

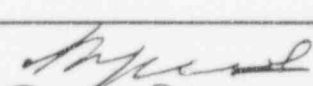

NUSCO
CALCULATION CHANGE NOTICE
(CCN)

REF #3

(Plus Attachments)

PAGE

1 OF 23

CTED CALCULATION/PLANT <input type="checkbox"/> MP1 <input checked="" type="checkbox"/> MP2 <input type="checkbox"/> MP3 <input type="checkbox"/> CY OTHER _____			
2. CALCULATION NO. 89-078-873ES	REVISION NO. 00	CHANGE NO. 002	CALCULATION ORIGINATED BY: <input checked="" type="checkbox"/> NU <input type="checkbox"/> VENDOR
3. CALCULATION TITLE MP2 TARGET THRUST CALCULATION FOR 2-CS-16.1A AND B			
4. REFERENCES			
1. MOV-RTH-95-033	4. Memo MOV-95-010		
2. MOV-95-391	5. M2-95-00608		
3. NP-6660D, Appl Guide for MOVs in Nuclear Power Plants.			
5. REASON FOR CHANGE			
1. TO CALCULATE THE THRUST REQUIRED TO OPEN UNDER PRESSURE LOCKING CONDITIONS FOR DIFFERENT SCENARIOS AND COMPARE WITH THE MOV DESIGN CAPABILITY.			
2. TO CALCULATE THE CONTACT STRESSES TO DETERMINE IF THE VALVE IS LEAK TIGHT.			
6. DESCRIPTION OF CHANGE & TECHNICAL JUSTIFICATION			
<u>REQUIRED THRUST TO OPEN UNDER PRESSURE LOCKING CONDITIONS</u>			
CN IS APPLICABLE TO BOTH VALVES (2-CS-16.1A/B). HOWEVER, THE ANALYSIS IS PERFORMED FOR 2-CS-16.1A, SINCE THE MOTOR CAPACITY WHICH IS THE LIMITING COMPONENT IS LESS THAN ITS SISTER VALVE, 2-CS-16.1B. ALSO THE MEASURED PACKING LOAD IS GREATER FOR 2-CS-16.1A IS GREATER THAN ITS SISTER VALVE.			
FOUR CASES HAVE BEEN IDENTIFIED FOR PRESSURE LOCKING. THESE CASES ARE DESCRIBED IN DETAIL IN REFERENCE 1. A SUMMARY OF THE PRESSURE CONDITIONS AND THE CALCULATED REQUIRED THRUSTS FOR EACH CASE ARE SHOWN ON THE NEXT PAGE.			
CASE 1: PRESSURE LOCKING PRIOR TO ACCIDENT CONDITIONS			
CASE 2: PRESSURE LOCKING CONDITIONS AFTER LARGE BREAK LOCA			
CASES 3, 4: PRESSURE LOCKING CONDITIONS AFTER SMALL BREAK LOCA			
<u>LEAK TIGHTNESS</u>			
THE ACTUAL CONTACT STRESSES ARE COMPARED TO THOSE REQUIRED TO OBTAIN LEAK TIGHT SEAL. THE ACTUAL CONTACT STRESSES ARE CALCULATED USING THE AS LEFT MEASURED TOTAL THRUST AND THE SEAT AREA OF CONTACT. THE CALCULATED CONTACT STRESS (1370 PSI) IS LESS THAN THE REQUIRED STRESS (4000 PSI, Ref 3) FOR LEAK TIGHTNESS. SEE ATTACHED CALCULATION.			
7. NUCLEAR INDICATOR <input checked="" type="checkbox"/> CATI <input type="checkbox"/> RWQA <input type="checkbox"/> FPQA <input type="checkbox"/> ATWS		8. AFFECTED CALC PAGES NONE	
9. PREPARED BY: PRINTED NAME P. S. BANDARU		SIGNATURE 	DATE 7/27/95
10. EWDD BY: PRINTED NAME P. S. HIGGINS		SIGNATURE  SEE ATTACHED SWAPPER FOR	DATE 7/27/95
11. APPROVED BY: PRINTED NAME S. T. HODGE 9608120094 960807 PDR ADOCK 05000336 P PDR		SIGNATURE  FOR STH	DATE 7-27-95

Required Thrust to Open to Overcome Pressure Locking

The Pressure conditions for the cases listed on the cover page are summarized below. These scenarios are described in more detail in Reference 1.

	UPSTREAM (CTMT SIDE)	BONNET PRESSURE	DOWNSTREAM (RWST SIDE)	OVERALL DIFF PRESSURE
CASE 1	2 PSIG	37 PSIG	37PSIG	35 PSID
CASE 2	15 PSIG	37 PSIG	20 PSIG	39 PSID
CASE 3	10 PSIG	37 PSIG	20 PSIG	44 PSID
CASE 4	10PSIG	20 PSIG	20 PSIG	10 PSID

The line pressure in the MOV run is assumed to be lower of either the upstream or downstream pressures for conservatism. The overall differential pressure is the sum of the differential pressures between bonnet to valve upstream and bonnet to valve downstream. The purpose of this DP is to use in the MOV Software to determine the required thrust to open.

$$DP = (BONNET PR. - UPSTREAM PR) + (BONNET PR. - DOWNSTREAM PR)$$

This analysis is limited to only the 'A' valve (2-CS-16.1 A) for the following reasons.

1. The motor capability is more limiting than for its sister valve 2-CS-16.1B.
2. The measured packing load is greater than for its sister valve 2-CS-16.1B.

Determination Leak Tightness

Maximum Measured As left Total Thrust for 2-CS-16.1A = 29225 lbs (Reference 5)
(Total Thrust is greater for CS-16.1 A than CS-16.1B)

$$\begin{aligned} \text{Measured Thrust Corrected for Combined Accuracies} &= 29225 \times (1 + 0.1065) \\ &= 32337 \text{ lbs} \end{aligned}$$

$$\text{Seat Ring OD (B2)} = 24.021 \text{ in (Reference 4)}$$

$$\text{Seat Ring OD (B3)} = 23.387 \text{ in (Reference 4)}$$

$$\begin{aligned} \text{Area of Contact} &= \pi/4 \times (B2^2 - B3^2) \\ &= 23.606 \text{ sq. in} \end{aligned}$$

$$\begin{aligned} \text{Contact Stresses} &= (32337 \times 0.5) / 23.606 \\ &= 684.9 \text{ psi} \end{aligned}$$

The contact stresses required for leak tightness is 4000 psi from Reference 3. Therefore, the valve is not considered leak tight.

Conclusion:Required Thrust to Overcome Pressure Locking:

The table below summarizes the required thrust to open for pressure locking for each case. The estimated required thrust values for all cases are less than the MOV design capability. Therefore, these valves are capable of opening under postulated pressure locking conditions.

	REQUIRED THRUST TO OPEN FOR PRESSURE LOCKING	MOV CAPABILITY
CASE 1	12967 LBS	18025 LBS
CASE 2	13868 LBS	18025 LBS
CASE 3	15079 LBS	18025 LBS
CASE 4	6977 LBS	18025 LBS

Contact Stresses for Leak Tightness:

The valve will not be leak tight based on a comparison with the contact stresses shown in Reference 3. Therefore this supports the assumption that under pressure locking conditions, the bonnet pressure would equalize the upstream or downstream pressure over an extended period.

NORTHEAST UTILITIES

INPUTS

CAN 2 To

SITE: MILLSTONE UNIT 2

VALVE NO.: CASE 1

CALC. NO.: 89-078-873ES REV 0
 PROGRAM: BWNT MOVE Ver. 4.0
 DATE: 07/27/95
 VALVE S/N: E-5278-16-1
 OPER. S/N: 152444
 OPER. O/N: 358222E

INPUT DESCRIPTION	INPUT DATA	REFERENCES
VALVE MANUFACTURER	ANCHOR DARLING	7.22
VALVE SIZE	24.00 ✓ IN.	7.22
VALVE TYPE	GATE	7.22
ANSI RATING	150 ✓ LB	7.22
VALVE STEM DIAMETER	2.2500 ✓ IN.	7.24
OPER. STEM DIAMETER	2.2500 ✓ IN.	7.24
NO. THREADS/INCH	3.0 ✓	7.24
NO. THREAD STARTS	2 ✓	7.24
ACME THREAD TYPE	STANDARD	SECTION 3.9
STROKE LENGTH/LIFT	25.3750 ✓ IN.	7.24
STROKE TIME OPEN-CLOSE	43.50 SEC.	7.18
STROKE TIME CLOSE-OPEN	42.50 SEC.	7.19
VALVE SEAT DIAMETER	23.7040 IN.	7.24
VALVE MATERIAL	A351-CF8	7.24
DIFF. PRESSURE	35 ✓ PSI	7.21
LINE PRESSURE	-2 ✓ PSI	7.21
SEISMIC LIMIT - THRUST	85000 LB	7.27
MFG. SUGGESTED - THRUST	0 LB	
MAX. VLV LIMITS - THRUST	85000 LB	7.27
OPERATOR MANUFACTURER	LIMITORQUE	7.22
OPERATOR SIZE	SMB-1	7.22
NOMINAL MOTOR SIZE	25.0 FT-LB	7.22
MOTOR RPM	3400	7.22
MOTOR TYPE	AC	
MOTOR MANUFACTURER	PEERLESS	7.22
MOTOR SERIAL NUMBER	FZ29156WC	7.22
UNIT RATIO	72.42/1	SECTION 2.10
HAND WHEEL RATIO	25.30/1 ✓	7.12
SAFETY RELATED	YES	7.7
COEFF. OF FRICTION	0.1500	SECTION 3.2
TORQUE SWITCH SETTING	1.000/4.250 ✓	7.13
MAX. SPRING PACK TORQUE	980 FT-LB	7.13
MIN. SPRING PACK TORQUE	108 FT-LB	7.13
SPRING PACK NUMBER	60-600-0007	7.22

PREPARED BY

PJD

DATE

7/27/95

REVIEWED BY

Psa

DATE

7/27/95

PAGE NO.

4 OF 23

NORTHEAST UTILITIES

CALCULATED OR TABLE VALUES

CCN 2 To

SITE: MILLSTONE UNIT 2

VALVE NO.: CASE 1

CALC. NO.: 89-078-873ES REV 0
 PROGRAM: BWNT MOVE Ver. 4.0
 DATE: 07/27/95
 VALVE S/N: E-5278-16-1
 OPER. S/N: 152444
 OPER. O/N: 358222E

<u>DESCRIPTION</u>	<u>VALUE</u>	
VALVE STEM AREA	3.98	IN.**2
VALVE SEAT AREA	441.30✓	IN.**2
CALCULATED UNIT RATIO	64.02	
AVERAGE STROKE TIME	43.00	SEC.
DESIGN STROKE TIME	48.64	SEC.
HAND WHEEL EFFICIENCY	0.30	
HAND WHEEL TORQUE	250.00	FT-LB
MAXIMUM STALL RATIO	171.00	
STD.OPER.THRUST RATING	45000.00	LB
STD.OPER.TORQUE RATING	850.00	FT-LB
DYNAMIC RUNNING LOAD	4626.05	LB
RUNNING EFFICIENCY	0.55	

NOTE: Calculated Stroke Time Does Not Account for Degraded Voltage.

PREPARED BY PIB DATE 7/27/95
 REVIEWED BY PSH DATE 7/27/95 PAGE NO. 5 OF 23

NORTHEAST UTILITIES

CALCULATED VALUES AND OVER-RIDES

CCN 2 to

SITE: MILLSTONE UNIT 2

VALVE NO.: CASE 1

CALC. NO.: 89-078-873ES REV 0
PROGRAM: BWNT MOVE Ver. 4.0
DATE: 07/27/95
VALVE S/N: E-5278-16-1
OPER. S/N: 152444
OPER. O/N: 358222E

<u>DESCRIPTION</u>		<u>VALUE</u>	<u>UNITS</u>	<u>OVER-RIDE FLAG</u>
VALVE FACTOR		0.540		ON
PACKING LOAD		4634.00	LB	ON
PISTON EFFECT		-7.95	LB	OFF
STEM FACTOR		0.0226	FT	OFF
UNIT PULLOUT EFFICIENCY		0.40		OFF
DESIGN APPLICATION FACTOR		0.90		OFF
STALL EFFICIENCY		0.55		OFF
STALL FACTOR		1.10		OFF
UNDER VOLTAGE APP. FACTOR		0.75		ON
OP RATED THRUST FACT (CST)	1.4000	63000.00	LB	ON
OP RATED TORQUE FACT (CST)	1.0000	850.00	FT-LB	OFF
THRUST (TT) FACTOR	1.4000	63000.00	LB	ON
TORQUE (TT) FACT	1.1000	935.00	FT-LB	OFF

PREPARED BY

PSD

DATE

7/27/95

REVIEWED BY

PSH

DATE

7/27/95

PAGE NO. 6 OF 23

NORTHEAST UTILITIES

SUMMARY OF CALCULATED VALUES

CCN 2 to

SITE: MILLSTONE UNIT 2

VALVE NO.: CASE 1

CALC. NO.: 89-078-873ES REV 0
 PROGRAM: BWNT MOVE Ver. 4.0
 DATE: 07/27/95
 VALVE S/N: E-5278-16-1
 OPER. S/N: 152444
 OPER. O/N: 358222E

LOAD CASES	THRUST (LBS)	STEM TORQUE (FT-LB)	MOTOR TORQUE (FT-LB)	HANDWHEEL TORQUE (FT-LB)
------------	-----------------	---------------------------	----------------------------	--------------------------------

DESIGN CATEGORY

DESIGN EQUATIONS	12967	293	11.2	39
MFG. SUGGESTED THRUST	0	0	0.0	0

MAX DESIGN CATEGORY

MAX. VALVE MFG. LIMITS *	85000	1921	73.7	253
SEISMIC LIMIT (THRUST) *	85000	1921	73.7	253
MAX. OPER RATED CAP. (THRUST) *	63000	1424	54.6	188
MAX. OPER RATED CAP. (TORQUE) *	37611	850	32.6	112
MAX. OPER SPRING PACK CAP. *	43363	980	37.6	129
MIN. OPER SPRING PACK CAP.	4779	108	4.1	14
MAX. OPER MOTOR CAPACITY				
FULL VOLTAGE (100%)	32044	724	25.0	NA
UNDER VOLTAGE (75%) *	18025	407	14.1	NA
MAX. OUTPUT @ MOTOR STALL	48467	1095	27.5	NA

* LIMITED BY MOTOR CAP. UNDER-VOLTAGE 18025 ✓ 407 14.1 NA

OBSERVATIONS

- THE CALCULATED UNIT RATIO IS WITHIN 20% OF THE MFG UNIT RATIO.
- UNIT RATIO INDICATES THAT THIS OPERATOR IS LOCKING TYPE.
- THE OPERATOR CAN WITHSTAND STALL TORQUE AND THRUST.
- VALVE CAN WITHSTAND STALL
- DYN. RUN. LOAD IS BELOW 33% OF THE MAX MOTOR CAP. AT 100% VOLTAGE.
- MOTOR TORQUE ADEQUATE TO OPEN VALVE AT UNDER VOLTAGE CONDITION.
- MOTOR TORQUE ADEQUATE TO CLOSE VALVE AT UNDER VOLTAGE CONDITION.

NOTES:

1. PARALLEL DISC GATE - VALVE FACTOR 0.3 PER ANCHOR DARLING STRESS REPORT, LOG R91.192, DATED 12-10-91
2. LRA UV PER CALC PA89-078-0272E2, REV 0
3. RE-EVALUATED FOR LIMITORQUE PART 21 (ACCURACY) 12/26/92

PREPARED BY P/b DATE 7/27/95

REVIEWED BY PSH DATE 7/27/95 PAGE NO. 7 OF 23

NORTHEAST UTILITIES

TARGET THRUST WINDOW

CCN 2 To

SITE: MILLSTONE UNIT 2

VALVE NO.: CASE 1

CALC. NO.: 89-078-873ES REV 0
PROGRAM: BWNT MOVE Ver. 4.0
DATE: 07/27/95
VALVE S/N: E-5278-16-1
OPER. S/N: 152444
OPER. O/N: 358222E

EQUIPMENT ACCURACIES & REPEATABILITY:

DIAGNOSTIC ACCURACIES:	9.40	%
TORQUE SWITCH REPEATABILITY:	5.00	%
COMBINATION (SRSS):	10.65	%
RATE OF LOADING:	1.10	

CALCULATED REQUIRED THRUST (ADJUSTED FOR ACCURACIES AND RATE OF LOADING):

CALCULATED REQUIRED THRUST:	10258	LBS
MINIMUM SP CAPACITY:	5883	LBS (AVAILABLE)

MOV HARDWARE CAPABILITY (ADJUSTED FOR ACCURACIES):

	CST	TT	
LIMITING SEISMIC STEM THRUST:	76821	76821	LBS
MAX VALVE LIMIT:	76821	76821	LBS
MAX OPERATOR LIMIT: (THRUST)	56938	56938	LBS
MAX OPERATOR LIMIT: (TORQUE)	33992	37391	LBS
MAX SPRING PACK CAP.:	39190		LBS
MOTOR @ 75% VOLTAGE:	16290		LBS

	THRUST		COMPONENT
MAXIMUM TOTAL THRUST/TORQUE: (MAX TT)	37391	LBS	OPERATOR (TORQUE)
MAXIMUM CONTROL SWITCH TRIP: (MAX CST)	16290	LBS	MOTOR @ 75% VOLTAGE
TARGET (CALCULATED)	14661	LBS	MINCST - MAXCST MARGIN 58.8%
MINIMUM CONTROL SWITCH TRIP: (MIN CST IN AVAILABLE THRUST)	10258	LBS	

NOTES:

- o MAX TT includes the thrust imparted by inertia.
- o A TT factor of 1.4000 was applied
- o The next limiting component is OPERATOR (TORQUE) and the margin to the Min Req. CST is 231.4 %.
- o The suggested target/thrust does not account for inertia.

PREPARED BY PJB DATE 7/27/95

REVIEWED BY tsl DATE 7/27/95 PAGE NO. 8 OF 23

NORTHEAST UTILITIES

INPUTS

SITE: MILLSTONE UNIT 2
VALVE NO.: CASE 2

CCN 2 To
CALC. NO.: 89-078-873ES REV 0
PROGRAM: BWNT MOVE Ver. 4.0
DATE: 07/27/95
VALVE S/N: E-5278-16-1
OPER. S/N: 152444
OPER. O/N: 358222E

INPUT DESCRIPTION	INPUT DATA	REFERENCES
VALVE MANUFACTURER	ANCHOR DARLING	7.22
VALVE SIZE	24.00 IN.	7.22
VALVE TYPE	GATE	7.22
ANSI RATING	150 LB	7.22
VALVE STEM DIAMETER	2.2500 IN.	7.24
OPER. STEM DIAMETER	2.2500 IN.	7.24
NO. THREADS/INCH	3.0	7.24
NO. THREAD STARTS	2	7.24
ACME THREAD TYPE	STANDARD	SECTION 3.9
STROKE LENGTH/LIFT	25.3750 IN.	7.24
STROKE TIME OPEN-CLOSE	43.50 SEC.	7.18
STROKE TIME CLOSE-OPEN	42.50 SEC.	7.19
VALVE SEAT DIAMETER	23.7040 IN.	7.24
VALVE MATERIAL	A351-CF8	7.24
DIFF. PRESSURE	39 ✓ PSI	7.21
LINE PRESSURE	-15 ✓ PSI	7.21
SEISMIC LIMIT - THRUST	85000 LB	7.27
MFG. SUGGESTED - THRUST	0 LB	
MAX. VLV LIMITS - THRUST	85000 LB	7.27
OPERATOR MANUFACTURER	LIMITORQUE	7.22
OPERATOR SIZE	SMB-1	7.22
NOMINAL MOTOR SIZE	25.0 FT-LB	7.22
MOTOR RPM	3400	7.22
MOTOR TYPE	AC	
MOTOR MANUFACTURER	PEERLESS	7.22
MOTOR SERIAL NUMBER	FZ29156WC	7.22
UNIT RATIO	72.42/1	SECTION 2.10
HAND WHEEL RATIO	25.30/1	7.12
SAFETY RELATED	YES	7.7
COEFF. OF FRICTION	0.1500	SECTION 3.2
TORQUE SWITCH SETTING	1.000/4.250	7.13
MAX. SPRING PACK TORQUE	980 FT-LB	7.13
MIN. SPRING PACK TORQUE	108 FT-LB	7.13
SPRING PACK NUMBER	60-600-0007	7.22

PREPARED BY PSD DATE 7/27/95

REVIEWED BY PSH DATE 7/27/95 PAGE NO. 9 OF 23

NORTHEAST UTILITIES

CALCULATED OR TABLE VALUES

CCN 270

SITE: MILLSTONE UNIT 2

VALVE NO.: CASE 2

CALC. NO.: 89-078-873ES REV 0
PROGRAM: BWNT MOVE Ver. 4.0
DATE: 07/27/95
VALVE S/N: E-5278-16-1
OPER. S/N: 152444
OPER. O/N: 358222E

<u>DESCRIPTION</u>	<u>VALUE</u>	
VALVE STEM AREA	3.98	IN.**2
VALVE SEAT AREA	441.30	✓ IN.**2
CALCULATED UNIT RATIO	64.02	
AVERAGE STROKE TIME	43.00	SEC.
DESIGN STROKE TIME	48.64	SEC.
HAND WHEEL EFFICIENCY	0.30	
HAND WHEEL TORQUE	250.00	FT-LB
MAXIMUM STALL RATIO	171.00	
STD.OPER.THRUST RATING	45000.00	LB
STD.OPER.TORQUE RATING	850.00	FT-LB
DYNAMIC RUNNING LOAD	4574.36	LB
RUNNING EFFICIENCY	0.55	

NOTE: Calculated Stroke Time Does Not Account for Degraded Voltage.

PREPARED BY PSD DATE 7/27/95REVIEWED BY PSW DATE 7/27/95 PAGE NO. 10 OF 23

NORTHEAST UTILITIES

CALCULATED VALUES AND OVER-RIDES

CCN 2 TO

SITE: MILLSTONE UNIT 2

VALVE NO.: CASE 2

CALC. NO.: 89-078-873ES REV 0

PROGRAM: BWNT MOVE Ver. 4.0

DATE: 07/27/95

VALVE S/N: E-5278-16-1

OPER. S/N: 152444

OPER. O/N: 358222E

<u>DESCRIPTION</u>		<u>VALUE</u>	<u>UNITS</u>	<u>OVER-RIDE FLAG</u>
VALVE FACTOR		0.540	✓	ON
PACKING LOAD		4634.00	✓ LB	ON
PISTON EFFECT		-59.64	LB	OFF
STEM FACTOR		0.0226	FT	OFF
UNIT PULLOUT EFFICIENCY		0.40		OFF
DESIGN APPLICATION FACTOR		0.90		OFF
STALL EFFICIENCY		0.55		OFF
STALL FACTOR		1.10		OFF
UNDER VOLTAGE APP. FACTOR		0.75		ON
OP RATED THRUST FACT (CST)	1.4000	63000.00	LB	ON
OP RATED TORQUE FACT (CST)	1.0000	850.00	FT-LB	OFF
THRUST (TT) FACTOR	1.4000	63000.00	LB	ON
TORQUE (TT) FACT	1.1000	935.00	FT-LB	OFF

PREPARED BY

PSD

DATE

7/27/95

REVIEWED BY

PSA

DATE

7/27/95

PAGE NO. 11 OF 23

NORTHEAST UTILITIES

SUMMARY OF CALCULATED VALUES

CCN 2 TO

SITE: MILLSTONE UNIT 2

VALVE NO.: CASE 2

CALC. NO.: 89-078-873ES REV 0
 PROGRAM: BWNT MOVE Ver. 4.0
 DATE: 07/27/95
 VALVE S/N: E-5278-16-1
 OPER. S/N: 152444
 OPER. O/N: 358222E

LOAD CASES	STEM THRUST (LBS)	MOTOR TORQUE (FT-LB)	HANDWHEEL TORQUE (FT-LB)
------------	-------------------------	----------------------------	--------------------------------

DESIGN CATEGORY

DESIGN EQUATIONS	13868	313	12.0	41
MFG. SUGGESTED THRUST	0	0	0.0	0

MAX DESIGN CATEGORY

MAX. VALVE MFG. LIMITS *	85000	1921	73.7	253
SEISMIC LIMIT (THRUST) *	85000	1921	73.7	253
MAX. OPER RATED CAP. (THRUST) *	63000	1424	54.6	188
MAX. OPER RATED CAP. (TORQUE) *	37611	850	32.6	112
MAX. OPER SPRING PACK CAP. *	43363	980	37.6	129
MIN. OPER SPRING PACK CAP.	4779	108	4.1	14
MAX. OPER MOTOR CAPACITY				
FULL VOLTAGE (100%)	32044	724	25.0	NA
UNDER VOLTAGE (75%) *	18025	407	14.1	NA
MAX. OUTPUT @ MOTOR STALL	48467	1095	27.5	NA

* LIMITED BY MOTOR CAP. UNDER-VOLTAGE 18025 407 14.1 NA

OBSERVATIONS

- THE CALCULATED UNIT RATIO IS WITHIN 20% OF THE MFG UNIT RATIO.
- UNIT RATIO INDICATES THAT THIS OPERATOR IS LOCKING TYPE.
- THE OPERATOR CAN WITHSTAND STALL TORQUE AND THRUST.
- VALVE CAN WITHSTAND STALL
- DYN. RUN. LOAD IS BELOW 33% OF THE MAX MOTOR CAP. AT 100% VOLTAGE.
- MOTOR TORQUE ADEQUATE TO OPEN VALVE AT UNDER VOLTAGE CONDITION.
- MOTOR TORQUE ADEQUATE TO CLOSE VALVE AT UNDER VOLTAGE CONDITION.

NOTES:

1. PARALLEL DISC GATE - VALVE FACTOR 0.3 PER ANCHOR DARLING STRESS REPORT, LOG R91.192, DATED 12-10-91
2. LRA UV PER CALC PA89-078-0272E2, REV 0
3. RE-EVALUATED FOR LIMITORQUE PART 21 (ACCURACY) 12/26/92

PREPARED BY

PJD

DATE

7/27/95

REVIEWED BY

PS4

DATE

7/27/95

PAGE NO.

12 OF 23

NORTHEAST UTILITIES

TARGET THRUST WINDOW

CCN 2 TO

SITE: MILLSTONE UNIT 2

CALC. NO.: 89-078-873ES REV 0

PROGRAM: BWNT MOVE Ver. 4.0

DATE: 07/27/95

VALVE NO.: CASE 2

VALVE S/N: E-5278-16-1

OPER. S/N: 152444

OPER. O/N: 358222E

EQUIPMENT ACCURACIES & REPEATABILITY:

DIAGNOSTIC ACCURACIES:	9.40	%
TORQUE SWITCH REPEATABILITY:	5.00	%
COMBINATION (SRSS):	10.65	%
RATE OF LOADING:	1.10	

CALCULATED REQUIRED THRUST (ADJUSTED FOR ACCURACIES AND RATE OF LOADING):

CALCULATED REQUIRED THRUST:	11368	LBS
MINIMUM SP CAPACITY:	5883	LBS (AVAILABLE)

MOV HARDWARE CAPABILITY (ADJUSTED FOR ACCURACIES):

	CST	TT	
LIMITING SEISMIC STEM THRUST:	76821	76821	LBS
MAX VALVE LIMIT:	76821	76821	LBS
MAX OPERATOR LIMIT: (THRUST)	56938	56938	LBS
MAX OPERATOR LIMIT: (TORQUE)	33992	37391	LBS
MAX SPRING PACK CAP.:	39190		LBS
MOTOR @ 75% VOLTAGE:	16290		LBS

	THRUST		COMPONENT
MAXIMUM TOTAL THRUST/TORQUE: (MAX TT)	37391	LBS	OPERATOR (TORQUE)
MAXIMUM CONTROL SWITCH TRIP: (MAX CST)	16290	LBS	MOTOR @ 75% VOLTAGE
TARGET (CALCULATED)	14661	LBS	MINCST - MAXCST MARGIN 43.3%
MINIMUM CONTROL SWITCH TRIP: (MIN CST IN AVAILABLE THRUST)	11368	LBS	

NOTES:

- o MAX Tf includes the thrust imparted by inertia.
- o A TT factor of 1.4000 was applied
- o The next limiting component is OPERATOR (TORQUE) and the margin to the Min Req. CST is 199.0 %.
- o The suggested target/thrust does not account for inertia.

PREPARED BY 9/0 DATE 7/27/95REVIEWED BY PSA DATE 7/28/95 PAGE NO. 13 OF 23

NORTHEAST UTILITIES

INPUTS

SITE: MILLSTONE UNIT 2

VALVE NO.: CASE 3

CCN 2 TO

CALC. NO.: 89-078-873ES REV 0

PROGRAM: BWNT MOVE Ver. 4.0

DATE: 07/27/95

VALVE S/N: E-5278-16-1

OPER. S/N: 152444

OPER. O/N: 358222E

INPUT DESCRIPTION	INPUT DATA	REFERENCES
VALVE MANUFACTURER	ANCHOR DARLING	7.22
VALVE SIZE	24.00 IN.	7.22
VALVE TYPE	GATE	7.22
ANSI RATING	150 LB	7.22
VALVE STEM DIAMETER	2.2500 IN.	7.24
OPER. STEM DIAMETER	2.2500 IN.	7.24
NO. THREADS/INCH	3.0	7.24
NO. THREAD STARTS	2	7.24
ACME THREAD TYPE	STANDARD	SECTION 3.9
STROKE LENGTH/LIFT	25.3750 IN.	7.24
STROKE TIME OPEN-CLOSE	43.50 SEC.	7.18
STROKE TIME CLOSE-OPEN	42.50 SEC.	7.19
VALVE SEAT DIAMETER	23.7040 IN.	7.24
VALVE MATERIAL	A351-CF8	7.24
DIFF. PRESSURE	44 ✓ PSI	7.21
LINE PRESSURE	-10 ✓ PSI	7.21
SEISMIC LIMIT - THRUST	85000 LB	7.27
MFG. SUGGESTED - THRUST	0 LB	
MAX. VLV LIMITS - THRUST	85000 LB	7.27
OPERATOR MANUFACTURER	LIMITORQUE	7.22
OPERATOR SIZE	SMB-1	7.22
NOMINAL MOTOR SIZE	25.0 FT-LB	7.22
MOTOR RPM	3400	7.22
MOTOR TYPE	AC	
MOTOR MANUFACTURER	PEERLESS	7.22
MOTOR SERIAL NUMBER	FZ29156WC	7.22
UNIT RATIO	72.42/1	SECTION 2.10
HAND WHEEL RATIO	25.30/1	7.12
SAFETY RELATED	YES	7.7
COEFF. OF FRICTION	0.1500	SECTION 3.2
TORQUE SWITCH SETTING	1.000/4.250	7.13
MAX. SPRING PACK TORQUE	980 FT-LB	7.13
MIN. SPRING PACK TORQUE	108 FT-LB	7.13
SPRING PACK NUMBER	60-600-0007	7.22

PREPARED BY

PJR

DATE

7/27/95

REVIEWED BY

BKH

DATE

7/27/95

PAGE NO. 14 OF 23

NORTHEAST UTILITIES

CALCULATED OR TABLE VALUES

CCN 270

SITE: MILLSTONE UNIT 2

VALVE NO.: CASE 3

CALC. NO.: 89-078-873ES REV 0
PROGRAM: BWNT MOVE Ver. 4.0
DATE: 07/27/95
VALVE S/N: E-5278-16-1
OPER. S/N: 152444
OPER. O/N: 358222E

<u>DESCRIPTION</u>	<u>VALUE</u>	
VALVE STEM AREA	3.98	IN.**2
VALVE SEAT AREA	441.30	✓ IN.**2
CALCULATED UNIT RATIO	64.02	
AVERAGE STROKE TIME	43.00	SEC.
DESIGN STROKE TIME	48.64	SEC.
HAND WHEEL EFFICIENCY	0.30	
HAND WHEEL TORQUE	250.00	FT-LB
MAXIMUM STALL RATIO	171.00	
STD.OPER.THRUST RATING	45000.00	LB
STD.OPER.TORQUE RATING	850.00	FT-LB
DYNAMIC RUNNING LOAD	4594.24	LB
RUNNING EFFICIENCY	0.55	

NOTE: Calculated Stroke Time Does Not Account for Degraded Voltage.

PREPARED BY P/D DATE 7/27/95
REVIEWED BY PSH DATE 7/27/95 PAGE NO. 15 OF 23

NORTHEAST UTILITIES

CALCULATED VALUES AND OVER-RIDES

SITE: MILLSTONE UNIT 2

VALVE NO.: CASE 3

CCN 2 To
CALC. NO.: 89-078-873ES REV 0
PROGRAM: BWNT MOVE Ver. 4.0
DATE: 07/27/95
VALVE S/N: E-5278-16-1
OPER. S/N: 152444
OPER. O/N: 358222E

<u>DESCRIPTION</u>		<u>VALUE</u>	<u>UNITS</u>	<u>OVER-RIDE FLAG</u>
VALVE FACTOR		0.540	✓	ON
PACKING LOAD		4634.00	✓ LB	ON
PISTON EFFECT		-39.76	LB	OFF
STEM FACTOR		0.0226	FT	OFF
UNIT PULLOUT EFFICIENCY		0.40		OFF
DESIGN APPLICATION FACTOR		0.90		OFF
STALL EFFICIENCY		0.55		OFF
STALL FACTOR		1.10		OFF
UNDER VOLTAGE APP. FACTOR		0.75		ON
OP RATED THRUST FACT (CST)	1.4000	63000.00	LB	ON
OP RATED TORQUE FACT (CST)	1.0000	850.00	FT-LB	OFF
THRUST (TT) FACTOR	1.4000	63000.00	LB	ON
TORQUE (TT) FACT	1.1000	935.00	FT-LB	OFF

PREPARED BY

Mn

DATE

7/27/95

REVIEWED BY

PSH

DATE

7/27/95

PAGE NO. 16 OF 23

NORTHEAST UTILITIES

SUMMARY OF CALCULATED VALUES

CCN 2 TO

SITE: MILLSTONE UNIT 2

VALVE NO.: CASE 3

CALC. NO.: 89-078-873ES REV 0
 PROGRAM: BWNT MOVE Ver. 4.0
 DATE: 07/27/95
 VALVE S/N: E-5278-16-1
 OPER. S/N: 152444
 OPER. O/N: 358222E

LOAD CASES

THRUST (LBS)	STEM TORQUE (FT-LB)	MOTOR TORQUE (FT-LB)	HANDWHEEL TORQUE (FT-LB)
-----------------	---------------------------	----------------------------	--------------------------------

DESIGN CATEGORY

DESIGN EQUATIONS	15079	341	13.1	45
MFG. SUGGESTED THRUST	0	0	0.0	0

MAX DESIGN CATEGORY

MAX. VALVE MFG. LIMITS *	85000	1921	73.7	253
SEISMIC LIMIT (THRUST) *	85000	1921	73.7	253
MAX. OPER RATED CAP. (THRUST) *	63000	1424	54.6	188
MAX. OPER RATED CAP. (TORQUE) *	37611	850	32.6	112
MAX. OPER SPRING PACK CAP. *	43363	980	37.6	129
MIN. OPER SPRING PACK CAP.	4779	108	4.1	14
MAX. OPER MOTOR CAPACITY				
FULL VOLTAGE (100%)	32044	724	25.0	NA
UNDER VOLTAGE (75%) *	18025	407	14.1	NA
MAX. OUTPUT @ MOTOR STALL	48467	1095	27.5	NA

* LIMITED BY MOTOR CAP. UNDER-VOLTAGE 18025 407 14.1 NA

OBSERVATIONS

- THE CALCULATED UNIT RATIO IS WITHIN 20% OF THE MFG UNIT RATIO.
- UNIT RATIO INDICATES THAT THIS OPERATOR IS LOCKING TYPE.
- THE OPERATOR CAN WITHSTAND STALL TORQUE AND THRUST.
- VALVE CAN WITHSTAND STALL
- DYN. RUN. LOAD IS BELOW 33% OF THE MAX MOTOR CAP. AT 100% VOLTAGE.
- MOTOR TORQUE ADEQUATE TO OPEN VALVE AT UNDER VOLTAGE CONDITION.
- MOTOR TORQUE ADEQUATE TO CLOSE VALVE AT UNDER VOLTAGE CONDITION.

NOTES:

1. PARALLEL DISC GATE - VALVE FACTOR 0.3 PER ANCHOR DARLING STRESS REPORT, LOG R91.192, DATED 12-10-91
2. LRA UV PER CALC PA89-078-0272E2, REV 0
3. RE-EVALUATED FOR LIMITORQUE PART 21 (ACCURACY) 12/26/92

PREPARED BY PSD DATE 7/27/95

REVIEWED BY PSA DATE 7/27/95 PAGE NO. 17 OF 23

NORTHEAST UTILITIES

TARGET THRUST WINDOW

CCN 2 70

SITE: MILLSTONE UNIT 2

VALVE NO.: CASE 3

CALC. NO.: 89-078-873ES REV 0

PROGRAM: BWNT MOVE Ver. 4.0

DATE: 07/27/95

VALVE S/N: E-5278-16-1

OPER. S/N: 152444

OPER. O/N: 358222E

EQUIPMENT ACCURACIES & REPEATABILITY:

DIAGNOSTIC ACCURACIES:	9.40	%
TORQUE SWITCH REPEATABILITY:	5.00	%
COMBINATION (SRSS):	10.65	%
RATE OF LOADING:	1.10	

CALCULATED REQUIRED THRUST (ADJUSTED FOR ACCURACIES AND RATE OF LOADING):

CALCULATED REQUIRED THRUST:	12859	LBS
MINIMUM SP CAPACITY:	5883	LBS (AVAILABLE)

MOV HARDWARE CAPABILITY (ADJUSTED FOR ACCURACIES):

	CST	TT	
LIMITING SEISMIC STEM THRUST:	76821	76821	LBS
MAX VALVE LIMIT:	76821	76821	LBS
MAX OPERATOR LIMIT: (THRUST)	56938	56938	LBS
MAX OPERATOR LIMIT: (TORQUE)	33992	37391	LBS
MAX SPRING PACK CAP.:	39190		LBS
MOTOR @ 75% VOLTAGE:	16290		LBS

	THRUST		COMPONENT
MAXIMUM TOTAL THRUST/TORQUE: (MAX TT)	37391	LBS	OPERATOR (TORQUE)
MAXIMUM CONTROL SWITCH TRIP: (MAX CST)	16290	LBS	MOTOR @ 75% VOLTAGE
TARGET (CALCULATED)	14661	LBS	MINCST - MAXCST MARGIN 26.7%
MINIMUM CONTROL SWITCH TRIP: (MIN CST IN AVAILABLE THRUST)	12859	LBS	

NOTES:

- o MAX TT includes the thrust imparted by inertia.
- o A TT factor of 1.4000 was applied
- o The next limiting component is OPERATOR (TORQUE) and the margin to the Min Req. CST is 164.3 %.
- o The suggested target/thrust does not account for inertia.

PREPARED BY PSB DATE 7/27/95REVIEWED BY PH DATE 7/27/95 PAGE NO. 18 OF 23

NORTHEAST UTILITIES

INPUTS

CCN 2 TO

SITE: MILLSTONE UNIT 2

VALVE NO.: CASE 4

CALC. NO.: 89-078-873ES REV 0
 PROGRAM: BWNT MOVE Ver. 4.0
 DATE: 07/27/95
 VALVE S/N: E-5278-16-1
 OPER. S/N: 152444
 OPER. O/N: 358222E

INPUT DESCRIPTION	INPUT DATA	REFERENCES
VALVE MANUFACTURER	ANCHOR DARLING	7.22
VALVE SIZE	24.00 IN.	7.22
VALVE TYPE	GATE	7.22
ANSI RATING	150 LB	7.22
VALVE STEM DIAMETER	2.2500 IN.	7.24
OPER. STEM DIAMETER	2.2500 IN.	7.24
NO. THREADS/INCH	3.0	7.24
NO. THREAD STARTS	2	7.24
ACME THREAD TYPE	STANDARD	SECTION 3.9
STROKE LENGTH/LIFT	25.3750 IN.	7.24
STROKE TIME OPEN-CLOSE	43.50 SEC.	7.18
STROKE TIME CLOSE-OPEN	42.50 SEC.	7.19
VALVE SEAT DIAMETER	23.7040 IN.	7.24
VALVE MATERIAL	A351-CF8	7.24
DIFF. PRESSURE	10 PSI	7.21
LINE PRESSURE	-10 PSI	7.21
SEISMIC LIMIT - THRUST	85000 LB	7.27
MFG. SUGGESTED - THRUST	0 LB	
MAX. VLV LIMITS - THRUST	85000 LB	7.27
OPERATOR MANUFACTURER	LIMITORQUE	7.22
OPERATOR SIZE	SMB-1	7.22
NOMINAL MOTOR SIZE	25.0 FT-LB	7.22
MOTOR RPM	3400	7.22
MOTOR TYPE	AC	
MOTOR MANUFACTURER	PEERLESS	7.22
MOTOR SERIAL NUMBER	FZ29156WC	7.22
UNIT RATIO	72.42/1	SECTION 2.10
HAND WHEEL RATIO	25.30/1	7.12
SAFETY RELATED	YES	7.7
COEFF. OF FRICTION	0.1500	SECTION 3.2
TORQUE SWITCH SETTING	1.000/4.250	7.13
MAX. SPRING PACK TORQUE	980 FT-LB	7.13
MIN. SPRING PACK TORQUE	108 FT-LB	7.13
SPRING PACK NUMBER	60-600-0007	7.22

PREPARED BY

P/B

DATE

7/27/95

REVIEWED BY

P/S

DATE

7/27/95

PAGE NO.

19 OF 23

NORTHEAST UTILITIES

CALCULATED OR TABLE VALUES

CCN 2 TO

SITE: MILLSTONE UNIT 2

VALVE NO.: CASE 4

CALC. NO.: 89-078-873ES REV 0
PROGRAM: BWNT MOVE Ver. 4.0
DATE: 07/27/95
VALVE S/N: E-5278-16-1
OPER. S/N: 152444
OPER. O/N: 358222E

<u>DESCRIPTION</u>	<u>VALUE</u>	
VALVE STEM AREA	3.98	IN.**2
VALVE SEAT AREA	441.30 /	IN.**2
CALCULATED UNIT RATIO	64.02	
AVERAGE STROKE TIME	43.00	SEC.
DESIGN STROKE TIME	48.64	SEC.
HAND WHEEL EFFICIENCY	0.30	
HAND WHEEL TORQUE	250.00	FT-LB
MAXIMUM STALL RATIO	171.00	
STD.OPER.THRUST RATING	45000.00	LB
STD.OPER.TORQUE, RATING	850.00	FT-LB
DYNAMIC RUNNING LOAD	4594.24	LB
RUNNING EFFICIENCY	0.55	

NOTE: Calculated Stroke Time Does Not Account for Degraded Voltage.

PREPARED BY PJH DATE 7/27/95
REVIEWED BY PSU DATE 7/27/95 PAGE NO. 20 OF 23

NORTHEAST UTILITIES

CALCULATED VALUES AND OVER-RIDES

CCN 2 TO

SITE: MILLSTONE UNIT 2

VALVE NO.: CASE 4

CALC. NO.: 89-078-873ES REV 0
 PROGRAM: BWNT MOVE Ver. 4.0
 DATE: 07/27/95
 VALVE S/N: E-5278-16-1
 OPER. S/N: 152444
 OPER. O/N: 358222E

DESCRIPTION	VALUE	UNITS	OVER-RIDE FLAG
VALVE FACTOR	0.540		ON
PACKING LOAD	4634.00	LB	ON
PISTON EFFECT	-39.76	LB	OFF
STEM FACTOR	0.0226	FT	OFF
UNIT PULLOUT EFFICIENCY	0.40		OFF
DESIGN APPLICATION FACTOR	0.90		OFF
STALL EFFICIENCY	0.55		OFF
STALL FACTOR	1.10		OFF
UNDER VOLTAGE APP. FACTOR	0.75		ON
OP RATED THRUST FACT (CST)	1.4000	63000.00 LB	ON
OP RATED TORQUE FACT (CST)	1.0000	850.00 FT-LB	OFF
THRUST (TT) FACTOR	1.4000	63000.00 LB	ON
TORQUE (TT) FACT	1.1000	935.00 FT-LB	OFF

PREPARED BY PSB DATE 7/27/95
 REVIEWED BY PSH DATE 7/27/95 PAGE NO. 21 OF 23

NORTHEAST UTILITIES

SUMMARY OF CALCULATED VALUES

CCN 2 To

SITE: MILLSTONE UNIT 2

VALVE NO.: CASE 4

CALC. NO.: 89-078-873ES REV 0

PROGRAM: BWNT MOVE Ver. 4.0

DATE: 07/27/95

VALVE S/N: E-5278-16-1

OPER. S/N: 152444

OPER. O/N: 358222E

LOAD CASES

	STEM THRUST (LBS)	MOTOR TORQUE (FT-LB)	HANDWHEEL TORQUE (FT-LB)
--	-------------------------	----------------------------	--------------------------------

DESIGN CATEGORY

DESIGN EQUATIONS	6977	158	6.0	21
MFG. SUGGESTED THRUST	0	0	0.0	0

MAX DESIGN CATEGORY

MAX. VALVE MFG. LIMITS *	85000	1921	73.7	253
SEISMIC LIMIT (THRUST) *	85000	1921	73.7	253
MAX. OPER RATED CAP. (THRUST) *	63000	1424	54.6	188
MAX. OPER RATED CAP. (TORQUE) *	37611	850	32.6	112
MAX. OPER SPRING PACK CAP. *	43363	980	37.6	129
MIN. OPER SPRING PACK CAP.	4779	108	4.1	14
MAX. OPER MOTOR CAPACITY				
FULL VOLTAGE (100%)	32044	724	25.0	NA
UNDER VOLTAGE (75%) *	18025	407	14.1	NA
MAX. OUTPUT @ MOTOR STALL	48467	1095	27.5	NA

* LIMITED BY MOTOR CAP. UNDER-VOLTAGE	18025	407	14.1	NA
---------------------------------------	-------	-----	------	----

OBSERVATIONS

- THE CALCULATED UNIT RATIO IS WITHIN 20% OF THE MFG UNIT RATIO.
- UNIT RATIO INDICATES THAT THIS OPERATOR IS LOCKING TYPE.
- THE OPERATOR CAN WITHSTAND STALL TORQUE AND THRUST.
- VALVE CAN WITHSTAND STALL
- DYN. RUN. LOAD IS BELOW 33% OF THE MAX MOTOR CAP. AT 100% VOLTAGE.
- MOTOR TORQUE ADEQUATE TO OPEN VALVE AT UNDER VOLTAGE CONDITION.
- MOTOR TORQUE ADEQUATE TO CLOSE VALVE AT UNDER VOLTAGE CONDITION.

NOTES:

1. PARALLEL DISC GATE - VALVE FACTOR 0.3 PER ANCHOR DARLING STRESS REPORT, LOG R91.192, DATED 12-10-91
2. LRA UV PER CALC PA89-078-0272E2, REV 0
3. RE-EVALUATED FOR LIMITORQUE PART 21 (ACCURACY) 12/26/92

PREPARED BY

PJB

DATE

7/27/95

REVIEWED BY

PSK

DATE

7/27/95

PAGE NO.

22 OF 23

NORTHEAST UTILITIES

TARGET THRUST WINDOW

CCN 2 TO

SITE: MILLSTONE UNIT 2

VALVE NO.: CASE 4

CALC. NO.: 89-078-873ES REV 0

PROGRAM: BWNT MOVE Ver. 4.0

DATE: 07/27/95

VALVE S/N: E-5278-16-1

OPER. S/N: 152444

OPER. O/N: 358222E

EQUIPMENT ACCURACIES & REPEATABILITY:

DIAGNOSTIC ACCURACIES:	9.40	%
TORQUE SWITCH REPEATABILITY:	5.00	%
COMBINATION (SRSS):	10.65	%
RATE OF LOADING:	1.10	

CALCULATED REQUIRED THRUST (ADJUSTED FOR ACCURACIES AND RATE OF LOADING):

CALCULATED REQUIRED THRUST	2885	LBS
MINIMUM SP CAPACITY:	5883	LBS (AVAILABLE)

MOV HARDWARE CAPABILITY (ADJUSTED FOR ACCURACIES):

	CST	TT	
LIMITING SEISMIC STEM THRUST:	76821	76821	LBS
MAX VALVE LIMIT:	76821	76821	LBS
MAX OPERATOR LIMIT: (THRUST)	56938	56938	LBS
MAX OPERATOR LIMIT: (TORQUE)	33992	37391	LBS
MAX SPRING PACK CAP.:	39190		LBS
MOTOR @ 75% VOLTAGE:	16290		LBS

	THRUST		COMPONENT
MAXIMUM TOTAL THRUST/TORQUE: (MAX TT)	37391	LBS	OPERATOR (TORQUE)
MAXIMUM CONTROL SWITCH TRIP: (MAX CST)	16290	LBS	MOTOR @ 75% VOLTAGE
TARGET (CALCULATED)	11766	LBS	MINCST - MAXCST MARGIN 176.9%
MINIMUM CONTROL SWITCH TRIP: (MIN CST IN AVAILABLE THRUST)	5883	LBS	MIN SPRING PACK

NOTES:

- o MAX TT includes the thrust imparted by inertia.
- o A TT factor of 1.4000 was applied
- o The next limiting component is OPERATOR (TORQUE) and the margin to the Min Req. CST is 477.8 %.
- o The suggested target/thrust does not account for inertia.

PREPARED BY PJB DATE 7/27/95

REVIEWED BY PSH DATE 7/27/95 PAGE NO. 23 OF 23