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February 17, 1989

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U. S. Nuclear Regulatory Commission
Region II, Suite 2900
101 Marietta Street N. W.
Atlanta, GA 30323

VOGTLE ELECTRIC GENERATING PLANT - UNITS 1 and 2
OPERATING LICENSES NPF-68 AND NPF-79
GENERIC LETTER NO., 88-14 INSTRUMENT AIR
SUPPLY SYSTEM PROBLEMS AFFECTING SAFETY RELATED EQUIPMENT

Gentlemen:

Generic Letter 88-14 requested that each licensee/applicant review NUREG - 1275, Volume 2 and perform a design and operational verification of the instrument air system. A response to this generic letter was to be submitted to the NRC within 180 days.

Attached is a response to the identified concerns of NUREG - 1275, Volume 2. The reviews and/or investigations indicate that the design, installation, testing, operation and maintenance of the instrument air systems at Plant Vogtle are adequate to ensure the proper and reliable operation of pneumatically-operated, safety-related equipment.

If you have any questions, please advise.

Mr. W. G. Hairston, III states that he is a Senior Vice President of Georgia Power Company and is authorized to execute this oath on behalf of Georgia Power Company and that, to the best of his knowledge and belief, the facts set forth in this letter and enclosures are true.

GEORGIA POWER COMPANY

By: [signature]
W. G. Hairston, III

Sworn to and subscribed before me this 17th day of February, 1989.

[signature]
Notary Public

MY COMMISSION EXPIRES DEC. 15, 1992

WH/ijb

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Georgia Power

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Enclosure:

cc: Georgia Power Company
Mr. P. D. Rice
Mr. C. K. McCoy
Mr. G. Bockhold, Jr.
GONORMS

U.S. Nuclear Regulatory Commission
Mr. M. L. Ernst, Acting Regional Administrator
Mr. J. B. Hopkins, Licensing Project Manager, NRR (2 copies)
Mr. J. F. Rogge, Senior Resident Inspector-Operations, Vogtle

APPENDIX C

VOGTLE ELECTRIC GENERATING PLANT
UNITS 1 AND 2
RESPONSE TO GENERIC LETTER 88-14

G.L. Item 1: Verification by test that actual instrument air quality is consistent with the manufacturers' recommendations for individual components served.

A. Action Plan:

1. Verify the Instrument Air Quality from performance of preoperational test procedures.

2. Periodic verification during performance of preventive maintenance (PM) tasks associated with the Instrument Air System.

3. Select sample points and conduct additional in-plant testing to measure actual instrument air quality.

4. Verify diesel generator air start system air quality from preoperational test procedures.

B. Response:

Testing of instrument air system air quality has been accomplished as follows at VEGP:

1. Testing activities during the performance of preoperational test procedures consisted of verifying the air quality (moisture and oil content) immediately downstream of the afterfilter for each set of dryers and at the end of selected feeder lines. This testing was accomplished in accordance with the VEGP stated position of conformance to Regulatory Guide 1.68.3 which is provided in FSAR Section 1.9.68.4.2. This statement of conformance committed VEGP to meeting the quality requirements of ANSI/ISA S7.3-1975 for verifying moisture and oil content and noted that verification of particulate size at the end of each feeder line is not considered necessary at VEGP since "the VEGP instrument air system design is such that instrument air is filtered at the dehumidifier and at each instrument (by a local filter/regulator) in accordance with individual instrument manufacturer's requirements." To meet the requirements of ANSI/ISA S7.3-1975, the acceptance criteria for maximum allowable oil content was established as 1 ppm (w/w) and the maximum allowable moisture content was established at -15°F dewpoint at line pressure (see FSAR Section 9.3.1.2.2). The results of the preoperational testing of instrument air quality are tabulated in Tables 1 and 2. These results show that preoperational testing verified that the instrument air systems for both units meet the moisture and oil content requirements of ANSI/ISA S7.3-1975.

2. For Unit 1, periodic verification during performance of PM tasks consisted primarily of verifying the air quality (moisture and oil content) immediately downstream of the afterfilter for each set of dryers. Verification of moisture content (dewpoint) at the end of a representative feeder line has also been performed on eight separate occassions. The PM acceptance criteria for maximum allowable oil content is established as 1 ppm (w/w) and maximum allowable moisture content is established as -60°F dewpoint at line pressure. The results of the PM verifications of instrument air system air quality are tabulated in Table 3. These results show that oil content has consistently been verified to be 0 ppm (a few measurements were recorded as less than 1 ppm); however, dewpoint, on occasion, has been found to exceed the PM acceptance criteria of -60°F. In these cases, corrective maintenance was typically required to restore the dewpoint to less than -60°F. While the dewpoint has been found to exceed the PM acceptance criteria in several instances (typically due to a malfunctioning solenoid valve associated with the dryers), the dewpoint has still consistently been verified to be less than the ANSI/ISA S7.3-1975 requirement of -15°F at line pressure. This demonstrates that the VEGP instrument air system design is such that high quality instrument air can typically be supplied even with a malfunctioning system component.

   Verification of particulate size has not been performed as a part of the PM verifications of instrument air quality; such verification has not been considered necessary for the same reason as stated previously for not performing such verification during the preoperational tests for the instrument air system. However, as a part of the inspections performed per PM checklist SCL00285, "Valve/Damper Stroke", the local air filters/regulators for approximately 39 safety related air-operated valves were inspected during the Unit 1 first refueling outage (Fall, 1988). These inspections verified that no cleaning or replacement of the air filters was required. Vogtle Electric Generating Plant considers that periodic inspection and cleaning or replacement as necessary of these local air filters for each safety related air-operated component is an appropriate method of ensuring that instrument air quality is maintained consistent with the manufacturers' recommendations for size of particulates contained in the air stream. The VEGP program for performing such periodic inspections is discussed later in this response.

3. Additional inplant testing of the operating Instrument Air System consisted of verifying the oil content and dewpoint for five (5) instrument air feeder lines. The results of this testing are tabulated in Table 4. These results show

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that the oil content and dewpoint was again verified to meet the requirement of ANSI/ISA S7.3-1975. This testing, com - bined with the periodic PM measurements of air quality, is considered as sufficient for reverifying the air quality testing results of preoperational test 1-3KB-01 for VEGP Unit 1. The air quality testing results of preoperational test 2-3KB-01 for VEGP Unit 2 are still considered current and therfore reverification of those results is not considered necessary at this time.

Vogtle Electric Generating Plant concludes that the above testing has been sufficient to verify that actual instrument air system air quality is consistent with the manufacturers' recommendations for individual components served. This conclusion is made based on a review that was conducted of the manufacturers' literature associated with individual air operated components. This review indicated that while certain recommendations, such as "filtered," "dry," or "oil free," have been made for the supply air, quantitative air quality requirements have not been specified. The above described testing verified moisture and oil content to be consistent with the quantitative requirements of ANSI/ISA S7.3 - 1975 and the inspection of local air filters (Unit 1) verified particulate size to be acceptable for instrument air as supplied to the individual components. Therefore, the instrument air system air quality is considered as having been verified as consistent with the manufacturers' recommendations.

Testing of air quality for the diesel generator air start system has also been accomplished for VEGP Units 1 and 2. The VEGP diesel generator air start system was supplied by Transamerica Delaval. (Note: VEGP diesel generators are also Transamerica Delaval) and consists of two separate compressed air systems or trains per diesel, with each individual train consisting of one suction filter, compressor, aftercooler, air dryer, and air receiver. Downstream of each air receiver is a y-strainer/filter for removing particulates and oil. Further downstream, filters exist for the starting air distributor and for the engine control panel. The maximum dewpoint acceptance criteria for the VEGP diesel air start system has been established as 50°F at system pressure (see FSAR Table 9.5.6-1). This dewpoint criteria was established based on the design capability of the air start system, the fact that the air is compressed to between 225 and 250 psig, which raises the dewpoint, and the minimum diesel generator room design temperature of 50°F. Preoperational test procedures 1-3KJ-01 "Diesel Generator Train A Starting Air System" (Unit 1), 1-3KJ-02 "Diesel Generator Train B Starting Air System" (Unit 1), 2-3KJ-01 Diesel Generator Train A Starting Air System" (Unit 2), and 2-3KJ-02 "Diesel Generator Train B Starting Air System" (Unit 2) included a verification of dewpoint for starting air contained in each receiver. The results of this preoperational verification of dewpoint are tabulated in Table 5. These results

show that the dewpoint acceptance criteria was met for all but the No. 2 air start train for the Unit 1 "B" diesel. After replacement of a bad condenser fan motor and recharging the dryer with refrigerant, this air start train was also verified to meet the dewpoint acceptance criteria.

Testing of the diesel generator air start system for particulate and oil content is not considered necessary due to the system design which includes the previously mentioned y-strainer/filter and downstream filters. Transamerica Delaval (now IMO Delaval) has specified the exact filters to be used in these applications. These filters are periodically inspected and cleaned or replaced in accordance with the generic maintenance recommendations developed by the Transamerica Delaval Owner's Group (see Appendix II of the TDI Diesel Generator Design Review and Quality Revalidation Report - VEGP: Note: This report was previously submitted to the NRC). The VEGP program for performing these periodic inspections is discussed in more detail later in this response.

A review was conducted of Transamerica Delaval recommendations and of the recommendations developed by the Transamerica Delaval Owner's Group. This review indicated that quantitative air quality requirements have not been specified for the diesel generator air start system. Therefore, VEGP considers that the air quality testing performed during preoperational tests 1-3KJ-01, 1-3KJ-02, 2-3KJ-01, and 2-3KJ-02 was sufficient to verify the air quality of the diesel air start systems for Units 1 and 2 consistent with the manufacturers' recommendations.

II. Item 2: Verification that maintenance practices, emergency procedures and training are adequate to ensure that safety-related equipment will function as intended on loss of instrument air.

A. Action Plan:

1. Evaluate current maintenance programs and practices to determine overall adequacy for components within the scope of the generic letter.

2. Review plant procedures designed to mitigate the effects of a loss of instrument air.

3. Review the content and scope of training programs for adequacy in the area of required response to a loss of instrument air.

instrument air is not available. EOP 19002-C "Natural Circulation Cooldown," Rev. 6, includes a note prior to Step 4 indicating that makeup to the volume control tank is not possible without instrument air available. Attachment A of EOP 19030-C, "Steam Generator Tube Rupture," Rev. 7, provides instructions for establishing charging flow without instrument air available and applies to Step 22 of that procedure.

The types of procedural controls as discussed above are considered adequate for ensuring that safety-related air-operated components will function as intended on loss of instrument air.

3. Training

Current training for licensed operators includes lesson plans, instructional units, and simulator exercises as follows:

LO-LP-02110	"Service and Instrument Air Systems"
LO-IU-02110-001	"Start Air Compressors"
LO-IU-02110-002	"Respond to Instrument Air System Alarms"
LO-IU-02110-003	"Respond to Service Air System Alarms"
LO-IU-02110-004	"Respond to a Loss of Instrument Air to Containment"
LO-SE-60019	"RHR Operations With Malfunctions"
LO-SE-60023	"Coolant & Feedwater & Air Systems Malfunctions"
LO-LP-60321	"Loss of Instrument Air"
LO-IU-60321-001	"Respond to Loss of Instrument Air"

Lesson Plan LO-LP-60321 is based on abnormal operating procedure (AOP) 18028-C and includes training on how to detect a loss of instrument air, response of critical components to a loss of instrument air, how to compensate for certain critical components assuming failure positions which are not necessarily favorable for actual plant conditions, and how to recover from a loss of instrument air. Simulator exercise LO-SE-60019 introduces a loss of instrument air during operations associated with plant shutdown (Mode 5) and simulator exercise LO-SE-60023 introduces a loss of instrument air during power operation (Mode 1). The operator is expected to utilize the guidance of AOP 18028-C for responding to both simulator exercise scenarios.

Current training for non-licensed operators includes lesson plans and instructional units as follows:

NL-LP-02201	"Service and Instrument Air Systems - Outside Area Operator"

NL-LP-02301	"Service and Instrument Air Systems - Turbine Building Operator"
NL-IU-02301-00-001	"Perform Service/Instrument Air Start-Up Inspections"
NL-IU-02301-01-002	"Operate Air Dryers"
NL-IU-02301-01-003	"Blowdown Moisture Separator Drain Traps an Air Receivers"
NL-IU-02301-01-004	"Cross-Connect Unit Compressed Air Systems"
NL-IU-02301-01-005	"Restore Instrument Air to Turbine Building Following Isolation"
NL-IU-02301-00-006	"Restore Service Air Following Isolation"
NL-IU-02301-01-007	"Check Proper Operation of Rotary Air Compressor"
NL-IU-02301-00-008	"Check Proper Operation of Reciprocating Air Compressors"
NL-IU-02301-01-009	"Check Operation of Master Energy Conservator"
NL-LP-02401	"Service and Instrument Air Systems - Auxiliary Building Operator"
NL-LP-53112	"Introduction to Valve Actuators"
NL-IU-53112-00-001	"Verify Power-Operated Valve Operation"
NL-LP-53170	"Introduction to Basic Air Compressors"

NL-LP-02201, NL-LP-02301, and NL-LP-02401 provide training on the purposes of the instrument air system, flowpath, identification of major air-users, expected response of major components to a loss of instrument air, and pertinent industry events. The discussion of industry events is based on events described by NRC Information Notice 87-28, NUREG-1275, Vol. 2, and SOER 88-01 and is intended to sensitize the plant equipment operator to the importance of the instrument air system and to problems which could occur if instrument air quality is allowed to degrade.

Current training for maintenance personnel includes Lesson Plan ME-LP-10003 "Air Operator Maintenance," which is provided to mechanical maintenance personnel and GE-LP-12516, "Service and Instrument Air," which is provided to I & C personnel.

ME-LP-10003 provides training on the basic purpose and principle of operation of air operators, various types of air operators, general maintenance practices for troubleshooting common mechanical and operational causes of air operator failures, and includes a review of NRC Information Notice 87-28, NUREG-1275, Vol. 2, and SOER 88-01 to emphasize the need to prevent degradation of the instrument air system by allowing foreign material such as oil, water, dirt, or debris to enter the system while performing maintenance. GE-LP-12516 provides training on the purpose of

the instrument air system, major components, functions and flowpath, emphasizes that significant problems have occurred at various nuclear plants due to the contamination of instrument air and instructs the student to observe for contamination while performing maintenance on the instrument air system or components serviced by instrument air.

The above described training for licensed operators, non-licensed operators, and maintenance personnel has been reviewed against the recommendations of NUREG-1275, Vol. 2, and revised where appropriate to incorporate those recommendations. This training is considered adequate for ensuring that safety-related equipment will function as intended on loss of instrument air.

G.L. Item 3: Verification that the design of the entire instrument air system including air or other pneumatic accumulators is in accordance with its intended function, including verification by test that air-operated, safety-related components will perform as expected in accordance with all design-bases events, including a loss of the normal instrument air system. This design verification should include an analysis of current air operated component failure positions to verify that they are correct for assuring required safety functions.

A. Action Plan:

1. Identify, by reviewing plant design documentation, the system and component level safety design bases.

2. Create a list of all safety-related components within the scope of the generic letter.

3. Review the testing that was performed for each safety-related component within the scope of the generic letter.

4. Schedule any additional safety-related component testing required.

B. Response:

Safety-related active instrument air users for VEGP Units 1 and 2 are tabulated in Tables 6 and 7. The current failure position for each of these components, as indicated on Piping and Instrumentation Diagrams (P & ID's), was checked against the FSAR-FMEA Tables and/or design calculations as appropriate. The current failure positions for these components were verified to be correct for assuring the required safety functions.

With exceptions as noted below, loss of instrument air pressure tests were performed for the components listed in Tables 6 and 7 during construction acceptance testing for each unit. The air-operated valves listed in Table 6 were individually tested in accordance with construction acceptance test CAT-M-04 "Air Operated Valves." The air-operated dampers listed in Table 7 were individually tested in accordance with CAT-M-07 "HVAC Pneumatic Operated Dampers." This testing was performed to meet the VEGP stated position of conformance to Regulatory Guide 1.68.3 which is provided in FSAR Section 1.9.68.4.2.

Loss of instrument air pressure testing performed per CAT-M-04 consisted of placing the valve opposite to its fail-safe position and then verifying the valve properly moved to its fail-safe position on slowly bleeding off the air from the actuator and, as applicable, on suddenly venting the positioner or controller air supply port to atmosphere. Loss of instrument air pressure testing performed per CAT-M-07 consisted of placing the damper opposite to its fail-safe position and then verifying the damper properly moved to its fail-safe position on slowly reducing the air pressure to the actuator.

The main feedwater isolation valves (i.e., valves 1HV5227, 1HV5228, 1HV5229, 1HV5230, 2HV5227, 2HV5228, 2HV5229, and 2HV5230) were not CAT-M-04 tested. These valves are hydraulic actuated valves but require a source of air to perform their safety function in that air-operated pilot valves have to reposition on a feedwater isolation signal to allow the flow of hydraulic fluid to the appropriate side of the hydraulic piston. The source of air is ensured by air reservoirs and instrument air check valves which seat when supplied instrument air pressure is decreased. The VEGP MFIV's are the same valves as those described in NRC Information Notice 85-35 and which are used as main steam isolation valves at Byron Unit 1. Following issuance of Notice 85-35, the VEGP MFIV's were modified by replacing the air check valves with those of a slightly different design. The ability of these air check valves to seat on a gradual loss of supplied instrument air pressure and to therefore not impact the ability of the MFIV's to perform their safety function is periodically verified in accordance with testing performed per Procedure 14850-1 (14850-2) "Cold Shutdown Valve Inservice Test." This testing is considered adequate verification for the MFIV's as required by the Generic Letter.

Dampers AHV12479, AHV12480, AHV12481, AHV12482, 1HV12604, 1HV12605, 1HV12606, 1HV12607, 2HV12604, 2HV12605, 2HV12606, and 2HV12607 are air-operated dampers, but are also equipped with an inflatable bubble tight seal. A source of air is ensured by a reserve air storage tank and an instrument air check valve for each damper. A CAT-M-07 test was performed for each of these dampers which verified that each properly assumed a closure position on loss of instrument air.

CAT-M-07 does not include confirmation of proper operation of inflatable bubble tight seals. Therefore MWO's will be issued to perform testing that confirms the proper operation of these seals on loss of instrument air. These MWO's will also include the testing of the inflatable bubble tight seals for non-pneumatic dampers 1HY12562 and 1HY12563. This testing will be completed by 1 September 1989.

It could not be verified that Valve 1CY9446 or Dampers AHY2534, 2HY12146, 2HY12147, 2HY12148, and 2HY12149 had been tested according to CAT-M-04 or CAT-M-07. However, these items have been tested to confirm that they move to their proper position when required (i.e., on receipt of a Control Room Isolation, Safety Injection, or Fuel Handlig Building Isolation signal, as applicable). MWO's will be issued to perform additional testing which is expected to be completed by 1 September 1989.

The adequacy of the diesel generator air start system air receivers to perform their intended function was verified during preoperational tests 1-3KJ-05 "Diesel Generator Train A Synchronization, Load Rejection, 5 Air Starts, and 35 Consecutive Starts" (Unit 1, Train A), 1-3KJ-06 (Unit 1, Train B), 2-3KJ-05 (Unit 2, Train A), and 2-3KJ-06 (Unit 2, Train B). The five air starts test consisted of verifying that each air receiver contained sufficient air to perform five air starts of the diesel with the associated air compressor deenergized and with the redundant air receiver isolated from the diesel. This testing is considered adequate verification as required by the Generic Letter.

Use of safety-related pneumatic accumulators at VEGP is limited to air accumulators for the MFIV's, air accumulators for safety-related bubble tight dampers equipped with inflatable seals, and the diesel generator air start system air receivers. The adequacy of these accumulators to perform their intended function on a loss of normal supplied air pressure was verified as discussed above.

G.L. Item 4: Provide a discussion of the VEGP program for maintaining proper instrument air quality.

A. Action Plan:

Review the instrument air quality program and make any improvements deemed necessary.

B. Response:

Procedure 11880-1 (11880-2) "Turbine Building Rounds Sheets" requires the Turbine Building operator to check prefilter and

afterfilter differential pressure for each set of air dryers, to check the moisture (dessicant-type) indicator located on each dryer can, to blowdown the prefilter and afterfilter drains for each set of air dryers, to blowdown the instrument air receivers, to blowdown the moisture separator drains, and to perform various checks and blowdowns for the rotary and receprocating air compressors. These inspections and blowdowns are performed shiftly. Maintenance Work Orders and/or Deficiency Cards are initiated as appropriate to resolve potential problems identified during these inspections.

Preventive Maintenance (PM) standardized checklist SCL00402 has been originated to provide for periodically verifying the dew - point and oil content immediately downstream of the afterfilter for each set of instrument air dryers on both Units. Previously, PM verifications of instrument air dewpoint and oil content were performed for Unit 1 per PM repetitive task 12420005-001W-N. Table 3 reflects results obtained by performance of this previous PM task.

Standardized PM checklist SCL00332 has been originated to provide for a periodic inspection of the air filters for the safety-related air-operated valves listed in Table 6. The air-set/regulator and associated air filter per this checklist will be inspected for contaiminants such as oil, water, dirt, or debris and the filter will be replaced if it exhibits signs of clogging or is physically damaged. If a filter is found which needs replacing, then Maintenance Engineering will determine what other instrument air users in the vincinity of the subject component should be similary inspected. The frequency for the inspections described by SCL00332 has been established to correspond to the intervals of other required inspections for the subject valves and will occur at either 24, 36, or 48 month intervals dependent on the particular valve.

VEGP considers the above described inspections and blowdowns to be a sufficient method to ensure proper air quality is maintained for the instrument air system.

Procedure 11882-1 (11882-2) "Outside Areas Rounds Sheets" requires a shiftly "general" inspection of the diesel generator air start system air compressors. Maintenance Work Orders and/or Deficiency Cards are initiated as appropriate to resolve potential problems identified during these inspections.

PM standardized checklist SCL00166 has been originated to provide for periodically performing a dewpoint measurement of the starting air contained in the diesel air start system air receivers for both units.

Inspection of the y-strainer/filter, starting air distributor filter, engine control cabinet filter, and the barring device air filter for the diesel generator air start system is performed on an "End-of-Cycle" basis which corresponds to the generic maintenance recommendations developed by the Trans-america Delaval Owner's Group. These inspections are performed per the instructions of Procedure 28714-C "EOC Diesel Generator Checkout" and were completed for the Unit 1 diesels during the recent Unit 1 refueling outage (reference MWO's 18806319, 18806320, 18806321, and 18806322).

VEGP considers the above described inspections to be a sufficient method to ensure proper air quality is maintained for the diesel generator air start system.

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TABLE 1

PREOPERATIONAL TEST 1-3KB-01 (UNIT 1)

INSTRUMENT AIR QUALITY

DATE	LOCATION	DEWPOINT	OIL CONTENT
10/30/86	Afterfilter "A" Discharge	-60°F	0 ppm
10/30/86	Afterfilter "B" Discharge	-72°F	0 ppm
10/30/86	Turbine Bldg. El. 195' & 220'	-50°F	0 ppm
10/30/86	Turbine Bldg. El. 245' & 270'	-60°F	0 ppm
10/30/86	Auxiliary Bldg. Line	-48°F	0 ppm
11/17/86	Auxiliary Boiler & Cooling Tower	-36°F	0 ppm

TABLE 2

PREOPERATIONAL TEST 2-3KB-01 (UNIT 2)

INSTRUMENT AIR QUALITY

DATE	LOCATION	DEWPOINT	OIL CONTENT
06/04/88	After filter "A" Discharge	-80°F	0 ppm
06/04/88	Afterfilter "B" Discharge	-80°F	0 ppm
05/15/88	Turbine Bldg. El. 195' & 220'	-80°F	0 ppm
05/15/88	Turbine Bldg. El. 245' & 270'	-80°F	0 ppm
05/15/88	Auxiliary Bldg. Line	-80°F	0 ppm

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TABLE 3

PM CHECKS (UNIT 1)

INSTRUMENT AIR QUALITY

DATE (MWO#)	LOCATION	DEWPOINT	OIL CONTENT
11/18/86 (18619762)	Afterfilter "A" Discharge	-80°F	
03/15/87 (18703110)	Afterfilter "B" Discharge	-35°F	
06/29/87 (18705688)	Afterfilter "B" Discharge	-40°F	
11/05/87 (18708997)	Afterfilter "B" Discharge	-6.8°F	
11/19/87 (18708995)	Afterfilter "A" Discharge	-80°F	
12/03/87 (18711877)	Afterfilter "A" Discharge	-80°F	
07/19/88 (18804297)	Afterfilter "A" Discharge	-80°F	0 ppm
	Afterfilter "B" Discharge	-80°F	0 ppm
07/26/88 (18804461)	Afterfilter "A" Discharge	-80°F	<1 ppm
	Afterfilter "B" Discharge	-80°F	<1 ppm
08/02/88 (18804615)	Afterfilter "A" Discharge	-63°F	<1 ppm
	Afterfilter "B" Discharge	-74°F	<1 ppm
08/09/88 (18804802)	Afterfilter "A" Discharge	-68°F	0 ppm
	Afterfilter "B" Discharge	-72°F	0 ppm
08/16/88 (18805141)	Afterfilter "A" Discharge	-71°F	0 ppm
	Afterfilter "B" Discharge	-73°F	0 ppm
	I & C Shop Line	-80°F	
08/23/88 (18805400)	Afterfilter "A" Discharge	-70°F	0 ppm
	Afterfilter "B" Discharge	-78°F	0 ppm
	I & C Shop Line	-80°F	
08/30/88 (18805507)	Afterfilter "A" Discharge	-80°	0 ppm
	Afterfilter "B" Discharge	-78°	0 ppm
	I & C Shop Line	-80°F	
09/06/88 (18805661)	Afterfilter "A" Discharge	-80°F	0 ppm
	Afterfilter "B" Discharge	-80°F	0 ppm
	Control Bldg. Level B	-80°F	
09/13/88 (18805833)	Afterfilter "A" Discharge	-80°F	0 ppm
	Afterfilter "B" Discharge	-80°F	0 ppm
09/21/88 (18806086)	Afterfilter "A" Discharge	-80°F	0 ppm
	Afterfilter "B" Discharge	-80°F	0 ppm
	I & C Shop Line		

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TABLE 3 (Continued)

PM CHECKS (UNIT 1)

INSTRUMENT AIR QUALITY

DATE (MWO#)	LOCATION	DEWPOINT	OIL CONTEN
09/27/88 ([illegible])	Afterfilter "A" Discharge	-67°F	0 ppm
	Afterfilter "B" Discharge	-70°F	0 ppm
	Control Bldg. Level B	-77°F	
10/04/88 (18806273)	Afterfilter "A" Discharge	-71°F	0 ppm
	Afterfilter "B" Discharge	-71°F	0 ppm
10/05/88 (18806475)	Afterfilter "A" Discharge	-80°F	0 ppm
	Afterfilter "B" Discharge	-80°F	0 ppm
	Control Bldg. Level B	-80°F	
10/22/88 (18806727)	Afterfilter "A" Discharge	-68°F	0 ppm
	Afterfilter "B" Discharge	-68°F	0 ppm
10/29/88 (18806998)	Afterfilter "A" Discharge	-68°F	0 ppm
	Afterfilter "B" Discharge	-68°F	0 ppm
11/15/88 (18807138)	Afterfilter "A" Discharge	-20°F	0 ppm
	Afterfilter "B" Discharge	-20°F	0 ppm
11/21/88 (18807315)	Afterfilter "A" Discharge	-20°F	0 ppm
	Afterfilter "B" Discharge	-20°F	0 ppm
11/29/88 (18808384)	Afterfitler "A" Discharge	-80°F	0 ppm
	Afterfilter "B" Discharge	-56°F	0 ppm
12/06/88 (18808385)	Afterfilter "A" Discharge	-80°F	0 ppm
	Afterfilter "B" Discharge	-59°F	0 ppm
12/16/88 (18808653)	Afterfilter "A" Discharge	-76°F	0 ppm
	Afterfilter "B" Discharge	-61°F	0 ppm
12/20/88 (18808654)	Afterfilter "A" Discharge	-69°F	0 ppm
	Afterfilter "B" Discharge	-60°F	0 ppm
12/27/88 (18808655)	Afterfilter "A" Discharge	-61°F	0 ppm
	Afterfilter "B" Discharge	-43°F	0 ppm
01/03/89 (18808854)	Afterfilter "A" Discharge	-46°F	0 ppm
	Afterfilter "B" Discharge	-22°F	0 ppm
01/10/89 (18808966)	Afterfilter "A" Discharge	-80°F	0 ppm
	Afterfilter "B" Discharge	-80°F	0 ppm

* PM measurement of oil content was implemented in 1988

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TABLE 4

SPECIAL TESTING (Unit 1)

INSTRUMENT AIR QUALITY

(MWO #18900303)

DATE	LOCATION	DEWPOINT	OIL CONTENT
02/03/89	Turbine Bldg. Level 1	-80°F	0 ppm
02/03/89	Control Bldg. Level B	-80°F	0 ppm
02/03/89	Auxiliary Bldg. Level D	-80°F	0 ppm
02/03/89	Diesel Generator Bldg. 1A	-80°F	0 ppm
02/03/89	Diesel Generator Bldg. 1B	-80°F	0 ppm

TABLE 5

DIESEL GENERATOR AIR START SYSTEM

AIR QUALITY PREOP TESTING

DATE	PREOP	AIR START TRAIN	ROOM TEMP	DEWPOINT
11/03/86	1-3KJ-01	1-2403-G4-001-K01	77°F	48.3°F
11/03/86	1-3KJ-01	1-2403-G4-001-K02	77°F	48.2°F
11/04/86	1-3KJ-02	1-2403-G4-002-K01	79°F	49.1°F
11/04/86	1-3KJ-02	1-2403-G4-002-K02	79°F	61.9°F
10/06/87	2-3KJ-01	2-2403-G4-001-K01	77°F	41.4°F
10/06/87	2-3KJ-01	2-2403-G4-001-K02	77°F	42.4°F
10/13/87	2-3KJ-02	2-2403-G4-002-K01	63°F	36.3°F
12/11/87	2-3KJ-02	2-2403-G4-002-K02	71°F	40°F

APPENDIX C

TABLE 6
SAFETY-RELATED
INSTRUMENT AIR USERS
----ACTIVE VALVES----

VALVE	VENDOR	AIR FILTER MODEL	SIZE(M)	FMEA-FSAR REF.	POSITI
1HV13005A 2HV13005A	FISHER	P595	50	FMEA-FSAR TABLE 10.3.3-1	CLOSED
1HV13005B 2HV13005B	FISHER	P595	50	FMEA-FSAR TABLE 10.3.3-1	CLOSED
1HV13006A 2HV13006A	FISHER	P595	50	FMEA-FSAR TABLE 10.3.3-1	CLOSED
1HV13006B 2HV13006B	FISHER	P595	50	FMEA-FSAR TABLE 10.3.3-1	CLOSED
1HV13007A 2HV13007A	FISHER	P595	50	FMEA-FSAR TABLE 10.3.3-1	CLOSED
1HV13007B 2HV13007B	FISHER	P595	50	FMEA-FSAR TABLE 10.3.3-1	CLOSED
1HV13008A 2HV13008A	FISHER	P595	50	FMEA-FSAR TABLE 10.3.3-1	CLOSED
1HV13008B 2HV13008B	FISHER	P595	50	FMEA-FSAR TABLE 10.3.3-1	CLOSED
1HV7603A 2HV7603A	CONOFLOW	FH-20	35	FMEA-FSAR TABLE 10.3.3-1	CLOSED
1HV7603B 2HV7603B	CONOFLOW	FH-20	35	FMEA-FSAR TABLE 10.3.3-1	CLOSED
1HV7603C 2HV7603C	CONOFLOW	FH-20	35	FMEA-FSAR TABLE 10.3.3-1	CLOSED

(Continued)

APPENDIX C

TABLE 6 (Continued)
SAFETY-RELATED
INSTRUMENT AIR USERS
-----ACTIVE VALVES-----

VALVE	VENDOR	AIR FILTER MODEL	SIZE(M)	FMEA-FSAR REF.	POSI
1HY7603D 2HY7603D	CONOFLOW	FH-20	35	FMEA-FSAR TABLE 10.3.3-1	CLOS
1HY5280 2HY5280	FISHER	67AFR	40	FMEA-FSAR TABLE 10.3.3-1	CLOS
1HY5281 2HY5281	FISHER	67AFR	40	FMEA-FSAR TABLE 10.3.3-1	CLOS
1HY3502 2HY3502	FISHER	67AFR	40	NONE	CLOSE
1HY8823 2HY8823	FISHER	P-594-1	40	NONE	CLOSE
1HY8824 2HY8824	FISHER	P-594-1	40	NONE	CLOSE
1HY8843 2HY8843	CONOFLOW	FH-20	35	NONE	CLOSED
1HY8881 2HY8881	CONOFLOW	FH-20	35	NONE	CLOSED
1HY27901 2HY27901	CONOFLOW	GFH20XT1782	35	NONE	CLOSED
1HY8871 2HY8871	FISHER	P594-1	40	NONE	CLOSED
1HY8964 2HY8964	FISHER	P594-1	40	NONE	CLOSED
1HY8888 2HY8888	FISHER	P594-1	40	NONE	CLOSED
1HY8880 2HY8880	FISHER	P-594-1	40	NONE	CLOSED
1HY8160 2HY8160	CONOFLOW	FH-20	35	NONE	CLOSED
1HY8152 2HY8152	FISHER	P594-1	40	NONE	CLOSED

(Continued)

APPENDIX C

TABLE 6 (Continued)
SAFETY-RELATED
INSTRUMENT AIR USERS
----ACTIVE VALVES----

VALVE	VENDOR	AIR FILTER MODEL	SIZE(M)	FMEA-FSAR REF.	POSIT
1HY8825 2HY8825	FISHER	P-594-1	40	NONE	CLOS
1HY8890A 2HY8890A	FISHER	P-594-1	40	NONE	CLOS
1HY8890B 2HY8890B	FISHER	P-594-1	40	NONE	CLOS
1HY8033 2HY8033	CONOFLOW	FH20XTKXGB1	35	NONE	CLOSE
1HY8047 2HY8047	CONOFLOW	FH20XTKXGB1	35	NONE	CLOSE
1HY8028 2HY8028	CONOFLOW	FH20XTKXGB1	35	NONE	CLOSE
1HY3513 2HY3513	FISHER	P595	50	NONE	CLOSED
1HY3514 2HY3514	FISHER	67AFR	40	NONE	CLOSED
1HY3507 2HY3507	FISHER	P595	50	NONE	CLOSED
1HY3508 2HY3508	FISHER	67AFR	40	NONE	CLOSED
1HY5278 2HY5278	FISHER	67AFR	40	FMEA-FSAR TABLE 10.3.3-1	CLOSED
1HY5279 2HY5279	FISHER	67AFR	40	FMEA-FSAR TABLE 10.3.3-1	CLOSED
1HY7699 2HY7699	CONOFLOW	FH20XTKXGB1	35	NONE	CLOSED
[illegible]	CONOFLOW	FH20XTKXGB1	35	[illegible]	[illegible]

(Continued)

APPENDIX C

TABLE 6 (Continued)
SAFETY-RELATED
INSTRUMENT AIR USERS
----ACTIVE VALVES----

VALVE	VENDOR	AIR FILTER MODEL	SIZE(M)	FMEA-FSAR REF.	POSI'
1HY780 2HY780	CONOFLOW	GFH20XT1782	35	NONE	CLOSE
1HY781 2HY781	CONOFLOW	GFH20XT1782	35	NONE	CLOSE
1HY7126 2HY7126	CONOFLOW	FH20XTKXG81	35	NONE	CLOSE
1HY7150 2HY7150	CONOFLOW	FH20XTKXG81	35	NONE	CLOSE
1HY9385 2HY9385	CONOFLOW	GFH20XT1782	35	NONE	CLOSE
1HY9378 2HY9378	FISHER	67AFR	40	NONE	CLOSED
1HY15198 2HY15198	CONOFLOW	GFH20XT1782	35	FMEA-FSAR TABLE 10.4.9-4	CLOSED
1HY15197 2HY15197	CONOFLOW	GFH20XT1782	35	FMEA-FSAR TABLE 10.4.9-4	CLOSED
1HY15199 2HY15199	CONOFLOW	GFH20XT1782	35	FMEA-FSAR TABLE 10.4.9-4	CLOSED
1HY15196 2HY15196	CONOFLOW	GFH20XT1782	35	FMEA-FSAR TABLE 10.4.9-4	CLOSED
1CY9446 2CY9446	FISHER	67AFR/67FR	40	NONE	CLOSED
1CY9447 2CY9447	FISHER	67AFR/67FR	40	NONE	CLOSED

(Continued)

APPENDIX C

TABLE 6 (Continued)
SAFETY-RELATED
INSTRUMENT AIR USERS
-----ACTIVE VALVES-----

VALVE	VENDOR	AIR FILTER MODEL	SIZE(M)	FMEA-FSAR REF.	POS
1HY8145 2HY8145	FISHER	P-594-1	40	FIG. 3.6.1-1 (SHEET 25)	CLC
1HY15214 2HY15214	FISHER	P595	50	NONE	CLC
1HY10957 2HY10957	CONOFLOW	GFH20XT1782	35	NONE	CLO.
1HY10958 2HY10958	CONOFLOW	GFH20XT1782	35	NONE	CLO:
1HY15212A 2HY15212A	FISHER	P595	50	FMEA-FSAR TABLE 10.3.3-1	CLOS
1HY15212B 2HY15212B	FISHER	P595	50	FMEA-FSAR TABLE 10.3.3-1	CLOS
1HY15212C 2HY15212C	FISHER	P595	50	FMEA-FSAR TABLE 10.3.3-1	CLOS
1HY15212D 2HY15212D	FISHER	P595	50	FMEA-FSAR TABLE 10.3.3-1	CLOS:
1HY15216A 2HY15216A	FISHER	P595	50	FMEA-FSAR TABLE 10.3.3-1	CLOS:
1HY15216B 2HY15216B	FISHER	P595	50	FMEA-FSAR TABLE 10.3.3-1	CLOSE.
1HY15216C 2HY15216C	FISHER	P595	50	FMEA-FSAR TABLE 10.3.3-1	CLOSE
1HY15216D 2HY15216D	FISHER	P595	50	FMEA-FSAR TABLE 10.3.3-1	CLOSE

(Continued)

APPENDIX C

TABLE 6 (Continued)
SAFETY-RELATED
INSTRUMENT AIR USERS
----ACTIVE VALVES----

VALVE	VENDOR	AIR FILTER MODEL	SIZE(M)	FMEA-FSAR REF.	POS
1LV0459 2LV0459	FISHER	P594-1	40	NONE	CLO.
1LV0460 2LV0460	FISHER	P594-1	40	NONE	CLOS
1HV8153 2HV8153	FISHER	P594-1	40	NONE	CLOS
1HV8154 2HV8154	CONOFLOW	FH-20	35	NONE	CLOS
1HV5227 2HV5227	WATTS	F-602-4EJ	40	NONE	CLOSE
1HV5228 2HV5228	WATTS	F-602-4EJ	40	NONE	CLOSE
1HV5229 2HV5229	WATTS	F-602-4EJ	40	NONE	CLOSE
1HV5230 2HV5230	WATTS	F-602-4EJ	40	NONE	CLOSED
AHV19722	CONOFLOW	GFH20XT1782	35	NONE	CLOSED
AHV19723	CONOFLOW	GFH20XT1782	35	NONE	CLOSED

* Assumes failure position on feedwater isolation signal

APPENDIX C
TABLE 7
SAFETY-RELATED INSTRUMENT AIR USERS
-----ACTIVE DAMPERS-----

DAMPER	VENDOR	AIR FILTER MODEL	SIZE(M)	FMEA-FSAR REF.	
AHY2534	NORGREN	F12-400A3M	50	TABLE 9.4.2-2	
AHY2535	NORGREN	F12-400A3M	50	TABLE 9.4.2-2	
AHY2528	NORGREN	F12-400A3M	50	TABLE 9.4.2-2	
AHY2529	NORGREN	F12-400A3M	50	TABLE 9.4.2-2	
AHY12482	NORGREN	F12-400A3M	50	TABLE 9.4.2-2	
AHY12481	NORGREN	F12-400A3M	50	TABLE 9.4.2-2	(
AHY12479	NORGREN	F12-400A3M	50	TABLE 9.4.2-2	(
AHY12480	NORGREN	F12-400A3M	50	TABLE 9.4.2-2	(
AHY12152	NORGREN	F12-400A3M	50	TABLE 6.4.4-1	C
AHY12153	NORGREN	F12-400A3M	50	TABLE 6.4.4-1	C
AHY12162	NORGREN	F12-400A3M	50	TABLE 6.4.4-1	C
AHY12163	NORGREN	F12-400A3M	50	TABLE 6.4.4-1	Cl
1HY12605 2HY12605	NORGREN	F12-400A3M	50	TABLE 9.4.3-5	Cl
1HY12607 2HY12607	NORGREN	F12-400A3M	50	TABLE 9.4.3-5	CL
1HY12604 2HY12604	NORGREN	F12-400A3M	50	TABLE 9.4.3-5	CL
1HY12606 2HY12606	NORGREN	F12-400A3M	50	TABLE 9.4.3-5	CL
1HY12146 2HY12146	NORGREN	F12-400A3M	50	TABLE 6.4.4-1	CL
1HY12147 2HY12147	NORGREN	F12-400A3M	50	TABLE 6.4.4-1	CL
1HY12143 2HY12143	NORGREN	F12-400A3M	50	TABLE 6.4.4-1	CL

APPENDIX C
TABLE 7 (CONTINUED)
SAFETY-RELATED
INSTRUMENT AIR USERS
-----ACTIVE DAMPERS-----

DAMPER	VENDOR	AIR FILTER MODEL	SIZE(X)	FMEA-FSAR REF
1HY12149 2HY12149	NORGREN	F12-400A3M	50	TABLE 6.4.4-1
1HY2626B 2HY2626B	FISHER	262C	40	NONE
1HY2627B 2HY2627B	FISHER	262C	40	NONE
1HY2628B 2HY2628B	FISHER	262C	40	NONE
1HY2629B 2HY2629B	FISHER	262C	40	NONE
1HY2636A	NORGREN	F12-400A3M	50	TABLE 9.4.5-3
1HY2636B	NORGREN	F12-400A3M	50	TABLE 9.4.5-3
1HY2638A	NORGREN	F12-400A3M	50	TABLE 9.4.5-3
1HY2638B	NORGREN	F12-400A3M	50	TABLE 9.4.5-3
1HY12562	BALSTON			TABLE 9.4.5-3
1HY12563	BALSTON			TABLE 9.4.5-3
1HY12596 2HY12596	FISHER	67AFR	40	NONE
1HY12597 2HY12597	FISHER	67AFR	40	NONE
1TY12086/12086A 2TY12086/12086A	NORGREN	F12-400A3M	50	TABLE 9.4.7-2
1TY12098/12098A 2TY12098/12098A	NORGREN	F12-400A3M	50	TABLE 9.4.7-2
1TY12085/12085A 2TY12085/12085A	(USES FILTER ON 1TY12098) (USES FILTER ON 2TY12098)			TABLE 9.4.7-2
1HY12010 2HY12010	NORGREN	F12-400A3M	50	TABLE 9.4.8-2

*These are electric operated dampers with air operated bubble tight seals; does not assume failure position on loss of instrument air.

APPENDIX C

TABLE 7 (CONTINUED)
SAFETY-RELATED
INSTRUMENT AIR USES
----ACTIVE DAMPERS----

DAMPERS	VENDOR	AIR FILTER MODEL	SIZE(M)	FMEA-FSAR REF.
1HY12010A 2HY12010A	NORGREN	F12-400A3M	50	NONE
1TY12095A/12095C 2TY12095A/12095C	NORGREN	F12-400A3M	50	TABLE 9.4.7-2
1TY12095B/12095D 2TY12095B/12095D	NORGREN	F12-400A3M	50	TABLE 9.4.7-2
1TY12094A/12094C 2TY12094A/12094C	NORGREN	F12-400A3M	50	TABLE 9.4.7-2
1TY12094B/12094D 2TY12094B/12094D	NORGREN	F12-400A3M	50	TABLE 9.4.7-2
1TY12096/12096A 2TY12096/12096A	NORGREN	F12-400A3M	50	TABLE 9.4.7-2
1TY12097/12097A 2TY12097/12097A	(USES FILTER ON 1TY12096) (USES FILTER ON 2TY12096)			TABLE 9.4.7-2
1TY12099/12099A 2TY12099/12099A	NORGREN	F12-400A3M	50	TABLE 9.4.7-2
1TY12100/12100A 2TY12100/12100A	NORGREN	F12-400A3M	50	TABLE 9.4.7-2
1TY12101/12101A 2TY12101/12101A	NORGREN	F12-400A3M	50	TABLE 9.4.7-2

APPENDIX D

FAILURE DATA TRENDING REPORT FOR ADVs, FWIVs, AND MSIV's

COMPRESSED GAS SYSTEM EVALUATION AND ANALYSIS

TABLE D-1

FAILURE DATA TRENDING

FOR MSIV/FWIV FAILURES

FDT NO.	COMPONENT	FAILURE DESCRIPTION	CAUSE
185506 (861022)	1JSGAPT - 0233	Pressure transmitter had a leaking fitting	Suspect plug may have been dirty
300073 (880613)	1JSGEUV - 0171	N1 4-way valve changed out twice	One found cracked, the other dirty
327201	2JSGAUY - 0170B	Accumulator was low in pressure	Cause of loss of N_2 pressure suspect dirty solenoid valve
269329 (880107)	1JSGEUV - 0170	Solenoid valve was blowing air past seat	Several leaking air line fittings
231709 (870615)	1JSGEUV - 0171	Accumulator pressure on precharge check was low	Leaky tubing/ fitting
234562 (870629)	1JSGEUV - 0171	Accumulator failed precharge pressure check	Unknown N_2 leakage
269297 (880107)	1JSGEUV - 0171	Accumulator dumped without operator action	Several leaking air line fittings
269335 (880107)	1JSGEUV - 0180	Accumulator dumped without operator action	Several leaking air line fittings
269336 (880108)	1JSGEUV - 0181	Both sources of air had to be operated or valve would lift open	Several leaking air line fittings
206430 (870128)	2JSGAPT - 0229	Fittings were leaking N_2	Loose fittings.

COMPRESSED GAS SYSTEM EVALUATION AND ANALYSIS

TABLE D-1

FAILURE DATA TRENDING

FOR MSIV/FWIV FAILURES

FDT NO.	COMPONENT	FAILURE DESCRIPTION	CAUSE
300797 (880615)	2JSGAUY - 0170B	Solenoid valve was leaking internally	Cause unknown
206430 (870128)	2JSGBPT - 0230	Fittings were leaking N_2	Loose fittings
332657 (881221)	1JSGEUV - 0171	Accumulator precharge pressure check failed low	Suspect due to thermal changes
173605 (860815)	1JSGEUV - 0180	Leaked at inverted flair elbows	Borken o-ring
281575 (880227)	1JSGEUV - 0180	Accumulator SEIS alarm	N_2 pressure low due to normal operating condition
281575 (880227)	1SJGEUV - 0181	Accumulator SEIS alarm	N_2 pressure low due to normal operating condition
281575 (880227)	1SJGEUV - 0170	MSIV accumulator alarm annunciated	N_2 pressure low due to normal operating condition
237893 (870714)	1JSGEUV - 0171	Accumulator failure pressure low	Suspect pressure loss was due to thermal changes

COMPRESSED GAS SYSTEM EVALUATION AND ANALYSIS

TABLE D-1

FAILURE DATA TRENDING

FOR MSIV/FWIV FAILURES

FDT NO.	COMPONENT	FAILURE DESCRIPTION	CAUSE
281575 (880227)	1JSGEUV - 0171	Accumulator SEIS alarm	Believe due to normal operating condition
192513 (861113)	2JSGEUV - 0181	Output of regulators was low causing an alarm on SESS	Regulator out of adjustment
267440 (871229)	2JSGEUV - 0170	Valve failure pressure test functional testing	Faulty 4-way valve suspect normal wear
99003000 (890117)	3JSGEUV - 0171	Accumulator pressure was low	Normal temperature variations and aging caused pressure to be low
298533 (880604)	3JSGEUV - 0180	Oil was leaking from top of accumulator	Degraded o-ring suspect normal wear/aging
153490 (860515)	1JSGEUV - 0181	Air/hydraulic pump would not produce full pressure	Normal wear on pump internal parts
192453 (861126)	1JSGEUV - 0181	MSIV had service air leak	Worn check valve

COMPRESSED GAS SYSTEM EVALUATION AND ANALYSIS

TABLE D-1

FAILURE DATA TRENDING

FOR MSIV/FWIV FAILURES

FDT NO.	COMPONENT	FAILURE DESCRIPTION	CAUSE
224796 (870511)	2JSGEUV - 0170	4-way valve was not operating properly	Suspect normal wear
234022 (870627)	2JSGEUV - 0170	Hi pressure regulator diaphram was blowing air	Suspect normal wear
259180 (871109)	2JSGEUV - 0170	4-way valve was stuck 90% open	Suspect normal wear, aging
299834 (880611)	1JSGEUV - 171	Accumulator failed to pump up after exercise	N1 4-way valve defective, normal wear
118201 (851105)	1JSGEUV - 180	Operator had low hydraulic pressure	Suspect normal wear
153464 (860514)	1JSGEUV - 180	Valve closed and would not open	Suspect air/ oil pump failure thru normal wear
281354 (880227)	1JSGEUV - 0170	Air accumulator alarmed on low pressure	Air pressure gauge out of adjustment normal wear/ aging of components
310386 (880815)	1JSGEUV - 0170	Valve did not fully close	Faulty 4-way valve normal wear aging
333112 (881230)	1JSGEUV - 0170	Accumulator pressure low	Temperature variations and aging

APPENDIX E

REFERENCE MATERIAL ASSOCIATED WITH PREVENTATIVE MAINTENANCE

COMPRESSED GAS SYSTEM EVALUATION AND ANALYSIS

APPENDIX E

REFERENCE MATERIAL ASSOCIATED WITH PREVENTATIVE MAINTENANCE (PM)

PURPOSE

This Appendix recommends preventative maintenance enhancements to increase the reliability of the CGS and to maintain proper gas quality.

Supplier documents for maintenance and operation of various components within the Compressed Gas System (i.e., Instrument Air and Nitrogen Systems) were reviewed to determine the recommended maintenance intervals. SIMS Repetitive Work Tasks were reviewed to compare existing requirements with vendor recommendation.

RECOMMENDED PREVENTATIVE MAINTENANCE ACTIONS

1. Comment on Existing Repetitive Work Tasks

The equipment/instrument listed in Table E-3 have a Repetitive Work task generated in the SIMS data base which is not kept current. The due date currently given for the performance of the task is only an estimate for planning purpose and is not an actual task performance due date. A review of the original frequency stated for the equipment/instruments listed in Table 3 shows that the original frequency is comparable to the manufacturer's recommended maintenance interval. Therefore, the Repetitive Work Tasks for the equipment/instruments listed in Table E-3 and E-4 should be changed to the original requirements.

2. Additional Preventative Maintenance Tasks

Tables E-1 and E-2 identifies additional monitoring, inspection and/or preventative maintenance tasks that are currently not performed under the PVNGS Repetitive Task Program for the CGS. These recommended tasks do not supercede the tasks that currently exist in the PVNGS Repetitive Task Program. Instead, the recommended tasks should be performed in conjunction with the existing tasks. For additional monitoring see Tables E-1 and E-2.

COMPRESSED GAS SYSTEM EVALUATION AND ANALYSIS

TABLE E-1

ADDITIONAL PMs REQUIRED FOR INSTRUMENT AIR SYSTEM

ITEM	MAINTENANCE/TEST
Monitor air quality for particles and hydrocarbons.	Test every three months (see Note 1).
Compressor free air regulator.	Revise operations procedure to drain these filters air least once a week or crack open drain valves to allow drainage.
Compressor after-cooler.	Inspect for evidence of leakage yearly (see Note 2).
Safety valves.	Manually "pop" the valves once for refueling to verify proper operation (Note 3).
Compressor solenoid valves.	Inspect and clean (as necessary) on annual compressor teardown (Note 4).
Compressor sequence controller PIC-39 and PCV-43.	Adjust/verify proper operation during annual compressor teardown (Note 5).
IA header nitrogen isolation valve (IAN-PV-52).	Verify proper operation at refueling (Note 6).

1

COMPRESSED GAS SYSTEM EVALUATION AND ANALYSIS

TABLE E-2

ADDITIONAL PMS REQUIRED FOR THE NITROGEN SYSTEM

ITEM	PREVENTATIVE MAINTENANCE/TESTS
Liquid Nitrogen Storage Tank M-GAN-X01	Visually inspect every 6 months in accordance with note 7.
Tank Pressure Buildup Regulator J-GAN-PCV-96	Move regulator through 10 PSI of adjustment and reset to original setpoint every 6 months. See note 8.
Tank Pressure Economizer Regulator J-GAN-PCV-99	Move regulator through 10 psi of adjustment and reset to original setpoint every 6 months. See note 8.
Calibrate Liquid Level Gage for "0"	Calibrate at every 6 months. See note 9.
Liquid Nitrogen Pump M-GAN-P01A & B	Perform maintenance per note 10 once every year or 1000 hours of operation. Also perform maintenance every 2000 hours of operation per note 11.
Nitrogen regulators J-GAN-PCV-49, 49A, and J-GAN-PC-41	Perform maintenance according to note 12 once 3 months.
Nitrogen Temperature Valve J-GAN-TCV-48	Check for shutoff at -20F with refrigerant at every refueling. Reference 13-MM-104-55 Section f.8.c.3. This requirement is changed from the manufacturers recommendations since the system must be taken out of service to perform this task. (1)
Nitrogen Regulators J-GAN-PC-31 J-GAN-PC-38	Run the regulators through 20 psig of adjustments every 3 months. Return to setpoint. Reference 13-MM-104-55 Section f.8.d.1.
Nitrogen Safety Valves J-GAN-PSV-29 & 36	Test and reset every year. Reference 13-MM-104-55 Section f.8.e. (1)
Rupture Discs J-GAN-PSE-85 & 92	Replace rupture discs every 3 years. Reference 13-MM-104-55 Section f.8.e.

COMPRESSED GAS SYSTEM EVALUATION AND ANALYSIS

NOTES:

1) ANPP's current PM Program does not inspect the piston rod packing and/or oil scraper rings. This testing will ensure that air quality is maintained and oil carryover does not occur.

2) Inspect the tell-tale hole which is on the after-cooler for evidence of air or water leakage. Air or water will indicate seal failure that needs to be corrected 1

3) Manufacturer's instruction is to inspect once per six months. However, inspection once per six months could cause undesirable transients on an operating unit. Therefore, inspection once per refueling is recommended. Reference M050.50.

4) If the solenoid is buzzing loud enough to be clearly heard at arm length, then the solenoid internals need cleaning. These solenoids are upstream of the after-filters and are supplied by air from the receiver which may not be as clean as the air required by the ISA standards. In addition, inspect proper operation of the cooling water solenoid isolation valve. 1

5) PIC-39 should be inspected to verify that appropriate pressure signal (i.e., 3.15 lb.) is delivered to the adjustable bias ratio relays from the pneumatic indicating controller. The output of the bias ratio relays should be verified to assure PIC-39 is operating adequately when the compressors are shifted. 1

6) Verify proper operation of this valve once per refueling by isolating the nitrogen header on both sides of the valve and generating a PSL-52 open signal. This task should be performed at each refueling to avoid isolation of the IA system backup during normal operation.

7)
   A. Check for frost spot on outer vessel. These indicate a poor vacuum or a void in the perlite insulation.

   B. Check the pressure in the vacuum insulated space if A. indicates frost spots. 1

   C. Check for ice buildup around relief devices and rupture discs.

8) Reference Tech Manual 13-MM-104-55 Section f.8.a.7.

9) Reference Tech Manual 13-MM-104-55 Section f.8.a.6.

10) Remove crankshaft, connecting rod, and cross head assembly from bearing housing.

   A. Check the two main bearings and the connecting rod bearing for smooth running while rotating by hand around crankshaft. If they feel rough, replace.

   B. Disassemble wrist pin from connecting rod and visually inspect wrist pin and needle bearing.

C. If the wrist pin shows either: 1) roller drag marks, 2) marks from abrasive particles, or 3) shows any sign of material removal of material removal or any other unusual wear, replace the wrist pin and needle bearing or bushing immediately.

D. Check cross head and bushings in the housing for wear or damage. (Use of a drop light is recommended). If more than 20% of rubbing surface displays longitudinal marks from abrasive particles, replace bushings and cross head.

11) A. Remove liquid end assembly (P1600-1002) from sump.

B. Diassemble all components.

C. Replace packing, push rod guides, sump gasket, and all O-rings.

D. Replace valve plate, discharge ball, and valve body.

E. Visually inspect all other parts. Replace any parts appearing to be worn or damaged.

F. Check for dirt buildup on filter and in bottom of sump can. Clean and reuse.

12. Run the control valves through 20 psig of adjustment. Return to set points. Reference 13-MM-104-55, Section f.8.c.1 and f.8.c.2.

COMPRESSED GAS SYSTEM EVALUATION AND ANALYSIS

TABLE. E-3

EQUIPMENT AND TAG NUMBER LISTING
INSTRUMENT AIR SUBSYSTEM

AIR DRYERS

JIANMSH0091; 0092

JIANPDIS0024; 0025; 0028; 0029 ⚠1

JIANPSH0093; 0094

RECEIVER

JANPI0018; 0019; 0020

COMPRESSOR

JIANPI0044; 0046; 0053; 0054; 0055
JIANPI0102; 0103; 0104
JIANPI0121; 0122; 0123 ⚠1
JIANPSH0062; 0063; 0064
JANPS0071; 0072; 0073
JANTI0114; 0115; 0116
JANTI0131; 0132; 0133
JANTI0134; 0135; 0136
JANTS0006; 0007; 0008
JIANTSH0056; 0057; 0058
JIANTSH0059; 0060; 0061

AFTERCOOLER ⚠1

JIANTI0036; 0037; 0038

AIR HEADER

JIANPI0214; 0230; 0231; 0232 ⚠1
PL00P0032
PSL0033
JIANPSL0216

AFTER COOLER

1MIANM06A

TABLE E-4

EQUIPMENT AND TAG NUMBER LISTING
NITROGEN SUBSYSTEM

Liquid Nitrogen Tank

J-GAN-PSE-0095
J-GAn-PI-0094
J-GAN-LISL-0039

Liquid Nitrogen Pump

J-GAN-PSH-0116 1
J-GAN-PSH-0115 1

Nitrogen Low Pressure Manifold

J-GAN-PI-0042
J-GAN-PSH-0076 1
J-GAN-PI-0078
J-GAN-PI-142

High Pressure Manifold

J-GAN-PSL-0004
J-GAN-PI-0040
J-GAN-PV-0038
J-GAN-PC-0038
J-GAN-PSH-0077
J-GAN-PI-0079
J-GAN-PC-0031
J-GAN-PV-0031
J-GAN-PI-0032 1
J-GAN-PSL-003
J-GAN-PI-0037, 0030
J-GAN-TIS-0117B
J-GAN-PSHL-0140

APPENDIX F

LEAK TEST OF ADV INSTRUMENT AIR CHECK VALVE

BACK LEAKAGE TESTS OF ADV INSTRUMENT NITROGEN CHECK VALVE

Prepared For
Arizona Public Service Company

By
Dr. Ramendra P.Roy
Department of Mechanical & Aerospace Engineering
Arizona State University

May, 1989

SUMMARY

A test apparatus for conducting back leakage tests of an ADV Instrument Nitrogen Check Valve was set up. The tests were carried out at two air supply pressures of 95 psig and 80 psig. The average leakage rates at 95 psig and 80 psig were 356 bubbles/min. ± 11 bubbles/min. and 297 bubbles/min. ± 6 bubbles/min. respectively.

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1.0 INTRODUCTION

The objective of this project was to obtain back leakage test data for one 1 inch series, 6000 lb., stainless steel Y-type spring check valve with stellite metal-to-metal seat. The valve was to be installed in a horizontal position and the tests were to be conducted in accordance with ANSI/API 527, "Commercial Seat Tightness of Safety Relief Valves with Metal-to-Metal Seats". The procedure outlined in this document was to be followed because no separate document is available for spring check valves with metal-to-metal seats. The leakage measurements were to be conducted at supply air pressures of 95 psig and 80 psig.

The valve was provided by Arizona Public Service Company (APS). A requirement was imposed that the valve not be welded or altered in any way during the tests.

2.0 THE TEST APPARATUS AND PROCEDURE

2.1 TEST APPARATUS

Figure 1 is a schematic diagram of the test apparatus. Air, free of oil and water, is supplied from an air accumulator (at 125 psig pressure). A pressure regulator was installed upstream of the check valve tested so that the air pressure at the valve inlet could be

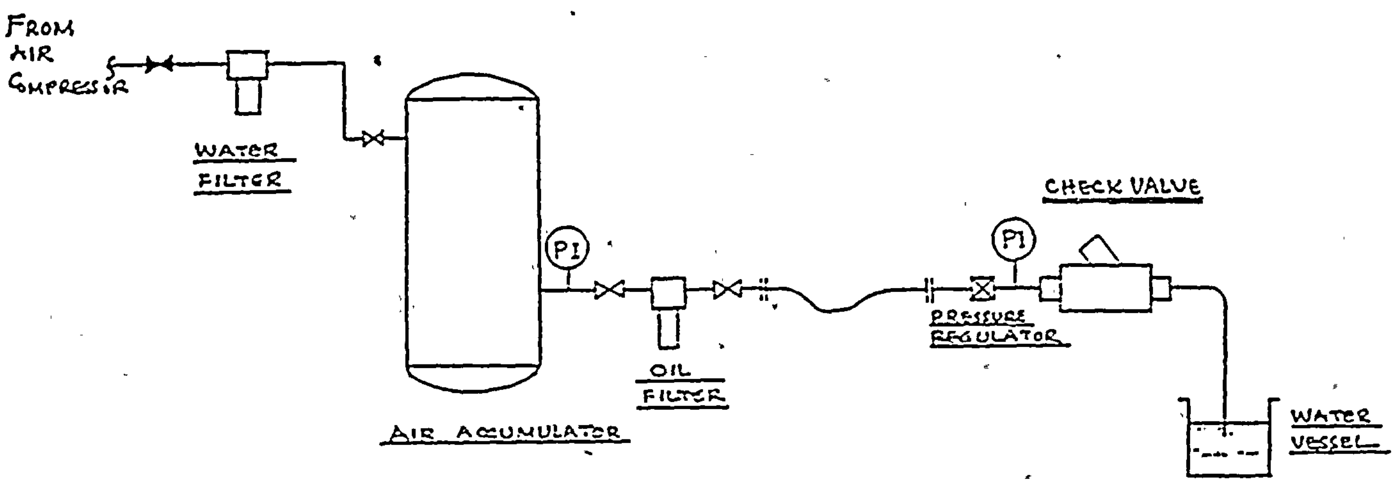

Fig. 1 Schematic diagram of the test apparatus

controlled. A 5/16 inch (7.9 mm) O.D. stainless steel tube with 0.035 inch (0.89 mm) wall thickness was installed at the downstream end of the check valve as per ANSI/API 527 requirement. The discharge end of this tube was cut square and smooth, and immersed parallel to and 1/2 inch (12.7 mm) below the water (distilled) surface in the water vessel. Figure 2 is a more detailed sketch of the check valve and associated fittings and the stainless steel tube.

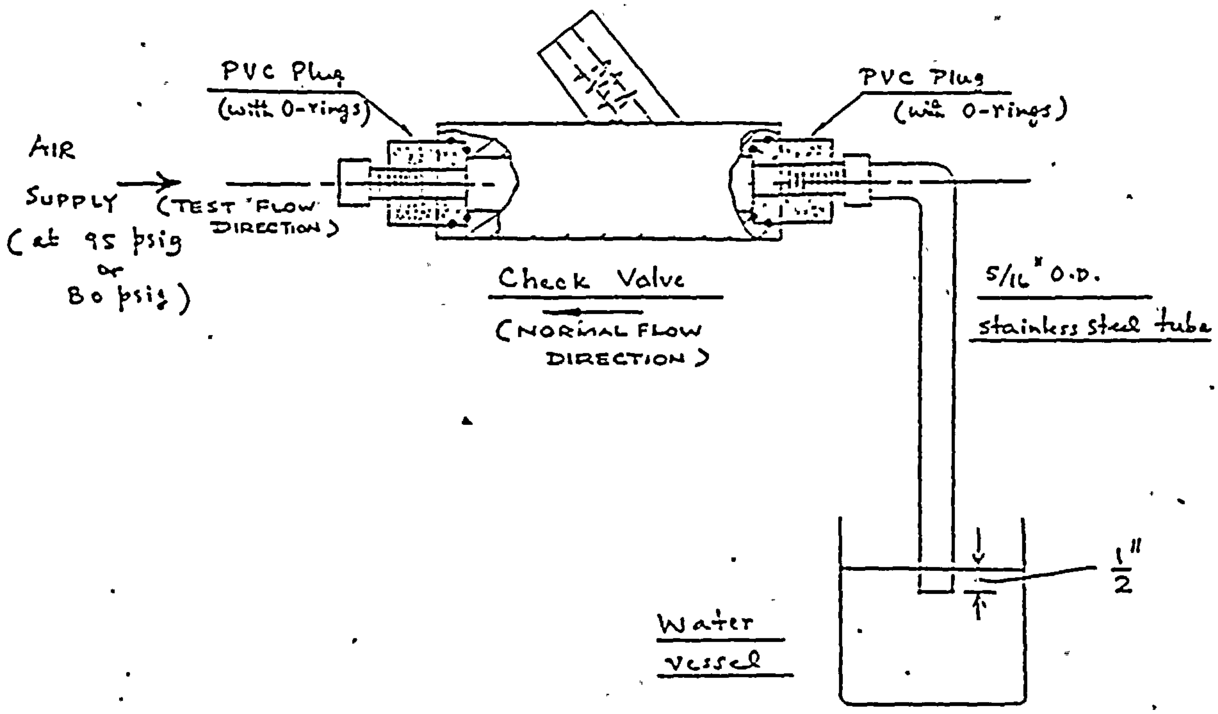

Fig. 2 A sketch of the check valve with the exit tube

The PVC plugs and the stainless steel fittings on the inlet and the exit sides of the check valve were subjected to soap bubble leak tests to ensure that they were indeed leaktight. The check valve was installed in the horizontal position for all tests. A pressure gage installed immediately upstream of the valve indicated the supply air pressure.

The air pressure buildup in the check valve exit tube was negligible because of minimal resistance to air flow along the exit path.

2.2 TEST PROCEDURE

Two series of tests were run at each of the two air supply pressures (viz. 95 psig and 80 psig). One series of tests corresponded to the check valve as obtained from APS. The second series of tests was run <u>after</u> exercising the check valve by establishing air flow in the normal

direction through it several times.

At each supply pressure, the valve leakage rate in bubbles per minute was determined by counting the number of bubbles over a specific time interval. Since the bubbles emerged from the tube at rates too high for visual counting, the 'popping' sound made by each bubble as it emerged was depended upon for counting. Results obtained by this method proved to be quite consistent as can be seen from the data presented in Section 3.0. A stop watch was used for establishing the counting time interval.

Some degree of independence between the various bubble count rates obtained was provided by having three different individuals participate in the counting experiment.

RESULTS

3.1 TEST DATA

Table 1

Check Valve Leak Test Data at Air Supply Pressure of 95 psig

Series 1 (before exercising the valve)

time interval (second)	Leakage (# of bubbles)
5.20	30
5.29	30
4.01	25
1.61	10
2.47	15
2.01	12

Average = 356 bubbles/min. ± 11 bubbles/min.

Series 2 (after exercising the valve)

time interval (second)	Leakage (# of bubbles)
5.06	30
3.48	20
3.51	21
3.46	21
3.40	20

Average = 356 bubbles/min. ± 10 bubbles/min.

Table 2

Check Valve Leak Test Data at Air Supply Pressure of 80 psig

Series 1 (before exercising the valve)

time interval (second)	Leakage (# of bubbles)
8.13	40
6.28	30
10.23	50
6.25	30
5.15	25

Average = 291 bubbles/min. ± 5 bubbles/min.

Series 2 (after exercising the valve)

time interval (second)	Leakage (# of bubbles)
5.96	30
4.06	20
3.96	20
3.91	20

Average = 302 bubbles/min. ± 6 bubbles/min.

3.2 AVERAGE LEAKAGE RATES

The average leakage rate at air supply pressure of 95 psig was 356 bubbles/min. ± 11 bubbles/min.

The average leakage rate at air supply pressure of 80 psig was 297 bubbles/min. ± 6 bubbles/min.

△1

APPENDIX G

Pneumatic Component Inspection Results for Air Quality Concerns

Compressed Gas System Evaluation and Analysis △1

A pilot program for pneumatic component inspection has been initiated at PVNGS. The objectives of the program are:

1. Inspect a sample of pneumatic components from unit 2 to gain confidence that no degradation of equipment has resulted due to potentially degraded air quality during past plant operations.

2. Gain experience in the inspection of pneumatic components for a proposed future plant wide evaluation. The information gained from this pilot program will be used to write the inspection procedure for the greater scope statistical evaluation discussed in section IV.F of this study.

Four 3/4 inch air operated 2-way normally open pilot valves from Unit 2 were inspected . These valves are part of the pneumatic control system for the Steam Bypass Control Valves. In addition, four pneumatic positioners for the Atmospheric Dump Valves from Unit 3 were inspected. None of the components that were inspected showed any indication of degradation due to potential air quality problems. A light layer of dust on some components was the only indication of contamination that was observed. There was no indication of any hydrocarbon or moisture contamination in any active area of the pneumatic component.

The pilot valves from Unit 2 showed the greatest spread in dust accumulation among components. One valve appeared to have been installed for a considerable amount of time while the other three valves had significantly less dust accumulation and may not have seen as much service. A time in service determination could not be made since there no way to tie the specific valve to specific work history. There are four identical part numbered pilot valves on each Steam Bypass Control Valve pneumatic control system and the valve identification tags only stated which SBCV they came from.

The Atmospheric Dump Valve positioners from unit three showed essentially the same amount of dust buildup from one positioner to another. A SIMS work order search revealed that three of the positioners had been in service since startup and one had been replaced on November 25, 1987. The amount of dust in the positioners was very light and had the consistency of flour.

The amount and size of dust observed on both the pilot valves and positioners was considered to be well within acceptable limits and all components were considered to be completely functional with respect to instrument air contamination. Attached are the inspection results for each component.

Compressed Gas System Evaluation and Analysis ⚠1

VALVE AND DAMPER PNEUMATIC COMPONENT INSPECTION

Date: May 2, 1989

Unit: 2

Parent component or component tag no: 2JSGNPV1003

Component name: Air operated 2-way normally open valve

Manufacturer: Ross

Model no: 2752AS001

Manufactured: 1/78

COMMENTS:

General condition: The valve, when disassembled, showed evidence of considerable use as indicated by the valve diaphragm and control O-rings wear, condition of valve disk, and scraping on the housing.

Exterior condition:

1. No physical damage to housing.

2. Cap screws holding top flange and bottom flange have light rust on all exposed surfaces.

3. The diaphragm vent has light brownish red accumulation of dirt and oil mix. (oil is believed to be O-ring lubricant).

4. The pipe thread sealant is limited to the thread contact area.

Process Side;

1. Light brownish red accumulation of dust type material is seen on the valve seat assembly, return spring, and inlet/outlet housing. Dust was dry and very fine. The dust, when accumulated, had the approximate consistency of flour. There is not enough accumulation of dust to obtain a sample for chemical analysis.

2. The inlet/outlet housing had slight discoloration and staining on the aluminum. The source of this staining is unknown.

Control Side;

1. The valve actuator bonnet inlet side passage to

bonnet area is blocked off by the bonnet flange. Corrosion products and fiber products were found at this point on the bonnet flange. The corrosion products appear white to light grey and flaky.

2. Diaphragm process O-ring and control air O-ring are well worn but appear serviceable on disassembly.

3. The diaphragm bottom cavity shows slight accumulation of what appears to be atmospheric dirt.

4. The valve seat shows dirt on the inlet cavity.

Conclusions:

1. Although the valve shows considerable wear and should be reworked before being reassembled, it appears that the valve is still functional.

2. There is no evidence that any air quality concerns that would keep this valve from functioning

3. There is no evidence that the small amount of dust found in the valve would impair its function. All dust inspected was very fine and powdery.

4. There is no evidence of oil from the compressors was observed. The only lubricant observed appeared to O-ring lubrication. Dirt and oil mix was only seen at the O-ring area and attributed to O-ring lubrication.

5. The only evidence of internal corrosion was seen on the inlet flange at the inlet side passage to bonnet area. This is a stagnant flow area of the valve and only present on this design because the body is used for more than one application. The passage is blocked off for this application, and the corrosion is only on the flange area.

Compressed Gas System Evaluation and Analysis

VALVE AND DAMPER PNEUMATIC COMPONENT INSPECTION

Date: May 2, 1989

Unit: 2

Parent component or component tag no: Unknown

Component name: Air operated 2-way normally open valve

Manufacturer: Ross

Model no: 2752A5001

Manufactured: 2/78

COMMENTS:

General Condition: The valve appears to have been in service only a short time or does not see much service. There appears to be little wear on the O-rings or scraping of the O-ring on the diaphragm housing.

Exterior condition;

1. No physical damage to the housing.

2. Top and bottom flange cap screws are clean with no rust.

3. Slight oil and dust buildup on the diaphragm vent.

Process Side;

1. Very clean with virtually no evidence of dust buildup on the valve body, inlet and outlet housing, valve seat assembly, and return spring.

2. There is no evidence of corrosive effects on this side of the valve.

Control side:

1. Very clean with virtually no evidence of dust buildup on the actuator bonnet or upper diaphragm.

2. There is no evidence of corrosive effects on this side of the valve.

Conclusions:

1. This valve has probably not been in service for a long period of time or it is not used often. The valve shows virtually no wear.

2. There is no evidence that any air quality concerns that would keep this valve from functioning.

3. There is no evidence that the small quantity of dust particles found in the valve would impair valve operation.

4. There is no evidence of oil from the compressors in the valve. The only lubricant observed appears to be O-ring lubrication.

5. There is no evidence that the valve has ever experienced internal corrosion.

Compressed Gas System Evaluation and Analysis

1

VALVE AND DAMPER PNEUMATIC COMPONENT INSPECTION

Date: May 2, 1989

Unit: 2

Parent component or component tag no: Unknown

Component name: Air operated 2-way normally open valve

Manufacturer: Ross

Model no: 2752A5001

Manufactured: 2/78

COMMENTS:

General Condition; The valve appears to have been in service only a short time or does not see much service. There appears to be little wear on the O-rings or scraping of the O-ring on the diaphragm housing.

Exterior condition;

1. Normal inservice wear is evident on this valve.

2. Top and bottom flange cap screws are clean with no rust.

3. A large amount of oil and dust buildup on the diaphragm vent. It appears that the valve was not cleaned on the outside after rework.

Process Side;

1. Very clean with virtually no evidence of dust buildup on the valve body, inlet and outlet housing, valve seat assembly, and return spring. All process side components appear to be bright and shiny.

2. There is no evidence of corrosive effects on this side of the valve.

Control side;

1. The valve appears to have been opened before as evidenced by a torn bonnet gasket.

2. Very clean with virtually no evidence of dust buildup on the actuator bonnet or upper diaphragm.

3. The bottom side of the diaphragm has O-ring

lubricant mixed with a slight amount of dust particles.

4. There is no evidence of corrosive effects on the inside of the valve.

Conclusions:

1. This valve has probably not been in service for a long period of time or it is not used often. The valve shows virtually no wear.

2. There is no evidence that any air quality concerns that would keep this valve from functioning.

3. There is no evidence that the small quantity of dust particles found in the valve would impair valve operation.

4. There is no evidence of oil from the compressors in the valve. The only lubricant observed appears to be O-ring lubrication.

5. There is no evidence that the valve has ever experienced corrosion.

Compressed Gas System Evaluation and Analysis ⚠ 1

VALVE AND DAMPER PNEUMATIC COMPONENT INSPECTION

Date: May 2, 1989

Unit: 2

Parent component or component tag no: 2SGNPV1001

Component name: Air operated 2-way normally open valve

Manufacturer: Ross

Model no: 2752A5001

Manufactured: 2/78

COMMENTS:

General Condition; The valve appears to have been in service a very short time. There appears to be no wear on the O-rings or scraping of the O-ring on the diaphragm housing.

Exterior condition;

1. Normal inservice wear is evident on this valve.

2. Top and bottom flange cap screws have very slight amounts of rust on them. The cap screws have been lubricated with what appears to be a graphite based lubricant.

3. A slight amount of oil and dust buildup is on the diaphragm vent. It appears that the valve was not cleaned on the outside after rework.

Process Side:

1. Very clean with no evidence of dust buildup on the valve body, inlet and outlet housing, valve seat assembly, and return spring. All process side components appear to have been recently polished.

2. There is no evidence of corrosive effects on this side of the valve.

Control side:

1. The valve appears to have been opened before as evidenced by a torn bonnet gasket. This gasket was not replaced.

2. Very clean with virtually no evidence of dust buildup on the actuator bonnet or upper diaphragm.

3. The bottom side of the diaphragm is completely clean with no sign of dirt or dust. The diaphragm O-rings were replaced but not lubricated.

4. There is no evidence of corrosive effects on the inside of the valve.

Conclusions:

1. This valve has probably not been in service for a long period of time or it is not used often. The valve shows virtually no wear.

2. There is no evidence that any air quality concerns that would keep this valve from functioning.

3. There is no evidence of oil from the compressors in the valve.

5. There is no evidence that the valve has ever experienced corrosion.

Compressed Gas System Evaluation and Analysis △1

VALVE AND DAMPER PNEUMATIC COMPONENT INSPECTION

Date: May 3, 1989

Unit: 3

Parent component or component tag no: 3JSGBHV0178

Component name: Atmospheric dump valve pneumatic positioner

Manufacturer: Moore (model 74G)

Serial No: Not given

Time in service: Since startup

COMMENTS:

General condition; The positioner, when completely disassembled, showed that its internal pneumatic cavities were very clean. The disassembly was taken beyond the manufacture's recommendations for general maintenance. The pilot plungers and seats were the dirtiest components in the positioner. This observation agrees with the manufacture's general maintenance instructions.

Exterior condition;

1. Slight oil and dust was observed on the positioner.
2. The positioner is missing its exhaust air bug screen.
3. The air pressure gages used during startup are on the positioner air ports.
4. The air supply inlet fitting is cross-threaded.

Pilot plunger and seats;

1. The upper and lower pilot plunger caps, plungers, and plunger springs were removed. The plungers, plunger seats, and springs showed a slight amount of dust. The plunger cavity showed a medium amount of dust.
2. The .011 inch orifices in the pilot plungers appeared to be completely free of dust and not plugged. This is evidenced by observations of very round holes with round chamfers on the plungers.
3. The quantity of dust found on the plungers and plunger seats was not enough to use for a chemical composition or particle size sample.

4. The dust that was observed had the consistency of flour.

5. There was no evidence of lubrication products or oil on the plungers, plunger seats, or springs.

6. After cleaning the plungers and plunger seats no indication of corrosion or rusting was observed. Both components polished well with a lint free rag or cotton swab and alcohol.

Other positioner internals;

1. The vent path and air supply path were covered with a light amount of reddish brown dust.

2. The vent cavity and flapper nozzle area were clean and free of dust, oil, or corrosion.

3. The nozzle exhaust area of the flapper beam was covered with a fine black radial pattern of dust.

4. The output adjustment screw was found to be 4 7/8 turns from the bottom which is normal.

5. The output port was clean.

6. The valve restriction port was not observed due to difficulty in removing the output diaphragm assembly. The vendor manual cautions that any undue force or prying of this assembly must be avoided.

Conclusions:

1. This positioner is considered to be very clean considering that it has been installed since startup with no maintenance of the pneumatic components.

2. There is no evidence that any air quality concerns would keep this positioner from functioning.

3. There is no evidence of any oil from the compressors or other sources in the positioner.

4. There is no evidence of any corrosion on the positioner.

VALVE AND DAMPER PNEUMATIC COMPONENT INSPECTION

Date: May 3, 1989

Unit: 3

Parent component or component tag no: 3JSGAHV0184

Component name: Atmospheric dump valve pneumatic positioner

Manufacturer: Moore (model 74G)

Serial No: M101943-1

Time in service: Since startup

COMMENTS:

General condition; The positioner showed that its pilot plungers and seats were clean. The disassembly was limited to the pilot plunges due to difficulty in removing the output diaphragm assembly of 3JSGAHV0178 and observations from prior inspection of positioner 3JSGAHV0178. This positioner showed that the dirtiest component was the plungers and seats. This was verified by the manufacturer's instruction manual.

Exterior condition;

1. Slight oil and dust was observed on the positioner.

2. The air pressure gages used during startup are on the positioner air ports.

Pilot plunger and seats;

1. The upper and lower pilot plunger caps, plungers, and plunger springs were removed. The plungers, plunger seats, and springs showed a slight amount of dust. The plunger cavity showed a medium amount of dust.

2. The upper plunger assembly had slightly more dust on it than the bottom plunger assembly.

3. The .011 inch orifices in the pilot plungers appeared to be completely free of dust and not plugged. This is evidenced by observations of very round holes with round chamfers on the plungers.

4. The quantity of dust found on the plungers and plunger seats was not enough to use for a chemical composition or particle size sample.

5. The dust that was observed had the consistency of flour.

6. There was no evidence of lubrication products or oil on the plungers, plunger seats, or springs.

7. After cleaning the plungers and plunger seats no indication of corrosion or rusting was observed. Both components polished well with a lint free rag or cotton swab and alcohol.

Conclusions:

1. This positioner is considered to be very clean considering that it has been installed since startup with no maintenance of the pneumatic components.

2. There is no evidence that any air quality concerns would keep this positioner from functioning.

3. There is no evidence of any oil from the compressors or other sources in the positioner.

4. There is no evidence of any corrosion on the positioner.

VALVE AND DAMPER PNEUMATIC COMPONENT INSPECTION

Date: May 3, 1989

Unit: 3

Parent component or component tag no: 3JSGAHV0179

Component name: Atmospheric dump valve pneumatic positioner

Manufacturer: Moore (model 74G)

Serial No: 14121-74G7DH

Time in service: Since startup

COMMENTS:

General condition; The positioner showed that its pilot plungers and seats were clean. The disassembly was limited to the pilot plunges due to difficulty in removing the output diaphragm assembly of 3JSGAHV0178 and observations from prior inspection of positioner 3JSGAHV0178. This positioner showed that the dirtiest component was the plungers and seats. This was verified by the manufacturer's instruction manual.

Exterior condition;

1. Slight oil and dust was observed on the positioner.

2. The air pressure gages used during startup are on the positioner air ports.

Pilot plunger and seats;

1. The upper and lower pilot plunger caps, plungers, and plunger springs were removed. The plungers, plunger seats, and springs showed a slight amount of dust. The plunger cavity showed a medium amount of dust.

2. The upper plunger assembly had slightly more dust on it than the bottom plunger assembly.

3. The .011 inch orifices in the pilot plungers appeared to be completely free of dust and not plugged. This is evidenced by observations of very round holes with round chamfers on the plungers.

4. The quantity of dust found on the plungers and plunger seats was not enough to use for a chemical composition or particle size sample.

5. The dust that was observed had the consistency of flour.

6. There was no evidence of lubrication products or oil on the plungers, plunger seats, or springs.

7. After cleaning the plungers and plunger seats no indication of corrosion or rusting was observed. Both components polished well with a lint free rag or cotton swab and alcohol.

Conclusions:

1. This positioner is considered to be very clean considering that it has been installed since startup with no maintenance of the pneumatic components.

2. There is no evidence that any air quality concerns would keep this positioner from functioning.

3. There is no evidence of any oil from the compressors or other sources in the positioner.

4. There is no evidence of any corrosion on the positioner.

VALVE AND DAMPER PNEUMATIC COMPONENT INSPECTION

Date: May 3, 1989

Unit: 3

Parent component or component tag no: 3JSGBHV0185

Component name: Atmospheric dump valve pneumatic positioner

Manufacturer: Moore (model 74G)

Serial No: M114618-1

Time in service: Replaced on 11/25/87

COMMENTS:

General condition; The positioner showed that its pilot plungers and seats were clean. The disassembly was limited to the pilot plunges due to difficulty in removing the output diaphragm assembly of 3JSGAHV0178 and observations from prior inspection of positioner 3JSGAHV0178. This positioner showed that the dirtiest component was the plungers and seats. This was verified by the manufacturer's instruction manual.

Exterior condition;

1. Slight oil and dust was observed on the positioner.

2. The air pressure gages used during startup are on the positioner air ports.

Pilot plunger and seats;

1. The upper and lower pilot plunger caps, plungers, and plunger springs were removed. The plungers, plunger seats, and springs showed a slight amount of dust. The plunger cavity showed a medium amount of dust.

2. The upper plunger assembly had slightly more dust on it than the bottom plunger assembly.

3. The .011 inch orifices in the pilot plungers appeared to be completely free of dust and not plugged. This is evidenced by observations of very round holes with round chamfers on the plungers.

4. The quantity of dust found on the plungers and plunger seats was not enough to use for a chemical composition or particle size sample.

5. The dust that was observed had the consistency of flour.

6. There was no evidence of lubrication products or oil on the plungers, plunger seats, or springs.

7. After cleaning the plungers and plunger seats no indication of corrosion or rusting was observed. Both components polished well with a lint free rag or cotton swab and alcohol.

Conclusions:

1. This positioner is considered to be very clean considering that it has been installed for two years with no maintenance of the pneumatic components.

2. There is no evidence that any air quality concerns would keep this positioner from functioning.

3. There is no evidence of any oil from the compressors or other sources in the positioner.

4. There is no evidence of any corrosion on the positioner.

APPENDIX H

LOW PRESSURE NITROGEN SYSTEM TEST RESULTS

COMPRESSED GAS SYSTEM EVALUATION AND ANALYSIS

Summary

This Appendix provides a summary of the tests which were run to determine the cause for the pressure drop in the backup nitrogen system to the compressed gas system, test results, conclusion, and proposed corrective actions. For the temporary test setup, refer to the Nuclear Administrative Technical Manual procedure noted under each test section.

TEST 1

Procedure No.: 73TI-9IA02, Rev. 0
05/14/89

The low pressure nitrogen (GA) backup supply to instrument air (IA) header test was set up to determine actual conditions which the nitrogen system would experience during a loss of instrument air. T-Mod 2-89-IA-018 was installed to support this gathering of data as per the test instruction.

The scope of the test was to throttle temporary valve TV-3 to establish flow rates of 300, 400, 500, 700, and 900 standard cubic feet per minute. Pressures were recorded both at the nitrogen skid (at the low pressure nitrogen header PI-78 and at the high pressure nitrogen header PI-79) and at the temporary modification manifold TPI-1 at two minute time intervals for each established flow rate. The nitrogen level was also recorded as was particulate samples.

The test results indicated that the nitrogen header just downstream of the regulators immediately dropped off to 90 psig with flow of 300 SCFM and with subsequent higher flow rates (the highest attainable consistent flow rate was 737-740 SCFM) the pressure dropped to 82-86 PSIG. The pressure in the turbine building at TPI-1 dropped off rapidly with the higher flow rates. Figure 1 shows the pressure at the instrument air header interface at various flow rates.

These results indicated two initial problems:

1) The regulators weren't providing the proper flow to establish the 82-86 PSIG out at the low press nitrogen header.

2) There was a considerable pressure drop being caused in the piping from the regulators to the temporary gage in the turbine building.

From the results above, engineering decided to rerun the test and additionally record the nitrogen pressure upstream of the low pressure nitrogen regulators at the PI-42. This would indicate if there was a system design problem (i.e., Item 1, the vaporizer and/or piping couldn't supply the proper quantity of nitrogen at the desired pressure with the regulators wide open) or that the regulators were either sized wrong and/or set incorrectly. For Item 2, EED and NED engineers evaluated the piping configuration from the regulators to the T-Mod setup and determined that the check valve 2IAN-V056 contained a spring which could be the cause for the high pressure drop experienced during testing. The results from the particulate samples indicated more particles greater than the 3 micron level than we would like to see in the instrument air system.

COMPRESSED GAS SYSTEM EVALUATION AND ANALYSIS

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TEST 2
Procedure No.: 73TI-9IA02, Rev. 0
05/17/89

The low pressure nitrogen (GA) backup supply to instrument air (IA) header test was set up to observe the performance of the nitrogen system with the spring from check valve 2IAN-V056 removed. T-Mod 2-89-IA-018 remained installed to support this gathering of data as per the test instruction. The internal spring was removed from check valve 2IAN-V056 per EER 89-IA-007 and T-Mod 2-89-IA-023.

The actual test was to throttle temporary valve TV-3 to establish flow rates of 300, 400, 500, 700, and 900 standard cubic feet per minute. Pressures were recorded both at the nitrogen skid (at the low pressure nitrogen header PI-78 and PI-42 and at the high pressure nitrogen header PI-79) and at the temporary modification manifold TPI-1 at two minute time intervals for each established flow rate. The nitrogen level was also recorded as was particulate samples.

The test results indicated that the nitrogen header just downstream of the regulators immediately dropped off to 94 psig with flow of 300 SCFM and with subsequent higher flow rates (the highest attainable consistent flow rate was 811-818 SCFM) the pressure dropped to 82-90 psig. The pressure in the turbine building at TPI-1 dropped off rapidly with the higher flow rates but not as rapidly as test 1 with the spring installed in the check valve (a 2-6 psig increase occurred as a result of the spring removed). The pressure upstream of the pressure regulators PCV-49 and PCV-49A consistently was higher than the downstream pressure by 54-60 PSIG. This seemed to indicated that the low pressure nitrogen vaporizer and piping supplying the regulators PCV-49 and PCV-49A was doing its design function. This drew the conclusion that the regulators were the cause of the immediate pressure drop (under flowing conditions) observed at PI-78. Whether the regulators were either not sized correctly, not set properly, or faulty could not be determined, therefore, EED and NED engineers decided to rerun the test.

The results from the particulate samples still indicated more particles greater than the 3 micron level than we would like to see in the instrument air system. Figure 1 shows the pressure at the instrument air header at various flow rates.

TEST 3
Procedure No.: 73TI-9IA02, Rev. 1
05/19/89

This revision of the low pressure nitrogen (GA) backup supply to instrument air (IA) header test specifically tests the operability of the pressure control valves (PCV49, PCV49A and PV41) which supply the low pressure nitrogen header, allows the setting of these same valves, and tests the system under the same flow rates established during the previous tests (73TI-9IA02, Rev. 0).

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The test allowed isolation of the three pressure regulators in various sequences and allowed for the throttling of the bypass valve around the regulators PCV49 and PCV49A. The results indicated that a flow at over 1000 SCFM could be obtained from the low pressure N2 system with the high pressure nitrogen backup not supplying any nitrogen. Additionally, the pressure at TPI-1 was 78 PSIG with a flow of 953 SCFM. This extremely high flow was likewise obtained with the high pressure nitrogen regulator PV41 not supplying any nitrogen. Figure 2 shows the nitrogen system capacity and pressure at the interface with the instrument air system with the bypass valve throttled to maintain a pressure of 115 psig downstream of the regulator.

After obtaining this initial data, each regulator was isolated and calibrated in accordance with the table below at a flow of approximately 200 SCFM.

REGULATOR	AS FOUND SETTING	AS LEFT SETTING
2JGAN-PCV49	98 PSIG	113 PSIG
2JGAN-PCV49A	88 PSIG	105 PSIG
2JGAN-PV41	85 PSIG	100 PSIG

The original test at the various flow rates of 300, 400, 500, 700, and 900 SCFM was afterwards accomplished. The test results indicated that the nitrogen header just downstream of the regulators dropped off to 108 PSIG with a flow of 289 SCFM and with subsequent higher flow rates the pressure dropped off to 100 PSIG. Figure 2 shows the nitrogen system capacity and pressure at the instrument air header interface after the regulator adjustment. The upstream pressure of regulators PCV49 and PCV49A remained at 150-160 PSIG. This indicates that the regulators, even though set under dynamic (flowing) conditions, still drifted down at the high flow rates from their original settings. The pressure at TPI-1 still dropped 16 PSIG at 700 SCFM and dropped 29 psig at 902 SCFM.

After the flow testing, samples were taken of the nitrogen stream and the particulate readings indicated that the quantity of particulates had decreased significantly from the previously two tests. There were only 3-5 particles greater than or equal to 5 microns but less than 10 microns and 105-158 particles greater than or equal to 3 microns but less than 5 microns. The original high number of particles in the low pressure nitrogen system is attributed to the lack of full flow purging the system during the startup phase.

Conclusions

In conclusion, the three tests that were performed on the low pressure nitrogen system indicated that the nitrogen skid upstream of the pressure regulators GAN-PCV-049, 049A and GA-PC-041 can satisfactorily deliver the anticipated flow of 1000 SCFM at 100 PSIG downstream of the regulator.

However, the regulators and the components downstream of the regulators are not functioning correctly to deliver the maximum desired flow and pressure to meet the IA header demand without operator action.

Pressure regulator J-GAN-PCV-49 currently has an outstanding work order (W.O. #00339794) which requires removal, inspection, repair and/or replacement of the valve as necessary to ensure that the valve maintains pressure downstream at 115 PSIG ± 3 PSIG. The subject valve was adjusted per 73-9IA02, Rev. 1, satisfactorily at flow condition such that the pressure downstream is currently within the required range. The system was then tested to ensure proper operation. Therefore, it is not necessary to perform W.O. 00334794 as a restart item. In addition, the subject valves are currently being evaluated for replacement with more efficient type regulators as outlined below.

After evaluating all the test data, the following are recommended for resolution of the low obtained pressures:

For Short Term/Immediate Resolution

In order to maintain system pressure of 85 PSIG at flow rates in excess of 700 SCFM (during a transient situation) an operator needs to be dispatched to the low pressure control panel and to manually throttle bypass valve GAN-V260 to maintain a pressure of 100-120 PSIG at PI-78. Important attention must be made to the fact of not exceeding the high pressure setpoint of 125 PSIG so as to provide a safety margin between line operating pressure and the setting on the pressure safety valve (140 PSIG) and rupture disk (165 PSIG).

For Long Term/Total Resolution

1) Evaluate setting the regulators (PCV-49, PCV-49A, and PV-41) to a higher setpoint, which will give us a subsequently higher pressure at the high flow rates which had previously dropped off,

2) Evaluate procurement and installation of regulators which are guaranteed not to drift drastically under various flowrates, and

3) Evaluate installing a spring with a small compression ratio, in accordance with the manufacturers recommendations, in place of the removed spring from check valve IAN-V056 (EER-89-GA-007), and

4) Additionally, evaluate component by component the design pressure drop (at our desired flow/pressure conditions) of all valves and piping from the nitrogen regulators to the interface where nitrogen backs up instrument air and change out any component for which an enhancement is possible.

5) Install a filter in the nitrogen line just upstream of the nitrogen/instrument air interface to filter out particles greater than 3 microns. Site Mod 2-SM-GA-003 has been developed to install this filter. This should be installed during an available outage, but this need not be a restart item as there is no specific safety consequences with the present setup. The modification will enhance the present setup and comply with the intent of Generic Letter 88-14 as it is ANPP's position of complying in a timely manner with all the recommendations of the NRC.

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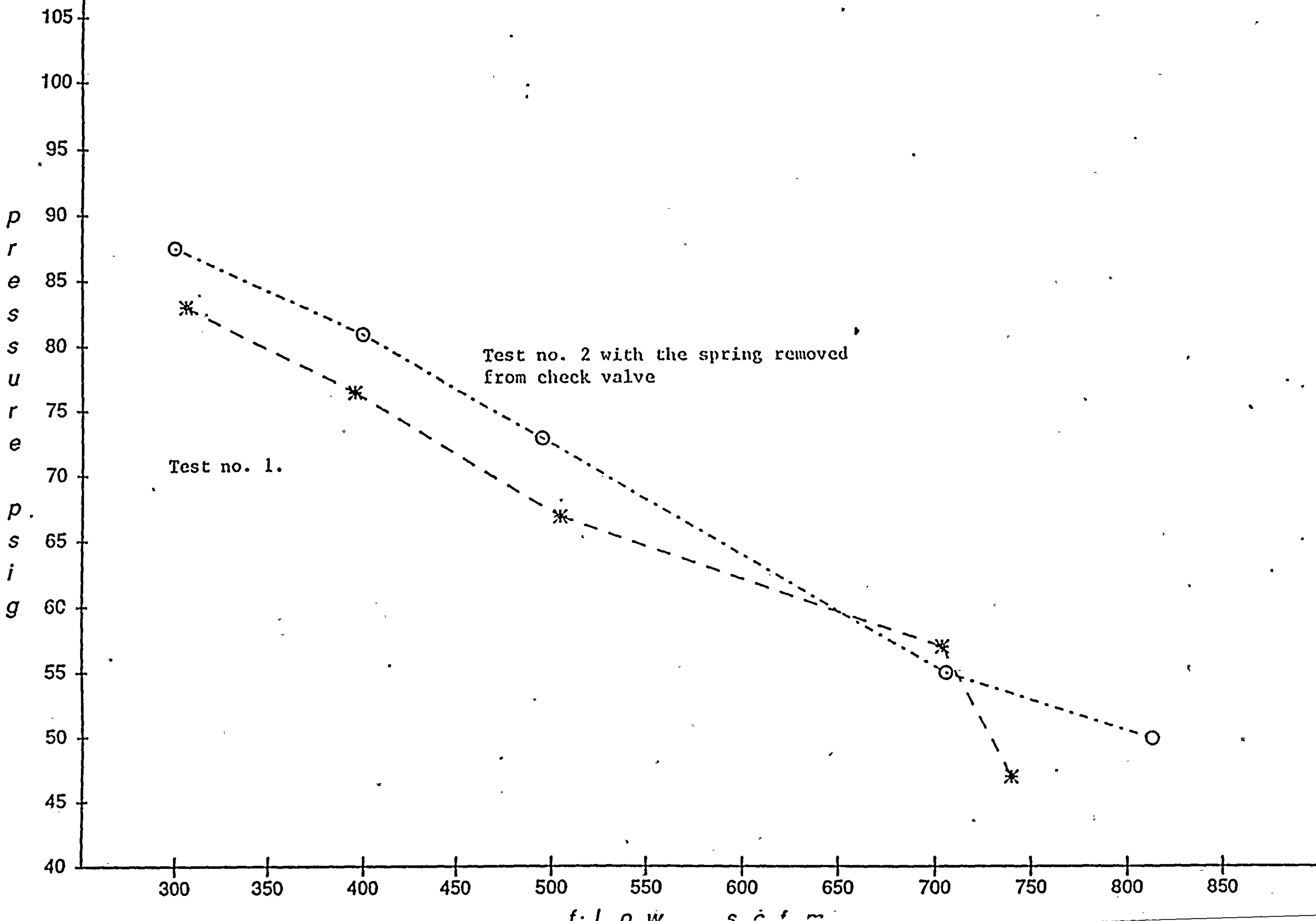
PRESSURE VS FLOW

Nitrogen system test per 73TI-9IA02 Rev. o

Figure 1



PRESSURE VS FLOW

Nitrogen Test Per Procedure 73TI-9IA02, Rev. 1
Figure 2