PP&L

CALCULATION COVER SHEET

CALC. NO. M-VLV-193
FILE NO. R2-1M
SUPERSEDED BY

SAFETY-RELATED [X]
ASME III OR XI [ ]
OTHER QUALITY [ ]
NON QUALITY [ ]

PROJECT SSES MOV Program

ER/CTN NO. 402288

DESIGN ACTIVITY/PMR NUMBER

PAGE 1 OF 40

TITLE/DESCRIPTION MOV Data Detail, Limit Switch Settings and Torque Switch Settings for: HV-144F001

SYSTEMS AFFECTED 161

STATEMENT OF PROBLEM

NRC Generic Letter 89-10 required establishment of a program to provide for the testing, inspection and maintenance of safety-related motor-operated valves. This calculation provides the data details for the valve identified above which will be used to prepare the Data Detail Drawing which will support the testing, inspection and maintenance activities.

DESIGN BASIS (EPM-QA-208 OR EPM-QA-400)

See Section 2.0 for Methodology.

This calculation serves as the design inputs for drawing # M-1195

REFERENCES/FORMULAE

See Section 3.0 for Inputs/References.

SUMMARY/CONCLUSIONS

See Section 6.0 for Results/Conclusions.

Voltage Used = 80%
86.4% Voltage Used for Limiting Valve Factor Calculation

Rev 2 added pages 23A & 23B plus 2 new references

ENGINEERING TURNOVER
(ETO) BINDER AFFECTED? [ ] YES-If Yes enter: Binder # _____ Vol. _____
Calc. File _____ Pgs. _____
[ ] NO

REV. NO.	DATE	PREPARED BY	REVIEWED/CHECKED BY	DATE	APPROVED BY	DATE
2	10-1-91	DHHunt	RWMcHugh	10.2.91	KWAnderson	10/3/91
1	9-24-91	DHHunt	JMPanchison	9-24-91	KWAnderson	9/24/91
0	9-20-91	Rw McHugh	JMPanchison	9-21-91	KWAnderson	9/21/91

FORM EPM-QA-216A REV.1

mls/frb0061(12)

RWH 9-19-91
JMM 9-21-91

DESIGN INPUTS CHECKLIST

Title & No. M-VLV-193 Rev. 0

A. DESIGN INPUTS

		APPLICABLE YES	NO
1.	APPLICABLE CODES		
	Codes: ASME, ASTM, AISI. Standards: ANSI, IEEE, AWS, ANS Regulatory Requirements.	[X]	[ ]
2.	PERFORMANCE REQUIREMENTS		
	A. Input Requirements - For services such as air, water, electricity, lube oil, etc.	[X]	[ ]
	B. Output Requirements - Physical output such as: capacity, pressure, temperature, voltage, velocities of fluids, pressure drops separation and isolation both system and unit, and redundancy requirements of structures systems and components.	[X]	[ ]
	C. Operational requirements under various conditions, such as plant startup, normal plant operation, plant shutdown, plant emergency operation, special or infrequent operation and system abnormal or emergency operation. This includes the overall effect on the plant (i.e., the potential loss of generation).	[X]	[ ]
	D. Failure effects requirements of structures, systems and components, including a definition of those events and accidents which they must be designed to withstand.	[ ]	[X]
3.	COMPATIBILITY		
	A. Compatibility and suitability of material selection, such as chemical and physical characteristics, radiation and heat resistance protective coatings and corrosion resistance.	[ ]	[X]
	B. Operational interface requirements including definition of the functional interface involving structures, systems and components.	[ ]	[X]
4.	INSTALLATION (ITEMS MAY APPLY TO ANY DISCIPLINE)		
	A. Transporting and Storing - Includes environmental conditions anticipated during storage, construction and operation and handling storage and shipping requirements.	[ ]	[X]
	B. Civil - Plant layout and arrangement requirements, escape from enclosures, anchor bolts, penetrations, equipment foundations.	[ ]	[X]
	C. Piping - Thermal expansion or heat restriction requirements, vibration or dynamic loading considerations, stress, shock, reaction forces and pipe supports.	[ ]	[X]
	D. Electrical - Voltage, source, grounding conduit/raceway requirements.	[X]	[ ]
	E. Instrumentation - Instrumentation and control requirements including indicating instruments, control and alarms required for operation, testing and maintenance and calibration.	[X]	[ ]
	F. Chemistry - Water chemistry considerations, including sampling provisions.	[ ]	[X]
5.	MAINTAINABILITY		
	A. Accessibility - Maintenance, ISI and ALARA accessibility requirements.	[ ]	[X]
6.	TEST REQUIREMENTS - Including pre-OPS, ISI and LLRT tests.	[ ]	[X]
7.	SAFETY - Personnel and public safety including special blocking, radiation exposures, ALARA environmental concerns, effluents and noise.	[ ]	[X]
8.	SECURITY - Physical security plant considerations.	[ ]	[X]
9.	DESIGN CONSIDERATIONS - Form EPM-QA-208B2 and B3.	[X]	[ ]
10.	OTHER - _____	[ ]	[X]

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DESIGN INPUTS CHECKLIST

Title & No. M-VLV-193 Rv. 0

B. DESIGN CONSIDERATIONS

SUBJECT	APPLICABLE YES	APPLICABLE NO	REFERENCE PROCEDURE	NPE LEAD	ISSUED GUIDANCE
1. Dynamic Qualification	[ ]	[X]	EPM-QA-222	CIV Vernarr	
2. Environmental Qualification	[X]	[ ]	EPM-QA-222	CIV Derkacs	GDG-03
2.1 Relay Qualified Life	[ ]	[X]		ELC Nudge	SEA-EE-170 SEA-EE-171
3. Electrical Separation	[ ]	[X]		ELC Akus	E-1012
4. II over I, Safety Impact	[ ]	[X]	EPM-QA-211	CIV Rose	
5. Fire Protection	[ ]	[X]	NDI-QA-15.3.1 EPM-QA-440	EP Kohn	Fire Protection Manual
6. Appendix R -				ELC Backenstoe	EDS-01
6.1 Safe Shutdown Analysis	[ ]	[X]			
6.2 Combustible Loading Anal.	[ ]	[X]		CIV Delgado	CDS-03 & Dwg. C-1929
7. Flooding Protection	[ ]	[X]		MCH	
8. Jet Impingement	[ ]	[X]		MCH	
9. Missile Protection	[ ]	[X]		CIV Reinsmith	
10. Radiation Exposure, ALARA	[ ]	[X]	NDI-6.4.2	CIV Matchick	Memo AM-151 DG-G-100
11. Physical Separation	[ ]	[X]		CIV Rose	Dwg. C-1804
12. HVAC Requirements	[ ]	[X]		MCH Agnew	
13. Electrical Load/Voltage Study	[X]	[ ]		ELC Sleva/Nudge	EDG-02 EDS-02
14. Human Factors Engineering	[ ]	[X]	NDI-15.3.12	EP Patnaude	Human Factors Specifications & Guidelines Manual
15. Inservice Inspection Requirements	[ ]	[X]	NDI-QA-15.3.7	EP Lindberg	ISI Manuals
16. Materials Compatibility	[ ]	[X]		EP Willertz	
17. ASME Code Compliance (See Note 1)	[ ]	[X]		MCH Sattar	
18. Design Assessment	[ ]	[X]		SE Detamore	PLI-59437 dated 3/31/89
19. Fuel/Core Effects	[ ]	[X]	NDI-QA-7.2.2	NFE Kulick	

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DESIGN INPUTS CHECKLIST

Title & No. M-VLV-193 Rev 0

B. DESIGN CONSIDERATIONS

SUBJECT	APPLICABLE YES	APPLICABLE NO	REFERENCE PROCEDURE	NPE LEAD	ISSUED GUIDANCE
20. Heavy Loads	[ ]	[X]	M-1435	MCH Kostelnick	
21. Radwaste Minimization	[ ]	[X]		MCH	NDPL85-003
22. Approved Materials	[ ]	[X]	NDI-QA-15.3.9	EP Morgan	Susq. Approved Matl's PLI-37573 of 1/10/85 PLI-45673 of 5/22/86
23. Secondary Containment, Control Structure, Ventilation Zone Boundary Penetrations	[ ]	[X]		MCH Agnew	
24. Electrical Load Tracking	[ ]	[X]		ELC Sleva/Nudge	EDS-02
25. Computer Program Change including Display Formats	[ ]	[X]	EPM-QA-401	CPU	
26. Environmental Protection	[ ]	[X]	NDI-QA-6.3.2	(Nuc. Svcs.- J. S. Fields)	
27. Station Blackout	[ ]	[X]		ELC Sleva	GDS-08

NOTE 1: For modifications to ASME III systems/components (both paperwork only and physical changes) request in the installation instructions that Plant Staff prepare the required documentation package per NDI-QA-5.3.4 and AD-QA-522.

dc/a1861(11)

PP&L DESIGN INPUTS (con't)

2. TITLE M-VLV-193 Rv. 0

1. PAGE 5 OF 40

FILE NO. R35

3. NO

4. ITEM	5. DISCUSSION (GWM 9.19.91, MP 9-21-91)
1.	Applicable Codes: Calculation shall address requirements of NRC Generic Letter 89-10
2. A, B, C	Performance Requirements: Electricity input requirements are given by Limitorque Data Sheets, SEA-ME-237 and the MBS-01 Torque and Thrust calculation. Output requirements for the actuator are given by the MBS-01 calculation. Operational requirements when the actuator is required to function, including ΔP, are given in SEA-ME-237.
4 D	Installation - Electrical: Electrical voltage, current and source requirements are given in the calculation data tables. (Table: Electrical/Motor Design Information).
4 E	Instrumentation: Geared Limit Switch Settings and Spring Pac/Torque Switch Settings are given in tables in the calculation.

FORM EPM-QA-208C, REV. 3

Rev 9.19.91
9-21-91

Calculation Contents

RWM 9.19.91
JMP 9-21-91

1.0 Purpose/Scope

The purpose of this calculation is to develope all of the information necessary to create a Motor Operated Valve Data Detail Drawing for the subject MOV. In order to meet this end the following specific activities will be performed in this calculation to complete the MOV Detail Drawing for the subject MOV:

1.1 Research existing design documents and records for the MOV to determine best available configuration data. This data will be used as input to the MOV Data Detail Drawing as well as to the calculations to be performed herein.

1.2 An actuator sizing calculation will be performed to determine the required actuator parameters (e.g.actuator size, motor size, spring pack, torque switch settings, etc.).

1.3 Using the results of Item 1.2, diagnostic test acceptance criteria will be established.

1.4 Based on the design function of the MOV, geared limit switch settings will be determined. For the purposes of this calculation, the limit switch functions to be considered will be limited to:

a.) Torque switch bypass (open and close direction)

b.) Full open limit switch

c.) Valve position indication

1.5 A review of previously approved spring pack Replacement Item Equivalency Evaluations (RIEE's or RIE's) will be performed for the particular MOV being evaluated. Changes to these RIE's will be processed as necessary based on the results of this calculation.

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2.0 Methodology

Existing design documents, modifications and field work authorizing documents will be reviewed to identify required inputs to the MOV Data Detail Drawing. Lists of the required inputs as well as a cross reference to the data source are provided in Section 3.0 of this calculation.

2.1 Actuator Sizing Calculations: These will be performed using the software version of Mechanical Design Standard (MDS) Number 01 (Input a.). The following methods will be used to compliment the techniques used in the software package:

a.) The active valve stroke length is a required program input which allows the program to calculate a design valve stroke time. The active stroke length will be calculated based on the following expression:

$$\text{ACTIVE STROKE LENGTH} = Z * FSL$$

Where:

Z = The setpoint of the full open limit switch in percent open (typically 97%)

FSL = Full Valve Stroke Length from the closed position to the fully open (backseated) position. If FSL is not specifically known it can be calculated using the following expression:

$$FSL = \frac{HWT * SL}{HGR}$$

Where:

HWT = The number of handwheel turns required for the valve to travel from fully closed to fully

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open.

SL = The valve stem lead.

HGR = The overall handwheel gear ratio.

b.) Program overrides will be used to allow the calculation to reflect the current configuration of the MOV.

c.) Once an expected motor run torque is calculated, a typical motor curve will be consulted to determine an estimated midstroke loaded motor speed (RPM). The calculation will be rerun using this value as an override, the result being a more representative design stroke time.

d.) For gate valves the calculation will be run using a valve factor of .3.

e.) The calculation will be run with various acceptable spring packs to allow for flexibilty in future replacement. Only spring packs approved on spring pack equivalencies will be included on the MOV Data Detail Drawing.

2.2 VOTES Diagnostic Thrust Acceptance Criteria: Once the actuator sizing has been completed diagnostic test thrust acceptance criteria will be established using the following methodology:

a.) The Minimum Allowable Thrust will be established as 115% of the design calculated required thrust. This allows for at least 10% error in the diagnostic test results and 5% variation in torque switch repeatability.

b.) The Maximum Allowable Running Thrust will be established as the Stuffing Box Friction load used in the actuator sizing calculations.

c.) The Maximum Allowable Thrust will be established as the thrust corresponding to the minimum of the following:

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1.) Actuator thrust rating,

2.) 120% of the equivalent thrust at maximum allowable actuator output torque,

3.) Maximum allowed valve thrust (if available).

d.) The acceptance criteria at each torque switch setting will be specified as the expected thrust +/- 20% .

e.) In all cases items a.) and c.) shall take precedence over item d.).

2.3 Limit Switch Settings: This section of the calculation will determine the appropriate geared limit switch settings for valve control and position indication. The limit switch settings will be established per the requirements of MDS-03 (Input b.). The switch settings will be specified in percentages of physical stem travel from either full open or full closed.

2.4 Other Items

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3.0 Inputs/References

3.1 The principle design inputs for this calculation are:

a.) MDS-01 "Design Standard for the Sizing of Limitorque Actuators Including Thrust Calculation, Actuator Sizing, Spring Pack Selection and Torque Switch Setting Determination." Revision 1.

b.) MDS-03 "Design Standard for Determining and Setting Valve Motor Actuator Limit Switches." Revision 0.

3.2 Information required for entry on the MOV Data Detail Drawing and as input to this calculation is provided on pages 11 through 15 of this calculation. Reference Numbers are provided for each of the entries. A listing of all references is provided on Page 14. (Note: Copies of references not readily available are provided as attachment to this calculation).

General Valve Design

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	Data Value	Reference No.
Valve Manufacturer	ANCHOR DARLING	1
Vendor Drawing Number	93-13748	1
Valve Serial Number		
Valve Quality Class	Q	9
Valve ASME Section III Edition and Class	1971 THRU W'72 CL. 1	1
Valve Location (Inside/Outside Containment)	INSIDE	9
Valve Type	GATE	1
Valve Pressure Class	600	1
Valve Size (Inches)	6.	1
Valve Seat Area (Inches Squared)	25.43	4
Stem Information:		
Stem Diameter (Inches):		
At Stuffing Box Location	1.5	2
At Threaded Portion	1.5	2
Thread Pitch/Lead	0.333 | 0.333	2
Stem Material	A276 - 410	1
Original Design Stroke Time (Seconds)	28	3

General Valve Design (Cont.)

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R-0

	Data Value	Reference No.
Process Parameters:		
Flow Medium	WATER	11
Design/Maximum Pressure (PSIG)	1250 / 1375	7
Design/Maximum Temperature (F)	565 / 565	7
Design/Maximum Flow (GPM or LB/HR)	310 / 436	11
Throttled Flow (GPM or LB/HR)	NA	
Max. Operating Differential Press. (PSID):		
Opening Direction	NA	
Closing Direction	1053	11
Additional Physical Parameters:		
Valve Max. Thrust Capability (LBS)	NOT AVAILABLE	
End Connections/Rating	BW - SCH. 80	1
Body Material	SA 105 II	1
Disc Trim Material	STELLITE	1
Body Seat Trim Material	STELLITE	1
Guide Rib Facing (Gate Valves Only)	SA 105 II	1
Drain/Bypass Required (Y/N)	N | N	1, 3

Actuator Design

	Data Value	Reference No.
General:		
Actuator Quality Class	Q	9
Safety Function (Open/Close)	C	11
Actuator Manufacturer	LIMITORQUE	1
Main Unit (e.g. SMB):		
Actuator Order Number	381264 X	4
Actuator Serial Number	213457	4
Actuator Size	SMB-00-10	4
Gearing Information:		
Motor Pinion Number of Teeth	21	4
Worm Gear Number of Teeth	44	4
Worm to Worm Gear Ratio	45:1	4
Overall Actuator Ratio	94.0:1	4
Lost Motion Drive Sleeve (Y/N)		
Auxilary Worm/Bevel Gear Unit:		
Unit Order Number	NA	
Unit Serial Number	NA	
Unit Type/Size	NA	
Unit Gear Ratio	NA	
Overall Handwheel Ratio	4.38:1	6
Handwheel Orientation (Top or Side Mount)	SIDE	1
Handwheel Efficiency	95%	6

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Electrical/Motor Design Information

	Data Value		Reference No. Rev. 0
Motor Class (1E/Non1E)	1E		12 RWM 9-19-91 JMP 9-24-91
Power Supply Type (AC/DC)	AC		4
Power Source	1B23605B		11
Voltage Supply/Phase/Frequency	460 / 3 / 60		13
Motor Manufacturer	RELIANCE		13
Motor Serial Number			
Design Motor Speed (RPM)	3600		13
Motor Start/Run Torque (ft-lbs)	10	7	4
Motor Horsepower	1.3		13
Service Factor	1.0		13
Motor Type/Frame Size	/M56		4
Motor Frame Design/Enclosure Type	/TENV		13
Winding Type (DC Motors)	NA		
Motor Duty Rating (min.)			
Insulation Class	RH		13
Temp. Rise/Ambient Temp. (C)	115	40	13,5
Full Load/Locked Rotor Current (Amps) or KVA Code (LRIC) at Supply Voltage (See Note 3)	2.3	11.9	13
DC Motor Field Current (Amps)	NA		
Limit Switch Comp/Motor Spaceheaters (Y/N)			

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GMM 9-21-91
4 DAH 10-1-91
RWM 10-2-91

References:

1. Anchor Darling Valve Drawing 93-13748 (FF 110100 5001), Rev 7
2. Anchor Darling Letter dated 2/20/90 (copy attached)
3. Valve Specification Data Sheet P10 Sh 9 (copy attached)
4. Work Authorization S81177 (copy attached)
5. Motor Operator Information Sheet for 381264X (copy attached)
6. SEL-11, Limitorque Standard Handwheel Ratios (copy attached)
7. SEIS Pipeline Index, Rev 6
8. Anchor Darling Design Report E5853-23D (FF 110101 ~~0901~~ 0301), Rev 1 (copy of referenced page attached)
9. P & I D M-144 RWCU Sht 1 Rev 28
10. Not used
11. SEA-ME-238 Design Basis Development Priority 2 Motor Operated Valves, Rev 0 (copy of data sheet attached)
12. Electrical Schematic Dwg. E-165 Sh 6 Rev 18
13. Induction Motor Data Sheet 8856-P10A-131(4)-4
14. Anchor Darling Telecopy dated 3/28/91 (copy attached)
15. Reliance A-C motor performance curve M1458 (copy attached) 4
16. PP&L Calculation E-AAA-619, Rev 3.4 RWM

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4.0 Assumptions

1. For the purposes of this calculation, attempts have been made to verify design information against actual as-installed information as documented in Plant Work Authorizations. Where actual as-installed information is unavailable the original design information will be used. Upon completion of field as-built verification, any discrepencies will be reconciled and this calculation shall be revised as appropriate.

2. Stuffing box friction values will be consistent with the empirical values listed in MDS-01 unless otherwise noted herein.

3. Unless noted otherwise, the stem factor used herein will be based on a coefficient of friction of 0.15 (Reference 14). This is consistent with the original design seismic analysis. The SSES MOV preventative maintenance and trending program will ensure the valve stems/stem nuts are maintained in a manner which supports this assumption.

4. The minimum voltage available will be assumed to be 80% unless noted otherwise. If the electrical voltage drop calculations show this to be unconservative a lower value will be used. If the use of 80% initially produces unacceptable results the electrical voltage drop calcs will be consulted in an attempt to remove some of the conservatism.

5. Gate valve sizing calculations will be run using a valve factor of .3.

6. During the initial preparation of this calculation, the valve maximum thrust capability may not yet be available. In these cases, the maximum thrust/torque shall be based on the following:

   Maximum Torque

   The maximum allowed torque shall be the lesser of the maximum torque calculated by the MDS01 software or the torque corresponding to the original design maximum torque switch setting.

   Maximum Thrust

   The maximum allowed thrust shall be the lesser of the actuator thrust rating or 120% of the equivalent thrust at the maximum allowable actuator output torque.

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5.0 Calculations

5.1 Actuator Sizing Calculation

The results of the actuator sizing calculations are provided as follows:

Run #	Conditions	Calc. Pages
1.	SPRING PACK : 0022 VALVE FACTOR : 0.3	P. 10, 11
2.	SPRING PACK : 0049 VALVE FACTOR : 0.3	P. 1.22
3.		
4.		

5.2 VOTES Diagnostic Thrust Acceptance Criteria

The calculation of the thrust acceptance criteria was performed per the method outlined in 2.2.

SEE PAGE 13 FOR RESULTS.

5.3 Limit Switch Settings

SEE PAGE 71 FOR RESULTS

PP&L REVISION 1.90226 DATED 08-14-90 - TODAY IS 09-20-1991 15:27:20 RVM 9.20.91 GMP 9-21-91

VALVE Info (Input) (TABLE # 1) - FILE: 144F001A

Calculated by: Checked by:

Valve MANUFACTURER:	ANCHOR DARLING
Valve TYPE (GATE or GLOBE):	GATE
Valve SIZE:	6
Valve TAG Number:	HV144F001
Valve VENDOR DRAWING number:	93-13748
Valve PP&L Drawing number:	
Valve LOCATION:	
Valve SYSTEM:	
Valve LINE (ie. PIPE LINE I.D.):	
Valve MAXIMUM Design THRUST:	0

VALVE Data (Input) (TABLE # 2) - FILE: 144F001A

ANCHOR DARLING GATE Tag: HV144F001

Valve STEM DIAMETER (Inches):	1.5
Valve STEM PITCH:	.333
Valve STEM LEAD (Inches):	.333
Valve SEAT AREA (Sq-Inches):	25.43
Valve STEM AREA (Default = 0 Sq-Inches):	1.76715
Req'd STEM SPEED (0 or 3-6=Globe or 12-14=Gate):	0
Valve STROKE LENGTH (Inches):	0
Req'd STROKE TIME (Seconds):	0 (0 Min.)
Valve INLET PRESSURE (PSIG):	1053
Valve PRESSURE DROP (PSIG):	1053
Valve Factor (.2 or .3=Gate 1.1=Globe):	.3
Valve STUFFING BOX FRICTION (Default = 0 Lbs):	1500
Valve STEM/NUT Coeff. FRICTION (0 .15 or .2):	.15

Manual ACTUATOR RATIO Selected: 94.29 : 1
Manual ACTUATOR Selected: 6
Manual SPRING PAC CURVE Selected: 23

MOTOR Data (Input) (TABLE # 3) - FILE: 144F001A

ANCHOR DARLING GATE Tag: HV144F001

Motor TYPE (AC or DC):	AC
Motor RPM (900 1800 or 3600):	3600
Motor REDUCED VOLTAGE Percent (Default=0.8):	.8
HIgh TEMPerature application (Y or N):	N
COMPound motor GEAR application (Y or N):	N
AIR MoToRs (Y or N):	N
MODULTRONIC MoToRs (Y or N):	N
HILO Applications (Y or N):	N
Non-Rising Stem - OPERator thrust (Y or N):	N
Non-Rising Stem - VaLVe thrust (Y or N):	N

Manual MOTOR Selected: 5

PP&L REVISION 1.90226 DATED 08-14-90 - TODAY IS 09-20-1991 15:27:20 Run 9.20.91

Calculation RESULTS (TABLE # 4) - FILE: 144F001A
 AMP 9-21-91

Calculated by: Checked by:

ANCHOR DARLING GATE Tag: HV144F001

Valve STEM FACTOR:	0.0132	
STUFFING BOX FRICTION:	1500	Lbs
THRUST:	11394.15	Lbs
STEM TORQUE:	150.2606	Ft-Lbs
STEM SPEED:	12.00764	Inches/Min.
UNIT RPM:	36.05897	RPM
Design STROKE TIME:	0	Seconds
OVERALL ACTUATOR RATIO:	94.29	

* SMB-00 ACTUATOR selected having a 43.6 - 109 Ratio RANGE (IACT= 6)
* SMB-00 43.6 - 109 UNIT Efficiencies: PULLOUT= 40 RUN= 55 STALL= 60
* * USER Selected ACTUATOR
* * USER Selected ACTUATOR Ratio

used 3600 Rpm 'AC' Motor OPERATING at 3400 Rpm

APPLICATION FACTOR:	.9		
Calc. MOTOR START TORQUE:	4.426667	Ft-Lbs	
MIDSTROKE RUN THRUST:	3360.809	Lbs	
Calc. MOTOR RUN TORQUE:	.8546311	Ft-Lbs	(5 X RUN= 4.273155)

* 10 Ft-Lbs SMB-00 MOTOR with 102 Maximum Ratio Selected (IMTR= 5)
* * USER Selected MOTOR

Revised MOTOR START TORQUE:	6.916667	Ft-Lbs	
STALL TORQUE:	622.314	Ft-Lbs	
STALL THRUST:	47189.61	Lbs	(2.5 X Rated= 35000)

* * USER Selected Motor SIZE

* SPRING PAC Curve: SMB-00 OBSOL Selected (ISPG= 23)
* * USER Selected SPRING PAC Curve
SPRING PAC No: 60-600-0022-1
BILL of Materials No: NONE

* Calc. SPRING PAC SETTING:	1.730234		
* Set SPRING PAC to:	1.75	Normal TORQUE:	152 Ft-Lbs
Max. SPRING PAC SETTING:	2	Max. TORQUE:	174 Ft-Lbs

MOTOR SIZE Checks:	10	Ft-Lbs vs	4.426667	Ft-Lbs Calc. Start TORQUE
	10	Ft-Lbs vs	6.916667	Ft-Lbs Revised Start TORQUE
	10	Ft-Lbs vs	4.273155	Ft-Lbs 5 X RUN TORQUE

MOTOR STALL Check: 47189.61 Lbs vs 35000 Lbs 2.5 X Actuator THRUST

TORQUE SWITCH Checks:	174	Ft-lbs vs	250	Ft-Lbs Actuator RATING
	13194	Lbs vs	14000	Lbs Max. Actuator THRUST
	174	Ft-Lbs vs	622	Ft-Lbs Stall TORQUE
	2	SETTING vs	3.315	Max. SPRING PAC Setting

* * WARNING - 47189.61 Lbs EXCEEDS 2.5 X Actuator THRUST

PP&L REVISION 1.90226 DATED 08-14-90 - TODAY IS 09-20-1991 15:26:22 QAM 9.20.91

VALVE Info (Input) (TABLE # 1) - FILE: 144F001 GMP 9-21-91

Calculated by: Checked by:

Valve MANUFACTURER:	ANCHOR DARLING
Valve TYPE (GATE or GLOBE):	GATE
Valve SIZE:	6
Valve TAG Number:	HV144F001
Valve VENDOR DRAWING number:	93-13748
Valve PP&L Drawing number:	
Valve LOCATION:	
Valve SYSTEM:	
Valve LINE (ie. PIPE LINE I.D.):	
Valve MAXIMUM Design THRUST:	0

VALVE Data (Input) (TABLE # 2) - FILE: 144F001

ANCHOR DARLING GATE Tag: HV144F001

Valve STEM DIAMETER (Inches):	1.5
Valve STEM PITCH:	.333
Valve STEM LEAD (Inches):	.333
Valve SEAT AREA (Sq-Inches):	25.43
Valve STEM AREA (Default = 0 Sq-Inches):	1.76715
Req'd STEM SPEED (0 or 3-6=Globe or 12-14=Gate):	0
Valve STROKE LENGTH (Inches):	0
Req'd STROKE TIME (Seconds):	0 (0 Min.)
Valve INLET PRESSURE (PSIG):	1053
Valve PRESSURE DROP (PSIG):	1053
Valve Factor (.2 or .3=Gate 1.1=Globe):	.3
Valve STUFFING BOX FRICTION (Default = 0 Lbs):	1500
Valve STEM/NUT Coeff. FRICTION (0 .15 or .2):	.15

Manual ACTUATOR RATIO Selected: 94.29 : 1
Manual ACTUATOR Selected: 6

MOTOR Data (Input) (TABLE # 3) - FILE: 144F001

ANCHOR DARLING GATE Tag: HV144F001

Motor TYPE (AC or DC):	AC
Motor RPM (900 1800 or 3600):	3600
Motor REDUCED VOLTAGE Percent (Default=0.8):	.8
HIgh TEMPerature application (Y or N):	N
COMPound motor GEAR application (Y or N):	N
AIR MoToRs (Y or N):	N
MODULTRONIC MoToRs (Y or N):	N
HILO Applications (Y or N):	N
Non-Rising Stem - OPERator thrust (Y or N):	N
Non-Rising Stem - VaLVe thrust (Y or N):	N

Manual MOTOR Selected: 5

RWM 9-20-91
JMP 9-21-91

PP&L REVISION 1.90226 DATED 08-14-90 - TODAY IS 09-20-1991 15:26:22

Calculation RESULTS (TABLE # 4) - FILE: 144F001

Calculated by: Checked by:

ANCHOR DARLING GATE Tag: HV144F001

Valve STEM FACTOR:	0.0132	
STUFFING BOX FRICTION:	1500	Lbs
THRUST:	11394.15	Lbs
STEM TORQUE:	150.2606	Ft-Lbs
STEM SPEED:	12.00764	Inches/Min.
UNIT RPM:	36.05897	RPM
Design STROKE TIME:	0	Seconds
OVERALL ACTUATOR RATIO:	94.29	

* SMB-00 ACTUATOR selected having a 43.6 - 109 Ratio RANGE (IACT= 6)
* SMB-00 43.6 - 109 UNIT Efficiencies: PULLOUT= 40 RUN= 55 STALL= 60
* * USER Selected ACTUATOR
* * USER Selected ACTUATOR Ratio

used 3600 Rpm 'AC' Motor OPERATING at 3400 Rpm

APPLICATION FACTOR:	.9		
Calc. MOTOR START TORQUE:	4.426667	Ft-Lbs	
MIDSTROKE RUN THRUST:	3360.809	Lbs	
Calc. MOTOR RUN TORQUE:	.8546311	Ft-Lbs	(5 X RUN= 4.273155)

* 10 Ft-Lbs SMB-00 MOTOR with 102 Maximum Ratio Selected (IMTR= 5)
* * USER Selected MOTOR

Revised MOTOR START TORQUE:	6.916667	Ft-Lbs	
STALL TORQUE:	622.314	Ft-Lbs	
STALL THRUST:	47189.61	Lbs	(2.5 X Rated= 35000)

* * USER Selected Motor SIZE

* SPRING PAC Curve: SMB-00 MEDUM Selected (ISPG= 7)
SPRING PAC No: 60-600-0049-1
BILL of Materials No: 0301-112

* Calc. SPRING PAC SETTING:	2.070642		
* Set SPRING PAC to:	2.25	Normal TORQUE:	156 Ft-Lbs
Max. SPRING PAC SETTING:	2.75	Max. TORQUE:	175 Ft-Lbs

MOTOR SIZE Checks:	10 Ft-Lbs vs	4.426667	Ft-Lbs Calc. Start TORQUE
	10 Ft-Lbs vs	6.916667	Ft-Lbs Revised Start TORQUE
	10 Ft-Lbs vs	4.273155	Ft-Lbs 5 X RUN TORQUE

MOTOR STALL Check: 47189.61 Lbs vs 35000 Lbs 2.5 X Actuator THRUST

TORQUE SWITCH Checks:	175 Ft-lbs vs	250	Ft-Lbs Actuator RATING
	13270 Lbs vs	14000	Lbs Max. Actuator THRUST
	175 Ft-Lbs vs	622	Ft-Lbs Stall TORQUE
	2.75 SETTING vs	3	Max. SPRING PAC Setting

* * WARNING - 47189.61 Lbs EXCEEDS 2.5 X Actuator THRUST

PP&L Form 2454 (10/83)
Cat. #973401

Dept. _____
Date 9-16 19 91
Designed by [signature]
Approved by _____

PENNSYLVANIA POWER & LIGHT COMPANY
CALCULATION SHEET

PROJECT MOV Data Detail, Limit Switch Settings, and Torque Switch Settings for HV-

ER No. Rev. 0
M-VLV-193
Sht. No. 23 of 40

THIS VALVE HAS NO SAFETY FUNCTION TO OPEN.

PULLOUT TORQUE CALCULATION: (100% Voltage)

Pullout Torque (ft-lbs) = Motor Start Torque x Overall Actuator Ratio x Stall Efficiency

Pullout Torque (ft-lbs) = 10 x 94.29 x .4 x .9

Pullout Torque (ft-lbs) = 339 ft-lbs

Equivalent Thrust (lbs) = 339/0.0132 = 25682 lbs.

TORQUE SWITCH SETTING CHECK (cont'd):

Torque (ft-lbs) at Max Torque Switch Setting	vs.	Voltage Pullout Torque (ft-lbs)
MDS01 - SPRING PACK Torque		
@ max set. (0022) 174	vs.	339
@ max set. (0049) 175		

BECAUSE THE ORIGINAL DESIGN MAX TORQUE SWITCH SETTING RESULTS IN EXCEEDING MAX ACTUATOR RATING, MDS01 COMPUTER RUN WILL SET THE NEW LIMITING CRITERIA. (SO WILL USE 175 #)

PP&L Form 2454 (10 83)
Cat #973401

Dept. _____
Date 10-1 1991
Designed by NRL/RWM
Approved by _____

PENNSYLVANIA POWER & LIGHT COMPANY
CALCULATION SHEET
PROJECT _____
HV 144F001

ER No. _____
M-VLV-193 Rev 2
Sht. No. 23A of 40
RWM 10.2.91

Check for Limiting Valve Factor in closing direction:

$$LVF = \frac{RVT\ stall - F - (A_{ss} \times P)}{A_{se} \times \Delta P}$$

[MDS-01 Rev 2 Eqn. 23]

Where: $F = 1500$ lbs
$A_{ss} = 1.77$ in²
$A_{se} = 25.43$ in²
$P = 1053$ psi
$\Delta P = 1053$ psi
OAR = 94.29
Unit Stall Eff. = .6
FS = .0132
Reduced Voltage = 86.4% (Ref. 16)

Actual motor start torque = 12.4 ft-lbs (Ref. 15)

Reduced Voltage Stall Torque = Reduced Voltage Motor Start Torque × OAR × Unit Stall Eff. × Appl. Factor

$= 12.4 \times (.864)^2 \times 94.29 \times .6 \times .9$

$= 471.3$

Reduced Voltage Stall Thrust = $\frac{RV\ Stall\ Torque}{FS} = \frac{471.3}{.0132} = 35705$

Thus:

$$LVF = \frac{35705\ 1500 - (1.77 \times 1053)}{25.43 \times 1053}$$

$= 1.2$

PP&L Form 2454 (10/83)
Cat #973401

Dept. _____ | PENNSYLVANIA POWER & LIGHT COMPANY | ER No. _____

Date 10-1 19 91 | CALCULATION SHEET | M-VLV-193 Rev 2

Designed by DWH/RwM | PROJECT _____ | Sht. No. 23 B of 40

Approved by _____ | _____ | RwM 10.2.91

HV144FD01

The foregoing calculation used actual motor start torque from the motor curve. Using nominal motor start torque instead gives:

$$\text{Reduced Voltage Stall Torque} = 10 \times (.864)^2 \times 94.29 \times .6 \times .9$$

$$= 380.1$$

$$\text{Reduced Voltage Stall Thrust} = \frac{380.1}{.0132} = 28796$$

$$LVF = \frac{28796 - 1500 - (1.77 \times 1053)}{25.43 \times 1053}$$

$$= 0.95$$

DHH 8-14-91
GMP 9-21-91
Rev 9.23.91

Geared Limit Switch Settings

	Data Value		Reference No.
Electrical Schematic & Connection Diagram No.	E-165 SH. 6	E-379-11 SH. 1	12
Full Stroke Length & Number of Handwheel Turns		79	4

Limit Switch Number	Function	Setpoint (See Note 4)	Equivalent No. of Handwheel Turns	
ZS-1				
ZS-2				
ZS-3	CLOSE LIGHT	3% C		
ZS-4	OPEN L.S.	97% O		
ZS-5				
ZS-6				
ZS-7	OPEN LIGHT	3% O		
ZS-8	CTS BYPASS	97% C		
ZS-9				
ZS-10				
ZS-11				
ZS-12				
ZS-13				
ZS-14				
ZS-15				
ZS-16				

Spring Pack/Torque Switch Settings

RWM 9.19.91
GMP 9-21-91

	Data Value		Reference No.
Minimum Required Torque (ft-lbs)	150		
Maximum Allowable Torque (ft-lbs)	175	Max torque switch setting	

	Original Design	Replacement 1	Replacement 2	
Spring Pack Number	60-600-0022-1	60-600-0049-1		
Limitorque B/M Number	NONE	0301-112		
Lowest Allowed Torque Switch Setting	1.75	2.25		
Corresponding Expected Actuator Output Torque (ft-lbs)	152	156		
Highest Allowed Torque Switch Setting	2	2.75		
Corresponding Expected Actuator Output Torque (ft-lbs)	174	175		
RIE Number		91.0154		

VOTES Thrust Acceptance Criteria

RoM 9.19.91
MP 9-21-91

	Data Value		Reference No.
Minimum Thrust Required (lbs)	13110	11394.15 x 1.15	
Maximum Total Thrust Allowable (lbs)	14000	Max act. rating	
Maximum Allowable Running Thrust (lbs)	1500		

Torque Switch Setting		Acceptable Thrust Range at Torque Switch Trip (lbs) Original Design Spring Pack Installed	Replacement 1 Spring Pack Installed	Replacement 2 Spring Pack Installed	Reference No.
1.0					
1.25					
1.5					
1.75	152	11515 13110 – 13818			
2.0	174	13182 13110 – 14000			
2.25	156		11818 13110 — 14000		
2.50	166		12576 13110 — 14000		
2.75	175		13258 13110 – 14000		
3.0					
3.25					
3.50					
3.75					
4.0					

QWM 9-19-91
GMP 9-21-91
⚠ DNR 9-24-91
GMP 9-24-91

6.0 Results/Conclusions

6.1 All available MOV Data Detail Drawing input has been researched and documented herein. Where it was determined that information was unavailable from existing records, the field has been left blank. This information will be determined during the as-built walkdown.

6.2 The results of the actuator sizing calculations, VOTES diagnostic acceptance criteria calculations and limit switch setting determination are provided within the body of the calculation.

6.3 The following anomolies have been identified through the performance of this calculation:

1.) THIS CALC. ESTABLISHES NEW TORQUE SWITCH SETTINGS WHICH DIFFER FROM THE ORIGINAL DESIGN.

2.) This calculation identified an error on the original Limitorque motor operator information sheet (Ref. 5). Limitorque identified the motor as a 10 ft-lb D.C. motor, however, based on actual nameplate data it is known that the motor is a 10 ft-lb A.C. motor (see Ref. 4). ⚠

Ref #2
M-VLV-193 Rev 0
Page 28 of 40

Anchor/Darling

Valve Company

701 FIRST STREET
P.O. BOX 3428
WILLIAMSPORT, PA 17701-0428
(717) 327-4800
TELEX: 759953

February 20, 1990

PENNSYLVANIA POWER & LIGHT COMPANY
Two North Ninth Street
Allentown, PA 18101

Attn: Mr. Ken Anderson, Engineering

SUBJECT: VALVE DATA

Dear Ken,

The valve data you requested at our recent meeting is enclosed.

Please advise if you need further information.

Yours sincerely,

ANCHOR/DARLING VALVE COMPANY

R. W. Dommers
Director - Marketing & Sales

/cll

cc: J. J. Chappell
R. J. Stout

encl.

STEM DATA FOR P.P.&L. (SUSQUEHANNA)

CERT. DWG NO.	A/DV S.O. ITEM NO	VALVE SIZE/TYPE	STEM DIA AT S BOX	STEM DIA AT THDS	PITCH & LEAD	
21700	15G4-2	2-1500-DD	.750	.750	1/3 - 1/3	
21699	15G4-1	2-1500-DD	.750	.750	1/3 - 1/3	
13661	5853-1	4-900-FW	1.250	1.250	1/3 - 2/3	149F007
13662	5853-2	4-900-FW	1.250	1.250	1/3 - 2/3	149F008
13689	5854-14	20-150-FW	1.875	1.875	1/3 - 1/3	
13692	5854-21	6-150-FW	1.125	1.125	1/3 - 1/3	
13699	5854-9	3-300-FW	.875	.875	1/3 - 1/3	
13709	5853-8	14-900-FW	2.375	2.375	1/3 - 1	151F006
13711	5853-11	10-900-FW	2.000	2.000	1/3 - 1	
13712	5853-15	6-900-FW	1.625	1.625	1/3 - 2/3	
13713	5853-85	4-900-GB	1.500	1.500	1/4 - 1/4	149F022
13715	5854-18	10-150-FW	1.500	1.500	1/3 - 1/3	
13739	5855-2	20-900-FW	3.125	3.125	1/3 - 1	151F003
13740	5855-3	20-900-FW	3.125	3.125	1/3 - 2/3	151F004
13747	5855-10	6-900-GB	2.125	2.125	1/3 - 2/3	
13795	5853-28	10-900-GB	3.125	3.125	1/4 - 1/4	
13797	5853-5	3-900-FW	1.125	1.125	1/3 - 2/3	149F010
13798	5853-6	3-900-FW	1.125	1.125	1/3 - 2/3	
13801	5853-21	10-600-FW	1.875	1.875	1/3 - 2/3	
13802	5853-22	10-600-FW	1.875	1.875	1/3 - 2/3	
13808	5854-27	18-300-GB	3.250	3.250	1/4 - 1/4	
13812	5854-30	6-300-GB	1.500	1.500	1/4 - 1/4	
13814	5853-93	4-600-FW	1.250	1.250	1/3 - 2/3	
13831	5854-28	12-300-GB	2.500	2.500	1/4 - 1/2	
13858	5854-16	16-150-FW	1.750	1.750	1/3 - 1/3	151F004
13956	5796-3	6-900-FW	1.625	1.625	1/3 - 1/3	
13981	5854-89	3-150-FW	.750	.750	1/3 - 2/3	
14071	5853-109	4-900-FW	1.250	1.250	1/3 - 1/3	
15251	5853-87	4-900-GB	1.500	1.500	1/4 - 1/4	
13687	5854-12	24-150-FW	2.000	2.000	1/3 - 1/3	
13710	5853-10	12-900-FW	2.250	2.250	1/3 - 1	
13741	5855-4	12-900-FW	2.250	2.250	1/3 - 1	151F005
15175	9052-1	4-150-FW	1.000	1.000	1/4 - 1/2	
13738	5855-1	24-900-FW	3.750	3.250	1/3 - 1	151F003
13691	5854-19	6-150-FW	1.125	1.125	1/3 - 1/3	
* 13688		20-150-FW	1.875	1.875	1/3 - 1/3	151F006
* 13748			1.5	1.5	1/3 - 1/3	
* 13668			1.5	1.5	1/3 - 1/3	

REF. #3

M-VLV-193 Rv. 0 Page 30 of 540

VALVE NO.	10"-EBA-GT-MO-F003	6"-EBA-GT-MO-F001-B	6"-EBA-GT-MO-F004
SERVICE	MAIN STEAM	REACTOR RECIRCULATION	REACTOR RECIRCULATION
TYPE	GATE	GATE	GATE
LINE OR EQUIPMENT REF.	DBA-102	DBA-101	DBA-101
Motor Type	D.C.	A.C.	D.C.
SIZE	10"	6"	6"
COMMODITY	STEAM	DEMINERALIZED WATER	DEMINERALIZED WATER
DESIGN/MAX. PRESS. (PSIG)	1230 / 1350	1250 / 1375	1250 / 1375
DESIGN/MAX. TEMP. (°F)	565 / 565	565 / 565	565 / 565
FLOW Normal/Max.	184.5×10^3 #/hr / SAME	352 GPM / 358 GPM	352 GPM / 358 GPM
VALVE RATING	600 # ASME	600# ASME	600# ASME
TYPE ENDS/RATING	B.W. / SCH. 80	B.W. / SCH. 80	B.W. / SCH. 80
BODY MATERIAL	SEE APPENDIX 3	SEE APPENDIX 3	SEE APPENDIX 3
TRIM MATERIAL	See A/DV Dwg		→
SEAT FACINGS	STELLITE	STELLITE	STELLITE
PACKING	CRANE 187-J	CRANE 187-J	CRANE 187-J
TYPE BONNET	PRESSURE SEAL	PRESSURE SEAL	PRESSURE SEAL
TYPE OF SEATS	SEE APPENDIX 3	SEE APPENDIX 3	SEE APPENDIX 3
TYPE OF DISC	FLEXIBLE (NET SPLIT)	FLEXIBLE (NET SPLIT)	FLEXIBLE (NET SPLIT)
BYPASS SIZE & TYPE	—	—	—
HANDWHEEL PULL-BREAKAWAY LBS	100	70	70
Act. Op. DIFF. PRESS. (Max.)	Δ 1172 PSID	1000 PSID	1000 PSID
PORT DIAMETER (seat)	8.88	5.38	5.38
PRESS. DROP (PSI)	0.047 / 0.040	0.016 / 0.017	0.016 / 0.017
VELOCITY (FPS) (seat)	43 / 38	6.9 / 7.0	6.9 / 7.0
VALVE WEIGHT LBS incl. oper.	1530	570	565
MOTOR OPER (TYPE/SIZE/SPD)	SMB 1-40/1900	SMB 00-10 / 3600	SMB 00-15 / 1900
OPER. SPEED FT/MIN/HP	1.1 / 2.9	1 / 1.3 Δ	1 / 1.1
TIME TO OPEN	Δ 50 SECS.	~28 sec	~28 sec
TIME TO CLOSE	Δ 50 SECS.	~28 sec	~28 sec
FULL LOAD CURRENT (440V, 3Ø, 60C)	11.1	2.3	4
STALLED MOTOR CURRENT	85.4	11.9	25
MOTOR OPERATOR WEIGHT	430	210	215
COST • EACH VALVE			
BYPASS			
TURN & INSTALL LIMIT SWS.			
TESTS • MAGNAFLUX			
TESTS • X-RAY			
NO. REQUIRED UNIT 1 / UNIT 2	1 / 1	1 / 1	1 / 1
TOTAL COST			
MANUFACTURER	Anchor / Darling	→	→
MODEL OR FIG. NO.			
VENDOR	Anchor / Darling	→	→
P/O (& ITEM) NO. 8856-P-10	4.3 + 4.4	4.5 + 4.6	4.7 + 4.8
FOREIGN PRINT NO.	93-13802	93-13748	93-13668
WELD END DWG. REFERENCE 8856-M-	-149, SHTS. 3C6 + 4D0	SHTS. 3C6 + 4C0	SHTS. 3C6 + 4C0
P & I DIAGRAM REF. 8856-M-	155	144	144
LOCATION DWG. REF.			
Seismic Class 1 (Yes/No)	YES	YES	YES
Active Valve (Yes/No)	YES	YES	YES

REV.	DESCRIPTION	DATE	APPROV	MATL	SUPV	CHK	DR	END
2	Revised Diff. Press & Oper. Times for Items 1 thru 4	6/6/82						
4	Added Active Valve Designation							
3								

BECHTEL CORPORATION
POWER DIVISION ENGINEERING

VALVE DATA SHEET Δ 9-2-82 RHm A/DV
MOTOR OPERATED

SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 AND 2
PENNSYLVANIA POWER & LIGHT COMPANY

JOB No 8856

ATTACHMENT NO. 2
8856-P-10

SHEET 9 OF 15

REV. 4

M-323-C 4-16-58

M-VLV-145 Rev. 1
REF. #4
Page 31 of 40

SUSQUEHANNA WORK AUT

S8177

I. PROBLEM DESCRIPTION

INSPECT AND REWORK THE MOTOR ACTUATOR AS NECESSARY.

UNIT: 1 | SYSTEM & EQUIP NUMBER: 61 HV-144 F001 | LOCATION: [redacted] | NEED DATE: ASAP

RESP. WORK GROUP: MECH (ELEC) LABOR INSTR [redacted] C CHEM SUB GRP

Identified (Print): Tom Miller | Date: 9/19/88

Approved (Signature): [signature] | Date: 9-19-88

MODIFICATION RELATED ☐ YES ☑ NO PMR#

II. WORK CLASSIFICATION

LIMITORQUE ACTUATOR

EQUIP QUAL ☑ YES ☐ NO | QUALITY ☑ YES ☐ NO | ASME CODE ☐ YES ☑ NO | TECH SPEC [redacted] ☑ YES ☐ NO | RELIABILITY RELATED ☐ YES ☑ NO

ACCT. or ER NO.: 7426.22 | LOC. or CODE: 104

Work Group Supervisor: D E Robinson | Date: 9-25-88

III. WORK PLANNING

A. INVESTIGATION

INITIAL INPUT STATUS & AF: P/VAN PTA | PLAN CODE: THA L3A | PRIORITY CODE: 5 | WORK CODE: [redacted] | PLANT STATUS CODE: FUEL

REMOVED

Work Group Foreman: [redacted] | Date:

Operations Authorization: [redacted] | Date:

B. WORK PLAN

PER ATTACHED WORK INSTRUCTIONS

A95948

90-555

J. Hennie 10-1-88

M. Rebuck 10-12-90

Contact QCX1-62 via Re. Req.

[signature] 10/15/88

ERF NO.: [redacted] | ERF REQ. ☑ YES ☐ NO | HP REVIEW ☑ YES ☐ NO

RWP NO.: [redacted] 90-555 90

ZONE: C E-76 M-48 [redacted] 3-11-90 | EST. Man Hrs. | RWP Man Hrs. 45 50

Work Group Foreman: [signature] Date: 10-16-90

[redacted] Date: 10/21/90

C. POST MAINTENANCE TESTING REQUIREMENTS

STROKE VALVE, OBSERVE PROPER OPERATION AND INDICATION

Quality Control Review: [signature] Date: 11-23-88

Operations Authorization: A95948 Date: 10-3-90

IV. ACTION TAKEN · EQUIPMENT HISTORY SUMM

Performed routine actuator o/h for HV-144 F001. Replaced spring pack per QIEE 90-0206.

HEALTH PHYSICS
☐ NO HP
☐ HP CK
☑ RWP REQUIRED
☐ REVIEW # 90-555
[signature] 2-16-90

HEALTH PHYSICS
☐ NO HP 2-16-90
☐ HP CK
☑ RWP REQUIRED
☐ REVIEW # 88-150
[signature] 11-28-88

Work Completed: [signature] Date: 10-15-90

ERF SIGNED OFF ☐ N/A ☑ YES Date: 10/20/90

Work Group Review: [signature] Date: 10/15/90

Quality Control Review: [signature] Date: 10/22/90

RECEIVED E & S CONST.
Logged: (1) 10/4/88 (2)_____ (3)_____

CIA 90-3272 D

V. PROBLEM CODE

Copy To Planner ☐ Yes ☐ No | PROBLEM: AV | CAUSE: DA | ACTION: GH | BWR:

Operations Review: [signature] Date: 10/22/90

FORM AD-QA-609-1, Rev. 8 PART 1 — ORIGINAL PART 2 — COPY PART 3 — COPY Page ____ of ____

WA NO 881177
VALVE ID HV144F001

5.8 Actuator Removal

STEP		AS-FOUND	CONFIRM
5.8.1	Torque Switch "OPEN" setting	2	CRM
	Torque Switch "CLOSE" setting	2	CRM
5.8.4.a	Valve Position	CLOSE ( ) MID ( ) OPEN (X) OTHER ____	N/A

5.9 SMB-000/SMB-00 Overhaul

5.9.7.f Drive sleeve parts replaced YES ( ) NO (X) NA ( ) DJS

Parts Replaced: ____

5.9.9.b # of turns 15 1/2 AS FOUND DJS

5.9.9.c GAP .315 AS FOUND DJS

5.9.9.e "AS FOUND"

Washer	Thickness	Height	Washer	Thickness	Height
1	.099	.155	14		
2	.103	.154	15		
3	.098	.153	16		
4	.099	.156	17		
5	.098	.155	18		
6	.098	.157	19		
7	.098	.155	20		
8	.098	.155	21		
9	.098	.153	22		
10	.100	.156	23		
11	.098	.153	24		
12			25		
13			26		

5.9.9.j Worm/torque spring replaced YES (X) NO ( ) NA ( ) DJS

Parts Replaced: NEW SPRING PAL

~~PCAF 1-90-1276S~~

~~PAGE 2 OF 2~~

M-VLV-193 Rev 1
Ref 4
Page 33 of 40

VALVE ID H0144F001
WO NO. 58177
SYSTEM 161

5.13 Acutator Trouble Shooting

NAMEPLATE/REFERENCE DATA

PSID _____

AREA _____
ELEV _____

HANDWHEEL TURNS / 1 STROKE 79

SCAFFOLD NEEDED (Y/N) _____

ACTUATOR:
ORDER NO. 381264/X
SERIAL NO. 213457
SIZE SMB 00

MOTOR:
ID NO. 713109-LZ
MANUFACTURER RELIANCE
HORSE POWER 1.3
VOLTAGE 230/460
START TORQUE 10 FT LBS.
RUN TORQUE 2 FT LBS.
START CURRENT N/A
RUN CURRENT 4.8 / 2.4
INSUL CLASS BH
FRAME SIZE M56
OPERATING TEMP 40 C
DUTY 15 min.

TORQUE SWITCH	LIMITORQUE DESIGN INFO	AS FOUND	AS LEFT	INITIALS/DATE
OPEN SETTING		2	2 1/2 (Mel 10-12-90)	JMS 10/12/90
CLOSE SETTING		2	2 1/2 (Mel 10-12-90)	JMS 10/12/90
NORMAL (MIN)			2	Mel 10-12-90
MAXIMUM			2 3/4	Mel
LIMITER PLATE		2.75	2.75 (2 3/4)	Mel
CAL CHART INSTALLED		1.75 / 2.75	2 / 2 3/4 (2.75	Mel

PCAF-1-90-0765

SPRING PACK	LIMITORQUE DESIGN INFO	AS FOUND	AS LEFT	INITIALS/DATE
PART NO.	60-600-0022-1	60-600-0022-1	0301-112	JW / 10-10-90
NO. OF WASHERS		11	15	JW / 10-10-90
AVG. THICKNESS		.098	.076	JW / 10-10-90
SPRING PACK GAP		.315	.395	JW / 10-10-90
SPRING PACK PRELOAD		.077	.225	JW / 10-10-90

PCAF
PAGE

WA NO S 81177
VALVE ID HV144F001

SECTION IV (RATIOS/EFFICIENCIES)	LIMITORQUE	AS FOUND	AS LEFT	CONFIRM
Actuator Overall Ratio	97:0	94.0	94.0	DJS
Pinion Gear to Wormshaft Gear Ratio	2.0711	2.09:1	2.09:1	GJW
Worm to Worm Gear Ratio	45:1	45:1	45:1	DJS
Worm to Worm Gear Efficiency				
Handwheel to Stem Ratio	4.38:1	4.38:1	4.38:1	GJW
Handwheel to Stem Efficiency				
# Motor Pinion Gear Teeth	24	21	21	DJS
# Wormshaft Gear Teeth	44	44	44	DJS

5.13.12 Actuator operates satisfactorily. ____

Comments:

EWR _____

RIEE # 90-0206

New Spring PAC # ~~90-0301-112~~ 91-0

New ~~Torque Switch~~ Settings: NORM 2
Cal chart MAX 2 3/4

As Left, Ave Run Static Current: OPEN 2.1 Motor Number CLS-125A
CLOSE 2.3

5.13.13 This completed data sheet has been forwarded to Maintenance Engineer.

Signature / Date 10/15/90

Review / Date 10/16/90

FORM MT-GM-050-7, Rev. 1, Page 2 of 8, (File R7-1)

Attachment 2

~~Attachment A~~
~~Page 4 of 11~~

M-VLV-193 Rv.0
REFERENCE #5
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MOTOR OPERATOR INFORMATION SHEET

LIMITORQUE ORDER NO.: 381264 ITEM: X

OPERATOR SERIAL NOS.: 213457 & 458

OPERATOR TYPE: SMB OPERATOR SIZE: 00

DESIGN UNIT RPM (AS DEFINED IN LIMITORQUE SEL-3): 38.8

SPRING PACK NUMBER: 60-600-0022-1

NORMAL TORQUE SWITCH SETTING: 1 3/4

CORRESPONDING INPUT TORQUE (LB-FT): 8 FT. LBS.
(SEE NOTE 1)

CORRESPONDING OPERATOR OUTPUT TORQUE (LB-FT): 149 FT. LBS.

CORRESPONDING OPERATOR OUTPUT THRUST (LBS): 10,797 LBS.

MAXIMUM TORQUE SWITCH SETTING: 2 3/4

CORRESPONDING INPUT TORQUE (LB-FT): 13 FT. LBS.
(SEE NOTE 1)

CORRESPONDING OPERATOR OUTPUT TORQUE (LB-FT): 236 FT. LBS.

CORRESPONDING OPERATOR OUTPUT THRUST (LBS): → 14,000 LBS.
MAX RATING OF UNIT

GEAR RATIO INFORMATION

MOTOR PINION NUMBER OF TEETH: 21 WORM SHAFT GEAR NO. OF TEETH: 44

WORM TO WORM GEAR RATIO: 45:1

OVERALL ACTUATOR RATIO: 94.0:1

NOTE 1: INPUT TORQUE IS TORQUE FROM WORMSHAFT ON SMB-00 & 000 AND FROM HANDWHEEL ON SMB-0 AND LARGER.

LIMITORQUE SIGNATURE: Bradley Stone

~~Attachment 3~~

~~Attachment A~~
~~Page 5 of 11~~

M-VLV-193 Rev. 0
REF #5
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LIMITORQUE MOTOR NAMEPLATE

DATA SHEET

ORDER NUMBER: 381264 X SERIAL NUMBER: 213457 & 458

MOTOR NAME PLATE DATA

IDENTIFICATION NUMBER: 715005

START TORQUE (LB-FT): 10 FT LB. HORSEPOWER: .5

RUN TORQUE (LB-FT): 2 FT. LBS. S.F.: 1.0

TYPE: T FRAME: P56 PHASE: DC

MOTOR SPEED (RPM): 1900 HZ: C.P.D

VOLTS: 240 DC CODE — AMPS: A 2.7/F 0.23

AMB. C: 40° INSULATION CLASS: B DUTY: 5 MIN.

LIMITORQUE SIGNATURE: Bradley Stone

Stroke length = stem lead × handwheel turns × $\frac{1}{HWR}$

STANDARD HANDWHEEL RATIOS FOR SMB & HMB UNITS

UNIT SIZE	HANDWHEEL RATIO	UNIT RATIO	EFF.%
SMB-000	1:1	All	100
SMB-00	1:1	All	100
	*4.38:1	All	95
SMB-0 SB-0	8.93:1	11.2-26.1	60
	21.1:1	26.4-96.2	30
	33:1	102.6-150.8	25
	54.1:1	158.3-247	25
SMB-1 SB-1	10.75:1	11.6-25.6	60
	25.3:1	27.2-88.4	30
	49.0:1	92.4-171.6	25
	66.7:1	191.7-234	25
SMB-2 SB-2	9:1	10.6-25.5	60
	22.3:1	26.2-82.5	30
	40.5:1	84.8-150	25
	57.4:1	153-212.5	25
SMB-3 SB-3	7.15:1	11.1-24.1	60
	11.07:1	25.7-37.3	60
	28.37:1	43.9-95.5	30
	39.4:1	98.6-132.8	25
	55.36:1	138.4-186.4	25
SMB-4 SMB-4T SB-4	8.7:1	13.4-32.3	60
	13.06:1	33.6-48.4	60
	33.69:1	51.8-124.9	30
	39.87:1	131.8-147.9	25
	59.13:1	152.1-219.3	25
SMB-5 SMB-5T	86:1) 163.5:1)	61.4-93.4	25
	142.0:1) 269.8:1)	101.4-230.2	25

UNIT SIZE	HANDWHEEL RATIO	UNIT RATIO	EFF.%
HMB-00	19:1	9.7-22.0	60
	45:1	23.0-109.0	30
HMB-0	15.7:1	11.2-26.1	60
	37:1	26.4-96.2	30
	58:1	102.6-150.8	25
	95:1	158.3-247	25
HMB-1	14.5:1	11.6-25.6	60
	34:1	27.2-88.4	30
	66:1	92.4-171.6	25
	90:1	191.7-234	25
HMB-2	13.3:1	10.6-27.2	60
	33:1	26.2-82.5	30
	60:1	84.8-150.0	25
	85:1	153-212.5	25
HMB-3	10.3:1	11.1-24.1	60
	16:1	25.7-37.3	60
	41:1	35.9-95.5	30
	57:1	98.6-132.8	25
	80:1	138.4-186-4	25
HMB-4 HMB-4T	12.7:1	10.1-32.3	60
	50:1	40.0-124.9	30
	58:1	131.8-147.9	25

*This ratio supplied when torque required exceeds 65 ft/lbs.

△ For SMB-5 and SMB-5T unit, this ratio provided as standard. Alternate ratio shown provided only on request.

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REF. # 8
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ANCHOR/DARLING VALVE CO.

MOTOR OPERATOR DATA SHEET

Customer: Bechtel SF P.O. No. 8856-P-10-A

Prepared by: RHM Approved by: DJK 3-17-75 Sht 2 of

Form Line Number		
	S.O. No.	E5853
	Vlv. Size, Press. & Type	6" 600# Gate
	No. Req'd & (Item No.)	23, 24, 64, 65

1	Seat Mean Dia. In. & Area In.^{2}	= A = .7854 x d^2 = .7854(5.69)^2	25.43
2	System Design Press. PSI	= Line Pressure = P_1 Use	1600
3	Design Diff. Press. PSI	= ΔP Use	1600
4	Disc Thrust LBS	= Td = A x P (Line 1 x Line 3)	40688
5	Stem Thrust Tent. LBS	= $T_t = T_d$ x f (Line 4 x Coeff Friction)*	12206
6	Stem End Thrust	= T_e = .7854 x D_s^2 x P_1 (stem area x Line 2)	2827
7	Stuff Box Load LBS	= T_s	1500
8	Total Stem Thrust LBS	= F = $T_t + T_e + T_s$ (Sum. of Lines 5,6 & 7)	16533

$D_s = 1\frac{1}{2}$ Dia

*Coefficient of Friction: Double Disc .2
Flex Wedge .3 ✓
Globe Valve 1.1

3

~~CN#2 pg 4 of 20~~

PENNSYLVANIA POWER & LIGHT
Susquehana Steam Electric Station
MOV - Design Basis Review

VALVE TAG NUMBER:HV-144F001 UNIT 1 PRIORITY: 2
VALVE DWG NO.FF110100-5001 MFG. ANCHOR/DARLING

DESIGN DATA		REF NO	MATERIAL/DIMENSIONAL DATA		REF NO
Valve Type	GT	3	Stroke Length (in)	6.000	25
Valve Size	6.00	3	Stroke Time (sec)	28	4
Pressure Class	600	3	Orifice Diameter (in)	5.375	24
Valve Code	SR ~~PC~~	6	Stem Diameter (in)	1.500	24
Area/Room	26/I-400	5,10	Stem Pitch (in)	0.33	24
Elevation	750'-7"	5	Stem Lead (in)	0.33	24
Line No.	DBA-101	1	Stem Material	A276-410	3
Normal Valve Pos	O	1	Stem Mod of Elasticity	29.200	26
Actuator Size	SMB-00-10	3	Stem Mod of Rigidity	11.300	26
Valve Orientation	H	5	Valve Thrust Capability		
Stem Orientation	V	5	Dsk Guide Fac Mat	SA105II	3
Power Supply	1B236053	6	Dsk Seat Surf Mat	STELLITE	3
Rework Window	SEE TS 4.4.4				

DEFINITION OF SAFETY RELATED FUNCTION

HV-144F001 IS THE REACTOR WATER CLEANUP SYSTEM INBOARD CONTAINMENT ISOLATION VALVE. THIS VALVE IS NORMALLY OPEN AND WILL CLOSE ON REACTOR LOW LEVEL OR ON INDICATION OF AN RWCU LINE BREAK. THE VALVES SAFETY FUNCTION IS TO CLOSE ON REACTOR LOW LEVEL, UPON INDICATION OF AN RWCU LINE BREAK. ~~THE VALVE MUST BE CAPABLE OF RECOVERY FROM MISPOSITIONING.~~ Recovery from mispositioning is not required since this valve is not classified as position changeable.

VALVE OPERATIONAL DATA

	Lrge Brk LOCA	Smal Brk LOCA	Station Blackout	HELB	LOOP	Fire	Inadvert Oper
Max Diff Press	D ~~983~~	D ~~1115~~	NA	1053 ~~1162~~	0	~~0~~ ~~1056~~ C	NA ~~1056~~
Dir Diff Press	D	D	NA	D	NA	D	NA ~~D~~
Flow Rate	310	310	NA	436	0	310	NA ~~436~~
Line Press(psig	979 ~~983~~	1112 ~~1115~~	NA	1053 ~~1162~~	1053 ~~1056~~	1053 ~~1056~~	NA 1056
Fluid	W	W	NA	W	W	W	NA ~~W~~
Process Temp(F)	542	558	NA	563	551	551	NA ~~581~~
Duty Cycle	1	1	NA	1	1	1	NA ~~1~~
Time Line (sec)	*	*	NA	0	I	I	NA ~~I~~
Envr Profile(F)	340	340	NA	150	150	150	NA ~~150~~
Initiate Signal	L2	L2	NA	F1	L2	S	NA ~~M~~
Valve Cycle	C	C	NA	C	C	C	NA ~~O,C~~
Normal Cond					O,C		

See CN #2 - Basis for Operational Developement has been updated.

REF #14

M-VLV-193 Rev 0
Ref. #14
Page 1 of 10

Anchor/Darling
Valve Company

701 FIRST STREET
P.O. BOX 3428
WILLIAMSPORT, PA 17701-0428
(717) 327-4800
TELEX: 760963

FAX: (717) 327-4805

Date 3/28/91

>>>-------> Fax 215-774-7830
From To

TO: Joe Panchinson - PPL

SUBJ: A/DV EB109

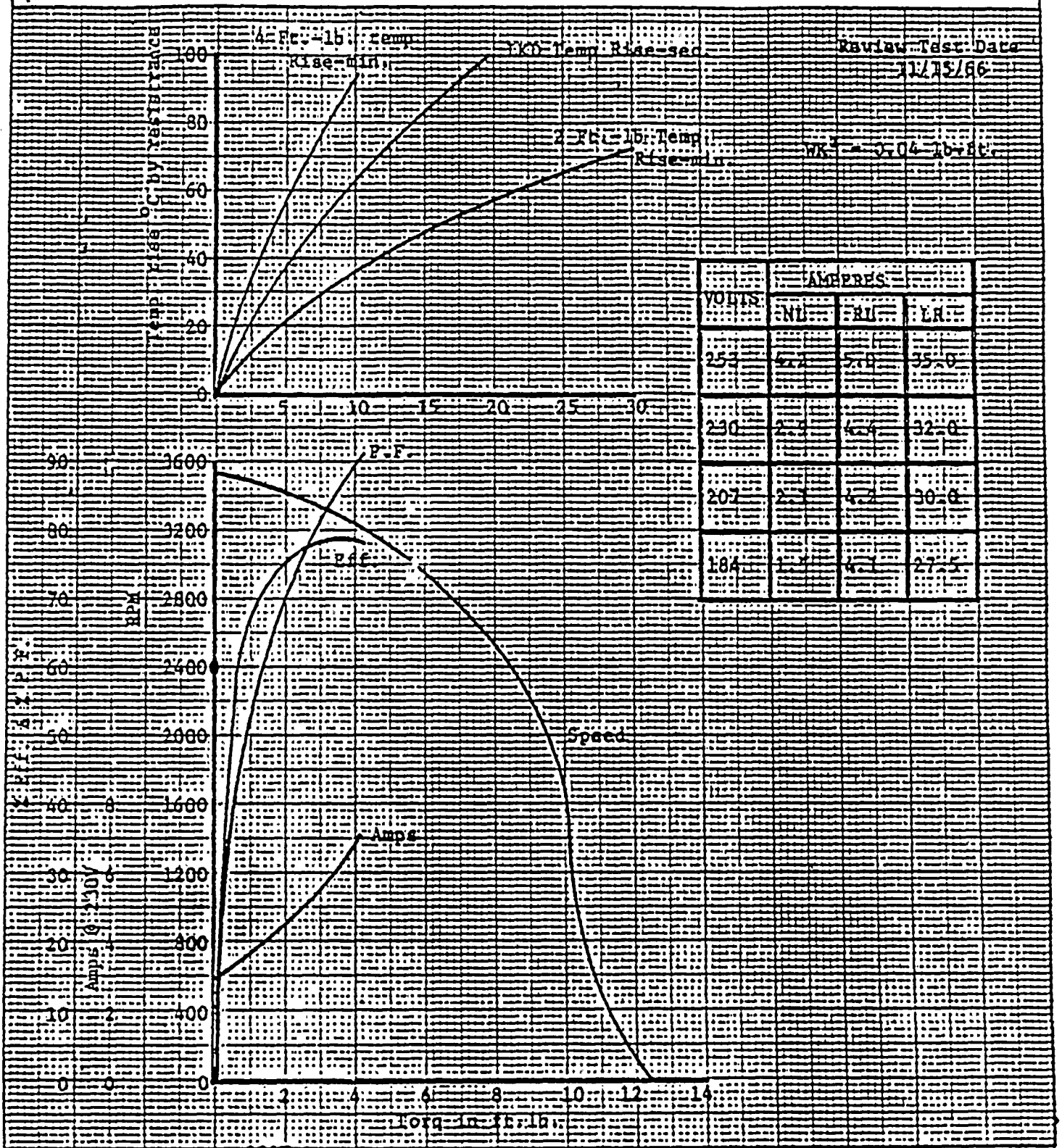
Stem Factor used for motor actuator sizing for SSES was based on $\mu = 0.15$.

RM Smith 3/29/91

Signed: Bobbie Bergman

Ref 15
10 ft.-lb. LKD M-VLV-193 Rev 2

REL. S.O.	RPM 3400	S.F. 1.0	ROTOR E1891 (164B25)
FRAME 56	VOLTS 230/460	NEMA DESIGN	TEST S.O. E2066
HP 1.3	AMPS 4.8/2.4	CODE LETTER L	TEST DATE 11-15-66
TYPE P	DUTY 15 min.	ENCLOSURE TENV	STATOR RES. @ 25°C @230V
PHASE/HERTZ 3/60	AMB°C/INSUL 40°C/B	E/S 500200-50	2.5 OHMS (BETWEEN LINES)



VOLTS	AMPERES NL	AMPERES RL	AMPERES LR
253	4.4	5.0	35.0
230	2.9	4.4	32.0
207	2.1	4.2	30.0
184	1.7	4.1	27.5

AMPERES SHOWN FOR 230V CONNECTION. IF OTHER VOLTAGE CONNECTIONS ARE AVAILABLE, THE AMPERES WILL VARY INVERSELY WITH THE RATED VOLTAGE.

RELIANCE ELECTRIC COMPANY
CLEVELAND, OHIO 44117 U.S.A.

DR. BY DNR
CK. BY
APP. BY
DATE 7-21-77

A-C MOTOR PERFORMANCE CURVES

M1458 (Updated 413018-03-AT)
ISSUE DATE 7/21/77

RE 1572V82 Printed in U.S.A.