

Why Anti-Backlash Control is Important

Even the best manufacturing processes produce clearances between a screw and a mating nut. In applications where loads may be in either direction, backlash can result from these clearances creating unacceptable movement in the controlled mechanism as loads change. These applications are common in the paper, plastic, film, sheet metal forming processes, satellite, or other load-reversing applications.

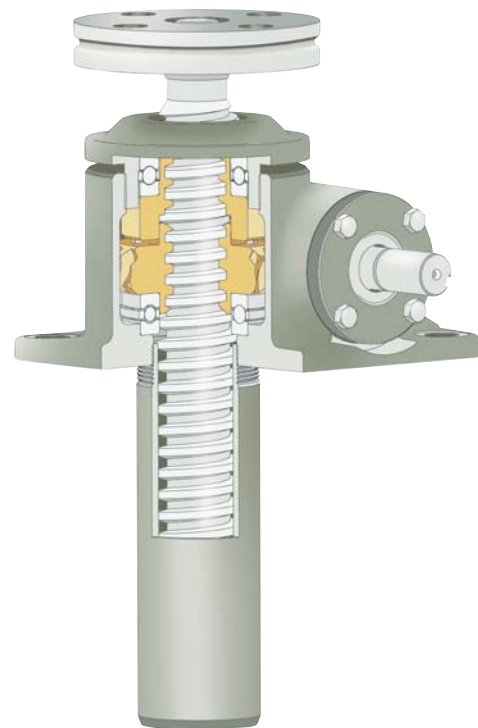
Such applications may be subjected to extreme vibrations. These vibrations can produce constant movement between the screw and lifting nut which can hammer the threads and cause premature wear.

To reduce this screw-to-nut backlash to an absolute minimum, Duff-Norton developed Anti-Backlash actuators. The design allows the backlash to be adjusted to the minimum value practical. As wear occurs, the actuator can be easily adjusted, without any disassembly, to return the backlash to its original minimum value.

Anti-Backlash Actuators

Features

- The industry's best backlash control
- A dual role as an internal safety nut
- Available with Standard, Optional, and Numeric Ratios
- Available in Stainless Steel for most capacities
- Precise motion control
- The ability to lock and hold a load, thereby eliminating the need for brake motors required for some applications
- Available on 1/4 to 150 Ton models



Anti-backlash Actuators

Anti-Backlash Actuator Model Numbering System

FL – TKM – 9402 – 6 – 1R

Model Prefix

R – Reducer
F – C-face Adapter
H – Hand Wheel
L – Limit Switch
E – Encoder
J – Rotary Counter

Screw End & Configuration

T – Threaded End
C – Clevis End
M – Top Plate
P – Plain End

K – Keyed Screw
CC – Double Clevis

D – Inverted Rotating
U – Upright Rotating

N – Numeric Ratio

Series & Capacity No.

Anti-Backlash (94xx, 48xx, 74xx, 4501)
Special AB (104xx, 58xx, 84xx, 5501)

(1800 series base configurations are only available on 2 and 50 ton models)

Small Capacity AB (45xx, 4555, 4625)
Special Small AB (55xx, 5555, 5625)

Capacities:

Upright model suffixes end with the capacity number.
Inverted model suffixes lower the capacity number by one digit.
Rotating model suffixes raise the capacity number by one digit.

1/4 & 1/2 Ton models suffixes are as shown and then change as previously described.

M – Base Model - Standard Material
SM – Base Model - Stainless Steel

Travel

1" increment travels are always represented using the exact travel amount.

Travels with fractional lengths are quoted using that length, but are serialized when the order is processed.

Serialized digits in this position may also be used for other models containing special features.

Model Suffix

B – Boot
L – Single End Worm Ext. Left
R – Single End Worm Ext. Right
1 – Optional Ratio #1
2 – Optional Ratio #2
X – Supplied without cover pipe



Anti-backlash actuators are commonly used on Satellites to enhance antenna tracking along the X,Y. and Z axes, and to protect Satellite performance against wind-shear.

Anti-Backlash Machine Screw Actuators Performance Specifications

Capacity (Tons)		1/4	1/2	1	2	3	5	10	15	20	25	35	50	75	100	150
Max. Speed Cfaced Driven (in/min)** (pg. 114)		—	—	—	72.0	72.0	108.0	108.0	108.0	108.0	107.5	107.5	—	—	—	—
Max. Speed Red. Driven (in/min)** (pg. 106-107)		—	—	—	14.4	14.4	21.9	21.9	21.9	21.9	22.2	22.4	12.2	—	—	—
Lifting Screw	Diameter (in)	1/2	5/8	3/4	1	1	1 1/2	2	2 1/4	2 1/2	3	3 3/4	4 1/2	5	6	7
	Pitch (in)	0.250	0.125	0.200	0.250	0.250	0.375	0.500	0.500	0.500	0.666	0.666	0.666	0.666	0.750	1.000
	Type	ACME	ACME	ACME	ACME	ACME	ACME	ACME	ACME	ACME	ACME	ACME	Mod. Sq.	Mod. Sq.	Mod. Sq.	Mod. Sq.
Worm Gear Ratios	Std.	5:1	5:1	5:1	6:1	6:1	6:1	8:1	8:1	8:1	10 2/3:1	10 2/3:1	10 2/3:1	12:1	12:1	12:1
	Optional No. 1	—	—	20:1	24:1	24:1	24:1	24:1	24:1	24:1	32:1	32:1	32:1	36:1	36:1	36:1
	Optional No. 2	—	—	—	12:1	12:1	12:1	—	—	—	—	—	—	—	—	—
Turns of Worm for 1" Stroke	Std.	20	40	25	24	24	16	16	16	16	16	16	16	16	16	12
	Optional No. 1	—	—	100	96	96	64	48	48	48	48	48	48	48	48	36
	Optional No. 2	—	—	—	48	48	32	—	—	—	—	—	—	—	—	—
Worm Torque at No Load (in-lb)	Std.	2	2	5	5	5	10	20	20	30	40	50	100	150	200	250
	Optional No. 1	—	—	5	5	5	10	20	20	30	40	50	100	150	200	250
	Optional No. 2	—	—	—	5	5	10	—	—	—	—	—	—	—	—	—
Maximum Horsepower per Actuator	Std.	1/3	1/3	1/2	2	2	4	5	5	5	8	8	15	15	25	25
	Optional No. 1	—	—	1/4	1/2	3/4	3/4	1 1/2	1 1/2	1 1/2	2 1/2	2 1/2	6	6	11	11
	Optional No. 2	—	—	—	3/4	1 1/4	2	—	—	—	—	—	—	—	—	—
Worm Torque at Full Load (in-lb)	Std.	14	23	61	132	181	495	825	1573	2255	2970	4400	8250	13200	17600	30921
	Optional No. 1	—	—	28	55	82	204	440	902	1287	1870	2640	4620	7095	9460	17050
	Optional No. 2	—	—	—	82	115	303	—	—	—	—	—	—	—	—	—
Efficiency Rating (%)	Std.	27.8	17.2	21.0	20.1	22.0	20.1	24.1	19.0	17.6	16.7	15.8	12.1	11.3	11.3	12.9
	Optional No. 1	—	—	11.6	12.1	12.1	12.2	15.1	11.0	10.3	8.9	8.8	7.2	7.0	7.0	7.8
	Optional No. 2	—	—	—	16.1	17.2	16.4	—	—	—	—	—	—	—	—	—
Weight with 6" Stroke (Raise) (lb)		2.3	2.3	5	17	17	35	52	66	93	160	240	410	1200	1200	1350
Weight per Additional 1" Stroke (Raise) (lb)		0.1	0.1	0.3	0.3	0.3	0.9	1.4	1.5	2.6	2.5	3.7	5.5	9.0	9.0	12.6
Key Torque (in-lb)		40	70	175	460	670	1750	4700	7580	10625	14000	26500	47110	88650	118200	216000
Max Worm Speed at Full Load (rpm)	Std.	1469	909	521	955	696	509	382	200	140	170	115	72	90	51	41
	Optional No. 1	—	—	573	573	573	232	215	105	73	84	60	82	53	73	41
	Optional No. 2	—	—	—	573	682	416	—	—	—	—	—	—	—	—	—
Max Load at Full Horsepower and 1750 rpm (lb)	Std.	407	474	469	2112	2285	2764	3978	3092	2698	4234	3832	5402	4485	8050	6361
	Optional No. 1	—	—	356	1041	1705	879	1620	1157	764	1367	1082	2568	1427	4237	2610
	Optional No. 2	—	—	—	1136	2174	2119	—	—	—	—	—	—	—	—	—

All actuator units can be supplied with standard raises up to 24 inches. Special raises up to 20 feet are available upon request. Standard inverted keyed models do not have a cover pipe (except for the 1-ton and 75-ton models). Closed height dimensions may increase for actuators supplied with bellows boots. See pages 143-144.

Stainless Steel Anti-Backlash Actuators Performance Specifications

Capacity (Tons) - 17-4PH Worm		2	5	10	15	20	25	35	50	100
Capacity (Tons) - 316 SS Worm		0.67	1.66	3.33	5.00	6.66	8.33	11.66	16.66	33.33
Lifting Screw	Diameter (in)	1	1 1/2	2	2 1/4	2 1/2	3	3 3/4	4 1/2	6
	Pitch (in)	0.250	0.375	0.500	0.500	0.500	0.666	0.666	0.666	0.750
	Type	ACME	ACME	ACME	ACME	ACME	ACME	ACME	Mod. Sq.	Mod. Sq.
Worm Gear Ratios	Std.	6:1	6:1	8:1	8:1	8:1	10 2/3:1	10 2/3:1	10 2/3:1	12:1
	Optional No. 1	24:1	24:1	24:1	24:1	24:1	32:1	32:1	32:1	36:1
	Optional No. 2	12:1	12:1	—	—	—	—	—	—	—
Turns of Worm for 1" Stroke	Std.	24	16	16	16	16	16	16	16	16
	Optional No. 1	96	64	48	48	48	48	48	48	48
	Optional No. 2	48	32	—	—	—	—	—	—	—
Worm Torque at No Load (in-lb)	Std.	5	10	20	20	30	40	50	100	200
	Optional No. 1	5	10	20	20	30	40	50	100	200
	Optional No. 2	5	10	—	—	—	—	—	—	—
Maximum Horsepower per Actuator	Std.	2	4	5	5	5	8	8	15	25
	Optional No. 1	1/2	3/4	1 1/2	1 1/2	1 1/2	2 1/2	2 1/2	6	11
	Optional No. 2	3/4	2	—	—	—	—	—	—	—
Worm Torque at Full load (in-lb) 17-4PH Worm	Std.	120	450	750	1430	2050	2700	4000	7500	16000
	Optional No. 1	50	185	400	820	1170	1700	2400	4200	8600
	Optional No. 2	75	275	—	—	—	—	—	—	—
Worm Torque at Full load (in-lb) 316SS Worm	Std.	43	156	263	490	703	926	1366	2566	5466
	Optional No. 1	20	68	147	287	410	593	833	1466	3000
	Optional No. 2	28	98	—	—	—	—	—	—	—
Efficiency Rating (%)	Std.	20.4	21.2	25.2	20.3	18.9	17.9	17.0	12.9	12.1
	Optional No. 1	11.1	12.1	15.1	11.6	10.8	9.3	9.3	7.5	7.4
	Optional No. 2	15.6	16.8	—	—	—	—	—	—	—
Weight with 6" Stroke (Raise) (lb)		17	35	52	66	93	160	240	410	1200
Weight per Additional 1" Stroke (Raise) (lb)		0.3	0.9	1.4	1.5	2.6	2.5	3.7	5.5	9.0
Key Torque (in-lb)		153	581	1565	2527	3538	4665	8828	15697	39396
Max Worm Speed at Full Load (rpm)	Std.	1750	1615	1198	643	449	544	369	368	288
	Optional No. 1	1576	694	645	330	231	266	189	258	231
	Optional No. 2	1669	1286	—	—	—	—	—	—	—
Max Load at Full Horsepower and 1750 rpm (lb)	Std.	1333	3047	4386	3406	2972	4664	4220	5949	8865
	Optional No. 1	1156	972	1791	1276	843	1507	1192	2831	4671
	Optional No. 2	1258	2339	—	—	—	—	—	—	—

When the screw (1) is under a compression load, the bottom of its thread surfaces are supported by the top thread surfaces of the worm gear (2). The anti-backlash nut (3), being pinned to the worm gear and floating on these pins and being adjusted downward by the shell cap, forces its bottom thread surfaces against the upper thread surfaces of the lifting screw at point (B). Thus, backlash between the worm gear threads and the lifting screw threads is reduced to a regulated minimum.

When wear occurs in the worm gear threads and the Anti-backlash nut thread, the load carrying thickness of the worm gear thread will be reduced. This wear will create a gap at point (B) and provide backlash equal to the wear on the threads.

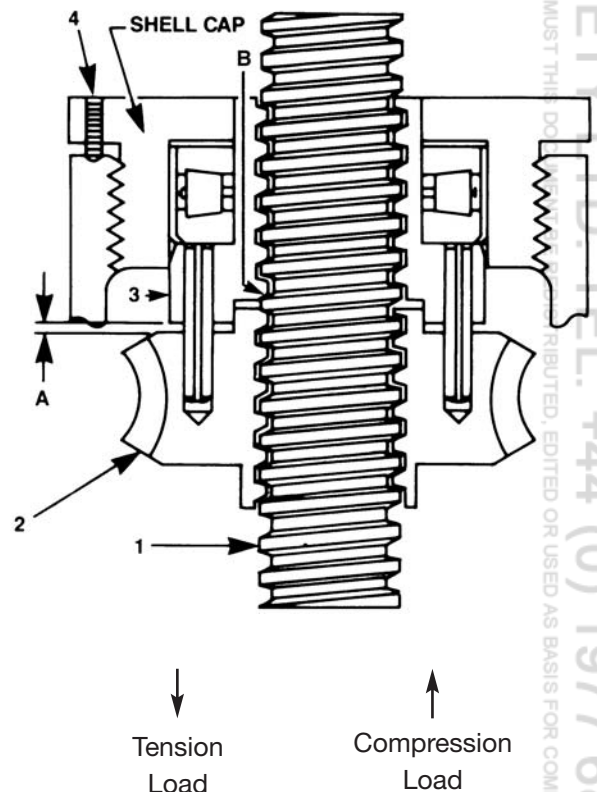
Under a compression load, the lifting screw will no longer be in contact with the lower thread surface of the anti-backlash nut. Under this condition, backlash will be present when a tension load is applied. The anti-backlash feature can be maintained simply by adjusting the shell cap until the desired amount of backlash reduction is achieved. This will reduce the separation (A) between the anti-backlash nut and the worm gear and will reduce the backlash between the worm gear threads and the lifting screw to the desired minimum value.

This will reduce the separation (A) between the anti-backlash nut and the worm gear and will reduce the backlash between the worm gear threads and the lifting screw to the desired minimum value.

To avoid binding and excessive wear, do not adjust lifting screw backlash to less than .0005”.

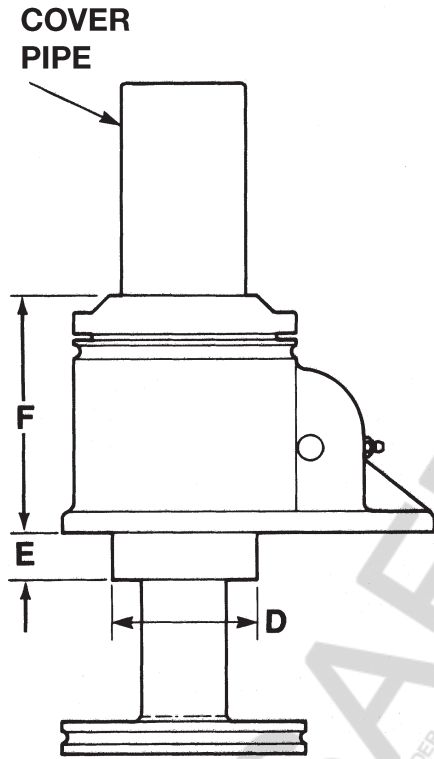
When separation (A) has been reduced to zero, the wear limit has been reached. . Replace the worn gear and backlash nut set at this point. This feature acts as a built in safety device.

Note: Use anti-backlash as a safety device or to provide wear indication for critical applications. Keyed anti-backlash models may require (A) key adaptor, which projects below jack base. See pg. 47 for dimensions.

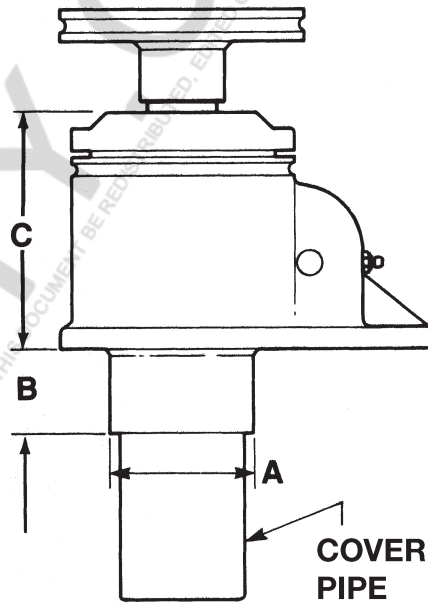


**Key Adaptor Dimensions for
Anti-Backlash Actuators**

Keyed Anti-Backlash Inverted



Keyed Anti-Backlash Upright



Actuator Capacity (Tons)	Upright A Dia. (in)	Upright B (in)	Upright C (in)	Inverted D Dia. (in)	Inverted E (in)	Inverted F (in)
1/4 & 1/2	1.66	Pipe Length	2.38	1.25	.81	2.88
1	1.66	.75	3.84	1.50	.38	3.38
2	2.25	1.25	3.88	2.25	.63	3.88
3	2.25	1.25	4.34	2.25	.63	4.34
5	2.75	1.75	5.44	2.75	.88	5.44
10	3.38	2.00	5.75	3.38	1.13	5.75
15	3.63	2.00	6.13	3.63	1.25	6.13
20	4.00	1.50	7.75	4.00	1.00	7.75
25	5.50	2.25	9.69	5.50	1.25	9.69
35	6.50	2.38	9.44	6.50	1.25	9.44
50	7.00	3.00	11.75	7.00	3.00	11.75

SELBY ENGINEERING AND LIFTING SAFETY LTD. TEL: +44 (0) 1977 684 600

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