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A. Datasheets dels motors

- Motors Fischer TI-085

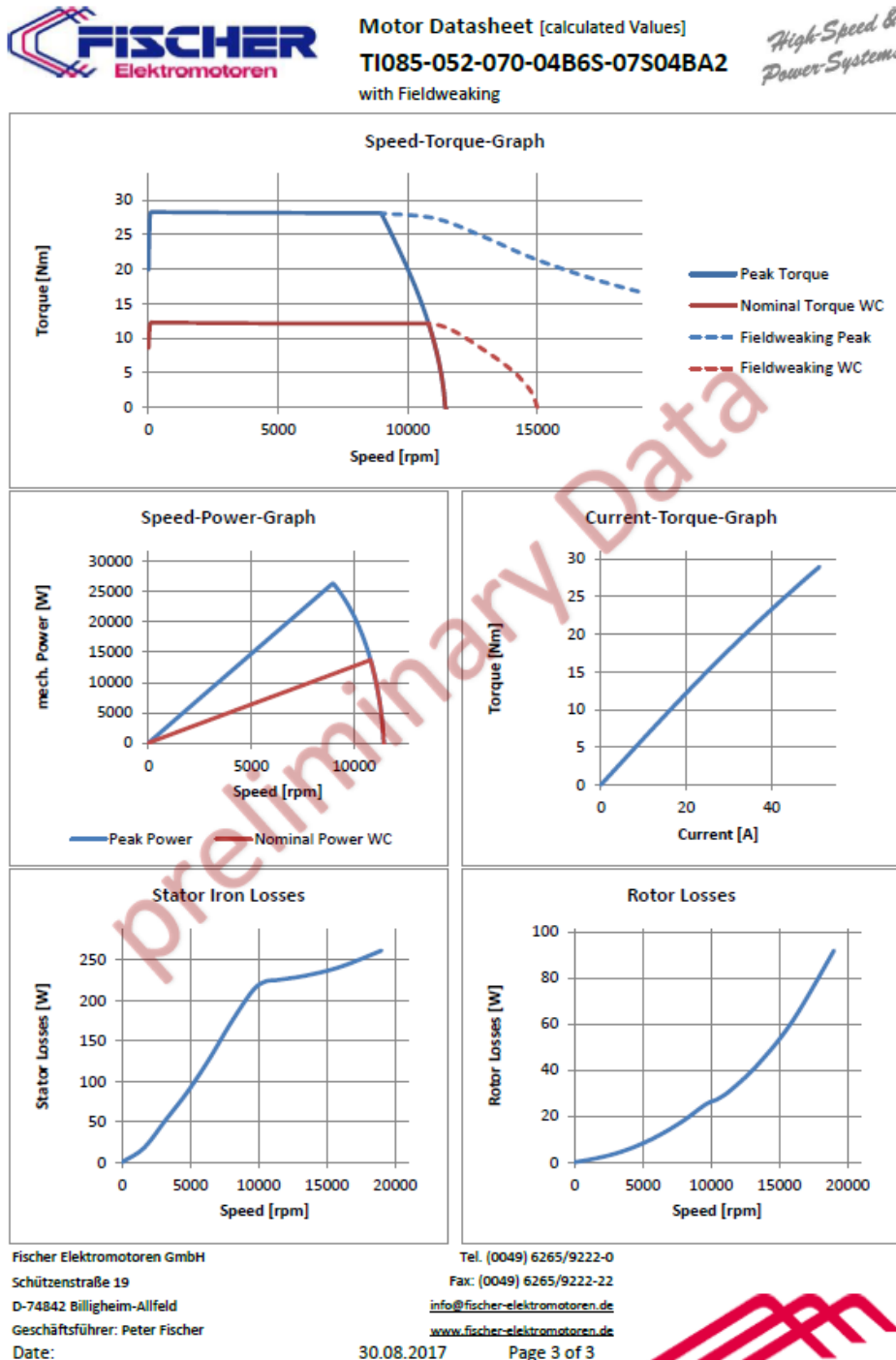


Figura A.1: Datasheet del motor de Fischer TI-085



Motor Datasheet [calculated Values]
TI085-052-070-04B6S-07S04BA2
 with Fieldweaking
 2017-104

High-Speed & Power-Systems

Project-No.:

	Symbol	Unit	Value	
Rated Data free Air Convection				
Nominal Torque	T _{NomAC}	Nm		
Nominal Current	I _{NomAC}	A _{rms}		
Nominal Speed	n _{NomAC}	rpm		
Nominal Power	P _{NomAC}	W		
Winding Losses ¹ / Total Losses ^{1,2}	P _{DAC}	W		
Holding Torque	T _{HAC}	Nm		
Holding Current	I _{HAC}	A _{rms}		
Rated Data Water cooled ($\varphi = 0^\circ$)				
Nominal Torque	T _{NomWC}	Nm	12,1	
Nominal Current	I _{NomWC}	A _{rms}	20,3	
Nominal Speed	n _{NomWC}	rpm	10800	
Nominal Power	P _{NomWC}	W	13719	
Winding Losses ¹ / Total Losses ^{1,2}	P _{DWC}	W	370	624
Holding Torque	T _{HWC}	Nm	8,6	
Holding Current	I _{HWC}	A _{rms}	14,4	
Peak Data ($\varphi = -10^\circ$)				
Peak Torque	T _{Peak}	Nm	28,1	
Peak Current	I _{Peak}	A _{rms}	50	
Speed at Peak Torque	n _{Peak}	rpm	8950	
Peak Power	P _{Peak}	W	26370	
Winding Losses ¹ / Total Losses ^{1,2}	P _{DPeak}	W	2249	2465
Data				
Torque Constant	k _t	Nm/A _{rms}	0,594	
BEMF Constant (Phase - Phase)	k _e	V _{rms} /(rad/s)	0,354	
Motor Constant	k _m	Nm/ \sqrt{W}	0,321	
Idle Speed	n _{idle}	rpm	11450	
max. Speed (Fieldweaking)	n _{max}	rpm	19000	
max. Frequency (Idle/Fieldweaking)	f _{max}	Hz	763	1267
DC Bus Voltage	U _{DC}	V _{DC}	600	
Ø Resistance per Phase (Winding only)	R _{Ph20}	Ω	0,228	
Ø Inductance per Phase (Winding only)	L _{Ph}	mH	0,726	
electr. Time Constant $\tau=L/R$	τ _{el}	ms	3,19	
Number of Polepairs	n		4	
Winding Connection			Star	

Date:

30.08.2017

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Figura A.2: Datasheet del motor de Fischer TI-085



Motor Datasheet [calculated Values]
TI085-052-070-04B6S-07S04BA2
 with Fieldweaking

*High-Speed &
Power-Systems*

	Symbol	Unit	Value
Data Watercooling			
Inlet Temperature of Coolant	T_{in}	°C	10 ... 40
Max. Temperature rise of Coolant	T_{max}	K	5
Min. required Coolant flow	Q_{min}	l/min	---
Volume of cooling channel	V_{cool}	l	---
thermal Time Constant	T_{th}	min	---

	Symbol	Unit	Value
Data Mechanics			
Rotor Inertia (assembly set)	J	kgm ²	$0,3 \cdot 10^{-3}$
Weight of Motor w/o Housing	m	kg	2,8
Outer Stator Diameter w/o Housing	dA	mm	85
Inner Stator Diameter	dAg	mm	51,6
Length of Stator	l	mm	70

Annotations - Losses

¹ Winding Losses are referred to a Coil Temperature of 100°C.

² The total Losses are made up of: Winding Losses; Stator Iron Losses; Rotor Losses;

Calculation of total Losses:

Winding Losses (at 100°C) + Stator Iron Losses (at speed X) + Rotor Losses (at speed X)

Annotations - general

Ensure that your servo drive can handle the Nominal- and Peakcurrent of the Motor

An adjustment of the Speed and DC Bus Voltage can be done after consultation

The nominal data in this datasheet are based on an ambient/coolant temperature of 20°C

Because the exact duty type depends also on the thermal connection of the motor, the embedded thermal monitoring system has to be analysed and attended.

The stated nominal Torques are without consideration of friction losses through Bearings or Sealings.

Date:

30.08.2017

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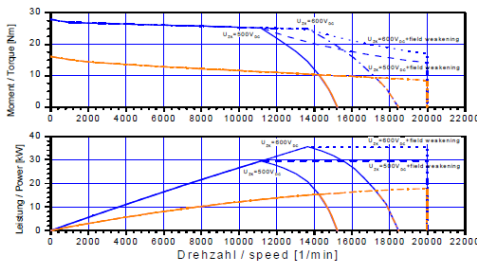
Figura A.3: Datasheet del motor de Fischer TI-085

- Motors AMK DT5-14-10-POW

Motor-Datenblatt motor data sheet



Bezeichnung/name	DT5-14-10-POW - 14000-B5	Formula Student VAC-BL.	Datum/date:	15.03.2017
Teile-Nr./part number	A2695ID	Zeichn.-Nr./drawing no.:	12702-01229	
Motorbeschreibung motor description:		Elektrische Daten electrical data:		
Motorprinzip/motor principle:	synchron	Nennspannung/rated voltage "Un" (ID32768):	350 V	
Kühlart/cooling type:	Flüssigkeit 5l/min liquid 5l/min	Nennstrom/rated current "In" (ID111):	31 Arms	
Bauform/mounting type:	IMB5	Dauerstillstandsstrom/cont. stall current "Io" (ID34096):	46,2 Arms	
Schutzart/degree of protection:	IP 65	Maximalstrom/maximum current "Imax" (ID109):	100 Arms	
Isolierklasse/insulation class:	F	Maximale Dauer für/duration for "Imax" (ID34168):	1,1 s	
Leistungsdaten performance data:		Drehmomentkonstante/torque constant "kt":	0,346 Nm/Arms	
Betriebsart/duty type:	S1 dT=80K	Spannungskonstante/voltage constant "ke" (ID 34234):	23 V/kU/min	
Dauerstillstandsmoment/continuous Stall Torque "Mo":	16 Nm	Schaltung/connection type:	Y	
Maximales Moment/maximum torque "Mmax":	28 Nm	Polzahl/number of poles "2p" (ID32775):	10 Pole	
Bemessungsmoment/rated torque "Mn" (ID32771):	10 Nm	Klemmenwiderstand/terminal resistance "Rtt" (ID34164):	0,146 Ohm	
Bemessungsleistung/rated power "Pn" (ID32772):	15,7 kW	Klemmeninduktivität/terminal inductance "Ltt" (ID34167):	0,6 mH	
Bemessungsdrehzahl/rated speed "Nn" (ID32772):	15000 rpm	Querachseninduktivität/quadrature axis inductance "Lq" (ID34046):	0,2 mH	
Theo. Leerlaufdrehzahl/theor. no-load-speed "No":	15217 rpm	Hauptachseninduktivität/direct axis inductance "Ld" (ID34045):	0,41 mH	
Motorkennlinien performance - characteristics:		Magn.-Strom/magn. current "Im" (ID32769):	61 Arms	
		Magn.-Strom/magn. current "Im1" (ID32770):	0 Arms	
		Rotorzeitkonstante/rotor time constant "Tr" (ID32774):	0,01 s	
		Reglereinstellungen controller settings:		
		Stromregler current controller:		
		Verstärkung q-Achse/gain q-axis "Kpq" (ID34151):	1,07 V/A	
		Verstärkung d-Achse/gain d-axis "Kpd" (ID34152):	1,07 V/A	
		Nachstellzeitkonstante/time constant "Tnq" (ID34050):	1 ms	
		Nachstellzeitkonstante/time constant "Tnd" (ID34052):	1 ms	
		Adaption Verstärkung/adaption gain "Kpq2" (ID 34179):	15 %	
		Adaption Nachstellzeit/adaption time constant "Tnq2" (ID 34180):	400 %	
		Untere Anpaßschwelle/lower adaption limit "lua" (ID34177):	28 %	
		Obere Anpaßschwelle/upper adaption limit "lua" (ID34178):	62 %	
		Drehzahlregler speed controller (default for plain motor):		
		Verstärkung/gain "Kp_n" (ID100):	40	
		Nachstellzeitkonstante/time constant "Tn_n" (ID101):	20 ms	
		Spannungsregler voltage controller:		
		Spannungsregler/voltage controller "Kp" (ID34148):	0,05 A/V	
		Spannungsregler/voltage controller "Tn" (ID34149):	8 ms	
		Spannungsüberhöhung "dU" (ID34235):	115 %	
		Systemwiderstand "Rs" (ID34233):	0,35 Ohm	



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Figura A.4: Datasheet del motor de AMK DT5-14-10-POW



Motor-Datenblatt motor data sheet



Bezeichnung/name **DT5-14-10-POW**- 14000-B5 - Formula Student VAC-BL. Datum/date: 15.03.2017
 Teile-Nr./part numbe **A2695ID** Zeichn.-Nr./drawing no.: 12702-01229

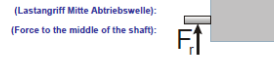
Mechanische Daten mechanical data:

Gesamtmasse/motor mass "m": 3,67 kg
 Motorträgheitsmoment/inertia "J": 2,74 kgcm²
 Mech. zul. Drehzahl/mech. speed limit "Nmax": 20000 rpm
 Rundlauf/run out (DIN 42955): N
 Wuchtgüte/balancing quality: G2,5
 Schwingstärke/vibration level (DIN ISO 2373): N
 Passfeder/shaft key: -

Lagerbelastung bearing load:

A/B - Lager/A/B - side bearing:

Lagertyp/bearing type : 6005 / 6003
 Fettsorte/type of grease: GE2 / GE2
 theo. Fettgebrauchsdauer/grease life time: 13000 / 18000 h
 bei Nenndrehzahl und 70°C Lageraußenringtemp/at rated speed and 158°F at outer bearing ring
 erforderliche Fettmenge/necessary grease quantity : 0 / g
 Maximale Axialkraft bei Montage/max. axial force for assembly: 3275 N



Bremsdaten brake data:

Typ/type: -
 Bremsmoment/brake torque: Nm
 Bremsenstrom/brake current: A
 Bremsenspannung/brake voltage: V
 Spannungsart/voltage type: -
 Einfallzeit/engage time "Te": 0 ms
 max. Bremsenergie/max. braking energy: J
 einmalig/single engagement: J
 Lebenslang/lifetime: J

Lüfterdaten fan data:

AMK-TNr./AMK part number: -
 Lüfterspannung/fan voltage: V
 Strom/current: A
 Frequenz/frequency: Hz

Wicklungsschutz thermistor:

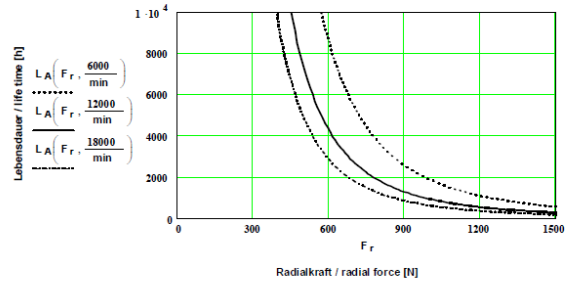
Typ/type (ID34166): KTY84
 Ansprechtemp./operation temp: - °C
 Widerstand/resistance (25°C) <= : 629 Ω

Geberdaten position encoder data:

AMK-TNr./AMK part number: 108072
 Typ/type: P
 Impulszahl/number of pulses: 262144

Bemerkungen remarks:

automatisch erstellt, Geber 18 Bit
 Daten nur gültig mit entsprechender Wasserkühlung



* Typenschildbezeichnung unterstrichen; bitte bei Rückfragen immer angeben /Nameplate data underlined; please state with every inquiry
 Ersteller/created by: SMM Änderungsstand Mechanik/revision motor-mechanics: 0.00 Änderungsdatum/motor revision motor date: 12.01.2017

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Figura A.5: Datasheet del motor de AMK DT5-14-10-POW

Efficiency DT5-14-10-POW- 1400 B5

eta [%]	Drehzahl [rpm]												
	48	1960	3950	5880	7870	9840	11780	13740	14720	15710	17690	19640	
M, Nm	3,2	99,3677413	90,6102935	90,4898039	90,9585099	91,9730321	86,6662194	86,4515455	89,4555678	93,4970876	90,2062277	96,3218785	93,774832
	3,9	31,2775335	89,5880579	90,3505147	91,00884	91,342575	92,7911286	93,4397007	92,8625462	95,4904485	91,8871399	92,0966029	99,3874042
	8,7	31,2205737	88,5451689	91,4125927	91,9339048	92,8018549	93,3785029	93,3796865	93,4366078	95,5697431	93,6273716	98,2340086	97,680286
	10	19,0608213	88,1664956	92,1159598	92,9057186	94,0647418	93,5982987	93,6836893	93,9982123	94,4849548	93,6493418	97,6459947	99,7930493
	11,3	22,6549331	85,0435473	90,634326	90,8918639	93,0120604	92,4222262	93,0415125	93,1267462	94,6249847	93,1987341	97,4823501	95,6328809
	16,2	14,3538199	81,9747957	88,3818828	90,5887935	91,4223727	91,8640446	91,9672486	92,6066072	93,6174448	92,7366039	96,2861726	97,9180059
	20,3	9,87199642	75,7885572	84,5847819	87,1932926	89,2945244	90,1091195	88,9985589	91,2402298	92,5084549	92,3052563	92,7006855	95,951768
	24	7,16636516	66,3304128	78,1260351	81,7200674	85,167477	86,6649351	87,0573406	89,502578	89,7041181	90,5072258		
	26,9	5,52144636	64,0075812	75,8176556	81,3073731	85,2498867	87,4039649						
	28,3	4,75842846	61,9190232	74,2468569	80,5548287	83,6152836	85,0842563						

Figura A.6: Datasheet del motor de AMK DT5-14-10-POW

- Motors AMK DD5-14-10-POW

Motor-Datenblatt motor data sheet



Bezeichnung/name	DD5-14-10-POW - 18600-B5	Formula Student	Datum/date:	15.03.2017
Teile-Nr./part number	A2370DD		Zeichn.-Nr./drawing no.:	12703-01260
Motorbeschreibung motor description:		Elektrische Daten electrical data:		
Motorprinzip/motor principle:	Flüssigkeit synchron	Nennspannung/rated voltage "Un" (ID32768):	350 V	
Kühlart/cooling type:		Nennstrom/rated current "In" (ID111):	41 Arms	
Bauform/mounting type:		Dauerstillstandsstrom/cont. stall current "Io" (ID34096):	53.1 Arms	
Schutzart/degree of protection:		Maximalstrom/maximum current "Imax" (ID109):	105 Arms	
Isolierklasse/insulation class:	F	Maximale Dauer für/duration for "Imax" (ID34168):	1.24 s	
Leistungsdaten performance data:		Drehmomentkonstante/torque constant "kt":	0.26 Nm/Arms	
Betriebsart/duty type:	S1 dT=100K	Spannungskonstante/voltage constant "ke" (ID 34234):	18,8 V/Um/min	
Dauerstillstandsmoment/continuous Stall Torque "Mo":	13,8 Nm	Schaltung/connection type:	D	
Maximales Moment/maximum torque "Mmax":	21 Nm	Polzahl/number of poles "2p" (ID32775):	10 Pole	
Bemessungsmoment/rated torque "Mn" (ID32771):	9,8 Nm	Klemmenwiderstand/terminal resistance "Rtt" (ID34164):	0,135 Ohm	
Bemessungsleistung/rated power "Pn":	12,3 kW	Klemmeninduktivität/terminal inductance "Ltt" (ID34167):	0 mH	
Bemessungsdrehzahl/rated speed "Nn" (ID32772):	12000 rpm	Querachseninduktivität/quadrature axis inductance "Lq" (ID34046):	0,12 mH	
Theo. Leerlaufdrehzahl/theor. no-load-speed "No":	18617 rpm	Hauptachseninduktivität/direct axis inductance "Ld" (ID34045):	0,24 mH	
Motorkennlinien performance - characteristics:		Magn.-Strom/magn. current "Im" (ID32769):	35 Arms	
		Magn.-Strom/magn. current "Im1" (ID32770):	0 Arms	
		Rotorzeitkonstante/rotor time constant "Tr" (ID32774):	0,01 s	
		Reglereinstellungen controller settings:		
		Stromregler current controller:		
		Verstärkung q-Achse/gain q-axis "Kpq" (ID34151):	0,64 V/A	
		Verstärkung d-Achse/gain d-axis "Kpd" (ID34152):	0,58 V/A	
		Nachstellzeitkonstante/time constant "Tnq" (ID34050):	1,2 ms	
		Nachstellzeitkonstante/time constant "Tnd" (ID34052):	1,2 ms	
		Adaption Verstärkung/adaption gain "Kpq2" (ID 34179)	20 %	
		Adaption Nachstellzeit/adaption time constant "Tnq2" (ID 34180)	400 %	
		Untere Anpaßschwelle/lower adaption limit "lua" (ID34177):	19 %	
		Obere Anpaßschwelle/upper adaption limit "lua" (ID34178):	68 %	
		Drehzahlregler speed controller (default for plain motor):		
		Verstärkung/gain "Kp_n" (ID100):	40	
		Nachstellzeitkonstante/time constant "Tn_n" (ID101):	20 ms	
		Spannungsregler voltage controller:		
		Spannungsregler/voltage controller "Kp" (ID34148):	0,08 A/V	
		Spannungsregler/voltage controller "Tn" (ID34149):	6 ms	
		Spannungsüberhöhung "dU" (ID34235):	116 %	
		Systemwiderstand "Rs" (ID34233):	0 Ohm	

Kennlinie kann die maximal zulässige Drehzahl übersteigen! / Characteristic may exceed mechanical speed limit of motor

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Figura A.7: Datasheet del motor de AMK DD5-14-10-POW

Motor-Datenblatt motor data sheet



Bezeichnung/name	DD5-14-10-POW - 18600-B5	- Formula Student	Datum/date:	15.03.2017
Teile-Nr./part number	A2370DD		Zeichn.-Nr./drawing no.:	12703-01260
Mechanische Daten mechanical data:		Lagerbelastung bearing load:		
Gesamtmasse/motor mass "m":	3,55 kg	(Lastangriff Mitte Abtriebswelle):		
Motorträgheitsmoment/inertia "J":	2,74 kgcm ²	(Force to the middle of the shaft):		
Mech. zul. Drehzahl/mech. speed limit "Nmax":	20000 rpm	A/B - Lager/A/B - side bearing:	6005 / 6003	
Rundlauf/run out (DIN 42955):	N	Lagertyp/bearing type :	GE2 / GE2	
Wuchtgüte/balancing quality:	G2,5	Fettsorte/type of grease:	13000 / 18000 h	
Schwingstärke/vibration level (DIN ISO 2373):	N	theo. Fettgebrauchsdauer/grease life time:	bei Nenndrehzahl und 70°C Lageraußenringtemplat rated speed and 158°F at outer bearing ring	
Passfeder/shaft key:	-	erforderliche Fettmenge/necessary grease quantity :	0 / g	
Bremsdaten brake data:		Maximale Axialkraft bei Montage/max. axial force for assembly:	3275 N	
Typ/type:	-	A - Lager/A - side bearing:		
Bremsmoment/brake torque:	Nm			
Bremsstrom/brake current:	A	<p>Lebensdauer / life time [h]</p> <p>Radialkraft / radial force [N]</p>		
Bremsspannung/brake voltage:	V	<p>$L_A \left(\frac{6000}{\text{min}} \right)$</p> <p>$L_A \left(\frac{12000}{\text{min}} \right)$</p> <p>$L_A \left(\frac{18000}{\text{min}} \right)$</p>		
Spannungsart/voltage type:	-			
Einfallzeit/engage time "Te":	0 ms			
max. Bremsenergie/max. braking energy:	J			
einmalig/single engagement:	J			
Lebenslang/lifetime:	J			
Lüfterdaten fan data:		Geberdaten position encoder data:		
AMK-TNr./AMK part number:	-	Typ/type (ID34166):	KTY84	
Lüfterspannung/fan voltage:	V	Ansprechtemp./operation temp:	- °C	
Strom/current:	A	Widerstand/resistance (25°C) <=:	629 Ω	
Frequenz/frequency:	Hz	AMK-TNr./AMK part number:	108072	
Wicklungsschutz thermistor:		Typ/type:	P	
		Impulszahl/number of pulses:	262144	
		Bemerkungen remarks:		
		automatisch erstellt, Geber 18 Bit, Sonderparameter FSE		
		Daten nur gültig mit entsprechender Wasserkühlung		

Ersteller/created by: SMM Änderungsstand Mechanik/revision motor-mechanics: 0.00 Änderungsdatum/motor revision motor date: 26.10.2016

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Figura A.8: Datasheet del motor de AMK DD5-14-10-POW



Efficiency: DD5-14-10-xxW-19000

"calculated values @ operating temp. - differences up to 2% possible"



Current [Arms]	Torque [Nm]	speed [rpm]									
		500	1000	2000	3000	4000	6000	10000	12000	15000	19000
5	1,3	64,37	71,33	73,64	74,70	75,43	76,57	77,00	77,08	77,56	78,14
10	2,7	58,42	70,48	77,57	80,40	82,01	83,92	85,16	85,44	85,97	86,50
20	5,4	44,94	60,81	73,35	78,82	81,94	85,43	88,20	88,88	89,71	90,44
30	7,9	35,59	51,90	67,02	74,26	78,54	83,42	87,58	88,65	89,84	90,86
40	10,4	29,14	44,78	61,01	69,41	74,57	80,62	85,93	87,34	88,86	90,16
50	12,5	24,17	38,71	55,22	64,39	70,24	77,30	83,73	85,48	87,37	88,98
60	14,4	20,41	33,76	50,04	59,65	65,99	73,88	81,33	83,42	85,66	87,59
70	16,0	17,31	29,40	45,10	54,87	61,55	70,10	78,56	80,97	83,56	85,81
80	17,4	14,82	25,75	40,67	50,41	57,28	66,34	75,70	78,40	81,34	83,91
90	18,5	12,81	22,67	36,72	46,30	53,25	62,67	72,77	75,75	79,02	81,91
100	19,6	11,17	20,05	33,21	42,51	49,44	59,09	69,82	73,06	76,63	79,83

Field weakening 600VDC		speed [rpm]									
Current [Arms]	Torque [Nm]	500	1000	2000	3000	4000	6000	10000	12000	15000	19000
5	1,3	64,37	71,33	73,64	74,70	75,43	76,57	77,00	77,08	77,56	78,14
10	2,7	58,42	70,48	77,57	80,40	82,01	83,92	85,16	85,44	85,97	86,50
20	5,4	44,94	60,81	73,35	78,82	81,94	85,43	88,20	88,88	89,71	90,44
30	7,9	35,59	51,90	67,02	74,26	78,54	83,42	87,58	88,65	89,84	90,86
40	10,4	29,14	44,78	61,01	69,41	74,57	80,62	85,93	87,34	88,86	90,16
50	12,5	24,17	38,71	55,22	64,39	70,24	77,30	83,73	85,48	87,37	88,98
60	14,4	20,41	33,76	50,04	59,65	65,99	73,88	81,33	83,42	85,66	87,59
70	16,0	17,31	29,40	45,10	54,87	61,55	70,10	78,56	80,97	83,56	85,81
80	17,4	14,82	25,75	40,67	50,41	57,28	66,34	75,70	78,40	81,34	83,91
90	18,5	12,81	22,67	36,72	46,30	53,25	62,67	72,77	75,75	79,02	81,91
100	19,6	11,17	20,05	33,21	42,51	49,44	59,09	69,82	73,06	76,63	79,83

efficiency data relates to current

17.11.2014

Figura A.9: Datasheet del motor de AMK DD5-14-10-POW

B. Propietats dels diferents tipus de materials

En les següents taules es mostren les gràfiques per tal de trobar els paràmetres A i B sol·licitats a les equacions 7.24 i 7.64.

No.	Material	Stress	Type	Abbrevia-tion	Fig.	Quality	A	B	Hard-ness	Min. hard-ness	Max. hard-ness
1	Normalized low carbon steels/cast steels ^a	Contact	Wrought normalized low carbon steels	St	1 a)	ML/MQ	1,000	190	HBW	110	210
2						ME	1,520	250		110	210
3			Cast steels	St (cast)	1 b)	ML/MQ	0,986	131	HBW	140	210
4						ME	1,143	237		140	210
5		Bending	Wrought normalized low carbon steels	St	2 a)	ML/MQ	0,455	69	HBW	110	210
6						ME	0,386	147		110	210
7			Cast steels	St (cast)	2 b)	ML/MQ	0,313	62	HBW	140	210
8						ME	0,254	137		140	210

Figura B.1: Taula per escollir els paràmetres A i B

No.	Material	Stress	Type	Abbrevia-tion	Fig.	Quality	A	B	Hard-ness	Min. hard-ness	Max. hard-ness
9	Cast iron materials	Contact	Black malleable cast iron	GTS (perl.)	3 a)	ML/MQ	1,371	143	HBW	135	250
10						ME	1,333	267		175	250
11			Nodular cast iron	GGG	3 b)	ML/MQ	1,434	211	HBW	175	300
12						ME	1,500	250		200	300
13			Grey cast iron	GG	3 c)	ML/MQ	1,033	132	HBW	150	240
14						ME	1,465	122		175	275
15		Bending	Black malleable cast iron	GTS (perl.)	4 a)	ML/MQ	0,345	77	HBW	135	250
16						ME	0,403	128		175	250
17			Nodular cast iron	GGG	4 b)	ML/MQ	0,350	119	HBW	175	300
18						ME	0,380	134		200	300
19			Grey cast iron	GG	4 c)	ML/MQ	0,256	8	HBW	150	240
20						ME	0,200	53		175	275
21	Through hardened wrought steels ^b	Contact	Carbon steels	V	5	ML	0,963	283	HV	135	210
22						MQ	0,925	360		135	210
23						ME	0,838	432		135	210
24			Alloy steels	V	5	ML	1,313	188	HV	200	360
25						MQ	1,313	373		200	360
26						ME	2,213	260		200	390
27		Bending	Carbon steels	V	6	ML	0,250	108	HV	115	215
28						MQ	0,240	163		115	215
29						ME	0,283	202		115	215
30			Alloy steels	V	6	ML	0,423	104	HV	200	360
31						MQ	0,425	187		200	360
32						ME	0,358	231		200	390
33	Through hardened cast steels	Contact	Carbon steels	V (cast)	7	ML/MQ	0,831	300	HV	130	215
34						ME	0,951	345		130	215
35			Alloy steels	V (cast)	7	ML/MQ	1,276	298	HV	200	360
36						ME	1,350	356		200	360
37		Bending	Carbon steels	V (cast)	8	ML/MQ	0,224	117	HV	130	215
38						ME	0,286	167		130	215
39			Alloy steels	V (cast)	8	ML/MQ	0,364	161	HV	200	360
40						ME	0,356	186		200	360

Figura B.2: Taula per escollir els paràmetres A i B

No.	Material	Stress	Type	Abbrevia- tion	Fig.	Qual- ity	A	B	Hard- ness	Min. hard- ness	Max. hard- ness	
41	Case hard- ened wrought steels ^c	Contact		Eh	9	ML	0,000	1 300	HV	600	800	
42						MQ	0,000	1 500		660	800	
43						ME	0,000	1 650		660	800	
44		Bend- ing		Core hardness: ≥25 HRC, lower ≥25 HRC, upper ≥30 HRC	Eh	10	ML	0,000	312	HV	600	800
45							MQ	0,000	425		660	800
46								0,000	461		660	800
47								0,000	500		660	800
48							ME	0,000	525		660	800
49		Flame- or induction- hardened wrought and cast steels		Contact		IF	11	ML	0,740	602	HV	485
50	MQ		0,541					882	500	615		
51	ME		0,505					1 013	500	615		
52	Bend- ing			IF		12	ML	0,305	76	HV	485	615
53							MQ	0,138	290		500	570
54								0,000	369		570	615
55								0,271	237		500	615
55							ME	0,271	237		500	615
56	Nitrided wrought steels/nitrid- ing steels ^d / through hard- ening steels ^b nitride		Contact	Nitriding steels		NT (nitr.)	13 a)	ML	0,000	1 125	HV	650
57		MQ			0,000			1 250	650	900		
58		ME			0,000			1 450	650	900		
59		Bend- ing	Through hard- ening steels	NV (nitr.)	13 b)	ML	0,000	788	HV	450	650	
60						MQ	0,000	998		450	650	
61						ME	0,000	1 217		450	650	
62							0,000	270		650	900	
63							0,000	420		650	900	
64			0,000	468	650	900						
65		Bend- ing	Through hard- ening steels	NV (nitr.)	14 b)	ML	0,000	258	HV	450	650	
66						MQ	0,000	363		450	650	
67	ME					0,000	432	450		650		
67						0,000	432	450		650		
67						0,000	432	450		650		
68	Wrought steels nitro- carburized ^e	Contact	Through hard- ening steels	NV (nitro- car.)	15	ML	0,000	650	HV	300	650	
69						MQ/ME	1,167	425		300	450	
70							0,000	950		450	650	
71		Bend- ing		Through hard- ening steels	NV (nitro- car.)	16	ML	0,000	224	HV	300	650
72							MQ/ME	0,653	94		300	450
73								0,000	388		450	650

Figura B.3: Taula per escollir els paràmetres A i B

C. Renderitzats del disseny proposat



Figura C.1: Engranatges transmissió planetària

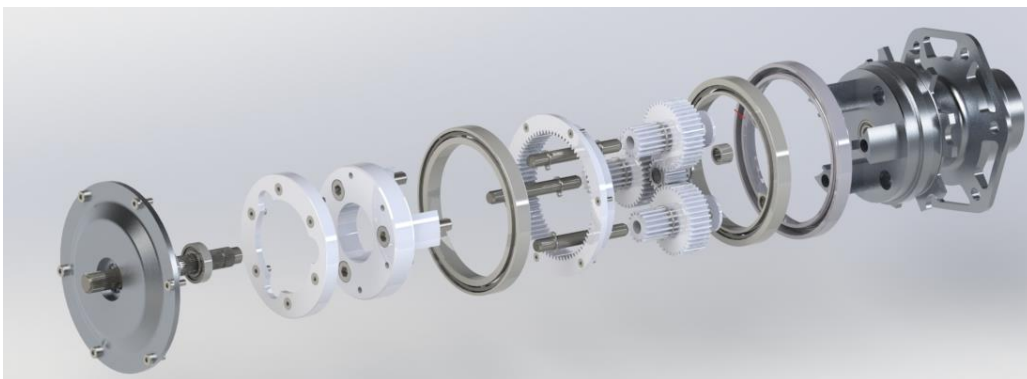


Figura C.2: Conjunt transmissió planetària

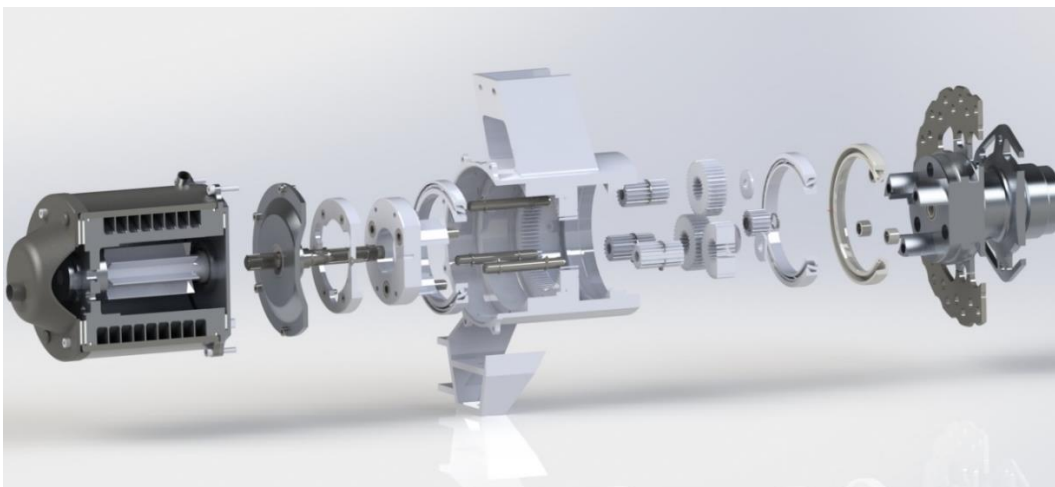
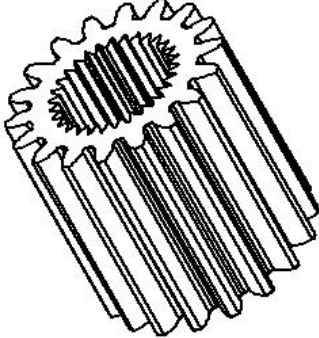
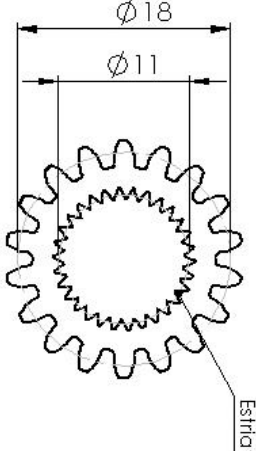


Figura C.3: Conjunt transmissió i motor

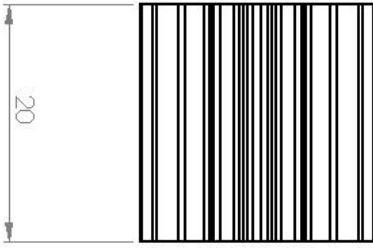
D. Plànols





Dades estriat

Norma	DIN 5481		
Núm. de dents	Z	30	--
Diàmetre de cap	da	10	mm
Diàmetre de fons	df	12	mm





Toleràncies generals segons ISO 2768-m

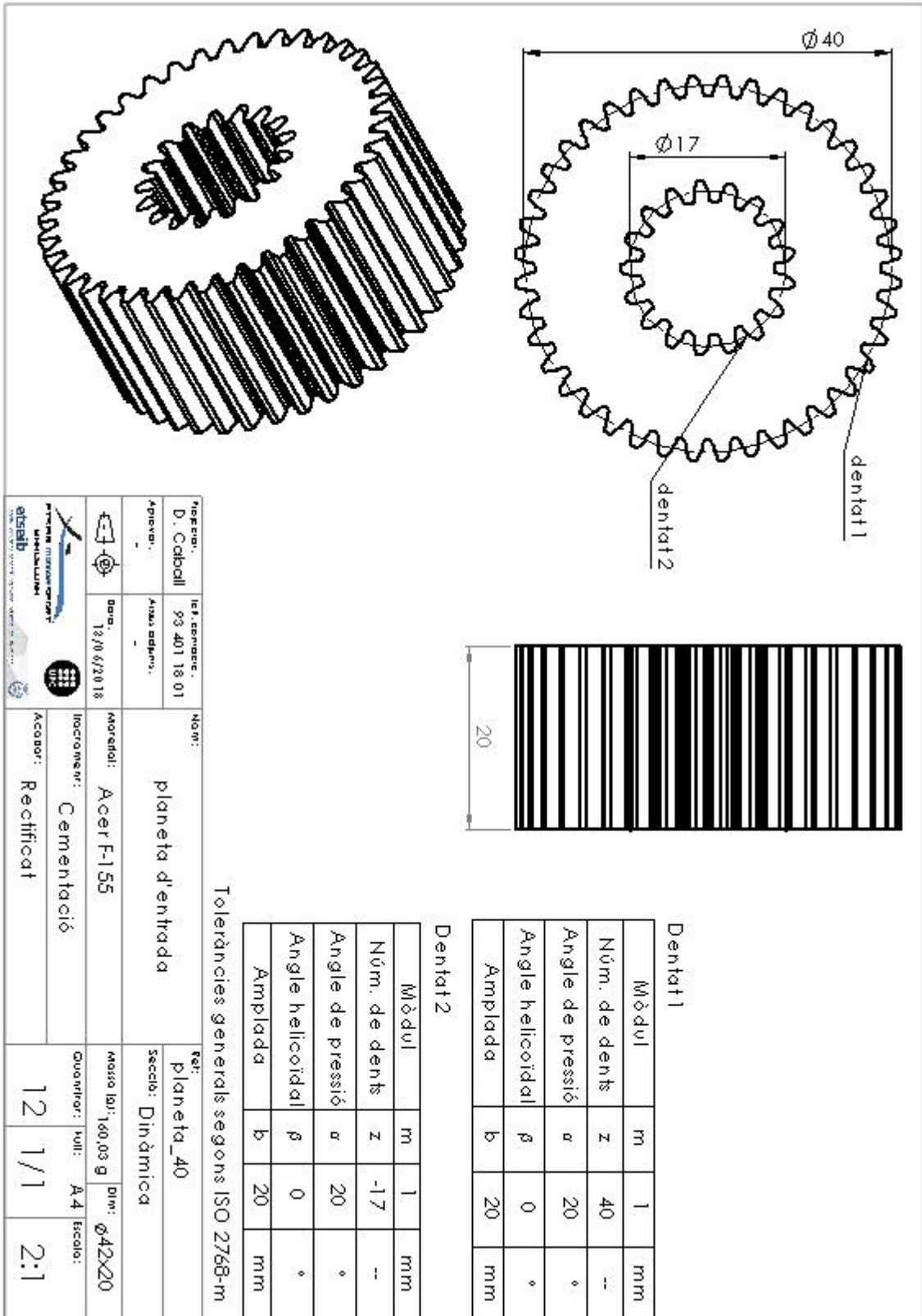
Projectat:	Tel·l. contacte:	Norma:
D. Cdball	93 401 18 01	SOL
Aprovat:	Assist. adjunts:	
	Data:	Material:
	13/06/2018	Acer F-155
		Tractament:
		Cementació
		Acabat:
		Rectificat

Ref:	SOL_18
Secció:	Dinàmica
Massa (g):	23,8 g
Dim:	Ø20x20
Quantitat:	4
Fuill:	1/1
Dim:	A4
Escala:	2:1

Toleràncies generals segons ISO 2768-m







Toleràncies generals segons ISO 2768-m

Mòdul	m	1	mm
Núm. de dents	z	17	--
Angle de pressió	α	20	°
Angle helicoidal	β	0	°
Amplada	b	45,1	mm

Nom:		planeta de sortida		Ref:		planeta_2	
Projecte:		D.Caball		Ref. contacte:		93 401 18 01	
Aprovat:		-		Apunts adjunts:		-	
Data:		13/06/2018		Material:		Acer F-155	
Tractament:		Cementació		Acabat:		Rectificat	
Quantitat:		12		Full:		A4	
Escala:		2:1		Massa (g):		60,1 g	
				Dim:		Ø19x45	

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