

**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.

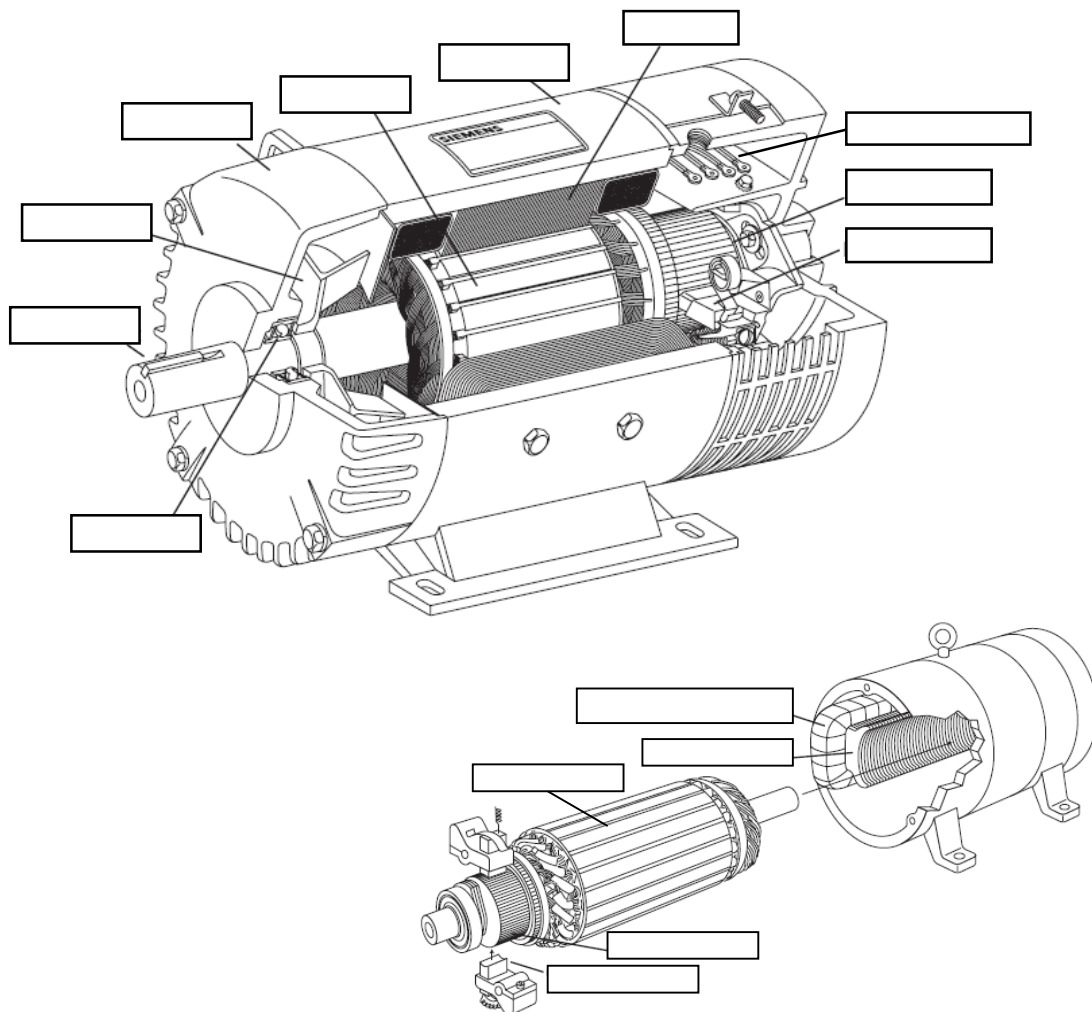
Documents available

- PL classes      1) Baldor-catálogo.pdf                      2) Micromotor Crouzet catálogo.pdf  
                         3) Sinomotor DC Motors

Web sites:

- <https://www.baldor.com/mvc/DownloadCenter/Files/9AKK107331>  
<https://www.farnell.com/datasheets/89672.pdf>  
<https://www.crouzet.com/products/dc-motors>  
<https://www.simomotor.com.cn/dc-motor/>

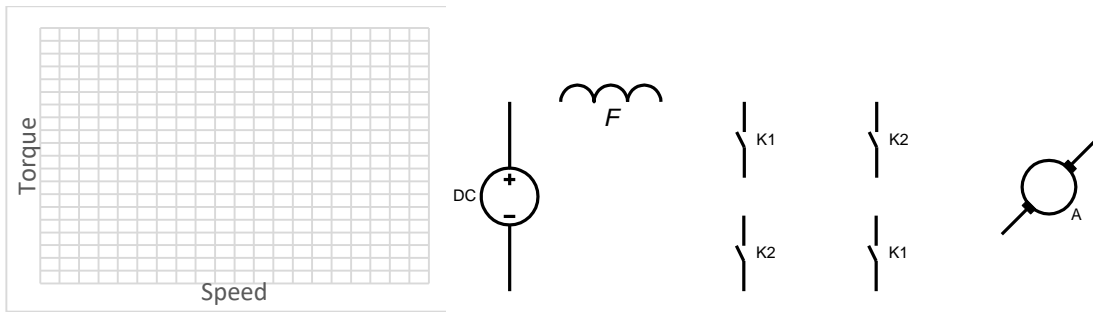
1. Identification of the main components of DC motors, with brushes: fill in the following figure the designation of the respective component.



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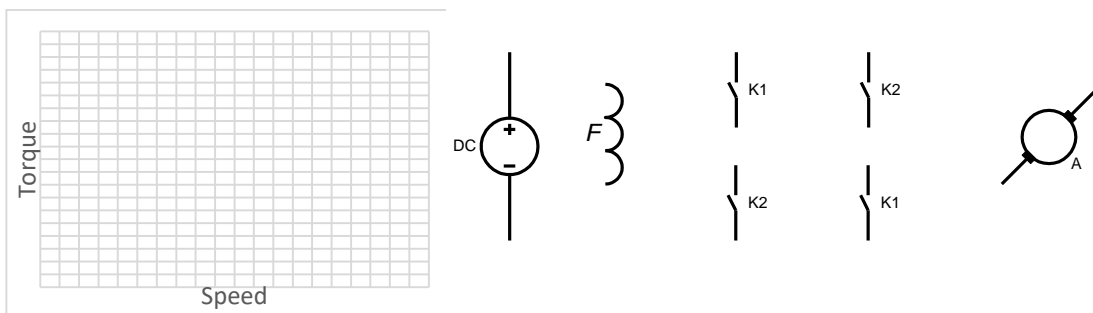
2. Using the electrical contacts (K1, K2) complete the connection to the DC source, of the elements F and A of a DC motor, in order to implement the inversion of the direction of rotation of each motor; also sketch the respective characteristic curves (T, N).

a. DC Series



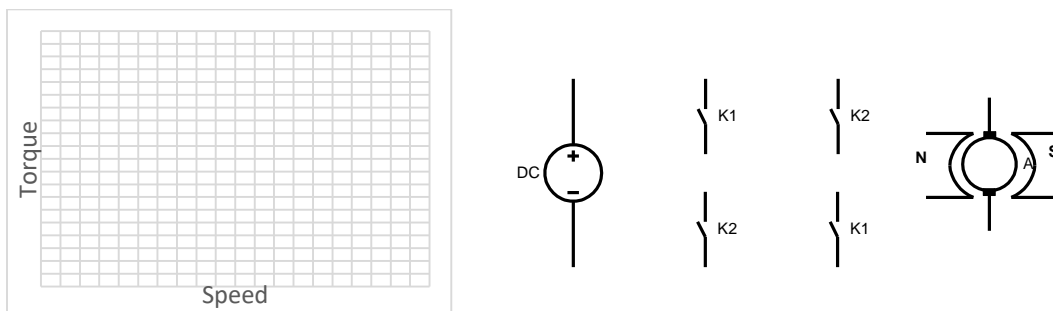
- high starting torque

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: \_\_\_\_\_ A: \_\_\_\_\_

F: \_\_\_\_\_ A: \_\_\_\_\_

F: \_\_\_\_\_ A: \_\_\_\_\_

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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: \_\_\_\_\_

Power at base speed: \_\_\_\_\_ [kW]

Rated speed: \_\_\_\_\_ [rpm]

Rated voltage: armature \_\_\_\_\_ [ ]

field \_\_\_\_\_ [ ]

Rated current: armature \_\_\_\_\_ [ ]

field \_\_\_\_\_ [ ]

Insulation class: \_\_\_\_

Max. temperature: ambient \_\_\_\_\_ [ °C] armature windings \_\_\_\_\_ [ °C]

<b>SIEMENS</b>					
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.	

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=CWulQ1ZSE3c>

<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>