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U. S. Nuclear Utilities
Via: MUG Primary Contacts

U. S. Nuclear Regulatory Commissions
Via: Mr. Tom Scarbrough

N. U. S. Information Services, Inc.
Via: Mr. Russ Colthorpe

**SUBJECT: TECHNICAL UPDATE 98-01
AND TECHNICAL UPDATE 98-01 SUPPLEMENT #1**

Attached please find subject documents.

A series of utility workshops were held to discuss TU 98-01 and also solicit input as to the clarity of the document. Results of these discussions are presented in "Supplement #1."

A future TU will be issued that addresses the application of D.C. motors.

Regards,

LIMITORQUE CORPORATION

P.G. McQuillilan
Nuclear/Special Project Manager

PGMc/af
Attachment

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PDR



Limiterque Technical Update 98-01

Subject: Actuator Output Torque Relation

Reference: SMB/SB/SBD Actuators / Base Motors

The purpose of this update is to provide guidance to determine the output torque capability of a Limitorque valve actuator. The following equation is to be utilized:

$$T_0 = (T_1) \times (P.E.) \times (OAR) \times \left(\frac{V_T}{V_R}\right)^2 \times (A.F.)$$

Where:

T₀ = Actuator Output Torque

T₁ = Motor Rated Torque (Nameplate Rating).

P.E. = Pullout Efficiency (Reference attached sheet SEL (7) dated 6/93.

OAR = Overall Actuator Gear Ratio.

V_T = Motor Terminal Voltage

V_R = Motor Rated Voltage

A.F. = 0.9 (Ref: SEL. - 4 dated 7/77)

The term $\frac{V_T}{V_R}$ is only included when V_T is less than 90% of V_R and is not valid if V_T is less than 70% of V_R.

Page 1 of 3

The following examples are provided:

- #1 SMB-0 actuator consisting of a 10ft.-lb., 1800 rpm, 460-3-60 motor, 29.6 O.A.R. and 414 volts (90% v) at the motor.

$$T_0 = (10 \text{ ft.lb}) \times (0.4) \times (29.6) \times (0.9)$$

$$T_0 = 106 \text{ ft.lb.}$$

- #2 SMB-1 actuator consisting of a 40ft.lb, 1800 rpm, 575 - 3.60 motor, 47.6 O.A.R. and 460 volts (80%v) at the motor.

$$T_0 = (40 \text{ ft.lb.} \times (0.4) \times (47.6) \times \left(\frac{460}{575} \right)^2 \times (0.9))$$

$$T_0 = 438 \text{ ft lb.}$$

The following points should be noted:

- #1 The use of run efficiency instead of pullout efficiency is not allowed.
- #2 The efficiency values given on SEL (7) are not to be construed as actual efficiency values. They are only valid when utilized with the previously given equation.
- #3 The use of the voltage exponent 2.0 is only valid when utilized in the previously given equation. i.e., extrapolation of test data using this exponent may result in erroneous conclusions.

Usage of the previously given equation results in bounding and conservative estimations of actuator output torque and applies generically to all size SMB/SB/SBD actuators. The actuator output torque of a specific unit will generally exceed this calculated value. The following methods may be used to determine a specific actuator's output torque capability:

- #1 Actual Test Data
- #2 Specific validated engineering data
- #3 Limitorque certified calculation data

Further, actuators that fall in the following categories will require a specific configuration review by L to determine output torque capability:

- a.) Unit with a 25 ft.lb, 3600 rpm motor in a 56 frame.
- b.) Unit with a 60 ft.lb, 1800 rpm motor in a 56 frame
- c.) SMB-1 units with a 66:1 worm gear ratio.



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5/15/98

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attachment

PM/rw

GATE & GLOBE VALVE EFFICIENCY CHART

UNIT SIZE	RATIO RANGE	UNIT EFFICIENCIES		
		1800/1800 MOTOR SPEEDS		
		PULLOUT	RUN	APPROX. STALL
000	12.50—30.30	60	60	60
	33.50—100.00	40	50	50
	102.00—136.00	35	45	45
00	7.70—22.04	60	60	80
	23.00—41.00	40	50	60
	43.60—109.00	40	50	50
	114.00—183.90	35	45	45
0	18.50—26.10	65	65	85
	26.42—41.33	40	55	55
	43.69—96.20	40	50	50
	102.60—130.80	35	45	45
	158.30—247.00	30	40	40
	18.50—25.65	60	65	85
1	27.20—40.15	40	50	55
	42.50—88.40	40	50	50
	92.40—171.60	35	45	45
	191.70—234.00	30	40	40
	10.60—17.77	60	65	85
	18.85—25.65	60	60	85
2	26.24—41.51	40	55	55
	43.99—82.50	40	50	50
	84.84—150.00	35	45	45
	153.00—212.50	30	40	40
	11.05—24.11	65	70	90
3	25.76—37.28	60	70	90
	43.87—57.40	40	55	60
	61.50—95.53	40	50	60
	98.61—132.81	38	45	50
	138.40—186.40	33	45	50
	10.13—32.30	65	70	90
4	33.60—48.45	60	60	90
	51.79—124.95	40	55	55
	131.76—147.90	35	50	50
	152.13—219.30	33	45	45
	61.42—96.40	40	55	60
5	101.12—230.17	40	50	60

UNIT EFFICIENCIES		
3000/3600 MOTOR SPEEDS		
PULLOUT	RUN	APPROX. STALL
60	65	60
40	50	55
35	50	50
65	65	90
45	60	65
40	55	60
35	50	50
65	70	95
65	70	90
45	55	60
40	50	55
40	50	50
35	45	45
65	70	95
65	65	90
45	60	60
40	55	55
35	50	50
35	45	45
70	75	95
65	70	95
45	60	60
40	55	60
38	50	55
35	50	50
70	75	95
65	70	95
40	60	60
38	55	55
35	50	50
45	60	65
40	55	65



NON-LOCKING GEARING

APPLICATION FACTORS:

- .9 Standard Units
- .8 900 RPM Motors
- .8 High Temperature Applications using "SB"
- .8 Compound Motor Gear Applications
- .8 Air Motors
- .75 Modutronic Motors
- .75 HiLo Applications
- .7 Non-Rising Stem Where Operator Takes Thrust
- .5 Non-Rising Stem Where Valve Takes Thrust

If 2 or more application factors are required (e.g., 900 RPM motor with compound gearing and a Hi Lo) use as follows:

$$\frac{.8 \text{ (900 RPM motor)} \times .8 \text{ (Comp.Grg.)} \times .75 \text{ (HiLo)}}{.9 \text{ (Std.)} \times .9 \text{ (Std.)}}$$

WHERE: 2 Factors are required + 1 Std. Factor (.9)

3 Factors are required + 2 Std. Factor (.9)

*GEAR RATING SERVICE FACTORS:

- 1.0 Standard Applications
- 1.25 Non-Rising Stem Applications where Operator takes the Thrust (torque and thrust)
- 2.0 Modulating Service (torque only)
- 2.0 Non-Rising Stem Applications where Valve Takes the Thrust (torque only)

* To use -

Obtain application requirements and multiply by "gear rating service factor" and insure the product is less than the unit ratings shown on SEL-9.

e.g., Modutronic Application:

Torque required per calculation 40'@ LVC
40'@ x 2.0 (gear service factor) = 80'@ - smallest unit
with sufficient torque rating is
000 with 90'@
rating.

LIMITORQUE TECHNICAL UPDATE

98-01

SUPPLEMENT #1

The following clarifications apply to TU-98-01:

- #1. The second example given on Page 2 should have the voltage ratio term (460/575) squared. Some early copies of TU-98-01 did not include this exponent.
- #2. Actuators that are in the following categories:
 - a. Unit with a 25 ft. lb., 3500 RPM motor in a 56 frame.
 - b. Unit with a 60 ft. lb., 1800 RPM motor in a 56 frame.
 - c. SMB-1 units with a 66:1 worm gear ratio

May also be evaluated by the following methods:

- a. Actual test data
- b. Specific validated engineering data
- c. Limitorque certified calculation data

In other words Limitorque certified calculation data is not the only acceptable evaluation method.

- #3. SB-1 and SBD-1 units are to be included in the following category:
 - a. SMB-1 units with a 66:1 worm gear ratio
- #4. The following data is required by Limitorque to perform a specific configuration analysis:
 - a. Actuator serial number and shop order number - this is only required if the actuator has not been modified from the original configuration.
 - b. Unit size
 - c. Worm gear set ratio and overall unit ratio
 - d. Motor torque, speed, voltage, frame size, manufacturer, and serial number
- #5. Limitorque furnished two series of "combination" motors i.e. 2/5 and 5/7 1/2/10. These motors could have been utilized to satisfy the torque requirements of the combination range e.g.:
 - a. If the required motor torque was less than or equal to 2 ft. lb., the 2/5 combination motor could have been furnished. In reality this motor has 5 ft. lb. capability. The same is true of the 5/7 1/2/10 which has 10 ft. lb. capability.
 - b. The following nameplate data will identify these motors:
 1. 48 frame - 230/460v-1.9/1.95 F.L.A. Above indicates 2/5 motor.
 2. 56 frame - 230/460v-4.6/2.3 F.L.A. Above indicates 5/7 1/2/10 motor.
 - c. Both motors are 1800 RPM design and manufactured by Reliance.
- #6. It should be noted that TU-98-01 guidance allows evaluation by alternative methods. It is acceptable to utilize these alternative methods to evaluate any actuator within the program population. It is not acceptable to apply portions of separate methodologies to evaluate a specific actuator's capability.


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