Appendix E

Zion Station Calculation 22S-B-005M-162

CALCULATION COVER SHEET

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ZION NUCLEAR STATION

Zion Calculation No: 22S-B-005M-162

Title: System Conditions During Safeguards Operation of 1(2)MOV-SI9011A&B

Project Title: MOV Program

PURPOSE: Determine system conditions at the moment valves 1(2)MOV-SI9011A&B are required to operate. Document the capability of the MOV to operate under potential pressure locking conditions.

CALCULATION TYPE: PC **TYPE ID:** Pressure

PLANT DESIGN CHANGE NUMBER: N/A **PROJECT NUMBER:** 4940

RELATED/REFERENCED CALCULATIONS: N/A

COMPONENT IDENTIFICATION NUMBERS: 1/2MOV-SI9011A&B

DRAWING NUMBERS: M-64, M-521

REMARKS: **This calculation was prepared to evaluate the capability of 1(2)MOV-SI9011A&B to open under a pressure locked condition. The results are not to be used to support design activities.**

CHRON: 0313966

REV. NO.	REVISION	APPROVED	DATE
0	Original Issue	SA Benesh	11/20/1995
1	Incorporates MOV capability determination	J R O'Hanlon	2/13/96

File: 9011ab_1.wpf
Printed: February 13, 1996

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CALCULATION TITLE PAGE

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☒ SAFETY RELATED ☐ REGULATORY RELATED ☐ NON-SAFETY RELATED

CALCULATION TITLE:

System Conditions during Safeguards Operation of 1(2)MOV-SI9011A&B

STATION/UNIT: ZION / Units 1 & 2 SYSTEM ABBREVIATION: SI

EQUIPMENT NO.: (IF APPL.) PROJECT NO.: (IF APPL.) 4940

1MOV-SI9011A
1MOV-SI9011B
2MOV-SI9011A
2MOV-SI9011B

REV: 0 STATUS: Approved QA SERIAL NO. OR CHRON NO. DATE: 11/13/95

PREPARED BY: _____ DATE: 11/13/95

REVISION SUMMARY:

Original issue

DO ANY ASSUMPTIONS IN THIS CALCULATION REQUIRE LATER VERIFICATION ☐ YES ☒ NO

REVIEWED BY: _____ DATE: 11/13/95

REVIEW METHOD: Detailed Review COMMENTS (C OR NC): NC

APPROVED BY: _____ DATE: 11/22/95

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CALCULATION REVISION PAGE

CALCULATION NO. 22S-B-005M-162 PAGE NO.: 3 of 19

REV:1 STATUS: Approved QA SERIAL NO. OR CHRON NO. DATE: 2/12/1996

PREPARED BY: G.C. LAUBER DATE: 2/12/1996

REVISION SUMMARY:

This revision includes the determination of the capability of the MOV to open under the system conditions described in revision 0 of this calculation and repeated here. The capability determination also incorporates the results of motor terminal voltage calculation 22S-B-005E-160 Revision 3.

This calculation supersedes 22S-B-005M-162 Revision 0 entirely.

DO ANY ASSUMPTIONS IN THIS CALCULATION REQUIRE LATER VERIFICATION ☐ YES ■ NO

REVIEWED BY: DATE: 2/13/95

REVIEW METHOD: Detail Review COMMENTS (C OR NC): NC

APPROVED BY: DATE: 2/13/96

REV: STATUS: QA SERIAL NO. OR CHRON NO. DATE:

PREPARED BY: DATE:

REVISION SUMMARY:

DO ANY ASSUMPTIONS IN THIS CALCULATION REQUIRE LATER VERIFICATION ☐ YES ☐ NO

REVIEWED BY: DATE:

REVIEW METHOD: COMMENTS (C OR NC):

APPROVED BY: DATE:

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CALCULATION NO. 22S-B-005M-162	REV. NO. 1	PAGE NO. 4 of 19
DESCRIPTION: System Conditions During Safeguards Operation of 1(2)MOV-SI9011A&B. Determination of MOV capability to operate under these conditions.	PAGE NO.	SUB-PAGE NO.

1.0 PURPOSE/OBJECTIVE

The purpose of this calculation is to identify the system conditions prevailing when the motor-operated hot leg recirculation valves in the Safety Injection System, 1(2)MOV-SI9011A&B, are called upon to operate in response to a design basis accident.

System conditions and motor terminal voltages will be input to the T^2 rising stem MOV calculation computer program to determine the capability of the actuator to overcome the potential pressure locking condition. This calculation is to be used as input into an operability analysis; not design.

2.0 METHOD/ACCEPTANCE CRITERIA

The motor operator for a double-disc gate valve is designed to open the valve with full pressure on one side and zero pressure on the other side. Pressure inside the valve bonnet is assumed to equal the full upstream or downstream pressure, whichever is greater. Pressure locking becomes a possibility when pressure is rapidly lost on both the upstream and downstream sides of the valve, but pressure is maintained inside the valve bonnet to seal both discs independently against their seats. No credit is taken for depressurization of the bonnet due to leakage unless the upstream and downstream sides of the valve have been depressurized for an extended time period, or unless depressurization is relatively slow.

The UFSAR, EOPs, and AOPs were consulted to determine when the above valves and the associated pumps (the Safety Injection Pumps) are called upon to operate. Pressure inside the valve bonnet is assumed to equal the highest pressure on either side of the valve before the start of the event. Upstream and downstream pressures are determined at the instant the valve is called upon to open, and for several seconds thereafter if the valve does not open immediately. The minimum expected voltage on the 480 volt bus at the instant the valve is required to operate and for several seconds thereafter is used.

Once the system pressures are determined, they are input into the T^2 program which calculates minimum forces required to open the valve and the capability of the actuator to develop the torque and thrust to open the valves. The minimum required force will be compared to both the motor actuator output capacity as well as the structural limitations of the valve and actuator. If required, the motor capacity at stall may be used to demonstrate operability. As pressure locking only occurs in a closed valve, only the calculated opening forces will be reviewed.

The MOV is considered acceptable if the calculated capacity of the actuator is greater than the minimum thrust required to open the valve under pressure locking conditions.

3.0 ASSUMPTIONS

3.1 Pressure inside the valve bonnet is assumed to equal the highest pressure on either side of the valve immediately before the start of the event.

3.2 No credit is taken for short-term leakage out of the valve bonnet.

3.3 Piping line head losses and elevation head differences are negligible and are not included unless stated otherwise in the text of this calculation.

3.4 Valve factors are the same under normal and pressure locked conditions. This is conservative as the pressure in the valve bonnet tends too force the discs away from the guides resulting in a reduction in guide/disc friction under pressure locking conditions.

3.5 The force required to open a double seated flexible wedge gate (FWG) valve under pressure locking conditions is conservatively estimated as the sum of the differential pressure load on the valve discs plus the static unwedging force that was measured during static diagnostic testing. Recent pressure locking tests conducted by ComEd have shown that this will yield a conservative result. This assumption applies only to 2SI9011B which is a FWG valve. 1(2)SI9011A and 1SI9011B are double disc gate valves and are treated differently.

3.6 The stem friction coefficient of friction is the same in the open direction as measured in the close direction. This value is bounded by degrading the measured value by 0.05 over a 36 month lubrication cycle. This is consistent with WP-175 guidance.

3.7 Pumps meet their nominal performance curves. Minor degradation will have no effect on the accuracy of this calculation.

3.8 Other case specific assumptions are contained within the body of this calculation and its' Attachments.

4.0 DESIGN INPUT

4.1 Nuclear Fuel Services Calculation No. RSA-Z-92-02, Rev. 0: Zion ECCS Flow Verification

4.2 Calculation 22S-B-001M-242, Rev. 0: Coupled Heat Exchanger Modelling of Residual Heat Rejection at Various Sump Temperatures

4.3 Nuclear Fuel Services NDIT 950052, Rev. 0 dated October 19, 1995: Transmittal of Zion Sump Data from Analysis of Record for LOCA Containment Response (NFS:PSA:95-126)

4.4 22S-B-005E-160 Rev. 3. Motor Terminal Voltages for Safety Injection MOVs.

4.5 Fax: TJ Matty of Westinghouse to N. Boscia - Dated 1/27/1994 (Attachment G)

4.6 Zion Station MOV Margin Review for 1(2)SI9011A,B (Attachment F)

4.7 Other case specific Design Inputs are contained within the body of this calculation and its' Attachments.

5.0 REFERENCES

5.1 Drawing M-62, Rev. AL: Diagram of Residual Heat Removal, Zion Station Unit 1.

5.2 Drawing M-64, Rev. AH: Diagram of Safety Injection System, Zion Station Unit 1.

5.3 Drawing M-65, Rev. AM: Diagram of Safety Injection System, Zion Station Unit 1.

5.4 Drawing M-520, Rev. AF: Diagram of Residual Heat Removal, Zion Station Unit 2.

5.5 Drawing M-521, Rev. U: Diagram of Safety Injection System, Zion Station Unit 2.

5.6 Drawing M-522, Rev. AJ: Diagram of Safety Injection System, Zion Station Unit 2.

5.7 Drawing M-258, Rev. T: Auxiliary Building Piping, Misc. Plans & Sections, Zion Station Unit 2.

5.8 Drawing M-259, Rev. R: Auxiliary Building Piping, Misc. Plans, Zion Station Unit 2.

5.9 Pope-Morrison Isometric Drawing SI-19, Rev. [none], 6-15-72: Safety Injection Lines From P-125 and P-126, Reactor Building #1 and Aux. Bldg.

5.10 Pope-Morrison Isometric Drawing SI-217, Rev. B, 12-24-73: Safety Injection Lines From P-125 and P-126, Reactor Building #2 and Aux. Bldg.

5.11 UFSAR, Section 6.3.2.2.5: Emergency Core Cooling System Valves

5.12 UFSAR, Table 6.3-5: Design Parameters - Emergency Core Cooling System Pumps

5.13 UFSAR, Section 15.6.5: Reactor Coolant System Pipe Rupture (Loss-of-Coolant Accident)

5.14 EOP E-1, Rev. 4: Loss of Reactor or Secondary Coolant

5.15 EOP ES-1.3, Rev. 8: Transfer to Cold Leg Recirculation

5.16 EOP ES-1.4, Rev. 3: Transfer to Simultaneous Hot and Cold Leg Recirculation

5.17 AOP-6.3, Rev. 2: Loss of RHR Shutdown Cooling

5.18 TSS 15.6.35-1, Rev. 28: Manual Actuation of the Safety Injection and Safe Shutdown Systems and Diesel Generator Loading Test

5.19 TSS 15.6.43-1, Rev. 21: Endurance Testing of Diesel Generators During Refueling

5.20 TSS 15.6.84, Rev. 24: Charging And Safety Injection Check Valve Verification Test

5.21 TSS 15.6.85, Rev. 17: RHR Check Valve Verification Test

5.22 Zion Environmental Qualification Report, Appendix B.

5.23 Initial Operability Assessment No. 95-0530, Rev. 1 (4/20/95)

5.24 Crane Technical Paper 410, 1988.

5.25 Cameron Hydraulic Data, 18th edition, Ingersoll-Dresser Pumps, 1994.

5.26 Other case specific References are contained within the body of this calculation and its' Attachments.

6.0 CALCULATIONS

6.1 SYSTEM CONDITIONS

Pressure locking of valves 1(2)MOV-SI9011A&B will only be a potential concern if both the upstream and downstream sides of the valves are depressurized when the valve is required to open. The Zion Station Emergency Operating Procedures (EOPs) require the nuclear station operator to open these valves manually in order to realign the system for simultaneous hot and cold leg recirculation, approximately 12 to 13 hours (per EOP E-1, Reference 14) after a loss of coolant accident. Per UFSAR Section 6.3.2.2.5 (Reference 11), a large-break LOCA will reduce the downstream pressure (i.e., RCS pressure) to containment pressure (close to zero psig) by that time. Just prior to the opening demand on the SI9011A&B valves, the SI System will be in cold leg recirculation, taking suction from the RHR heat exchangers.

The temperature of the water during cold leg recirculation will not exceed the outlet temperature of the RHR heat exchangers, plus a slight amount of heating from the SI pumps. The outlet temperature of the RHR heat exchangers is a function of the inlet temperature of the RHR heat exchangers and the fouling factor on the Service Water side of the Component Cooling heat exchangers. The thermal performance of the RHR and CC heat exchangers was modeled as a function of containment sump (i.e., RHR inlet) temperature in Calculation 22S-B-001M-242 (Design Input 2). In this calculation, containment sump temperatures of 150°F, 200°F and 250°F were assumed, and calculations were performed for CC heat exchanger fouling factors of 0.001 and 0.002 hr-ft^2-°F/Btu. Sump temperature as a function of time after the accident is given in NDIT 950052, Rev. 0 dated October 19, 1995 from Nuclear Fuel Services (Design Input 3). Applying linear interpolation to the data given in the NDIT, the sump temperature at 12 hours is 156°F. Using 156°F as the RHR inlet temperature and applying linear interpolation to the data in Table 7.2 of calculation 22S-B-001M-242 (for the 0.002 hr-ft^2-°F/Btu fouling factor, the more conservative case), the RHR water outlet temperature is 125°F. Using the formula for pump heating in Cameron (Reference 25), page 1-28, and a conservative pump efficiency rating of 70%, the maximum temperature rise through the SI pump is:

$$\Delta T = \frac{h_{2\ pumps}(1.0 - E)}{778\ UE} = \frac{2663\ ft\ (1.0 - 0.70)}{778\ (1\ Btu/lb\text{-}°F)(0.70)} = 1.5°F$$

Therefore, the temperature at the SI9011 valves will not exceed **126.5°F.** Interpolating from the table in Reference 24, page A-6, the density of water at this temperature is 61.607 lb/ft^3.

During cold leg recirculation, the upstream side of the valve would be pressurized by one or two SI pumps. If one SI pump is running, the pressure at this point can be conservatively estimated from the combined total developed head of the SI and RHR pumps with a cold leg injection flow of 586 gpm (the minimum cold leg flow with one medium-head pump running per TSS 15.6.84, Reference 20). The SI pump total developed head is 1735 feet based on 586 gpm; performance is taken from Table 1 of Design Input 1 (Attachment A), interpolating if necessary, without the 85% multiplier which would lead to an unconservative result in this situation. The exact flow rate from each RHR pump may vary depending on physical condition and system lineup; conservatively, the shutoff head from Table 7 of Design Input 1 can be used (400 feet). Using Assumption 3 and converting head to pressure, the upstream pressure during cold leg recirculation with one pump running is

$$\frac{61.6\ lb/ft^3}{144\ in^2/ft^2} \times (1735 + 400)\ ft = 913\ psi \qquad \textbf{Eq. 1} \text{ (Ref. 17, Equation 3-23)}$$

However, EOP ES-1.3, Transfer to Cold Leg Recirculation (Reference 15), does not preclude having two SI pumps running, if both are available. With two SI pumps running, each pump will develop more head and provide less flow according to its performance curve, as tabulated in Design Input 1. The pressure drop through the system varies with the square of the flow rate (Reference 24, Equation 3-14), because the system resistance is fixed by manual valves which are throttled during flow balancing per TSS 15-6.84 and then restrained from drifting by locknuts on the valve stems. Adding a second SI pump will cause each pump to provide less flow (although the overall flow rate due to both pumps will increase) and provide more developed head. Therefore, the resulting pressure increase over the 1-pump case can be described by the following relationship:

$$\frac{P_{2\ pumps}}{913\ psig} = \left[\frac{Q_{per\ pump} * 2\ pumps}{586\ gpm}\right]^2; \qquad \textbf{Eq. 2} \text{ (Derived from the above statements)}$$

where $P_{2\ pumps} = (h_{2\ pumps} + 400\ ft) \times (61.6\ lb/ft^3 \div 144\ in^2/ft^2)$. **Eq. 3**

Solving the above for the total developed head of an SI pump with both running and taking suction from RHR, as a function of the flow rate of one SI pump, results in the following relationship:

$$h_{2\ pumps} = \frac{4\ (Q_{per\ pump})^2 \times 913\ psig \times 144\ in^2/ft^2}{(586\ gpm)^2 \times 61.6\ lb/ft^3} - 400\ ft, \qquad \textbf{Eq. 4}$$

or: $$h_{2\ pumps} = 0.02486 \times (Q_{per\ pump})^2 - 400\ ft \qquad \textbf{Eq. 5}$$

This relationship can be shown in tabular form, and compared to the pump performance data from Table 1 of Design Input 1.

$Q_{per\ pump}$	$h_{2\ pumps}$	TDH from Table 1, Design Input 1
0.0	—	3300.0
40.0	—	3200.0
220.0	803	3000.0
310.0	1989	2800.0
370.0	3003	2600.0
420.0	3985	2400.0
520.0	6322	2000.0
594.8	8395	1700.0

The second column above represents the pump developed head required to overcome the pressure drop due to system resistance, based on the two SI pumps each producing the flow rate shown in the first column, and the third column represents the pump performance curve. If the data in the above table were plotted, the point where the curves cross would represent the actual operating point with both pumps running. By inspection it can be seen that the operating point lies between 310 and 370 gpm per pump. If linear interpolation is used between 310 and 370 gpm to determine the pump developed head at intermediate flowrates, the head will be equal to:

$$h_{2\ pumps} = \frac{(Q_{per\ pump} - 310\ gpm)}{370\ gpm - 310\ gpm} \times (2600\ ft - 2800\ ft) + 2800\ ft \qquad \textbf{Eq. 6}$$

Equating the two expressions for $h_{2\ pumps}$ (Equations 5 and 6) yields

$$0.02486\ (Q_{per\ pump})^2 - 400\ ft = \frac{(Q_{per\ pump} - 310\ gpm)}{370\ gpm - 310\ gpm} \times (2600\ ft - 2800\ ft) + 2800\ ft \qquad \textbf{Eq. 7}$$

The resulting quadratic equation is

$$0.02486\ (Q_{per\ pump})^2 - \frac{2600\ ft - 2800\ ft}{370\ gpm - 310\ gpm} \times Q_{per\ pump} + 310\ gpm \times \frac{2600\ ft - 2800\ ft}{370\ gpm - 310\ gpm} - 3200\ ft = 0;$$

simplified, $0.02486\ (Q_{per\ pump})^2 + 3.333\ Q_{per\ pump} - 4233 = 0.$ **Eq. 8**

Solving the quadratic equation, the only positive solution is $\mathbf{Q_{per\ pump} = 351\ gpm.}$

Interpolating from Design Input 1, Table 1 (the pump head-capacity data), the head is

$$h_{2\ pumps} = \frac{351\ gpm - 310\ gpm}{370\ gpm - 310\ gpm} \times (2600\ ft - 2800\ ft) + 2800\ ft = \mathbf{2663\ ft}$$

To check: $0.02486 \times (351\ gpm)^2 - 400\ ft = 2663\ ft.$

From Eq. 3, the pressure at the SI pump discharge with both SI pumps running and taking suction from RHR is:

$$P_{2\ pumps} = (2663\ ft + 400\ ft) \times (61.6\ lb/ft^3 \div 144\ in^2/ft^2) = \mathbf{1310\ psi.}$$

Therefore, it can be assumed that the internal bonnet pressure of valves 1(2)MOV-SI9011A&B will not exceed 1310 psig at the end of cold leg recirculation.

EOP ES-1.4, Transfer to Simultaneous Hot and Cold Leg Recirculation (Reference 16), Step 2b (Page 4) requires the operator to shut off the SI pump prior to closing the SI9010 valve and opening the SI9011 valve. Therefore, it can be assumed that the upstream pressure on the SI9011 valve rapidly decreases to a pressure approaching the SI pump suction pressure (from the RHR system) just prior to receiving a signal to open. Although the RHR pumps were assumed to produce 400 ft of head above, this is unconservative for the purpose of calculating the minimum upstream pressure. The maximum flow rate of each RHR pump is 4500 gpm per UFSAR Table 6.3-5 (Reference 12) with a head of 300 ft. Although this is not runout for the pump, the flow rate is controlled by the operator and is not allowed to exceed 4500 gpm (see the caution on Page 12 of TSS 15.6.85, Reference 21, for example). The head of 300 ft. quoted in the Reference 12 table is used because it is slightly more conservative than using a

value obtained by interpolation from Table 7 of Design Input 1. Also, elevation head losses cannot be neglected in this case; the difference in elevation between the containment sump (for conservatism assume El. 569'-0", the minimum level required to initiate cold leg recirculation per EOP ES-1.3, Reference 15) and the highest valve (approx. El. 594'-0", per References 7, 8, 9, and 10) will reduce the head at the valve by 25 ft. Therefore, the minimum pressure upstream of the SI9011 valves when the SI pumps are off but aligned to take suction from RHR is:

$(300 \text{ ft} - 25 \text{ ft}) \times (61.6 \text{ lb/ft}^3 \div 144 \text{ in}^2/\text{ft}^2) =$ **118 psig**

Per EOP ES-1.4, the SI pump is started by the step immediately after the step which requires opening the SI9011 valve. If the SI pump is assumed to have been started immediately following the demand for SI9011, pressure upstream of the valve would begin rising within seconds after the opening signal. If the valve does not open, the SI pumps will be dead-headed (the miniflow line will have been isolated by this point). The discharge pressure at shutoff is 1520 psig per UFSAR Table 6.3-5 (Reference 12). Since the SI pump is taking suction from the RHR system at 400 feet (maximum neglecting elevation head differences), the total discharge pressure could be as high as:

$1520 \text{ psig} + (400 \text{ ft}) \times (61.6 \text{ lb/ft}^3 \div 144 \text{ in}^2/\text{ft}^2) =$ **1691 psig**

Revision 1 Note: This value would only be used if pump discharge pressure was needed to assist in valve opening.

Zion Abnormal Operating Procedure AOP-6.3, Loss of RHR Shutdown Cooling (Reference 17), Appendix E also may require the SI9011 valves to be opened in order to replace lost coolant inventory using the SI pumps, as one of several methods of responding to low vessel level when RHR is unavailable. In this case the SI pumps will not have been running immediately before the SI9011 valves are called upon to open, unless they were being tested.

6.2 T^2 CALCULATION

6.2.1 INPUTS

Only those inputs that represent changes to the existing As-Built datasheets (Attachment G) and affect this calculation are listed below. Other changes to the As-Built datasheets listed on the change sheet were not verified and do not affect this calculation.

Differential Pressure:

Using the results of the system evaluation above, a differential pressure can be calculated for input to the T^2 program:

Pup	=	118	psi
Pdown	=	0	psi
Pbonnet	=	1310	psi

Calculate differential pressure (**DPx**) across the upstream and downstream discs:

DPup = **Pbonnet - Pup**
= 1310 - 118
= 1192 psid

DPdown = **Pbonnet - Pdown**
= 1310 - 0
= 1310 psid

The T^2 calculation program assumes that only one valve disc is subjected to differential pressure. Under the conditions described above there will be differential pressure across both discs. In calculating force required to overcome differential pressure loads the following equation is used:

Fdp = **DP * Aorifice * VF**

Where:

Aorifice is the valve seat orifice area in square inches
VF is the design valve factor which is dimensionless

Valve Factors used in this calculation are as follows:

	Measured VFclose	VF to be used
1SI88011A	.503	.65
1SI88011B	.647	.65
2SI88011A	.550	.65
2SI88011B	.891	.778*

*Based on the measured close VF of 0.9 and the following relationship:

$$VF_{open} = \frac{VF_{close}}{1 + 2\,VF_{close}\sin\theta}$$

To calculate the force required to overcome a pressure locked condition, Fdp will need to be calculated for each disc:

Fdppreslock = **Fdpup + Fdpdown**
= **(DPup * Aorifice * VF) + (DPdown * Aorifice * VF)**

Because valve factor (**VF**) and orifice area (Aorifice) are the same for both the upstream and downstream valve discs the equation can be simplified to:

Fdppreslock = **DPup** + **DPdown** * (Aorifice * **VF**)

For the T2 program input the differential pressures will be added to determine a differential pressure which is equivalent to a single seated valve by adding the upstream and downstream differential pressures:

DPequivalent = Fdpup + Fdpdown
= 1192 + 1310
= 2502 psid

Stem Factor:

The starting coefficient of frictions are from the as-left test data (Attachment F) for a well lubricated stem. These values were measured during valve closure at control switch trip and are assumed to represent the friction coefficient during unseating. The measured value will be increased by 0.05 to reflect a potentially degraded friction coefficient. This bounding value will be used in the motor gearing capacity evaluation.

1SI9011A,B use .9 to .14

2SI9011A,B use 0.15 to 0.20

Actuator Motor Terminal Voltage:

In calculation 22S-B-005E-160 Rev. 3 (Design Input 4) motor terminal voltage for 1(2) SI 9011A, B is calculated for the period of time when the 480 V busses are at there worst case voltage.

1SI9011A	392 VAC
1SI9011B	393 VAC
2SI9011A	404 VAC
2SI9011B	394 VAC

2SI9011B Valve Limiting Structural Component for the OPEN Direction:

The allowable loading for the valve disc ears was increased to 27,299 lbf by Westinghouse (Design Input 5, Attachment G).

Application Factor:

The application factor is an input into the motor gearing capacity evaluation. Per Limitorque Technical Update 93-03 this value may be set to 1.0 when degraded voltage is considered. For purposes of this calculation, the application factor for motor stall (AF_SC) will be set to .95. This additional 5% is to account for motor degradation due to elevated temperatures. In all cases the temperature degradation factor is greater than .95, therefore use of a .95 application factor is conservative.

Actuator Thrust Rating:

MOV White Paper 122 (Ref. 13) allows extension of actuator thrust limits to 162% of nominal with no reduction in the qualified life of 2000 cycles. It is used here to allow structural limits to be more accurately reflected.

Packing Loads:

The packing load issue is addressed on a case-by-case basis in section 6.3.

6.3 CAPABILITY CALCULATION RESULTS

Capability calculations will be performed for 1SI9011B, 2SI9011A and 2SI9011B. Unit 1SI9011A and 1SI9011B valves are identical and, because it has the highest static running load of the two, 1SI9011B will be used to determine the capability of the MOVs to open under pressure locked conditions. Unit 2SI9011A will be evaluated separately because its' tested stem factor is higher than the Unit 1SI9011A and 1SI9011B valves. Unit 2 SI-9011B will be evaluated separately as it is a FWG valve with a larger operator than the other three.

Results of the T^2 calculations are included as Attachment G for the nominal (current as-built design) case and Attachment H for the pressure locking case. The T^2 output was uses the design inputs currently in the controlled database and was prepared in accordance with NEP 17-02 (Ref. 10).

6.3.1 NOMINAL CASE

The nominal case is included here to allow the reader to compare the current design assumptions and results to those for the pressure locking case. It should not be used for design activities.

6.3.2 PRESSURE LOCKING CASE 1(2)SI9011A AND 1SI9011B

The T^2 program does not take credit for the "piston effect". Piston effect is the force exerted on the cross sectional area of the stem (Astem) by the pressurized fluid in the valve bonnet which actually assists valve opening. For the purpose of these evaluations piston effect will be subtracted from the minimum required thrust to open the MOV. For 1(2)SI9011A and 1SI9011B:

Where Astem = .7854 * $(1.625)^2$
= 2.07 square inches

Fpiston = Pbonnet * Astem
= 1310 * 2.07
= 2717 lbf

Pressure Locking Case 1SI9011A, B

For 1SI9011B the valve packing load coefficients (KP_O_A/KP_O_T) will be increased to account for the high running loads measured during static diagnostic testing. Packing load is calculated by multiplying the packing coefficient by the stem diameter. The measured static packing load (see ATT. F), was measured as 4988 lbf. Rounding the load up to 5,000 lbf and dividing by stem diameter :

KP_O_A/KP_O_T = Fstatic run / Dstem
= 5000 / 1625
= 3077 lbf / inch of stem diameter

Subtracting Fpiston from the minimum required thrust to OPEN 1SI9011B :

Minimum required thrust to OPEN	23571 lbf
Less Fpiston	2717 lbf
Adjusted minimum required thrust to OPEN	20854 lbf

Comparison of actuator motor gearing capacity at degraded voltage to minimum required thrust for 1SI9011B :

Actuator capacity, worst case stem mu	22272 lbf
Adjusted minimum required thrust to OPEN	20854 lbf
Margin	**1418 lbf**

Comparison of actuator structural capacity to minimum required thrust for 1SI9011B :

Actuator structural torque capacity, worst case stem mu	29891 lbf
Minimum required thrust to OPEN	20854 lbf
Margin	**9037 lbf**

Pressure Locking Case 2SI9011A

For 2SI9011A, B the valve packing load coefficients (KP_O_A/KP_O_T) will be decreased to account for the lower than assumed running loads measured during static diagnostic testing. Packing load is calculated by multiplying the packing coefficient by the stem diameter. The measured static packing load (see ATT. F), was measured as 655 lbf. Dividing by stem diameter :

KP_O_A/KP_O_T = Fstatic run / Dstem

= 655 / 1.625
= 403 lbf / inch of stem diameter

Subtracting Fpiston from the minimum required thrust to OPEN 2SI9011A :

Minimum required thrust to OPEN	19525 lbf
Less Fpiston	2717 lbf
Adjusted minimum required thrust to OPEN	16808 lbf

Comparison of actuator motor gearing capacity at degraded voltage to minimum required thrust for 2SI9011A :

Actuator capacity, worst case stem mu	16925 lbf	
Adjusted minimum required thrust to OPEN	16808 lbf	
Margin		**117 lbf**

Comparison of actuator structural capacity to minimum required thrust for 2SI9011A :

Actuator structural torque capacity, worst case stem mu	24336 lbf
Minimum required thrust to OPEN	16808 lbf
Margin	**7528 lbf**

6.3.3 PRESSURE LOCKING CASE 2SI9011B

The force required to open a double seated flexible wedge gate (FWG) valve is conservatively estimated as the sum of the differential pressure load on the valve discs plus the static unwedging force that was measured during static diagnostic testing. Recent pressure locking tests conducted by ComEd have shown that this will yield a conservative result.

The static unwedging force is not a variable which is input to T^2 and it must be added to one of the variables which is a component of the minimum required thrust. For 2SI9011B the valve packing load coefficients (KP_O_A/KP_O_T) will be increased to account for the static unwedging force. Packing load is calculated by multiplying the packing coefficient by the stem diameter. The measured static unwedging load (see ATT. F), which includes actual packing load, was measured as 9738 lbf. Rounding the load up to 10,000 lbf and dividing by stem diameter :

KP_O_A/KP_O_T = Fstatic unwedge / Dstem
= 10000 / 1.375
= 7272 lbf / inch of stem diameter

The T^2 program does not take credit for the "piston effect". Piston effect is the force exerted on the cross sectional area of the stem (Astem) by the pressurized fluid in the valve bonnet which actually assists valve opening. For the purpose of these evaluations piston effect will be subtracted from the minimum required thrust to open the MOV. For 2SI9011B:

Where Astem = .7854 * $(1.375)^2$
= 1.49 square inches

Fpiston = Pbonnet * Astem
= 1310 * 1.49
= 1952 lbf

Subtracting Fpiston from the minimum required thrust to OPEN:

Minimum required thrust to OPEN	24342 lbf
Less Fpiston	1952 lbf
Adjusted minimum required thrust to OPEN	22390 lbf

Comparison of actuator motor gearing capacity at degraded voltage to minimum required thrust:

Actuator capacity, worst case stem mu	26914 lbf
Adjusted minimum required thrust to OPEN	22390 lbf
Margin	**4524 lbf**

Comparison of actuator structural capacity to minimum required thrust for 2SI9011B :

Actuator structural thrust capacity, worst case stem mu	26400 lbf
Less adjusted minimum required thrust to OPEN	22390 lbf
Margin	**4010 lbf**

7.0 SUMMARY AND CONCLUSIONS

The worst-case system conditions (from a pressure-locking standpoint) under which valves 1(2)MOV-SI9011A&B will be required to open are:

- Downstream pressure: Near containment atmospheric pressure until valve opens.
- Upstream pressure: Ranges from 118 to 171 psi at instant of opening demand, increasing to up to 1691 psi over the next few seconds if the valve does not open, or 913 psi if the valve opens (pumps are started one at a time).
- Bonnet pressure: Up to approximately 1310 psi, the prevailing system pressure prior to shutting down the SI pump, not including any heating effects.
- Process temperature: Maximum 126.5°F; temperature will not change significantly in the brief time interval that the upstream side of the valve is depressurized.
- Comparing **1SI9011A, B** actuator motor gearing capacity, worst case stem mu, at degraded voltage to minimum required thrust there is a margin of 1418 lbf .

- Comparing **1SI9011A, B** actuator structural thrust capacity, worst case stem mu, at degraded voltage to minimum required thrust there is a margin of 9037 lbf .
- Comparing **2SI9011A** actuator motor gearing capacity, worst case stem mu, at degraded voltage to minimum required thrust there is a margin of 117 lbf .
- Comparing **2SI9011A** actuator structural thrust capacity, worst case stem mu, at degraded voltage to minimum required thrust there is a margin of 7528 lbf .
- Comparing **2SI9011B** actuator motor gearing capacity, worst case stem mu, at degraded voltage to minimum required thrust there is a margin of 4524 lbf .
- Comparing **2SI9011B** actuator structural thrust capacity, worst case stem mu, at degraded voltage to minimum required thrust there is a margin of 4010 lbf .
- Based on the results of the above calculation the actuator has margin to open under a pressure locked condition. The results of the calculation include normal provisions for expected degradation during the normal maintenance interval.
- This calculation was prepared to evaluate the capability of 1(2)MOV-SI9011A&B to open under a pressure locked condition. The results are not to be used to support design activities.

(Final)

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WESTINGHOUSE ELECTRIC CORPORATION
NUCLEAR & ADVANCED TECHNOLOGY DIVISION
ENGINEERING TECHNOLOGY/MED

COVER SHEET FOR TELECOPY NO. (412) 374-6639
WIN: 284-6639

ATTENTION: N. Bosoin

LOCATION:

TELECOPY NO.: 708-512-8660

CONFIRMATION NO.:

NOTES: Based on the review of the Wedge on the 4GM58FN valve manufactured by Velan at Locations 9010 and 9011 (Dwg 88517-3) the following allowable loads were determined at a temperature of 110F. The allowable is based on the original NDE Testing requirements applied to the wedge in equipment Specification G-676258.

Closing Load - Wedge Rate - 31355 lb., Open Load - Ears - 27099 lb.

NOTE: If NDE requirements change from original, Loads may require re-evaluation

FROM: J Mosby **PHONE:** 6401

DATE: 1/27/94 **TELECOPY NO.:** (412) 374-6639
WIN: 284-6639
or: 284-6647

NUMBER OF PAGES INCLUDING COVER SHEET 1

ATTACHMENT: G PAGE: 61 OF 1
Comed Calculation No:
225-B-005M-162 Rev 1

Station: ZION	Valve Number : 2SI9011B	RSMDS Revision Number:

COMMENTS : STATIC WR#Z35927 EVALUATED 2-19-94. TEST WAS AUX SENSOR TEST. I ASSOCIATED STATIC TEST DATA TAKEN FROM UPDATE OF TEST 8 WITH 2.31 DATED I 7-12-93. TCF FOR THAT UPDATE IS 1.215. DP TEST RE-EVALUATED USING I PI-15 ON 12/30/93. C14 FROM THE ASSOCIATED STATIC TEST WAS NOT ENTERED I SINCE IT WAS AT A LOWER TSS. SP TEST WAS USED FOR TORQUE AT CST FOR THE I DP TEST. WR#Z16985. DESIGN INPUTS FROM RSMDS "AS-BUILT 02/06/95 I 18:05. ON 10/07/94, THE VALVE FACTOR WAS INCREASED BASED ON CHRON # I 211374. SINCE THE LIMIT SWITCH IS CONTROLLING C14, AN ESTIMATE OF C14 I TORQUE IS REQUIRED. BASED ON THE EVALUATION OF THE STATIC TEST RESULTS, I THE COF WAS 0.07. TO BE CONSERVATIVE , A COF OF 0.15 WAS USED TO I CALCULATE C14 TORQUE. 4827 X 0.0171 = 82.5 FT-LBS.

Preparer: _____ 5/31/95
Compiles appropriate information and Inputs to Program.

Reviewer: John A. Speed 5/31/95
Ensures compiled information is appropriate and input correctly.

Approver: _____ 5/31/95
Certifies Preparer and Reviewer are Qualified.

Station: ZION	Valve Number : 2SI9011B	RSMDS Revision Number:

Design Inputs:

Ranking:	LOW	PRA Rank:		Vendor :	VELAN
Valve Type :	GATE	Model:	4GM58FN	Pres. Class :	1500
Valve Size :	4	Seat Diameter :	3.06	Orifice Diameter:	3.063
Seat Angle:	5.00	LSBT / VUF:	0.95 : 0.80	THIF/TQIF :	1.00 : 1.00
Actuator :	SMB-0-40	Shop Order No. :	362506C	Spring Pack:	0501-184
Torque Min/Max:	87 : 500	TSS Min/Max:	1 : 3	Eff- Pull/Run/StallP:	40 : 55 : 55
OAR :	41.3				
Motor Start/Stall :	40 : 49	Motor Size:		Rate Voltage/Type:	460 : AC
Motor RPM:	1800	Motor Frame:	0	Brake Torque :	
Stem Dia. Valve/Act:	1.375 : 1.375	Pitch:	1/3	Lead:	2/3
Test/Found COF:	0.150 : 0.200	Stem Thread:	STANDARD	Packing Coefficient:	1000

DBD INFO:

Line Pres O/C:	1705 : 33	dP Open/Close :	1695 : 33	AMB Temperature (F):	130
UV O/C:	397 : 397	Flow:	N/A	Media:	LIQUID

dP Test INFO

Test Date :	01/16/93	Test Number:	13	Associated Static Test Date :	01/15/93
TSS :	1.75	RR Running Torque:		Test Number:	8
Line Pres. Open:				Line Pres. Open:	0
Line Pres. Close :				Line Pres. Close:	0
Measured Close dP :	1510	Max Thrust Opening:	10164	Hard Seat Contact :	193
Max Up to and Including Hard Seat:	10215	Torque at CST:	199	Average Running Close :	62
Close Running :	165	Torque Location:	TSP		
Thrust at CST	13174			CST Thrust :	

DP Results

Measured COF :	0.114	Valve Condition :	131	RR Required Torque Close:	
Valve Factor Close:	0.891	Extrapolator Flow Cutoff:	10264	DP Margin Close:	321.1 %
Measured ROL:	5.0 %	Extrapolated Max Pullout Thrust :	10164	Pullout Margin:	63.9 %

STATION : ZION	Valve Number: 2SI9011B	RSMDS Revision Number:

Static Test INFO

Test Date/Number :	02/18/94 : 6	Close Control:	LS	TSS :	1.00
AVG Run Close:	463	Thrust @ CST :	4827	Torque @ CST :	82.5
AVG Run Open:	1837	Max Thrust Close:	16812	Max Torque Close:	
Thrust @ Hard Seat Contact:	915	Max Thrust Open:	9738	RR Running Torque:	
				Torque Location:	VTC

Static Results

Valve Condition:	452	Measured COF Close:	0.150	Max Torque Close:	287.5
Rate of Loading Used :	5.0 %	Measured Stem Factor:	0.017	RR Req'd Torque	
Operability Valve Factor:	0.900	SF(.08)/SF(Measured):	1.000		

	MRT		Margin		MGC		Margin	
(VF = gate/globe)	Close	Open	Close	Open			Open	Close
VF = 0.2/0.9:	1066	9738	3955.0	65.4 %	Full Voltage & WP:	56361	82.7 %	91.4 %
VF = 0.3/1.0:	1092	9738	3858.4	65.4 %	Under Voltage:	35619	72.7 %	86.4 %
VF = 0.4/1.1:	1117	9738	3769.8	65.4 %	w/ UV & WP-125 :	41980	76.8 %	88.5 %
VF = 0.5/1.2:	1143	9738	3681.8	65.4 %	w/ UV & Temp. Eff.:	38714	74.8 %	87.5 %
VF = 0.6/1.3:	1168	9738	3600.9	65.4 %	w/ UV, Temp Eff., WP-125, & Brake:	43226	77.5 %	88.8 %
VF = 0.7/1.4:	1194	9738	3520.3	65.4 %				
VF = 0.8/1.5:	1220	9738	3443.1	65.4 %	Motor Pullout Capability:	28155	65.4 %	
VF = 0.9/1.6:	1245	9738	3372.0	65.4 %				
VF = 1.0/1.7:	1271	9738	3300.9	65.4 %	Act. Thrust Limit:	26400	63.1 %	36.3 %
VF = 1.1/1.8:	1296	9738	3235.3	65.4 %	Kalsi Thrust Limit :	38880	75.0 %	56.8 %
VF = 1.2/1.9:	1322	10326	3169.7	63.3 %	Act. Torque Limit:	550		47.7 %
Operability VF:	1245	9738	3372.0	65.4 %				

Seismic Limiting Component Close:	YOKE LEGS	Seismic Thrust Limit:	28900	Seismic Thrust Margin:	41.8 %
Valve Limiting Component Close:	DISC - PLATE	Weak Link Close Thrust:	19492	Weak Link Margin Close:	13.7 %
Valve Limiting Component Open :	DISC - EARS	Weak Link Open Thrust:	20202	Weak Link Margin Open:	51.8 %

Prepared with MOV Operability Review Program ver. 940507 Printed: 05/31/95 02:28:40 PM

Printed with Form Rev: 0

Station: ZION	Valve Number : 2SI9011A	RSMDS Revision Number:

COMMENTS : DP TESTS WERE RE-EVALUATED USING PI-15 ON 12-16-93. STATIC WR#Z35928. I DP TORQUE AT CST FROM WR#Z16984. DESIGN INPUTS FROM RSMDS "AS-BUILT I 02/24/95 16:08". ON 10/07/94, THE VALVE FACTOR WAS INCREASED BASED ON I CHRON # 211374. SINCE THE LIMIT SWITCH IS CONTROLLING C14, AN ESTIMATE I OF TORQUE IS REQUIRED AT C14. BASED ON THE STATIC TEST RESULTS, THE STEM I IS NON-LOCKING. THEREFORE, IT CAN SHOWN THAT THE COF IS LESS THAN 0.15. I TO BE CONSERVATIVE A COF OF 0.15 WILL BE USED AND THE TORQUE FOR C14 I WILL BE ESTIMATED. 11752 X 0.0191 = 224.5 FT-LBS.

Preparer: [signature] 5/31/95
Compiles appropriate information and Inputs to Program.

Reviewer: [signature] 5/31/95
Ensures compiled information is appropriate and input correctly.

Approver: [signature] 5/31/95
Certifies Preparer and Reviewer are Qualified.

Station: ZION	Valve Number : 2SI9011A	RSMDS Revision Number:

Design Inputs:

Ranking:	LOW	PRA Rank:		Vendor :	ANCHOR/DARLING
Valve Type :	GATE DD	Model:	4GM58FN	Pres. Class :	1500
Valve Size :	4	Seat Diameter :	3.81	Orifice Diameter:	3.813
Seat Angle:	0.00	LSBT / VUF:	0.95 : 0.40	THIF/TQIF :	1.00 : 1.00
Actuator :	SMB-0-15	Shop Order No. :	348862A	Spring Pack:	0501-184
Torque Min/Max:	87 : 500	TSS Min/Max:	1 : 3	Eff- Pull/Run/StallP:	40 : 50 : 55
OAR :	69.6				
Motor Start/Stall :	15 : 20	Motor Size:		Rate Voltage/Type:	460 : AC
Motor RPM:	3600	Motor Frame:	0	Brake Torque :	
Stem Dia. Valve/Act:	1.625 : 1.625	Pitch:	1/3	Lead:	2/3
Test/Found COF:	0.150 : 0.200	Stem Thread:	STUB	Packing Coefficient:	1000

DBD INFO:

Line Pres O/C:	1705 : 33	dP Open/Close :	1695 : 33	AMB Temperature (F):	130
UV O/C:	411 : 411	Flow:	N/A	Media:	LIQUID

dP Test INFO

Test Date :	01/16/93	Test Number:	18	Associated Static Test Date :	01/16/93
TSS :	2.25	RR Running Torque:		Test Number:	16
Line Pres. Open:				Line Pres. Open:	0
Line Pres. Close :				Line Pres. Close:	0
Measured Close dP :	1455	Max Thrust Opening:	5019	Hard Seat Contact :	1939
Max Up to and Including Hard Seat:	12334	Torque at CST:	279	Average Running Close :	1391
Close Running :	2650	Torque Location:	TSP		
Thrust at CST	14729			CST Thrust :	16395

DP Results

Measured COF :	0.147	Valve Condition :	548	RR Required Torque Close:	
Valve Factor Close:	0.550	Extrapolator Flow Cutoff:	12402	DP Margin Close:	72.8 %
Measured ROL:	10.2 %	Extrapolated Max Pullout Thrust :	8498	Pullout Margin:	50.3 %

STATION : ZION	Valve Number: 2SI9011A	RSMDS Revision Number:

Static Test INFO

Test Date/Number :	02/06/94 : 3	Close Control:	LS	TSS :	1.50
AVG Run Close:	1098	Thrust @ CST :	11752	Torque @ CST :	224.5
AVG Run Open:	655	Max Thrust Close:	25109	Max Torque Close:	
Thrust @ Hard Seat Contact:	1889	Max Thrust Open:	1096	RR Running Torque:	
				Torque Location:	TSP

Static Results

Valve Condition:	791	Measured COF Close:	0.150	Max Torque Close:	479.6
Rate of Loading Used :	10.2 %	Measured Stem Factor:	0.019	RR Req'd Torque	
Operability Valve Factor:	0.650	SF(.08)/SF(Measured):	1.000		

	MRT		Margin		MGC		Margin	
(VF = gate/globe)	Close	Open	Close	Open			Open	Close
VF = 0.2/0.9:	2263	1433	847.1 %	91.6 %	Full Voltage & WP:	26024	95.8 %	54.8 %
VF = 0.3/1.0:	2305	3368	829.8 %	80.3 %	Under Voltage:	19636	94.4 %	40.2 %
VF = 0.4/1.1:	2347	5304	813.2 %	69.0 %	w/ UV & WP-125 :	20775	94.7 %	43.4 %
VF = 0.5/1.2:	2389	7239	797.1 %	57.7 %	w/ UV & Temp. Eff.:	21382	94.9 %	45.0 %
VF = 0.6/1.3:	2431	9175	781.6 %	46.4 %	w/ UV, Temp Eff., WP-125, & Brake:	21432	94.9 %	45.2 %
VF = 0.7/1.4:	2472	11110	767.0 %	35.1 %	Motor Pullout Capability:	17106	93.6 %	
VF = 0.8/1.5:	2514	13046	752.5 %	23.7 %				
VF = 0.9/1.6:	2556	14981	738.5 %	12.4 %	Act. Thrust Limit:	26400	95.8 %	4.9 %
VF = 1.0/1.7:	2598	16917	724.9 %	1.1 %	Kalsi Thrust Limit :	38880	97.2 %	35.4 %
VF = 1.1/1.8:	2640	18852	711.8 %	-10.2 %	Act. Torque Limit:	550		12.8 %
VF = 1.2/1.9:	2682	20788	699.1 %	-21.5 %				
Operability VF:	2451	10143	774.4 %	40.7 %				

Seismic Limiting Component Close: BODY-BONNET FLNG	Seismic Thrust Limit: 33100	Seismic Thrust Margin:	24.1 %
Valve Limiting Component Close: OPR & YOKE BOLTS	Weak Link Close Thrust: 52800	Weak Link Margin Close:	52.4 %
Valve Limiting Component Open : DISC THREADS	Weak Link Open Thrust: 53450	Weak Link Margin Open:	97.9 %

Prepared with MOV Operability Review Program ver. 940507 Printed: 05/31/95 01:51:38 PM
Printed with Form Rev: 0

Station: ZION	Valve Number: 1SI9011B	RSMDS Revision Number:

COMMENTS : STATIC WR#940029677, EVALUATED 10/10/95. ASS STATIC WR#Z34544, I EVALUATED 1-29-94. DP WR#Z27435, EVALUATED10-2-94. DESIGN INPUTS FROM I RSMDS AS-BUILT 2/24/95 16:13. 100% BYPASS OF CLOSE TORQUE SWITCH.

Preparer: _____ 11 16 95
Compiles appropriate information and Inputs to Program.

Reviewer: _____ 11/16/95
Ensures compiled information is appropriate and input correctly.

Approver: _____ 11/20/95
Certifies Preparer and Reviewer are Qualified.

Station: ZION	Valve Number : 1SI90T1B	RSMDS Revision Number:

Design Inputs:

Ranking:	LOW	PRA Rank:		Vendor :	ANCHOR/DARLING
alve Type :	GATE DD	Model:	4GM58FN	Pres. Class :	1500
Valve Size :	4	Seat Diameter :	3.81	Orifice Diameter:	3.813
Seat Angle:	0.00	LSBT / VUF:	0.95 0.40	THIF/TQIF :	1.00 : 1.00
Actuator :	SMB-0-15	Shop Order No. :	345629C1	Spring Pack:	0501-184
Torque Min/Max:	87 : 500	TSS Min/Max:	1 3	Eff- Pull/Run/StallP:	40 : 50 : 55
OAR :	78.8				
Motor Start/Stall :	15 20	Motor Size:		Rate Voltage/Type:	460 AC
Motor RPM:	3600	Motor Frame:	0	Brake Torque :	
Stem Dia. Valve/Act:	1.625 : 1.625	Pitch:	1/3	Lead:	2/3
Test/Found COF:	0.150 : 0.200	Stem Thread:	STUB	Packing Coefficient:	1000

DBD INFO:

Line Pres O/C:	1705 : 33	dP Open/Close :	1695 : 33	AMB Temperature (F):	130
UV O/C:	398 : 398	Flow:	N/A	Media:	LIQUID

dP Test INFO

Test Date :	02/20/94	Test Number:	9	Associated Static Test Date :	01/29/94
TSS :	1.25	RR Running Torque:		Test Number:	8
Line Pres. Open:				Line Pres. Open	
Line Pres. Close :				Line Pres. Close:	
Measured Close dP :	1493	Max Thrust Opening:	6287	Hard Seat Contact :	1963
Max Up to and Including Hard Seat:	13467	Torque at CST:	114	Average Running Close :	2284
Close Running :	2435	Torque Location:	VTC		
Thrust at CST	15640			CST Thrust :	7837

DP Results

Measured COF :	-0.023	Valve Condition :	0	RR Required Torque Close:	
Valve Factor Close:	0.647	Extrapolator Flow Cutoff:	13535	DP Margin Close:	119.9 %
Measured ROL:	-99.6 %	Extrapolated Max Pullout Thrust :	11273	Pullout Margin:	37.9 %

STATION: ZION	Valve Number: 1SI9011B	RSMDS Revision Number:

Static Test INFO

Test Date/Number:	10/10/95 : 7	Close Control:	LS	TSS:	1.75
AVG Run Close:	5073	Thrust @ CST:	11646	Torque @ CST:	170.52
AVG Run Open:	4988	Max Thrust Close:	20583	Max Torque Close:	300.97
Thrust @ Hard Seat Contact:	5032	Max Thrust Open:	5423	RR Running Torque:	
				Torque Location:	VTC

Static Results

Valve Condition:	0	Measured COF Close:	0.085	Max Torque Close:	301
Rate of Loading Used:	-99.6 %	Measured Stem Factor:	0.015	RR Req'd Torque	
Operability Valve Factor:	0.650	SF(.08)/SF(Measured):	1.000		

(VF = gate/globe)	MRT Close	MRT Open	Margin Close	Margin Open
VF = 0.2/0.9:	5217	5423	470.6 %	70.1 %
VF = 0.3/1.0:	5254	7343	466.6 %	59.6 %
VF = 0.4/1.1:	5292	9279	462.5 %	48.9 %
VF = 0.5/1.2:	5330	11214	458.5 %	38.3 %
VF = 0.6/1.3:	5368	13150	454.5 %	27.6 %
VF = 0.7/1.4:	5405	15085	450.7 %	16.9 %
VF = 0.8/1.5:	5443	17021	446.9 %	6.3 %
VF = 0.9/1.6:	5481	18956	443.1 %	-4.4 %
VF = 1.0/1.7:	5518	20892	439.5 %	-15.0 %
VF = 1.1/1.8:	5556	22827	435.8 %	-25.7 %
VF = 1.2/1.9:	5594	24763	432.1 %	-36.4 %
Operability VF:	5386	14118	452.7 %	22.3 %

MGC		Margin Open	Margin Close
Full Voltage & WP:	38545	85.9 %	69.8 %
Under Voltage:	27273	80.1 %	57.3 %
w/ UV & WP-125:	28855	81.2 %	59.6 %
w/ UV & Temp. Eff.:	29699	81.7 %	60.8 %
w/ UV, Temp Eff., WP-125, & Brake:	29767	81.8 %	60.9 %
Motor Pullout Capability:	18161	70.1 %	
Act. Thrust Limit:	26400	79.5 %	22.0 %
Kalsi Thrust Limit:	38880	86.1 %	47.1 %
Act. Torque Limit:	550		45.3 %

Seismic Limiting Component Close:	BODY-BONNET FLNG	Seismic Thrust Limit:	33100	Seismic Thrust Margin:	37.8 %
Valve Limiting Component Close:	OPER & YOKE BOLTS	Weak Link Close Thrust:	52800	Weak Link Margin Close:	61.0 %
Valve Limiting Component Open:	DISC THREADS	Weak Link Open Thrust:	53450	Weak Link Margin Open:	89.9 %

Prepared with MOV Operability Review Program ver. 940507 Printed: 11/16/95 12:06:30 PM

Printed with Form Rev: 0

Station: ZION	Valve Number: 1SI9011A	RSMDS Revision Number:

COMMENTS : STATIC WR #940029678. DESIGN INPUT FROM RSMDS REV "AS-BUILT 02/24/95 16:12". TEST AFTER CHANGE TO LIMIT CLOSE CONFIGURATION. SEISMIC LIMIT PER CHRON #215456 DATED 9/14/95.

ASSOCIATED STATIC AND DP WR #Z27435. THESE TESTS WERE PERFORMED WITH THE CLOSE TORQUE SWITCH BYPASS SET AT 100%, SIMULATING A LIMIT CLOSE CONFIGURATION. THE C14 THRUST WERE REMOVED SO THE SOFTWARE WOULD APPLY A 5% ROLF.

Preparer: _____ 11/10/95
Compiles appropriate information and Inputs to Program.

Reviewer: _____ 11/14/95
Ensures compiled information is appropriate and input correctly.

Approver: _____ 11/14/95
Certifies Preparer and Reviewer are Qualified.

Station: ZION	Valve Number : 1SI90T1A	RSMDS Revision Number:

Design Inputs:

Ranking:	LOW	PRA Rank:		Vendor :	ANCHOR/DARLING
alve Type :	GATE DD	Model:	4GM58FN	Pres. Class :	1500
Valve Size :	4	Seat Diameter :	3.81	Orifice Diameter:	3.813
Seat Angle:	0.00	LSBT / VUF:	0.95 0.40	THIF/TQIF :	1.00 : 1.00
Actuator :	SMB-0-15	Shop Order No. :	348862A	Spring Pack:	0501-184
Torque Min/Max:	87 : 500	TSS Min/Max:	1 3	Eff- Pull/Run/StallP:	40 : 50 : 55
OAR :	69.6				
Motor Start/Stall :	15 20	Motor Size:		Rate Voltage/Type:	460 AC
Motor RPM:	3600	Motor Frame:	0	Brake Torque :	
Stem Dia. Valve/Act:	1.625 : 1.625	Pitch:	1/3	Lead:	2/3
Test/Found COF:	0.150 : 0.200	Stem Thread:	STUB	Packing Coefficient:	1000
DBD INFO:					
Line Pres O/C:	1705 : 33	dP Open/Close :	1695 : 33	AMB Temperature (F):	130
UV O/C:	393 : 393	Flow:	N/A	Media:	LIQUID

dP Test INFO

Test Date :	02/20/94	Test Number:	5	Associated Static Test Date :	02/20/94
TSS :	1	RR Running Torque:		Test Number:	1
Line Pres. Open:				Line Pres. Open	
Line Pres. Close :				Line Pres. Close:	
Measured Close dP :	1459	Max Thrust Opening:	3640	Hard Seat Contact :	678
Max Up to and Including Hard Seat:	10843	Torque at CST:	0	Average Running Close :	124
Close Running :	1906	Torque Location:			
Thrust at CST	0			CST Thrust :	0

DP Results

Measured COF :	-0.078	Valve Condition :	554	RR Required Torque Close:	
Valve Factor Close:	0.503	Extrapolator Flow Cutoff:	10911	DP Margin Close:	139.9 %
Measured ROL:	5.0 %	Extrapolated Max Pullout Thrust :		Pullout Margin:	

STATION: ZION	Valve Number: TSI90111A	RSMDS Revision Number:

Static Test INFO

Test Date/Number :	09/26/95 : 5	Close Control:	LS	TSS :	1.00
AVG Run Close:	475	Thrust @ CST :	10916	Torque @ CST :	155.63
AVG Run Open:	523	Max Thrust Close:	29571	Max Torque Close:	440.94
Thrust @ Hard Seat Contact:	456	Max Thrust Open:	1243	RR Running Torque:	
				Torque Location:	VTC

Static Results

Valve Condition:	0	Measured COF Close:	0.081	Max Torque Close:	440.9
Rate of Loading Used :	5.0 %	Measured Stem Factor:	0.014	RR Req'd Torque	
Operability Valve Factor:	0.650	SF(.08)/SF(Measured):	1.000		

(VF = gate/globe)	MRT Close	MRT Open	Margin Close	Margin Open
VF = 0.2/0.9:	651	1243	3920.5	92.1 %
VF = 0.3/1.0:	691	2745	3687.8	82.4 %
VF = 0.4/1.1:	731	4681	3480.5	70.1 %
VF = 0.5/1.2:	770	6616	3299.1	57.7 %
VF = 0.6/1.3:	810	8552	3131.3	45.3 %
VF = 0.7/1.4:	850	10487	2979.2	32.9 %
VF = 0.8/1.5:	889	12423	2844.1	20.6 %
VF = 0.9/1.6:	929	14358	2717.4	8.2 %
VF = 1.0/1.7:	969	16294	2601.1	-4.2 %
VF = 1.1/1.8:	1008	18229	2496.6	-16.6 %
VF = 1.2/1.9:	1048	20165	2397.5	-28.9 %
Operability VF:	830	9520	3053.4	39.1 %

	MGC	Margin Open	Margin Close
Full Voltage & WP:	34759	96.4 %	68.6 %
Under Voltage:	23980	94.8 %	54.5 %
w/ UV & WP-125 :	25371	95.1 %	57.0 %
w/ UV & Temp. Eff.:	26113	95.2 %	58.2 %
w/ UV, Temp Eff., WP-125, & Brake:	26173	95.3 %	58.3 %
Motor Pullout Capability:	15640	92.1 %	
Act. Thrust Limit:	26400	95.3 %	-12.0 %
Kalsi Thrust Limit :	38880	96.8 %	23.9 %
Act. Torque Limit:	550		19.8 %

Seismic Limiting Component Close:	BODY-BONNET BOLTING	Seismic Thrust Limit:	38500	Seismic Thrust Margin:	23.2 %
Valve Limiting Component Close:	OPER & YOKE BOLTS	Weak Link Close Thrust:	52800	Weak Link Margin Close:	44.0 %
Valve Limiting Component Open :	DISC THREADS	Weak Link Open Thrust:	53450	Weak Link Margin Open:	97.7 %

Prepared with MOV Operability Review Program ver. 940507 Printed: 11/10/95 11:02:17 AM

Printed with Form Rev: 0

CHANGE LIST

Station: ZION System: SI Valve No: 2SI90118 PARAMETER

CHANGED: 02/09/96 14:12:42 PRINTED: 02/09/96 14:12:42

FIELD NAME	AS-BUILT VALUE	CHANGED VALUE	FIELD NAME	AS-BUILT VALUE	CHANGED VALUE
POP	1705	1310	DPOP	1695	2502
THIF	1.00	1.40	TQIF	1.00	1.40
SEF_O_A	0.780	0.778	SEF_O_T	0.780	0.778
KP_O_T	1000	7272	KP_O_A	1000	7272
AF	0.900	1.000	MR_FAC	0.977	0.978
MVOP	397	394	ALLTOP	20202	27299
C_DATE	02/06/95	02/09/96	C_TIME	10:37:32	14:12:42
PREP	PSESR		RVWR	DAVIEJX	

TARGET THRUST WORKSHEET

T2 v 3.1 Copyright ComEd 1994 CODE TESTED OK: 02/09/96 14:12 PARAMETER 2SI9011B
ZION SI SYSTEM
GATE VALVE:RUN EFF. USED FOR ISOLATION SERVICE
Valve Type/Service: GATE /I Valve Size: 4.00 in Equip.Tol.(O/C): 9.00/ 9.00% Thrust Rating: 24000 lbs

Springpack No: 0501-184 CS.Tol.(O/C): 0.0/ 5.0% TCFOa: 1.000 TCFOt: 1.000 Actuator Type: SMB-0-40
TCFCa: 1.000 TCFCt: 1.000
[redacted] Rating: 40.0 ft-lbs Nominal Speed: 1800 rpm Rated Voltage: 460 VAC OGR: 41.30L Torque Rating: 500 ft-lbs

Stem Dia (V/A): 1.375/1.375 in Pitch:Lead: 1/3 :2/3 Stem Factor: 0.0200 ft (μa=0.200) StFμa/StFμt: 1.1696 ASR: 1.10
0.0171 ft (μt=0.150) ASRG: 1.10
Stem Travel: 3.625 in Stem Speed: 27.44 ipm Stroke Time: 7.93/ 12 secs Thread: STANDARD THIF: 1.40
VUF: 0.80 TQIF: 1.40
Env Tp/MR Fac: 54.4°C/0.978 SeF(Oa/Ot): 0.778/0.778 SeF(Ca/Ct): 0.900/0.900 VC: 0 lbs ROLF: 0.950

CLOSING DIRECTION

μt=0.150				μa=0.200			
TSS Sprgpk	28900 YOKE LEGS (S)			TSS Sprgpk	28900 YOKE LEGS (S)		
	26400 ACT STRUC LMT THRST(C)				26400 ACT STRUC LMT THRST(C)		
	26125 ACT STRUC LMT TORQ(C)				26125 ACT STRUC LMT TORQ(C)		
LmtCls +10%	19492 DISC-PLATE	65090 Motor Stall Max		LmtCls +10%	19492 DISC-PLATE	55652 Motor Stall Max	
3.00 LmtCls Top Top	13923 (12623) DISC-PLATE/1.40	25959 [25388] Motor Stall Cap		3.00 LmtCls Top Top	13923 (12623) DISC-PLATE/1.40	25959 [25388] Motor Stall Cap	
	23571 (21371) Static Tst Lmt ACT STRUC LMT THRST(O)/1.40/0.80	32146 (29146) Degraded Mtr Cap			21166 (19190) Static Tst Lmt MOTOR GEARING(O)/1.40/0.80	32146 (29146) Degraded Mtr Cap	
		31439 (28504) Elev Tp Mtr Cap				31439 (28504) Elev Tp Mtr Cap	
1.00 5088 Bot Bot	1812 Minimum * 1.103 Tol=(5.00^2+ 9.00^2)^0.5=10.30%	1424 (4%) Running Load		1.00 4350 Bot Bot	1812 Minimum * 1.103 Tol=(5.00^2+ 9.00^2)^0.5=10.30%	1424 (4%) Running Load	
4579 -10%	1643 Minimum Required	1375 Packing Load		3915 -10%	1643 Minimum Required	1375 Packing Load	

OPENING DIRECTION

μt=0.150				μa=0.200			
TSS Sprgpk	32164 ACT STRUC LMT TORQ(O)	24010 (22028) Backseat Limit		TSS Sprgpk	28900 YOKE LEGS (S)	24010 (22028) Backseat Limit	
	28900 YOKE LEGS (S)				27500 ACT STRUC LMT TORQ(O)		
	27299 DISC EARS				27299 DISC EARS		
32164 +10%	26400 (24220) ACT STRUC LMT THRST(O)	65090 Motor Stall Max		27500 +10%	26400 (24220) ACT STRUC LMT THRST(O)	55652 Motor Stall Max	
3.00 29240 Top Top		31478 [30785] Motor Stall Cap		3.00 25000 Top Top		26914 [26321] Motor Stall Cap	
1.75 14145 Max Max		28350 (26009) Degraded Mtr Cap		2.00 14675 Max Max		24239 (22238) Degraded Mtr Cap	
3.00 29240 Min Min	31033 Min.*1.090*1.170 StFμa/StFμt = 1.170	27726 (25437) Elev Tp Mtr Cap		3.00 25000 Min Min	26533 Min.*1.090	23706 (21748) Elev Tp Mtr Cap	
1.00 5088 Bot Bot	26533 Minimum * 1.090 Tol=(0.00^2+ 9.00^2)^0.5= 9.00%	9999 (36%) Running Load		1.00 4350 Bot Bot	26533 Minimum * 1.090 Tol=(0.00^2+ 9.00^2)^0.5= 9.00%	9999 (42%) Running Load	
4579 -10%	24342 Minimum Required	9999 Packing Load		3915 -10%	24342 Minimum Required	9999 Packing Load	

Remarks: _____

T2 v3.1 [redacted]ght ComEd 1994 CODE TESTED OK: 02/09/96 14:12 THRUST WINDOW CALCUL[redacted]FOR ZION SI VALVE 2SI9011B PARAMETER [redacted]

Valve Type/Service(VALVE_TYPE/VALVE_SERV): GATE :I
Valve Size/Class (VALVE_SIZE/VLVPRESCLS): 4.00:1500
Vendor (VENDOR): VELAN
Valve Model No. (MODEL_NO): 4GM58FN
System Design P/T (SYS_DES_PR/SYS_DES_TP): 2485:650
Opening Press. - Line/dP (POP/DPOP): 1310:2502
Closing Press. - Line/dP (PCL/DPCL): 33: 33
Flow Direction/Media (FLOW/MEDIA): N/A :LIQUID
Contact Seat/Orifice Dia. (SED/ORI_DIA): 3.0630: 3.0630
Seat Factor - Open (SEF_O_A/SEF_O_T): 0.778 :0.778
Seat Factor - Close (SEF_C_A/SEF_C_T): 0.900 :0.900
Stem Diameter - Valve/Act. (STD/STD_A): 1.375:1.375
Packing Load Coeffs (KP_O_A/KP_O_T): 7272:7272
Packing Load Coeffs (KP_C_A/KP_C_T): 1000:1000
Thread (THREAD): STANDARD
Pitch/Lead (PITCH/LEAD): 1/3 :2/3
μa/μt (MU_A/MU_T): 0.200:0.150
Vlv Cond/ROLF/Vlv Unwdg Fac (VC/ROLF/VUF): 0:0.950:0.80
Inertia Factor - Thrust/Torque(THIF/TQIF): 1.40:1.40
Stem Factor - As-Found/Test (STF_A/STF_T): 0.0200:0.0171
TCF(O) @ μa/μt (ET_CF_O_A/ET_CF_O_T): 1.442:1.356
TCF(C) @ μa/μt (ET_CF_C_A/ET_CF_C_T): 1.442:1.356
SHEET _____ OF _____
9602091412 PID No: GN09406

App Fac/Stall Cap App Fac[redacted] (AF/AF_SC): 1.000:0.950
Environmental Temperature (ENV_TEMP): 54.4
Motor Rating-Start/Degrade Fac.(MR/MR_FAC): 40.0:0.978
Motor Rating-Stall/Cap Fac. (MR_S/MR_S_SC): 49.00:0.9541
Motor Voltage - Op/Cl/SW (MVOP/MVCL/VSW): 394:397:DV
Rated Voltage/Motor Type (RV/AC_DC): 460:AC
Locked Rotor Current (LK_RTR_I): 38.00
Thermal Overload Size (T_OVRL_SZ): CR123C5.92A
Motor RPM/Full Ld Fac. (MOTOR_RPM/RPM_FAC): 1800:0.9444
Stem Speed/IST Stroke Time(STS/REQD_ST_TM): 27.44: 12
Stem Travel (ST_TRVL): 3.625
Stem Material (ST_MAT): A461.17-4PH

Limiting Component(O)	Thrust	Temp	Factor
DISC EARS (LMT_CMP_OP)	27299 (ALLTOP)	0 (ALLTOP_TP)	1.000 (ALLTOP_FAC)
BONNET (LMT_CMP_O2)	42325 (ALLTOP2)	0 (ALLTOP_TP2)	
YOKE LEGS (S) (SEI_CMP_OP)	28900 (SEI_OP)	0 (SEI_OP_TP)	1.000 (SEI_OP_FAC)

Limiting Component(C)	Thrust	Temp	Factor
DISC-PLATE (LMT_CMP_CL)	19492 (ALLTCL)	0 (ALLTCL_TP)	1.000 (ALLTCL_FAC)
BONNET (LMT_CMP_C2)	42325 (ALLTCL2)	0 (ALLTCL_TP2)	
YOKE LEGS (S) (SEI_CMP_CL)	28900 (SEI_CL)	0 (SEI_CL_TP)	1.000 (SEI_CL_FAC)

Backseat Lmt/Seat Angle(BK_ST_LMT/SEAT_ANGLE): 24010: 5.0

Actuator Vendor (ACTVENDOR): [redacted]ITORQUE
Shop Order No. (SHP_ORD_NO): 362506C
Actuator Model (ACTMODELNO): SMB-0-40
Act. Thrust Rating/ASR (ATR/ASR): 24000:1.10
Act. Torque Rating/ASRG (MATR/ASRG): 500:1.10
Overall Unit Ratio/L (OAR/LOCK_GS): 41.30:L
Eff.-Pull/Run/Stall/Stall Cap (EFFP/EFFR/EFFS/EFFSC): 40:55:55:40
Spring Pack No./LC (SPRG_PK_NO/LC): 0501-184 :L
Torq. Output-Min/Max(TO_MIN/TO_MAX): 87: 500
TSS - Min/Max (MIN_TSS/MAX_TSS): 1.00:3.00
Equip.Tol.(O)-Th/CS(ET_TH_O/ET_CS_O): 9.00: 0.00
Equip.Tol.(C)-Th/CS(ET_TH_C/ET_CS_C): 9.00: 5.00

Packing Load	
As-Left (Open/Close):	9999 lbs / 1375 lbs
As-Found (Open/Close):	9999 lbs / 1375 lbs
Running Load	
As-Left (Open/Close):	9999 lbs / 1424 lbs
As-Found (Open/Close):	9999 lbs / 1424 lbs
Minimum Required Thrust	
As-Left (Open/Close):	24342 lbs / 1643 lbs
As-Found (Open/Close):	24342 lbs / 1643 lbs

	OPENING								CLOSING							
	Pullout		Run		Stall Capacity		Stall		Pullout		Run		Stall Capacity		Stall	
Gear Efficiency	40	40	55	55	40	40	55	55	40	40	55	55	40	40	55	55
Motor Rating	40.0	40.0	40.0	40.0	46.75	46.75	49.00	49.00	40.0	40.0	40.0	40.0	46.75	46.75	49.00	49.00
Voltage	394AC	394AC	394AC	394AC	394AC	394AC	460AC	460AC	397AC	397AC	397AC	397AC	397AC	397AC	460AC	460AC
Application Factor	1.000	1.000	1.000	1.000	0.950	0.950	1.000	1.000	1.000	1.000	1.000	1.000	0.950	0.950	1.000	1.000
Coefficient of Friction	0.200	0.150	0.200	0.150	0.200	0.150	0.200	0.150	0.200	0.150	0.200	0.150	0.200	0.150	0.200	0.150
Stem Factor	0.0200	0.0171	0.0200	0.0171	0.0200	0.0171	0.0200	0.0171	0.0200	0.0171	0.0200	0.0171	0.0200	0.0171	0.0200	0.0171
Motor Gearing Capacity	24239	28350	33329	38981	26914	31478	55652	65090	24610	28783	33838	39577	27325	31959	55652	65090
Elevated Temp M/G Cap	23706	27726	32596	38123	26321	30785	54427	63658	24068	28150	33094	38706	26724	31256	54427	63658
Spring Pack Capacity (μ = 0.200, Stem Factor = 0.0200)					90% of Minimum =		3915		Minimum =		4350		Maximum =		25000	110% of Maximum = 27500
Spring Pack Capacity (μ = 0.150, Stem Factor = 0.0171)					90% of Minimum =		4579		Minimum =		5088		Maximum =		29240	110% of Maximum = 32164

OPENING						CLOSING					
COMPONENT	μ=0.200	μ=0.150	COMPONENT LESS INERTIA	μ=0.200	μ=0.150	COMPONENT	μ=0.200	μ=0.150	COMPONENT LESS INERTIA	μ=0.200	μ=0.150
ACT STRUC LMT THRST(O)	26400	26400	ACT STRUC LMT THRST(O)/1.40	18857	18857	ACT STRUC LMT THRST(C)	26400	26400	ACT STRUC LMT THRST(C)/1.40	18857	18857
ACT STRUC LMT TORQ(O)	27500	32164	ACT STRUC LMT TORQ(O)/1.40	19643	22974	ACT STRUC LMT TORQ(C)	27500	32164	ACT STRUC LMT TORQ(C)/1.40	19643	22974
DISC EARS	27299	27299	DISC EARS/1.40	19499	19499	DISC-PLATE	19492	19492	DISC-PLATE/1.40	13923	13923
YOKE LEGS (S)	28900	28900	YOKE LEGS (S)/1.40	20643	20643	YOKE LEGS (S)	28900	28900	YOKE LEGS (S)/1.40	20643	20643

CHANGE LIST

Station: ZION | System: SI | Valve No: 2SI9011A | PARAMETER

CHANGED: 02/12/96 08:42:34 | PRINTED: 02/12/96 08:42:34

FIELD NAME	AS-BUILT VALUE	CHANGED VALUE	FIELD NAME	AS-BUILT VALUE	CHANGED VALUE
POP	1705	1310	DPOP	1695	2502
THIF	1.00	1.40	TQIF	1.00	1.40
VUF	0.40	0.80	KP_O_T	1000	403
KP_O_A	1000	403	AF	0.900	1.000
MR_FAC	0.979	0.980	MVOP	411	404
SEI_CL	33100	38500	SEI_CMP_CL	BODY-BONNET FLNG (S)	BODY-BONET BOLTS (S)
SEI_OP	33100	38500	SEI_CMP_OP	BODY-BONNET FLNG (S)	BODY-BONET BOLTS (S)
C_DATE	02/17/95	02/12/96	C_TIME	09:51:00	08:42:34
PREP	PSESR		RVWR	DAVIEJX	

TARGET THRUST WORKSHEET

T2 v 3.1 Copyright ComEd 1994 CODE TESTED OK: 02/12/96 08:42 PARAMETER 2SI9011A
ZION SI SYSTEM
GATE VALVE:RUN EFF. USED FOR ISOLATION SERVICE
Valve Type/Service: GATE DD/I Valve Size: 4.00 in Equip.Tol.(O/C): 9.00/ 9.00% Thrust Rating: 24000 lbs

[redacted]ingpack No: 0501-184 CS.Tol.(O/C): 0.0/ 5.0% TCFOa: 1.000 TCFOt: 1.000 Actuator Type: SMB-0-15
TCFCa: 1.000 TCFCt: 1.000

[redacted]r Rating: 15.0 ft-lbs Nominal Speed: 3600 rpm Rated Voltage: 460 VAC OGR: 69.60L Torque Rating: 500 ft-lbs

Stem Dia (V/A): 1.625/1.625 in Pitch:Lead: 1/3 :2/3 Stem Factor: 0.0226 ft (μa=0.200) StFμa/StFμt: 1.1832 ASR: 1.62
0.0191 ft (μt=0.150) ASRG: 1.10
Stem Travel: 4.090 in Stem Speed: 32.57 ipm Stroke Time: 7.53/ 12 secs Thread: STUB THIF: 1.40
VUF: 0.80 TQIF: 1.40
Env Tp/MR Fac: 54.4°C/0.980 SeF(Oa/Ot): 0.650/0.650 SeF(Ca/Ct): 0.650/0.650 VC: 300 lbs ROLF: 0.950

CLOSING DIRECTION

μt=0.150				μa=0.200			
TSS Sprgpk	52800 OPER. & YOKE BOLTS			TSS Sprgpk	52800 OPER. & YOKE BOLTS		
	38880 ACT STRUC LMT THRST(C)				38880 ACT STRUC LMT THRST(C)		
	38500 BODY-BONET BOLTS (S)				38500 BODY-BONET BOLTS (S)		
LmtCls +10%	23119 ACT STRUC LMT TORQ(C)	40084 Motor Stall Max		LmtCls +10%	23119 ACT STRUC LMT TORQ(C)	33876 Motor Stall Max	
3.00 LmtCls Top Top	16514 (14972) ACT STRUC LMT TORQ(C)/1.40	16641 [16308] Motor Stall Cap		3.00 LmtCls Top Top	16514 (14972) ACT STRUC LMT TORQ(C)/1.40	16641 [16308] Motor Stall Cap	
	14756 (13379) Static Tst Lmt MOTOR GEARING(O)/1.40/0.80	17517 (15882) Degraded Mtr Cap			12471 (11307) Static Tst Lmt MOTOR GEARING(O)/1.40/0.80	17517 (15882) Degraded Mtr Cap	
		17166 (15564) Elev Tp Mtr Cap				17166 (15564) Elev Tp Mtr Cap	
1.00 4555 Bot Bot	2469 Minimum * 1.103 Tol=(5.00^2+ 9.00^2)^0.5=10.30%	1693 (8%) Running Load		1.00 3850 Bot Bot	2469 Minimum * 1.103 Tol=(5.00^2+ 9.00^2)^0.5=10.30%	1693 (9%) Running Load	
4099 -10%	2238 Minimum Required	1625 Packing Load		3465 -10%	2238 Minimum Required	1625 Packing Load	

OPENING DIRECTION

μt=0.150				μa=0.200			
TSS Sprgpk	53450 DISC THREADS	15180 (13927) Backseat Limit		TSS Sprgpk	53450 DISC THREADS	15180 (13927) Backseat Limit	
	38880 ACT STRUC LMT THRST(O)				38880 ACT STRUC LMT THRST(O)		
	38500 BODY-BONET BOLTS (S)				38500 BODY-BONET BOLTS (S)		
28796 +10%	28796 (26418) ACT STRUC LMT TORQ(O)	40084 Motor Stall Max		24336 +10%	24336 (22327) ACT STRUC LMT TORQ(O)	33876 Motor Stall Max	
3.00 26178 Top Top		20027 [19626] Motor Stall Cap		3.00 22124 Top Top		16925 [16587] Motor Stall Cap	
1.50 9961 Max Max		16865 (15472) Degraded Mtr Cap		1.75 10702 Max Max		14253 (13076) Degraded Mtr Cap	
2.75 23475 Min Min	25183 Min.*1.090*1.183 StFμa/StFμt = 1.183	16527 (15163) Elev Tp Mtr Cap		2.75 19840 Min Min	21283 Min.*1.090	13968 (12814) Elev Tp Mtr Cap	
1.00 4555 Bot Bot	21283 Minimum * 1.090 Tol=(0.00^2+ 9.00^2)^0.5= 9.00%	655 (4%) Running Load		1.00 3850 Bot Bot	21283 Minimum * 1.090 Tol=(0.00^2+ 9.00^2)^0.5= 9.00%	655 (5%) Running Load	
4099 -10%	19525 Minimum Required	655 Packing Load		3465 -10%	19525 Minimum Required	655 Packing Load	

Remarks: [redacted]

T2 v3.[redacted]ight ComEd 1994 CODE TESTED OK: 02/12/96 08:42 THRUST WINDOW CALC[redacted] FOR ZION SI VALVE 2SI9011A PARAMETER [redacted]

Valve [redacted]ervice(VALVE_TYPE/VALVE_SERV): GATE DD:I
Valve Size/Class (VALVE_SIZE/VLVPRESCLS): 4.00:1500
Vendor (VENDOR): ANCHOR/DARLING
Valve Model No. (MODEL_NO): 4GM58FN
System Design P/T (SYS_DES_PR/SYS_DES_TP): 2485:650
Opening Press. - Line/dP (POP/DPOP): 1310:2502
Closing Press. - Line/dP (PCL/DPCL): 33: 33
Flow Direction/Media (FLOW/MEDIA): N/A :LIQUID
Contact Seat/Orifice Dia. (SED/ORI_DIA): 3.8130: 3.8130
Seat Factor - Open (SEF_O_A/SEF_O_T): 0.650 :0.650
Seat Factor - Close (SEF_C_A/SEF_C_T): 0.650 :0.650
Stem Diameter - Valve/Act. (STD/STD_A): 1.625:1.625
Packing Load Coeffs (KP_O_A/KP_O_T): 403: 403
Packing Load Coeffs (KP_C_A/KP_C_T): 1000:1000
Thread (THREAD): STUB
Pitch/Lead (PITCH/LEAD): 1/3 :2/3
μa/μt (MU_A/MU_T): 0.200:0.150
Vlv Cond/ROLF/Vlv Unwdg Fac (VC/ROLF/VUF): 300:0.950:0.80
Inertia Factor - Thrust/Torque(THIF/TQIF): 1.40:1.40
Stem Factor - As-Found/Test (STF_A/STF_T): 0.0226:0.0191
TCF(O) @ μa/μt (ET_CF_O_A/ET_CF_O_T): 1.083:1.069
TCF(C) @ μa/μt (ET_CF_C_A/ET_CF_C_T): 1.083:1.069
SHEET _____ OF _____
9602120842 PID No: GN09406

App Fac/Stall Cap App[redacted] (AF/AF_SC): 1.000:0.950
Environmental Temperature (ENV_TEMP): 54.4
Motor Rating-Start/Degrade Fac.(MR/MR_FAC): 15.0:0.980
Motor Rating-Stall/Cap Fac. (MR_S/MR_S_SC): 20.00:0.9375
Motor Voltage - Op/Cl/SW (MVOP/MVCL/VSW): 404:411:DV
Rated Voltage/Motor Type (RV/AC_DC): 460:AC
Locked Rotor Current (LK_RTR_I): 26.00
Thermal Overload Size (T_OVRL_SZ): CR123C5.92A
Motor RPM/Full Ld Fac. (MOTOR_RPM/RPM_FAC): 3600:0.9444
Stem Speed/IST Stroke Time(STS/REQD_ST_TM): 32.57: 12
Stem Travel (ST_TRVL): 4.090
Stem Material (ST_MAT): 17-4-PH

Limiting Component(O)	Thrust	Temp	Factor
DISC THREADS (LMT_CMP_OP)	53450 (ALLTOP)	0 (ALLTOP_TP)	1.000 (ALLTOP_FAC)
STEM (LMT_CMP_O2)	142200 (ALLTOP2)	0 (ALLTOP_TP2)	
BODY-BONET BOLTS (S) (SEI_CMP_OP)	38500 (SEI_OP)	0 (SEI_OP_TP)	1.000 (SEI_OP_FAC)

Limiting Component(C)	Thrust	Temp	Factor
OPER. & YOKE BOLTS (LMT_CMP_CL)	52800 (ALLTCL)	0 (ALLTCL_TP)	1.000 (ALLTCL_FAC)
STEM (LMT_CMP_C2)	88295 (ALLTCL2)	0 (ALLTCL_TP2)	
BODY-BONET BOLTS (S) (SEI_CMP_CL)	38500 (SEI_CL)	0 (SEI_CL_TP)	1.000 (SEI_CL_FAC)

Backseat Lmt/Seat Angle(BK_ST_LMT/SEAT_ANGLE): 15180: 0.0

Actuator Vendor (ACTVENDOR[redacted]MITORQUE
Shop Order No. (SHP_ORD_NO): 348862A
Actuator Model (ACTMODELNO): SMB-0-15
Act. Thrust Rating/ASR (ATR/ASR): 24000:1.62
Act. Torque Rating/ASRG (MATR/ASRG): 500:1.10
Overall Unit Ratio/L (OAR/LOCK_GS): 69.60:L
Eff.-Pull/Run/Stall/Stall Cap (EFFP/EFFR/EFFS/EFFSC): 40:50:55:40
Spring Pack No./LC (SPRG_PK_NO/LC): 0501-184 :L
Torq. Output-Min/Max(TO_MIN/TO_MAX): 87: 500
TSS - Min/Max (MIN_TSS/MAX_TSS): 1.00:3.00
Equip.Tol.(O)-Th/CS(ET_TH_O/ET_CS_O): 9.00: 0.00
Equip.Tol.(C)-Th/CS(ET_TH_C/ET_CS_C): 9.00: 5.00

Packing Load		
As-Left (Open/Close):	655 lbs /	1625 lbs
As-Found (Open/Close):	655 lbs /	1625 lbs
Running Load		
As-Left (Open/Close):	655 lbs /	1693 lbs
As-Found (Open/Close):	655 lbs /	1693 lbs
Minimum Required Thrust		
As-Left (Open/Close):	19525 lbs /	2238 lbs
As-Found (Open/Close):	19525 lbs /	2238 lbs

	OPENING								CLOSING							
	Pullout		Run		Stall Capacity		Stall		Pullout		Run		Stall Capacity		Stall	
Gear Efficiency	40	40	50	50	40	40	55	55	40	40	50	50	40	40	55	55
Motor Rating	15.0	15.0	15.0	15.0	18.75	18.75	20.00	20.00	15.0	15.0	15.0	15.0	18.75	18.75	20.00	20.00
Voltage	404AC	404AC	404AC	404AC	404AC	404AC	460AC	460AC	411AC	411AC	411AC	411AC	411AC	411AC	460AC	460AC
Application Factor	1.000	1.000	1.000	1.000	0.950	0.950	1.000	1.000	1.000	1.000	1.000	1.000	0.950	0.950	1.000	1.000
Coefficient of Friction	0.200	0.150	0.200	0.150	0.200	0.150	0.200	0.150	0.200	0.150	0.200	0.150	0.200	0.150	0.200	0.150
Stem Factor	0.0226	0.0191	0.0226	0.0191	0.0226	0.0191	0.0226	0.0191	0.0226	0.0191	0.0226	0.0191	0.0226	0.0191	0.0226	0.0191
Motor Gearing Capacity	14253	16865	17816	21081	16925	20027	33876	40084	14751	17454	18439	21818	17517	20727	33876	40084
Elevated Temp M/G Cap	13968	16527	17460	20659	16587	19626	33199	39282	14456	17105	18070	21381	17166	20312	33199	39282
Spring Pack Capacity (μ = 0.200, Stem Factor = 0.0226)					90% of Minimum =	3465			Minimum =	3850			Maximum =	22124	110% of Maximum =	24336
Spring Pack Capacity (μ = 0.150, Stem Factor = 0.0191)					90% of Minimum =	4099			Minimum =	4555			Maximum =	26178	110% of Maximum =	28796

OPENING						CLOSING					
COMPONENT	μ=0.200	μ=0.150	COMPONENT LESS INERTIA	μ=0.200	μ=0.150	COMPONENT	μ=0.200	μ=0.150	COMPONENT LESS INERTIA	μ=0.200	μ=0.150
ACT STRUC LMT THRST(O)	38880	38880	ACT STRUC LMT THRST(O)/1.40	27771	27771	ACT STRUC LMT THRST(C)	38880	38880	ACT STRUC LMT THRST(C)/1.40	27771	27771
ACT STRUC LMT TORQ(O)	24336	28796	ACT STRUC LMT TORQ(O)/1.40	17383	20568	ACT STRUC LMT TORQ(C)	24336	28796	ACT STRUC LMT TORQ(C)/1.40	17383	20568
DISC THREADS	53450	53450	DISC THREADS/1.40	38179	38179	OPER. & YOKE BOLTS	52800	52800	OPER. & YOKE BOLTS/1.40	37714	37714
BODY-BONET BOLTS (S)	38500	38500	BODY-BONET BOLTS (S)/1.40	27500	27500	BODY-BONET BOLTS (S)	38500	38500	BODY-BONET BOLTS (S)/1.40	27500	27500

CHANGE LIST

Station: ZION | System: SI | Valve No: 1SI9011B | PARAMETER

CHANGED: 02/12/96 08:04:00 | PRINTED: 02/12/96 08:04:00

FIELD NAME	AS-BUILT VALUE	CHANGED VALUE	FIELD NAME	AS-BUILT VALUE	CHANGED VALUE
P	1705	1310	DPOP	1695	2502
THIF	1.00	1.40	TQIF	1.00	1.40
VUF	0.40	0.80	VC	700	0
STF_T	0.0191	0.0149	STF_A	0.0226	0.0184
MU_T	0.150	0.090	MU_A	0.200	0.140
KP_O_T	1000	3077	KP_O_A	1000	3077
ET_CF_O_T	1.069	1.053	ET_CF_O_A	1.083	1.066
ET_CF_C_T	1.069	1.053	ET_CF_C_A	1.083	1.066
AF	0.900	1.000	MR_FAC	0.979	0.980
MVOP	398	393	SEI_CL	33100	38500
SEI_CMP_CL	BODY-BONNET FLNG (S)	BODY-BONET BOLTS (S)	SEI_OP	33100	38500
SEI_CMP_OP	BODY-BONNET FLNG (S)	BODY-BONET BOLTS (S)	C_DATE	02/17/95	02/12/96
C_TIME	09:51:29	08:04:00	PREP	PSESR	
RVWR	DAVIEJX				

TARGET THRUST WORKSHEET

T2 v 3.1 Copyright ComEd 1994 CODE TESTED OK: 02/12/96 08:04 PARAMETER 1SI9011B
ZION SI SYSTEM
GATE VALVE:RUN EFF. USED FOR ISOLATION SERVICE
Valve Type/Service: GATE DD/I Valve Size: 4.00 in Equip.Tol.(O/C): 9.00/ 9.00% Thrust Rating: 24000 lbs

Springpack No: 0501-184 CS.Tol.(O/C): 0.0/ 5.0% TCFOa: 1.000 TCFOt: 1.000 Actuator Type: SMB-0-15
TCFCa: 1.000 TCFCt: 1.000
[redacted]r Rating: 15.0 ft-lbs Nominal Speed: 3600 rpm Rated Voltage: 460 VAC OGR: 78.80L Torque Rating: 500 ft-lbs

Stem Dia (V/A): 1.625/1.625 in Pitch:Lead: 1/3 :2/3 Stem Factor: 0.0184 ft (μa=0.140) StFμa/StFμt: 1.2349 ASR: 1.62
0.0149 ft (μt=0.090) ASRG: 1.10
Stem Travel: 4.090 in Stem Speed: 28.76 ipm Stroke Time: 8.53/ 12 secs Thread: STUB THIF: 1.40
VUF: 0.80 TQIF: 1.40
Env Tp/MR Fac: 54.4°C/0.980 SeF(Oa/Ot): 0.650/0.650 SeF(Ca/Ct): 0.650/0.650 VC: 0 lbs ROLF: 0.950

CLOSING DIRECTION

		μt=0.090		μa=0.140	
TSS Sprgpk		52800 OPER. & YOKE BOLTS		52800 OPER. & YOKE BOLTS	
		38880 ACT STRUC LMT THRST(C)		38880 ACT STRUC LMT THRST(C)	
		38500 BODY-BONET BOLTS (S)		38500 BODY-BONET BOLTS (S)	
	LmtCls +10%	28397 ACT STRUC LMT TORQ(C)	58174 Motor Stall Max	28397 ACT STRUC LMT TORQ(C)	47109 Motor Stall Max
3.00 Top	LmtCls Top	20283 (18390) ACT STRUC LMT TORQ(C)/1.40	21700 [21266] Motor Stall Cap	20283 (18390) ACT STRUC LMT TORQ(C)/1.40	21700 [21266] Motor Stall Cap
		20266 (18374)Static Tst Lmt MOTOR GEARING(O)/1.40/0.80	22843 (20710) Degraded Mtr Cap	16411 (14879)Static Tst Lmt MOTOR GEARING(O)/1.40/0.80	22843 (20710) Degraded Mtr Cap
			22386 (20296) Elev Tp Mtr Cap		22386 (20296) Elev Tp Mtr Cap
1.00 Bot	5839 Bot	2138 Minimum * 1.103 Tol=(5.00^2+ 9.00^2)^0.5=10.30%	1693 (6%) Running Load	2138 Minimum * 1.103 Tol=(5.00^2+ 9.00^2)^0.5=10.30%	1693 (7%) Running Load
	5255 -10%	1938 Minimum Required	1625 Packing Load	1938 Minimum Required	1625 Packing Load

OPENING DIRECTION

		μt=0.090		μa=0.140	
TSS Sprgpk		53450 DISC THREADS	15180 (13927) Backseat Limit	53450 DISC THREADS	15180 (13927) Backseat Limit
		38880 ACT STRUC LMT THRST(O)		38880 ACT STRUC LMT THRST(O)	
		38500 BODY-BONET BOLTS (S)		38500 BODY-BONET BOLTS (S)	
	36913 +10%	36913 (33865) ACT STRUC LMT TORQ(O)	58174 Motor Stall Max	29891 +10% 29891 (27423) ACT STRUC LMT TORQ(O)	47109 Motor Stall Max
3.00 Top	33557 Top		27504 [26954] Motor Stall Cap	27174 Top	22272 [21827] Motor Stall Cap
1.25 Max	9304 Max		23161 (21249) Degraded Mtr Cap	1.50 10340 Max	18756 (17207) Degraded Mtr Cap
2.75 Min	30092 Min	31727 Min.*1.090*1.235 StFμa/StFμt = 1.235	22698 (20824) Elev Tp Mtr Cap	2.75 24368 Min	25692 Min.*1.090	18380 (16863) Elev Tp Mtr Cap
1.00 Bot	5839 Bot	25692 Minimum * 1.090 Tol=(0.00^2+ 9.00^2)^0.5= 9.00%	5000 (22%) Running Load	1.00 4728 Bot	25692 Minimum * 1.090 Tol=(0.00^2+ 9.00^2)^0.5= 9.00%	5000 (27%) Running Load
	5255 -10%	23571 Minimum Required	5000 Packing Load	4255 -10%	23571 Minimum Required	5000 Packing Load

Remarks: _____

T2 v3 [redacted]yright ComEd 1994 CODE TESTED OK: 02/12/96 08:04 THRUST WINDOW CAL[redacted]N FOR ZION SI VALVE 1S19011B PARAMETER

Valve [redacted] Service(VALVE_TYPE/VALVE_SERV): GATE DD:I
Valve Size/Class (VALVE_SIZE/VLVPRESCLS): 4.00:1500
Vendor (VENDOR): ANCHOR/DARLING
Valve Model No. (MODEL_NO): 4GM58FN
System Design P/T (SYS_DES_PR/SYS_DES_TP): 2485:650
Opening Press. - Line/dP (POP/DPOP): 1310:2502
Closing Press. - Line/dP (PCL/DPCL): 33: 33
Flow Direction/Media (FLOW/MEDIA): N/A :LIQUID
Contact Seat/Orifice Dia. (SED/ORI_DIA): 3.8130: 3.8130
Seat Factor - Open (SEF_O_A/SEF_O_T): 0.650 :0.650
Seat Factor - Close (SEF_C_A/SEF_C_T): 0.650 :0.650
Stem Diameter - Valve/Act. (STD/STD_A): 1.625:1.625
Packing Load Coeffs (KP_O_A/KP_O_T): 3077:3077
Packing Load Coeffs (KP_C_A/KP_C_T): 1000:1000
Thread (THREAD): STUB
Pitch/Lead (PITCH/LEAD): 1/3 :2/3
μa/μt (MU_A/MU_T): 0.140:0.090
Vlv Cond/ROLF/Vlv Unwdg Fac (VC/ROLF/VUF): 0:0.950:0.80
Inertia Factor - Thrust/Torque(THIF/TQIF): 1.40:1.40
Stem Factor - As-Found/Test (STF_A/STF_T): 0.0184:0.0149
TCF(O) @ μa/μt (ET_CF_O_A/ET_CF_O_T): 1.066:1.053
TCF(C) @ μa/μt (ET_CF_C_A/ET_CF_C_T): 1.066:1.053
SHEET _____ OF _____
9602120804 PID No: GN09406

App Fac/Stall Cap App[redacted]. (AF/AF_SC): 1.000 0.950
Environmental Temperature (ENV_TEMP): 54.4
Motor Rating-Start/Degrade Fac.(MR/MR_FAC): 15.0:0.980
Motor Rating-Stall/Cap Fac. (MR_S/MR_S_SC): 20.00:0.9375
Motor Voltage - Op/Cl/SW (MVOP/MVCL/VSW): 393 398:DV
Rated Voltage/Motor Type (RV/AC_DC): 460:AC
Locked Rotor Current (LK_RTR_I): 26.00
Thermal Overload Size (T_OVRL_SZ): CR123C3.01A
Motor RPM/Full Ld Fac. (MOTOR_RPM/RPM_FAC): 3600:0.9444
Stem Speed/IST Stroke Time(STS/REQD_ST_TM): 28.76: 12
Stem Travel (ST_TRVL): 4.090
Stem Material (ST_MAT): 17-4-PH

Limiting Component(O)	Thrust	Temp	Factor
DISC THREADS (LMT_CMP_OP)	53450 (ALLTOP)	0 (ALLTOP_TP)	1.000 (ALLTOP_FAC)
STEM (LMT_CMP_O2)	142200 (ALLTOP2)	0 (ALLTOP_TP2)	
BODY-BONET BOLTS (S) (SEI_CMP_OP)	38500 (SEI_OP)	0 (SEI_OP_TP)	1.000 (SEI_OP_FAC)

Limiting Component(C)	Thrust	Temp	Factor
OPER. & YOKE BOLTS (LMT_CMP_CL)	52800 (ALLTCL)	0 (ALLTCL_TP)	1.000 (ALLTCL_FAC)
STEM (LMT_CMP_C2)	88295 (ALLTCL2)	0 (ALLTCL_TP2)	
BODY-BONET BOLTS (S) (SEI_CMP_CL)	38500 (SEI_CL)	0 (SEI_CL_TP)	1.000 (SEI_CL_FAC)

Backseat Lmt/Seat Angle(BK_ST_LMT/SEAT_ANGLE): 15180: 0.0

Actuator Vendor (ACTVENDO[redacted]MITORQUE
Shop Order No. (SHP_ORD_NO): 345629C1
Actuator Model (ACTMODELNO): SMB-0-15
Act. Thrust Rating/ASR (ATR/ASR): 24000:1.62
Act. Torque Rating/ASRG (MATR/ASRG): 500:1.10
Overall Unit Ratio/L (OAR/LOCK_GS): 78.80:L
Eff.-Pull/Run/Stall/Stall Cap (EFFP/EFFR/EFFS/EFFSC) : 40:50:55:40
Spring Pack No./LC (SPRG_PK_NO/LC): 0501-184 :L
Torq. Output-Min/Max(TO_MIN/TO_MAX): 87: 500
TSS - Min/Max (MIN_TSS/MAX_TSS): 1.00:3.00
Equip.Tol.(O)-Th/CS(ET_TH_O/ET_CS_O): 9.00: 0.00
Equip.Tol.(C)-Th/CS(ET_TH_C/ET_CS_C): 9.00: 5.00

Packing Load	
As-Left (Open/Close):	5000 lbs / 1625 lbs
As-Found (Open/Close):	5000 lbs / 1625 lbs
Running Load	
As-Left (Open/Close):	5000 lbs / 1693 lbs
As-Found (Open/Close):	5000 lbs / 1693 lbs
Minimum Required Thrust	
As-Left (Open/Close):	23571 lbs / 1938 lbs
As-Found (Open/Close):	23571 lbs / 1938 lbs

	OPENING								CLOSING							
	Pullout		Run		Stall Capacity		Stall		Pullout		Run		Stall Capacity		Stall	
Gear Efficiency	40	40	50	50	40	40	55	55	40	40	50	50	40	40	55	55
Motor Rating	15.0	15.0	15.0	15.0	18.75	18.75	20.00	20.00	15.0	15.0	15.0	15.0	18.75	18.75	20.00	20.00
Voltage	393AC	393AC	393AC	393AC	393AC	393AC	460AC	460AC	398AC	398AC	398AC	398AC	398AC	398AC	460AC	460AC
Application Factor	1.000	1.000	1.000	1.000	0.950	0.950	1.000	1.000	1.000	1.000	1.000	1.000	0.950	0.950	1.000	1.000
Coefficient of Friction	0.140	0.090	0.140	0.090	0.140	0.090	0.140	0.090	0.140	0.090	0.140	0.090	0.140	0.090	0.140	0.090
Stem Factor	0.0184	0.0149	0.0184	0.0149	0.0184	0.0149	0.0184	0.0149	0.0184	0.0149	0.0184	0.0149	0.0184	0.0149	0.0184	0.0149
Motor Gearing Capacity	18756	23161	23444	28951	22272	27504	47109	58174	19236	23754	24045	29693	22843	28208	47109	58174
Elevated Temp M/G Cap	18380	22698	22976	28372	21827	26954	46167	57011	18851	23279	23564	29099	22386	27644	46167	57011
Spring Pack Capacity (μ = 0.140, Stem Factor = 0.0184)					90% of Minimum =		4255		Minimum =		4728		Maximum =		27174	
													110% of Maximum =		29891	
Spring Pack Capacity (μ = 0.090, Stem Factor = 0.0149)					90% of Minimum =		5255		Minimum =		5839		Maximum =		33557	
													110% of Maximum =		36913	

OPENING						CLOSING					
COMPONENT	μ=0.140	μ=0.090	COMPONENT LESS INERTIA	μ=0.140	μ=0.090	COMPONENT	μ=0.140	μ=0.090	COMPONENT LESS INERTIA	μ=0.140	μ=0.090
ACT STRUC LMT THRST(O)	38880	38880	ACT STRUC LMT THRST(O)/1.40	27771	27771	ACT STRUC LMT THRST(C)	38880	38880	ACT STRUC LMT THRST(C)/1.40	27771	27771
ACT STRUC LMT TORQ(O)	29891	36913	ACT STRUC LMT TORQ(O)/1.40	21351	26366	ACT STRUC LMT TORQ(C)	29891	36913	ACT STRUC LMT TORQ(C)/1.40	21351	26366
DISC THREADS	53450	53450	DISC THREADS/1.40	38179	38179	OPER. & YOKE BOLTS	52800	52800	OPER. & YOKE BOLTS/1.40	37714	37714
BODY-BONET BOLTS (S)	38500	38500	BODY-BONET BOLTS (S)/1.40	27500	27500	BODY-BONET BOLTS (S)	38500	38500	BODY-BONET BOLTS (S)/1.40	27500	27500

FIELD DATA SHEET

T2 v3.1 Copyright ComEd 1994 AS-BUILT CODE TESTED OK: 02/06/95 18:05

VALVE TAG NUMBER: 2SI9011B

STATION: ZION VALVE TYPE: GATE ACTUATOR TYPE: SMB-0-40

AS-FOUND TEST (Y/N): _____ CALIBRATION DEVICE TYPE: _____ LOC: _____

TORQUE SWITCH BYPASS %: OPEN _____ % CLOSE _____ %

SYSTEM CONDITIONS: DP(OPEN): _____ DP(CLOSE): _____ LP(OPEN): _____ LP(CLOSE): _____

FLOW RATE(OPEN): _____ gpm FLOW RATE(CLOSE): _____ gpm

YOKE TEMPERATURE DURING CALIBRATION: _____ °F STEM TEMPERATURE: _____ °F

VOTES SWITCH PROBE(S) LOCATIONS

	WIRE NUMBER	DESCRIPTION
A)		
B)		
C)		
D)		

ANTICIPATED AMP PROBE SETTING: _____ LEAD MONITORED: _____

DYNAMIC TARGET THRUST WINDOW: MINIMUM _____ lbs MAXIMUM _____ lbs

STEM FACTORS: As-Left: 0.0171 at μ=0.150 As-Found: 0.0200 at μ=0.200

STEM NUT IS: NON-LOCKING @ μ = 0.150 LOCKING @ μ = 0.200 OGR: LOCKING

ANTICIPATED MOV STROKE TIME: _____ sec. RSMDS or OTHER _____

MAXIMUM ALLOWABLE STROKE TIME: _____ sec. RSMDS or OTHER _____

ANTICIPATED GAIN SETTINGS: _____ VFS

TESTING LIMITS/CLAMP STEM LOCATION	UNTHREADED (μ=0.150)	THREADED (μ=0.150)	THREADED (μ=0.200)
VALVE TESTING STRUCTURAL LIMIT (CLOSING, lbs)	17673	17221	17112
VALVE TESTING STRUCTURAL LIMIT (OPENING, lbs)	18534	18005	17881
ACTUATOR TESTING STRUCTURAL LIMIT (THRUST, lbs)	23936	23324	23177
ACTUATOR TESTING STRUCTURAL LIMIT (TORQUE, ft-lbs)	499	486	483
MOTOR CAPACITY (OPENING, lbs)	23219	22556	19154
MOTOR CAPACITY (CLOSING, lbs)	31552	30745	26121
BACKSEATING LIMIT (OPENING, lbs)	22028	21399	21252

MAXIMUM TORQUE (MAX TSS for generic springpack curve @ μ= N/A , N/A) N/A ft-lbs

CALCULATED MINIMUM THRUST REQUIRED TO OPEN 11117 lbs

AVERAGE PACKING LOAD BASIS (Ot/Oa/Ct/Ca): 1375/ 1375/ 1375/ 1375 lbs

COMMENTS: _____

SHEET 5 OF 5

9502061037 PID No: GN09406

T2 v3.1 ... ComEd 1994 CODE TESTED OK: 02/06/95 18:05 THRUST WINDOW CALCULATI OR ZION SI VALVE 2SI9011B AS-BUILT

Valve Type/Se. ce(VALVE_TYPE/VALVE_SERV): GATE :I
Valve Size/Class (VALVE_SIZE/VLVPRESCLS): 4.00:1500
Vendor (VENDOR): VELAN
Valve Model No. (MODEL_NO): 4GM58FN
System Design P/T (SYS_DES_PR/SYS_DES_TP): 2485:650
Opening Press. - Line/dP (POP/DPOP): 1705:1695
Closing Press. - Line/dP (PCL/DPCL): 33: 33
Flow Direction/Media (FLOW/MEDIA): N/A :LIQUID
Contact Seat/Orifice Dia. (SED/ORI_DIA): 3.0630: 3.0630
Seat Factor - Open (SEF_O_A/SEF_O_T): 0.780 :0.780
Seat Factor - Close (SEF_C_A/SEF_C_T): 0.900 :0.900
Stem Diameter - Valve/Act. (STD/STD_A): 1.375:1.375
Packing Load Coeffs (KP_O_A/KP_O_T): 1000:1000
Packing Load Coeffs (KP_C_A/KP_C_T): 1000:1000
Thread (THREAD): STANDARD
Pitch/Lead (PITCH/LEAD): 1/3 :2/3
μa/μt (MU_A/MU_T): 0.200:0.150
Vlv Cond/ROLF/Vlv Unwdg Fac (VC/ROLF/VUF): 0:0.950:0.80
Inertia Factor - Thrust/Torque(THIF/TQIF): 1.00:1.00
Stem Factor - As-Found/Test (STF_A/STF_T): 0.0200:0.0171
TCF(O) @ μa/μt (ET_CF_O_A/ET_CF_O_T): 1.442:1.356
TCF(C) @ μa/μt (ET_CF_C_A/ET_CF_C_T): 1.442:1.356
SHEET 4 OF 5
9502061037 PID No: GN09406

App Fac/Stall Cap App Fac. (AF/AF_SC): 0.900:0.950
Environmental Temperature (ENV_TEMP): 54.4
Motor Rating-Start/Degrade Fac.(MR/MR_FAC): 40.0:0.977
Motor Rating-Stall/Cap Fac. (MR_S/MR_S_SC): 49.00:0.9541
Motor Voltage - Op/Cl/SW (MVOP/MVCL/VSW): 397:397:DV
Rated Voltage/Motor Type (RV/AC_DC): 460:AC
Locked Rotor Current (LK_RTR_I): 38.00
Thermal Overload Size (T_OVRL_SZ): CR123C5.92A
Motor RPM/Full Ld Fac. (MOTOR_RPM/RPM_FAC): 1800:0.9444
Stem Speed/IST Stroke Time(STS/REQD_ST_TM): 27.44: 12
Stem Travel (ST_TRVL): 3.625
Stem Material (ST_MAT): A461.17-4PH

Limiting Component(O)	Thrust	Temp	Factor
DISC EARS (LMT_CMP_OP)	20202 (ALLTOP)	0 (ALLTOP_TP)	1.000 (ALLTOP_FAC)
BONNET (LMT_CMP_O2)	42325 (ALLTOP2)	0 (ALLTOP_TP2)	
YOKE LEGS (S) (SEI_CMP_OP)	28900 (SEI_OP)	0 (SEI_OP_TP)	1.000 (SEI_OP_FAC)

Limiting Component(C)	Thrust	Temp	Factor
DISC-PLATE (LMT_CMP_CL)	19492 (ALLTCL)	0 (ALLTCL_TP)	1.000 (ALLTCL_FAC)
BONNET (LMT_CMP_C2)	42325 (ALLTCL2)	0 (ALLTCL_TP2)	
YOKE LEGS (S) (SEI_CMP_CL)	28900 (SEI_CL)	0 (SEI_CL_TP)	1.000 (SEI_CL_FAC)

Backseat Lmt/Seat Angle(BK_ST_LMT/SEAT_ANGLE): 24010: 5.0

Actuator Vendor (ACTVENDOR): LIM.TORQUE
Shop Order No. (SHP_ORD_NO): 362506C
Actuator Model (ACTMODELNO): SMB-0-40
Act. Thrust Rating/ASR (ATR/ASR): 24000:1.10
Act. Torque Rating/ASRG (MATR/ASRG): 500:1.10
Overall Unit Ratio/L (OAR/LOCK_GS): 41.30:L
Eff.-Pull/Run/Stall/Stall Cap (EFFP/EFFR/EFFS/EFFSC): 40:55:55:40
Spring Pack No./LC (SPRG_PK_NO/LC): 0501-184 :L
Torq. Output-Min/Max(TO_MIN/TO_MAX): 87: 500
TSS - Min/Max (MIN_TSS/MAX_TSS): 1.00:3.00
Equip.Tol.(O)-Th/CS(ET_TH_O/ET_CS_O): 9.00: 0.00
Equip.Tol.(C)-Th/CS(ET_TH_C/ET_CS_C): 9.00: 5.00

Packing Load			
As-Left (Open/Close):	1375 lbs /	1375 lbs	
As-Found (Open/Close):	1375 lbs /	1375 lbs	
Running Load			
As-Left (Open/Close):	1375 lbs /	1424 lbs	
As-Found (Open/Close):	1375 lbs /	1424 lbs	
Minimum Required Thrust			
As-Left (Open/Close):	11117 lbs /	1643 lbs	
As-Found (Open/Close):	11117 lbs /	1643 lbs	

	OPENING								CLOSING							
	Pullout		Run		Stall Capacity		Stall		Pullout		Run		Stall Capacity		Stall	
Gear Efficiency	40	40	55	55	40	40	55	55	40	40	55	55	40	40	55	55
Motor Rating	40.0	40.0	40.0	40.0	46.75	46.75	49.00	49.00	40.0	40.0	40.0	40.0	46.75	46.75	49.00	49.00
Voltage	397AC	397AC	397AC	397AC	397AC	397AC	460AC	460AC	397AC	397AC	397AC	397AC	397AC	397AC	460AC	460AC
Application Factor	0.900	0.900	0.900	0.900	0.950	0.950	1.000	1.000	0.900	0.900	0.900	0.900	0.950	0.950	1.000	1.000
Coefficient of Friction	0.200	0.150	0.200	0.150	0.200	0.150	0.200	0.150	0.200	0.150	0.200	0.150	0.200	0.150	0.200	0.150
Stem Factor	0.0200	0.0171	0.0200	0.0171	0.0200	0.0171	0.0200	0.0171	0.0200	0.0171	0.0200	0.0171	0.0200	0.0171	0.0200	0.0171
Motor Gearing Capacity	22149	25905	30454	35619	27325	31959	55652	65090	22149	25905	30454	35619	27325	31959	55652	65090
Elevated Temp M/G Cap	21639	25309	29754	34800	26696	31224	54372	63593	21639	25309	29754	34800	26696	31224	54372	63593

Spring Pack Capacity (μ = 0.200, Stem Factor = 0.0200)	90% of Minimum = 3915	Minimum = 4350	Maximum = 25000	110% of Maximum = 27500
Spring Pack Capacity (μ = 0.150, Stem Factor = 0.0171)	90% of Minimum = 4579	Minimum = 5088	Maximum = 29240	110% of Maximum = 32164

OPENING						CLOSING					
COMPONENT	μ=0.200	μ=0.150	COMPONENT LESS INERTIA	μ=0.200	μ=0.150	COMPONENT	μ=0.200	μ=0.150	COMPONENT LESS INERTIA	μ=0.200	μ=0.150
ACT STRUC LMT THRST(O)	26400	26400	ACT STRUC LMT THRST(O)/1.00	26400	26400	ACT STRUC LMT THRST(C)	26400	26400	ACT STRUC LMT THRST(C)/1.00	26400	26400
ACT STRUC LMT TORQ(O)	27500	32164	ACT STRUC LMT TORQ(O)/1.00	27500	32164	ACT STRUC LMT TORQ(C)	27500	32164	ACT STRUC LMT TORQ(C)/1.00	27500	32164
DISC EARS	20202	20202	DISC EARS/1.00	20202	20202	DISC-PLATE	19492	19492	DISC-PLATE/1.00	19492	19492
YOKE LEGS (S)	28900	28900	YOKE LEGS (S)/1.00	28900	28900	YOKE LEGS (S)	28900	28900	YOKE LEGS (S)/1.00	28900	28900

TARGET THRUST WORKSHEET

T2 v 3.1 Copyright ComEd 1994 CODE TESTED OK: 02/06/95 18:05 AS-BUILT 2SI9011B
ZION SI SYSTEM
GATE VALVE:RUN EFF. USED FOR ISOLATION SERVICE

Valve Type/Service: GATE /I	Valve Size: 4.00 in	Equip.Tol.(O/C): 9.00/ 9.00%	Thrust Rating: 24000 lbs
Springpack No: 0501-184	CS.Tol.(O/C): 0.0/ 5.0%	TCFOa: 1.000 TCFOt: 1.000 TCFCa: 1.000 TCFCt: 1.000	Actuator Type: SMB-0-40
Motor Rating: 40.0 ft-lbs	Nominal Speed: 1800 rpm	Rated Voltage: 460 VAC OGR: 41.30L	Torque Rating: 500 ft-lbs
Stem Dia (V/A): 1.375/1.375 in	Pitch:Lead: 1/3 :2/3	Stem Factor: 0.0200 ft (μa=0.200) 0.0171 ft (μt=0.150)	StFμa/StFμt: 1.1696 ASR: 1.10 ASRG: 1.10
Stem Travel: 3.625 in	Stem Speed: 27.44 ipm	Stroke Time: 7.93/ 12 secs	Thread: STANDARD THIF: 1.00 VUF: 0.80 TQIF: 1.00
Env Tp/MR Fac: 54.4°C/0.977	SeF(Oa/Ot): 0.780/0.780	SeF(Ca/Ct): 0.900/0.900	VC: 0 lbs ROLF: 0.950

CLOSING DIRECTION

μt=0.150

TSS	Sprgpk	Value	Motor
		28900 YOKE LEGS (S)	
		26400 ACT STRUC LMT THRST(C)	
		26125 ACT STRUC LMT TORQ(C)	
	LmtCls +10%	19492 DISC-PLATE	65090 Motor Stall Max
3.00 Top	LmtCls Top	19492 (17673) DISC-PLATE/1.00	25959 [25362] Motor Stall Cap
		25253 (22895)Static Tst Lmt DISC EARS/1.00/0.80	28932 (26231) Degraded Mtr Cap
			28266 (25628) Elev Tp Mtr Cap
1.00 Bot	5088 Bot	1812 Minimum * 1.103 Tol=(5.00^2+ 9.00^2)^0.5=10.30%	1424 (4%) Running Load
	4579 -10%	1643 Minimum Required	1375 Packing Load

μa=0.200

TSS	Sprgpk	Value	Motor
		28900 YOKE LEGS (S)	
		26400 ACT STRUC LMT THRST(C)	
		26125 ACT STRUC LMT TORQ(C)	
	LmtCls +10%	19492 DISC-PLATE	55652 Motor Stall Max
3.00 Top	LmtCls Top	19492 (17673) DISC-PLATE/1.00	25959 [25362] Motor Stall Cap
		25253 (22895)Static Tst Lmt DISC EARS/1.00/0.80	28932 (26231) Degraded Mtr Cap
			28266 (25628) Elev Tp Mtr Cap
1.00 Bot	4350 Bot	1812 Minimum * 1.103 Tol=(5.00^2+ 9.00^2)^0.5=10.30%	1424 (5%) Running Load
	3915 -10%	1643 Minimum Required	1375 Packing Load

OPENING DIRECTION

μt=0.150

TSS	Sprgpk	Value	Motor
		32164 ACT STRUC LMT TORQ(O)	24010 (22028) Backseat Limit
		28900 YOKE LEGS (S)	
		26400 ACT STRUC LMT THRST(O)	
	32164 +10%	20202 (18534) DISC EARS	65090 Motor Stall Max
3.00 Top	29240 Top		31959 [31224] Motor Stall Cap
2.25 Max	20183 Max		25905 (23766) Degraded Mtr Cap
1.75 Min	14145 Min	14173 Min.*1.090*1.170 StFμa/StFμt = 1.170	25309 (23219) Elev Tp Mtr Cap
1.00 Bot	5088 Bot	12118 Minimum * 1.090 Tol=(0.00^2+ 9.00^2)^0.5= 9.00%	1375 (5%) Running Load
	4579 -10%	11117 Minimum Required	1375 Packing Load

μa=0.200

TSS	Sprgpk	Value	Motor
		28900 YOKE LEGS (S)	24010 (22028) Backseat Limit
		27500 ACT STRUC LMT TORQ(O)	
		26400 ACT STRUC LMT THRST(O)	
	27500 +10%	20202 (18534) DISC EARS	55652 Motor Stall Max
3.00 Top	25000 Top		27325 [26696] Motor Stall Cap
2.50 Max	19838 Max		22149 (20320) Degraded Mtr Cap
1.75 Min	12094 Min	12118 Min.*1.090	21639 (19853) Elev Tp Mtr Cap
1.00 Bot	4350 Bot	12118 Minimum * 1.090 Tol=(0.00^2+ 9.00^2)^0.5= 9.00%	1375 (6%) Running Load
	3915 -10%	11117 Minimum Required	1375 Packing Load

Remarks: ______________________________

SHEET 3 OF 5
9502061037 PID No: GN09406

TARGET THRUST WORKSHEET

T2 v 3.1 Copyright ComEd 1994 CODE TESTED OK: 02/06/95 18:05 AS-BUILT 2SI90118
ZION SI SYSTEM
GATE VALVE:RUN EFF. USED FOR ISOLATION SERVICE: TORQUE CORRECTION FACTOR APPLIED
Valve Type/Service: GATE /I Valve Size: 4.00 in Equip.Tol.(O/C): 9.00/ 9.00% Thrust Rating: 24000 lbs

Springpack No: 0501-184 CS.Tol.(O/C): 0.0/ 5.0% TCFOa: 1.442 TCFOt: 1.356 TCFCa: 1.442 TCFCt: 1.356 Actuator Type: SMB-0-40

Motor Rating: 40.0 ft-lbs Nominal Speed: 1800 rpm Rated Voltage: 460 VAC OGR: 41.30L Torque Rating: 500 ft-lbs

Stem Dia (V/A): 1.375/1.375 in Pitch:Lead: 1/3 :2/3 Stem Factor: 0.0200 ft (μa=0.200) 0.0171 ft (μt=0.150) StFμa/StFμt: 1.1696 ASR: 1.10 ASRG: 1.10

Stem Travel: 3.625 in Stem Speed: 27.44 ipm Stroke Time: 7.93/ 12 secs Thread: STANDARD THIF: 1.00 VUF: 0.80 TQIF: 1.00

Env Tp/MR Fac: 54.4°C/0.977 SeF(Oa/Ot): 0.780/0.780 SeF(Ca/Ct): 0.900/0.900 VC: 0 lbs ROLF: 0.950

μt=0.150 CLOSING DIRECTION μa=0.200

TSS	Sprgpk			TSS	Sprgpk		
		28900 YOKE LEGS (S)				28900 YOKE LEGS (S)	
		26400 ACT STRUC LMT THRST(C)				26400 ACT STRUC LMT THRST(C)	
		26125 ACT STRUC LMT TORQ(C)				26125 ACT STRUC LMT TORQ(C)	
	LmtCls +10%	19492 DISC-PLATE	65090 Motor Stall Max		LmtCls +10%	19492 DISC-PLATE	55652 Motor Stall Max
3.00 Top	LmtCls Top	19492 (17221) DISC-PLATE/1.00	25959 [25362] Motor Stall Cap	3.00 Top	LmtCls Top	19492 (17112) DISC-PLATE/1.00	25959 [25362] Motor Stall Cap
		25253 (22310)Static Tst Lmt DISC EARS/1.00/0.80	28932 (25561) Degraded Mtr Cap			25253 (22169)Static Tst Lmt DISC EARS/1.00/0.80	28932 (25399) Degraded Mtr Cap
			28266 (24973) Elev Tp Mtr Cap				28266 (24815) Elev Tp Mtr Cap
1.00 ot	5088 Bot	1860 Minimum * 1.132 Tol=(5.00^2+12.20^2)^0.5=13.19%	1424 (4%) Running Load	1.00 Bot	4350 Bot	1871 Minimum * 1.139 Tol=(5.00^2+12.98^2)^0.5=13.91%	1424 (5%) Running Load
	4579 -10%	1643 Minimum Required	1375 Packing Load		3915 -10%	1643 Minimum Required	1375 Packing Load

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μt=0.150 OPENING DIRECTION μa=0.200

TSS	Sprgpk			TSS	Sprgpk		
		32164 ACT STRUC LMT TORQ(O)	24010 (21399) Backseat Limit			28900 YOKE LEGS (S)	24010 (21252) Backseat Limit
		28900 YOKE LEGS (S)				27500 ACT STRUC LMT TORQ(O)	
		26400 ACT STRUC LMT THRST(O)				26400 ACT STRUC LMT THRST(O)	
	32164 +10%	20202 (18005) DISC EARS	65090 Motor Stall Max		27500 +10%	20202 (17881) DISC EARS	55652 Motor Stall Max
3.00 Top	29240 Top		31959 [31224] Motor Stall Cap	3.00 Top	25000 Top		27325 [26696] Motor Stall Cap
2.25 Max	20183 Max		25905 (23087) Degraded Mtr Cap	2.50 Max	19838 Max		22149 (19604) Degraded Mtr Cap
1.75 Min	14145 Min	14589 Min.*1.122*1.170 StFμa/StFμt = 1.170	25309 (22556) Elev Tp Mtr Cap	1.75 Min	12094 Min	12560 Min.*1.130	21639 (19154) Elev Tp Mtr Cap
1.00 Bot	5088 Bot	12474 Minimum * 1.122 Tol=(0.00^2+12.20^2)^0.5=12.20%	1375 (5%) Running Load	1.00 Bot	4350 Bot	12560 Minimum * 1.130 Tol=(0.00^2+12.98^2)^0.5=12.98%	1375 (6%) Running Load
	4579 -10%	11117 Minimum Required	1375 Packing Load		3915 -10%	11117 Minimum Required	1375 Packing Load

Remarks:

RISING STEM MOV DATA SHEET SAFETY RELATED

T2 v3.1 Copyright ComEd 1994 CODE TESTED OK: 02/06/95 18:05 ZION SI AS-BUILT 2SI9011B

INPUT DATA

Valve No: 2SI9011B Type: GATE Size: 4.00 in Vendor: VELAN Model No: 4GM58FN Flow: N/A
Contact Seat Diameter (SED): 3.0630 inches

Limiting Component to Open			Limiting Component to Close		
1. DISC EARS	at 20202 lbs	and Tmax = N/A °F	1. DISC-PLATE	at 19492 lbs	and Tmax = N/A °F
2. BONNET	at 42325 lbs	and Tmax = N/A °F	2. BONNET	at 42325 lbs	and Tmax = N/A °F
S. YOKE LEGS (S)	at 28900 lbs	and Tmax = N/A °F	S. YOKE LEGS (S)	at 28900 lbs	and Tmax = N/A °F

Shop Order No. 362506C Act. Model No: SMB-0-40 Spring Pack No: 0501-184 OAR: 41.30L

Stem Dia.(Valve/Act.): 1.375/ 1.375 in Stem Mat.: A461.17-4PH Pitch: 1/3 Lead: 2/3 Thread: STANDARD

Motor Rating: 40.0 ft-lbs (Start Torque) Nominal RPM: 1800 Rated Voltage: 460 VAC Gear Efficiency(Pullout/Run/Stall): 40/ 55/ 55 %

Locked Rotor Current: 38.00 amps Thermal Overload Size: CR123C5.92A Environmental Temperature: 54.4°C

Opening Direction		Closing Direction	
Maximum Pressure (System/Differential):	1705 psig/ 1695 psid	Maximum Pressure (System/Differential):	33 psig/ 33 psid
Minimum Motor Terminal Voltage:	397 volts	Minimum Motor Terminal Voltage:	397 volts
Opening Stall Capacity(Degraded Voltage,μ=0.200):	27325 lbs	Closing Capacity (Degraded Voltage, μ=0.200):	30454 lbs
Motor Stall Thrust (μ = 0.150):	65090 lbs	Motor Stall Torque:	1113 ft-lbs

PERFORMANCE BASES

Calc. Stroke Time @ Full Load RPM: 7.9 secs @ 1700 RPM Stroke Length: 3.625 in Pkg Ld: 1375/1375/1375/1375 lbs (Ot)/(Oa)/(Ct)/(Ca)

Test Equipment Tolerance (Opening/Closing): 9.00/ 9.00 % Control Circuit Tolerance (Opening/Closing): 0.00/ 5.00 %

Bounding Factors

Analyzed Condition	Coeff of Friction	Stem Factor	TCF Open	TCF Close	Vlv Fac Open	Vlv Fac Close	Packing Fac Open	Packing Fac Close
As-Left:	μt=0.150	0.0171 ft	1.356	1.356	0.780	0.900	1000 lbs/in	1000 lbs/in
As-Found:	μa=0.200	0.0200 ft	1.442	1.442	0.780	0.900	1000 lbs/in	1000 lbs/in

Vlv Cond: 0 lbs
ROLF: 0.950
Env Tp Fac: 0.977
ASR Thrust: 1.10
ASR Torque: 1.10

STRUCTURAL LIMITS

Opening Weak-Link	Opening Seismic	Closing Weak-Link	Closing Seismic	Backseat	Actuator Thrust	Actuator Torque
20202 lbs	28900 lbs	19492 lbs	28900 lbs	24010 lbs	26400 lbs	550 ft-lbs

MINIMUM REQUIRED THRUST

Analyzed Condition	As-Left	As-Found	Analyzed Condition	As-Left	As-Found
Opening:	11117 lbs	11117 lbs	Closing:	1643 lbs	1643 lbs

CLOSING TARGETS

Min. Thrust: 1,000 lbs (Static, μ= 0.15) Min. Thrust: Limit lbs (Dynamic, μ= 0.15) Max. Thrust 17,000 lbs (μ= 0.15)

Min. TSS: — Max. TSS: — Min. Torque: — ft-lbs Max Torque: — ft-lbs TCF Applied (Y/N)? Y

Accel. Lub. Sched. Req'd (Y/N)? N Remarks: Close torque switch bypassed to 100% of travel. Set open torque switch to 2.0 or greater than 250'# and less than 307'#.

PREPARER: Sean Ralm 2/13/95 Date REVIEWER: [signature] 2/17/95 Date

SHEET 1 OF 5 APPROVER: [signature] 2/20/95 Date

9502061037 PID No: GN09406

FIELD DATA SHEET

T2 v3.1 Copyright ComEd 1994 AS-BUILT CODE TESTED OK: 02/24/95 16:08

VALVE TAG NUMBER: 2SI9011A

STATION: ZION VALVE TYPE: GATE DD ACTUATOR TYPE: SMB-0-15

AS-FOUND TEST (Y/N): _____ CALIBRATION DEVICE TYPE: _____ LOC: _____

TORQUE SWITCH BYPASS %: OPEN _____ % CLOSE _____ %

SYSTEM CONDITIONS: DP(OPEN): _____ DP(CLOSE): _____ LP(OPEN): _____ LP(CLOSE): _____

FLOW RATE(OPEN): _____ gpm FLOW RATE(CLOSE): _____ gpm

YOKE TEMPERATURE DURING CALIBRATION: _____ °F STEM TEMPERATURE: _____ °F

VOTES SWITCH PROBE(S) LOCATIONS

	WIRE NUMBER	DESCRIPTION
A)		
B)		
C)		
D)		

ANTICIPATED AMP PROBE SETTING: _____ LEAD MONITORED: _____

DYNAMIC TARGET THRUST WINDOW: MINIMUM _____ lbs MAXIMUM _____ lbs

STEM FACTORS: As-Left: 0.0191 at μ=0.150 As-Found: 0.0226 at μ=0.200

STEM NUT IS: LOCKING @ μ = 0.150 LOCKING @ μ = 0.200 OGR: LOCKING ?

ANTICIPATED MOV STROKE TIME: _____ sec. RSMDS or OTHER _____

MAXIMUM ALLOWABLE STROKE TIME: _____ sec. RSMDS or OTHER _____

ANTICIPATED GAIN SETTINGS: _____ VFS

TESTING LIMITS/CLAMP STEM LOCATION	UNTHREADED (μ=0.150)	THREADED (μ=0.150)	THREADED (μ=0.200)
VALVE TESTING STRUCTURAL LIMIT (CLOSING, lbs)	47871	47635	47587
VALVE TESTING STRUCTURAL LIMIT (OPENING, lbs)	49037	48759	48703
ACTUATOR TESTING STRUCTURAL LIMIT (THRUST, lbs)	35251	35077	35041
ACTUATOR TESTING STRUCTURAL LIMIT (TORQUE, ft-lbs)	499	496	496
MOTOR CAPACITY (OPENING, lbs)	14109	14029	11843
MOTOR CAPACITY (CLOSING, lbs)	17429	17343	14642
BACKSEATING LIMIT (OPENING, lbs)	13927	13848	13832

MAXIMUM TORQUE (MAX TSS for generic springpack curve @ μ= N/A , N/A) N/A ft-lbs

CALCULATED MINIMUM THRUST REQUIRED TO OPEN 14506 lbs

AVERAGE PACKING LOAD BASIS (Ot/Oa/Ct/Ca): 1625/ 1625/ 1625/ 1625 lbs

COMMENTS: _____

SHEET 5 OF 5

9502170951 PID No: GN09406

ComEd Calculation: 22S-B-005M-162 Rev. 1 ATTACHMENT: D PAGE: D14 of 20

T2 v3.1 Copyright ComEd 1994 CODE TESTED OK: 02/24/95 16:08 THRUST WINDOW CALCULATION FOR ZION SI VALVE 2SI9011A AS-BUILT

Valve Type/Service(VALVE_TYPE/VALVE_SERV): GATE DD:I
Valve Size/Class (VALVE_SIZE/VLVPRESCLS): 4.00:1500
Vendor (VENDOR): ANCHOR/DARLING
Valve Model No. (MODEL_NO): 4GM58FN
System Design P/T (SYS_DES_PR/SYS_DES_TP): 2485:650
Opening Press. - Line/dP (POP/DPOP): 1705:1695
Closing Press. - Line/dP (PCL/DPCL): 33: 33
Flow Direction/Media (FLOW/MEDIA): N/A :LIQUID
Contact Seat/Orifice Dia. (SED/ORI_DIA): 3.8130: 3.8130
Seat Factor - Open (SEF_O_A/SEF_O_T): 0.650 :0.650
Seat Factor - Close (SEF_C_A/SEF_C_T): 0.650 :0.650
Stem Diameter - Valve/Act. (STD/STD_A): 1.625:1.625
Packing Load Coeffs (KP_O_A/KP_O_T): 1000:1000
Packing Load Coeffs (KP_C_A/KP_C_T): 1000:1000
Thread (THREAD): STUB
Pitch/Lead (PITCH/LEAD): 1/3 :2/3
μa/μt (MU_A/MU_T): 0.200:0.150
Vlv Cond/ROLF/Vlv Unwdg Fac (VC/ROLF/VUF): 300:0.950:0.40
Inertia Factor - Thrust/Torque(THIF/TQIF): 1.00:1.00
Stem Factor - As-Found/Test (STF_A/STF_T): 0.0226:0.0191
TCF(O) @ μa/μt (ET_CF_O_A/ET_CF_O_T): 1.083:1.069
TCF(C) @ μa/μt (ET_CF_C_A/ET_CF_C_T): 1.083:1.069

SHEET 4 OF 5

9502170951 PID No: GN09406

App Fac/Stall Cap App Fac. (AF/AF_SC): 0.900:0.950
Environmental Temperature (ENV_TEMP): 54.4
Motor Rating-Start/Degrade Fac.(MR/MR_FAC): 15.0:0.979
Motor Rating-Stall/Cap Fac. (MR_S/MR_S_SC): 20.00:0.9375
Motor Voltage - Op/Cl/SW (MVOP/MVCL/VSW): 411:411:DV
Rated Voltage/Motor Type (RV/AC_DC): 460:AC
Locked Rotor Current (LK_RTR_I): 26.00
Thermal Overload Size (T_OVRL_SZ): CR123C5.92A
Motor RPM/Full Ld Fac. (MOTOR_RPM/RPM_FAC): 3600:0.9444
Stem Speed/IST Stroke Time(STS/REQD_ST_TM): 32.57: 12
Stem Travel (ST_TRVL): 4.090
Stem Material (ST_MAT): 17-4-PH

Limiting Component(O)	Thrust	Temp	Factor
DISC THREADS (LMT_CMP_OP)	53450 (ALLTOP)	0 (ALLTOP_TP)	1.000 (ALLTOP_FAC)
STEM (LMT_CMP_O2)	142200 (ALLTOP2)	0 (ALLTOP_TP2)	
BODY-BONNET FLNG (S) (SEI_CMP_OP)	33100 (SEI_OP)	0 (SEI_OP_TP)	1.000 (SEI_OP_FAC)

Limiting Component(C)	Thrust	Temp	Factor
OPER. & YOKE BOLTS (LMT_CMP_CL)	52800 (ALLTCL)	0 (ALLTCL_TP)	1.000 (ALLTCL_FAC)
STEM (LMT_CMP_C2)	88295 (ALLTCL2)	0 (ALLTCL_TP2)	
BODY-BONNET FLNG (S) (SEI_CMP_CL)	33100 (SEI_CL)	0 (SEI_CL_TP)	1.000 (SEI_CL_FAC)

Backseat Lmt/Seat Angle(BK_ST_LMT/SEAT_ANGLE): 15180: 0.0

Actuator Vendor (ACTVENDOR): LIMITORQUE
Shop Order No. (SHP_ORD_NO): 348862A
Actuator Model (ACTMODELNO): SMB-0-15
Act. Thrust Rating/ASR (ATR/ASR): 24000:1.62
Act. Torque Rating/ASRG (MATR/ASRG): 500:1.10
Overall Unit Ratio/L (OAR/LOCK_GS): 69.60:L
Eff.-Pull/Run/Stall/Stall Cap (EFFP/EFFR/EFFS/EFFSC): 40:50:55:40
Spring Pack No./LC (SPRG_PK_NO/LC): 0501-184 :L
Torq. Output-Min/Max(TO_MIN/TO_MAX): 87: 500
TSS - Min/Max (MIN_TSS/MAX_TSS): 1.00:3.00
Equip.Tol.(O)-Th/CS(ET_TH_O/ET_CS_O): 9.00: 0.00
Equip.Tol.(C)-Th/CS(ET_TH_C/ET_CS_C): 9.00: 5.00

Packing Load	
As-Left (Open/Close):	1625 lbs / 1625 lbs
As-Found (Open/Close):	1625 lbs / 1625 lbs
Running Load	
As-Left (Open/Close):	1625 lbs / 1693 lbs
As-Found (Open/Close):	1625 lbs / 1693 lbs
Minimum Required Thrust	
As-Left (Open/Close):	14506 lbs / 2238 lbs
As-Found (Open/Close):	14506 lbs / 2238 lbs

	OPENING								CLOSING							
	Pullout		Run		Stall Capacity		Stall		Pullout		Run		Stall Capacity		Stall	
Gear Efficiency	40	40	50	50	40	40	55	55	40	40	50	50	40	40	55	55
Motor Rating	15.0	15.0	15.0	15.0	18.75	18.75	20.00	20.00	15.0	15.0	15.0	15.0	18.75	18.75	20.00	20.00
Voltage	411AC	411AC	411AC	411AC	411AC	411AC	460AC	460AC	411AC	411AC	411AC	411AC	411AC	411AC	460AC	460AC
Application Factor	0.900	0.900	0.900	0.900	0.950	0.950	1.000	1.000	0.900	0.900	0.900	0.900	0.950	0.950	1.000	1.000
Coefficient of Friction	0.200	0.150	0.200	0.150	0.200	0.150	0.200	0.150	0.200	0.150	0.200	0.150	0.200	0.150	0.200	0.150
Stem Factor	0.0226	0.0191	0.0226	0.0191	0.0226	0.0191	0.0226	0.0191	0.0226	0.0191	0.0226	0.0191	0.0226	0.0191	0.0226	0.0191
Motor Gearing Capacity	13276	15709	16595	19636	17517	20727	33876	40084	13276	15709	16595	19636	17517	20727	33876	40084
Elevated Temp M/G Cap	12997	15379	16246	19223	17149	20291	33165	39242	12997	15379	16246	19223	17149	20291	33165	39242
Spring Pack Capacity (μ = 0.200, Stem Factor = 0.0226)					90% of Minimum = 3465		Minimum = 3850				Maximum = 22124				110% of Maximum = 24336	
Spring Pack Capacity (μ = 0.150, Stem Factor = 0.0191)					90% of Minimum = 4099		Minimum = 4555				Maximum = 26178				110% of Maximum = 28796	

OPENING					CLOSING				
COMPONENT	μ=0.200	μ=0.150	COMPONENT LESS INERTIA	μ=0.200	μ=0.150	COMPONENT	μ=0.200	μ=0.150	COMPONENT LESS INERTIA	μ=0.200	μ=0.150
ACT STRUC LMT THRST(O)	38880	38880	ACT STRUC LMT THRST(O)/1.00	38880	38880	ACT STRUC LMT THRST(C)	38880	38880	ACT STRUC LMT THRST(C)/1.00	38880	38880
ACT STRUC LMT TORQ(O)	24336	28796	ACT STRUC LMT TORQ(O)/1.00	24336	28796	ACT STRUC LMT TORQ(C)	24336	28796	ACT STRUC LMT TORQ(C)/1.00	24336	28796
DISC THREADS	53450	53450	DISC THREADS/1.00	53450	53450	OPER. & YOKE BOLTS	52800	52800	OPER. & YOKE BOLTS/1.00	52800	52800
BODY-BONNET FLNG (S)	33100	33100	BODY-BONNET FLNG (S)/1.00	33100	33100	BODY-BONNET FLNG (S)	33100	33100	BODY-BONNET FLNG (S)/1.00	33100	33100

TARGET THRUST WORKSHEET

T2 v 3.1 Copyright ComEd 1994 CODE TESTED OK: 02/24/95 16:08 AS-BUILT 2SI9011A
ZION SI SYSTEM
GATE VALVE:RUN EFF. USED FOR ISOLATION SERVICE
Valve Type/Service: GATE DD/I Valve Size: 4.00 in Equip.Tol.(O/C): 9.00/ 9.00% Thrust Rating: 24000 lbs

Springpack No: 0501-184 CS.Tol.(O/C): 0.0/ 5.0% TCFOa: 1.000 TCFOt: 1.000 Actuator Type: SMB-0-15
TCFCa: 1.000 TCFCt: 1.000
Motor Rating: 15.0 ft-lbs Nominal Speed: 3600 rpm Rated Voltage: 460 VAC OGR: 69.60L Torque Rating: 500 ft-lbs

Stem Dia (V/A): 1.625/1.625 in Pitch:Lead: 1/3 :2/3 Stem Factor: 0.0226 ft (μa=0.200) StFμa/StFμt: 1.1832 ASR: 1.62
0.0191 ft (μt=0.150) ASRG: 1.10
Stem Travel: 4.090 in Stem Speed: 32.57 ipm Stroke Time: 7.53/ 12 secs Thread: STUB THIF: 1.00
VUF: 0.40 TQIF: 1.00
Env Tp/MR Fac: 54.4°C/0.979 SeF(Oa/Ot): 0.650/0.650 SeF(Ca/Ct): 0.650/0.650 VC: 300 lbs ROLF: 0.950

CLOSING DIRECTION

		μt=0.150		μa=0.200	
TSS	Sprgpk	52800 OPER. & YOKE BOLTS		52800 OPER. & YOKE BOLTS	
		38880 ACT STRUC LMT THRST(C)		38880 ACT STRUC LMT THRST(C)	
		33100 BODY-BONNET FLNG (S)		33100 BODY-BONNET FLNG (S)	
	LmtCls +10%	23119 ACT STRUC LMT TORQ(C)	40084 Motor Stall Max	23119 ACT STRUC LMT TORQ(C)	33876 Motor Stall Max
3.00 Top	LmtCls Top	23119 (20961) ACT STRUC LMT TORQ(C)/1.00	16641 [16291] Motor Stall Cap	23119 (20961) ACT STRUC LMT TORQ(C)/1.00	16641 [16291] Motor Stall Cap
		38447 (34858) Static Tst Lmt MOTOR GEARING(O)/1.00/0.40	15765 (14293) Degraded Mtr Cap	32493 (29460) Static Tst Lmt MOTOR GEARING(O)/1.00/0.40	15765 (14293) Degraded Mtr Cap
			15434 (13993) Elev Tp Mtr Cap		15434 (13993) Elev Tp Mtr Cap
1.00 Bot	4555 Bot	2469 Minimum * 1.103 Tol=(5.00^2+ 9.00^2)^0.5=10.30%	1693 (9%) Running Load	2469 Minimum * 1.103 Tol=(5.00^2+ 9.00^2)^0.5=10.30%	1693 (10%) Running Load
	4099 -10%	2238 Minimum Required	1625 Packing Load	3465 -10% 2238 Minimum Required	1625 Packing Load

OPENING DIRECTION

		μt=0.150		μa=0.200	
TSS	Sprgpk	53450 DISC THREADS	15180 (13927) Backseat Limit	53450 DISC THREADS	15180 (13927) Backseat Limit
		38880 ACT STRUC LMT THRST(O)		38880 ACT STRUC LMT THRST(O)	
		33100 BODY-BONNET FLNG (S)		33100 BODY-BONNET FLNG (S)	
	28796 +10%	28796 (26418) ACT STRUC LMT TORQ(O)	40084 Motor Stall Max	24336 +10% 24336 (22327) ACT STRUC LMT TORQ(O)	33876 Motor Stall Max
3.00 Top	26178 Top		20727 (20291) Motor Stall Cap	3.00 Top 22124 Top	17517 [17149] Motor Stall Cap
1.75 Max	12664 Max		15709 (14412) Degraded Mtr Cap	2.00 Max 12987 Max	13276 (12180) Degraded Mtr Cap
2.25 Min	18069 Min	18709 Min.*1.090*1.183 StFμa/StFμt = 1.183	15379 (14109) Elev Tp Mtr Cap	2.25 Min 15271 Min 15811 Min.*1.090	12997 (11924) Elev Tp Mtr Cap
1.00 Bot	4555 Bot	15811 Minimum * 1.090 Tol=(0.00^2+ 9.00^2)^0.5= 9.00%	1625 (11%) Running Load	1.00 Bot 3850 Bot 15811 Minimum * 1.090 Tol=(0.00^2+ 9.00^2)^0.5= 9.00%	1625 (13%) Running Load
	4099 -10%	14506 Minimum Required	1625 Packing Load	3465 -10% 14506 Minimum Required	1625 Packing Load

Remarks: _____

SHEET 3 OF 5
9502170951 PID No: GN09406

TARGET THRUST WORKSHEET

T2 v 3.1 Copyright ComEd 1994 CODE TESTED OK: 02/24/95 16:08 AS-BUILT 2SI9011A
ZION SI SYSTEM
GATE VALVE:RUN EFF. USED FOR ISOLATION SERVICE: TORQUE CORRECTION FACTOR APPLIED
Valve Type/Service: GATE DD/I Valve Size: 4.00 in Equip.Tol.(O/C): 9.00/ 9.00% Thrust Rating: 24000 lbs

Springpack No: 0501-184 CS.Tol.(O/C): 0.0/ 5.0% TCFOa: 1.083 TCFOt: 1.069 Actuator Type: SMB-0-15
TCFCa: 1.083 TCFCt: 1.069
Motor Rating: 15.0 ft-lbs Nominal Speed: 3600 rpm Rated Voltage: 460 VAC OGR: 69.60L Torque Rating: 500 ft-lbs

Stem Dia (V/A): 1.625/1.625 in Pitch:Lead: 1/3 :2/3 Stem Factor: 0.0226 ft (μa=0.200) StFμa/StFμt: 1.1832 ASR: 1.62
0.0191 ft (μt=0.150) ASRG: 1.10
Stem Travel: 4.090 in Stem Speed: 32.57 ipm Stroke Time: 7.53/ 12 secs Thread: STUB THIF: 1.00
VUF: 0.40 TQIF: 1.00
Env Tp/MR Fac: 54.4°C/0.979 SeF(Oa/Ot): 0.650/0.650 SeF(Ca/Ct): 0.650/0.650 VC: 300 lbs ROLF: 0.950

CLOSING DIRECTION

μt=0.150				μa=0.200			
TSS Sprgpk	52800 OPER. & YOKE BOLTS			TSS Sprgpk	52800 OPER. & YOKE BOLTS		
	38880 ACT STRUC LMT THRST(C)				38880 ACT STRUC LMT THRST(C)		
	33100 BODY-BONNET FLNG (S)				33100 BODY-BONNET FLNG (S)		
LmtCls +10%	23119 ACT STRUC LMT TORQ(C)	40084 Motor Stall Max		LmtCls +10%	23119 ACT STRUC LMT TORQ(C)	33876 Motor Stall Max	
3.00 LmtCls Top Top	23119 (20858) ACT STRUC LMT TORQ(C)/1.00	16641 [16291] Motor Stall Cap		3.00 LmtCls Top Top	23119 (20837) ACT STRUC LMT TORQ(C)/1.00	16641 [16291] Motor Stall Cap	
	38447 (34686)Static Tst Lmt MOTOR GEARING(O)/1.00/0.40	15765 (14223) Degraded Mtr Cap			32493 (29285)Static Tst Lmt MOTOR GEARING(O)/1.00/0.40	15765 (14209) Degraded Mtr Cap	
		15434 (13924) Elev Tp Mtr Cap				15434 (13910) Elev Tp Mtr Cap	
1.00 4555 Bot Bot	2481 Minimum * 1.108 Tol=(5.00^2+ 9.62^2)^0.5=10.84%	1693 (9%) Running Load		1.00 3850 Bot Bot	2484 Minimum * 1.110 Tol=(5.00^2+ 9.75^2)^0.5=10.95%	1693 (10%) Running Load	
4099 -10%	2238 Minimum Required	1625 Packing Load		3465 -10%	2238 Minimum Required	1625 Packing Load	

OPENING DIRECTION

μt=0.150				μa=0.200			
TSS Sprgpk	53450 DISC THREADS	15180 (13848) Backseat Limit		TSS Sprgpk	53450 DISC THREADS	15180 (13832) Backseat Limit	
	38880 ACT STRUC LMT THRST(O)				38880 ACT STRUC LMT THRST(O)		
	33100 BODY-BONNET FLNG (S)				33100 BODY-BONNET FLNG (S)		
28796 +10%	28796 (26269) ACT STRUC LMT TORQ(O)	40084 Motor Stall Max		24336 +10%	24336 (22175) ACT STRUC LMT TORQ(O)	33876 Motor Stall Max	
3.00 26178 Top Top		20727 [20291] Motor Stall Cap		3.00 22124 Top Top		17517 [17149] Motor Stall Cap	
1.75 12664 Max Max		15709 (14330) Degraded Mtr Cap		2.00 12987 Max Max		13276 (12097) Degraded Mtr Cap	
2.25 18069 Min Min	18815 Min.*1.096*1.183 StFμa/StFμt = 1.183	15379 (14029) Elev Tp Mtr Cap		2.25 15271 Min Min	15920 Min.*1.097	12997 (11843) Elev Tp Mtr Cap	
1.00 4555 Bot Bot	15901 Minimum * 1.096 Tol=(0.00^2+ 9.62^2)^0.5= 9.62%	1625 (11%) Running Load		1.00 3850 Bot Bot	15920 Minimum * 1.097 Tol=(0.00^2+ 9.75^2)^0.5= 9.75%	1625 (13%) Running Load	
4099 -10%	14506 Minimum Required	1625 Packing Load		3465 -10%	14506 Minimum Required	1625 Packing Load	

Remarks:

RISING STEM MOV DATA SHEET

Safety Related

T2 v3.1 Copyright ComEd 1994 CODE TESTED OK: 02/24/95 16:08 ZION SI AS-BUILT 2SI9011A

INPUT DATA

Valve No: 2SI9011A Type: GATE DD Size: 4.00 in Vendor: ANCHOR/DARLING Model No: 4GM58FN Flow: N/A
Contact Seat Diameter (SED): 3.8130 inches

Limiting Component to Open		Limiting Component to Close	
1. DISC THREADS	at 53450 lbs and Tmax = N/A °F	1. OPER. & YOKE BOLTS	at 52800 lbs and Tmax = N/A °F
2. STEM	at 142200 lbs and Tmax = N/A °F	2. STEM	at 88295 lbs and Tmax = N/A °F
S. BODY-BONNET FLNG (S)	at 33100 lbs and Tmax = N/A °F	S. BODY-BONNET FLNG (S)	at 33100 lbs and Tmax = N/A °F

Shop Order No. 348862A Act. Model No: SMB-0-15 Spring Pack No: 0501-184 OAR: 69.60L

Stem Dia.(Valve/Act.): 1.625/ 1.625 in Stem Mat.: 17-4-PH Pitch: 1/3 Lead: 2/3 Thread: STUB

Motor Rating: 15.0 ft-lbs Nominal RPM: 3600 Rated Voltage: 460 VAC Gear Efficiency(Pullout/Run/Stall): 40/ 50/ 55 %
(Start Torque)
Locked Rotor Current: 26.00 amps Thermal Overload Size: CR123C5.92A Environmental Temperature: 54.4°C

Opening Direction		Closing Direction	
Maximum Pressure (System/Differential):	1705 psig/ 1695 psid	Maximum Pressure (System/Differential):	33 psig/ 33 psid
Minimum Motor Terminal Voltage:	411 volts	Minimum Motor Terminal Voltage:	411 volts
Opening Stall Capacity(Degraded Voltage,μ=0.200):	17517 lbs	Closing Capacity (Degraded Voltage, μ=0.200):	16595 lbs
Motor Stall Thrust (μ = 0.150):	40086 lbs	Motor Stall Torque:	766 ft-lbs

PERFORMANCE BASES

Calc. Stroke Time @ Full Load RPM: 7.5 secs @ 3400 RPM Stroke Length: 4.090 in Pkg Ld: 1625/1625/1625/1625 lbs (Ot)/(Oa)/(Ct)/(Ca)
Test Equipment Tolerance (Opening/Closing): 9.00/ 9.00 % Control Circuit Tolerance (Opening/Closing): 0.00/ 5.00 %

Bounding Factors

Analyzed Condition	Coeff of Friction	Stem Factor	TCF Open	TCF Close	Vlv Fac Open	Vlv Fac Close	Packing Fac Open	Packing Fac Close
As-Left:	μt=0.150	0.0191 ft	1.069	1.069	0.650	0.650	1000 lbs/in	1000 lbs/in
As-Found:	μa=0.200	0.0226 ft	1.083	1.083	0.650	0.650	1000 lbs/in	1000 lbs/in

Vlv Cond:	300 lbs
ROLF:	0.950
Env Tp Fac:	0.979
ASR Thrust:	1.62
ASR Torque:	1.10

STRUCTURAL LIMITS

Opening Weak-Link	Opening Seismic	Closing Weak-Link	Closing Seismic	Backseat	Actuator Thrust	Actuator Torque
53450 lbs	33100 lbs	52800 lbs	33100 lbs	15180 lbs	38880 lbs	550 ft-lbs

MINIMUM REQUIRED THRUST

Analyzed Condition	As-Left	As-Found	Analyzed Condition	As-Left	As-Found
Opening:	14506 lbs	14506 lbs	Closing:	2238 lbs	2238 lbs

CLOSING TARGETS

Min. Thrust: 4000 (Static, μ= 0.15) lbs Min. Thrust: Limit (Dynamic, μ= 0.15) lbs Max. Thrust 13,900 (μ= 0.15) lbs

Min. TSS: — Max. TSS: — Min. Torque: — ft-lbs Max Torque: — ft-lbs TCF Applied (Y/N)? Y

Accel. Lub. Sched. Req'd (Y/N)? N Remarks: Set open torque switch to 1.875 or greater than 277'# and less than 293'#

PREPARER: Sean Rahn 2/24/95 Date REVIEWER: [signature] 3/1/95 Date

SHEET 1 OF 5
9502170951 PID No: GN09406

APPROVER: [signature] 3/2/95 Date

FIELD DATA SHEET

T2 v3.1 Copyright ComEd 1994 AS-BUILT CODE TESTED OK: 02/24/95 16:13

VALVE TAG NUMBER: 1SI9011B

STATION: ZION VALVE TYPE: GATE DD ACTUATOR TYPE: SMB-0-15

AS-FOUND TEST (Y/N): _____ CALIBRATION DEVICE TYPE: _____ LOC: _____

TORQUE SWITCH BYPASS %: OPEN _____ % CLOSE _____ %

SYSTEM CONDITIONS: DP(OPEN): _____ DP(CLOSE): _____ LP(OPEN): _____ LP(CLOSE): _____

FLOW RATE(OPEN): _____ gpm FLOW RATE(CLOSE): _____ gpm

YOKE TEMPERATURE DURING CALIBRATION: _____ °F STEM TEMPERATURE: _____ °F

VOTES SWITCH PROBE(S) LOCATIONS

	WIRE NUMBER	DESCRIPTION
A)		
B)		
C)		
D)		

ANTICIPATED AMP PROBE SETTING: _____ LEAD MONITORED: _____

DYNAMIC TARGET THRUST WINDOW: MINIMUM _____ lbs MAXIMUM _____ lbs

STEM FACTORS: As-Left: 0.0191 at μ=0.150 As-Found: 0.0226 at μ=0.200

STEM NUT IS: LOCKING @ μ = 0.150 LOCKING @ μ = 0.200 OGR: LOCKING

ANTICIPATED MOV STROKE TIME: _____ sec. RSMDS or OTHER _____

MAXIMUM ALLOWABLE STROKE TIME: _____ sec. RSMDS or OTHER _____

ANTICIPATED GAIN SETTINGS: _____ VFS

TESTING LIMITS/CLAMP STEM LOCATION	UNTHREADED (μ=0.150)	THREADED (μ=0.150)	THREADED (μ=0.200)
VALVE TESTING STRUCTURAL LIMIT (CLOSING, lbs)	47871	47635	47587
VALVE TESTING STRUCTURAL LIMIT (OPENING, lbs)	49037	48759	48703
ACTUATOR TESTING STRUCTURAL LIMIT (THRUST, lbs)	35251	35077	35041
ACTUATOR TESTING STRUCTURAL LIMIT (TORQUE, ft-lbs)	499	496	496
MOTOR CAPACITY (OPENING, lbs)	14979	14895	12573
MOTOR CAPACITY (CLOSING, lbs)	18504	18413	15546
BACKSEATING LIMIT (OPENING, lbs)	13927	13848	13832

MAXIMUM TORQUE (MAX TSS for generic springpack curve @ μ= N/A , N/A) N/A ft-lbs

CALCULATED MINIMUM THRUST REQUIRED TO OPEN 14906 lbs

AVERAGE PACKING LOAD BASIS (Ot/Oa/Ct/Ca): 1625/ 1625/ 1625/ 1625 lbs

COMMENTS: _____

SHEET 5 OF 5

9502170951 PID No: GN09406

T2 v3.1 Copyright ComEd 1994 CODE TESTED OK: 02/24/95 16:13 THRUST WINDOW CALCULATION FOR ZION SI VALVE 1SI9011B AS-BUILT

Valve Type/Service(VALVE_TYPE/VALVE_SERV): GATE DD:I
Valve Size/Class (VALVE_SIZE/VLVPRESCLS): 4.00:1500
Vendor (VENDOR): ANCHOR/DARLING
Valve Model No. (MODEL_NO): 4GM58FN
System Design P/T (SYS_DES_PR/SYS_DES_TP): 2485:650
Opening Press. - Line/dP (POP/DPOP): 1705:1695
Closing Press. - Line/dP (PCL/DPCL): 33: 33
Flow Direction/Media (FLOW/MEDIA): N/A :LIQUID
Contact Seat/Orifice Dia. (SED/ORI_DIA): 3.8130: 3.8130
Seat Factor - Open (SEF_O_A/SEF_O_T): 0.650 :0.650
Seat Factor - Close (SEF_C_A/SEF_C_T): 0.650 :0.650
Stem Diameter - Valve/Act. (STD/STD_A): 1.625:1.625
Packing Load Coeffs (KP_O_A/KP_O_T): 1000:1000
Packing Load Coeffs (KP_C_A/KP_C_T): 1000:1000
Thread (THREAD): STUB
Pitch/Lead (PITCH/LEAD): 1/3 :2/3
μa/μt (MU_A/MU_T): 0.200:0.150
Vlv Cond/ROLF/Vlv Unwdg Fac (VC/ROLF/VUF): 700:0.950:0.40
Inertia Factor - Thrust/Torque(THIF/TQIF): 1.00:1.00
Stem Factor - As-Found/Test (STF_A/STF_T): 0.0226:0.0191
TCF(O) @ μa/μt (ET_CF_O_A/ET_CF_O_T): 1.083:1.069
TCF(C) @ μa/μt (ET_CF_C_A/ET_CF_C_T): 1.083:1.069
SHEET 4 OF 5
9502170951 PID No: GN09406

App Fac/Stall Cap App Fac. (AF/AF_SC): 0.900:0.950
Environmental Temperature (ENV_TEMP): 54.4
Motor Rating-Start/Degrade Fac.(MR/MR_FAC): 15.0:0.979
Motor Rating-Stall/Cap Fac. (MR_S/MR_S_SC): 20.00:0.9375
Motor Voltage - Op/Cl/SW (MVOP/MVCL/VSW): 398:398:DV
Rated Voltage/Motor Type (RV/AC_DC): 460:AC
Locked Rotor Current (LK_RTR_I): 26.00
Thermal Overload Size (T_OVRL_SZ): CR123C3.01A
Motor RPM/Full Ld Fac. (MOTOR_RPM/RPM_FAC): 3600:0.9444
Stem Speed/IST Stroke Time(STS/REQD_ST_TM): 28.76: 12
Stem Travel (ST_TRVL): 4.090
Stem Material (ST_MAT): 17-4-PH

Limiting Component(O)	Thrust	Temp	Factor
DISC THREADS (LMT_CMP_OP)	53450 (ALLTOP)	0 (ALLTOP_TP)	1.000 (ALLTOP_FAC)
STEM (LMT_CMP_O2)	142200 (ALLTOP2)	0 (ALLTOP_TP2)	
BODY-BONNET FLNG (S) (SEI_CMP_OP)	33100 (SEI_OP)	0 (SEI_OP_TP)	1.000 (SEI_OP_FAC)
Limiting Component(C)	**Thrust**	**Temp**	**Factor**
OPER. & YOKE BOLTS (LMT_CMP_CL)	52800 (ALLTCL)	0 (ALLTCL_TP)	1.000 (ALLTCL_FAC)
STEM (LMT_CMP_C2)	88295 (ALLTCL2)	0 (ALLTCL_TP2)	
BODY-BONNET FLNG (S) (SEI_CMP_CL)	33100 (SEI_CL)	0 (SEI_CL_TP)	1.000 (SEI_CL_FAC)

Backseat Lmt/Seat Angle(BK_ST_LMT/SEAT_ANGLE): 15180: 0.0

Actuator Vendor (ACTVENDOR): LIMITORQUE
Shop Order No. (SHP_ORD_NO): 345629C1
Actuator Model (ACTMODELNO): SMB-0-15
Act. Thrust Rating/ASR (ATR/ASR): 24000:1.62
Act. Torque Rating/ASRG (MATR/ASRG): 500:1.10
Overall Unit Ratio/L (OAR/LOCK_GS): 78.80:L
Eff.-Pull/Run/Stall/Stall Cap (EFFP/EFFR/EFFS/EFFSC): : 40:50:55:40
Spring Pack No./LC (SPRG_PK_NO/LC): 0501-184 :L
Torq. Output-Min/Max(TO_MIN/TO_MAX): 87: 500
TSS - Min/Max (MIN_TSS/MAX_TSS): 1.00:3.00
Equip.Tol.(O)-Th/CS(ET_TH_O/ET_CS_O): 9.00: 0.00
Equip.Tol.(C)-Th/CS(ET_TH_C/ET_CS_C): 9.00: 5.00

Packing Load		
As-Left (Open/Close):	1625 lbs /	1625 lbs
As-Found (Open/Close):	1625 lbs /	1625 lbs
Running Load		
As-Left (Open/Close):	1625 lbs /	1693 lbs
As-Found (Open/Close):	1625 lbs /	1693 lbs
Minimum Required Thrust		
As-Left (Open/Close):	14906 lbs /	2638 lbs
As-Found (Open/Close):	14906 lbs /	2638 lbs

	OPENING								CLOSING							
	Pullout		Run		Stall Capacity		Stall		Pullout		Run		Stall Capacity		Stall	
Gear Efficiency	40	40	50	50	40	40	55	55	40	40	50	50	40	40	55	55
Motor Rating	15.0	15.0	15.0	15.0	18.75	18.75	20.00	20.00	15.0	15.0	15.0	15.0	18.75	18.75	20.00	20.00
Voltage	398AC	398AC	398AC	398AC	398AC	398AC	460AC	460AC	398AC	398AC	398AC	398AC	398AC	398AC	460AC	460AC
Application Factor	0.900	0.900	0.900	0.900	0.950	0.950	1.000	1.000	0.900	0.900	0.900	0.900	0.950	0.950	1.000	1.000
Coefficient of Friction	0.200	0.150	0.200	0.150	0.200	0.150	0.200	0.150	0.200	0.150	0.200	0.150	0.200	0.150	0.200	0.150
Stem Factor	0.0226	0.0191	0.0226	0.0191	0.0226	0.0191	0.0226	0.0191	0.0226	0.0191	0.0226	0.0191	0.0226	0.0191	0.0226	0.0191
Motor Gearing Capacity	**14095**	**16678**	**17619**	**20847**	**18597**	**22005**	**38394**	**45382**	**14095**	**16678**	**17619**	**20847**	**18597**	**22005**	**38394**	**45382**
Elevated Temp M/G Cap	13799	16328	17249	20409	18207	21543	37549	44429	13799	16328	17249	20409	18207	21543	37549	44429
Spring Pack Capacity (μ = 0.200, Stem Factor = 0.0226)					90% of Minimum =	3465	Minimum =	3850			Maximum =	22124	110% of Maximum =	24336		
Spring Pack Capacity (μ = 0.150, Stem Factor = 0.0191)					90% of Minimum =	4099	Minimum =	4555			Maximum =	26178	110% of Maximum =	28796		

OPENING						CLOSING					
COMPONENT	μ=0.200	μ=0.150	COMPONENT LESS INERTIA	μ=0.200	μ=0.150	COMPONENT	μ=0.200	μ=0.150	COMPONENT LESS INERTIA	μ=0.200	μ=0.150
ACT STRUC LMT THRST(O)	38880	38880	ACT STRUC LMT THRST(O)/1.00	38880	38880	ACT STRUC LMT THRST(C)	38880	38880	ACT STRUC LMT THRST(C)/1.00	38880	38880
ACT STRUC LMT TORQ(O)	24336	28796	ACT STRUC LMT TORQ(O)/1.00	24336	28796	ACT STRUC LMT TORQ(C)	24336	28796	ACT STRUC LMT TORQ(C)/1.00	24336	28796
DISC THREADS	53450	53450	DISC THREADS/1.00	53450	53450	OPER. & YOKE BOLTS	52800	52800	OPER. & YOKE BOLTS/1.00	52800	52800
BODY-BONNET FLNG (S)	33100	33100	BODY-BONNET FLNG (S)/1.00	33100	33100	BODY-BONNET FLNG (S)	33100	33100	BODY-BONNET FLNG (S)/1.00	33100	33100

TARGET THRUST WORKSHEET

T2 v 3.1 Copyright ComEd 1994 CODE TESTED OK: 02/24/95 16:13 AS-BUILT 1SI9011B
ZION SI SYSTEM
GATE VALVE:RUN EFF. USED FOR ISOLATION SERVICE

Valve Type/Service: GATE DD/I | Valve Size: 4.00 in | Equip.Tol.(O/C): 9.00/ 9.00% | Thrust Rating: 24000 lbs

Springpack No: 0501-184 | CS.Tol.(O/C): 0.0/ 5.0% | TCFOa: 1.000 TCFOt: 1.000 TCFCa: 1.000 TCFCt: 1.000 | Actuator Type: SMB-0-15

Motor Rating: 15.0 ft-lbs | Nominal Speed: 3600 rpm | Rated Voltage: 460 VAC OGR: 78.80L | Torque Rating: 500 ft-lbs

Stem Dia (V/A): 1.625/1.625 in | Pitch:Lead: 1/3 :2/3 | Stem Factor: 0.0226 ft (μa=0.200) 0.0191 ft (μt=0.150) | StFμa/StFμt: 1.1832 | ASR: 1.62 ASRG: 1.10

Stem Travel: 4.090 in | Stem Speed: 28.76 ipm | Stroke Time: 8.53/ 12 secs | Thread: STUB VUF: 0.40 VC: 700 lbs | THIF: 1.00 TQIF: 1.00 ROLF: 0.950

Env Tp/MR Fac: 54.4°C/0.979 | SeF(Oa/Ot): 0.650/0.650 | SeF(Ca/Ct): 0.650/0.650

CLOSING DIRECTION

		μt=0.150		μa=0.200	
TSS	Sprgpk	52800 OPER. & YOKE BOLTS		52800 OPER. & YOKE BOLTS	
		38880 ACT STRUC LMT THRST(C)		38880 ACT STRUC LMT THRST(C)	
		33100 BODY-BONNET FLNG (S)		33100 BODY-BONNET FLNG (S)	
	LmtCls +10%	23119 ACT STRUC LMT TORQ(C)	45382 Motor Stall Max	23119 ACT STRUC LMT TORQ(C)	38354 Motor Stall Max
3.00 Top	LmtCls Top	23119 (20961) ACT STRUC LMT TORQ(C)/1.00	17668 [17297] Motor Stall Cap	23119 (20961) ACT STRUC LMT TORQ(C)/1.00	17668 [17297] Motor Stall Cap
		40819 (37009)Static Tst Lmt MOTOR GEARING(O)/1.00/0.40	16738 (15175) Degraded Mtr Cap	34497 (31277)Static Tst Lmt MOTOR GEARING(O)/1.00/0.40	16738 (15175) Degraded Mtr Cap
			16386 (14857) Elev Tp Mtr Cap		16386 (14857) Elev Tp Mtr Cap
1.00 Bot	4555 Bot	2910 Minimum * 1.103 Tol=(5.00^2+ 9.00^2)^0.5=10.30%	1693 (8%) Running Load	2910 Minimum * 1.103 Tol=(5.00^2+ 9.00^2)^0.5=10.30%	1693 (10%) Running Load
	4099 -10%	2638 Minimum Required	1625 Packing Load	2638 Minimum Required	1625 Packing Load

OPENING DIRECTION

		μt=0.150		μa=0.200	
TSS	Sprgpk	53450 DISC THREADS	15180 (13927) Backseat Limit	53450 DISC THREADS	15180 (13927) Backseat Limit
		38880 ACT STRUC LMT THRST(O)		38880 ACT STRUC LMT THRST(O)	
		33100 BODY-BONNET FLNG (S)		33100 BODY-BONNET FLNG (S)	
	28796 +10%	28796 (26418) ACT STRUC LMT TORQ(O)	45382 Motor Stall Max	24336 (22327) ACT STRUC LMT TORQ(O)	38354 Motor Stall Max
3.00 Top	26178 Top		22005 [21543] Motor Stall Cap	22124 Top	18597 [18207] Motor Stall Cap
1.75 Max	12664 Max		16678 (15301) Degraded Mtr Cap	12987 Max	14095 (12931) Degraded Mtr Cap
2.25 Min	18069 Min	19225 Min.*1.090*1.183 StFμa/StFμt = 1.183	16328 (14979) Elev Tp Mtr Cap	15271 Min	16247 Min.*1.090	13799 (12660) Elev Tp Mtr Cap
1.00 Bot	4555 Bot	16247 Minimum * 1.090 Tol=(0.00^2+ 9.00^2)^0.5= 9.00%	1625 (10%) Running Load	3850 Bot	16247 Minimum * 1.090 Tol=(0.00^2+ 9.00^2)^0.5= 9.00%	1625 (12%) Running Load
	4099 -10%	14906 Minimum Required	1625 Packing Load	3465 -10%	14906 Minimum Required	1625 Packing Load

Remarks: _____

TARGET THRUST WORKSHEET

T2 v 3.1 Copyright ComEd 1994 CODE TESTED OK: 02/24/95 16:13 AS-BUILT 1SI9011B
ZION SI SYSTEM
GATE VALVE:RUN EFF. USED FOR ISOLATION SERVICE: TORQUE CORRECTION FACTOR APPLIED
Valve Type/Service: GATE DD/I Valve Size: 4.00 in Equip.Tol.(O/C): 9.00/ 9.00% Thrust Rating: 24000 lbs

Springpack No: 0501-184 CS.Tol.(O/C): 0.0/ 5.0% TCFOa: 1.083 TCFOt: 1.069 TCFCa: 1.083 TCFCt: 1.069 Actuator Type: SMB-0-15

Motor Rating: 15.0 ft-lbs Nominal Speed: 3600 rpm Rated Voltage: 460 VAC OGR: 78.80L Torque Rating: 500 ft-lbs

Stem Dia (V/A): 1.625/1.625 in Pitch:Lead: 1/3 :2/3 Stem Factor: 0.0226 ft (μa=0.200) 0.0191 ft (μt=0.150) StFμa/StFμt: 1.1832 ASR: 1.62 ASRG: 1.10

Stem Travel: 4.090 in Stem Speed: 28.76 ipm Stroke Time: 8.53/ 12 secs Thread: STUB THIF: 1.00

VUF: 0.40 TQIF: 1.00

Env Tp/MR Fac: 54.4°C/0.979 SeF(Oa/Ot): 0.650/0.650 SeF(Ca/Ct): 0.650/0.650 VC: 700 lbs ROLF: 0.950

CLOSING DIRECTION

μt=0.150					μa=0.200				
TSS	Sprgpk	52800 OPER. & YOKE BOLTS			TSS	Sprgpk	52800 OPER. & YOKE BOLTS		
		38880 ACT STRUC LMT THRST(C)					38880 ACT STRUC LMT THRST(C)		
		33100 BODY-BONNET FLNG (S)					33100 BODY-BONNET FLNG (S)		
	LmtCls +10%	23119 ACT STRUC LMT TORQ(C)	45382 Motor Stall Max			LmtCls +10%	23119 ACT STRUC LMT TORQ(C)	38354 Motor Stall Max	
3.00 Top	LmtCls Top	23119 (20858) ACT STRUC LMT TORQ(C)/1.00	17668 [17297] Motor Stall Cap		3.00 Top	LmtCls Top	23119 (20837) ACT STRUC LMT TORQ(C)/1.00	17668 [17297] Motor Stall Cap	
		40819 (36826) Static Tst Lmt MOTOR GEARING(O)/1.00/0.40	16738 (15100) Degraded Mtr Cap				34497 (31091) Static Tst Lmt MOTOR GEARING(O)/1.00/0.40	16738 (15085) Degraded Mtr Cap	
			16386 (14783) Elev Tp Mtr Cap					16386 (14768) Elev Tp Mtr Cap	
1.00 Bot	4555 Bot	2924 Minimum * 1.108 Tol=(5.00^2+ 9.62^2)^0.5=10.84%	1693 (8%) Running Load		1.00 Bot	3850 Bot	2927 Minimum * 1.110 Tol=(5.00^2+ 9.75^2)^0.5=10.95%	1693 (10%) Running Load	
	4099 -10%	2638 Minimum Required	1625 Packing Load			3465 -10%	2638 Minimum Required	1625 Packing Load	

OPENING DIRECTION

μt=0.150					μa=0.200				
TSS	Sprgpk	53450 DISC THREADS	15180 (13848) Backseat Limit		TSS	Sprgpk	53450 DISC THREADS	15180 (13832) Backseat Limit	
		38880 ACT STRUC LMT THRST(O)					38880 ACT STRUC LMT THRST(O)		
		33100 BODY-BONNET FLNG (S)					33100 BODY-BONNET FLNG (S)		
	28796 +10%	28796 (26269) ACT STRUC LMT TORQ(O)	45382 Motor Stall Max			24336 +10%	24336 (22175) ACT STRUC LMT TORQ(O)	38354 Motor Stall Max	
3.00 Top	26178 Top		22005 [21543] Motor Stall Cap		3.00 Top	22124 Top		18597 [18207] Motor Stall Cap	
1.75 Max	12664 Max		16678 (15216) Degraded Mtr Cap		2.00 Max	12987 Max		14095 (12843) Degraded Mtr Cap	
2.25 Min	18069 Min	19334 Min.*1.096*1.183 StFμa/StFμt = 1.183	16328 (14895) Elev Tp Mtr Cap		2.25 Min	15271 Min	16359 Min.*1.097	13799 (12573) Elev Tp Mtr Cap	
1.00 Bot	4555 Bot	16340 Minimum * 1.096 Tol=(0.00^2+ 9.62^2)^0.5= 9.62%	1625 (10%) Running Load		1.00 Bot	3850 Bot	16359 Minimum * 1.097 Tol=(0.00^2+ 9.75^2)^0.5= 9.75%	1625 (12%) Running Load	
	4099 -10%	14906 Minimum Required	1625 Packing Load			3465 -10%	14906 Minimum Required	1625 Packing Load	

Remarks:

SHEET 2 OF 5
9502170951 PID No: GN09406

RISING STEM MOV DATA SHEET

Safety Related

T2 v3.1 Copyright ComEd 1994 CODE TESTED OK: 02/24/95 16:13 ZION SI AS-BUILT 1SI9011B

INPUT DATA

Valve No: 1SI9011B Type: GATE DD Size: 4.00 in Vendor: ANCHOR/DARLING Model No: 4GM58FN Flow: N/A
Contact Seat Diameter (SED): 3.8130 inches

Limiting Component to Open			Limiting Component to Close		
1. DISC THREADS	at 53450 lbs and Tmax = N/A °F		1. OPER. & YOKE BOLTS	at 52800 lbs and Tmax = N/A °F	
2. STEM	at 142200 lbs and Tmax = N/A °F		2. STEM	at 88295 lbs and Tmax = N/A °F	
S. BODY-BONNET FLNG (S)	at 33100 lbs and Tmax = N/A °F		S. BODY-BONNET FLNG (S)	at 33100 lbs and Tmax = N/A °F	

Shop Order No. 345629C1 Act. Model No: SMB-0-15 Spring Pack No: 0501-184 OAR: 78.80L

Stem Dia.(Valve/Act.): 1.625/ 1.625 in Stem Mat.: 17-4-PH Pitch: 1/3 Lead: 2/3 Thread: STUB

Motor Rating: 15.0 ft-lbs Nominal RPM: 3600 Rated Voltage: 460 VAC Gear Efficiency(Pullout/Run/Stall): 40/ 50/ 55 %
(Start Torque)
Locked Rotor Current: 26.00 amps Thermal Overload Size: CR123C3.01A Environmental Temperature: 54.4°C

Opening Direction		Closing Direction	
Maximum Pressure (System/Differential):	1705 psig/ 1695 psid	Maximum Pressure (System/Differential):	33 psig/ 33 psid
Minimum Motor Terminal Voltage:	398 volts	Minimum Motor Terminal Voltage:	398 volts
Opening Stall Capacity(Degraded Voltage, μ=0.200):	18597 lbs	Closing Capacity (Degraded Voltage, μ=0.200):	17619 lbs
Motor Stall Thrust (μ = 0.150):	45382 lbs	Motor Stall Torque:	867 ft-lbs

PERFORMANCE BASES

Calc. Stroke Time @ Full Load RPM: 8.5 secs @ 3400 RPM Stroke Length: 4.090 in Pkg Ld: 1625/1625/1625/1625 lbs (Ot)/(Oa)/(Ct)/(Ca)
Test Equipment Tolerance (Opening/Closing): 9.00/ 9.00 % Control Circuit Tolerance (Opening/Closing): 0.00/ 5.00 %

Bounding Factors

Analyzed Condition	Coeff of Friction	Stem Factor	TCF Open	TCF Close	Vlv Fac Open	Vlv Fac Close	Packing Fac Open	Packing Fac Close
As-Left:	μt=0.150	0.0191 ft	1.069	1.069	0.650	0.650	1000 lbs/in	1000 lbs/in
As-Found:	μa=0.200	0.0226 ft	1.083	1.083	0.650	0.650	1000 lbs/in	1000 lbs/in

Vlv Cond:	700 lbs
ROLF:	0.950
Env Tp Fac:	0.979
ASR Thrust:	1.62
ASR Torque:	1.10

STRUCTURAL LIMITS

Opening Weak-Link	Opening Seismic	Closing Weak-Link	Closing Seismic	Backseat	Actuator Thrust	Actuator Torque
53450 lbs	33100 lbs	52800 lbs	33100 lbs	15180 lbs	38880 lbs	550 ft-lbs

MINIMUM REQUIRED THRUST

Analyzed Condition	As-Left	As-Found	Analyzed Condition	As-Left	As-Found
Opening:	14906 lbs	14906 lbs	Closing:	2638 lbs	2638 lbs

CLOSING TARGETS

Min. Thrust: 1,000 (Static, μ= 0.15) lbs Min. Thrust: Limit (Dynamic, μ= 0.15) lbs Max. Thrust 14,500 (μ= 0.15) lbs

Min. TSS: — Max. TSS: — Min. Torque: — ft-lbs Max Torque: — ft-lbs TCF Applied (Y/N)? Y

Accel. Lub. Sched. Req'd (Y/N)? N Remarks: Set open torque switch to 2.0 or greater than 285'# and less than 310'#.

PREPARER: Sean Rabon 2/24/95 Date REVIEWER: [signature] 3/1/95 Date

SHEET 1 OF 5 APPROVER: [signature] 3/2/95 Date
9502170951 PID No: GN09406

FIELD DATA SHEET

T2 v3.1 Copyright ComEd 1994 AS-BUILT CODE TESTED OK: 02/24/95 16:12

VALVE TAG NUMBER: 1SI9011A

STATION: ZION VALVE TYPE: GATE DD ACTUATOR TYPE: SMB-0-15

AS-FOUND TEST (Y/N): _____ CALIBRATION DEVICE TYPE: _____ LOC: _____

TORQUE SWITCH BYPASS %: OPEN _____ % CLOSE _____ %

SYSTEM CONDITIONS: DP(OPEN): _____ DP(CLOSE): _____ LP(OPEN): _____ LP(CLOSE): _____

FLOW RATE(OPEN): _____ gpm FLOW RATE(CLOSE): _____ gpm

YOKE TEMPERATURE DURING CALIBRATION: _____ °F STEM TEMPERATURE: _____ °F

VOTES SWITCH PROBE(S) LOCATIONS

	WIRE NUMBER	DESCRIPTION
A)		
B)		
C)		
D)		

ANTICIPATED AMP PROBE SETTING: _____ LEAD MONITORED: _____

DYNAMIC TARGET THRUST WINDOW: MINIMUM _____ lbs MAXIMUM _____ lbs

STEM FACTORS: As-Left: 0.0191 at μ=0.150 As-Found: 0.0226 at μ=0.200

STEM NUT IS: LOCKING @ μ = 0.150 LOCKING @ μ = 0.200 OGR: LOCKING

ANTICIPATED MOV STROKE TIME: _____ sec. RSMDS or OTHER _____

MAXIMUM ALLOWABLE STROKE TIME: _____ sec. RSMDS or OTHER _____

ANTICIPATED GAIN SETTINGS: _____ VFS

TESTING LIMITS/CLAMP STEM LOCATION	UNTHREADED (μ=0.150)	THREADED (μ=0.150)	THREADED (μ=0.200)
VALVE TESTING STRUCTURAL LIMIT (CLOSING, lbs)	47871	47635	47587
VALVE TESTING STRUCTURAL LIMIT (OPENING, lbs)	49037	48759	48703
ACTUATOR TESTING STRUCTURAL LIMIT (THRUST, lbs)	35251	35077	35041
ACTUATOR TESTING STRUCTURAL LIMIT (TORQUE, ft-lbs)	499	496	496
MOTOR CAPACITY (OPENING, lbs)	12900	12827	10828
MOTOR CAPACITY (CLOSING, lbs)	15936	15857	13388
BACKSEATING LIMIT (OPENING, lbs)	13927	13848	13832

MAXIMUM TORQUE (MAX TSS for generic springpack curve @ μ= N/A , N/A) N/A ft-lbs

CALCULATED MINIMUM THRUST REQUIRED TO OPEN 14206 lbs

AVERAGE PACKING LOAD BASIS (Ot/Oa/Ct/Ca): 1625/ 1625/ 1625/ 1625 lbs

COMMENTS: _____

SHEET 5 OF 5

9502170951 PID No: GN09406

T2 v3.1 Copyright ComEd 1994 CODE TESTED OK: 02/24/95 16:12 THRUST WINDOW CALCULATION FOR ZION SI VALVE 1SI9011A AS-BUILT

Valve Type/Service(VALVE_TYPE/VALVE_SERV): GATE DD:I
Valve Size/Class (VALVE_SIZE/VLVPRESCLS): 4.00:1500
Vendor (VENDOR): ANCHOR/DARLING
Valve Model No. (MODEL_NO): 4GM58FN
System Design P/T (SYS_DES_PR/SYS_DES_TP): 2485:650
Opening Press. - Line/dP (POP/DPOP): 1705:1695
Closing Press. - Line/dP (PCL/DPCL): 33: 33
Flow Direction/Media (FLOW/MEDIA): N/A :LIQUID
Contact Seat/Orifice Dia. (SED/ORI_DIA): 3.8130: 3.8130
Seat Factor - Open (SEF_O_A/SEF_O_T): 0.650 :0.650
Seat Factor - Close (SEF_C_A/SEF_C_T): 0.650 :0.650
Stem Diameter - Valve/Act. (STD/STD_A): 1.625:1.625
Packing Load Coeffs (KP_O_A/KP_O_T): 1000:1000
Packing Load Coeffs (KP_C_A/KP_C_T): 1000:1000
Thread (THREAD): STUB
Pitch/Lead (PITCH/LEAD): 1/3 :2/3
μa/μt (MU_A/MU_T): 0.200:0.150
Vlv Cond/ROLF/Vlv Unwdg Fac (VC/ROLF/VUF): 0:0.950:0.40
Inertia Factor - Thrust/Torque(THIF/TQIF): 1.00:1.00
Stem Factor - As-Found/Test (STF_A/STF_T): 0.0226:0.0191
TCF(O) @ μa/μt (ET_CF_O_A/ET_CF_O_T): 1.083:1.069
TCF(C) @ μa/μt (ET_CF_C_A/ET_CF_C_T): 1.083:1.069
SHEET 4 OF 5
9502170951 PID No: GN09406

App Fac/Stall Cap App Fac. (AF/AF_SC): 0.900:0.950
Environmental Temperature (ENV_TEMP): 54.4
Motor Rating-Start/Degrade Fac.(MR/MR_FAC): 15.0:0.979
Motor Rating-Stall/Cap Fac. (MR_S/MR_S_SC): 20.00:0.9375
Motor Voltage - Op/Cl/SW (MVOP/MVCL/VSW): 393:393:DV
Rated Voltage/Motor Type (RV/AC_DC): 460:AC
Locked Rotor Current (LK_RTR_I): 26.00
Thermal Overload Size (T_OVRL_SZ): CR123C3.01A
Motor RPM/Full Ld Fac. (MOTOR_RPM/RPM_FAC): 3600:0.9444
Stem Speed/IST Stroke Time(STS/REQD_ST_TM): 32.57: 12
Stem Travel (ST_TRVL): 4.090
Stem Material (ST_MAT): 17-4-PH

Limiting Component(O)	Thrust	Temp	Factor
DISC THREADS (LMT_CMP_OP)	53450 (ALLTOP)	0 (ALLTOP_TP)	1.000 (ALLTOP_FAC)
STEM (LMT_CMP_O2)	142200 (ALLTOP2)	0 (ALLTOP_TP2)	
BODY-BONNET FLNG (S) (SEI_CMP_OP)	33100 (SEI_OP)	0 (SEI_OP_TP)	1.000 (SEI_OP_FAC)

Limiting Component(C)	Thrust	Temp	Factor
OPER. & YOKE BOLTS (LMT_CMP_CL)	52800 (ALLTCL)	0 (ALLTCL_TP)	1.000 (ALLTCL_FAC)
STEM (LMT_CMP_C2)	88295 (ALLTCL2)	0 (ALLTCL_TP2)	
BODY-BONNET FLNG (S) (SEI_CMP_CL)	33100 (SEI_CL)	0 (SEI_CL_TP)	1.000 (SEI_CL_FAC)

Backseat Lmt/Seat Angle(BK_ST_LMT/SEAT_ANGLE): 15180: 0.0

Actuator Vendor (ACTVENDOR): LIMITORQUE
Shop Order No. (SHP_ORD_NO): 348862A
Actuator Model (ACTMODELNO): SMB-0-15
Act. Thrust Rating/ASR (ATR/ASR): 24000:1.62
Act. Torque Rating/ASRG (MATR/ASRG): 500:1.10
Overall Unit Ratio/L (OAR/LOCK_GS): 69.60:L
Eff.-Pull/Run/Stall/Stall Cap (EFFP/EFFR/EFFS/EFFSC): 40:50:55:40
Spring Pack No./LC (SPRG_PK_NO/LC): 0501-184 :L
Torq. Output-Min/Max(TO_MIN/TO_MAX): 87: 500
TSS - Min/Max (MIN_TSS/MAX_TSS): 1.00:3.00
Equip.Tol.(O)-Th/CS(ET_TH_O/ET_CS_O): 9.00: 0.00
Equip.Tol.(C)-Th/CS(ET_TH_C/ET_CS_C): 9.00: 5.00

Packing Load		
As-Left (Open/Close):	1625 lbs /	1625 lbs
As-Found (Open/Close):	1625 lbs /	1625 lbs
Running Load		
As-Left (Open/Close):	1625 lbs /	1693 lbs
As-Found (Open/Close):	1625 lbs /	1693 lbs
Minimum Required Thrust		
As-Left (Open/Close):	14206 lbs /	1938 lbs
As-Found (Open/Close):	14206 lbs /	1938 lbs

	OPENING								CLOSING							
	Pullout		Run		Stall Capacity		Stall		Pullout		Run		Stall Capacity		Stall	
Gear Efficiency	40	40	50	50	40	40	55	55	40	40	50	50	40	40	55	55
Motor Rating	15.0	15.0	15.0	15.0	18.75	18.75	20.00	20.00	15.0	15.0	15.0	15.0	18.75	18.75	20.00	20.00
Voltage	393AC	393AC	393AC	393AC	393AC	393AC	460AC	460AC	393AC	393AC	393AC	393AC	393AC	393AC	460AC	460AC
Application Factor	0.900	0.900	0.900	0.900	0.950	0.950	1.000	1.000	0.900	0.900	0.900	0.900	0.950	0.950	1.000	1.000
Coefficient of Friction	0.200	0.150	0.200	0.150	0.200	0.150	0.200	0.150	0.200	0.150	0.200	0.150	0.200	0.150	0.200	0.150
Stem Factor	0.0226	0.0191	0.0226	0.0191	0.0226	0.0191	0.0226	0.0191	0.0226	0.0191	0.0226	0.0191	0.0226	0.0191	0.0226	0.0191
Motor Gearing Capacity	12138	14363	15173	17953	16016	18951	33876	40084	12138	14363	15173	17953	16016	18951	33876	40084
Elevated Temp M/G Cap	11884	14061	14854	17576	15680	18553	33165	39242	11884	14061	14854	17576	15680	18553	33165	39242
Spring Pack Capacity (μ = 0.200, Stem Factor = 0.0226)					90% of Minimum = 3465		Minimum = 3850				Maximum = 22124		110% of Maximum = 24336			
Spring Pack Capacity (μ = 0.150, Stem Factor = 0.0191)					90% of Minimum = 4099		Minimum = 4555				Maximum = 26178		110% of Maximum = 28796			

OPENING						CLOSING					
COMPONENT	μ=0.200	μ=0.150	COMPONENT LESS INERTIA	μ=0.200	μ=0.150	COMPONENT	μ=0.200	μ=0.150	COMPONENT LESS INERTIA	μ=0.200	μ=0.150
ACT STRUC LMT THRST(O)	38880	38880	ACT STRUC LMT THRST(O)/1.00	38880	38880	ACT STRUC LMT THRST(C)	38880	38880	ACT STRUC LMT THRST(C)/1.00	38880	38880
ACT STRUC LMT TORQ(O)	24336	28796	ACT STRUC LMT TORQ(O)/1.00	24336	28796	ACT STRUC LMT TORQ(C)	24336	28796	ACT STRUC LMT TORQ(C)/1.00	24336	28796
DISC THREADS	53450	53450	DISC THREADS/1.00	53450	53450	OPER. & YOKE BOLTS	52800	52800	OPER. & YOKE BOLTS/1.00	52800	52800
BODY-BONNET FLNG (S)	33100	33100	BODY-BONNET FLNG (S)/1.00	33100	33100	BODY-BONNET FLNG (S)	33100	33100	BODY-BONNET FLNG (S)/1.00	33100	33100

TARGET THRUST WORKSHEET

T2 v 3.1 Copyright ComEd 1994 CODE TESTED OK: 02/24/95 16:12 AS-BUILT 1SI9011A
ZION SI SYSTEM
GATE VALVE:RUN EFF. USED FOR ISOLATION SERVICE
Valve Type/Service: GATE DD/I Valve Size: 4.00 in Equip.Tol.(O/C): 9.00/ 9.00% Thrust Rating: 24000 lbs

Springpack No: 0501-184 CS.Tol.(O/C): 0.0/ 5.0% TCFOa: 1.000 TCFOt: 1.000 Actuator Type: SMB-0-15
TCFCa: 1.000 TCFCt: 1.000
Motor Rating: 15.0 ft-lbs Nominal Speed: 3600 rpm Rated Voltage: 460 VAC OGR: 69.60L Torque Rating: 500 ft-lbs

Stem Dia (V/A): 1.625/1.625 in Pitch:Lead: 1/3 :2/3 Stem Factor: 0.0226 ft (μa=0.200) StFμa/StFμt: 1.1832 ASR: 1.62
0.0191 ft (μt=0.150) ASRG: 1.10
Stem Travel: 4.090 in Stem Speed: 32.57 ipm Stroke Time: 7.53/ 12 secs Thread: STUB THIF: 1.00
VUF: 0.40 TQIF: 1.00
Env Tp/MR Fac: 54.4°C/0.979 SeF(Oa/Ot): 0.650/0.650 SeF(Ca/Ct): 0.650/0.650 VC: 0 lbs ROLF: 0.950

CLOSING DIRECTION

μt=0.150				μa=0.200			
TSS Sprgpk	52800 OPER. & YOKE BOLTS			TSS Sprgpk	52800 OPER. & YOKE BOLTS		
	38880 ACT STRUC LMT THRST(C)				38880 ACT STRUC LMT THRST(C)		
	33100 BODY-BONNET FLNG (S)				33100 BODY-BONNET FLNG (S)		
LmtCls +10%	23119 ACT STRUC LMT TORQ(C)	40084 Motor Stall Max		LmtCls +10%	23119 ACT STRUC LMT TORQ(C)	33876 Motor Stall Max	
3.00 LmtCls Top Top	23119 (20961) ACT STRUC LMT TORQ(C)/1.00	15215 [14896] Motor Stall Cap		3.00 LmtCls Top Top	23119 (20961) ACT STRUC LMT TORQ(C)/1.00	15215 [14896] Motor Stall Cap	
	35153 (31872)Static Tst Lmt MOTOR GEARING(O)/1.00/0.40	14414 (13069) Degraded Mtr Cap			29709 (26936)Static Tst Lmt MOTOR GEARING(O)/1.00/0.40	14414 (13069) Degraded Mtr Cap	
		14112 (12794) Elev Tp Mtr Cap				14112 (12794) Elev Tp Mtr Cap	
1.00 4555 Bot Bot	2138 Minimum * 1.103 Tol=(5.00^2+ 9.00^2)^0.5=10.30%	1693 (10%) Running Load		1.00 3850 Bot Bot	2138 Minimum * 1.103 Tol=(5.00^2+ 9.00^2)^0.5=10.30%	1693 (11%) Running Load	
4099 -10%	1938 Minimum Required	1625 Packing Load		3465 -10%	1938 Minimum Required	1625 Packing Load	

OPENING DIRECTION

μt=0.150				μa=0.200			
TSS Sprgpk	53450 DISC THREADS	15180 (13927) Backseat Limit		TSS Sprgpk	53450 DISC THREADS	15180 (13927) Backseat Limit	
	38880 ACT STRUC LMT THRST(O)				38880 ACT STRUC LMT THRST(O)		
	33100 BODY-BONNET FLNG (S)				33100 BODY-BONNET FLNG (S)		
28796 +10%	28796 (26418) ACT STRUC LMT TORQ(O)	40084 Motor Stall Max		24336 +10%	24336 (22327) ACT STRUC LMT TORQ(O)	33876 Motor Stall Max	
3.00 26178 Top Top		18951 [18553] Motor Stall Cap		3.00 22124 Top Top		16016 [15680] Motor Stall Cap	
1.75 12664 Max Max		14363 (13177) Degraded Mtr Cap		2.00 12987 Max Max		12138 (11136) Degraded Mtr Cap	
2.25 18069 Min Min	18322 Min.*1.090*1.183 StFμa/StFμt = 1.183	14061 (12900) Elev Tp Mtr Cap		2.25 15271 Min Min	15484 Min.*1.090	11884 (10902) Elev Tp Mtr Cap	
1.00 4555 Bot Bot	15484 Minimum * 1.090 Tol=(0.00^2+ 9.00^2)^0.5= 9.00%	1625 (12%) Running Load		1.00 3850 Bot Bot	15484 Minimum * 1.090 Tol=(0.00^2+ 9.00^2)^0.5= 9.00%	1625 (14%) Running Load	
4099 -10%	14206 Minimum Required	1625 Packing Load		3465 -10%	14206 Minimum Required	1625 Packing Load	

Remarks: _____

SHEET 3 OF 5

TARGET THRUST WORKSHEET

T2 v 3.1 Copyright ComEd 1994 CODE TESTED OK: 02/24/95 16:12 AS-BUILT 1SI9011A
ZION SI SYSTEM
GATE VALVE:RUN EFF. USED FOR ISOLATION SERVICE: TORQUE CORRECTION FACTOR APPLIED
Valve Type/Service: GATE DD/I Valve Size: 4.00 in Equip.Tol.(O/C): 9.00/ 9.00% Thrust Rating: 24000 lbs

Springpack No: 0501-184 CS.Tol.(O/C): 0.0/ 5.0% TCFOa: 1.083 TCFOt: 1.069 Actuator Type: SMB-0-15
TCFCa: 1.083 TCFCt: 1.069
Motor Rating: 15.0 ft-lbs Nominal Speed: 3600 rpm Rated Voltage: 460 VAC OGR: 69.60L Torque Rating: 500 ft-lbs

Stem Dia (V/A): 1.625/1.625 in Pitch:Lead: 1/3 :2/3 Stem Factor: 0.0226 ft (μa=0.200) StFμa/StFμt: 1.1832 ASR: 1.62
0.0191 ft (μt=0.150) ASRG: 1.10
Stem Travel: 4.090 in Stem Speed: 32.57 ipm Stroke Time: 7.53/ 12 secs Thread: STUB THIF: 1.00
VUF: 0.40 TQIF: 1.00
Env Tp/MR Fac: 54.4°C/0.979 SeF(Oa/Ot): 0.650/0.650 SeF(Ca/Ct): 0.650/0.650 VC: 0 lbs ROLF: 0.950

CLOSING DIRECTION

μt=0.150				μa=0.200			
TSS Sprgpk	52800 OPER. & YOKE BOLTS			TSS Sprgpk	52800 OPER. & YOKE BOLTS		
	38880 ACT STRUC LMT THRST(C)				38880 ACT STRUC LMT THRST(C)		
	33100 BODY-BONNET FLNG (S)				33100 BODY-BONNET FLNG (S)		
LmtCls +10%	23119 ACT STRUC LMT TORQ(C)	40084 Motor Stall Max		LmtCls +10%	23119 ACT STRUC LMT TORQ(C)	33876 Motor Stall Max	
3.00 LmtCls Top Top	23119 (20858) ACT STRUC LMT TORQ(C)/1.00	15215 [14896] Motor Stall Cap		3.00 LmtCls Top Top	23119 (20837) ACT STRUC LMT TORQ(C)/1.00	15215 [14896] Motor Stall Cap	
	35153 (31714) Static Tst Lmt MOTOR GEARING(O)/1.00/0.40	14414 (13004) Degraded Mtr Cap			29709 (26776) Static Tst Lmt MOTOR GEARING(O)/1.00/0.40	14414 (12991) Degraded Mtr Cap	
		14112 (12731) Elev Tp Mtr Cap				14112 (12718) Elev Tp Mtr Cap	
1.00 4555 Bot Bot	2149 Minimum * 1.108 Tol=(5.00^2+ 9.62^2)^0.5=10.84%	1693 (10%) Running Load		1.00 3850 Bot Bot	2151 Minimum * 1.110 Tol=(5.00^2+ 9.75^2)^0.5=10.95%	1693 (11%) Running Load	
4099 -10%	1938 Minimum Required	1625 Packing Load		3465 -10%	1938 Minimum Required	1625 Packing Load	

OPENING DIRECTION

μt=0.150				μa=0.200			
TSS Sprgpk	53450 DISC THREADS	15180 (13848) Backseat Limit		TSS Sprgpk	53450 DISC THREADS	15180 (13832) Backseat Limit	
	38880 ACT STRUC LMT THRST(O)				38880 ACT STRUC LMT THRST(O)		
	33100 BODY-BONNET FLNG (S)				33100 BODY-BONNET FLNG (S)		
28796 +10%	28796 (26269) ACT STRUC LMT TORQ(O)	40084 Motor Stall Max		24336 +10%	24336 (22175) ACT STRUC LMT TORQ(O)	33876 Motor Stall Max	
3.00 26178 Top Top		* 18951 [18553] Motor Stall Cap		3.00 22124 Top Top		16016 [15680] Motor Stall Cap	
1.75 12664 Max Max		14363 (13102) Degraded Mtr Cap		2.00 12987 Max Max		12138 (11060) Degraded Mtr Cap	
2.25 18069 Min Min	18426 Min.*1.096*1.183 StFμa/StFμt = 1.183	14061 (12827) Elev Tp Mtr Cap		2.25 15271 Min Min	15590 Min.*1.097	11884 (10828) Elev Tp Mtr Cap	
1.00 4555 Bot Bot	15572 Minimum * 1.096 Tol=(0.00^2+ 9.62^2)^0.5= 9.62%	1625 (12%) Running Load		1.00 3850 Bot Bot	15590 Minimum * 1.097 Tol=(0.00^2+ 9.75^2)^0.5= 9.75%	1625 (14%) Running Load	
4099 -10%	14206 Minimum Required	1625 Packing Load		3465 -10%	14206 Minimum Required	1625 Packing Load	

Remarks: *NOTE: Open capability is based on White Paper 125 R.O. ACTUAL MOTOR CAPACITY IS GREATER THAN MRT.

RISING STEM MOV DATA SHEET

T2 v3.1 Copyright ComEd 1994 CODE TESTED OK: 02/24/95 16:12 ZION SI AS-BUILT 1SI9011A

INPUT DATA

Valve No: 1SI9011A Type: GATE DD Size: 4.00 in Vendor: ANCHOR/DARLING Model No: 4GM58FN Flow: N/A
Contact Seat Diameter (SED): 3.8130 inches

Limiting Component to Open		Limiting Component to Close	
1. DISC THREADS	at 53450 lbs and Tmax = N/A °F	1. OPER. & YOKE BOLTS	at 52800 lbs and Tmax = N/A °F
2. STEM	at 142200 lbs and Tmax = N/A °F	2. STEM	at 88295 lbs and Tmax = N/A °F
S. BODY-BONNET FLNG (S)	at 33100 lbs and Tmax = N/A °F	S. BODY-BONNET FLNG (S)	at 33100 lbs and Tmax = N/A °F

Shop Order No. 348862A Act. Model No: SMB-0-15 Spring Pack No: 0501-184 OAR: 69.60L

Stem Dia.(Valve/Act.): 1.625/ 1.625 in Stem Mat.: 17-4-PH Pitch: 1/3 Lead: 2/3 Thread: STUB

Motor Rating: 15.0 ft-lbs Nominal RPM: 3600 Rated Voltage: 460 VAC Gear Efficiency(Pullout/Run/Stall): 40/ 50/ 55 %
(Start Torque)
Locked Rotor Current: 26.00 amps Thermal Overload Size: CR123C3.01A Environmental Temperature: 54.4°C

Opening Direction		Closing Direction	
Maximum Pressure (System/Differential):	1705 psig/ 1695 psid	Maximum Pressure (System/Differential):	33 psig/ 33 psid
Minimum Motor Terminal Voltage:	393 volts	Minimum Motor Terminal Voltage:	393 volts
Opening Stall Capacity(Degraded Voltage,μ=0.200):	16016 lbs	Closing Capacity (Degraded Voltage, μ=0.200):	15173 lbs

Motor Stall Thrust (μ = 0.150): 40084 lbs Motor Stall Torque: 766 ft-lbs

PERFORMANCE BASES

Calc. Stroke Time @ Full Load RPM: 7.5 secs @ 3400 RPM Stroke Length: 4.090 in Pkg Ld: 1625/1625/1625/1625 lbs (Ot)/(Oa)/(Ct)/(Ca)
Test Equipment Tolerance (Opening/Closing): 9.00/ 9.00 % Control Circuit Tolerance (Opening/Closing): 0.00/ 5.00 %

Bounding Factors

Analyzed Condition	Coeff of Friction	Stem Factor	TCF Open	TCF Close	Vlv Fac Open	Vlv Fac Close	Packing Fac Open	Packing Fac Close
As-Left:	μt=0.150	0.0191 ft	1.069	1.069	0.650	0.650	1000 lbs/in	1000 lbs/in
As-Found:	μa=0.200	0.0226 ft	1.083	1.083	0.650	0.650	1000 lbs/in	1000 lbs/in

Vlv Cond:	0 lbs
ROLF:	0.950
Env Tp Fac:	0.979
ASR Thrust:	1.62
ASR Torque:	1.10

STRUCTURAL LIMITS

Opening Weak-Link	Opening Seismic	Closing Weak-Link	Closing Seismic	Backseat	Actuator Thrust	Actuator Torque
53450 lbs	33100 lbs	52800 lbs	33100 lbs	15180 lbs	38880 lbs	550 ft-lbs

MINIMUM REQUIRED THRUST

Analyzed Condition	As-Left	As-Found	Analyzed Condition	As-Left	As-Found
Opening:	14206 lbs	14206 lbs	Closing:	1938 lbs	1938 lbs

CLOSING TARGETS

Min. Thrust: 1,000 (Static, μ= 0,15) lbs Min. Thrust: Limit (Dynamic, μ= 0,15) lbs Max. Thrust 12,500 (μ= 0,15) lbs

Min. TSS: — Max. TSS: — Min. Torque: — ft-lbs Max Torque: — ft-lbs TCF Applied (Y/N)? Y

Accel. Lub. Sched. Req'd (Y/N)? N Remarks: Set open torque switch to 2.0 or greater than 272 '# and less than 310'#. Open capability based on White Paper 125. R.0.

PREPARER: Sean Rolan 8/7/95 Date REVIEWER: [signature] ALL 8/8/95 Date

SHEET 1 OF 5 APPROVER: J R Dreher 8/9/95 Date
9502170951 PID No: GN09406

TARGET THRUST WORKSHEET

T2 v 3.1 Copyright ComEd 1994 CODE TESTED OK: 02/24/95 16:12 AS-BUILT 1SI9011A
ZION SI SYSTEM
GATE VALVE:RUN EFF. USED FOR ISOLATION SERVICE: TORQUE CORRECTION FACTOR APPLIED
Valve Type/Service: GATE DD/I Valve Size: 4.00 in Equip.Tol.(O/C): 9.00/ 9.00% Thrust Rating: 24000 lbs

Springpack No: 0501-184 CS.Tol.(O/C): 0.0/ 5.0% TCFOa: 1.083 TCFOt: 1.069 Actuator Type: SMB-0-15
TCFCa: 1.083 TCFCt: 1.069
Motor Rating: 15.0 ft-lbs Nominal Speed: 3600 rpm Rated Voltage: 460 VAC OGR: 69.60L Torque Rating: 500 ft-lbs

Stem Dia (V/A): 1.625/1.625 in Pitch:Lead: 1/3 :2/3 Stem Factor: 0.0226 ft (μa=0.200) StFμa/StFμt: 1.1832 ASR: 1.62
0.0191 ft (μt=0.150) ASRG: 1.10
Stem Travel: 4.090 in Stem Speed: 32.57 ipm Stroke Time: 7.53/ 12 secs Thread: STUB THIF: 1.00
VUF: 0.40 TQIF: 1.00
Env Tp/MR Fac: 54.4°C/0.979 SeF(Oa/Ot): 0.650/0.650 SeF(Ca/Ct): 0.650/0.650 VC: 0 lbs ROLF: 0.950

CLOSING DIRECTION

	μt=0.150		μa=0.200	
TSS Sprgpk	52800 OPER. & YOKE BOLTS		52800 OPER. & YOKE BOLTS	
	38880 ACT STRUC LMT THRST(C)		38880 ACT STRUC LMT THRST(C)	
	33100 BODY-BONNET FLNG (S)		33100 BODY-BONNET FLNG (S)	
LmtCls +10%	23119 ACT STRUC LMT TORQ(C)	40084 Motor Stall Max	23119 ACT STRUC LMT TORQ(C)	33876 Motor Stall Max
3.00 Top LmtCls Top	23119 (20858) ACT STRUC LMT TORQ(C)/1.00	15215 [14896] Motor Stall Cap	23119 (20837) ACT STRUC LMT TORQ(C)/1.00	15215 [14896] Motor Stall Cap
	35153 (31714)Static Tst Lmt MOTOR GEARING(O)/1.00/0.40	14414 (13004) Degraded Mtr Cap	29709 (26776)Static Tst Lmt MOTOR GEARING(O)/1.00/0.40	14414 (12991) Degraded Mtr Cap
		14112 (12731) Elev Tp Mtr Cap		14112 (12718) Elev Tp Mtr Cap
1.00 Bot 4555 Bot	2149 Minimum * 1.108 Tol=(5.00^2+ 9.62^2)^0.5=10.84%	1693 (10%) Running Load	1.00 Bot 3850 Bot 2151 Minimum * 1.110 Tol=(5.00^2+ 9.75^2)^0.5=10.95%	1693 (11%) Running Load
4099 -10%	1938 Minimum Required	1625 Packing Load	3465 -10% 1938 Minimum Required	1625 Packing Load

OPENING DIRECTION

	μt=0.150		μa=0.200	
TSS Sprgpk	53450 DISC THREADS	15180 (13848) Backseat Limit	TSS Sprgpk 53450 DISC THREADS	15180 (13832) Backseat Limit
	38880 ACT STRUC LMT THRST(O)		38880 ACT STRUC LMT THRST(O)	
	33100 BODY-BONNET FLNG (S)		33100 BODY-BONNET FLNG (S)	
28796 +10%	28796 (26269) ACT STRUC LMT TORQ(O)	40084 Motor Stall Max	24336 +10% 24336 (22175) ACT STRUC LMT TORQ(O)	33876 Motor Stall Max
3.00 Top 26178 Top		* 18951 [18553] Motor Stall Cap	3.00 Top 22124 Top	16016 [15680] Motor Stall Cap
1.75 Max 12664 Max		14363 (13102) Degraded Mtr Cap	2.00 Max 12987 Max	12138 (11060) Degraded Mtr Cap
2.25 Min 18069 Min	18426 Min.*1.096*1.183 StFμa/StFμt = 1.183	14061 (12827) Elev Tp Mtr Cap	2.25 Min 15271 Min 15590 Min.*1.097	11884 (10828) Elev Tp Mtr Cap
1.00 Bot 4555 Bot	15572 Minimum * 1.096 Tol=(0.00^2+ 9.62^2)^0.5= 9.62%	1625 (12%) Running Load	1.00 Bot 3850 Bot 15590 Minimum * 1.097 Tol=(0.00^2+ 9.75^2)^0.5= 9.75%	1625 (14%) Running Load
4099 -10%	14206 Minimum Required	1625 Packing Load	3465 -10% 14206 Minimum Required	1625 Packing Load

Remarks: * NOTE: Open capability is based on White Paper 125 R.0. ACTUAL MOTOR CAPACITY IS GREATER THAN MRT.

SHEET 2 OF 5
9502170951 PID No: GN09406

NUCLEAR FUEL SERVICES DEPARTMENT NUCLEAR DESIGN INFORMATION TRANSMITTAL	NDIT No. 950052 Rev. No. 0 Page 2 of 2

As you requested, NFS is transmitting the calculated sump temperature data (from NFS Calcnote PSA-Z-95-03, Revision 0) at approximately 12 hours following a postulated design basis Loss of Coolant Accident (assuming an 8' quench front).

The temperature data from 9.72 to 15.28 hours is given in the table below. The containment sump temperature at a specific time (e.g. at 12 hours) may be determined by linear interpolation.

Time (seconds)	Time (hours)	Sump Temperature (°F)
34998.9	9.72	157.947
39998.9	11.11	156.623
44998.9	12.50	155.650
49998.9	13.89	154.873
54998.9	15.28	154.205

If you have questions regarding this information, please contact me at Downers Grove, Ext. 3059.

ATTACHMENT: C PAGE: C 2 of C 2
Comed Calculation No:
22S-B-005M-162 Rev 0

NUCLEAR FUEL SERVICES DEPARTMENT
NUCLEAR DESIGN INFORMATION TRANSMITTAL

☒ SAFETY RELATED ☐ NON-SAFETY RELATED ☐ REGULATORY RELATED	Originating Organization ☒ Nuclear Fuel Services ☐ Other (specify) _____	NDIT No. 950052 Rev. No. 0 Page 1 of 2

Station Zion Unit 1 & 2 Cycle All Generic _____

To: Zion Central Files Attn: Mr. Brian E. Jelke

Subject Transmittal of Zion Sump Data from Analysis of Record for LOCA Containment Response (NFS:PSA:95-126)

Amy Jo Patterson Preparer	Amy Jo Patterson Preparer's Signature	10/19/95 Date
Craig G. Holmes Reviewer	Craig G. Holmes Reviewer's Signature	10/19/95 Date
Kenneth N. Kovar NFS Supervisor	Signed for KNK. NFS Supervisor's Signature	10/19/95 Date

Status of Information:
☒ Verified
☐ Unverified
☐ Engineering Judgement

Method and Schedule of Verification for Unverified NDITs: N/A

Description of Information: Containment Sump data at approximately 12 hours is being transmitted per your request.

Purpose of Information: The sump temperature at 12 hours following a LOCA will be used in Zion Engineering Calculation 22S-B-005M-162 to evaluate the pressure locking of containment sump valves (NRC GL 95-07).

Source of Information: "Zion LOCA Containment Integrity Analysis," NFS Calcnote PSA-L-95-03, Revision 0, A. J. Patterson, March 8, 1995.

Supplemental Distribution: T. A. Rieck/NFS -CF, Chron, PSA-CF, K. N. Kovar, C. G. Holmes

CHRON No:

ATTACHMENT: C PAGE: C1 of C2
Comed Calculation No:
22S-B-005M-162 Rev 0

Table 7.2. Coupled Heat Exchanger Performance at 0.002 hr-ft²-°F/Btu Service Water Fouling

RHR water inlet temperature, °F	250.0	200.0	150.0
RHR water outlet temperature, °F	177.4	150.0	121.7
CC water outlet temperature, °F	172.7	145.3	117.9
CC water inlet temperature, °F	111.7	102.6	93.4
SW water outlet temperature, °F	106.5	98.6	90.7
SW water inlet temperature, °F	80.0	80.0	80.0
heat load, Btu/hr	105,750,000	74,090,000	42,732,000
$U*A(RHR) \times 10^6$, Btu/hr-°F	1.780	1.725	1.655
$U*A(CC) \times 10^6$, Btu/hr-°F	2.257	2.230	2.197

The tabulated results are graphically presented in Figures 7.1 and 7.2. The appropriate M-TASC outputs are included in Attachment D (0.001 SW fouling) and Attachment E (0.002 SW fouling). The data start at RHR inlet temperature 250 °F. In each output data attachment, a total of six runs are included: one for each exchanger at all three temperature levels examined.

ATTACHMENT: B PAGE: B1 of B1
Comed Calculation No:
22S-B-005M-162 Rev 0

Table 6 SI Pump Analysis Assumptions

SI Pump	
Head Degradation	15%
Flow Imbalance	10 gpm
Miniflow	20.0 gpm @ Pump Runout

Table 7 RHR Pump Performance

Zion Unit 2A RHR Pump Performance				
Head (ft)	Flow (gpm)	Head (psi)	Head 85% + 8.75 psi NPSH (psi)	Flow (lbm/sec)
400.0	0.0	166.7	150.45	0.0
395.0	1000.0	164.6	148.65	187.2
390.0	2000.0	162.5	146.85	267.4
380.0	2500.0	158.3	143.35	334.2
370.0	3000.0	154.2	139.85	401.1
350.0	3650.0	145.8	132.65	488.0
330.0	4100.0	137.5	125.65	548.1
300.0	4700.0	125.0	115.05	628.3
250.0	5500.0	104.2	97.35	735.3

ATTACHMENT: A PAGE: A3 of A3
Comed Calculation No:
22S-B-005M-162 Rev 0

Charging Pump	
Head Degradation	15%
Seal Injection Flow	Seal line resistance set to K value of 2942.62 consistent with 52 gpm @ nominal pressure (Reference 4)
Flow Imbalance	12 gpm
Miniflow	80 gpm @ Nominal Press. 41.5 gpm @ Pump Runout (Reference 4)

Table 5 SI Pump Performance

Zion Combined SI Pump Performance Curve to Obtain the most conservative head-flow curve (nominal and 85% head)				
Head (ft)	Flow (gpm)	Head (psi)	Head 85% (psi)	Flow (lbm/sec)
3400.0	0.0	1416.7	1204.2	0.0
3300.0	50.0	1375.0	1168.8	6.7
3200.0	150.0	1333.3	1133.3	20.1
3000.0	340.0	1250.0	1062.5	45.5
2800.0	400.0	1166.7	991.7	53.5
2600.0	450.0	1083.3	920.8	60.2
2400.0	500.0	1000.0	850.0	66.8
2000.0	590.0	833.3	708.3	78.9
1800.0	640.0	750.0	637.5	85.6

ATTACHMENT: A PAGE: A2 OF A3
Comed Calculation No:
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ATTACHMENT: A PAGE: A1 of A3
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Table 1 Benchmark SI Pump Performance (Case 1)

W 1978 SI Performance Curve			
Head (ft)	Flow (gpm)	Head (psi)	Flow (lbm/sec)
3300.0	0.0	1375.0	0.0
3200.0	40.0	1333.3	5.3
3000.0	220.0	1250.0	29.4
2800.0	310.0	1166.7	41.4
2600.0	370.0	1083.3	49.5
2400.0	420.0	1000.0	56.1
2000.0	520.0	833.3	69.5
1700.0	594.8	708.3	79.5

Table 2 Benchmark SI Pump Performance (Case 2)

W 1978 SI Performance Curve			
Head (ft)	Flow (gpm)	Head (psi)	Flow (lbm/sec)
3300.0	0.0	1430.0	0.0
3000.0	178.0	1300.0	24.7
2800.0	280.0	1213.3	38.9
2600.0	340.0	1126.7	47.3
2400.0	390.0	1040.0	54.2
2000.0	497.0	866.7	69.1
1700.0	580.0	736.7	80.6

Table 3 Charging Pump Performance

Zion Unit 1A 85% Charging Pump Performance Curve	
Head (psi)	Flow (gpm)
2125.0	0.0
2092.8	100.0
2039.7	150.0
1915.6	200.0
1809.1	250.0
1614.0	300.0
1489.9	350.0
1277.0	400.0
1064.2	450.0
815.9	500.0
532.1	550.0

Table 4 Charging Pump Analysis Assumptions