Georgia Power Company
Route 2, Box 299A
Waynesboro, Georgia 30830
Telephone 404 554-9961
404 724-8114

Southern Company Services, Inc
Post Office Box 2625
Birmingham, Alabama 35202
Telephone 205 870-6011

Vogtle Project

May 7, 1986

Director of Nuclear Reactor Regulation
Attention: Mr. B. J. Youngblood
PWR Project Directorate #4
Division of PWR Licensing A
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

File: X7BC35
Log: GN-903

NRC DOCKET NUMBERS 50-424 AND 50-425
CONSTRUCTION PERMIT NUMBERS CPPR-108 AND CPPR-109
VOGTLE ELECTRIC GENERATING PLANT - UNITS 1 AND 2
SER OPEN ITEM 1: EQUIPMENT QUALIFICATION

Dear Mr. Denton:

Pursuant to our March 18, 1985 response and the Request for Additional Information dated October 4, 1985, we are providing the attached response regarding Containment Purge and Vent Valves. One copy is being sent to your consultant for review.

If your staff requires any additional information, please do not hesitate to contact me.

Sincerely,

J. A. Bailey

J. A. Bailey
Project Licensing Manager

JAB/sm
Enclosure

xc:
- R. E. Conway
- R. A. Thomas
- J. E. Joiner, Esquire
- B. W. Churchill, Esquire (1)
- M. A. Miller (3)
- B. Jones, Esquire
- G. Bockhold, Jr.
- D. C. Teper (1)
- Clarke Kido (1)
- Jag Singh
- L. T. Gucwa
- Vogtle Project File

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Sent Direct
To: M. Miller

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RESPONSE TO NRC QUESTIONS
CONTAINMENT PURGE AND VENT VALVES

Each NRC question from the October 4, 1985 letter is repeated below, followed by the VEGP response.

1. The following information is needed in order to evaluate containment purge valve operability:

1a. Provide an isometric sketch of the piping configuration showing elbows, flow orifice, tees, and debris screens within 20 pipe diameters of the mini purge valves (HV-2626B, 2627B, 2628B, 2629B).

RESPONSE: The piping configuration is shown on the following drawings (Attachment 1):

HV-2626B : 1K4-1505-003-02, 1X4DJ4113
HV-2627B : 1K4-1505-003-01, 1X4DJ4143
HV-2628B : 1K4-1506-002-02, 1X4DJ4123
HV-2629B : 1K4-1506-002-01, 1X4DJ4155

The location of nearby in-line components is also summarized in Attachment 2.

1b. Show valve stem position relative to piping system. Indicate direction of disc closure as viewed from actuator.

RESPONSE: Valve stem positions are shown in the drawings in Attachment 1. Direction of disc closure is defined in Attachment 2.

1c. Provide a vendor drawing or sketch of the valve assembly including actuator and supports. Identify materials used to construct the valve assembly, especially sealing surfaces, stem, disc, and bearing. Indicate yoke angle as a function of disc opening angle.

RESPONSE: The valves are shown in the drawings listed below (Attachment 3). These drawings also identify the materials of construction.

HV-2626B : 39A2459, 48A9881
HV-2627B : 39A2461, 48A9883
HV-2628B : 39A2459, 48A9881
HV-2629B : 39A2461, 48A9883

The yoke arm angle leads the disc angle by 45° in a counterclockwise direction.

2. Identify the accident event and sequence which produce the peak containment pressure used in the Vogtle submittal.

2a. Cite the specific FSAR sections, tables, and figures associated with this worst case event.

RESPONSE: The environmental qualification profiles for the purge valves are shown in FSAR figure 3.11.B.1-1 (sheets 9 and 11). These profiles envelope the conditions from a LOCA and MSLB. The accident which produces the peak containment pressure is a double ended rupture at the reactor coolant pump suction with minimum safety injection. Table 1 below provides the sequence of events for this break.

2b. Indicate the containment pressure and temperature at 5 seconds from event initiation as well as the times at which the peak values are reached.

RESPONSE: At 5 seconds after initiation of the event, the containment pressure is approximately 21 psig, and the temperature is approximately 217°F. The peak pressure is calculated to be 42.3 psig at 117 seconds, and the peak temperature is calculated to be 290°F at 116 seconds.

Table 1

Sequence of Events for a double ended reactor coolant pump suction break with minimum safety injection.

Time Sequence of Events	(Seconds)
Start	0.0
Safety injection/containment isolation signal	< 1.0
Containment air cooler starts	95.5
Containment spray starts	116.8
Recirculation starts	2706.0

3. Table 2 of the submittal does not indicate the load combinations and acceptance criteria that were used to calculate the actuator torque requirements.

3a. Identify all loads and conditions that were used to demonstrate operability of the 14 inch purge valve.

3b. Identify the most highly stressed components, locations, applied loading condition, stress intensity, acceptance criteria, and material composition.

RESPONSE: The intent of the Table 2 data is clarified as follows: This printout was furnished primarily to provide the basis for the "Required Actuator Torque" data listed on page 2 of Attachment 13 to Fisher Report FQP 11AB-7 (in response to NRC Question 1F: "Demonstration that the maximum combined torque developed by the valve is below the actuator rating"). The subject here was actuator torque capability and adequacy, not a stress analysis of critical components. A similar printout was used in Attachment 9 of Qualification Report FQP-11AB-7 in the course of a combined loads shaft analysis (see response to item 4c below for additional explanation of this printout format).

Table 2 Shaft Analysis Calculations were based on the maximum possible operational load conditions, i.e., a pressure drop of 60 psid when the valve is closed and a pressure drop of 50 psid for all open angles, enveloping the maximum DBA condition. The required torque calculation is based on torque requirements due to shaft bearing friction, packing friction, unbalance effects, seating loads (when near closure), and dynamic flow-induced loads (when open). Any net seismic-induced torque would be so low (with respect to operational loads) that it is considered insignificant when considering torque requirements.

It is realized that stress values do appear on the Table 2 printout (STRS 1 through STRS 6) associated with various load combinations and locations. This stress data is not of significance here, except to note that these stresses are within the respective allowables (ST, SS, SB) in all cases. The significance and basis of these stress printouts and allowables will be addressed below (in response to Question 4C). In conclusion, the response to the original NRC Question 1F points out that the Bettis actuator torque capability is far greater than valve torque requirements at all angles, even when a DBA condition Δ P (50 psid) is present across an open valve.

4. The response to Attachment 2, Item A3 does not provide enough detail to determine how load and environmental factors have been considered.

4a. Provide a copy of Fisher Qualification Report FQP-11A for review. Clearly indicate those sections of the report which address parts "a" to "f" of item A3.

RESPONSE: Fisher Qualification Reports FQP-11A and FQP-11AB-7 are provided as Attachments 4 & 5. Those sections that address parts "a" to "f" of item A3 are identified.

a.) Simulation of LOCA - paragraph 5.5 (results in section XI) of Fisher Report FQP-11A.
b.) Seismic loading - Attachment 2 & 4 FQP 11AB-7.
c.) Temperature soak - section III, Appendix IV and V, Report FQP-11A.
d.) Radiation exposure - paragraph 5, subparagraph 5.3, report FQP-11A.
e.) Chemical exposure - GH Bettis Report No. 37274, volume 4, Environmental Qualification Test Report, section 6.
f.) Debris - see item 4d below.

4b. Confirm that the LOCA and seismic loads have been combined and applied in a manner which simulates the worst case condition.

RESPONSE: LOCA and seismic loads have not been combined together but considered separately. LOCA effects for these valves are limited to containment back pressure. This pressurization does not impact the time required to vent the valves, for the following reasons:

The valves are equipped with BETTIS NT316B-SR2-M3 spring-return actuators. The spring side of the cylinder actuator is vented to the local ambient conditions; if the pressure side is vented (through the solenoid) to the same local ambient conditions, no pressure differential will exist across the cylinder as a result of surrounding local pressure rise. The spring will still drive the actuator to the safety-mode (closed) position and maintain that position as long as the solenoid remains de-energized and as long as no subsequent re-opening signal is received.

In the event of a delay in solenoid de-energization, a local ambient pressure rise will reduce the ΔP across the cylinder, which will initially partially close the valve. When the solenoid subsequently de-energizes and vents, the spring would complete the closure stroke.

In the event the external ambient pressure is maintained at an elevated level for a prolonged period with the solenoid still energized, and providing the regulator is vented to the same ambient level with a sufficiently high supply, the regulator would eventually adjust the air supply to the cylinder actuator to re-establish the initial full-open position.

Adequate spring-driven torque output is available from the actuator to control the valve from any open or closed position (regardless of external ambient pressure), providing the cylinder casing is vented (locally). The torque available is well within the capabilities of the NT316B-SR2-M3. For seismic load considerations see item 4C below.

The containment back pressure could also impact the torque required to close the valves. To address this, peak containment (LOCA) pressure was used in determining the fluid conditions across the valve at all open angles of rotation (10° to 90°). ΔP across the valve was considered equal to peak containment pressure (PSIG). Material properties were evaluated at peak containment temperatures.

4c. Seismic loading was supplemented by analysis and testing of a Vogtle production valve. Identify this valve. State the purpose for each supplemental analysis and test. Describe how these findings were used to demonstrate operability of the 14 inch purge valve.

RESPONSE: The supplemental analysis and testing that was referred to in the response to NRC Question A.3 is contained in Fisher Qualification Report FQP-11AB-7, Rev. B, dated 10/31/85 (Attachment 5). The following is a summary of each item in that report relating to the operability qualification:

4.c.1 Attachment 1 of Report FQP-11AB-7 contains frequency test data obtained from a FFT test of a production unit extended-structure (Actuator and actuator bracket with attached appurtenances). The production unit used was S/N: 8670355, Tag. No. 2-HV-2628B. The purpose of this test was to confirm valve extended-structure rigidity and verify adequacy of the seismic stress analysis mathematical model used (see following section).

4.c.2 Attachment 2 of Report FQP-11AB-7 contains the seismic structural stress analysis data confirming structural adequacy of the Fisher-supplied actuator bracket and bracket bolting under combined operational (actuator reaction torque) and seismic loads. The seismic loads used were at a level of 9.5 g triaxial, far in excess of the specified 4.5 g triaxial SSE level for these valve assemblies.

At the 9.5 g triaxial level, all extended structure stresses examined were still within or at the allowable limits. The highest stressed components were the SAE Grade 5 bracket-to-body bolts (100% of the 46,000 psi allowable) and one of the outrigger support struts (60% of the 27,000 psi allowable - 90% of yield). The non-pressure-retaining actuator bracket is made of weldable carbon steel. The adequacy of the stress analysis model was confirmed by correlation of the calculated and tested extended-structure frequency using the same mathematical model. (See the data furnished in Attachment 1 of the FQP-11AB-7 report, pointing out that the correlation difference is within the acceptable range.) A summary of the stresses, material, and allowables is presented on page 41 of the seismic analysis printout (in Attachment 2 of Report FQP-11AB-7).

In conclusion, the seismic analysis presented in Attachment 2 of Report FQP-

11AB-7 confirms the structural integrity of the actuator bracket and bracket bolting under SSE level loading conditions, with substantial margin.

4.c.3 Attachment 3 of Report FQP-11AB-7 contains stress calculations for the pressure-retaining parts, due to operational (pressure and torque) loads. The loading conditions and allowables are shown on Page 2 for the materials indicated on Page 1. These allowables are based on the "S" values listed in the ASME B&PV Code Section III, Appendix I, Table 1-7.1 (for Class 2 and 3 components), using the 1.5 "S" values for bending stresses (for Level A service limits per Table NC/ND-3521.1) and 0.75 "S" values for shear stresses. The design pressure/temperature (60 psig/300°F) values were used in the calculations and in determination of the allowables. A summary of the calculated stresses is presented on Page 14 of Attachment 3 for comparison with the allowables. It should be noted that all these stresses are well under the allowables.

In addition, a calculation is presented on page 15 of attachment 3 comparing cross-sectional areas, section moduli, and material allowables at the valve ends for comparison with the connected piping. This comparison demonstrates that the valve body is substantially stronger than the connected piping and can safely withstand pipeline-induced loads. (This Code Case [illegible]35-1 procedure has since been incorporated into the ASME B&PV Code Section III as Section NC/ND-3521.)

Attachment 4 of Report FQP-11AB-7 contains the Static Sideload Test Description and Results. This data is included to demonstrate <u>operability</u> of these active valve assemblies under OBE/SSE seismic conditions. The same valve assembly was used for this test program that was used for the frequency test, i.e., a 14" 9280 butterfly production valve with a NT316B-SR2-M3 Bettis Actuator, S/N 8670355, Tag No. 2-HV-2628B.

(At the conclusion of the non-destructive test, this test valve was refurbished for shipment as an N-stamped valve. Particulars about this test valve are presented on the test valve data sheet, Page 15 of Report 70, Problem 1662 (Attachment 4). Four operational loading cycles were run.

The test results indicate satisfactory operability performance with no restrictions or limitations, when subject to seismic induced loading (of 10g), well in excess of the resultant SSE value (7.8 g). All operability requirements were met.

Attachment 7 of Report FQP-11AB-7 contains Fisher Report 8, Problem 1685-3 documenting radiation exposure effects on a similar butterfly valve and Bettis Actuator. This valve assembly was exposed to gamma radiation at various levels up to a maximum cumulative dose of 200 Mrads. Further details concerning the test valve and test program are provided in Report FQP-11A.

Attachment 8 of Report FQP-11AB-7 contains data from flow and closure tests of a similar, but smaller butterfly valve. These model tests were done to demonstrate that stroking times were not strongly affected by flow conditions; a minor correction factor to use in estimating full-flow closure times from no-flow closure time results was determined. (See Para. 5.3 of FQP-11AB-7.)

Attachment 9 of Report FQP-11AB-7 contains a Combined Loads Shaft Analysis, to show that the valve shaft is adequate under combined dynamic flow torques and seismic loads. (The shaft is considered to be the most highly stressed and most critical component.)

Dynamic flow-induced stresses were obtained from the Shaft Analysis Calculation printout, similar to that provided in Table 2 of Attachment 13 to Fisher Report FQP-11AB-7. Only the values for

0° and 90° were used, since these were the most critical. The following explanation is provided for the printout data:

Under "Generated Variables":

ST = Allowable bending/tensile stress for the 17-4PH shaft.
SS = Allowable shear stress for the 17-4PH shaft.
SB = Allowable bearing stress for the graphite-bronze bushings.

Note: The "ST" and "SS" values used were somewhat conservative. The same allowables as used in the Attachment 3 calculations could have been used.

The explanation for the calculated stress values is given here:

STRS 1 - Normal stress due to bending and torsion (allowable value--ST) between the hub and bushing with respect to tension - in psi.

STRS 2 - Shear stress due to bending and torsion between hub and bushing - in psi (allowable value--SS).

STRS 3 - Shear stress due to torsion and direct shear between hub and bushing - in psi (allowable value--SS).

STRS 4 - Shear stress due to torsion at disc connection - in psi (allowable value--SS).

STRS 5 - Shear stress due to torsion at the drive connection - in psi (allowable value--SS).

STRS 6 - Bearing stress due to bearing load at bushing location - in psi (allowable value--SB).

Seismic disc loads imposed on the shaft due to the disc were investigated by use of an ANSYS finite element program. The seismic loads were then combined with the dynamic flow induced loads, and the stresses were totalized as principal stresses and compared to the allowables. This was done for both the 0° and 90° open conditions, and for two locations on the shaft where the stresses were high, namely at the disc hub location, and at the disc pin hole location. The load carrying limitation of the shaft results from the maximum shear stress at the pin hole location when the disc is 90° open. The normal, shear, and bearing stresses were found to be within the allowables in all cases. A more detailed explanation may be found in the discussion provided in Attachment 9 of Report FQP-11AB-7. However, the principal stress-inducing conditions were:

Δp = 60 psid when disc closed
Δp = 50 psid when disc fully open
SSE level g loading: 4.5 g triaxial

Although the combined loads shaft stress analysis was not directly done to demonstrate operability, this analysis provides assurance that operability will not be threatened by yielding or failure of the most critical item (shaft).

4d. Confirm that the use of debris screens as well as the periodic inservice inspection of the valve assembly is sufficient to preclude the build-up of corrosion products or debris that could "lock up" the valve stem or damage the sealing surfaces.

RESPONSE: The details of the debris screens are shown on drawings 1K4-1505-003-02 and 1K4-1506-002-02 (Attachment 1).

In accordance with the Standard Review Plan, BTP CSB 6-4 paragraph B.1g, the mini purge exhaust and supply outlets inside the containment are equipped with 30" diameter debris screens to ensure that isolation valve closure will not be prevented by debris which could potentially become entrained in the escaping air and steam following a postulated LOCA. The debris screens are designed to withstand a differential pressure of 60 psig. They provide a 4.5:1 reduction in approach velocity to minimize entrainment potential.

The debris screens coupled with periodic in-service inspections and leak testing of the valve assemblies will be sufficient to preclude buildup of corrosion products or debris that could lock up the valve stems or damage the seal surface.

4e. Identify any materials, such as elastomers or lubricants, which could be adversely affected by environmental factors (temperature, pressure, radiation aging, containment spray composition, etc.).

RESPONSE: Valve elastomers, packing, gaskets, seals and lubricants are defined in Attachment 5 and 6. The soft parts in the Bettis operator and valve will be periodically replaced per the plant planned maintenance/surveillance program.

4f. Identify what specific measures will be taken to ensure that material degradation will not adversely affect the ability of the purge valve to perform its function when required.

RESPONSE: Elastomer parts i.e. "O" rings, T-ring seals, packing, components and gaskets for the valves will be replaced during periodic maintenance periods as provided by planned maintenance/surveillance programs.

5. Clarify how data was extrapolated from the 4 and 6 inch valve tests to demonstrate operability of the 14 inch purge valves.

5a. Identify the combination of test loads and environmental conditions used to demonstrate operability of the 14 inch valve.

5b. Identify the loads applied to the 14 inch valve, which were scaled up from test data of smaller valves. Describe the method of extrapolation used.

5c. Compare the disc profile, closure time, and torque requirements for the 14 inch purge valve with the 4 and 6 inch valves used in the model tests.

RESPONSE: The 4" and 6" valve tests referenced were not done as part of the <u>operability</u> demonstration of the subject 14 inch purge valves. Operability testing was performed on 14" Vogtle valve (see Fisher Report FQP-11AB-7 Attachment 4). In fact, these model tests were done years ago solely to form the basis for actuator sizing data, and there is no specific connection with these early tests and the subject 14" purge valves. The model test data was organized, interpolated, and extrapolated to arrive at sizing factors for the range of possible Type 9200/9280 butterfly valves sizes and configurations.

The 14" purge valves of concern have a conventional offset cast disc construction with an aspect ratio of 3.7:1, which falls within the range of aspect ratios used in the model tests (2:1 to 14:1). Explanation of the aspect ratio significance and the test procedure followed is presented in the Fisher Report FQP-11AB-7 Attachment 13 (second and third paragraphs, page 2). Fisher agrees with the statement about the scaling procedure data: "No published data is available describing the precise scaling procedure used in establishing the sizing tables... ". It may be added that the sizing tables have been in use for some 10-15 years with no significant changes in dynamic torque factors at opening angles greater than 20°; indications are that the sizing coefficients being used are quite conservative. There have been some refinements in sizing procedures for seated and near-seated positions, based on subsequent seating torque experience; however, adequacy of the seating torque sizing for the 14" purge valves has been determined using the latest and best data available, and this has been verified by test in the course of the static side load testing (see Attachment 4 of Report FQP-11AB-7). The torque values obtained from the sizing data are presented in the table under the response to NRC Question 1F ("Required Actuator Torque"), Attachment 13 to Fisher Report FQP-11AB-7.

The torque sizing coefficients developed were based on a test program of operational loads due to dynamic flow-induced loads on the disc, bearing and packing friction, and unbalanced pressure loads. As noted before, seismic loads will have insignificantly small effects on net torque requirements. However, seismic-induced loading effects on critical components (shaft, primarily) have been considered, as pointed out in the current reply to NRC reviewer Question 4C above.

Report FQP-11AB-5 (Attachment No. 7) discusses the purpose and significance of the valve closure test (using a 6" valve), done to determine the significance of fluid flow on valve closure times. This closure test was not done specifically to support operability of the subject 14" purge and vent valves, but was a prior test which was judged to be applicable. The 6" test valve was a similar Type 9200 valve design, with a EPDM T-ring seal and with an appropriately-sized Bettis spring-return pneumatic actuator (521C-SR80). The disc aspect ratio in this case was 2.90:1, not far from the 14" purge and vent valve ratio of 3.7:1. It should be recalled that model tests were not used to establish stroking times for the 14" purge valves; stroking times were established by applying the flow correction factor to no-flow stroking times determined from production assembly tests of the 14" purge valves (see paragraph 5.3 of Report FQP-11AB-7).

6. The response to Attachment 2, Item 1, does not indicate the valve closure period or closure rate.

6a. Indicate the maximum elapsed time from LOCA initiation to close the valve for the worst case conditions. Confirm that the valve closure period does not exceed the plant technical specifications.

RESPONSE: The maximum elapsed time allowed from LOCA initiation to close of the value, for the worst conditions is 5 seconds (per specification requirements). The actual closing time is 3 seconds per Test Report Attachment 5 of Fisher Report FQP-11AB-7, identified as, "Certificate of Compliance and Related Documentation." The plant technical specifications require the valves to close within 5 seconds.

6b. Indicate the maximum lag time due to cylinder over pressure venting.

RESPONSE: Maximum lag time will be provided following the field stroking test. (See response to Item 6c below.)

6c. Although production valve stroking times have been taken, it is indicated that the "best stroking time data" could be obtained during a field stroking test at the plant site. Confirm that the production valve stroke times were within acceptable limits. Compare the loads and configuration used to time the production valves with the conditions associated with performing a field stroking test at the plant site.

RESPONSE: The field stroking test is scheduled to be performed by May 1, 1986. Test results will be forwarded at that time.

7. The response to Attachment 1 Item A(b) suggests a scenario whereby failure of the solenoid to deenergize on demand could leave the purge valve in the open position.

7a. Confirm the ability of the solenoid to deenergize on demand for the scenario postulated in item A(b).

RESPONSE: Failure or delay of the solenoid to deenergize will keep the valve (inside the containment only) partially open due to pressure difference Δ P on the actuator piston. This is considered a single failure. The redundant valve outside the containment will close as required.

7b. In the event of a delay of solenoid deenergization as discussed in Item A(a), indicate the maximum elapsed time from LOCA initiation to close the 14 inch purge valve.

RESPONSE: Isolation valves located inside and outside containment will close within 5 seconds and isolate the containment. Any delay in the solenoid deenergization would be electronic in nature, and would have a negligible impact on valve closing time.

8. The brief discussion of piping system geometry given in responses 7 and 8, Attachment 2, does not address adequately the flow effects of upstream elbows or tee on the valve closing torque. Discuss or describe operability of the valves under this condition and the basis for any conclusions.

RESPONSE: It is noted that a line is missing in the response to Question 7 (Attachment B to Fisher Report FQP-11AB-7.) The second paragraph should read:

"The concern over geometrical piping system effects is relevant, since Fisher typically sizes butterfly valves assuming a uniform flow profile, while various piping configurations directly upstream could produce a non-uniform flow as illustrated by Figure A of Attachment 3."

The 14" purge valves are oriented as shown in Figure A of Attachment 3 (see above), such that any non-uniform flow effects are distributed along the length of the valve shaft, distributed equally on both "wings" of the disc. The previous response should be clarified by the addition of the word "since", as follows:

"a. Valve/Flow Orientation, Figure A

> Since the plant layout is such that the valve is oriented to the flow as depicted in Figure A (Attachment 3), the nonuniform flow profile will not produce an additional torque on the valve disc, since both "wings" of the disc (as split by the shaft) will be subjected to the same flow with respect to time."

The effect of discontinuities on flow and butterfly valve torque characteristics has been a subject of considerable concern in recent years. Fisher has no specific test data or correction factor recommendations to offer on this subject, except for the obvious caution that discontinuities should be located as far as possible from the valves. In doing flow testing, Fisher locates pressure taps at least 5 pipe diameters from the valve, to minimize non-uniformity effects. (This is consistent with recommendations of the Fluid Controls Institute Bulletin FCI 58-2.) It is believed that the effects of discontinuities on torque requirements is not as serious as the first feared. In spite of recommendations to avoid installing valves near discontinuities, discontinuities often are present at other plants, and there has been no known instance of field problems regarding operability attributed to discontinuities.

ATTACHMENTS

1. Piping Drawings
2. Valve Summary Table
3. Valve Drawings
4. Fisher Qualification Report FQP-11A, Rev. C
5. Fisher Qualification Report FQP-11AB-7, Rev. B
6. Bettis Qualification Report 37274, Rev. 3
7. Fisher Qualification Report FQP-11AB-5, Rev. A

Attachment 1

Includes BPC drawings:

- 1K4-1505-003-01 (Rev. 2)
- 1K4-1505-003-02 (Rev. 2)
- 1K4-1506-002-01 (Rev. 5)
- 1K4-1506-002-02 (Rev. 2)
- 1X4DJ4123 (Rev. 8)
- 1X4DJ4143 (Rev. 8)
- 1X4DJ4155 (Rev. 5)
- 1X4DJ4113 (Rev. 7)

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ATTACHMENT 2

Valve Tag Number	HV-2626B	HV2627B	HV2628B	HV2629B
1. Direction of Flow	Inlet-butt weld end outlet-raised face	Inlet-raised face outlet-butt weld end	Inlet-raised face outlet-butt weld end	Inlet-butt weld end outlet-raised face
2. Disc closure Direction	Clockwise	Clockwise	Clockwise	Clockwise
3. Curved side of disc	Upstream	Downstream	Downstream	Upstream
4. Orientation and distance of elbows, tee, bend within 20 pipe diameter of valve.	Tee-19'5" upstream, horizontal line 90° elbow-11'-6-1/4" upstream horizontal line. Tee-6'-9-11/16" upstream, vertical line. 90° elbow-2'8-11/16 upstream, vertical line. Flow orifice-23'-6-5/8 upstream, vertical line. Flow orifice-1'-10-1/4" downstream, horizontal line.	Tee-3'-0" downstream horizontal line. 90° elbow-10'-10-3/4" downstream, horizontal line. Tee-15'-7-5/16" downstream, vertical line. 90° elbow-19'-8-5/16" downstream vertical line. Flow orifice-1'-1-5/8" upstream, vertical line. Flow orifice-24'-3-1/4" downstream, horizontal line.	Tee-18'-9-9/16 upstream, horizontal line. 90° elbow-11'-9-3/4" upsream, horizontal line. Tee-3'-9-3/4" upstream, vertical line. 90° elbow-1'-8-3/4" upstream, vertical line. Flow orifice-25'-4-9/16" upstream, horizontal line. Flow orifice-1'10-1/8" downstream, horizontal line. Flow orifice-1'-10-1/8" downstream, horizontal line.	Tee-4'-0" downstream, horizontal line. 90° elbow-10'11-13/16 downstream horizontal line. Tee-16'-11'-3/16 downstream vertical line. 90° elbow-21-0-3/16" downstream, vertical line. Flow orifice-2'-7" upstream, horizontal line. Flow orifice-24'-7-10/16" downstream, horizontal line.
90 5. Shaft orientation.	Vertical	Vertical	Vertical	Vertical
6. Distance between valves.	22'-5" (between - V-2626B & 2627B)		22'-9-9/16" (between HV-2628B & 2629B)	

ATTACHMENT 3

Includes Vendor drawings:

BPC Log # X5AC03-5109-3 (Vendor drawing No. 39A2459)
X5AC03-5113-2 (Vendor drawing No. 48A9881)
X5AC03-5110-3 (Vendor drawing No. 39A2461)
X5AC03-5111-2 (Vendor drawing No. 48A9883)

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ATTACHMENT 4

Includes:

Fisher Qualification Report FQP-11A

(BPC Log # X5AC03-5068-4)

INDEX SHEET

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Log Number AXSA C03-5068

Document Number FQP-11A Document Title Qualy Report FQP-11A

Original Number of Sheets 0-612 Date Rec'd 5-20-85 Sub. No. 4

R - REVISE
A - ADD
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RECEIPT SHEET NUMBER	Rev. No.	Date Rec'd	Sub. No.
(A) Shts 597, 598	–	8-12-85	5
(R) Shts 53 thru 58, 075	–	↓	↓
thru 84, 104 thru 107, 125,	–	↓	↓
130, 131, 242, 243, 248, 249,	–	↓	↓
252 thru 286, 434-436	–	↓	↓
437, 438, 439, 442, 443	–	↓	↓
(D) Sheets 287 thru 293	–	↓	↓
Duplicates of sheets 280 thru 286	–	↓	↓

R
A
D