



ELECON

Modular Single Shaft Extruder Gear Units

General Points

While the first point determines gearbox size and ratio, the axial forces and desired bearing life govern the axial bearing and its housing

In order to obtain an economical drive assembly which is adapted in the best possible way to the materials processing technical demands, Elecon has developed an

Extruder Gear Modular-Series

POSIREX

The extruder gear modular consists of a combination of **Gear units** (of different size and ratios of the Posired 2 series) and flanged **axial bearing housing** for the take-up of axial self-aligning roller bearings of different load capacities.

According to their functions both these assemblies are to be designed independently of each other.

Selection :

- | Gearbox : page 8
- | Axial bearing page 2

From the combination of both assemblies the single shaft extruder gear is produced.

Combination possibilities : Page 9

Assembly :

Gearboxes : Series Posired 2 (as per leaflet no.264) The Standard gear range of the Posired 2 series includes single to 4 stage helical and bevel helical gearboxes in 19 sizes with ratios from 1.25:1 to 710:1

Gears : Helical gears, low noise, casehardened and ground. Profile correction for optimum load response. Spiral bevel gears - Klingenberg, case hardened and ground.

Casing : casing of great robustness in grey cast iron, designed according to the latest acoustic and heat transfer technologies.

Lubrication : Gears and antifriction bearings are splash lubricated as standard. Force feed lubrication systems are available as standard options.

Cooling : as standard option built-in cooling coil. Combined cooling and lubricating system are also available on request.

The quality assurance system in accordance with ISO 9001 registration no.041004756 Rw TUV CERT guarantees a uniformly high standard.

Assembly :

Axial bearing housing with self-aligning roller bearings

Axial bearing housing: Spheroidal graphite cast iron

Extruder flange may be customized to suit client's requirements

Versions of the output shafts according to the screw shaft requirements. Axial screw forces are contained in the axial bearing casing.

Axial self-aligning roller bearings of 293...E and 294...E series.

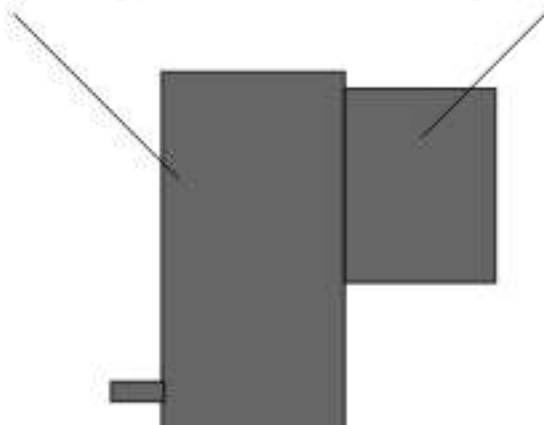
Further axial bearing versions are possible upon consultation with our design office.

Gearbox system Posider 2 (two to three-stage)

Axial bearing housing with self-aligning roller bearings.

Gear Function of :
Input power
Reduction Ratio

Axial bearings Function of :
Screw diameter
Screw thrust load
Screw speed
Bearing life





Selection of the thrust bearing

The thrust pressure F_{ax} [kN] of the extruder screw (has to be specified by the extruder manufacturer)

For an approximative calculation by neglecting possible supplementary forces of technological nature for specific to extruders, it is sufficient to suppose that :

$$F_{ax} = p \cdot \frac{D_s^2 \cdot p_a}{4 \cdot 10000}$$

The necessary dynamical bearing capacity of the thrust bearing

C_{requ} [kN]

$$C_{requ} = f_d \cdot F_{ax} \cdot \left(\frac{L_h \cdot 60 \cdot n_s}{10^6} \right)^{\frac{3}{10}}$$

$C_{requ} < C_{selection\ table}$

Rating example

Screw diameter : $D_s = 80\text{ mm}$

Working pressure : $P_a = 500\text{ bar}$

Speed of the extruder screw : $n_s = 100\text{ min}^{-1}$

Thrust bearing life duration : $L_h = 20\ 000\text{ h}$

Determination of the axial force of the extruder screw :

$$F_{ax} = p \cdot \frac{D_s^2 \cdot p_a}{4 \cdot 10000} \text{ [kN]}$$

$$F_{ax} = p \cdot \frac{80^2 \cdot 500}{4 \cdot 10000} = 251\text{ kN}$$

Selection

Choice from the dimension sheet Thrust bearing

Frame size 424 \mathcal{A} F_{ax} permissible = 262 kN > F_{ax} actual = 251 kN or rating by calculation using the dynamic bearing capacity of the thrust bearing :

$$C_{requ} = 1.06 \cdot 251 \cdot 20000 \cdot 60 \cdot \frac{1000000^{\frac{3}{10}}}{1000000} \text{ kN}$$

Choice of the thrust bearing from the table (page 3) size 29424 E

$C_{requ} = 1119\text{ kN} < C_{actual} = 1170\text{ kN}$

n_s [min⁻¹] Speed of the extruder screw
 f_d Factor for sense of rotation (max=1.06)

D_s [mm] Extruder screw diameter

P_a [bar] Working pressure

F_{ax} [kN] Thrust pressure from the extruder screw

L_h [h] Bearing life duration

C_{requ} [kN] Required dynamic bearing capacity of the thrust bearing

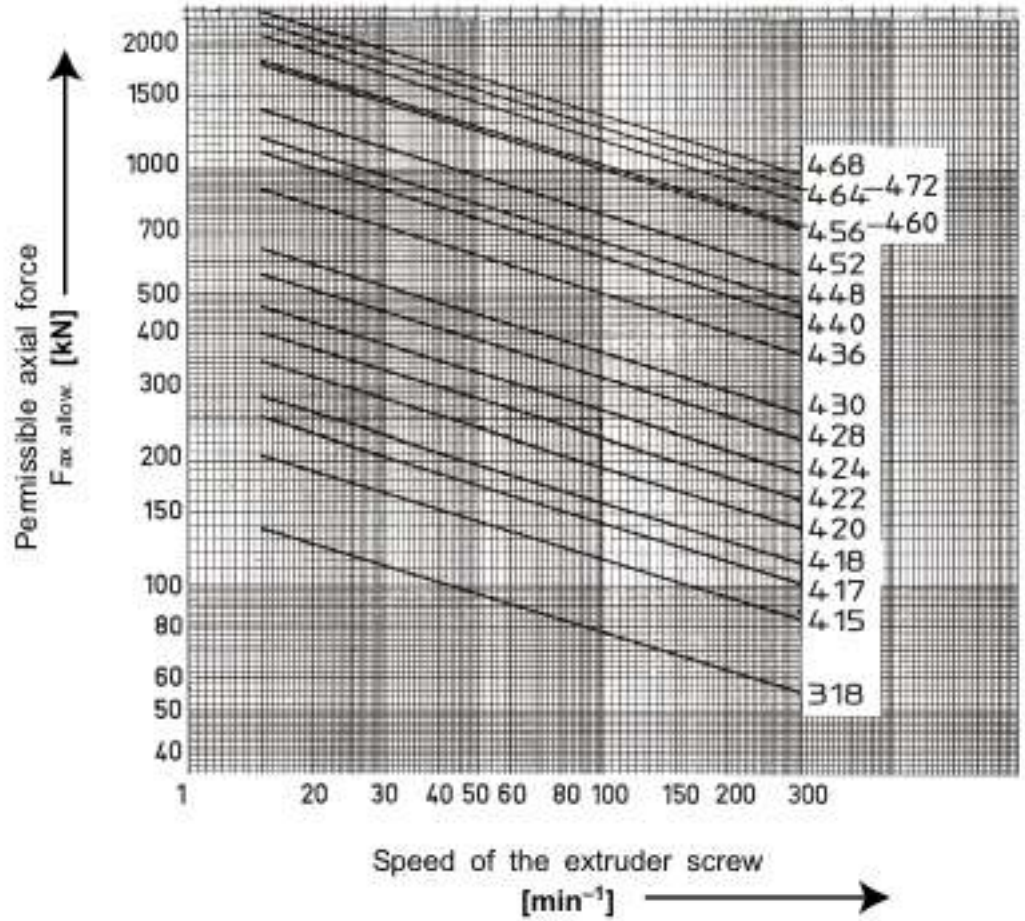
$C_{selection\ table}$ [kN] Dynamic bearing capacity of the thrust bearing according to the selection table

If the required gearbox / thrust bearing combination cannot be found in the selection table "Combination Gear Unit - Thrust Bearing" (page 9) please proceed as follows :

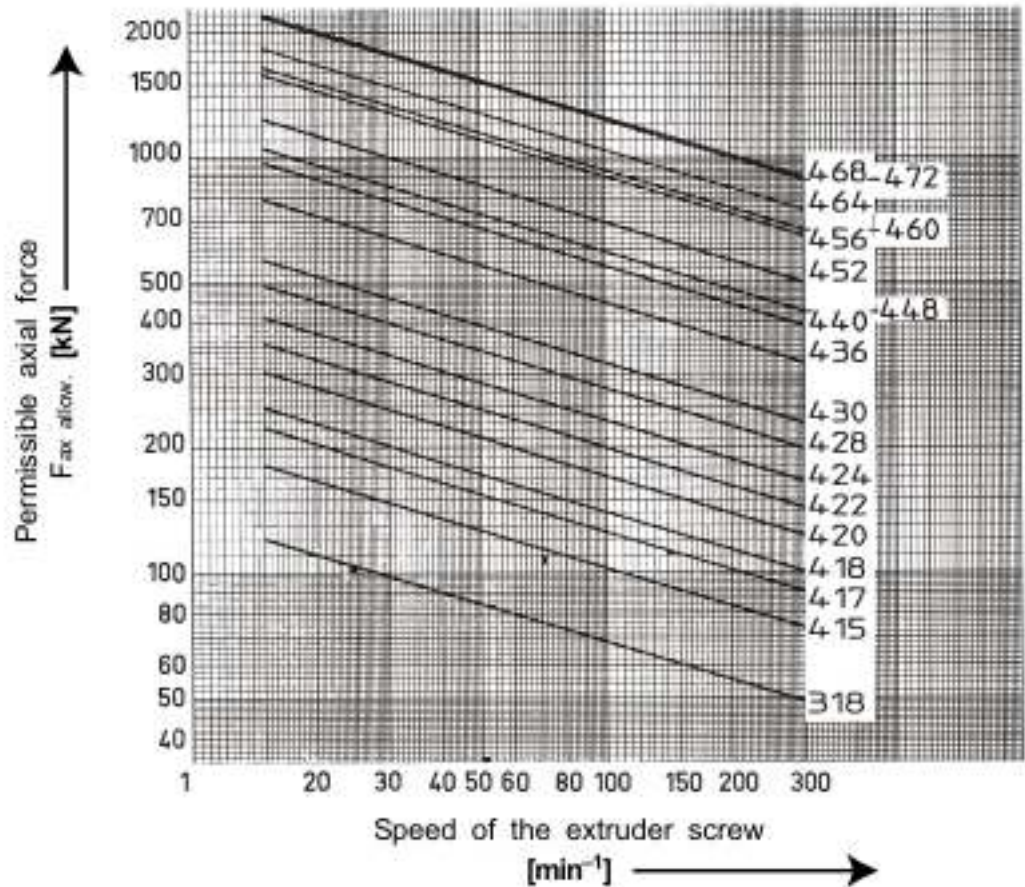
- for a **smaller** thrust bearing use the smallest bearing housing relative to the chosen reducer size.
- for a **larger** thrust bearing please contact your local engineer at the Elecon sales office.



20 000 h



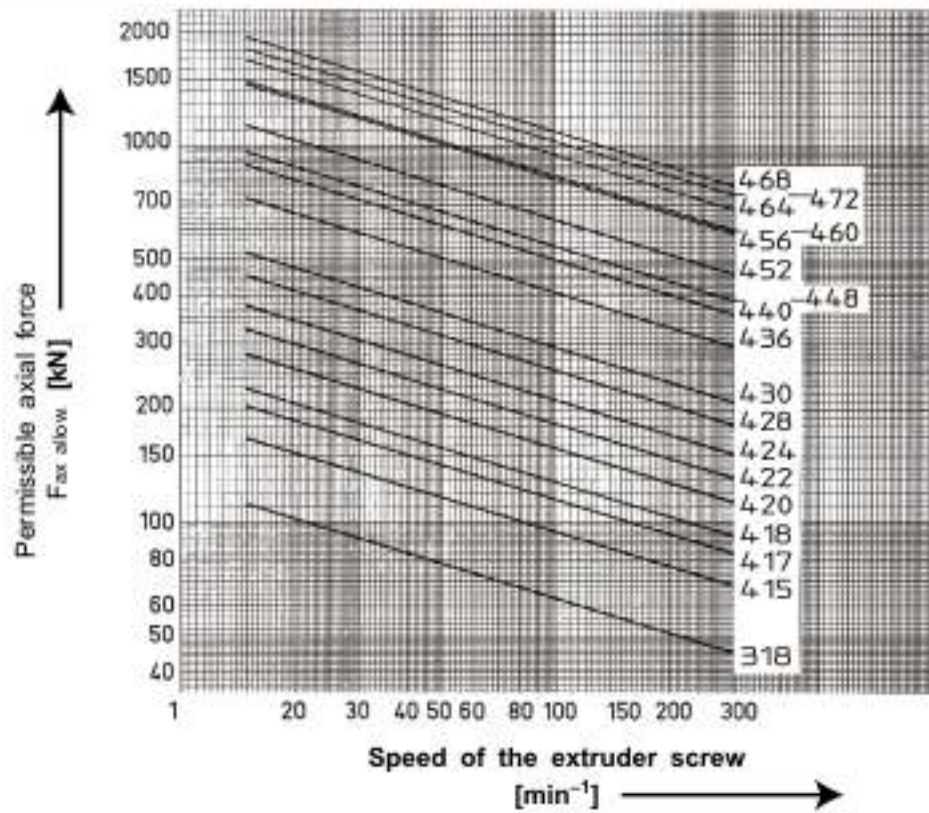
30 000 h



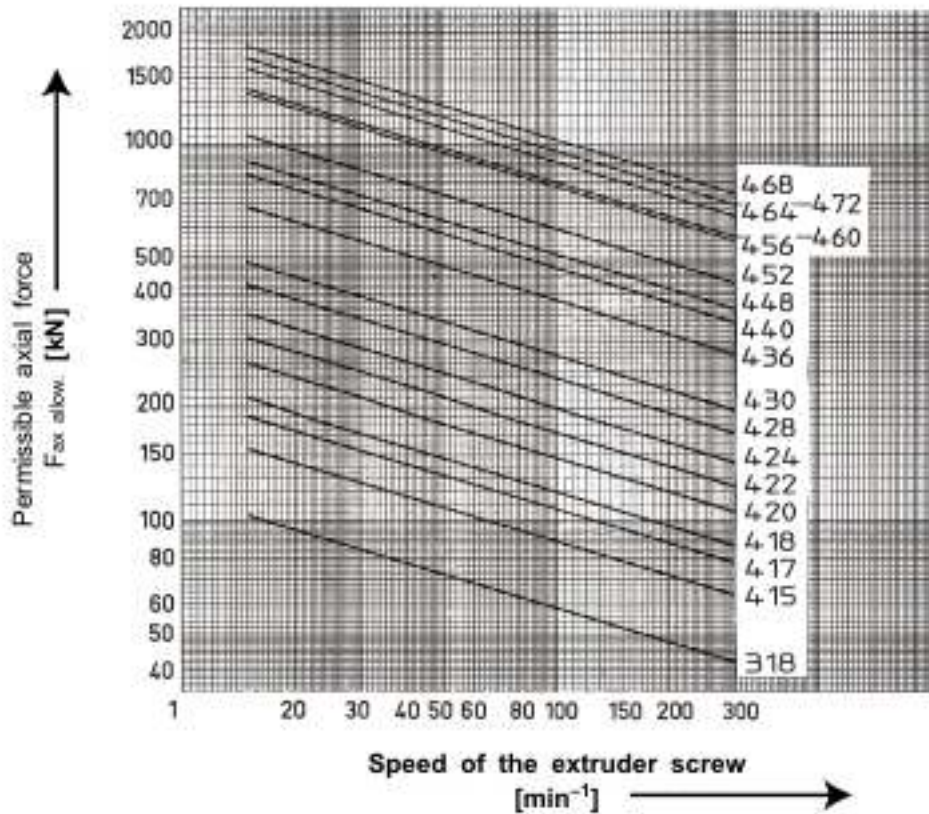


Requested thrust bearing life duration

40 000 h



50 000 h





Dimensions

Thrust bearing and Hollow shaft Elecon Standard

Keyway as per DIN 6885/1

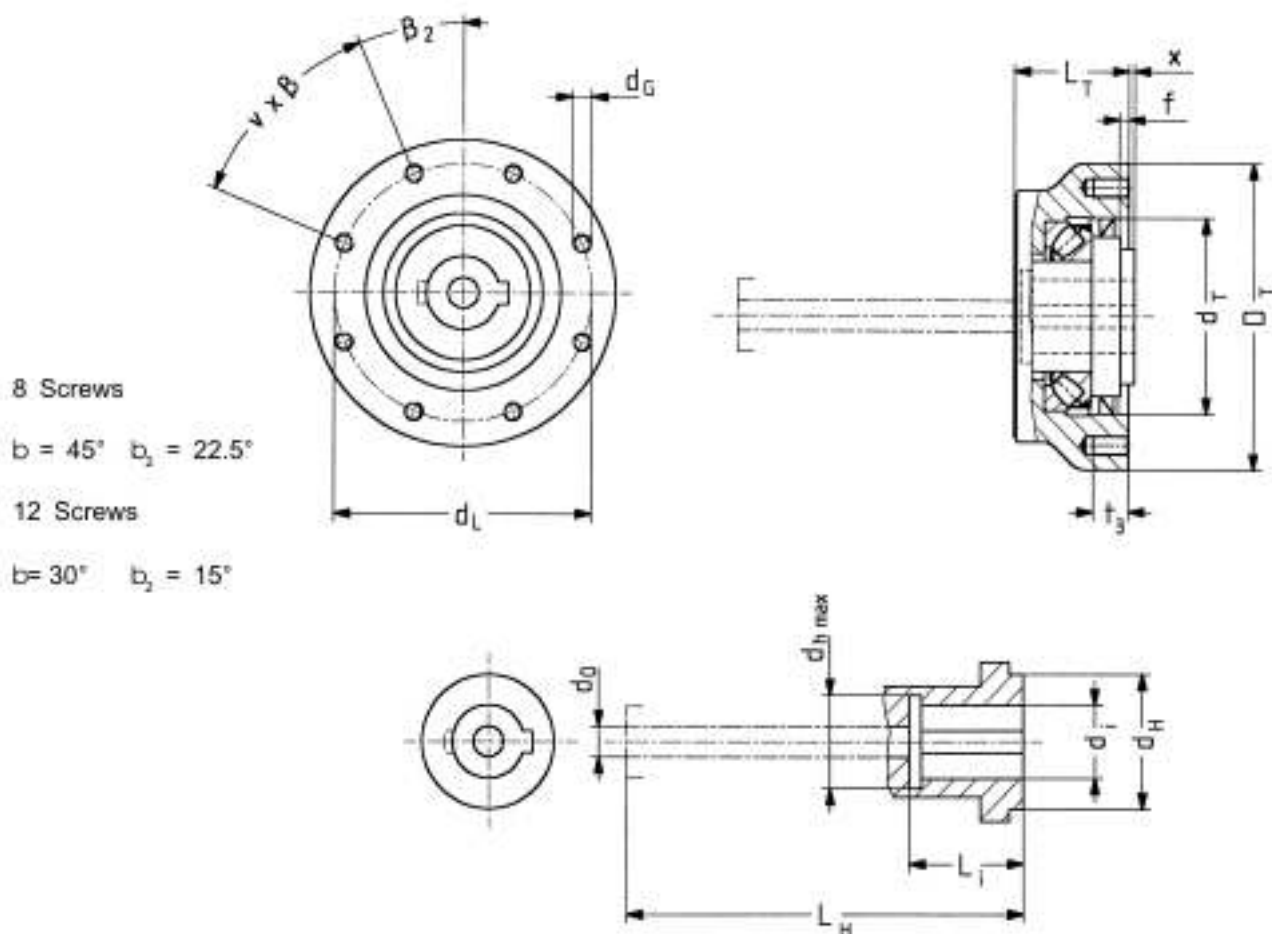
PROSIREX Type	Full self-aligning roller bearing		Thrust bearing housing									Hollow shaft						
	Dynamic Capacity [kN]	Index	D _T mm	d _T H7	L _T	f	d _L	d _o	t ₁	x	No. of Bolts	d _h mm	L _h	d _i mm	d _{h max} mm	L _i	Keys	d _o mm
X.14-318	345	29318E	250	160	95	8	210	M16	30	5	8	110	336	50	61	100	1	25
X.14-415	518	29415E	250	160	108	8	210	M16	30	5	8	100	365	45	57	80	2	25
X.14-417	633	29417E	280	180	120	8	230	M20	35	5	8	110	361	50	61	100	1	25
X.14-418	702	29418E	280	190	125	8	240	M20	35	5	8	110	366	50	61	100	1	25
X.14-420	863	29420E	298	210	140	8	260	M20	35	5	8	120	381	50	61	100	1	25
X.16-418	702	29418E	280	190	125	8	240	M20	35	5	8	110	366	50	61	110	2	30
X.16-420	863	29420E	298	210	140	8	260	M20	35	5	8	120	381	60	74	90	2	30
X.16-422	1010	29422E	330	230	145	8	280	M24	40	5	8	130	386	70	84	120	1	30
X.16-424	1170	29424E	355	250	150	10	310	M24	40	5	8	150	391	80	95	100	1	30
X.18-420	863	29420E	298	210	140	8	260	M20	35	5	8	120	469	60	74	130	2	30
X.18-422	1010	29422E	330	230	145	8	280	M24	40	5	8	130	454	70	84	110	2	30
X.18-424	1170	29424E	355	250	150	10	310	M24	40	5	8	150	459	80	96	140	1	30
X.18-428	1400	29428E	378	280	170	10	340	M24	40	5	8	170	479	80	96	140	1	30
X.20-424	1170	29424E	355	250	150	10	310	M24	40	5	8	150	484	80	96	110	2	40
X.20-428	1400	29428E	378	280	170	10	340	M24	40	5	8	170	479	90	106	150	1	40
X.20-430	1610	29430E	410	300	175	10	360	M24	40	5	8	180	484	100	118	120	1	40
X.22-428	1400	29428E	378	280	170	10	340	M24	40	5	8	170	543	90	106	140	2	40
X.22-430	1610	29430E	410	300	175	10	360	M24	40	5	8	180	548	100	118	160	1	40
X.22-436	2250	29436E	468	360	205	10	420	M30	50	5	8	220	578	130	151	140	1	40
X.25-436	2250	29436E	468	360	205	10	420	M30	50	5	8	220	606	130	151	170	1	50
X.25-440	2760	29440E	510	400	225	12	460	M30	50	5	8	240	626	140	165	150	1	50
X.28-436	2250	29436E	468	360	205	10	420	M30	50	5	8	220	670	130	151	150	2	60
X.28-440	2760	29440E	510	400	225	12	460	M30	50	5	8	240	690	140	165	180	1	60
X.28-448	2990	29448E	558	440	230	12	510	M36	60	5	8	290	695	170	197	180	1	60
X.31-440	2760	29440E	510	400	225	12	460	M30	50	5	8	240	692	140	165	160	2	60
X.31-448	2990	29448E	558	440	230	12	510	M36	60	5	8	290	697	170	197	180	1	60
X.31-452	3510	29452E	620	480	245	12	550	M36	60	5	8	310	712	180	210	200	1	60
X.35-440	2760	29440E	510	400	225	12	460	M30	50	10	8	200	840	130	147	195	2	60
X.35-448	2990	29448E	570	440	240	12	510	M36	60	10	12	240	845	170	191	255	1	60
X.35-452	3510	29452E	620	480	260	12	550	M36	60	10	12	260	865	190	213	285	1	60
X.35-456	4310	29456E	680	520	295	12	600	M36	60	10	12	280	900	200	223	300	1	70
X.40-448	2990	29448E	570	440	225	12	510	M36	60	10	12	240	835	170	191	255	2	60
X.40-452	3510	29452E	620	480	235	12	550	M36	60	10	12	260	865	190	213	285	2	60
X.40-456	4310	29456E	680	520	265	12	600	M36	60	10	12	280	895	200	223	300	1	70
X.40-460	4370	29460E	700	540	270	12	620	M36	60	10	12	300	920	220	245	330	1	70
X.42-452	3510	29452E	620	480	235	12	550	M36	60	10	12	260	930	190	213	285	2	60
X.42-456	4310	29456E	680	520	265	12	600	M36	60	10	12	280	960	200	223	300	2	70
X.42-460	4370	29460E	700	540	270	12	620	M36	60	10	12	300	985	220	245	330	1	70
X.42-484	4950	29484E	800	650	345	12	720	M36	60	10	12	320	1020	240	267	360	1	80
X.45-456	4310	29456E	680	520	265	12	600	M36	60	10	12	280	985	200	223	300	2	70
X.45-460	4370	29460E	700	540	270	12	620	M36	60	10	12	300	1010	220	245	330	2	70
X.45-464	4950	29464E	800	650	345	12	720	M36	60	10	12	320	1045	240	267	360	1	80
X.45-468	5750	29468E	860	700	360	12	780	M42	70	10	12	340	1100	250	277	375	1	80
X.47-460	4370	29460E	700	540	270	12	620	M36	60	10	12	300	975	220	245	330	2	70
X.47-464	4950	29464E	800	650	345	12	720	M36	60	10	12	320	1010	240	267	360	2	80
X.47-468	5750	29468E	860	700	360	12	780	M42	70	10	12	340	1075	250	277	375	1	80
X.47-472	5350	29472E	900	700	390	12	800	M42	70	10	12	360	1095	270	297	405	1	90



Dimensions

900-6000-MB 1/1

Thrust bearing and Hollow shaft Elecon Standard

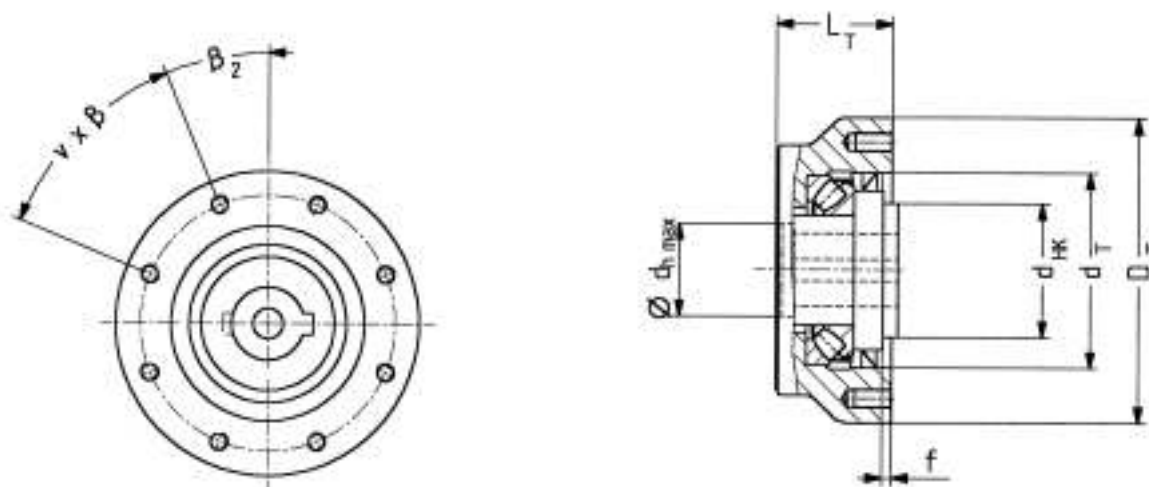


Dimensions

900-6001-MB 1/1

Thrust bearing and Hollow shaft - acc. to client's requirements

Dimensions see overleaf





Dimensions

Thrust bearing and Hollow shaft - acc. to client's requirements

Keyway as per DIN 6885/1

Output hollow shaft with involute splines acc. to DIN 5480 or other profiles acc.to client's requirements

PROSIREX Type	Add self-aligning roller bearing		Thrust bearing housing					Hollow shaft	
	Dynamic Capacity [kN]	Index	D _T	d _T H7	L _T	f	v No. of Bolts	d _h	d _{h max}
X.14-318	345	29318E	250	160	95	8	8	110	61
X.14-415	518	29415E	250	160	108	8	8	100	57
X.14-417	633	29417E	280	180	120	8	8	110	61
X.14-418	702	29418E	280	190	125	8	8	110	61
X.14-420	863	29420E	298	210	140	8	8	120	61
X.16-418	702	29418E	280	190	125	8	8	110	61
X.16-420	863	29420E	298	210	140	8	8	120	74
X.16-422	1010	29422E	330	230	145	8	8	130	64
X.16-424	1170	29424E	355	250	150	10	8	150	95
X.18-420	863	29420E	298	210	140	8	8	120	74
X.18-422	1010	29422E	330	230	145	8	8	130	64
X.18-424	1170	29424E	355	250	150	10	8	150	96
X.18-428	1400	29428E	378	280	170	10	8	170	96
X.20-424	1170	29424E	355	250	150	10	8	150	96
X.20-428	1400	29428E	378	280	170	10	8	170	106
X.20-430	1610	29430E	410	300	175	10	8	180	118
X.22-428	1400	29428E	378	280	170	10	8	170	106
X.22-430	1610	29430E	410	300	175	10	8	180	118
X.22-436	2250	29436E	468	360	205	10	8	220	151
X.25-436	2250	29436E	468	360	205	10	8	220	151
X.25-440	2760	29440E	510	400	225	12	8	240	165
X.28-436	2250	29436E	468	360	205	10	8	220	151
X.28-440	2760	29440E	510	400	225	12	8	240	165
X.28-448	2990	29448E	558	440	230	12	8	260	197
X.31-440	2760	29440E	510	400	225	12	8	240	165
X.31-448	2990	29448E	558	440	230	12	8	260	197
X.31-452	3510	29452E	620	480	245	12	8	310	210
X.35-440	2760	29440E	510	400	335	23	8	200	147
X.35-448	2990	29448E	570	440	340	23	12	240	191
X.35-452	3510	29452E	620	480	360	23	12	260	213
X.35-456	4310	29456E	680	520	395	27.5	12	280	223
X.40-448	2990	29448E	570	440	325	23	12	240	191
X.40-452	3510	29452E	620	480	365	23	12	260	213
X.40-456	4310	29456E	680	520	385	27.5	12	280	223
X.40-460	4370	29460E	700	540	410	32.5	12	300	245
X.42-452	3510	29452E	620	480	365	23	12	260	213
X.42-456	4310	29456E	680	520	385	27.5	12	280	223
X.42-460	4370	29460E	700	540	410	32.5	12	300	245
X.42-464	4950	29464E	800	650	445	33	12	320	267
X.45-456	4310	29456E	680	520	385	27.5	12	280	223
X.45-460	4370	29460E	700	540	410	32.5	12	300	245
X.45-464	4950	29464E	800	650	445	33	12	320	267
X.45-468	5750	29468E	860	700	500	40	12	340	277
X.47-460	4370	29460E	700	540	370	32.5	12	300	245
X.47-464	4950	29464E	800	650	405	33	12	320	267
X.47-468	5750	29468E	860	700	470	40	12	340	277
X.47-472	5350	29472E	900	700	490	41.5	12	360	297



Gear box rating

- | Selection of type and size of the reducer
 - | Required ratio $i_{requ} = \frac{n1}{n2}$
 - | Choice of the corresponding nominal ratio iN
(for the actual ratio i see the page 10)
 - | Selection of reducer size
Check of the nominal power rating of the reducer
 $P_N \geq P_e \cdot f_t$
 f_t = application factor (between 1.5 and 2.0 in accord with
- Determine the required torque
- $$T_{requ} = 9550 \frac{P_e}{n2} \cdot i$$
- | Selection of cooling system
 $P_t \geq P_e$
 $P_t = P_t \cdot f_w \cdot f_A \cdot f_L$

$n1$ [min ⁻¹]	input speed of the reducer
$n2$ [min ⁻¹]	output speed of the reducer
i_{requ}	required ratio
iN	nominal ratio
i_{actual}	actual ratio
P_M [kW]	motor power
P_N [kW]	nominal reducer power
P_e [kW]	effective machine power
f_t	application factor
f_A	utilisation factor
f_w	thermal factor
f_L	thrust bearing factor
T_{requ} [Nm]	required reducer output torque
P_t [kW]	thermal limit power of the reducer
P_{t0} [kW]	thermal limit power of the reducer without special cooling measures
P_{t3} [kW]	thermal limit power of the reducer with cooling coil
J_u [°C]	ambient temperature

Rating example

Working machine : Profile extruding machine
Actual extruder power : $P_e = 50$ kW
Speed : $n2 = 100$ min⁻¹
Ambient temperature : $J_u = 30^\circ$ C
Application factor : $f_t = 1.6$

Driving machine : three phase A.C. motor (squirrel-cage motor)
Motor power : $P_M = 55$ kW, motor speed: $n1 = 1450$ min⁻¹

Selection

1. Demanded : extruder drive for horizontal installation, disposition R11 with hollow shaft (see the ordering example)
2. Ratio :
 $i_{requ} = n1 / n2 = 1450/100 = 14.5$
 $iN = 14$

3. Required output torque of the gear box : $T_{requ} = 9550 \frac{P_e}{n2} \cdot i$
 $T_{requ} = 9550 \cdot \frac{50}{100} = 7650$ Nm

In the torque table (Page 11) may be found the design XC 18 with 8360 Nm

The actual ratio of this reducer is : $i_{actual} = 14.2$ (page 10)

4. Thermal limit verification : $P_e \leq P_t$ in which $P_t = P_{t3} \cdot f_A \cdot f_w \cdot f_L$
(thermal limit power and factors see page 13)
 P_{t3} : P_{t3} thermal limit power with cooling coil
 $P_{t3} = 133$ kW
with the utilisation factor f_A from the table 2 :
 $f_A = 0.91$ for $\frac{P_e}{P_N} = \frac{50}{100} = 53\%$

with the thrust bearing factor f_L from the table 3 :
 $f_L = 0.89$

With the temperature factor f_w from the table 1 :
 $f_w = 0.86$ for $J_u = 30^\circ$ C

Reducer with cooling coil: $P_t = 133 \cdot 0.91 \cdot 0.86 \cdot 0.89 = 92.6$ kW

$P_e = 50$ kW < $P_t = 92.6$ kW

Complete designation for the reducer and the thrust bearing housing :

XC	18	-	R1	1	-	H	11	-	14	-	Z	3	-	424
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Input drive using belt pulleys:

Because of the different loads and because of the dependence of the bearing life duration on the belt radial force working angle, please ask for precisions if this occurs.
If, after the verification of the standard bearing configuration, the bearing life duration results as insufficient, optionally reinforced bearing configuration may be offered.