be recalculated.

(5) Truncation Limits. If the PRA has not been quantified with a truncation limit in accordance with Ref. 1, the PRA model shall be requantified with the truncation limit lowered to this value. The importance measures shall then be recalculated.

(6) Common Cause. Sensitivity analyses shall determine the impact of increased or decreased common cause failure rates. Importance measures shall then be recalculated.

(b) The results of these sensitivity studies and any others that are performed, shall be documented. In addition to the magnitude of the changes to the CDF or LERF, all insights obtained from the results shall be described.

(c) The results and insights of these sensitivity studies shall be provided to the Plant Expert Panel for their consideration in the final categorization of the components.

4.1.4 Qualitative Assessments. Qualitative assessments shall be performed for all IST components, modeled and not modeled.

(a) The following qualitative assessments shall be performed:

(1) impact of initiating events (i.e., the impact of failure or degradation as it might result in an initiator);

(2) potential consequences of shutdown (outage) conditions; and

(3) response to external events (e.g., seismic, fire, high winds/tornadoes, flooding, etc.).

(b) Qualitative assessments shall be performed for plant-specific design bases conditions and events not modeled in a PRA.

(c) Qualitative assessments shall consider the impacts upon the plant to:

(1) prevent or mitigate accident conditions;

(2) reach and/or maintain safe shutdown conditions;

(3) preserve the reactor primary coolant pressure boundary integrity; and

(4) maintain containment integrity.

(d) Qualitative assessments shall also consider:

(1) safety function being satisfied by the component's operation;

(2) level of redundancy existing at the plant to fulfill the component's function;

(3) ability to recover from a failure of the component;

(4) performance history of the component;

(5) plant technical specifications requirements applicable to the component;

(6) emergency operating procedure instructions that use the component(s); and

(7) design and current licensing basis information relevant to IST component function.

(e) The cumulative impacts of combinations of component unavailability, which could impact an entire system (e.g., multi-train impacts) or critical safety function (e.g., multi-system impacts), shall also be considered.

(f) These qualitative assessments and the plant expert panel's disposition of them shall be documented so independent parties can review and cognizant analysts who did not take part in the original assessment can confirm the result.

(g) These qualitative assessments shall be available to the Plant Expert Panel for their decision of component safety categorization.

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4.1.5 Components Not Modeled

(a) If IST components not modeled in the original at-power PRA are subsequently determined to have an impact upon the ability of the facility to respond to events initiated while the plant is at power, consideration should be given to updating the PRA model to incorporate the effects of the component(s), then using the updated model to provide a quantified basis for categorization (either HSSC or LSSC).

(b) If IST components not modeled in the original shutdown PRA (for facilities with a shutdown PRA) are subsequently determined to have an impact upon the ability of the facility to respond to events initiated while the plant is shutdown, consideration should be given to updating the shutdown PRA model to incorporate the effects of the component(s), then using the updated model to provide a quantified basis for categorization (either HSSC or LSSC).

4.2 Component Safety Categorization

This paragraph provides requirements for the Plant Expert Panel's review and evaluation process for categorizing IST components relative to their safety significance, using both deterministic and probabilistic insights.

4.2.1 Plant Expert Panel Utilization. The Plant Expert Panel shall blend deterministic and probabilistic information to classify IST components into HSSC or LSSC categories.

(a) PRA Insights. The results of PRA analyses shall be used by the Plant Expert Panel to determine the safety significance of components within the scope of IST and PRA programs. Information contained in PRAs relative to the role of components in mitigating or preventing core damaging events or radiological release events shall be considered. The scope of the PRA and depth of probabilistic analyses shall be assessed, evaluated, and documented. As a minimum, the following shall be documented:

(1) The level of plant specific PRA analysis available for assessing the applicability of PRA information relative to IST programs. For example, written documentation describing the level of plant specific PRA analysis such as Level 1 PRA (assessment of core damage frequency) and/or Level 2 PRA (assessment of core damage frequency plus containment performance).

(2) Scope of initiating events considered (internal events, external events, both).

(3) Typical failure modes considered (e.g., hardware failures, testing/maintenance failures, common cause failures, human errors).

(4) PRA scope for plant configurations (e.g., low power risk, shutdown risk, transition mode risk, at-power risk) reviewed relative to the applicability of PRA information and IST component function(s).

(b) Deterministic Insights. The Plant Expert Panel shall also consider deterministic factors when assessing the safety significance of components within the scope of IST programs (See Appendix A of this Code Case for a sample list of deterministic questions).

4.2.2 Plant Expert Panel Requirements

(a) Plant Procedure. A procedure approved by the Owner shall describe the process, including:

(1) designated members and alternates;
(2) designated chairman and alternate;
(3) quorum;
(4) attendance records;
(5) agendas;
(6) motions for approval;
(7) process for decision making;
(8) documentation and resolution of differing opinions;
(9) minutes;
(10) implementation of feedback/corrective actions;
(11) feedback to the PRA; and
(12) required training.

(b) Training. The Plant Expert Panel shall be trained and indoctrinated by the Owner in the specific requirements to be used for this Code Case. Training and indoctrination shall include the application of risk analysis methods and techniques used for this Code Case. At a minimum, the risk methods and techniques include:

(1) PRA fundamentals (e.g., PRA technical approach, PRA assumptions and limitations, failure probability, truncation limits, uncertainty);
(2) use of risk importance measures;
(3) assessment of failure modes;
(4) reliability versus availability;
(5) risk thresholds; and
(6) expert judgment elicitation.

Each of the aforementioned topics shall be covered in the indoctrination to the extent necessary to provide the Plant Expert Panel with a level of knowledge needed to adequately evaluate and approve the scope of the IST selections, using both probabilistic and deterministic information.

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(c) Experience. The Owner shall establish requirements for ensuring adequate experience levels of Plant Expert Panel members. Member experience levels shall be documented and maintained by the Owner.

(d) Requirements. The Owner shall ensure:

(1) there are at least five experts designated as members of the Plant Expert Panel. Members may be experts in more than one field; however, excessive reliance on any one member's judgment shall be avoided.

(2) the chairperson is familiar with this Code Case and facilitates Plant Expert Panel activities, to ensure that the requirements of this Code Case are satisfied.

(3) Expertise in the following functions is represented on the Plant Expert Panel:

(a) operation
(b) safety analysis engineering
(c) probabilistic risk assessment

(e) Recommendations. The Owner:

(1) should select additional members of the Plant Expert Panel who have the following plant expertise:

(a) systems performance
(b) maintenance
(c) licensing
(d) component performance
(e) ASME inservice testing
(f) quality assurance

(2) may designate alternate members to the Plant Expert Panel on a temporary basis; however, vacancies in the Plant Expert Panel membership should be filled by qualified individuals within a reasonable period of time;

(3) may invite other plant or nuclear industry experts to attend some or all of the sessions of the Plant Expert Panel as visitors to provide observations, opinions, or recommendations.

4.2.3 Plant Expert Panel Decision Criteria. Plant Expert Panel decision criteria for categorizing components as HSSC and LSSC shall be documented.

4.2.4 Reconciliation. Decisions of the Plant Expert Panel shall be arrived at by consensus. Differing opinions shall be documented and resolved, if possible.

(a) If a resolution cannot be achieved concerning the safety significance classification of a component, then the component shall be classified HSSC.

(b) If components have a high initial ranking from the PRA (i.e., RAW > 2 or F-V > 0.005) but are ultimately ranked as LSSCs, the Plant Expert Panel shall provide written justification of their decision.

4.3 Testing Strategy Formulation

(a) The Owner shall develop testing strategies for HSSCs and LSSCs following the requirements provided in the risk informed component code cases.

(b) After testing strategies are developed, the Owner shall provide the planned changes (e.g., test frequency, testing effectiveness, and test duration) for input to the evaluation of aggregate risk.

4.4 Evaluation of Aggregate Risk

4.4.1 Decision Criteria

(a) Appropriate decision criteria for aggregate risk effects shall be established and documented by the Owner.

(1) Decision criteria shall be based on thresholds for aggregate risk limits using standard figures-of-merit (e.g., CDF, LERF). (Reference 1 provides guidance.)

(2) Performance criteria used for other regulatory requirements, such as the Maintenance Rule (10 CFR 50.65) or other formal industry programs, may be taken into consideration when developing decision criteria for aggregate risk effects.

(b) Decision criteria may be determined both qualitatively and quantitatively.

4.4.2 Quantitative Assessment

(a) An aggregate risk evaluation shall be performed prior to implementation, as applicable, using the PRA.

(1) Quantitative attributes associated with this Code Case shall be considered and included in the quantitative evaluation, as appropriate, and within the scope of the PRA.

(2) Each applicable quantitative IST attribute shall be incorporated into the quantitative evaluation, as appropriate, until all proposed changes have been dispositioned (i.e., incorporated or not incorporated).

(3) Attributes not included in the quantitative evaluation shall be documented.

(4) Once all appropriate inputs have been incorporated, the PRA shall be rerun to assess the overall risk impact.

(5) Proposed IST program change shall be assessed to determine compliance with approved decision criteria and to quantitatively determine if any adjustments or compensatory measures are warranted.

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(b) Types of quantitative attributes that should be considered in the quantitative evaluation include changes in:

(1) testing frequency;
(2) test duration;
(3) failure rates;
(4) failure modes;
(5) common cause failure susceptibility; and
(6) compensatory measures.

Compensatory measures include both those specifically incorporated into plant programs and those developed by the Owner for specific situations. Management directed compensatory measures should also be included in the quantitative assessment, as appropriate. Verifiable values of failure rates shall be used in the quantification process for IST component.

(c) Testing effectiveness shall be evaluated by periodic assessments or when new failure modes are identified that impact risk quantification.

(1) New failure modes shall be incorporated in accordance with the Owner's risk management and corrective action programs into the quantitative evaluation, as appropriate.

(2) Changes resulting from programs that significantly affect the reliability or availability of components that perform important safety functions shall be assessed, and, if appropriate, incorporated into the PRA for requantification.

Such assessments may be performed in conjunction with the plant specific Maintenance Rule (10 CFR 50.65) requirements.

4.4.3 Qualitative Evaluation

(a) Aggregate risk effects shall be qualitatively evaluated (i.e., risk decreases as well as risk increases) for IST program changes (e.g., testing effectiveness).

(b) Pertinent performance indicators, industry programs, or other scrutable methods for establishing aggregate risk effects shall be identified and monitored.

(c) Owner feedback processes and corrective action programs shall be considered in the evaluation of aggregate risk.

4.4.4 Defense in Depth. The Owner shall ensure that the IST aspects of Defense in Depth are maintained.

4.5 Inservice Testing Program

4.5.1 Maximum Testing Interval

(a) The results of the aggregate risk evaluation shall determine the maximum test interval based on safety significance.

(b) Within the maximum test interval set by the aggregate risk evaluation, the Owner shall establish a testing strategy for each individual component as specified in the applicable risk informed component code cases.

4.5.2 Implementation Schedule. A schedule shall be developed for implementing the testing strategies as specified in the risk informed component code cases.

4.5.3 Feedback to Aggregate Risk. Once the test schedule has been developed, the schedule shall be reviewed against the assumptions of the aggregate risk evaluation.

4.5.4 Transition Plan. A transition plan shall be developed for each component type to ensure adequate information is collected to support justification of stepwise test interval extension up to and including the maximum allowable interval.

4.6 Performance Monitoring

4.6.1 HSSC Attribute Trending. For HSSCs, the Owner shall establish a set of attributes to be tested in accordance with the requirements of risk informed component code cases and will implement a trending program for those attributes selected for monitoring.

4.6.2 LSSC Performance Trending. For LSSCs, the Owner shall identify testing strategies in accordance with the requirements of risk informed component code cases and shall trend component performance.

4.7 Feedback and Corrective Actions

4.7.1 Feedback

(a) The Owner shall establish a feedback process incorporating elements of both conditional and periodic feedback such that component performance information is directed to both the IST and PRA programs. Conditional feedback shall occur on a timely fashion following component failure. Periodic feedback shall be considered for maintenance of the PRA.

(b) Each program shall assimilate performance information to ensure the appropriate unavailability information is reflected in decision making.

(c) The Owner shall establish a feedback process so IST programmatic changes are directed to the PRA program.

4.7.2 Corrective Action. In addition to the requirements in the IST Code of Record with respect to

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Corrective Actions, the Owner shall establish a Corrective Action Program that identifies and tracks to resolution all failures of similar types of components within an IST Program incorporating risk insights, including transportability evaluation.

4.7.3 Component Safety Recategorization. The component's operational readiness is not changed by recategorization.

5 RESERVED

6 RESERVED

7 RESERVED

8 RECORDS AND REPORTS

In addition to the requirements in the Code of Record with respect to Records, the Owner shall maintain the following records of the Plant Expert Panel and the component.

8.1 Plant Expert Panel Records

(a) Membership and attendance
(b) Member expertise representation and training records
(c) Member experience (years of experience in each of the expertise categories)
(d) Meeting agendas
(e) Meeting minutes
(f) Plant procedure

8.2 Component Records

(a) Risk significance based on PRA importance measures
(b) Additional PRA quantitative information
(c) Deterministic information
(d) Plant Expert Panel categorization decisions of HSSC or LSSC
(e) Basis for the HSSC/LSSC decision

9 REFERENCES

EPRI TR. 105396, PSA Applications Guide, August 1995

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APPENDIX A
Sample List of Component Deterministic Questions

This nonmandatory Appendix provides guidance to the Plant Expert Panel for including additional components into the IST program and categorizing them as HSSC or LSSC.

A1 DESIGN BASIS ANALYSIS

(a) Is component considered in design basis analysis?

(b) Is component function considered important in the Safety Analysis Report?

(c) Are there any Tech Spec considerations for this component?

A2 10 CFR 100 RELEASE LIMIT

(a) Could the failure of this component be considered a breach in an engineered safety barrier?

(b) Could the failure of this valve result in an uncontained release of radioactive material in excess of that allowed in 10 CFR 100?

A3 MAINTENANCE RELIABILITY

(a) Is component important to maintaining system reliability?

(b) What type of component failures have been experienced for this and similar style components?

(c) What does the maintenance history indicate about the reliability of this component?

(d) Does the component receive preventive maintenance and is it effective for preventing identified failures?

(e) How are component failures detected?

A4 EFFECT OF COMPONENT FAILURE ON SYSTEM OPERATIONAL READINESS

(a) Is component important to maintaining system availability?

(b) How does component failure affect system performance?

(c) Does component failure cause other system component failures?

(d) What is the system component level of defense in depth?

(e) Does the system or component perform other functions outside the scope of the PRA?

(f) Can system or component failure modes affect redundant trains or other similar component?

A5 OTHER DETERMINISTIC CONSIDERATIONS

(a) Should other component failure modes be considered in the PRA model?

(b) Is this component used to mitigate the consequences of an accident caused by external events?

(c) Is this component important for safe shutdown?

(d) Is this component required to maintain the safe shutdown condition?

(e) Should other component failure modes which may not be included in the PRA be considered (e.g., aging effects, structural supports, human performance failures).

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