5. MAC 090

5.1. Technical Data

Designation	Symbol	Unit	Motor type MAC ...			
			090 A - • - Z •	090 B - • - P •	090 C - • - K •	090 C - • - ED
Nominal motor speed [1]	n	min^{-1}	2000	2000	2000	5000
Continuous torque at standstill [2]	M_{dN}	Nm	3.7 (5.0) [5]	7.2 (10.5) [5]	10.4 (16.0) [5]	10.0 (16.0) [5]
Continuous current at standstill	I_{dN}	A	8.1(10.9) [5]	11.9 (17.4) [5]	17.0 (26.1) [5]	35.0 (52.0) [5]
Rotor moment of inertia [3]	J_M	kgm^2	20 x 10^{-4}	36 x 10^{-4}	53 x 10^{-4}	53 x 10^{-4}
Torque constant at 20 °C	K_m	Nm/A	0.51	0.67	0.68	0.31
Windings resistance at 20 °C	R_A	Ohm	1.85	0.97	0.60	0.12
Windings inductance	L_A	mH	1.9	5.1	3.6	0.8
Maximum peak of pulse current	I_{peak}	A	53	86	125	270
Thermal time constant	T_{th}	min	45 (30) [5]	60 (45) [5]	60 (45) [5]	60 (45) [5]
Mass [4]	m_M	kg	12.5	18	23	23
			090 A - • - R •	090 B - • - N •	090 B - • - J •	090 C - • - G •
Nominal motor speed [1]	n	min^{-1}	3000	3000	3000	3000
Continuous torque at standstill [2]	M_{dN}	Nm	3.5 (5.0) [5]	6.7 (10.5) [5]	6.7 (10.5) [5]	9.6 (16.0) [5]
Continuous current at standstill	I_{dN}	A	11.4 (16.3) [5]	13.0 (20.0) [5]	18.2 (28.5) [5]	24.8 (41.3) [5]
Rotor moment of inertia [3]	J_M	kgm^2	20 x 10^{-4}	36 x 10^{-4}	36 x 10^{-4}	53 x 10^{-4}
Torque constant at 20 °C	K_m	Nm/A	0.34	0.58	0.41	0.43
Windings resistance at 20 °C	R_A	Ohm	0.56	0.75	0.38	0.24
Windings inductance	L_A	mH	3.2	3.9	2.0	1.5
Maximum peak of pulse current	I_{peak}	A	76	98	137	196
Thermal time constant	T_{th}	min	45 (30) [5]	60 (45) [5]	60 (45) [5]	60 (45) [5]
Mass [4]	m_M	kg	12.5	18	18	23

[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 5.1: 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	0.0572
		V/min^{-1}	1.5/1000	3/1000	6/1000 [2]

[1] Tachovoltage can be selected application-related.
[2] If the 6 V/1000 min^{-1t} tachometer is used, then the maximum usable speed is limited to 1600 min^{-1}.

Fig 5.2: General data MAC 090

Designation	Symbol	Unit	Data holding brake		
			Standard		heavy-duty
Principle of action				electrically-actuated release	
Holding torque	M_H	Nm	6.5		14
Nominal voltage	U_N	V		DC 24 ± 10%	
Nominal current	I_N	A	0.7		0.7
Moment of inertia	J_B	kgm^2	1.06×10^{-4}		3.6×10^{-4}
Release delay	t_L	ms	60		70
Clamping delay	t_K	ms	20		30
Mass	m_B	kg	0.5		0.5

Fig 5.3: Technical data - holding brake

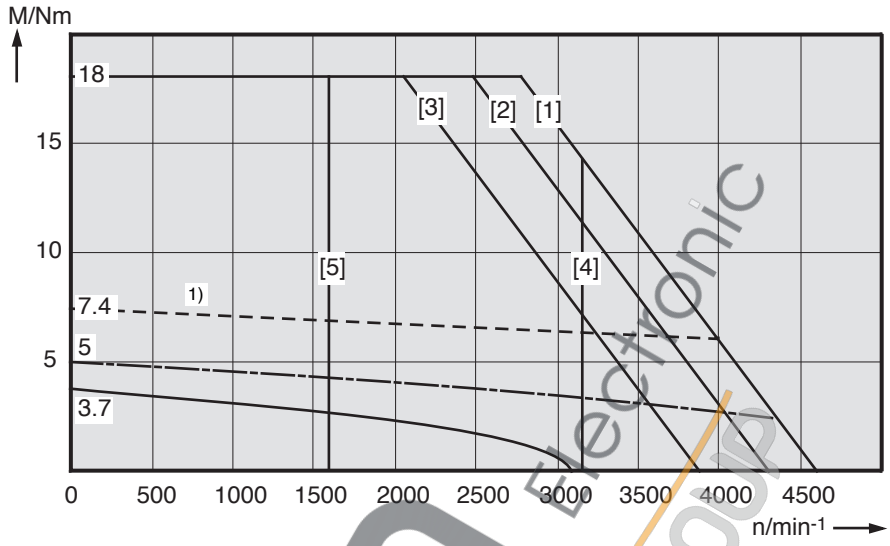
Designation	Symbol	Unit	Data surface cooling	
			Axial cooling	Radial cooling
Power consumption	S_N	VA	40/42	40/42
Nominal voltage	U_N	V	AC 230 or 115 [1]	AC 230 or 115 [1]
Frequency	f	Hz	50/60	50/60
Mass	m_L	kg	approx. 3.3 [2]	approx. 3.2 [2]
Protection category blower unit			IP 24	IP 24
Protection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

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

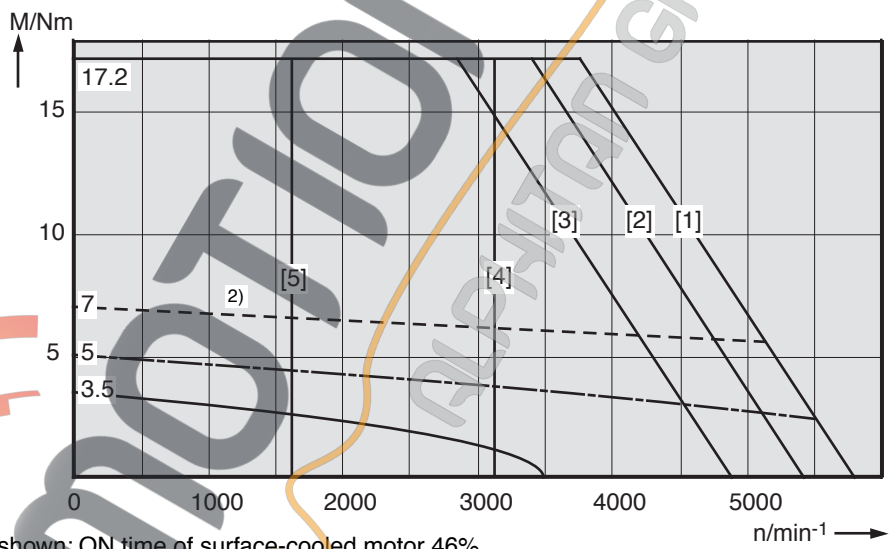
Fig 5.4: Technical data - surface cooling

5.2. Torque-Speed Characteristics

MAC 090 A - • - Z • 2000 min^{-1}



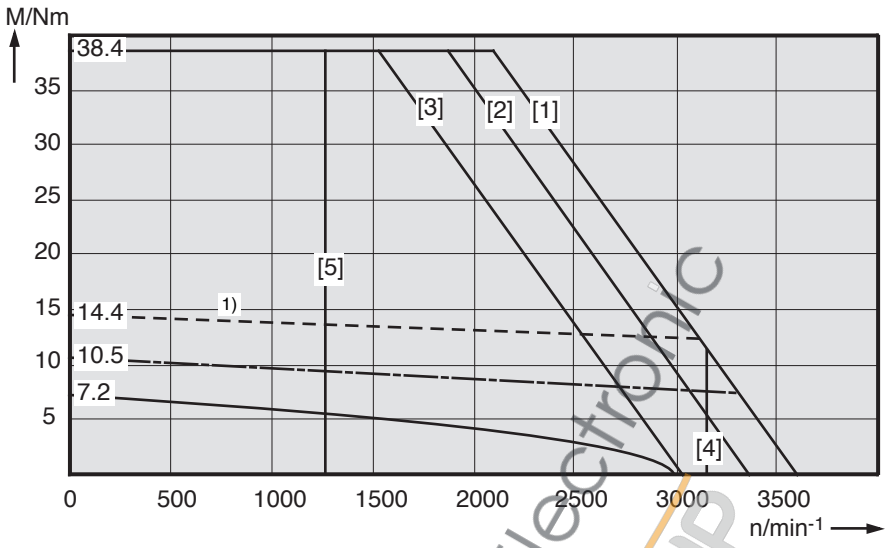
MAC 090 A - • - R • 3000 min^{-1}



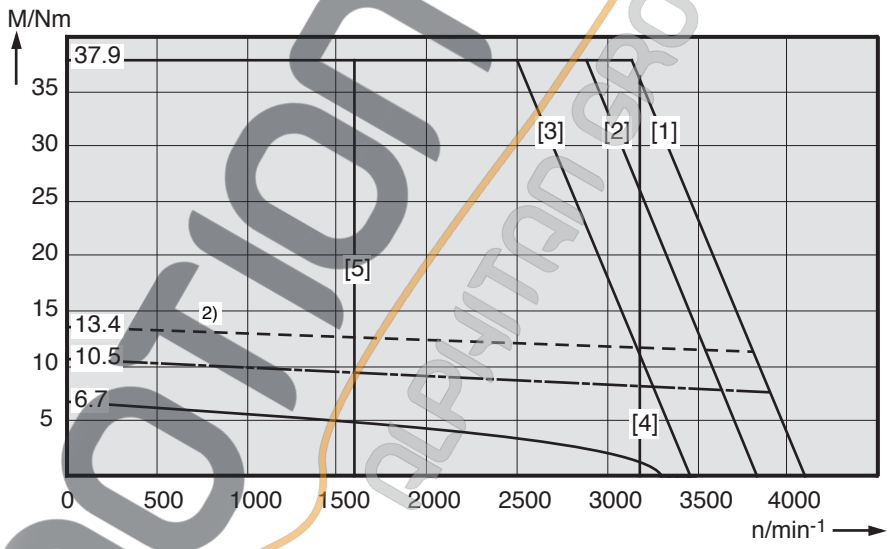
1) shown: ON time of surface-cooled motor 46%
2) shown: ON time of surface-cooled motor 51%

Fig 5.5: Torque-speed characteristics MAC 090

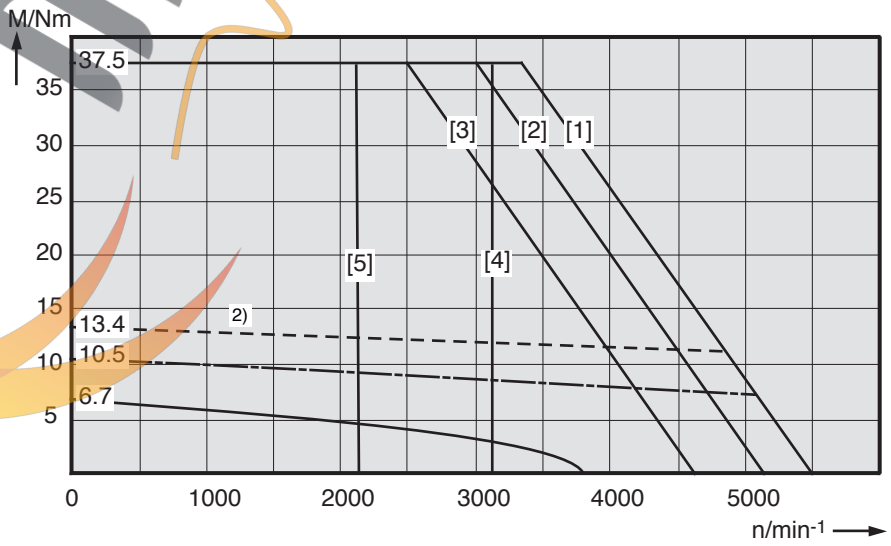
MAC 090 B - • - P •
2000 min^{-1}



MAC 090 B - • - N •
3000 min^{-1}



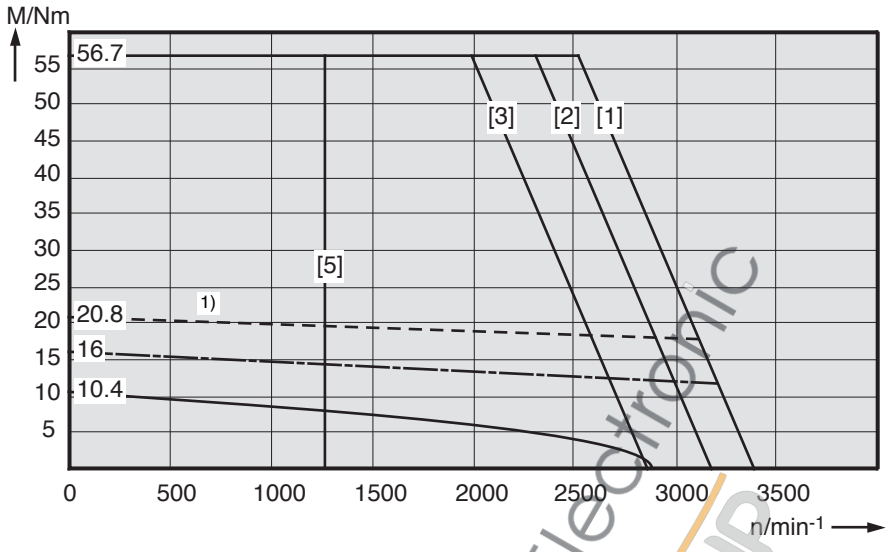
MAC 090 B - • - J •
3000 min^{-1}



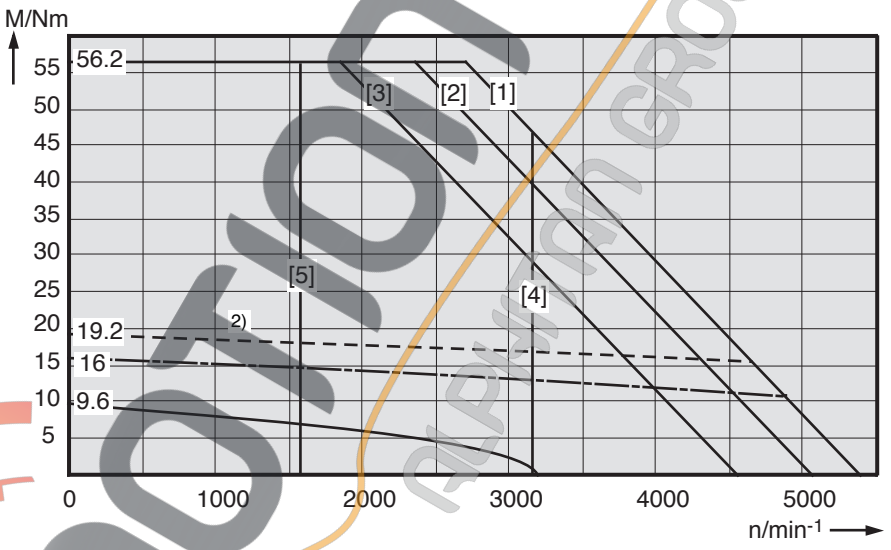
1) shown: ON time of surface-cooled motor 53%
2) shown: ON time of surface-cooled motor 61%

Fig 5.6: Torque-speed characteristics MAC 090

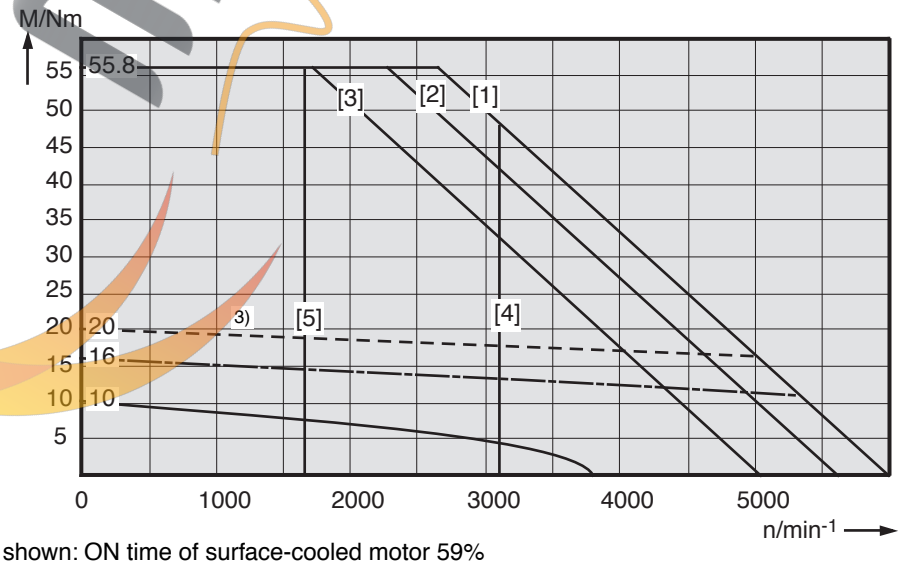
MAC 090 C - • - K •
2000 min^{-1}



MAC 090 C - • - G •
3000 min^{-1}



MAC 090 C - • - E •
5000 min^{-1}



[1] shown: ON time of surface-cooled motor 59%
[2] shown: ON time of surface-cooled motor 69%
[3] shown: ON time of surface-cooled motor 64%

Fig 5.7: Torque-speed characteristics MAC 090

5.3. Shaft load capacity

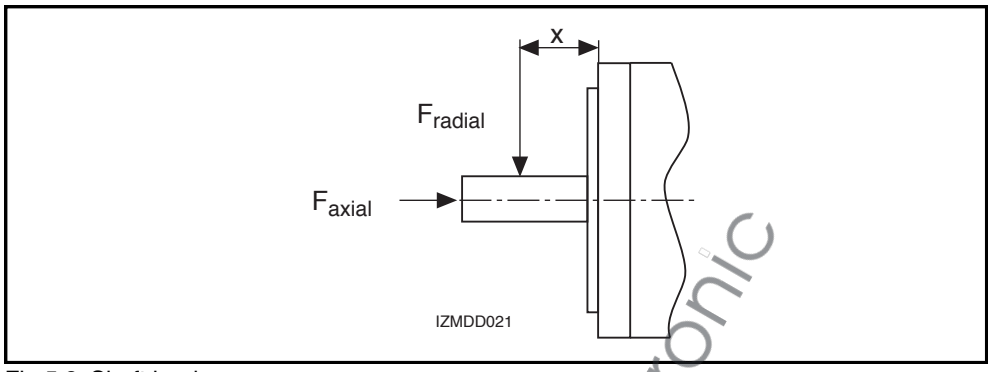


Fig 5.8: Shaft load

Permissible radial force
F_{radial}

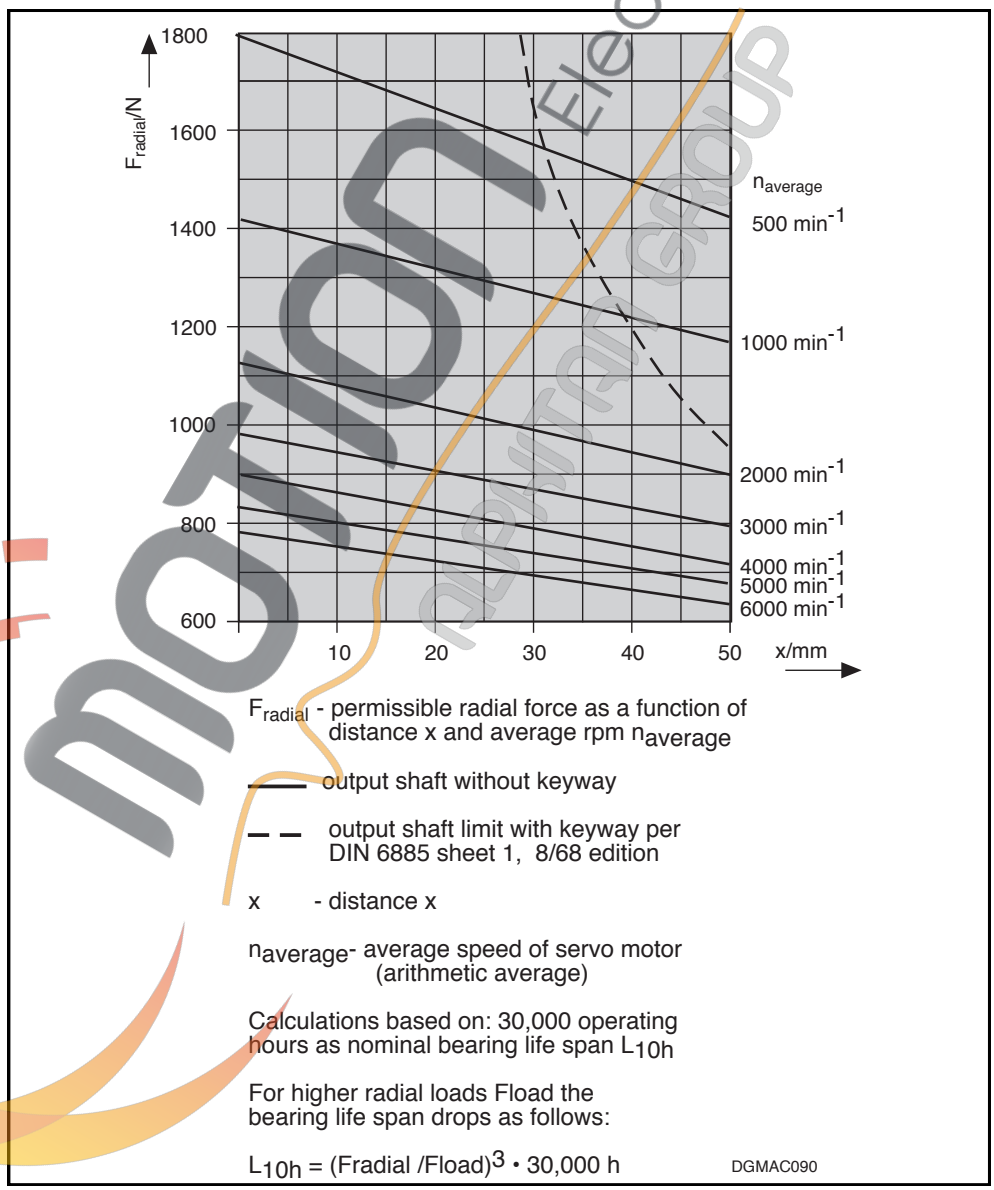


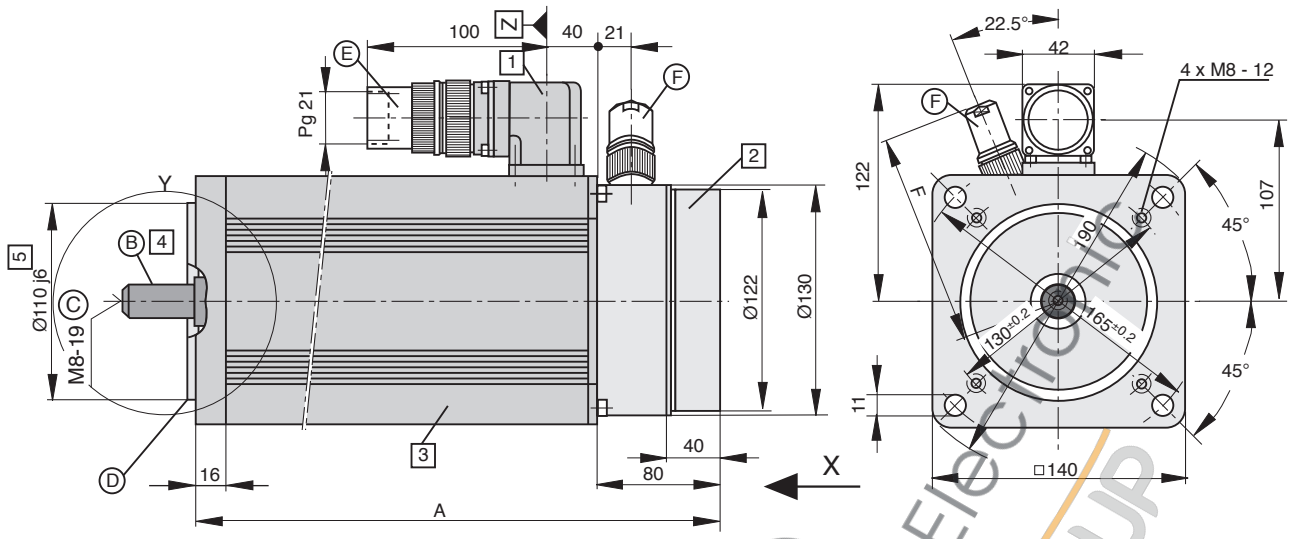
Fig 5.9: Permissible radial force

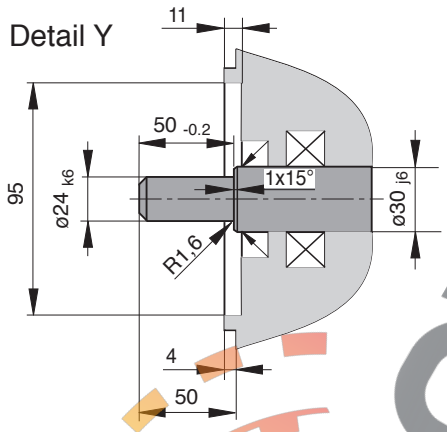
Permissible axial force
F_{axial}

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

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

5.4. Dimensional data - natural convection





C
- 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

D 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)

E **Motor power connector**
INS 108 must be ordered separately.

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

Table

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

A

Size \ Dim.	A[1)]
MAC 090 A	277
MAC 090 B	342
MAC 090 C	407

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

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

MB090-0/1

Fig 5.10: Dimensional data - MAC 090 (natural convection)

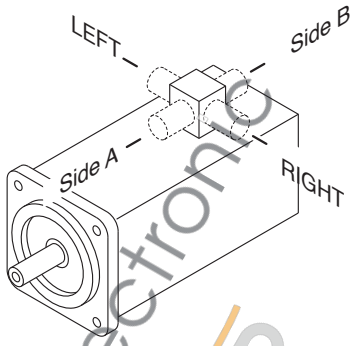
Available options

1 Power connection

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

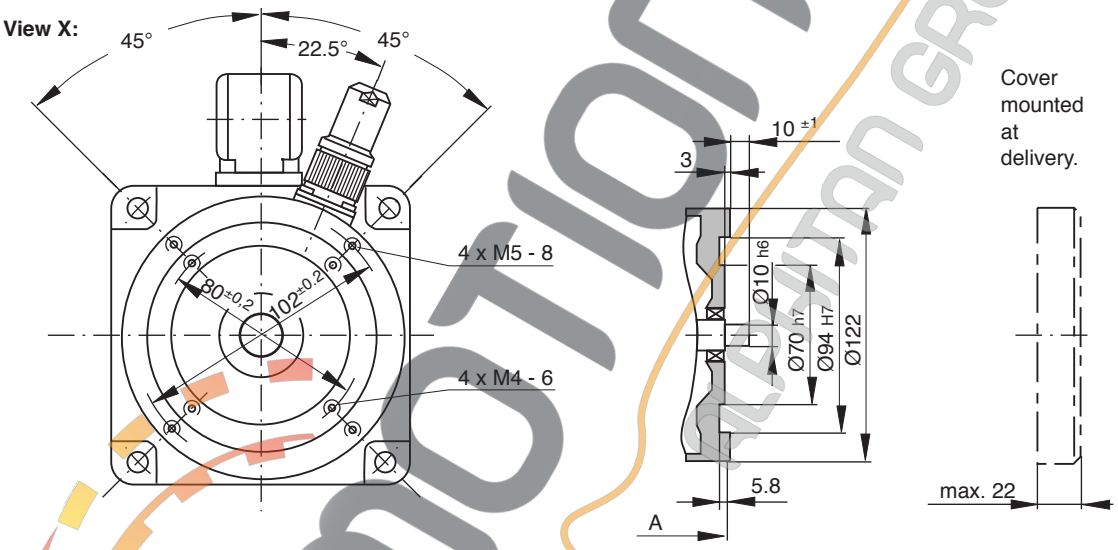
- to side A
- to side B
- to the right
- to the left

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.

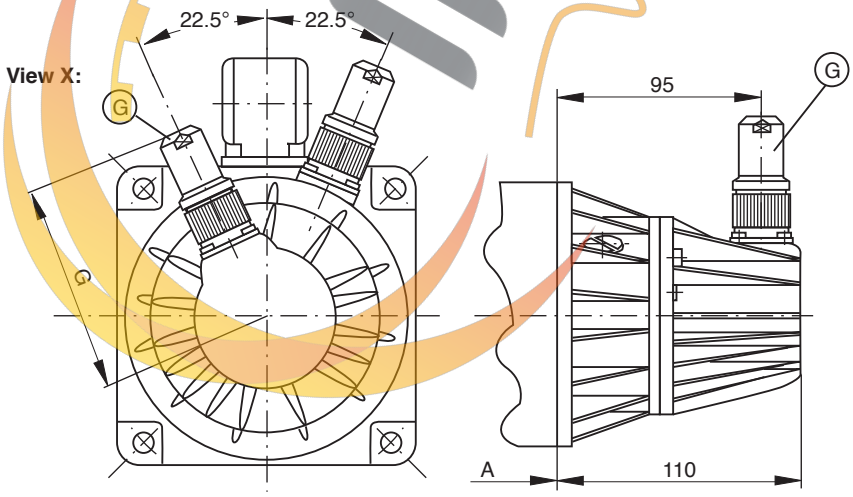


2 Motor version

- 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)

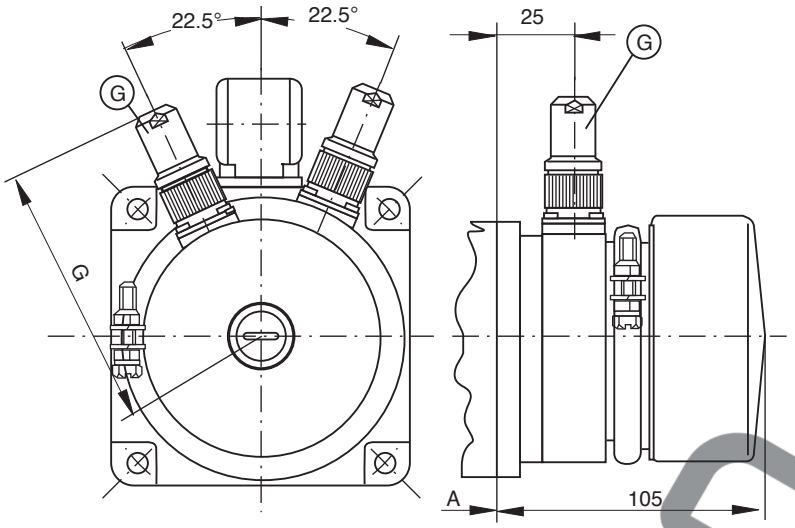
MB090-0/2

Fig 5.11: Dimensional data - MAC 090 - 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

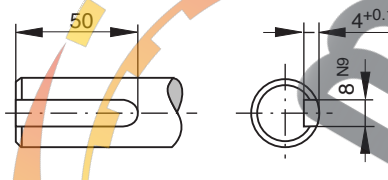
- without blocking brake
  Dim. A retained
- Standard blocking brake: 6.5 Nm
  Dim. A retained
- heavy-duty blocking brake: 14.0 Nm

Table for 14 Nm blocking brake

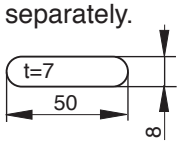
Size \ Dim.	A
MAC 090 A	327
MAC 090 B	392
MAC 090 C	457

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 5 x 5 x 22
Must be ordered separately.



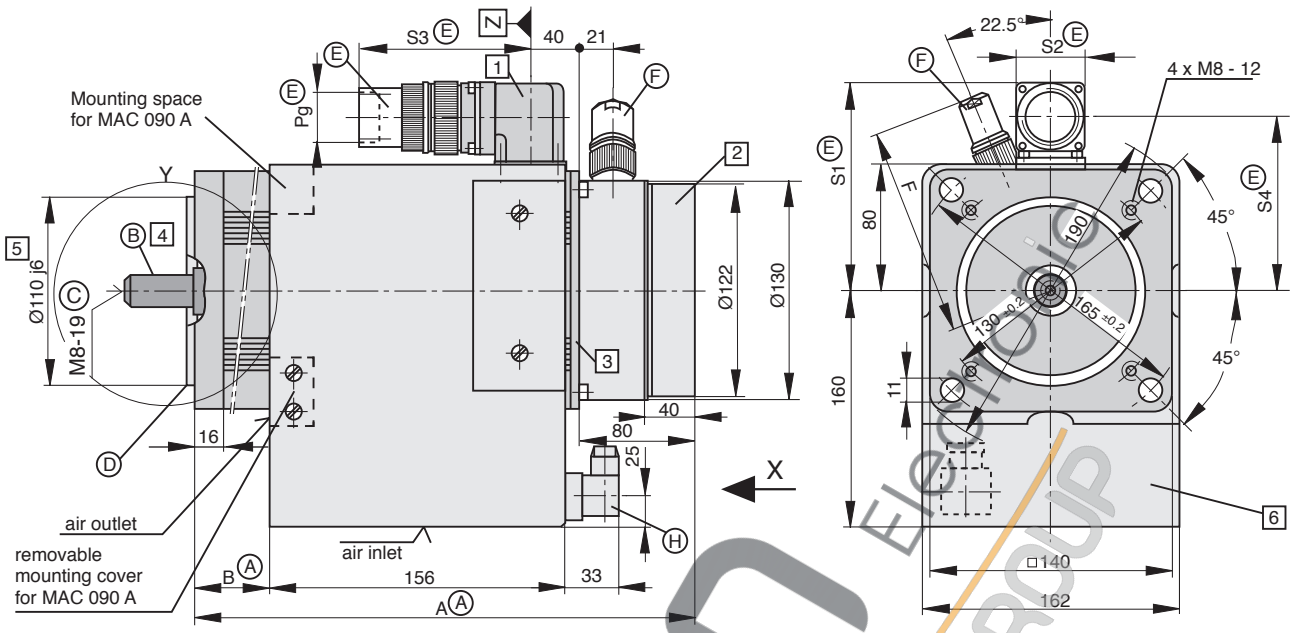
5 Special centering diameter

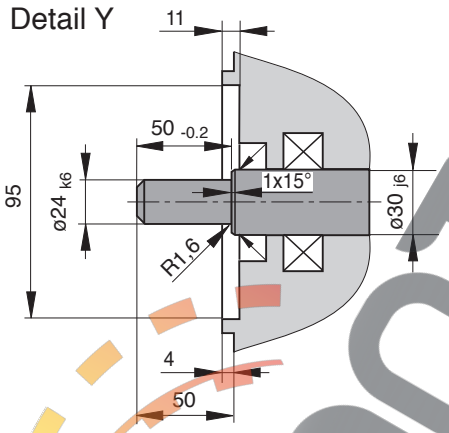
- Ø130 j6

MB090-0/3

Fig 5.12: Dimensional data - MAC 090 - available options - (natural convection)

5.5. Dimensional data - radial cooling





(A) Dimensional table

Size \ Dim.	A 1)	B 1)
MAC 090 A	277	78
MAC 090 B	342	86
MAC 090 C	407	151

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

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

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

(C)
- 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

(D) 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)

(E) **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 MAC090 C-•-E•
3) other MAC090 •-•-•

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

Table

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

MB090-1rad/1

Fig 5.13: Dimensional data - MAC 090 (radial cooling)

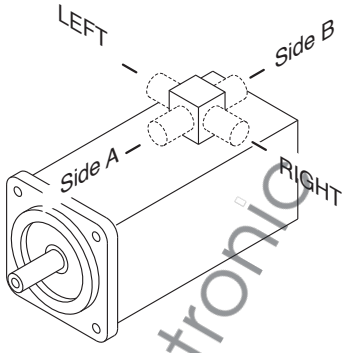
Available options

1 Power connection

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

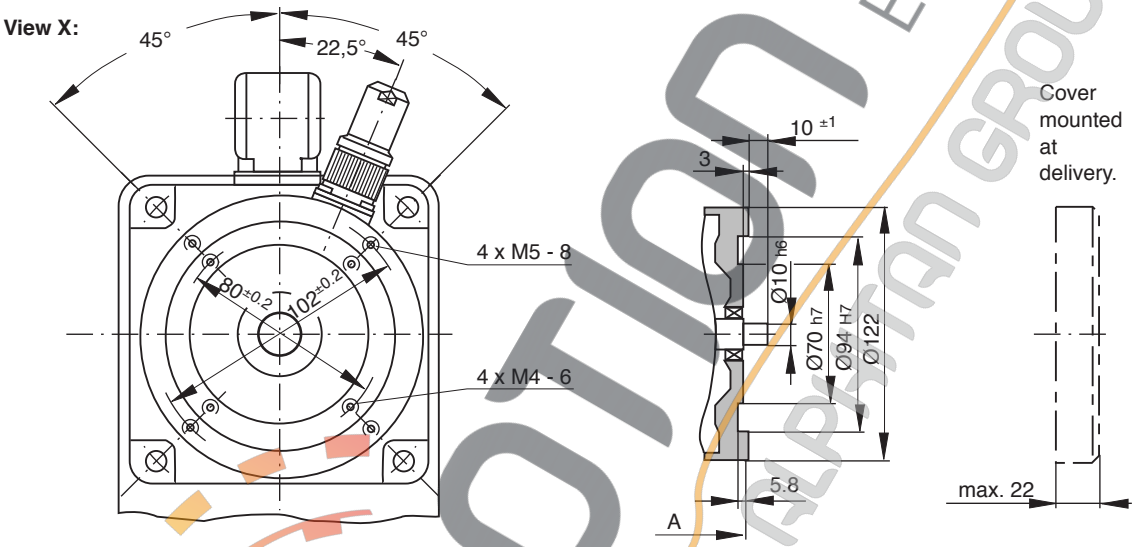
- to side A
- to side B
- to the right
- to the left

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.

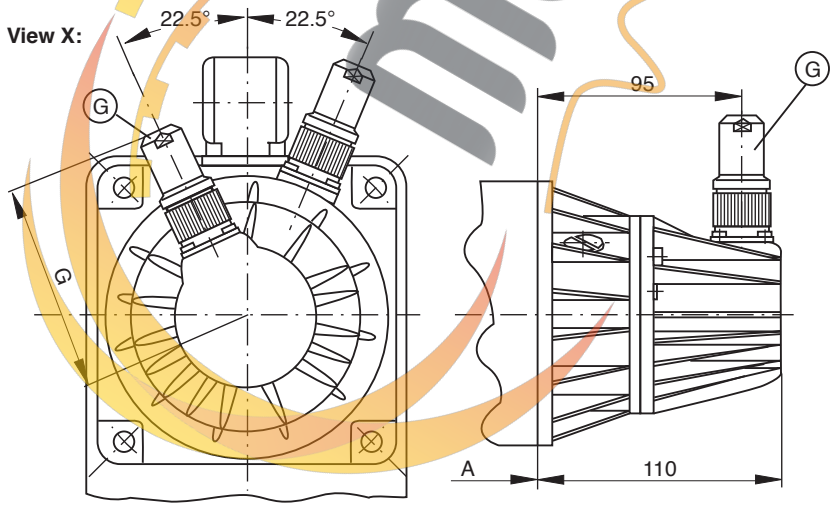


2 Motor version

- 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)

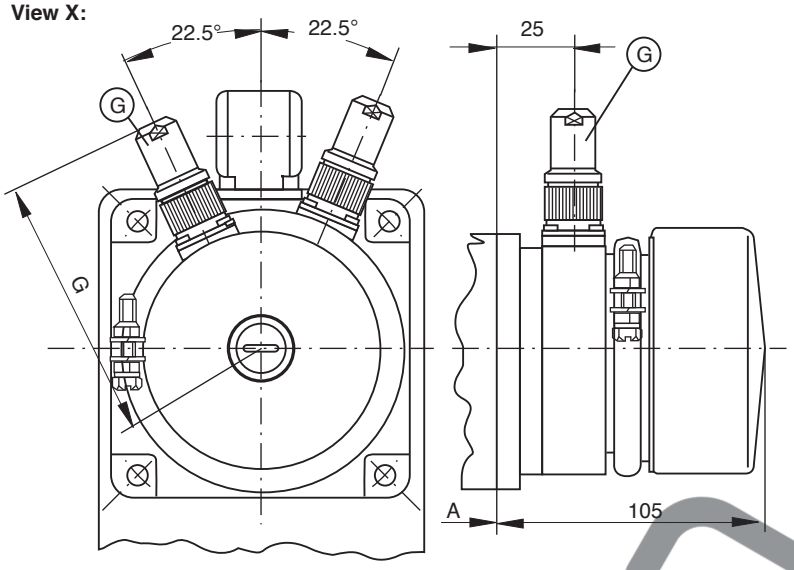
MB090-1rad/2

Fig 5.14: Dimensional data - MAC 090 - 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
angle conn.	INS 322	102

3 Blocking brake

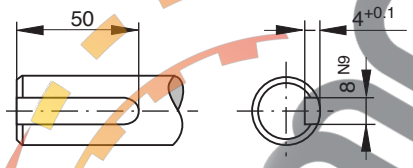
- without blocking brake
  Dim. A and B retained
- Standard blocking brake: 6.5 Nm
  Dim. A and B retained
- heavy-duty blocking brake: 14.0 Nm

Table for 14 Nm blocking brake

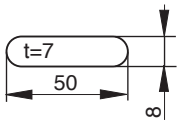
Size \ Dim.	A	B
MAC 090 A	327	128
MAC 090 B	392	136
MAC 090 C	457	185

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 5 x 5 x 22
Must be ordered separately.

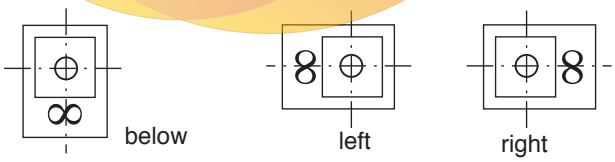


5 Special centering diameter

- Ø130 j6

6 Blower arrangement

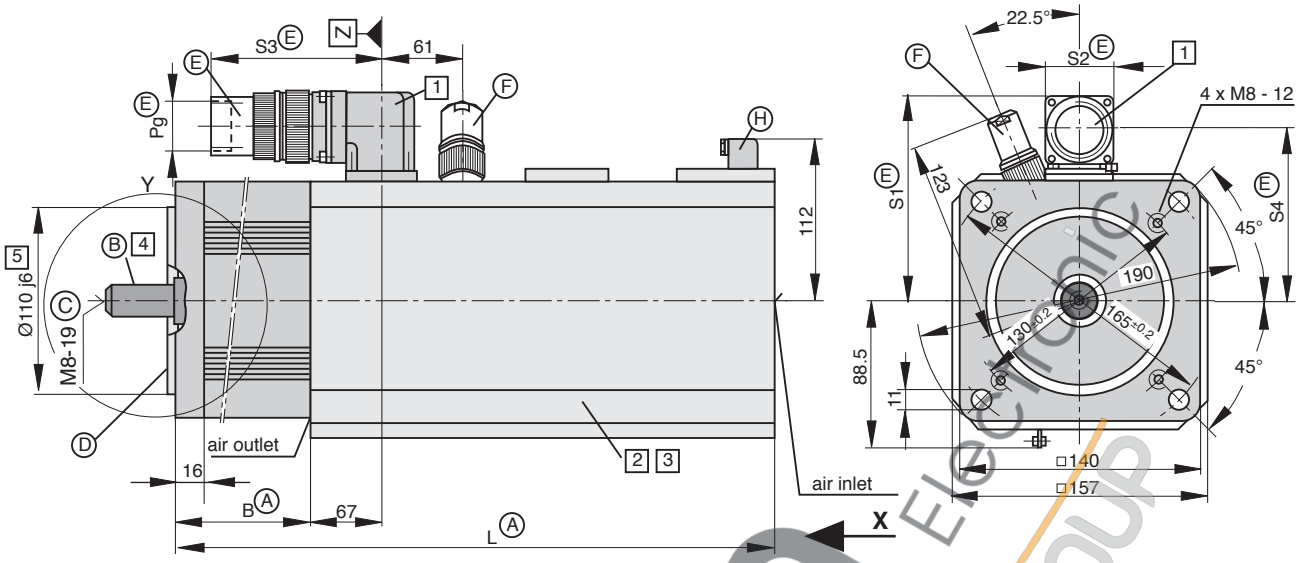
Looking towards motor shaft.

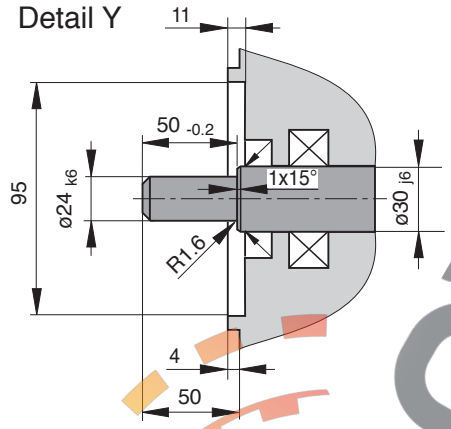


MB090-1rad/3

Fig 5.15: Dimensional data - MAC 090 - available options - (radial cooling)

5.6. 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 MAC090 C-•-E•
[3] other MAC090 •-•-•

Ⓐ **Dimensional table**

Size / Dim.	A [1]	B [1]
MAC 090 A	355	90
MAC 090 B	420	155
MAC 090 C	485	220

[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.

MB090-1/1

Fig 5.16: Dimensional data - MAC 090 (axial cooling)

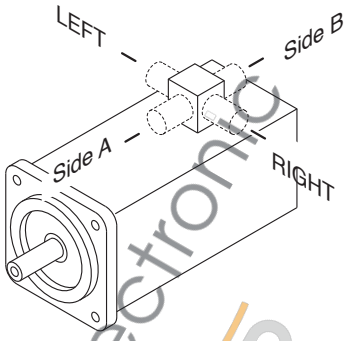
Available options

1 Power connection

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

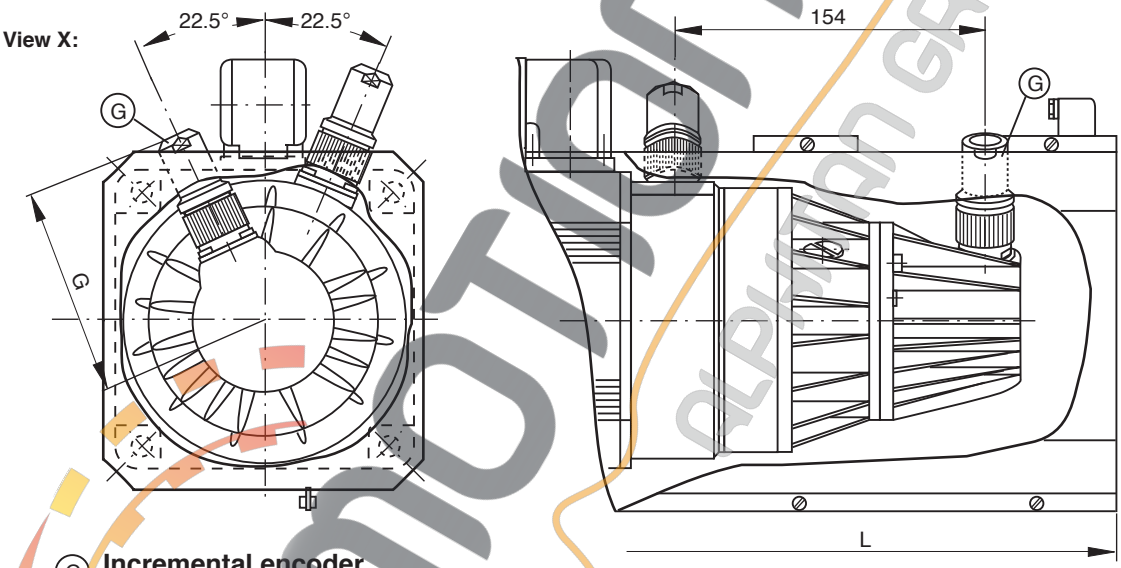
- to side A
- to side B
- to the right
- to the left

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 090 A	455	90
MAC 090 B	520	155
MAC 090 C	585	220

- Tachofeedback and mounted absolute encoder (see following page)

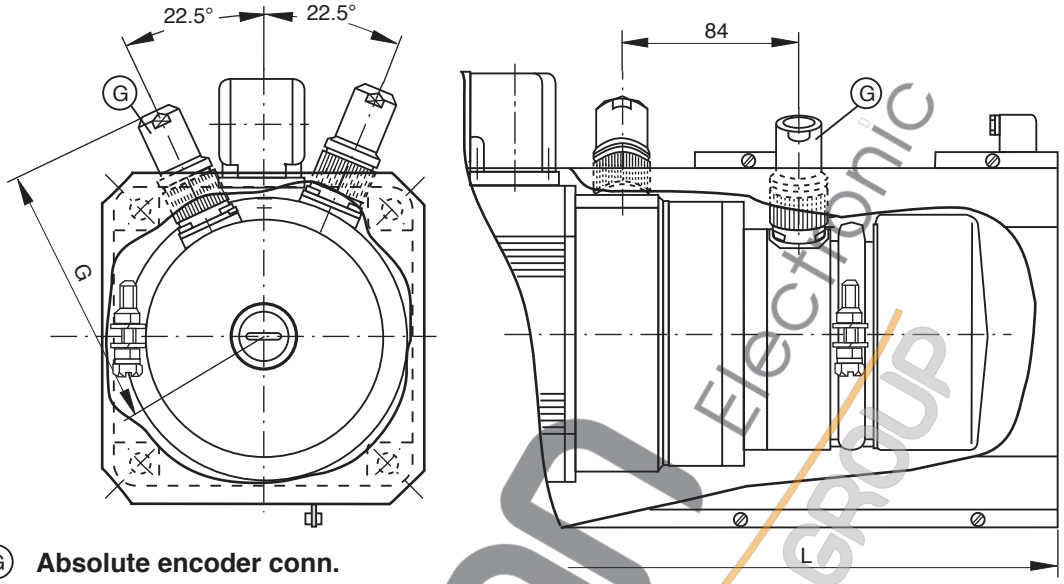
MB090-1/2

Fig 5.17: Dimensional data - MAC 090 - available options - (axial 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

Size \ Dim.	L	B
MAC 090 A	455	90
MAC 090 B	520	155
MAC 090 C	585	220

3 **Blocking brake**

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

Table for blocking brake with 14.0 Nm holding torque

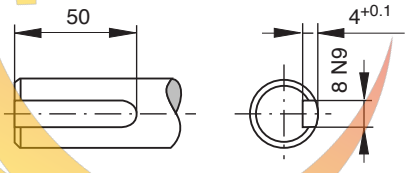
Size \ Dim.	Vers. 2 L	Vers. 2 B	Vers. 4 L	Vers. 4 B
MAC 090 A	405	140	505	140
MAC 090 B	470	205	570	205
MAC 090 C	535	270	635	270

Vers. 2 =
Motor with tachofeedback

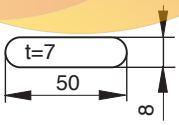
Vers. 4 =
Motor with tachofeedback and mounted encoder

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

MB090-1/3

Fig 5.18: Dimensional data - MAC 090 -available options - (axial cooling)

5.7. Available Options

Type code fields — Example: MAC 090 A-0-ES-4 - C/110-A-0/WI 520LV/S000

1. Motor for analogue drives	MAC
2. Motor size	090
3. Motor length	A, B, C

4. Type of cooling:

natural convection	surface cooling							
	axial		radial					
			blower right		blower below		blower left	
	AC 230 V	AC 115 V	AC 230 V	AC 115 V	AC 230 V	AC 115 V	AC 230 V	AC 115 V
0	1[1]	2[1]	6	A	7	B	8	C

5. Type of windings

Nominal rpm	Standard applications, motor length				with increased smooth run quality, motor length			
	A	B	B	C	A	B	B	C
2000 min $^{-1}$	ZD	PD	--	KD	ZG	PG	--	KG
3000 min $^{-1}$	RD	ND	JD	GD	RG	NG	JG	GG
5000 min $^{-1}$	--	--	--	ED	--	--	--	EG

6. Motor feedback

Motor type	
with tachofeedback	2
with tachofeedback and second shaft end	3
with tachofeedback and mounted incremental or absolute encoder	4
Tacho voltage	
set to nominal motor speed (nominal rpm > 3000 min $^{-1}$: 1,5 V/1000 min $^{-1}$) (nominal rpm ≤ 3000 min $^{-1}$: 3 V/1000 min $^{-1}$)	-
1.5 V/1000 min $^{-1}$	H
6 V/1000 min $^{-1}$	L
Tacho type	
Standard	C
increased smooth run quality	F

7. Centering diameter	
for design B05 and B14	110
for design B05 and B14	130 [2]
8. Power connection	
connector to side A	A
connector to side B	B
connector to right (looking onto output shaft)	R
connector to left (looking onto output shaft)	L
9. Blocking brake	
without blocking brake	0
with standard blocking brake (6.5 Nm)	1
with heavy-duty blocking brake (14 Nm)	2
Mounted encoder	
10. Type [3]	
Incremental encoder with standard mounting	WI
Incremental encoder with shock-damped mounting	DI
11. Encoder code [3]	
For available types, see section 2.4 "Motor feedback"	
12. Special types	
Fixed and documented by INDRAMAT with special number (see Drawing no.: 106-0105-4301-XX)	
Does not apply to standard motors.	

1) For type 3 motors (with 2nd shaft end and tachofeedback). Not available with axial surface cooling.

2) additional S0 no. required (see Fig. 5.20)

3) type code fields 10 and 11 do not apply to motor types 2 and 3

TLMAC090

Fig 5.19: Type codes - MAC 090

5.8. Special Options

Specification of Option	S003	S005	S012	S013	S019	S023	S031
Special centering diameter 130	X		X		X		X
Heavy-duty blocking brake				X	X	X	X
output shaft with shaft sealing		X	X			X	X

Fig 5.20: Special options with a MAC 090