Stock and custom-designed, spring-powered devices for the design engineer

AMETEK®
HUNTER SPRING PRODUCTS

Hunter Spring is the industry leader in design and manufacture of flat coiled springs for the commercial, industrial, medical and military markets. Our flat springs are produced using a variety of materials including 301 stainless steel, high carbon spring steel, Elgiloy, Havar and Inconel. Choose from our spring types shown here, or contact our Application Engineers to assist you in choosing the right spring for your design.

Force Output Springs

FOR APPLICATIONS REQUIRING OUTPUT FORCE (LINEAR TRAVEL):

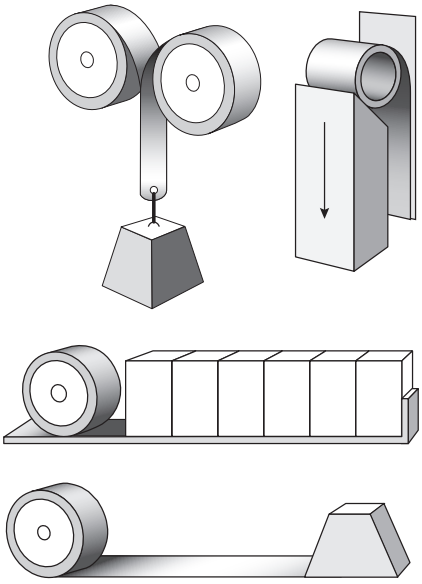
NEG'ATOR® extension springs ***p.4,5***

NEG'ATOR motor assemblies ***p.8,9***

Arbor mounted reels ***p.10***

Base mounted reels ***p.11***

Bracket mounted reels ***p.12***



NEG'ATOR CONSTANT FORCE SPRINGS

The NEG'ATOR constant force spring consists of a strip of flat material prestressed into a coil of nearly constant radius. In the linear form it produces virtually constant force over a long deflection. Also available custom, is a unique ability to have a varying force gradient.

MECHANICAL REELS

There are four basic reel types to select from: with mounting bracket, with mounting base, with arbor thru-hole for stud mounting, and base mounted NEG'ATOR motor assemblies. For counter-balancing, retrieving, returning or other long-deflection functions.

Torque Output Springs

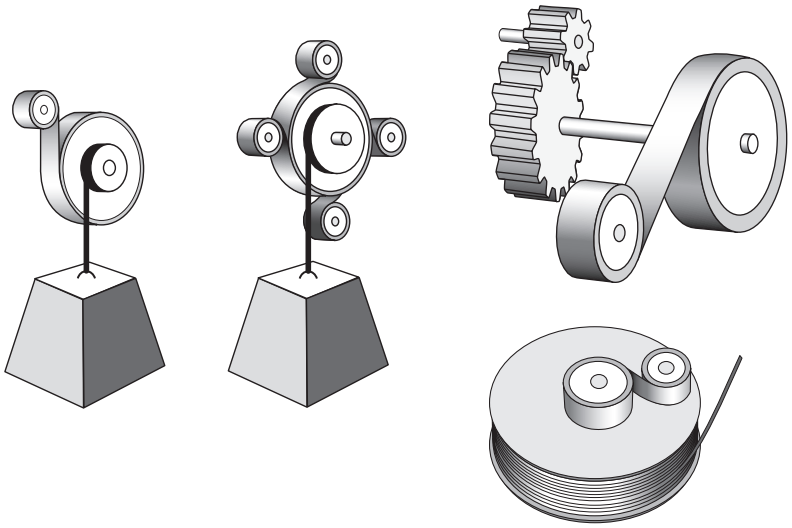
FOR APPLICATIONS REQUIRING OUTPUT TORQUE (ROTATIONAL TRAVEL):

Power spring (torque increases with turns) **p.6**

SPIR'ATOR® spring (torque increases with turns) **p.6**

NEG'ATOR constant torque springs . . . **p.7**

RW spring (less than 240° travel, high constant torque) . . ***Call Customer Service***



POWER SPRINGS

The most commonly used type of flat spring. Since the storage of energy is cumulative, torque output decreases as the spring unwinds. These springs produce relatively high torque in a small number of turns.

SPIR'ATOR SPRINGS

The SPIR'ATOR spring consists of a strip of flat spring material stressed in a tight coil then reverse wound onto an arbor and restrained by an outer casing. This spring can produce a lower force gradient than the power spring, and thinner materials produce a greater number of turns within the same package size.

NEG'ATOR CONSTANT TORQUE SPRINGS

The NEG'ATOR constant torque spring consists of a strip of flat material prestressed into a coil of nearly constant radius. In the motor form it produces virtually constant torque over a long deflection. Also available custom, is a unique ability of this spring to have a negative torque gradient.

NEG'ATOR®
Constant Force Extension Springs
FOR FORCE OUTPUT

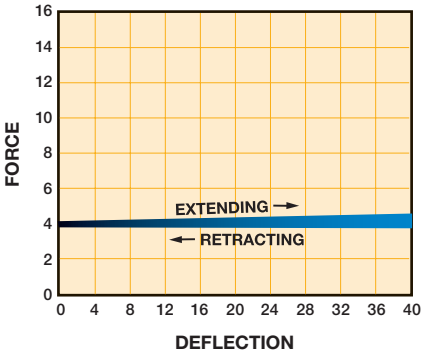
OVERVIEW

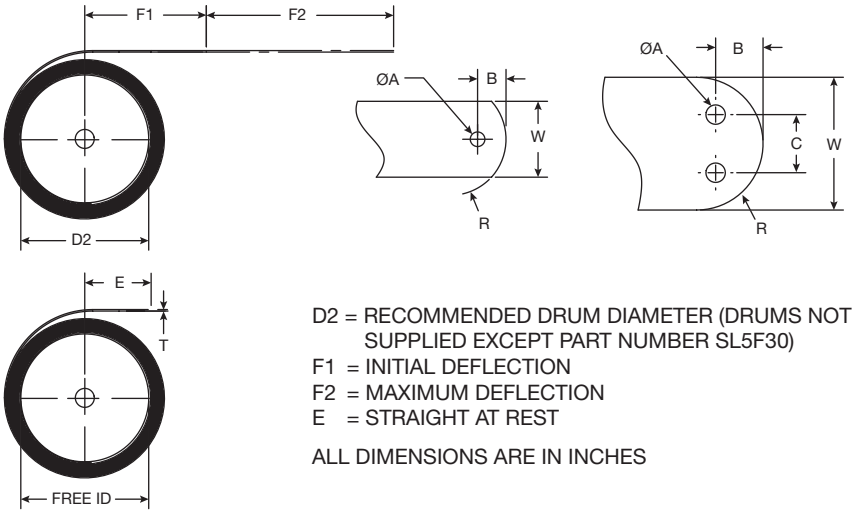
The NEG'ATOR Constant Force Spring represents the most basic, yet most versatile, type of constant force springs. It is a prestressed flat strip of spring material which is formed into virtually constant radius coils around itself or on a drum. When deflected, the spring material straightens as it leaves the drum. This straightened length of spring actually stores the spring's energy through it's tendency to assume its natural radius.

Hunter's own experienced engineers can help you select a Constant Force Extension Spring design to meet your space, life cycle, load and operation requirements.

FEATURES

- *Low force gradient over entire deflection range*
- *Extremely long linear extensions possible*
- *Maximum force generated at initial deflection*
- *Permits smaller package size due to inherent compact size and light weight*
- *Variety of materials can be used*





D2 = RECOMMENDED DRUM DIAMETER (DRUMS NOT SUPPLIED EXCEPT PART NUMBER SL5F30)
F1 = INITIAL DEFLECTION
F2 = MAXIMUM DEFLECTION
E = STRAIGHT AT REST

ALL DIMENSIONS ARE IN INCHES

Part Number	Spec Number	Load Lbs. ±10%	Drum Ø (D2)	Free Id (Ref.)	F1	F2	(T) Thickness	(W) Width	Band Length (In)	# of Holes	R.	A Ø	B	C	E
FATIGUE LIFE - 2,500 CYCLES MINIMUM															
SH3C10	194143	0.37	0.261	0.218	0.390	8	0.003	0.187	10	1	5/32	0.095	0.098	-	5/32
SH4C14	194146	0.49	0.349	0.291	0.525	12	0.004	0.187	14	1	5/32	0.095	0.098	-	5/32
SH4D14	194147	0.66	0.349	0.291	0.525	12	0.004	0.250	14	1	7/32	0.131	0.187	-	7/32
SH4E14	194148	0.83	0.349	0.291	0.525	12	0.004	0.312	14	1	7/32	0.131	0.187	-	7/32
SH5E15	194149	1.03	0.436	0.363	0.650	12	0.005	0.312	15	1	7/32	0.131	0.187	-	7/32
SH6F21	194151	1.48	0.523	0.436	0.785	18	0.006	0.375	21	1	1/2	0.191	0.344	-	1/4
SH6G21	194152	1.97	0.523	0.436	0.785	18	0.006	0.500	21	1	1/2	0.191	0.344	-	1/4
SH8G28	194153	2.63	0.697	0.581	1.06	24	0.008	0.500	28	1	1/2	0.191	0.344	-	3/8
SH8J28	194154	3.29	0.697	0.581	1.06	24	0.008	0.625	28	1	1/2	0.191	0.344	-	3/8
SH10J29	194120	4.12	0.873	0.727	1.31	24	0.010	0.625	29	1	1/2	0.191	0.344	-	7/16
SH10K29	194121	4.95	0.873	0.727	1.31	24	0.010	0.750	29	1	1/2	0.191	0.344	-	7/16
SH12K36	194130	5.94	1.050	0.873	1.56	30	0.012	0.750	36	1	1/2	0.191	0.344	-	1/2
SH12P36	194131	7.92	1.050	0.873	1.56	30	0.012	1.000	36	1	1-1/32	0.193	0.375	-	3/4
SH16P38	194136	10.60	1.400	1.16	2.10	30	0.016	1.000	38	1	1-1/32	0.193	0.375	-	3/4
SH20R47	194137	16.50	1.750	1.46	2.60	36	0.020	1.250	47	1	1-1/32	0.193	0.375	-	7/8
SH20S47	194138	19.80	1.750	1.46	2.62	36	0.020	1.500	47	2	1-1/32	0.256	0.625	0.766	7/8
SH25S48	194141	24.80	2.180	1.82	3.27	36	0.025	1.500	48	2	1-1/32	0.256	0.625	0.766	1-1/8
SH25U48	194142	33.00	2.180	1.82	3.27	36	0.025	2.000	48	2	1-1/32	0.256	0.625	0.766	1-1/8
SH31U58	194144	40.90	2.710	2.26	4.00	42	0.031	2.000	58	2	1-1/32	0.256	0.625	0.766	1-1/4
FATIGUE LIFE - 13,000 CYCLES MINIMUM															
SK4D15	194168	0.32	0.533	0.444	0.80	12	0.004	0.250	15	1	7/32	0.131	0.187	-	1/4
SK4E15	194169	0.40	0.533	0.444	0.80	12	0.004	0.312	15	1	7/32	0.131	0.187	-	1/4
SK5E16	194171	0.49	0.665	0.555	1.00	12	0.005	0.312	16	1	7/32	0.131	0.187	-	5/16
SK6F23	194172	0.71	0.798	0.666	1.20	18	0.006	0.375	23	1	1/2	0.191	0.344	-	3/8
SK6G23	194173	0.95	0.798	0.666	1.20	18	0.006	0.500	23	1	1/2	0.191	0.344	-	3/8
SK8G30	194174	1.26	1.060	0.888	1.59	24	0.008	0.500	30	1	1/2	0.191	0.344	-	1/2
SK8J30	194134	1.58	1.060	0.888	1.59	24	0.008	0.625	30	1	1/2	0.191	0.344	-	1/2
SK10J32	194156	1.98	1.330	1.11	2.00	24	0.010	0.625	32	1	1/2	0.191	0.344	-	5/8
SK10K32	194157	2.37	1.330	1.11	2.00	24	0.010	0.750	32	1	1/2	0.191	0.344	-	5/8
SK12K40	194158	2.84	1.590	1.33	2.38	30	0.012	0.750	40	1	1/2	0.191	0.344	-	7/8
SK12P40	194159	3.79	1.590	1.33	2.38	30	0.012	1.000	40	1	1-1/32	0.193	0.375	-	7/8
SK15P42	194161	4.74	1.990	1.66	2.98	30	0.015	1.000	42	1	1-1/32	0.193	0.375	-	1
SK18P47	194162	5.69	2.400	2.00	3.60	32	0.018	1.000	47	1	1-1/32	0.193	0.375	-	1-1/8
SK20S52	194163	9.48	2.650	2.22	3.97	36	0.020	1.500	52	2	1-1/32	0.256	0.625	0.766	1-1/4
SK25S57	194164	11.90	3.330	2.78	5.00	36	0.025	1.500	57	2	1-1/32	0.256	0.625	0.766	1-1/2
SK25U57	194166	15.80	3.330	2.78	5.00	36	0.025	2.000	57	2	1-1/32	0.256	0.625	0.766	1-1/2
SK31U68	194167	19.60	4.120	3.44	6.18	42	0.031	2.000	68	2	1-1/32	0.256	0.625	0.766	2
FATIGUE LIFE - 20,000 CYCLES MINIMUM															
SL4D16	194188	0.23	0.631	0.526	0.95	12	0.004	0.250	16	1	7/32	0.131	0.187	-	5/16
SL5E17	194189	0.36	0.787	0.656	1.18	12	0.005	0.312	17	1	7/32	0.131	0.187	-	13/32
SL5F30	194191	0.43	0.750	0.656	1.12	25	0.005	0.375	30	1	7/32	0.187	0.312	-	5/16
SL6F24	194192	0.52	0.947	0.789	1.43	18	0.006	0.375	24	1	1/2	0.191	0.344	-	1/2
SL6G24	194193	0.70	0.947	0.789	1.43	18	0.006	0.500	24	1	1/2	0.191	0.344	-	1/2
SL8G31	194194	0.93	1.260	1.05	1.88	24	0.008	0.500	31	1	1/2	0.191	0.344	-	5/8
SL10J33	194176	1.46	1.580	1.32	2.37	24	0.010	0.625	33	1	1/2	0.191	0.344	-	3/4
SL12K42	194177	2.09	1.900	1.58	2.87	30	0.012	0.750	42	1	1/2	0.191	0.344	-	7/8
SL12P42	194178	2.80	1.900	1.58	2.87	30	0.012	1.000	42	1	1-1/32	0.193	0.375	-	7/8
SL15P46	194179	3.50	2.370	1.98	3.56	30	0.015	1.000	46	1	1-1/32	0.193	0.375	-	1
SL15R46	194181	4.37	2.370	1.98	3.56	30	0.015	1.250	46	1	1-1/32	0.193	0.375	-	1
SL20R54	194182	5.83	3.160	2.63	4.75	36	0.020	1.250	54	1	1-1/32	0.193	0.375	-	1-1/2
SL20S54	194183	6.99	3.160	2.63	4.75	36	0.020	1.500	54	2	1-1/32	0.256	0.625	0.766	1-1/2
SL25S59	194184	8.74	3.960	3.30	6.00	36	0.025	1.500	59	2	1-1/32	0.256	0.625	0.766	1-1/2
SL25U59	194186	11.70	3.960	3.30	6.00	36	0.025	2.000	59	2	1-1/32	0.256	0.625	0.766	1-1/2
SL31U69	194187	14.40	4.890	4.08	7.30	42	0.031	2.000	69	2	1-1/32	0.256	0.625	0.766	2

Dimensions are in inches.

Custom Power Springs

Torque and the total number of turns are the most important output requirements in a power spring design. The performance of the spring is defined by the dimensions of the spring material (thickness, width, & length) and the space available (housing & arbor diameters).

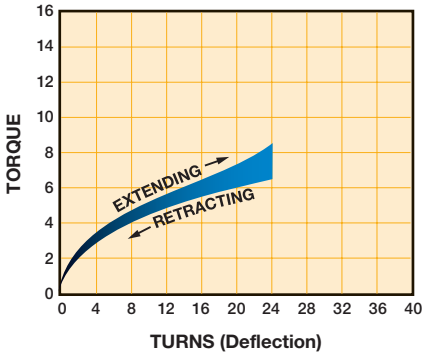
Hunter Spring does not stock power springs. Springs are designed for customer specific applications. Contact Hunter Spring Sales for additional information.

SPIR'ATOR® PRESTRESSED POWER SPRING

OVERVIEW

The SPIR'ATOR prestressed spiral Power Spring is produced by reverse winding a NEG'ATOR on an arbor and enclosing it in a case. Rotational energy can be obtained from either the arbor or case or, when linear motion is required, through use of a pulley and cable attachment.

With torque and deflection being equal, a SPIR'ATOR generally requires 20% less space than a power spring.



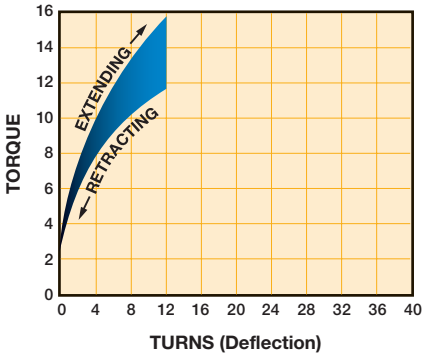
FEATURES

- *Higher prestressing generally permits the use of thinner material thus a smaller package size than comparable power springs*
- *Low torque gradient yields usable torque throughout the operating range*
- *Can provide more than twice the turns of a conventional power spring*
- *Compact and lightweight*

POWER SPRINGS

OVERVIEW

The spring's natural tendency to expand imparts a moment to either the arbor or case, producing usable torque. The torque generated is cumulative so that the torque increases as the spring is wound tighter and decreases as it unwinds. These springs can be shipped in customer designed housings for immediate assembly into the product, or simple retaining rings for transfer to the customer's housing.



FEATURES

- *High-torque delivery per unit of deflection*
- *Normal residual stresses*
- *Wide assortment of materials can be used*

NEG'ATOR®
Constant Torque Springs
FOR TORQUE OUTPUT

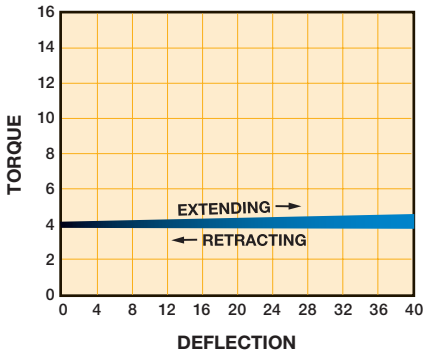
DESIGN

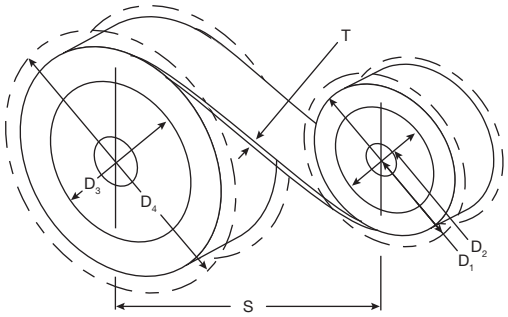
These springs are made of Type 301 high-yield stainless steel and are supplied in coils for mounting on motor drums.

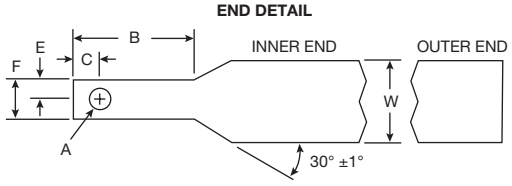
Custom designs are available; please contact us and allow our Application Engineers to provide you a design to meet your needs.

FEATURES

- *Long deflections at nearly constant torque; positive or limited negative gradients can be achieved*
- *Minimal intercoil friction and resultant hysteresis as is common in power springs*
- *Provides rotary motion directly from output drum or linear displacement via cable and spool arrangement*







ENDS OF STOCK B MOTOR SPRINGS ARE FORMED AS "TONGUES" FOR MOUNTING

SYMBOLS
w = MATERIAL WIDTH
t = MATERIAL THICKNESS
D_3 = OUTPUT DRUM DIAMETER
D_2 = TAKE-UP DRUM DIAMETER

Part Number	* Torque Lb.-In. ±10%	Recom'd Drum Ø		Recom'd FLANGE Ø		S	Spring Dimensions			# of Turns	Spring End Detail				
		Storage (D2)	Output (D3)	Storage (D1)	Output (D4)		Thick-ness (T)	Width (W)	Length		A	B	C	E	F
FATIGUE LIFE - 2,500 CYCLES MINIMUM															
20002	0.13	0.32	0.56	0.51	0.69	0.69	0.002	0.250	44	20	0.093	0.750	0.125	0.078	0.156
20004	0.34	0.51	0.89	0.82	1.11	1.11	0.004	0.250	70	20	0.093	0.750	0.125	0.078	0.156
20005	0.65	0.64	1.12	1.02	1.38	1.38	0.005	0.312	87	20	0.120	1.260	0.187	0.105	0.210
20006	1.13	0.77	1.34	1.23	1.66	1.66	0.006	0.375	106	20	0.120	1.260	0.187	0.105	0.210
20007	1.81	0.9	1.57	1.45	1.94	1.95	0.007	0.437	124	20	0.120	1.260	0.187	0.105	0.210
20008	2.65	1.03	1.78	1.64	2.21	2.21	0.008	0.500	144	20	0.120	1.500	0.250	0.156	0.317
20009	3.87	1.16	2.01	1.86	2.48	2.48	0.009	0.562	159	20	0.172	1.500	0.250	0.156	0.317
20010	5.50	1.28	2.23	2.04	2.76	2.76	0.010	0.625	175	20	0.172	1.500	0.250	0.156	0.317
20011	7.06	1.41	2.46	2.27	3.04	3.04	0.011	0.687	195	20	0.172	1.500	0.250	0.156	0.317
20012	9.00	1.53	2.67	2.45	3.32	3.32	0.012	0.750	210	20	0.172	1.500	0.250	0.156	0.317

Dimensions are in inches.

*** Torque ratings listed are for "unwinding" portion of cycle. In long running motors (over 15 turns), torque at full wind end of cycle may be slightly greater.**

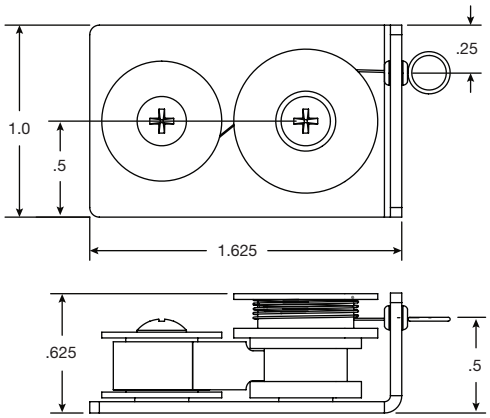
NEG'ATOR® Motor Assemblies

NEG'ATOR Spring Motor assemblies are composed of a single spring mounted on a storage drum and mounted either singularly or in pairs to an output drum with an integral cable. The entire assembly is mounted on a base plate.

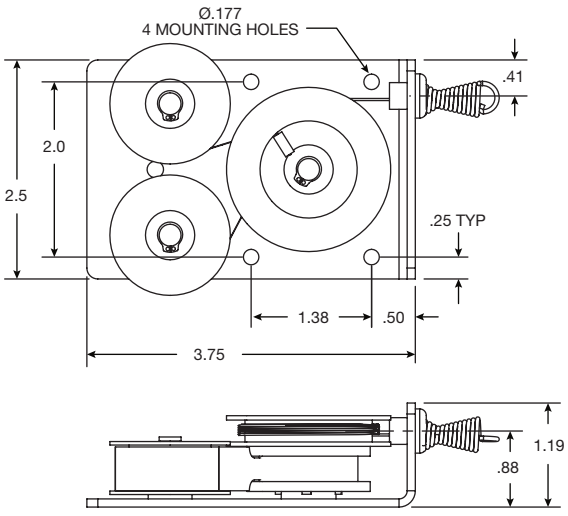
COMPONENT	ML-1448	ML-2900 Series	ML-2400 Series
Base	Stainless steel	Zinc-plated steel	Zinc-plated steel
Drums	Nylon	Acetal (POM)	Acetal (POM)
Spring	Type 301 high-yield stainless steel	Type 301 high-yield stainless steel	Type 301 high-yield stainless steel
Cable	Ø.015" nylon monofilament (15 lb. test)	Ø.024" uncoated stainless steel	Ø.031" 3x7 high-yield galv. steel aircraft cable coated to Ø.047" with nylon

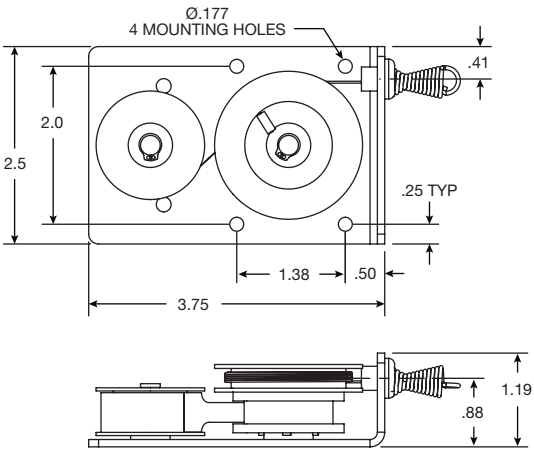
Diagrams are shown in "right" configurations.

RIGHT ONLY
ML-1448



RIGHT ONLY
ML-2919
ML-2920
ML-2921



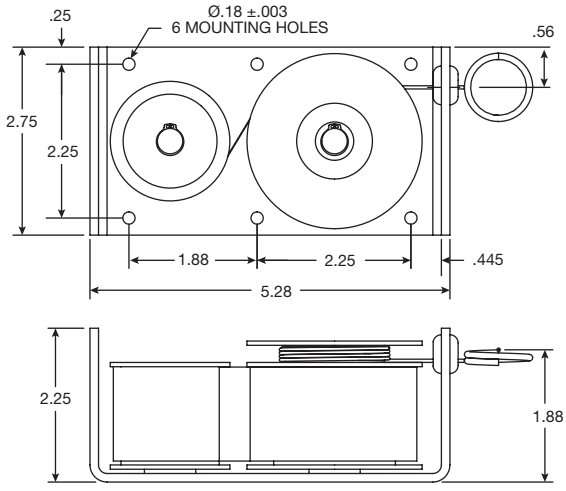


RIGHT ONLY
ML-2917
ML-2918

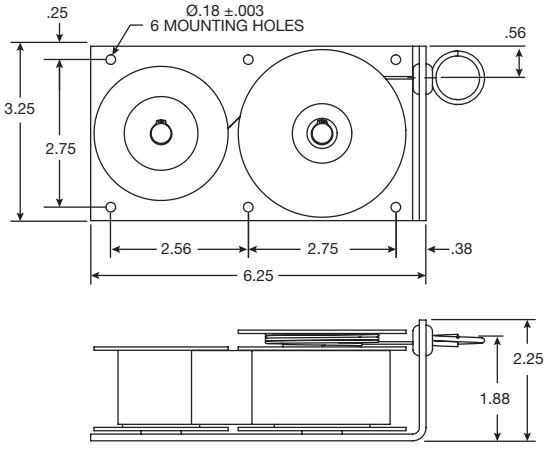
Part Number	Spec Number	Cable Tension (lbs)	Length (in)	No. of Turns	Fatigue Life (min)	Cable Type
ML-1448	196560	0.375	36	20	3,000	Ø.015" nylon monofilament (15 lb. test)
ML-2917	196565	1.0	72	15	7,500	Ø.024" uncoated stainless steel
ML-2918	196570	2.0	72	15	2,500	Ø.024" uncoated stainless steel
ML-2919	196575	3.0	72	15	4,500	Ø.024" uncoated stainless steel
ML-2492	193280	3.1	273	45	15,000	Ø.031" 3x7 high-yield galv. steel aircraft cable coated to Ø.047" with nylon
ML-2920	196580	4.0	72	15	2,500	Ø.024" uncoated stainless steel
ML-2490	193275	5.0	235	40	9,000	Ø.031" 3x7 high-yield galv. steel aircraft cable coated to Ø.047" with nylon
ML-2921	196585	5.0	72	15	2,000	Ø.031" 3x7 high-yield galv. steel aircraft cable coated to Ø.047" with nylon
ML-2476	193225	7.5	42	8	6,000	Ø.031" 3x7 high-yield galv. steel aircraft cable coated to Ø.047" with nylon
ML-2488	193270	7.5	207	36	6,000	Ø.031" 3x7 high-yield galv. steel aircraft cable coated to Ø.047" with nylon
ML-2478	193230	10.0	37	7	5,000	Ø.031" 3x7 high-yield galv. steel aircraft cable coated to Ø.047" with nylon
ML-2486	193260	10.0	184	33	4,000	Ø.031" 3x7 high-yield galv. steel aircraft cable coated to Ø.047" with nylon
ML-2484	193250	13.5	160	29	2,500	Ø.031" 3x7 high-yield galv. steel aircraft cable coated to Ø.047" with nylon
ML-2480	193235	15.0	33	6	2,500	Ø.031" 3x7 high-yield galv. steel aircraft cable coated to Ø.047" with nylon
ML-2482	193242	15.0	160	29	2,000	Ø.031" 3x7 high-yield galv. steel aircraft cable coated to Ø.047" with nylon

Diagrams are shown in "right" configurations.

RIGHT	LEFT
ML-2476	**ML-2477**
ML-2478	**ML-2479**
ML-2480	**ML-2481**



RIGHT	LEFT
ML-2482	**ML-2483**
ML-2484	**ML-2485**
ML-2486	**ML-2487**
ML-2488	**ML-2489**
ML-2490	**ML-2491**
ML-2492	**ML-2493**



Arbor-mounted Reels

SPECIFICATIONS

SPRING: High-carbon steel

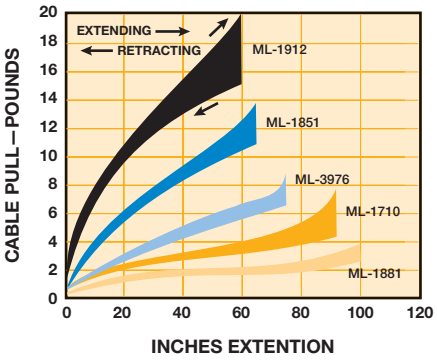
CABLE: 7 x 7 construction, preformed galvanized steel with nylon coating

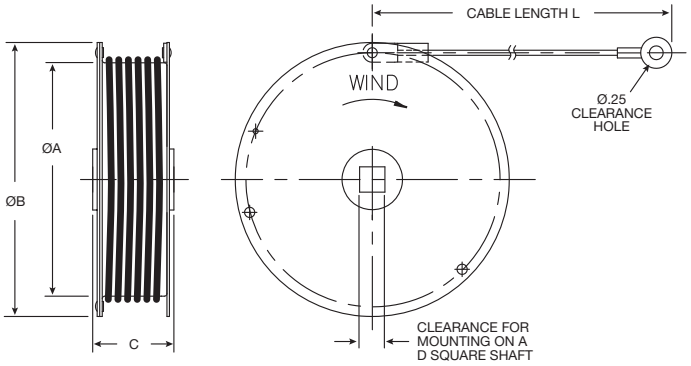
CASE: Steel, epoxy powder coated

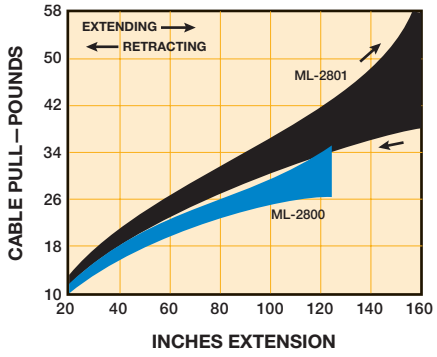
ARBOR: Acetal (POM)

Part Number	Spec Number	Dimensions				Cable	
		A	B	C	D	Dia.	Length
ML-1710	192400	2.875	3.375	1.0	0.313	0.094	90
ML-1851	191581	2.875	3.375	1.0	0.313	0.094	60
ML-1881	192405	2.875	3.375	1.0	0.313	0.094	123
ML-1912	192410	2.875	3.375	1.0	0.313	0.094	60
ML-2800	191986	4.125	5.0	1.625	0.438	0.094	120
ML-2801	192415	5.0	6.0	1.625	0.438	0.094	108
ML-3976	192435	2.875	3.375	1.0	0.313	0.094	60

Dimensions are in inches.

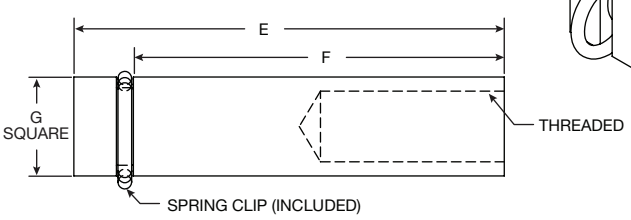


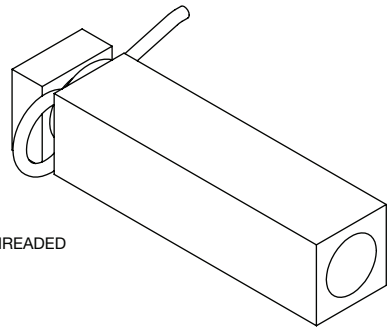




Part Number	Dim. Across Flats (G)	Overall Length (E)	Shank Length (F)	Thread Size	Material
H705410	0.3125	1.4375	1.1875	1/4-20	Plated steel
H705155	0.4375	2.23438	1.98675	3/8-16	Plated steel

OPTIONAL MOUNTING ARBOR





Base-mounted Reels

SPRING: Type 301 stainless steel SPIR'ATOR spring

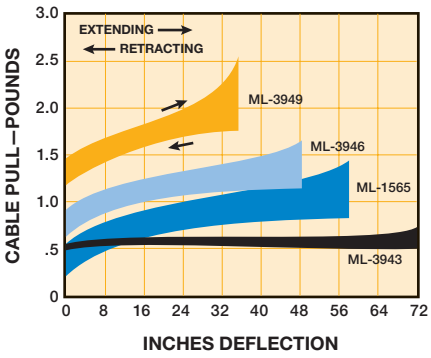
CABLE: .024" diameter 7x3 stainless steel

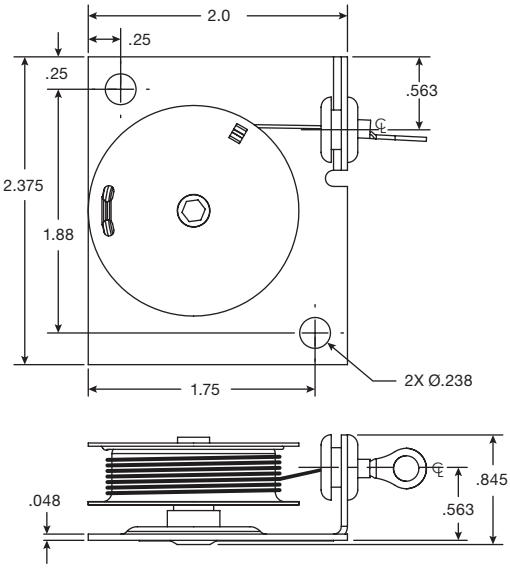
BASE: Steel, zinc coated

DRUM: stainless steel

Part Number	Spec Number	Length
ML-3949	192430	42"
ML-3946	192425	52"
ML-3943	192420	84"
ML-1565*	191606	64"

*** Nylon coated cable to .034" diameter.**





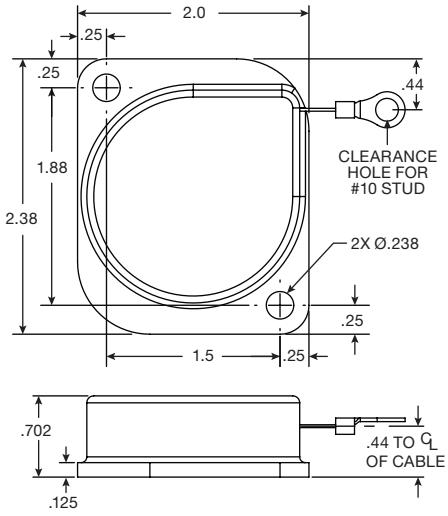
Plastic Spring-powered Reels

The ML-4575 series utilizes the SPIR'ATOR prestressed power spring. The closed case construction makes the spring unit tamper-proof when mounted.

Ring terminal provides customer the ability to secure cables with Velcro®, tie wraps, zip ties, etc. for many cable management applications.

FEATURES

- *Compact*
- *Lightweight*
- *Stainless steel cable*
- *Cable available either coated to .024" or uncoated to .018"*
- *Custom terminations available*



Part Number	Spec Number	Cable Length	Force
ML-4575-1	190515	42" (coated)	2.0 lb
ML-4575-2	190520	52" (coated)	1.5 lb
ML-4575-3	190525	64" (coated)	1.0 lb
ML-4575-4	190530	84" (coated)	0.5 lb
ML-4575-5	198266	27" (coated)	3.0 lb
ML-4575-10	198367	42" (uncoated)	2.0 lb
ML-4575-11	198368	52" (uncoated)	1.5 lb
ML-4575-12	198369	64" (uncoated)	1.0 lb
ML-4575-13	198370	84" (uncoated)	0.5 lb

Bracket-mounted Reels

SPECIFICATIONS

SPRING: High carbon steel SPIR'ATOR spring (except ML-1548 which has power spring)

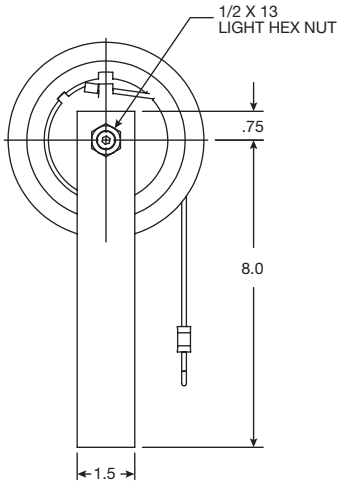
CABLE: 3/32" diameter, galvanized steel, nylon, coated to 1/8" diameter, 126" long

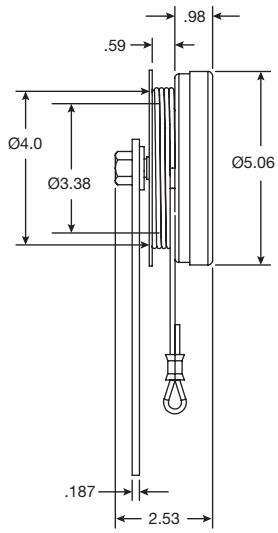
CASE AND CABLE REEL: Steel, zinc coated

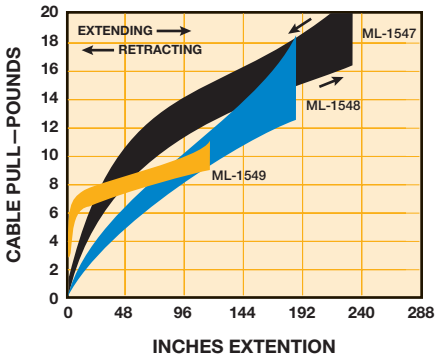
MOUNTING BRACKET: Steel, zinc coated

Part Number	Spec Number	Retraction Force (lbs)	Length (in)	Mounting Type	Cable Type
ML-1547	192395	15.0	126	Bracket	Ø3/32" galvanized steel nylon coated to Ø.125
ML-1548	192396	11.0	126	Bracket	Ø3/32" galvanized steel nylon coated to Ø.125
ML-1549	192397	8.0	126	Bracket	Ø3/32" galvanized steel nylon coated to Ø.125

Dimensions are in inches.







Due to the wide range of applications our products can be used in, AMETEK Hunter Spring cannot guarantee the accuracy of information or suitability of our product in any given situation due to factors beyond our control. Users of our products should perform their own tests to determine the suitability of the product for their particular purpose. Statements concerning the possible use of our products are not intended as recommendations to use our products in the infringement of any patent. Specifications subject to change without notice.

AMETEK®
HUNTER SPRING PRODUCTS
820 Pennsylvania Blvd. • Feasterville, PA 19053
TEL: 215-355-6900 • FAX: 215-354-1801
www.ametekhunterspring.com

ISO 9001 REGISTERED MANUFACTURER

©2013, by AMETEK, Inc. All rights reserved.

Printed in the U.S.A.

1M913PC (160176)