

PL 2 - DC motors (brushed) - Main components

Objectives: Identification of the main components and demonstration of the working principle of DC motors with brushes. Electrical connections for command of inversion of motors rotation direction. Torque-speed characteristic curves. Examples of DC motors commercially available.

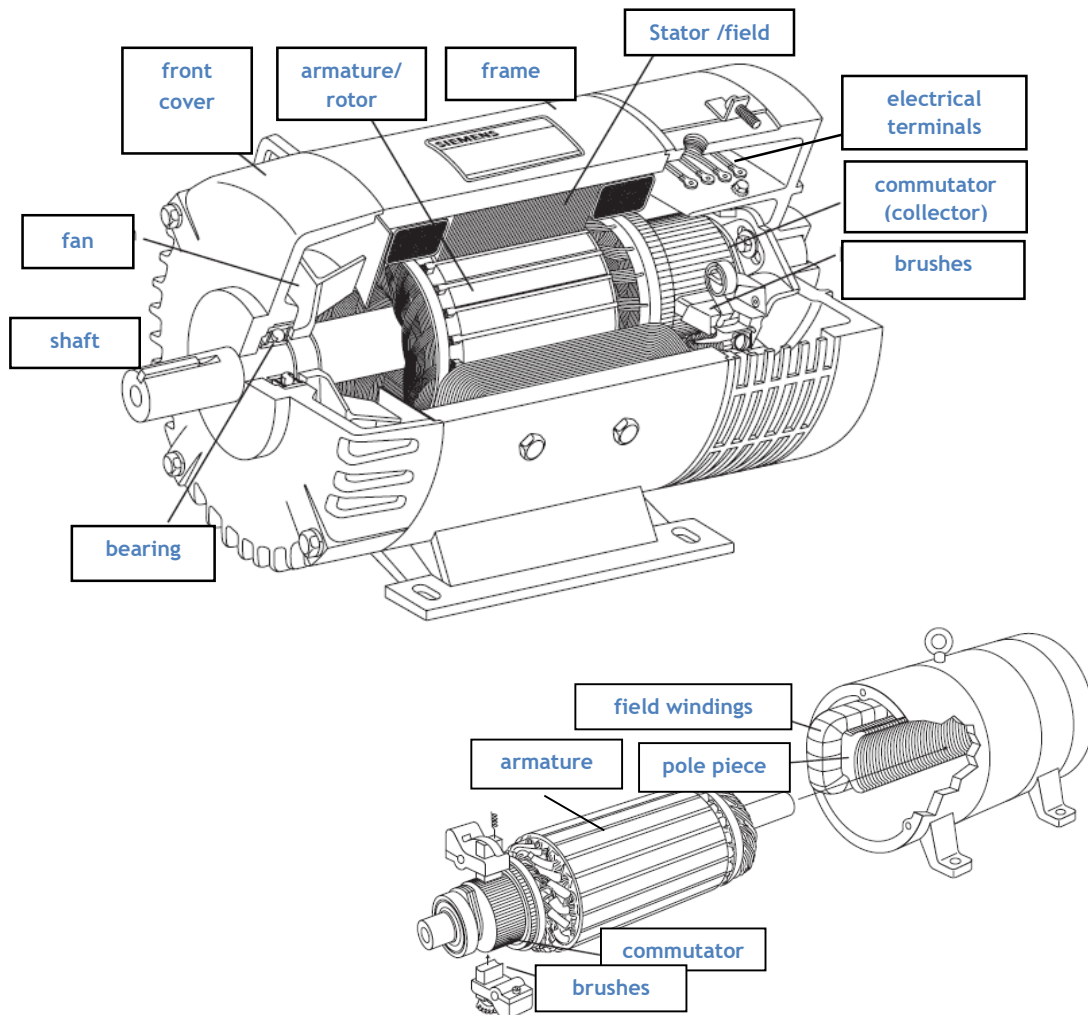
Documents available

- PL classes 1) Baldor-catálogo.pdf 2) Micromotor-catálogo.pdf
 3) Siemens-1-DC Motors.pdf 4) Siemens-2-SIMOTICS_Motors.pdf

Web sites:

- <https://www.baldor.com/mvc/DownloadCenter/Files/CA501>
<https://www.farnell.com/datasheets/89672.pdf>
<https://www.crouzet.com/products/dc-motors>
<https://new.siemens.com/us/en/products/drives/sinamics-electric-drives/dc-drive-technology.html>
<https://new.siemens.com/in/en/products/drives/electric-motors/dc-motors.html>

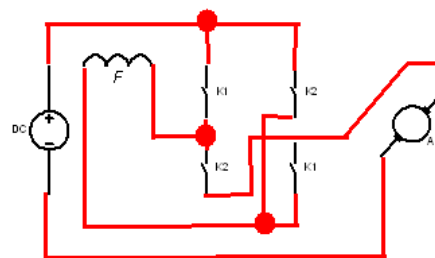
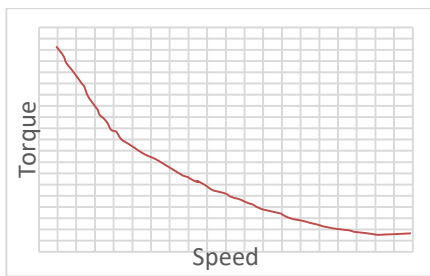
1. Identification of the main components of DC motors, with brushes: fill in the following figure the designation of the respective component.



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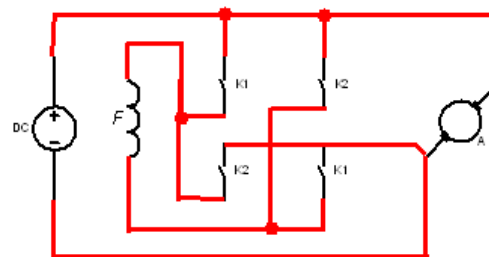
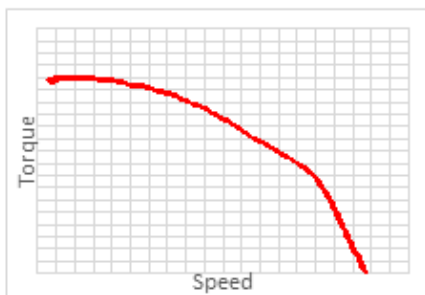
2. Using the electrical contacts (K1, K2) complete the connection to the DC source, of the elements F and A of a DC motor, in order to implement the inversion of the direction of rotation of each motor; also sketch the respective characteristic curves (T,N).

a. DC Series



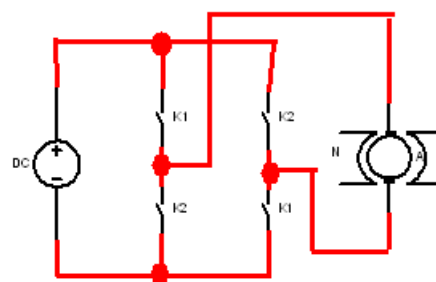
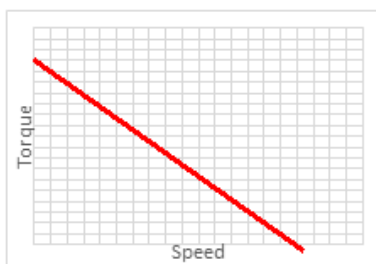
- high starting torque

b. DC Parallel (Shunt)



- speed remains approximately constant (10% variation)

c. DC permanent magnet



- linear relation (T, ω)

d. Indicate the most often used designation for the elements F and A, in brushed DC motors:

F: ___ stator

F: ___ field /excitation (“campo”)

F: ___ inductor (“indutor”)



A: ___ rotor

A: ___ armature

A: ___ induced (“induzido”)



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3. Review the information contained in the nameplate below, corresponding to a DC motor and complete the following list of characteristics:

DC motor winding type: Separated excitation / Shunt

Power at base speed: 7.5 [kW]

Rated speed: 1180 [rpm]

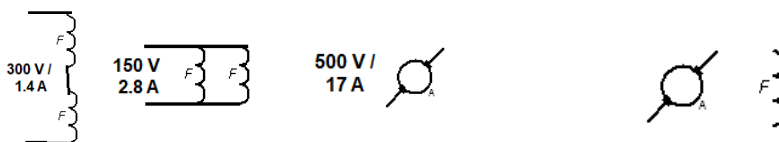
Rated voltage: armature 500 [V]

field 300/150 [V]

Rated current: armature 17 [A]

field 1.4/2.8 [A]

SIEMENS					
HP	10	RPM	1180	VOLTS	500
ARM AMPS	17.0	WOUND	SHUNT		
FLD AMPS	1.4/2.8	FLD OHMS	25C	156	
INSUL CLASS	F	DUTY	CONT	MAX AMBIENT 40° C	
PWR SUP CODE	C	FLD VOLTS	300/150		
TYPE	E	ENCL	DP	INSTR	
MOD				SER	
NP38A424835AP				DIRECT CURRENT MOTOR MADE IN U.S.A.	



Insulation class: F

Max. temperature: ambient 40 [°C] armature windings 155 [°C]

Class F → 40° + 115° = 155°

4. Using the information available on the catalogues of three suppliers of brushed DC motors, indicate possible range values for the following technical characteristics:

	<i>Baldor</i>	<i>Sinomotor</i>	<i>Crouzet</i>
Type of motor			
windings			
Rated power			
Speed range			
Torque			
Voltage			
Current			
Size			
Weight			
Cost			
Applications			

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Additional sources of info

Animation of permanent magnet DC motor and wounded field DC motor

<https://www.youtube.com/watch?v=CWuIQ1ZSE3c>

<https://www.youtube.com/watch?v=GQatiB-JHdI>

<https://www.youtube.com/watch?v=LAtPHANefQo>

Permanent magnet DC motor with ironless rotor coil:

<https://www.portescap.com/en/products/brush-dc-motors/brushed-dc-motor-basics>

Video with historical data of electrical machines development:

<https://www.youtube.com/watch?v=ZCSeq8T1AHo>

Reference to 3 manufacturers of small DC motors (micro motors)

Faulhaber/Micromo: <https://www.faulhaber.com/en/home/>

Portescap: <https://www.portescap.com/>

Maxon: <https://www.maxongroup.com/>

Brushless DC Motor (Brushless DC Permanent Magnet Synchronous motors)

<https://www.nidec.com/en/technology/motor/basic/00017/>

<https://www.nanotec.com/eu/en/knowledge-base/category/functionality>