Installation, Operation & Maintenance Instructions

ROTARY 1/4 TURN MODULAR SPRING RETURN.

Suitable for use in safe area and hazardous gas/dust atmospheres (ATEX / UKEX)

GENERAL SPRING RETURNS & INPUT/OUTPUT VARIANTS.

NOTE : FOR APPLICATIONS REQUIRING FUNCTIONAL SAFETY TO IEC 61508, REFER TO PRODUCT SAFETY MANUAL TD170 FOR RELEVANT DETAILS IN ADDITION TO DETAILS GIVEN IN THIS DOCUMENT.

Contents:

1. Spring Core Assembly.

The design of the Kinetrol modular spring return contains the same clock spring type as the non-reversible design (described in TD129). The working principle and many design details, which account for it's enviable reputation, remain unchanged.

This version of the spring contains a core assembly to which the input and output devices can be added, removed or interchanged with other functional types without the need for a separate external 'keeper plate'. It includes a torque retaining feature (coupling stop plate). The fixed angle of travel within this module is 97° or 90° as standard (other angles may be available on request).

Figures 1a &1b show an open end view and cross-section through the reversible spring core modules.

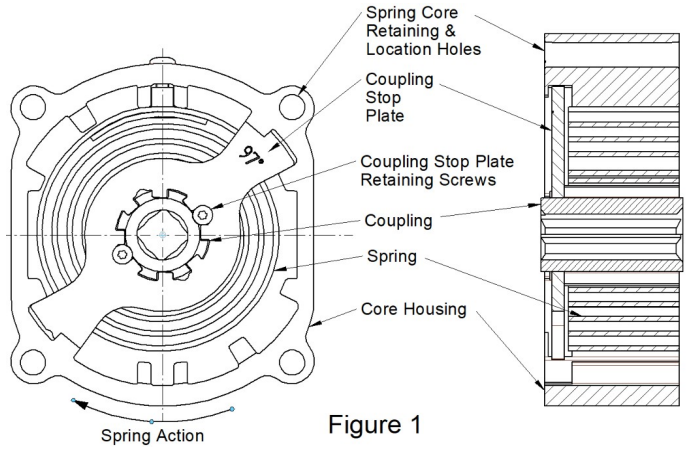


Figure 1

The spring torque ensures the coupling stop plate rests against the two stop surfaces as shown above. This allows the spring to be removed safely from the application. The coupling stop plate is retained to the coupling by two or four fasteners. The coupling contains a through square drive which allows the spring to be fitted either way around (ie for reversing clockwise or anticlockwise movement). The Core can be fitted with input & output flanges of various types as described in later sections.

The coupling stops may be removed for spring tension adjustment. The description of how to achieve this is described in Chapter 4. The standard angle of travel for actuated fitment is 97°. Options are available as standard (90° & 97°). 90° is normally used for manual drive options. 97° is normally used for actuated options to allow angle of travel to be adjusted using the actuator travel stops, however, if no adjustment is required, the 90° option can be used with an actuator but with stroke limited to 90°.

The core housing contains 4 equispaced screw clearance holes which allow the module to be clamped between the input and output components as described in the following chapters.

Note: Spring Core Reversal. One of features of the Modular design is that the Spring Core may assembled to give either a clockwise or anti-clockwise rotation. This can be achieved on spring assemblies of <u>all</u> types described here if already built. The reversal of the Module assembly process allows the core to be inverted prior to reassembly (as described in relevant section). If a fire-fail-safe module is used ensure the linkage is also reversed. Labelling of the part may also need to be remarked or replaced to show the correct part number.

2. Kinetrol Actuator Input.

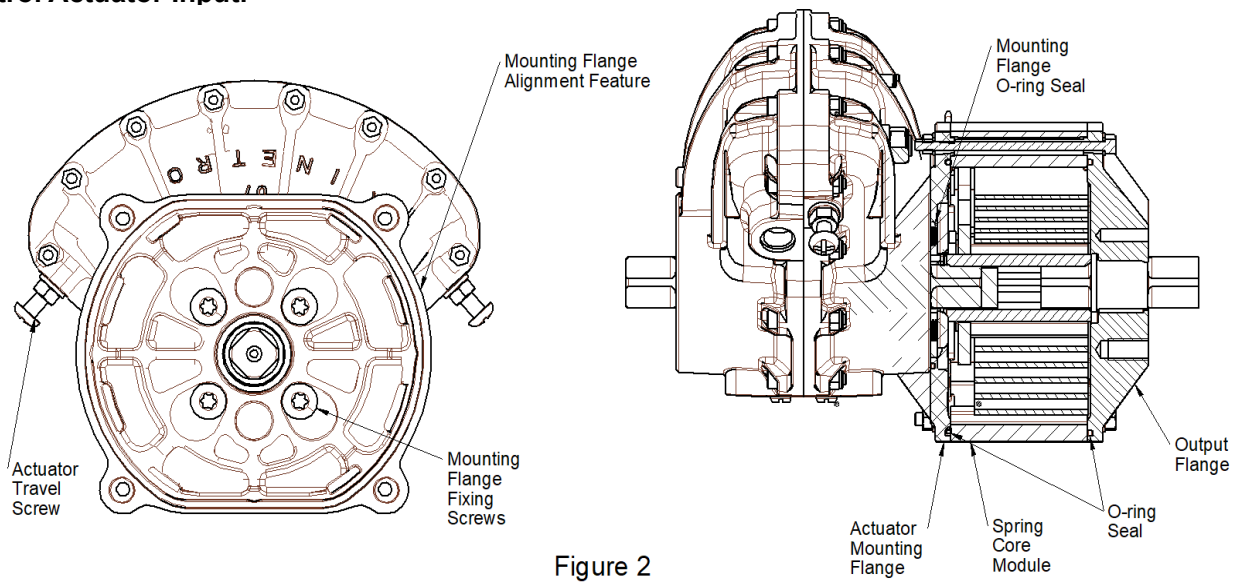


Figure 2

To assemble the Kinetrol actuator to the Modular Spring:

2.1 Securely support the actuator with the drive square facing upward (preferred method is to fit the other side of actuator to a bracket and secure bracket to a work bench.
2.2 Fit the mounting flange with o-ring and fixing screws. Ensure the radiused alignment feature points towards the travel stop screws of the actuator. Fit supplied screws using low strength thread adhesive and torque tighten to TD111.
2.3 Turn the actuator output square to unpressurised end of spring stroke and unscrew travel screw at this end by three complete turns.
2.4 Fit the spring core module o-ring seal correctly in its groove in the baseplate. Apply a small amount of grease to the o-ring groove at the 'pinch points' may assist in this process.
2.5 Slide the spring core module over the actuator square (with a small amount of general purpose grease applied) ensuring the radial and flat sides align with the baseplate features and that the desired direction of travel (clockwise or anti-clockwise) will be achieved. Note: the spring is fitted with a label which shows an arrow which indicates the direction of spring torque.
2.6 The spring core corner holes should locate over 4 spigots on the baseplate. To achieve this, the travel screw might need to be unscrewed further complete recorded turns.
2.7 Fit the desired output drive (see section 3) to the spring core module.
2.8 Fit the 4 long corner screws with flat washers and whilst holding the nuts in place tighten the screws using low strength thread adhesive to the torque shown in Table 1 below. Note that the size 15 does not use nuts but has a threaded baseplate.
2.9 Return the actuator travel screw to its original position and lock.
2.10 Pressurise the actuator to check the spring functions smoothly.

CAUTION:
Never hammer or use other undue force on spring diecast mounting plate, output drive flanges or spring module. End loading of spring module coupling must be avoided.

Module Corner Fixing Screws					
		Spring Size			
		03/05	07/08	09/10	12/14/15
Screw size	ISO	M4	M5	M8	M10
Screw Torque	(Nm)	1.7	5.7	23	33
	(ibfin)	15	50	197	292

Table 1

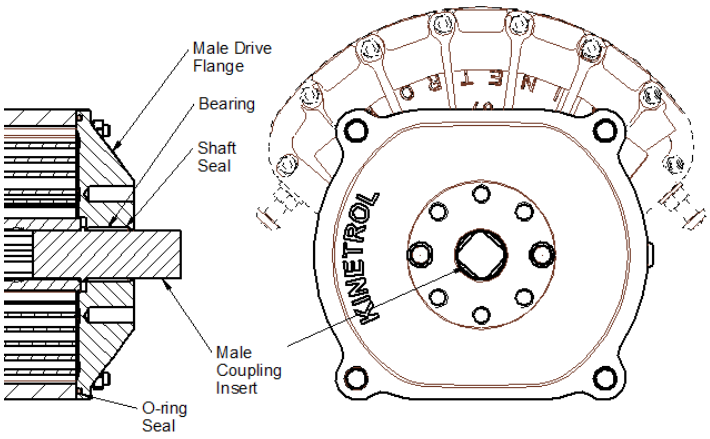
3.1a Kinetrol Male Flange Assembly.

Figures 3 shows the male Kinetrol output drive which is standard on Kinetrol actuators. This Kinetrol output option fits directly to the Core module.

To assemble:

3.1.1 The coupling must first be inserted into the drive flange bearing and care must be taken not to damage the shaft seal. A 'bullet' is available from Kinetrol on request to avoid seal damage.
3.1.2 Insert the static o-ring seal into the groove in the flange (as in 2.4).
3.1.3 Fit the 4 corner screws & washers through the flange holes.
3.1.4 Refer to Input Drive section in 2.6 for remaining assembly sequence.

Note: It is essential that the full number of screws are used when mounting the spring interface to valve and all tightened evenly. Refer to TD111.



Kinetrol Male Drive Flange Assembly
Figure 3

Model	Number of Holes	ISO Thread	Thread Depth (mm)	PCD (mm)	ANSI Thread (UNC)	Thread Depth (")	PCD (")	Model	Number of Holes	ISO Thread	Thread Depth (mm)	PCD (mm)	ANSI Thread (UNC)	Thread Depth (")	PCD (")
03	4	M5	10	31.1	10-24	0.39	1.225	10	4	M10	16	102.0	3/8-16	0.63	4.02
05	6	M5	10	34.9	10-24	0.39	1.375	12	4	M12	24	77.8	1/2-13	0.94	3.06
07	4	M8	16	50.8	5/16-18	5/8	2	14	4	M16	28	98.8	5/8-11	1.12	3.89
08	4	M8	16	70.0	5/16-18	0.63	2.76	15	4	M16	28	140	5/8-11	1.13	5.51
09	4	M10	20	65.0	3/8-16	0.79	2.56								

Mounting hole sizes – Kinetrol Male Spring Table 2.

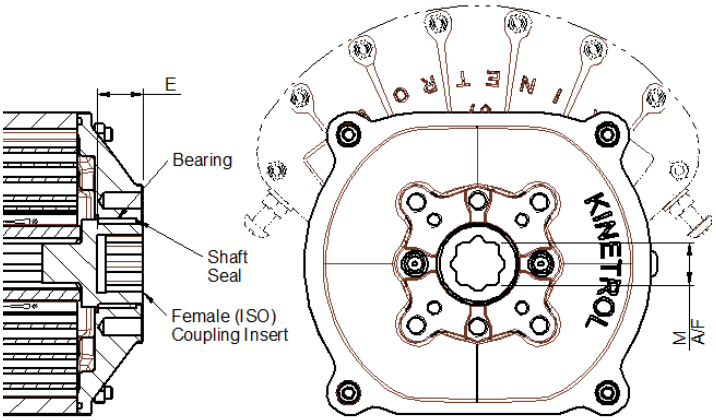
Mounting hole sizes for ISO adaptor addition: refer to Kinetrol technical data sheet TD128.

3.1b Kinetrol Female ISO Flange Assembly.

Figure 4 shows the female ISO threaded flange option available for all sizes and which complies with ISO 5211.

The thread and internal square sizes are shown in Table 3.

Assembly as described in section 3.1a.



Female (ISO) Drive Flange Assembly
Figure 4

Model	ISO Flange	Number of Holes	Thread		Thread Depth		PCD		E		M	
			ISO	UNC	(mm)	(inch)	(mm)	(inch)	(mm)	(inch)	(mm)	(inch)
03/05	F03/05/07	4	M5/M6/M8	10-24,¼,5/16	10/12/13	0.39/0.47/0.51	36/50/70	1.42/1.97/2.76	12/16 (03/05)	0.47/0.63 (03/05)	11/14 (03/05)	0.433/0.551 (03/05)
	F04	4	M5	10-24	10	0.39	42	1.65				
07/08	F05/07	4	M6/M8	¼ 5/16	12/13	0.47/0.51	50/70	1.97/2.76	19	0.75	17	0.669
09/10	F07/F10	4	M8/M10	5/16, 3/8	13/18	0.51/0.71	70/102	2.76/4.02	24	0.94	22	0.866
12	F10	4	M10	3/8-16	18	0.71	102	4.02	29	1.14	27	1.063
12/14/15	F14	4	M16	5/8	28	1.1	140	5.51	38	1.5	36	1.42

Mounting hole sizes – DIN/ISO Spring Flange. Metric & English. Table 3

3.1c Kinetrol Female ISO Through Hole Flange Assembly.

Figure 5 shows the ISO5211 compliant Flange option with clearance holes.

This can be used to interface the spring core with an ISO compliant actuator drive or driven device eg a process valve.

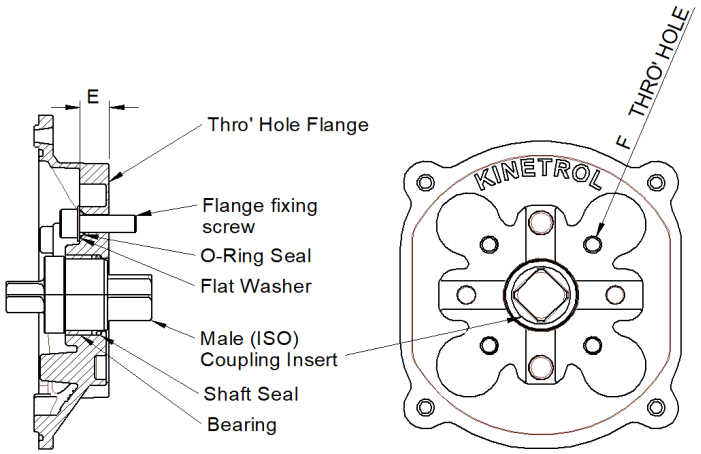
The coupling insert is either a male (as shown), female shown in section 3.1b or the version shown in section 3.1d.

The flange fixing screws are used with a flat washer and o-ring seal as shown in Figure 5 in order to prevent ingress of fluid or dust.

The screw length is chosen to ensure correct engagement with the interface device. The table below lists the thickness of the flange to assist in this choice. It also lists the type of head required (socket head cap screw or hexagon head). Stainless steel screws are prefered to help avoid corrosion.

Once the flange is secured to the interface device, the remaining assembly procedure is described in 3.1a.

Ensure the spring is not enloaded during the mounting process and that coupling interface surfaces are lightly greased.



Through Hole (ISO) Drive Flange Assembly
Figure 5

Model	ISO Flange	Screw Thread		Screw Head Type	Hole length E		PCD		Model	ISO Flange	Screw Thread		Screw Head Type	Hole length E		PCD	
		ISO	UNC		(mm)	(inch)	(mm)	(inch)			ISO	UNC		(mm)	(inch)	(mm)	(inch)
03/05	F05	M6	1/4	Socket	10	0.39	50	1.97	09/10	F07	M8	5/16	TBA	22	0.88	70	2.76
	F07	M8	5/16		10	0.39	70	2.76	09/10	F10	M10	3/8		23	0.91	102	4.02
07/08	F05	M6	1/4	Hex	16	0.63	50	1.97	12	F12	M12	1/2	TBA	37	1.46	125	4.92
	F07	M8	5/16		16	0.63	70	2.76	14/15	F14	M16	5/8	TBA	37	1.46	140	5.51

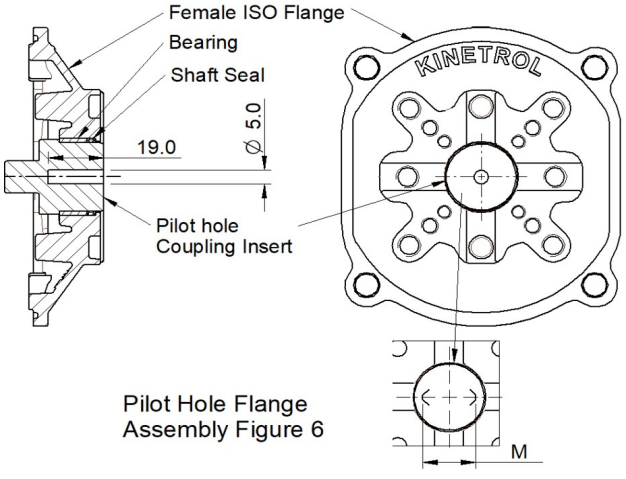
3.1d Kinetrol Female Pilot-hole Flange Assembly.

Figure 6 shows the ISO Flange option with pilot hole in the Coupling Insert which can be machined to fit special, low volume drive shapes eg a process valve stem.

The coupling must be machined with maximum sizes shown in the chart bellow to ensure the coupling strength is maintained.

The table also shows that smaller sizes are stainless steel whilst the larger sizes are low carbon steel which must be zinc plated following machining. The plating thickness must be taken into account to ensure correct final fit and care should be taken to prevent hydrogen embrittlement. If in doubt contact Kinetrol.

The assembly proceedure is the same as described in 3.1a.



Pilot Hole Flange Assembly Figure 6

Model	ISO Flange	Material Type	Maximum Size M		Maximum Depth of M		Model	ISO Flange	Material Type	Maximum Size M		Maximum Depth of M	
			(mm)	(inch)	(mm)	(inch)				(mm)	(inch)	(mm)	(inch)
03/05	F03/F05/F07	SS	18.2	0.72	17	0.67	09/10/12	F07/F10	MS	29.5	1.16	24	0.94
07/08	F05/F07	SS	22.8	0.90	19	0.75	12/14/15	F12/F14	MS	47	1.85	32	1.26

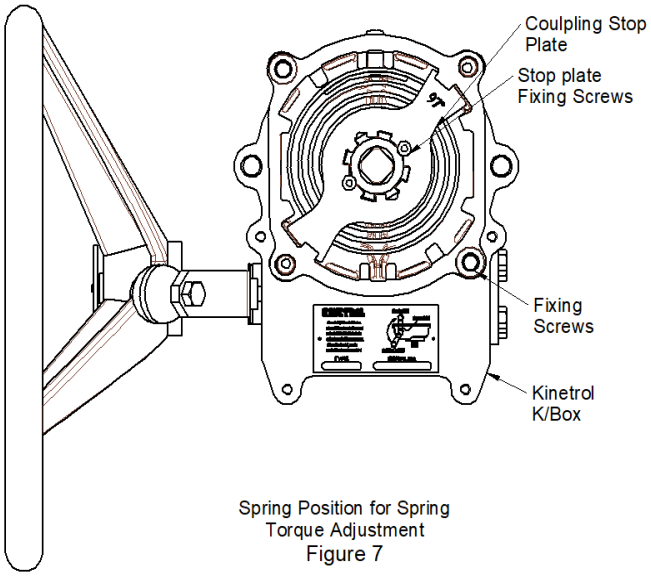
4. Spring Tension (Torque) Adjustment.

WARNING: The wound steel spring stores large amounts of energy which, if suddenly released, can be dangerous. If in doubt contact Kinetrol.

The following procedure allows the spring tension to be reduced or increased in 90° increments.

4.1 Ensure actuator end stop is adjusted to allow spring stop to contact.
4.2 Detach spring core from valve or mechanism ready for attachment to a Kinetrol K-Box gear unit.
4.3 Fit a male drive flange, shown in Figure 3, to the baseplate of a suitable size K-Box and insert the male drive coupling insert into the K-Box Coupling. Fit the K-box baseplate to the gearbox and securely fix to Bench or other suitably stable surface such that the spring flange faces upwards and the handwheel can freely rotate.
4.4 Fit the spring to be retensioned to the flange with the spring stop plate facing upwards as shown in Figure 5. Retain using at least 2 core assembly screws and use larger washers to ensure the screws clamp over the larger holes.
4.5 Wind the handweel to rotate the spring near the centre position.
4.6 Remove the stop plate fixing screws and remove the stop plate.
4.7 The spring centre can now rotated in 90°increments to increase or reduce spring torque.
4.8 When the desired retorque has been achieved, replace the spring stop plate and secure by reusing the stop plate screws with thread locking adhesive.
4.9 The K-Box handle can now be rotated such that the stop plate rests against the housing.
4.10 Remove the housing fixing screws and remove the spring core unit.

Note: This is the procedure recommended for spring core retensioning for all applications including manual handle & fire-fail-safe and actuated.



Spring Position for Spring Torque Adjustment
Figure 7

5. Manual Handle Input Assembly.

The manual handle option is intended to allow manual override of the spring action for temporary operation. It is achieved by the operator pulling on the handle whilst stood in a stable position and rotating the handle by 90°.

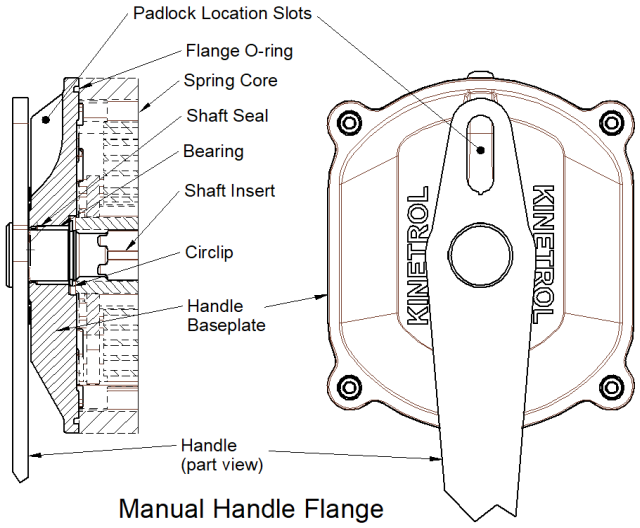
Care must also be taken during handle release as the rotation of the handle without control will result in fast handle movement which could be hazardous to anything in its path. Sudden release might also result in permanent deformation of the spring assembly or valve and attachment.

The handle option has provision for a padlock to be fitted through slots in the handle and base-plate. This allows the handle to be secured to prevent unauthorised operation. A pad-lock with a 10mm (3/8”) max shackle diameter can be used.

The handle and shaft insert is manufactured from stainless steel and handle grip is electrically conductive which allows it to be ATEX Cat 2 approved as standard.

Assemble the manual handle from a spares kit of parts as follows:

5.1 Slide the handle over the shaft insert and press into place.
5.2 Slide the shaft insert into the base-plate and through the seal and bearing (take care not to damage o-ring seal) and retain using the external circlip.
5.4 Fit the base-plate/handle assembly to the spring core assembly ensuring the flange o-ring is in place and the handle is pointing in the desired direction Such that the padlock holes are aligned. Use 90° stroke core.
5.5 Fit the output drive (see section 3) to the spring core assembly. Whilst holding the nuts and washers in place tighten the four fixing screws using low strength thread adhesive to the torque stated in Table 1.



Manual Handle Flange Assembly. Figure 8

6. Fire Fail-safe input Assembly.

Figure 7 shows two views of the Fire fail-safe option which is mounted to a 'male drive flange' via a mount plate. A shaft insert fits through the main lever and through the flange bearing & seal and is retained by a circlip.

90° Travel spring module is used with this assembly but 97° module can be used if slight overtravel is not regarded as a problem.

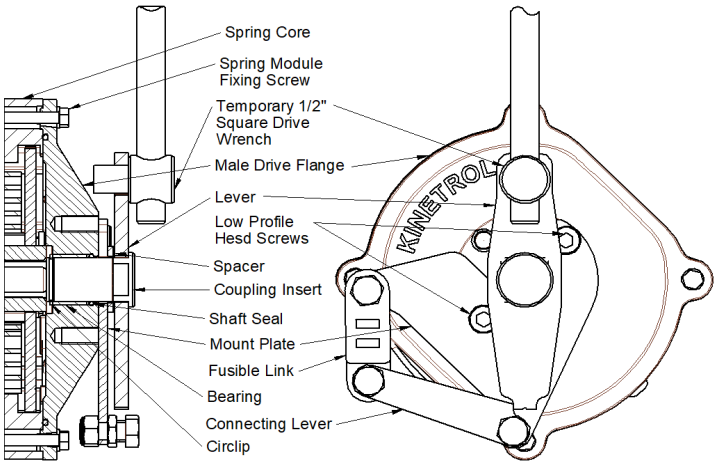
The spring torque causes the lever to act against a connecting lever which in turn applies tension to the fusible link. In the event of an environmental temperature greater than the link solder melting point, the link splits into two and the spring rotates the shaft to a safe position.

The parts are reversible by simply reversing the connecting lever and fusible link screws in their respective mounting holes.

Fusible links are available for 74° & 100°C as standard.

To assemble:

6.1 Pass the spring module fixing screws & washers through the flange outer holes.
6.2 Fit the mounting plate to the drive flange using low profile head screws and thread adhesive in the desired orientation.
6.3 Fit one end of the Fusable link and Connecting Lever to the plate using screws provided in the correct orientation for the spring direction required.
6.4 Pass the shaft Insert through the lever and add spacer.
6.5 Pass the shaft Insert through the bearing & shaft seal (take care not to damage the shaft seal) and fit Circlip to secure.
6.6 Fit the output drive (see section 3) to the spring core module. Whilst holding the nuts and washers in place tighten the four fixing screws using low strength thread adhesive to the torque stated in Table 1.
6.7 The module can now be fitted the valve or later after the link has been energised.
6.8 Secure the assembly to a bench or in a vice.
6.9 Fit a ½" square drive torque wrench in the lever and rotate the spring by 90° to allow the connecting lever hole to align with a hole in the fusable link and fit the retaining screw and nut.



Fire Fail-Safe Link Module
Figure 9

7. Materials of Construction.

7.1 Spring Module Core.

Spring Housing – Aluminium Alloy
Inner Coupling – Aluminium Alloy
Spring & Backing Plate – Carbon Spring Steel
Coupling Stop – Stainless Steel.
Grease

7.2 Kinetrol Actuator Mounting Option.

Mounting Flange – Aluminium Alloy
Fixing Screws – Stainless Steel
Flange Seals. - Low Temperature (-54 to -60°C) – EPDM Rubber
Standard Temperature (-40 to +80°C) – NBR Rubber
High Temperature (-20° to 100°C) – Fluorocarbon Rubber

7.3 Male & Female Output Flanges.

Output Flange – Aluminium Alloy
Coupling Insert – 303 Stainless Steel.
Flange & Shaft Seal - Low Temperature (-54 to +60°C) – EPDM Rubber
Standard Temperature (-40 to +80°C) – NBR Rubber
High Temperature (-20° to 100°C) – Fluorocarbon Rubber
Bearing – Bronze backed Steel.

7.5 Manual Handle Input Option.

Flange – Aluminium Alloy
Coupling Insert – 303 Stainless Steel
Handle – 304 Stainless Steel
Handle Cover – Charge dissipative PVC
Flange & Shaft Seal -Low Temperature (-54 to -60°C) – EPDM Rubber
Standard Temperature (-40 to +80°C) – NBR Rubber
High Temperature (-20° to 100°C) – Fluorocarbon Rubber
Bearing – Bronze backed Steel.

7.6 Fire-Fail-safe Input Option.

Flange – Aluminium Alloy
Coupling Insert – 303 Stainless Steel
Lever 304 Stainless Steel
Flange & Shaft Seal - Low Temperature (-54 to +60°C) – EPDM Rubber
Standard Temperature (-40 to +80°C) – NBR Rubber
High Temperature (-20° to 100°C) – Fluorocarbon Rubber
Bearing – Bronze backed Steel.
Link -304 Stainless Steel
Thermal Link – Plated Steel (2 pieces) joined by specific melting point solder.

8. Labelling (ATEX & UKEX) & Conditions for safe use.

Kinetrol Springs with options described in this manual are approved for use in areas where explosive dusts or gases are present.

The marking shown below is contained within a label attached to the centre module. The label also indicates the direction of spring action with a warning about the potential dangers of energy stored in spring assemblies.

The first line of the label shows an 'X' which indicates Special Conditions for Safe Use. These are:

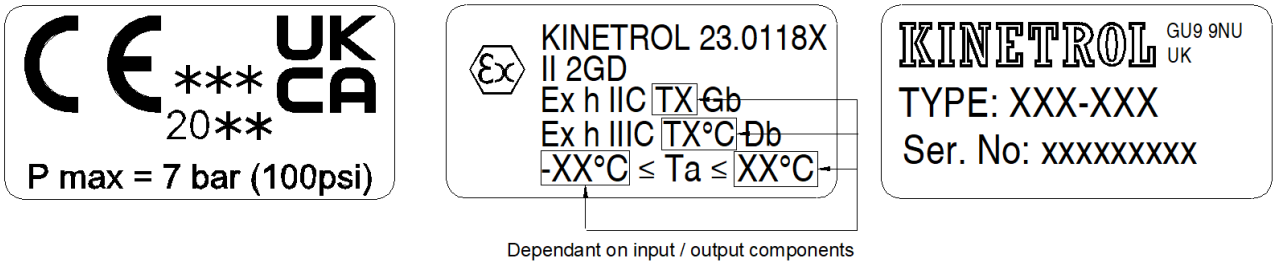
1) The maximum rubbing or impact speed of any part of the assembly should not exceed 1 m/s.
2) Do not allow dust to build up on external surfaces.
3) Spring internal stops should not be used to arrest the load in models 14 & 15 or if the rotational energy exceeds 500J.

Ambient temperature range is dependent on the input/output components chosen and seals specified in them. The spring core module has no rubber or plastic parts fitted and therefore the ambient temperature limitations are determined by the input and output assemblies fitted. These are listed as follows:

Actuator fitment: Standard seals: -40°C < Ta < +80°C. Fluorocarbon Rubber seals: -20°C < Ta < +100°C. Low temperature: -54°C < Ta <+60°C

Manual Handle: Standard seals: -40°C < Ta < +80°C. Low temperature: -54°C < Ta < +60°C

Fire-fail-safe: 74°C Link Yield: -40°C < Ta < + 38°C 100°C Link Yield: -40°C < Ta < +66°C



9.Part Codes & Spare Parts.

ITEM NO.	DESCRIPTION		SPARE PART NUMBERS FOR MODULAR SPRING ASSEMBLIES								
			03	05	07	08				14	15
1	Spring Core Assembly	97° Travel	03#-0R0	05#-0R0	07#-0R0	08#-0R0				14#-0R0	15#-0R0
		90° Travel	03#-0R0-90	05#-0R0-90	07#-0R0-90	-				-	-
2	Actuator Mounting Plate & Fixings		SPR03#-0001	SPR05#-0001	SPR07#-0001	SPR08#-0001				SPR14#-0001	SPR15#-0001
3	Kinetrol Male Output Flange Assembly		SPR03#-0002	SPR05#-0002	SPR07#-0002	SPR08#-0002				SPR14#-0002	SPR15#-0002
4	Female Output Flange Assembly		SPR03@F0002	SPR05@F0002	SPR07@F0002	SPR07@F0002				SPR14@F0002	SPR15@F0002
5	Manual Handle Input Assembly		SPR03#-1006	SPR05#-1006	SPR07#-1006	-				-	-
6	Fire Fail-safe Input Assembly 74°C Link		SPR03#-0074	SPR05#-0074	SPR07#-0074	-				-	-
7	Fire Fail-safe Input Assembly 100°C Link		SPR03#-0100	SPR05#-0100	SPR07#-0100	-				-	-

Note: In table above:- # Is replaced by 4 for metric threads & 7 for ANSI threads.
@ Is replaced by 3 for metric threads & 7 for ANSI threads.