Quadrant II – Transcript and Related Materials

Programme : **Bachelor of Science (First Year)**

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Paper Title : **Repair and Maintenance of Electrical and Electronic Appliances**

Unit : **III**

Module Name : **Introduction, working principle, construction, operation, Installation, Maintenance and Repair: Electric stove, Induction Cooktop**

Module No : **02**

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Notes:

Electric Stove

Introduction:

- An electric stove or electric range is a stove with an integrated electrical heating device to cook and bake.
- Electric stoves became popular as replacements for solid-fuel (wood or coal) stoves which required more labor to operate and maintain. Some modern stoves come in a unit with built-in extractor hoods.
- The stove's one or more "burners" (heating elements) may be controlled by a rotary switch with a finite number of positions (which may be marked out by numbers such as 1 to 10, or by settings such as Low, Medium and High), each of which engages a different combination of resistances and hence a different heating power; or may have an "infinite switch" called a *simmerstat* that allows constant variability between minimum and maximum heat settings. Some stove burners and controls incorporate thermostats.

Working Principle:

- Electric burners are typically coil style: a flattened spiral of electrical wire sheathed in metal that heats up when the control knob is turned on, triggering electricity to flow into the wire.
- You can see the intensity of the electrical flow in the glow of the burner.
- Each heating element on your electric stove (typically four or five in total) connects to its own control switch. When this switch is turned on, it closes the circuit by connecting two "legs," each with 120 volts of alternating current. Electric current travels down each leg, and when this current collides in the heating element, heat is produced**.**
- A temperature switch also exists as part of this circuit, which allows you to easily adjust the heat output for your electric stove top. When the specified temperature is reached, the circuit will open and current will no longer be supplied to the heating element.
- But, when the temperature cools down too much, the circuit will close again to supply more heat. Because each burner represents its own circuit, you can remove and replace one faulty burner instead of replacing the entire stove.

Plate Surface

The surfaces of such plates have different types. Today, taking into account technological progress, they are divided into the following categories:

- Enamelled surfaces. The burners are made of cast iron. The advantages of this device are as follows:
    1. affordable price;
    2. ease of maintenance and repair work.

Also, this coating has good resistance to mechanical stress. This is extremely important. After all, in the kitchen, the fall of small utensils and heavy dishes is not excluded.
There are also its weaknesses:

1. The food is cooked for quite some time.
2. The percentage of thermal energy is wasted. This is especially evident when the burners turn off. And they cool extremely long. So only the air in the room is heated.
3. Cleaning the surface is a rather time-consuming task. It takes a lot of time. The use of special chemicals is required.

- Glass-ceramic surfaces: They are on many modern models. As a result, the boards have a very aesthetic and stylish look. Other strengths are:
    4. The entire cooking area is covered by a sheet with a ceramic surface. It is characterized by the highest durability.

5. Only the cooking zone is heated. This is a guarantee of safe use.
6. The surface is perfectly smooth. Thanks to what the ware does not accidentally tip over.
7. The maximum diameter of the burners is 60 cm.
8. Hot plates quickly heat up and cool down. The heating component is working intensively. It takes a minute for it to cool completely.
9. The surface is easy to care for. It is laundered simply and using mild cleaning products.
10. The electrical circuit is formed so that when the dishes are removed from the burner, the heater will automatically turn off.

Heating components

Stoves may differ in the arrangement of their burners, the varieties of which are as follows:

1. Spiral Outwardly they remind us of an electric kettle. Its task is to heat the dishes that are placed on it. These burners have a single and double variation. In the second view, the second spiral is immediately arranged around the circumference of the initial spiral. These devices can be adjusted using the rotary switches. This is a mechanical control. It happens smoothly.
2. Pancake: They are characterized by a continuous surface. It is heated by at least two components. They are fixed on a metal base. Here you can control the process using special rotary switches. They attach the heater in various combinations. They have several positions. These are level power controllers.
3. Halogen: Here, the heating elements, which differ in structure, are positioned under the hob in an arbitrary algorithm, according to the design specialists. The dishes are heated thanks to the halogen emitter. The zone marked with LEDs heats up almost instantly. On such a burner it is convenient to prepare products without prolonged languishing. And electricity consumes a maximum of 2 kW per hour.
   For this modification, only cast iron or steel utensils are required. This criteria should not be forgotten. You can adjust the heat through special touch keys. They are located on the upper side of the hob. In budget devices, there is a standard control method: regulators are used located on the front control console.
4. Ceramic: Similar heating components resemble mazes. There is a spiral. The material of its manufacture is a nichrome thread. Each burner has its own pattern.
   Only in this situation the spiral heats the maximum zone.
   These devices are installed under the planes of glass ceramics, where culinary processes are meant. Often in one plate these options are combined with item 3.
   To control the heating of these devices, switches are designed. They have a smooth adjustment, with two levels.

Induction Cooktop

Introduction:

- Induction cooking is performed using direct induction heating of cooking vessels, rather than relying on indirect radiation, convection, or thermal conduction. Induction cooking allows high power and very rapid increases in temperature to be achieved, and changes in heat settings are instantaneous.
- In an induction cooktop ("induction hob" or "induction stove"), a coil of copper wire is placed under the cooking vessel and an alternating electric current is passed through it. The resulting oscillating magnetic field wirelessly induces an electrical current in the vessel. This large eddy current flowing through the resistance of the vessel results in resistive heating.

Working Principle:

- Induction cooking heats a cooking vessel by electromagnetic induction, instead of by thermal conduction from a flame, or an electrical heating element.
- The cooking vessel must be made of or contain a ferromagnetic metal such as cast iron or stainless steel. Heat is coming from within the pan, making this method of cooking a lot more efficient. You therefore need to ensure that your pans are suitable to use on an induction hob. Copper or aluminium pans would not work unless they have additional layers added onto the bottom that are magnetic.
- Inside the glass cooktop, there's an electronically controlled coil of metal. When you turn on the power, you make a current flow through the coil.
- When current passes through a coil, a magnetic field is produced around it. If the current used is AC (Alternating Current) , the magnetic field produced keeps changing its direction.
- When an electric conductor is placed in this alternating magnetic field, the magnetic lines cut through the surface of the conductor. This generate eddy currents.

- Eddy currents are basically electricity produced within a conductor due to the presence of an alternating magnetic field and these currents flow in loops through the conductor. Due to the resistance of the material these eddy currents produce heat.

Operation:

- When you stand a suitable cooking pan on top of an induction cooktop that's powered up, the magnetic field produced by the cooktop penetrates the metal of the pan. So we have a fluctuating magnetic field moving around inside a piece of metal (the base and sides of the pan)—and that makes an electric current flow through the pan too (that's all that induction means).
- Now this is not quite the same as the electric current that flows through a wire, carrying electrical energy in a straight line from (say) a battery to a flashlight bulb. It's a kind of whirling, swirling electric current with lots of energy but nowhere to go; we call it an eddy current. As it swirls around inside the metal's crystalline structure, it dissipates its energy. So the metal pan gets hot and heats up whatever food is inside it, first by conduction (it passes its heat energy directly to the food) but also by convection (liquid food rises and falls in the pan carrying heat with it

Repair and Maintenance:

- When in use, first determine the voltage sufficient to provide the appliance. Because the power requirement of each appliance is different.
- Soft objects or newspaper, thin tape should not be placed under the induction cooker. The induction cooker has a vent, and there is a certain temperature inside the body when the induction cooker works. In order to make the induction cooker to play a better role and normally work, extending its life, this part of the heat must be promptly emitted.
- After the food is heated, you should turn off the induction cooker and pick up hot utensils, not affix to the surface of the appliance. This is because when the vessel finished heating is placed on the surface of the appliance, heat transfer will turn the heat back to the surface of the appliance, it will destroy the panel as well as the internal parts of the appliance.

- If a stove burner won't come on, the likely culprit is spilled food. Use a toothbrush to clean off food spills from the igniter. On an electronic ignition stove, it's a little ceramic nub located either on the stovetop or under the ceramic seal strike plate. Also make sure that the round ceramic seal strike plate is properly seated on the burner.
- If a burner on your electric stove isn't working properly, turn the burner off and pull it out of its socket. Then plug it in again and wiggle it around. If it feels loose, remove the burner again and gently bend the burner prongs slightly outward for a tighter connection.