# HPLA Linear actuator - User Guide

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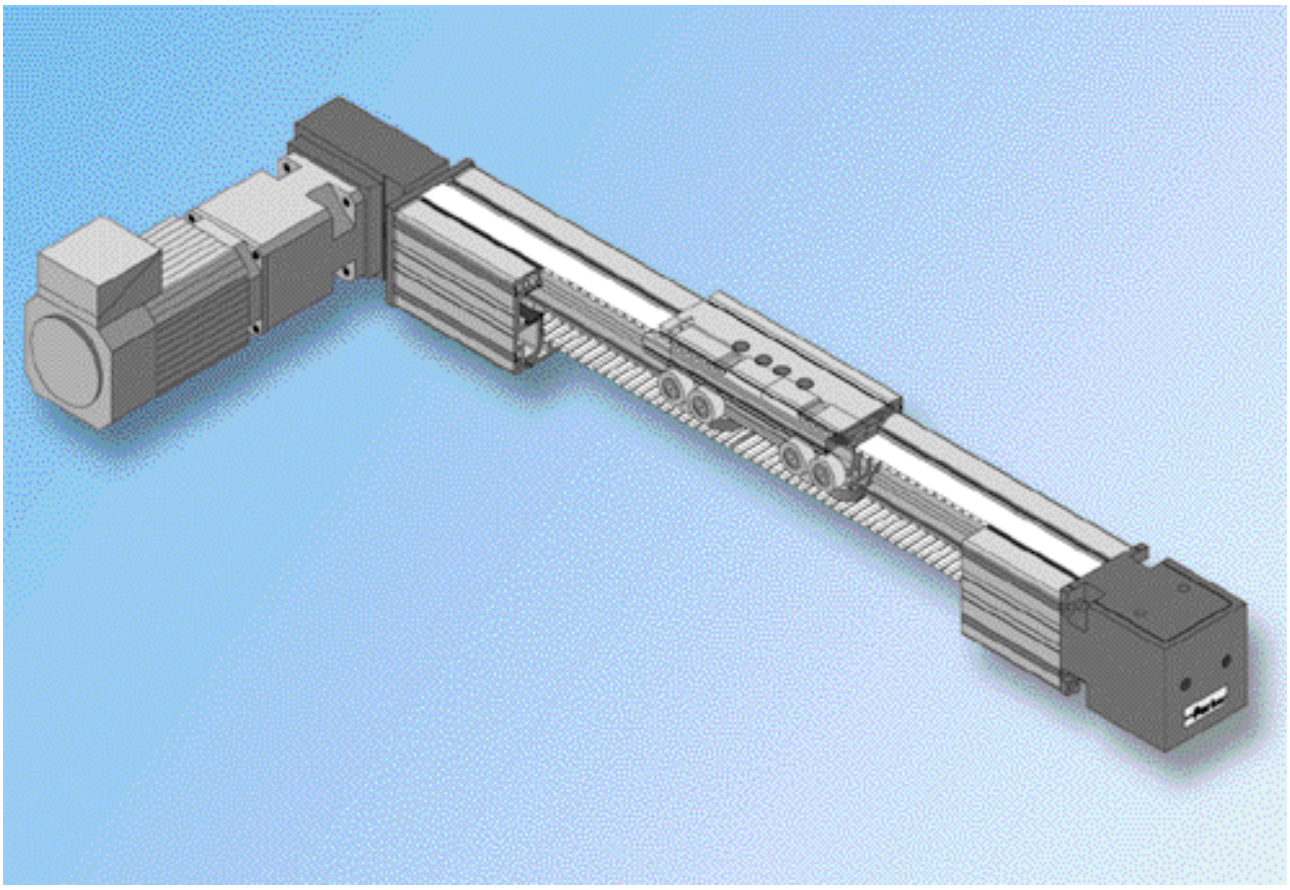
## Mounting, start-up, maintenance, repair



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Parker

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# 1 Safety

## 1.1 Correct usage

The HPLA linear actuator can be used, amongst other things, for:

positioning, transporting, feeding, removing, palletising, loading, unloading, handling and manipulating workpieces or tools.

As it can be used in widely differing areas, responsibility for use in a specific application rests with the user.

The user must ensure that in mounting workpieces or tools on the carriage of the linear actuator there is no danger to personnel and/or possible damage to property. This also applies, for example, in the case of the timing belt breaking.

The linear actuator may only be used in those areas which are inaccessible to personnel during operation.

If the linear actuator is used in areas which are accessible to personnel, then it must be installed in such a way that they are not endangered during operation.

## 1.2 Identification of residual dangers and danger areas

If there are residual dangers for personnel or property, in spite of the linear actuator being used under safely constructed conditions, then the user must indicate these residual dangers by the use of signs and written rules of conduct.

**Safety notices used**

| | |
|---|---|
| **Danger** | means that a dangerous situation can lead to death or serious physical injury if not otherwise prevented by corresponding safety measures. |
| **Warning** | means that a possibly dangerous situation can lead to possible serious injury if not otherwise prevented by corresponding safety measures. |
| **Caution** | means that a possible dangerous situation can lead to minor physical injury or damage to property if not otherwise prevented by corresponding safety measures. |
| **Note** | is an important piece of information on the product, its handling or the respective section of the handbook to which you should refer in particular. |

## 1.3 General dangers resulting from non-observance of the safety notices

This machine component has been constructed using the latest technology and is safe in operation. However, dangers can arise through the machine if operators who are untrained or have not at least been instructed in the machine operation, use it incorrectly or put it to improper use.

**As a consequence, there may be a risk of:**

1. Danger to the life and limb of the user or a third party
2. Damage to the machine and the user's other property

On installing the linear actuator in a machine, the safety regulations given in this introduction must be sensibly integrated into the operating instructions for the machine.

## 1.4 Safety-conscious working

In all work which involves the installation, the start-up, the set-up, the operation, the modification of conditions of use and operation methods, maintenance, inspections and repairs, the advice given in the start-up instructions must be followed.

### 1.4.2 Operating personnel

The following work may only be carried out by correspondingly trained and authorised per-sonnel:

Mounting and calibration work on the linear actuator
Attachment of safety limit switches (sensors)
Attachment and connection of the drive and checking the direction of rotation

## 1.5 Safety notices for the user company

Supervisors must familiarise themselves with both the whole chapter on "Safety" and the necessary handling of the linear actuator.

Supervisors must ensure that the chapter on Safety and the description of the corresponding handling have been read, understood and are being maintained by the personnel responsible for mounting and operation.

The linear actuator must only be operated when in perfect condition.

## 1.6 Safety notices for the operating personnel

Do not use any method of working which adversely affects the operating safety of the linear actuator.

The operating personnel and supervisory staff are obliged to check the linear actuator and the machine at least once per shift for any signs of external visible damage or faults, any changes which have occurred ( including the operating behaviour) which adversely affect the safety, and to report these immediately.

Components and accessories have been specially designed for the product. In acquiring replacement parts and replacing worn parts, only our genuine replacement parts must be used. We would like to make you particularly aware that genuine parts and accessories not supplied by us have also not been checked and released by us. The installation and/or use of such products can therefore, under certain circumstances, have an adverse effect on the constructional characteristics of the machine and thus affect active and/or passive operating safety.

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

On no account may any safety fixtures be removed or overridden.

Protective fixtures may not be made ineffective or bypassed.

The relevant requirements and national accident-prevention regulations are always to be com-plied with when installing and operating our mechanical linear actuators.

## 1.7 Advice on particular dangers

The HPLA must be fastened or supported at the prescribed minimum distances in accordance with the details in these instructions.

Please ensure that no danger can arise through movement of the HPLA.

If the HPLA moves in danger areas, then these areas can be defined using final limit switches.

## 1.8 Unauthorised conversions and modifications

The linear actuator may not be altered either in construction or in any way which affects safety without our permission. Any unauthorised alteration of this kind excludes any liability on our part.

## 1.9 Transport

| | |
|---|---|
| **Danger** | Do not walk under the suspended load - there is a risk of injury!<br>Ensure that parts subject to movement do not move off-centre or out of position. |

| | |
|---|---|
| **Note** | Take care when transporting long actuators. Deflection can badly affect the gui-dance.<br>Equally, the profile can change and adversely affect the performance of the carriage. |

Only use transport equipment with adequate lifting capacity. When using ropes, ensure that these are not twisted or knotted. If several ropes are used, all should be under equal tension.

When transporting the HPLA using a fork lift truck, the position of equilibrium must be counter-balanced and the load secured if necessary.

An estimate of the weight of the HPLA can be made as follows:

Measure the length L of the profile and read off the reference value for the weight from Diagram 1.

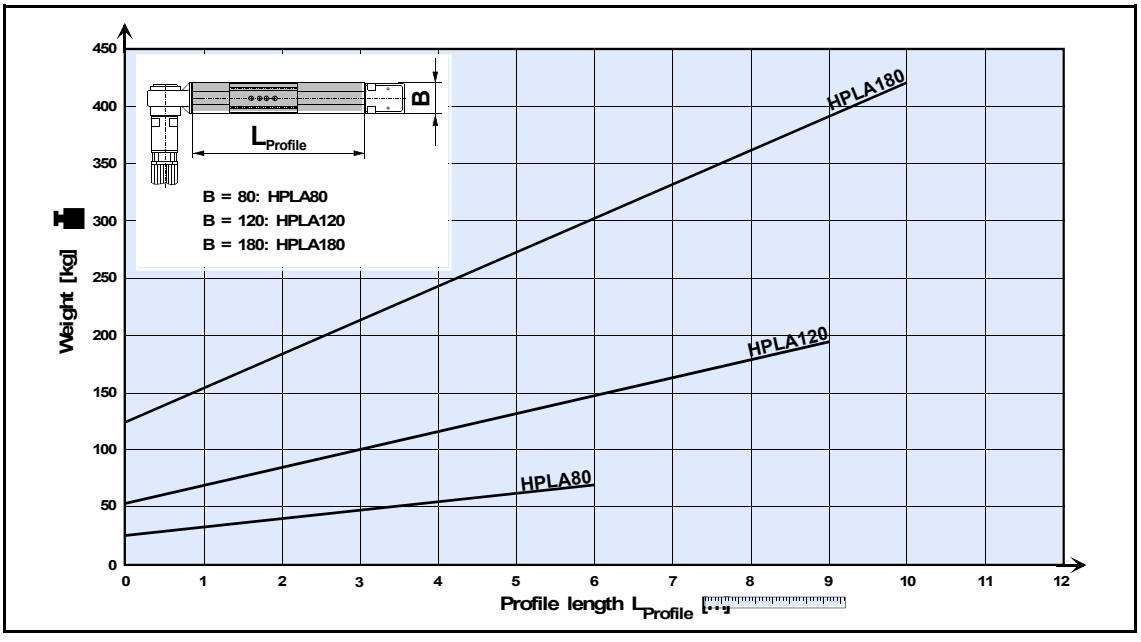
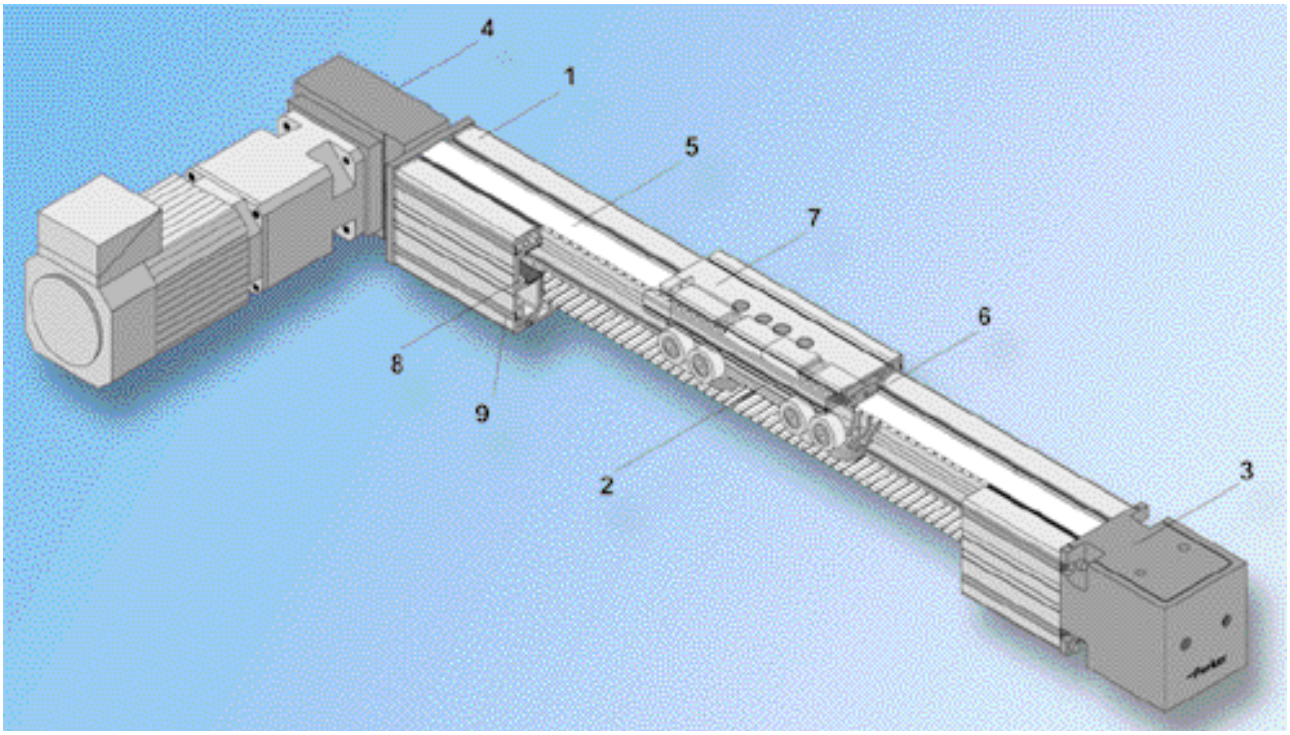



**Diagram1:** Reference values for the HPLA transportation weight (single actuator with motor and gearbox)

# 2 Technical data

## 2.1 Product construction and description




### The profile (1)

By using finite element analysis we have optimised the aluminium extru-sion bar profile to maximise rigidity (torsion and deflection) and minimise weight.
The modular concept permits the same profile to be used for all HPLA variants:
a) drive version with timing belt drive
b) version with rack-and-pinion
c) guide with plastic rollers on alu-minium
d) guide with steel rollers on a steel strip which is integrated into the profile.

6 steel strips (8) are fitted into the profile of the version with steel rollers.
The profile can be supplied in cross-sections of:
80 x 80mm (HPLA80)
120 x 120mm (HPLA120)
180 x 180mm (HPLA180).

Two assembly grooves are located on the two sides and on the bottom. These can be used in accordance with DIN-508 for T-nuts to fasten ad-ditional mechanical components and to connect several linear actuators. When combined with the covering profile (9), this forms cable ducts, e.g. for the sensor cables.

### The carriage (2)

The aluminium carriage profile has also been optimised using FEA methods. The plastic or steel rollers (mounted on roller bearings and lu-bricated for life) are set via the ec-centric to eliminate play on all sides. The carriage can be supplied in two sizes as the standard carriage with 12 rollers or extended carriage with 24 rollers.

### The tensioning station (3)

An easily accessible tensioning sta-tion which is simple to maintain and assemble. It is used to set the neces-sary tension of the timing belt and its alignment (parallel to the pulleys).

### The drive station (4)

The HPLA can be delivered with numerous drive options. Every-thing is possible – from the pulley mounted on gearbox shaft through a fully supported hollow shaft up to a drive shaft on left, on right or on both sides.

### The timing belt (5)

The timing belt is slip-free and is re-inforced by integral steel wires, there-by ensuring maximum travel speeds and repeatability.

### Clamping of timing belt (6)

The timing belt clamping angle and the large area of the clamping guar-antees a secure connection between the timing belt and the carriage.
The clamping system allows the tim-ing belt to be replaced without the load attachment plate having to be dismantled. This means that attach-ments do not normally need to be removed.

### The load attachment plate (7)

The longitudinal grooves integrated on the top of the plate offer many op-tions for the assembly of attach-ments. When used in conjunction with our clamping profiles, this allows for simple incorporation in a multiple axis system.
Simple and adjustable attachment of operating cams or switch lugs is pro-vided by means of lateral and longi-tudinal grooves.
Height and bolt points are unaffected if the steel strip cover is attached at a later date.

## 2.2 Technical data

| HPLA Size | Unit | HPLA080 | | HPLA120 | | HPLA180 | | |
|---|---|---|---|---|---|---|---|---|
| | | Timing belt drive | | Timing belt drive | | Timing belt drive | | Rack-and-pinion |
| | | Plastic roller guidance | Steel roller guidance | Plastic roller guidance | Steel roller guidance | Plastic roller guidance | Steel roller guidance | Plastic roller guidance |
| **Weight and mass moments of inertia** | | | | | | | | |
| Weight of base unit with zero stroke | | | | | | | | |
| HPLA with standard carriage (S) | kg | 6,0 | 6,6 | 18,6 | 19,8 | 49,8 | 53,4 | 71,8 |
| as above with steel strip cover | kg | 6,8 | 7,5 | 20,2 | 21,6 | 57,2 | 61,6 | 78,4 |
| HPLA with extended carriage (E) | kg | 7,8 | 8,6 | 23,5 | 25,2 | 67,4 | 72,6 | 88,6 |
| as above with steel strip cover | kg | 8,6 | 9,5 | 25,2 | 27,1 | 74,8 | 80,9 | 95,2 |
| Carriage + load att.. plate (S) | kg | 1,5 | 1,6 | 5,5 | 5,7 | 11,4 | 11,8 | 9,9 |
| as above with steel strip cover | kg | 1,7 | 1,8 | 5,8 | 6,0 | 12,3 | 12,6 | 12,5 |
| Carriage + load att. plate (E) | kg | 2,4 | 2,6 | 8,5 | 8,9 | 20,3 | 21,0 | 17,2 |
| as above with steel strip cover | kg | 2,6 | 2,8 | 8,8 | 9,2 | 21,1 | 21,8 | 19,8 |
| Weight of drive module | kg | -- | -- | -- | -- | -- | -- | 20,0 |
| Weight p. metre of add. length | kg/m | 6,0 | 7,2 | 13,5 | 15,4 | 29,2 | 33,4 | 31,4 |
| as above with steel strip cover | kg/m | 6,1 | 7,3 | 13,7 | 15,5 | 29,4 | 33,6 | 31,5 |
| Mass moment of inertia related to the drive shaft with zero stroke [1] | | | | | | | | |
| HPLA with standard carriage (S) | kgcm² | 16,0 | 16,6 | 136 | 140 | 668 | 695 | 646 |
| as above with steel strip cover | kgcm² | 17,8 | 18,4 | 142 | 146 | 725 | 743 | 698 |
| HPLA with extended carriage (E) | kgcm² | 23,6 | 24,7 | 191 | 198 | 1074 | 1107 | 793 |
| as above with steel strip cover | kgcm² | 25,4 | 26,5 | 197 | 204 | 1121 | 1154 | 845 |

| | | | | | |
|---|---|---|---|---|---|
| **Travel paths and speeds** | | | | | |
| Maximum travel speed | m/s | 5,0 | | | |
| Maximum acceleration | m/s² | 10,0 | | | |
| Maximum travel path, standard-carr. (S/T) [2] with one profile bar | mm | 5610 | 5590 | 9560 | 9530 | 9440 | 9400 | 8880 |
| as above with steel strip cover | mm | 5540 | 5520 | 9470 | 9440 | 9240 | 9200 | 8680 |
| Maximum travel path, extended carr. (E/F) [2] with one profile bar | mm | 5460 | 5440 | 9360 | 9330 | 9140 | 9100 | 8580 |
| as above with steel strip cover | mm | 5390 | 5370 | 9270 | 9240 | 8940 | 8900 | 8380 |

| | | | | |
|---|---|---|---|---|
| **Geometrical data of guide profile** | | | | |
| Cross-section | mmxmm | 80 x 80 | 120 x 120 | 180 x 180 |
| Moment of inertia Ix | cm⁴ | 139 | 724 | 3610 |
| Moment of inertia Iy | cm⁴ | 165 | 830 | 4077 |
| E-module (aluminium) | N/mm² | 0,72 * 10⁵ | | |

| | | | | | |
|---|---|---|---|---|---|
| **Forces, torques and efficiency** | | | | | |
| Nominal drive torque | Nm | 26,5 | 74,2 | 244 | 58 |
| Maximum drive torque | Nm | 47,4 | 131,4 | 368 | 58 |
| Nominal thrust force with fully supported hollow-shaft bearing | N | 925 | 1696 | 3733 | -- |
| Thrust force (effective load) | N | see page 10 | see page 11 | see page 12 | 1300 |
| Repeatability | mm | ± 0,2 | ± 0,2 | ± 0,2 | ± 0,05 |
| Efficiency | % | 95 | 95 | 95 | 80 |

| | | | | | |
|---|---|---|---|---|---|
| **Data of pulley and timing belt** | | | | | |
| Travel distance per revolution | mm/U | 180 | 270 | 420 | 280 |
| Number of teeth on pulley | | 18 | 27 | 21 | 28 |
| Timing belt width / pitch | mm | 25 / 10 | 32 / 10 | 56 / 20 | 42 / 10 |
| Weight of timing belt | kg/m | 0,166 | 0,213 | 0,550 | 0,251 |
| Response radius of the pulley of the drive ($R_A$) | mm | 28,7 | 43,0 | 66,8 | 44,56 |

1) Additional mass moment of inertia due to effective load and weight of timing belt: (see chapter 2.4).

2) Longitudinal flange connection can be used for longer travel paths. Some restrictions have to be considered for: maximum load permitted, drive torque, speed, acceleration and

**Technical data issued July/2003, safety factor taken into consideration S=1. Data applies for a temperature range of between -10°C and + 40°C. The technical data applies under standard conditions and only for the individually specified operating mode and nature of load. In the case of compound loads, it must be verified in accordance with the laws of physic and technical standards, whether single data have to be re-duced. Please contact us in the case of doubt.**

## 2.3 Load bearing capacity of carriage and timing belt

The thrust force Fx the timing belt is capable of transferring depends on its pretension. If nothing other is indicated the HPLA will be delivered with a standard pretension. With this pretension the HPLA is able to transfer the nominal thrust force F_nom. If your application needs a higher thrust force the timing belt gets a higher pretension and is able to transfer thrust forces up to F_max. If the force you transfer is greater than the pretension of timing belt it can happen that the timing belt jumps on the pulley. The service life (s_nom. / s_max) of the drive chain (without guiding system; with pulley mounted on gearbox shaft: bearing of gearbox), depends on the pretension and the thrust force that occurs.

The forces and torques the carriage is capable of transferring is speed-dependent. The curves shown in the graphs apply to a standard carriage (S/T). With the extended carriage (E/F) all the values apart from Fx (load-bearing capacity of timing belt) can be doubled, if the load is applied equally to both halves of the carriage or distributed uniformly along its entire length. The curves show the maximum load-bearing capacity of a carriage in one direction of force or torque. If several loads are applied in

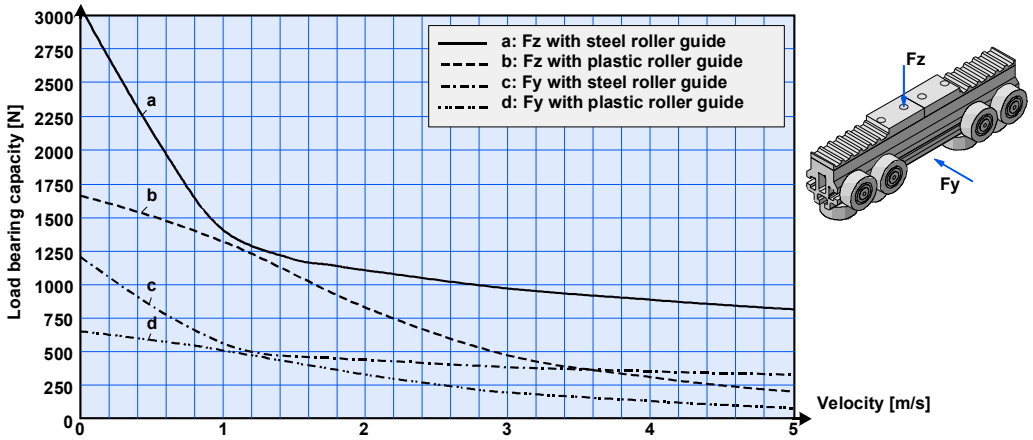
### 2.3.1 Load bearing capacity HPLA80

**Please note the explanations in chapter "Load bearing capacity of carriage and timing belt", page 10!**

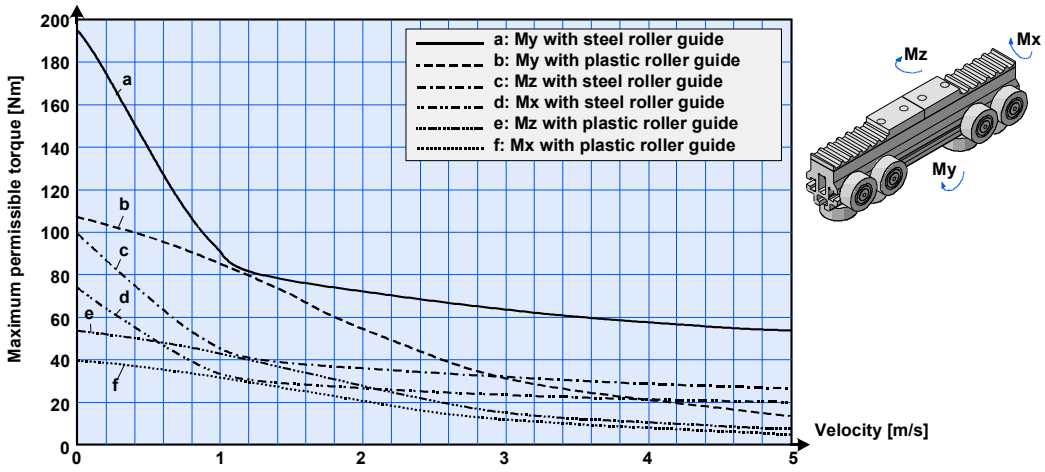
| Thrust force HPLA80 (Fx) | Transferable thrust force (with dual actuators: each belt drive) | | Nominal service life * | |
|---|---|---|---|---|
| **Drive options (→ page 53)** | **F_nom. [N]** | **F_max [N]** | **s_nom. [km]** | **s_max [km]** |
| NL/NR / DL/DR / LR/RL (Single-/Dual actuator, hollow shaft bearing) | 925 | 1114 | 81000 | 46000 |
| SL/SR / SB (Single-/Dual actuator, full-shaft bearing) | 925 | 1114 | 81000 | 46000 |
| GL/GR // FL/FR, Single actuator, pulley mounted on gearbox shaft P3 (A) | 474 | 602 | 81000 | 40000 |
| GL/GR // FL/FR, Single actuator, pulley mounted on gearbox shaft P3V (A) | 925 | 1114 | 81000 | 46000 |
| GL/GR // FL/FR, Single actuator, pulley mounted on gearbox shaft P4 (B) | 557 | 671 | 81000 | 46000 |
| GL/GR // FL/FR, Single actuator, pulley mounted on gearbox shaft P4V (B) | 925 | 1114 | 81000 | 46000 |
| GL/GR // FL/FR, Single actuator, pulley mounted on gearbox shaft PE4 (Q) | 500 | 600 | 81000 | 46000 |
| GL/GR // FL/FR, Single actuator, pulley mounted on gearbox shaft PE5 (R) | 675 | 900 | 81000 | 46000 |

* The calculation of nominal service life for roller bearings bases on: at least 90% of all bearings achieve or exceed the nominal service life.

**Load bearing capacity HPLA80 (Fy and Fz)**




**Maximum permissible torque HPLA80 (Mx, My and Mz)**



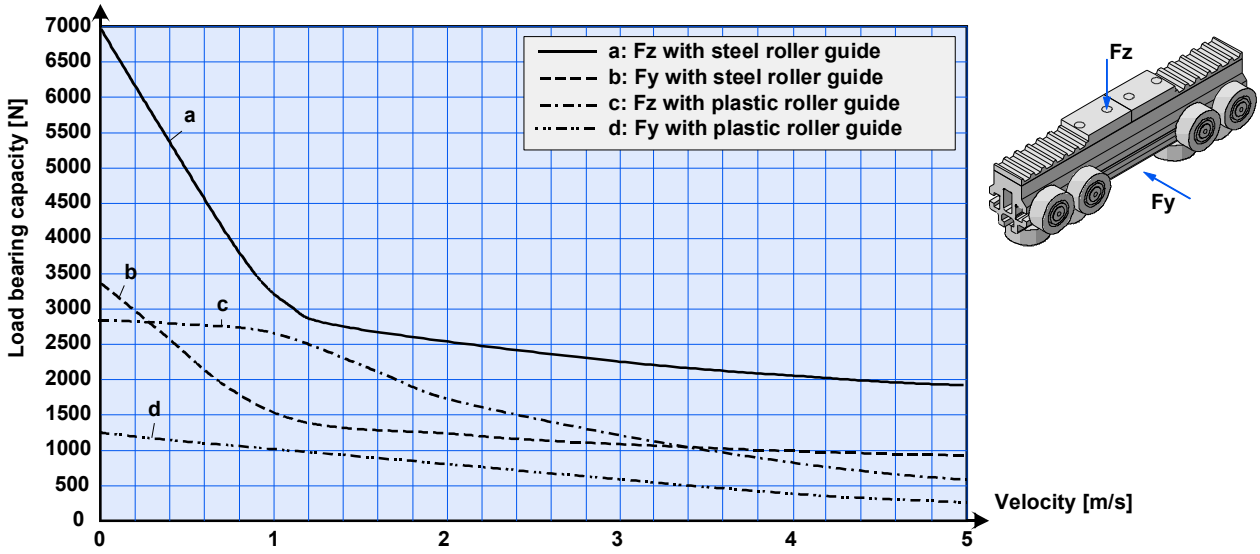
## 2.3.2 Load bearing capacity HPLA120

**Please note the explanations in chapter "Load bearing capacity of carriage and timing belt", page 10!**

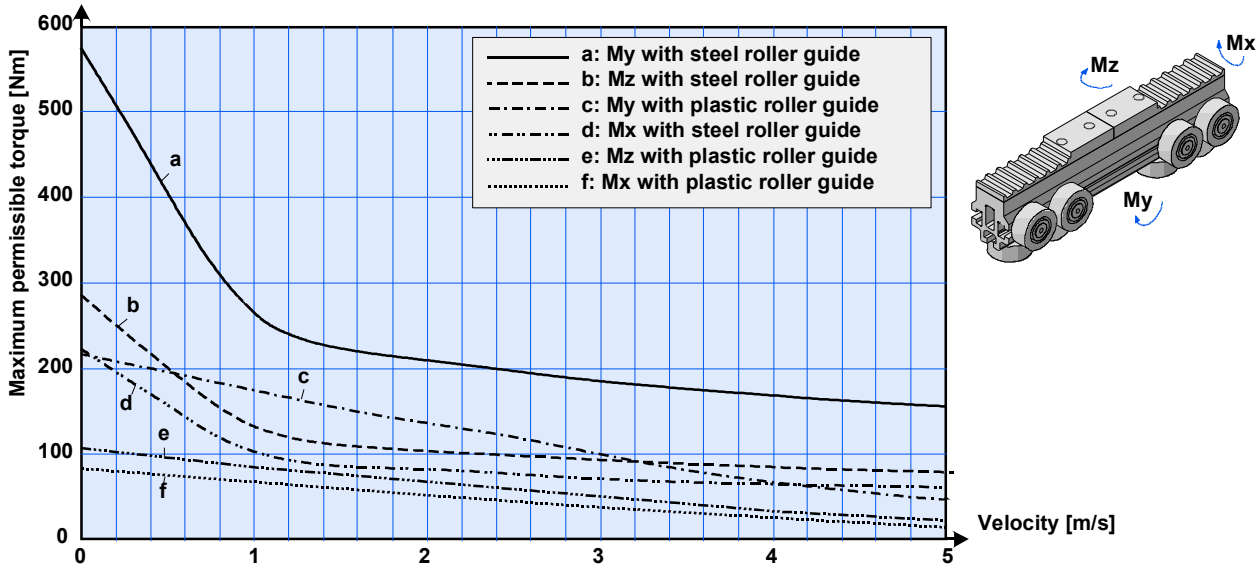
| Thrust force HPLA120 (Fx) | Transferable thrust force (with dual actuators: each belt drive) | | Nominal service life * | |
|---|---|---|---|---|
| Drive options (→ page 53) | F_nom. [N] | F_max [N] | s_nom. [km] | s_max [km] |
| NL/NR / DL/DR / LR/RL (Single-/Dual actuator, hollow shaft bearing) | 1696 | 2234 | 85000 | 37000 |
| SL/SR / SB (Single-/Dual actuator, full-shaft bearing) | 1696 | 2234 | 85000 | 37000 |
| GL/GR // FL/FR, Single actuator, pulley mounted on gearbox shaft P4 (B) | 627 | 905 | 85000 | 28000 |
| GL/GR // FL/FR, Single actuator, pulley mounted on gearbox shaft P4V (B) | 1514 | 2014 | 85000 | 36000 |
| GL/GR // FL/FR, Single actuator, pulley mounted on gearbox shaft P5 (C) | 1059 | 1529 | 85000 | 28000 |
| GL/GR // FL/FR, Single actuator, pulley mounted on gearbox shaft P5V (C) | 1696 | 2234 | 85000 | 37000 |
| GL/GR // FL/FR, Single actuator, pulley mounted on gearbox shaft PE5 (R) | 675 | 900 | 85000 | 37000 |

* The calculation of nominal service life for roller bearings bases on: at least 90% of all bearings achieve or exceed the nominal service life.

### Load bearing capacity HPLA120 (Fy and Fz)




### Maximum permissible torque HPLA120 (Mx, My, Mz)



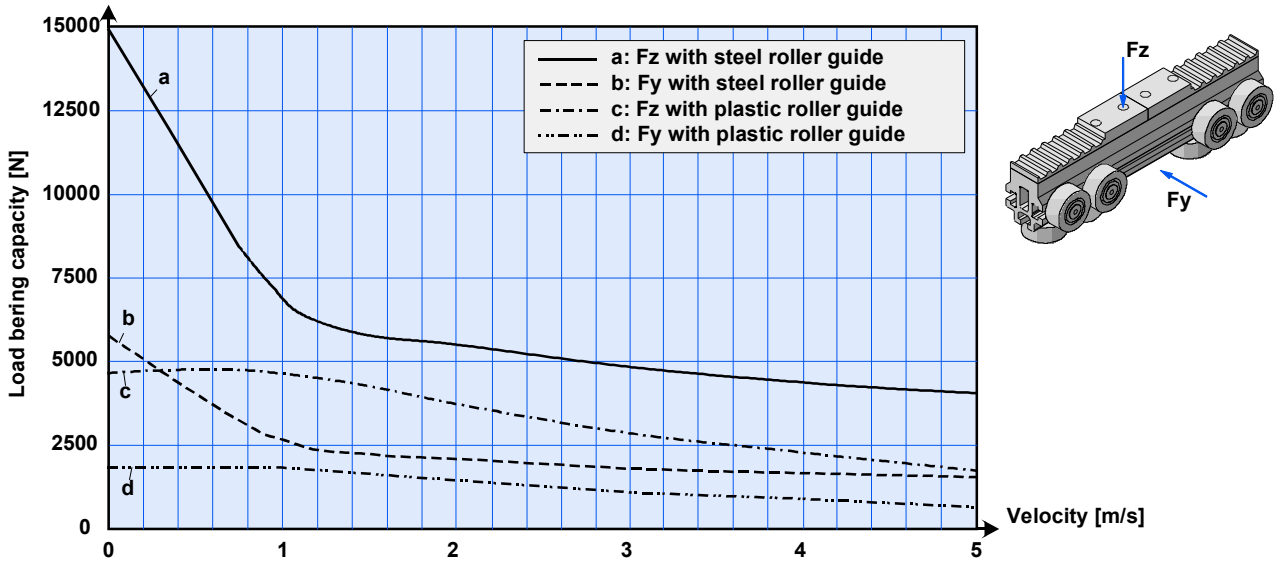
## 2.3.3 Load bearing capacity HPLA180

**Please note the explanations in chapter "Load bearing capacity of carriage and timing belt", page 10!**

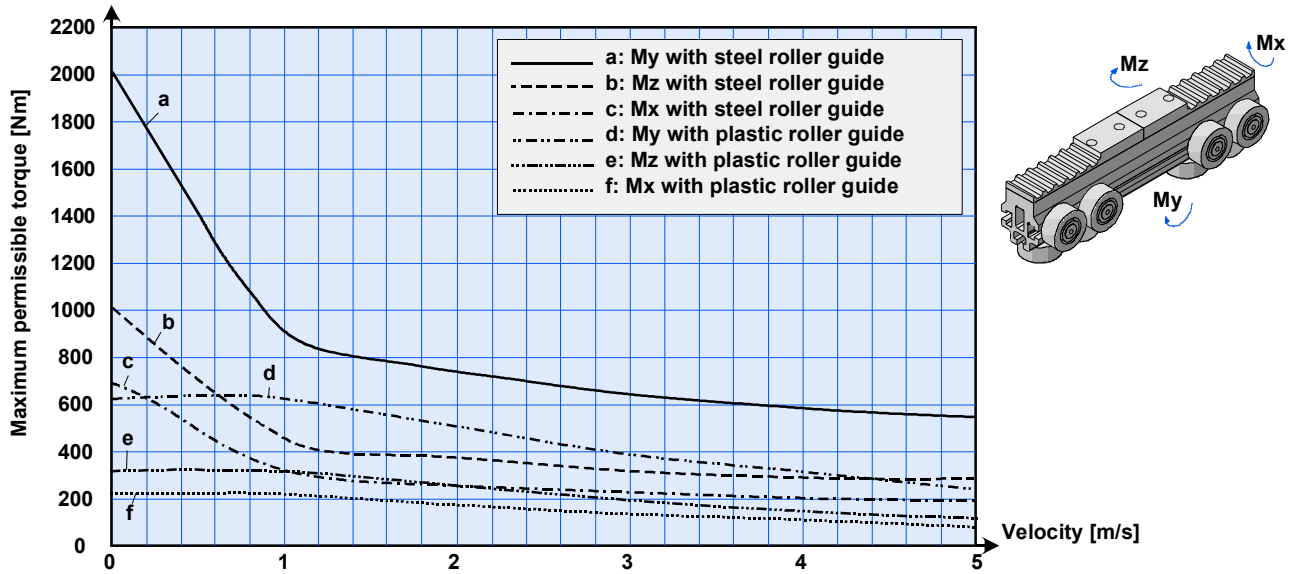
| Thrust force HPLA180 (Fx) | Transferable thrust force (with dual actuators: each belt drive) | | Nominal service life * | |
|---|---|---|---|---|
| Drive options (→ page 53) | F_nom. [N] | F_max [N] | s_nom. [km] | s_max [km] |
| NL/NR / DL/DR / LR/RL (Single-/Dual actuator, hollow shaft bearing) | 4169 | 5457 | 100000 | 45000 |
| SL/SR / SB (Single-/Dual actuator, full-shaft bearing) | 3770 | 3770 | 136000 | 136000 |
| GL/GR // FL/FR, Single actuator, pulley mounted on gearbox shaft P5 (C) | 1160 | 1519 | 100000 | 45000 |
| GL/GR // FL/FR, Single actuator, pulley mounted on gearbox shaft P5V (C) | 2513 | 2513 | 112000 | 112000 |
| GL/GR // FL/FR, Single actuator, pulley mounted on gearbox shaft P7 (D) | 1654 | 2164 | 100000 | 45000 |
| GL/GR // FL/FR, Single actuator, pulley mounted on gearbox shaft P7V (D) | 3561 | 4398 | 100000 | 54000 |

* The calculation of nominal service life for roller bearings bases on: at least 90% of all bearings achieve or exceed the nominal service life.

### Load bearing capacity HPLA180 (Fy and Fz)




### Maximum permissible torque HPLA180 (Mx, My, Mz)



## 2.4 Additional mass moment of inertia due to effective load and weight of the timing belt

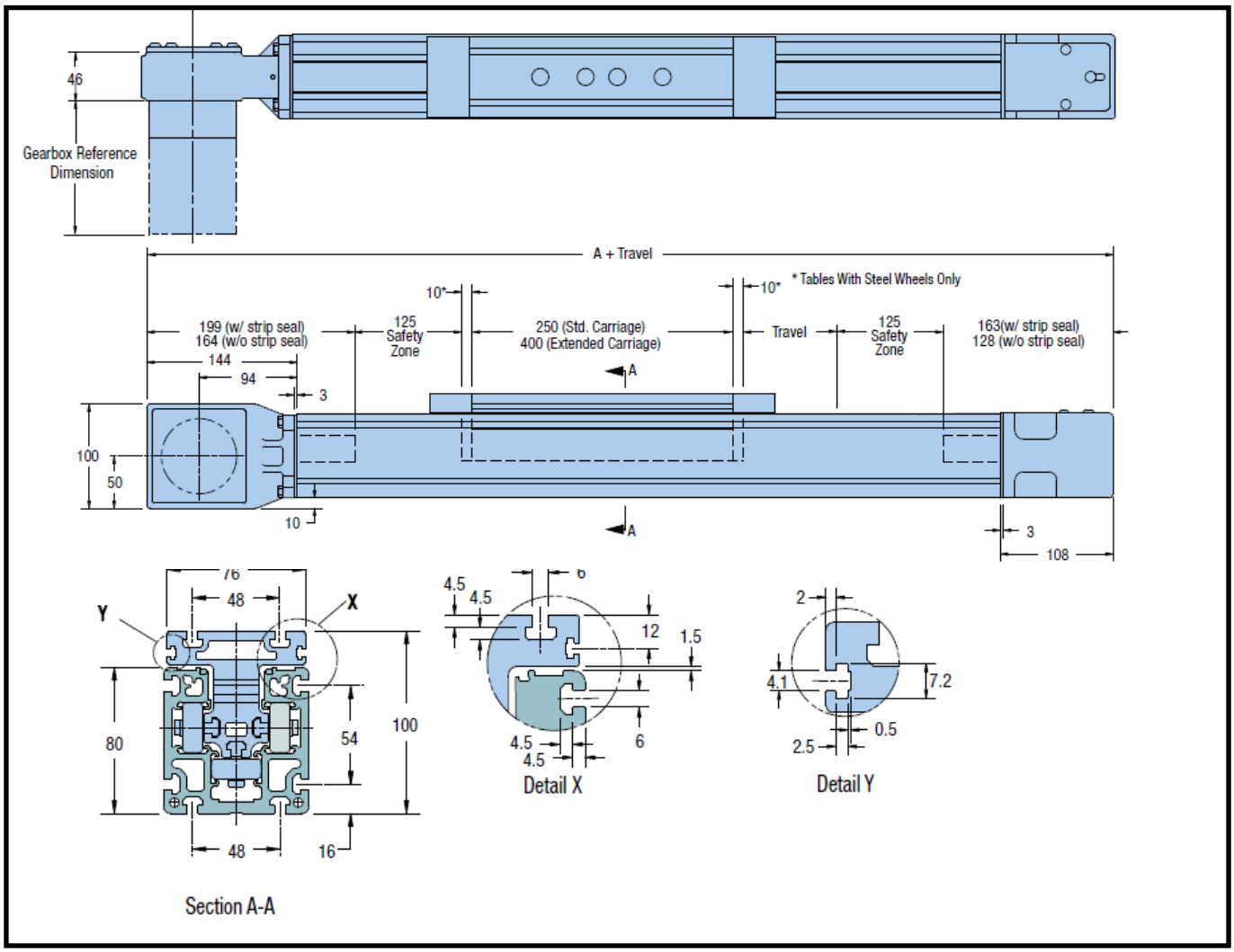
| Formula for actuators with timing belt: | | | Formula for actuators with rack: |
|---|---|---|---|
| $J_Z$ | = | $J_{NL} + J_{R.}$ | $J_Z = m_{NL} \times R_A^2$ |
| $J_{NL}$ | = | $m_{NL} \times R_A^2$ | Add weight of motor and gearbox to the effective load! |
| $J_R$ | = | $m_R \times R_A^2$ | |
| $m_R$ | = | $L_R \times m_{R1M}$ | |
| $L_R$ | ≈ | 2 x stroke + $L_{R0H}$ | |

**Key**:

$J_Z$ = Additional mass moment of inertia [kgcm$^2$]
$J_{NL}$ = Additional mass moment of inertia due to the effective load [kgcm$^2$]
$J_R$ = Additional mass moment of inertia due to the weight of timing belt [kgcm$^2$]
$m_{NL}$ = Weight of the effective load moved by the linear actuator [kg]
$m_R$ = Weight of timing belt [kg]
$m_{R1M}$ = Weight per metre of timing belt (see technical data, page 9) [kg/m]
$L_R$ = Length of timing belt [m]
$L_{R0H}$ = Length of timing belt of an actuator without stroke (see Table 7, page 28)
$R_A$ = Response radius of pulley (see technical data, page 9) [cm]

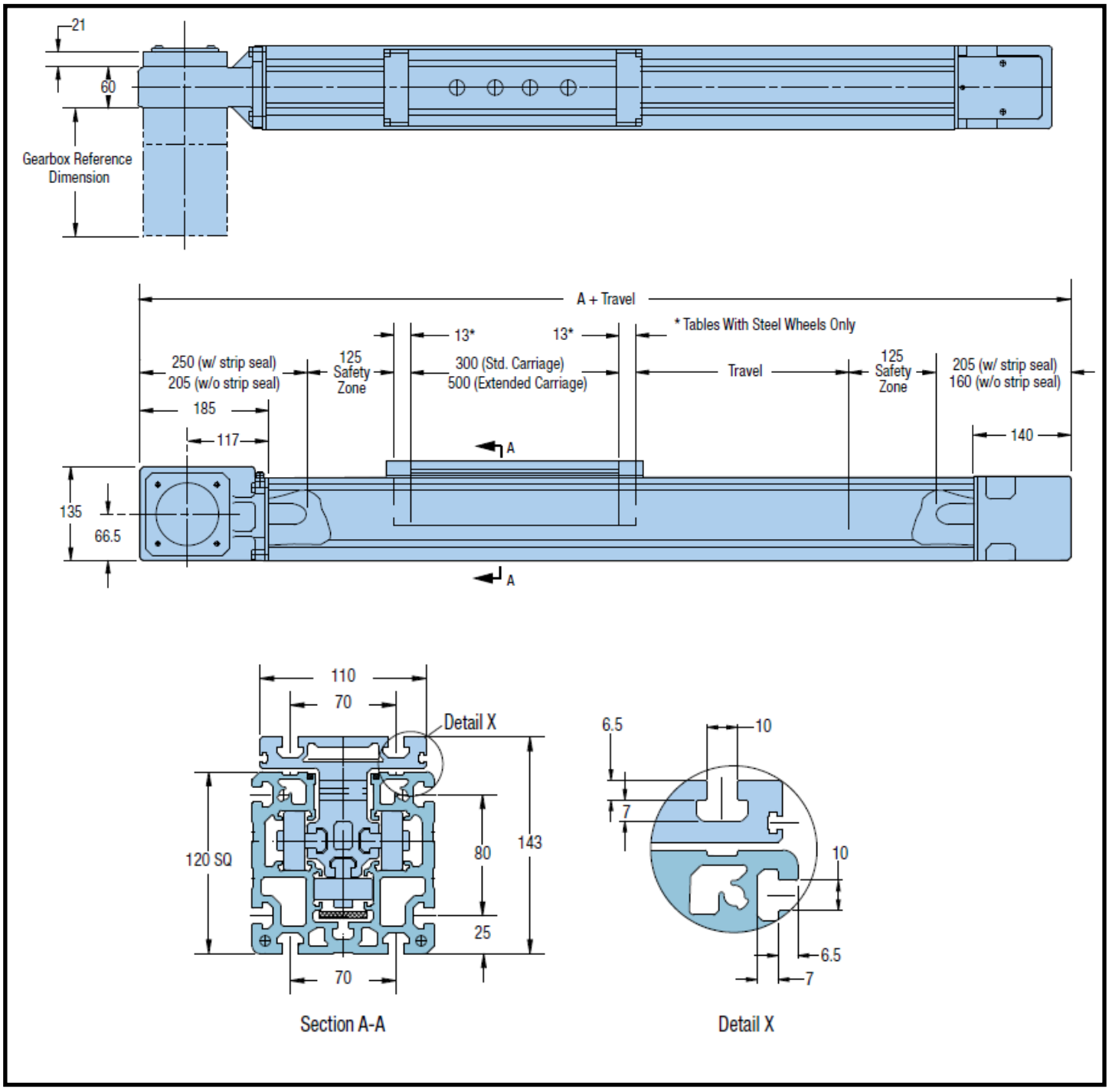
## 2.5 Dimensions

### 2.5.1 Dimensions of HPLA80 with timing belt



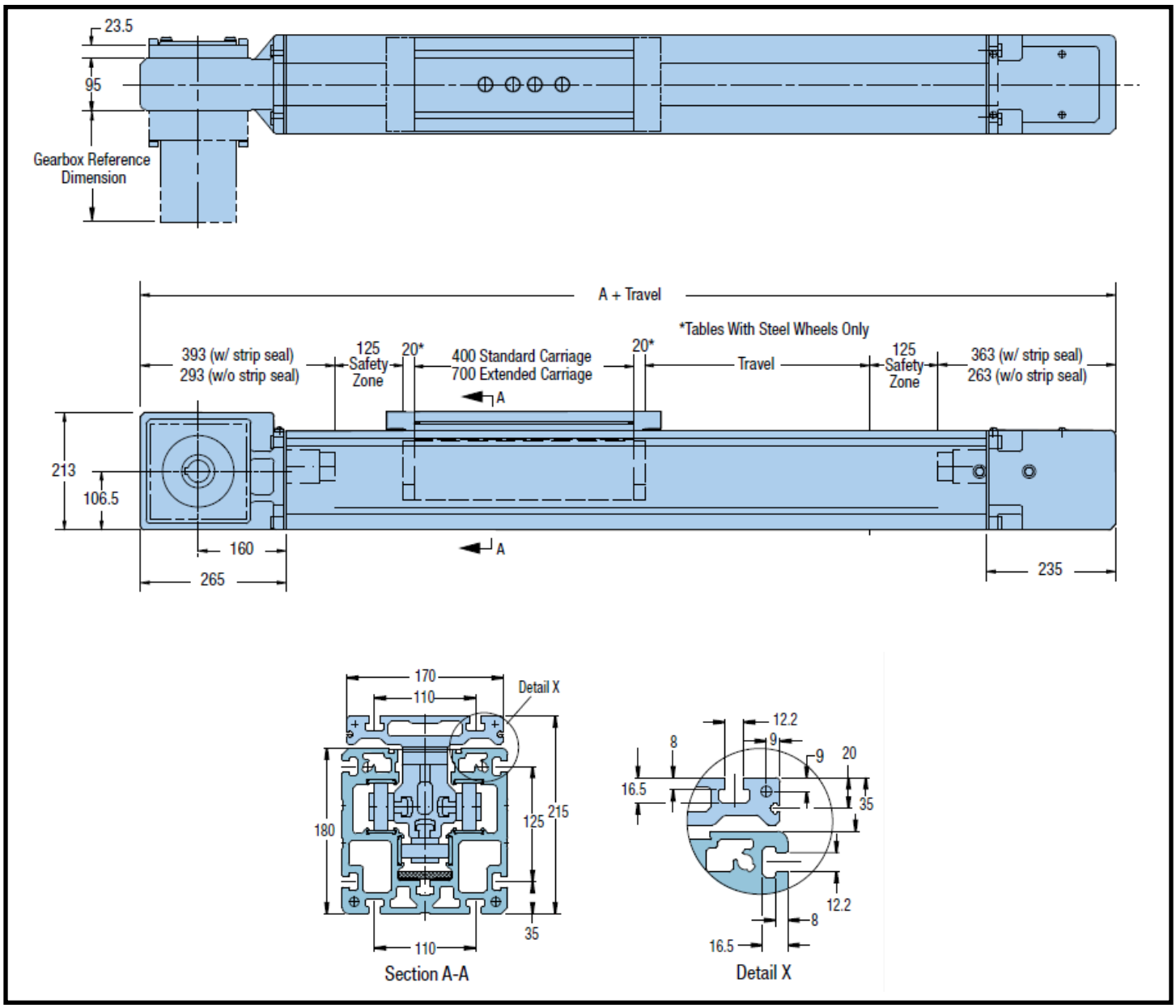

| Description | Dimension A (mm) | |
|---|---|---|
| | With Strip Seal | Without Strip |
| Standard Carriage - Polyamide Wheels | 862 | 792 |
| Standard Carriage - Steel Wheels | 882 | 812 |
| Extended Carriage - Polyamide Wheels | 1012 | 942 |
| Extended Carriage - Steel Wheels | 1032 | 962 |

## 2.5.2 Dimensions of HPLA120 with timing belt



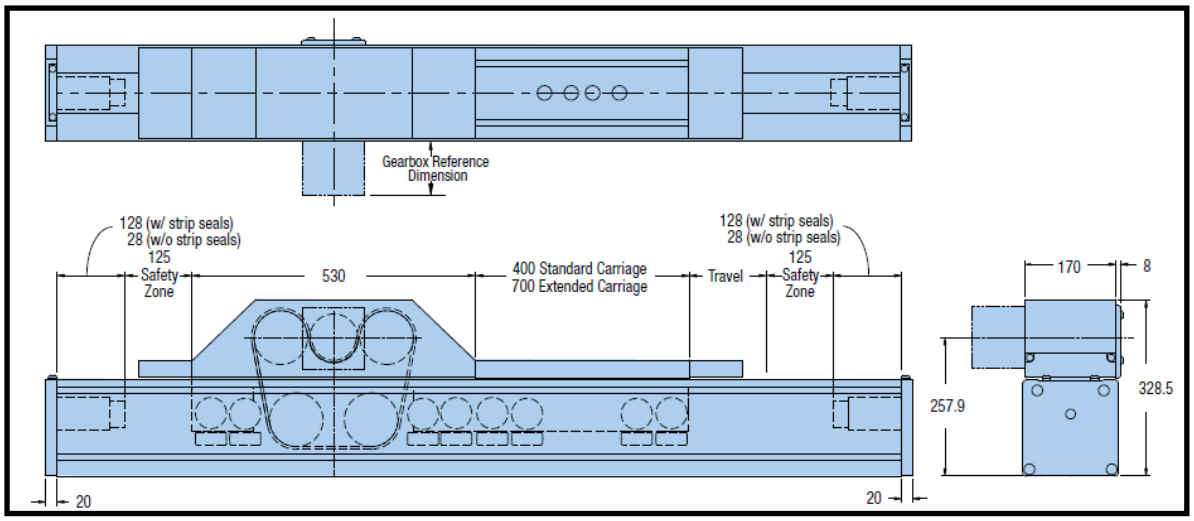

| Description | Dimension A (mm) | |
|---|---|---|
| | With Strip Seal | Without Strip Seal |
| Standard Carriage - Polyamide Wheels | 1005 | 915 |
| Standard Carriage - Steel Wheels | 1031 | 941 |
| Extended Carriage - Polyamide Wheels | 1205 | 1115 |
| Extended Carriage - Steel Wheels | 1231 | 1141 |

## 2.5.3 Dimensions of HPLA180 with timing belt

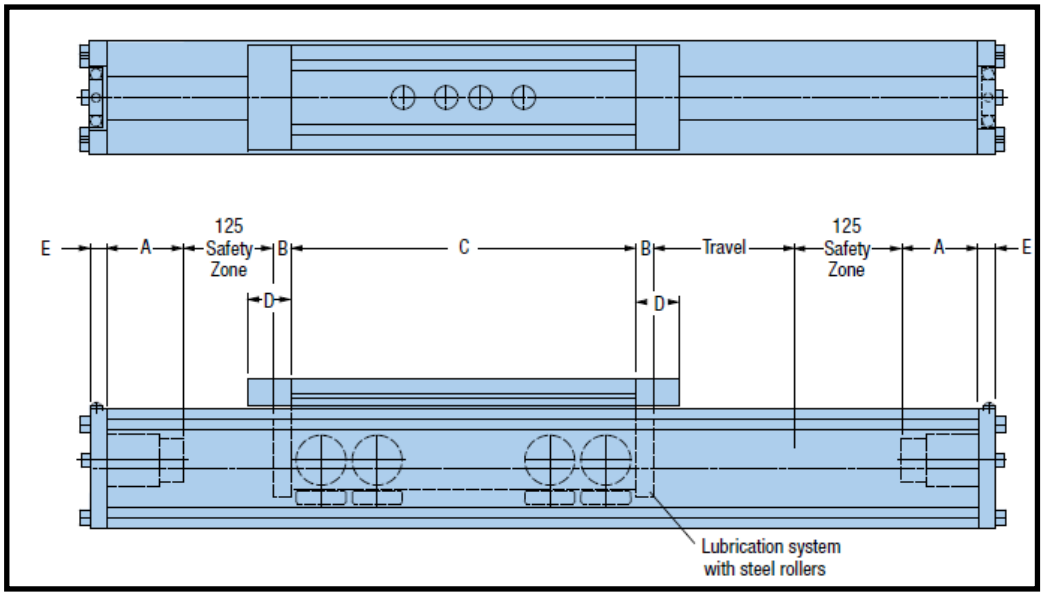



| Description | Dimension A (mm) | |
|---|---|---|
| | With Strip Seal | Without Strip Seal |
| Standard Carriage - Polyamide Wheels | 1408 | 1206 |
| Standard Carriage - Steel Wheels | 1446 | 1246 |
| Extended Carriage - Polyamide Wheels | 1706 | 1506 |
| Extended Carriage - Steel Wheels | 1746 | 1546 |

## 2.5.4 Dimensions of HPLA180 with rack-and-pinion drive




## 2.5.5 Dimensions of idler unit




| Series | Carriage Length | Wheel Type | With Strip Seal (mm) | | | | | Without Strip Seal (mm) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | A | B | C | D | E | A | B | C | D | E |
| HPLA080 | Standard | Polyamide | 55 | - | 250 | 40 | 10 | 20 | - | 250 | - | 10 |
| HPLA080 | Extended | Polyamide | 55 | - | 400 | 40 | 10 | 20 | - | 400 | - | 10 |
| HPLA080 | Standard | Steel | 55 | 10 | 250 | 40 | 10 | 20 | 10 | 250 | - | 10 |
| HPLA080 | Extended | Steel | 55 | 10 | 400 | 40 | 10 | 20 | 10 | 400 | - | 10 |
| HPLA120 | Standard | Polyamide | 65 | - | 300 | 50 | 15 | 20 | - | 300 | - | 15 |
| HPLA120 | Extended | Polyamide | 65 | - | 500 | 50 | 15 | 20 | - | 500 | - | 15 |
| HPLA120 | Standard | Steel | 65 | 13 | 300 | 50 | 15 | 20 | 13 | 300 | - | 15 |
| HPLA120 | Extended | Steel | 65 | 13 | 500 | 50 | 15 | 20 | 13 | 500 | - | 15 |
| HPLA180 | Standard | Polyamide | 128 | - | 400 | 100 | 20 | 28 | - | 400 | - | 20 |
| HPLA180 | Extended | Polyamide | 128 | - | 700 | 100 | 20 | 28 | - | 700 | - | 20 |
| HPLA180 | Standard | Steel | 128 | 20 | 400 | 100 | 20 | 28 | 20 | 400 | - | 20 |
| HPLA180 | Extended | Steel | 128 | 20 | 700 | 100 | 20 | 28 | 20 | 700 | - | 20 |

## 2.6 Definition of stroke, usable stroke and safety travel

**Usable stroke:** The usable stroke is the stroke needed for your application. It is always shorter than the stroke.

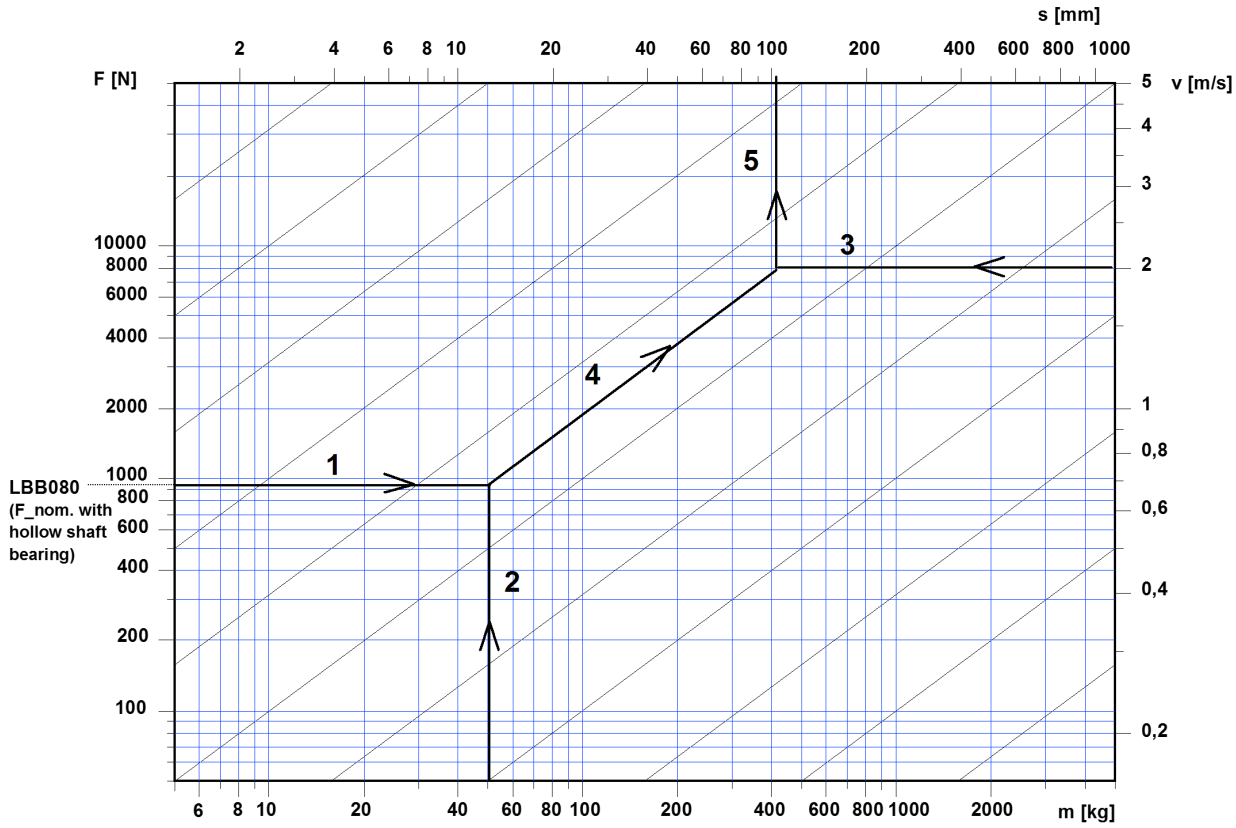
**Stroke:** The stroke to be specified in the order code is the maximum mechanical stroke between the internal end-buffers. It consists of:

**Stroke = Usable stroke + right safety travel + left safety travel + 20mm***

* We recommend to add approximately 10mm additional travel on each side as compensation for the hysteresis of the limit switches or - depending on the control unit - as additional travel for a software limit stop.

The right and left safety travel is in each case the safety travel which is required in order to slow the linear actuator to rest without hitting the mechanical end stop, using an emergency stop ramp after hitting a limit switch. F shows the transferable thrust force (see **Table 9**) for each actuator and may not be exceeded. In the event

### 2.6.1 Establishing required safety travel




**Key:**
**m:** Effective load in kg (for an HPLA with rack-and-pinion drive please add the weight of the motor and the gearbox to the effective load)
**v:** Velocity of linear actuator before slowing down in m/s.
**F:** Braking force of drive during the emergency stop ramp in N.
**s:** The required safety travel s in mm that results from the moved weight, velocity and braking force.

**Example:**

The example in the diagram shows the determination of a safety travel for a HPLA80 with 50 kg effective load (2), slowed-down from a velocity of 2 m/s (3) with the permissible thrust force for this actuator F_nom. (925 N) (1). The required safety travel is then approximately 110 mm (5).

# 3 Start-up

## 3.1 General

If you have ordered the HPLA standard actuator with drive and sensors, then this will be supplied completely mounted and ready for operation.

Spliced or jointed HPLA actuators and dual actuators will be supplied in a dismantled state for delivery and safety reasons. (Assembly instructions in chapters 5.9 and 5.10).

If you have not planned to use a Parker drive, attach your motor-gearbox combination according to the manufacturer's details which apply.

The fitting position of the HPLA is always horizontal and with the profile opening facing upwards, unless planned otherwise.

| | | |
|---|---|---|
|  | **Note** | If the actuator is fitted vertically, ensure that the drive is on top. This is due to the elastic properties of the drive belt. |

## 3.2 Support structure preparation

Each point of support must be level and parallel to within 0.2 mm.

All support points must be aligned to one another with a parallelism better than 0.5 mm.

In the case of dual actuator systems, parallelism of 0.2 mm between the actuators must be guaranteed.

Ideal distance between supports (for deflection of approx .1 mm)

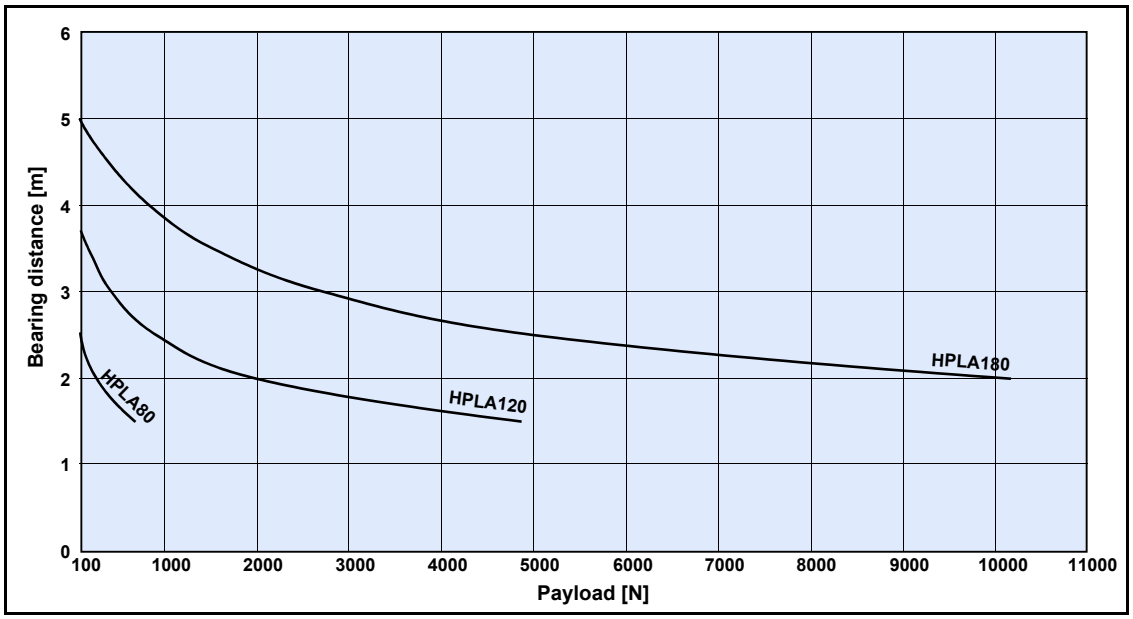



**Diagram 2:** Ideal distance between supports (for deflection of approx 1 mm)

To simplify mounting and adjustment, the support points for the HPLA fastening can consist of adapter plates which can be aligned using adjustment and clamping screws.

## 3.3 Installation

| | |
|---|---|
| **Caution** | Take care when transporting long actuators. Deflection can badly affect the gui-dance. Equally, the profile can change and adversely affect the performance of the carriage. |
| **Note** | When the HPLA is being fitted, with the carriage projection upwards, do not remove the adhesive film until the conclusion of all assembly work in order to avoid dirt getting into the interior of the HPLA. |
| **Note** | When installing the HPLA, make sure there is adequate access to the tensioning station and the carriage for maintenance purposes! (There have to be enough place behind the tensioning station to put out the carriage completely). |

### 3.3.1 Installing a single actuator

1. Remove the actuator from the transportation box.
2. Place the HPLA on the levelled connection points (spirit level, levelling instrument).
3. Attach the actuator. To do this, place sliding blocks in the t-slot groove of the profile and fasten with screws. Do not drill the profile!
4. Attach the add-on accessories.
5. Remove the dust cover (adhesive film).

### 3.3.2 Installing a dual actuator

1. Remove the actuator from the transportation box.
2. Place the HPLA on the levelled connection points (spirit level, levelling instrument).
3. Attach the actuator. To do this, place sliding blocks in the t-slot groove of the profile and fasten with screws. Do not drill the profile!
4. Attach the second actuator and fasten loosely.
5. Measure the parallelism (e.g. by tape measure) (see Figure 1).
6. Measure both diagonals to check that it is square (tape measure) (see Figure 1). If necessary, correct the diagonal measurement by parallel movement of the second actuator.
7. Check the horizontal orientation of both actuators to one another (spirit level, levelling instrument), and correct if necessary.
8. Finally, fasten the second actuator.
9. Attach the add-on accessories.
10. Remove the dust cover (adhesive film).

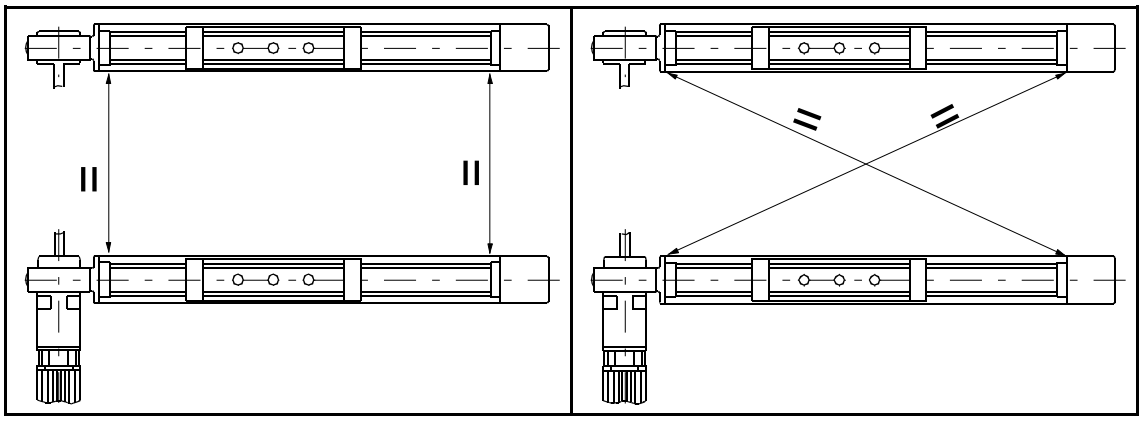


**Figure 1:** Aligning a dual actuator

| | |
|---|---|
| **Note** | When installing the actuator vertically, the above procedure must be modified accordingly. |

## 3.4 Sensors/sensors

### 3.4.1 General

The HPLA linear actuator is available with two different sensor variants.

1. Version with three sensors:

   If you have ordered the linear actuator together with three sensors and termination box, they will be supplied completely wired. The position of sensors have to be adjusted by customer.

| | |
|---|---|
| **Note** | Some servo controls (e.g. COMPAX S from Parker) operate with a software end limit. With the COMPAX S, for example, this lies 10mm in front of the sensors. To find out the measurement for the software end limit of your control, please refer to its documentation. |

2. Version with one sensor as machine home:

   If you have ordered the linear actuator together with one sensor, ensure that your controller has software end limits (end limits can be programmed). The maximum travel distance in both positive and negative directions is then defined via these limits.

   The sensor in this version is wired directly to the controller.

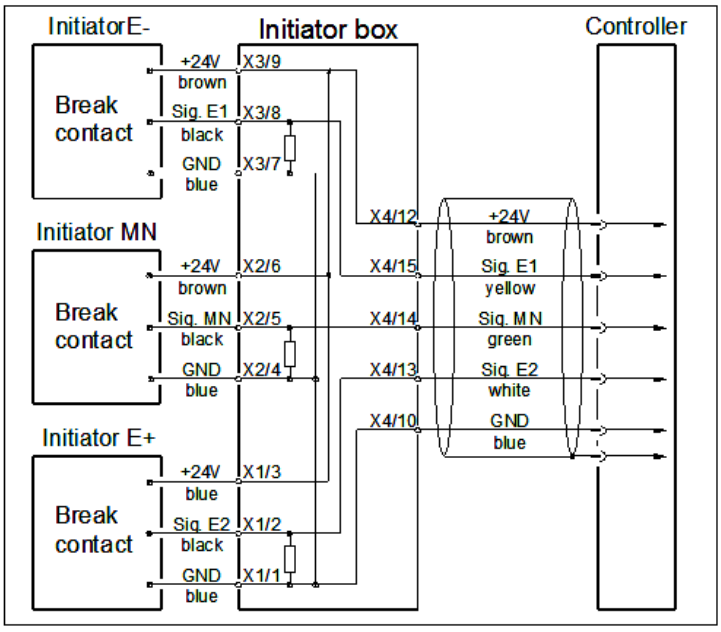
   **General recommendation:** The following safety distances should be maintained:

   1. Calculation of safety travel: see chapter 2.6.1
   2. If you require a smaller safety travel, please contact Parker.

| | |
|---|---|
| **Note** | The usable stroke of the linear actuator can be calculated by:<br>Usable stroke = stroke - (right safety travel + left safety travel + 20mm). |

### 3.4.2 Version with three sensors

#### 3.4.2.1 Wiring sensors/ sensors




If the HPLA is supplied with ini-tiators and a termination box, then the components will be wired according to Figure 2.

Dependent upon the order request, a cable configured as follows will be connected to the termination box.

To connect the cable to your controller, refer to the corres-ponding handbook.

**Figure 2:** Connecting the position sensors; MN: Machine-zero; Sig.: Signal

### 3.4.2.2 Setting up the end limits

| | Note | Generally the tripping plate, sensors and distributor box are attached on the same side as the motor. |
|---|---|---|

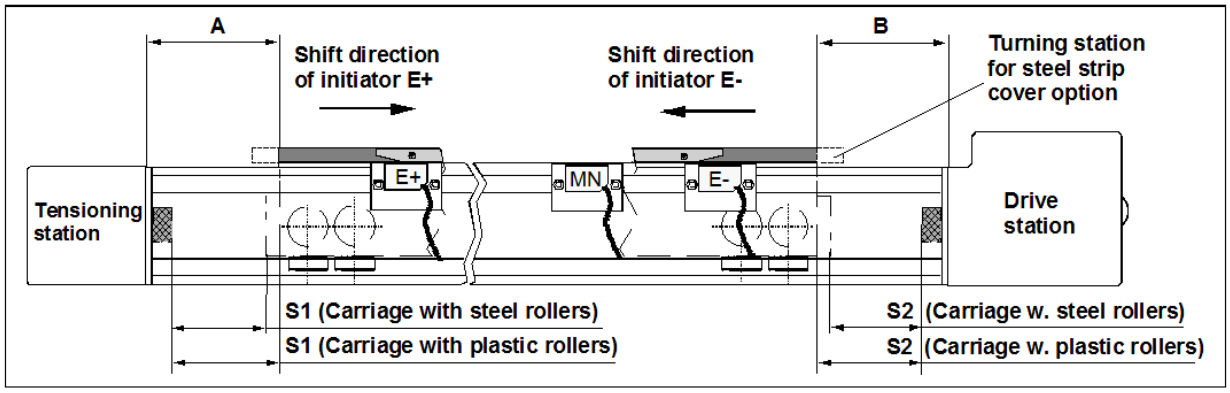



**Figure 3**: External sensors: setting up end limits and safety distances

| Dimensions | Unit | HPLA80 with plastic rollers | | HPLA80 with steel rollers | |
|---|---|---|---|---|---|
| | | Standard | Steel strip cov. opt. | Standard | Steel strip cov. opt. |
| A | mm | 23 + S | 58 + S | 33 + S | 68 + S |
| B | mm | 23 + S | 58 + S | 33 + S | 68 + S |

**Table 1:** Distances for setting up the external sensors on the HPLA80. Calculation of safety travel S, see chapter 2.6.1.

| Dimensions | Unit | HPLA120 with plastic rollers | | HPLA120 with steel rollers | |
|---|---|---|---|---|---|
| | | Standard | Steel strip cov. opt. | Standard | Steel strip cov. opt. |
| A | mm | 25 + S | 70 + S | 38 + S | 83 + S |
| B | mm | 25 + S | 70 + S | 38 + S | 83 + S |

**Table 2:** Distances for setting up the external sensors on the HPLA120. Calculation of safety travel S, see chapter 2.6.1.

| Dimensions | Unit | HPLA180 with plastic rollers | | HPLA180 with steel rollers | |
|---|---|---|---|---|---|
| | | Standard | Steel strip cov. opt. | Standard | Steel strip cov. opt. |
| A | mm | 33 + S | 133 + S | 53 + S | 153 + S |
| B | mm | 33 + S | 133 + S | 53 + S | 153 + S |

**Table 3:** Distances for setting up the external sensors on the HPLA180. Calculation of safety travel S, see chapter 2.6.1.

**Setting up the end limits E- and E+**

1. Attach the tripping plate centrally on the load attachment plate using the screws supplied.
2. Arrange the limit switches according to the sequence shown in **Figure 3**.
3. **E-:** Bring the carriage with the load attachment plate into position as Figure 3 and Table 3 (dimension B). Move limit switch E- from the drive station in the direction of the tensioning station until it operates
4. **E+:** Bring the carriage with the load attachment plate into position as in Figure 3 and Table 3 (dimension A). Move limit switch **E+** from the tensioning station in the direction of the drive station until it operates
5. Make sure that the carriage runs smoothly. The distance between the tripping plate and the limit switch should be approximately 1.5 mm with electronic sensor switches (see manufacturer's details).

**Setting up the machine zero point MN**

The sensor switch for the machine zero point is fitted approximately 150mm away from the limit switch E- in the direction of the tensioning station. The distance between the tripping plate and the limit switch should be approximately 1.5 mm with electronic sensor switches (see manufacturer's details).

### 3.4.3 Version with one sensor

If only one sensor is used, ensure that this is used as the machine zero point sensor.

#### 3.4.3.1 Wiring the sensor

As was mentioned above, the sensor is connected directly to the controller. The wiring should be undertaken in accordance with the appropriate product documentation.

#### 3.4.3.2 Setting up the end limits

The maximum travel distance in both the positive and negative direction is defined by the software end limits (end limits can be programmed). The machine zero point sensor must always be within the software end limits.

| | |
|---|---|
| **Caution** | The software end limits are not usually pre-set. They must therefore be defined before start-up and entered in the control unit (e.g. COMPAX S produced by Parker: |

| | |
|---|---|
| **Note** | Recommendation: The real zero point of your controller should be the **same** as the machine zero point. |

# 4. Maintenance

## 4.1 Maintenance schedule

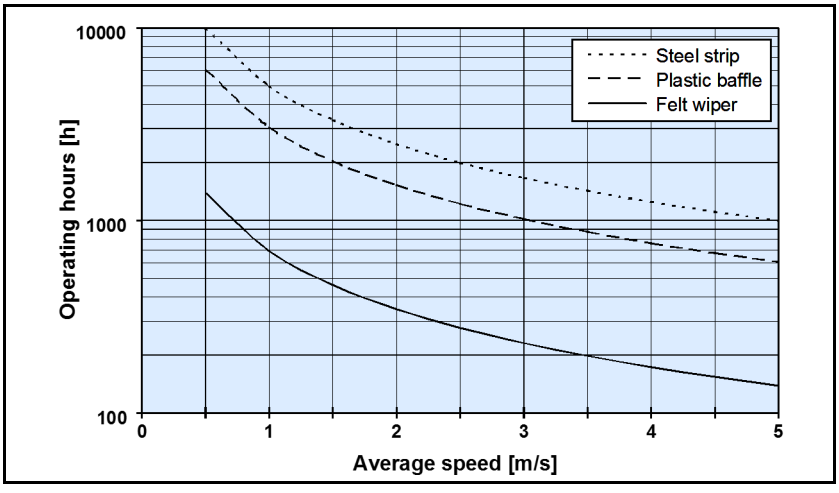
| When | What | Action | Removal |
|---|---|---|---|
| **After start-up** | Carriage | Carry out check for play and adjustment. | Chapter 5.4 |
| | Timing belt | Carry out check for pre-tension and adjustment. | Chapter 5.2.3 |
| **One week later after timing belt** | Timing belt | Measure the timing belt tension. If the tension is less than 0.9 x operating tension, then increase timing belt tension to | Chapter 5.2.3 |
| **Weekly** | Linear actuator | Clean all affected parts dependent on the type of dirt (Guidance, carriage, tensioning station, drive sta-tion)<br>If there is a considerable contamination clean daily.<br>If there is a great deal of contamination, consider retrofitting a | Chapter 5.11.1.2 |
| **Every six months** | Timing belt | Check pre-tension, adjustment and wear.<br>Judge the wear on the timing belt through a visual check. If there is a large amount, then change the timing belt. If abnor-mal timing belt wear is found, then using chapter 4.3 , the cause(s) can be found and removed. | Chapter 5.2 |
| | Carriage | Check the carriage play | Chapter 5.4.2 |
| | Plastic rollers | Check for wear | Chapter 5.4.4 |
| | Steel rollers | Lubricate guide | Chapter 5.5 |

**Table 4:** HPLA maintenance schedule

## 4.2 Replacement intervals for steel strip cover wearing parts

| Travel | Item | Action | Removal |
|---|---|---|---|
| **2500 km** | Felt wiper | Replace | Chapter 5.11.1.4 |
| **11000 km** | Running bar/baffle | Replace | Chapter 5.11.1.5 |
| **18000 km** | Steel strip | Replace | Chapter 5.11.1.3 |

**Table 5:** HPLA wearing parts with steel strip cover




The diagram on the left shows the con-version from the maximum per-mitted travel given in Table 5 into operating hours based on average travel speed.

## 4.3 Causes of abnormal timing belt wear

The appearance of a certain amount of wear can have several causes, therefore it is not always possible to come to a clear conclusion. The following table shows the possible causes of typical faults:

| Error type | Cause | Removal |
|---|---|---|
| **Abnormal wear on loaded tooth profiles** | Incorrect belt tension | Change the timing belt, adjust the pre-tension Chapter 5.2. |
| | Overload | Change the timing belt, adjust the pre-tension Chapter 5.2<br>Check whether the load is within the permitted |
| **Abnormal wear on the tooth flank of the belt** | Pre-tension too great<br>Drive torque too high | Change the timing belt, adjust the pre-tension Chapter 5.2<br>Check the drive ratings |
| **Abnormal wear on the toes of the belt** | Incorrect timing belt orientation<br>Edge of the roller/pulley deformed | Change the timing belt, adjust the pre-tension Chapter 5.2<br>Change the roller/pulley |
| **Shearing of belt teeth** | Pre-tension too low | Change the timing belt, adjust the pre-tension Chapter 5.2 |
| **Tears in the belt teeth** | Incorrect belt tension | Change the timing belt, adjust the pre-tension Chapter 5.2 |
| | Overload | Change the timing belt, adjust the pre-tension Chapter 5.2<br>Check whether the load is within the permitted |
| | Ageing of the belt material | Change the timing belt, adjust the pre-tension Chapter 5.2 |
| **Breaking of the timing belt** | Incorrect belt tension | Change the timing belt, adjust the pre-tension Chapter 5.2 |
| | Overload | Change the timing belt, adjust the pre-tension Chapter 5.2<br>Check whether the load is within the permitted |
| **Softening of the belt material** | Operating temperature too high | Change the timing belt, adjust the pre-tension Chapter 5.2<br>Lower operating temperature |
| | Contact with solvents | Change the timing belt, adjust the pre-tension Chapter 5.2<br>Do not clean the belt using solvents |
| **Jumping over teeth, loss of machine zero point** | Pre-tension too low<br>Incorrect motor position (i.e. bottom) in vertical application | Adjust pre-tension correctly.<br>If possible, have drive at the top. Alternatively increase pre-tension or reduce load in longitudinal direction |

**Table 6:** Causes of abnormal tooth wear

# 5. Assembly/repair

Use only genuine replacements parts from Parker Hannifin.

In the case of incorrect repair, no claims will be possible under the guarantee.

For help with problems:

Parker Hannifin Corporation
Electromechanical Automation Division
Tel: 800-245-6903
Fax: 724-861-3330
Email: emn_sales@parker.com
emn_support@parker.com

## 5.1 Safety notices

Before carrying out maintenance and repairs, turn the main switch to '0' or 'off' and secure it against being switched on again by means of a padlock. If the machine must remain ready for operation during certain repair work, particular care must be taken. Make sure that there is no possibility of personnel staying in the danger area; if necessary, secure against unauthorised access by additional barriers.

Repairs may only be carried out by authorised engineers or by Parker personnel.

Work on the electrical equipment may only be carried out by engineers qualified for such work - the relevant regulations must be followed (IEC..., EN..., national accident prevention regulations).

Where it is necessary to dismantle safety devices during set up, repair and maintenance work, the safety devices must be refitted immediately on conclusion of the work. The machine must be disabled before disassembly.

As the whole system can be exposed to steady-state vibration during operation, all screws and nuts must be secured.

For this, the following are used, dependent on the situation:

Loctite 243 or a Schnorr lock washer. Unless otherwise indicated, use Loctite 243.

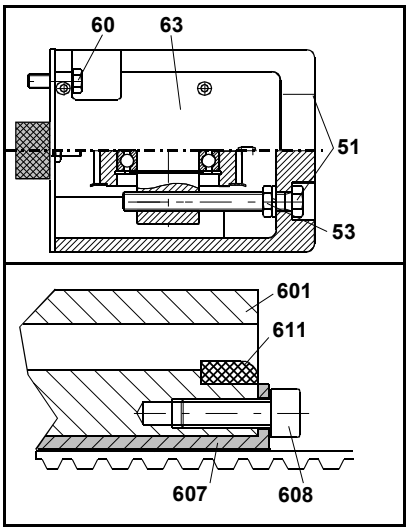
## 5.2 Changing, tensioning and aligning the timing belt

### 5.2.1 General information on the timing belt

1. Unpack new timing belts immediately. They must be stored in a circular shape at room temperature in a dry store.
2. Timing belts must not be kinked.
3. The pitches of the timing belt and the pulley must match.
4. Long-term temperatures of a maximum of 80° C are permitted. In the short term, the temperature can reach 120° C.
5. The drives must be protected from dust, dirt, hot water and steam as well as acids and alkalis.

### 5.2.2 Changing the timing belt

1. Move the carriage to a reference point (e.g. machine zero, real zero ...). Mark the carriage position on the HPLA profile (felt pen).
2. If necessary, remove the steel strip cover (chapter 5.11)

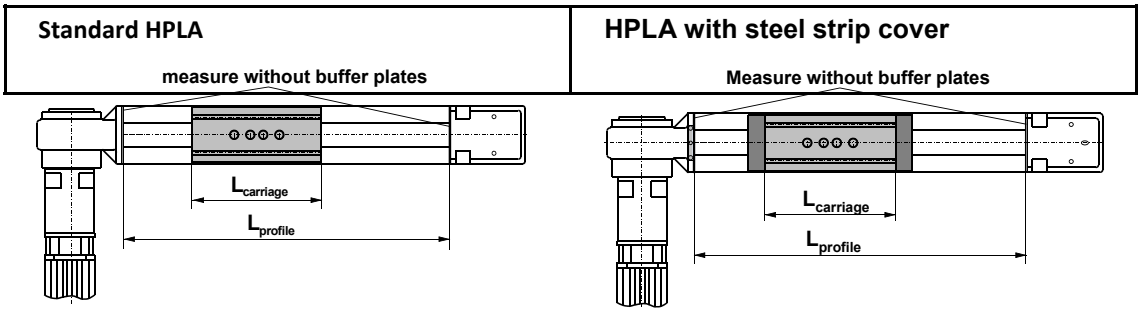



3.Slacken the timing belt: Remove the dust cover (63) of the tensioning station. Loosen the lock-nut (53). Loosen the tensioning screws (51) approximately 10 turns

4.Loosen the timing belt clamp:
Remove the screw (608). Completely pull out and remove the bracket. If the bracket is tight and cannot be loosened, then the load attachment plate must be removed.

5.Cutting down the new timing belt:
There are three possible ways of establishing the length of the timing belt.

a) Cut down the new timing belt according to the associated piece list
b) Measure the profile length and calculate the belt length using **Formula 1**




**Belt length = 2 x $L_{profile}$ - $L_{carriage}$ + K**

**Formula 1:** calculating the timing belt length

| Type | K |
|---|---|
| HPLA80 | 570mm |
| HPLA120 | 740mm |
| HPLA180 | 1190mm |

c) Pull out the old timing belt from the HPLA and lay it out on the floor. Lay the new timing belt next to it and check the length of the old one to the new. In the case of differences in pitch, transfer the pitch from the old belt to the new.

6.Thread up the new timing belt.

| | | |
|---|---|---|
| | **Note** | If the old timing belt has not yet been removed from the actuator, the new one can be attached to the old one using adhesive tape and pulled through. |

7.Push the timing belt between the carriage and the load attachment plate. Insert the timing belt retaining bracket (607) and secure it with the screw (608).

8. Tensioning the timing belt: see Chapter 5.2.3
9. Aligning the timing belt: see Chapter 5.3.
10. Fasten the dust cover (63).
11. If necessary, fasten the steel strip cover: see Chapter 5.11
12. Setting up the reference point: see Chapter 5.4.6

### 5.2.3 Tensioning the timing belt

#### 5.2.3.1 Fundamentals

| | | |
|---|---|---|
|  | **Note** | The timing belt pre-tension must be adapted to the operating loads, however it may not exceed the maximum permitted values for setting the tension stated in Table 1*. |

* If you want to exceed these values, please contact Parker.

The timing belt tension to be set depends on the force required to be transferred by the timing belt Fx (Fx = Fstatic+ Fdynamic)

In order to stop the timing belt jumping, the timing belt pre-tension (operating tension) must be approximately 10% above the force to be transmitted Fx.

In the case of new or old slackened timing belts, the pre-tension will reduce by about 20% a short time after first being tensioned. Therefore on tensioning the belt, a tension should be set which is approximately 1.25 times the operating tension. This tension is defined in **Table 9** as the tension to be set .

Here in **Table 9**, a differentiation is made between standard values and the maximum permitted values which are based respectively upon different statements of operating life for the drive system.

| | Standard value | Maximum permitted values |
|---|---|---|
| **Service life** | 20.000 hours | 6.000 hours |
| **Average speed** | 1,5 m/s | 1,5 m/s |

**Table 8:** Service life used as a basis for drive units

For this reason, the standard value should be set first of all if the application allows. If at the standard value set, the upper and lower timing belt touches, then the belt tension should be increased in stages until the belt can no longer touch. The belt tension may not, however, exceed the maximum permitted value from **Table 9**.

In the case of dual actuators, if the load is applied symmetrically between the actuators, the belt tension can be halved.

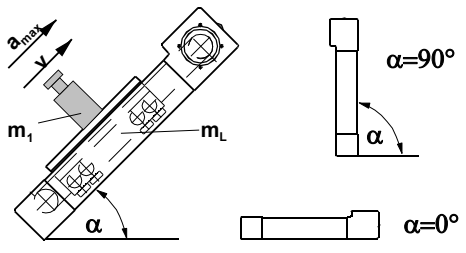
If the tension of a timing belt which has been in operation for more than a week is less than 0.9 x the operating tension, then the timing belt tension must be increased to 1.1 x operating tension (**Table 9**).

| | | |
|---|---|---|
|  | **Note** | HPLA systems are already pretensioned at the respective standard value when supplied. |

| | | Standard values | | | | Maximum permitted values | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | $Fx_{max}$ [N] | Tension to be set [N] | | Operat. tens. [N] | $Fx_{max}$ [N] | Tension to be set [N] | | Operat. tens. [N] |
| HPLA | Stöber-gearboxtype / bearing | maximum transfer-rable force | new/ old slackened belts | on re-tensioning | varies with time | maximum transfer-rable force | new/ old slackened belts | on re-tensioning | varies with time |
| 80 | Hollow shaft with P3 / P4/DD | 925 | 1272 | 1119 | 1017 | 1114 | 1531 | 1348 | 1225 |
| | P3 N | 474 | 651 | 573 | 521 | 602 | 828 | 729 | 662 |
| | P3 V | 925 | 1272 | 1119 | 1017 | 1114 | 1531 | 1348 | 1225 |
| | P4 N[6] | 557 | 766 | 674 | 613 | 671 | 922 | 812 | 738 |
| | P4 V[7] | 925 | 1272 | 1119 | 1017 | 1114 | 1531 | 1348 | 1225 |
| | SR, SL, SB | 925 | 1272 | 1119 | 1017 | 1114 | 1531 | 1348 | 1225 |
| | LR, RL | 925 | 1272 | 1119 | 1017 | 1114 | 1531 | 1348 | 1225 |
| | PE4 | 500 | 687 | 605 | 550 | 600 | 825 | 726 | 660 |
| | PE5 | 675 | 928 | 817 | 743 | 900 | 1237 | 1089 | 990 |
| 120 | Hollow shaft with P4 / P5/DD | 1696 | 2332 | 2052 | 1865 | 2234 | 3072 | 2703 | 2457 |
| | P4 N[6] | 627 | 862 | 759 | 690 | 905 | 1244 | 1095 | 995 |
| | P4 V[7] | 1514 | 2081 | 1831 | 1665 | 2014 | 2769 | 2436 | 2215 |
| | P5 N[6] | 1059 | 1456 | 1281 | 1165 | 1529 | 2102 | 1850 | 1682 |
| | P5 V[7] | 1696 | 2332 | 2052 | 1865 | 2234 | 3072 | 2703 | 2457 |
| | SR[8], SL[9], SB[10] | 1696 | 2332 | 2052 | 1865 | 2234 | 3072 | 2703 | 2457 |
| | LR[11], LR[12] | 1696 | 2332 | 2052 | 1865 | 2234 | 3072 | 2703 | 2457 |
| | PE5 | 675 | 928 | 817 | 743 | 900 | 1237 | 1089 | 990 |
| 180 | Hollow shaft with P5 / P7/DD | 4169 | 5732 | 5045 | 4586 | 5457 | 7504 | 6603 | 6003 |
| | P5 N[6] | 1160 | 1595 | 1404 | 1276 | 1519 | 2089 | 1838 | 1671 |
| | P5 V[7] | 2513 | 3456 | 3041 | 2765 | 2513 | 3456 | 3041 | 2765 |
| | SR[8], SL[9], SB[10] | 3770 | 5184 | 4562 | 4147 | 3770 | 5184 | 4562 | 4147 |
| | LR[11], LR[12] | 3770 | 5184 | 4562 | 4147 | 3770 | 5184 | 4562 | 4147 |
| | P7 N[6] | 1654 | 2274 | 2000 | 1819 | 2164 | 2975 | 2618 | 2380 |
| | P7 V[7] | 3561 | 4896 | 4309 | 3917 | 4398 | 6047 | 5322 | 4838 |

6. N: Stöber gearbox with normal bearings
7. V: Stöber gearbox with reinforced bearings
8. SR: Shaft on right
9. SL: Shaft on left
10. SB: Shaft on both sides
11. LR: Gearbox on left with an additional output shaft on right
12. RL: Gearbox on right with an additional output shaft on left

## Determining the force Fx




**The installation is stationary:**

**Fx** = $F_{static}$

$F_{static} = (m_L+m_1) * 9{,}81 * \sin \alpha$

**The installation is in acceleration/ deceleration:**

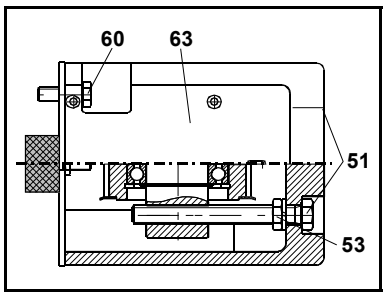
**Fx** = $F_{static} + F_{dynamic}$

$F_{static} = (m_L+m_1) * 9{,}81 * \sin \alpha$

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

| | |
|---|---|
| Fx | force arising [N] |
| $F_{static}$ | static force [N] |
| $F_{dynamic}$ | dynamic force [N] |
| $m_L$ | Mass of carriage [kg] |
| $m_1$ | Mass of load [kg] |
| $\alpha$ | Angle between surface plane and HPLA [°] |
| □ | |
| □ | maximum acceleration [$m/s^2$] |

### 5.2.3.2 Checking and adjusting the belt tension




1. If necessary, remove the steel strip cover (chapter 5.11.1.1)
2. Measure timing belt tension (chapter 5.2.3.3).
3. Compare the tension with the required value from **Table 9**
4. If the actual timing belt tension is less than 0.9 x operating tension, then the timing belt tension must be corrected. To do this, remove the dust cover (63) and loosen the lock-nut (53).
5. Adjusting the timing belt tension:
   Move towards the recommended tension by alternately adjusting and checking. To tension, simultaneously turn both tensioning screws (51) clockwise.
6. Align the timing belt: see chapter 5.3.
7. If necessary, replace the steel strip cover: see chapter 5.11

### 5.2.3.3 Measuring the timing belt tension

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

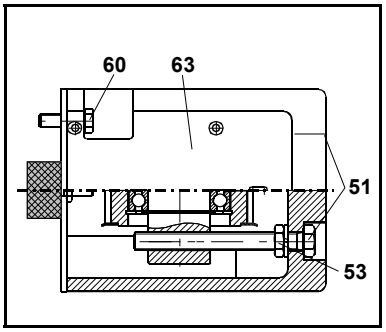
**Belt tension measuring device SM**

The RSM belt tension measuring device uses the oscillation frequency of the free running belt length, and converts this information into force (performs calculations specific to belt mass and free running belt length). This is a very fast and easy method of tensioning any type of timing belt.

The belt tension-measuring device can be obtained through Parker (Part. No. 003-7112-01 ).

## 5.3 Checking the belt run and aligning the timing belt

| | | |
|---|---|---|
| | **Note** | If the timing belt has to be re-tensioned, then this must be done before aligning. Exact alignment is only possible while the carriage is running. On reversing the di-rection of travel, it must start running towards the opposite flange. This means that with correct adjustment, the timing belt will always oscillate from left to right (looking in the direction of movement). In order to maintain the timing belt pre-tension, only adjust |



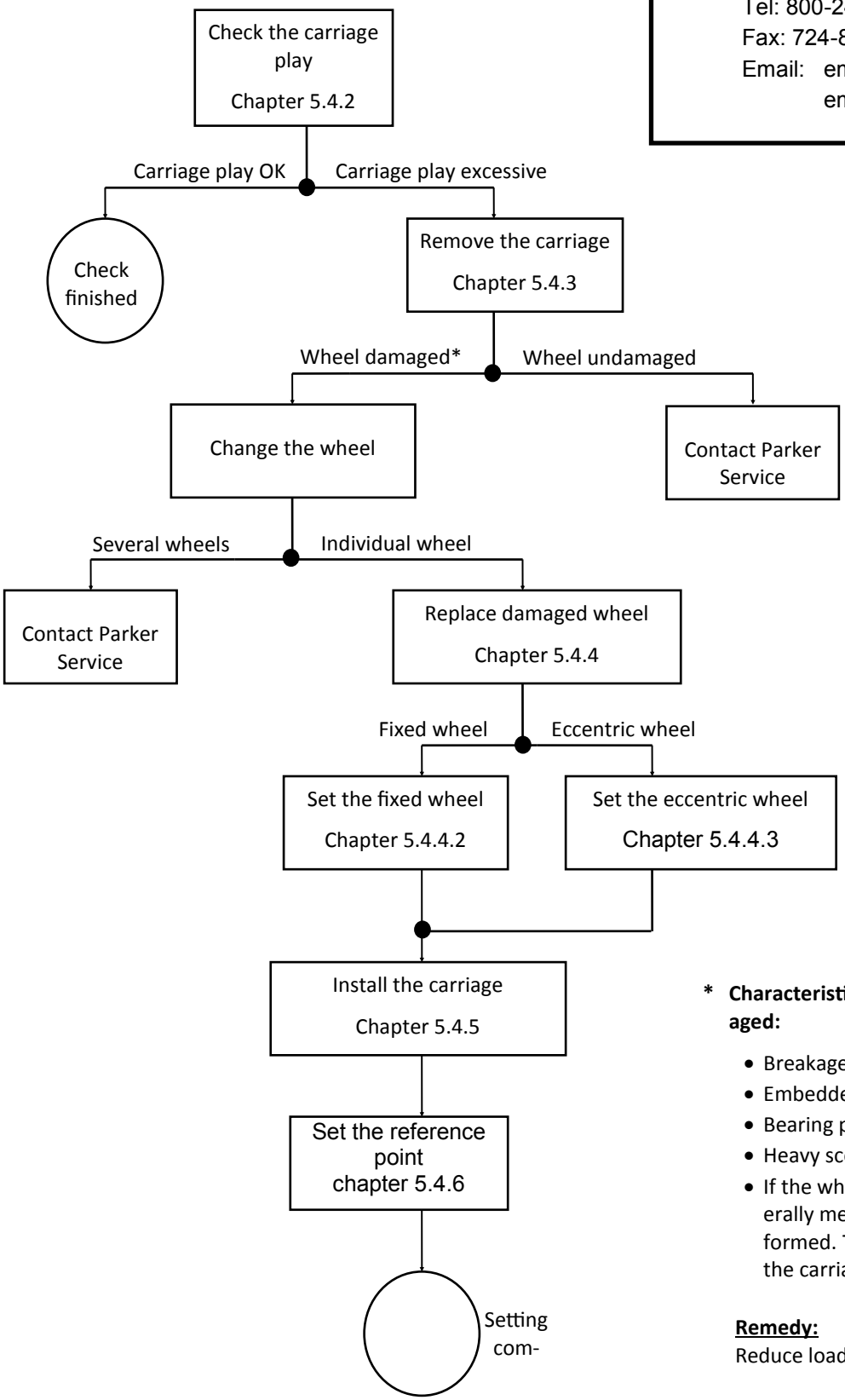

1. Remove the dust cover (63).
2. Check the running of the belt by moving the carriage (manually, if possible - otherwise at reduced speed).
   If the running of the belt is correct according to the above definition:
3. Replace the dust cover (63).
4. Otherwise: Loosen the lock-nut (53). Loosen the tensioning screw (51) anti-clockwise in small stages on the side on which the timing belt continually appears, until the timing belt runs in accordance with the above definition.
5. Tighten the lock-nuts (53) and replace the dust cover (63).

## 5.4 See Appendix A for screw torque values

### 5.4.1 Adjusting the carriage play

Parker Hannifin Corporation
Electromechanical Automation Division
Tel: 800-245-6903
Fax: 724-861-3330
Email: emn_sales@parker.com
emn_support@parker.com

Flow chart for changing and adjusting the wheels




* **Characteristics of a wheel which is damaged:**

- Breakages
- Embedded particles of dirt
- Bearing play
- Heavy scoring
- If the wheels "rumble", then this generally means that the wheels are deformed. This is caused by overloading the carriage.

**Remedy:**
Reduce load!

## 5.4.2 Checking the carriage play

| | Note | You can gain a rough idea of possible carriage play by trying to move the carriage or the mounted installation. A more exact method is described in the following pro-cedure: |
|---|---|---|

1. Arrange to be able to move over the greatest possible travel.
2. Remove the steel strip cover if there is one: chapter **5.11**.
3. In order to move the carriage by hand and to be able to see the wheels, remove the load attachment plate and the load from the carriage.
4. Remove the timing belt from the carriage: chapter 5.2.2 point 4.
5. Push the carriage over the complete travel. All wheels must turn during travel.
6. To check the pressure acting against it, prevent the wheels from turning using your index finger; it should be

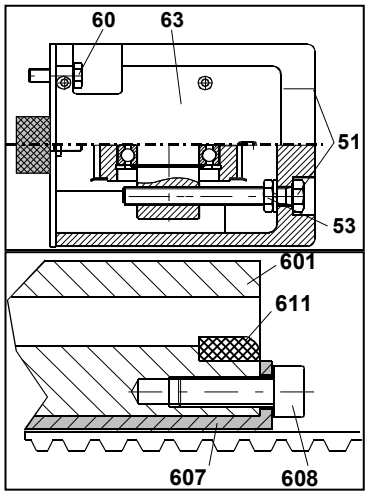
**Characteristics of a correctly adjusted carriage:**

- The carriage has no play
- The carriage can move over the whole travel area without any great difference in force

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

## 5.4.3 Removing the carriage

| | Danger | If the actuator is used in a vertical position, secure the carriage against movement. If the carriage is not secured, then it may fall downwards as a result of gravity. This can re-sult in |
|---|---|---|




1. Move the carriage to a reference point (e.g. machine zero or real zero). Mark the carriage position on the HPLA profile (use a felt pen).
2. If necessary, remove the steel strip cover (chapter 5.11)
3. Remove any attachments from the carriage.
4. Slacken the timing belt: Remove the dust cover (63) of the tensioning station. Loosen the lock-nut (53). Loosen the tensioning screws (51) by approximately 10 turns
5. Loosen the timing belt clamp: Remove the screw (608). Completely pull out and remove the bracket. If the bracket is tight and cannot be loosened, then the load attachment plate must be removed.
6. Remove the tensioning station by loosening the four fixing screws (60).
7. Mark the carriage with an arrow pointing towards the motor end and pull the carriage out of the profile.

| | Note | Re-insert the carriage later in the same direction, otherwise the wheel adjustment will be wrong! |
|---|---|---|

## 5.4.4 Changing individual wheels

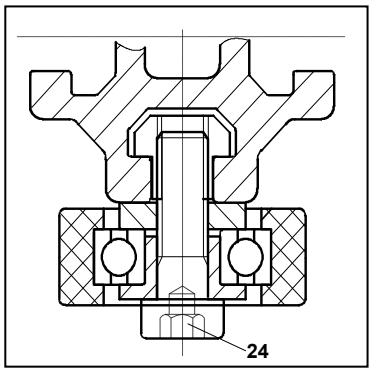
### 5.4.4.1 General

- The procedure is the same for changing both types of wheel - plastic and steel roller gui-dance versions. We would however point out that additional care must be exercised when working with steel wheels.
- The wheels of the plastic roller guidance version consist of ball bearings with a plastic casing. The steel rollers have integrated ball bearings and spherical bearing races.
- The ball bearings used in the plastic wheels correspond to the standard roller bearing standards and are lubricated for life.
- If they remain at standstill for a long time, the plastic wheels develop small flattened areas which will completely re-turn to shape after continuous use.
- Both wheel types can be used in environmental temperatures of -40°C to +80°C.

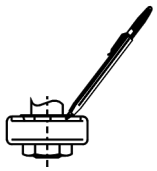
| | | |
|---|---|---|
| ⚠ | **Warning** | It is only possible to check the wheel running during movement of the actuator.<br>In doing this, particular care is required, as injury is possible. If possible, only move the ac-tuator manually (if necessary, dismantle the motor and gearbox in advance and lay the ac-tuator horizontally). If not, operate the actuator at a crawl using the jog button (speed < 1m/min). |

| | | |
|---|---|---|
| 💡 | **Note** | Experience and specialist knowledge is required to adjust a carriage correctly. Therefore wheels should, if possible, only be changed by Parker personnel. |

### 5.4.4.2 Changing and adjusting rigid (concentric) wheels




1. Remove the carriage (chapter 5.4.3)
2. Mark the position of the wheel on the carriage.
3. Loosen and remove the screw (24).
4. Remove the old wheel, and fit the new one in the correct position on the carriage.
5. Insert screw (24) with screw fastening (e.g. DELO ML5249) and tighten using the tightening torque Ma specified in **Table 10** page 35.
6. To check the rolling movement, make marks on the wheels using a felt-tip pen.

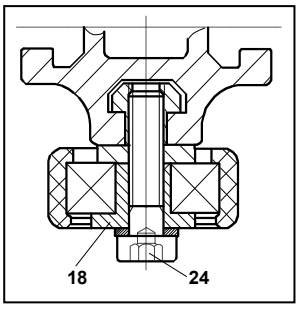


7. Remove any dirt and swarf from the running surfaces of the linear actuator.
8. Insert the carriage into the profile in the correct running direction and check the wheel adjustment along the whole of the travel. The wheels should turn along the whole travel.

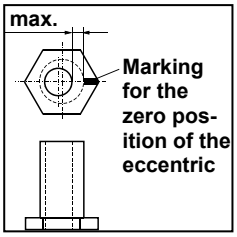
| | | |
|---|---|---|
| 💡 | **Note** | When adjusting the wheel play, only the wheels you have changed should be ad-justed. If this means that a correct adjustment of the carriage is impossible, then the carriage must be completely re-adjusted. Experience and specialist knowledge is required for this work and it should therefore only be carried out by a Parker mechanical engineer. |

9. To check the pressure acting against it, prevent the wheel from turning using your index finger; it should be possible to stop a wheel using minimal force.
10. If the adjustment is correct, finish the calibration work. Otherwise correct the wheel adjustments.

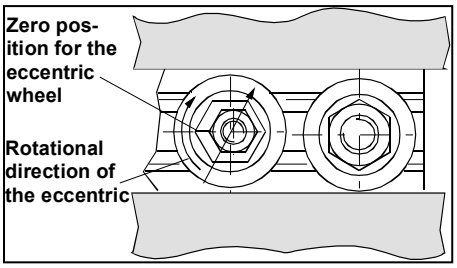
### 5.4.4.3 Changing and adjusting the eccentric wheels



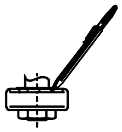

1. Remove the carriage (chapter 5.4.3)
2. Mark the position of the wheel on the carriage.
3. Loosen and remove the screw (24), remove the old lock washer.
4. Remove the old wheel and push out the eccentric bush (18).
5. Insert the eccentric bush into the new wheel, fit the parts on the screw (24) using a new lock washer. Slightly tighten the screw.




6. Align the position of the ec-centric bush so that on turn-ing the eccentric (18) clock -wise, the wheel comes to the same slideway as the one that the old wheel was on before dismantling




7. Tighten the screw (24) using tightening torque Ma according to **Table 10**.
8. To check the rolling movement, make marks on the wheels using a felt-tip pen.
9. Remove any dirt and swarf from the running surfaces of the linear actuator.
10. Insert the carriage into the profile in the correct running direction and check the wheel adjustment along the whole of the travel. The wheels should turn along the whole travel.



| | |
|---|---|
| **Note** | When adjusting the wheel play, only the wheels you have changed should be regu-lated. If this means that a correct adjustment of the carriage is impossible, then the carriage must be completely re-adjusted. Experience and specialist knowledge is required for this work and it should therefore only be carried out by a Parker mecha-nical engi-neer. |

11. Adjust the eccentric of the jockey wheel in small stages so that the carriage can be pushed freely and without play through the HPLA profile. Jockey wheels which are adjusted too tightly develop pressure marks which lead to running noise.
12. To check the pressure acting against it, prevent the wheel from turning using your index finger; it should be possible to stop a wheel using minimal force.
13. If the adjustment is correct, finish the calibration work. Otherwise repeat points 10 and 11 until the carriage adjustment is correct.

| HPLA | Rigid wheel / eccentric wheel |
|---|---|
| **80** | 7 Nm |
| **120** | 20 Nm |
| **180** | 70 Nm |

**Table 10**: Tightening torque of the wheel fastening screws

## 5.4.5 Installing the carriage

1. Place the carriage into the profile in the correct running direction.
2. Attach the tensioning station using 4 screws (60)
3. Attach the timing belt (chapter 5.2.2 from point 8 onwards)
4. Tension the timing belt (chapter 5.2.3, page 31)

### 5.4.6 Adjusting the reference point

Correct the machine zero point on the basis of the previously-marked carriage position. There are several ways of doing this depending on the motor and the controller. For further details, see the controller handbook.

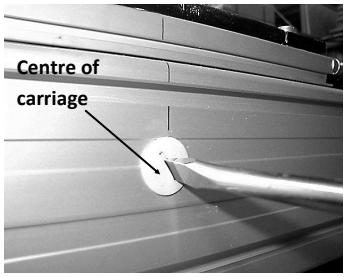
## 5.5 Re-lubricating the steel guide

1. Disconnect the control unit.
2. Align the centre of the carriage to the position of the lubrication access hole.

| | |
|---|---|
| **Warning** | Always check again that the control unit is disconnected because you will need to reach into the guide when re-lubricating! |

3. Unscrew plugs from HPLA profile.

| | |
|---|---|
| **Note** | Only use the following oil: Shell Omala Oil 220, order number: 180-006026. |

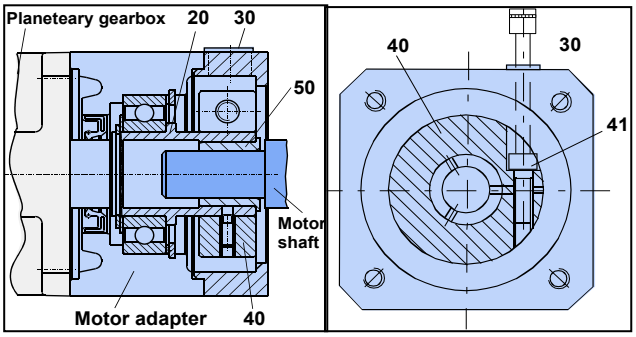



4. Push the lubrication gun through the access bore and push onto the nipple in the carriage.
5. Apply four to five strokes of re-lubrication.
6. Remove manual lubri-cation press and screw in the plug.

## 5.6 Changing or attaching the motor

| | |
|---|---|
| **Danger** | Danger due to electrical voltage. Work on the motor terminal box may only be carried out by an electrical engineer. |

### 5.6.1 Changing the motor in combination with a planetary gearbox




1. Move the carriage to a reference point (e.g. machine zero or real zero). Mark the carriage position on the HPLA profile (felt pen).
2. Switch off the actuator at the main switch and disconnect it from the electrical supply. Leave the motor and gearbox to cool.
3. Remove the motor and resolver cable.
4. Remove plug on assembly bore (30) of adapter housing
5. Unfasten the clamping screw (41) on the clamping ring; to do this guide extension of torque wrench through assembly bore (30)
6. Loosen the motor fastening.
7. Pull the motor away from the gearbox.

**Attaching a (new) motor**

1. Clean the motor shaft with de-greasing agent
2. If necessary, switch off the actuator at the main switch and disconnect it from the electrical supply. Leave the motor and gearbox to cool.
3. Place motor on adapter housing. NOTE - make sure that the motor shaft is fitted concentrically with the clamping hub (20) and/or clamping bush (50). Do not tilt!
4. Screw motor down to adapter housing
5. Tighten greased clamping screw (41) on to clamping ring; to do this guide extension of torque wrench through assembly bore (30). For tightening torque MA, see Table 11.
6. Re-seal assembly bore (30) with plug.
7. Connect motor and resolver cables - check the direction of rotation is correct.
8. Switch on the actuator.
9. Set up the reference point (chapter 5.4.6)

| Tightening torques MA | | |
|---|---|---|
| **Clamp screw** | **Wrench dimensional s [mm]** | **MA [Nm]** |
| M5 | 5 | 6 |
| M6 | 5 | 10 |
| M8 | 6 | 25 |
| M10 | 8 | 45 |
| M12 | 10 | 80 |

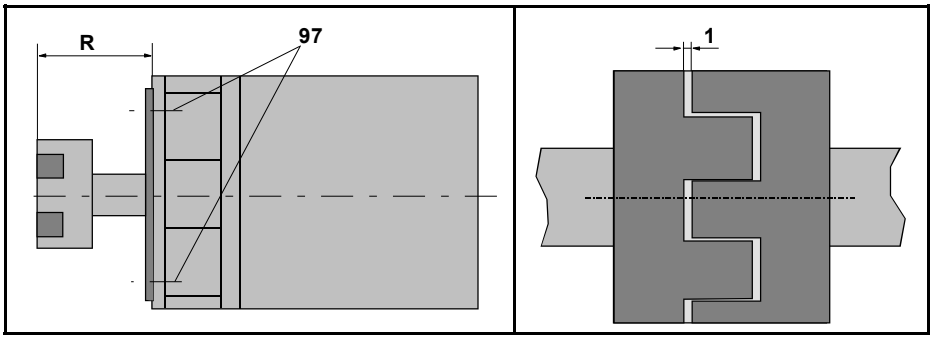
**Table 11:** Tightening torques for clamping screw

## 5.6.2 Further gearbox types

### 5.6.2.1 Shaft-hub connection via a shaft key

1. Move the carriage to a reference point (e.g. machine zero, real zero ). Mark the carriage position on the HPLA profile (felt pen).
2. Switch off the actuator at the main switch and disconnect it from the electrical supply. Leave the motor and gearbox to cool.
3. Remove the motor and resolver cable
4. Loosen the motor fastening
5. Pull the motor away from the gearbox.
6. Clean the motor shaft and the sleeve shaft hole of all lubricant.
7. If the shaft key shows signs of damage, replace it.
8. Insert the key in the motor shaft.
9. Install the motor (if necessary, turn the motor in order to find the groove) and tighten the motor fastening (97).
10. Connect motor and resolver cables - check the direction of rotation is correct
11. Switch on the actuator.
12. Set up the reference point (chapter 5.4.6)

### 5.6.2.2 Claw coupling

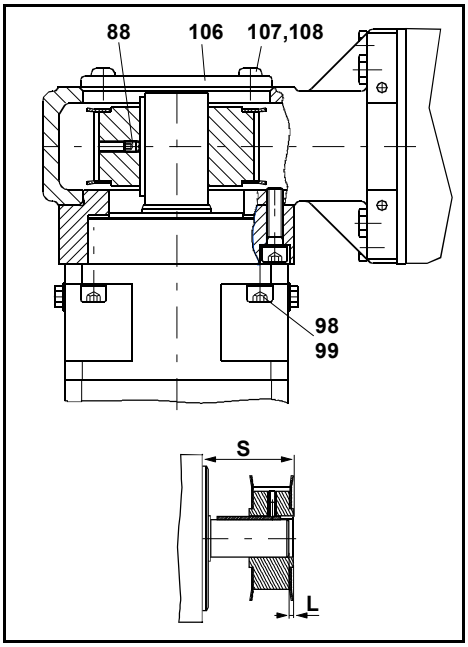



1. Move the carriage to a reference point (e.g. machine zero, real zero). Mark the carriage position on the HPLA profile (felt pen).
2. Switch off the actuator at the main switch and disconnect it from the electrical supply.
3. Remove the motor and resolver cable
4. Loosen the motor fastening
5. Pull the motor away from the gearbox
6. Measure distance R, dimension from the claw coupling to the motor flange (accuracy +/- 0.1 mm).
7. Loosen the clamp screw of the claw coupling half and pull this off the motor shaft.
8. Remove all traces of lubricant from the motor shaft and the hole of the claw coupling.
9. Place the claw coupling half on the new motor at the distance R. If necessary, rub down the motor shaft using emery paper, grade 360.

| | | |
|---|---|---|
|  | **Note** | There should be 1mm play in the axial direction between the coupling halves after mounting. Axial pressure must be avoided at all costs! |

10. Tighten the clamp screws of the claw coupling.
11. Install the motor (if necessary, turn the motor in order to find the tooth spaces) and tighten the motor fastening (97).
12. Connect motor and resolver cables - check the direction of rotation is correct
13. Switch on the actuator.
14. Set up the reference point (chapter 5.4.6)

## 5.7 Changing the gearbox (pulley mounted on gearbox shaft)




1. Dismantle the motor (chapter 5.6 continued, according to the gearbox used).
2. Slacken the timing belt (chapter 5.2.2 point 2-5).
3. Remove the cover plate (106).
4. Loosen the gearbox fastening (98) and carefully remove the gearbox.
5. Measure the distance S (distance from the upper edge of the pulley to the gearbox flange) or L (distance from the end of the shaft to the upper edge of the pulley) (accuracy +/- 0.1 mm).
6. Loosen the set screw (88) and carefully pull off the pulley (use claw puller).
7. Place the pulley on the new gearbox at the distance S (**Table 12**).

| | |
|---|---|
| **Caution** | Press down the pulley using the thread in the shaft. DO NOT use a hammer on the shaft as this can damage the gearbox. |

8. Measure the diameter of the core removing hole of the pulley tap. Using a twist drill 0.5mm smaller, drill carefully 1mm deep into the shaft key of the gearbox through the tap in the pulley. Remove any swarf.
9. Screw the set screw into the pulley using screw retention (Loctite).
10. Place the timing belt over the pulley.
11. Attach the gearbox to the linear actuator and tighten the gearbox fastening (98).
12. Tension the timing belt (chapter 5.2.3).
13. Fasten the cover plate (106).
14. Re-assemble the motor (chapter 5.5 continued, according to the gearbox used).

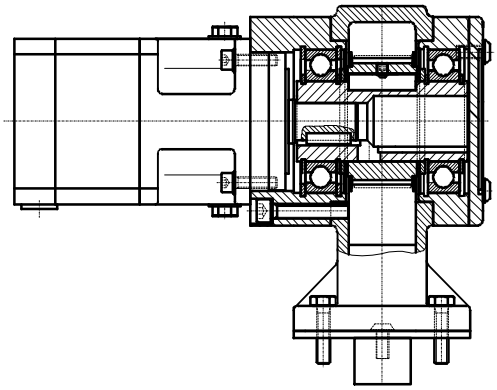
| | |
|---|---|
| **Note** | Install pulley on gearbox shaft so pulley is centered in drive housing. |

## 5.8 Replacing the pulley

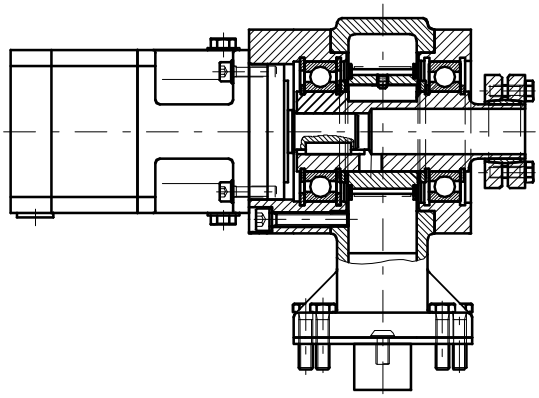
### 5.8.1 Replacing the pulley on the drive station

There are three different pulley bearing types in the drive housing:

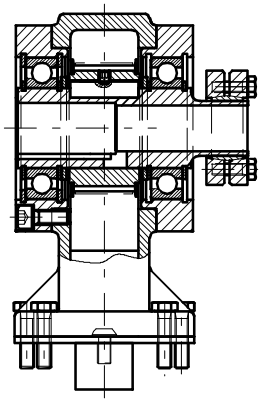
1. Bearing with hollow shaft:
   a) for single actuators
   b) for dual actuators
   c) for dual actuators with central drive
2. Bearing directly on shaft with dual actuators.
3. Pulley directly mounted on gearbox shaft.



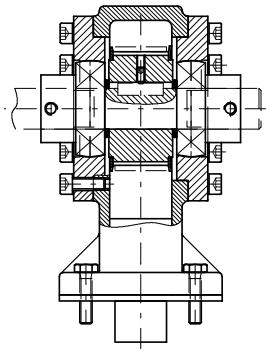
1a) Bearing with hollow shaft for single actuators.



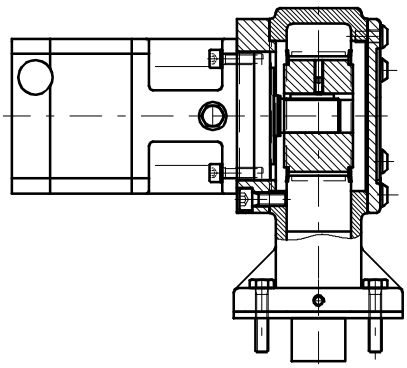
1b) Bearing with hollow shaft for dual actuators.



1c) Bearing for dual actuators with central drive



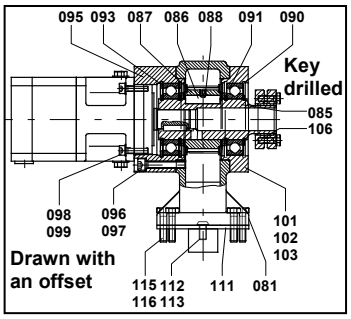
2) Bearing directly on shaft for dual actuators



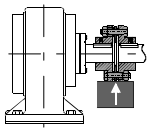
3) Pulley directly mounted on gearbox shaft.

Note - The following chapters contain descriptions of how to replace the pulleys in each instance.

### 5.8.1.1 Pulley with bearings on a hollow shaft (1a, 1b and 1c)

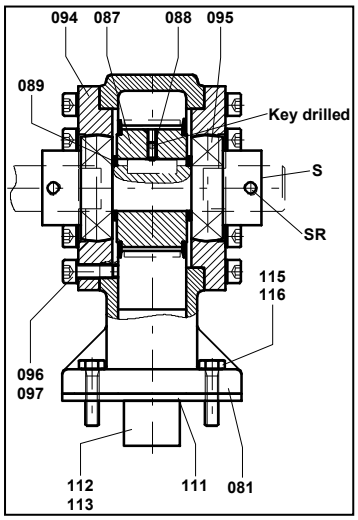



1. Unfasten screws (96) of intermediate flange and carefully take off flange (95) together with hollow shaft (85), bearings (90) and pulley (87).
2. Remove bearing (90). To do this, use special pliers to remove retaining rings (91).
3. Take off pulley (87). To do this, first unscrew threaded pin (88)
4. Check shaft key for damage and change if necessary
5. Insert new pulley, drill key and fix with threaded pin

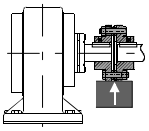


6. For assembly, proceed in reverse order - during assembly, slightly tighten screws of shrink-fit washer and then tighten to tightening torque Ma one after another and in small stages (1/4 revolution) (for tightening torque values, see **Table 13**, page 42).
7. Take off pulley (87). To do this, first unscrew threaded pin (88)
8. Check shaft key for damage and change if necessary
9. Insert new pulley, drill key and fix with threaded pin
10. For assembly, proceed in reverse order - during assembly, slightly tighten screws of shrink-fit washer and then tighten to tightening torque Ma one after another and in small stages (1/4 revolution) (for tightening torque values, see Table 13, page 42).

### 5.8.1.2 Pulley with bearings directly on shaft (2)




1. Slacken the timing belt: Remove the dust cover (63) of the tensioning station. Loosen the lock-nut (53).
   Loosen the tensioning screws (51) by approximately 10 turns.
2. When with a dual actuator, first support the coupling if necessary.
3. Unfasten clamping screws S of both adjustment rings of the PME bearings
4. Unfasten adjustment rings SR of both PME bearings (95) by turning in clockwise direction
5. Unfasten retaining screws (96) of flange (94) and carefully take off the flange.
6. Pull shaft and pulley (87) out of drive housing. When with dual actuators, first unfasten threaded pin of coupling.
7. Use shim rings (89) to pull off pulley (87). To do this, first unscrew threaded pin (88) .

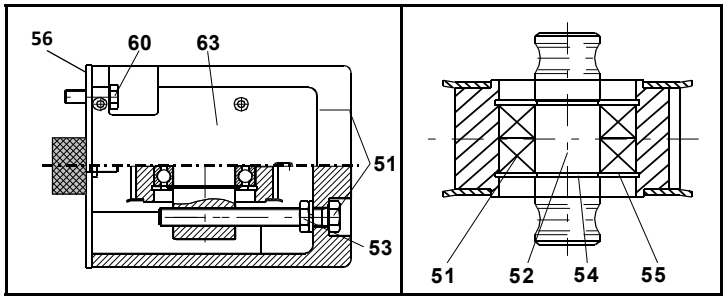


8. Check shaft key for damage and change if necessary
9. Insert new pulley, drill key and fix with threaded pin
10. For assembly, proceed in reverse order. Ensure that the pulley is again precisely located in the centre of the housing. This is ensured when the shim rings (89) are used.

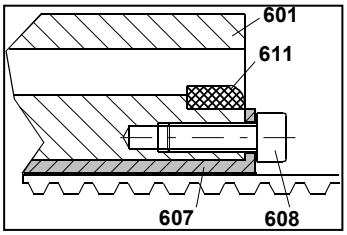
### 5.8.1.3 Pulley fitted directly on the gearbox shaft

For more information, see chapter 5.7

### 5.8.2 Replacing the pulley on the tensioning station




1. Move the carriage almost up to the tensioning station
2. Switch off the actuator at the main switch and ensure that it cannot be switched on again.
3. If needs be, remove the steel strip cover (chapter **5.11**)
4. Slackening the timing belt: Remove the dust cover (63) of the tensioning station. Loosen the lock-nut (53). Loosen the tensioning screws (51) by approximately 10 turns.




5. Loosen the timing belt clamp:
Unscrew screw (608). Completely pull out and remove the bracket. If the bracket is tight and cannot be loosened, then the load attachment plate must be removed
6. Unfasten 4 screws (60) and carefully take off tensioning station with baffle plate (56).
7. Unscrew the tensioning screws (62) out of the pulley socket pins until the complete pulley assembly can be removed.
8. Insert a new pulley assembly and screw the tensioning screws (62) into the bolts a few turns.
9. Place the timing belt around the pulley and attach the tensioning station using screws and new Schnorr lock washers.
10. Attach the timing belt according to chapter 5.2.2 points 7-12.

## 5.9 Dual actuators

### 5.9.1 General

Dual actuators are generally supplied as two individual actuators. Depending on the actuator spacing there are one or two Servoflex couplings on the spacer shaft (see chapter 5.9.3 page 43). These couplings compensate for both axial and angular misalignment. The coupling(s) consists of two shells and a spring assembly. This spring assembly accommodates the axial and angular misalignment. With the help of a shrink-fit washer, the two carriages can be aligned exactly to one another.

### 5.9.2 Aligning the carriages with one another

1. Undo the screws of the shrink-fit washer (see Figures on page 43) in sequence and one at a time until the bush is completely loosened (anti-clockwise).
2. Move the carriages to the defined position (e.g. to the end stop).
3. Tighten the screws of the shrink-fit washer in sequence by a quarter turn each until the stated tightening torque is reached (if possible use a torque wrench) (**Table 13**, page 42).

| Actuator type | Tightening torque Ma |
|---|---|
| **HPLA80** | 5 Nm |
| **HPLA120** | 12 Nm |
| **HPLA180** | 12 Nm |

**Table 13:** Tightening torque for shrink-fit washer

### 5.9.3 Actuator spacing

The following figures showed the different actuator spacing stages applicable for the three unit sizes HPLA80, HPLA120 and HPLA180.

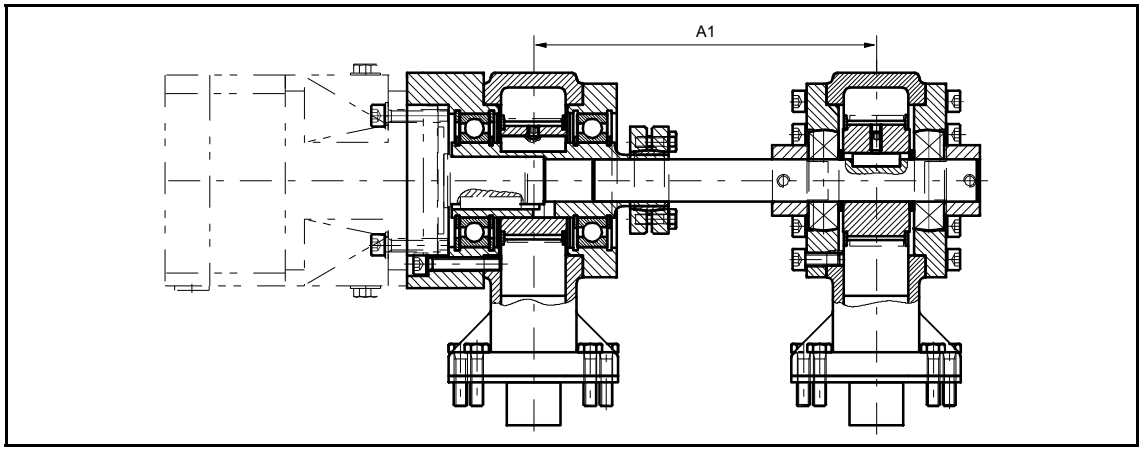



**Figure 4:** 1st actuator distance stage A1: up to 350mm. Version without coupling.

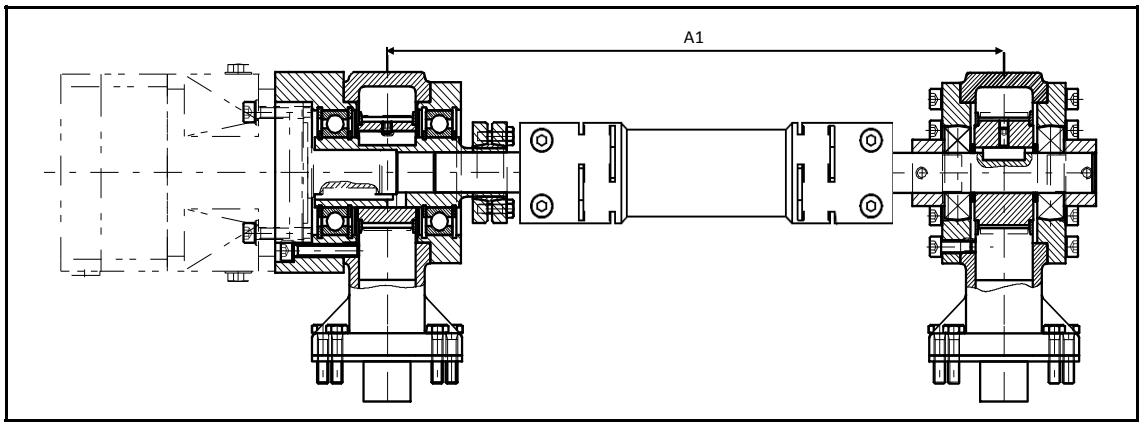



**Figure 5:** 2nd actuator distance stage A3: >351mm. Version with two couplings.

| Actuator distance stage | HPLA80 | HPLA120 | HPLA180 |
|---|---|---|---|
| 1st actuator distance | 120...350mm | 150...350mm | 250...350mm |
| 2nd actuator distance | > 351mm | | |

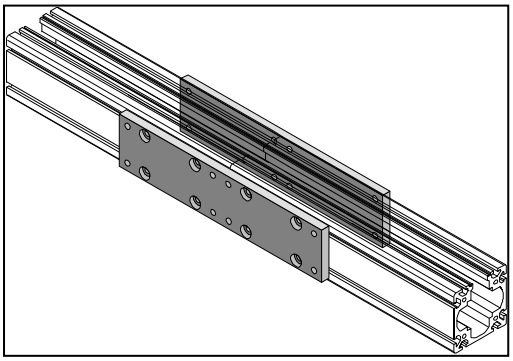
**Table 14:** Overview of the actuator spacing stages

Small actuator stages are possible once discussed with Parker.

## 5.10 Spliced or jointed actuators

### 5.10.1 General

| | | |
|---|---|---|
| | **Note** | **A maximum of one splicing plate is permitted for actuators with steel roller guidance!** |



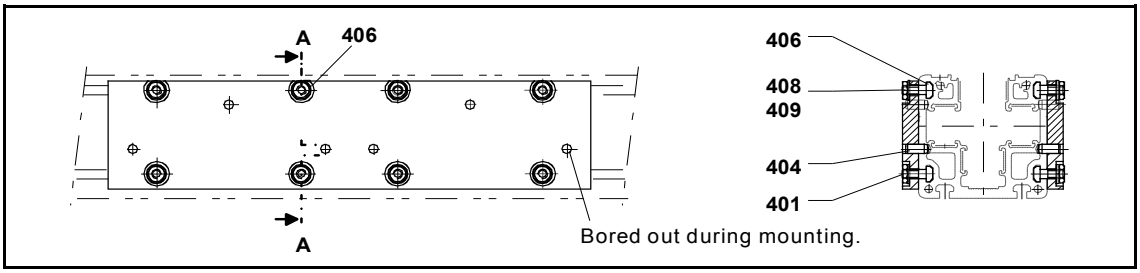
- Splicing plates are used to lengthen the travel or to simplify mounting when access is limited.
- The location of the splicing plates should always be close to a fixing point.
- The bearing distance should generally be between 1.0m and 1.5m.
- It is standard to always separate the profiles in the middle in order to keep the profile elements the same size.

- If a splicing plate is used to lengthen the travel, then the loading data must be reduced (**Table 15**).

| HPLA | Unit | 80 | 120 | 180 |
|---|---|---|---|---|
| **max. perm. load** | N | 0,5 x $F_x$ | 0,5 x $F_x$ | 0,5 x $F_x$ |
| **Speed** | m/s | < 1 | < 1 | < 1 |
| **Acceleration** | $m/s^2$ | < 1 | < 1 | < 1 |
| **Repeatability** | mm | > ±0,5 | > ±0,5 | > ±0,5 |

**Table 15:** Fx: HPLA080: page 10; HPLA120: page 11; HPLA180: page 12.

### 5.10.2 Mounting splicing plates



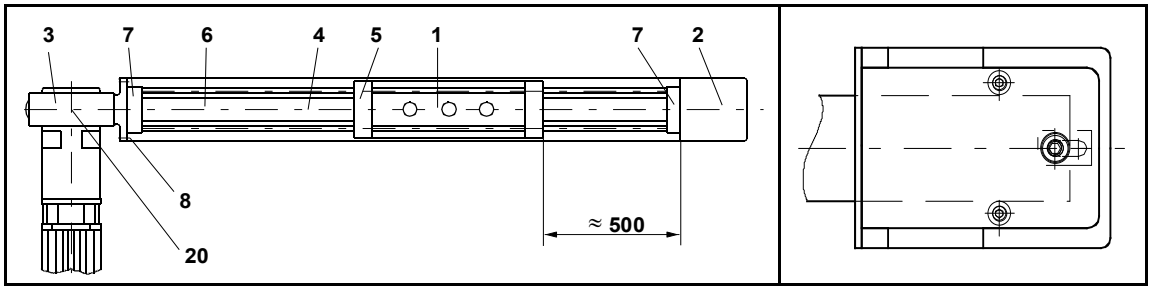

1. Align the profiles with one another.
2. Insert the t-bolts (406) (4 per profile and side).
3. Attach and fix the drilled plate (401), the lock washer (408) and nuts (409).
4. Align the profile exactly, check the running surfaces. Align if necessary. Check for bumps manually - you should not be able to feel any transition.
5. Check whether the pin holes are aligned; if necessary, adjust the position of the HPLA. Insert the pins (404).
6. Tighten the nuts (409) .
7. Mount the timing belt and align it (chapter 5.2).

## 5.11 Steel strip cover

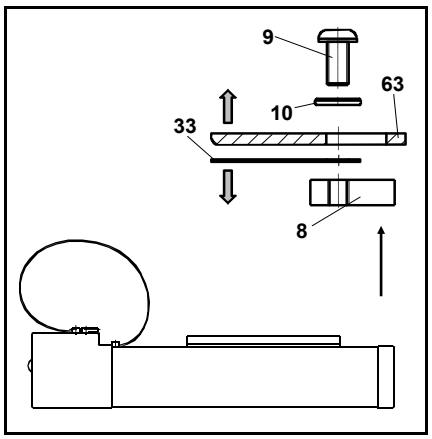
| | | |
|---|---|---|
| | **Note** | In all work on the steel strip cover, make sure that the steel strip is not kinked, distorted or damaged in any way. If the steel strip is damaged, it must be changed. |

### 5.11.1 Mounting, dismantling and replacing worn parts

#### 5.11.1.1 Dismantling the steel strip cover



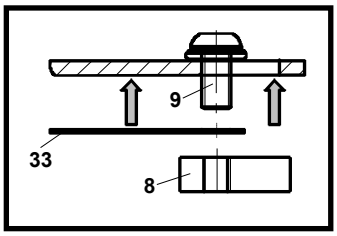

1. Stop the carriage (1) approx. 0.5m in front of the tensioning station (2).
2. Switch off the actuator at the main switch.




3. Undo the oval head screw which holds the steel strip (screw can now be moved in slotted hole).
4. Remove cover from tensioning station (63) and unscrew steel strip (33) from cover.
5. Dismantle the strip guides (5) on both sides of the load attachment plate. Make sure that the drag bar (felt wiper) and the springs do not fall out.
6. Pull the steel strip carefully through the carriage.
7. Roll up the steel strip carefully in the direction of the drive station and fix using adhesive tape

#### 5.11.1.2 Mounting the steel strip cover

1. Unroll the steel strip and feed the end through the carriage. Slide the steel strip over the whole length of the stroke by pulling gently on it.
2. The strip guides (5) on both sides of the load attachment plate must be joined securely at the sides and top. Make sure that the springs and felt wiper are still in the housing.



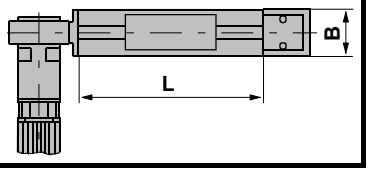

3. Fit steel strip on cover of tensioning station using oval head screw (9), lock washer and the t-nut (8) (do not tighten screw).
4. Screw on cover (with steel strip) of tensioning station and tighten. With the HPLA80, unfasten clamping plate if necessary and align steel strip (see chapter 5.11.2 page 47)
5. Tighten screw which fixes the steel strip (9).

| | | |
|---|---|---|
| | **Note** | Do not strain the steel strip! |

6. Switch on the actuator drive.

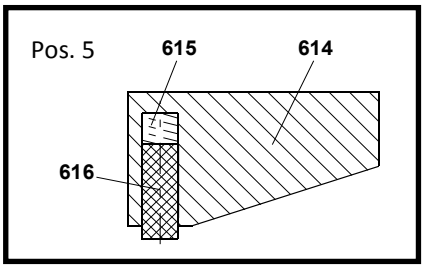
7. Move the carriage for approximately 10 strokes over the whole length at a low speed (v < 2 m/s). Watch the steel strip to see whether a "wave" forms in front of the respective turning station in the direction of movement.
8. Then stop the carriage coming from the drive station (20) at 0.5m before the tensioning station (2).
9. Unfasten steel strip fixing screw (9) in cover of tensioning station.
10. Smooth out the "wave", but do not strain the strip in doing so.
11. Tighten the screw.

### 5.11.1.3 Replacing the steel strip

| | | | |
|---|---|---|---|
| | **Note** | New steel strips must only be obtained from Parker. To order one, we will need to know the length L of the profile.<br>Using these details, the steel strip will be shortened and pierced with two fastening holes. |  |

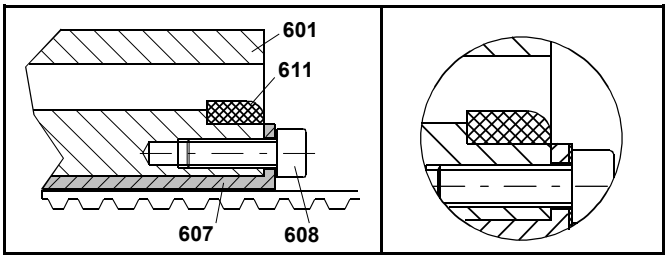
1. Dismantle the steel strip (see chapter 5.11.1.1).
2. Remove clamping piece from drive station. With the HPLA180 and HPLA120, pull steel strip off grooved drive stud. With the HPLA80, simply unfasten clamping plate (see Figure on page 48).
3. With a HPLA180 or HPLA120, connect new steel strip with grooved drive stud.
4. Secure clamping piece, and/or with the HPLA80 fix steel strip with clamping plate.
5. Mount the steel strip (chapter 5.11.1.2).

### 5.11.1.4 Replacing the drag bar (felt wiper)




1. Switch off the actuator at the main switch.
2. Dismantle the strip guides (5) on both sides of the load attachment plate.
3. Replace the felt wiper (617) with a new one. Make sure that the springs (616) do not fall out.
4. The strip guides (5) on both sides of the load attachment plate must be joined securely at the sides and the top.
5. Switch on the actuator drive.

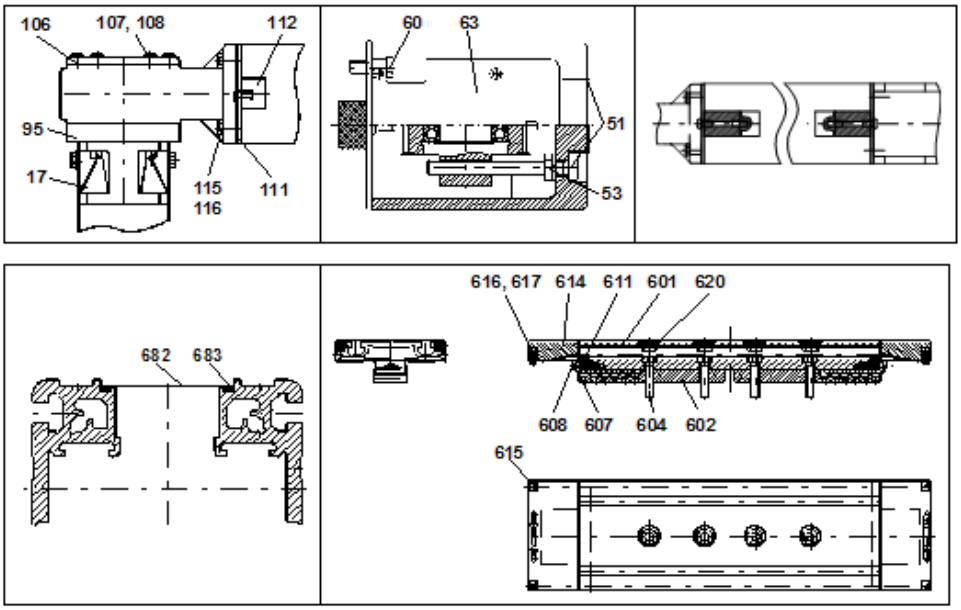
### 5.11.1.5 Replacing the baffle or running bar




1. Dismantle the steel strip (see chapter 5.11.1.1)
2. Push out the old baffles (611) to the side.
3. Push new baffles in the load attachment plate (601) so that the steel strip runs over the radius of the baffle. Align the baffle in the centre.
4. Mount the steel strip (see chapter 5.11.1.2)

## 5.11.2 Retrofitting the steel strip cover

| | | |
|---|---|---|
| | **Note** | To retrofit the steel strip cover, you will require:<br>A prepared load attachment plate (groove for the baffle, tapped holes for attaching the strip guides), add-on pieces, magnetic strip, steel strip, buffer extensions.<br>**Note:**<br>The height of the construction and the fixing points will remain unchanged.<br>The effective stroke will be reduced by 70mm in the HPLA80, by 90mm in the HPLA120 and by 200mm in the HPLA180 (also see dimensions sheets, page 14)<br>In order to retrofit, you will need to completely dismantle the HPLA. |



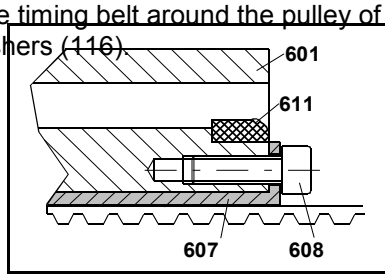

1. Switch off the actuator at the main switch and ensure that it cannot be switched on again.
2. Slacken the timing belt:
   Remove the dust cover (63) of the tensioning station.
   Loosen the lock-nut (53).
   Loosen the tensioning screws (51) by approximately 10 turns anti-clockwise.
3. Loosen the timing belt:
   Remove the protective caps (620), loosen the screws (604) and remove the load attachment plate (601). Take timing belt out of toothed strip (602) and remove toothed strip.
4. Clean the grooves for the magnetic strip (683) and spray with Delo-Quick 5002 activator. Apply Loctite 326 Adhesive to the grooves, insert the magnetic strips and press down.
5. Place the prepared load attachment plate and toothed strip (602) on the carriage, insert the screws (604), align the load attachment plate centrally and tighten the screws.

| | | |
|---|---|---|
| | **Caution** | Secure the carriage with the load attachment plate against moving or falling out by using adhesive tape. |

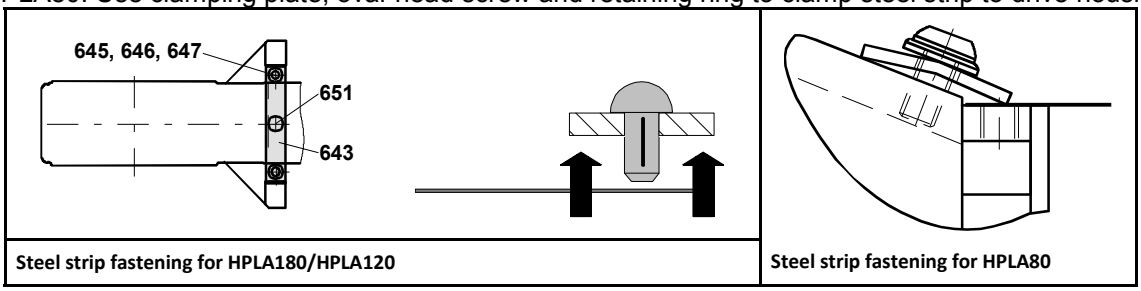
6. Loosen the 4 screws of the tensioning station (60), remove them carefully and remove the timing belt.
7. Clamp the metal base of the rubber buffer (112) in a vice according to the above and carefully remove the screw holding it to the baffle plate.

| | | |
|---|---|---|
| | **Note** | On dismantling the rubber buffer, only grip its metal base plate. For safety reasons, the fastening screw of the buffer is secured with Loctite. |

8. Mount the buffer extension:
   Apply Loctite to the set screw (14) and screw half its length into the spacer (13).
   Clean the thread of the rubber buffer, apply Loctite and screw the buffer onto the exposed half of the setscrew.
   Apply Loctite to the thread of the screw (113) and screw the spacer and rubber buffer on to the battle plate (111) of the tensioning station.
   Using pliers, grip the spacer and tighten up the screw securely. Make sure that the face of the spacer lies firmly against the housing of the tensioning station.
9. Place the timing belt around the pulley and fasten the tensioning station using screws (60) and new Schnorr lock washers.
10. Loosen the screws (4x) of the drive station (115), remove them carefully and remove the timing belt.
11. Remove the rubber buffer using a similar procedure to that with the tensioning station, lengthen it and re-attach.
12. Place the timing belt around the pulley of the drive station and fasten this using screws (115) and new Schnorr lock washers (116).




13. Unscrew the timing belt retaining bracket (607) from the dismantled load attachment plate.
14. Push the timing belt between the toothed strip and the load attachment plate. Secure timing belt clamping plate (607) with screw (608) (for screw fastening, also see page 27).
15. Tension the timing belt (chapter .5.2.3)
16. Align the timing belt (chapter 5.3)
17. Set up the reference point (chapter 5.4.6)
18. Push baffles (611) into the load attachment plate (601) so that the steel strip runs over the radius of the baffle. Align the baffle in the centre.
19. Clean the magnetic strip to remove any swarf or dirt.
20. Unroll the steel strip carefully, push it through the opening in the load attachment plate and lay it out over the whole HPLA profile.
21. Fasten steel strip onto drive station end. The steel strip on the HPLA80 is fixed differently from that on the HPLA180 and HPLA120:
    - HPLA180/HPLA120: Connect the clamping piece (643) carefully to the steel strip (6) using the grooved drive stud (651). Use with screws (645), washers (646) and shim (647) to fasten clamping piece on drive housing.
    - HPLA80: Use clamping plate, oval-head screw and retaining ring to clamp steel strip to drive housing.




Steel strip fastening for HPLA180/HPLA120

Steel strip fastening for HPLA80

22. Place two springs (617) and one felt wiper (616) in each of the strip guides (614).
23. Mount the steel strip cover according to chapter 5.11.1.2.

# 6 Wearing parts and replacement parts

## 6.1 Wearing parts

### 6.1.1 Wearing parts HPLA080

| Pos. | Name | Location | Order no. |
|---|---|---|---|
| 16 | Wheel R4OL0024 | Carriage for plastic roller guidance | 416-201070 |
| 32 | Timing belt 25AT10 HPF | Belt drive | 420-000016 |

**Table 16:** Wearing parts for the HPLA80-standard-version

| Pos. | Name | Location | Order no. |
|---|---|---|---|
| 33 | Steel strip 38mm x 0.152mm | Steel strip cover option | 400-300702 |

**Table 17:** HPLA wearing parts steel strip cover HPLA80

| Pos. | Name | Location | Order no. |
|---|---|---|---|
| 36 | Steel strip 15mm x 1.5mm | Steel guidance | 003-3573-03 |
| 16 | Wheel NPPU | Carriage, steel guidance | 003-3508-01 |
| 3 | Felt, lubricating cassette | Steel guidance | 003-3507-01 |

**Table 18:** Wearing parts for steel guidance HPLA80

| Pos. | Name | Location | Order no. |
|---|---|---|---|
| 87 | Pulley for hollow shaft bearing | Z4AS5053 D=35H7 | 101-1374-01 |
| 87 | Directly on shaft (for dual actuator) | Z4AS0057 D=20H7 | 101-1372-01 |
| 87 | Pulley directly mounted on gearbox shaft, gearbox P4 | Z4AS0054 D=22H7 | 101-1371-01 |

**Table 19:** Wearing parts: pulleys for HPLA80

### 6.1.2 Wearing parts HPLA120

| Pos. | Name | Location | Order no. |
|---|---|---|---|
| 16 | Wheel R4OL0103 | Carriage, plastic roller guidance | 003-3525-01 |
| 32 | Timing belt 32AT10 HPF | Belt drive | 420-000031 |

**Table 20:** Wearing parts for HPLA120-standard-version

| Pos. | Name | Location | Order no. |
|---|---|---|---|
| | | | |
| 33 | Steel strip 45mm x 0.152mm | Steel strip cover option | 400-300709 |

**Table 21:** HPLA wearing parts steel strip cover HPLA120

| Pos. | Name | Location | Order no. |
|---|---|---|---|
| 36 | Steel strip 20mm x 2mm | Steel guidance | 003-3573-02 |
| 15 | Wheel NPPU | Carriage, steel guidance | 003-3508-02 |
| 3 | Felt, lubricating cassette | Steel guidance | 003-3527-01 |

**Table 22:** Wearing parts for steel guidance HPLA120

| Pos. | Name | Location | Order no. |
|---|---|---|---|
| 87 | Pulley for hollow shaft bearing | Z4AS5045 D=50H7 | 101-1469-01 |
| 87 | Pulley directly mounted on gearbox shaft, gearbox P5 | Z4AS5050 D=32H7 | 101-1472-01 |

**Table 23:** Wearing parts: Pulleys for HPLA120

### 6.1.3 Wearing parts HPLA180

| Pos. | Name | Location | Order no. |
|---|---|---|---|
| 16 | Wheel R4OL0099 | Carriage, plastic roller guidance | 416-201080 |
| 32 | Timing belt 56AT20 PAZ | Belt drive | 420-000051 |

**Table 24:** Wearing parts for HPLA180-standard-version

| Pos. | Name | Location | Order no. |
|---|---|---|---|
| 33 | Steel strip 76mm x 0.152mm | Steel strip cover opt. | 400-300706 |
| 617 | Spare parts package for steel strip reversing unit. (4 felts, 4 baffles, 8 compression springs) | Steel strip cover opt. | 510-008401 |

**Table 25:** HPLA wearing parts steel strip cover HPLA180

| Pos. | Name | Location | Order no. |
|---|---|---|---|
| 15 | Wheels NPPU | Carriage, steel guidance | 416-200100 |
| 3 | Felt, lubricating cassette | Steel guidance | 180-300065 |

**Table 26:** Wearing parts for steel guidance HPLA180

| Pos. | Name | Location | Order no. |
|---|---|---|---|
| 87 | Pulley for hollow shaft bearing | Z4AS5030 D=60H7 | 420-100780 |
| 87 | Directly on shaft (for dual actuators) | Z4AS5048 D=40H7 | 420-100781 |
| 87 | Pulley directly mounted on gearbox shaft, gearbox P5 | Z4AS5052 D=32H7 | 420-100782 |

**Table 27:** Wearing parts: pulleys for HPLA180

## 6.2 Replacement parts

### 6.2.1 Replacement parts HPLA080

| Pos. | Name | Location | Order no. |
|---|---|---|---|
| 18 | Eccentric bush E4XZ0004 | Carriage | 125-068100 |
| 19 | Cylindrical bush B4UC0140 | Carriage | 125-071705 |
| 21 | Grooved stone T4NU0075 | Carriage | 131-700165 |
| 22 | Washer S4EI0008 | Carriage | 125-068150 |
| 23 | Schnorr lock washer M5 | Carriage | 135-201051 |
| 24 | Cylindrical screw DIN6912 M5x20 | Carriage | 130-302680 |
| 112 | Rubber buffer | Drive and tensioning station | 400-302100 |

**Table 28:** Replacement parts HPLA80-standard-version

| Pos. | Name | Location | Order no. |
|---|---|---|---|
| 614 | Cover flap P4LA2770 | Timing belt cover | 125-071707 |
| 615 | Cylindrical screw DIN912 M5x50 | Timing belt cover | 130-302327 |

**Table 29:** Replacement parts for steel strip cover HPLA80

| Pos. | Name | Location | Order no. |
|---|---|---|---|
| 37 | Round cord | Steel guidance | 125-071743 |
| -- | Lubricating cassette assembly | Steel guidance | on request |

**Table 30:** Replacement parts for steel guidance HPLA80

### 6.2.2 Replacement parts HPLA120

| Pos. | Name | Location | Order no. |
|---|---|---|---|
| 18 | Eccentric bush E4XZ0003 | Carriage | 125-070100 |
| 19 | Cylindrical bush B4UC0135 | Carriage | 125-071600 |
| 21 | Grooved stone T4NU0064 | Carriage | 131-700143 |
| 22 | Washer S4EI0145 | Carriage | 125-071601 |
| 23 | Schnorr lock washer M8 | Carriage | 135-201053 |
| 24 | Cylindrical screw DIN6912 M8x25 | Carriage | 130-302745 |
| 112 | Rubber buffer | Drive and tensioning station | 400-302102 |

**Table 31:** Replacement parts for HPLA120-standard version

| Pos. | Name | Location | Order no. |
|---|---|---|---|
| 614 | Cover flap P4LA2919 | Timing belt cover | 125-071635 |
| 615 | Cylindrical screw DIN912 M6x55 | Timing belt cover | 130-302352 |

**Table 32:** Replacement parts for steel strip cover HPLA120

| Pos. | Name | Location | Order no. |
|---|---|---|---|
| 37 | Round cord | Steel guidance | 125-071642 |
| -- | Lubricating cassette assembly | Steel guidance | on request |

**Table 33:** Replacement parts for steel guidance HPLA120

### 6.2.3 Replacement parts HPLA180

| Pos. | Name | Location | Order no. |
|---|---|---|---|
| 18 | Eccentric bush E4XZ0007 for plastic wheels | Carriage | 125-071500 |
| | Eccentric bush E4XZ0012 for steel wheels | | 125-071533 |
| 19 | Cylindrical bush B4UC0131 for plastic wheels | Carriage | 125-071501 |
| | Cylindrical bush B4UC0136 for steel wheels | | 125-071532 |
| 21 | Grooved stone T4NU0054 12(M10) x130 | Carriage | 131-700124 |
| 22 | Washer S4EI0134 | Carriage | 125-071502 |
| 23 | Fan washer DIN6798 d10.5(d19) | Carriage | 135-200620 |
| 24 | Countersunk screw DIN7991 M10x45 | Carriage | 130-106570 |
| 112 | Rubber buffer | Drive and tensioning station | 400-302002 |

**Table 34:** Replacement parts for HPLA180-standard-version

| Pos. | Name | Location | Order no. |
|---|---|---|---|
| 614 | Cover flap P4LA 2920 | Timing belt cover | 125-071512 |
| 615 | Cylindrical screw DIN912 M8x110 | Timing belt cover | on request |

**Table 35:** Replacement parts for steel strip cover HPLA180

| Pos. | Name | Location | Order no. |
|---|---|---|---|
| 37 | Round cord | Steel guidance | 125-071642 |
| -- | Lubricating cassette assembly | Steel guidance | on request |

**Table 36:** Replacement parts for steel guidance HPLA180

# 7 Order Code

Fill in an order code from each of the numbered fields to create a complete model order code.

| | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | ⑧ | ⑨ | ⑩ | ⑪ | ⑫ | ⑬ | ⑭ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Order Example: | HPLA080 | D1 | B1 | T2000 | C1 | DA1000 | S08 | F02 | G2-05 | K24 | R1 | H1 | LH1 | E1 |

## ① Series

**HPLA080**
**HPLA120**
**HPLA180**

## ② Drive System

| | |
|---|---|
| **D0** | Idler Unit |
| **D1** | Timing Belt Drive, Nominal Thrust, Maximum Life |
| **D2** | Timing Belt Drive,Maximum Thrust, Nominal Life |
| **D9** | Internal Rack and Pinion (HPLA180 only) |

## ③ Beaing Option

| | |
|---|---|
| **B1** | Polyamide Rollers |
| **B2** | Steel Rollers |

## ④ Travel

| | |
|---|---|
| **Tnnnn** | Specified travel in mm(nnnn=mm) |

## ⑤ Carriage

| | |
|---|---|
| **C1** | Standard Length Carriage with Load Plate* |
| **C2** | Extended Length Carriage with Load Plate* |
| **C3** | Standard Length Carriage with Clamping Bar* |
| **C4** | Extended Length Carriage with Clamping Bar* |

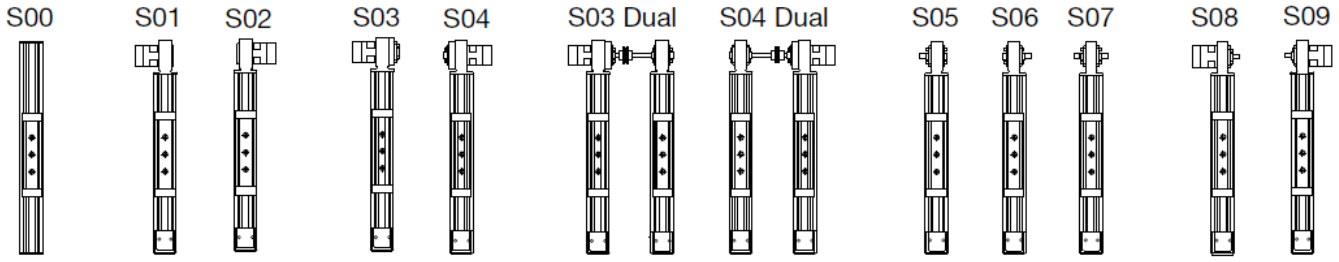
* See photos below.

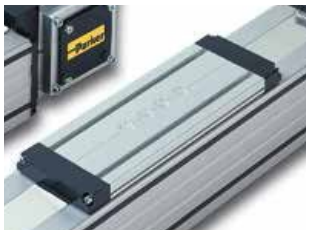
## ⑥ Link Shaft Option

| | |
|---|---|
| **DA0000** | No Link Shaft - Single Axis or Idler Unit |
| **Dannnn** | Double Unit, Specify Center to Center Distance (mm) |

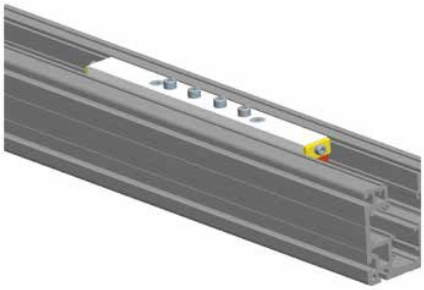
## ⑦ Drive Shaft Configuration

| | |
|---|---|
| **S00** | No Shaft, Idler Unit |
| **S01** | Unsupported Pulley, Flange Left |
| **S02** | Unsupported Pulley, Flange Right |
| **S03** | Supported Pulley, Flange Left |
| **S04** | Supported Pulley, Flange Right |
| **S05** | Supported Pulley, Shaft Option, Left |
| **S06** | Supported Pulley, Shaft Option, Right |
| **S07** | Supported Pulley, Shaft Option, Both |
| **S08** | Supported Pulley, Flange Left, Shaft Right |
| **S09** | Supported Pulley, Flange Right, Shaft Left |



*Load Plate carriage option*



*Clamping Bar carriage option*

## ⑧ Drive Housing Flange

| | |
|---|---|
| **F00** | No Flange |
| **F08** | PV90/PX90 Flange (HPLA80 ONLY) |
| **F09** | PX115/PV115 Flange (HPLA080 and HPLA120 only) |
| **F10** | PS90 Flange (HPLA080 and HPLA120 only) |
| **F11** | PS115 Flange (HPLA120 & HPLA180 only) |
| **F12** | PS142 Flange (HPLA180 only) |

## ⑨ Gearbox Option

| | |
|---|---|
| **G0-00** | No Gearbox |
| **G08-nn** | PX90 Gearbox included |
| **G09-nn** | PX115 Gearbox included |
| **G10-nn** | PS90 Gearbox included |
| **G11-nn** | PS115 Gearbox included |
| **G12-nn** | PS142 Gearbox included |
| **G14-nn** | PV90 Gearbox included |
| **G15-nn** | PV115 Gearbox included |

nn = ratio
Single stage ratios 3:1, 5:1, 10:1 Dual stage ratios 15:1, 25:1

## ⑩ Motor Kit Option

| | |
|---|---|
| **K00** | No Flange |
| **K20** | NEMA 23 stepper, 1/4” shaft |
| **K21** | BE23 |
| **K23** | SMN60, MPM72 (metric), N070,J070 |
| **K24** | SMN82, MPM89 (metric), N092, J092 |
| **K26** | BE34 |
| **K34** | MPP092x motorkit |
| **K36** | Parker MPP100/MPJ100 |
| **K39** | Parker MPP115/MPJ115 |
| **K41** | Parker MPP142/MPJ142 |
| **K50** | Parker HDY55;MPL15XX (Allen Bradley) |
| **K51** | AKM3X-AN (Kollmorgen) |
| **K52** | SGMAH-04 (Yaskawa) |
| **K53** | SGMAH-08 (Yaskawa) |
| **K54** | MKD041 (Indramat) |
| **K55** | AKM4X-AN (Kollmorgen) |
| **K56** | MKD070 (Indramat) |
| **K57** | MKD090 (Indramat) |

## ⑪ Environmental Option

| | |
|---|---|
| **R1** | Standard preparation with strip seal [1] |
| **R2** | Standard preparation with no strip seal |
| **R3** | Corrosion resistant preparation with strip seal [1, 2] |
| **R4** | Corrosion resistant preparation with no strip seal [2] |

[1] C1, C2 Carriage Load Plate Only

[2] B1 Bearing Option Polyamide Rollers Only)

## ⑫ Mounting Orientation

| | |
|---|---|
| **H1** | Carriage Up |
| **H2** | Carriage Down |
| **H3** | Carriage on Side, Drive Station Up |
| **H4** | Carriage on Side, Drive Station Down |

## ⑬ Limit/ Home Switch Option *

| | |
|---|---|
| **LH0** | No Limit Switch Assembly |
| **LH1** | Three Mechanical Switches |
| **LH2** | Two Mechanical Switches, One Proximity (NPN) |
| **LH3** | Three NPN Prox Switches,10-30 VDC |
| **LH4** | Three PNP Prox Switches, 10-30 VDC |

*C1, C2 Carriage Load Plate Only

## ⑭ Linear Encoder

| | |
|---|---|
| **E1** | Without Linear Encoder |
| **E5** | 5.0 Micron Resolution, Magnetic Type |
| **E7** | Sine Cosine Output, Magnetic Type |

*C1, C2 Carriage Load Plate Only

# Appendix A

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

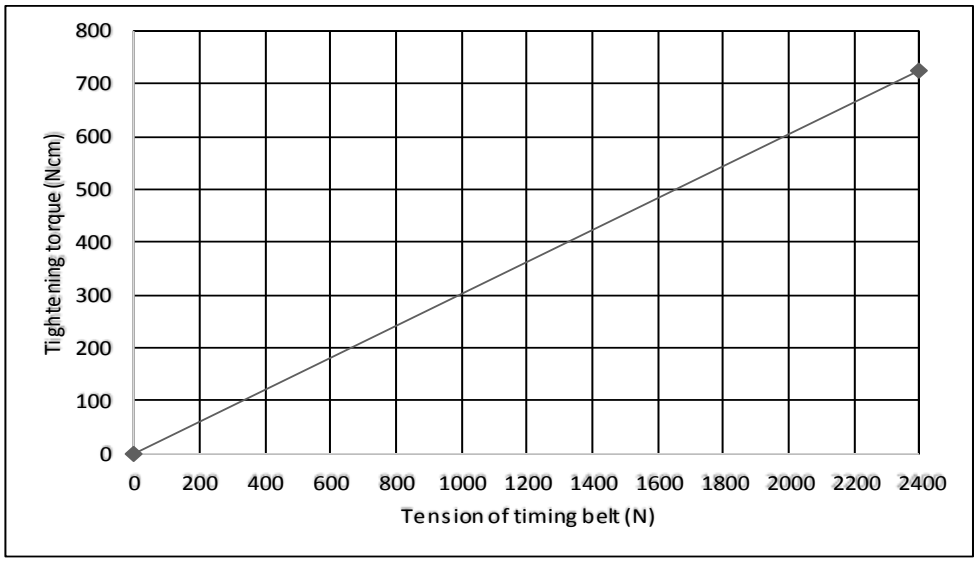



**Diagram 2:** Torque readings and resultant timing belt tension.