

**NATIONAL BUSINESS AND TECHNICAL EXAMINATIONS BOARD (NABTEB)**

**ELECTRICAL INSTALLATION AND MAINTENANCE WORKS (041)**

**MAY/JUNE, 2007**

Questions & Answers May/June 2007

**Question (1):**

Explain the statutory regulations regarding the use of the following winding materials/equipment:

- i. setting of winding machine
- ii. Liquid varnish
- iii. Oven

**Answer**

**i. SETTING OF WINDING MACHINE**

- a. Steady speed should be maintained to allow smooth and equal tension on the former for good construction of the coils.
- b. The winding machine should be placed on a flat surface for good operation.
- c. The use of correct former size for the construction of the coils.
- d. Fix the former properly to prevent shaking.
- e. There should be proper illumination for the operator of the machine to work effectively.
- f. There should be proper alignment between the former and the cable reel to prevent the twisting of the copper conductor.
- g. The counter should be set at zero.

**ii. Liquid Varnish**

- a. Electrical machines can only be varnished after it has been wound, soldered, branded and tested.

- b. Varnish is used on wound machines coil to prevent or reduce the following
  - i. moisture on wire insulation.
  - ii. vibration of the coils of wire in the machine slots.
- c. Varnish must be allowed to dry before the use of the machine. For instance, if an air dry varnish is applied, the machine is placed on the workbench to dry and if the ovens dry the machine is placed in the oven dry.

iii. **Oven**

- a. The oven must be set to required temperature before the varnished machine is placed on it.
- b. The oven must be closed when in use
- c. Flammable materials must not be placed near the oven during the operation
- d. Only oven dry varnished machines are baked in it.

2. **State the functions of the following tools and equipment used in an electrical winding workshop.**

- a. Mallet: used for shaping winding or coils wound and placed in the slots of machines.
- b. Workbench: is a study table on which the machine is placed for the winding jobs.
- c. Growler: is used to determine grounds shorts, open and reversed in windings.
- d. Knife: is used for cutting insulating material e.g. sleeve, branding rope e.t.c.
- e. Electrical oven: is used for drying varnished wound machines.
- f. Stripper: is used to remove enamel (insulator) from the winding wire.
- g. Hammer: is used for the insertion of wedges, tapping of machine casings and to drive in nails on the wooden board for formers.
- h. Plier: is used for holding, twisting and bending of wires
- i. Liquid Varnish: is used on wound machines coils to prevent or reduce the following:

a. Moisture on the wire insulation

b. Vibration of the coils of wire in the machine slots.

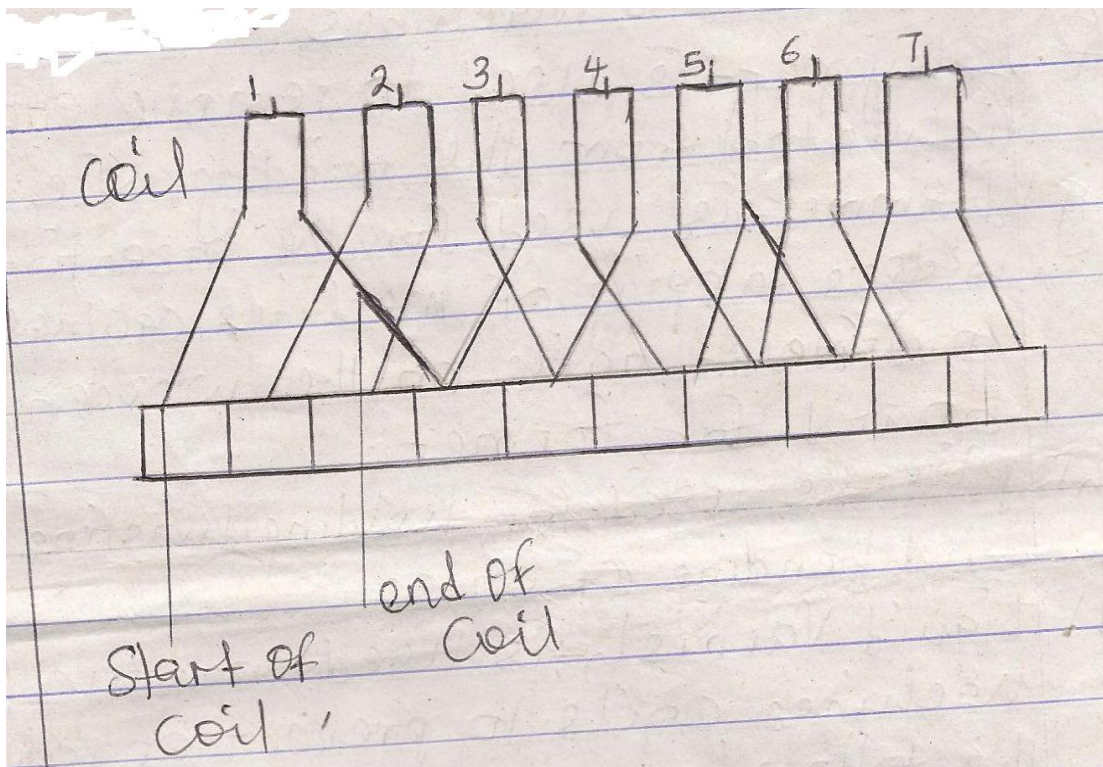
j. Hand gloves: are worn for protection against chemical effects and wire injuries.

3a. With the aid of a neat diagram explain a triplex winding.

3b. List four causes of overheated bearings.

**Answer**

3a. Triplex lap winding is one in which the end lead of a coil is connected to three bars away from the beginning lead. Thus the end of the first coil is connected to the start of the fourth and the end of the fourth to start of the seventh and so on.



3(b) i. cracked balls in the bearing

ii. lack of lubricant

iii. Dirty lubricant

iv. overload pulley or coupling

#### **Question 4 State procedure of dismantling a D.C. motor**

- a. Remove the pulley coupling with extractor
- b. Disconnect the wires to the brush holder terminals, from the brushes and field coils and remove the brushes.
- c. Remove the bearing plate at the driving end and the nuts or screws securing the end shield/plate.
- d. Mark the end shields and yoke so that the shields can be replace in the same position.
- e. lightly tap the front cover loose and remove.
- f. Remove the bolts securing the rear and shield.
- g. Tap the driving shaft with a mallet to free the rear end shield
- h. Unscrew and remove the rear bearing plate and separate the armature and end shield and take care not to damage the brush holders.

#### **Question 5**

- a. **State four causes of arcing at the brushes on a d.c. motor**
- b. **Explain the function of the following as applied to a d.c. machine.**
  - i. Yoke
  - ii. Pulley

#### **Answer**

- (a)
  - (i) Worn out brush
  - ii. Wrong position of brush
  - iii. Loose spring
  - iv. Overloaded mechanical brush
  - v. Worn out commutator

- (b) i. Yoke is a frame in which the field coils are fixed to make magnetic field of flux for the production of e.m.f. in case of generator or to cause rotation in case of motor.
- ii. Pulley is used to drive a machine or for lifting/lowering heavy objects.

### Question 6

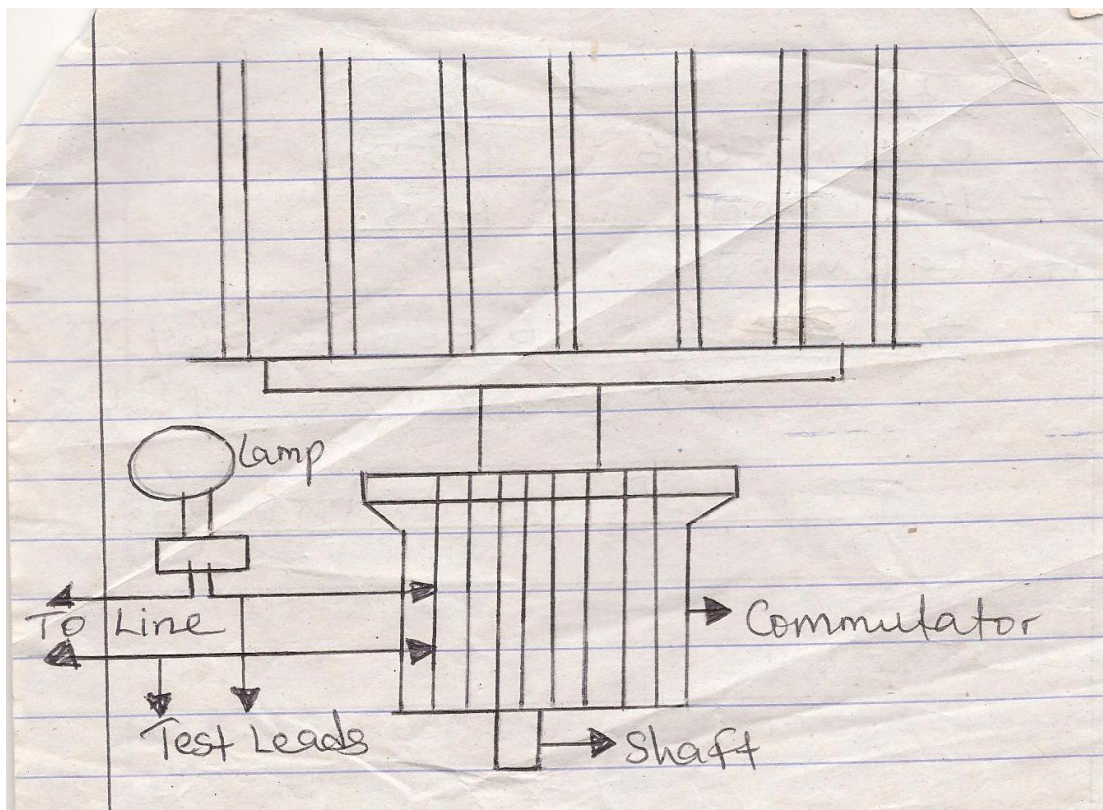
a. Define an armature

b. Explain with the aid of a diagram how a shortened commutator is revealed using test lamp.

Answer

a. Armature is the rotating part of a d.c machine.

b. Place one lead on a commutator bar and the other test lead on an adjacent bar. No light should be visible on the test lamp. If a light is observed, a short exists between the bars contacted by the test leads.



**Question 7:**

How many conductors are required for a 6-pole wound generator to provide an e.m.f. of 240V. If the pole flux is 40 millimeters, the speed is 750 rev/min

**Answer**

Poles = 6

Emf = 240

Flux = 40m =  $40 \times 10^{-3}$ webers

Speed = 750 rev/min

$$E = \frac{2Z}{C} \frac{N\Phi}{60}$$

$$Z \text{ (No. of Conductors)} = \frac{EA60}{\Phi NP}$$

Wave winding  $c = 2$

Lap winding  $A = P, C = 2P$

$$\text{Wave winding } = Z = \frac{240 \times 2 \times 60}{40 \times 10^{-3} \times 750 \times 6}$$

$$= \frac{28800}{004 \times 750 \times 6} = \frac{28800}{180}$$

= 160 conductors Ans

For lap winding:

$$Z = \frac{240 \times 6 \times 60}{4 \times 10^{-5} \times 750 \times 6} = \frac{86400}{180}$$

= 480 conductors Ans