

## Brushless - TK Frameless Motor

I motori brushless serie TK in esecuzione "frameless" offrono la più alta densità di coppia oggi disponibile per applicazioni ad alto rendimento con accoppiamento diretto. A differenza dei motori coppia tradizionali, le unità serie TK offrono sia alta coppia sia alta velocità e per questo di prestano all'uso come motori sia di mandrini che di tavole rotanti. I motori TK sono costituiti da statore e rotore forniti separati, previsti per l'assemblaggio diretto nella struttura della macchina. Sono motori trifase che incorporano magneti permanenti a terre rare (Ferro, Neodimio, Boro) e raggiungono la più alta densità di coppia, sia continua che di picco, oggi disponibile, unitamente ad alta velocità e possibilità di controllo del flusso in un campo a potenza costante di 10:1. Sui rotor vengono applicati magneti speciali con fattore di perdite minimo che permettono operazioni ad alta velocità con rotore sottile isotropico.

Tutti i rotor sono strutture rigide con magneti applicati e trattenuti meccanicamente senza collanti, mediante l'uso di una banda in fibra di carbonio precaricata, per un utilizzo in piena sicurezza anche alle alte velocità. I rotor sono frequentemente richiesti e forniti in esecuzione "semi custom" per consentire l'accoppiamento diretto con cuscinetti, encoder, freni. Tutti i motori TK, per ottenere la massima resa, sono progettati per raffreddamento a fluido (acqua). Su richiesta possono essere fornite carcasse a disegno del cliente, atte a contenere i circuiti magnetici della serie frameless standard disponibili, incorporanti il circuito di raffreddamento o anche sottoassiemi parziali di macchina, con cuscinetti ed encoder. Il campo delle coppie disponibili spazia da 2 a 55000 Nm con diametro massimo di 1150 mm; al di sopra di tale diametro, sono disponibili unità "semi custom" a segmenti, usualmente fino al diametro di 18 m.

The TK series of frameless brushless motors provide the highest torque density available today for direct drive, high performance applications. Unlike traditional torque motors, TK units have both high torque and high speed capability and thus operate seamlessly both as spindle and table motors. TK motors consist of separately supplied stator and rotor units suitable for direct assembly inside the structure of the machine. TK motors are three phase, rare earth (Iron Neodymium Boron) permanent magnet units and reach the highest continuous and peak torque density available today, together with high speed and flux control ability over a constant power range up to 10:1. The rotors use special magnets with minimized loss factor allowing high speed operation with a thin isotropic rotor.

All rotors are rigid units with mechanical, glue free magnet retention, preloaded carbon fiber sleeve for safe operation even at very high speed. Rotor are often semi custom units to allow direct coupling to bearings, encoders, brakes. All TK motors are designed for fluid (water) cooling on the outside of the stator for maximum performance. Conduction/convection cooling is also possible. Constant power operation (flux control) always requires water cooling. Customized frames with integral cooling or even partial machine subassemblies with bearings and encoders are manufactured on request based on the standard frameless magnetic designs available. The torque range spans from 2 to 55,000 Nm with maximum diameter 1150mm; above that size, segmented semi custom units are available, currently up to 18 m diameter.

## Settori di Applicazione:

### Produzione energia:

- Generatori ad accoppiamento diretto a bassa velocità e alto rendimento per impianti mini-idro ed eolici
- Generatori a magneti permanenti per piccole turbine a gas o a vapore

### Taglio metalli:

- Accoppiamento diretto a tavole rotanti per contouring e tornitura
- Accoppiamento diretto a mandrini di fresatrici e torni
- Motori tubolari per mandrini di macchine multi-mandrino
- Tavole rotanti indexanti per macchine transfer

### Stampaggio metalli:

- Accoppiamento diretto a volani di presse
- Macchine per laminazione
- Trafilatura a caldo e freddo

### Materie plastiche:

- Accoppiamento diretto a estrusori
- Gruppi di miscelazione e iniezione per macchine a iniezione (sostituiscono i motori idraulici)
- Eliminazione delle scatole per ingranaggi nei miscelatori, macinatori, trinciatrici

## Tipologie e vantaggi:

- Motori di grande diametro ad anello sottile per alta coppia e bassa velocità (motori coppia): l'azionamento diretto annulla il gioco ed elimina la necessità di una scatola di ingranaggi. La precisione, quindi, coincide con la alta precisione del sistema encoder (semplice, flessibile, programmabile).
- Motori per mandrini, torni e fresatrici: motori lunghi e snelli con possibilità di controllo del flusso con velocità da medie ad alte, con la più elevata densità di potenza, adatti per lavorazioni pesanti o per il controllo di carichi di grande inerzia.
- Motori tubolari, di piccolo diametro per unità a mandrini multipli: elevata potenza e velocità per applicazioni con interasse laterale limitato, teste di foratura multipla e torni a fantina mobile.

## Applications:

### Energy:

- Low speed high efficiency direct drive generators for mini hydro and wind power
- PM generators for small steam or gas turbine, cogeneration

### Metal cutting:

- DD rotary tables with both contouring and turning ability
- DD spindles for mills and lathes
- Tubular spindle motors for multi spindle machines
- Rotary table indexing for transfer machines

### Metal forming:

- DD flywheels for press
- Cold rolling machines
- DD Capstans for hot and cold rolling/drawing

### Plastic:

- DD extruders
- Injection and mixing stages for plastic injection molding machines, replacing hydraulic motor
- Gearbox suppression in mixer, grinders, shredders

## Type and advantages:

- Thin ring, large diameter motors for high torque, low speed (torque motors): direct drive eliminates play and removes the need of an accurate mechanical gearbox. The accuracy is the high accuracy of the encoder system (simple, flexible, reprogrammable).
- Spindle motors for mills and lathes: long and thin motors, brushless with flux control ability, medium to high speed, the highest power density, suitable for heavy machining or control of large inertia loads for spool winding/unwinding.
- Tube motors, small diameter, for multiple spindle units: High speed/power motors where lateral (pitch) space is limited, multiple drilling heads and Swiss type lathes.

## DIMENSIONI E CARATTERISTICHE TECNICHE – DIMENSION AND TECHNICAL FEATURES

<b>2 ÷ 20 Nm</b>	Symbol	TK85-50-01	TK85-100-01	TK85-140-01	TK106-45-01	TK106-90	Units
<b>Reference data (winding independent)</b>							
Nominal torque, S1, 0 speed, conduction + convection cooled IC 418 (1)	Tnc	2,8	6,4	9,9	3,6	8,5	Nmrms
Nominal torque, S1, 0 speed, water cooled (2)	Tnw	5,15	12	19	6,8	16	Nmrms
Peak torque, S6 10% (1)	Tpk	7,97	18,21	28,18	10	24	Nmrms
Maximum torque (3)	Tul	19	38	53	32	65	Nm
Maximum structural speed	Pn	2000	2000	2000	1000	1000	rad/sec
Critical flux control torque(4)	Pf	22	45	64	34	70	Nm
Motor constant	Tw	0,59	0,97	1,23	0,91	1,49	Nm/sqrt(W)
Pole number	PN	10	10	10	12	12	
Connection		Y	Y	Y	Y	Y	
<b>Physical data (winding independent)</b>							
Rotor inertia	Jm	0,3	0,6	0,84	0,8	1,45	mkgm2
Acceleration at maximum torque	apk	26563	30358	33543	12807	16684	rad/s2
Outer diameter	Dout	85	85	85	106	106	mm
Rotor hole diameter	Din	44	44	44	65	65	mm
Overall stator length	Stkout	82	132	172	83	128	mm
Stack length	Stk	50	100	140	45	90	mm
Stator mass	Msta	0,93	1,71	2,4	1,4	2,3	kg
Rotor mass	Mrot	0,38	0,76	1,06	0,5	1	kg
Insulation		Class H-F	Class H-F	Class H-F	Class H-F	Class H-F	
Protection		IP 00	IP 00	IP 00	IP 00	IP 00	
<b>Thermal data (winding independent)</b>							
Thermal imp. assumed for cond. Cooling (1)	Rtch	0,767	0,5	0,36	0,89	0,447	K/W
Thermal impedance, motor to cooling frame (2)	Rthw	0,25	0,12	0,086	0,228	0,11	K/W
Thermal capacity	Cth	391	718	1008	588	966	J/K
Thermal time constant cond cooling (1)	Tc	300	359	363	523	432	sec
Thermal time constant, water cooled (2)	Tw	98	86	87	134	106	sec
Loss at Tnc	L0c	87	174	260	55	111	W
Loss at Tnw	L0w	290	578	977	197	394	W
Coolant flow, 5 C temp rise, 35 C inlet	Cfl	0,8	1,7	2,8	0,6	1,1	lit/min
Treshold of built-in PTC	PTCt	130	130	130	130	130	oC
<b>Electrical data (winding dependent)</b>							
Nominal speed (knee speed) (5)	wn	628	628	628	538,57	537,39	rad/sec
Nominal power, water cooling, knee speed	Pnw	3,2	7,3	12	3,66	8,6	kW
Back E.M.F. between phases	Ke	0,58	0,58	0,58	0,65	0,65	Vs
Torque constant	Kt	1	1	1	1,13	1,13	Nm/Arms
Temp. coeff. of E.M.F. and Kt	dKe/dT	-0,09	-0,09	-0,09	-0,09	-0,09	%/oC
Winding resistance, 20oC	Rw	4,4	1,6	1	2,3	0,86	Ohm
Winding inductance	Lw	6	3	2,1	4,1	2	mH
Nominal current, zero speed (1)	In0	2,79	6,37	9,85	3,2	7,55	Arms
Nominal current, zero speed (2)	In	5,4	12,57	19,91	6,36	14,96	Arms
Maximum current (3)	lpk	23,64	47,28	66,2	35,53	72,17	Arms
Frequency	fn	500	500	500	515	513	Hz
Efficiency at rated power	n	0,92	0,93	0,92	0,95	0,96	

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20 ÷ 80 Nm		TK106-180-	TK164-60-04	TK164-110-03	TK170-60-0.6	TK170-112-0.6	Units
<b>Reference data (winding independent)</b>							
Nominal torque, S1, 0 speed, conduction + convection cooled IC 418 (1)	Tnc	16,6	19	40	14	26	Nmrms
Nominal torque, S1, 0 speed, water cooled (2)	Tnw	33	37	80	32	63	Nmrms
Peak torque, S6 10% (1)	Tpk	47	54	114	40	74	Nmrms
Maximum torque (3)	Tul	119	93	171	78	117	Nm
Maximum structural speed	Pn	1000	500	500	3000	3000	rad/sec
Critical flux control torque(4)	Pf	141	86	157	67	118	Nm
Motor constant	Tw	2,18	2,33	3,63	1,74	2,7	Nm/sqrt(W)
Pole number	PN	12	12	12	4	4	
Connection		Y	Y	Y	Y	Y	
<b>Physical data (winding independent)</b>							
Rotor inertia	Jm	2,7	4,3	7,3	5	8	mkgm <sup>2</sup>
Acceleration at maximum torque	apk	17498	12576	15595	7662	9135	rad/s <sup>2</sup>
Outer diameter	Dout	106	164	164	170	170	mm
Rotor hole diameter	Din	65	96	96	65	65	mm
Overall stator length	Stkout	218	102	152	145	197	mm
Stack length	Stk	180	60	110	60	112	mm
Stator mass	Msta	4,3	4,8	8	9,5	13,5	kg
Rotor mass	Mrot	2	1,3	2,4	2,4	3,9	kg
Insulation		Class H-F	Class H-F	Class H-F	Class H-F	Class H-F	
Protection		IP 00	IP 00	IP 00	IP 00	IP 00	
<b>Thermal data (winding independent)</b>							
Thermal imp. assumed for cond. Cooling (1)	Rtch	0,25	0,39	0,214	0,38	0,25	K/W
Thermal impedance, motor to cooling frame (2)	Rthw	0,057	0,092	0,05	0,067	0,04	K/W
Thermal capacity	Cth	1806	2016	3360	3990	5670	J/K
Thermal time constant cond cooling (1)	Tc	452	786	719	1516	1418	sec
Thermal time constant, water cooled (2)	Tw	103	185	168	267	227	sec
Loss at Tnc	L0c	198	267	491	248	378	W
Loss at Tnw	L0w	789	1030	1880	1250	2096	W
Coolant flow, 5 C temp rise, 35 C inlet	Cfl	2,3	3	5,4	7,2	12	lit/min
Threshold of built-in PTC	PTCt	130	130	130	130	130	oC
<b>Electrical data (winding dependent)</b>							
Nominal speed (knee speed) (5)	wn	537,15	173,29	173,99	860	842	rad/sec
Nominal power, water cooling, knee speed	Pnw	17,73	6,41	13,92	27,52	53,05	kW
Back E.M.F. between phases	Ke	0,65	1,8	1,76	0,38	0,38	Vs
Torque constant	Kt	1,13	3,13	3,05	0,65	0,65	Nm/Arms
Temp. coeff. of E.M.F. and Kt	dKe/dT	-0,09	-0,09	-0,09	-0,09	-0,09	%/oC
Winding resistance, 20oC	Rw	0,4	2,69	1,06	0,21	0,09	Ohm
Winding inductance	Lw	1	12,63	6,58	2,1	1,2	mH
Nominal current, zero speed (1)	ln0	14,74	6,08	13,12	21,5	39,92	Arms
Nominal current, zero speed (2)	ln	30,85	12,46	27,62	51,72	101,83	Arms
Maximum current (3)	lpk	122,13	37,19	70,12	149,71	224,57	Arms
Frequency	fn	513	166	166	274	268	Hz
Efficiency at rated power	n	0,96	0,86	0,88	0,96	0,96	



80 ÷ 330 Nm	Symbol	TK164-110-03	TK164-250-09	TK240-60-04	TK240-140-04	TK270-40-07	TK270-80-08	Units
<b>Reference data (winding independent)</b>								
Nominal torque, S1, 0 speed, conduction + convection cooled IC 418 (1)	Tnc	40	106	41	96	43	107	Nmrms
Nominal torque, S1, 0 speed, water cooled (2)	Tnw	80	209	96	226	95	254	Nmrms
Peak torque, S6 10% (1)	Tpk	114	302	117	273	122	305	Nmrms
Maximum torque (3)	Tul	171	389	252	505	188	376	Nm
Maximum structural speed	Pn	500	500	1000	1000	400	200	rad/sec
Critical flux control torque(4)	Pf	157	366	172	343	142	297	Nm
Motor constant	Tw	3,63	6,31	4,74	7,86	5,28	9,35	Nm/sqrt(W)
Pole number	PN	12	12	16	16	24	24	
Connection		Y	Y	Y	Y	Y	Y	
<b>Physical data (winding independent)</b>								
Rotor inertia	Jm	7,3	16	20	37	21	38	mkgm2
Acceleration at maximum torque	apk	15595	18855	5834	7384	5828	8014	rad/s2
Outer diameter	Dout	164	164	240	240	270	270	mm
Rotor hole diameter	Din	96	96	150	150	180	180	mm
Overall stator lenght	Stkout	152	292	108	178	78	118	mm
Stack lenght	Stk	110	250	70	140	40	80	mm
Stator mass	Msta	8	17	12	21	8,8	16,3	kg
Rotor mass	Mrot	2,4	5,5	2,7	5,2	1,9	3,6	kg
Insulation		Class H-F	Class H-F	Class H-F	Class H-F	Class H-F	Class H-F	
Protection		IP 00	IP 00	IP 00	IP 00	IP 00	IP 00	
<b>Thermal data (winding independent)</b>								
Thermal imp. assumed for cond. Cooling (1)	Rtch	0,214	0,093	0,22	0,113	0,36	0,178	K/W
Thermal impedance, motor to cooling frame (2)	Rthw	0,05	0,021	0,038	0,019	0,066	0,031	K/W
Thermal capacity	Cth	3.360	7.140	5.040	8.820	3.696	6.846	J/K
Thermal time constant cond cooling (1)	Tc	719	664	1.109	997	1.331	1.219	sec
Thermal time constant, water cooled (2)	Tw	168	150	194	168	244	212	sec
Loss at Tnc	L0c	491	1.120	290	583	246	496	W
Loss at Tnw	L0w	1.880	4.380	1.398	2.800	1.200	2.570	W
Coolant flow, 5 C temp rise, 35 C inlet	Cfl	5,4	12,6	4	8	3,4	7,4	lit/min
Treshold of built-in PTC	PTCt	130	130	130	130	130	130	oC
<b>Electrical data (winding dependent)</b>								
Nominal speed (knee speed) (5)	wn	173,99	52,4	118,52	113,8	66,38	51,93	rad/sec
Nominal power, water cooling, knee speed	Pnw	13,92	10,95	11,38	25,72	6,31	13,19	kW
Back E.M.F. between phases	Ke	1,76	5,13	2,53	2,54	4,21	4,92	Vs
Torque constant	Kt	3,05	8,89	4,38	4,4	7,29	8,53	Nm/Arms
Temp. coeff. of E.M.F. and Kt	dKe/dT	-0,09	-0,09	-0,09	-0,09	-0,09	-0,09	%/oC
Winding resistance, 20oC	Rw	1,06	2,98	1,28	0,47	2,87	1,25	Ohm
Winding inductance	Lw	6,58	24	9,3	4,7	20,76	13,61	mH
Nominal current, zero speed (1)	In0	13,12	11,92	9,36	21,82	5,89	12,55	Arms
Nominal current, zero speed (2)	In	27,62	24,74	23,06	54,07	13,71	31,36	Arms
Maximum current (3)	lpk	70,12	54,69	71,88	143,49	32,21	55,13	Arms
Frequency	fn	166	50	151	145	127	99	Hz
Efficiency at rated power	n	0,88	0,71	0,89	0,9	0,84	0,84	

<b>330 ÷ 1400 Nm</b>	Symbol	TK240-240-04	TK270-120-12	TK370-70-25	TK370-140-35	TK450-60-40	TK570-50-50	Units
<b>Reference data (winding independent)</b>								
Nominal torque, S1, 0 speed, conduction + convection cooled IC 418 (1)	Tnc	202	170	195	684	232	419	Nmrms
Nominal torque, S1, 0 speed, water cooled (2)	Tnw	477	382	507	861	585	988	Nmrms
Peak torque, S6 10% (1)	Tpk	575	484	555	1093	660	1192	Nmrms
Maximum torque (3)	Tul	865	565	692	1384	1004	1450	Nm
Maximum structural speed	Pn	1000	200	200	200	200	200	rad/sec
Critical flux control torque(4)	Pf	573	427	538	916	618	1011	Nm
Motor constant	Tw	10,97	12,01	14,64	20,73	19	30,16	Nm/sqrt(W)
Pole number	PN	16	24	40	40	48	64	
Connection		Y	Y	Y	Y	Y	Y	
<b>Physical data (winding independent)</b>								
Rotor inertia	Jm	60	53	111	186	170	420	mkgm2
Acceleration at maximum torque	apk	9582	9129	5000	5876	3884	2839	rad/s2
Outer diameter	Dout	240	270	370	370	450	570	mm
Rotor hole diameter	Din	150	180	280	280	340	480	mm
Overall stator length	Stkout	278	158	108	178	98	98	mm
Stack length	Stk	240	120	70	140	60	50	mm
Stator mass	Msta	33	22,8	20	33	18,2	30	kg
Rotor mass	Mrot	8,5	5,2	5	10	5,25	6	kg
Insulation		Class H-F	Class H-F	Class H-F	Class H-F	Class H-F	Class H-F	
Protection		IP 00	IP 00	IP 00	IP 00	IP 00	IP 00	
<b>Thermal data (winding independent)</b>								
Thermal imp. assumed for cond. Cooling (1)	Rtch	0,067	0,119	0,14	0,061	0,138	0,117	K/W
Thermal impedance, motor to cooling frame (2)	Rthw	0,011	0,021	0,017	0,013	0,019	0,021	K/W
Thermal capacity	Cth	13.860	9.576	8.400	13.860	7.644	12.600	J/K
Thermal time constant cond cooling (1)	Tc	929	1.140	1.176	845	1.055	1.474	sec
Thermal time constant, water cooled (2)	Tw	152	201	143	180	145	265	sec
Loss at Tnc	L0c	1.327	740	669	1.256	506	706	W
Loss at Tnw	L0w	3.740	3.740	4.800	6.300	3.564	3.933	W
Coolant flow, 5 C temp rise, 35 C inlet	Cfl	10,7	10,7	13,8	18,1	10,2	11,3	lit/min
Threshold of built-in PTC	PTCt	130	130	130	130	130	130	oC
<b>Electrical data (winding dependent)</b>								
Nominal speed (knee speed) (5)	wn	104,44	34,17	14,65	10,47	8,73	7,55	rad/sec
Nominal power, water cooling, knee speed	Pnw	49,82	13,05	7,43	9,02	5,11	7,46	kW
Back E.M.F. between phases	Ke	2,53	7,16	14,85	20,1	24,2	29	Vs
Torque constant	Kt	4,39	12,4	25,72	34,81	41,92	50,23	Nm/Arms
Temp. coeff. of E.M.F. and Kt	dKe/dT	-0,09	-0,09	-0,09	-0,09	-0,09	-0,09	%/oC
Winding resistance, 20oC	Rw	0,24	1,6	4,63	4,23	7,3	4,16	Ohm
Winding inductance	Lw	2,8	20	40,96	44,1	79	52	mH
Nominal current, zero speed (1)	In0	46,04	13,71	7,48	11,03	5,53	8,34	Arms
Nominal current, zero speed (2)	In	114,45	32,42	20,75	26,03	14,69	20,7	Arms
Maximum current (3)	lpk	246,45	56,95	33,63	49,69	29,94	36,08	Arms
Frequency	fn	133	65	47	33	33	38	Hz
Efficiency at rated power	n	0,93	0,78	0,61	0,59	0,59	0,65	

<b>1400 ÷ 6000 Nm</b>	Symbol	TK370-210-45	TK370-300-12	TK450-120-40	TK450-240-40	TK570-100-65	TK570-200-65	TK570-300-55	Units
<b>Reference data (winding independent)</b>									
Nominal torque, S1, 0 speed, conduction + convection cooled IC 418 (1)	Tnc	673	961	530	1152	750	1600	2440	Nmrms
Nominal torque, S1, 0 speed, water cooled (2)	Tnw	1600	2286	1407	3057	1800	3740	5670	Nmrms
Peak torque, S6 10% (1)	Tpk	1915	2736	1508	3279	2135	4154	6944	Nmrms
Maximum torque (3)	Tul	2076	2966	2008	4016	2900	5800	8700	Nm
Maximum structural speed	Pn	200	200	200	200	200	200	200	rad/sec
Critical flux control torque(4)	Pf	1621	2315	1227	2465	2178	4050	6281	Nm
Motor constant	Tw	29,43	36,42	30,56	47,06	38,19	57,4	72,1	Nm/sqrt(W)
Pole number	PN	40	40	48	48	64	64	64	
Connection		Y	Y	Y	Y	Y	Y	Y	
<b>Physical data (winding independent)</b>									
Rotor inertia	Jm	311	444	309	586	790	1420	2050	mkgm2
Acceleration at maximum torque	apk	6159	6159	4882	5595	2702	3207	3387	rad/s2
Outer diameter	Dout	370	370	450	450	570	570	570	mm
Rotor hole diameter	Din	280	280	340	340	480	480	480	mm
Overall stator length	Stkout	248	338	158	278	148	248	348	mm
Stack length	Stk	210	300	120	240	100	200	300	mm
Stator mass	Msta	57	63,33	48	89	45	84	122	kg
Rotor mass	Mrot	15	21,43	10,5	21	11	22	33	kg
Insulation		Class H-F	Class H-F	Class H-F	Class H-F	Class H-F	Class H-F	Class H-F	
Protection		IP 00	IP 00	IP 00	IP 00	IP 00	IP 00	IP 00	
<b>Thermal data (winding independent)</b>									
Thermal imp. assumed for cond. Cooling (1)	Rtch	0,048	0,034	0,061	0,036	0,066	0,033	0,022	K/W
Thermal impedance, motor to cooling frame (2)	Rthw	0,008	0,006	0,01	0,005	0,01	0,006	0,004	K/W
Thermal capacity	Cth	23.940	26.600	20.160	37.380	18.900	35.280	51.240	J/K
Thermal time constant cond cooling (1)	Tc	1.149	894	1.230	1.346	1.247	1.164	1.127	sec
Thermal time constant, water cooled (2)	Tw	192	149	198	183	189	194	190	sec
Loss at Tnc	L0c	1.933	2.761	1.012	2.024	1.400	2.820	4.220	W
Loss at Tnw	L0w	10.975	15.679	7.193	14.250	8.100	15.600	22.800	W
Coolant flow, 5 C temp rise, 35 C inlet	Cfl	31,5	44,9	20,6	40,9	23,2	44,7	65,4	lit/min
Threshold of built-in PTC	PTCt	130	130	130	130	130	130	130	oC
<b>Electrical data (winding dependent)</b>									
Nominal speed (knee speed) (5)	wn	7,37	32,96	8,16	7,95	5,6	5,86	7	rad/sec
Nominal power, water cooling, knee speed	Pnw	11,79	75,35	11,49	24,31	10,07	21,93	39,71	kW
Back E.M.F. between phases	Ke	26,4	7,33	24,15	24,2	37,71	36	31,7	Vs
Torque constant	Kt	45,73	12,7	41,83	41,92	65,32	62,35	54,91	Nm/Arms
Temp. coeff. of E.M.F. and Kt	dKe/dT	-0,09	-0,09	-0,09	-0,09	-0,09	-0,09	-0,09	%/oC
Winding resistance, 20oC	Rw	3,62	0,18	2,81	1,19	4,39	1,77	0,87	Ohm
Winding inductance	Lw	43	2,32	39,6	19,8	40,82	20	10	mH
Nominal current, zero speed (1)	In0	14,72	75,69	12,67	27,48	11,48	25,66	44,44	Arms
Nominal current, zero speed (2)	In	36,83	189,42	35,41	76,77	29,01	63,14	108,7	Arms
Maximum current (3)	lpk	56,75	291,86	60,01	119,76	55,49	116,27	198,07	Arms
Frequency	fn	23	105	31	30	29	30	36	Hz
Efficiency at rated power	n	0,52	0,83	0,61	0,63	0,55	0,58	0,64	

<b>6000 ÷ 55000 Nm</b>		Symbol	TK795-140-70	TK795-330-80	TK1150-250-110	TK1900-160-300	Units
<b>Reference data (winding independent)</b>							
Nominal torque, S1, 0 speed, conduction + convection cooled IC 418 (1)	Tnc	3665	8231	16900	27000	Nmrms	
Nominal torque, S1, 0 speed, water cooled (2)	Tnw	5900	14630	26251	36000	Nmrms	
Peak torque, S6 10% (1)	Tpk	8862	21975	39431	54075	Nmrms	
Maximum torque (3)	Tul	9500	25000	45000	55000	Nm	
Maximum structural speed	Pn	100	100	80	30	rad/sec	
Motor constant	Tw	70,35	122,94	225,85	368,37	Nm/sqrt(W)	
Pole number	PN	60	60	72	84		
Connection		Y	Y	Y	Y		
<b>Physical data (winding independent)</b>							
Rotor inertia	Jm	3300	7600	21000	88000	mkgm <sup>2</sup>	
Acceleration at maximum torque	apk	2686	2892	1878	614	rad/s <sup>2</sup>	
Outer diameter	Dout	795	795	1150	1900	mm	
Stator hole diameter	Daq	690	690	990	1740	mm	
Rotor hole diameter	Din	660	660	920	1650	mm	
Overall stator length	Stkout	200	390	310	230	mm	
Stack length	Stk	140	330	250	160	mm	
Stator mass	Msta	119	263	508	463	kg	
Rotor mass	Mrot	26	63	88	116	kg	
Insulation		Class C-H	Class C-H	Class C-H	Class C-H		
Protection		IP 00	IP 00	IP 00	IP 00		
<b>Thermal data (winding independent)</b>							
Thermal imp. assumed for cond. Cooling (1)	Rtch	0,023	0,014	0,011	0,011	K/W	
Thermal impedance, motor to cooling frame (2)	Rthw	0,007	0,003	0,0035	0,0057	K/W	
Thermal capacity	Cth	49.980	110.460	213.360	194.460	J/K	
Thermal time constant cond cooling (1)	Tc	1.150	1.546	2.347	2.139	sec	
Thermal time constant, water cooled (2)	Tw	335	309	747	1.108	sec	
Loss at Tnc	L0c	3.900	6.400	7.760	7.800	W	
Loss at Tnw	L0w	12.055	24.700	20.100	15.700	W	
Coolant flow, 5 C temp rise, 35 C inlet	Cfl	34,6	70,8	57,6	45	lit/min	
Threshold of built-in PTC	PTCt	130	130	130	130	oC	
<b>Electrical data (winding dependent)</b>							
Nominal speed (knee speed) (5)	wn	6,22	5,86	2,79	2,51	rad/sec	
Nominal power, water cooling, knee speed	Pnw	36,71	85,8	73,14	90,27	kW	
Back E.M.F. between phases	Ke	42,5	46	83,9	113	Vs	
Torque constant	Kt	73,61	79,67	145,32	195,72	Nm/Arms	
Temp. coeff. of E.M.F. and Kt	dKe/dT	-0,09	-0,09	-0,09	-0,09	%/oC	
Winding resistance, 20oC	Rw	0,73	0,28	0,28	0,19	Ohm	
Winding inductance	Lw	13,9	6,5	14,7	11	mH	
Nominal current, zero speed (1)	ln0	49,79	103,31	116,3	137,95	Arms	
Nominal current, zero speed (2)	ln	84,37	193,29	190,15	193,62	Arms	
Maximum current (3)	lpk	161,32	392,22	387,08	351,26	Arms	
Frequency	fn	30	28	16	17	Hz	
Efficiency at rated power	n	0,75	0,78	0,78	0,85		



**Legenda:**

1. Motore montato in carcassa in lega leggera con superficie esterna pari al 500% della superficie dello statore, ambiente 40°C, rame a 120°C;
2. Motore raffreddato ad acqua, ingresso acqua 35°C, temperatura rame 120°C;
3. Coppia a cui il circuito magnetico satura per cui non e' possibile alcun ulteriore sovraccarico;
4. Coppia al ginocchio a cui corrisponde potenza costante illimitata;
5. Limite del funzionamento a coppia costante con alimentazione 400 Vac.

**Legend:**

1. Motor in a light alloy casing with outer surface equal to 500% of the surface of the stator, environment 40°C, copper 120°C;
2. Engine water-cooled, water inlet 35°C, 120°C temperature copper;
3. Torque at which the magnetic circuit saturates. No additional overhead;
4. Couple at knee point which corresponds to constant power unlimited;
5. Limit of constant torque operation at 400 Vac.



Tavole indexanti con motori coppia autoportanti / Rotary table indexing with self-supporting torque motor



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