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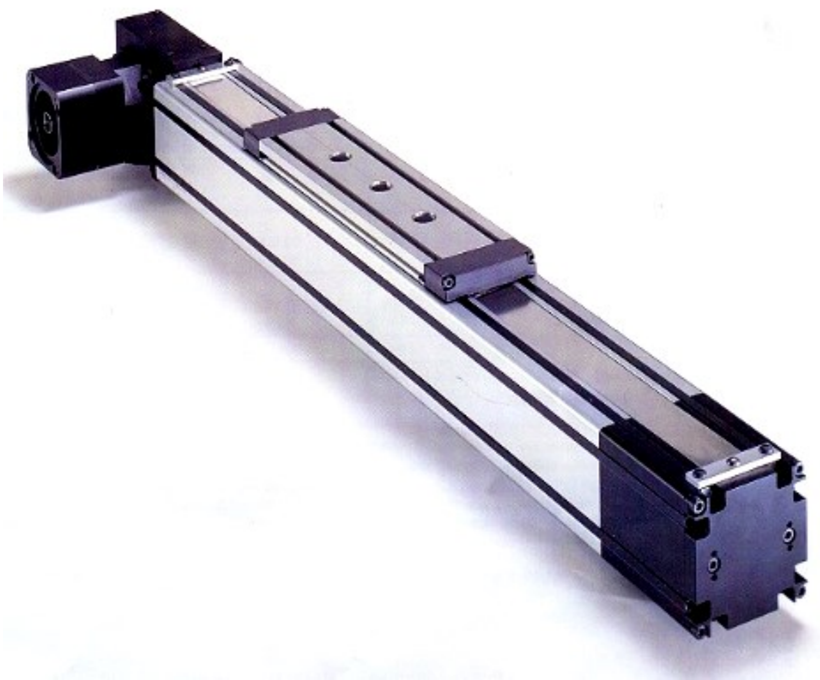
Installation, Operation, Maintenance and Repair Manual



HLE 100 SR Series Linear Drives

Parker

Important User Information

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For assistance contact:
Parker Hannifin Corporation
Electro Mechanical Division
1140 Sandy Hill Road
Irwin , PA 15642

Ph 724-861-8200
800-245-6903
E-mail : emn_applications@parker.com
www.parkermotion.com

HLE100 Series Product Manual

REVISON NOTES

REV D UPDATE LINK SHAFT INFORMATION DUE TO REDESIGN 6/13/16
-RECREATED - DUE TO NO ORIGINAL

1 Safety

1.1 General

It is the responsibility of the end user to ensure that equipment is installed and operated in accordance with both local and federal safety codes and guidelines. The user must ensure that the attachment of workpieces/ tools or other de vices on the moving carriage of the linear unit does not endanger persons and/or property.

1.2 Symbols and Definitions used within this document

Special attention with regard to the safety of personnel, equipment and property should be considered when one or m ore of the symbols listed below are shown in this document. During equipment installation and operation, any area/condition considered unsafe should be identified by posting appropriate signs or placards.

Safety notices used:

⚠ **Danger**	Dangerous situation—can lead to death or serious physical injury if not otherwise prevented by corresponding safety measures.
⚠ **Warning**	Possible dangerous situation—can lead to possible serious injury if not otherwise prevented by corresponding safety measures.
⚠ **Caution**	Possible dangerous situation—can lead to minor physical injury or damage to property if not otherwise prevented by corresponding safety measures.
Note	Important Product information—special handling instructions or indicates a certain section of the handbook to which you should refer.

1.2.1 Operating personnel

The following work should only be carried out by trained and authorized personnel:

- Installation and calibration of the linear drive.
- Connection of safety limit switches (initiators).
- Installation and start-up of motors and drives

1.3 End User Safety notices

Supervisors, Technicians, and Installation personnel should familiarize themselves with chapters on "Safety" and “Installation” of this document prior to Installation/operation of equipment.

1.4 Safety notice for operating personnel

Operating personnel must inspect linear drive unit(s)/machine, once per shift for any signs of visible damage or loose hardware. Do not operate equipment suspected of erratic behavior or unusual noise levels.

Parker has specially designed components and accessories. Use only genuine Parker replacement parts. Use of unauthorized parts can effect machine performance and safety.

We accept no liability for damages arising through the use of non-genuine parts and accessories.

We accept no liability for safety features removed or disabled.

Use Federal and local safety requirements/regulations during installing and operation.

1.5 Advice on particular dangers

HLE linear drives must be supported at the prescribed minimum distances (see Chapter 3.2).

Stand clear of moving parts, such as the HLE carriage.

1.6 Unauthorized conversions and modifications

Linear drive units can not be altered in any manner that will affect safety. Any unauthorized alterations will exclude any liability on the part of Parker.

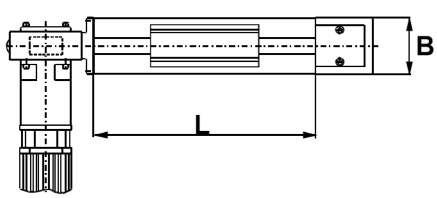
1.7 Handling and Transporting Danger

⚠ **Danger**	When lifting, stand clear of suspended load(s)! Ensure parts subject to movement do not move off-center or shift out of position.

⚠ **Caution**	When transporting long axis, permanent deformation of the aluminum profile due to deflection can result if not supported properly. Changes in profile straightness can adversely affect the performance of the moving carriage.

Always use transport equipment with adequate lifting capacity. Lifting straps or ropes must not be twisted, knotted, or frayed. If several ropes are used, all should be under equal tension.

- An estimate of weight on the HLE100SR can be made as follows:



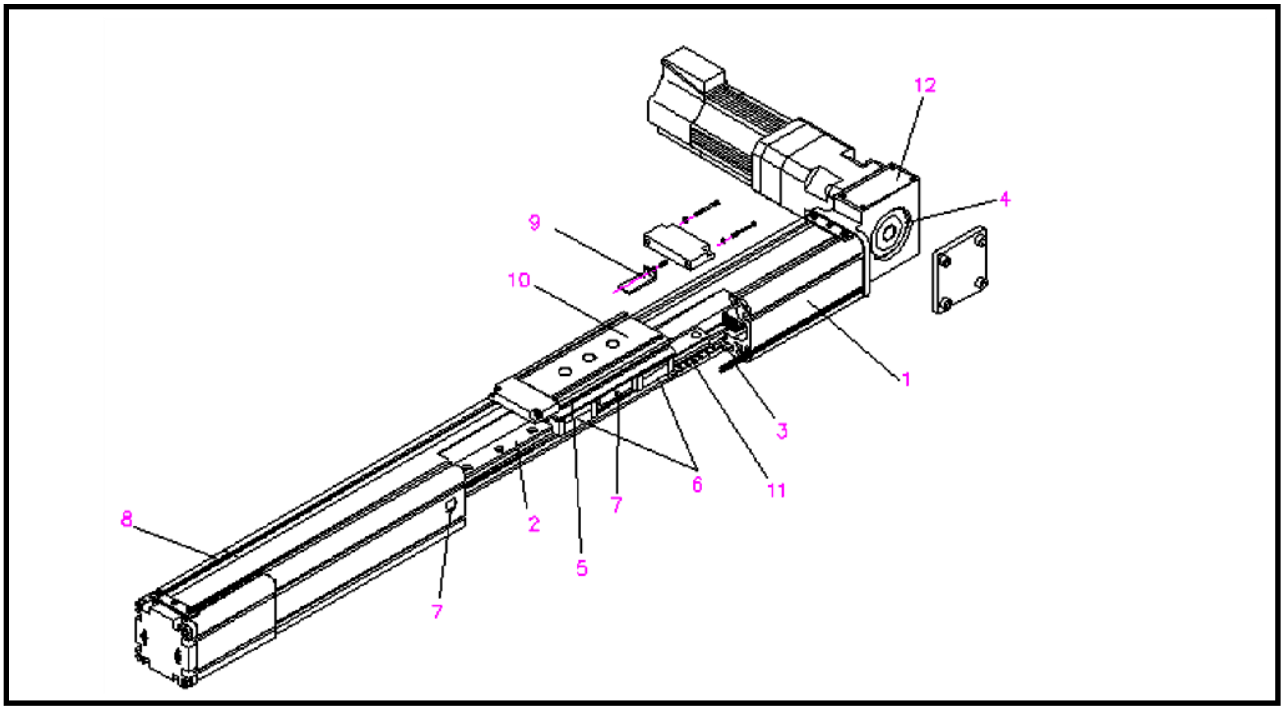
B =100mm ⇒ HLE100SR

	Weight	
	Std. Carriage	**Ext. Carriage**
Basic Unit (0 Travel)	26 kg	30 kg
Each additional Meter	13.3 Kg	13.3 kg

Figure 1: Reference value for HLE100SR transportation weight (with motor and gearbox)

2 Technical data

2.1 HLE100SR Product construction and description



Aluminum profile (1)

Main body of drive unit, with 8 External integrated “T ” slots. All profiles are annolite coated.

Running surfaces (2)

Steel square rail bolted to an extruded internal “T ” slot, provides guidance system for high capacity linear bearing blocks (qty.2).

Plastic “T” Slot cover (3)

Protects “T ” slot from dirt. Contains wiring w hen “T ” slots are used as conduit.

Flanged Drive Pulley (4)

Transfers drive tor que to timing belt (10) and simultaneously guides the belt.

Carriage (5)

Positioned by the timing belt an d supported by two (2) bearing blocks, the carriage rigidly pilots the load along the steel rail within the profile.

Bearing Blocks (6)

Sealed linear bearings specifically designed to transport heavy loads at high speeds. Rides on a precision square rail running the length of the profile.

Lubrication system (7)

A hole located on bot h s ides of the aluminum profile provides fast and easy access for lubricating bearing blocks.

Tensioning station (8)

Two tensioning screws with an external locking device provide belt tension and orientation between pulley flanges.

Timing belt holding bracket (9)

Secures timing belt between load attachment plate and carriage. Makes changing timing be possible without having to dismantle the load attachment plate (10).

Load attachment plate (10)

Aluminum profile with integrated “T” slots and cavity for passage of steel cover strip.

Timing belt (11)

Slip-free polyurethane timing belt reinforced with inlaid steel-cord. Used to provide power trans mission between drive pulley and carriage.

Drive station (12)

Provides flange mounting on both sides o f ho using and flexibility in the options available:

- **Standard**
Drive pulley keyed directly to the gearbox output drive shaft.
- **Left shaft (WLO) / right shaft (WRO) / Double shaft (WBO)**
Fixed mounting of drive pulley through a keyed shaft positioned between ball-bearing sets.
- **Drive and shaft (ALW or ARW)**
Drive pulley mounted to gearbox shaft, extends through drive housing.

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2.2 Technical data

HLE100 Square Rail	Unit	HLE100SR	
		No Strip Seal	Standard Strip Seal
Dimensions, mass moments of inertia			
Dimension of base unit, 1m stroke			
Normal carriage NL	kg	28.5	29.5
Extended carriage VL	kg	32.3	33.3
Carriage + load attachment plate NL	kg	2.1	2.2
Carriage + load attachment plate VL	kg	3.7	3.8
Mass of drive profile	kg/m	13.2	13.3
Mass moment of inertia related to the drive shaft			
Normal carriage NL	$kgcm^2$	33.4	34.8
Extended carriage VL	$kgcm^2$	50.9	52.2
Travel and speeds			
Maximum travel speed[1]	m/s	3	
Maximum acceleration[1]	m/s^2	10	
Maximum travel distance, normal carriage NL[2]	mm	6240	6150
Maximum travel distance, extended carriage VL[2]	mm	6090	6000
Geometrical data			
Cross-section	mm x mm	100 x 100	
Moment of inertia Ix	cm^4	377	
Moment of inertia Iy	cm^4	432	
Modulus of elasticity	N/mm^2	$0.72 * 10^5$	
Pulley data, torque's and forces			
Travel distance per revolution	mm/rev	234.2	
Pulley diameter	mm	74.5	
Belt weight	g/mm	0.15	
Peak drive torque[3]	Nm	61.5	
Max. belt traction [3] (effective load)	N	1650	
Repeatability	mm	±0.2	

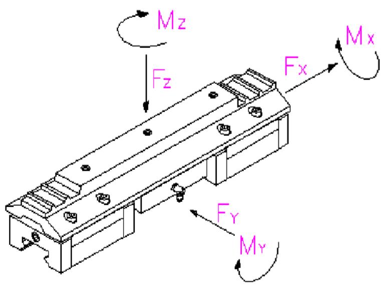
[1] Higher speeds and accelerations are possible. Please consult factory.

[2] Profile can be spliced to provide longer travel, speeds and accelerations may have to be reduced, consult factory.

[3] Increased tension of timing belt necessary

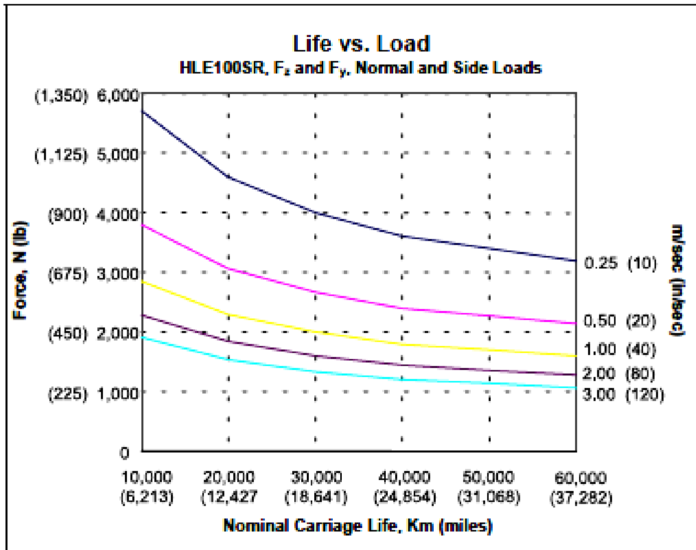
Technical data as at 01/98, Safety taken into consideration S=1. Data valid for a temperature-range from -10°C to +40°C.

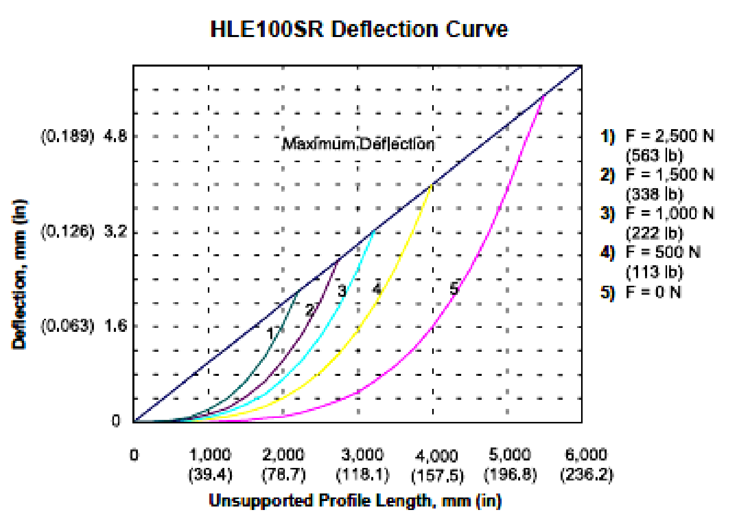
2.3 Carriage loads and timing belt strength

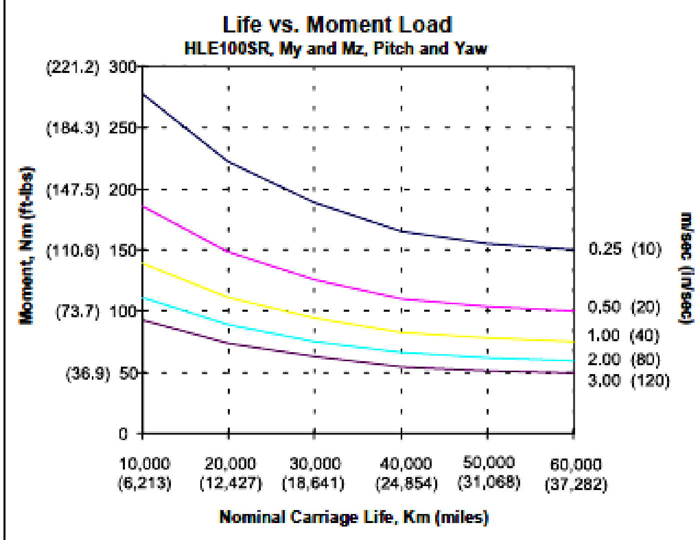


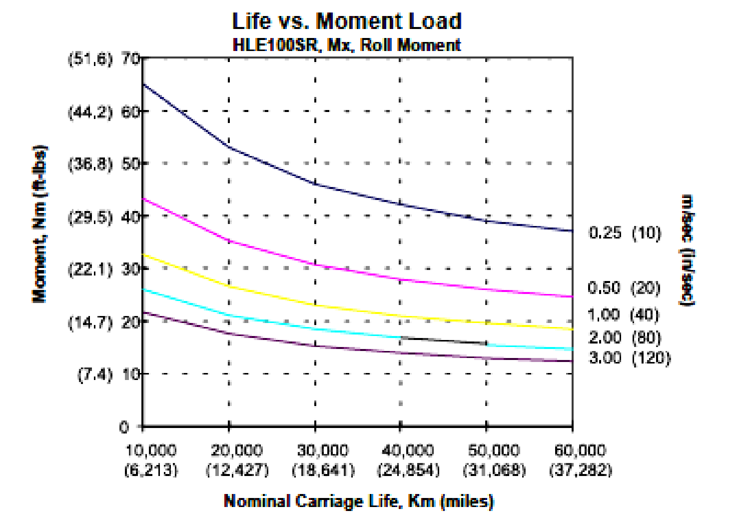
Forces transferred by the carriage and timing belt are speed dependent. Curves shown in graphs are valid for the nor mal carriage (NL).

Curves show the maximum load-bearing capacity of a carriage in one direction of force or torque. If several loads are applied from different directions, values stated in the curves **may not be fully exploited**, i .e. t he load or speed should be reduced if necessary.









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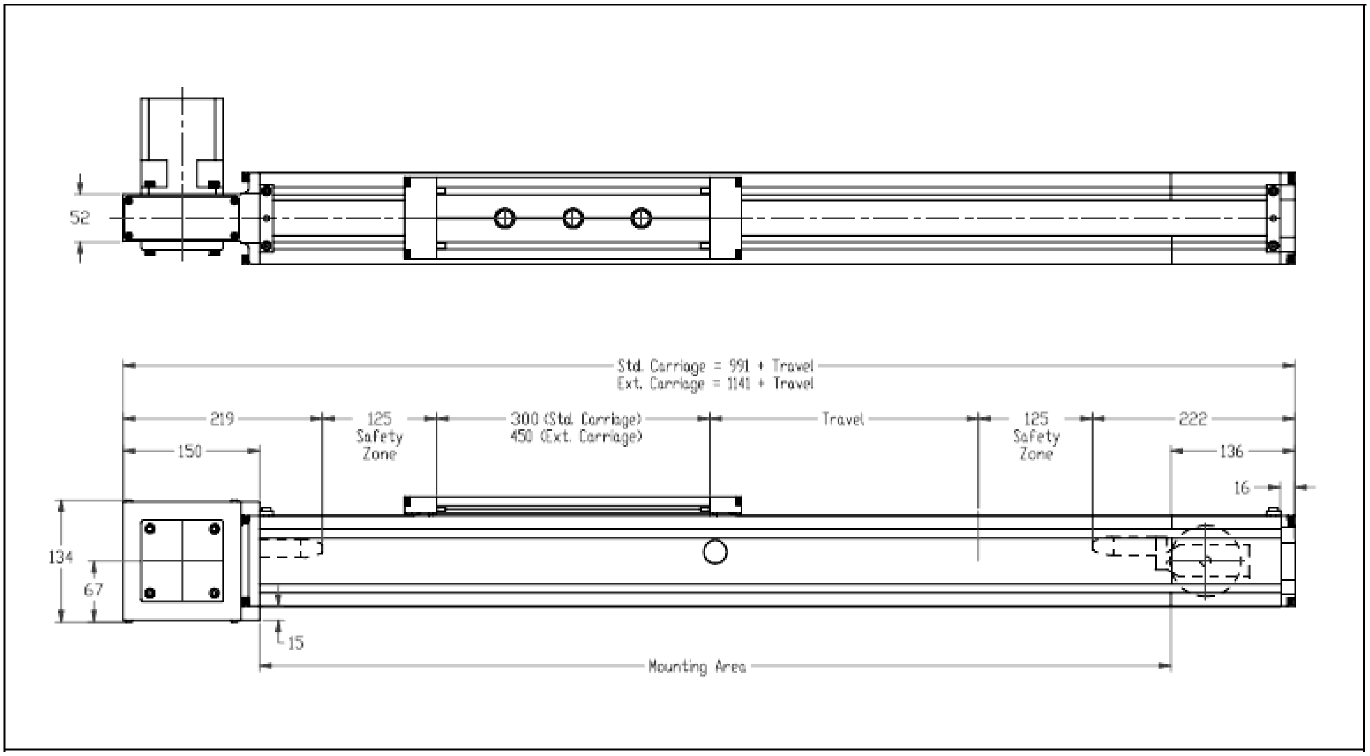
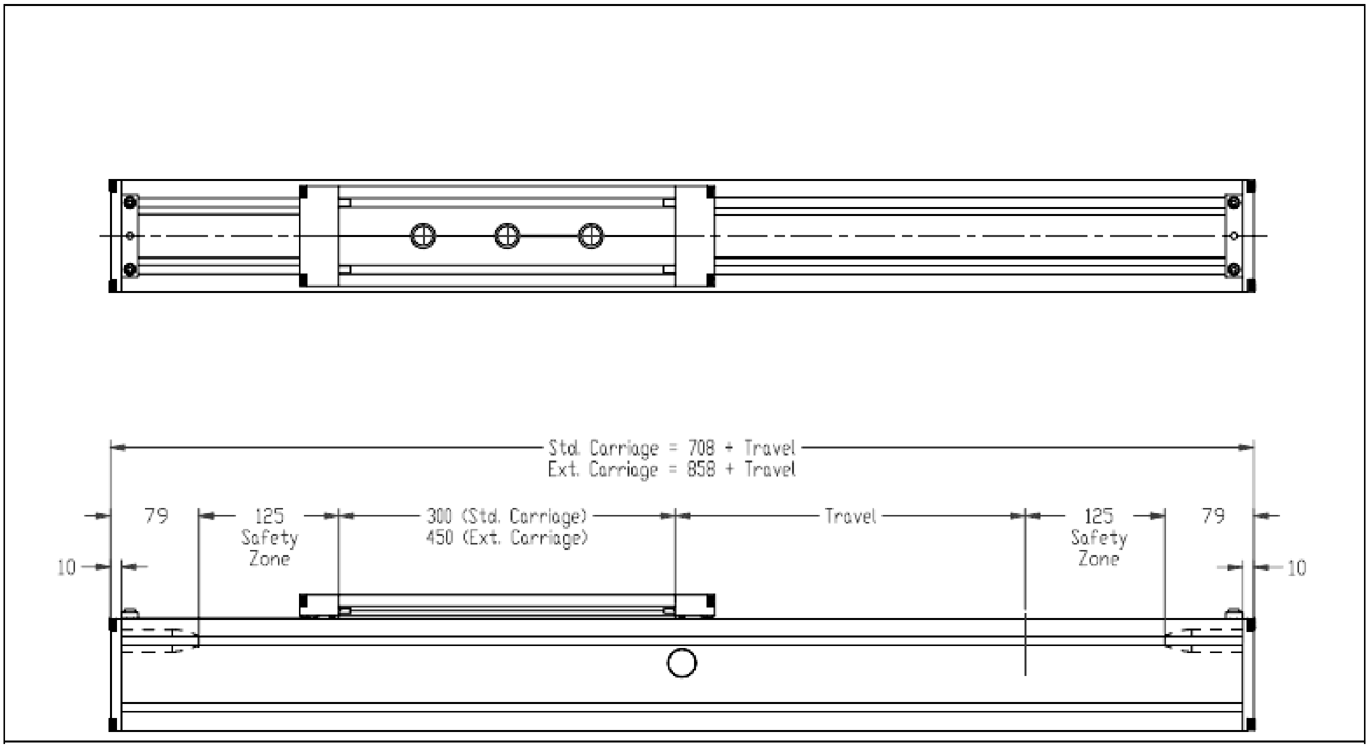
2.4 Dimensions

2.4.1 Dimensions HLE100SR Drive unit



2.4.2 Dimensions HLE100SR Idler



3 Installation

3.1 General

Single HLE linear drive units ordered with limit switches will be supplied completely assembled and mechanically ready for operation.

Long units and/or HLE double axes will be supplied dismantled for delivery and safety reasons. (Assembly instructions can be found in chapters 4.10 & 4.11).

Unless otherwise noted, motors should always be mounted in accordance to the motor manufacturers specifications.

Note	In vertically mounted applications, the drive station should be at the top of the unit, placing belt tension between drive pulley and load.

3.2 Substructure preparation

- Each point of support must be level and plane parallel to 0.2 mm.
- All points of support must be aligned to one another with parallelism not to exceed 0.5 mm.
- For double drive units, a one axis parallelism of 0.2 mm must be guaranteed.
- Ideal distance between supports (provides drive deflection of 1 mm per meter), see Diagram 1
- To simplify leveling, points of HLE drive support can include a series of adapter plates that can be leveled using adjustment screws.

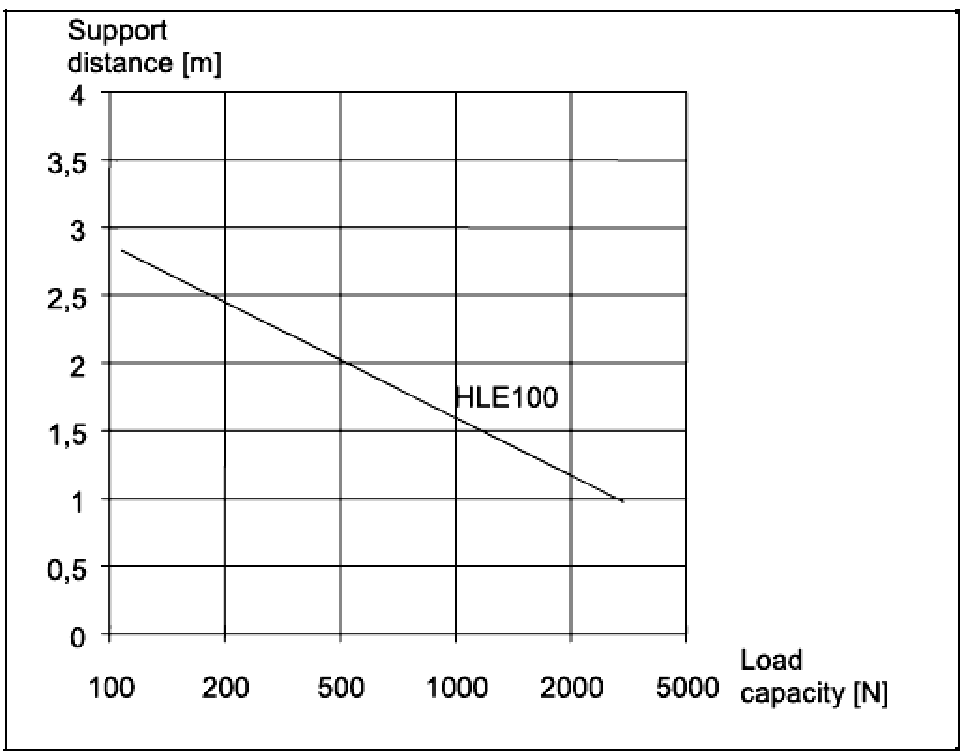


Diagram 1: Ideal distance between supports (Deflection of approx. 1 mm)

3.3 Installing

Caution	Permanent deformation of long drive units can occur if handled improperly. Twisted and bent profile can affect the performance of the carriage.

Note	During installation, plastic film tape may be used to cover the slot opening to prevent contamination by dirt and debris (does not apply to units equipped with cover system).

Note	Always make provisions for easy access to the tension station adjustment screws and carriage assembly for maintenance purposes!

3.3.1 Installing a single axis

1. Remove drive unit from crate, strip off protective film and inspect for transportation damage.
2. Place protective tape over drive slot (does not apply to units equipped with cover system).
3. Place HLE on pre-leveled connection points (use leveling instrument).
4. Secure drives using clamping profiles within the "T"-slot grooves of profile or fasten with screws or “T” bolts directly from bottom “T” slots. . Do not drill into profile!
5. Attach equipment to load plate.
6. Remove dust cover (adhesive film).

3.3.2 Installing a double axis

1. Remove drive unit from crate, strip off protective film and inspect for transportation damage.
2. Place protective tape over drive slot (does not apply to units equipped with cover system).
3. Place HLE’s on pre-leveled connection points (use leveling instrument).
4. Secure motor driven HLE using clamping profiles within the “T”-slot grooves of profile or fasten with screws or “T” bolts directly from bottom “T” slots. . Do not drill into profile!
5. Install second drives (non-driven axis) same as in step #4, but do not tighten fasteners.
6. Measure for parallelism (tape measure) [Figure 2 left].
7. Check squareness with diagonal measurement (tape measurer) [Figure 2 right]. If adjustment is needed, correct by moving non -driven axis.
8. Check horizontal orientation of both axes to one another (use leveling instrument), and correct by moving non-driven axis.
9. Install connecting axle shaft (does not apply if second axis is an idler unit).
10. Remove the dust cover (adhesive film).
11. Tighten all hardware.

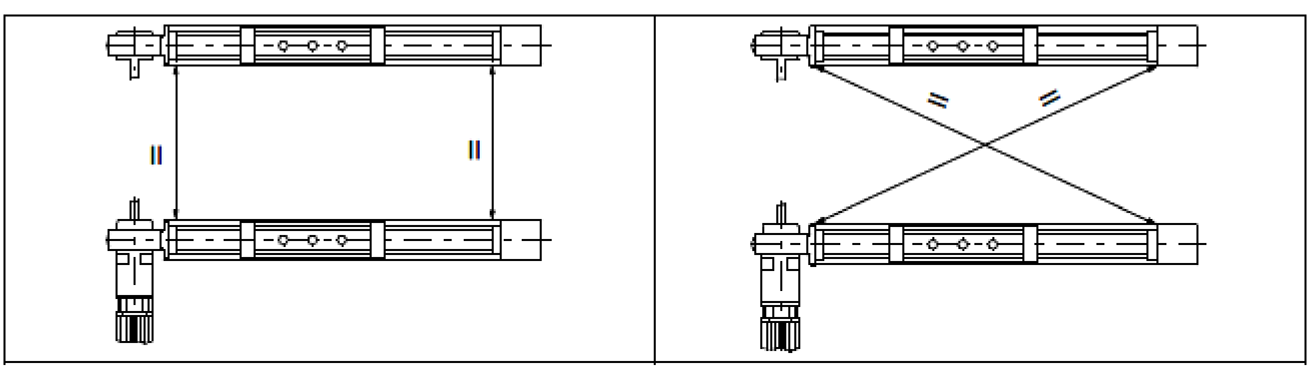


Figure 2: Aligning double axis unit

3.4 Limit Switches/Sensors

3.4.1 General

- HLE is supplied with limit switches are pre-mounted to the unit but must be properly adjusted to customer requirements.

Note	Requirements for switches/sensors when connecting motors and drives vary depending on manufacturer. Consult driver/controller manual for switch configuration.

Note	**Recommendation**: A minimum end of travel safety distance of **125mm** should be maintained.

3.4.2 Setting up end of travel limits

Note	Unless otherwise specified, the tripping plate and initiator switches are mounted on the motor/gearbox side of the unit.

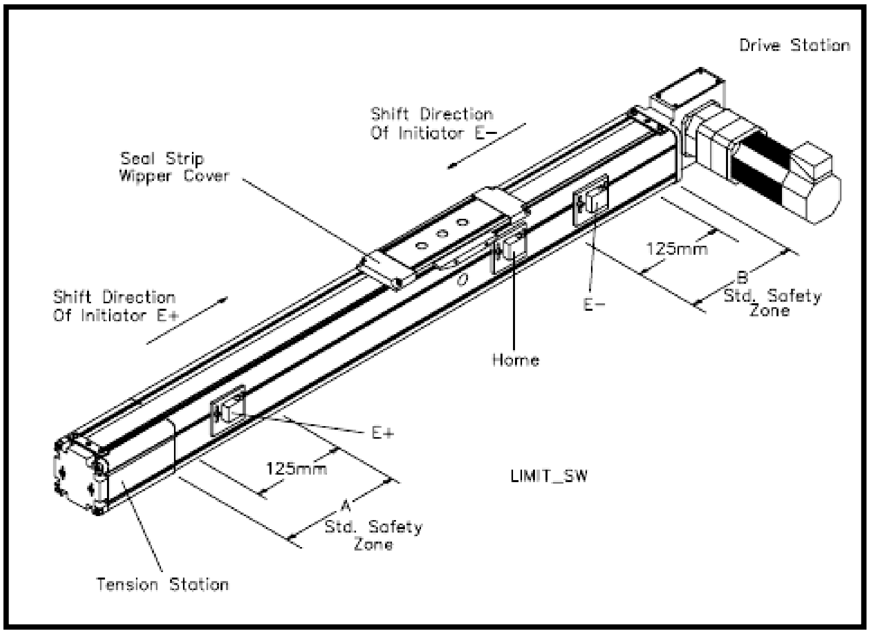


Figure 3: Limit switches (initiators): Setting up end of travel limits and safety zones.

Dimensions HLE100SR	Unit	HLE without seal	HLE with Strip Seal
A	mm	187	211
B	mm	170	194

Table 1: Distances for setting up the limit switches (initiators), based on 125 mm safety zone

1. If not already installed, fasten tripping plate on the side of load attachment plate using the screws provided. The ramp side of trip plate is used to activate mechanical switches.
2. Arrange limit switches according to sequence given in Figure 3.
3. **E-:** Position carriage with the load attachment plate as indicated in Figure 3 and Table 1 (dimension B). Slide limit switch **E-** from drive station toward the direction of the tension station end until it triggers.
4. **E+:** Re-position carriage with load attachment p late as shown i n Figure 3 and Table 1 (dimension A) . Slide limit switch **E+** away from tension station in the direction of the drive station until it triggers.
5. Make certain the carriage runs smoothly. Check distance between surface of tripping plate and limit switch body (approx. 1. 5 mm) with electronic proximity switches (see manufacturer instructions).
6. Six (6) "T" slot grooves running the length of the profile can be used as conduit for limit switch wire leads. Plastic "T" slot cover secures wires within the groove.

4 Maintenance

4.1 Maintenance schedule

When	What	Action	Removal
After Start-up	Timing belt	Check belt tension, tracking and adjustment.	Chapter 4.5.4 & 4.5.5
One week,	Timing belt	Measure timing belt tension. If tension is less than 0.9 x the operating tension, increase timing belt tension to 1.1 x the operating tension.	Chapter 4.5.4
Daily	Entire drive	Depending on the application, clean all affected parts (internal, tensioning station, drive station).	Chapter 4.12.7
		In very dirty environments, retrofit with steel strip cover.	
Every six months	Bearings	Lubricate carriage bearing blocks (see Note below)	Chapter 4.6.2
	Timing belt	Check tension.	Chapter 4.5.4 & 4.5.5
		Visually inspect timing belt for wear. Excessively worn belts should be replaced. For abnormal timing belt wear, see chapter 4.3, for possible cause(s) and cure(s).	

Table 2: HLE maintenance schedule

Note: Use only LITHIUM 12 HYDROXYSTEARATE SOAP BASE containing additives to enhance oxidation resistance and rust protection. Daedal grease type #1, Model # G1 (70/80 cSt @ 100 degrees C) is recommended for grease lubrication and ISO grade 32-100 for oil lubrication.

CAUTION: Never mix petroleum base, with synthetic base lubricants. For special or severe service conditions, consult factory.

4.2 Replacement interval for steel strip cover wearing parts

Travel	What	Action	Removal
3750 km	Felt wiper bar	Replace	Chapter 1.12.5
11000 km	Bearing strip	Replace	Chapter 1.12.6
22000 km	Steel cover strip	Replace	Chapter 1.12.3

Table 3: HLE wear parts with steel strip cover

4.3 Abnormal timing belt wear

Several factors can cause abnormal timing belt wear. Determination of the type of belt wear may allow f or the specification of a particular cause. T he following table shows possible causes for typical cases:

Observation	Probable Cause	Cure
Abnormal wear on belt tooth flank.	Tension too high.	Change timing belt, adjust tension (see 4.5.3).
	Drive torque too high.	Check drive characteristics.
Abnormal wear on belt sides.	Incorrect timing belt tracking.	Change timing belt, adjust tension (see 4.5.3).
	Edge of roller/pulley deformed.	Change belt pulleys.
Shearing of belt teeth.	Tension too low.	Change timing belt, adjust tension (see 4.5.3).
	Overload or system crash.	
Tears in belt teeth or abnormal wear on loaded tooth profiles.	Incorrect belt tension.	Change timing belt, adjust tension (see 4.5.3).
	Overload.	Change timing belt, adjust tension (see 4.5.3).
		Check if load is greater than drive units capability.
	Aging of belt material.	Change timing belt, adjust tension (see 4.5.3).
Broken timing belt.	Incorrect belt tension.	Change timing belt, adjust tension (see 4.5.3).
	Overload.	Change timing belt, adjust tension (see 4.5.3).
		Check if load is greater than drive units capability.
Softening of belt material.	Operating temperature too high.	Change timing belt, adjust tension (see 4.5.3).
		Lower operating temperature.
	Contact with solvents.	Change timing belt, adjust tension (see 4.5.3).
		Do not clean belt with solvents.
Belt skipping over pulley, loss of machine zero point.	Tension too low	Adjust tension to correct value.
	Incorrect motor position (bottom) in vertical application.	If possible, have drive on top. Alternative: increase tension or reduce loads in longitudinal direction.

Table 2: Abnormal belt wear

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4.4 Maintenance and repair

4.4.1 Safety notices

Before performing maintenance and/or repair, ensure the main electrical disconnect switch for the equipment being worked on is in the “ OFF” position and secured with padlock(s). If additional automation equipment is in operation within the work area, barriers, fences or other means must be taken to ensure safety.

Where it is necessary to disconnect or remove safety devices during maintenance, such devices must be

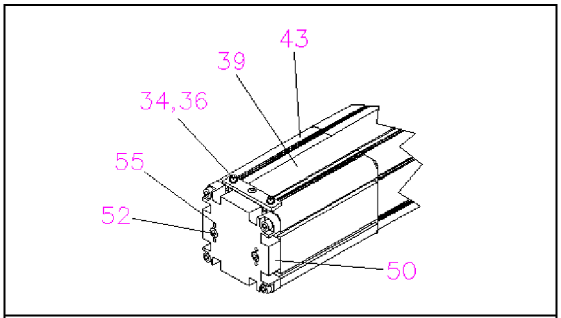
4.5 Replacing, tensioning and aligning timing belts

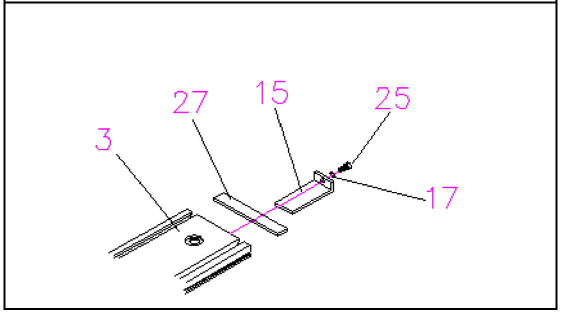
4.5.1 General information

- Unpack new timing belts immediately. Store flat on their side, in a coiled circular shape at room temperature in a dry place.
- Timing belts must not be kinked.
- The pitch of timing belt and mating pulley teeth must be the same.
- Long-term temperatures at a maximum of 178° F (80° C) are permitted.
- Store linear drives in a clean dry environment.

4.5.2 Replacing timing belt

1. Move carriage to a reference point along the HLE profile (e.g. machine zero, real zero ...). Mark the carriage position (felt pen) on profile.
2. Remove steel strip cover bracket bolts at the tension station end of unit (see 4.12.2)

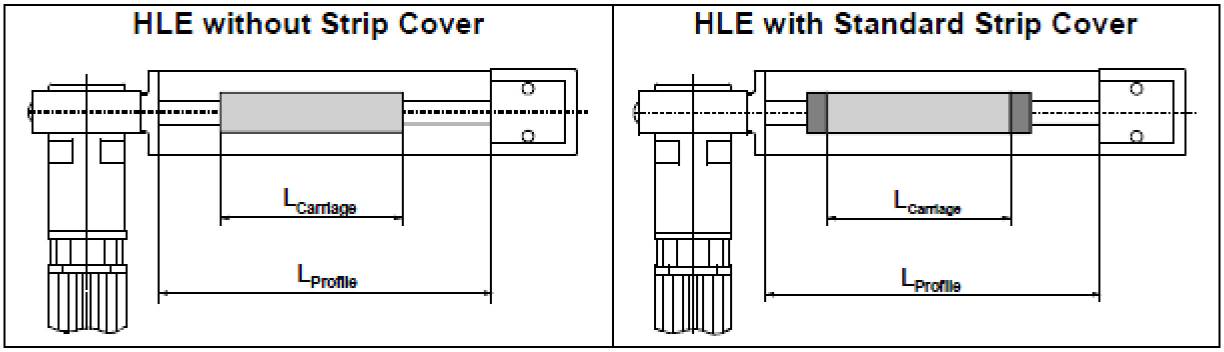




3. Loosening timing belt: Carefully roll back steel cover strip (39) from tension station. Locate lock-screw access holes (55) on the very end of the tension station. Insert Allen key through hole and loosen lock-screws (turn clockwise) Qty.4.
   Loosen the tensioning screws (52) approximately 10 turns counter-clockwise.

4. Loosen timing belt clamp:
   Remove screw (25), from load attachment plate (3). Thread a M6x10 screw, into thread of timing belt retaining bracket (15) and as a jacking screw, carefully push back spacer bracket and timing belt retaining bracket (15) a few mm.

   Completely pull out and remove bracket (15). If retaining bracket is too tight and cannot be loosened, the load attachment plate (3) must be removed.
5. Cutting new timing belt to proper length:
   Measure profile length and calculate belt length by adding a **correction value** from the table below, or simply measure the old timing belt.



HLE	100
Correction value	547mm

Table 3: Correction values.

Belt length = 2 x $L_{profile}$ - $L_{carriage}$ + correction value

Formula 1: Calculation for timing belt length

6. Timing Belt installation.

Reminder:

HLE100 SR: timing belt passes through cavity in lower portion of HLE100 profile.

Note	After belt has been removed from carriage, but prior to pulling out of linear drive, tape old timing belt end to new belt end, and thread through drive unit using old belt.

7. Locate the cavity between carriage and load attachment plate, at one end of the carriage. Insert timing belt into cavity (6 teeth). Slide timing belt retaining bracket (620) along back side of timing belt, into cavity, and shim with spacer bracket (619). Fasten both using screws (621).
8. Tension timing belt: chapter 4.5.4.
9. Check tracking, and align belt: chapter 4.5.7.
10. **Tighten lock-screws counter-clockwise (63), after all adjustments are made**.
11. If steel strip cover was removed, re-install (see 4.12.3).
12. Re-set reference point: (see 4.6.7).

4.5.3 Tensioning timing belt

General

Note	Timing belt tension depends on mass of load to be transferred and forces required to move that load. Do not exceed values for setting tension stated in Table 5.

Factors when tensioning timing belt:

- Drive used (gearbox, drive orientation).
- Total force transferred by the timing belt Fx ($Fx = F_{static} + F_{dynamic}$).

To keep teeth of belt from skipping over drive pulley teeth, timing belt tension (operating tension) must be approximately 10% above actual force required to perform its function (Fx).

During the break-in period of a linear drive unit, timing belts will take an initial stretch. As a result, belts w ill lose approximately 20% of their tens ion. Therefore, to compensate, tension must be adjusted to 1.25 times greater than the operating tension. This tension is defined in Table 5 as **tension to be set**.

Table 4, provides a service life you might expect based on **standard values**, or **maximum values,** as outlined in Table 5.

	Standard value	Maximum value
Service life	25,000 km	100 km
Direct & side load (Fz, Fy)	3000 N	26,700 N
Pitch & yaw moment (My, Mz)	200 Nm	1280 Nm
Roll Moment ((Mx)	48 Nm	310 Nm

Table 4: Drive unit service life

For maximum service life, the **standard value** should be set first. Timing belts within long drive units may sag to the point that belt teeth rub along square drive rail during operation. Tension must be increased in stages until the belt teeth no longer touch. Never exceed the **maximum value** torque’s shown in Table 5.

For double axis units with an equally shared load, total belt tension for each drive can be cut in half.

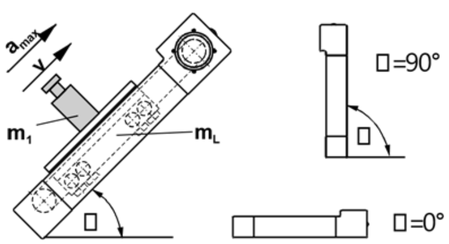
If timing belt tension of drive unit drops below 0.9 x operating tension, after one week of operation, belt tension should be increased to 1.1 x operating tension (Table 5).

Note	HLE drives supplied with gearboxes or drive stations with bearing sets will have tensioned timing belts from the factory (adjusted to **standard value**).

HLE	Gearbox type / bearings	Standard values				Maximum values			
		Fx_{max} [N]	Tension to be set [N]		Operating tension [N]	Fx_{max} [N]	Tension to be set [N]		Operating tension [N]
		maximum transferable force	new/ old slackened belts	on re-tensioning	adjusts with time	maximum transferable force	new/ old slackened belts	on re-tensioning	adjusts with time
100	PL90	580	810	715	650	780	1090	960	870
	PLE80/90	400	560	495	450	630	870	770	700
	PL115	580	810	715	650	780	1090	960	870
	PLE120/115	580	810	715	650	780	1090	960	870
	Shaft Option 2,3,4,5 & 6	580	810	715	650	780	1090	960	870

Table 5: Recommended and maximum timing belt tension.

Determining force F_X:



Stationary load:

$\mathbf{F_x} = F_{static}$

$F_{static} = (m_L+m_1) * 9.81 * \sin\alpha$

If load is in acceleration/ deceleration:

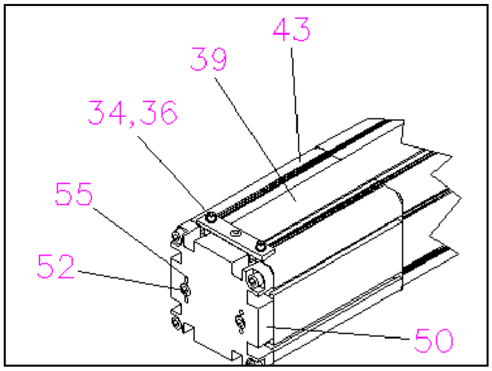
$\mathbf{F_x} = F_{static} + F_{dynamic}$

$F_{static} = (m_L+m_1) * 9.81 * \sin\alpha$

$F_{dynamic} = (m_L+m_1) * a_{max}$

F_x	Total force [N]
F_{static}	Static force [N]
$F_{dynamic}$	Dynamic force [N]
m_L	Mass of carriage [kg]
m_1	Mass of load [kg]
α	Angle between surface plane and HLE [°]
a_{max}	Maximum acceleration [m/s^2]

4.5.4 Checking and adjusting timing belt tension



1. Measure timing belt tension (see 4.5.5).
2. Compare actual tension with required value in Table.
   If timing belt tension is less than 0.9 x operating tension, shown in Table 5, re-adjust belt to correct value. Insert Allen key through access (55) hole (Qty.4) on end of tension station and loosen lock-screw by rotating clockwise.
3. Adjusting belt tension:
   Clockwise rotation of adjustment screws (52) will increase belt tension. Screws should be adjusted equally.
4. Check timing belt tracking: (see 4.5.7)

4.5.5 Measuring timing belt tension

The most accurate method of measuring belt tension is the SM (+/- 5% accuracy) .

Belt tension measuring device SM

The RSM belt tension measuring device uses the oscillation frequency of the free running belt length, and converts this information into force (performs calculations specific to belt mass and free running belt length). This is a very fast and easy method of tensioning any type of timing belt.
The belt tension-measuring device can be obtained through Parker (Part. No. 003-7112-01).

4.5.6 Tensioning timing belt using a torque wrench

Timing belt tension force is proportional to the adjusted torque of the tensioning screw (52).

Based on a required timing belt tension, a tightening tor que for the tensioning screws (52) is given and can be set using a torque wrench. This method, due to the dispersion of the friction coefficient, can at best be only approximately 30% accurate.

Diagram represents the relationship between timing belt tension and tightening torque. Curve shown applies for new, clean, non-lubricated screws and threads.

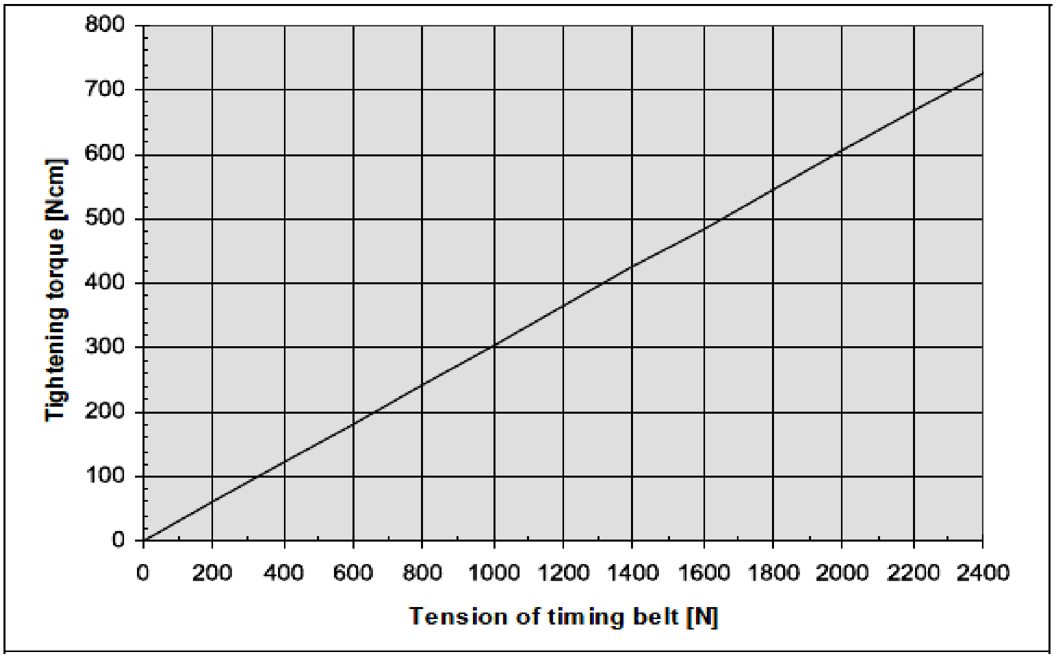
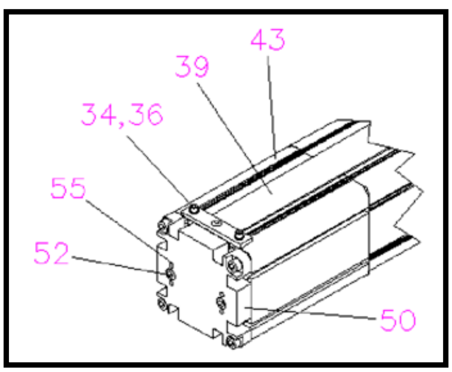


Diagram 2: Torque readings and resultant timing belt tension.

4.5.7 Timing belt tracking

Note	Adjustments to timing belt tension must be done prior to checking/adjusting belt tracking. Tracking can only be checked with the carriage in motion. Proper tracking is when the timing belt oscillates between tension station pulley flanges, but does not attempt to ride up on the sides of the flanges.



1. Remove bolts (34,36) from cover strip bracket. Carefully roll-back the steel cover strip (39) from tension station area.
2. Check operation of belt by moving the carriage (manually, if possible -or electrically at reduced speed). If belt operation is correct according to the abovementioned definition, replace cover strip seal (39).
3. If not, loosen lock-bolts (55) clock-wise (Qty.4). Rotate tensioning screw (52) counter-clockwise in small stages while checking timing belt position, continue to adjust until timing belt runs in accordance with the above definition.
4. Tighten lock-screws (55) and replace steel cover strip (39).

4.6 Carriage

Note	Carriage play is when one can grab the load attachment plate and find movement (side to side or up and down) when applying moderate forces. Check for a worn out linear bearing block or wear on the steel rail.

1.Remove the load from the load attachment plate.
2.If equipped with a steel strip cover - remove it: (see 4.12.2).

3. Remove timing belt from carriage: (see 4.5).

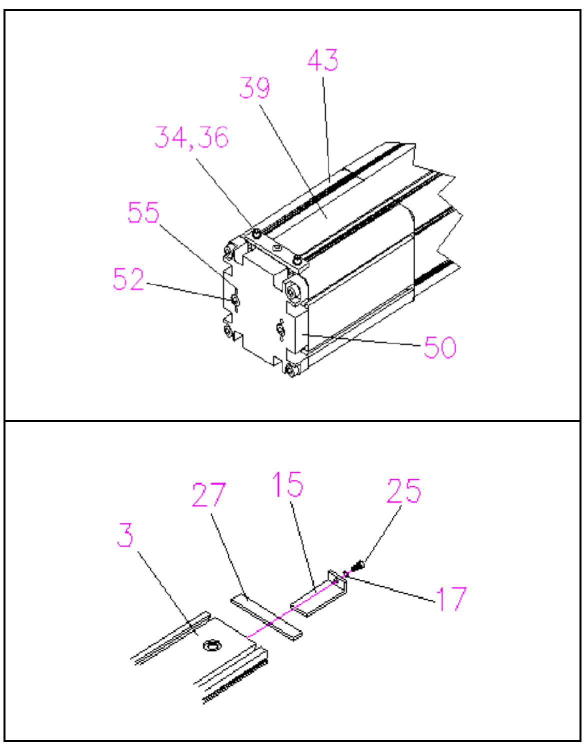
⚠ **Danger**	On vertical axis units, secure the carriage to prevent movement. When the timing belt is disconnected from the carriage, it will fall due to gravity if not supported. This can result in damage to people or property.

4. Visually check for rust or corrosion of the steel rail system. Completely change out both steel rail and bearing block assembly (see 4.6.3 & 4.6.4)
5. Push the carriage over the complete travel of the rail while observing the area were the linear bearing block engages the steel rail. The carriage should feel smooth but tight throughout its travel.
6. Lubricate the bearing block (see 4.6.5) and check for excessive leakage at seals located at ends of blocks.
7. Excessive side to side movement indicates wear between linear bearing block and steel rail. Completely change out both steel rail and bearing block assembly (see 4.6.3 & 4.6.4)

There are no adjustments to linear bearing blocks to compensate for wear.

4.6.2 Carriage removal

1. Move carriage to a reference point (e.g. machine zero, real zero ...). Mark carriage position on HLE profile (felt pen).
2. If equipped with a steel strip cover - remove it: (see 4.12.2).



Loosening the timing belt:

3. Remove bolts (34,36) from cover strip bracket. Carefully roll back the steel cover strip (39) from tension station area.
4. Loosen lock-bolts (55) clockwise (Qty.4).Rotate tensioning screw (52) counterclockwise to Loosen.

Loosen the timing belt clamp:

5. Remove screw (25), from load attachment plate (3). Thread a M6x10 screw, into thread of timing belt retaining bracket (15) and as a jacking screw, carefully push back spacer bracket and timing belt retaining bracket (15) a few mm. Completely pull out and remove bracket (15). If the retaining bracket is too tight and cannot be loosened, the load attachment plate (3) must be removed.

6. Remove tension station hold down screws (62) Qty.4, and lift tension station from profile. Pull carriage assembly out through end of profile.

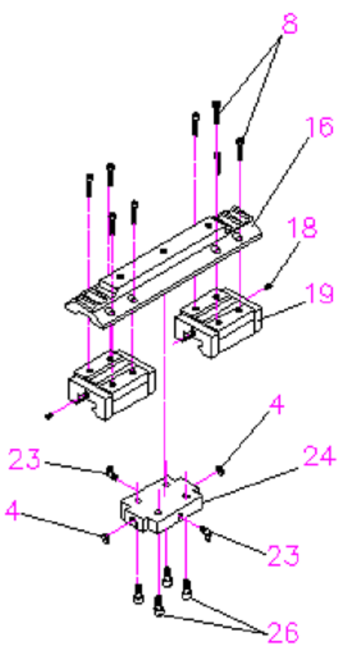
4.6.3 Changing bearing blocks

General

- Linear bearing blocks consist of re-circulating (one string on each side) ball bearings captured within the block.
- The bearing blocks are sealed at each end and lubricated through a zerk fitting located on an aluminum spacer block attached to the center of the carriage. Lubrication is required (see 4.6.5).
- Although linear bearing blocks are capable of operating at a maximum temperature of 248°F (120°C) and continuously at 212°F (100°C), the timing belt can only withstand environmental temperatures between 40°F (-40°C) to 178°F (+80°C).

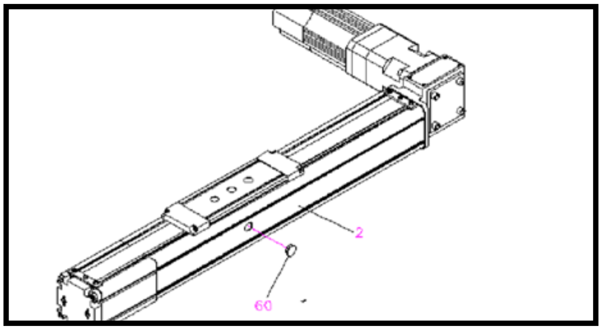
⚠ **Warning**	If checking for bearing block damage while carriage is in motion within profile, care should be taken, to prevent injury. If possible, move the carriage manually (best done if motor and gearbox are removed and drive unit is horizontal). If using motor, operate drive unit with jog button at low speed (< 1m/min).

Note	When removing bearing block from guide rail observe reference markings on both block and rail. Bearing blocks are ground on one side (its ref. mark) and rails have arrows embossed on the top of the rail indicating its ref. mark. During re-assembly it is important to match these reference marks (see below).



1. Remove carriage from steel rail guide (see4.6.2).
2. Place on a clean surface.
3. Remove socket head cap screws (8) from top of carriage.
4. Lift old bearing block from carriage frame. Position replacement block on carriage (note reference mark on side of block).
5. Thread in socket head screws (8) with screw retention (Loctite 243) but do not tighten.
6. Repeat steps 3 through 5 for second bearing block.
7. Clean inside of linear drive profile and apply grease to steel rail (see 4.6.5).
8. Guide carriage assembly on to steel rail and insert into profile (match ref. mark on side of block to ref. marks on rail).
9. Slide carriage assembly along rail until bolt heads of first bearing block align with grooves provided in the sides of access slot in profile.
10. Center carriage within access slot and tighten the four bolts.
11. Repeat steps 9 & 10 for second bearing block.
12. Manually move the carriage along the full length of travel. Movement should be smooth with no apparent binding.
13. Check for side to side carriage free-play. If excessive play is present, replace steel square rail (see 4.6.4).

4.6.4 Lubrication of bearing block



1. Remove round dust cover (pressed on) located on either side of profile.
2. Center Carriage in relation to hole by manually moving or slowly jogging unit.
3. Looking into hole, locate zerk fitting installed in carriage spacer block.
4. Using a grease gun, pump 5 shots of grease (type specified in chapter 4.1) into fitting.
5. Replace round dust cover.

Note	Both linear bearing blocks are lubricated through this process. It is not necessary to repeat this procedure on the opposite side of profile.

4.6.5 Changing steel square rail

1. Remove carriage (see 4.6.2).
2. Using a 5mm Allen wrench, loosen all bolts located on top of square rail. Side rail along the "T" slot and out through end of profile. Remove bolts and "T" nuts from rail assembly and clean in preparation for re-use.
3. Clean inside of profile.
4. Install hardware from step #2 into new square rail (do not tighten).
5. Locate reference marks on top side of rail (arrows) and insert rail into profile guiding "T" nuts into "T" slot groove located at the bottom inside portion of profile (ref. arrow mark side of rail against ledge running the length of profile).
6. Push rail against ledge while tightening all bolts.

4.6.6 Adjust reference point

Correct machine zero (home) point on the basis of previously marked carriage/profile position. There are several ways of doing this depending on motor/controller used. For further details, see controller handbook.

4.7 Replacing motor

Danger	Danger due to electrical shock, disconnect all electrical power to the system prior to removing old motor.

4.7.1 Motors in combination with Neugart planetary gearbox

Gearboxes supplied on purchase orders after 7-98 will be equipped with input clamping devices of the split collar design (See Figure 4). This design captures the sun gear within the back flange portion of gearbox.

1. Move carriage to reference point (e.g. machine zero, real zero, home ...). Mark carriage position on HLE profile (felt pen).
2. Place main electrical disconnect switch in "OFF" position. Allow motor and gearbox to cool.
3. Remove motor and resolver cable.
4. Remove motor bolts (97).
5. Remove cover screw from side of back flange plate (Figure 5).

6. While back driving the linear drive unit (slowly push load attachment plate by hand) the motor shaft will rotate to a position where the clamp screw on the clamping collar aligns with the hole in the side of the back flange.
7. Insert an Allen key through the access hole, into clamp screw and loosen (rotate counter clockwise).
8. Pull the motor straight off from gearbox housing.
9. Inspect internal bore and shaft of new motor to insure sizing of both are correct.
10. Clean motor shaft and clamping bore of any grease.

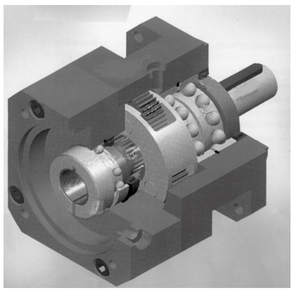


Figure 4

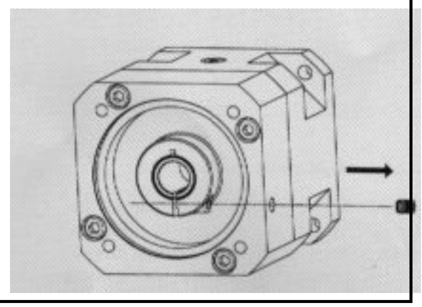


Figure 5

11. Adjust position of clamping screw located on clamping collar to provide easy access of Allen key through hole on side of back flange (Figure 5).
12. If motor was supplied with key embedded in output shaft, remove it and discard.
13. Install motor onto gearbox with keyway in motor shaft aligned with slots in clamping collar as shown in Figure 6.
14. Position motor flange to gearbox flange, verify that no air gap is present between flange faces and bolt the two together (Figure 7).
15. Insert Allen key through hole in back flange and into bolt on clamping collar. Tighten to values shown in table 7.

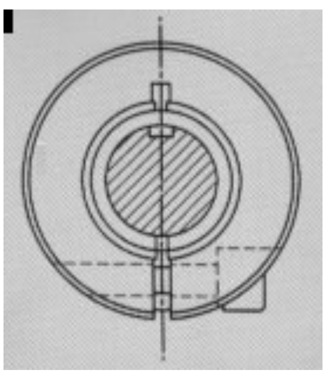


Figure 6

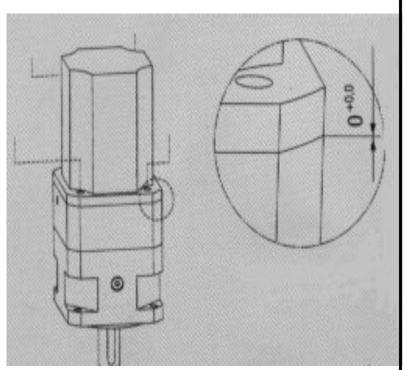


Figure 7

Gearbox	PL 90	PL 115	PLE 80/90	PLE 120/115
Torque	7 Nm	12 Nm	7 Nm	12 Nm

Table 7. Clamping collar torque values.

Gearbox	PL 90	PL 115	PLE 80/90	PLE 120/115
Max. motor wt.	10kg	22kg	4.5kg	15kg

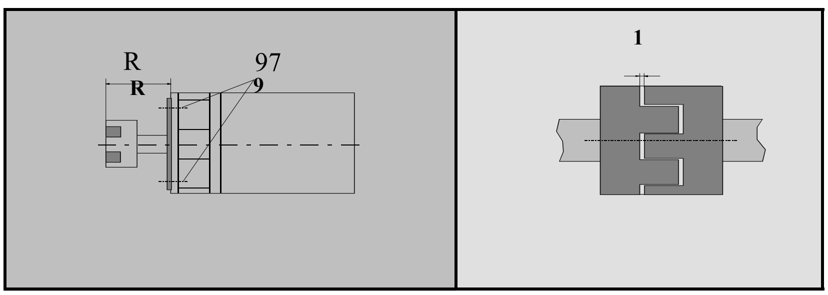
Table 8: Maximum motor weight on Neugart planetary gearbox (horizontal position).

4.7.2 Further gearbox designs

Shaft-hub connection with keyway

1. Move carriage to a reference point (e.g. machine zero, real zero ...). Mark carriage position on HLE profile (felt pen).
2. Place main electrical disconnect switch in “OFF” position. Allow motor gearbox to cool.
3. Remove motor and resolver cables.
4. Remove motor/gearbox bolts (97).
5. Pull the motor off gearbox.
6. Clean motor shaft and inside pinion sleeve of all lubricant.
7. If key shows signs of damage, replace it.
8. Insert key in keyway of motor shaft.
9. Insert motor into input of gearbox and tighten motor bolts (97).
10. Reinstall motor and resolver cables.
11. Re-set reference point (see 4.6.7)

4.7.3 Claw coupling



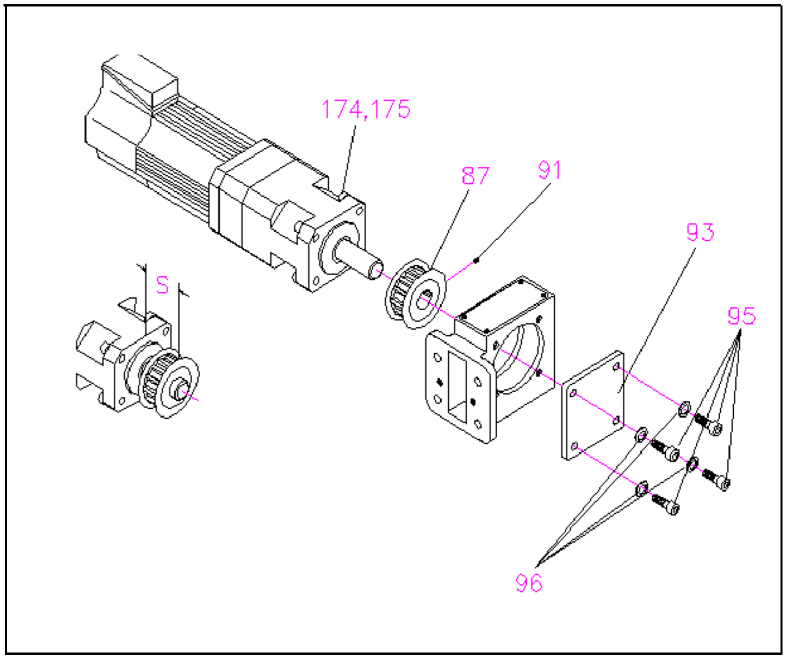
1. Move carriage to a reference point (e.g. machine zero, real zero ...). Mark carriage position on HLE profile (felt pen).
2. Place main electrical disconnect switch in “OFF” position. Allow motor gearbox to cool.
3. Remove motor and resolver cables.
4. Remove motor/gearbox bolts (97).
5. Pull motor off gearbox.
6. Measure distance **R**, dimension from claw coupling face to motor flange (accuracy +/- 0.1 mm).
7. Loosen clamp screw of claw coupling half and pull straight off motor shaft.
8. Clean any lubricant from motor shaft and mating hole of claw coupling.
9. Place claw coupling half on new motor shaft at distance **R**. If fit is too tight, use emery paper on shaft of motor (grade 360).

Note	There should be approximately 1mm clearance between the coupling halves after installation. Axial pressure must be avoided!

10. Tighten clamp screws of claw coupling.
11. Install the motor by aligning teeth in coupling halves and tighten motor/gearbox bolts (97).
12. Replace motor and resolver cables.
13. Re-set reference point (see 4.6.7)

4.8 Changing gearbox

4.8.1 Changing gearbox on a single axis



1. Remove motor (chapter 4.7)
2. Slacken timing belt (chapter 0 point 2-5).
3. Remove cover plate (93).
4. Loosen gearbox bolts (97) and carefully pull gearbox straight out of drive housing.
5. Measure distance S, dimension from upper edge of drive pulley to gearbox flange (accuracy +/- 0.1 mm).
6. Loosen setscrew (91) and carefully pull pulley straight off shaft (use claw puller).
7. Place drive pulley on new gearbox at distance S (Table 10).

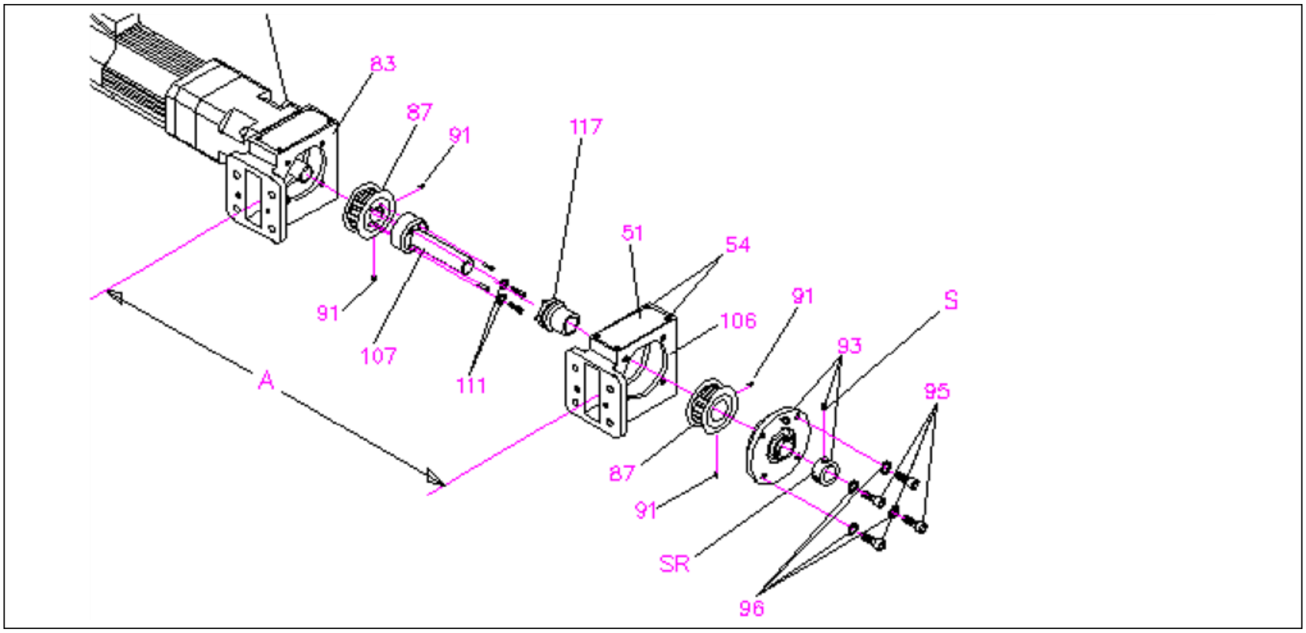
⚠ Caution	Press drive pulley onto shaft. Do not use a hammer for this operation, as this can damage gearbox.

8. Remove set screw from pulley (91) and measure hole diameter. Using a twist drill 0.5mm smaller than hole, carefully drill 1mm deep into key of gearbox through tapped hole in pulley.
9. Screw set screw into pulley and use screw retention (Loctite).
10. Place timing belt over pulley as gearbox is inserted into drive unit.
11. Tighten gearbox fasteners (97).
12. Tension timing belt (chapter 4.5).
13. Re-install cover plate (93).
14. Re-install motor (see 4.7.1, according to gearbox used).

Gearbox type	HLE100 SR
PLE80/90	41.5 mm
PL90	41.5 mm
PL115	41.5 mm
PLE120/115	41.5 mm

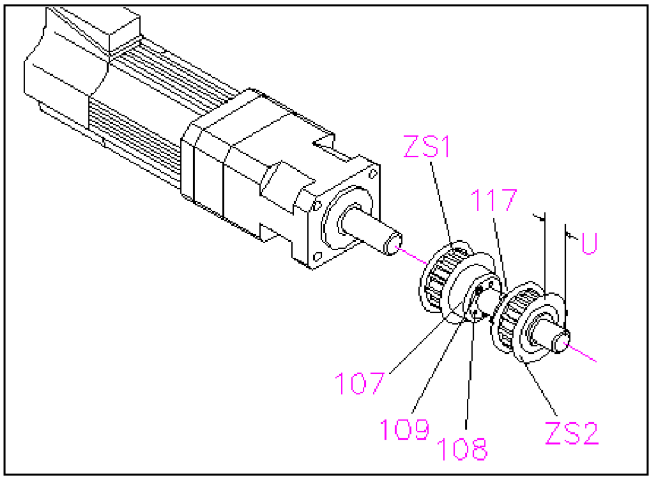
Table 10: Standard distance **S** between pulley and gearbox

4.8.2 Changing gearbox on a double axis with A x1 < drive separation < x2



1. Remove motor (see 4.7, according to gearbox used).
2. Loosen timing belt on both axes (see 4.5).
3. Loosen setscrew (S) on clamp collar of PME bearing (93).
4. Remove clamp collar (SR) of PME bearing (93) by rotating collar counter-clockwise.
5. Remove pressure marks from setscrew (S) on shaft piece (107) using rasp or emery.

Note	If pressure marks from clamp set screw are not removed, damage to the PME bearing can result when shaft is removed



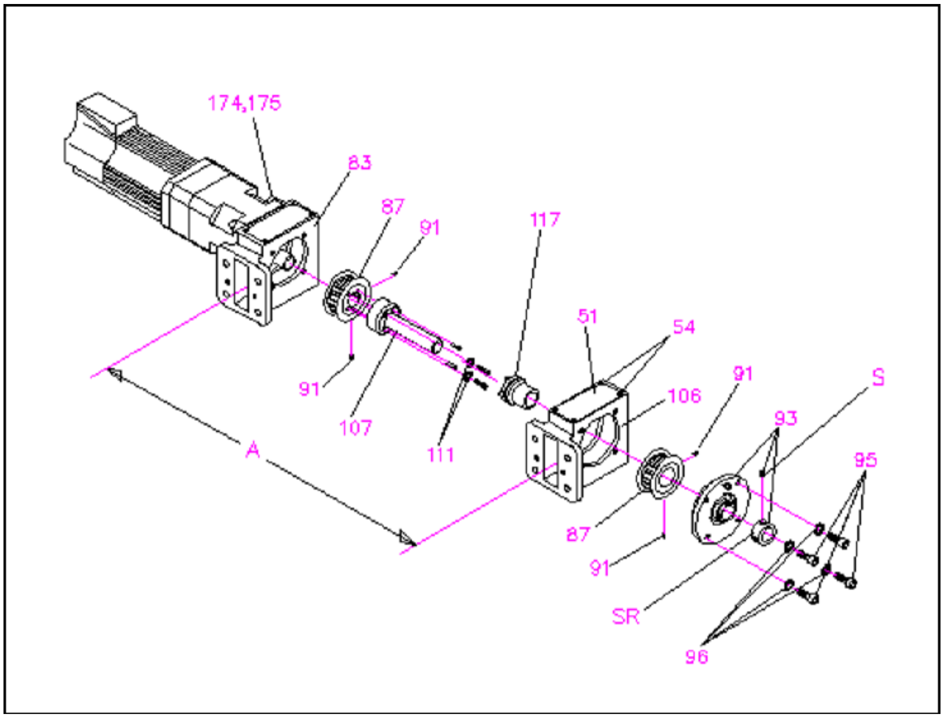
6. Loosen gearbox bolts (174, 175) and remove gear-box.
7. Measure distance U, dimension from end of shaft to side of pulley 2 (ZS2) (accuracy +/- 0.1 mm)
8. Loosen screws of ETP-split-bushing (117). Carefully pull off pulley 2 (ZS2) (use a puller).
9. Measure distance from shaft collar (107) to gearbox flange (accuracy +/- 0.1 mm).
10. Pull pins (108) from shaft assembly using a puller.
11. Loosen screws (109) and remove shaft from pulley.
12. Remove set screw from pulley 1 (ZS1) and clean.

[1]HLE100 SR = 105 mm
[2]HLE100 SR = 225mm

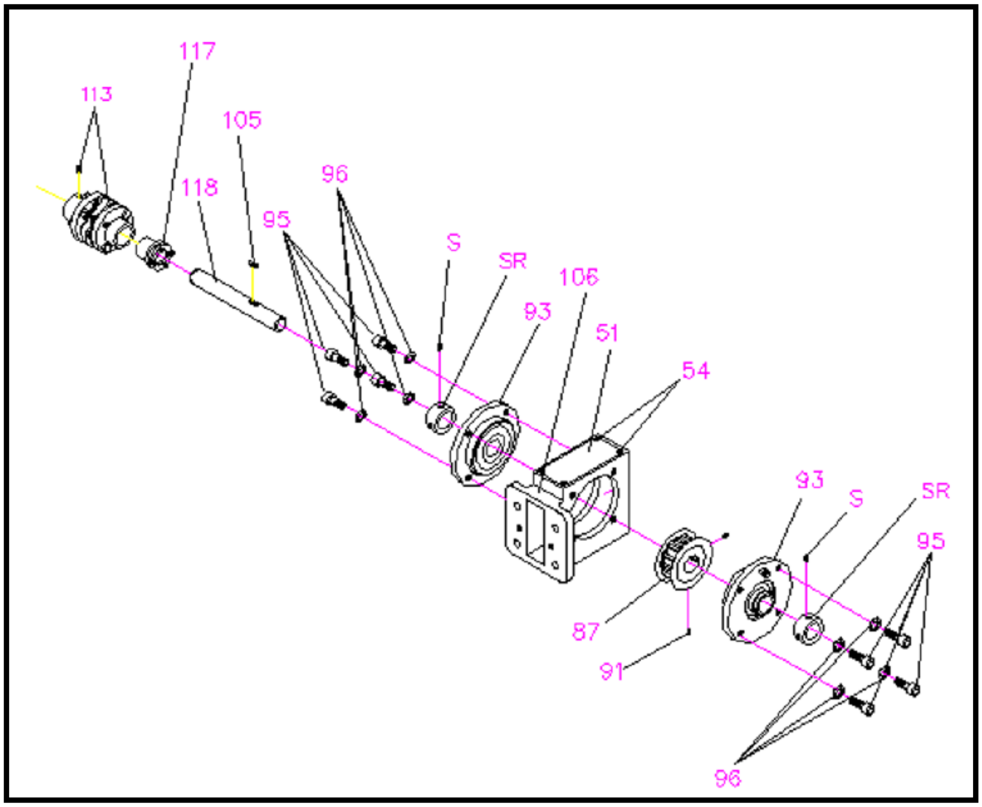
13. Carefully pull pulley straight off gearbox shaft (use a puller tool).
14. Align keyway grooves of pulley and stub shaft to one another and loosely connect both parts using screws (109).
15. Press pins (108) into holes and tighten screws (109).
16. Place pulley (ZS1) with stub shaft on new gearbox at distance recorded in step #9.

Caution	Install pulley using a press. Do not use a hammer, as this may damage gearbox.

17. Spot drill key of gearbox through tapped hole in pulley (ZS) and remove metal chips.
18. Screw set screw into pulley and use screw retention (Loctite)..
19. Place pulley (ZS2) on shaft at distance **U**.
20. Tighten screws of ETP-Split-bushing.
21. Insert gearbox onto linear drive unit and tighten bolts (174,175).
22. Place timing belt over pulley. Check carriage position.
23. Install clamp collar (SR) of PME bearing (93) onto shafts and slightly tighten (clockwise). Tighten set-screw (S).
24. Adjust some tension to timing belt. Loosen screws of ETP-split-bushing (117). Align carriage of non-driven axis to carriage of driven axis. Tighten screws of ETP-split-bushing.
25. Tension timing belt on both axes (see 4.5).
26. Re-check alignment of carriages.
27. Install motor (see 4.7).



4.8.3 Changing gearbox on a double axes with A x2[3] < drive separation < 500 mm



1. Remove motor (chapter 4.7, according to gearbox used).
2. Loosen timing belt on HLE driven rail (see 4.5)).
3. Loosen screws of the ETP bushing (113) one turn at a time in sequence until bushing is loose (counter-clockwise).
4. Locate keyed coupling half on the drive side of the unit, and loosen the setscrew. Push the coupling half over the shaft toward the drive station.

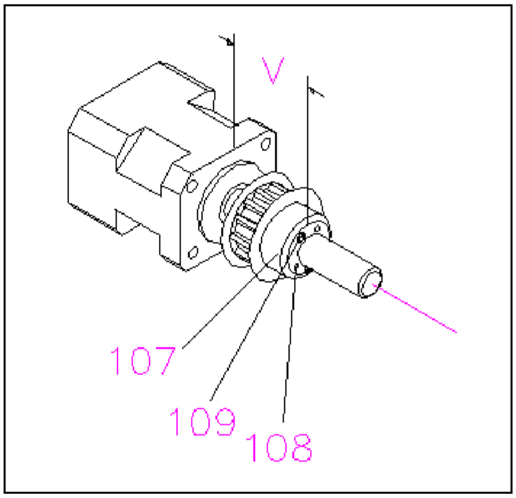
Caution	If keyed coupling half is too tight, coupling hardware should be loosened by lightly pressing in axial direction. Never use a hammer on shaft or the coupling half, as this can lead to displacement of timing belt pulley on driven side.

5. Loosen setscrew (S) on clamp collar of PME bearing (93) on side of drive.
6. Loosen clamp collar of PME bearing (93) by turning counter-clockwise.

Note	If pressure marks from clamp set screw are not removed, damage to the PME bearing can result when shaft is removed.

7. Remove pressure marks from left by screw (S) on stub shaft (118) using rasp or emery paper.
8. Loosen gearbox fasteners (174,175) and remove gearbox.

[3] HLE100SR = 225mm

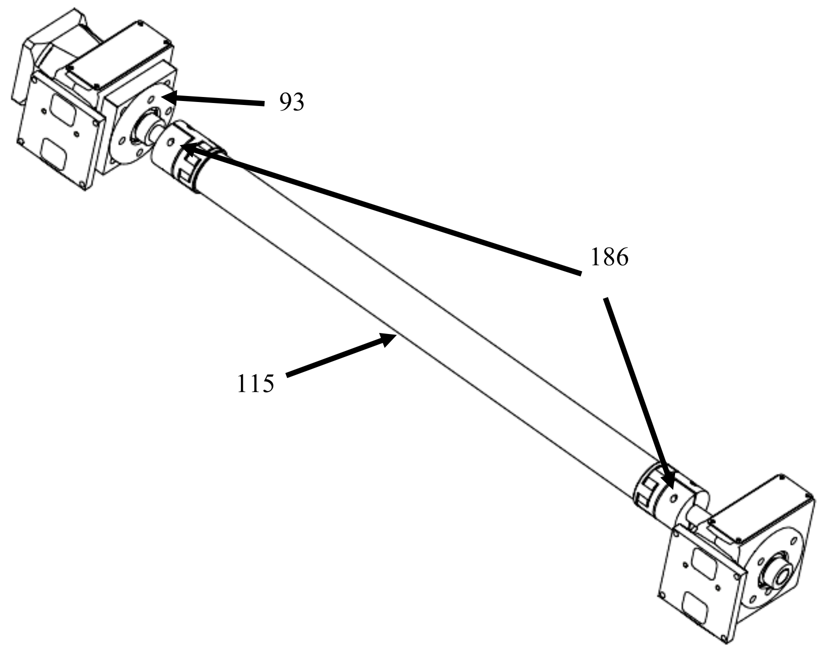


9. Measure distance V, dimension from shaft collar to gearbox flange (accuracy +/- 0.1 mm).
10. Pull pins (107) using a puller.
11. Remove screws (108) and pull shaft from pulley.
12. Remove set screw from pulley and clean it.
13. Carefully pull pulley (use a puller tool) from shaft.
14. Align keyway grooves of pulley and shaft to one another and loosely connect both parts using screws (108).
15. Press pins (107) into holes and tighten screws (108).
16. Place pulley with stub shaft on new gearbox shaft at distance **V**.

⚠ **Caution**	Install pulley using a press. Do not use a hammer, as this may damage gearbox.

17. Spot drill key of gearbox through tapped hole in pulley (ZS) and remove metal.
18. Thread set screw into pulley and use screw retention (Loctite).
19. Insert gearbox onto linear unit and tighten gearbox fasteners (174,175).
20. Place timing belt over pulley.
21. Place clamp collar (SR) of PME bearing (93) onto shafts and slightly tighten (clockwise). Tighten setscrew (S).
22. Push coupling (113) over stub shaft (118) until end of shaft is flush with coupling half.
23. Tighten setscrew with screw retention (Loctite) into keyed coupling half.
24. Tension timing belt of axis on driven side (chapter 5.2.3).
25. Align carriage position (see 4.10.2).
26. Slightly tighten screws of ETP bushing (117), then in small stages (1/4 turns) tighten in sequence to a torque of Ma = 8 Nm.
27. Install motor (see 4.7, according to gearbox used).

4.8.4 Changing gearbox on a double axes with A drive separation > 500 mm

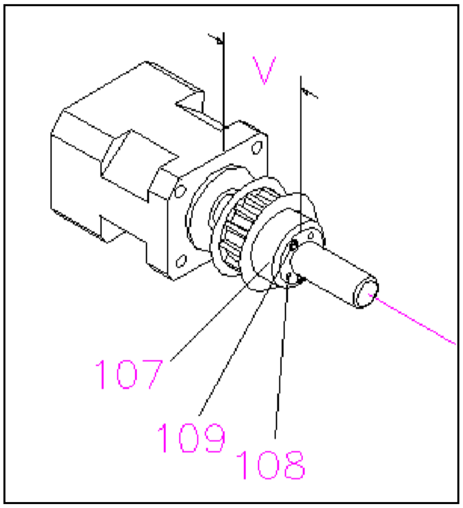


1. Remove motor (see 4.7, according to gearbox used).
2. Loosen timing belt on HLE driven side (see 4.5).
3. Dismantle connecting shaft (115), by loosening 2 screws (186) on each end of link shaft.
4. Loosen setscrew (S) on clamp collar of PME bearing (93) on side of drive.
5. Loosen clamp collar (SR) of PME bearing (93) by rotating counter-clockwise.
6. Remove pressure marks from setscrew (S) on shaft (115) using rasp or emery paper.

⚠ **Caution**	If keyed coupling half is too tight, coupling hardware (107) should be loosened by lightly pressing in axial direction. Never use a hammer on shaft or the coupling half, as this can lead to displacement of timing belt pulley on driven side.

7. Remove gearbox fasteners and pull gearbox straight off drive.

Note	If pressure marks from clamp set screw are not removed, damage to the PME bearing can result when shaft is removed.



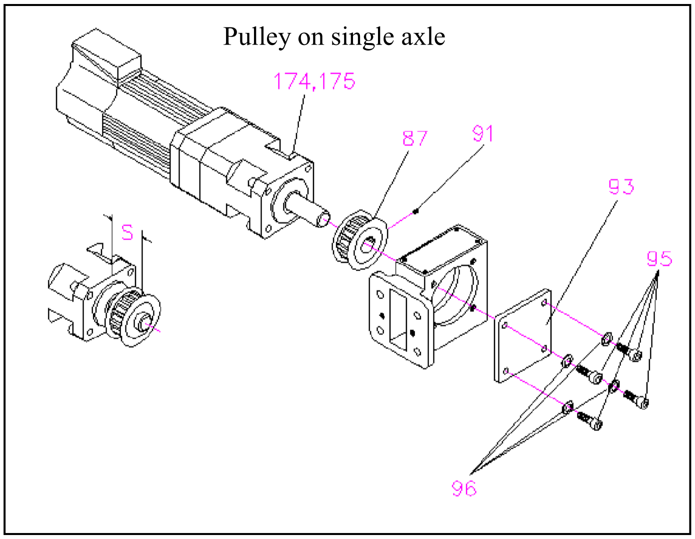
8. Measure distance, V, dimension from shaft collar to gearbox flange (accuracy +/- 0.1 mm).
9. Pull pins (108) using a puller.
10. Remove screws (109) and pull shaft from pulley.
11. Remove set screw from pulley and clean it.
12. Carefully pull pulley (use a puller tool) from shaft.
13. Align keyway grooves of pulley and shaft to one another and loosely connect both parts using screws (1).
14. Press pins (108) into holes and tighten screws (109).
15. Place pulley with shaft on new gearbox at distance V.

Caution	Install pulley using a press. Do not use a hammer, as this may damage gearbox.

16. Spot drill key of gearbox through tapped hole in pulley (ZS) and remove metal chips.
17. Thread set screw into pulley and use screw retention (Loctite).
18. Insert gearbox onto linear unit and tighten gearbox fasteners (174,175).
19. Place timing belt over pulley.
20. Place clamp collar (SR) of PME bearing (93) onto shafts and slightly tighten (clockwise). Tighten setscrew (S).
21. Tension timing belt of axis on driven side (see 4.5).
22. Insert connecting shaft. Tighten the 2 screws on drive end of link shaft.
23. Align carriage position (see 4.10.2).
24. Tighten 2 screws on opposite side of link shaft
25. Install motor (according to gearbox used).

Note	Do not over-tighten screws. Inspect spring assemblies to ensure they do not bulge.

4.9 Replacing drive pulley at gearbox - single axis



1. Remove motor (see 4.7, according to gearbox used).
2. Loosen timing belt (see 4.5)
3. Remove cover plate (93).
4. Remove gearbox bolts (174, 175) and pull gear-box straight our of drive housing.
5. Measure distance, S, dimension from upper edge of pulley to gearbox flange (accuracy +/- 0.1 mm).
6. Loosen setscrew (91) and carefully pull pulley straight off of shaft (use claw puller).
7. Turn key over. If both sides of key are drilled, replace key.
8. Install new pulley on gearbox shaft. Position at S distance, See Table 11

⚠ Caution	Press drive pulley onto shaft. Do not use a hammer, as this may damage gearbox.

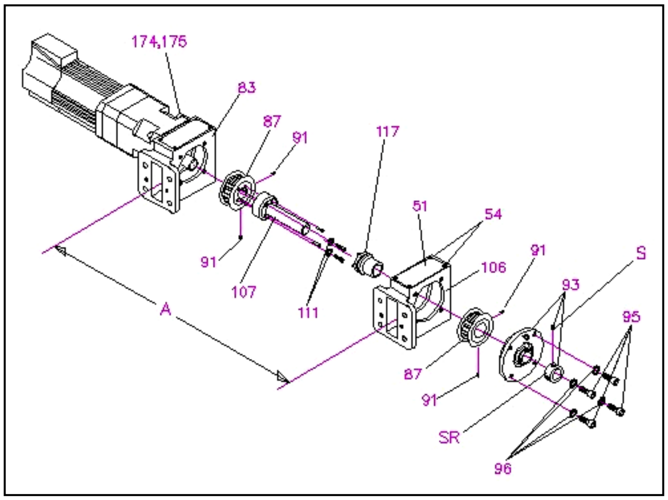
9. Remove setscrew (91) from pulley and measure hole diameter. Using a twist drill 0.5mm smaller than hole, carefully spot drill 1mm deep into key of gearbox through tapped hole in pulley. Clean up any metal chips.
10. Screw set screw into pulley using screw retention (Loctite).
11. Place timing belt over pulley as gearbox is inserted into drive housing.
12. Install and tighten gearbox bolts (174,175).
13. Tension timing belt (see 4.5).
14. Re-install cover plate (93).
15. Re-install motor (see 4.7, according to gearbox used).

Gearbox type	HLE100 SR
PLE80/90	41.5 mm
PL90	41.5 mm
PL115	41.5 mm
PLE120/115	41.5 mm

Table 11: Distance **S** - pulley face and gearbox flange

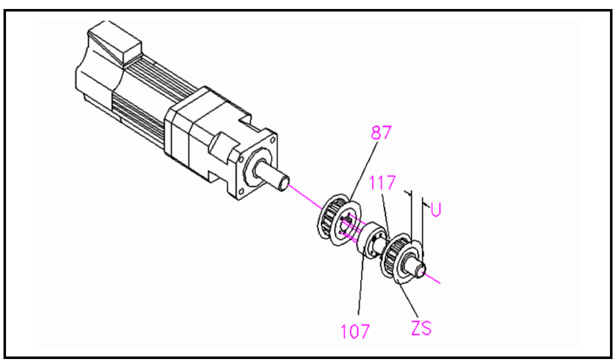
4.9.1 Replacing pulley on driven side of double axes.

4.9.1.1 Double axes A, Double axes A, x1[4] < A < X2[5]



1. Remove motor (see 4.7, according to gearbox used).
2. Loosen timing belt on both axes (see 4.5).
3. Loosen setscrew (S) on clamp collar of PME bearing (93).
4. Remove clamp collar (SR) of PME bearing (93) by rotating counterclockwise.
5. Remove pressure marks from setscrew (S) on shaft piece (107) using rasp or emery.
6. Take out gearbox bolts (174,175) and pull gearbox straight off drive housing.
7. Measure distance **U**, the dimension from face side of shaft to side of pulley (accuracy +/- 0.1 mm).
8. Loosen screws of ETP-split bushing (117). Carefully pull out pulley 2 (ZS2) (use puller tool).

Note	If pressure marks from clamp set screw are not removed, damage to the PME bearing can result when shaft is removed.



9. Position new pulley on shaft at distance **U**.
10. Tighten screws of ETP-split-bushing.
11. Install gearbox onto linear drive housing and tighten bolts(174,175).
12. Place timing belt over pulley.
13. Place clamp collar (SR) of PME bearing (93) onto shaft and tighten (turn clockwise). Tighten setscrew (S).
14. Apply minimum tension to timing belt. Loosen screws of ETP-split-bushing. Align carriage of non-driven axis to carriage of driven axis. Tighten screws of ETP-split-bushing.
15. Tension timing belt on both axes (see 4.5) 16. Install motor (see 4.7, according to gearbox used).

[4]HLE100 SR = 105mm
[5]HLE100 SR= 225mm

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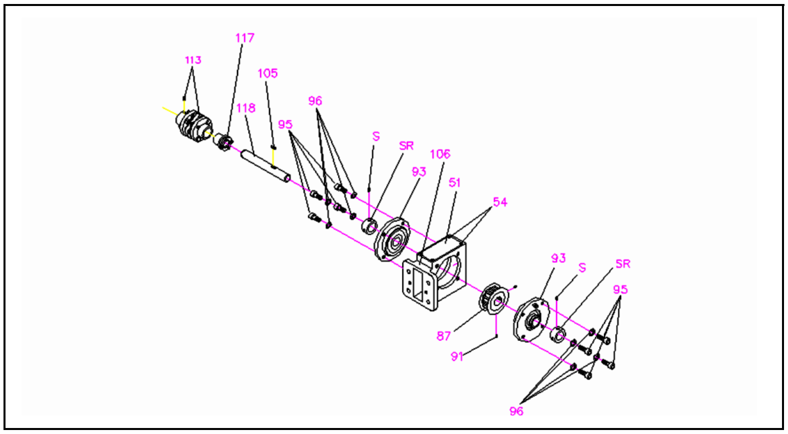
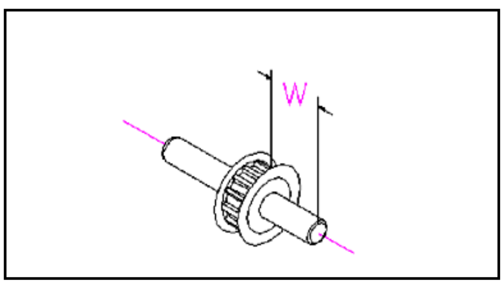
4.9.1.2 Double axes A, Double axes A, x1[6] < A < 500 mm



1. Loosen timing belt on the non-driven HLE (see 4.5).
2. Loosen screws of ETP bushing (117) one turn at a time in sequence until bushing is loosened (counter-clockwise).
3. Back off setscrew (S) on the clamp collar of inner PME bearing (93).
4. Loosen clamp collar of PME bearing (93) by rotating counter-clockwise.
5. Remove pressure marks from shaft (118) made from setscrew (S) by using rasp or emery.

Note	If pressure marks from clamp set screw are not removed, damage to the PME bearing can result when shaft is removed.

6. Loosen setscrew (S) on clamp collar of outer PME bearing (93).
7. Remove collar of outer PME bearing (93) by rotating counter-clockwise.
8. Remove pressure marks from setscrew (S) on shaft piece (118) using rasp or emery.
9. Loosen screws (95,96) of outer PME bearing and remove bearing from drive housing.
10. Carefully remove shaft with pulley from housing.



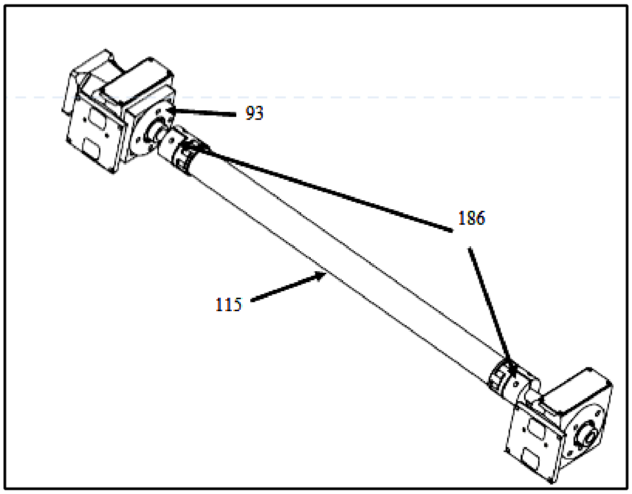
11. Measure distance, W, dimension from face side of shafts to pulley (accuracy +/- 0.1 mm).
12. Loosen setscrew and carefully pull off pulley (use claw puller).
13. Turn key over. If both sides of key are drilled, replace key.
14. Locate new pulley on shaft at distance W.
15. Spot drill key of gearbox through tapped hole of pulley. Using a twist drill 0.5 mm smaller, drill carefully 1 mm deep into key through the tapped hole in pulley. Clean any metal chips.

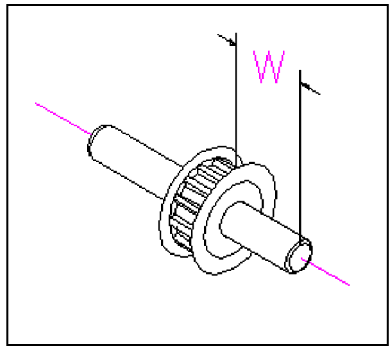
Caution	Press drive pulley onto shaft. Do not use a hammer, as this may damage gearbox.

16. Thread set screw into pulley using screw retention (Loctite).
17. Place timing belt over pulley.
18. Install exterior PME bearing on shaft (118) and fasten using 4 screws (95,96).
19. Move shaft in axial direction. It should have 0.1 - 0.2mm play.
20. Position shaft by hand and install clamp collar (SR) on exterior portion of PME bearing (93) (rotate clockwise) and tighten setscrew (S).
21. Install clamp collar (SR) of inner PME bearing (93) (clockwise), and tighten set screw (S).
22. Tension timing belt (see 4.5)
23. Align carriage position to match second drive unit carriage position (see 4.10.2).
24. Tighten screws of ETP coupling (117) and in small stages (1/4 turns) tighten in sequence to a torque of Ma = 8 Nm.

[6] HLE100SR = 225 mm

4.9.4 Double axes separation > 500mm.





1. Loosen timing belt on HLE driven rail (see 4.5).
2. Disconnect drive shaft, by removing 2 screws on each end of link shaft. Remove drive shaft.
3. Loosen setscrew (S) on clamp collar of inner PME bearing (93).
4. Remove clamp collar of PME bearing (93) by rotating counter-clockwise.
5. Remove pressure marks made from setscrew (S) on shaft using rasp or emery paper

Note	If pressure marks from clamp set screw are not removed, damage to the PME bearing can result when shaft is removed.

6. Remove 4 screws of inner PME bearing and remove bearing.
7. Loosen setscrew (S) on clamp collar of outer PME bearing (93).
8. Remove clamp collar of outer PME bearing (93) by turning counter-clockwise.
9. Remove pressure marks from setscrew (S) on shaft piece using rasp or emery paper.
10. Pull shaft and pulley assembly straight out of housing.
11. Measure distance **W**, dimension from face side of shafts to pulley (accuracy +/- 0.1 mm).
12. Loosen setscrew and pull pulley off shaft (use claw puller).
13. Turn key over. If both sides of key are drilled, replace the key.
14. Position new pulley on shaft at distance **W**.
15. Using a twist drill 0.5mm smaller than the threaded set screw hole in pulley, drill carefully 1mmdeep into key of gearbox through tapped hole in pulley. Clean up metal chips.

Caution	Press drive pulley onto shaft. Do not use a hammer, as this may damage gearbox.

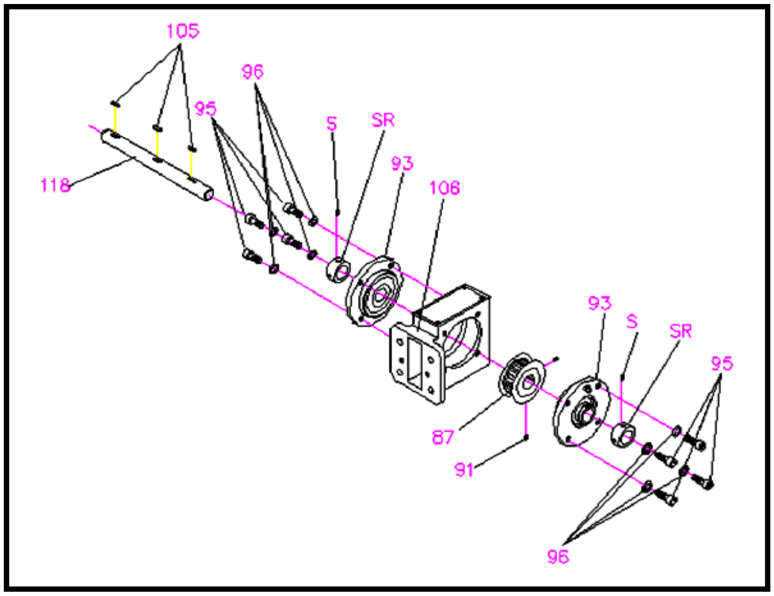
16. Thread set screw into pulley using screw retention (Loctite).
17. Place timing belt over pulley.
18. Insert PME bearing on shaft and secure to housing using 4 bolts.
19. Move shaft in axial direction. It should have 0.1 - 0.2mm play.
20. Position shaft by hand and install clamp collar (SR) on inner PME bearing (93) (rotate clockwise) and tighten setscrew (S).

21. Install clamp collar (SR) of outer PME bearing (93) (rotate clockwise) and tighten setscrew (S).
22. Tension timing belt (see 4.5).
23. Install drive shaft. Tighten the 2 screws on drive end of link shaft.

Note	Do not over-tighten screws. Inspect spring assemblies to ensure they do not bulge.

24. Align carriage position (chapter 4.10.2).
25. Tighten the 2 screws on opposite end of link shaft.

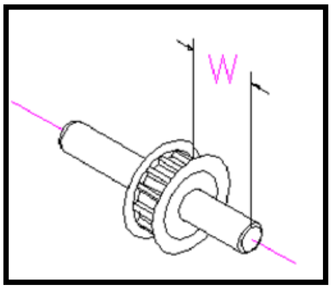
4.9.5 Replacing pulley shaft left (WLO), shaft right (WRO), both sides (WBO)



1. Disassemble and remove any add-on pieces from drive shaft(s).
2. Remove tension from HLE timing belt (see 4.5).
3. Loosen setscrew (S) on clamp collar of PME bearing (93) located on side of drive housing.
4. Remove clamp collar (SR) of PME bearing (93) by rotating counterclockwise.
5. Remove pressure marks from the set-screw (S) on shaft (118) using rasp or emery board.

Note	If pressure marks from the clamp set screw are not removed, damage to the PME bearing can result when shaft is removed.

6. Undo the 4 screws (95,96) of PME bearing located on other side of drive housing and remove bearing.
7. Loosen setscrew (S) on clamp collar of second PME bearing (93).
8. Remove clamp collar (SR) of second PME bearing (93) by rotating counter clockwise.
9. Remove pressure marks from setscrew (S) on shaft (118) using rasp or emery paper.
10. Pull shaft with pulley assembly straight out of housing.

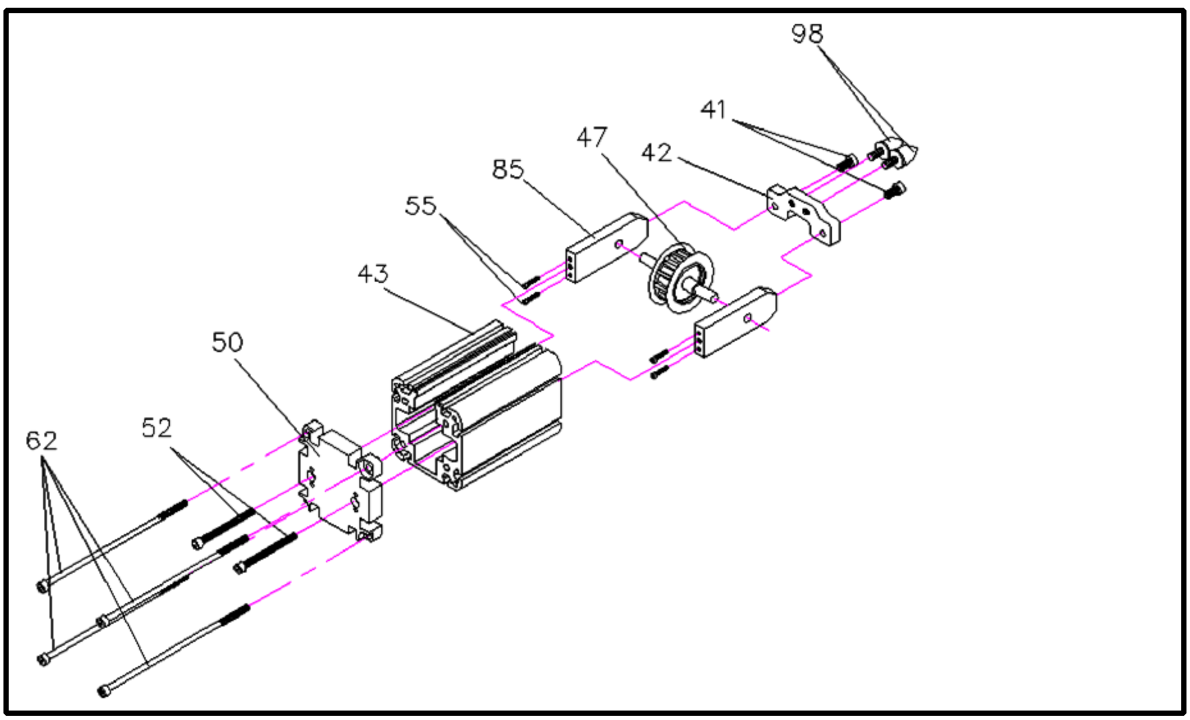


11. Measure distance W, dimension from face side of shaft to pulley (accuracy +/- 0.1 mm).
12. Loosen setscrew and pull off pulley (use claw puller).
13. Turn key over. If both sides of key have been drilled, replace key.
14. Locate new pulley on shaft at distance W.

⚠ Caution	Press drive pulley onto shaft. Do not use a hammer for this operation, as this can damage shaft and/or pulley.

15. Using a twist drill 0.5mm smaller than tapped hole in pulley, spot drill 1mm deep into key. Clean up any metal chips.
16. Thread set screw into pulley using screw retention (Loctite).
17. Install shaft (118) into PME bearing (93).
18. Place timing belt over pulley.
19. Insert PME bearing on shaft (178) and secure to housing using 4 bolts (176).
20. Position shaft by hand and install clamp collar (SR) on inner PME bearing (167) (rotate clockwise) and tighten setscrew (S).
21. Install clamp collar (SR) of outer PME bearing (167) (rotate clockwise) and tighten set screw(s).
22. Tension timing belt (see 4.5)

4.9.5 Replacing tension station pulley



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1. Position carriage near tension station.
2. Place main electrical disconnect switch in “OFF” position.
3. Loosen timing belt (see 4.5).
4. Remove timing belt (14) from tension station end of carriage (see 4.5.2).
5. Remove mounting screws (62) and lift tension station from end of profile.
6. Separate end plate (50) and tension station sub-assembly from tension housing (43), by pulling end plate straight off of housing (43).
7. Thread tension screws (52) out of tension pulley supports (85) until pulley assembly is removed from adjustment screws.
8. Remove bumper crossbar bolts (41) and remove bumper crossbar (42) from pulley supports.
9. Slide pulley supports (85) from tension pulley assembly (47).
10. Slip pulley supports (85) onto new pulley assembly (47) and install bumper crossbar (41) using socket head cap screws (41).
11. Align center holes located on the back of pulley supports with adjustment screw holes on back plate (50).
12. Thread adjustment screws (52) into pulley supports (approximately 5 threads), by first inserting them through access holes located in end plate (50).
13. Insert tension station sub-assembly into tension station housing (43).
14. Place timing belt around pulley and fasten tension station to end of profile using bolts (62).
15. Reconnect timing belt per instruction in chapter 4.5.

4.10 Double axes

4.10.1 General

Double axes are generally shipped as two single axis assemblies. Link shafts with Servoflex coupling(s) are dismantled for ease of shipping. These couplings allow for misalignment and offset angles between the two axes. The coupling(s) consist of two shell halves and a spring assembly. This spring assembly provides the balance between axial and offset angles. Using an ETP compression bushing in one coupling half provides a method of adjusting carriage position that would otherwise not be possible with a fixed keyway design.

4.10.2 Aligning carriages of double axes < 500

1. Unscrew screws of ETP bushing one turn at a time in sequence until the bushing is completely loosened (counter-clockwise) .
2. Move carriages to a defined position (e.g. to end stop).

Tighten screws of ETP tension bushing in sequence (quarter turn) until torque shown in table below is reached (if possible, use a torque wrench) (see Table 12).

Shaft diameter	Tightening torque Ma
15mm	5Nm
19mm-42mm	8Nm
45mm-65mm	13Nm

Table 12: Torque values for bolts on ETP tension bushings

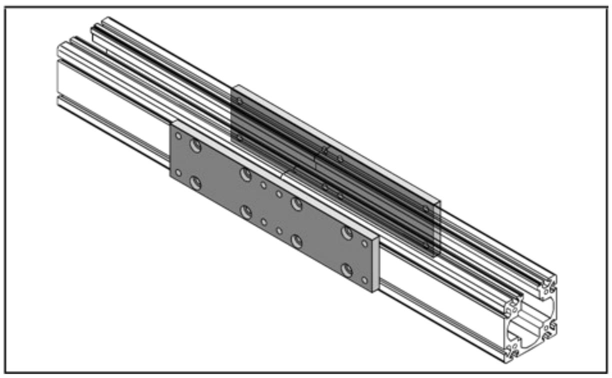
4.10.2 Aligning carriages of double axes > 500

1. Loosen 2 screws at one end of link shaft.
2. Move carriages to a defined position (e.g. to end stop).

Tighten 2 screws previously loosened on linkshaft.

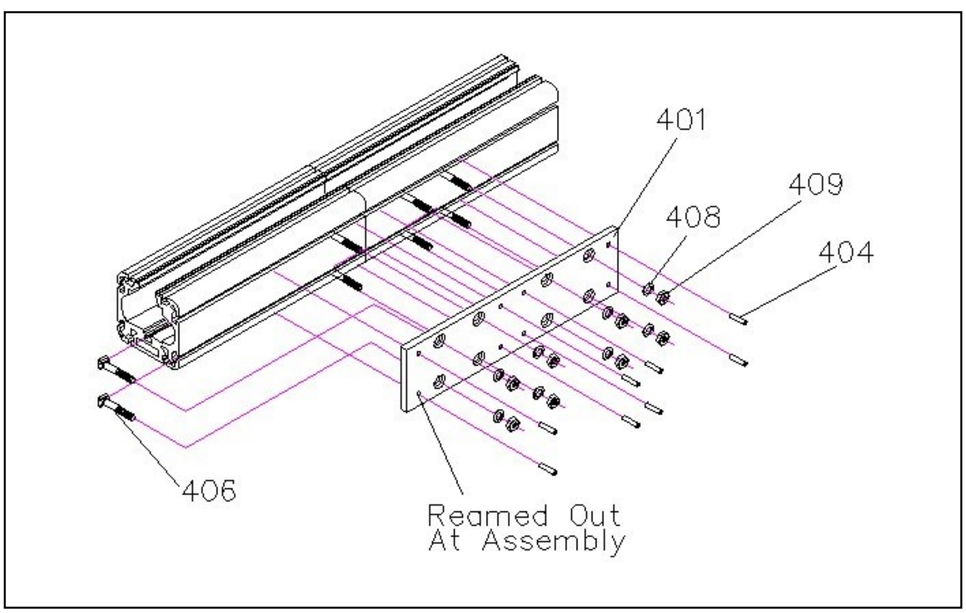
4.11 Long axis

4.11.1 General



- Splice plates are used to lengthen travel or to simplify shipping or installation when access is limited.
- Always design applications to provide support at the splice joint.
- Spliced drive units, unless specified, are always supplied with profile of equal lengths.
- Carriages of extremely long drive units may require a reduction in load and speed (Consult the factory).

4.11.2 Splice plate installation

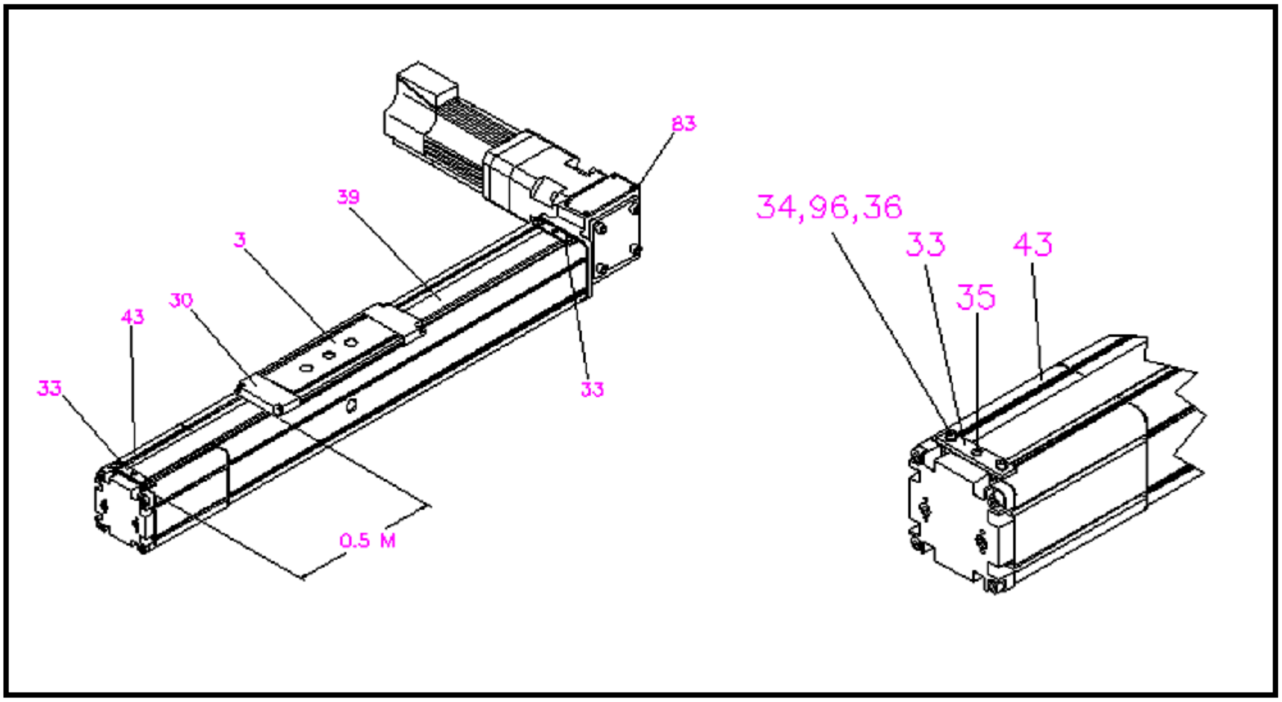


1. Align sections of profile to be spliced.
2. Insert “T”-bolts (406) into “T” slot grooves of profile (4 per profile/side).
3. Position splice plate (401) over “T” bolts (406) and install lock washers (408), and nuts (409).
4. Align profile, checking internal running surfaces. You should not feel any transition at seam.
5. Pin holes located on plate (Qty.8) should align with pre-drilled holes in profile of HLE. Carefully drive pins (threaded portion of pin (404) facing out) into plate and until flush with plate surface.
6. Tighten all nuts (409).
7. Install timing belt and check belt tracking (see 4.5 & 4.5.7).

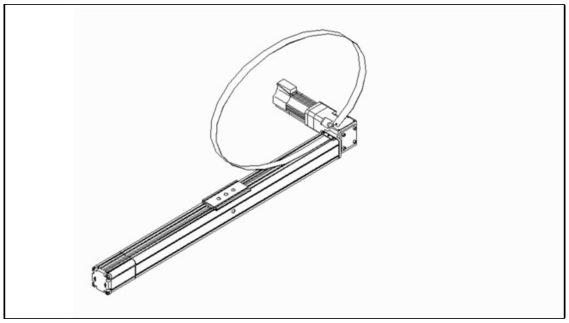
4.12 Steel strip cover Installation and Maintenance

Note	While performing maintenance on drive units equipped with steel strip cover seals, ensure steel strip is never kinked, distorted, or damaged. Damaged strip seals must be replaced.

4.12.1 Steel strip cover removal

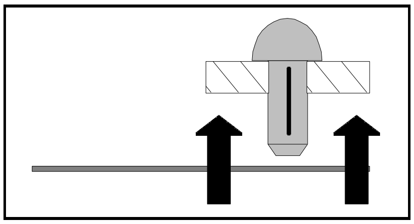


1. Position carriage (3) approx. 0.5m in front of tension station end of unit.
2. Switch off the axis at the main electrical switch.
3. Remove screws (34) and lift strip clamp (33) along with grooved drive stud (35).
4. Remove steel strip from grooved drive stud.
5. Dismantle the wiper covers (30) on both sides of load attachment plate.
   Ensure that wiper (felt) and springs do not fall out of the covers.
6. Pull steel strip (39) through cavity in carriage.
7. Carefully roll up and tape steel strip to top of drive station (see illustration).



4.12.2 Steel strip cover installation

1. Unroll steel strip and feed one end through cavity in carriage. Carefully pull and position steel strip along the entire length of profile. Strip should rest on magnets embedded in profile.

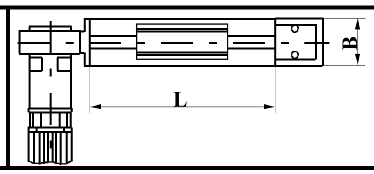


2. Inspect felt seal wiper located within wiper cover (30). Replace if worn or damaged. Bolt wiper cover assembly (wiper and springs) on both sides of load attachment plate (3).
3. Connect seal clamp (33) to steel strip (39) using grooved drive stud (35).
4. Fasten clamps using screws (34).App ly electrical power.
5. Apply electrical power.

Note	Do not strain or attempt to stretch steel cover strip!

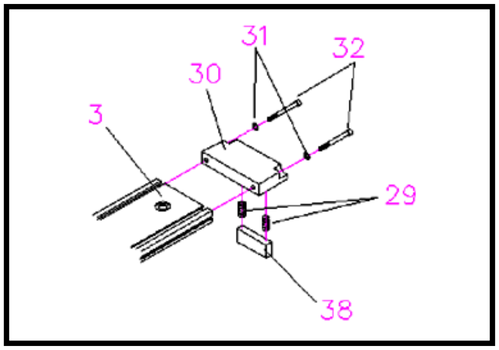
6. Operate drive unit approximately 10 cycles at a low speed (v < 2 m/s), allowing carriage to travel entire length of unit. Check steel strip at leading edge of wiper cover for a possible "wave" to form in direction of movement.
7. If “wave” is present, position carriage 0.5m from tension station (2).
8. Loosen screws (34) of seal clamp (33) at tension station end.
9. Smooth out "wave", but do not strain the strip seal.
10. Tighten seal clamp hardware.

4.12.3 Replacing the steel strip.

Note	Steel cover strip material must be obtained from Parker. Length of profile “L” must be provided when ordering this part, along with cross-section “B” of profile in order to ensure proper size.	

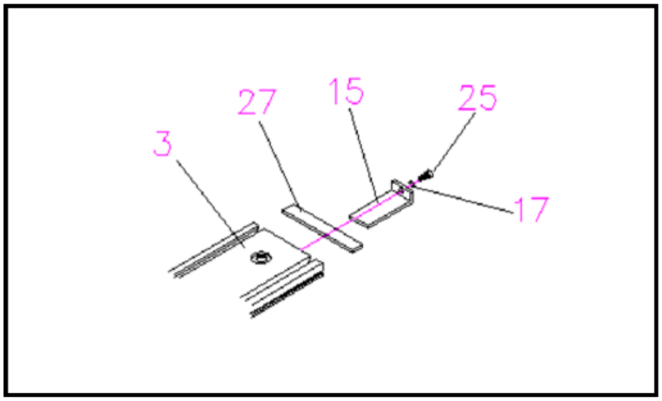
1. Remove steel cover strip (see 4.12.2)
2. Disassemble second strip clamp (33) from profile. Disconnect steel strip from grooved stud (35).
3. Connect grooved drive stud to one end of new steel strip material.
4. Fasten strip clamp to profile.
5. Install steel strip (see 4.12.3)

4.12.4 Replacing wipers.



1. Ensure main disconnect switch is in “OFF” position.
2. Remove wiper cover (30) on both sides of load attachment plate. NOTE: felt wiper is spring loaded within cover.
3. Replace felt wiper (38). Making sure springs (29) do not fall out.
4. Re-install wiper covers (30) on both sides of load attachment plate with existing hardware.

4.12.5 Replacing bearing strip.



1. Remove steel cover strip (see 4.12.2)
2. Apply force to end of bearing strip (27) and slide it out of the side of the load attachment plate.
3. Push new bearing strip in the side of load attachment plate (3). Ensure that steel strip runs over radius provided on bearing strip. Center bearing strip in load attachment plate.
4. Install steel cover strip (see 4.12.3)

4.12.6 Steel cover strip field retrofit.

Note

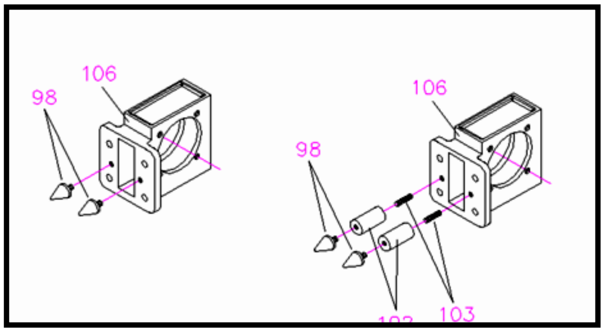
This retrofit will require the following additional parts:

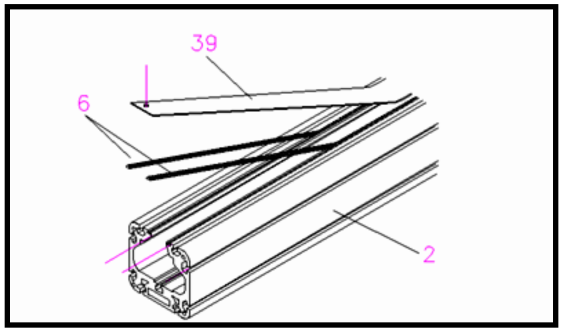
A prepared load attachment plate (groove for cover lead bearing strip, ends threaded for wiper covers), wiper cover assemblies, magnetic strip, steel cover strip, internal bumper extension.

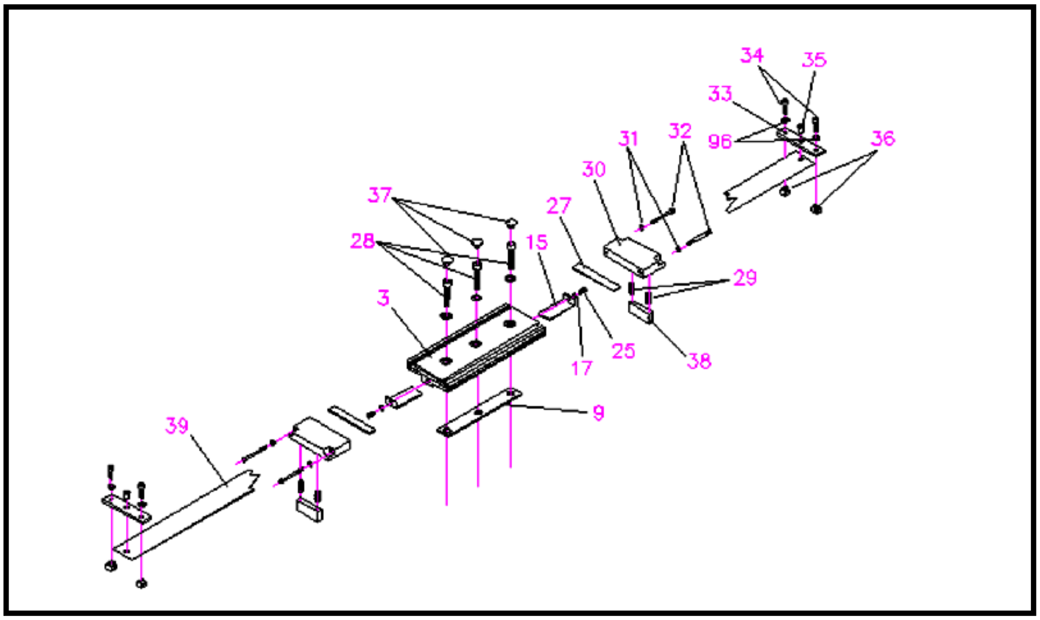
Note

- Will not alter construction height and load connection points will remain unchanged.
- Effective travel will reduce by 90mm.

Retrofit process requires dismantling of the HLE drive unit.







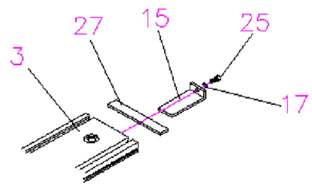
1. Ensure main electrical disconnect switch is locked in the "OFF" position.
2. Loosen timing belt:
   A. Loosen lock-screws (55) located through access hole on end of tension station (turn clock wise).
   B. Loosen belt tension screws (52) approximately 10 turns (counter-clockwise).
3. Remove plastic protective caps (37) embedded in load attachment plate (3), remove screws (28) and lift off load attachment plate.
4. Lift timing belt out of toothed portion of carriage.
5. Clean small dovetail channels that run along each side of open slot of profile (2).
6. Apply Loctite #410 adhesive within channels and insert magnetic strips (39). Press down on magnets to ensure smooth fit. Remove excess adhesive.
7. Place load attachment plate (designed for seal system) on carriage, insert screws (28), centrally align load attachment plate and tighten screws.
8. Reinstall plastic protective caps (37).

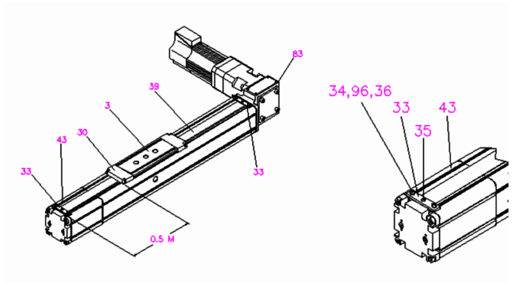
⚠ **Caution**	Secure carriage assembly within profile (tape) to ensure it does not slide out when end housings are removed.

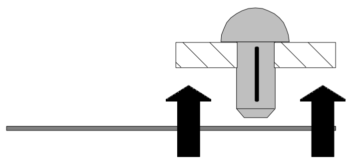
9. Remove mounting screws of drive station housing (106), lift from profile and unthread timing belt from drive pulley (87).
10. Remove rubber bumpers (98) and install extension stand-offs (102, 103).

11. Installing bumper extension:
    Apply Loctite to set screw (103) and screw half its length into extension standoff (102).
    Clean threaded portion of rubber bumper, apply Loctite and screw into other end of stand-off.
    Apply Loctite to exposed portion of set screw and thread assembly into tension station. Using pliers, grip stand-off and tighten. Repeat this step for second bumper assembly.
12. Insert four "T" nuts (36, two per slot, for seal clamp 33) into the two "T" slot grooves located on top of profile.
13. Slide two of these "T" nuts (one per slot) down the length of profile (2) until they rest against tension station end plate (50).
14. Thread timing belt around drive pulley and secure drive station to profile using screws (100) and new Schnorr lock washers (101).

Note	Rubber bumpers are equipped with a metal (2 mm thick) base. The threaded portion of bumper is glued in with Loctite.







15. Disassemble timing belt retaining bracket (15) from previous load attachment plate.
16. Locate the cavity between carriage and load attachment plate, at one end of carriage. Insert timing belt into cavity (6 teeth for HLE100). Slide timing belt retaining bracket (15) along backside of timing belt, into cavity. Fasten using screw (25). Repeat this step for other end of carriage.
17. Tension timing belt (see 4.5)
18. Check timing belt tracking (see 4.5.7)
19. Set reference point (see 4.6.7)
20. Insert bearing strip (27) according to chapter (see 4.12.6). NOTE: Position radius up toward seal strip.
21. Clean magnetic strip.
22. Carefully push steel cover strip through cavity in load attachment plate and allow it to rest on to the magnetic material imbedded within HLE profile. Cover strip and HLE profile are same length.
23. Insert grooved drive stud (35) through strip clamp (33) and into hole in seal strip for clamp to be fastened at drive station end of unit.
24. With "T" nuts (one in each of the two "T" slot grooves on top of profile) secure seal clamp with the steel strip using screws (34) into "T" nuts and push clamp against drive housing.
25. Place two springs (29) and one felt wiper (38) in each wiper cover housing (30).
26. Secure both wiper cover assemblies to the end of load attachment plate (3).
27. Continue seal strip assembly in accordance with chapter 4.12.3.

5 Replacement parts

5.1 Replacement parts HLE100 SR

Item	Description	Design Style				Unit	Part Number
		NL	VL	NL D	VL D		
14	**Timing belt 25 AT 10 HPF**	Length L see chapter 4.5.2				m	420-000016
16	**Linear bearing block**	2	2	4	4	pieces	003-2503-01
18	**Steel square rail (25 mm wide)**	Profile Length				m	100-3582-01

Table 1: HLE 100 SR

Item	Description	Design Style				Unit	Part Number
		NL	VL	NL D	VL D		
607	**Cover lead bearing strip**	2	2	4	4	pieces	125-069700
616	**Felt wiper**	2	2	4	4	pieces	180-300060
615	**Wiper pressure springs**	4	4	8	8	pieces	003-3504-01
130	**Steel strip 0.125 x 38**	Length: see Chapter 4.12.4				m	400-300702
131	**Magnetic strip**	2 x length: see Chapter 4.12.7				m	400-300712

Table 2: HLE100 SR, steel-strip cover option

Pulley HLE100 SR	Bore size [mm]	Part number
Tension station (complete)	32	002-1648-01
Pulley by Drive Option, Where used		
AOHLE100SR-SP1, DA-HLE100SR-G500, DAHLE100SR-LE500, WR/LO-HLE100SR, WBO-HLE100SR	20	420-100103
AW-HLE100SR-DP1	20	420-100103 (pinned)
AO-HLE100SR-SP2, MB-HLE100SR	25	420-100105
AW-HLE100SR-SP2	25	420-100105 (pinned)
Tension Station Pulley	32	420-100112

Table 3: Pulley HLE100 SR

Notes

EM Sales Offices

Australia

Parker Hannifin (Australia) Pty Ltd.
9 Carrington Road
Castle Hill NSW 2154
Australia
Tel: +61 (0) 2 9634-7777
Fax: +61 (0) 2 9634 3749

Brazil

Parker Hannifin Ind. Com Ltda.
Av. Lucas Nogueira Garcez 2181
Esperança
12325-900 Jacarei, SP
Tel: 12 3954 5100
Fax: 12 3954 5262
Email: automation.brazil@parker.com

Canada

Parker Hannifin (Canada) Inc.
160 Chisholm Dr
Milton, Ontario L9T 3G9
Tel: 905-693-3000
Fax: 905-876-1958
Email: miltoncustservice@parker.com

China

Parker Hannifin Motion & Control
(Shanghai) Co., Ltd
280 Yunqiao Rd. Jin Qiao Export
Processing Zone
Shanghai 201206, China
Tel: (86-21) 50312525
Fax: (86-21) 64459717

France

Parker SSD Parvex
8 avenue du Lac
B.P. 249
F-21007 Dijon Cedex
Tel: +33 (0) 3 80 42 41 40
Fax: +33 (0) 3 80 42 41 23

Germany

Electromechanical Europe
Parker Hannifin GmbH & Co KG
Robert-Bosch-Strasse 22
D-77656 Offenburg
Germany
Tel: +49 (0) 781 509 0
Fax: +49 (0) 781 509 98176

India

Parker Hannifin India Pvt. Ltd
Automation Group-SSD Drives Div.
133 & 151 Developed Plots Estate
Perungudi, Chennai 600 096
Tel: 044-4391-0799
Fax: 044-4391-0700

Italy

Parker Hannifin SpA
Via Gounod 1
20092 Cinsello Balsamo
Milano, Italy
Tel: +39 02 361081
Fax: +39 02 36108400

Korea

Parker Hannifin Korea
9th Floor KAMCO Yangjae Tower
949-3 Dogok 1-dong Gangnam-gu
Seoul 135-860, Korea
Tel: 82-2-559-0454
Fax: 82-2-556-8187

Mexico

Parker Hannifin de Mexico
Eje uno Norte No.100
Parque Industrial Toluca 2000
Toluca, CP 50100 México
Tel: 52-722-275-4200
Fax: 52-722-279-0316

Singapore

Parker Hannifin Singapore Pte Ltd
11, Fourth Chin Bee Road
Singapore 619702
Tel: (65) 6887 6300
Fax: (65) 6265 5125/6261 4929

Taiwan

Parker Hannifin Taiwan Co., Ltd
No. 40, Wuchiuan 3rd Road
Wuku Industrial Park
Taipei County, Taiwan 248
ROC
Tel: 886 2 2298 8987
Fax: 886 2 2298 8982

Thailand

Parker Hannifin (Thailand) Co., Ltd.
1023, 3rd Floor, TPS Building,
Pattanakarn Road,
Suanluang, Bangkok 10250
Thailand
Tel: (66) 02717 8140
Fax: (66) 02717 8148

UK

Parker Hannifin Ltd.
Tachbrook Park Drive
Tachbrook Park
Warwick CV34 6TU
Tel: +44 (0) 1926 317970
Fax: +44 (0) 1926 317980

USA

Parker Hannifin Electromechanical Automation Division Main Office/ Compumotor/CTC
5500 Business Park Drive
Rohnert Park, CA 94928 USA
Tel: 707-584-7558
800-358-9070
Fax: 707-584-8015
Email: emn_support@parker.com

Parker Hannifin Electromechanical Automation Division/Daedal
1140 Sandy Hill Road
Irwin, PA 15642
Tel: 724-861-8200
800-245-6903
Fax: 724-861-3330
Email: ddlcat@parker.com