

SERVICE MANUAL



HPEL-xx-BS1

HPEL-xx-BS2

HPEL-xx-RS



HyperCyl®
By Aries Engineering Company, Inc.

Aries Engineering Co.Inc.
Gen4-2212478

Contents

<u>Warranty and Legal disclaimer</u>	<u>3</u>
<u>Safety Information and Warnings</u>	<u>5</u>
<u>HyperCyl-EMA Mechanical Installation</u>	<u>6</u>
<u>Lubrication</u>	<u>7</u>
<u>Drive-Belt Adjustment and Tension</u>	<u>8</u>
<u>HyperCyl-EMA Electrical Specifications</u>	<u>10</u>
<u>End-of-Stroke Sensors</u>	<u>10</u>
<u>Load Cell</u>	<u>11</u>
<u>Maintenance</u>	<u>12</u>
<u>General Procedures and Timelines</u>	<u>12</u>
<u>Maintenance intervals</u>	<u>12</u>



Warranty and Limitation of Liability

Products are warranted for one year from date of Shipment as determined by the serial number on the product label. Labels are generated and applied to the product at the time of shipment and are also Stamped into the actuator. Product repairs are warranted for 90 days from the Shipment date of the repair. The date of repair is recorded within Aries Engineering's database tracked by individual product serial number.

Aries Engineering warrants its product(s) to the original purchaser and in the case of original equipment manufacturers, to their original customer to be free from defects in material and workmanship and to be made only in accordance with Aries' standard published catalog specifications for the product(s) as published at the time of purchase. Warranty or performance to any other specifications is not covered by this warranty, unless otherwise agreed to in writing by Aries Engineering and documented as part of any and all contracts, including but not limited to purchase orders, sales orders, order confirmations, purchase contracts and purchase agreements. In no event shall Aries be liable or have any responsibility under such warranty if the product(s) has been improperly stored, installed, used or maintained, or if Buyer has permitted any unauthorized modifications, adjustments and/or repairs to such product (s). Written notice of claimed defects shall have been given to Aries Engineering within thirty (30) days from the date of any such defect is first discovered, at which point a Return Number, originated by Aries Service Manager, will be issued. The product(s) claimed to be defective must be returned to Aries, transportation prepaid by Buyer, with written specification of the claimed defect. Evidence acceptable to Aries Engineering must be furnished that the claimed defects were not caused by misuse, abuse, or neglect by anyone other than Aries.

Components such as seals, wipers, bearings, brakes, bushings, gears, and roller/ball screw parts are considered wear parts and must be inspected and serviced on a regular basis. Any damage caused by failure to properly lubricate Aries products and/or to replace wear parts at appropriate times, is not covered by this warranty. Any damage due to excessive loading is not covered by this warranty. Electronic component damage due to improper connection to power sources, or connection to a power source at an incorrect voltage is not covered by this warranty. Electronic component damage caused by operating beyond limits established by factory set parameters is not covered by this warranty. The use of products or components under load such that they reach the end of their expected life is a normal characteristic of the application of mechanical products. Reaching the end of a product's expected life does not indicate any defect in material or workmanship and is not covered by this warranty.

Costs for shipment of units returned to the factory for warranty repairs are the responsibility of the owner of the product. Aries Engineering will return ship all covered-warranty repairs or replacements via UPS Ground at no cost to the customer.

For international customers, Aries will return ship covered-warranty repairs or replacements via UPS Expedited Service and cover the associated shipping costs. Any VAT or local country taxes are the responsibility of the owner of the product.

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Warranty and Limitation of Liability

The foregoing warranty is in lieu of all other warranties (except as Title), whether expressed or implied, including without limitation, any warranty of merchantability, or of fitness for any particular purpose, other than as expressly set forth and to the extent specified herein, and is in lieu of all other obligations or liabilities on the part of Aries.

Seller's maximum liability with respect to these terms and conditions and any resulting sale, arising from any cause whatsoever, including without limitation, breach of contract or negligence, shall not exceed the price specified herein of the product(s) giving rise to the claim, and in no event shall Aries be liable under this warranty otherwise for special, incidental or consequential damages, whether similar or dissimilar, of any nature arising or resulting from the purchase, installation, removal, repair, operation, use or breakdown of the product(s) or any other cause whatsoever, including negligence.

The foregoing warranty shall also apply to products or parts which have been repaired or replaced pursuant to such warranty, and within the period of time, in accordance with Seller's stated warranty.

NO PERSON, INCLUDING ANY AGENT OR REPRESENTATIVE OF ARIES, IS AUTHORIZED TO MAKE ANY REPRESENTATION OR WARRANTY ON BEHALF OF ARIES CONCERNING ANY PRODUCTS MANUFACTURED BY ARIES, EXCEPT TO REFER PURCHASERS TO THIS EXPRESS WARRANTY.



Questions & Assistance

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Please Send Repairs to

130 Aries Drive
Dundee, MI 48131
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Phone: 734-529-8855



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Safety Information

HyperCyl-EMA Linear Actuators must be installed and operated in such a way that all applicable safety requirements are met. As an installer, it is your responsibility to identify and comply with all relevant safety standards. Severe personal injury as well as equipment damage may result from any failure to heed this warning. Read and understand this entire service guide before installation and operation of this equipment. The installation and maintenance of this actuator should only be performed by personnel who have been appropriately trained. Such persons should be familiar with the potential hazards associated with electrical and mechanical equipment. The individual or group having overall responsibility for this equipment must ensure that operators are adequately trained. Under no circumstances will Aries Engineering be liable for any incidental, consequential, or special damages resulting from use or misuse of this equipment or this service guide.

! Warning !

Motion equipment is capable of rapid movement and very high forces. Start/ Stop Motion may occur at any time. KEEP CLEAR of any machinery until the on site supervisor has determined that all sources of electrical or mechanical potential energy have been disabled or otherwise “locked out”. Avoid contact or physical proximity to the actuator, while it is in operation.

This product is sold, as a component, to be installed in a complete system using Best engineering practice and must be installed with all applicable Safety Guidelines for your location followed. Aries Engineering continually strives to improve all of its products, therefore we reserve the right to modify equipment and service guides without prior notice.



Mechanical Installation

During installation of the actuator, the following constraints must be considered:

- Load, velocity, and motor input torque should not exceed catalog specifications
- Avoid distortion of the actuator body
- Proper alignment of the actuator relative to the load travel
- Prevent side loading of the piston rod. Excessive side load on the output rod of the actuator will dramatically reduce the Life of the actuator and should be avoided completely.
- Linear acceleration and deceleration should not exceed values stated in catalog

As with any actuator, special care must be taken to avoid impact. Any impact will jeopardize actuator life and could potentially cause extreme damage to actuator, press or persons nearby. Care should be taken to avoid high speed impact with objects of high rigidity that immediately stop the travel of the actuator with no deceleration or energy absorption. An example would be a high speed impact of two solid steel parts. The resulting impact will create a very short effective deceleration time. Kinetic energy contained in the rotating inertia of the actuator and motor can possibly generate extremely high impact forces that exceed the mechanical capacities of the actuator and cause physical damage to the actuator.

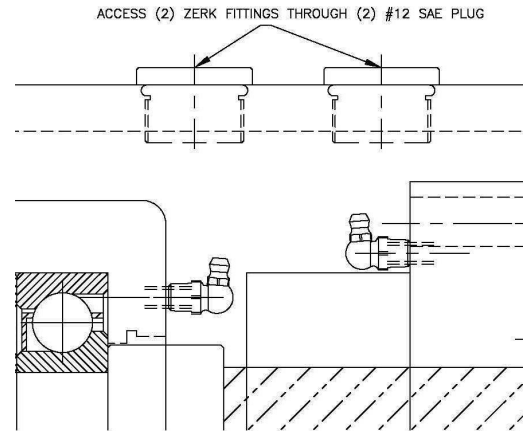
1. **Connect over-travel limit switches;** Connect to control circuitry, before energizing the motor, to reduce the possibility of damage through accidental extension or retraction beyond the mechanical limits of the actuator.
2. **Check Motor Pulley;** (If your EMA came with a Motor installed Skip to #5). It should be inline with the ball screw pulley within 1/32 inch. Fasten pulley to motor shaft with supplied set screw and/or taper lock bushing.
3. **Drive-Belt;** This will be properly tensioned from Factory. Gear-belt drives should NOT be extremely tight such as other belt drives (V-belt, Poly-V, Flat belt, etc.). If belt tension is too great, it applies excessive and unnecessary loading on bearings, Nut and tension Screws. When the belt is too loose, belt will jump teeth and prematurely wear the Belt and/or Pulleys. ([See page 8 for proper Installation/Tensioning.](#))
4. **Actuator Pulley;** In the event this pulley is removed or replaced - DO NOT use the fully retracted or fully extended rod position to counter-act the applied wrench torque.
5. **End Effectors;** Caution should be exercised when attaching any device to the end of the piston rod. Ensure Power is turned off & LOTO. Use the wrench flats on the piston end to prevent rotation while attaching the End-Effector. Any axial torque exceeding 50 lbf/ft may damage the internal anti-rotation system and could potentially cause further system issues.



Lubrication

HyperCyl-EMA actuators (Ball & Roller Screw) are shipped from the factory fully lubricated with a high temperature grease. Access Zerk fitting by (2) -12SAE Plugs located on the Outer Tube. Ensure actuator is at Home Position and in LOTO situation, remove both -12 SAE plugs. Apply grease (Mobilith SHC 220) to BOTH Zerk fittings per the schedule listed below.

RMS Rotation Speed (RPM)	Recommended Renewal Period (in hours of operation)
250	Every 10,000
500	Every 10,000
1000	Every 8,000
1500	Every 7,000
2000	Every 5,800
2500	Every 5,000



Aries recommends using Mobilith SHC 220, a high performance, extreme-pressure grease. The unique physical properties of the synthetic base oil provides outstanding protection against wear, rust, corrosion and high or low temperature degradation. Mobilith SHC allows for very low starting and running torque values. Its operating range is -40 degrees C to 150 degrees C (-40 degrees F to 302 degrees F). The application, orientation, travel speed, and other variables determine the lubrication level to be used. Periodic renewal of the bearing and screw grease is recommended according to the periods shown in the table above and the formula below.

Follow the procedure below for renewing the lubrication.

It is important to use RMS rotational speed to determine lubrication renewal period. To determine this value follow the equation below:

$$VRMS = [(V_1^2 t_1 + V_2^2 t_2 + V_3^2 t_3 + \dots) / (t_1 + t_2 + t_3 + \dots)]^{1/2}$$

Where:

V_{rms} = RMS Rotational speed (rpm)

$V_{1,2,3...}$ = Rotational speed of roller screw shaft for corresponding $t_{1,2,3...}$ time (rpm)

$t_{1,2,3...}$ = Time at corresponding $V_{1,2,3...}$ rotational speed (minutes).

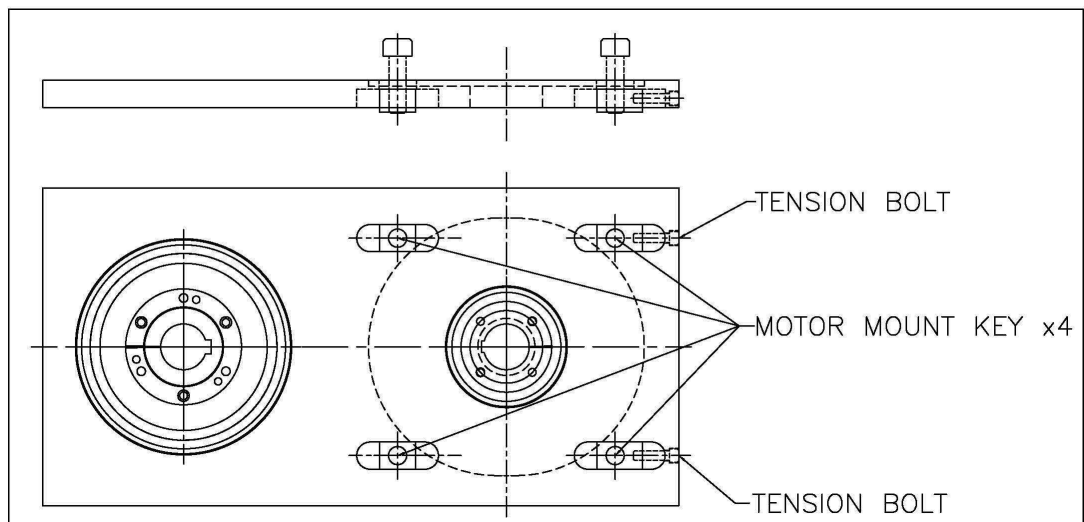
Drive Belt Adjustment and Tension

! CAUTION !

Do not remove the belt cover while the actuator is operating. Always remove power from the attached motor before removing the belt cover to service any component of the drive train (i.e. belts, pulleys, bushings, etc...). Failure to do so can result in damage to the actuator or cause serious injury to the operator.

The synchronous belt drives in use with all HyperCyl-EMA actuators do not require as much tension as other belt drives that depend on friction. The re-tightening procedure should begin by installing the belt with a snug fit, neither too tight nor too loose. The HyperCyl-EMA actuators use a polymer reinforced belt drive system. The drive train does not require any lubrication and any oil or dirt contamination within the belt drive system will decrease belt effectiveness and life. The belt and pulley system should be inspected periodically for excessive wear and proper tensioning.

1. Remove (6) 1/4-20 BHCS Housing bolts, remove housing and set aside.
2. **Loosen, DO NOT remove** the (4) **Servo-Motor** mounting Bolts. Locate the (2) 1/4-20 SHCS adjustment screws located on the side of the Motor Mounting Plate closest to the Servo-Motor.
3. Measure the belt span, as shown in the diagram (CD).
4. With one pulley free to rotate, use a spring scale to apply a perpendicular force (see chart below) to the center of the belt width at the mid-point of the belt span (P). For belts wider than 2", it is suggested that a strip of key-stock be placed across the belt face under the point of force to prevent distortion.
5. Measure the deflection of the belt at the mid-point (DEF). While applying the correct force, there should be 1/64" of deflection (DEF) for every inch (1.00") of belt span (CD).
6. With the belt tensioned correctly, re-tighten the (4) Servo-Motor mount holes.



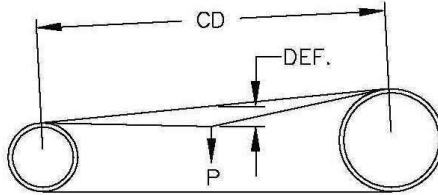
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Drive Belt Adjustment and Tension

Method of Tensioning Trapezoidal Gearbelt Drives

Gearbelt drives do not need to be extremely tight such as other belt drives. (V-Belt, Poly-V, Flat Belt, etc.) If belt tension is too great, it imposes excessive, and unnecessary loading on bearings. When belt is too loose (particularly on High Torque Applications), belts may "jump" teeth. In order to tension a drive properly, the following may be followed:

FORMULA:



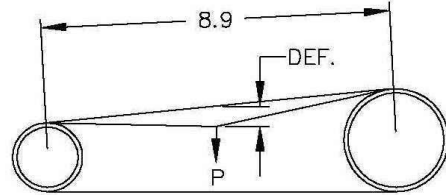
$$T_s = T + \frac{CD \times K}{L_B}$$

$$P = \frac{T_s}{16}$$

$$DEF. = \frac{CD}{64}$$

CD = Center Distance
 L_B = Belt Length
 T_s = Static Tension
 P = Deflecting Force
 DEF. = Amount of Deflection in inches
 T = Tension in lbs. (from table below)
 K = Constant (from table below)

EXAMPLE:



$$T_s = 70 + \left(\frac{8.9 \times 46}{24} \right) \quad T_s = 87.058$$

$$P = \frac{87.058}{16} \quad P = 5.4 \text{ lbs.}$$

$$DEF. = \frac{8.9}{64} \quad \left(\text{i.e., belt \#240H100 is 24" long, 1" wide, "H" belt.} \right)$$

CD = Center Distance
 L_B = Belt Length
 T_s = Static Tension
 P = Deflecting Force
 DEF. = Amount of Deflection in inches
 T = Tension in lbs. (from table below)
 K = Constant (from table below)

<u>HyperCyl-EMA MODEL #</u>	<u>BELT WIDTH</u>	<u>C-T-C SPAN</u>	<u>BELT PN#</u>	<u>APPROX DEFLECTION FORCE (LBS)</u>
HPEL-01- (BS1& BS2 & RS)	0.577"	5.660"	6408M12	1 LBS
HPEL-02- (BS1 & BS2)	0.577"	6.820"	6408M12	1 LBS
HPEL-02-RS	0.971"	5.600"	6008M22	2.5 LBS
HPEL-04- (BS1 & BS2)	0.971"	7.820"	8008M22	2.5 LBS
HPEL-04-RS	0.971"	8.880"	8008M22	2.5 LBS
HPEL-06-BS1	1.482"	7.850"	8008M32	4 LBS
HPEL-08-BS1	2.506"	7.860"	8808M60	10 LBS
HPEL-08-RS	1.482"	8.450"	8808M35	4 LBS
HPEL-10 (BS1)	1.775"	8.220"	96614M42	5.5 LBS
HPEL-10-RS	1.775"	8.800"	96614M42	5.5 LBS
HPEL-15-RS	2.720"	8.270"	96614M65	10 LBS
HPEL-20-RS	2.720"	11.530"	140014M65	10 LBS
HPEL-25-RS	3.743"	10.350"	119014M90	13 LBS

End-of-Stroke Sensor Specifications

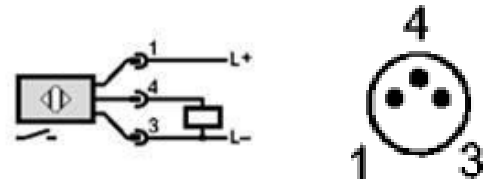
End-of-Stroke Limit Sensors (conductor-type) are used at (2) locations on HyperCyl-EMA actuators to prevent the unit from over-traveling in either advance or retract motions.

! CAUTION !

The Upper (retract) Limit Switch is used to **SET** the Home Position for all Gen2 and Gen3 Actuators. These units have only the (2) overtravel sensors, absent (1) dedicated Home Sensor.

1. On initial setup and **BEFORE** the Servo-Motor moves for the first time, ensure sensors are wired correctly per the diagrams below.
2. Once switches are wired and LED's are lit, **adjust your Servo-Motor Velocity and/or Speed so the actuator is at 0.50 in/sec or less.**
3. Then simply move or jog until the Retract sensor is lit. This is your Upper Over-Travel limit setting. **DO NOT USE THIS SETPOINT AS HOME.**
4. **Advance the ram 0.500" from max retract sensor; this is now your Home Position.** In your programming, permit this 0.500" advancement from Upper Travel sensor to permit a gap between the Over-Travel and Home.
5. Once the Home and Retract positions are programmed, Adjust your velocity to 1.0 in/sec. Advance/jog the ram to 7.00" (standard stroke being 8.00") and **STOP**. Adjust your velocity to 0.50 in./sec.
6. Advance/job the ram under 0.50 in/sec until the Lower Over-Travel sensor is lit. You now have your overtravel advance and retract positions found.

<u>HyperCyl-EMA Model #</u>	<u>IFM Sensor PN#</u>
HPEL-01-BS2 & RS	IE5366
HPEL-02-BS2 & RS	IE5366
HPEL-04-RS	IE5366
HPEL-04-BS2	IE5338
HPEL-08-BS1 & RS	IE5338
HPEL-10-BS1 & RS	IE5338
HPEL-15-RS	IE5338
HPEL-20-RS	IE5338
HPEL-25-RS	IE5338



	Cable	Terminal Chamber	US-100-plug
L+	BN	1 / 3	Pin 1 /BN
L-	BU	2 / 4	Pin 2 /BU
Output	BK	X	Pin 2 /WH Pin 4 /BK

- Gen2 and Gen3 actuators have an INTERNAL, doughnut style load cell. These load cells are calibrated in the same manner listed below, however to service or replace, the top-end of the actuator needs to be disassembled. For Gen4 actuators, the Load Cell is external @ rod end
- Calibrate within PLC analog card or otherwise according to the full scale value (40,000lbs example below) and the mean/average between Run1 and/or Run2 mV/V reading

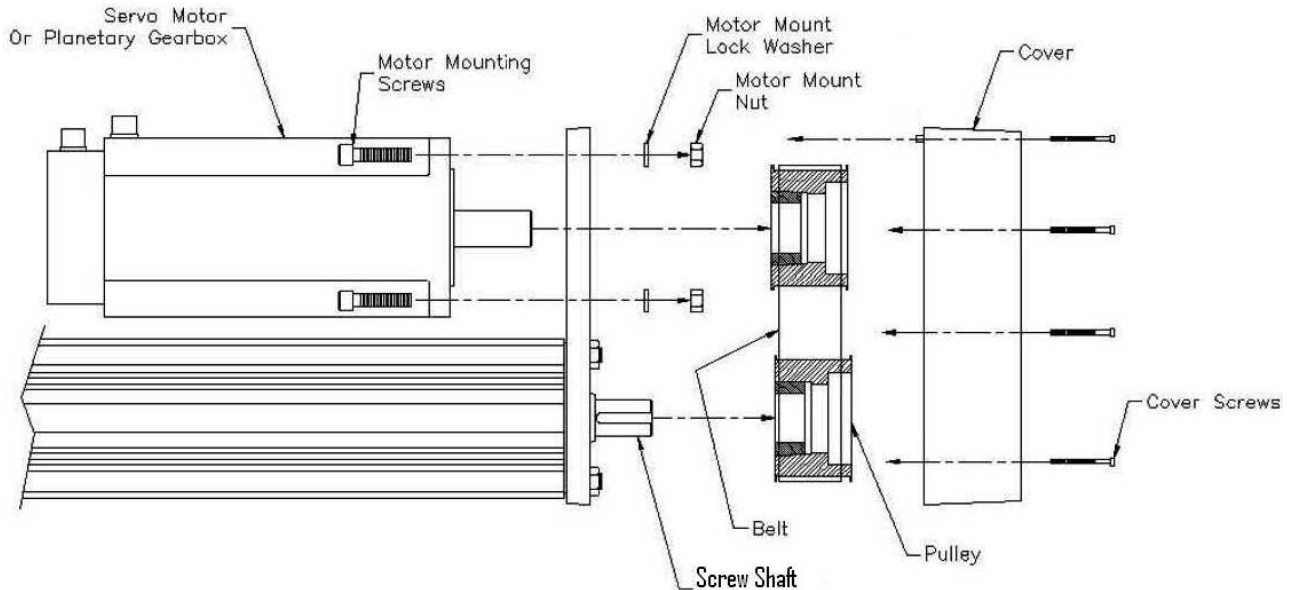


Applied Force 2 (lbs)	Run 2 Reading (mV/V)	Error in (mV/V)	% Error F.S.	% Non-rept. F.S.
8,048	0.39191	0.00130	0.07	0.04
16,058	0.78123	0.00184	0.10	0.04
24,048	1.16934	0.00216	0.11	0.01
32,026	1.55546	0.00106	0.05	0.01
40,001	1.94147	0.00000	0.00	0.01
0	0.00000	0.00000	0.00	0.00



Maintenance

The successful operation and longevity of this actuator is based on superior components, precise manufacturing, and extreme cleanliness. Unless your maintenance personnel are thoroughly familiar with this type of construction, any attempt to perform “field” repairs may worsen, rather than solve your problem. Emergency repairs and rebuilds are always given the highest priority by Aries Engineering.



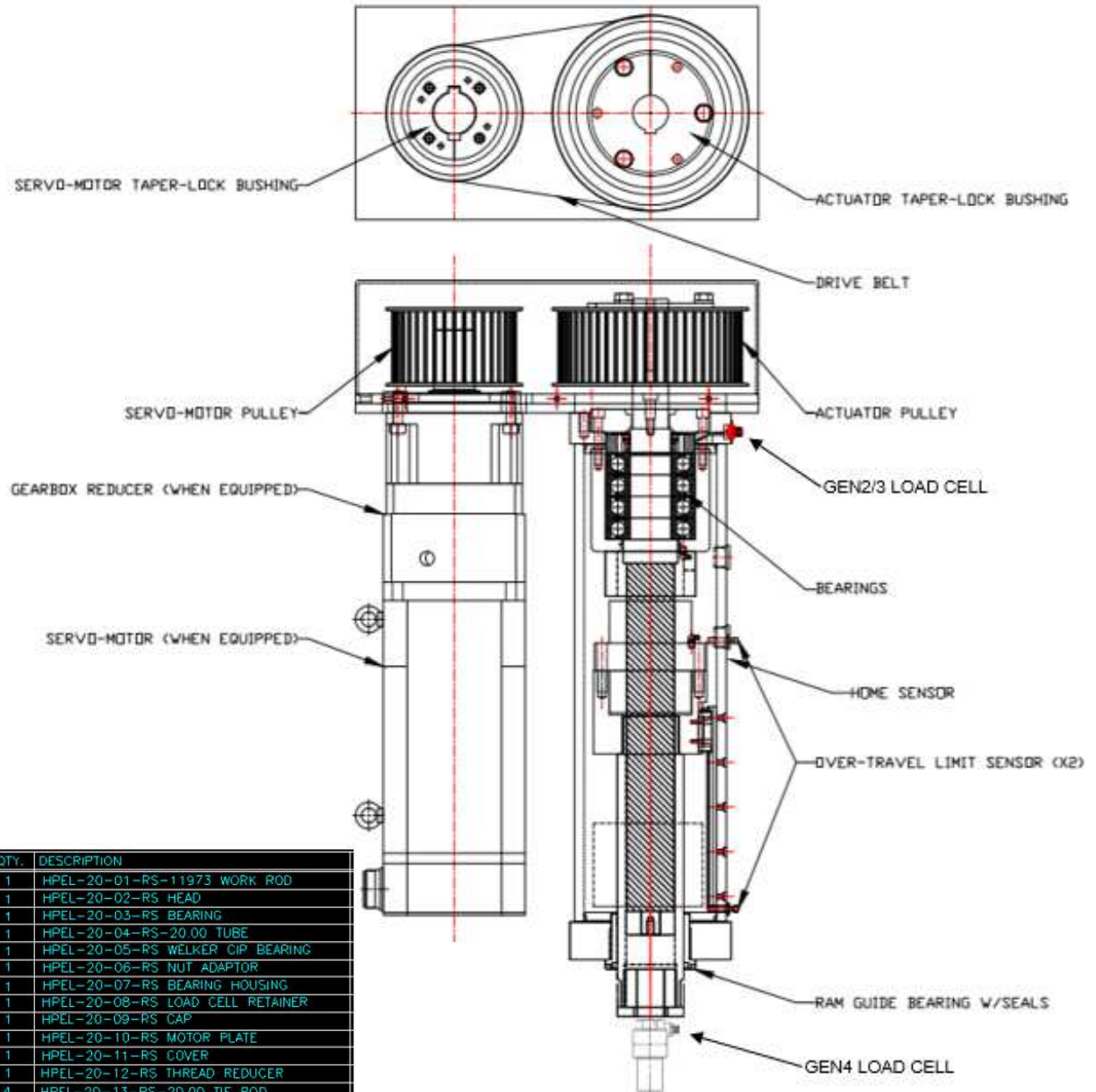
Top-End of HyperCyl-EMA

Components Requiring Periodic Maintenance

1. Drive Belt requires periodic maintenance for wear, cracking and proper tension (page#9) (3-6 months).
2. (2) Lube Points (discussed on pg.7) need to be greased according to your run-time in operation (hours).
 3. Typically every 3-6 months for high-volume applications.
 4. Typically every 6-12 months for low-volume applications.
5. Torque Motor mount Nuts to torque specs, Torque actuator mounting SHCS according to torque specs (3-6 months).

If you have questions regarding the performance, operation, disassembly or maintenance, we encourage you to contact Aries Engineering to assist with determining the issues and resolution. When calling or e-mailing, please have the Model # and Serial # of the unit, located on the label affixed to the end cap

Spare Parts & Components



DETAIL	QTY.	DESCRIPTION
1	1	HPEL-20-01-RS-11973 WORK ROD
2	1	HPEL-20-02-RS HEAD
3	1	HPEL-20-03-RS BEARING
4	1	HPEL-20-04-RS-20.00 TUBE
5	1	HPEL-20-05-RS WELKER CIP BEARING
6	1	HPEL-20-06-RS NUT ADAPTOR
7	1	HPEL-20-07-RS BEARING HOUSING
8	1	HPEL-20-08-RS LOAD CELL RETAINER
9	1	HPEL-20-09-RS CAP
10	1	HPEL-20-10-RS MOTOR PLATE
11	1	HPEL-20-11-RS COVER
12	1	HPEL-20-12-RS THREAD REDUCER
13	4	HPEL-20-13-RS-20.00 TIE ROD
14	2	HPEL-20-14-RS FIXTURE KEY
15	2	HPEL-20-15-RS FIXTURE KEY
16	1	HPEL-20-16-RS LOCK NUT
17	1	HPEL-20-17-RS-11973 STOP
18	1	HPEL-20-RS-20.00-64x15 ROLLER SCREW WITH 64x15 NUT
19	4	7311BG BEARING (MTN)
20	1	SSR15XTB1SS+580LK THK RAIL
21	1	RWAN-28 ZATKOFF WIPER
22	2	261 O-RING
23	1	LOAD CELL
25	1	VT018-005 MICRON GEAR REDUCER
26	2	IES338 IFM EFECTOR SENSOR
27	2	PKG 3M-6 PICQFAST CABLE
28	1	W5214M65 TBWOODS SPROCKET
29	1	W6414M65 TBWOODS SPROCKET
30	1	140D14M65 TBWOODS BELT
31	1	E55MM TBWOODS BUSHING
32	1	F48MM TBWOODS BUSHING
33	2	1095K27 ZERK FITTING (MCMMASTER)
34	1	PARKER V-SEAL #V-45A NBR



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