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DC Machines	المادة باللغة الانجليزية
مختبر المكنن الكهربائفة	المادة باللغة العربية
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Speed control of a D.C. shunt motor	عنوان المحاضرة باللغة الانجليزية
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Experiment NO. 2.2

Speed control of a D.C. shunt motor

OBJECT:

The object of the experiment is to study the effect of load application on the speed of a shunt motor and to examine the different method of speed control.

THEORY:

When a motor operates a counter electromotive force E is induced

In the armature as a result of conductors rotating and cutting the flux lines.

$$E_c = V_t - I_a R_a \quad (1)$$

Where

V_t = applied terminal voltage.

I_a = armature current.

R_a = armature resistance.

E_c is proportional to the speed of the armature and flux of the field.

$$E_c = K \phi N \quad (2)$$

K = a constant depending on armature winding.

ϕ = flux per pole

N = armature speed.

Combining eq. (1) and (2) above gives:

□

$$N=(V_L - I_a R_a)/(K\Phi)$$

As seen from eq. (3) the speed can be controlled in three ways:

1. By changing the field strength through the variation of the field current.
2. By increasing the armature resistance through inserting an additional resistance in series with the armature.
3. By varying the applied terminal voltage.

PROCEDURES:

Take the name plate data of the motor used in this Exp.

RUN (1): (speed chara of shunt motor)

1. Connect the circuit diagram shown in Fig (1). Switch on the D.C. supply and start the motor with the help of starter; Adjust the field current of motor to give rated speed at no load.
2. Load the motor to 100% of rated value in 6 steps and record all readings, Keeping the terminal voltage and field current constant.

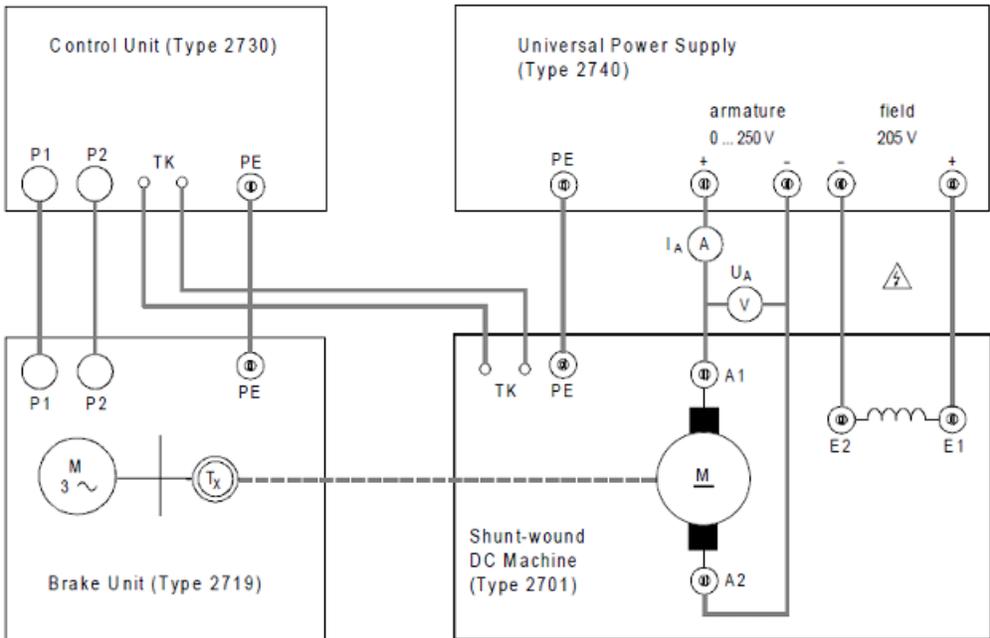


Fig. Experimental setup: No-load characteristic of the shunt-wound DC motor

RUN (2): (changing of field flux)

Adjust the field current to give a no - Load speed of 110% of rated Value and repeat run (1) item (2)

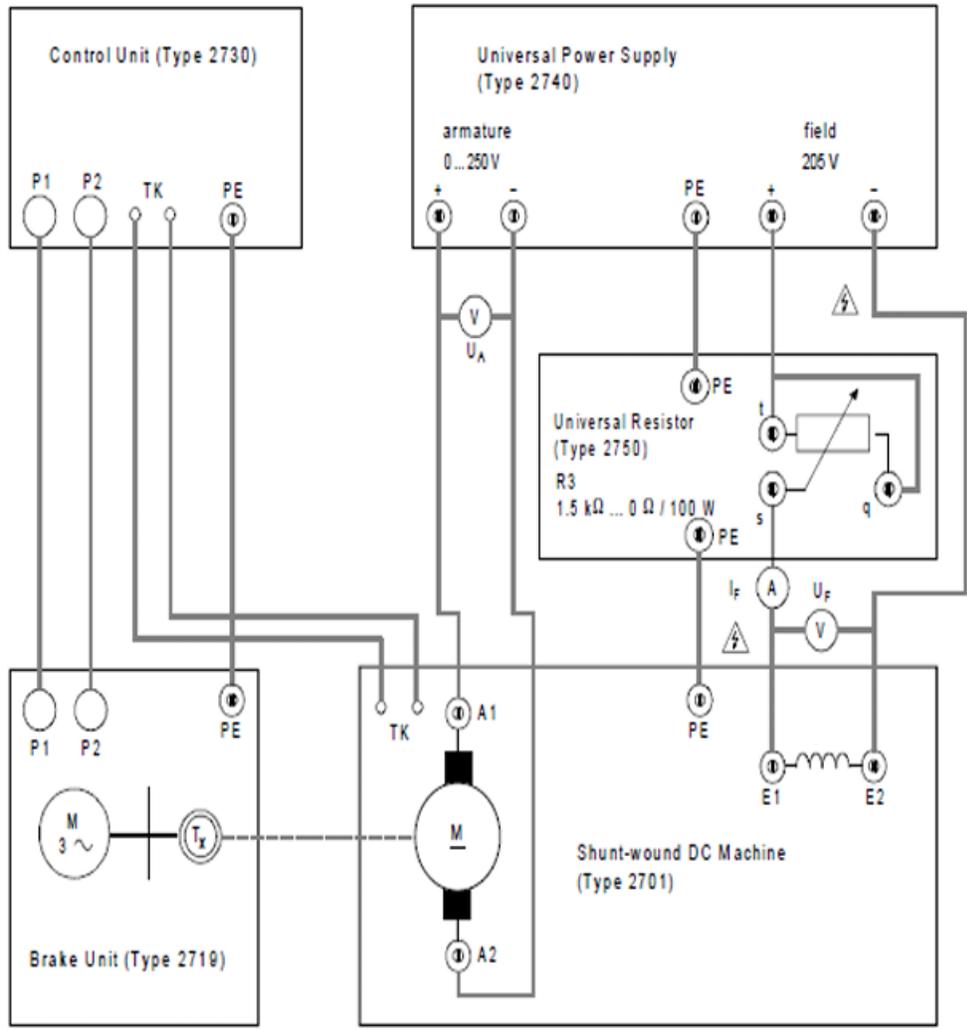


Fig. Experimental setup: Speed behaviour of the shunt-wound motor at flux shunting

RUN (3): (Adding resistant to Ra)

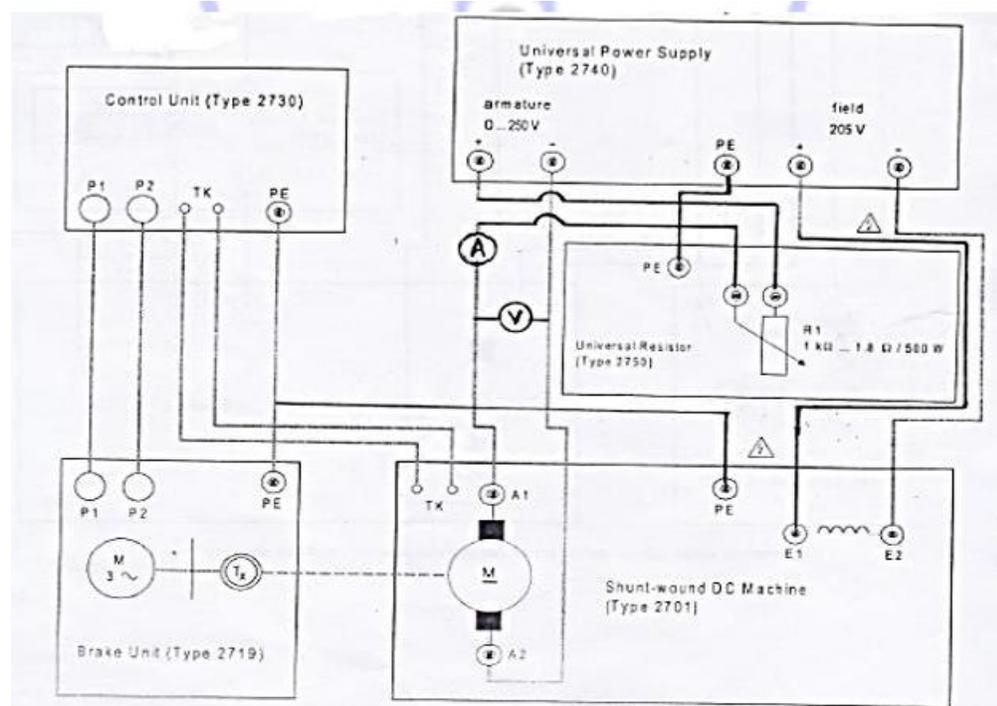
1. Insert a proper rheostat (the max. allowable current of this rheostat must be 120% of the rated armature current) in series with the motor armature circuit.

With this rheostat equal to Zero, adjust the no - load speed to the rated value as in run (1) item (1).

2. Load the motor to rated value armature current, then adjust the rheostat in the armature circuit until the speed drops to 30% of rated

value with rated armature current.

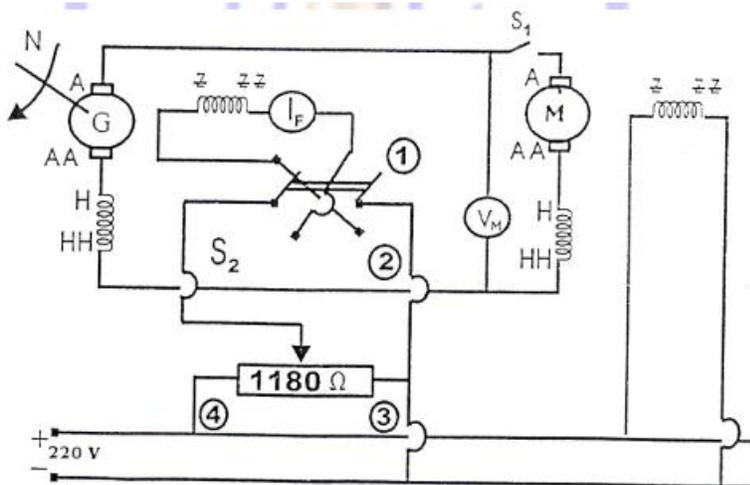
3. Keeping the rheostat setting and field current constant, reduce the Load current of generator to Zero in about 6 steps and record all readings.



RUN (4): (changing the armature voltage by ward-Leonard Method or G-M system).

1. Connect the circuit shown in fig (2).
2. By means of the rheostat (F) you can control the field current of the generator start with putting the slider of the rheostat (F) at point (3), (S1) open and (S2) on position (1). At this position the field current in the field winding of the generator equals Zero and its terminal voltage equals Zero and the motor does not start.

3. When (VG) equal to Zero or residual voltage close switch (S1) and move the slider towards position (4) slowly to reach half the rated voltage of the motor between the generator terminals. Remark the direction of rotation record speed with (VG). Change in 4 steps (IF) and record the readings of the speed and (VG) which is the voltage applied to the motor (M). Return back slowly with (IF) to zero and open (S1)
4. Put (S2) on position (2) and close switch (S1) move the slider towards position (4) and follow as in the previous item to take several readings of (VG) and speed of the motor (NM) Re mark its direction, It will be in opposite direction of that in item (3).



DISCUSSION:

1. Draw three charts, on each one the speed -load chara. $N = f(I_a)$. From results obtained from runs (1), (2) and (3).
2. In the above experiment, while starting the motor, what will happen if the armature circuit resistance is maximum?
3. If the armature current and field current of shunt motor are both reversed, does

the motor direction get reversed?

4. What precautions concerning,

a) the field circuit.

b) The armature current must be taken when operating the shunt motor.

5. How does the saturation in the machine affect the speed of shunt motor?

6. How will the load current affect the speed except its effected on $I_a R_a$ drop?

7. Discuss the three method of speed control from results obtained, which method is perfable and for what purposes they are used?

8. What are the advantage of use of (G- M) system and in which cases it is recommended?