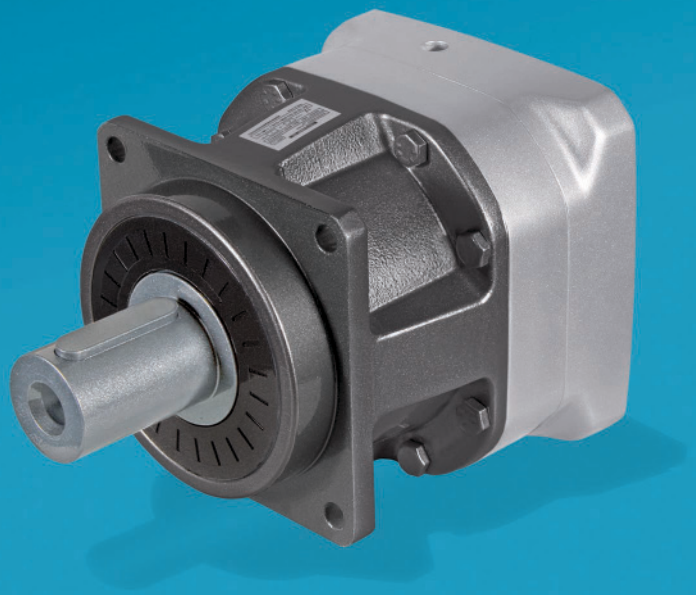
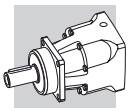
Bonfiglioli
Tecnoingranaggi

TQ series

Low-backlash gearboxes



Bonfiglioli
power, control and green solutions

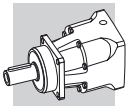


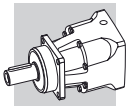
SUMMARY

Revisions

Refer to page 20 for the catalogue revision index.

Visit www.bonfiglioli.com to search for catalogues with up-to-date revisions.





1 GENERAL INFORMATION

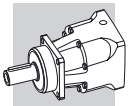
1.1 SYMBOLS, UNITS AND DEFINITIONS

Values depending on the APPLICATION

term	u.m.	definition
A_2	[N]	Axial force on output shaft
$A_{2\ EQU}$	[N]	Equivalent axial force applying on output shaft
$A_{2\ MAX}$	[N]	Maximum axial force applying on output shaft
R_2	[N]	Radial force on output shaft
$R_{2\ EQU}$	[N]	Equivalent radial force applying on output shaft
$R_{2\ MAX}$	[N]	Maximum radial force applying on output shaft
ED	[min]	Duration of the duty
ED%	[%]	Cyclic duration factor
$L_{10h\ TARGET}$	[h]	Output shaft bearings' desired basic rating life
$M_{1\ PEAK}$	[Nm]	Maximum input torque (limited by motor control)
$M_{2(1)}$ ... $M_{2(n)}$	[Nm]	Output torque at the times t_1 ... t_n
$M_{2\ EQU}$	[Nm]	Equivalent output torque
$M_{2\ MAX}$	[Nm]	Maximum output torque in case of emergency
$M_{T2\ EQU}$	[Nm]	Equivalent tilting moment applying on output shaft
$M_{T2\ MAX}$	[Nm]	Maximum tilting moment applying on output shaft
n_2	[min^{-1}]	Output speed
$n_{2(1)}$ ... $n_{2(n)}$	[min^{-1}]	Output speed based on the times t_1 ... t_n
$n_{2\ EQU}$	[min^{-1}]	Equivalent output speed
$n_{2\ MAX}$	[min^{-1}]	Maximum output speed
T	[C°]	Ambient temperature
t_1 ... t_n	[s]	Operating time
t_Σ	[s]	Cycle duration including pause
Z	[1/h]	Number of cycles per hour

Values depending on the GEAR DRIVE SELECTION

term	u.m.	definition
$A_{2\ 3\ max}$	[N]	Admissible axial force on output shaft
$A_{2\ max}'$	[N]	Axial force acting simultaneously with radial force
$R_{1\ max}$	[N]	Admissible radial force at midpoint of input shaft
$R_{2\ 3\ max}$	[N]	Admissible radial force at midpoint of output shaft
C_B	[Nm]	Constant for bearing's lifetime calculation
C_t	$\left[\frac{Nm}{arcmin}\right]$	Torsional stiffness
f_n	—	Speed factor
f_z	—	Cycle factor
f_T	—	Temperature adjusting factor
i	—	Gearbox ratio
J_G	[$kgcm^2$]	Mass moment of inertia of the gearhead
K_n	—	Speed constant
L_{10h}	[h]	Bearings basic rating life
L_Z	[mm]	Factor for bearing lifetime calculation
$M_{a\ 2}$	[Nm]	Maximum acceleration output torque
$M_{n\ 2}$	[Nm]	Rated output torque
$M_{p\ 2}$	[Nm]	Emergency stop output torque
$M_{T2\ max}$	[Nm]	Maximum tilting moment applying on output shaft
$n_{1\ max}$	[min^{-1}]	Maximum momentary input speed. The speed the unit can be driven at occasionally and in non-repetitive conditions For duty type S5, it cannot be applied continuously for more than 30 seconds
p	—	Bearing lifetime exponent
η	[%]	Gear efficiency
φ_R	[arcmin]	Reduced backlash is calculated in static conditions and with the application of a torque equal to 2% of the gear unit rated torque
φ_S	[arcmin]	Standard backlash is calculated in static conditions and with the application of a torque equal to 2% of the gear unit rated torque



1.2 SELECTING THE GEAR UNIT

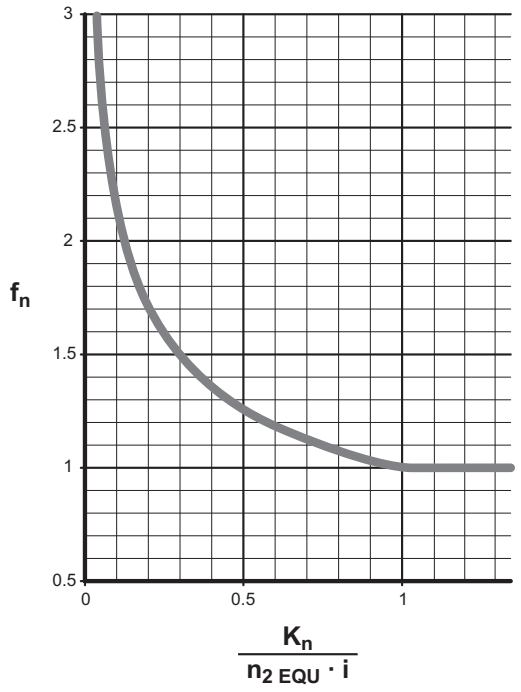
(a)	Ratio	i	—	$i = \frac{n_1}{n_2}$
(b)	Equivalent output torque	$M_{2\,EQU}$	[Nm]	$M_{2\,EQU} = \sqrt[3]{\frac{n_{2(1)} \cdot t_1 \cdot \lvert M_{2(1)} \rvert^3 + \ldots + n_{2(n)} \cdot t_n \cdot \lvert M_{2(n)} \rvert^3}{n_{2(1)} \cdot t_1 + \ldots + n_{2(n)} \cdot t_n}}$
(c)	Equivalent output speed	$n_{2\,EQU}$	[min^{-1}]	$n_{2\,EQU} = \frac{n_{2(1)} \cdot t_1 + n_{2(2)} \cdot t_2 + \ldots + n_{2(n)} \cdot t_n}{t_\Sigma}$
(d)	Speed factor	f_n	—	If $\frac{K_n}{n_{2\,EQU} \cdot i} \geq 1 \Rightarrow f_n = 1$ If $\frac{K_n}{n_{2\,EQU} \cdot i} < 1 \Rightarrow f_n$ = Obtain from diagram
(e)	Cyclic duration factor Duration of the duty	ED% ED	[%] [min]	$ED\% = \frac{t_1 + t_2 + \ldots + t_n}{t_\Sigma} \cdot 100$ $ED = t_1 + t_2 + \ldots + t_n$
(f)	Number of cycles per hour	Z	[1/h]	$Z = \frac{3600}{t_\Sigma}$
(g)	Cycle factor	f_z	—	see table below
(h)	Temperature adjusting factor	f_T	—	If T ≤ 30°C ⇨ $f_T = 1$ If T > 30°C ⇨ $f_T = 1 + \frac{T° - 30\ C}{100\,°C}$
(i)	Maximum input torque	$M_{1\,PEAK}$	[Nm]	a) maximum possible application torque b) limited motor torque by inverter c) maximum motor torque

Z	f_z
Z ≤ 1000	1.00
1000 < Z ≤ 1500	1.25
1500 < Z ≤ 2500	1.50
2500 < Z ≤ 4000	1.75
4000 < Z ≤ 6000	2.00
Z > 6000	contact us

K_n - speed constant

i	TQ 060	TQ 070	TQ 090	TQ 130	TQ 160
3	3076	3074	1017	1779	1055
4	2141	3319	1031	1433	1450
5	2426	3500	1681	2500	1645
7	4000	3500	3000	2500	2500
10	4000	3500	3000	2500	2500
16	4500	3500	3000	2800	2500
20	4500	3500	3000	2800	2500
25	4500	3500	3000	2800	2500
28	4500	3500	3000	2800	2500
35	4500	3500	3000	2800	2500
40	4500	3500	3000	2800	2500
50	4500	3500	3500	3200	2500
70	5000	4500	4000	3500	2500
100	5000	4500	4000	3500	2500

f_n - speed factor

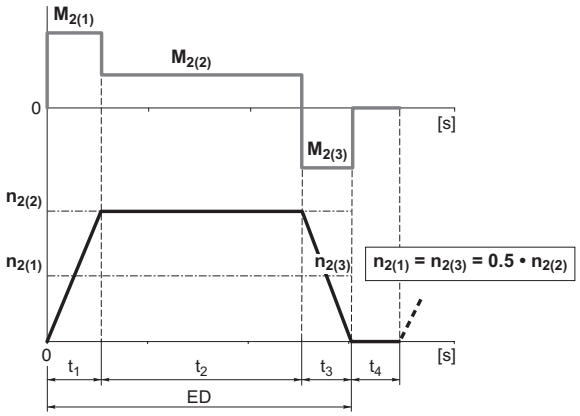


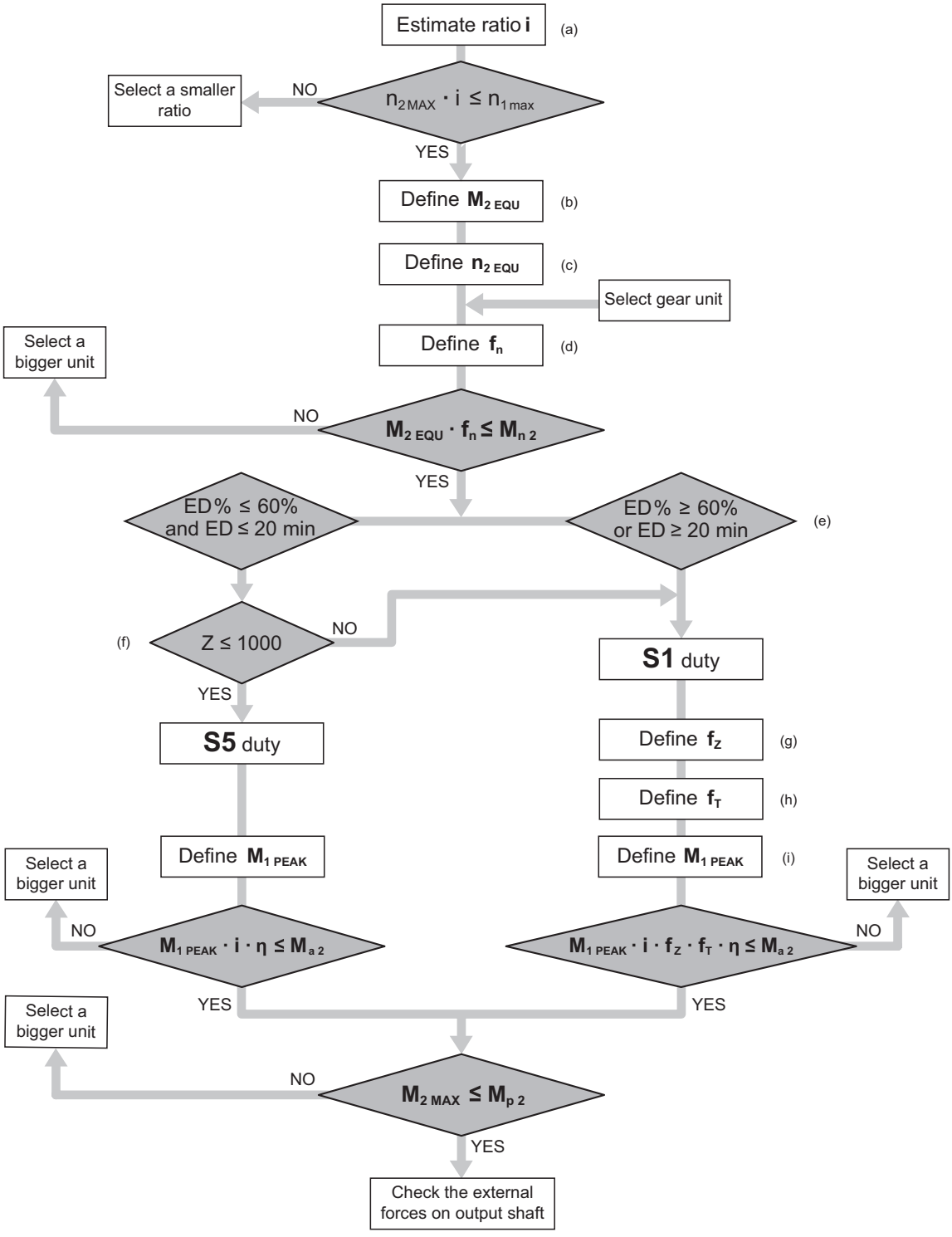
Load diagram

M_2: Output torque

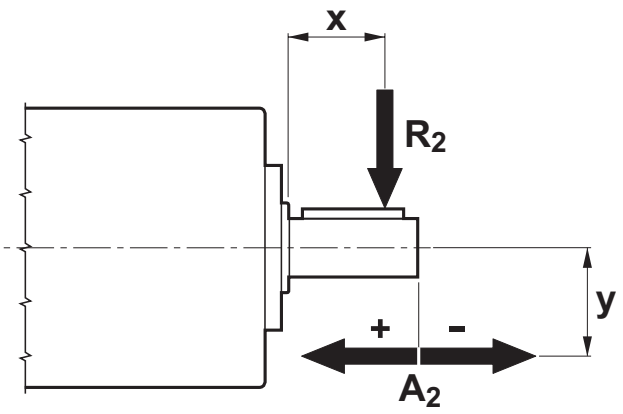
Speed diagram

n_2: Output speed



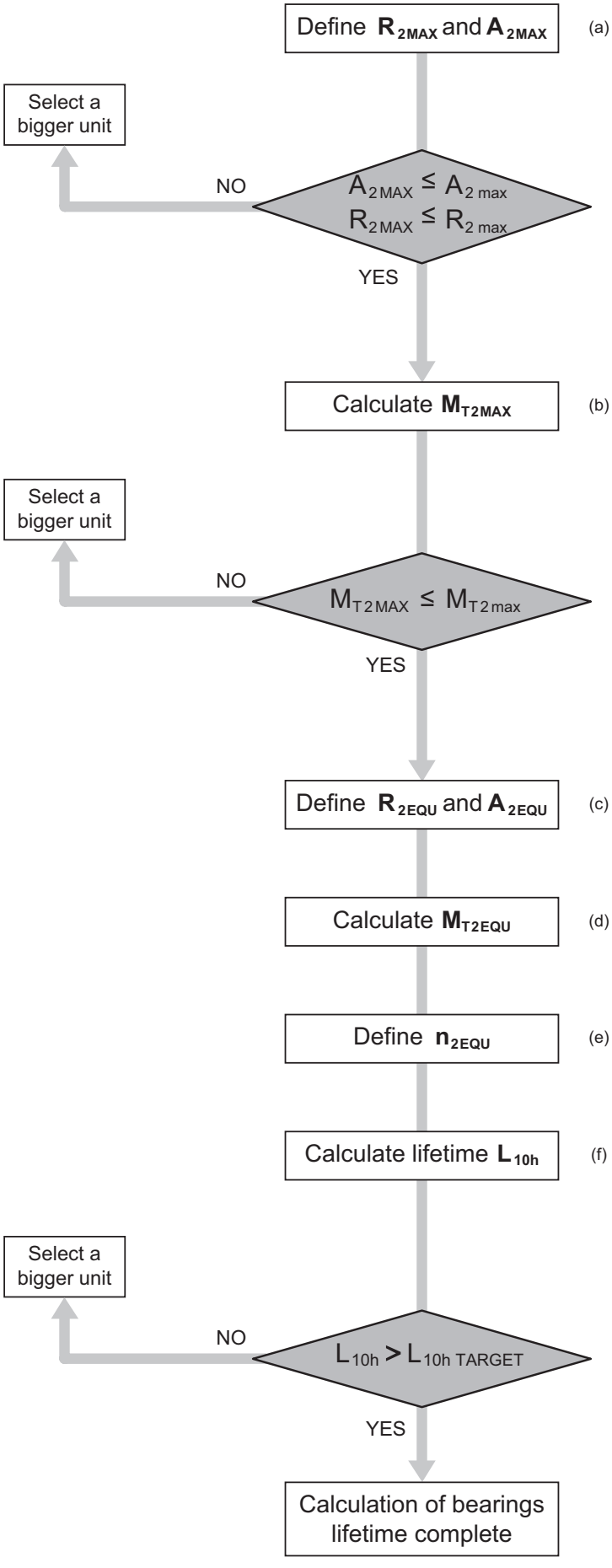


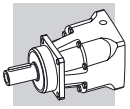
1.3 SERVICE LIFE OF BEARINGS



(a)	Maximum radial force applying on output shaft Maximum axial force applying on output shaft	$R_{2\,MAX}$ $A_{2\,MAX}$	[N] [N]	Please consider the specific conditions (e.g. belt drives under acceleration torque)
(b)	Maximum tilting moment applying on output shaft	$M_{T\,2\,MAX}$	[Nm]	$M_{T2MAX} = \frac{R_{2\,MAX} \cdot (x + L_Z) \pm A_{2\,MAX} \cdot y}{1000}$
(c)	Equivalent forces applying on output shaft	$R_{2\,EQU}$ $A_{2\,EQU}$	[N] [N]	$R_{2EQU} = \sqrt[3]{\frac{n_{2(1)} \cdot t_1 \cdot \lvert R_{2(1)} \rvert^3 + \ldots + n_{2(n)} \cdot t_n \cdot \lvert R_{2(n)} \rvert^3}{n_{2(1)} \cdot t_1 + \ldots + n_{2(n)} \cdot t_n}}$ $A_{2EQU} = \sqrt[3]{\frac{n_{2(1)} \cdot t_1 \cdot \lvert A_{2(1)} \rvert^3 + \ldots + n_{2(n)} \cdot t_n \cdot \lvert A_{2(n)} \rvert^3}{n_{2(1)} \cdot t_1 + \ldots + n_{2(n)} \cdot t_n}}$
(d)	Equivalent tilting moment applying on output shaft	$M_{T\,2\,EQU}$	[Nm]	$M_{T2EQU} = \frac{R_{2\,EQU} \cdot (x + L_Z) + A_{2\,EQU} \cdot y}{1000}$
(e)	Equivalent output speed	$n_{2\,EQU}$	[min^{-1}]	$n_{2EQU} = \frac{n_{2(1)} \cdot t_1 + n_{2(2)} \cdot t_2 + \ldots + n_{2(n)} \cdot t_n}{t_1 + t_2 + \ldots + t_n}$
(f)	Bearings' basic rating life	L_{10h}	[h]	$L_{10h} = \frac{16666}{n_{2EQU}} \cdot \left(\frac{C_B}{M_{T2EQU}} \right)^p$

		TQ 060	TQ 070	TQ 090	TQ 130	TQ 160
L_Z	[mm]	56	67	93.5	96	114.8
$M_{T\,2\,max}$	[Nm]	175.0	340.0	796.3	1233.0	2337.0
C_B	[Nm]	631.9	1064.7	2902.3	6440.0	9852.8
p	—	3	3	3	3.33	3.33


Define R_{2MAX} and A_{2MAX}
(a)
Select a bigger unit
NO
$A_{2MAX} \leq A_{2\,max}$
$R_{2MAX} \leq R_{2\,max}$
YES
Calculate M_{T2MAX}
(b)
Select a bigger unit
NO
$M_{T2MAX} \leq M_{T2\,max}$
YES
Define R_{2EQU} and A_{2EQU}
(c)
Calculate M_{T2EQU}
(d)
Define n_{2EQU}
(e)
Calculate lifetime L_{10h}
(f)
Select a bigger unit
NO
$L_{10h} > L_{10h\ TARGET}$
YES
Calculation of bearings lifetime complete



2 FEATURES OF TQ SERIES

Low backlash planetary drives of TQ series combine outstanding performances with a distinctive Italian style which makes them immediately recognizable amongst similar products within the reference industry.
Their design and construction has been developed with the goal of offering consumers a line of products which feature absolute and consistent Quality, which in turn provides a competitive advantage for machines and systems that adopt them as transmission devices.

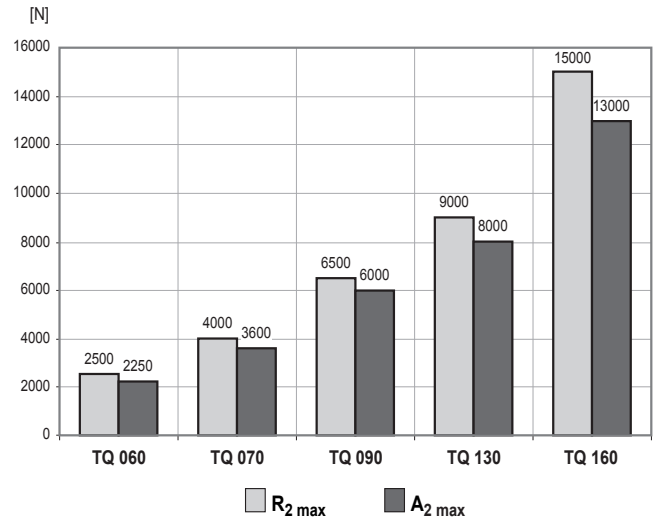
- TQ drives feature a single class of precision, corresponding to the following values of circumferential backlash
  1-stage units: standard φ_s = 3' (φ_s = 4' for TQ 060 and TQ 070)
  2-stage units: standard φ_s = 5' (φ_s = 6' for TQ 060 and TQ 070)
- A high IP rating (IP64) provides inner parts with protection against the ingress of dust and liquids.
- Input section oil seals made from a Fluoro elastomer compound are supplied as standard.
- Max noise level $L_P \leq 70$ dB(A) @ $n_1 = 3000$ min^{-1}.
- Numerous adapters allow matching the most popular brands of servomotors.
- Lubrication optimized for the type of duty specified when ordering.
  In the absence of contamination the lubricant requires no periodical changes.

duty	TQ 060 ... TQ 160	other seals
S1 (continuous)	synthetic oil viscosity ISO VG 220	Fluoro elastomer
S5 (intermittent)	NLGI grease consistency 00	NBR

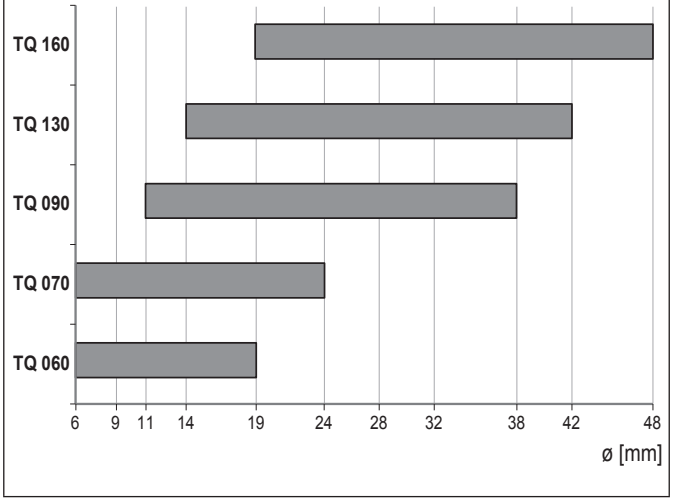
Distribution of nominal torque M_{n2} [Nm]														
[i]	3	4	5	7	10	16	20	25	28	35	40	50	70	100
TQ 060	21	30	30	25	20	30	30	30	30	30	30	30	25	20
TQ 070	45	70	70	60	40	70	70	70	70	70	70	70	60	40
TQ 090	130	200	180	160	110	200	180	180	200	180	200	180	160	110
TQ 130	260	400	400	360	280	400	400	400	400	400	400	400	360	280
TQ 160	530	800	800	750	550	800	800	800	800	800	800	800	750	550

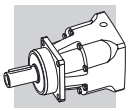
2-stage gearheads

Output shaft max. loading capacity



Available motor shaft diameters





3 ORDERING CODE

TQ **130** **1** **3** **STD** **80A** **CD** **19** **S5** **KL**

OUTPUT SHAFT CONFIGURATION
- **KL** smooth keyless shaft
- **KE** keyed shaft

DUTY
- **S1** continuous duty
- **S5** intermittent duty

INPUT SHAFT BORE

MOTOR COUPLING
- **CD** clamping device

INPUT SECTION
- **30 ... 230** motor adapter

BACKLASH

	STD (φs)	
	1-stage units	**2-stage units**
TQ 060	4'	6'
TQ 070	4'	6'
TQ 090	3'	5'
TQ 130	3'	5'
TQ 160	3'	5'

GEAR RATIO

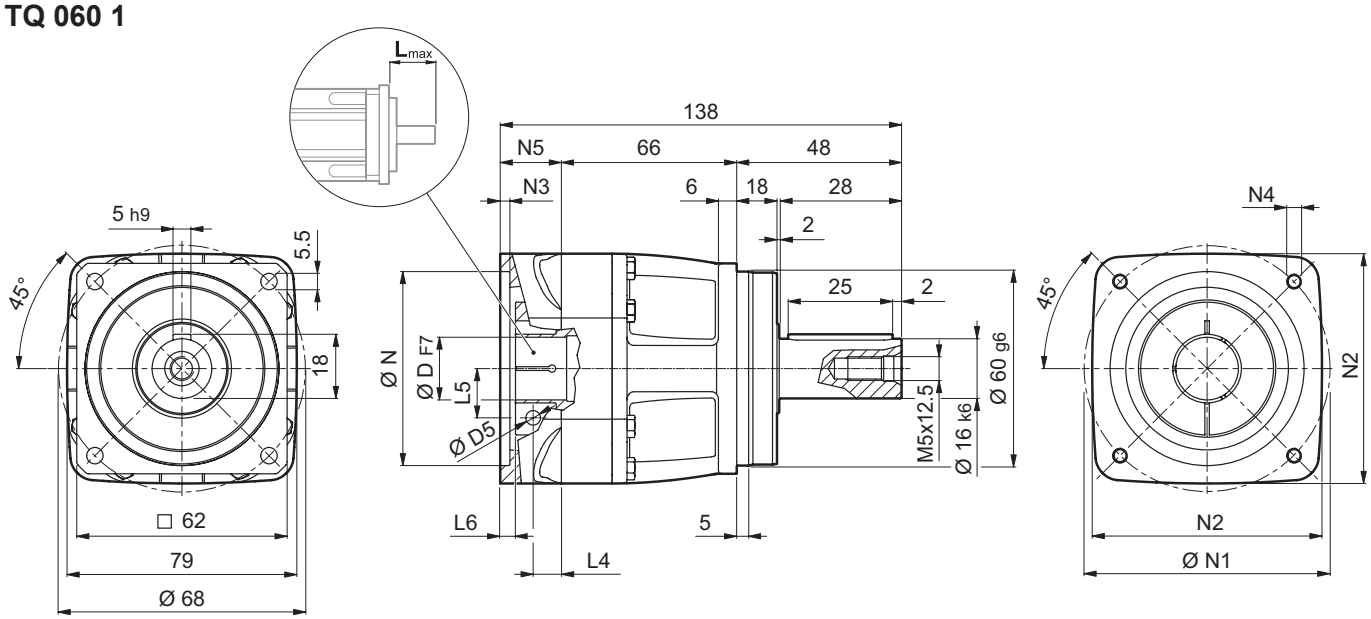
REDUCTIONS
- **1** **2**

FRAME SIZE
- **060** **070** **090** **130** **160**

SERIES
- **TQ**

4 DIMENSIONS AND TECHNICAL SPECIFICATIONS

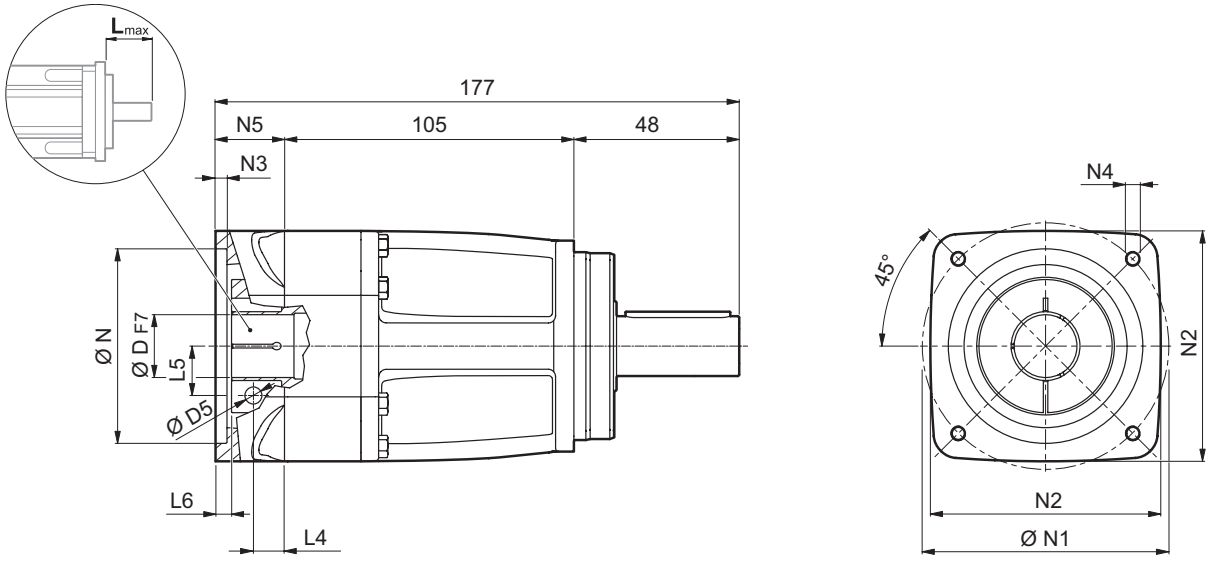
TQ 060 1



Kg	2.9

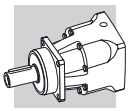
	D				
	6	**9**	**11**	**14**	**19**
D5	M4	M5	M6	M6	M6
L4	10.5	11.5	11.5	11.5	11.5
L5	8	10.5	12.5	14.5	16.5
L6	8.5	5	5	5	5

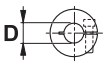
TQ 060 2



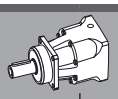
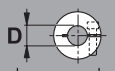
Kg	4.0

	D				
	6	**9**	**11**	**14**	**19**
D5	M4	M5	M6	M6	M6
L4	10.5	11.5	11.5	11.5	11.5
L5	8	10.5	12.5	14.5	16.5
L6	8.5	5	5	5	5

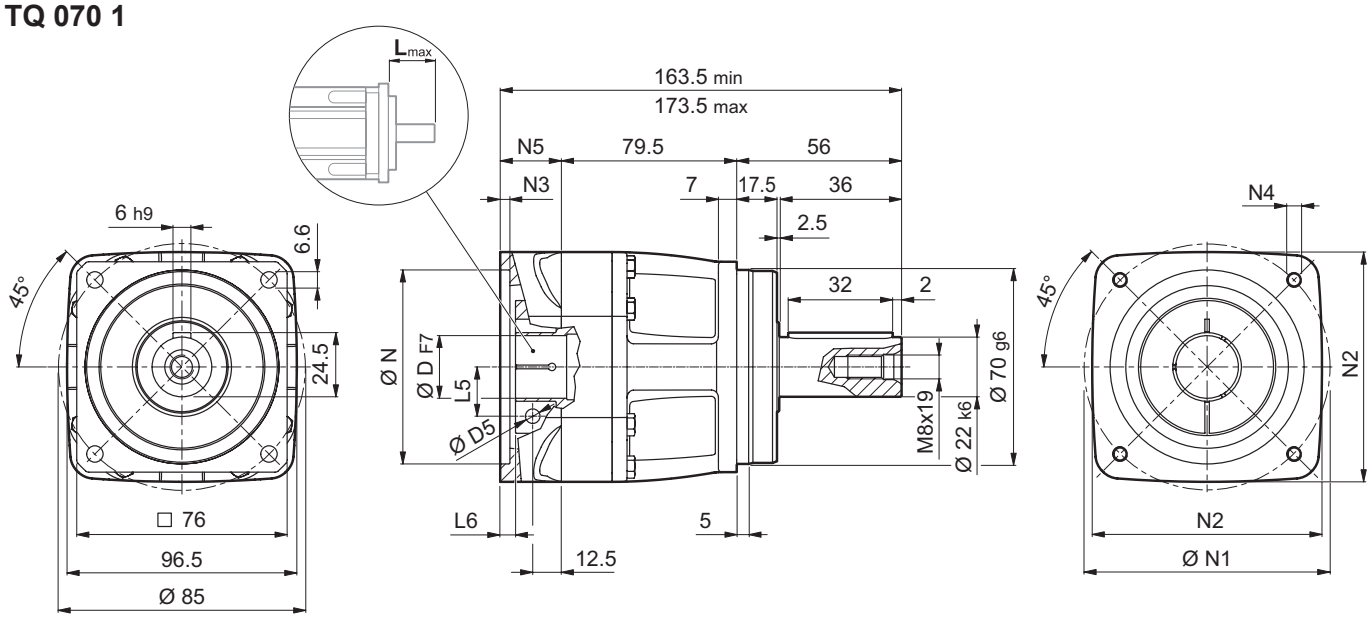


TQ 060 1 – TQ 060 2												
	D 					N	N1	N2	N3	N4	N5	L_{max}
30A	6	–	–	–	–	30	46	60	3.5	M4x10	24	40
40B	–	9	11	14	–	40	63	60	3.5	M4x10	24	40
50A	–	–	11	–	–	50	60	60	4.0	M4x10	24	40
50C	–	–	11	14	–	50	70	60	4.0	M4x10	24	40
60A	–	–	11	14	19	60	75	80	4.0	M5x12	24	40
70B	–	–	–	14	19	70	90	80	4.0	M5x12	24	40
80A	–	–	–	14	19	80	100	100	4.0	M6x14	24	40
95A	–	–	–	–	19	95	115	100	4.0	M8x24*	24	40
110B	–	–	–	–	19	110	145	120	4.0	M8x24*	24	40

* through hole

 i	$M_{n\,2}$ [Nm]	$M_{a\,2}$ [Nm]	$M_{p\,2}$ [Nm]	$n_{1\,max}$ [min^{-1}]	φ_S [arcmin]	C_t $\left[\frac{Nm}{arcmin}\right]$	$R_{2\,max}$ [N]	$A_{2\,max}$ [N]	η %	J_G [$kgcm^2$] D  6	9	11	14	19
TQ 060 1_3	21	32	60	6000	4'	4.8	2500	2250	97	0.72	0.79	0.87	0.90	0.92
TQ 060 1_4	30	45	80	6000	4'	4.8	2500	2250	97	0.65	0.72	0.70	0.73	0.74
TQ 060 1_5	30	45	80	6000	4'	4.8	2500	2250	97	0.59	0.65	0.62	0.66	0.67
TQ 060 1_7	25	38	70	6000	4'	4.8	2500	2250	97	0.54	0.59	0.56	0.59	0.61
TQ 060 1_10	20	30	55	6000	4'	4.8	2500	2250	97	0.49	0.54	0.53	0.56	0.57
TQ 060 2_16	30	45	80	6000	6'	4.7	2500	2250	94	0.07	0.08	0.07	0.08	0.08
TQ 060 2_20	30	45	80	6000	6'	4.7	2500	2250	94	0.07	0.07	0.07	0.08	0.08
TQ 060 2_25	30	45	80	6000	6'	4.7	2500	2250	94	0.06	0.07	0.07	0.07	0.07
TQ 060 2_28	30	45	80	6000	6'	4.7	2500	2250	94	0.06	0.06	0.06	0.06	0.06
TQ 060 2_35	30	45	80	6000	6'	4.7	2500	2250	94	0.05	0.06	0.05	0.06	0.06
TQ 060 2_40	30	45	80	6000	6'	4.7	2500	2250	94	0.05	0.05	0.05	0.05	0.05
TQ 060 2_50	30	45	80	6000	6'	4.7	2500	2250	94	0.04	0.05	0.05	0.05	0.05
TQ 060 2_70	25	38	70	6000	6'	4.7	2500	2250	94	0.04	0.04	0.04	0.04	0.04
TQ 060 2_100	20	30	55	6000	6'	4.7	2500	2250	94	0.04	0.04	0.04	0.04	0.04

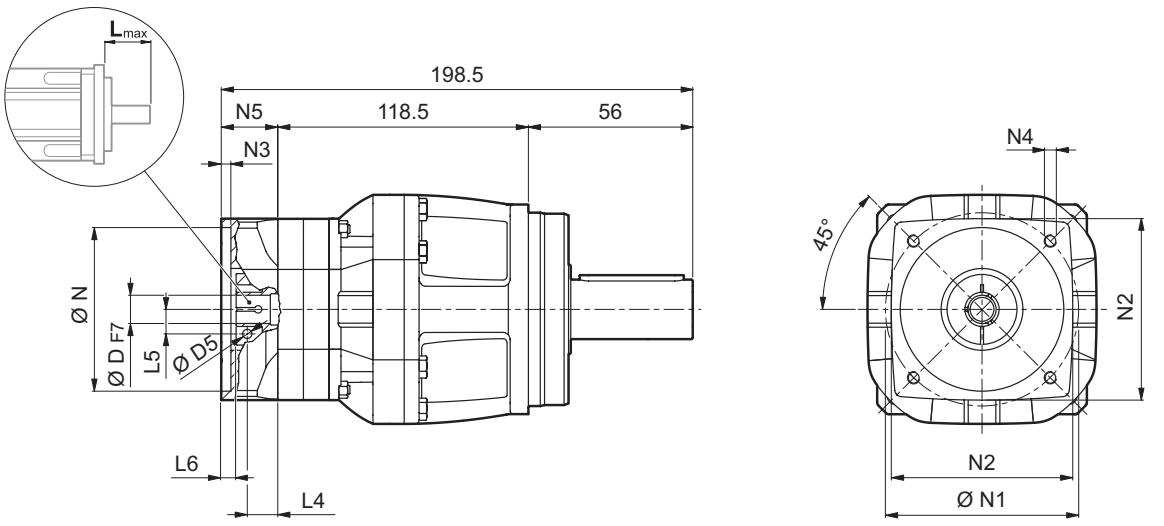
TQ 070 1



Kg	3.6

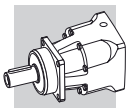
		D			
		11	**14**	**19**	**24**
D5		M6	M6	M6	M6
L5		12.5	14.5	16.5	19
L6	min	8	8	8	6.5
	max			18	

TQ 070 2



Kg	5.0

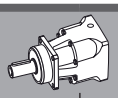
	D				
	6	**9**	**11**	**14**	**19**
D5	M4	M5	M6	M6	M6
L4	10.5	11.5	11.5	11.5	11.5
L5	8	10.5	12.5	14.5	16.5
L6	8.5	5	5	5	5



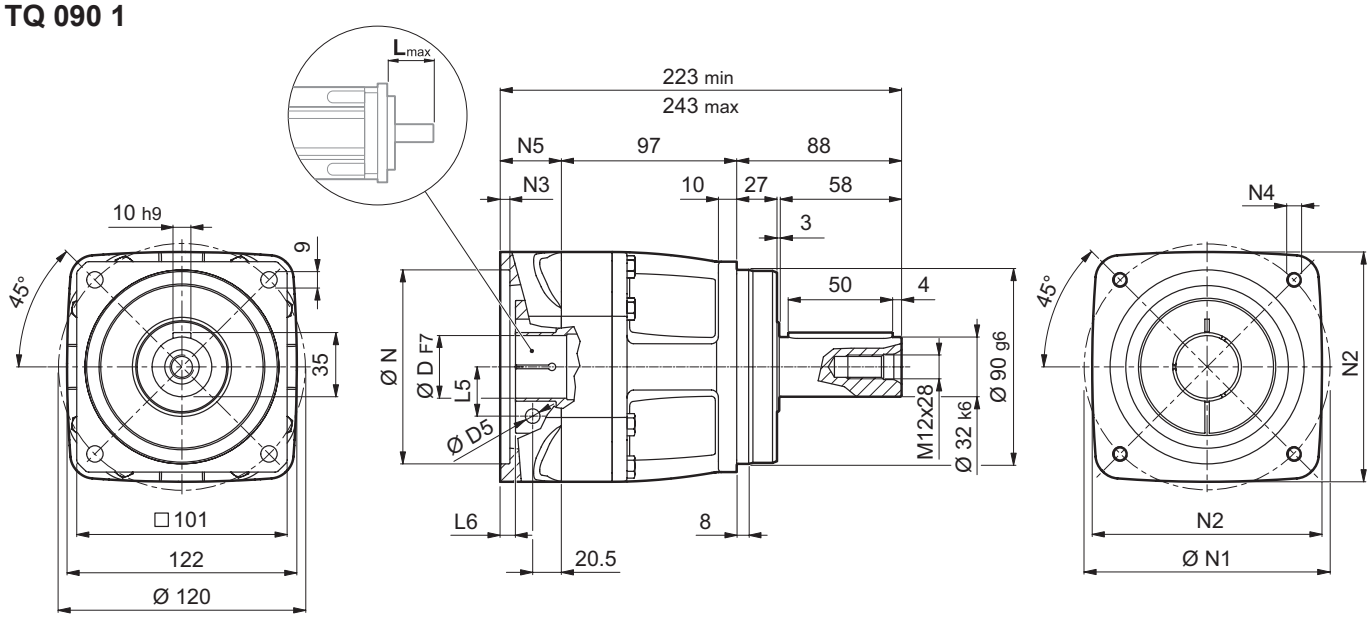
TQ 070 1													
	D						N	N1	N2	N3	N4	N5	L_{max}
50C	–	–	11	14	–	–	50	70	80	6.5	M4x12	28	50
60A	–	–	11	14	19	–	60	75	80	6.5	M5x14	28	50
70B	–	–	–	14	19	–	70	90	80	6.5	M5x14	28	50
80A	–	–	–	14	19	–	80	100	100	6.5	M6x14	28	50
95A	–	–	–	–	19	24	95	115	100	6.5	M8x18	28	50
110A	–	–	–	–	–	24	110	130	120	6.5	M8x18	28	50
110B	–	–	–	–	19	–	110	145	120	6.5	M8x20	38	60
130A	–	–	–	–	–	24	130	165	140	6.5	M10x19	28	50

TQ 070 2													
	D						N	N1	N2	N3	N4	N5	L_{max}
30A	6	–	–	–	–	–	30	46	60	3.5	M4x10	24	40
40B	–	9	11	14	–	–	40	63	60	3.5	M4x10	24	40
50A	–	–	11	–	–	–	50	60	60	4.0	M4x10	24	40
50C	–	–	11	14	–	–	50	70	60	4.0	M4x10	24	40
60A	–	–	11	14	19	–	60	75	80	4.0	M5x12	24	40
70B	–	–	–	14	19	–	70	90	80	4.0	M5x12	24	40
80A	–	–	–	14	19	–	80	100	100	4.0	M6x14	24	40
95A	–	–	–	–	19	–	95	115	100	4.0	M8x24*	24	40
110B	–	–	–	–	19	–	110	145	120	4.0	M8x24*	24	40

* through hole

 i	$M_{n\,2}$ [Nm]	$M_{a\,2}$ [Nm]	$M_{p\,2}$ [Nm]	$n_{1\,max}$ [min^{-1}]	φ_S [arcmin]	C_t $\left[\frac{Nm}{arcmin}\right]$	$R_{2\,max}$ [N]	$A_{2\,max}$ [N]	η %	J_G [kgcm^2] D 6	9	11	14	19	24
TQ 070 1_3	45	65	120	6000	4'	11.3	4000	3600	97	–	–	1.58	1.64	1.67	1.81
TQ 070 1_4	70	100	180	6000	4'	11.3	4000	3600	97	–	–	1.27	1.32	1.35	1.49
TQ 070 1_5	70	100	180	6000	4'	11.3	4000	3600	97	–	–	1.14	1.19	1.22	1.36
TQ 070 1_7	60	90	160	6000	4'	11.3	4000	3600	97	–	–	1.02	1.08	1.11	1.25
TQ 070 1_10	40	60	110	6000	4'	11.3	4000	3600	97	–	–	0.96	1.02	1.05	1.19
TQ 070 2_16	70	100	180	6000	6'	11.3	4000	3600	94	0.79	0.87	0.96	0.99	1.01	–
TQ 070 2_20	70	100	180	6000	6'	11.3	4000	3600	94	0.76	0.84	0.92	0.95	0.97	–
TQ 070 2_25	70	100	180	6000	6'	11.3	4000	3600	94	0.73	0.80	0.89	0.92	0.93	–
TQ 070 2_28	70	100	180	6000	6'	11.3	4000	3600	94	0.70	0.77	0.85	0.88	0.90	–
TQ 070 2_35	70	100	180	6000	6'	11.3	4000	3600	94	0.68	0.74	0.82	0.85	0.86	–
TQ 070 2_40	70	100	180	6000	6'	11.3	4000	3600	94	0.65	0.72	0.79	0.82	0.83	–
TQ 070 2_50	70	100	180	6000	6'	11.3	4000	3600	94	0.63	0.69	0.76	0.78	0.80	–
TQ 070 2_70	60	90	160	6000	6'	11.3	4000	3600	94	0.60	0.66	0.73	0.75	0.77	–
TQ 070 2_100	40	60	110	6000	6'	11.3	4000	3600	94	0.58	0.64	0.70	0.73	0.74	–

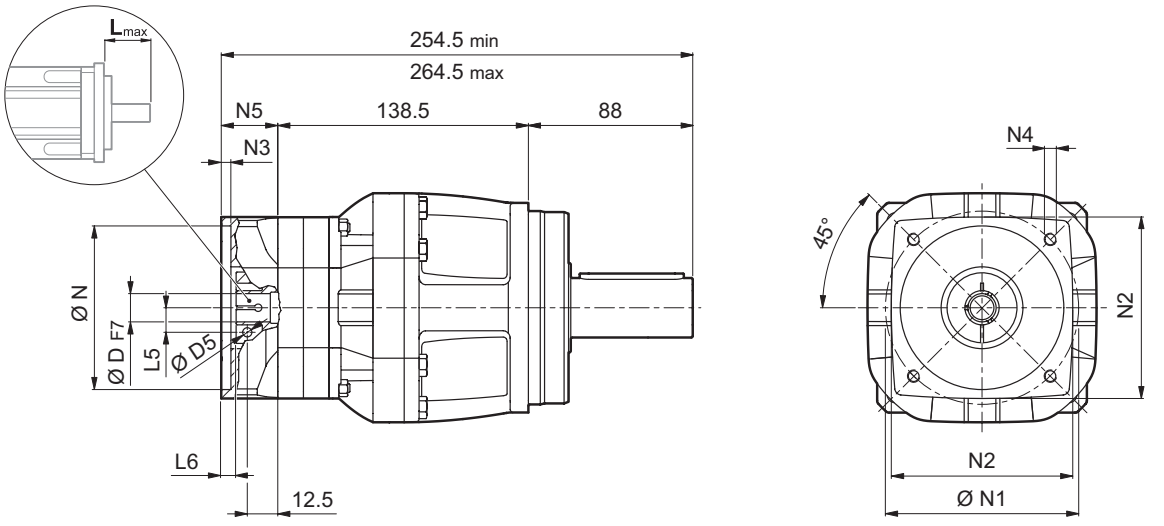
TQ 090 1



		D 14	19	24	28	32	38
D5		M6	M6	M6	M8	M8	M8
L5		14.5	16.5	19	22.5	24.5	28
L6	min	10	10	8.5	8.5	8.5	
	max					28.5	26

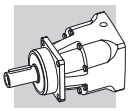
Kg	7.6

TQ 090 2



		D 11	14	19	24
D5		M6	M6	M6	M6
L5		12.5	14.5	16.5	19
L6	min	8	8	8	6.5
	max			18	

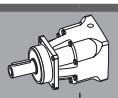
Kg	8.9



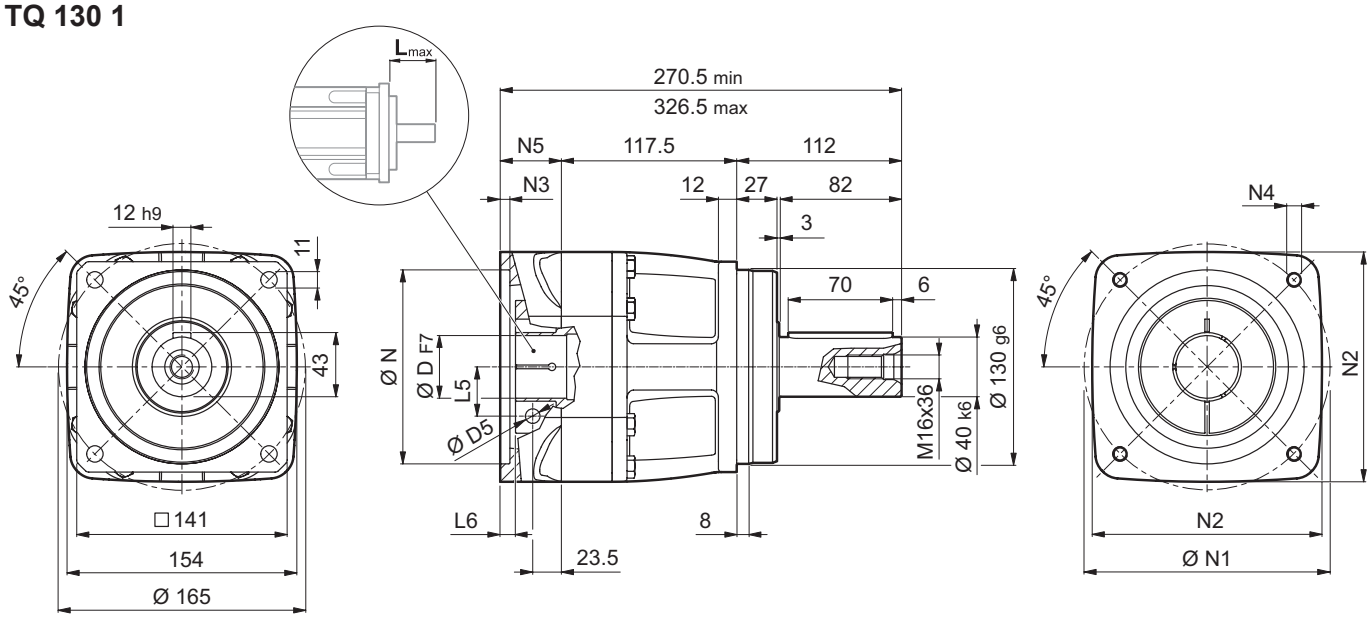
TQ 090 1														
	D							N	N1	N2	N3	N4	N5	L_{max}
60A	–	14	19	–	–	–	–	60	75	100	6.5	M5x14	38	60
80A	–	14	19	–	–	–	–	80	100	100	6.5	M6x14	38	60
95A	–	–	19	24	28	–	–	95	115	100	6.5	M8x18	38	60
110A	–	–	–	24	–	–	–	110	130	122	6.5	M8x20	38	60
110B	–	–	19	–	28	–	–	110	145	122	6.5	M8x20	38	60
130A	–	–	–	24	28	32	–	130	165	140	6.5	M10x20	38	60
180A	–	–	–	24	28	–	–	180	215	190	6.5	M12x38*	38	60
180A1	–	–	–	–	–	32	38	180	215	190	6.5	M12x27	58	80

* through hole

TQ 090 2														
	D							N	N1	N2	N3	N4	N5	L_{max}
50C	11	14	–	–	–	–	–	50	70	80	6.5	M4x12	28	50
60A	11	14	19	–	–	–	–	60	75	80	6.5	M5x14	28	50
70B	–	14	19	–	–	–	–	70	90	80	6.5	M5x14	28	50
80A	–	14	19	–	–	–	–	80	100	100	6.5	M6x14	28	50
95A	–	–	19	24	–	–	–	95	115	100	6.5	M8x18	28	50
110A	–	–	–	24	–	–	–	110	130	120	6.5	M8x18	28	50
110B	–	–	19	–	–	–	–	110	145	120	6.5	M8x20	38	60
130A	–	–	–	24	–	–	–	130	165	140	6.5	M10x19	28	50

 i	$M_{n\,2}$ [Nm]	$M_{a\,2}$ [Nm]	$M_{p\,2}$ [Nm]	$n_{1\,max}$ [min^{-1}]	φ_S [arcmin]	C_t $\left[\frac{Nm}{arcmin}\right]$	$R_{2\,max}$ [N]	$A_{2\,max}$ [N]	η %	J_G [kgcm^2] D 11	14	19	24	28	32	38
TQ 090 1_3	130	200	400	4500	3'	28	6500	6000	97	–	6.44	6.46	6.56	6.78	6.99	7.50
TQ 090 1_4	200	300	500	4500	3'	28	6500	6000	97	–	5.41	5.44	5.54	5.76	5.96	6.48
TQ 090 1_5	180	280	500	4500	3'	28	6500	6000	97	–	4.94	4.96	5.06	5.28	5.49	6.00
TQ 090 1_7	160	250	500	4500	3'	28	6500	6000	97	–	4.53	4.56	4.66	4.88	5.08	5.60
TQ 090 1_10	110	170	350	4500	3'	28	6500	6000	97	–	4.30	4.33	4.43	4.65	4.86	5.37
TQ 090 2_16	200	300	500	4500	5'	28	6500	6000	94	1.25	1.31	1.33	1.47	–	–	–
TQ 090 2_20	180	280	500	4500	5'	28	6500	6000	94	1.22	1.28	1.30	1.44	–	–	–
TQ 090 2_25	180	280	500	4500	5'	28	6500	6000	94	1.10	1.16	1.19	1.33	–	–	–
TQ 090 2_28	200	300	500	4500	5'	28	6500	6000	94	1.02	1.08	1.10	1.24	–	–	–
TQ 090 2_35	180	280	500	4500	5'	28	6500	6000	94	1.01	1.07	1.09	1.23	–	–	–
TQ 090 2_40	200	300	500	4500	5'	28	6500	6000	94	0.96	1.02	1.04	1.18	–	–	–
TQ 090 2_50	180	280	500	4500	5'	28	6500	6000	94	0.95	1.01	1.04	1.18	–	–	–
TQ 090 2_70	160	250	500	4500	5'	28	6500	6000	94	0.95	1.01	1.03	1.18	–	–	–
TQ 090 2_100	110	170	350	4500	5'	28	6500	6000	94	0.95	1.01	1.03	1.17	–	–	–

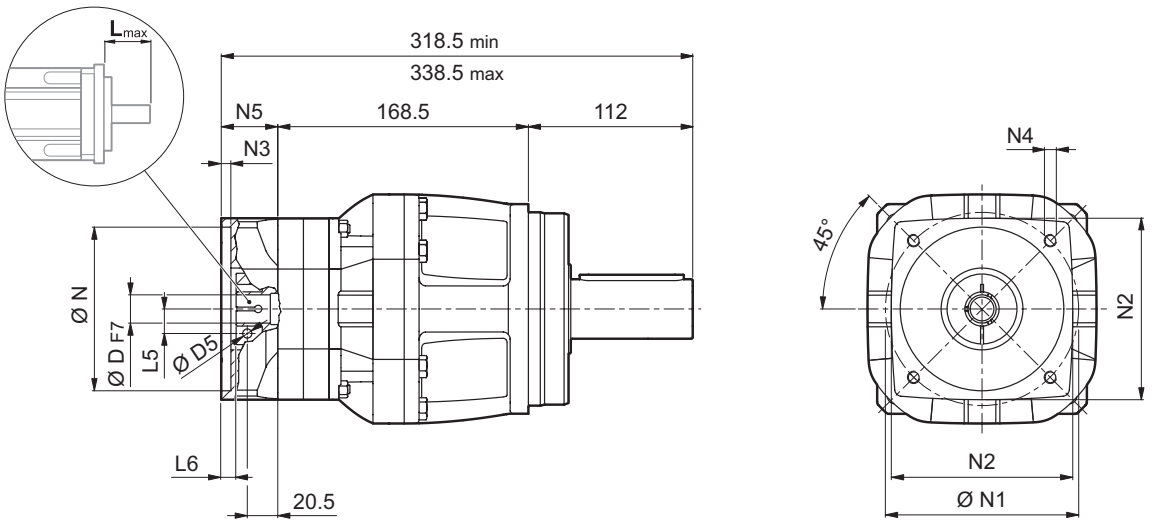
TQ 130 1



		D 19	24	28	32	38	42
D5		M6	M6	M8	M8	M8	M10
L5		16.5	19	22.5	24.5	28	33
L6	min	10	8.5	8.5	8.5		
	max				28.5	26	58.5

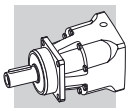
Kg	15.6

TQ 130 2



		D 14	19	24	28	32	38
D5		M6	M6	M6	M8	M8	M8
L5		14.5	16.5	19	22.5	24.5	28
L6	min	10	10	8.5	8.5	8.5	
	max					28.5	26

Kg	19.1



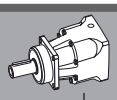
TQ 130 1

	D						N	N1	N2	N3	N4	N5	L_{max}
80A	–	19	–	–	–	–	–	80	100	130	6.5	M6x14	41	60
95A	–	19	24	28	–	–	–	95	115	130	6.5	M8x18	41	60
110A	–	–	24	–	–	–	–	110	130	130	6.5	M8x20	41	60
110B	–	19	–	28	–	–	–	110	145	130	6.5	M8x20	41	60
130A	–	–	24	28	32	–	–	130	165	154	6.5	M10x20	41	60
180A	–	–	24	28	–	–	–	180	215	190	6.5	M12x27	41	60
180A1	–	–	–	–	32	38	–	180	215	190	6.5	M12x27	61	80
200A	–	–	–	–	–	–	42	200	235	210	6.5	M12x27	97	116

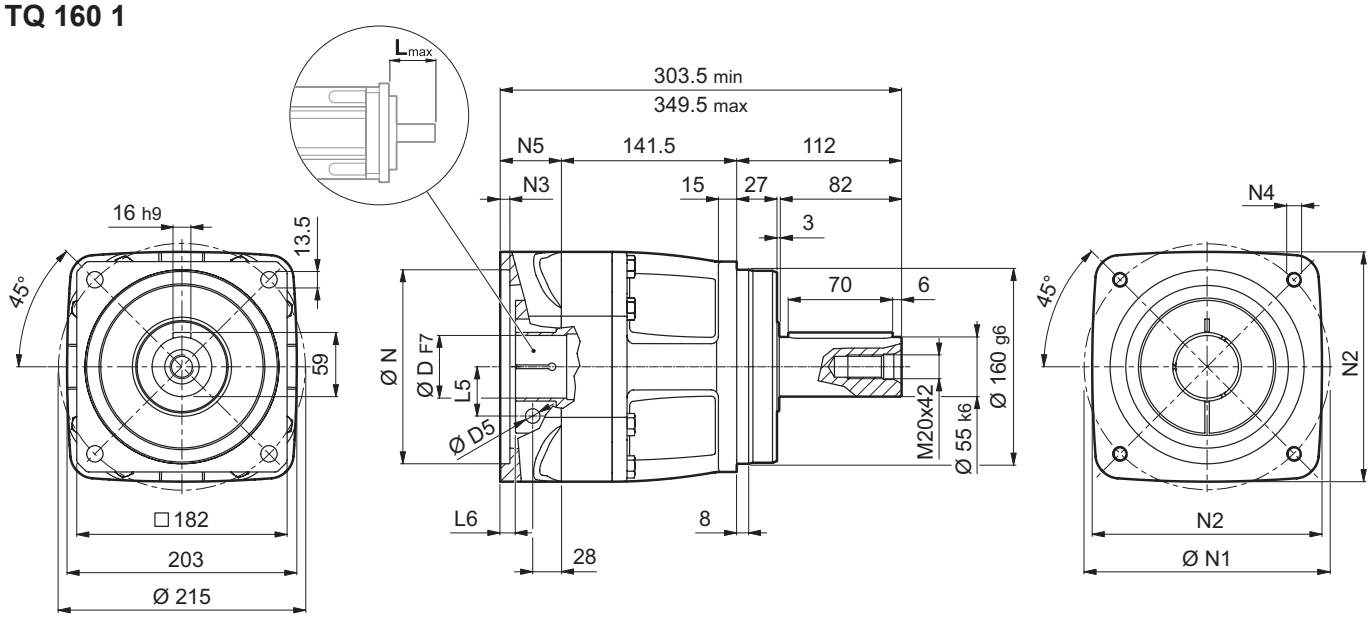
TQ 130 2

	D						N	N1	N2	N3	N4	N5	L_{max}
60A	14	19	–	–	–	–	–	60	75	100	6.5	M5x14	38	60
80A	14	19	–	–	–	–	–	80	100	100	6.5	M6x14	38	60
95A	–	19	24	28	–	–	–	95	115	100	6.5	M8x18	38	60
110A	–	–	24	–	–	–	–	110	130	122	6.5	M8x20	38	60
110B	–	19	–	28	–	–	–	110	145	122	6.5	M8x20	38	60
130A	–	–	24	28	32	–	–	130	165	140	6.5	M10x20	38	60
180A	–	–	24	28	–	–	–	180	215	190	6.5	M12x38*	38	60
180A1	–	–	–	–	32	38	–	180	215	190	6.5	M12x27	58	80

* through hole

 i	$M_{n\,2}$ [Nm]	$M_{a\,2}$ [Nm]	$M_{p\,2}$ [Nm]	$n_{1\,max}$ [min^{-1}]	φ_S [arcmin]	C_t [Nm/arcmin]	$R_{2\,max}$ [N]	$A_{2\,max}$ [N]	η %	J_G [kgcm^2] D 14	19	24	28	32	38	42
TQ 130 1_3	260	400	900	4000	3'	59	9000	8000	97	–	15.54	15.74	16.12	16.20	16.71	23.63
TQ 130 1_4	400	600	1000	4000	3'	59	9000	8000	97	–	11.01	11.22	11.59	11.67	12.18	19.10
TQ 130 1_5	400	600	1000	4000	3'	59	9000	8000	97	–	8.88	9.08	9.46	9.54	10.05	16.97
TQ 130 1_7	360	550	950	4000	3'	59	9000	8000	97	–	7.20	7.40	7.78	7.86	8.37	15.29
TQ 130 1_10	280	420	900	4000	3'	59	9000	8000	97	–	6.29	6.49	6.87	6.95	7.46	14.38
TQ 130 2_16	400	600	1000	4000	5'	58	9000	8000	94	5.43	5.46	5.56	5.78	5.98	6.50	–
TQ 130 2_20	400	600	1000	4000	5'	58	9000	8000	94	5.30	5.32	5.42	5.64	5.85	6.36	–
TQ 130 2_25	400	600	1000	4000	5'	58	9000	8000	94	4.86	4.89	4.99	5.21	5.42	5.93	–
TQ 130 2_28	400	600	1000	4000	5'	58	9000	8000	94	4.53	4.56	4.66	4.88	5.08	5.60	–
TQ 130 2_35	400	600	1000	4000	5'	58	9000	8000	94	4.49	4.51	4.61	4.83	5.04	5.55	–
TQ 130 2_40	400	600	1000	4000	5'	58	9000	8000	94	4.30	4.33	4.43	4.65	4.86	5.37	–
TQ 130 2_50	400	600	1000	4000	5'	58	9000	8000	94	4.28	4.31	4.41	4.63	4.84	5.35	–
TQ 130 2_70	360	550	950	4000	5'	58	9000	8000	94	4.27	4.29	4.39	4.61	4.82	5.33	–
TQ 130 2_100	280	420	900	4000	5'	58	9000	8000	94	4.26	4.28	4.38	4.60	4.81	5.32	–

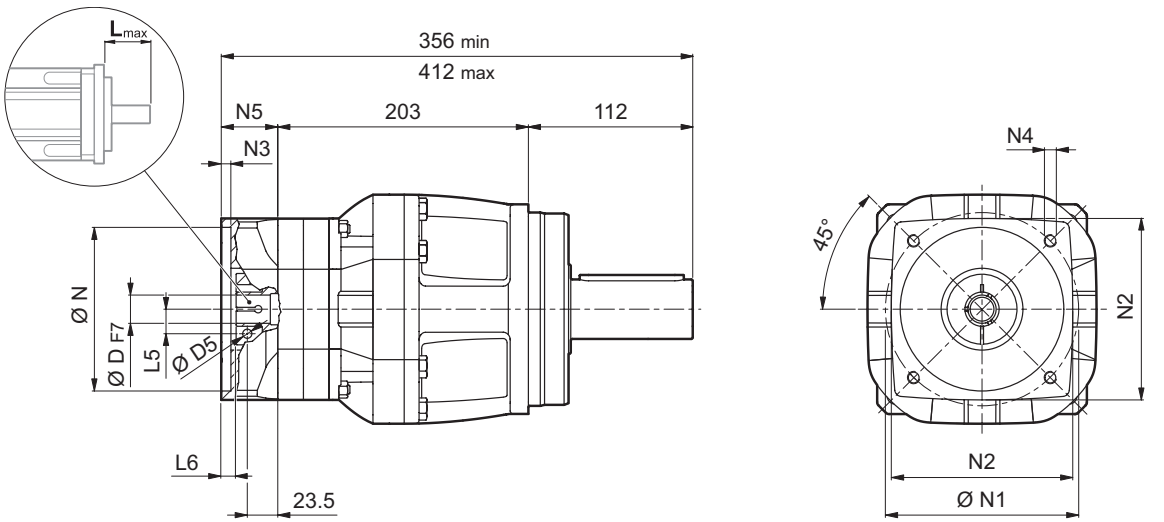
TQ 160 1



Kg	29.7

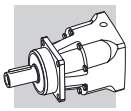
		D					
		24	**28**	**32**	**38**	**42**	**48**
D5		M6	M8	M8	M8	M10	M12
L5		19	22.5	24.5	28	33	36.5
L6	min	13	13	13	20.5		
	max			23	56.5	53	53

TQ 160 2



Kg	37.4

		D					
		19	**24**	**28**	**32**	**38**	**42**
D5		M6	M6	M8	M8	M8	M10
L5		16.5	19	22.5	24.5	28	33
L6	min	10	8.5	8.5	8.5		
	max				28.5	26	58.5

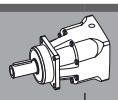


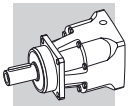
TQ 160 1

	D							N	N1	N2	N3	N4	N5	L_{max}
95A	–	24	28	–	–	–	–	95	115	158	6.5	M8x20	50	72
110A	–	24	–	–	–	–	–	110	130	158	6.5	M8x20	50	72
130A	–	24	28	32	–	–	–	130	165	158	6.5	M10x20	50	72
180A	–	24	28	–	–	–	–	180	215	203	6.5	M12x27	50	72
180A1	–	–	–	32	38	–	–	180	215	205	6.5	M12x27	60	82
200A	–	–	–	–	–	42	–	200	235	220	6.5	M12x27	96	118
230A	–	–	–	–	38	42	48	230	265	240	6.5	M12x27	96	118

TQ 160 2

	D							N	N1	N2	N3	N4	N5	L_{max}
80A	19	–	–	–	–	–	–	80	100	130	6.5	M6x14	41	60
95A	19	24	28	–	–	–	–	95	115	130	6.5	M8x18	41	60
110A	–	24	–	–	–	–	–	110	130	130	6.5	M8x20	41	60
110B	19	–	28	–	–	–	–	110	145	130	6.5	M8x20	41	60
130A	–	24	28	32	–	–	–	130	165	154	6.5	M10x20	41	60
180A	–	24	28	–	–	–	–	180	215	190	6.5	M12x27	41	60
180A1	–	–	–	32	38	–	–	180	215	190	6.5	M12x27	61	80
200A	–	–	–	–	–	42	–	200	235	210	6.5	M12x27	97	116

 i	$M_{n\,2}$ [Nm]	$M_{a\,2}$ [Nm]	$M_{p\,2}$ [Nm]	$n_{1\,max}$ [min^{-1}]	φ_S [arcmin]	C_t [Nm/arcmin]	$R_{2\,max}$ [N]	$A_{2\,max}$ [N]	η %	J_G [$kgcm^2$] D 19	24	28	32	38	42	48
TQ 160 1_3	530	800	1500	3500	3'	170	15000	13000	97	–	40.14	40.49	40.53	41.36	43.91	66.11
TQ 160 1_4	800	1200	2000	3500	3'	170	15000	13000	97	–	24.75	25.10	25.15	25.98	28.53	50.73
TQ 160 1_5	800	1200	2000	3500	3'	170	15000	13000	97	–	18.72	19.07	19.12	19.94	22.49	44.69
TQ 160 1_7	750	1150	2000	3500	3'	170	15000	13000	97	–	13.50	13.85	13.90	14.73	17.28	39.48
TQ 160 1_10	550	850	1600	3500	3'	170	15000	13000	97	–	10.58	10.93	10.98	11.80	14.35	36.55
TQ 160 2_16	800	1200	2000	3500	5'	170	15000	13000	94	10.11	10.31	10.68	10.76	11.28	18.19	–
TQ 160 2_20	800	1200	2000	3500	5'	170	15000	13000	94	9.73	9.93	10.31	10.39	10.90	17.82	–
TQ 160 2_25	800	1200	2000	3500	5'	170	15000	13000	94	8.06	8.26	8.63	8.72	9.23	16.14	–
TQ 160 2_28	800	1200	2000	3500	5'	170	15000	13000	94	6.90	7.11	7.48	7.56	8.07	14.99	–
TQ 160 2_35	800	1200	2000	3500	5'	170	15000	13000	94	6.78	6.98	7.36	7.44	7.95	14.87	–
TQ 160 2_40	800	1200	2000	3500	5'	170	15000	13000	94	6.15	6.35	6.72	6.80	7.32	14.23	–
TQ 160 2_50	800	1200	2000	3500	5'	170	15000	13000	94	6.09	6.29	6.66	6.74	7.26	14.17	–
TQ 160 2_70	750	1150	2000	3500	5'	170	15000	13000	94	6.04	6.24	6.61	6.69	7.20	14.12	–
TQ 160 2_100	550	850	1600	3500	5'	170	15000	13000	94	6.01	6.21	6.58	6.66	7.18	14.09	–



INDEX OF REVISIONS (R)

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	Description
4	Sect 1.2 “Selecting the gear unit”: - updated speed constant values (K_n)
8	Sect 2 “Features of TQ series”: - updated information about oil seals
10 ... 19	Sect. 4 “Dimensions and technical specifications”: - updated dimensions

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