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Adjustment and operational procedure of High Pressure and Low Pressure cut-outs in Refrigeration system

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Abstract: In refrigeration systems, the integration of high pressure (HP) and low pressure (LP) cut-outs plays a critical role in ensuring operational safety, system efficiency, and equipment longevity. High pressure cut-outs are designed to stop the compressor when the system pressure exceeds a safe limit, preventing potential damage due to overheating or rupture. Conversely, low pressure cut-outs protect the system by shutting down the compressor if the suction pressure drops too low, which can result from refrigerant leakage, evaporator freezing, or other faults. These protective devices help maintain optimal pressure ranges, enhance system reliability, and prevent costly failures. This paper presents an overview of the working principles, types, and applications of high and low pressure cut-outs in modern refrigeration systems, emphasizing their importance in both residential and industrial applications.

Keywords: HP cut-out, LP cut-out, compound cut-out, adjustment screw, high pressure switch, low pressure switch

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I. INTRODUCTION

Refrigeration systems are widely used in various sectors, from residential cooling units to large-scale industrial processes. The performance and safety of these systems depend heavily on maintaining proper operating pressures within the system. High pressure and low pressure cut-outs are essential protective devices installed to safeguard the refrigeration equipment from abnormal conditions.

A high pressure cut-out prevents the system from operating under dangerously high pressure conditions that could lead to compressor failure, pipe bursts, or system inefficiencies. Such high pressures may occur due to issues like condenser blockage, cooling fan failure, or excessive refrigerant charge. Meanwhile, a low pressure cut-out protects the system when suction pressure drops below safe operating levels, often caused by refrigerant leaks, evaporator freezing, or compressor malfunctions.

By monitoring the pressure levels and automatically shutting down the compressor when necessary, these cut-outs help prevent costly damages, ensure efficient operation, and extend the life of the system. Understanding the role, working mechanism, and maintenance of high and low pressure cut-outs is crucial for designing reliable and efficient refrigeration systems.

II. OBJECTIVES

1. To know about the function of a safety control in refrigeration system
2. To know about the purpose of a HP control and LP control used in refrigeration system
3. To know about the constructional details of HP and LP control used in refrigeration system
4. To know about the operation of HP and LP control used in refrigeration system.
5. To know about the method to adjust the range setting of HP and LP control.

III. TOOLS, EQUIPMENT AND GAUGES

1. Refrigeration equipment
2. High pressure and low pressure control
3. Screw driver
4. Adjustable wrench

The protection of the compressor and motor against excessively high or low pressure is the purpose of pressure controls.
Electrical switches are provided in the refrigeration system, so that as soon as the pressure goes up beyond the operating limits, the refrigeration system stops.

There are three types of pressure cut-out control.
1. High pressure cut-out control
2. Low pressure cut-out control
3. Compound cut-out control

IV. HIGH PRESSURE CUT-OUT CONTROL

A high pressure cut out is a safety device which stops the compressor before discharge pressure goes to excessively high values. It is an electrical switch which makes or breaks the circuit to the compressor, when the condensing pressure increases or decreases during the working of the refrigeration equipment.

1. Operates at high pressure due to high-ambient temperature, lack of proper cooling of the condenser.
2. When the pressure goes on increasing the motor and compressor demands more and more amount of power.
3. Excessive current drawn may damage the motor and compressor, hence it is to be protected.

Main parts of HP cutout control

High pressure control consists of the following main parts.
1. Knobs (for adjusting cut-out and differential)
2. Lock plate
3. Tension spring and compression spring
4. Diaphragm
5. Main body
6. Return spring
7. Retaining spring
8. Electrical contacts
9. Scale (provided with a pointer)
10. Inlet connection

Principle of working

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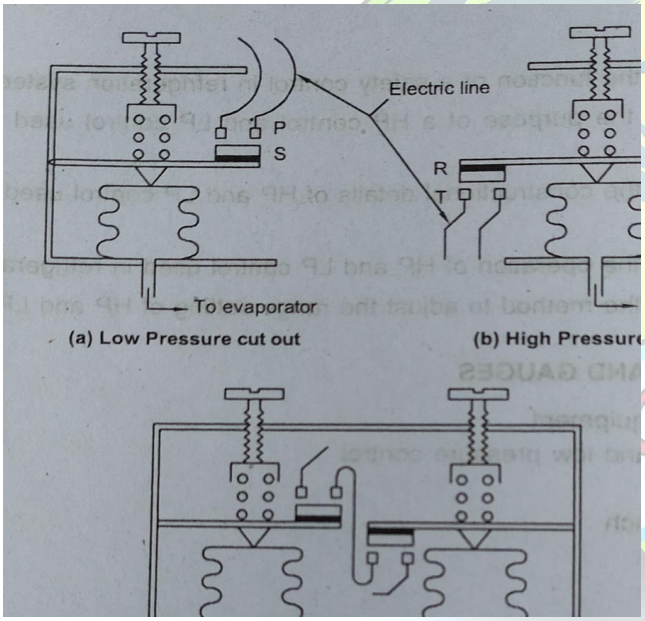
The high pressure cut-out is connected to high pressure side of the compressor to line between the compressor and condenser.

If the condenser fails to condense the refrigerant, the control will operate.

Pressure switches have resets which operate automatically or manually.

When the pressure in the discharge line rises above a certain predetermined pressure value, the high pressure control operates and stops the compressor by cutting off the power supply to the compressor motor.

When the pressure returns to normalcy the control acts to close the power supply and starts the compressor.



V. LOW PRESSURE CUT-OUT CONTROL

Low pressure cut-out stops the compressor, when the evaporator pressure falls below certain limit as set on the device. It is connected to the evaporator side. This control is necessary for low pressure safety control as well as temperature control. This cut-out control can even be connected to the suction side of the compressor. This pressure control switch makes and breaks the circuit to the compressor motor when the suction pressure goes low or high according to the preset value. Low suction pressure is created due to the decrease in the load on the refrigeration system.

Main parts of LP cutout control

The low pressure control consists of the following main parts.

1. Knob
2. Differential screws
3. Cut-out screw
4. Lock pin
5. Compression spring
6. Snap action spring
7. Terminals
8. Lever
9. Longitudinal lever
10. Bellows
11. Cross lever
12. Tension spring

Principle of working

When the pressure on the low side increases due to the rise in the refrigerant temperature, increased pressure causes the bellows to expand.

This expansion is transmitted through a lever which closes the electrical contacts and thus the circuit to the compressor is closed.

When the temperature and pressure reach a preset value, the bellows will contract causing the switch to open the circuit thus disconnecting the compressor.

This control protects the refrigeration system from air leaks into the system due to low suction pressure and freezing up of the evaporator.

Precautions

1. The high pressure control must never be fitted to the low side of the compressor and the low pressure control should never be fitted to the high side of the compressor.

2. The low pressure control and high pressure control must operate simultaneously.

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3. If the low pressure control operates, then at the same time the supply should be cut off from low pressure control as well as from high pressure control.

VI. COMPOUND CUT-OUT CONTROL

Compound cut-out has an arrangement to limit the upper and lower pressure Smits in a refrigeration system.

Working steps

1. Locate the place where the pressure tube is placed at the unit. Measure the dimensions of the tube.
2. Take a used high pressure and low pressure switch and remove the cover of the high and low pressure switches.
3. Locate the main compression setting spring and differential (range) setting spring.
4. Recognize the difference between main setting and differential setting reading scales.
5. Remove the fixed terminals and locate the actuating spring.
6. Locate the bellows.
7. Locate the plunger and switch.
8. Suppose a cut-out is set for -3° C is to be changed so that it should cut at -10° C. then the spring force has to be decreased by unscrewing the adjustment screw. The pressure in the evaporator decreases, the bellows get suppressed causing point P to separate from S (refer figure) thereby breaking the electric circuit.
9. In the case of high pressure cut-out, the connection is reversed (refer to figure). The electric circuit is complete as long the condensing pressure is below the upper set value. When the pressure goes beyond the upper limit, the bellows move up causing the lever to rise. This disconnects the point R from point T.
10. Adjustments can be made with the adjustment screw for the required pressures.

VII. ADJUSTMENTS IN LOW PRESSURE CUT-OUT

1. Determine the desired cut-out temperature of the refrigerated space.
2. Check the corresponding, pressure from the temperature pressure relationship chart for the refrigerant already charged in the system.
3. Determine the desired cut-in temperature of the refrigerated space.
4. Check the corresponding, pressure from the temperature pressure relationship chart for the same refrigerant charged in the system.
5. Check the refrigerated space temperature.
6. Remove the screw and take off the knob and the locking plate from the top of the LP control.
7. The required starting pressure is now set by means of the regulating spindle - 1 (range adjustment) and scale on the cover of the device.
8. Lock the spindle with the plate.
9. The required stopping pressure is now set by means of the regulating spindle - 2 (cut-out differential adjustment).
10. The scale which indicates the pressure difference between starting and stopping pressure is the differential, l.e., (starting pressure - differential stopping pressure)
11. Fit the knob on the spindle 2 for stopping pressure and secure it with the screw.
12. The starting pressure is now fixed.
13. The knob can be rotated for adjusting the stopping pressure.
14. Start the unit and check the newly set pressures by means of gauges.
15. Check the cut-in and cut-out temperatures of the refrigerated space by means of dial thermometer.

VIII. ADJUSTMENTS IN HIGH PRESSURE CUT-OUT

1. Determine the desired cut-out pressure of the unit.
2. Remove the screw and take off the locking plate.
3. Set the required stopping pressure by means of the regulating spindle -1 on the scale.
4. Set the required differential, i.e., the difference between stopping and starting pres-sure by means of the regulating spindle - 2.
5. Start the unit and wait till pressure rises for which the control is set.
6. Check the unit stops at the desired cut-out pressure.

Caution: The stopping pressure should not be set so low that the unit will stop during normal operation in the summer season.

7. Check the unit starts at starting pressure, i.e., (stopping pressure differential = starting pressure).
8. Fit the locking plate and screw it on.

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IX. CONCLUSION

The operation of high-pressure and low-pressure cut-outs in refrigeration systems is crucial for maintaining safe, efficient, and reliable system performance. High-pressure cut-outs protect the system from excessive pressure that could lead to equipment damage or safety hazards, while low-pressure cut-outs prevent compressor damage caused by refrigerant loss or system blockages. Proper setting, maintenance, and testing of these devices ensure that the refrigeration system operates within its designed parameters, enhancing system longevity, reducing downtime, and ensuring user safety. Ultimately, high-pressure and low-pressure cut-outs serve as essential safeguards that contribute significantly to the overall effectiveness and durability of refrigeration systems.

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