INSERVICE TESTING PLAN

For ASME Class 1, 2, and 3 Pumps and Valves

Cooper Nuclear Station

Nebraska Public Power District

Prepared by

Plant Engineering Department

Cooper Nuclear Station

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1.0 Basis for the Inservice Test Program

The base document from which the Inservice Test (IST) plan, schedule and program are developed is 10CFR50.55a(g). Burns & Roe, the Architect Engineer for Cooper Nuclear Station during construction was NPPD's agent in determining the ASME Code classifications of the plant components. NRC Regulatory Guide 1.26 was not yet published; hence, it was not used during Burns & Roe's classification.

2.0 The Second 120 Month Testing Interval

The commercial operation date for Cooper Nuclear Station is July 1, 1974. The IST 120 month testing interval now coincides with ISI 10 year interval. The second 120 month testing interval begins July 1, 1984 and ends June 30, 1994.

3.0 Applicable ASME Code

The Inservice Testing of ASME Class 1, 2, 3 pumps and valves is performed in accordance with Section XI of the ASME Boiler and Pressure Vessel Code 1980 edition through winter 1981 addenda, except where specific written relief from testing determined to be impractical has been granted by the NRC pursuant to 10CFR Part 50, Section 50.55a(g)(6)(i).

4.0 Inservice Testing Plan

4.1 The Inservice Testing (IST) plan is a general document which is provided to the regulatory agencies.

4.2 The IST plan provides:

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5.0 Inservice Testing Program

5.1 The Inservice Testing (IST) program is a detailed living document which is available to the regulatory agencies for audit.

5.2 The IST Program provides:

- 5.2.1 IST Pump Summary Listing.
- 5.2.2 General Pump Testing Procedure.
- 5.2.3 Pump Schedule.
- 5.2.4 Pump Drawings.
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- 5.2.6 General Valve Testing Procedure.
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- 5.2.8 Valve Drawings.
- 5.2.9 Summary of previous IST Tests.
- 5.2.10 Relief Requests.

5.3 The scheduling of Inservice Tests is in accordance with ASME Section XI. The mechanism for specific pump and valve scheduling is contained in Cooper Nuclear Station surveillance and maintenance procedures.

5.4 All records and reports are prepared in accordance with ASME Section XI, IWP-6000 and IWV-6000.

6.0 Extent of Testing

6.1 Pumps

6.1.1 Pumps are tested in accordance with ASME Section XI, Subsection IWP.

6.1.2 The scope of pumps tested is determined by Subsection IWP, Paragraph IWP-1100. In addition to the above scope, Service Water Pumps 1A, 1B, 1C, 1D; Service Water Booster Pumps 1A, 1B, 1C, 1D; and the HPCI pump will be included in the pump listing per the NPPD July 7, 1978 meeting with the NRC

6.2 Valves

6.2.1 Valves are tested in accordance with ASME Section XI, Subsection IWV, Table IWV-3700-1.

6.2.2 The scope of valves tested is determined by Subsection IWV, Paragraph IWV-1100.

6.2.3 Category E valves as defined by ASME Section XI 1974 edition through summer 1975 agenda will be deleted from the existing IST Program.

6.2.4 Category A valves will be re-evaluated to differentiate between active and passive functions, with re-classification as necessary.

6.2.5 Augmented valve testing as required per IEB 83-03 will be included in the IST program.

7.0 Relief Requests

7.1 When an ASME Code Class 1, 2, or 3 pump or valve is determined to be impractical to test in accordance with ASME Section XI, Subsections IWP and IWV, a specific relief request from the ASME Code is submitted to the NRC in accordance with Section 3.0 (above). Each written relief request contains the following information as a minimum:

7.1.1 Identification of pump(s) or valve(s) for whic lief is requested.

7.1.2 ASME Section III Code Class.

7.1.3 The specific ASME Code requirement that has been determined to be impractical.

7.1.4 Cooper Nuclear Station relief justification(s) information for requesting relief.

7.1.5 Specific alternative inspection(s) in lieu of ASME Code Section XI requirement(s).

7.2 The following is a list of Relief Requests:

Relief Request Number	Description
RP-01	Bearing Temperature
RF-02	SLC Pump Inlet Pressure
RP-03	SW Pump Vibration
RP-04	Pump Vibration Measurement Method
RV-01	Valve LLRT Method and Leakage Criteria
RV-02	RHR-MO-920, RHR-MO-921 Test Frequency
RV-03	RR-MO-54 A, B, RR-MO-53 A, B Test Frequency

Relief Request RP-01

Pump: All Pumps.

Class: Not applicable.

Function: Not applicable.

Test Requirement: Measure bearing temperature annually.

Basis for Relief: Bearing temperature measurements will not provide significant additional information regarding bearing condition than that already obtained by measuring vibration amplitude. Measurement of vibration amplitude provides more concise and consistent information with respect to pump and bearing condition. The usage of vibration amplitude measurements can provide information as to a change in the balance of rotating parts, misalignment of bearings, worn bearings, coupling misalignment, changes in internal hydraulic forces and general pump integrity prior to the pump condition degrading to the point where the component is jeopardized. Bearing temperature does not always predict such problems. An increase in bearing temperature most often does not occur until the bearing has deteriorated to a point where additional pump damage may occur. Bearing temperatures are also affected by the temperatures of the medium being pumped, which could yield misleading results.

Vibration readings are not affected by the temperature of the medium being pumped, thus the readings are more consistent. As described in relief request RP-04 unfiltered vibration velocity amplitude measurements will be made in inches/second rather than mils displacement amplitude measurement, with the exception of Standby Liquid Control pumps 1A and 1B, which will be measured in mils displacement due to their low rotating speed. This will provide a more sensitive determination of abnormal conditions. In addition, it is impractical to measure bearing temperatures on many of the pumps in the program. Some specific examples are as follows:

1. Service Water Pumps: There is no installed instrumentation to measure bearing temperature. Also, pump bearings are under water and, therefore, inaccessible.

2. Standby Liquid Control Pumps: There is no installed instrumentation to measure bearing temperature. Bearings are inaccessible for direct measurement due to the location of the bearing within the housing. Bearings are in an oil bath which is inaccessible.

3. High Pressure Coolant Injection:

Booster Pump - There is no installed instrumentation to measure bearing temperature. The booster pump bearings are anti-friction roller bearings. This type of bearing will not typically show a significant rise in temperature just before failure, as is the case with journal bearings.

Main Pump - Instrumentation to measure thrust and journal bearing temperatures is installed on the main pump. However, the HPCI unit cannot be operated for extended time periods in order to meet the acceptance criteria of IWP-3500, due to suppression pool temperature considerations.

4. Residual Heat Removal Pumps: These pumps utilize lower shaft guide bearings which are lubricated by medium pumpage. These bearings are in the main flowpath and are therefore exempt per IWP 4310.

Alternative Test: Unfiltered Vibration Velocity measurements will be taken quarterly to assess overall pump condition, on all pumps except SLC Pumps 1A and 1B. Unfiltered mils displacement readings will be taken on these pumps due to their low rotating speed.

Relief Request RP-02

Pump: SLC-1A, SLC-1B.

Class: IIN

Function: Emergency shutdown of the reactor without the use of control rods.

Test Requirement: Measure pump inlet pressure.

Basis for Relief: It is impractical to measure standby liquid control pump inlet pressure (thus making pump differential pressure impractical) in accordance with Section XI requirements. During pump testing, the pump suction is from a test tank rather than the main standby liquid control tank. The only means available to measure inlet pressure is to correlate tank level to inlet pressure. These pumps are positive displacement, and the measurement of inlet pressure is not critical in judging pump performance. Measuring the discharge pressure and the flow rate is adequate to detect changes in the hydraulic characteristics of the pumps.

Alternative Test: Monitor pump discharge pressure and pump flow rate at each Inservice Test.

Relief request RP-03

Pump:	Service Water Pumps 1A, 1B, 1C, 1D.
Class:	Class IV, Safety Related.
Function:	Emergency Equipment Cooling.
Test Requirement:	Measure Pump Vibration.
Basis for Relief:	The pump casings are physically located underwater and, therefore, inaccessible.
Alternative Testing:	Measure Pump Motor Vibration at upper and lower bearings.

Relief Request RP-04

Pump: All pumps except standby Liquid Control Pumps 1A and 1B.

Class: Not applicable.

Function: Not applicable.

Test Requirement: Requirements of Table IWP-3100-2.

Basis for Relief: Portable vibration monitoring equipment allowing for the measurement of vibration velocity in inches/second is available at the plant site. Vibration severity is a function of displacement and frequency. Since vibration velocity is a function of displacement and frequency, it can be concluded that a measure of vibration velocity is a direct measure of vibration severity. This has been found, through experience, to be true for frequencies between 600 cycles per minute (CPM) and 60,000 cycles per minute. All pumps at Cooper Nuclear Station fall into this range with the exception of the Standby Liquid Control pumps, which operate at 520 RPM. After determining overall pump condition using unfiltered vibration velocity measurements, the plant site has the capability to use a vibration analyzer with a tunable filter to determine the underlying cause of the vibration at various frequencies. The results of testing with an unfiltered velocity meter will be evaluated using the "General Machinery Vibration Severity Chart," published by IRD Mechanalysis, Inc., as a guide. See Page 9 for Chart.

Alternative Testing: The vibration testing data will be analyzed in accordance with the chart shown in RP-04.

Alert Range	$.314 \leq V \leq .628$
Required Action Range	$V \geq .628$ in/sec

Standby Liquid Control pumps 1A and 1B will be monitored in accordance with Table IWP-3100-2.

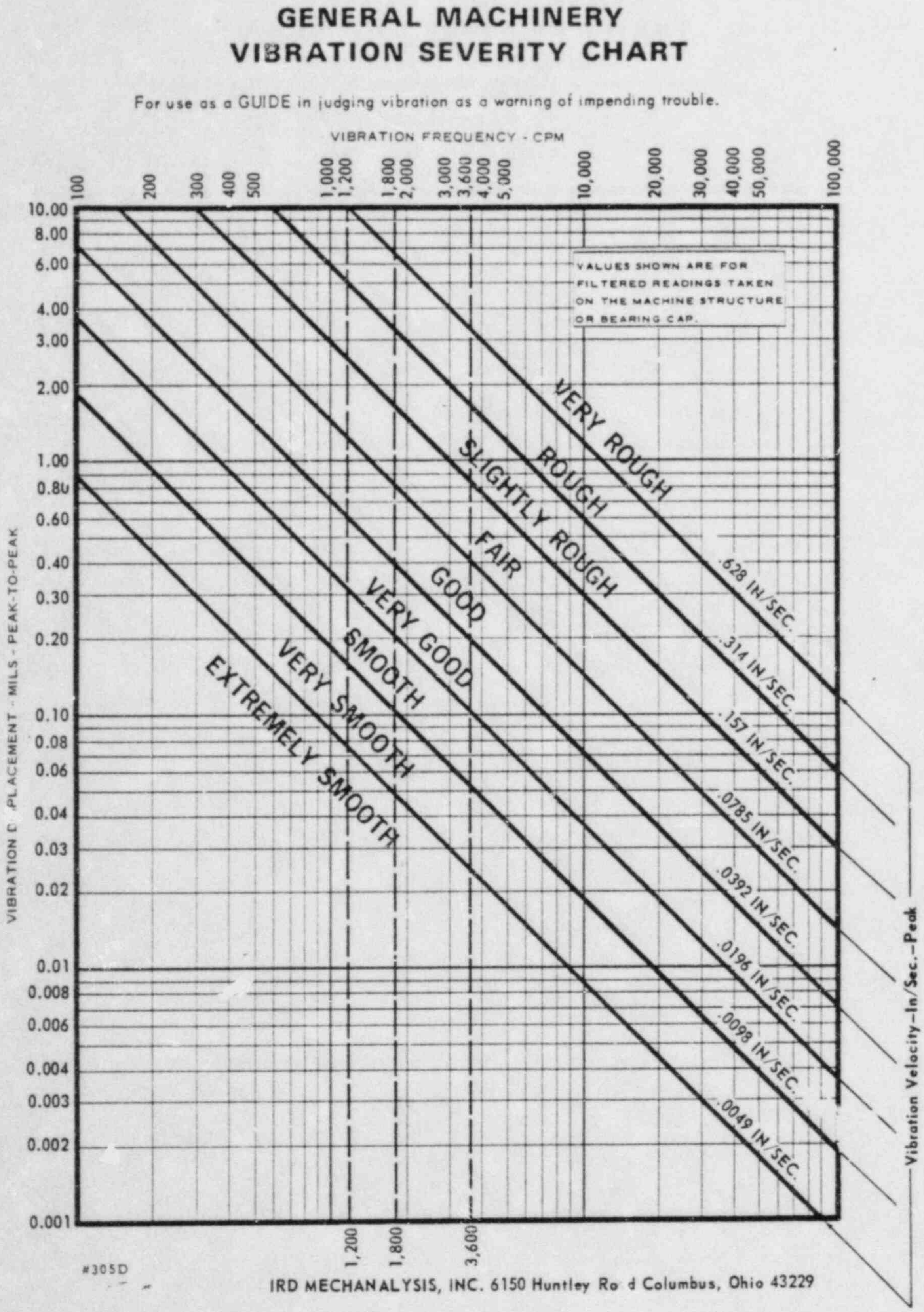

Figure 15. This chart can be used to cross-reference displacement with frequency to determine vibration severity.

Relief Request RV-01

Valve: Category A valves.

Class: IN, IIN

Function: Primary Containment Isolation.

Test Requirement: IWV-3420, Valve Leak Rate Test. Category A Valves shall be tested by the differential test pressure method with the analysis of leakage rates in accordance with IWV-3426.

Basis for Relief: The pressure decay method at initial pressure of 58 psig is suitable for measuring air or nitrogen leakage. The test method is one of the methods contained in 10CFR Appendix J. The basis for the leakage formula is the ideal gas laws. The MSIV's are tested at 29 psig, an exemption from 10CFR50 Appendix J, granted previously per Amendment 44 to DPR 46.

Specific allowable leakage rates for individual valves were established from baseline data when the valves were new and an appropriate range established. Technical Specifications established total allowable leakage at .6La, 189 scfh. This total does not include the MSIV's. This number is based on air as the test media and use of the pressure decay method. See attachment for comparison of Surveillance Procedure 6.3.1.1 leakage rates and ASME XI leakage rates.

Alternative Test: Use the pressure decay method to determine seat leakage. All valves tested at initial pressure of 58 psig with the exception of the MSIV's, which are tested at 29 psig, as previously mentioned. See attachment for basis and procedure for "Pressure Decay Method."

Maximum individual valve leakage rates will be per surveillance Procedure 6.3.1.1 with total leakage governed by Station Technical Specifications.

Valve No.	Surveillance Procedure 6.3.1.1	ASME Section XI
3" RW-AO-82	2.0 SCFH	.94 SCFH
3" RW-AO-83		.94 SCFH
3" RW-AO-94	1.5 SCFH	.94 SCFH
3" RW-AO-95		.94 SCFH
24" PC-MO-230	5.0 SCFH	7.5 SCFH
24" PC-AO-245		7.5 SCFH
ACAD-MO-1310		.3 SCFH
24" PC-MO-231	3.0 SCFH	7.5 SCFH
24" PC-AO-246		7.5 SCFH
1" ACAD-MO-1308		.3 SCFH
24" PC-MO-232	2.0 SCFH	7.5 SCFH
24" PC-AO-238		7.5 SCFH
24" PC-MO-233	5.0 SCFH	7.5 SCFH
24" PC-AO-237		7.5 SCFH
20" PC-AO-243	7.0 SCFH	6.25 SCFH
20" PC-CV-13		6.25 SCFH
20" PC-AO-244	10.0 SCFH	6.25 SCFH
20" PC-CV-14		6.25 SCFH
1" ACAD-MO-1301	.1 SCFH	.3 SCFH
1" ACAD-MO-1302		.3 SCFH
1" ACAD-MO-1303	.1 SCFH	.3 SCFH
1" ACAD-MO-1304		.3 SCFH
1" ACAD-MO-1305	.1 SCFH	.3 SCFH
1" ACAD-MO-1306		.3 SCFH
1" ACAD-MO-1311	.1 SCFH	.3 SCFH
1" ACAD-MO-1312		.3 SCFH

Valve No.	Surveillance Procedure 6.3.1.1	ASME Section XI
1" HPCI-AO-70	.1 SCFH	.3125 SCFH
1" HPCI-AO-71		.3125 SCFH
20" HPCI-CV-15	.5 SCFH	6.25 SCFH
20" HPCI-LVSC-44		6.25 SCFH
2" HPCI-CV-16	1.0 SCFH	.625 SCFH
2" HPCI-LVSC-50		.625 SCFH
3" RCIC-MO-15	2.0 SCFH	.94 SCFH
3" RCIC-MO-16		.94 SCFH
2" RCIC-MO-27	1.0 SCFH	.625 SCFH
2" RCIC-CV-13		.625 SCFH
6" RCIC-MO-41	.5 SCFH	1.875 SCFH
4" RCIC-AO-22	13 SCFH	1.25 SCFH
4" RWCU-15CV		1.25 SCFH
2" RCIC-CV-12	.1 SCFH	.625 SCFH
2" RCIC-LVSC-42		.625 SCFH
8" RCIC-CV-15	1 SCFH	2.5 SCFH
8" RCIC-LVSC-37		2.5 SCFH
18" RF-CV-13	10.0 SCFH	5.625 SCFH
18" RF-CV-14		5.625 SCFH
18" RF-CV-15	2.0 SCFH	5.625 SCFH
18" RF-CV-16		5.625 SCFH
24" MS-AO-80A	5 SCFH	7.5 SCFH
24" MS-AO-86A		7.5 SCFH
24" MS-AO-80B	5 SCFH	7.5 SCFH
24" MS-AO-86B		7.5 SCFH
24" MS-AO-80C	5 SCFH	7.5 SCFH
24" MS-AO-86C		7.5 SCFH
24" MS-AO-80D	5 SCFH	7.5 SCFH
24" MS-AO-86D		7.5 SCFH
3" MS-MO-74	1.5 SCFH	.94 SCFH
3" MS-MO-77		.94 SCFH
3/4" RR-AO-740	1.0 SCFH	.25 SCFH
3/4" RR-AO-741		.25 SCFH
6" RWCU-MO-15	2.0 SCFH	1.875 SCFH
6" RWCU-MO-18		1.875 SCFH

Valve No.	Surveillance Procedure 6.3.1.1	ASME Section XI
10" CS-MO-12A	1.0 SCFH	3.125 SCFH
10" CS-MO-12B		3.125 SCFH
24" RHR-MO-25A	5.0 SCFH	7.5 SCFH
24" RHR-MO-25B	1.5 SCFH	7.5 SCFH
24" RHR-MO-27B		7.5 SCFH
4" RHR-MO-16A	1.0 SCFH	1.25 SCFH
3" RHR-10CV		.9375 SCFH
3" RHR-12CV		.9375 SCFH
4" RHR-MO-16B	.1 SCFH	1.25 SCFH
3" RHR-11CV		.9375 SCFH
3" RHR-13CV		.9375 SCFH
4" RHR-MO-21A	1.0 SCFH	1.2 SCFH
4" RHR-MO-21B	1.5 SCFH	1.2 SCFH
10" RHR-MO-26A	1.0 SCFH	3.125 SCFH
10" RHR-MO-31A		3.125 SCFH
10" RHR-MO-26B	1.0 SCFH	3.125 SCFH
10" RHR-MO-31B		3.125 SCFH
18" RHR-MO-34A	1.0 SCFH	5.625 SCFH
6" RHR-MO-38A		1.875 SCFH
18" RHR-MO-39A		5.625 SCFH
18" RHR-MO-34A	8.0 SCFH	5.625 SCFH
6" RHR-MO-38A		1.875 SCFH
18" RHR-MO-39A		5.625 SCFH
1" RHR-MO-166A	.5 SCFH	.3125 SCFH
1" RHR-MO-167A		.3125 SCFH
1" RHR-MO-166B	.5 SCFH	.3125 SCFH
1" RHR-MO-167B		.3125 SCFH
1 1/2" SLC-CV-13	1.5 SCFH	.469 SCFH
1 1/2" SLC-CV-12		.469 SCFH
10" HPCI-MO-15	2.0 SCFH	3.125 SCFH
10" HPCI-MO-16		3.125 SCFH
14" HPCI-AO-18	10.0 SCFH	4.375 SCFH
4" HPCI-MO-25	1.0 SCFH	1.25 SCFH
4" HPCI-17CV		1.25 SCFH
16" HPCI-MO-58	3.0 SCFH	5.0 SCFH

A. The pressure decay method is suitable for measuring air or nitrogen leakage. The procedure for performing the test is as follows:

1. Connect the test apparatus to the test connection.

2. Pressurize the test volume to 58 psig with air; then isolate the test volume from the air supply.

3. Record the pressure in the test volume at regular intervals.

4. The leakage of the test volume is calculated as follows:

$$L = \frac{dP}{dt}\frac{V}{Ps} \quad 60$$

L = leakage in scf/hr

$\frac{dP}{dt}$ = the slope of a plot of the pressure vs. time data (psi/min)

V = the volume of the test volume (ft^3)

Ps = standard pressure (14.7 psia)

60 - constant to convert scf/min to scf/hr

B. The test method is one of the methods contained in 10CFR50 Appendix J. The basis for the formula is the gas laws.

$$PV = \frac{m}{M} \quad RT$$

Where P = pressure
V = volume
m = mass
M = molecular weight
R = universal gas constant
T = temperature (of test fluid)
Ps = standard pressure (14.7)
Ts = standard temperature

$$m = \frac{PVM}{RT}$$

$$\frac{dm}{dt} = \frac{(VM)}{(RV)}\frac{(dP)}{(dt)}$$

Assume temperature is stable and does not vary with time. Temperature is stabilized prior to taking data.

Leakage is equal to the change in mass with respect to time.

Leakage = $\frac{dm}{dt} \cdot \frac{(RTs)}{(MPs)}$ Constants for standard pressure, temperature, etc.

Leakage = $\frac{\not{R}Ts}{MP} \frac{VM}{\not{R}T} \frac{DP}{dt}$

Leakage = $\frac{530}{T} \frac{M\ gas}{M\ air} \frac{V}{14.7} \frac{dP}{dt} 60$

Assume T is greater than 70°F which it is at CNS so the first term drops out. The test media is air so the second term drops out, which leaves us with the following:

Leakage = $\frac{V}{14.7} \frac{dP}{dt} 60$

Relief Request RV-02

Valve: RHR-MO-920, RHR-MO-921.

Class: IIN

Function: Steam Supply to Augmented Off Gas System.

Test Requirement: Full-stroke excercise every three months or part-stroke every three months and Full-Stroke during cold shutdown.

Basis for Relief: Stroking these valves would require taking the Augmented Off Gas System off the line.

Alternative Test: Stroke RHR-MO-920, RHR-MO-921 at six month intervals. Also, stroke valve at no less than three month intervals when the Reactor is in cold shutdown $\geq$ 48 hours.

Relief Request RV-03

Valve:	RR-MO-54 A, B. RR-MO-53 A, B.
Class:	IN
Function:	RR-MO-54 A, B - Reactor Recirculation loops A and B discharge bypass valves. RR-MO-53 A, B - Reactor Recirculation loops A and B pump discharge isolation valves.
Basis for Relief:	General Electric recommends that RR-MO-54 A, B remain open during normal operation. See General Electric Service Information Letter 104. Stroking RR-MO-53 A, B is not recommended during normal reactor operation without running recirculation pumps back to minimum speed. This would cause an undesired transient in reactor power.
Alternative Test:	Stroke above valves once per year during refueling outage or quarterly when the reactor is in cold shutdown $\geq$ 48 hours.