FAQ

HOW CAN A RECIRCULATING CHILLER PROVIDE HEAT?

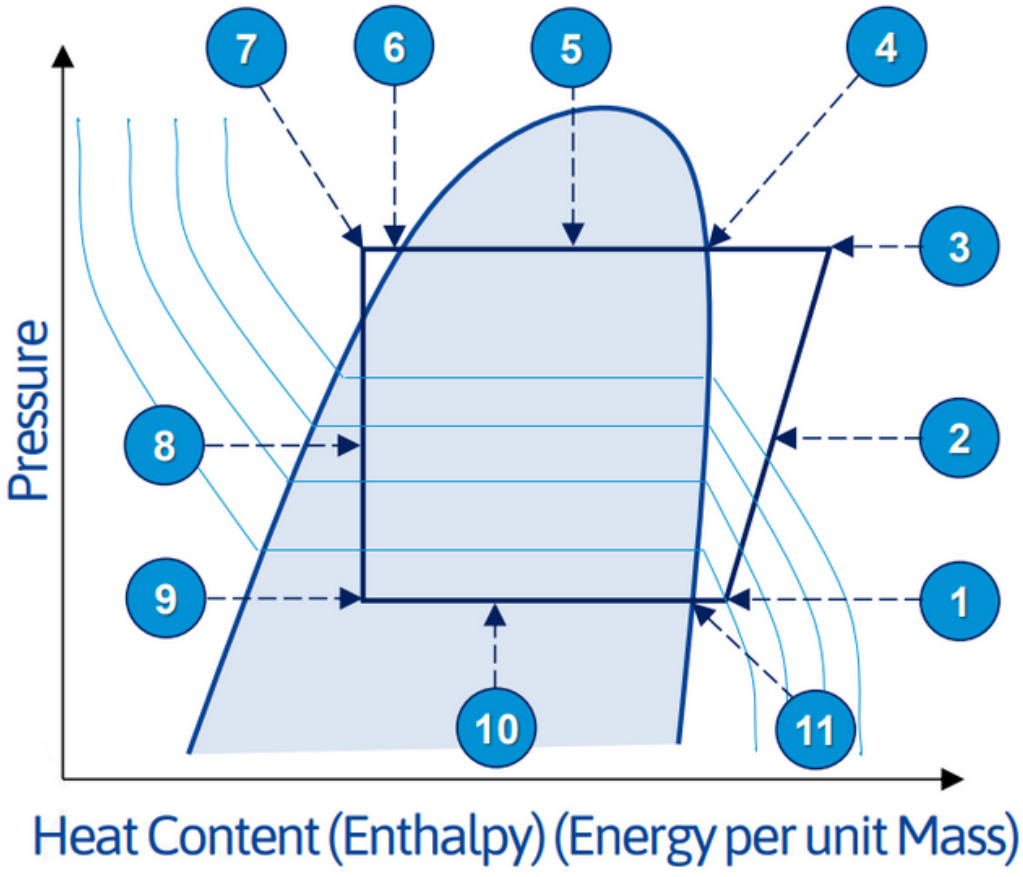
The heat of compression adds energy to the refrigerant:

- The act of compression itself causes the temperature to rise.
- Electrical energy input to the compressor enters the refrigerant through conduction as the refrigerant circulates.

Hot Gas Bypass (HGB) capacity control:

- Instead of allowing hot gaseous refrigerant to pass into the condenser to do conventional refrigeration, it is redirected into the evaporator via a discharge bypass valve (DBV or HGBV)).

The Reverse-Carnot Cycle



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The Reverse-Carnot Cycle

1. Compressor suction port draws refrigerant in.
2. Compression increases pressure and heat.
3. Sensible cooling begins at the condenser.
4. Sensible cooling completed; state change starts.
5. State change in condenser - constant temperature and pressure.
6. Latent cooling completed; further sensible cooling to point 7 ensures liquid supply. This is sub cooling.
7. Expansion process begins at the inlet to TEV.
8. Expansion is achieved by reducing pressure through a tiny orifice. Low pressure and temperature seen at outlet.
9. Inlet to evaporator provided with refrigerant already going through state change.
10. Boiling (evaporation) process continues in the evaporator.
11. Liquid cannot be compressed; additional sensible heating applied before gaseous refrigerant can enter thee compressor. This is known as superheat.

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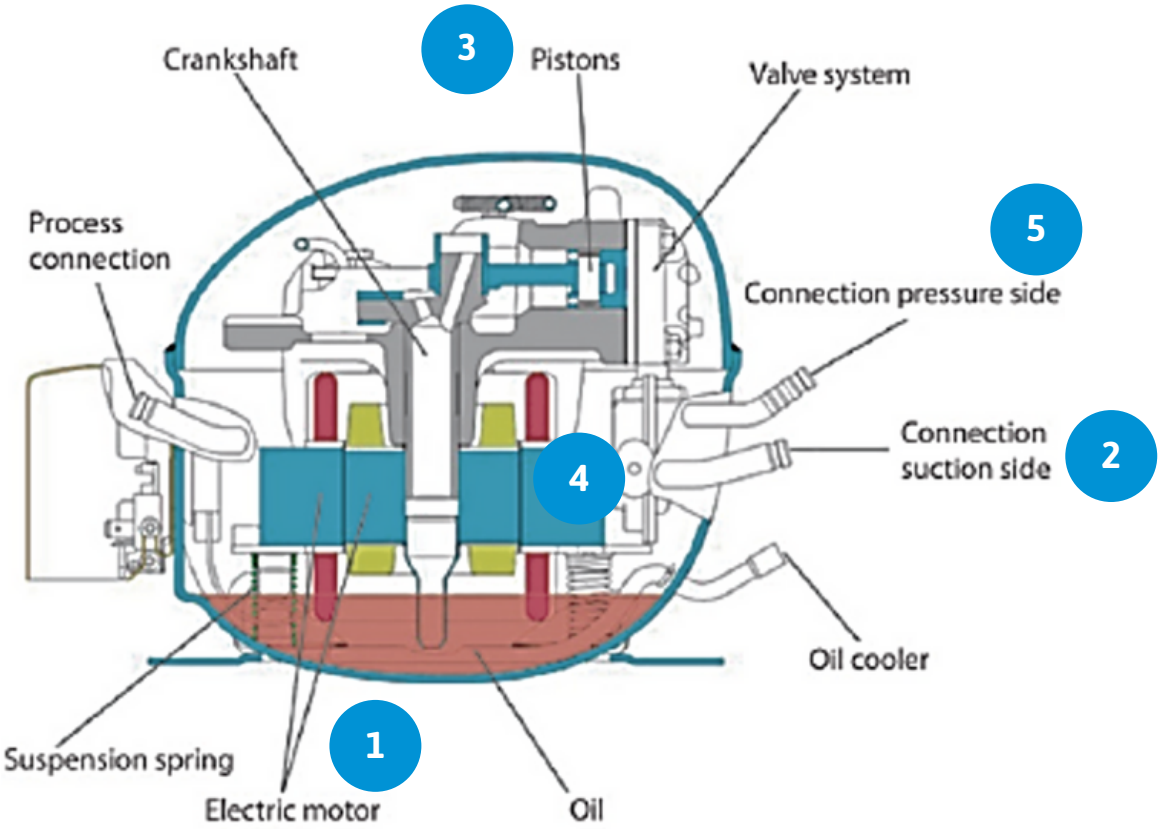
Compressors heat due to isentropic compression and electric motor inefficiency.



1 **Electrical Energy-In**

2 ***Refrigerant Low Pressure Low Temperature***

3 **Isentropic Compression**

4 **Wasted Electrical Energy**

5 **Refrigerant** ***High Pressure High Temperature***

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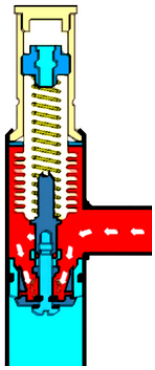
HGBV Capacity Replacement



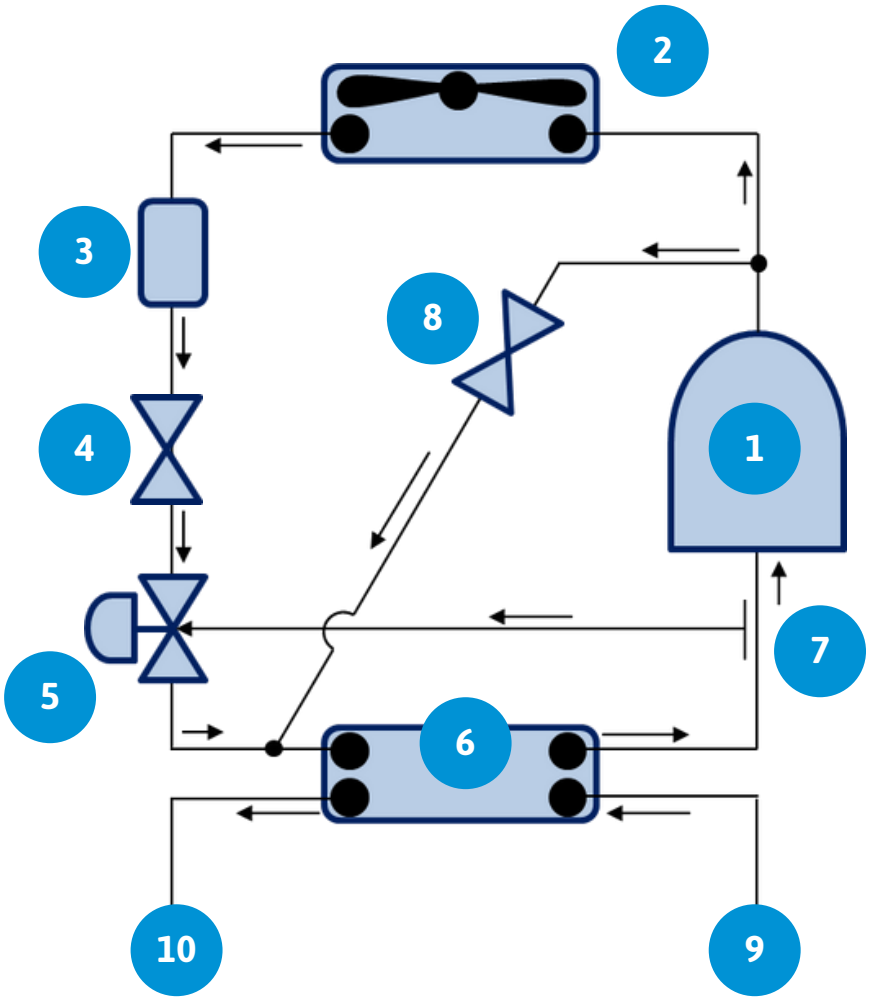
HGBV operates on suction pressure;

- The compressor cannot be allowed to continue pulling vacuum on the low side, or motor failure will occur.
- Mass recirculated through the condenser, expansion device, and evaporator must be replaced with mass from elsewhere in the system.

Minimum temperature set by HGBV;

- Closing the solenoid valve reduces pressure in the low side, HGBV setting controls when hot gas is allowed to bleed through.

Conventional ATC Fridge Circuit



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1. Compressor draws low pressure vapour in from suction line, and discharges high pressure vapour.
2. Condenser starts cooling high pressure vapour through fins and tubes. Once condensed into a liquid, the refrigerant is still warm and under high pressure.
3. Any non-refrigerant liquid or particulate matter is removed in the filter drier.
4. A solenoid valve controls the passage of liquid refrigerant.
5. Entering at high pressure, the refrigerant hits an orifice - a tiny hole within the expansion valve. A pressure drop occurs as the refrigerant passes through, resulting in a temperature reduction.
6. Refrigerant is now drawn through from compressor suction. As it passes through the evaporator, heat from the passing application fluid causes it to boil off, ensuring only vapour returns to the compressor.
7. To ensure that only vapour returns, a capillary tube runs back to the evaporator to alter the flow of the refrigerant through the expansion valve.
8. This is the Hot Bypass Valve. When the solenoid (4) closes (to reduce system capacity to zero), the suction from the compressor (1) draws hot high pressure vapour through the evaporator (6) from the system's high side. When cooling is required again, the solenoid (4) reopens, and expanded refrigerant flows again.
9. Heated liquid in from the application
9. Cooled liquid out to the application

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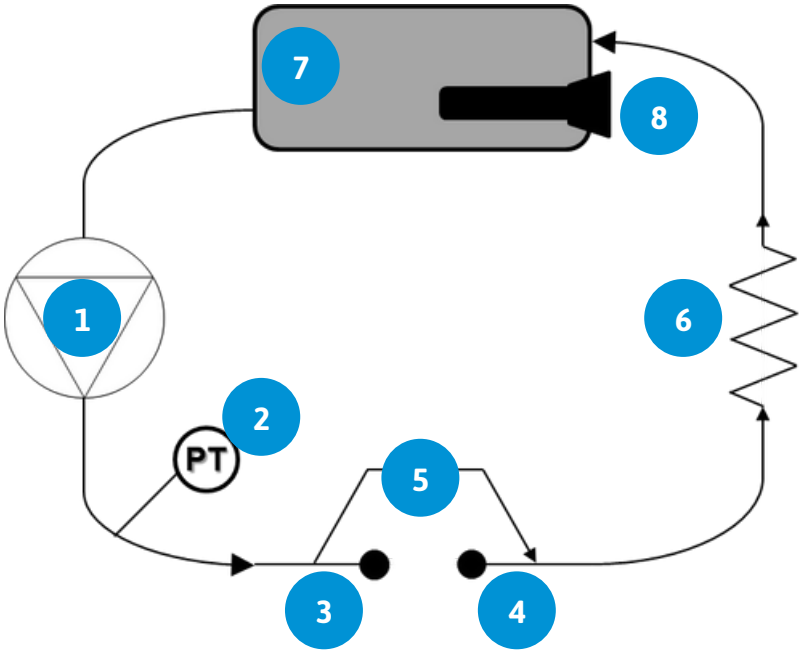
It is possible to provide heat faster by installing a heater in a flow-through water circuit.



1. Pump pressurises the system
2. Pressure and temperature measured
3. Chiller outlet fitting
4. Chiller inlet fitting
5. Application pressure relief valve
6. Heat exchanger to fridge system
7. Tank
8. Optional cartridge heater, which when fitted, reduces heating time compared to allowing the heat of compression to act alone.

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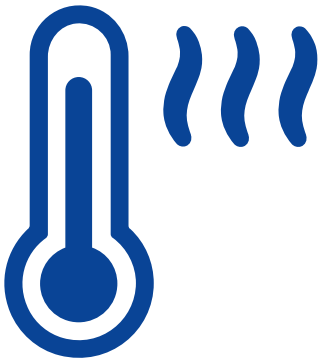
Common misconceptions

The compressor does the cooling;

- Low temperature can only be achieved by condensing and expansion. A compressor is only one of four critical components.

Chillers do not heat, they can only cool;

- Many manufacturers operate an 'on-off' system with a large tank. When tank temperature climbs above a set point, the refrigeration system switches on.
- These are typically less accurate than those systems with HGBV.



Please contact us with any further queries.