FLENDER EXTRUDER SELECTION PROCESS

STEP 1

SELECT NOMINAL RATIO i_N (see Tables 1 and 2)

Example: Input speed n_1 = 1750 rpm, Driven machine speed n_2 = 100 rpm
Ratio (required) $i_{Req} = n_1/n_2$ = 17.5 Closest available ratio i_N = 18

STEP 2

CALCULATE OUTPUT TORQUE

$$T_{2Req} = \frac{P_2 \times 9.55 \times f1}{n_2} [kNm]$$

Example: Power of Working Machine: P_2 = 75 kW
Factor for Driven Machine: f1 = 1.6 (For Extruder)
Required Gear Box Output Torque: T_{2Req} = 75 × 9.55 × 1.6 / 100 = 11.46 kNm

STEP 3

SELECT GEAR UNIT TYPE AND SIZE (see Table 1 for closest Nominal Torque)

$T_{2N} \geq T_{2Req}$

Example: Gear unit type E2HA size 6 with Nominal Torque T_{2N} = 13.5 kNm
13.5 kNm ≥ 11.46 kNm Gear Unit is okay

STEP 4

DETERMINE REQUIRED THERMAL CAPACITY

For gear units without auxiliary cooling (see Table 3): $P_2 \leq P_{G1}$
Example: 75kW ≰ 49kW Additional cooling is required

For gear units with cooling system (see Table 3): $P_2 \leq P_{G3}$
Example: 75kW ≤ 158kW Cooling system is sufficient

STEP 5

CALCULATE THRUST LOAD

$$Fa = \pi \times \frac{d_S^2}{4 \times 10000} \times p_S [kN]$$

Example:
Screw Diameter d_S = 100 mm Pressure on screw p_S = 350 bar
Thrust Load $Fa = \pi \times 100^2 \times 350 / 4 \times 10000$ = 275 kN

STEP 6

CALCULATE NOMINAL THRUST BEARING LIFE TIME

$$Lh_{10} = \frac{10^6}{60 \times n_2} \times \left(\frac{C_{dyn}}{Fa}\right)^{(10/3)} [h]$$

Example: Dyn. Capacity Thrust Bearing C_{dyn} = 1630 kN
Calc. Thrust Bearing Life Time $Lh_{10} = (10^6 / 60 \times 100) \times (1630 / 226)^{(10/3)}$
$Lh_{10} \geq 62810$ h

PRODUCT FEATURES

- **Housing design**
  Flender A-line of parallel shaft gear units has the most advanced system of modular design. One-piece cast-housings are universally designed with FEM-Analysis to have the best results regarding absorbing greater external forces. Increased stiffness guarantees optimum alignment of shafts and internal gears. Non-split housing also means there is a significantly reduced risk of leakage.
- **Gear ratings up**
  Flender's gearing geometry is maximized for power density and low noise operation. Increased root radius results in great tooth strength and higher rating.
- **Thrust bearing**
  Flender's extruder gear units are equipped with an enlarged spherical thrust bearing mounted forward to the housing. This smart design separates external loads from the torque-transmitting portion of the housing. We incorporated the latest generation of bearings that literally redefines the design limits of spherical roller bearings (SKF Explorer).
- **Standard cooling system**
  Another innovation is the standardized cooling system, which has a flanged pump and a plate heat exchanger. This system provides safety for work with high thermal capacity and permits easy maintenance.

- **Global standardization**
  Flender A-line of parallel shaft gear units also have a new unit construction principle. This means internal rotating gears and bearings are part of our standard product offering and generally available from stock. The hollow shaft and interface flange are easily customized to meet our customers' requirements.

FLENDER EXTRUDER GEAR UNITS

From:

Name: Company:

Address:

City: Postal Code:

Phone: Country:

FAX: Date:

E-mail: Ref. / Inquiry #:

PRIME MOVER
Motor Power_____kW @ Speed _____ rpm
❑ AC ❑ DC ❑ VFD
❑ Direct drive ❑ FLENDER STANDARD Coupling
❑ Belt drive Motor shaft dia: _____ tol: _____

DRIVEN MACHINE/EXTRUDER

Duty Cycle ❑ 24 hours ❑ _____ hours/day

Operating Cycle ❑ 100% ❑ _____ %

Ambient Temperature ❑ 40°C ❑ _____°C ❑ 20°C

Application ❑ Blow film ❑ Blow moulding ❑ Sheet ❑ Pipes
❑ Other _____

Extrusion Load
Screw dia. _____ mm
Pressure on screw _____ bar **OR** Load on screw _____ kN
Screw speed _____ rpm

REDUCER REQUIREMENT ❑ _____ unit(s)

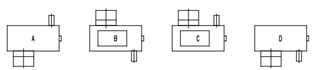
Type ❑ E2HA Double Reduction ❑ E3HA Triple Reduction

Size ❑ _____ ❑ by FLENDER

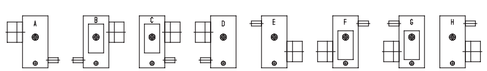
Output Shaft Design ❑ According to Drawing Number: _____ ❑ by FLENDER Standard

Assembly
(circle mounting position)

Horizontal



Vertical



FAX INQUIRY

(Please check box)

FLENDER

FLENDER

K21-1.0 EN 2005-05

EXTRUDER GEAR UNITS

Single Screw

FLENDER

FLENDER EXTRUDER GEAR UNITS

DOUBLE REDUCTION

Gear Unit E2HA size	6.3	7.1	8	9	10	11.2	12.5	14	16	18	20	22.4	25	28
	Nominal Ratio i_N / Nominal output torques T_{2N} in kNm and exact ratios i_{ist}													
4	6.3 6.319	6.3 6.857	6.3 7.778	6.3 8.485	6.3 9.722	6.3 10.694	6.3 12.444	6.3 13.865	6.3 15.556	6.3 17.602	6.3 19.444	6.2 22.037		
5	10.5 6.286	10.5 7.213	10.5 7.889	10.5 8.652	10.5 10.002	10.5 11.075	10.5 12.326	10.5 13.806	10.5 15.581	10.5 17.493	10.5 19.534	10.2 22.006		
6			13.5 7.792	13.5 8.940	13.5 9.778	13.5 10.724	13.5 12.397	13.5 13.726	13.5 15.278	13.5 17.111	13.5 19.311	13.5 21.681	13.5 24.212	13.0 27.725
7	19.0 6.088	19.0 7.048	19.0 7.799	19.0 8.660	19.0 9.660	19.0 10.648	19.0 11.307	19.0 13.939	19.0 15.717	19.0 17.598	19.0 19.742	18.6 20.982		
8			24.0 7.676	24.0 8.887	24.0 9.833	24.0 10.920	24.0 12.180	24.0 13.426	24.0 14.887	24.0 17.576	24.0 19.817	24.0 22.189	24.0 24.892	23.5 26.456
9	31.5 6.260	31.5 7.247	31.5 8.018	31.5 8.904	31.5 9.932	31.5 11.138	31.5 12.547	31.5 14.152	31.5 15.962	31.5 18.204	31.5 19.312	31.0 21.895		
10			39.5 7.848	39.5 9.085	39.5 10.053	39.5 11.163	39.5 12.452	39.5 13.964	39.5 15.765	39.5 17.743	39.5 20.012	39.5 22.824	39.5 24.212	38.9 27.451
11	55.5 6.246	55.5 6.900	55.5 7.644	55.5 8.974	55.5 10.046	55.5 10.889	55.5 12.174	55.5 13.704	55.5 15.556	55.5 17.111	55.5 19.074	54.5 21.491		
12			69.0 7.941	69.0 8.772	69.0 9.718	69.0 11.410	69.0 12.773	69.0 13.844	69.0 15.478	69.0 17.423	69.0 19.778	69.0 21.756	69.0 24.251	67.8 27.325
14			107.0 7.944	107.0 8.800	107.0 9.778	107.0 10.906	107.0 12.222	107.0 13.399	107.0 15.685	107.0 17.556	107.0 19.800	107.0 21.418	107.0 24.187	
16		160.0 7.316	160.0 8.076	160.0 8.941	160.0 9.935	160.0 11.087	160.0 12.440	160.0 13.769	160.0 15.550	160.0 17.457	160.0 19.765	160.0 23.024		

Table 1 Max permissible short time output torques (start up) $T_{2start} = T_{2N}/0,5$

TRIPLE REDUCTION

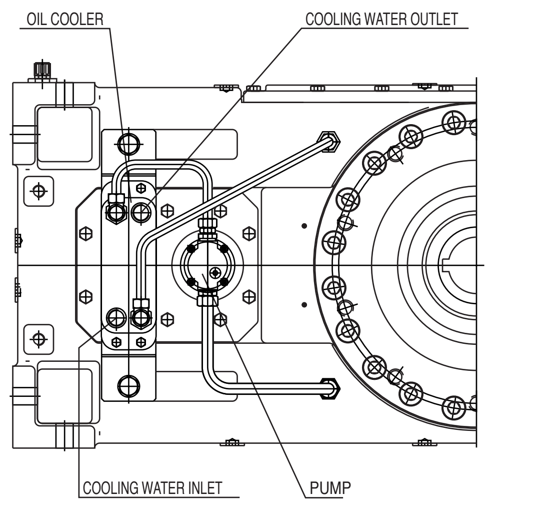
Gear Unit E3HA size	25	28	31.5	35.5	40	45	50	56	63	71	80	90	100	112
	Nominal Ratio i_N / Nominal output torques T_{2N} in kNm and exact ratios i_{ist}													
4	6.5 24.971	6.5 28.444	6.5 30.111	6.5 34.121	6.5 39.444	6.5 43.675								
5	11.0 25.011	11.0 28.490	11.0 31.161	11.0 34.177	11.0 39.508	11.0 43.745	11.0 48.689	11.0 54.532	11.0 61.543	11.0 69.742	11.0 78.723	11.0 86.806		
6			14.5 30.999	14.5 35.312	14.5 38.622	14.5 42.360	14.5 48.967	14.5 54.220	14.5 60.347	14.5 67.589	14.5 76.279	14.5 86.440	14.5 97.572	14.1 107.590
7	20.5 25.540	20.5 27.711	20.5 31.433	20.5 34.291	20.5 39.292	20.5 43.221	20.5 50.293	20.5 56.033	20.5 62.867	20.5 71.139	20.5 78.583	20.0 89.061		
8			25.5 32.202	25.5 34.940	25.5 39.633	25.5 43.236	25.5 49.542	25.5 54.496	25.5 63.413	25.5 70.651	25.5 79.267	25.5 89.696	25.5 99.083	25.2 112.294
9	34.0 25.439	34.0 29.187	34.0 31.942	34.0 35.013	34.0 40.474	34.0 44.816	34.0 49.881	34.0 55.866	34.0 63.049	34.0 70.787	34.0 79.049	33.5 89.050		
10			43.0 31.894	43.0 35.593	43.0 40.024	43.0 43.897	43.0 50.744	43.0 56.187	43.0 62.537	43.0 70.041	43.0 79.046	43.0 88.748	43.0 99.106	42.0 111.645
11	60.0 24.706	60.0 28.602	60.0 31.648	60.0 35.144	60.0 39.200	60.0 43.210	60.0 47.911	60.0 56.566	60.0 63.778	60.0 71.414	60.0 80.111	60.0 85.146		
12			75.0 31.412	75.0 36.366	75.0 40.238	75.0 44.683	75.0 49.840	75.0 54.938	75.0 60.916	75.0 71.919	75.0 81.089	75.0 90.798	75.0 101.856	75.0 108.257
14		109.0 27.292	109.0 31.447	109.0 36.406	109.0 40.283	109.0 44.733	109.0 49.896	109.0 55.957	109.0 63.171	109.0 71.100	109.0 80.190	109.0 91.457	109.0 97.020	109.0 110.000
16	173.0 24.245	173.0 28.036	173.0 30.971	173.0 34.311	173.0 40.284	173.0 45.096	173.0 48.878	173.0 54.647	173.0 61.514	173.0 69.826	173.0 76.809	173.0 85.620	173.0 96.471	

Table 2 Max permissible short time output torques (start up) $T_{2start} = T_{2N}/0,5$

Designation of Types E 2 H A 12

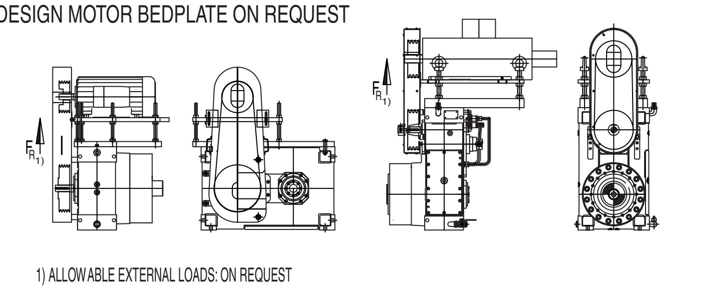
- E = Helical gear units for single screw extruder
- 2 = double reduction 3 = triple reduction
- H = Hollow output shaft
- A = Type A gear units (A-line)
- 12 = Size gear unit (04, 05, ... 10, 12, 14, 16, 18)

AUXILIARY COOLING



AUXILIARY COOLING WITH COOLING COIL ON REQUEST

DESIGN MOTOR BEDPLATE ON REQUEST



1) ALLOWABLE EXTERNAL LOADS: ON REQUEST

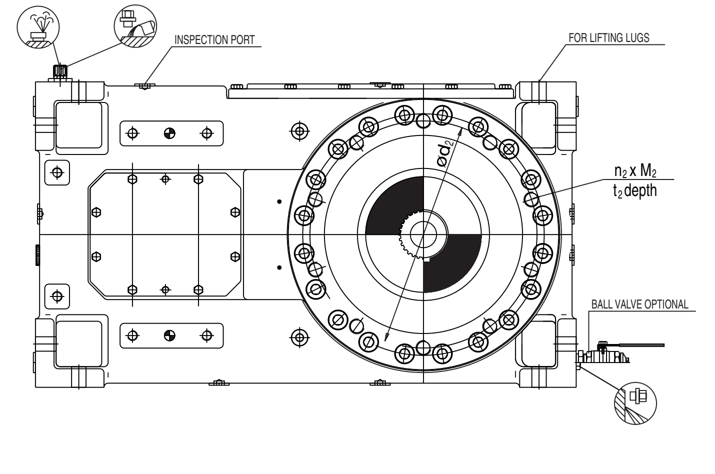
Gear Box size	Gear Unit type	Thermal Capacities P_{G1} [kW]	Thermal Capacities P_{G3} [kW]
4	E2HA	34	144
	E3HA	24	75
5	E2HA	41	150
	E3HA	28	106
6	E2HA	49	158
	E3HA	34	112
7	E2HA	58	245
	E3HA	40	127
8	E2HA	69	256
	E3HA	49	135
9	E2HA	80	338
	E3HA	56	173
10	E2HA	95	353
	E3HA	66	184
11	E2HA	112	438
	E3HA	78	220
12	E2HA	137	462
	E3HA	96	237
14	E2HA	200	1322
	E3HA	132	392
16	E2HA	251	2146
	E3HA	166	700

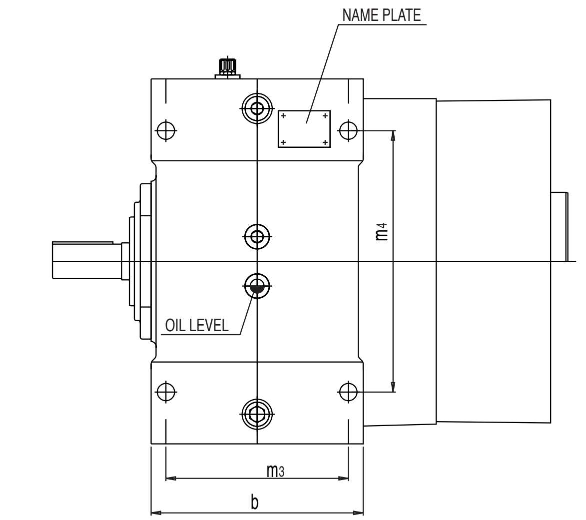
Table 3

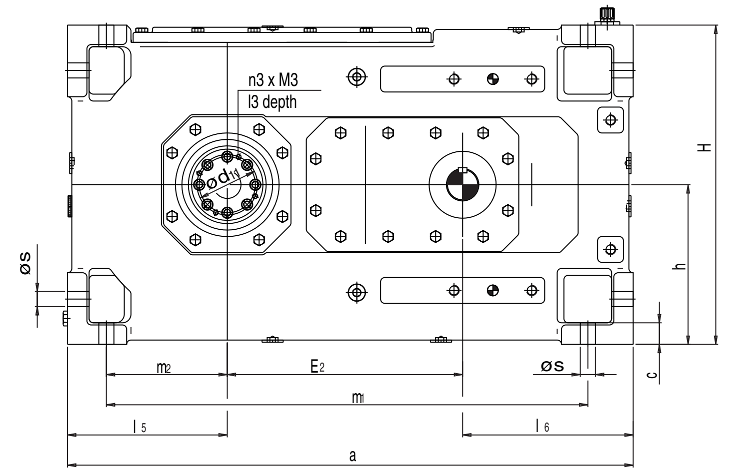
P_{G1}
Thermal capacities without cooling
Ambient temperature of 40°C
Indoor application, large hall
Splash lubrication
P_{G1} for vertical design
P_{G1} for horizontal design calculate $P_{G1} \times 0.95$

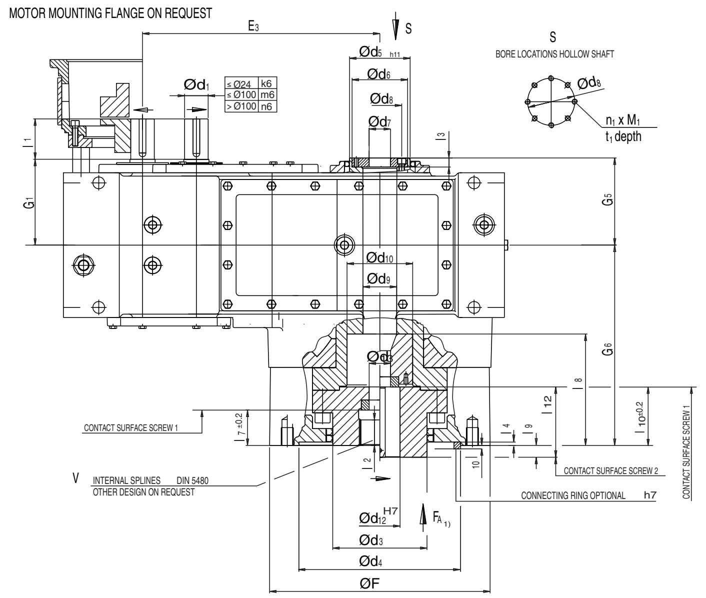
P_{G3}
Thermal capacities with standard cooling system
Input speed n_1 = 1750 rpm
Oil temperature difference 50°K
Ambient temperature of 40°C
Water inlet temperature 20°C
Indoor application, large hall
Splash lubrication
P_{G3} for vertical design
P_{G3} for horizontal design calculate $P_{G3} \times 0.95$

For other conditions please contact Flender representative for further information on ratings.



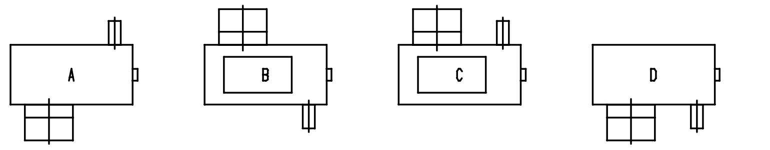






ASSEMBLY

Horizontal



Vertical

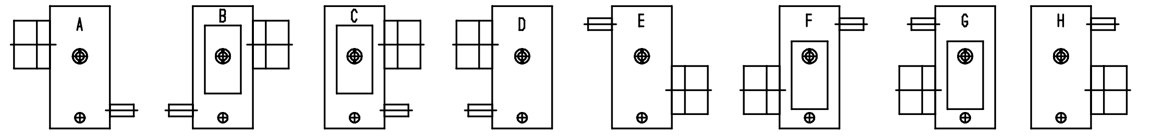


Table 4

SIZE	a	b	c	h	H	m_1	m_2	m_3	m_4	s
04	700	230	30	215	430	570	145	195	300	19
05	780	255	30	230	460	650	165	220	330	19
06	850	255	30	270	540	720	200	220	410	19
07	940	300	35	275	550	790	200	260	400	24
08	1030	300	35	320	640	880	245	260	490	24
09	1100	370	40	320	640	930	240	320	460	28
10	1200	370	40	370	740	1030	290	320	560	28
11	1310	430	50	370	740	1115	280	370	530	35
12	1450	430	50	440	880	1245	340	370	670	35

Double Reduction E2HA

SIZE	G_1	E_2	l_6	d_1 (i_N=6.3-11.2)	l_1 (i_N=6.3-11.2)	d_1 (i_N=12.5-22.4)	l_1 (i_N=12.5-22.4)	d_1 (i_N=8-14)	l_1 (i_N=8-14)	d_1 (i_N=16-28)	l_1 (i_N=16-28)
04	170	270	220	45	100	32	80	—	—	—	—
05	195	315	235	50	100	38	80	—	—	—	—
06	195	350	235	—	—	—	—	50	100	38	80
07	210	385	280	60	135	50	110	—	—	—	—
08	210	430	280	—	—	—	—	60	135	50	110
09	240	450	330	75	140	60	140	—	—	—	—
10	240	500	330	—	—	—	—	75	140	60	140
11	275	545	395	90	165	70	140	—	—	—	—
12	275	615	395	—	—	—	—	90	165	70	140

Triple Reduction E3HA

SIZE	G_1	E_3	l_6	d_1 (i_N=25-45)	l_1 (i_N=25-45)	d_1 (i_N=50-63)	l_1 (i_N=50-63)	d_1 (i_N=71-90)	l_1 (i_N=71-90)	d_1 (i_N=31.5-56)	l_1 (i_N=31.5-56)	d_1 (i_N=63-80)	l_1 (i_N=63-80)	d_1 (i_N=90-112)	l_1 (i_N=90-112)
04	150	360	130	40	60	*	*	—	—	—	—	—	—	—	—
05	160	405	145	40	70	30	50	24	40	—	—	—	—	—	—
06	160	440	145	—	—	—	—	—	—	40	70	30	50	24	40
07	185	495	170	45	80	35	60	28	50	—	—	—	—	—	—
08	185	540	170	—	—	—	—	—	—	45	80	35	60	28	50
09	230	580	200	60	125	45	100	32	80	—	—	—	—	—	—
10	230	630	200	—	—	—	—	—	—	60	125	45	100	32	80
11	255	705	235	70	120	50	80	42	70	—	—	—	—	—	—
12	255	775	235	—	—	—	—	—	—	70	120	50	80	42	70

SIZE	3) V DIN 5480	d_2	h11 d_3	H7 d_4	h11 d_5	H7/f7 d_6	d_7	d_8	d_9	H8 d_{10}	d_{11}	4) H7 d_{12}	d_{13}
04	55x2x30x26x9H	260	120	230	110	100	40	76	60	90	85	55	25
05	65x2x30x31x9H	330	140	290	120	100	40	76	60	95	85	65	28
06	75x2x30x36x9H	350	150	310	120	100	40	76	60	105	85	75	40
07	85x3x30x27x9H	400	170	365	130	120	50	95	70	120	95	85	40
08	90x3x30x28x9H	420	200	375	140	130	60	105	80	125	105	90	50
09	100x3x30x32x9H	450	200	400	150	130	60	105	80	135	105	100	50
10	110x4x30x26x9H	500	250	450	180	165	80	130	100	180	130	110	60
11	120x4x30x28x9H	550	280	480	180	165	80	130	100	195	130	120	60
12	130x4x30x31x9H	650	300	580	190	175	100	140	110	210	140	130	70

SIZE	G_5	G_6	l_2	l_3	l_4	l_5	l_7	l_8	1) l_9	2) l_9	l_{12}	n_1	t_1	M_1	n_2	t_2	M_2	n_3	M_3	ØF	Thrust Bearing	Weight (kg)
04	151	335	37	17	10	210	55	214	15	0	110	8	17	M10	8	29	M20	2	M8	365	294 24 E	415
05	165	355	45	17	10	230	60	215	15	0	108	8	17	M10	8	29	M20	2	M8	400	294 26 E	600
06	165	360	50	17	10	265	65	219	35	0	147	8	17	M10	12	29	M20	2	M8	445	294 28 E	665
07	190	420	55	22	10	275	70	259	35	0	157	8	19.5	M12	16	39	M24	2	M10	475	294 32 E	855
08	190	425	60	22	10	320	75	258	35	0	161	8	19.5	M12	12	46	M30	2	M10	535	294 34 E	1065
09	227	490	70	22	10	320	85	305	35	0	173	8	19.5	M12	16	39	M24	2	M10	545	294 36 E	1465
10	229	505	75	27	10	370	90	249	35	0	176	8	24	M16	8	53	M36	2	M16	615	294 48 E	1810
11	259	595	90	27	10	370	105	331	35	0	209	8	24	M16	10	53	M36	2	M16	655	294 52 E	2410
12	259	615	90	27	10	440	105	345	35	0	210	8	24	M16	16	53	M36	2	M16	765	294 56 E	2955

1) Hub with Keyway acc. DIN 6885/1
2) Hub with Splines acc. DIN 5480
3) preferential range spline DIN 5480
4) preferential range keyway DIN 6885/1
*on request

Dimensions for reference only, use certified prints for construction.