ANTI-BACKLASH ACTUATORS

¼ to 250 TONS

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 a minimum value practical. As wear occurs, the actuator can be easily adjusted, without any disassembly, to return the backlash to its' original minimum value.

FEATURES

- The industry's best backlash control.
- A dual role as an internal safety nut.
- Available with standard, optional, & 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 ¼ to 250 Ton models.

ANTI-BACKLASH ACTUATORS

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.

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

(1800 series base configurations are available only 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.

M - Base Model - Standard Material
S**M** - 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

B9003A TV - 10.50 - LX2 - BFL

Capacity

B9225A - 500 Lbs
B9250A - 1000 Lbs
B9003A - 3 Ton

Screw End

C - Clevis End Screw
CC - Double Clevis Ends
M - Top Plate Screw
P - Plain End Screw
T - Threaded End Screw

Travel

1" Incremental travels are always represented using the exact travel amount. Fractional lengths are represented and processed to the nearest 100ths.

Base Model

None - Upright Translating
D - Inverted Rotating
K - Keyed, anti-rotation
U - Upright Rotating
V - Inverted Translating

Model Suffix

L - Single End Worm Extension Left
N - Numeric Gear Ratio – 100 turns/inch
R - Single End Worm Extension Right
X - Supplied without Cover Pipe
1 - Alternate Gear Ratio #1
2 - Alternate Gear Ratio #2

Key Accessories

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

NOTE

Alphabet characters representing features and suffixes should always be used in alphabetic order to avoid questions of hierarchy.

Models for actuators with specialized features will have a serialized suffix such as B9225T-0001.

ANTI-BACKLASH ACTUATORS

PERFORMANCE TABLE - STANDARD MATERIALS

Specifications - Standard, Optional, and Numeric Ratios																		
Capacity (Tons)		**1/4**	**1/2**	**1**	**2**	**3**	**5**	**10**	**15**	**20**	**25**	**30**	**35**	**50**	**75**	**100**	**150**	**250**
Max. Speed C-face Driven (in/min)** Pg. 118		—	—	—	72.0	72.0	108.0	108.0	108.0	108.0	107.0	107.5	107.0	—	—	—	—	—
Max. Speed Reducer Driven (in/min)** Pg. 110		—	—	—	14.4	21.9	21.9	21.9	21.9	21.9	22.2	22.2	22.4	12.2	—	—	—	—
Dimensional Information Pg. 115		18	19	20	21-23	24	25	26	27	28	29	29	30	31-32	33	34	35	36
Lifting Screw	Diameter (in)	1/2	5/8	3/4	1	1	1-1/2	2	2-1/4	2-1/2	3	3	3-3/4	4-1/2	5	6	7	9
	Pitch (Std. & Opt.)	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	0.666	0.750	1.000	1.000
	Pitch (Numerical)	—	—	—	—	—	0.250	0.250	0.250	0.250	0.320	0.32	0.320	0.320	—	—	—	—
	Type	ACME	ACME	ACME	ACME	ACME	ACME	ACME	ACME	ACME	ACME	ACME	ACME	Mod. Sq.	Mod. Sq.	Mod. Sq.	Mod. Sq.	Mod. Sq.
Worm Gear Ratios	Standard	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	10-2/3:1	10-2/3:1	12:1	12:1	50:1
	Optional No. 1	—	—	20:1	24:1	24:1	24:1	24:1	24:1	24:1	32:1	32:1	32:1	32:1	32:1	36:1	36:1	—
	Optional No. 2	—	—	—	12:1	12:1	12:1	—	—	—	—	—	—	—	—	—	—	—
	Numeric Ratio	—	—	20:1	25:1	25:1	25:1	25:1	25:1	25:1	32:1	32:1	32:1	32:1	—	—	—	—
Turns of Worm for 1 inch Stroke	Standard	20	40	25	24	24	16	16	16	16	16	16	16	16	16	16	12	50
	Optional No. 1	—	—	100	96	96	64	48	48	48	48	48	48	48	48	48	36	—
	Optional No. 2	—	—	—	48	48	32	—	—	—	—	—	—	—	—	—	—	—
	Numeric Ratio	—	—	100	100	100	100	100	100	100	100	100	100	100	—	—	—	—
Worm Torque at No Load (in-lb)	Standard	2	2	5	5	5	10	20	20	30	40	40	50	100	150	200	250	200
	Optional No. 1	—	—	5	5	5	10	20	20	30	40	40	50	100	150	200	250	—
	Optional No. 2	—	—	—	5	5	10	—	—	—	—	—	—	—	—	—	—	—
	Numeric Ratio	—	—	5	5	5	10	20	20	30	40	40	50	100	—	—	—	—
Maximum Horsepower per Actuator	Standard	1/3	1/3	1/2	2	2	4	5	5	5	8	8	8	15	15	25	25	35
	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	2-1/2	6	6	11	11	—
	Optional No. 2	—	—	—	3/4	1-1/4	2	—	—	—	—	—	—	—	—	—	—	—
	Numeric Ratio	—	—	1/4	1/2	1/2	3/4	1-1/2	1-1/2	1-1/2	2-1/2	2-1/2	2-1/2	6	—	—	—	—
Worm Torque at Full Load* (in-lb)	Standard	13	21	55	120	165	450	750	1430	1811	2220	2640	4000	7500	12000	16000	28110	20000
	Optional No. 1	—	—	25	50	75	185	400	820	1035	1401	1685	2400	4200	6601	8600	15500	—
	Optional No. 2	—	—	—	75	105	275	—	—	—	—	—	—	—	—	—	—	—
	Numeric Ratio	—	—	25	48	72	175	370	640	925	1500	1800	2411	4040	—	—	—	—
Efficiency Rating (%)	Standard	30.6	18.9	23.1	22.1	24.2	22.1	26.5	20.9	22.0	22.4	22.4	17.4	13.3	12.4	12.4	14.2	8.0
	Optional No. 1	—	—	12.7	13.3	13.3	13.4	16.6	12.1	12.8	11.8	11.8	9.7	7.9	7.5	7.7	8.6	—
	Optional No. 2	—	—	—	17.7	19.0	18.1	—	—	—	—	—	—	—	—	—	—	—
	Numeric Ratio	—	—	12.7	13.3	13.2	9.1	8.6	7.5	6.9	5.3	5.3	4.6	3.9	—	—	—	—
Key Torque (in-lb)	Std. & Opt. 1 & 2	40	70	175	460	670	1750	4700	7580	10625	14000	16800	26500	47110	73000	118200	216000	423300
	Numeric Ratio	—	—	175	460	670	1599	4077	6645	9369	11474	13770	18561	30970	—	—	—	—
Maximum Worm Speed at Full Load (RPM)	Standard	1616	1000	573	1051	766	560	420	220	174	227	190	126	126	79	98	56	110
	Optional No. 1	—	—	630	630	631	278	236	115	91	112	94	66	90	57	81	45	—
	Optional No. 2	—	—	—	630	751	458	—	—	—	—	—	—	—	—	—	—	—
	Numeric Ratio	—	—	630	657	437	270	256	148	102	105	87	65	94	—	—	—	—
Maximum Load at Full Horsepower and 1750 RPM (lb)	Standard	455	527	520	2332	2521	3047	4386	3406	3370	5691	5691	4220	5949	4939	8865	7003	26780
	Optional No. 1	—	—	400	1156	1888	1064	1791	1276	956	1839	1839	1193	2831	1537	4670	2875	—
	Optional No. 2	—	—	—	1258	2402	2339	—	—	—	—	—	—	—	—	—	—	—
	Numeric Ratio	—	—	400	1210	1162	1031	1944	1646	1074	1714	1714	1187	2946	—	—	—	—
Weight with 6 inch Stroke (Raise) (lb)		2	2	5	17	17	35	52	66	93	160	160	240	410	650	1200	1350	2700
Weight per Add.1 inch Stroke (Raise) (lb)		0.1	0.1	0.3	0.3	0.3	0.9	1.4	1.5	2.6	2.5	2.5	3.7	5.5	6.5	9.0	12.6	23.0

All actuator units can be supplied with standard raises up to 24 inches. Special raises up to 20 feet are available upon request. Closed height dimensions may increase for actuators supplied with bellows boots. See page 148-149.

PERFORMANCE TABLE - STAINLESS STEEL

Specifications - Standard, Optional, and Numeric Ratios											
Capacity (Tons) - 17-4PH Worm		**2**	**5**	**10**	**15**	**20**	**25**	**30**	**35**	**50**	**100**
Capacity (Tons) - 316 SS Worm		**0.67**	**1.66**	**3.33**	**5.00**	**6.66**	**8.33**	**9.9**	**11.66**	**16.66**	**33.33**
Lifting Screw	Diameter (in)	1	1-1/2	2	2-1/4	2-1/2	3	3	3-3/4	4-1/2	6
	Pitch (Std. & Opt.)	0.250	0.375	0.500	0.500	0.500	0.666	0.666	0.666	0.666	0.750
	Pitch (Numerical)	—	0.250	0.250	0.250	0.250	0.320	0.32	0.320	0.320	—
	Type	ACME	ACME	ACME	ACME	ACME	ACME	ACME	ACME	Mod. Sq.	Mod. Sq.
Worm Gear Ratios	Standard	6:1	6:1	8:1	8:1	8:1	10-2/3:1	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	32:1	36:1
	Optional No. 2	12:1	12:1	—	—	—	—	—	—	—	—
	Numeric Ratio	25:1	25:1	25:1	25:1	25:1	32:1	32:1	32:1	32:1	—
Turns of Worm for 1 inch Stroke	Standard	25	17	17	17	16	16	16	16	16	16
	Optional No. 1	100	67	50	50	48	48	48	48	48	48
	Optional No. 2	50	33	—	—	—	—	—	—	—	—
	Numeric Ratio	100	100	100	100	100	100	100	100	100	—
Worm Torque at No Load (in-lb)	Standard	5	10	20	20	30	40	40	50	100	200
	Optional No. 1	5	10	20	20	30	40	40	50	100	200
	Optional No. 2	5	10	—	—	—	—	—	—	—	—
	Numeric Ratio	5	10	20	20	30	40	40	50	100	200
Maximum Horsepower per Actuator	Standard	2	4	5	5	5	8	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	2-1/2	6	11
	Optional No. 2	3/4	2	—	—	—	—	—	—	—	—
	Numeric Ratio	1/2	3/4	1-1/2	1-1/2	1-1/2	2-1/2	2-1/2	2-1/2	6	11
Worm Torque at Full Load* (in-lb) 17-4PH Worm	Standard	120	450	750	1430	2050	2700	2640	4000	7500	16000
	Optional No. 1	50	185	400	820	1170	1700	1685	2400	4200	8600
	Optional No. 2	75	275	—	—	—	—	—	—	—	—
	Numeric Ratio	48	175	370	640	925	1500	1800	2411	4040	—
Worm Torque at Full Load (in-lb) 316SS Worm	Standard	42	150	253	471	676	926	940	1366	2566	5466
	Optional No. 1	19	66	141	276	394	593	600	1466	1466	3000
	Optional No. 2	27	95	—	—	—	—	—	—	—	—
	Numeric Ratio	25	57	67	109	144	336	635	619	619	—
Efficiency Rating (%) - 17-4PH Worm	Standard	22.1	22.1	26.5	20.9	22.0	22.4	22.4	17.4	13.3	12.4
	Optional No. 1	13.3	13.4	16.6	12.1	12.8	11.8	11.8	9.7	7.9	7.7
	Optional No. 2	17.7	18.1	—	—	—	—	—	—	—	—
	Numeric Ratio	13.3	9.1	8.6	7.5	6.9	5.3	5.3	4.6	3.9	—
Efficiency Rating (%) - 316SS Worm	Standard	20.3	21.1	25.1	20.3	18.8	17.9	17.9	17.0	12.9	12.1
	Optional No. 1	10.9	12.0	15.0	11.5	10.7	9.3	9.3	9.3	7.5	7.4
	Optional No. 2	15.5	16.8	—	—	—	—	—	—	—	—
	Numeric Ratio	10.9	8.0	7.5	5.8	5.4	4.5	5.0	4.5	3.6	—
Key Torque (in-lb) - 17-4PH Worm	Std. & Opt.	460	1750	4700	7580	10625	14000	16800	26500	47110	118200
	Numeric Ratio	460	1599	4077	6645	9369	11474	13770	18561	30970	—
Key Torque (in-lb) - 316SS Worm	Std. & Opt.	153	581	1565	2527	3538	4665	5600	8828	15697	39396
	Numeric Ratio	211	460	551	959	1199	2328	2800	2358	4087	—
Weight with 6 inch Stroke (Raise) (lb)		17	35	52	66	93	160	160	240	410	1200
Weight per Additional 1 inch Stroke (Raise) (lb)		0.3	0.9	1.4	1.5	2.6	2.5	2.5	3.7	5.5	9.0

*For loads from 25% to 100% of actuator capacity, torque requirements are approximately proportional to the load.
Note: Contact Duff-Norton Customer Service for motorized performance.

How Anti-Backlash Works

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.

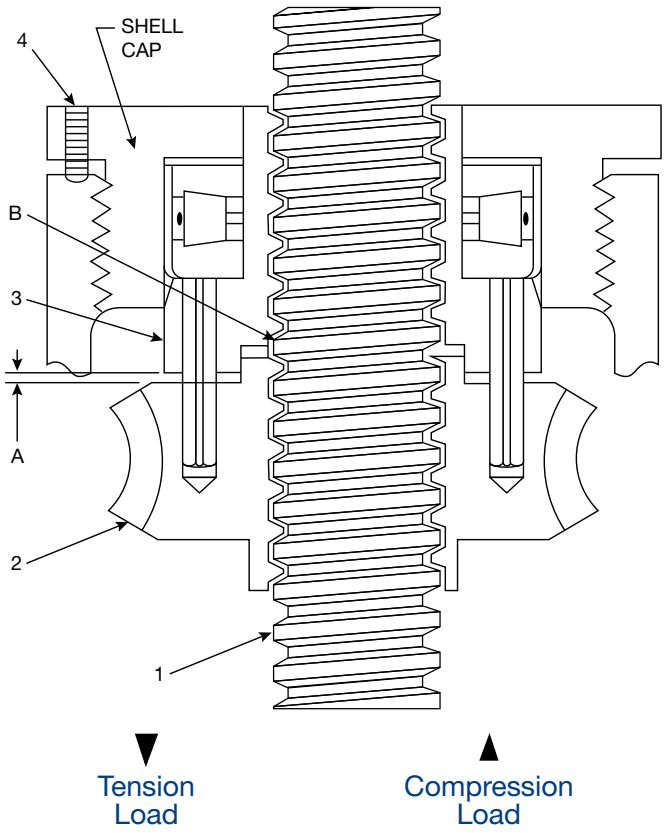
When wear occurs in the worm gear threads and the Anti-backlash nut thread, the load carrying thickness of the worm gear thread will be reduced. This wear will create a gap at point (B) and provide backlash equal to the wear on the threads.

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.

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.

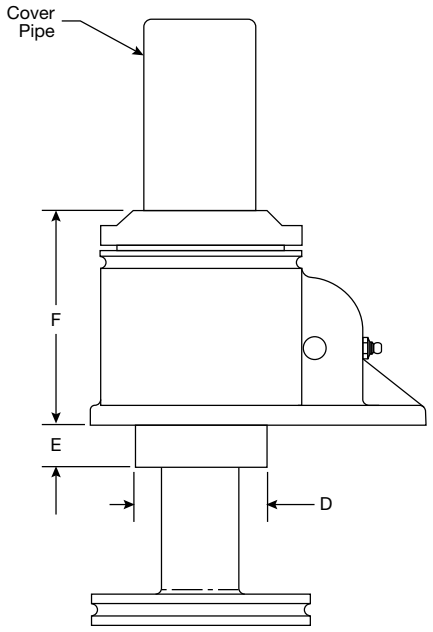


NOTE

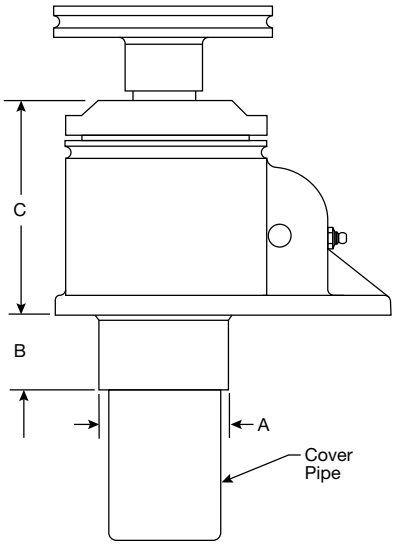
Use anti-backlash as a safety device or to provide wear indication for critical applications. Keyed anti-backlash models may require (A) key adaptor, which projects below jack base. See pg. 49 for dimensions.

KEY ADAPTOR DIMENSIONS

Keyed Anti-Backlash Inverted



Keyed Anti-Backlash Upright



Key Adaptor Dimensions for Anti-Backlash Actuator						
Actuator Capacity (Tons)	Upright A Diameter (in)	Upright B (in)	Upright C (in)	Inverted D Diameter (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 & 30	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