

DC MOTORS TESTS (MPS1)

1. SHUNT MOTOR TEST

RATING OF THE MOTOR TO BE TESTED

$$P_N = \dots$$

$$n_N = \dots$$

$$U_N = \dots$$

$$I_{fN} = \dots$$

$$I_N = \dots$$

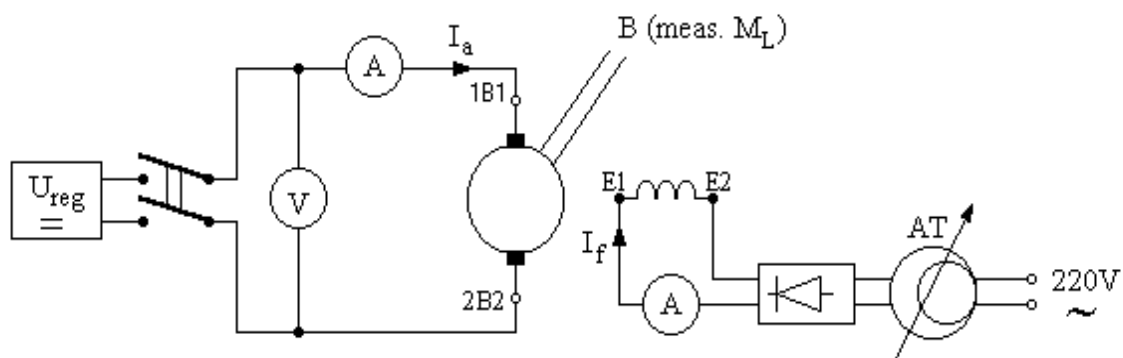
Calculations:

Rated torque $M_N = \dots$

Scheme of windings and terminals' symbols (diagram):

1.1. LOAD CHARACTERISTICS OF THE SHUNT MOTOR

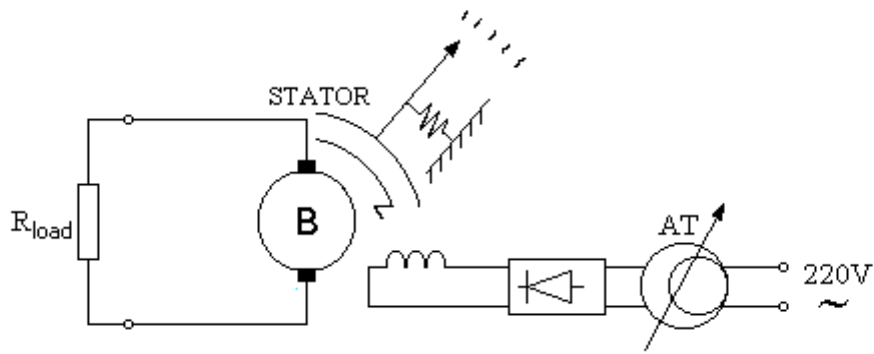
Measuring circuit diagram:



The motor windings are connected and supplied as in figure above, with the ranges of measuring instruments adjusted for the nominal values of voltage and current. First the field winding of the motor should be supplied ($I_f = I_{fN}$) and then the armature circuit is energized with gradually increasing voltage U .

During these measurements tested motor is loaded (is being braked) by means of electromagnetic dynamometer (brake) in form of separately excited DC generator with its stator suspended in bearings.

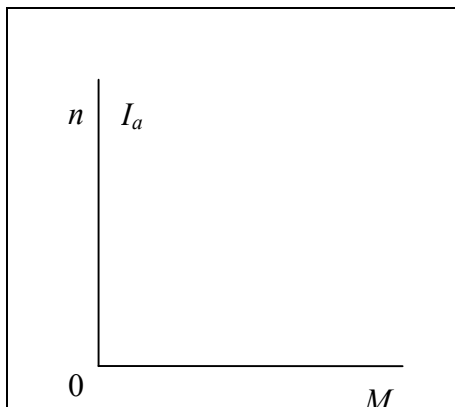
Brake arrangement; its windings connection:



CAUTION!

Always remember that the rotating motor cannot be devoid of excitation as it leads to infinite increase of the motor speed (over speeding)! This real danger imposes highest carefulness about motor field winding circuit connection and supply. It also dictates appropriate procedure that must be followed during switching off the motor!

- For $U = U_N$ and $I = I_{fN}$ make measurements for determining following characteristics:
- speed-torque characteristic $n = f(M)$,
 - armature current versus torque characteristic $I_a = f(M)$.



No of read.	I_a A	I_f A	M Nm	n rev/min
1				
2				
3				
...				

1.2. SPEED REGULATION CHARACTERISTICS OF THE SHUNT MOTOR

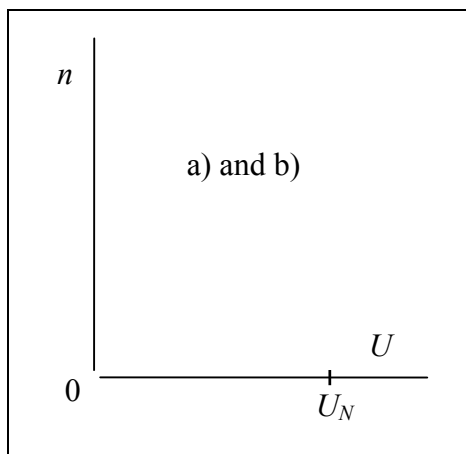
1.2.1. Speed characteristics $n=f(U)$

Required characteristics should be determined for two constant but different values of loading torque:

- $M \approx 0$ (braking generator output power = 0),
- $M = 0.5M_N$

and - in both cases - for $I_f = I_{fN}$.

Maintaining $M \approx 0$ determine the relation $n = f(U)$ for $U \in (0; U_N)$. Repeat the measurements for $M = 0.5M_N$.

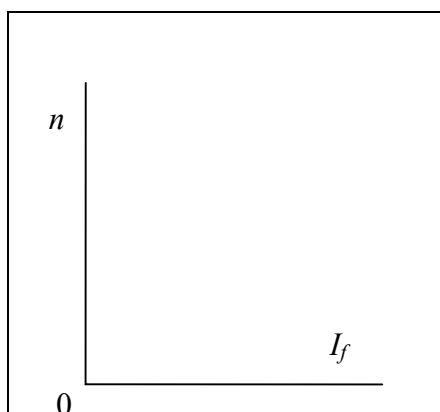


$$I_f = \dots$$

No of read.	U	I_a	M	n
	V	A	Nm	rev/min
1				
2				
3				
...				

1.2.2. Speed characteristics $n = f(I_f)$ for $M \approx 0$; $U = U_N$

In the motor windings arrangement as in previous test determine the dependence of speed upon the field current with armature voltage kept constant.

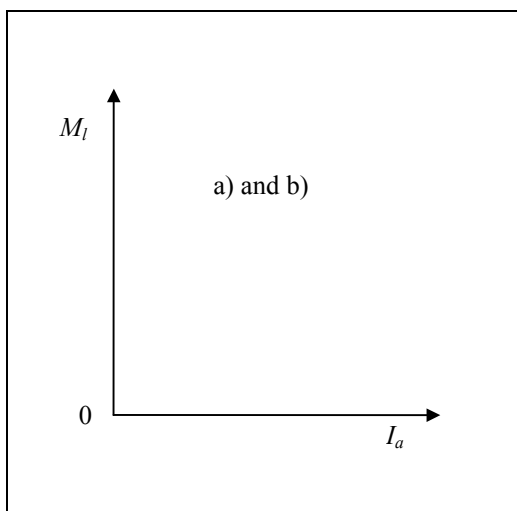


$$U = \dots \quad M = \dots$$

No of read.	I_f	I_a	n
	A	A	rev/min
1			
2			
3			
...			

Be aware that for decreasing field current the speed of motor increases. Due to the limited mechanical strength of rotor the permissible rotational speed is up to $1.2n_N$.

1.3. STARTING CHARACTERISTICS OF THE SHUNT MOTOR



Perform the measurements of the locked rotor torque (starting torque)

$$M_l = f(I_a) \quad I_a \in (0; I_{aN}) \quad I_f = \text{const.}$$

for two different values of the field current:

a) $I_f = I_{fN}$

b) $I_f = 0.5I_{fN}$

The results of measurements show at one diagram (max. dimension of the diagram - 1/2 of A4 size, computer print or hand drawing at graph paper).

2. SERIES MOTOR TESTS

RATING OF THE MOTOR TO BE TESTED

$$P_N = \dots$$

$$I_N = \dots$$

Calculations:

$$U_N = \dots$$

$$n_N = \dots$$

Rated torque $M_N = \dots$

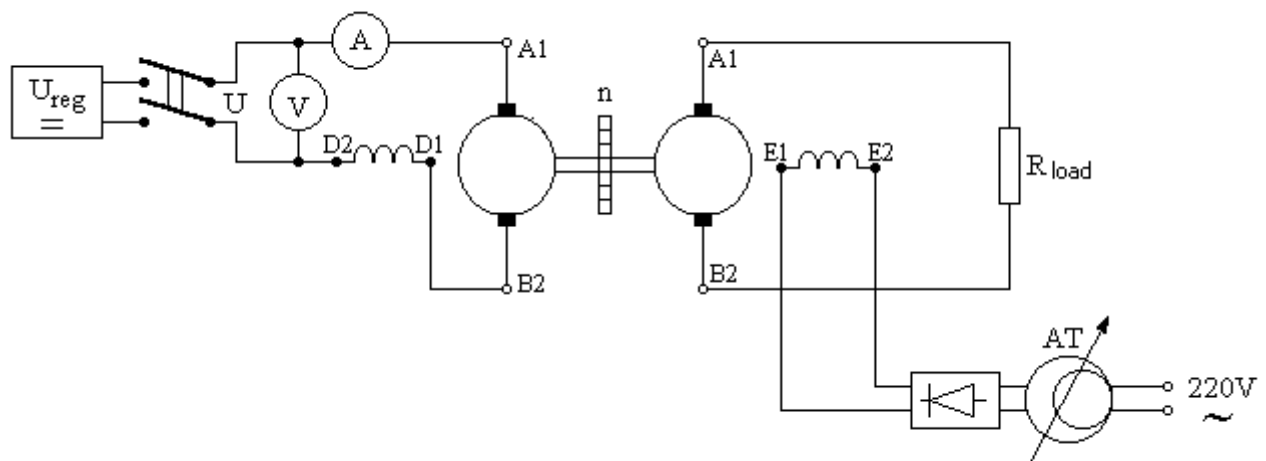
Scheme of windings and terminals' symbols (diagram):

Motor:

Braking generator:

2.1. LOAD CHARACTERISTICS OF SERIES MOTOR

Measuring circuit diagram:



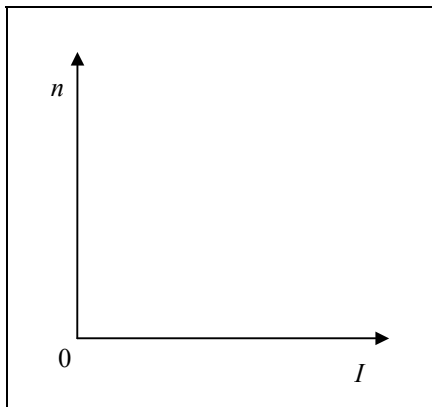
As it is seen from the diagram in this arrangement the direct measurement of motor torque is not available as the generator applied as a motor load has no stator suspended in bearings.

Due to the lack of direct measurement of motor torque, instead of speed-torque characteristic usually being determined, we can test $n = f(I)$ for $U = U_N$.

The range of the speed-current characteristic is limited by two conditions:

$n \leq 1.3n_N$ for the motor being too much unloaded;

$I \leq 1.2I_N$ for the motor overloaded.



No of read.	I_a	n
	A	rev/min
1		
2		
3		
...		

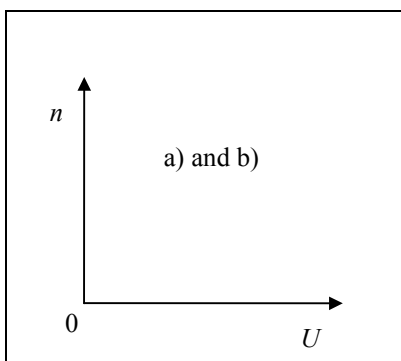
2.2. SPEED REGULATION CHARACTERISTICS $n = f(U)$

Measurements should be made for constant load of the motor:

a) $I = I_N$,

b) $I = 0.5I_N$

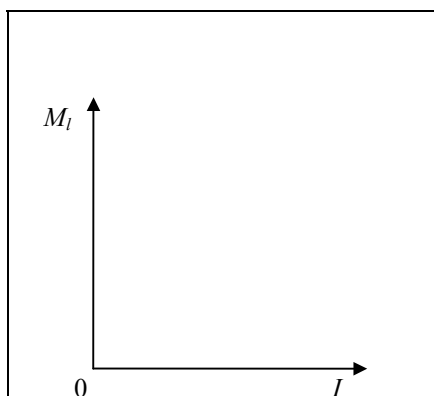
with the condition of the speed limitation to $1.3n_N$ always fulfilled.



No of read	$I_a = \dots$	
	U	n
	A	rev/min
1		
2		
3		
...		

2.3. STARTING CHARACTERISTICS OF THE SERIES MOTOR

The measurements of locked rotor torque (starting torque) can be made by means of the level attached to the motor shaft and the scales under the other end of the level.



level length = ... m

$I \in (0; I_N)$

No of read.	I	M_l
	A	N.m
1		
2		
3		
...		

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