6. MAC 093

6.1. Technical Data

Designation	Symbol	Unit	Motor type MAC …		
			093 A - • - WS	093 B - • - OS	093 C - • - KS
Nominal motor speed [1]	n	min^{-1}	2000	2000	2000
Continuous torque at standstill [2]	M_{dN}	Nm	9.2 (12.0) [5]	14.5 (20.0) [5]	19.5 (28.0) [5]
Continuous current at standstill	I_{dN}	A	11(14) [5]	18 (25) [5]	22 (32) [5]
Rotor moment of inertia [3]	J_M	kgm^2	22 x 10^{-4}	29 x 10^{-4}	42 x 10^{-4}
Torque constant at 20 °C	K_m	Nm/A	0.875	0.831	0.910
Windings resistance at 20 °C	R_A	Ohm	1.313	0.625	0.433
Windings inductance	L_A	mH	16.0	9.0	7.0
Maximum peak of pulse current	I_{peak}	A	54	89	110
Thermal time constant	T_{th}	min	50 (30) [5]	50 (45) [5]	50 (45) [5]
Mass [4]	m_M	kg	13.0	16.5	22.0
			093 A - • - PS	**093 B - • - JS**	**093 C - • - FS**
Nominal motor speed [1]	n	min^{-1}	3000	3000	3000
Continuous torque at standstill [2]	M_{dN}	Nm	9.2 (12.0) [5]	14.5 (18.3) [5]	19.5 (28.0) [5]
Continuous current at standstill	I_{dN}	A	15 (20) [5]	27 (34) [5]	35 (50) [5]
Rotor moment of inertia [3]	J_M	kgm^2	22 x 10^{-4}	29 x 10^{-4}	42 x 10^{-4}
Torque constant at 20 °C	K_m	Nm/A	0.620	0.554	0.579
Windings resistance at 20 °C	R_A	Ohm	0.659	0.227	0.175
Windings inductance	L_A	mH	8.0	4.0	2.9
Maximum peak of pulse current	I_{peak}	A	76	134	173
Thermal time constant	T_{th}	min	50 (45) [5]	50 (45) [5]	50 (45) [5]
Mass [4]	m_M	kg	13.0	16.5	22.0
			093 A - • - LS	**093 B - • - GS**	**093 C - • - DS**
Nominal motor speed [1]	n	min^{-1}	4000	4000	4000
Continuous torque at standstill [2]	M_{dN}	Nm	9.2 (12.0) [5]	14.5 (20.0) [5]	19.5 (28.0) [5]
Continuous current at standstill	I_{dN}	A	22 (28) [5]	38 (53) [5]	48 (69) [5]
Rotor moment of inertia [3]	J_M	kgm^2	22 x 10^{-4}	29 x 10^{-4}	42 x 10^{-4}
Torque constant at 20 °C	K_m	Nm/A	0.438	0.388	0.413
Windings resistance at 20 °C	R_A	Ohm	0.328	0.136	0.089
Windings inductance	L_A	mH	4.0	2.0	1.5
Maximum peak of pulse current	I_{peak}	A	108	192	242
Thermal time constant	T_{th}	min	50 (45) [5]	50 (45) [5]	50 (45) [5]
Mass [4]	m_M	kg	13.0	16.5	22.0
			093 A - • - HS	**093 B - • - ES**	**093 C - • - CS**
Nominal motor speed [1]	n	min^{-1}	6000	6000	6000
Continuous torque at standstill [2]	M_{dN}	Nm	9.2 (9.8) [5]	14.5 (20.0) [5]	19.5 (28.0) [5]
Continuous current at standstill	I_{dN}	A	32 (34) [5]	54 (74) [5]	60 (87) [5]
Rotor moment of inertia [3]	J_M	kgm^2	22 x 10^{-4}	29 x 10^{-4}	42 x 10^{-4}
Torque constant at 20 °C	K_m	Nm/A	0.292	0.277	0.331
Windings resistance at 20 °C	R_A	Ohm	0.146	0.069	0.057
Windings inductance	L_A	mH	1.8	1.0	0.9
Maximum peak of pulse current	I_{peak}	A	162	268	302
Thermal time constant	T_{th}	min	50 (45) [5]	50 (45) [5]	50 (45) [5]
Mass [4]	m_M	kg	13.0	16.5	22.0

[1] The usable motor speed is determined by the drive used.
Only those usable speeds n_{max} found in the selection lists of the motor-drive combinations are binding.
[2] With 60K overtemperature at the motor housing.
Continuous torque can be limited by the drive. See selection data.
[3] With tacho-generator, without holding brake
[4] With tacho-generator, without holding brake, without blower.
[5] Parenthetical values apply to versions with surface cooling.

Fig 6.1: Type-dependent motor data

Designation	Symbol	Unit	Data	
Permissible ambient temperature	T_{um}	°C	0 … + 45	
Permissible storage and transport temperature	T_L	°C	-20 … +80	
Maximum installation elevation		m	1000 m. above sea level	
Protection category			IP 65	
Insulation classification			F	
Housing coat			Black prime coat (RAL 9005)	
Voltage constant of the tachogenerator [1]	C_w	Vs/rad	0.0143	0.0286
		V/min^{-1}	1.5/1000	3/1000

[1] Tachovoltage can be selected application-related.

Fig 6.2: General data MAC 093

Designation	Symbol	Unit	Data holding brake		
			Standard	heavy-duty	extra heavy-duty
Principle of action			electrically actuated release		
Holding torque	M_H	Nm	6.5	14	22
Nominal voltage	U_N	V	DC 24 ± 10%		
Nominal current	I_N	A	0.7	0.7	0.7
Moment of inertia	J_B	kgm^2	1.06×10^{-4}	3.6×10^{-4}	3.6×10^{-4}
Release delay	t_L	ms	60	70	70
Clamping delay	t_K	ms	20	30	30
Mass	m_B	kg	0.6	1.1	1.1

Fig 6.3: Technical data - holding brake

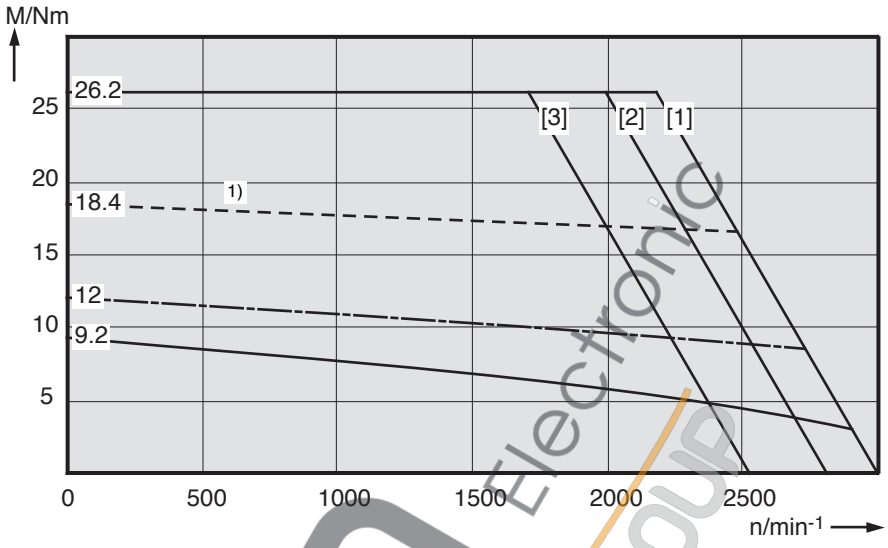
Designation	Symbol	Unit	Axial cooling	Radial cooling
Power consumption	S_N	VA	40/42	40/42
Nominal voltage	U_N	V	AC 230 or 115 [1]	AC 230 or 115 [1]
Frequency	f	Hz	50/60	50/60
Mass	m_L	kg	approx. 3.3 [2]	approx. 3.2 [2]
Protection category blower unit			IP 24	IP 24
Protection category blower motor			IP 44	IP 44

[1] 115 V special design
[2] Blower shroud for motor with tachofeedback.

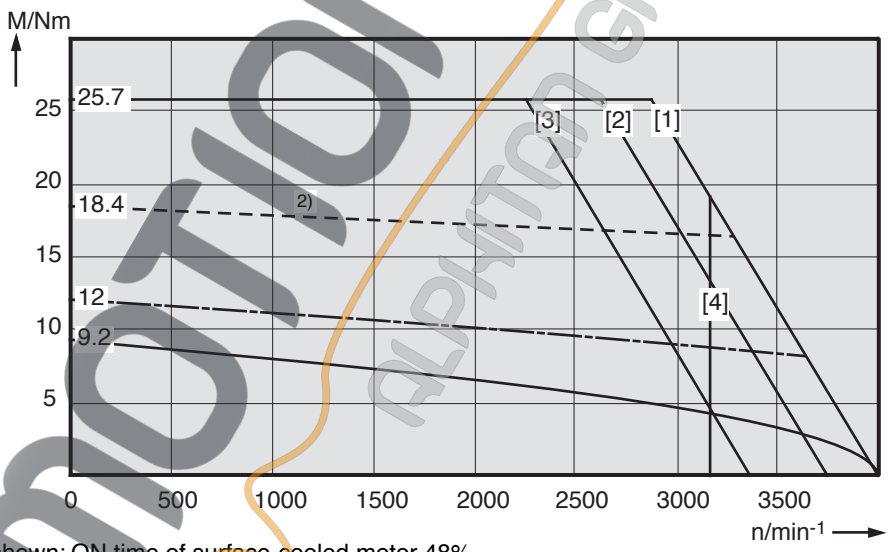
Fig 6.4: Technical data - surface cooling

6.2. Torque-Speed Characteristics

MAC 093 A - • - WS
2000 min^{-1}



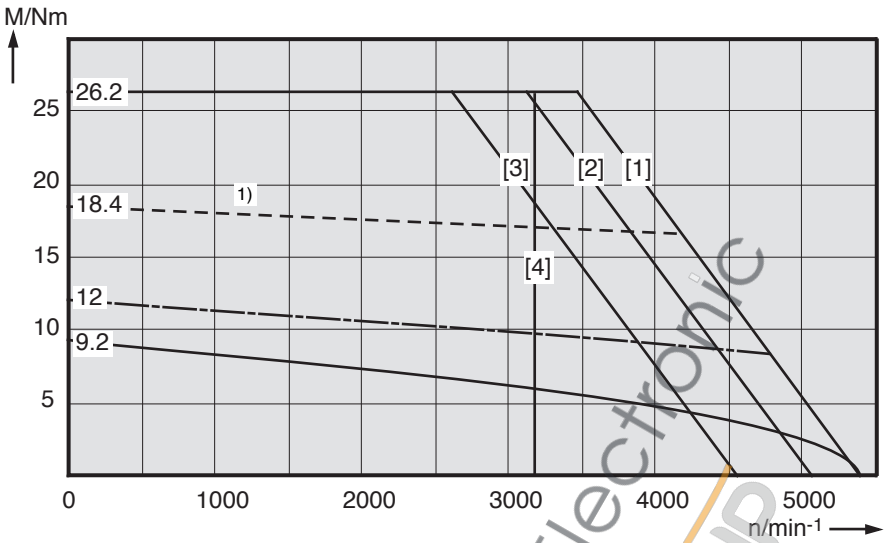
MAC 093 A - • - PS
3000 min^{-1}



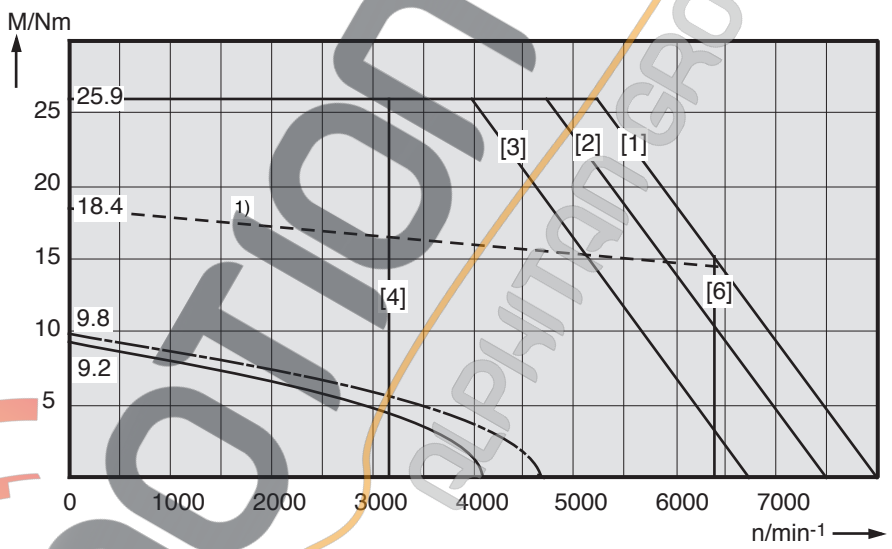
1) shown: ON time of surface-cooled motor 48%
2) shown: ON time of surface-cooled motor 40%

Fig 6.5: Torque-speed characteristics MAC 093

MAC 093 A - • - LS
4000 min^{-1}



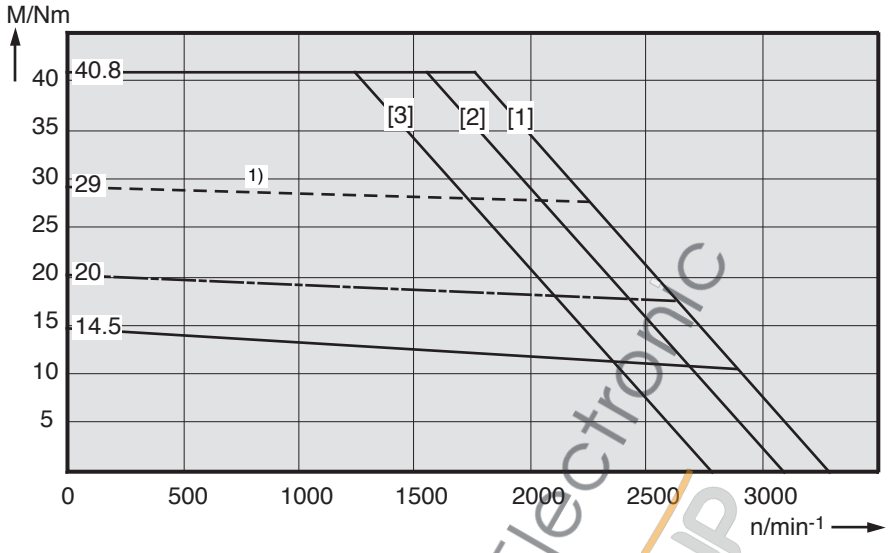
MAC 093 A - • - HS
6000 min^{-1}



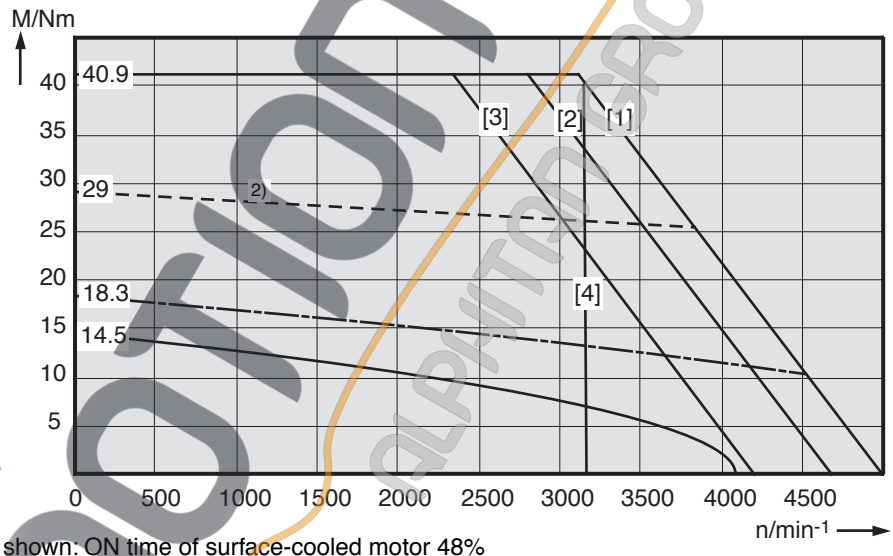
1) shown: ON time of surface-cooled motor 48%

Fig 6.6: Torque-speed characteristics MAC 093

MAC 093 B - • - OS
2000 min^{-1}



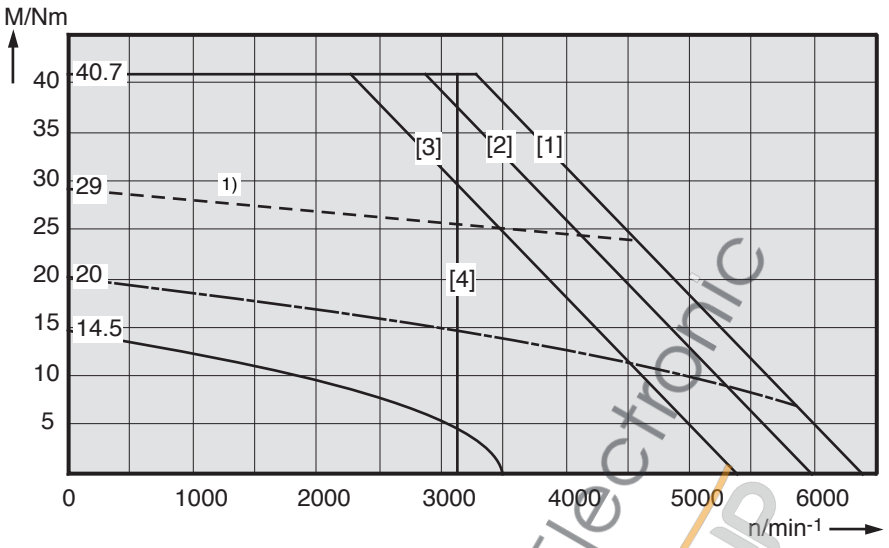
MAC 093 B - • - JS
3000 min^{-1}



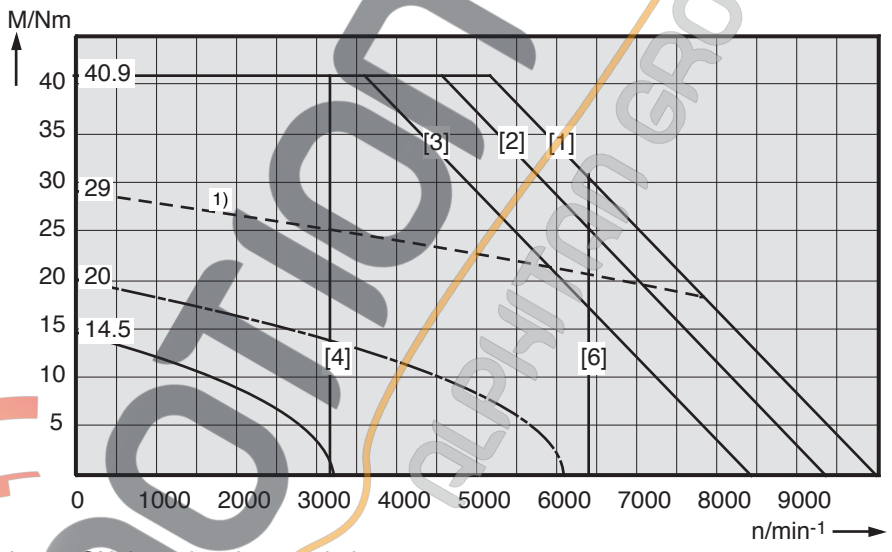
1) shown: ON time of surface-cooled motor 48%
1) shown: ON time of surface-cooled motor 40%

Fig 6.7: Torque-speed characteristics MAC 093

MAC 093 B - • - GS
4000 min^{-1}



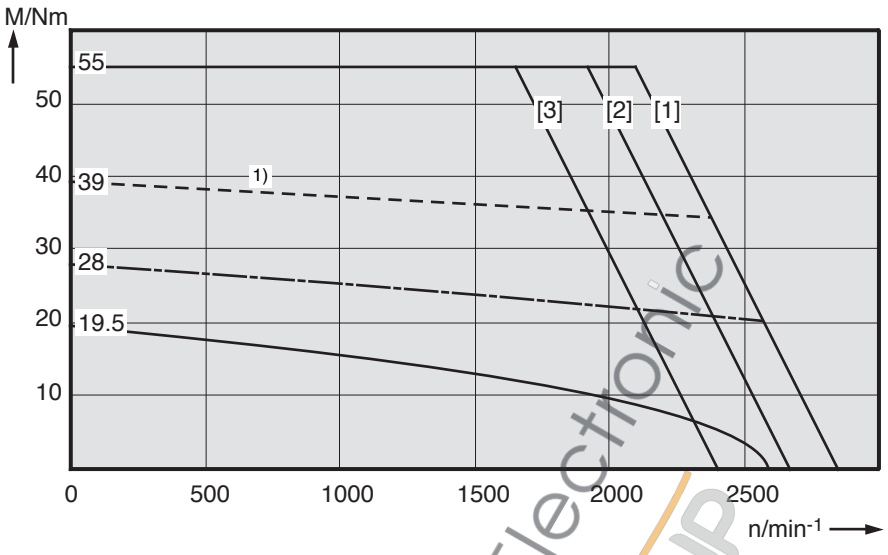
MAC 093 B - • - ES
6000 min^{-1}



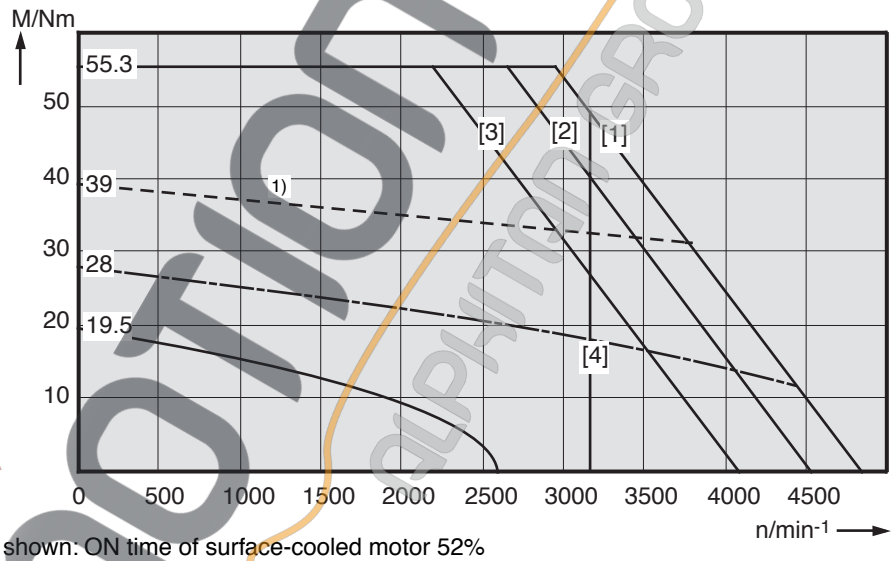
1) shown: ON time of surface-cooled motor 48%

Fig 6.8: Torque-speed characteristics MAC 093

MAC 093 C - • - KS
2000 min^{-1}



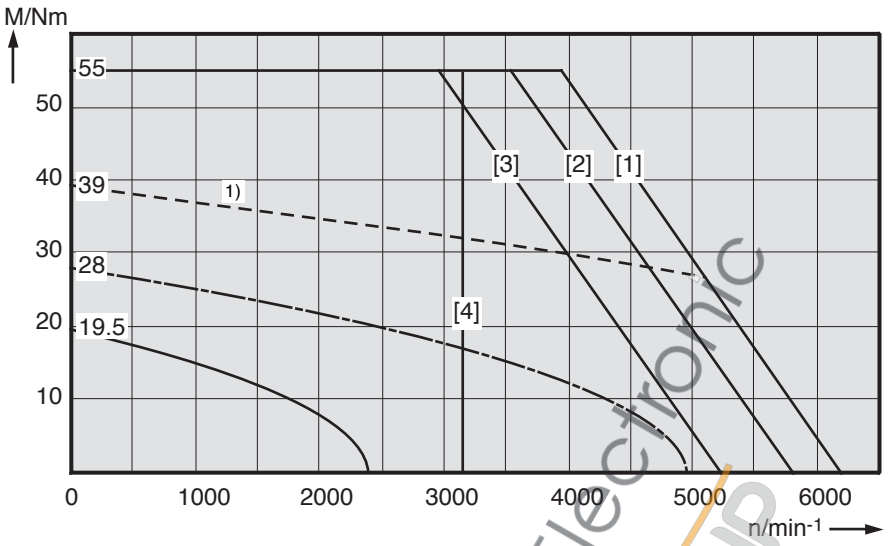
MAC 093 C - • - FS
3000 min^{-1}



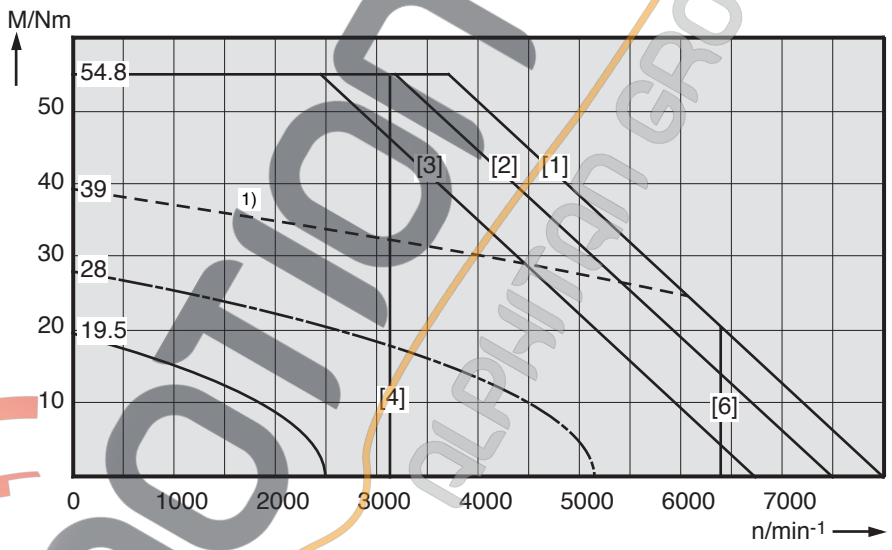
1) shown: ON time of surface-cooled motor 52%

Fig 6.9: Torque-speed characteristics MAC 093

MAC 093 C - • - DS
4000 min^{-1}



MAC 093 C - • - CS
6000 min^{-1}



1) shown: ON time of surface-cooled motor 52%

Fig 6.10: Torque-speed characteristics MAC 093

6.3. Shaft load capacity

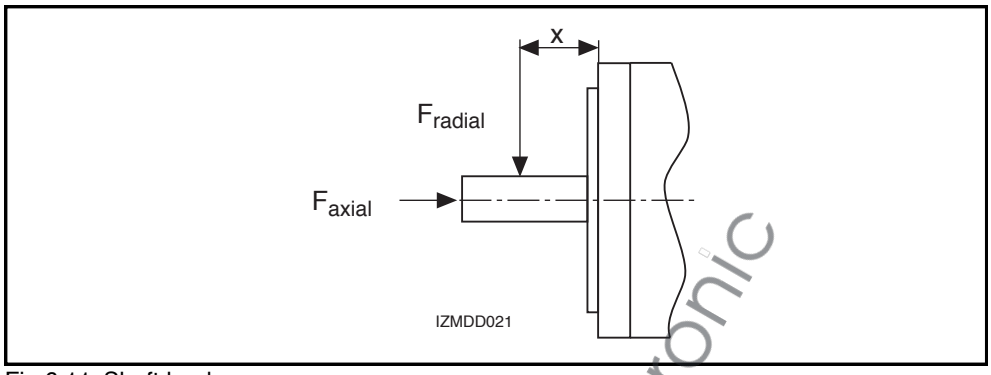


Fig 6.11: Shaft load

Permissible radial force
F_{radial}

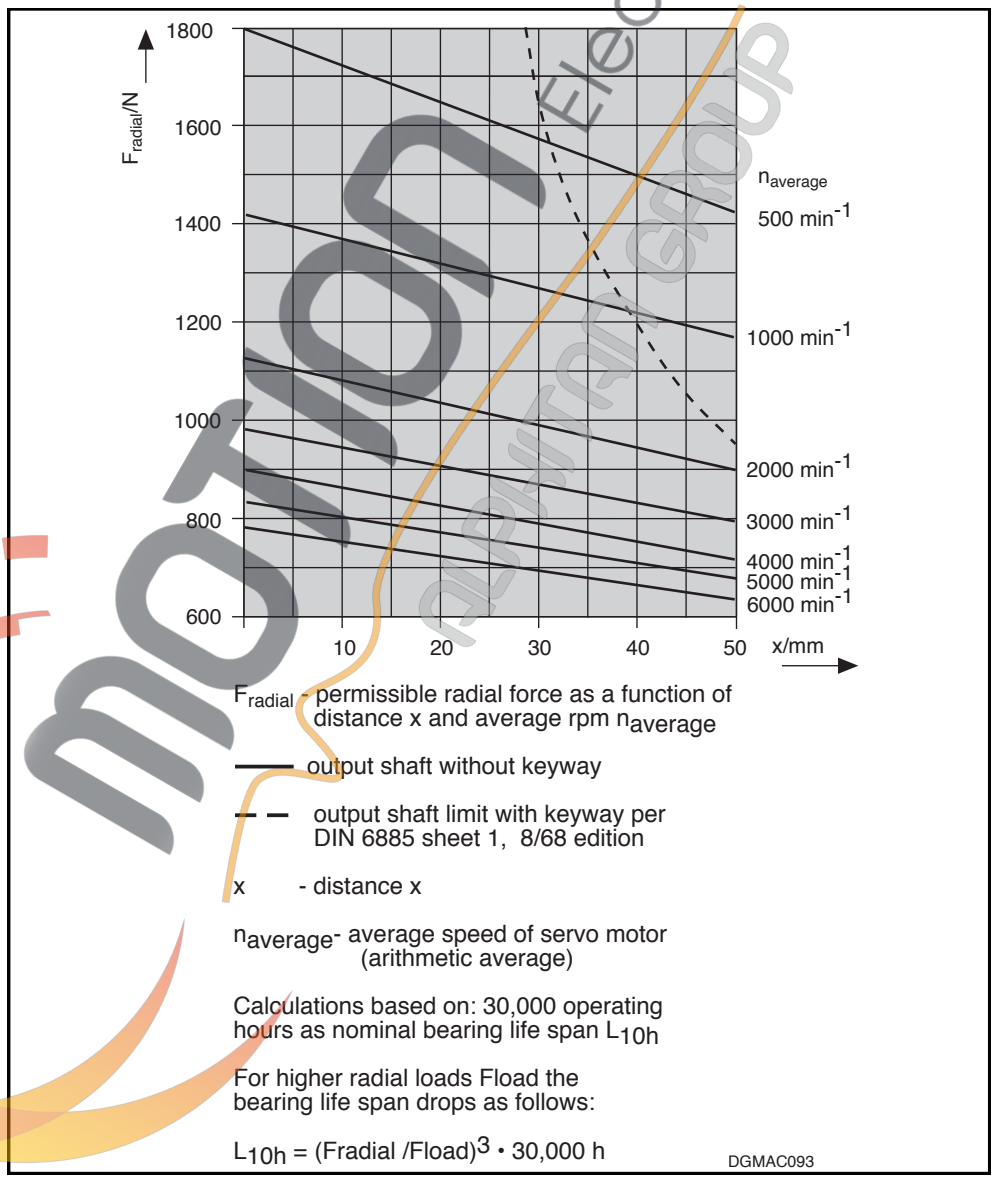


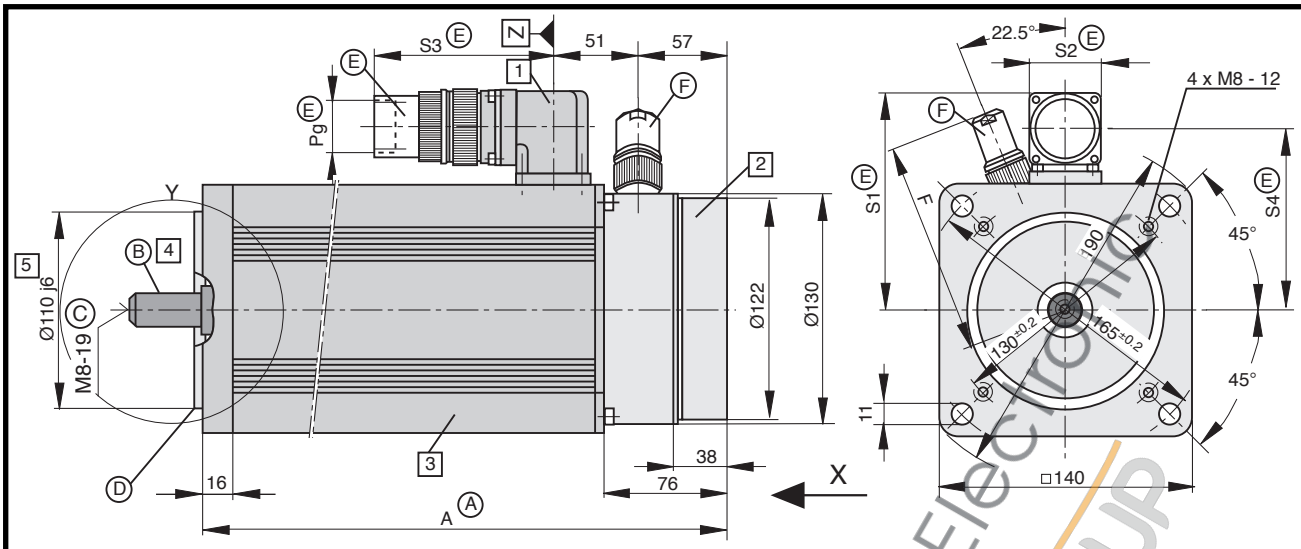
Fig 6.12: Permissible radial force

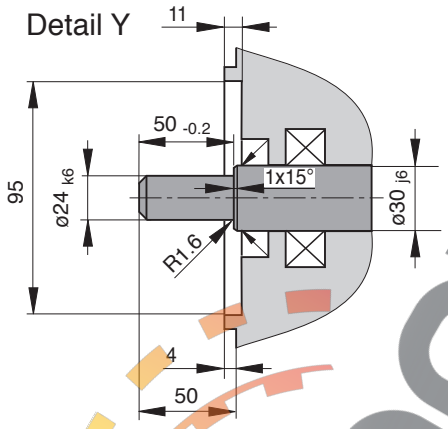
Permissible axial force
F_{axial}

$$F_{axial} = 0.34 \cdot F_{radial}$$

F_{axial} - Permissible axial force
F_{radial} - Permissible radial force

6.4. Dimensional data - natural convection





Ⓒ
- Shaft end per DIN 748 section 3, 7/75 edition, IEC 72, 1971 edition, cylindrical
- Center spigot DS M8-19 per DIN 332 section 2, 5/83 edition
- Max. tightening torque M_A for screws in the threads of the center spigot: 5Nm

Ⓓ Flange type per DIN 42948, 11/65 edition, makes mounting possible
- as per design B5 (throughhole in flange)
- as per design B14 (threads in flange)

Ⓔ **Motor power connector**
Must be ordered separately.

Table:

Type	S1	S2	S3	S4	Pg
INS 108 3)	122	42	100	107	21
INS 172 2)	135	53	145	109	36

2) with MAC 093 B-0-GS, MAC 093 B-0-ES
MAC 093 C-0-FS, MAC 093 C-0-DS
MAC 093 C-0-CS

3) other MAC 093 •-•-•

Ⓐ **Dimensional table Dim. A**

Size \ Dim.	A 1)
MAC 093 A	275
MAC 093 B	316
MAC 093 C	375

1) Bigger with some options. The then applicable dimension is indicated under the respective feature.

Ⓑ Position accuracy in terms of concentricity, excentricity and coaxiality to the shaft per DIN 42955, tolerance class N, 12/81 edition.

Ⓕ **Tachofeedback connector:**
Must be ordered separately.

Table

Name	Conn. type	Dim. F
straight connector	INS 302 INS 102	123 125
angle conn. 4)	INS 352 INS 312	121

4) Cannot be used in motors with power connector INS 172 and a power connector mounting direction towards side B.

MB093-0/1

Fig 6.13: Dimensional data - MAC 093 (natural convection)

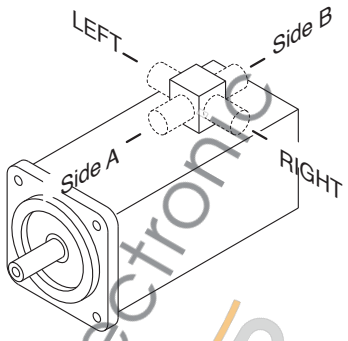
Available options

1 Power connection

The output direction of the electrical power connector is selected at the time the order is placed. Possible output directions are:

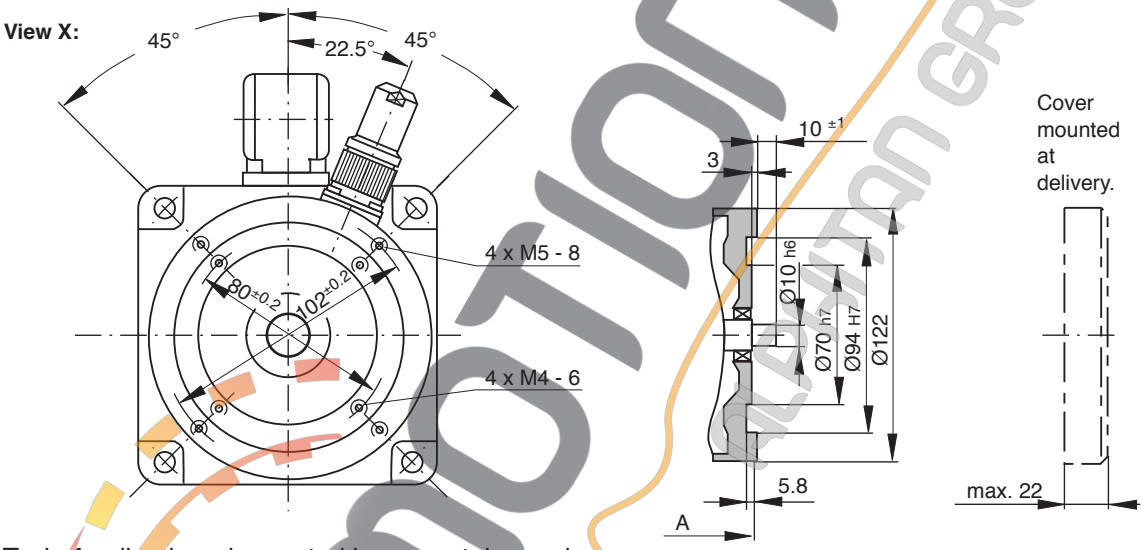
- to side A
- to side B
- to the right
- to the left

The drawing depicts side A as output direction. The dimensions of any other direction are obtained by a virtual turning of the connector housing around the Z axis.

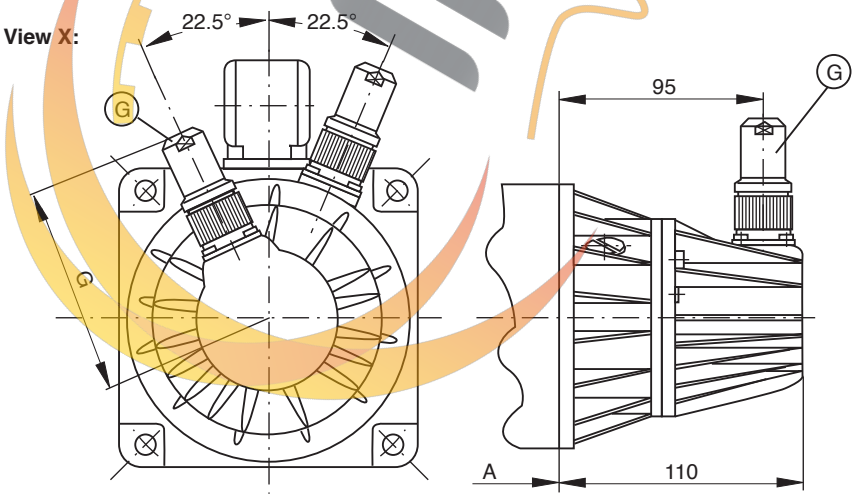


2 Motor version

- Tachofeedback and second shaft end



- Tachofeedback and mounted incremental encoder



G Incremental encoder connector

Must be ordered separately.

Name	Conn. type	Dim. G
straight conn.	INS 301 INS 101	88 90
angle conn.	INS 351 INS 311	86

- Tachofeedback and mounted absolute encoder (see following page)

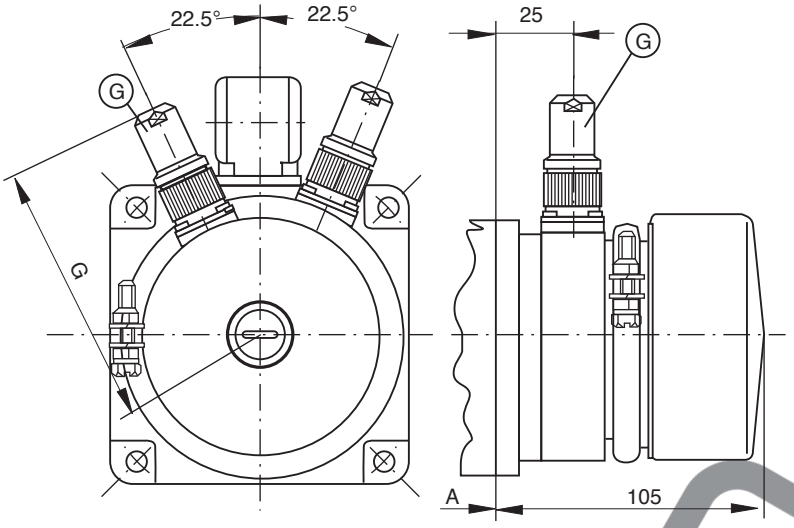
MB093-0/2

Fig 6.14: Dimensional data - MAC 093 - available options - (natural convection)

Available options

• Tachofeedback and mounted absolute encoder

View X:



Ⓖ **Absolute encoder conn.**
Must be ordered separately.

Name	Conn. type	Dim. G
straight conn.	INS 326 INS 92	104 106
angle conn.	INS 322	102

3 Blocking brake

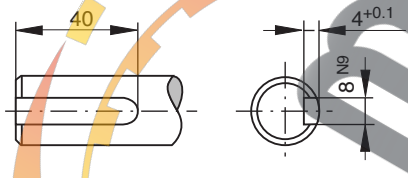
- without blocking brake
  Dim. A retained
- Standard blocking brake: 6.5 Nm
  Dim. A. retained
- heavy-duty blocking brake: 14.0 Nm
- extra heavy-duty blocking brake: 22.0 Nm

Table for blocking brake with 14 and 22 Nm

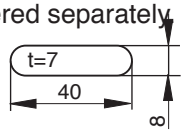
Size \ Dim.	A
MAC 093 A	305
MAC 093 B	346
MAC 093 C	405

4 Output shaft

- plain shaft (recommended type)
- with keyway per DIN 6885 sh. 1, 8/68 edition
  (Note! balanced with entire key.)



Matching key: DIN 6885-A 8 x 7 x 40
Must be ordered separately



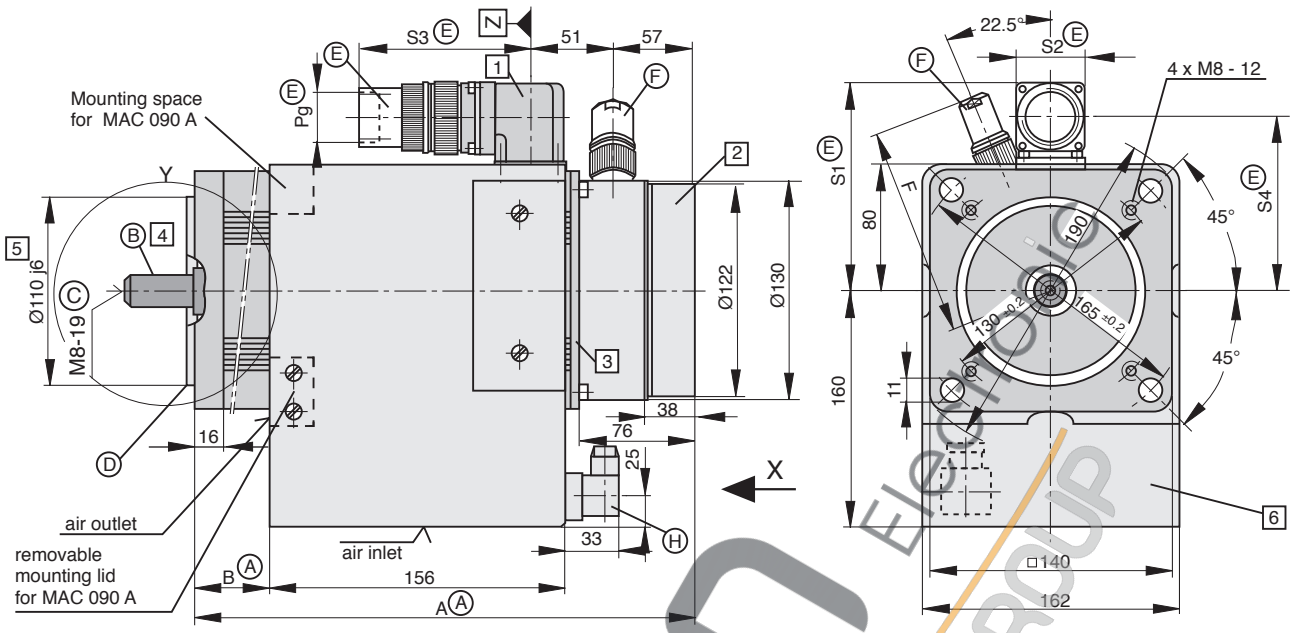
5 Special centering diameter

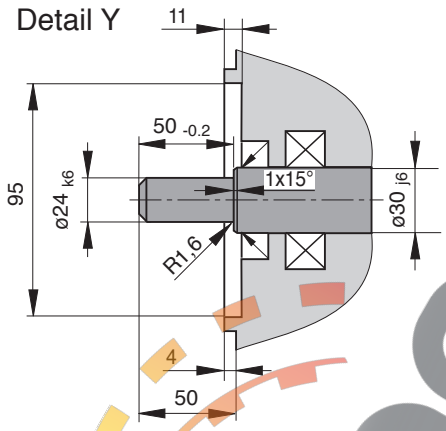
- Ø130 j6

MB093-0/3

Fig 6.15: Dimensional data - MAC 093 - available options - (natural convection)

6.5. Dimensional data - radial cooling





Ⓒ
- Shaft end per DIN 748 section 3, 7/75 edition, IEC 72, 1971 edition, cylindrical
- Center spigot DS M8-19 per DIN 332 section 2, 5/83 edition
- Max. tightening torque M_A for screws in the threads of the center spigot: 5Nm

Ⓓ Flange type per DIN 42948, 11/65 edition, makes mounting possible
- as per design B5 (throughhole in flange)
- as per design B14 (threads in flange)

Ⓔ **Motor power connector**
Must be ordered separately.

Ⓐ **Dimensional table**

Size \ Dim.	A [1]	B [1]
MAC 093 A	275	76
MAC 093 B	316	73
MAC 093 C	375	132

[1] Bigger with some options. The then applicable dimension is indicated under the respective feature.

Ⓑ Position accuracy in terms of concentricity, excentricity and coaxiality to the shaft per DIN 42955, tolerance class N, 12/81 edition.

Ⓗ **Blower connector: INS 195**
Must be ordered separately.

Table

Type \ Dim.	S1	S2	S3	S4	Pg
INS 108 [3]	122	42	100	107	21
INS 172 [2]	135	53	145	109	36

[2] with MAC 093 B-•-GS, MAC 093 B-•-ES, MAC 093 C-•-FS, MAC 093 C-•-DS, MAC 093 C-•-CS

[3] Other MAC093 •-•-•

Ⓕ **Tachofeedback connector:**
Must be ordered separately.

Table

Name	Conn. type	Dim. F
straight connector	INS 302 INS 102	123 125
angle conn. [4]	INS 352 INS 312	121

MB093-1rad/1

[4] Not for use in motors with power connector INS 172 and power connector mounting direction towards side B.

Fig 6.16: Dimensional data - MAC 093 (radial cooling)

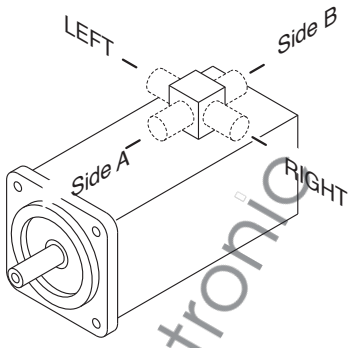
Available options

1 Power connection

The output direction of the electrical power connector is selected at the time the order is placed. Possible output directions are:

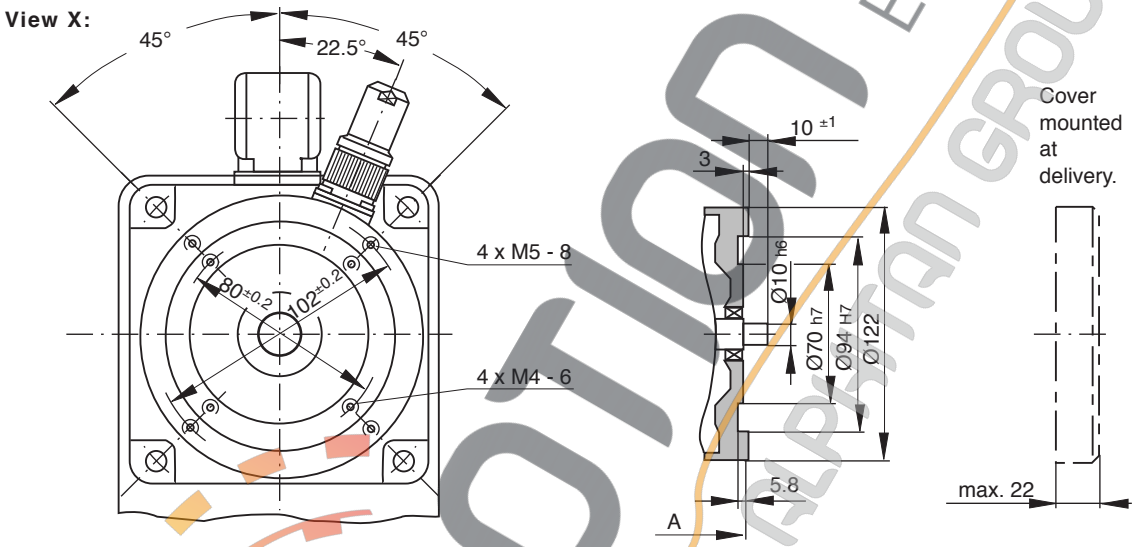
- to side A
- to side B
- to the right
- to the left

The drawing depicts side A as output direction. The dimensions of any other direction are obtained by a virtual turning of the connector housing around the Z axis.

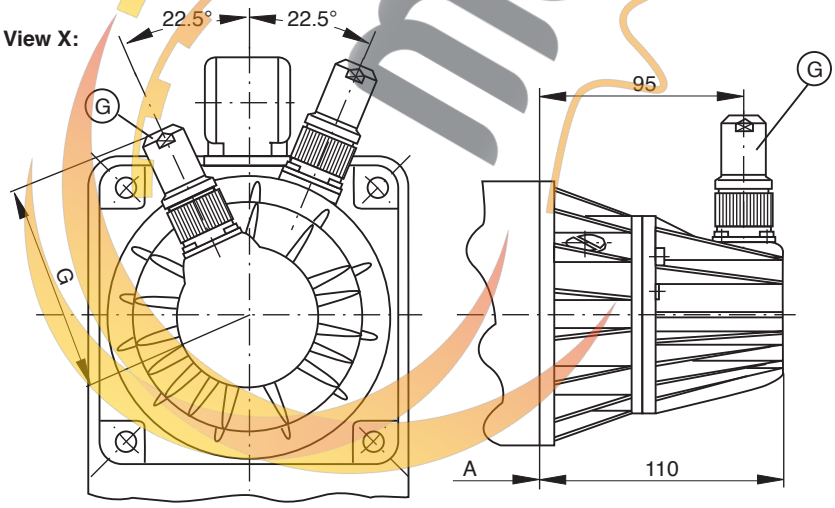


2 Motor version

- Tachofeedback and second shaft end



- Tachofeedback and mounted incremental encoder



G Incremental encoder connector

Must be ordered separately.

Name	Conn. type	Dim. G
straight conn.	INS 301 INS 101	88 90
angle conn.	INS 351 INS 311	86

- Tachofeedback and mounted absolute encoder (see following page)

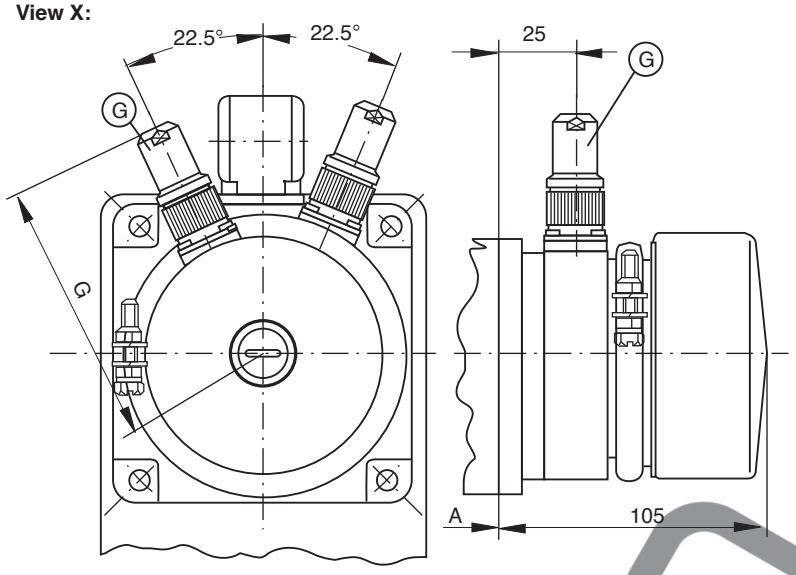
MB090-1rad/2

Fig 6.17: Dimensional data - MAC 093 - available options - (radial cooling)

Available options

• Tachofeedback and mounted absolute encoder

View X:



Ⓖ **Absolute encoder conn.**
Must be ordered separately.

Name	Conn. type	Dim. G
straight conn.	INS 326 INS 92	104 106
angle conn.	INS 322	102

3 Blocking brake

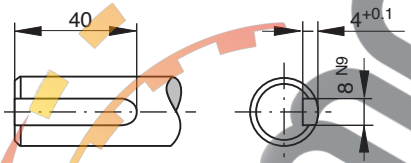
- without blocking brake
  Dim. A and B retained
- Standard blocking brake: 6.5 Nm
  Dim. A and B retained
- heavy-duty blocking brake: 14.0 Nm
- extra heavy-duty blocking brake: 22.0 Nm

Table for blocking brake with 14 and 22 Nm

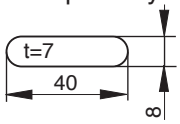
Size / Dim.	A	B
MAC 093 A	305	106
MAC 093 B	346	103
MAC 093 C	405	162

4 Output shaft

- plain shaft (recommended type)
- with keyway per DIN 6885 sh. 1, 8/68 edition
  (Note! balanced with entire key.)



Matching key: DIN 6885-A 8 x 7 x 40
Must be ordered separately.

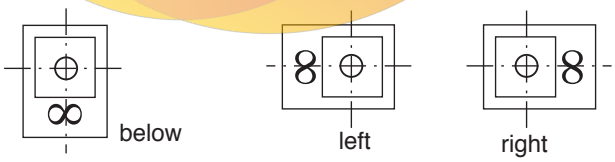


5 Special centering diameter

- Ø130 j6

6 Blower arrangement

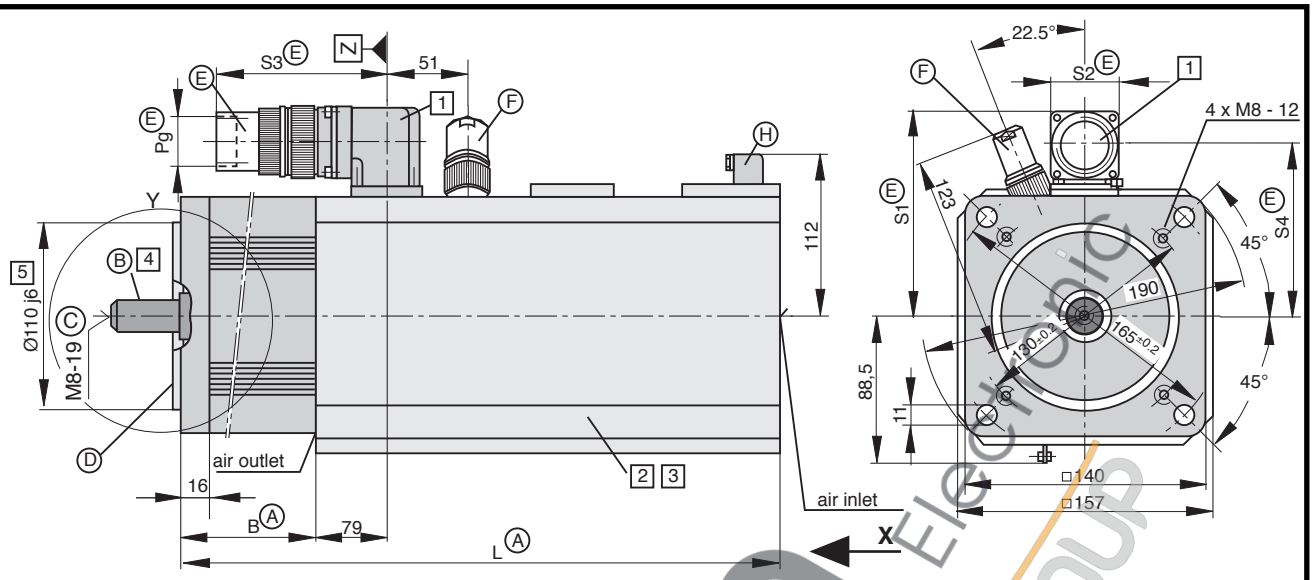
Looking towards motor shaft.

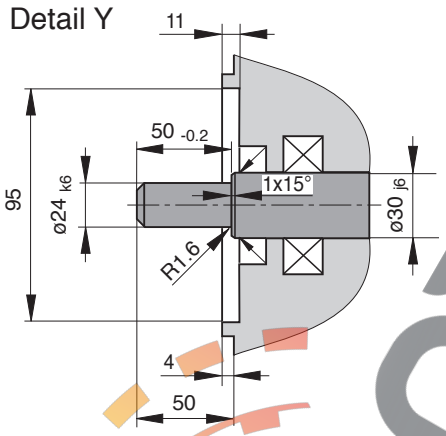


MB093-1rad/3

Fig 6.18: Dimensional data - MAC 093 - available options - (radial cooling)

6.6. Dimensional Data - Axial Cooling





Ⓒ
- Shaft end per DIN 748 section 3, 7/75 edition, IEC 72, 1971 edition, cylindrical
- Center spigot DS M8-19 per DIN 332 section 2, 5/83 edition
- Max. tightening torque M_A for screws in the threads of the center spigot: 5Nm

Ⓓ Flange type per DIN 42948, 11/65 edition, makes mounting possible
- as per design B5 (throughhole in flange)
- as per design B14 (threads in flange)

Ⓔ **Motor power connector**
Must be ordered separately.

Table

Type \ Dim.	S1	S2	S3	S4	Pg
INS 108 [3]	122	42	100	107	21
INS 172 [2]	135	53	145	109	36

[2] with MAC 093 B-•-GS, MAC 093 B-•-ES, MAC 093 C-•-FS, MAC 093 C-•-DS, MAC 093 C-•-CS

[3] other MAC093 •-•-•

Ⓐ **Dimensional table**

Size \ Dim.	A [1]	B [1]
MAC 093 A	354	89
MAC 093 B	395	130
MAC 093 C	454	189

[1] Bigger with some options. The then applicable dimension is indicated under the respective feature.

Ⓑ Position accuracy in terms of concentricity, excentricity and coaxiality to the shaft per DIN 42955, tolerance class N, 12/81 edition.

Ⓕ **Tachofeedback connector:**
Must be ordered separately;
types INS 302 or INS 102

Ⓗ **Blower connector: INS 195**
Must be ordered separately.

MB093-1/1

Fig 6.19: Dimensional data - MAC 093 (axial cooling)

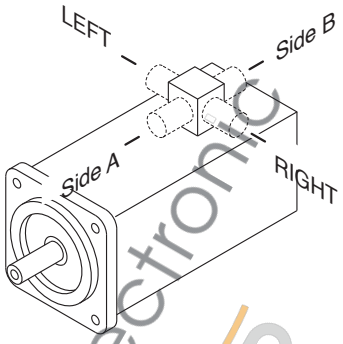
Available options

1 Power connection

The output direction of the electrical power connector is selected at the time the order is placed. Possible output directions are:

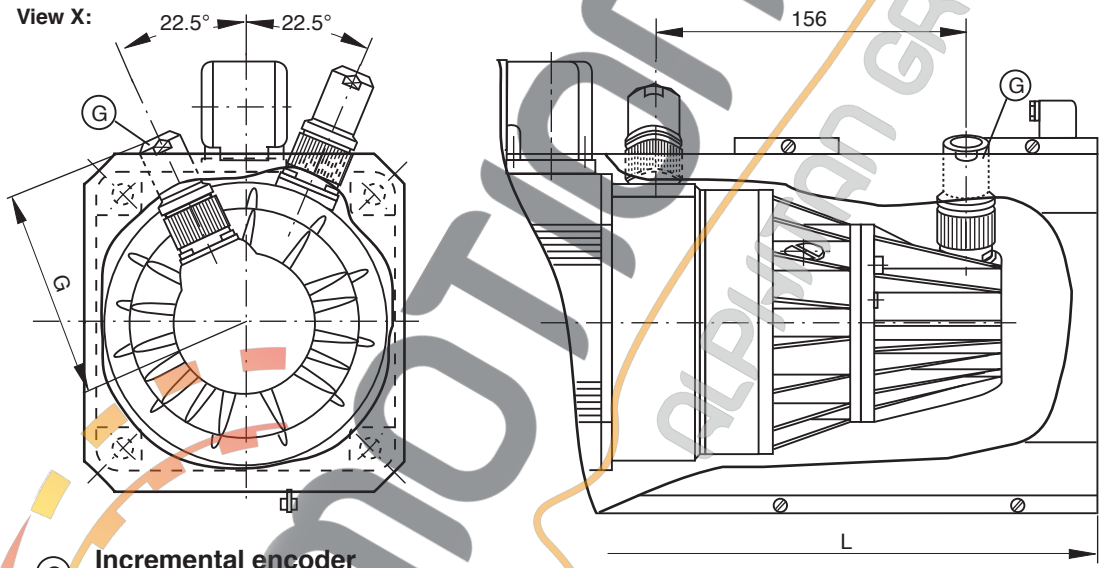
- to side A
- to side B
- to the right
- to the left

The drawing depicts side A as output direction. The dimensions of any other direction are obtained by a virtual turning of the connector housing around the Z axis.



2 Motor version

- Tachofeedback and mounted incremental encoder



G Incremental encoder connector

Must be ordered separately.

Name	Conn. type	Dim. G
straight conn.	INS 301	123
	INS 101	125

Table:

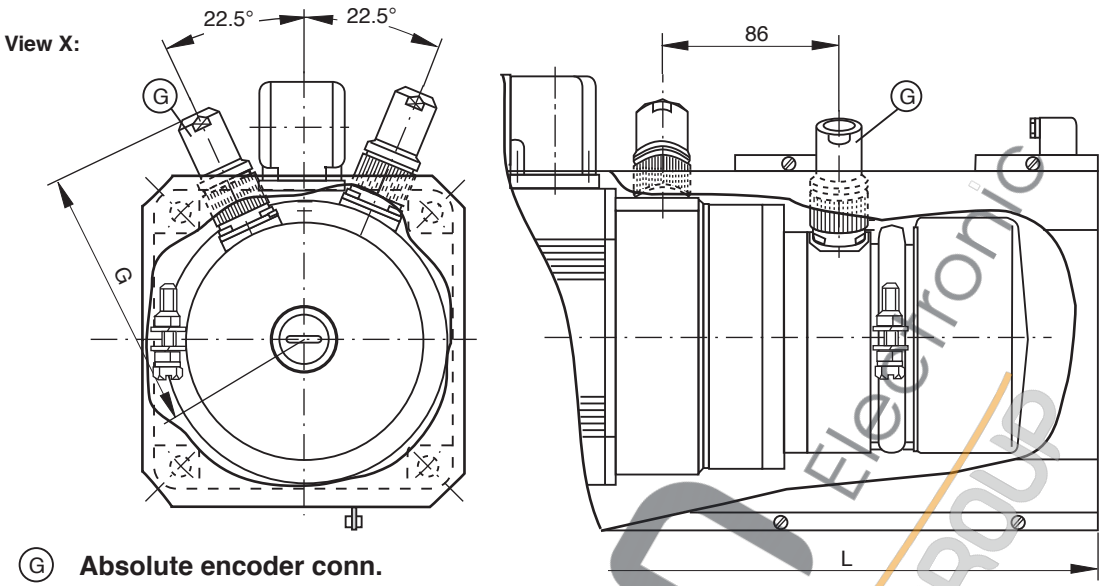
Size \ Dim.	L	B
MAC 093 A	454	89
MAC 093 B	495	130
MAC 093 C	554	189

MB093-1/2

Fig 6.20: Dimensional data - MAC 093 - available options - (axial cooling)

Available options

• Tachofeedback and mounted absolute encoder



Ⓖ **Absolute encoder conn.**
Must be ordered separately.

Name	Conn. type	Dim. G
straight conn.	INS 326 INS 92	104 106

Size \ Dim.	L	B
MAC 093 A	454	89
MAC 093 B	495	130
MAC 093 C	554	189

3 Blocking brake

- without blocking brake
  Dim. L and B retained
- Standard blocking brake: 6.5 Nm
  Dim. L and B retained
- heavy-duty blocking brake: 14.0 Nm
- extra heavy-duty blocking brake: 22.0 Nm

Table for blocking brake with 14 and 20 Nm

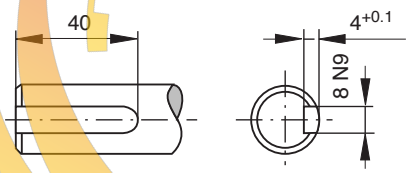
Size \ Dim.	Vers. 2 L	Vers. 2 B	Vers. 4 L	Vers. 4 B
MAC 093 A	384	119	484	119
MAC 093 B	425	160	525	160
MAC 093 C	484	219	584	219

Vers. 2 =
Motor with tachofeedback

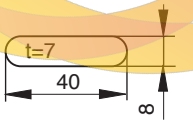
Vers. 4 =
Motor with tachofeedback and mounted encoder

4 Output shaft

- plain shaft (recommended type)
- with keyway per DIN 6885 sh. 1, 8/68 edition
  (Note! balanced with entire key.)



Matching key: DIN 6885-A 8 x 7 x 50
Must be ordered separately.



5 Special centering diameter

- Ø130 j6

MB093-1/3

Fig 6.21: Dimensional data - MAC 093 - available options - (axial cooling)

6.7. Available Options

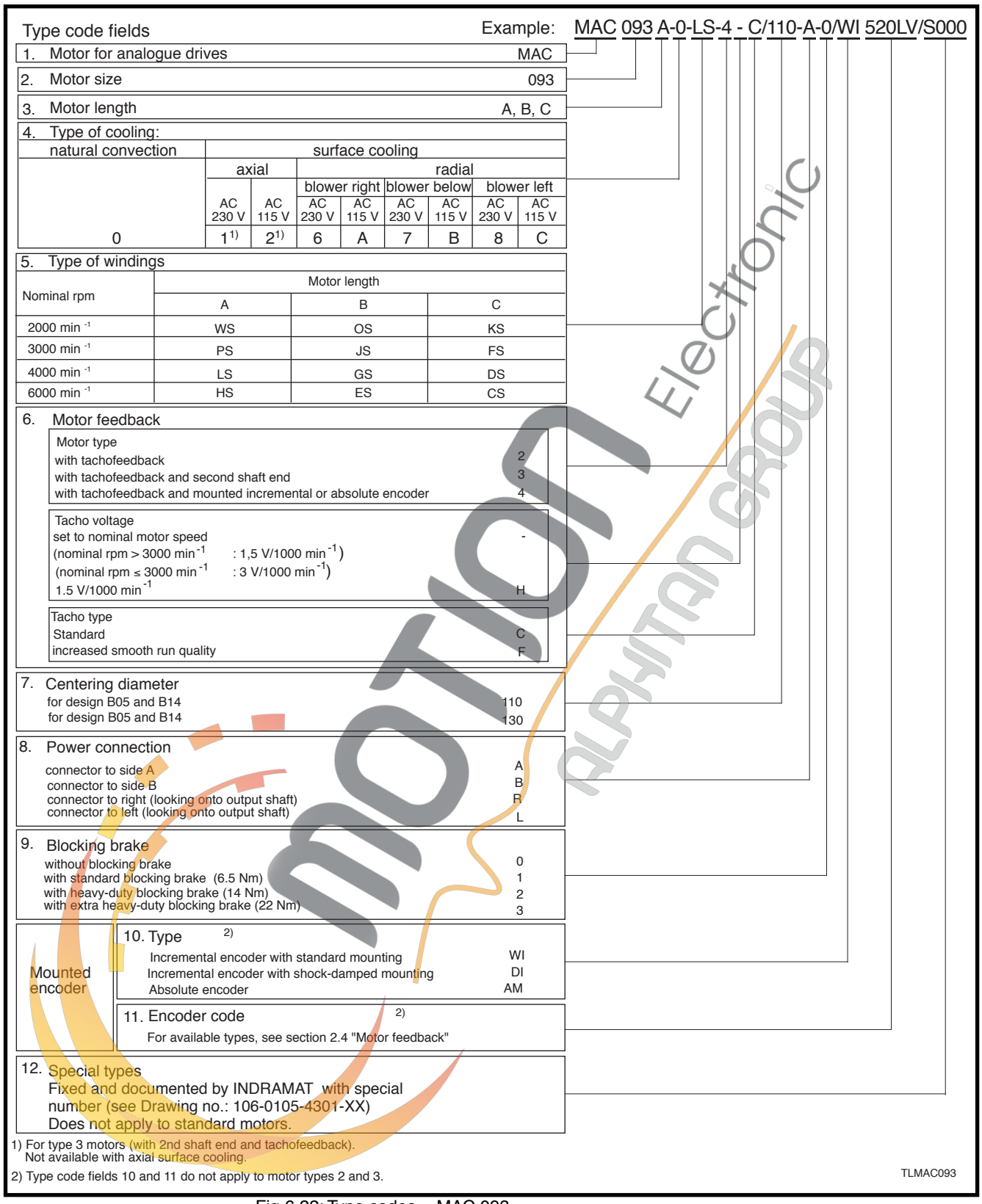


Fig 6.22: Type codes - MAC 093

6.8. Special Options

Specification of Option	S005
with keyway per DIN 6885, sheet 1	X

Fig 6.23: Special options with a MAC 093