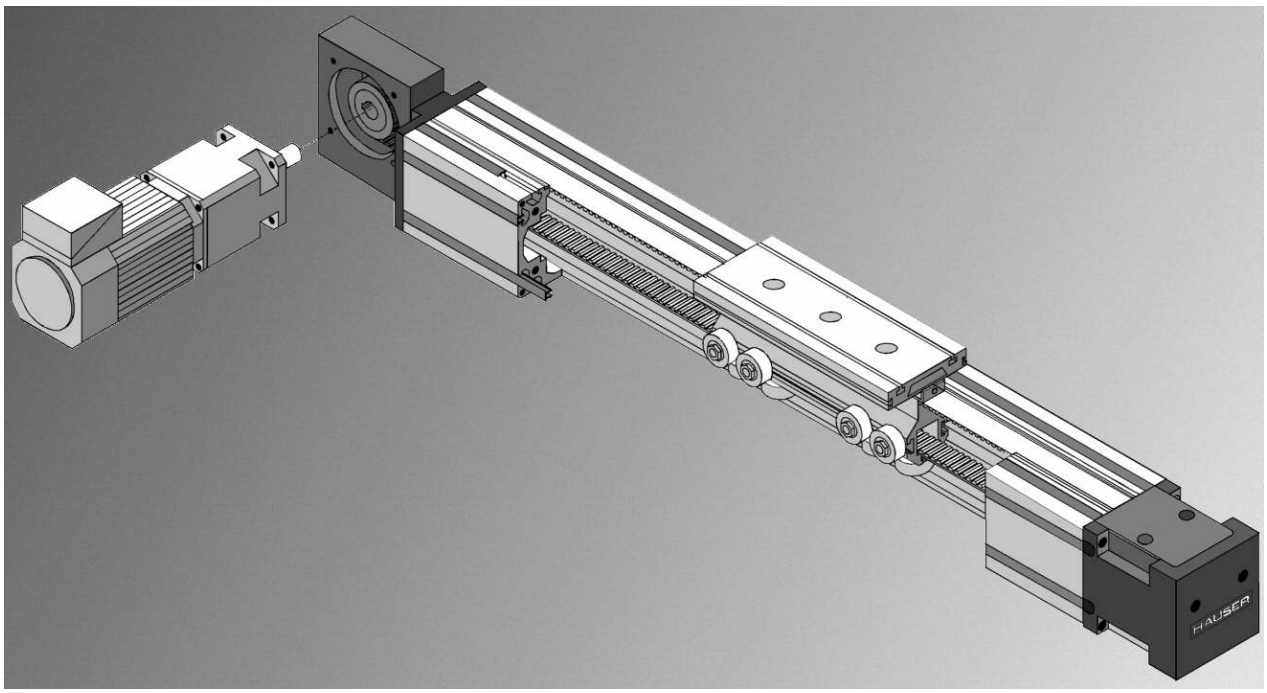
HLE-c Series Linear Drives

Installation, Operation, Maintenance and Repair Manual

Manual No. 100-9310-01 Rev. 5



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Jan. 06

REVISION NOTES:

Rev 5 – 01/06/2006

Changed revision code from letters to numbers
pg 51: Part #s, items #s, quantities, descriptions
pg 52: Part #s, items #s, quantities, descriptions
pg 53: Part #s, items #s, quantities, descriptions
pg 54: Part #s, items #s, quantities, descriptions
Last page: Deleted the index

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 devices 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 more 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 da-m-age 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 external 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

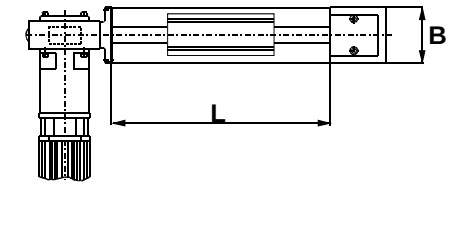
Danger	When lifting, stand clear of suspended load(s)! Ensure parts subject to movement do not move off-center or shift out of position.

Caution	When transporting long axes, 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 HLE product can be made as follows:

- Measure length L of aluminum profile and read reference value for the weight from table below (see **Figure 1**).



B=80mm ⇒ HLE80c
B=100mm ⇒ HLE100c
B=150mm ⇒ HLE150c

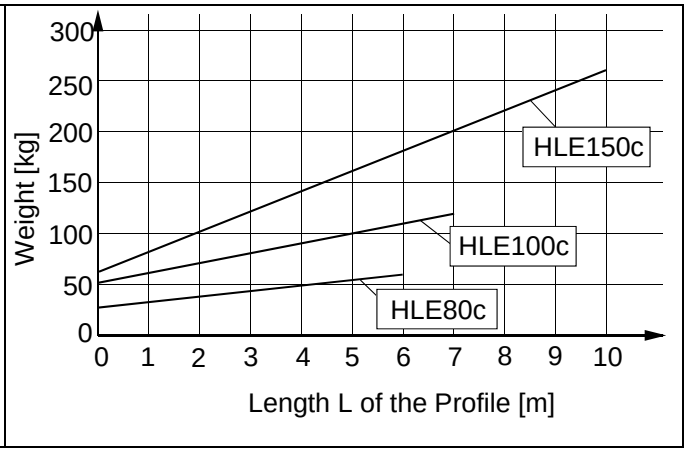
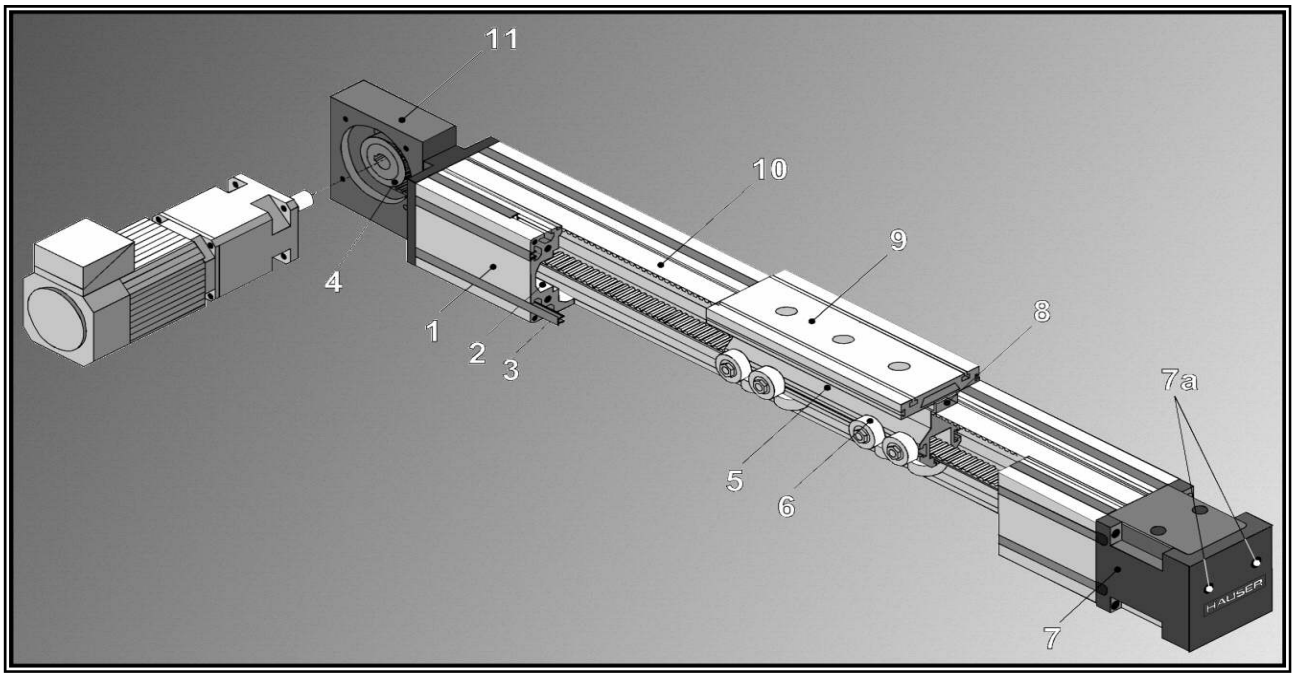


Figure 1: Reference values for HLE transportation weight (with motor and gearbox)

2 Technical data

2.1 HLE - c - RB Product construction and description



Aluminum profile (1)

Main body of drive unit incorporates 8 integral “T” slots. All profiles are made of Aluminum and are anilite coated.

Running surfaces (2)

Extruded internal channels (Qty.3), provides guidance system for carriage wheels (6).

Plastic “T” Slot cover (3)

Protects “T” slot from dirt. Contains wiring, when “T” slots are used as conduit.

Flanged Drive Pulley (4)

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

Carriage (5)

Positioned by the timing belt and supported by wheels (6), the carriage rigidly pilots the load using guides (2) within the profile.

Wheels (6)

Totally enclosed, permanently lubricated ball bearings with polymer treads in two designs:

Concentric wheel: transfers and supports main load to the aluminum profile

Eccentric wheel: used for adjusting free play between carriage/profile.

Tensioning station (7)

Two tensioning screws (7a), provide timing belt tension and belt orientation between pulley flanges.

Timing belt holding bracket (8)

Secures timing belt between the load attachment plate and carriage. Makes changing timing belt possible without having to dismantle the load attachment plate (9).

Load attachment plate (9)

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

Timing belt (10)

Slip-free polyurethane timing belt re-inforced with inlaid steel-cord. Used to provide power transmission between drive pulley and carriage.

Drive station (11)

Provides flange mounting on both sides of housing and provides 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 a drive pulley through a keyed shaft positioned between ball-bearing sets.

- **Drive and shaft (ALW or ARW)**
Drive pulley mounted to gearbox-driven shaft has a stub shaft supported by bearing set, extends through opposite side of drive housing.

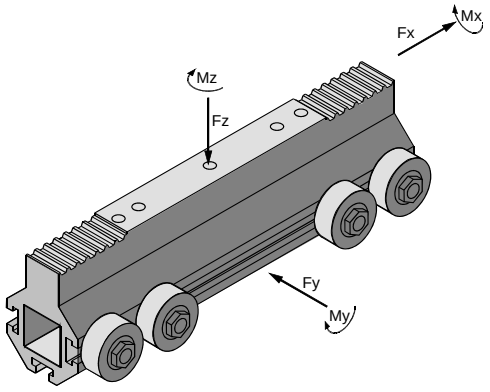
2.2 Technical data

HLE	Unit	80 c		100 c		150 c	
		No Strip Seal	Standard	No Strip Seal	Standard	No Strip Seal	Standard
Dimensions, mass moments of inertia							
Dimensions of base unit, 1m stroke							
Normal carriage NL	kg	15.9	16.6	22.4	23.4	51.6	53.6
Extended carriage VL	kg	17.9	18.7	25.5	26.5	58.8	60.8
Carriage + load attachment plate NL	kg	1.6	1.7	2.7	2.8	7.1	7.2
Carriage + load attachment plate VL	kg	2.6	2.7	4.3	4.4	11.2	11.3
Mass of drive profile	kg/m	7.0	7.1	9.9	10.0	21.1	21.2
Mass moment of inertia related to the drive shaft							
Normal carriage NL	$kgcm^2$	19.8	20.5	25.5	26.9	125.2	127.2
Extended carriage VL	$kgcm^2$	29.3	30.4	37.7	39.0	185.5	187.4
Travel and speeds							
Maximum travel speed[1]	m/s	5.0		5.0		5.0	
Maximum acceleration[1]	m/s^2	10.0		10.0		10.0	
Maximum travel distance, normal carriage NL[2]	mm	5350	5260	6300	6210	9150	9060
Maximum travel distance, extended carriage VL[2]	mm	5200	5110	6150	6060	9000	8910
Geometrical data							
Cross-section	mm x mm	80x80		100x100		150x150	
Moment of inertia I_x	cm^4	152		383		1940	
Moment of inertia I_y	cm^4	177		431		2147	
Modulus of elasticity	N/mm^2	$0.72*10^5$					
Pulley data, torque's and forces							
Travel distance per revolution	mm/rev	190		170		240	
Pulley diameter	mm	60.479		54.113		76.394	
Nominal drive torque	Nm	17.5		15.7		51.4	
Maximum drive torque[3]	Nm	32		40		108	
Nominal belt traction (effective load)	N	580		580		1350	
Max. belt traction[3] (effective load)	N	1058		1478		2827	
Repeatability[4]	mm	±0.2		±0.2		±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.
[4] Repeatability up to ± 0.05 mm.

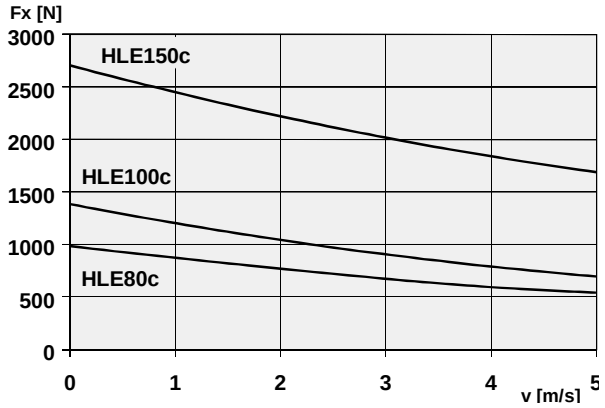
⇨ Technical data as at 01/98, Safety taken into consideration S=1. Data valid for a temperature-range from -10°C to +40°C.

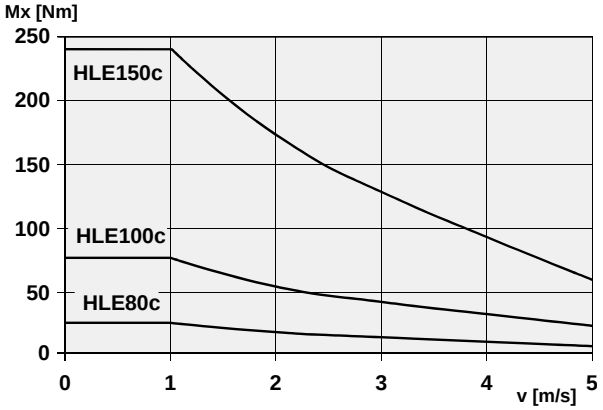
2.3 Carriage loads and timing belt strength

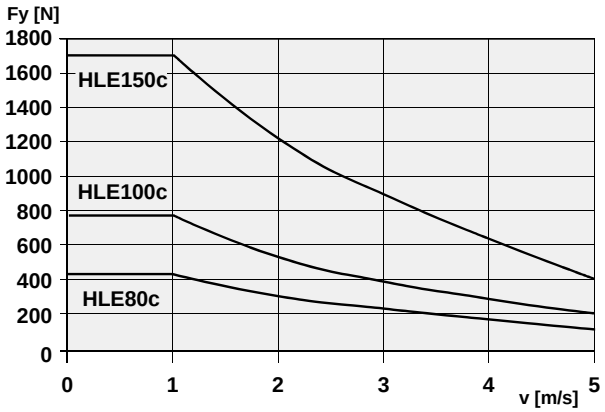


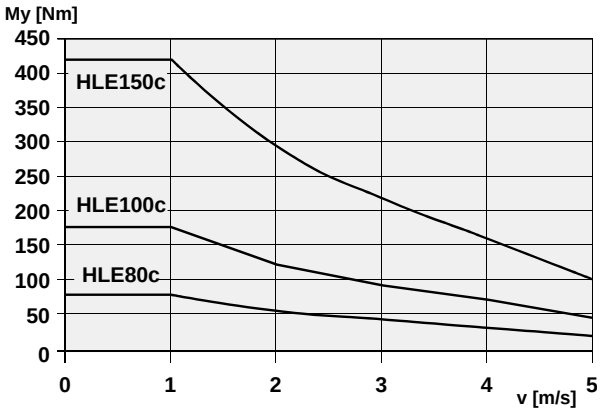
Forces transferred by the carriage and timing belt are speed dependent. Curves shown in graphs are valid for the normal carriage (NL). For extended carriages (VL), all values except for Fx (load capacity of timing belt) can be doubled if the load is applied in pairs or distributed uniformly along length of carriage.

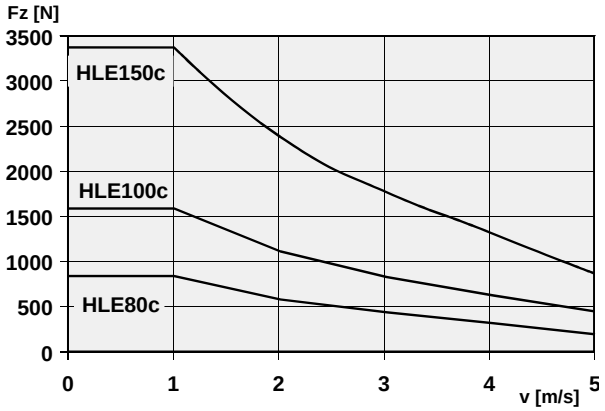
Curves show the maximum load-bearing capacity of a carriage in one direction of force or torque. If several loads are applied from different directions, values stated in the curves **may not be fully exploited**, i.e. the load or speed should be reduced if necessary.

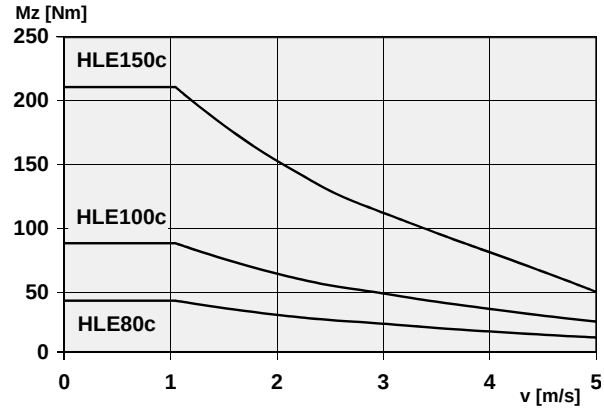






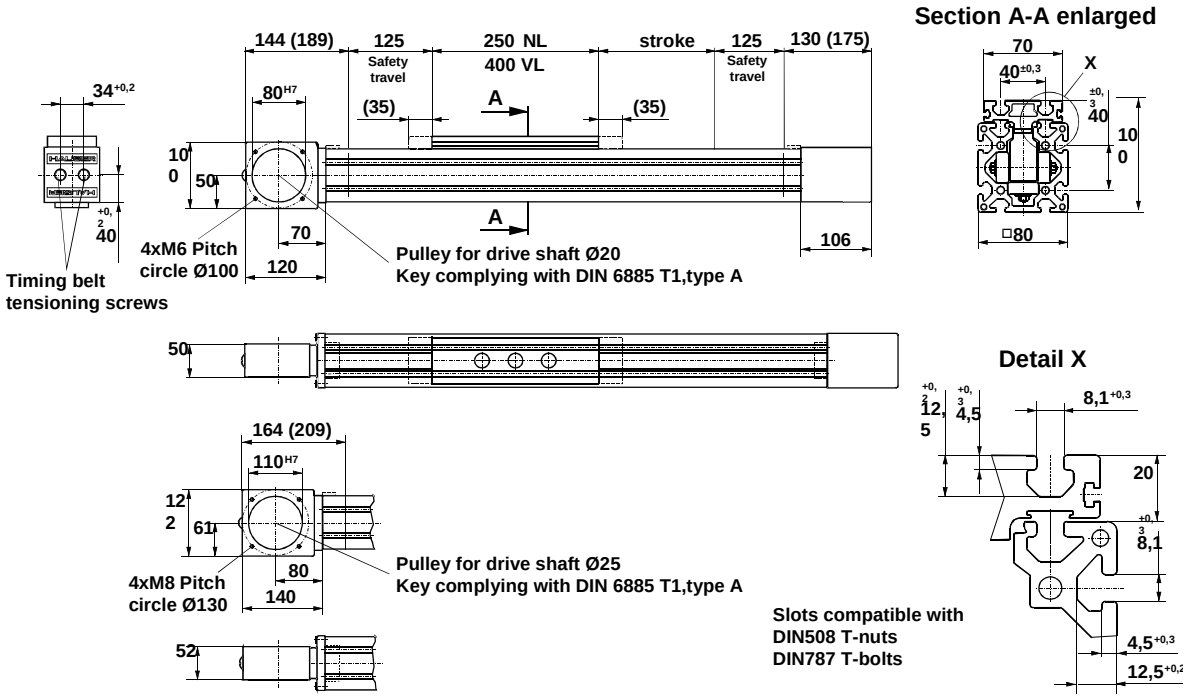




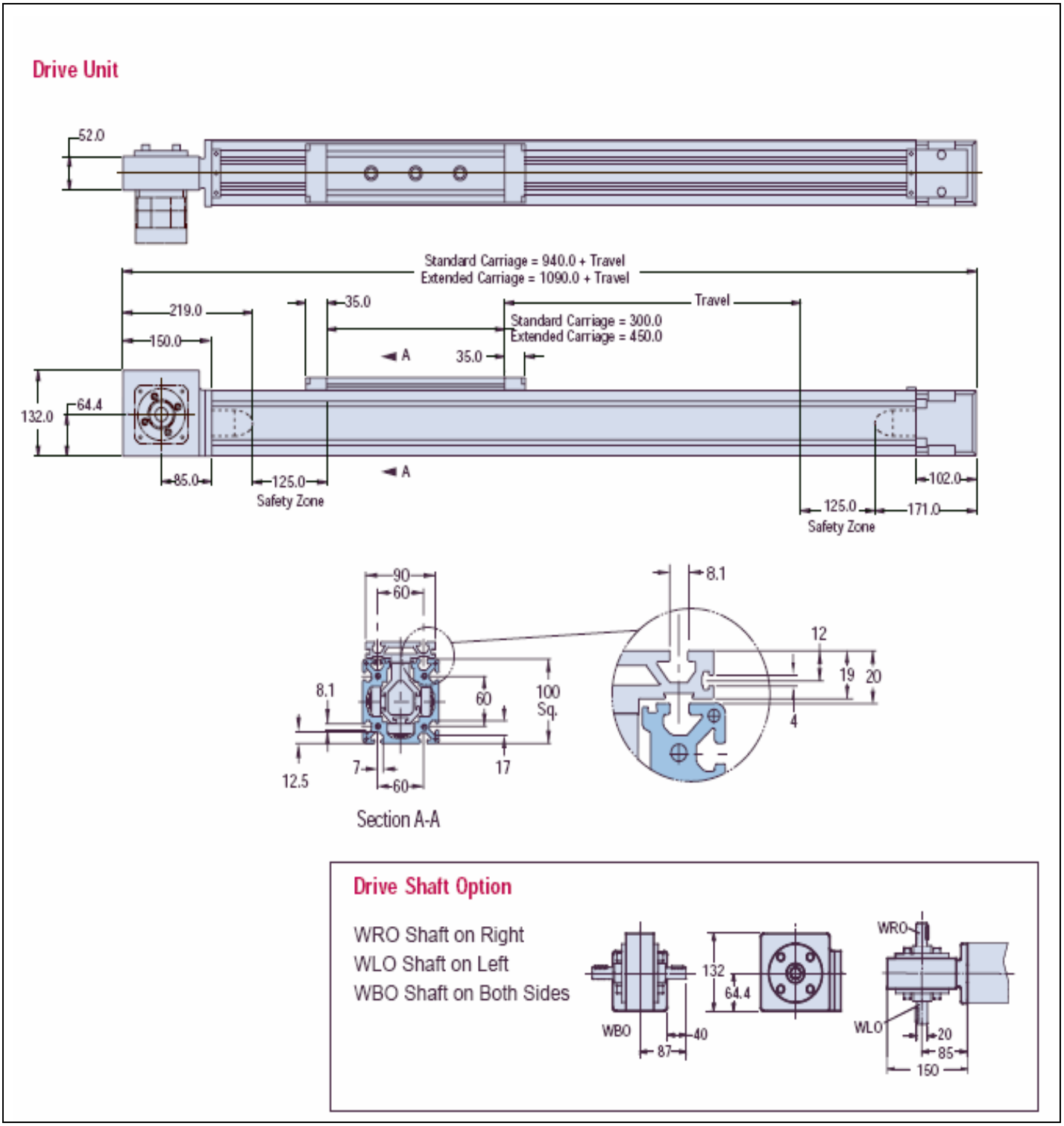


2.4 Dimensions

2.4.1 Dimensions HLE80 c

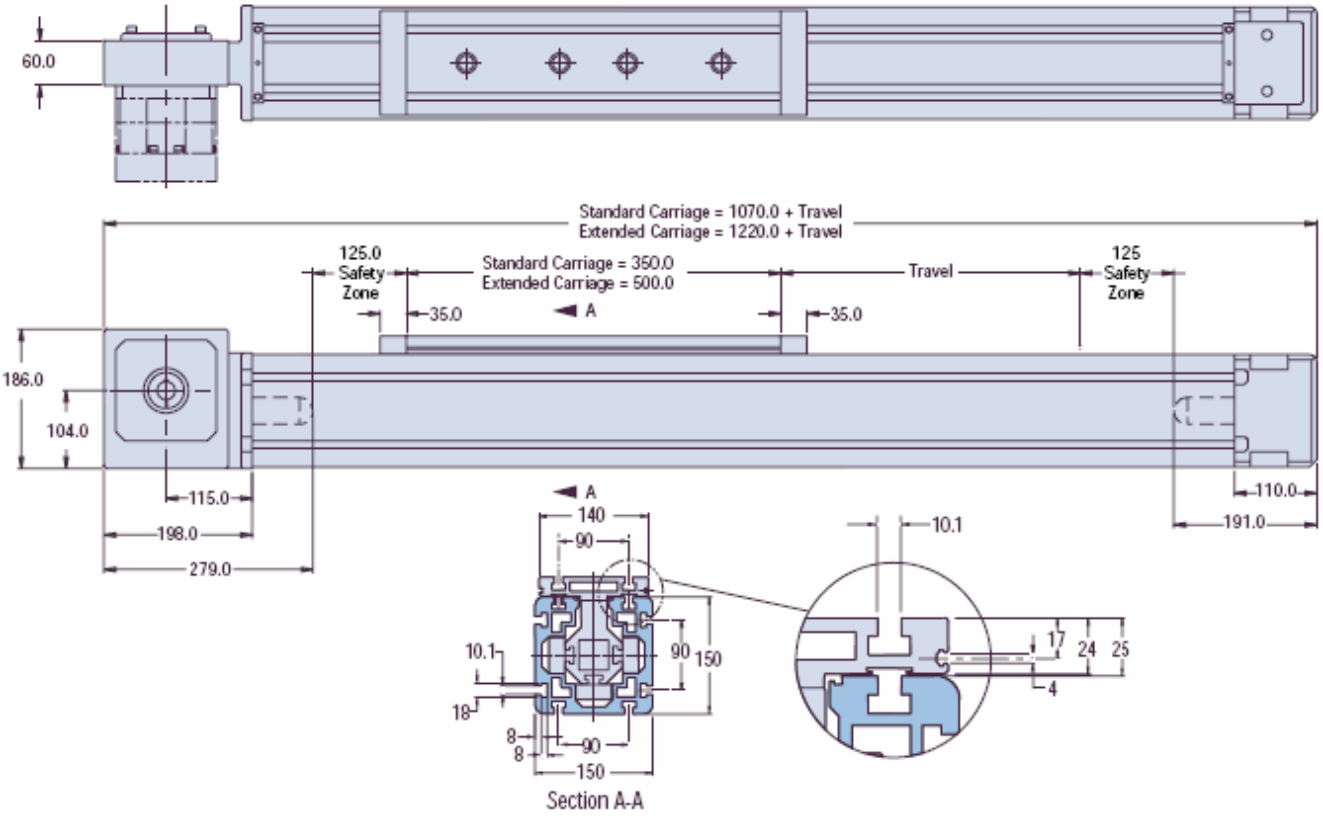


2.4.2 Dimensions HLE100 c



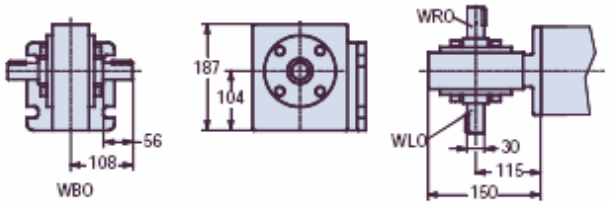
2.4.3 Dimensions HLE150c

Drive Unit



Drive Shaft Option

WRO Shaft on Right
WLO Shaft on Left
WBO Shaft on Both Sides



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 in a dismantled state 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 manufacturer's specifications

Unless otherwise specified, the standard installation of the linear drive is horizontal, with open slot in profile facing up.

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), see Diagram 1
- To simplify leveling, points of HLE drive support can include a series of adapter plates that can be leveled using adjustment jacking screws.

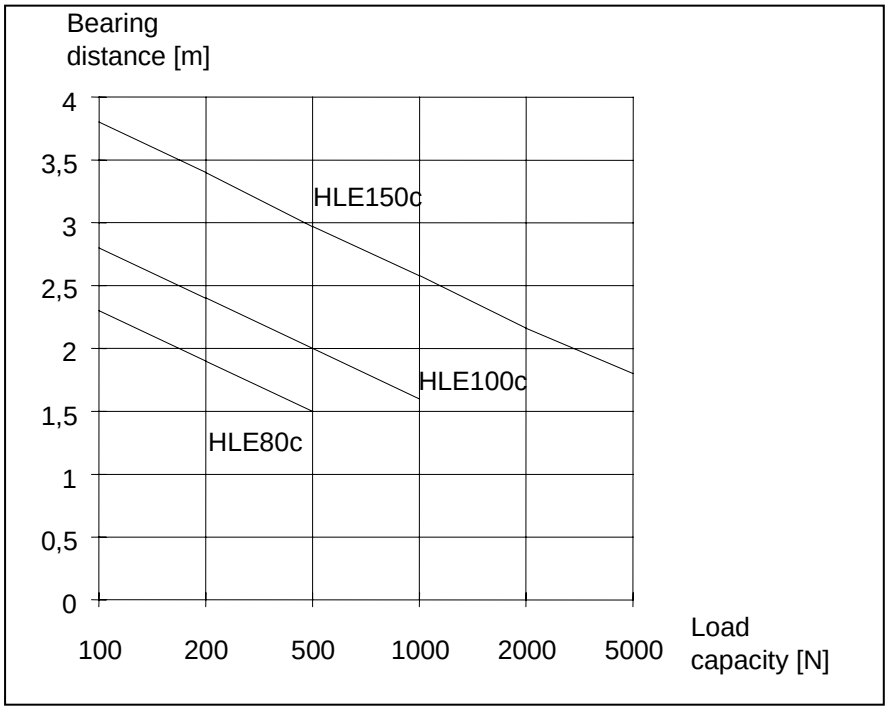


Diagram 1: Ideal distance between supports (Deflection of approx. 1 mm)

3.3 Installation)..

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 maybe used to cover the slot opening to prevent the ingress of 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 drive using clamping profiles within the “T”-slot grooves of profile and 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 and fasten with screws or “T” bolts directly from bottom “T” slots. . Do not drill into profile!
5. Install second drive (non-driven axis) same as in step #4, but do not tighten fasteners.
6. Measure for parallelism (tape measurer) [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 axis to one another (water level, 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.

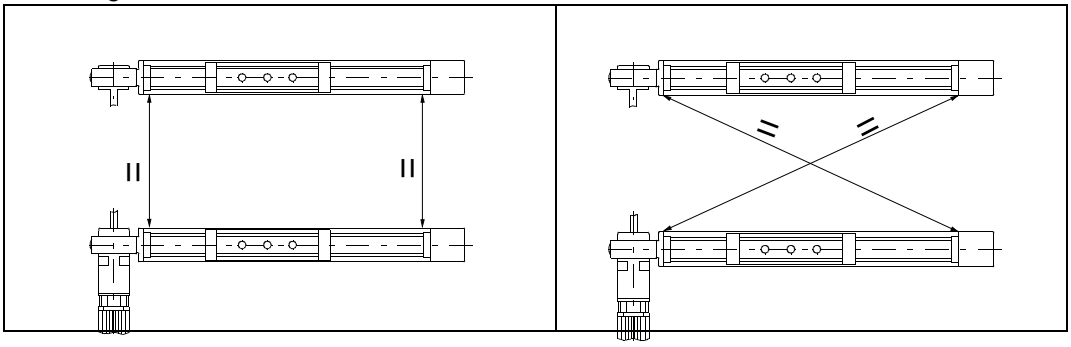


Figure 2: Aligning double axis unit

3.4 Limit Switches/Sensors

3.4.1 General

- HLE's 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.

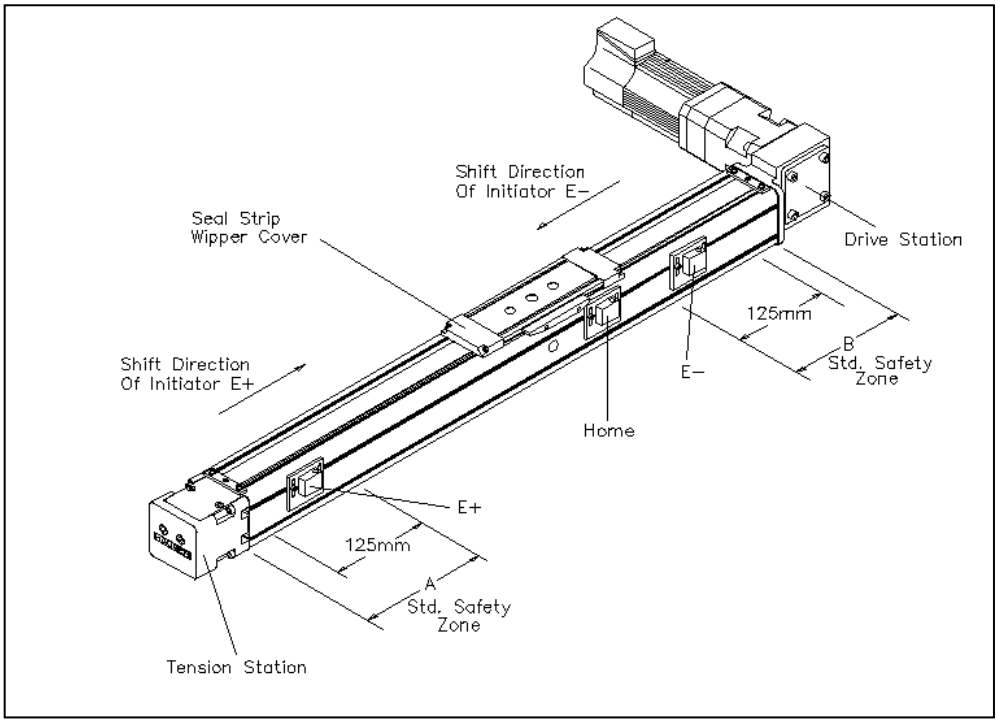


Figure 3: Limit Switches: setting up end of travel limits and safety zones.

Dimen-sions	Unit	HLE without Strip Seal			Standard HLE		
		HLE80c	HLE100c	HLE150c	HLE80c	HLE100c	HLE150c
A	mm	149	149	231	194	194	276
B	mm	149	149	161	194	194	191

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

Setting up the end limits E- and E+

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 plate as shown in 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

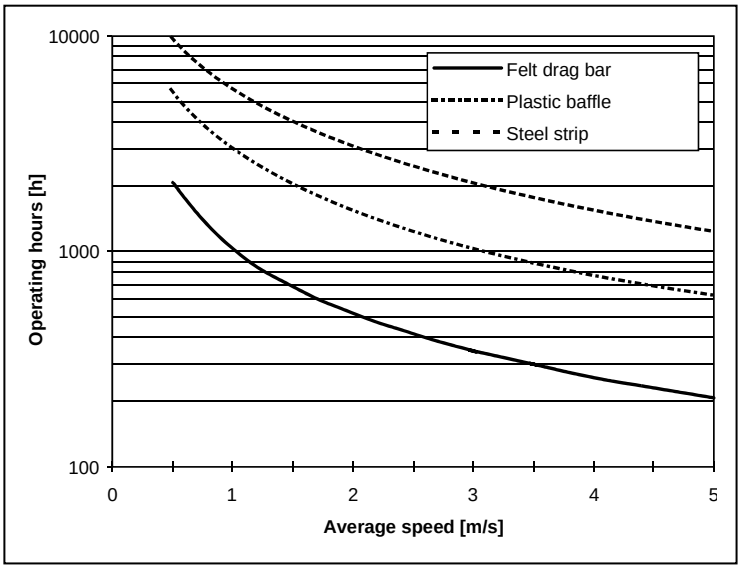
When	What	Action	Removal
After start-up	Carriage	Check carriage side play and wheel adjustment.	Chapter 4.6.1
	Timing belt	Check belt tension, tracking and adjustment.	Chapter 4.5.4 & 4.5.5
One week,	Timing belt	Measure timing belt tension. If tension is less than 0.9 x the operating tension, in-crease 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 slideway, carriage, tensioning station, drive station). In very dirty environments, retrofit with steel strip cover.	Chapter 4.12.7
Every six months	Carriage	Check carriage side play.	Chapter 4.6.1
	Wheels	Check for wear or damage of tread.	Chapter 4.6.2
	Timing belt	Check tension. 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).	Chapter 4.5.4 & 4.5.5

Table 2: HLE maintenance schedule

4.2 Replacement interval for steel strip cover wearing parts

Travel	What	Action	Removal
3750 km	Felt wiper bar	Replace	Chapter 4.12.5
11000 km	Bearing strip	Replace	Chapter 4.12.6
22000 km	Steel cover strip	Replace	Chapter 4.12.3

Table 3: HLE wearing parts with steel strip cover



Using average speeds, the adjacent diagram (Table 3) provides maximum permitted travel per operating hours.

4.3 Abnormal timing belt wear

Several factors can result in abnormal timing belt wear. Determination of the type of belt wear may allow for the specification of a particular cause. The following table shows possible causes for typical cases:

Observation	Probable Cause	Cure
Abnormal wear on belt tooth flank.	Tension too high. Drive torque too high.	Change timing belt, adjust tension (see 4.5.3). Check drive characteristics.
Abnormal wear on belt sides.	Incorrect timing belt tracking. Edge of roller/pulley deformed.	Change timing belt, adjust tension (see 4.5.3). Change belt pulleys.
Shearing of belt teeth.	Tension too low. Overload or system crash.	Change timing belt, adjust tension (see 4.5.3).
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 is too low. Incorrect motor position (bottom) in vertical applications.	Adjust tension to correct value. If possible, have drive on top. Alternative: increase tension or reduce loads in longitudinal direction.

Table 2: Abnormal belt wear

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 refitted and tested prior to placing equipment back in operation.

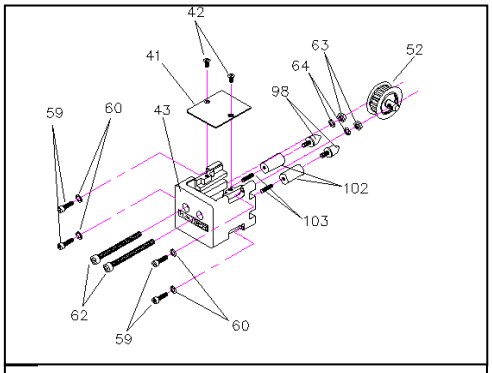
4.5 Replacing, tensioning and aligning timing belts

4.5.1 General information

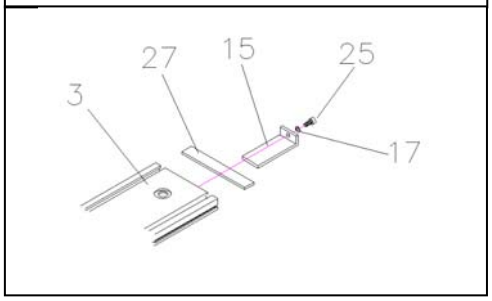
- Unpack new timing belts immediately. Store flat on their side, in a coiled circular shape at room temperature in a dry place.
- Timing belts must not be kinked.
- The pitch of timing belt and mating pulley teeth must be the same.
- Long-term temperatures at a maximum of 178^{o} F (80^{o} C) are permitted.
- 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 …).
2. Steel strip cover removal is optional (see 4.12.2)



3. Loosening timing belt: Remove dust cover (41) from tension station. Loosen lock-nuts (63) Qty.2. Loosen the tensioning screws (62) approximately 10 turns



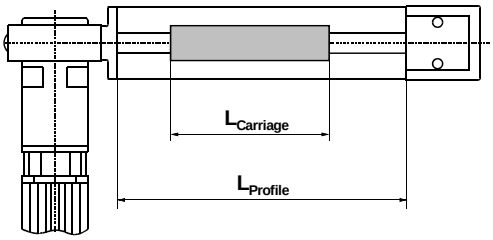
4. Loosen timing belt clamp:

   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.

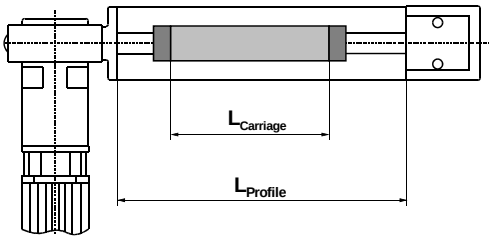
5. Cutting new timing belt to proper length.

Measure profile length and calculate belt length by adding a **correction value** from the table below, or simply measure the old timing belt.

HLE without Strip Cover



HLE with Standard Strip Cover



HLE	80c Standard	80c with PL115 or PLE120/115	100c	150c NL/VL
Correction value	520mm	540mm	547mm	510mm / 530mm

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:

HLE80c: timing belt passes under the carriage.
HLE100c/150c: timing belt passes through cavity in carriage.

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 for HLE80, and 7 teeth for HLE100/150). Slide timing belt retaining bracket (15) along back side of timing belt, into cavity, and shim with spacer bracket. Fasten both using screws (25).
8. Tension timing belt: chapter 4.5.4.
9. Check tracking, and align belt: chapter 4.5.7.
10. **Tighten lock nuts (63), after all adjustments are made.**
11. Fasten dust cover (41).
12. If steel strip cover was removed, re-install: (see 4.12.3).
13. 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 moved and forces required to move that load. Do not exceed tension 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 will lose approximately 20% of their tension. Therefore, tension must be compensated for, by adjusting to 1.25 times greater than the operating tension. This tension is defined in Table 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	30,000 hours	7,000 hours
Average speed	1 m/s	2 m/s

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 between upper and lower belt runs rub during operation. Tension must be in-creased in stages until the belt teeth no longer touch. Never exceed the **maximum torque values** shown in Table 5.

For double axes, and if the load is shared equally between axes, total belt ten-sion for each drive can be cut in half.

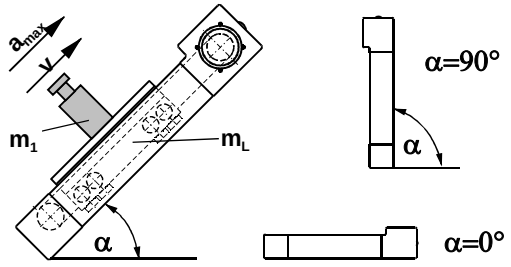
If timing belt tension of drive unit drops below 0.9 x operating tension, after one week of operation, belt tension should be increased to 1.1 x operating tension (Table).

Note	HLE drives supplied with gearboxes or drive stations with bearing sets will have pre-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
80c	90mm/92mm	580	810	715	650	780	1090	960	870
	PLE80/90	400	560	495	450	630	870	770	700
	115mm	580	810	715	650	780	1090	960	870
	PLE120/115	580	810	715	650	780	1090	960	870
	Shaft Option[1,2,3,4 & 6]	580	810	715	650	780	1090	960	870
100c	90mm / 92mm	580	810	715	650	780	1090	960	870
	PLE80/90	400	560	495	450	630	870	770	700
	115mm	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
150c	115mm	1350	1875	1650	1500	1620	2250	1980	1800
	PLE120/115	900	1250	1100	1000	1350	1875	1650	1500
	142mm	1350	1875	1650	1500	1620	2250	1980	1800
	U35	1350	1875	1650	1500[1]	1440	2000	1760	1600
	Shaft Option	1350	1875	1650	1500	1620	2250	1980	1800

Table 5: Recommended and maximum timing belt tension.

Determining force Fx



Stationary load:

Fx = F_{static}

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

If load is in acceleration /deceleration:

Fx = $F_{static} + F_{dynamic}$

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

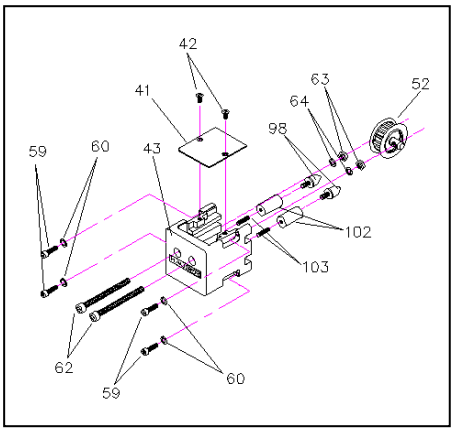
$F_{dynamic} = (m_L+m_1) * a_{max}$

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/s²]

[1] WRO = shaft right
[2] WLO = shaft left
[3] WBO = shaft both sides
[4] MBR = motor block right
[6] MBL = motor block left

<<<Shaft Options.

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.
3. If timing belt tension is less than 0.9 x operating tension, shown in Table 5, re-adjust belt to correct value. Remove dust cover (41) from tension station and loosen lock-nut (63) Qty.2.
4. Adjusting belt tension:
   clockwise rotation of adjustment screws (62) will increase belt tension. Screws should be adjusted equally.
5. 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 RSM (+/- 5% accuracy).

Belt tension measuring device RSM

The RSM belt tension measuring device calculates the oscillation frequency of the 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 Daedal (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 (62).

Based on a required timing belt tension, a tightening torque for the tensioning screws (62) is given and can be set using a torque wrench. However, 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.

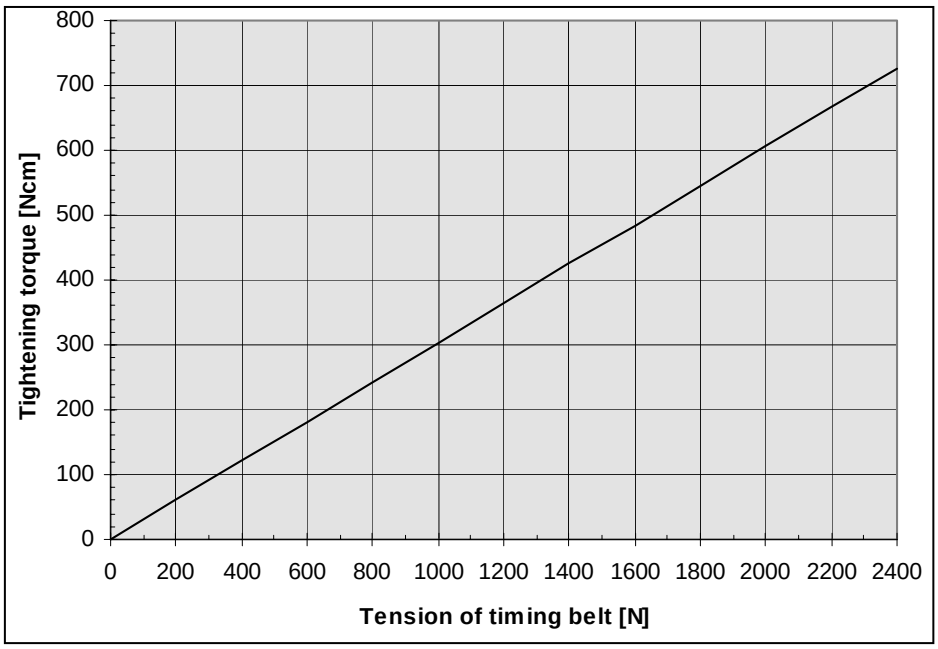
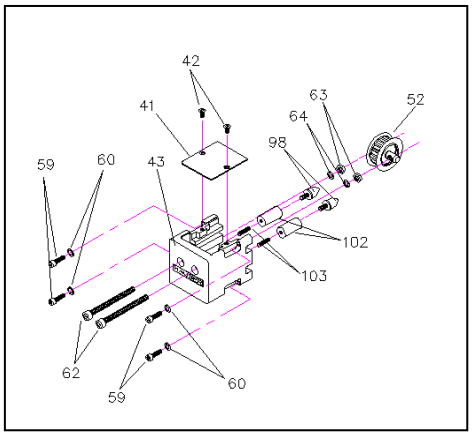


Diagram 2: Torque readings and resultant timing belt tension.

NOTE: Divide Ncm by 11.29 to get value in in-lbs

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 timing belt oscillates between tension station pulley flanges, but does not attempt to ride up on the sides of the flanges.

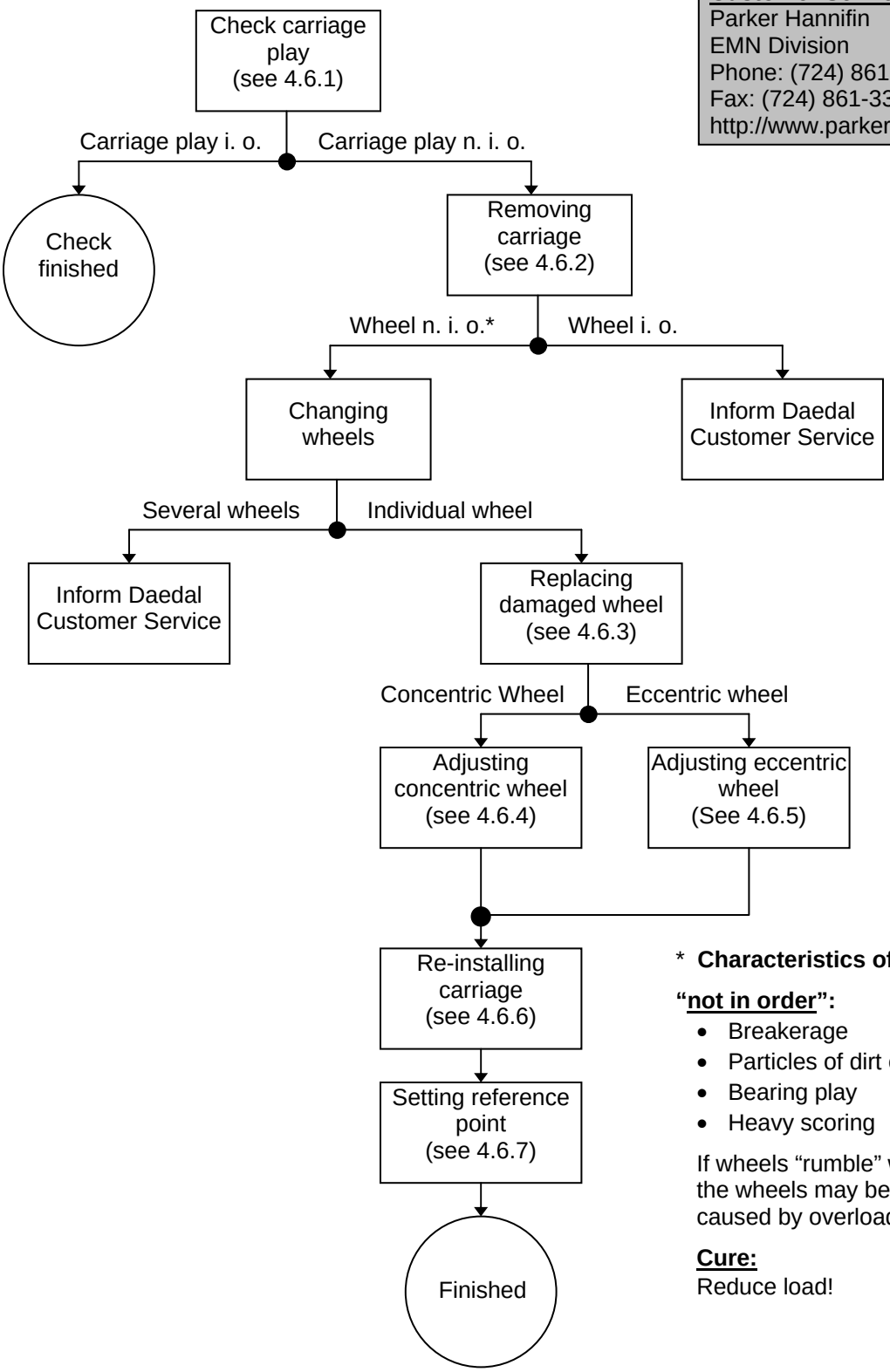


1. Remove dust cover (41) from tension station.
2. Check operation of belt by moving the carriage (manually, if possible - or electrically at reduced speed). If belt operation is correct according to the above mentioned definition, replace dust cover (41).
3. If not: loosen lock-nut (63). Rotate tensioning screw (62) 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-nuts (63) and replace dust cover (41).

4.6 Adjusting carriage play

Changing and/or adjusting wheels (flow chart)

Customer Service
Parker Hannifin
EMN Division
Phone: (724) 861-8200
Fax: (724) 861-3330
http://www.parkermotion.com



* **Characteristics of a wheel**

"<u>not in order</u>":

- Breakerage
- Particles of dirt embedded in tread
- Bearing play
- Heavy scoring

If wheels "rumble" when in motion, then the wheels may be deformed. This is caused by overloading the carriage.

<u>Cure:</u>
Reduce load!

<u>Key:</u>
i. o.: in order
n. i. o.: not in order

4.6.1 Checking carriage play

Note	The carriage should be stiff within the profile. 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 improper adjustment or worn carriage wheels:

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 timing belt is disconnected from carriage, it will fall due to gravity if not supported. This can result in damage to people or property.

4. While looking at the carriage wheels, push the carriage over the complete travel. All wheels must turn during travel.
5. To check wheel pressure acting against profile guides; prevent wheels from turning using your index finger; wheels should stop rotating when applying minimal force against them.

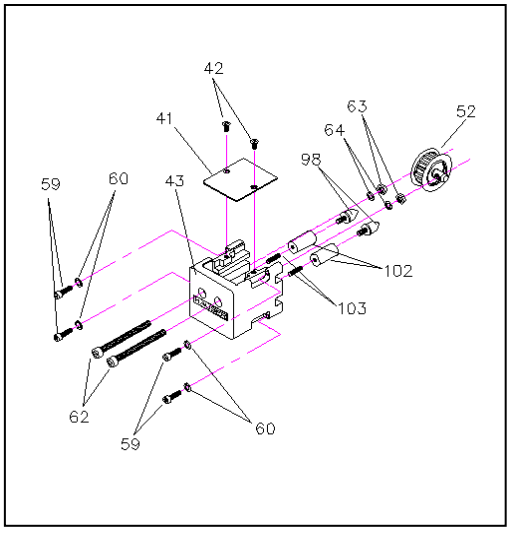
Carriage wheels are properly adjusted when:

- Carriage no longer shakes.
- Carriage can move over entire travel length with little difference in force applied.
- Carriage can be inserted into end of profile with smooth, light, even pressure (requires dismantling of the tensioning station from end of profile, see below)

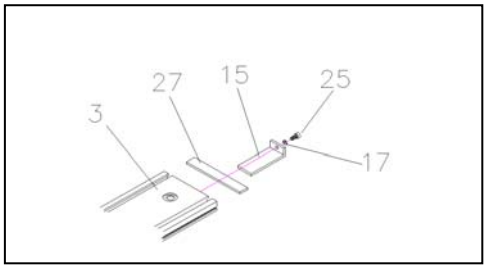
Note	Eccentric wheels adjusted too tightly develop pressure marks which lead to running noise and wheel defects. Replace defective wheels (see below).

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).



3. <u>Slackening the timing belt</u>:
   Remove dust cover (41) from tension station.
   Loosen lock-nuts (63).
   Loosen tensioning screws (62) approximately 10 turns.



4. Loosen the 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. Remove tension station hold down screws (59) Qty.4, and lift tension station from profile.
6. Pull carriage out through end of profile. Mark carriage with arrow (felt pen), so the carriage can be re-inserted in the same direction.

Note	When carriage is re-inserted into profile after adjustments are made, it must be inserted in the same direction (not rotated) or wheel adjustment may be incorrect.

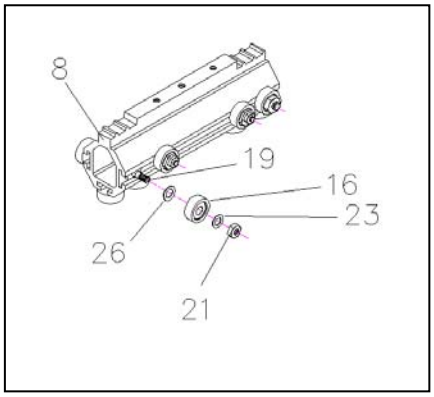
4.6.3 Changing individual wheels

General

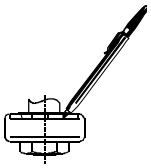
- The wheels consist of ball bearings with composite or polyamid tread.
- If the carriage remains stationary for long periods of time, flat spots can develop on the treads and create noise. Flattened tread areas will disappear once the carriage is put back in operation.
- The ball bearings are sealed and permanently lubricated. No additional lubrication is required.
- Carriage wheels can withstand environmental temperatures between 40°F (-40°C) to 178°F (+80°C).

Warning	If checking for wheel 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).

4.6.4 Changing and/or adjusting concentric wheel



1. Remove carriage (8) from profile (see 4.6.2)
2. Mark position of wheel (16) on carriage (felt pen).
3. Remove hex nut (21).
4. Slip old wheel off axle, replace with new, and position (slide within “T” slot) to mark on carriage.
5. Thread on hex nut (21) with screw retention (Loctite 243) and tighten to torque **Ma** provided in Table #6 on page 27.
6. Mark wheel tread with black felt pen to improve visibility of rolling movement of wheel.



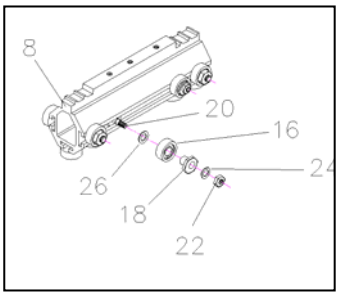
7. Clean inside of linear drive profile.

8. Check for arrow mark on carriage and insert into profile, in the correct orientation. Push carriage and check wheel adjustment along the length of the travel. Wheels should rotate along entire travel.

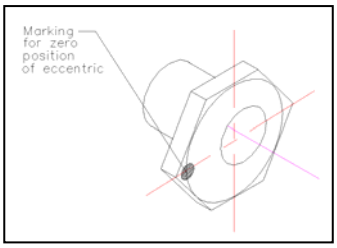
Note	When removing carriage play, adjust only replaced wheels first. If play still exists, then all carriage wheels must be re-adjusted.

9. Check wheel pressure acting against profile guides; prevent wheels from turning using your index finger; wheels should stop rotating when applying minimal force against them.

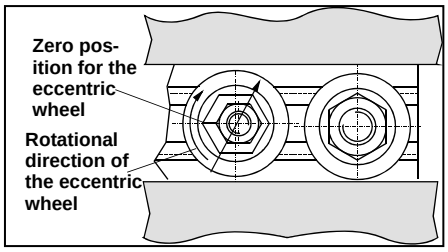
4.6.5 Changing and/or adjusting eccentric wheel



1. Remove carriage (8): (see 4.6.2)
2. Mark position of wheel on the carriage (felt pen).
3. Remove hex nut (22), and schnorr lock washer (24) from axle (20).
4. Remove old wheel and press out eccentric bushing (18).
5. Press bushing (18) into new wheel, and slide onto axle (20) with hex on bushing facing outward. Insert new schnorr lock washer (24), and hex nut (22) . Correct the position of wheel on carriage. Slightly tighten the hex nut (22).



6. Align position of eccentric bushing so that on rotating the eccentric bushing (18) clockwise, the wheel marking is on the same side as the old wheel was, prior to dismantling.



7. Tighten hex nut (22) using torque requirements **Ma** provided in Table #6.
8. Mark wheel tread with black felt pen to improve visibility of rolling movement of wheel.
9. Clean inside of linear drive profile.
10. Check for arrow mark on carriage and insert into profile, in the correct orientation. Push carriage and check wheel adjustment along the length of the travel. Wheels should rotate along entire travel.

Note	When removing carriage play, adjust only replaced wheels first. If play still exists, then all carriage wheels must be re-adjusted.

11. Adjust hexagon portion of eccentric wheel bushing in small stages until the carriage can be pushed freely and without play through the HLE profile. Eccentric wheels that are adjusted too tightly develop pressure marks on their treads, which can contribute to noise during operation.
12. Check wheel pressure acting against profile guides. Proper adjustment has been achieved when, with minimal pressure, from your finger the wheel can be stopped from rotating.
13. Repeat steps 10 and 11 as necessary, until carriage adjustment is correct.

HLE	Fastening	Concentric wheel	Eccentric wheel
80c	**Nut**	28.3 in-lbs	23.0 in-lbs
	Screw	91.2 in-lbs	23.9 in-lbs
100c	**Nut**	314.2 in-lbs	145.2 in-lbs
150c	**Nut**	350.5 in-lbs	235.4 in-lbs

Table 6: Torque values of wheel fastening elements.

NOTE: 8.85 in-lbs. = 1 Nm

4.6.6 Carriage Installation

1. Place carriage into end of profile (check for arrow mark on carriage) in the proper orientation.
2. Place tension station on end of profile and secure with screws (59) Qty.4.
3. Install timing belt (see 4.5.2).

4.6.7 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 planetary 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 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.

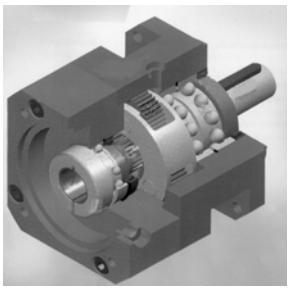


Figure 4

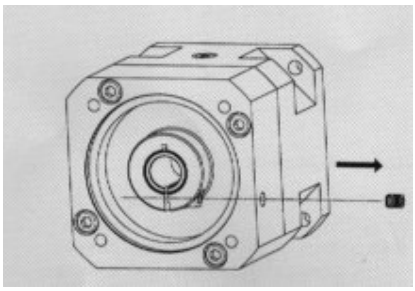


Figure 5

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).

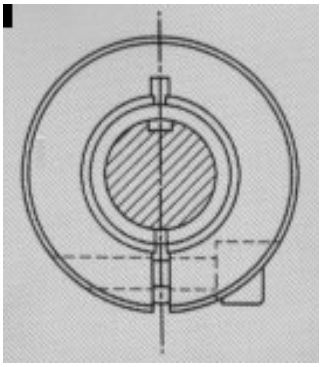


Figure 6

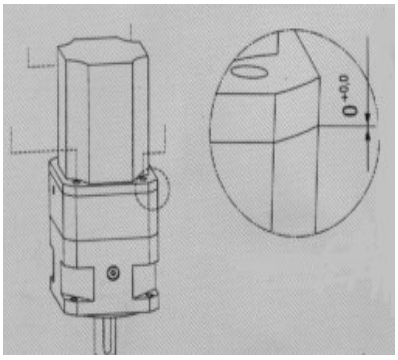


Figure 7

15. Insert allen key through hole in back flange and into bolt on clamping collar. Tighten to values shown in table 7.

Gearbox	PL 70	PL 90	PL 115	PL 142	PLE 80/90	PLE 120/115
Torque	31 in-lbs	62 in-lbs	106 in-lbs	266 in-lbs	62 in-lbs	106 in-lbs

Table 7. Clamping collar torque values

Gearbox	PL 90	PL 115	PL 142	PLE 80/90	PLE 120/115
Max. motor wt.	22lbs	48lbs	110lbs	10lbs	33lbs

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

4.7.2 Motors in combination with old style Neugart planetary gearbox

Gearboxes supplied on purchase orders prior to 7-98 will be equipped with input clamping devices of the ring feeder type. In this design, the sungear is not captured within the gearbox. Once removed from the gearbox back flange, loss of grease can occur. Care should also be taken as to not damage lips of seal or mating shaft of sun gear when removing from gear box.

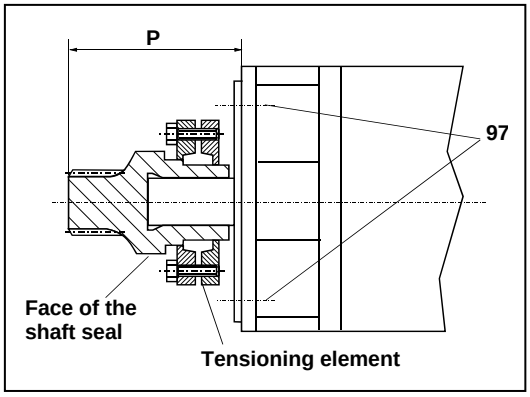


Figure 8: Distance **P**

Gearbox model #	Dimension P [mm]	Tightening torque [in-lbs]
PLE 80/90	58.5	27
PL 90	58.5	27
PL 115	74	27
PLE 120/115	74	27
PL 142	96	36

Table 9: Details of tensioning elements

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 gearbox to cool.
3. Remove motor and resolver cable.
4. Remove motor bolts (97).
5. Pull the motor straight off from gearbox housing.

Note	Motor gearbox combinations mounted vertically, with motor down, may loose lubricant once the motor is removed. Lubricant that is lost must be replaced!

6. Measure distance **P** (Figure); dimension from upper edge of pinion to motor flange (accuracy +/- 0.1mm).
7. Loosen clamp screws of tensioning element connection.
8. Pull pinion straight off motor shaft.
9. Clean motor shaft and pinion hole of all lubricant.
10. With standard HAUSER motors (HDX, HBMR), the pinion can be pushed until it meets the motor shaft. All other motors; place pinion on new motor at distance **P**. If fit is too tight, use emery paper on shaft of motor (grade 360).
11. Tighten clamp screws of tensioning element connection in stages, and in turn to torque value shown in Table 9.
12. Lightly grease running surfaces of pinion gear and shaft seal within gear box.
13. Install motor and tighten motor bolts (97).
14. Reconnect motor and resolver cable.
15. Re-set reference point (see 4.6.7)

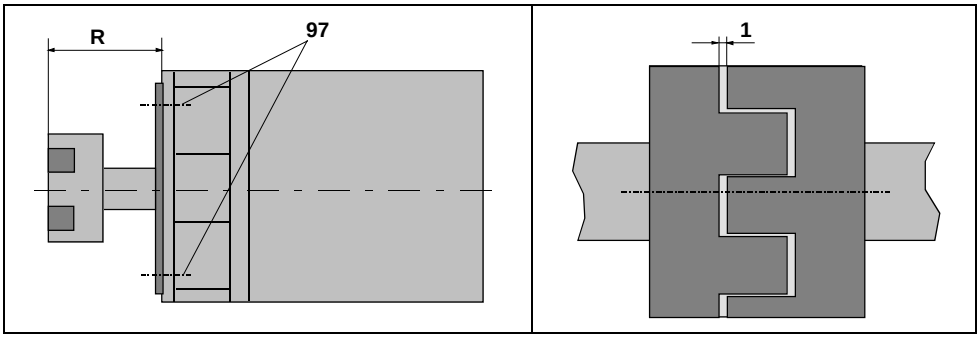
4.7.3 Further gearbox designs

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)

4.7.4 Claw coupling



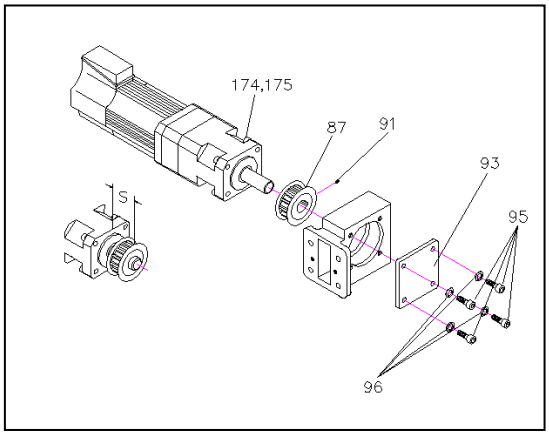
1. Move carriage to a reference point (e.g. machine zero, real zero ...). Mark carriage position on HLE profile (felt pen).
2. Place main electrical disconnect switch in “OFF” position. Allow motor gearbox to cool.
3. Remove motor and resolver cables.
4. Remove motor/gearbox bolts (97).
5. Pull motor 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 up reference point (see 4.6.7)

4.8 Changing gearbox

4.8.1 Changing gearbox on a single axis



1. Remove motor
2. Loosen timing belt
3. Remove cover plate (93).
4. Loosen gearbox bolts (174) 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 set screw (91) and carefully pull pulley straight off shaft (use claw puller).
7. Place drive pulley on new gearbox at distance **S** (Table 10).

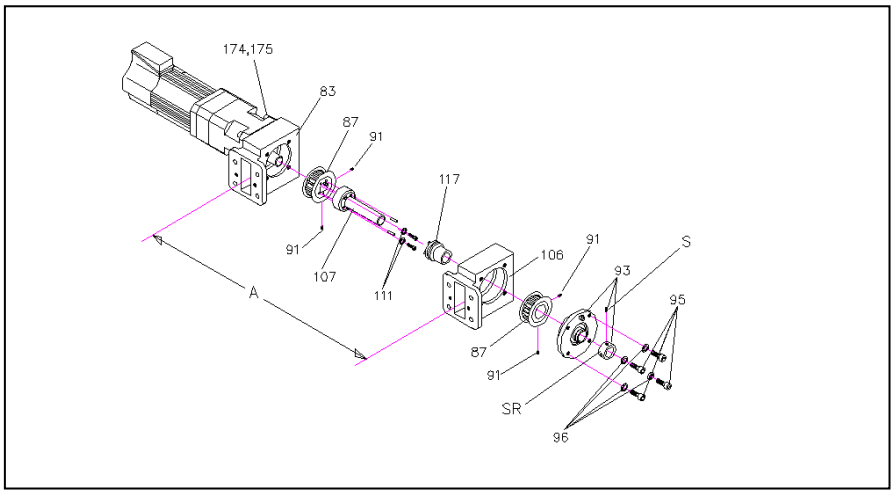
Note	Press drive pulley onto shaft. Do not use a hammer for this operation, as this can damage gearbox.

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. Clean up any metal chips.
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 (174).
12. Tension timing belt (chapter 0).
13. Re-install cover plate (93).
14. Re-install motor (see 4.7.1, according to gearbox used).

Gearbox type	HLE80c	HLE100c	HLE150c
PLE80/90	3.5 mm	1.5 mm	--
PL90	9.0 mm	4.0 mm	--
PL115	--	15.0 mm	8.0 mm
PLE120/115	18.5 mm	13.5 mm	6.5 mm
WPL142	--	--	8.5 mm

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

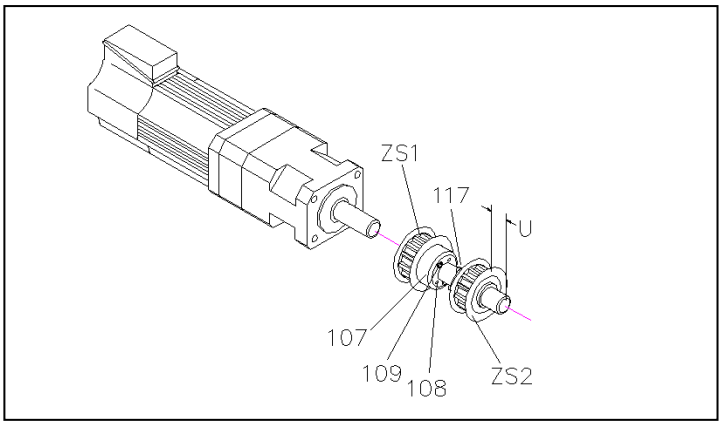
4.8.2 Changing gearbox on a double axis with A x1[5] < drive separation < x2[6]



1. Remove motor (see 4.7, according to gearbox used).
2. Loosen timing belt on both axes (see 4.5).
3. Loosen set screw (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 set screw (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) and remove gearbox.



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, dimension 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.
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).

[5] HLE80c = 80mm, HLE100c = 100mm, HLE150c = 150mm

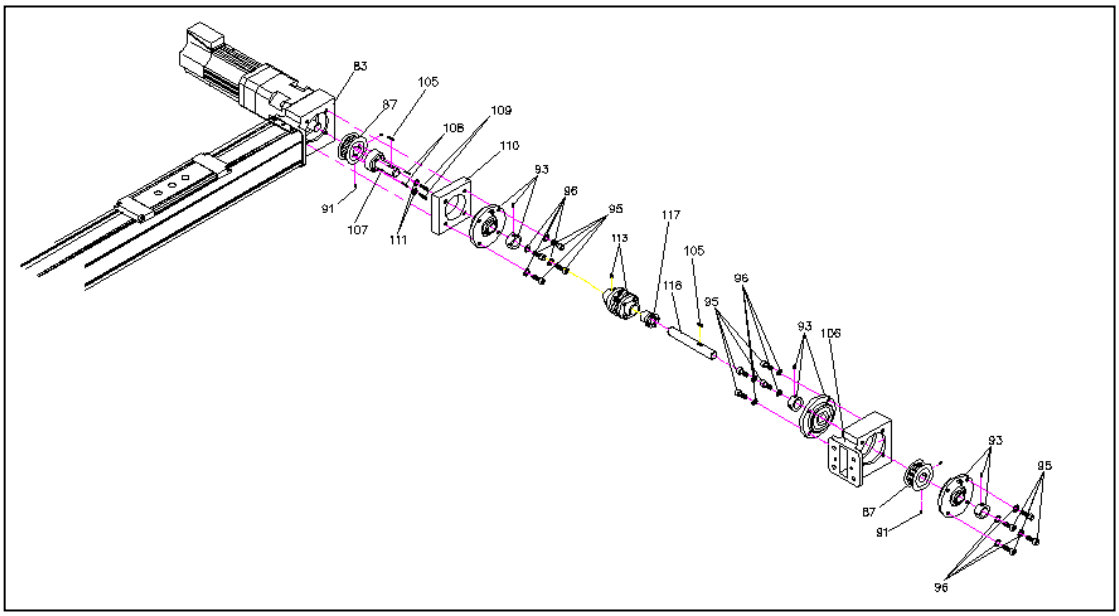
[6] HLE80c = 215mm, HLE100c = 215mm, HLE150c = 260mm

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 housing (83), install and tighten bolts (174).
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. 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[7] < drive separation < 500 mm



1. Disassemble 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 (117) one turn at a time in sequence until bushing is loosened (counter-clockwise).
4. Locate the keyed coupling half on the drive side of the unit, and loosen the set screw. Push the coupling half over the shaft toward the drive station.

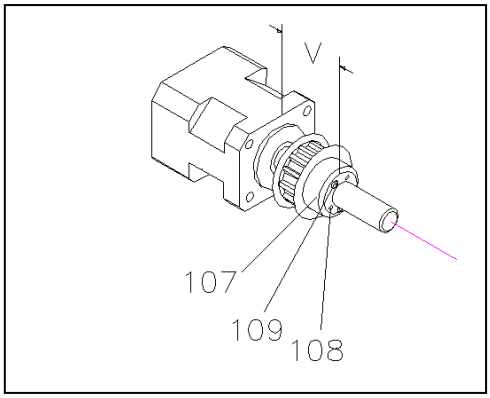
[7] HLE80c = 215mm, HLE100c = 215mm, HLE150c = 260mm

Caution	If coupling half (113) 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 set screw (S) on clamp collar of PME bearing (93) on side of drive.
6. Loosen clamp collar of PME bearing (93) by turning counter-clockwise.
7. Remove pressure marks from left by screw (S) on stub shaft (107) 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.

8. Loosen gearbox fasteners and remove gearbox from drive station.

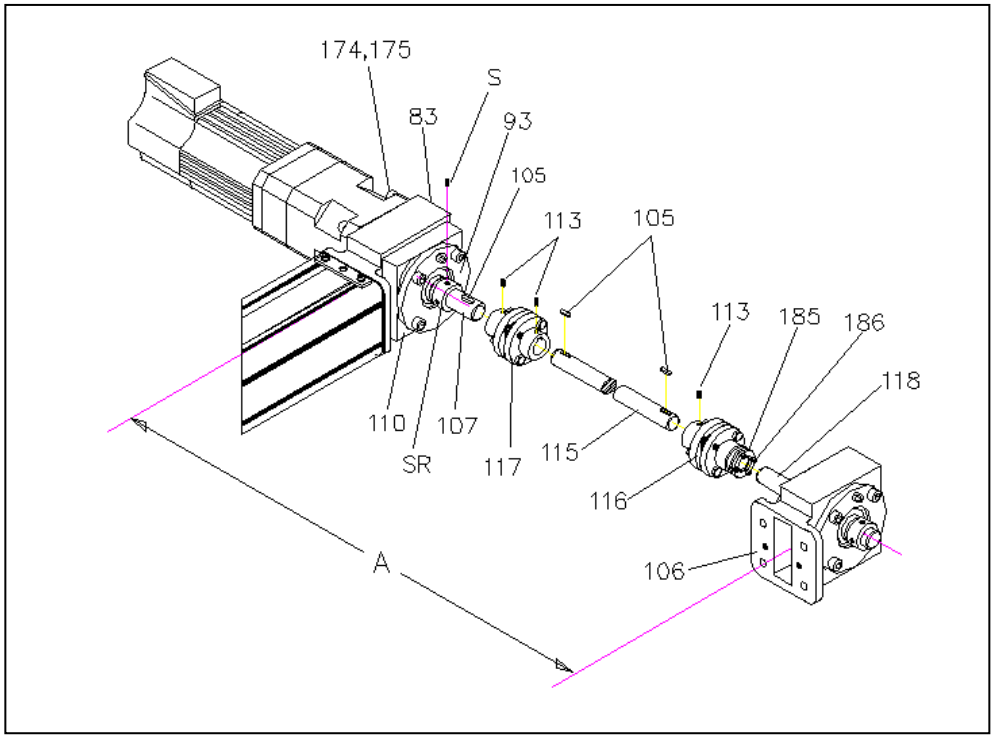


9. Measure distance **V**, dimension from shaft collar to gearbox flange (accuracy +/- 0.1 mm).
10. Pull pins (108) using a puller.
11. Remove screws (109) and pull shaft from pulley.
12. Remove set screw from pulley and clean it.
13. Carefully pull pulley (use a puller tool) from shaft.
14. Align keyway grooves of pulley and shaft to one another and loosely connect both parts using screws (109).
15. Press pins (108) into holes and tighten screws (109).
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.
20. Place timing belt over pulley.
21. Place clamp collar (SR) of PME bearing (93) onto shafts and slightly tighten (clockwise). Tighten set screw (S).
22. Push coupling (107) over stub shaft (107) until end of shaft is flush with coupling half.
23. Tighten set screw (113) with screw retention (Loctite) into 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 = 71in-lbs.
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



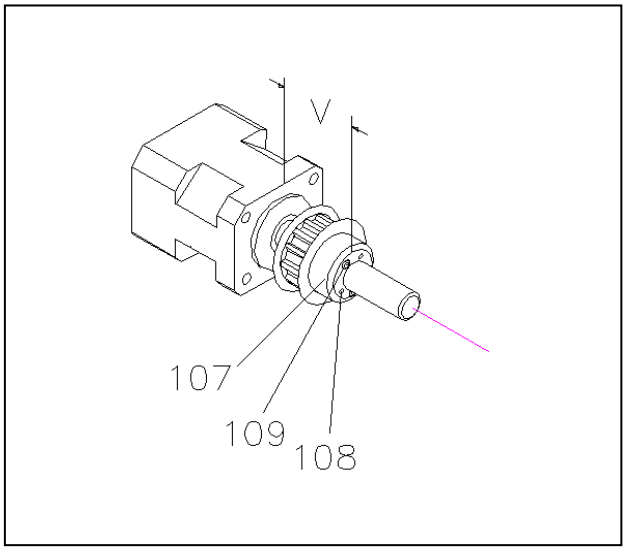
1. Remove motor (see 4.7, according to gearbox used).
2. Loosen timing belt on HLE driven side (see 4.5).
3. Unscrew screws (186) of ETP bushing (185) one turn at a time in sequence until the bush is completely loosened (counter-clockwise).
4. Dismantle connecting shaft (115), by loosening 4 screws on both couplings (117) and (116).
5. Loosen set screw (113) of coupling half (116) on driven side.

Caution	If coupling half is too tight, coupling hardware (116) 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.

6. Loosen set screw (S) on clamp collar of PME bearing (93) on side of drive.
7. Loosen clamp collar (SR) of PME bearing (93) by rotating counter-clockwise.
8. Remove pressure marks from set screw (S) on shaft (107) 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.

9. Remove gearbox fasteners (174,175) and pull gearbox straight off drive housing.



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

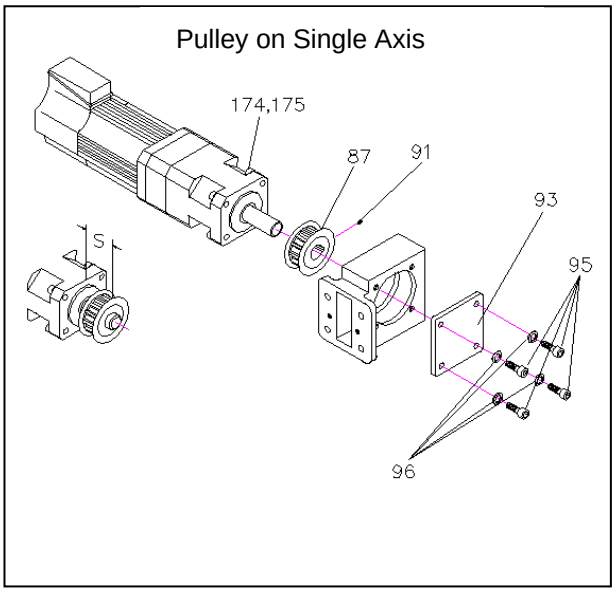
Caution	Install pulley using a press. Do not use a hammer, as this may damage gearbox.

18. Spot drill key of gearbox through tapped hole in pulley (ZS) and remove metal chips (See also chapter 0 right-hand figure).
19. Thread set screw into pulley and use screw retention (Loctite).
20. Insert gearbox onto linear unit and tighten gearbox fasteners (174,175).
21. Place timing belt over pulley.
22. Place clamp collar (SR) of PME bearing (93) onto shafts and slightly tighten (clockwise). Tighten set screw (S).
23. Push coupling (117) over stub shaft (107) until end of shaft is flush with coupling half.
24. Tighten set screw (113) with screw retention (Loctite) into coupling half.
25. Tension timing belt of axis on driven side (see 4.5)
26. Insert connecting shaft (118) into coupling half (116), tighten the 4 screws for each coupling half using screw retention (Loctite).

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

27. Align carriage position (see 4.10.2).
28. Slightly tighten screws (186) of ETP bushing (185), then in small stages (1/4 turns) tighten in sequence to a torque of Ma = 71in-lbs.
29. Install motor (chapter 4.7, according to gearbox used).

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. Withdraw gearbox bolts (95) and pull gearbox straight out of drive housing.
5. Measure distance **S**, dimension from end of shaft to pulley (accuracy +/- 0.1 mm).
6. Loosen set screw (91) and carefully pull pulley straight off 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. Table 11

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

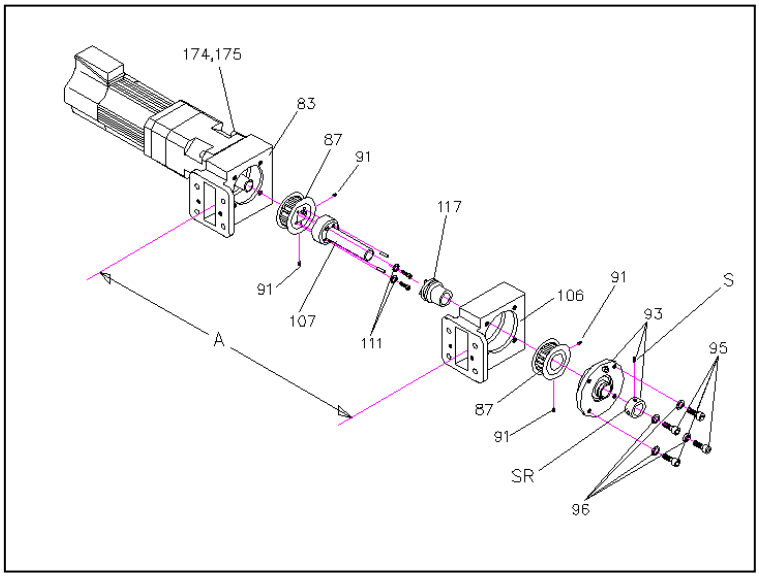
9. Remove set screw (91) from pulley and measure hole diameter. Using a twist drill 0.5mm smaller than hole, carefully spot drill 1mm deep into key of gearbox through tapped hole in pulley. Clean up any metal chips.
10. Screw set screw into pulley using screw retention (Loctite).
11. Place timing belt over pulley as gearbox is inserted into drive housing.
12. Install and tighten gearbox bolts (95).
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	HLE80c	HLE100c	HLE150c
PLE80/90	3.5 mm	1.5 mm	--
PL90	9.0 mm	4.0 mm	--
PL115	--	15.0 mm	8.0 mm
PLE120/115	18.5 mm	13.5 mm	6.5 mm
WPL142	--	--	8.5 mm

Table 11: Standard distance from end of shaft to pulley

4.9.1 Replacing pulley on driven side of double axes

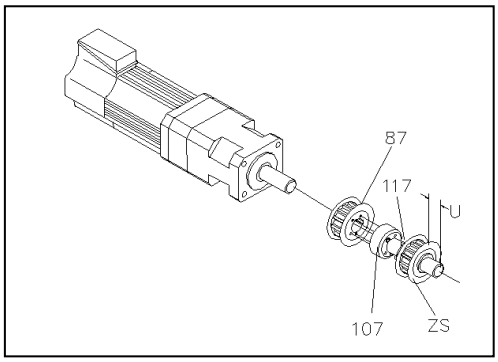
4.9.2 Double axes A x1[1] < drive separation< x[2]



1. Remove motor (see 4.7, according to gearbox used).
2. Loosen timing belt on both axis (see 4.5).
3. Loosen set screw (S) on clamp collar of PME bearing (93).
4. Remove clamp collar (SR) of PME bearing (93) by rotating counter-clockwise.
5. Remove pressure marks from set screw (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. Take out gearbox bolts (174) and pull gearbox straight off drive housing.

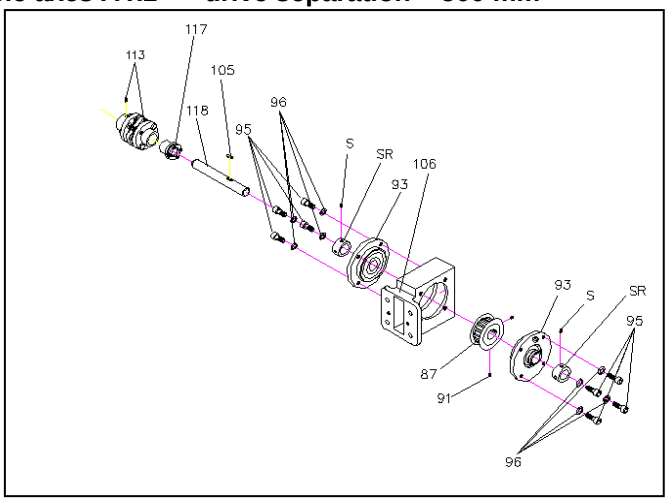


7. Measure distance **U**, the dimension from face side of shaft to side of pulley (accuracy +/- 0.1 mm).
8. Loosen screws of ETP-split-bushing (117). Carefully pull out pulley 2 (ZS2) (use pulley pulling tool).
9. Position new pulley on shaft at distance **U**
10. Tighten screws of ETP-split-bushing.
11. Install gearbox onto linear drive housing and tighten bolts (174).
12. Place timing belt over pulley.
13. Place clamp collar (SR) of PME bearing (93) onto shaft and tighten (turn clockwise). Tighten set screw (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).

[1] HLE100 = 100mm

[2] HLE100 = 215mm

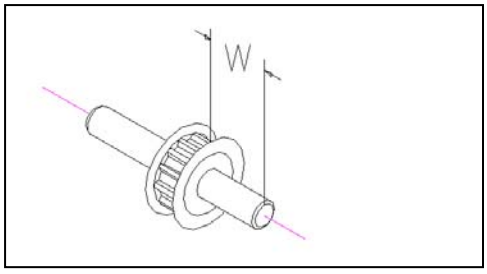
4.9.3 Double axes A x1[3] < drive separation < 500 mm



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-clock-wise).
3. Back off set screw (S) on the clamp collar of inner PME bearing (93).
4. Loosen clamp collar of PME bearing (93) by rotating counter-clock-wise.
5. Remove pressure marks from shaft (118) made from set screw (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 set screw (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 set screw (S) on shaft piece (118) using rasp or emery.
9. Loosen screws (95) of outer PME bearing and remove bearing from drive housing.
10. Remove shim ring (if used).
11. Carefully remove shaft with pulley from housing.
12. Remove inner shim ring (if used).



13. Measure distance **W**, dimension from face side of shafts to pulley (accuracy +/- 0.1 mm).
14. Loosen set screw and carefully pull off pulley (use claw puller).
15. Turn key over. If both sides of key are drilled, replace key.
16. Locate new pulley on shaft at distance **W**.

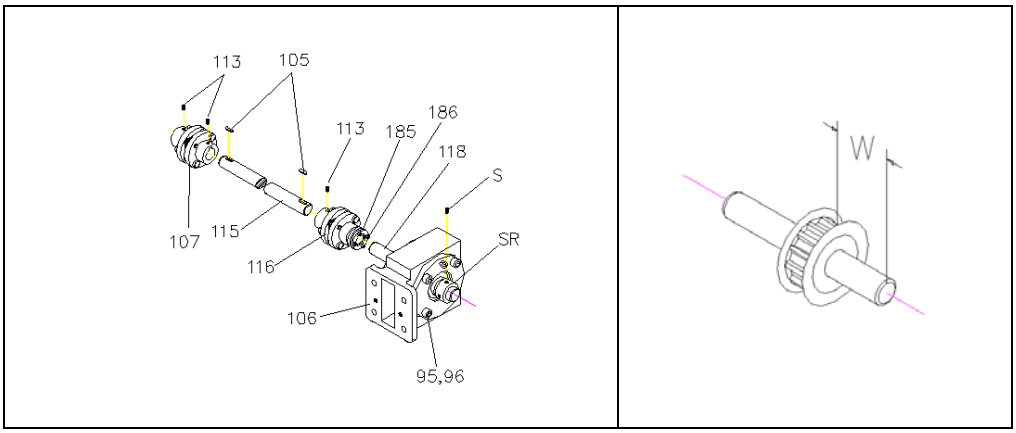
Caution	Press drive pulley onto shaft. Do not use a hammer for this operation, as this can damage gearbox.

17. Spot drill key of gearbox through tapped hole of pulley. Using a twist drill 0.5mm smaller, drill carefully 1mm deep into key through the tapped hole in pulley. clean any metal chips.
18. Thread set screw into pulley using screw retention (Loctite).
19. Place shim rings (if used) on top of pulley and push shaft through inner PME bearing and into ETP tension bushing.
20. Place timing belt over pulley.
21. Place shim rings (if used) on outer side of shaft.

[3] HLE100 = 215mm

22. Install exterior PME bearing on shaft (93) and fasten using 4 screws (95).
23. Move shaft in axial direction. It should have 0.1 - 0.2mm play. If there is no play, remove a thin shim ring (0.2mm).
24. Position shaft by hand and install clamp collar (SR) on exterior portion of PME bearing (93) (rotate clockwise) and tighten set screw (S).
25. Install clamp collar (SR) of inner PME bearing (93) (clockwise), and tighten set screw (S).
26. Tension timing belt (see 4.5)
27. Align carriage position to match second drive unit carriage position (see 4.10.2).
28. Tighten screws of ETP coupling (185) and in small stages (1/4 turns) tighten in sequence to a torque of Ma = 71in-lbs.

4.9.4 Double axes separation > 500mm.



1. Loosen timing belt on HLE driven rail (see 4.5).
2. Undo screws of ETP bushing (185) one turn at a time in sequence until bushing is completely loosened (anti-clockwise).
3. Disconnect drive shaft (118), by removing 4 screws on both couplings (107) and (116). Remove drive shaft.
4. Remove coupling half with ETP bushing (185) from short shaft (118).
5. Loosen set screw (S) on clamp collar of inner PME bearing (93).
6. Remove clamp collar of PME bearing (93) by rotating counter-clockwise.
7. Remove pressure marks made from set screw (S) on shaft piece (118) 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.

8. Remove 4 screws (95) of inner PME bearing and remove bearing.
9. Remove shim ring (if used).
10. Loosen set screw (S) on clamp collar of outer PME bearing (93).
11. Remove clamp collar of outer PME bearing (93) by turning counter-clockwise.
12. Remove pressure marks from set screw (S) on shaft piece (118) using rasp or emery paper.
13. Pull shaft and pulley assembly straight out of housing.
14. Slide off shim ring (if used).
15. Measure distance **W**, dimension from face side of shaft to pulley (accuracy +/- 0.1 mm)
16. Loosen set screw and pull pulley off shaft (use claw puller).
17. Turn key over. If both sides of key are drilled, replace the key.
18. Position 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 gearbox.

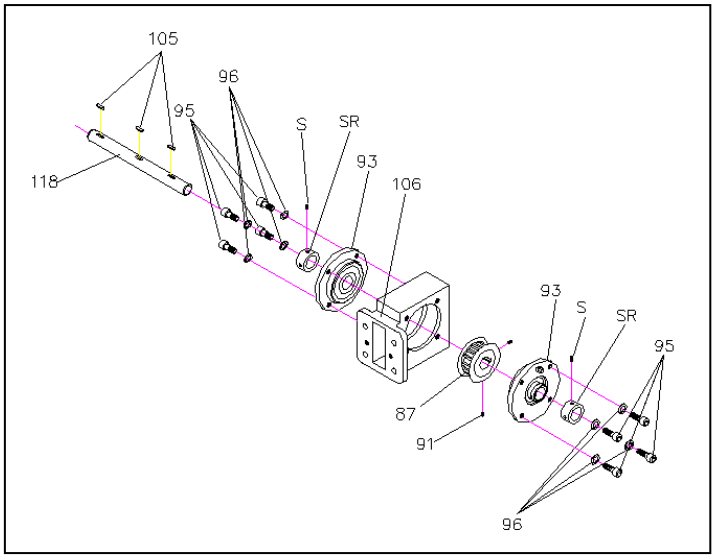
19. Using a twist drill 0.5mm smaller than the threaded set screw hole in pulley, drill carefully 1mm deep into key of gearbox through tapped hole in pulley. Clean up metal chips.
20. Thread set screw into pulley using screw retention (Loctite).
21. Place shim rings (if used) on top of pulley and install shaft in outer PME bearing.
22. Place timing belt over pulley.
23. Place shim rings (if used) on inner side of shaft.
24. Insert PME bearing on shaft (118) and secure to housing using 4 bolts (95).
25. Move shaft in axial direction. It should have 0.1 - 0.2mm play. If there is no play, remove a thin shim ring (0.2mm).
26. Position shaft by hand and install clamp collar (SR) on inner PME bearing (93) (rotate clockwise) and tighten set screw (S).
27. Install clamp collar (SR) of outer PME bearing (93) (rotate clockwise) and tighten set screw (S).
28. Tension timing belt (see 4.5).
29. Slide coupling half with ETP bushing on shaft (118).
30. Install drive shaft (115). Insert the 4 fasteners for each coupling (107) and (116), tighten and use screw retention (Loctite).

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

31. Align carriage position (chapter 4.10.2).
32. Slightly tighten screws (186) of ETP bushing (185), then in small stages (1/4 turns) tighten in sequence to a torque of Ma = 71in-lbs.

NOTE: If allen head torque wrench not available, replace with hex head screws.

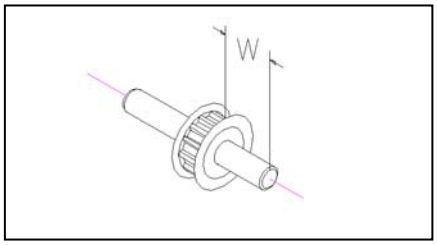
4.9.5 Replacing pulley shaft left (WLO), shaft right (WRO), both sides (WBO)



1. Disassemble and remove any add-on pieces from drive shaft(s).
2. Remove tension from HLE timing belt (see 4.5).
3. Loosen set screw (S) on clamp collar of PME bea-ring (93) located on side of drive housing.
4. Remove clamp collar (SR) of PME bearing (93) by rotating counter clockwise.
5. Remove pressure marks from the set screw (S) on shaft (118) 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. Undo the 4 screws (95) of PME bearing located on other side of drive housing and remove bearing.
7. Remove shim rings (if used).
8. Loosen set screw (S) on clamp collar of second PME bearing (93).
9. Remove clamp collar (SR) of second PME bearing (93) by rotating counter clockwise.
10. Remove pressure marks from set screw (S) on shaft (118) using rasp or emery paper.
11. Pull shaft with pulley assembly straight out of housing.
12. Remove shim rings (if used).

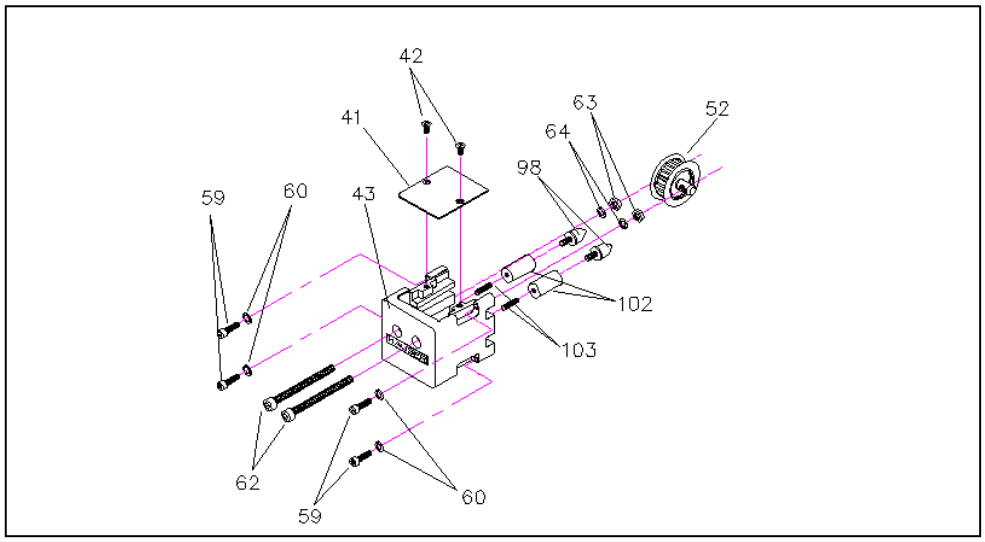


13. Measure distance **Y**, dimension from face side of shaft to pulley (accuracy +/- 0.1 mm).
14. Loosen set screw and pull off pulley (use claw puller).
15. Turn key over. If both sides of key have been drilled, replace key.
16. Locate new pulley on shaft at distance **Y**.

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

17. Using a twist drill 0.5mm smaller than tapped hole in pulley, spot drill 1mm deep into key. Clean up any metal chips.
18. Thread set screw into pulley using screw retention (Loctite).
19. Place shim rings on top of pulley and install shaft into PME bearing.
20. Place timing belt over pulley.
21. Place shim rings on other side of shaft.
22. Insert PME bearing on shaft (118) and secure to housing using 4 bolts (95).
23. Move shaft in axial direction. It should have 0.1 - 0.2mm play. If there is no play, remove a thin shim ring (0.2mm).
24. Position shaft by hand and install clamp collar (SR) on inner PME bearing (93) (rotate clockwise) and tighten set screw (S).
25. Install clamp collar (SR) of outer PME bearing (93) (rotate clockwise) and tighten set screw (S).
26. Tension timing belt (see 4.5)

4.9.6 Replacing tension station pulley



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 from tension station end of carriage (see 4.5.2).
5. Undo mounting screws (59) and lift tension station from end of profile.
6. Thread tension screws (62) out of pulley axle until pulley assembly is removed from adjustment screws.
7. Insert new pulley assembly (52) into tension station and thread tensioning screws (62) into pulley shaft a few turns.
8. Place timing belt around pulley and fasten tension station to end of profile using bolts (59) and new Schnorr lock washers (60).
9. 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 tension bushing in one shell 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

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).

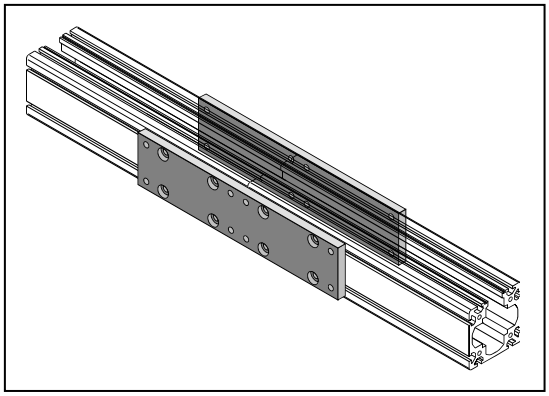
Tighten screws of ETP tension bushing in sequence (quarter turn) until torque shown in table below is reached (if possible, use a torque wrench) (see Table 12).

Shaft diameter	Tightening torque Ma
15mm	45 in-lbs
19mm-42mm	71 in-lbs
45mm-65mm	115 in-lbs

Table 12: Torque values for bolts on ETP tension bushings

4.11 Long axis

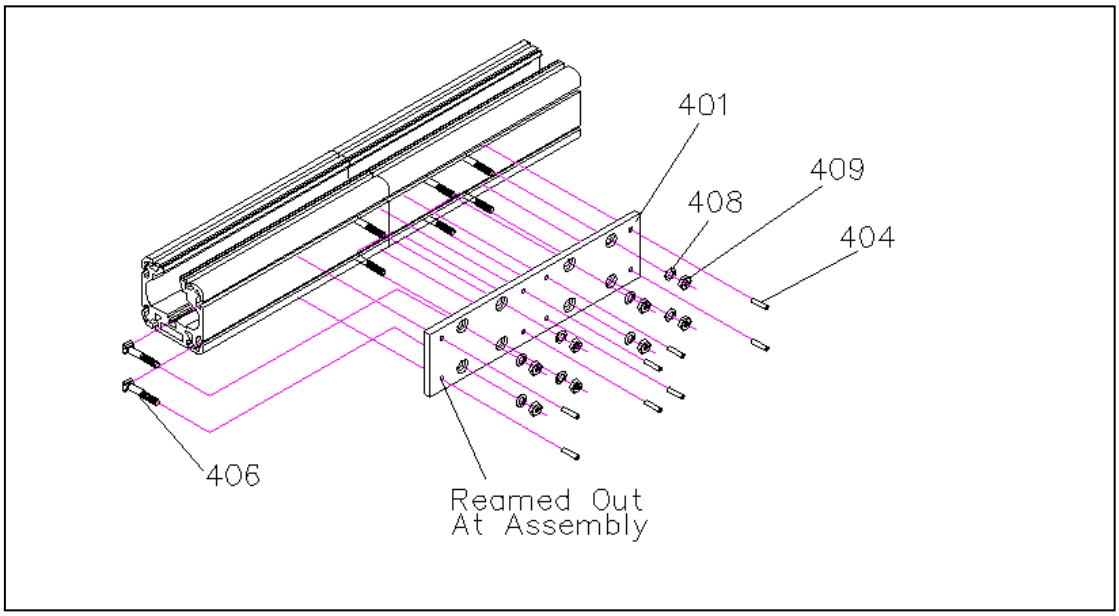
4.11.1 General



- 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 and side).
3. Position splice plate (401) over “T” bolts and install lock washers (408), and nuts (409).

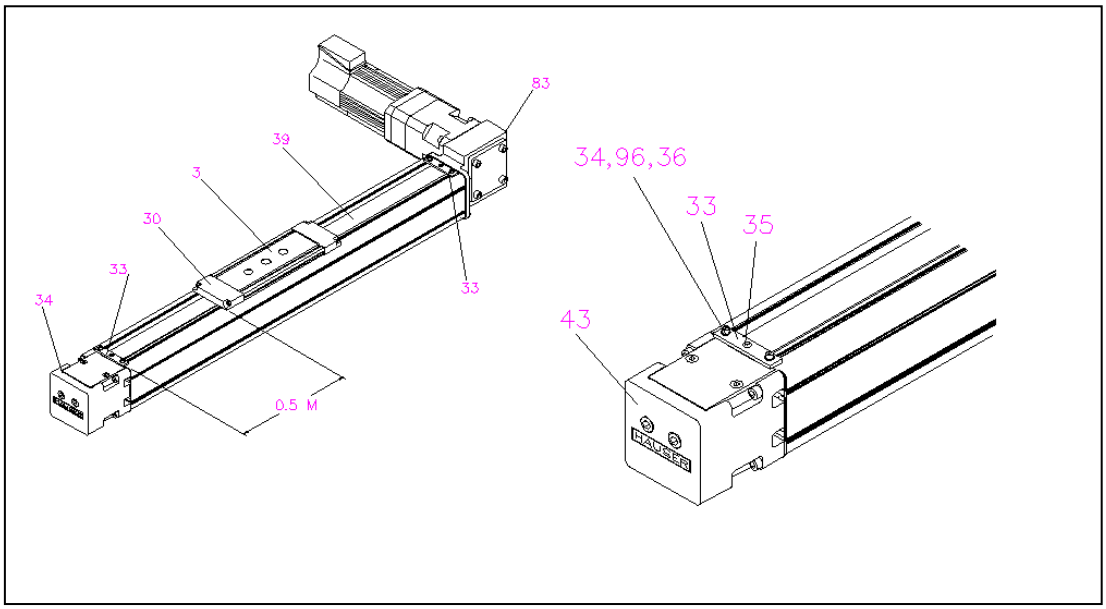
4. Align profile, checking internal running surfaces. You should not feel any transition at seam.
5. Pin holes located on plate (Qty.8) should align with pre-drilled holes profile of HLE. Carefully drive pins (threaded portion of pin (404) out) into plate until flush with plate surface.
6. Tighten all nuts (409)
7. Install timing belt and check belt tracking (see 4.5 & 4.5.7)

4.12 Steel strip cover

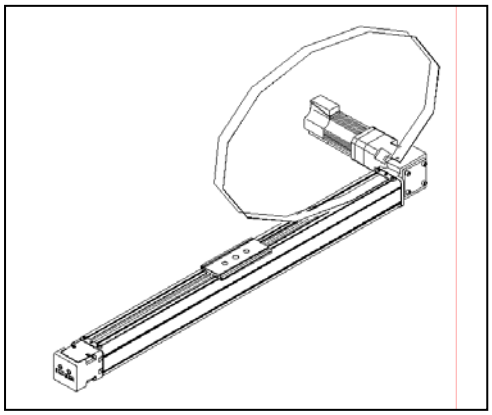
Note	While performing maintenance on drive units equipped with steel strip cover seals, ensure steel strip is never kinked, distorted, or damaged. Damaged strip seals must be replaced.

4.12.1 Installation and maintenance

4.12.2 Steel strip cover removal



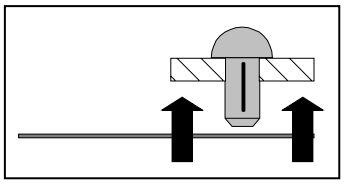
1. Position carriage (1) approx. 0.5m in front of tension station end of unit (2)
2. Switch off the axis at the main switch.



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 through cavity in carriage.
7. Carefully roll up and tape steel strip to top of drive station (see illustration).

4.12.3 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.

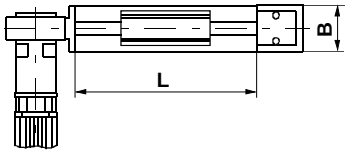


3. Connect seal clamp (33) to steel strip (39) using grooved drive stud (35).
4. Fasten clamps using screws (34).

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

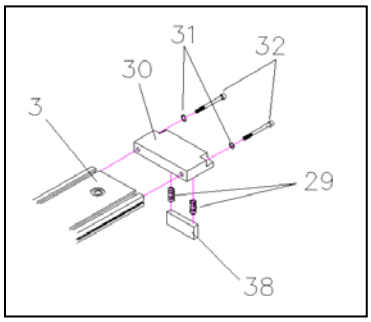
5. Apply electrical power.
6. Operate drive unit approximately 10 cycles at a low speed (v < 2 m/s), allowing carriage to travel entire length of unit. Check steel strip at leading edge of wiper cover for a possible "wave" to form in direction of movement.
7. If “wave” is present, position carriage 0.5m from tension station (43).
8. Loosen screws of seal clamp at tension station end.
9. Smooth out "wave", but do not strain the strip seal.
10. Tighten seal clamp hardware.

4.12.4 Replacing the steel strip.

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

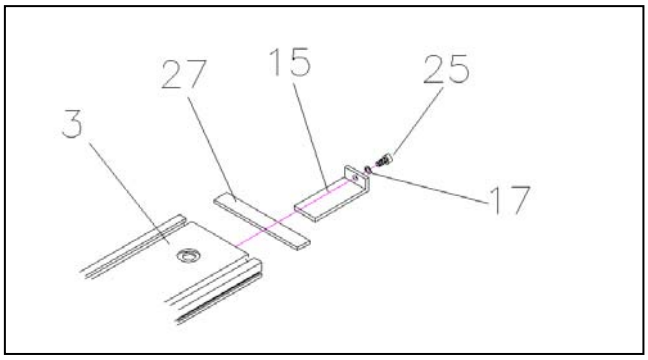
1. Remove steel cover strip (see 4.12.2)
2. Disassemble second strip clamp from profile. Disconnect steel strip from grooved drive stud.
3. Connect grooved drive stud to one end of new steel strip material.
4. Fasten strip clamp to profile.
5. Install steel strip (see 4.12.3)

4.12.5 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 (31,32).

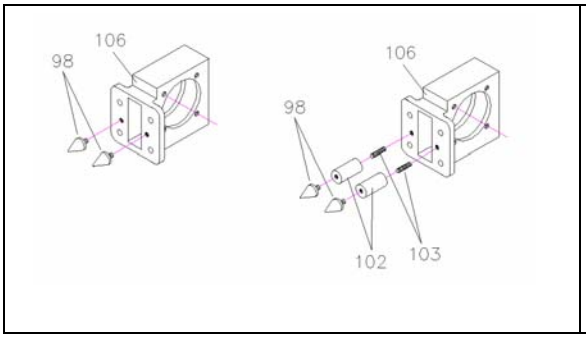
4.12.6 Replacing bearing strip.

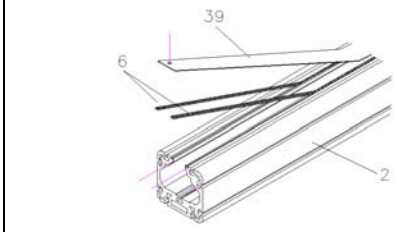


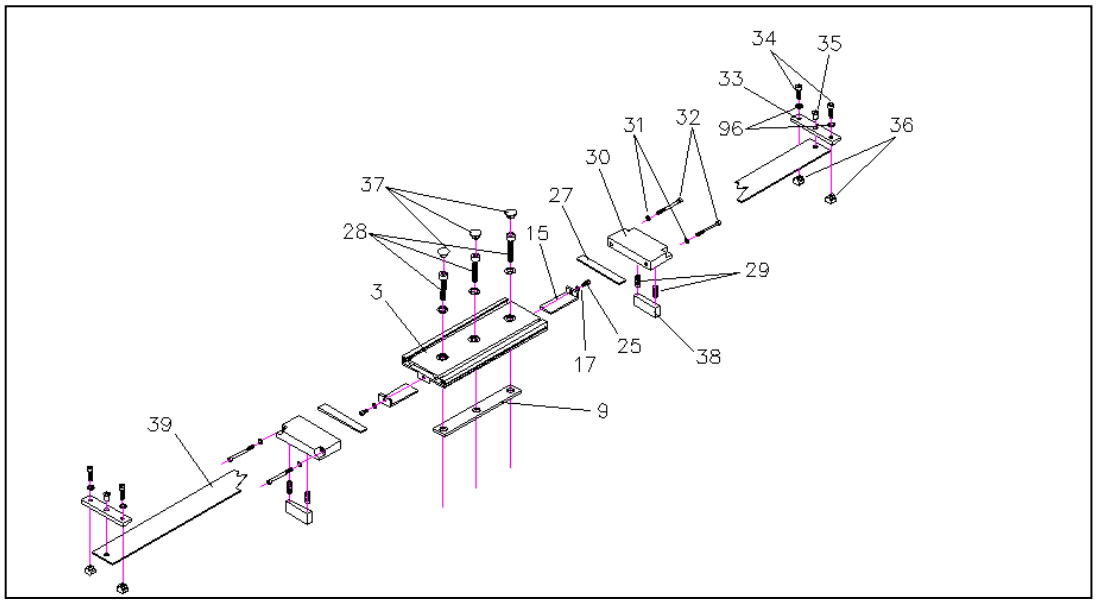
1. Remove steel cover strip (see 4.12.2)
2. Apply force to end of bearing strip (27) and slide it out of the side of the load attachment plate.
3. Push new bearing strip in the side of load attachment plate (3). Ensure that steel strip runs over radius provided on bearing strip. Center bearing strip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

4.12.7 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 complete dismantling of the HLE drive unit.







1. Ensure main electrical disconnect switch is locked in the “OFF” position.
2. Loosen timing belt:
   A. Remove tension station cover (33).
   B. Loosen adjustment screw lock nuts (63) located inside tension station (turn counter clockwise).
   C. Loosen belt tension screws (62) approximately 10 turns (counter-clockwise).
3. Remove plastic protective caps (37) embedded in load attachment plate, 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.
6. Apply Loctite #410 adhesive within channels and insert magnetic strips (6). 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 (28).

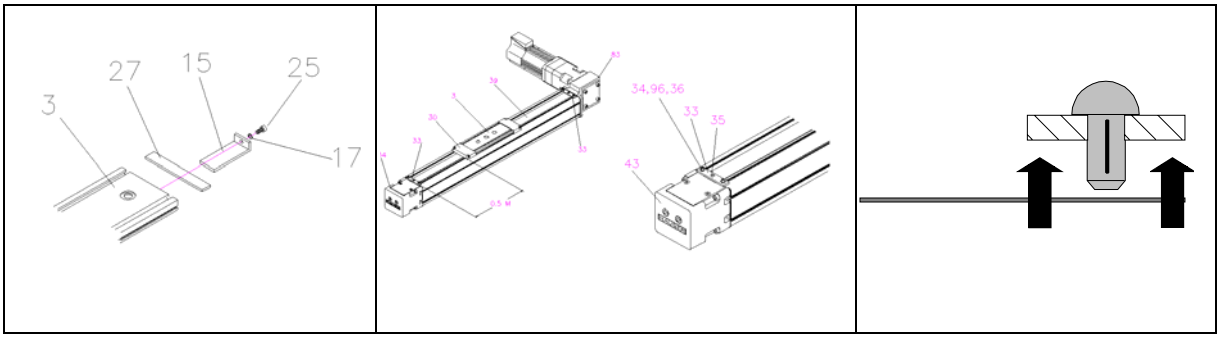
Caution	Secure carriage assembly within profile (tape) to ensure it does not slide out when end housings are removed.

8. Undo tension station mounting bolts (59), lift off tension station and unthread timing belt from tension pulley.
9. Unthread rubber bumpers (98) from tension station housing.

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

10. Installing bumper extension:
    Apply Loctite to set screw (103) and screw half its length into extension stand-off (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. Ensure face of standoff seats flat against housing of tension station. Repeat this step for second bumper assembly.
11. Thread timing belt around pulley and fasten tensioning station using screws (59) with new Schnorr lock washers (60).
12. Remove mounting screws of drive station housing (83), lift off profile and unthread timing belt from pulley.

13. Remove rubber bumper and install extension standoffs using the same procedure as the tension station end.
14. Push a “T” nut (for seal clamp 33) into the two “T” slot grooves located on top of profile.
15. Thread timing belt around drive pulley and secure drive station to profile using screws (100) and new Schnorr lock washers (101).



16. Disassemble timing belt retaining bracket (15) from previous load attachment plate.
17. Locate the cavity between carriage and load attachment plate, at one end of carriage. Insert timing belt into cavity (6 teeth for HLE80, and 7 teeth for HLE100/150). Slide timing belt retaining bracket (15) along back side of timing belt, into cavity. Fasten using screws (25). Repeat this step for other end of carriage.
18. Tension timing belt (see 4.5)
19. Check timing belt tracking (see 4.5.7)
20. Set reference point (see 4.6.7)
21. Insert bearing strip (27) according to chapter (see 4.12.6). NOTE: Position radius up toward seal strip.
22. Clean magnetic strip.
23. Carefully push steel cover strip through cavity in load attachment plate and allow it to rest onto the magnetic material imbedded within HLE profile. Length of strip and length of HLE profile should be the same.
24. 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.
25. 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.
26. Place two springs (29) and one felt wiper (38) in each wiper cover housing (30).
27. Secure both wiper cover assemblies to the end of load attachment plate.
28. Continue seal strip assembly in accordance with chapter 4.12.3.

5 Replacement parts

5.1 Replacement parts HLE80c

Item	Description	Design Style				Unit	Part Number
		NL	VL	NL D	VL D		
14	**Timing belt 16 AT 10 HF**	Length L see chapter 4.5.2				Meters	420-000011
16	**Wheel R4OL0028**	12	24	24	48	Pieces	416-201070
18	**Eccentric bushing**	6	18	12	36	Pieces	125-068100
19	**Axle – concentric wheel**	2	2	4	4	Pieces	125-068130
20	**Axle - eccentric wheel**	2	6	4	12	Pieces	125-068140
	Axle, 5 mm – eccentric side wheels	2	6	4	12	Pieces	125-068110
	Axle, 8 mm – concentric side wheel	2	2	4	4	Pieces	125-068120
	Spacer, for 5 mm shaft	6	10	12	20	Pieces	125-068150
	Spacer, for 8 mm shaft	10	18	20	36	Pieces	125-068160
26	**Lock washer M5**	10	22	20	44	Pieces	WRS-M005-0000
27	**Lock washer M8**	2	2	4	4	Pieces	WRS-M008-0000
	Nylon wear block	2	2	4	4	Pieces	125-068175
	Rubber bumper	1	1	2	2	Pieces	400-302001

Table 1:HLE80c

Item	Description	Design Style				Unit	Part Number
		NL	VL	NL D	VL D		
16	**Wheel R4OL0028**	12	24	24	48	Pieces	416-201072
18	**Eccentric bushing**	6	12	12	24	Pieces	135-703000
19	**V2A axle – concentric wheel**	2	2	4	4	Pieces	135-703005
20	**V2A axle– eccentric wheel**	2	6	4	12	Pieces	135-703010

Table 2: HLE80c - Stainless Steel Version

Item	Description	Design Style				Unit	Part Number
		NL	VL	NL D	VL D		
27	**Wear strip**	2	2	4	4	Pieces	125-069720
38	**Felt wiper**	2	2	4	4	Pieces	180-300059
29	**Wiper pressure springs**	4				Pieces	130-003005
39	**Steel strip 0.125 x 23**	Length: see Chapter 4.12.4				Meters	400-300701
6	**Magnetic strip**	2 x length: see Chapter 4.12.7				Meters	400-300712

Table 3: HLE80c, steel-strip cover option

Pulley HLE80	Bore size [mm]	Number [pc.] NL/VL	NL D/VL D	Part number
Tension station (complete)	32	1	2	510-900101
Drive pulley	20	1	1	420-100422
	22	1	1	100-7765-01
	25	1	1	420-100424
	19	1	1	420-100421
	24	1	1	420-100400

Table 4: Pulley HLE80C

5.2 Replacement parts HLE100c

Item	Description	Design Style NL	VL	NL D	VL D	Unit	Part Number
	Timing belt 25 AT 10 HF	Length L see chapter 4.5.2				Meters	420-000016
16	**Wheel R4OL0027-N4**	12	24	24	48	Pieces	416-201030
18	**Eccentric bushing**	6	18	12	36	Pieces	125-070100
24	**Lock washer M8**	6	18	12	36	Pieces	WRS-M008-0000
	Wheel and T-bolt assembly, concentric	6	6	12	12	Pieces	002-1453-01
	Wheel and T-bolt assembly, eccentric	6	18	12	36	Pieces	002-1453-02

Table 5: HLE 100c

Item	Description	Design Style NL	VL	NL D	VL D	Unit	Part Number
16	**Wheel R4OL0027-N4**	12	24	24	48	Pieces	416-201032
18	**Eccentric bushing**	6	18	12	36	Pieces	135-719000
24	**Lock washer M8**	6	18	12	36	Pieces	135-728720

Table 6: HLE100c - Stainless Steel Version

Item	Description	Design Style NL	VL	NL D	VL D	Unit	Part Number
27	**Wear strip**	2	2	4	4	Pieces	125-069700
38	**Felt wiper**	2	2	4	4	Pieces	180-300060
29	**Wiper pressure springs**	4				Pieces	130-003005
39	**Steel strip 0.125 x 38**	Length: see Chapter 4.12.4				Meters	400-300702
6	**Magnetic strip**	2 x length: see Chapter 4.12.7				Meters	400-300712

Table 7: HLE100c, steel-strip cover option

Pulley HLE100c	Bore size [mm]	Number [pc.] NL/VL	NL D/VL D	Part number
Tension station (complete)	32	1	2	510-000114
Drive pulley	20	1	1	420-100103
	22	1	1	100-7765-01
	25	1	1	420-100105

Table 8: Pulley HLE100c

5.3 Replacement parts HLE150c

Item	Description	Design Style NL	VL	NL D	VL D	Unit	Part Number
	Timing belt 25 AT 10 HF	Length L see chapter 4.5.2				Meters	420-000031
16	**Wheel , concentric**	6	6	12	12	Pieces	416-201020
	Wheel , eccentric	6	18	12	36	Pieces	416-201010
18	**Eccentric bushing**	6	18	12	36	Pieces	125-071100
	Lock washer M12	6	6	12	12	Pieces	WRS-M012-0000
	Lock washer M10	6	18	12	36	Pieces	WRS-M010-0000
	Wheel and T-bolt assembly, concentric	6	6	12	12	Pieces	002-1470-01
	Wheel and T-bolt assembly, eccentric	6	18	12	36	Pieces	002-1470-02

Table 9: HLE 150c

Item	Description	Design Style NL	VL	NL D	VL D	Unit	Part Number
16	**Wheel, concentric**	6	6	12	12	Pieces	416-201022
17	**Wheel, eccentric**	6	18	12	36	Pieces	416-201012
18	**Eccentric bushing**	6	18	12	36	Pieces	125-719100
23	**Lock washer M12**	6	6	12	12	Pieces	135-728730
24	**Lock washer M10**	6	18	12	36	Pieces	135-728725

Table 10: HLE150c - Stainless Steel Version

Item	Description	Design Style NL	VL	NL D	VL D	Unit	Part Number
27	**Wear strip**	2	2	4	4	Pieces	125-069740
38	**Felt wiper**	2	2	4	4	Pieces	180-300061
29	**Wiper pressure springs**	4				Pieces	130-003005
39	**Steel strip 0.125 x 55**	Length: see Chapter 4.12.4				Meters	400-300703
6	**Magnetic strip**	2 x length: see Chapter 4.12.7				Meters	003-1708-04

Table 11: HLE150c, steel-strip cover option

Pulley HLE150c	Bore size [mm]	Number [pc.] NL/VL	NL D/VL D	Part number
Tension station (complete)	47^{K7}	1	2	510-000125
Drive pulley	30^{H7}	1	1	420-100722
	25^{H7}	1	1	420-100721
	40^{H7}	1	1	420-100718
	24^{H7}	1	1	420-100724

Table 12: Pulley HLE150c