

Capacity Controls

- Identifying Carrier/Carlyle Hot-Gas or Suction Cut Off Capacity Control
- Installing 06D or 06E Capacity Control Valve
- Carrier/Carlyle Models 06D and 06E Hot Gas By-Pass
- Carrier/Carlyle Models 06D and 06E Suction Cut Off
- Carrier/Carlyle Models 5F, 5H, 6G, 06G, 6L, 06L
- Copeland 4R, 6R, 8R, 4D, 6D, 8D
- Copeland 9R, 9D
- Chrysler 2000 & 3000 Solenoid Controlled
- Chrysler 2000 & 3000 Pressure Controlled
- Trane Models A, B, E, F
- Trane Model M
- Trane Model R

Carrier / Carlyle Capacity Control Valves



Suction Cut-off

Hot Gas By-pass



Electric Operated

Pressure Operated

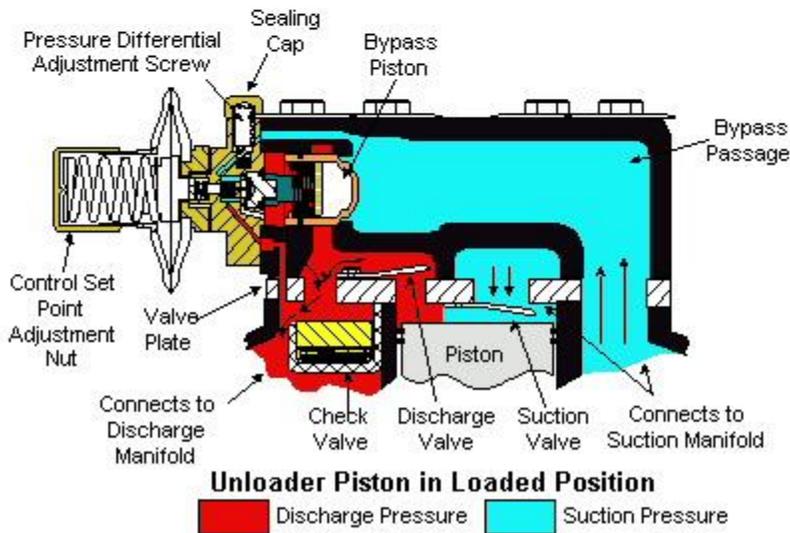
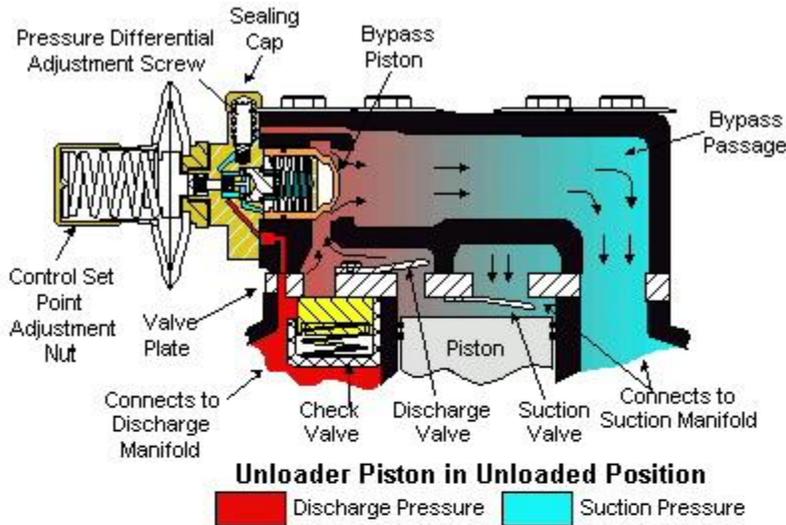
All new Carrier/Carlyle capacity control valves for the 06D and 06E compressors are shipped with a by-pass piston. This piston is not factory installed onto the valve on either the electric or pressure control valves. It must be field installed if used.

The use of this piston is determined by what type of capacity control the compressor has. The [suction cut-off unloader system](#) does not use the by-pass piston and it is discarded, however, the piston must be used on the hot gas by-pass unloader. On the suction cut-off unloader system, remove the blocking sleeve from the head and install the control valve with out the by-pass piston.

On the [hot gas by-pass system](#), remove the by-pass plug and spring from the head, install the by-pass piston that came with the control valve onto the control valve and then install the assembly on the head using the new screws that came with the control valve. Do not use the screws that were used on the flange.

06D-06E Hot Gas By-pass

Capacity Control on the Carrier/Carlyle 06D and 06E compressors is accomplished in one of two ways, hot gas by-pass (HGBP) or suction cut-off unloading (SCOU).



Both types can be electrically controlled with a solenoid or operated with a pressure operated capacity control valve. The hot gas by-pass shown here consists of the unloader head, the unloader control, and a matching HGBP valve plate. The unloader head has two chambers, one connected to the suction side of the compressor, the other connected to the discharge side of the compressor.

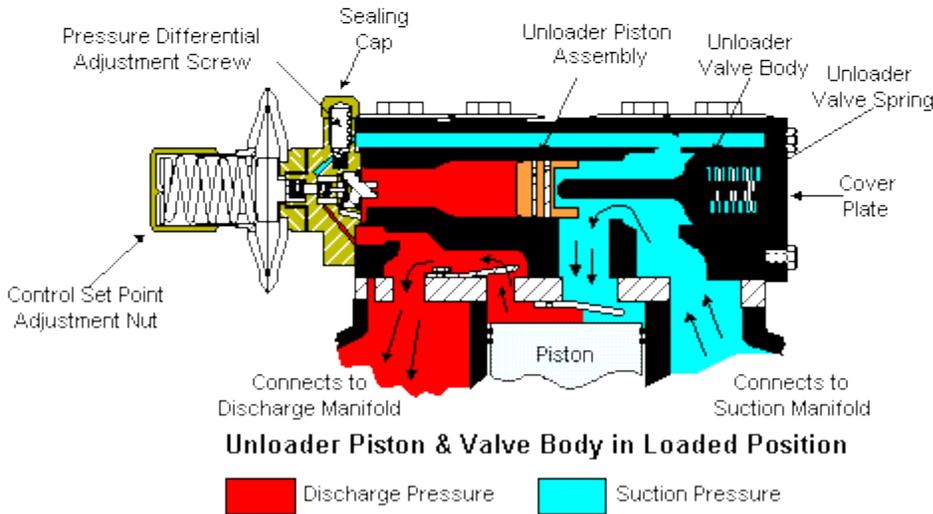
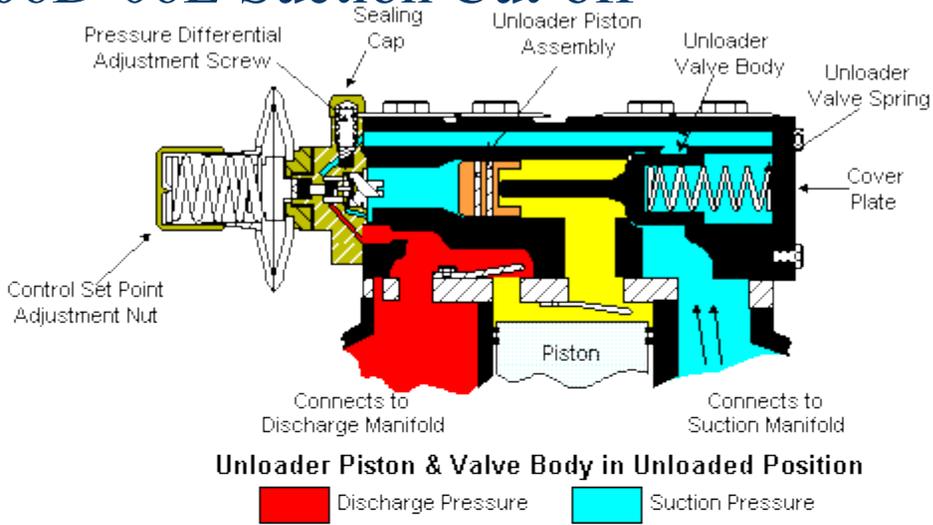
These two chambers are inter-connected with a passage between the two. This passage can be open or closed depending on the position of the bypass piston. When open, the refrigerant pumped by the cylinders in the unloader bank is by-passed back to the suction side of the compressor. When closed, the refrigerant is forced into the discharge manifold.

The discharge sides of all cylinder banks are connected internally via a discharge manifold. Since this type of unloading opens a port between both the discharge and suction sides of the compressor a check valve is necessary to prevent an unloader from bypassing the gas from all cylinders back into the suction. This check valve is part of the HGBP valve plate assembly and must be used with this type capacity control.

These compressors are shipped with a bypass plug and spring in all unloader heads. This plug and spring manually closes the unloader bypass port and loads the compressor. If an capacity control valve is installed the plug and spring must be removed.

Proper operation of the unloader control valve should be checked when installed. This includes the control set point and differential settings on the pressure operated control valve. An improperly installed or defective control valve can result in compressor failure.

06D-06E Suction Cut-off



Capacity

Control on the Carrier/Carlyle 06D and 06E compressors is accomplished in one of two ways, hot gas by-pass (HGBP) or suction cut-off unloading (SCOU).

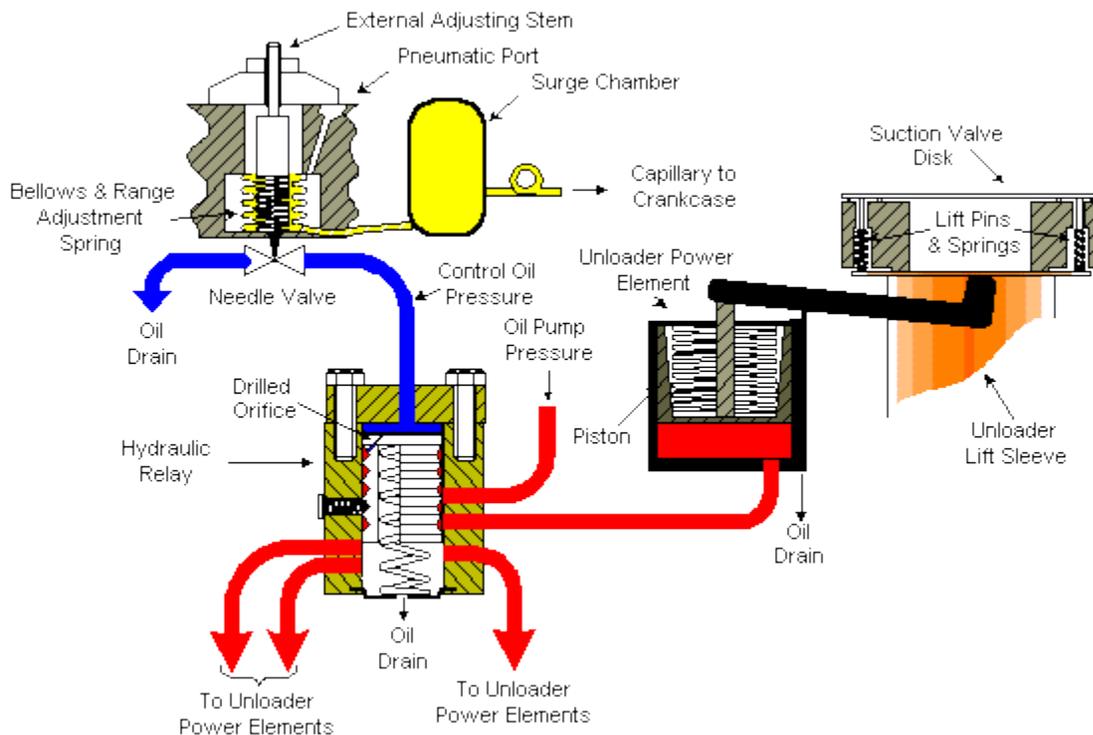
Both types can be electrically controlled with a solenoid or operated with a pressure operated capacity control valve. The suction cut off shown here consists of the unloader head assembly and the unloader control. The unloader head has three chambers, one connected to the suction side of the compressor, a second connected to the cylinders of that bank and the third connected to the discharge side of the compressor. The suction chamber and the cylinder chambers are

connected by means of a controlled passage. This passage can be open or closed depending on the position of the unloader piston. When open, the cylinders of the unloader bank and the suction side of the compressor are connected and the compressor is loaded. When closed, the cylinders of that bank are denied gas from the suction side of the compressor, hence the name “suction cut-off”.

These compressors are shipped with a blocking sleeve in all unloader heads. This sleeve manually opens the unloader valve and loads the compressor. If a capacity control valve is installed this sleeve must be removed.

Proper operation of the unloader control valve should be checked when installed. This includes the control set point and differential settings on the pressure operated control valve. An improperly installed or defective control valve can result in compressor failure.

5F-5H-06G-06L



Capacity Control on the Carrier/Carlyle 06L, 06G, 5H, and 5F40s and 60s is accomplished by

mechanically lifting the suction valve disks off the suction seats. When the valve is lifted all refrigerant in the cylinder is pumped back into the suction side of the compressor on the piston up stroke.

The unloader controls are basically the same. The only real difference is where the parts are located on each compressor and slightly differently designed hydraulic relay on the 06L compressors. There are three main components in this system, the needle valve, the hydraulic relay and the power elements.

The needle valve controls the position of the hydraulic relay piston by varying the oil pressure on top of this piston. This oil pressure is referred to as the “control oil pressure” and is the oil that comes thru a small orifice in the top of the relay piston. Pressure is varied by a controlled dumping of this oil back into the crankcase thru a needle valve. Three forces control the needle valve, suction pressure in one direction and the range adjustment spring plus external air pressure or atmospheric pressure in the other direction. A balance to maintain the desired suction pressure is achieved by changing the spring pressure using the external adjusting stem.

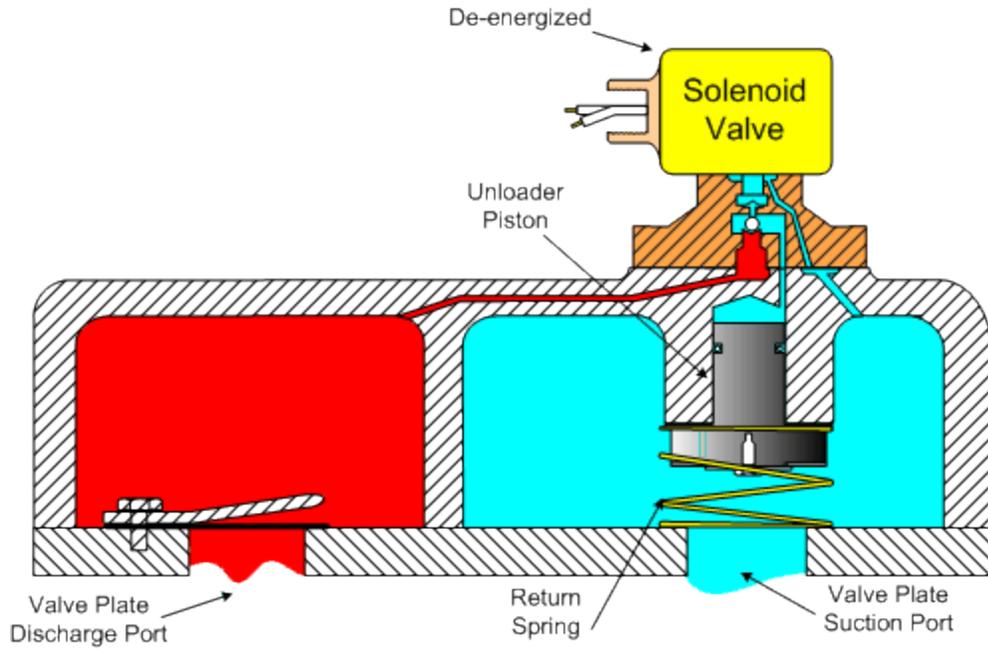
The hydraulic relay controls the oil supply from the oil pump to the power elements by opening or closing the supply oil lines to the power elements. Detent balls and springs in the relay control the steps of the relay piston. All the compressors have four steps though on four cylinder machines only three are actually used, the fourth is not piped to any power element.

These compressors can be operated electrically using remotely mounted solenoids piped back to the compressor but when used this way the operation of the oil relay to the power elements must be blocked. The manufacturer offers a kit for converting these

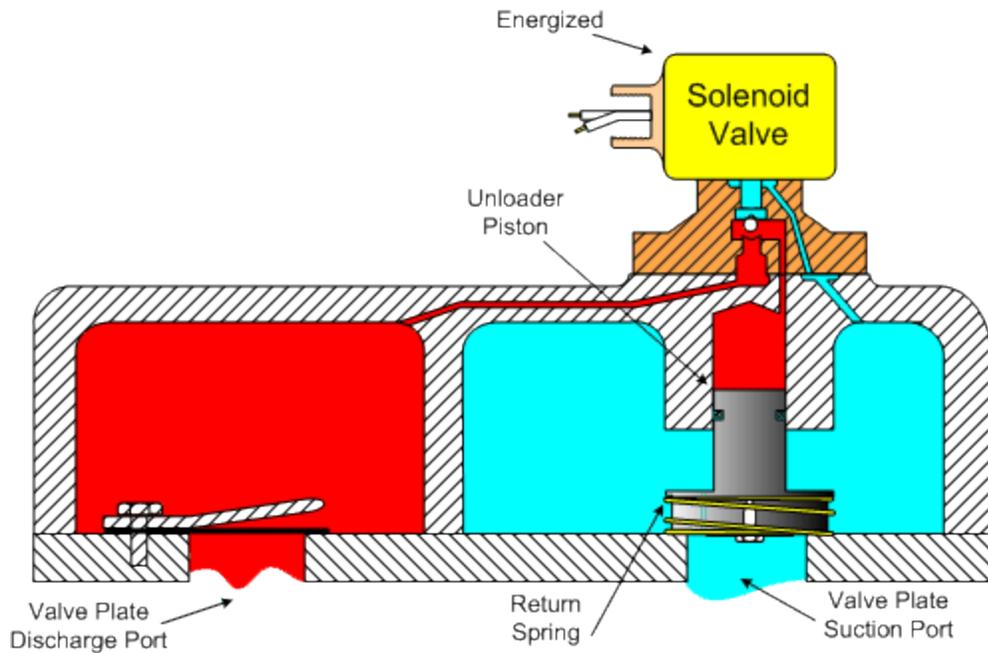
Copeland 4, 6 & 8

The Copeland 4R, 6R, 8R, 4D, 6D and 8D compressors all use blocked suction unloading. An electric solenoid is mounted on the compressor head which when energized opens a port from the discharge of the compressor to the top side of a piston internally in the head. This piston is pushed down closing the suction port in the valve plate. When de-energized the high pressure on top of the piston is vented back to the suction or low side of the compressor and a return spring pushes the piston off the valve plate suction port.

These compressors are shipped with the unloader ports flanged. If the solenoid is not installed the compressor operates in the loaded.



Unloader Piston in Loaded Position



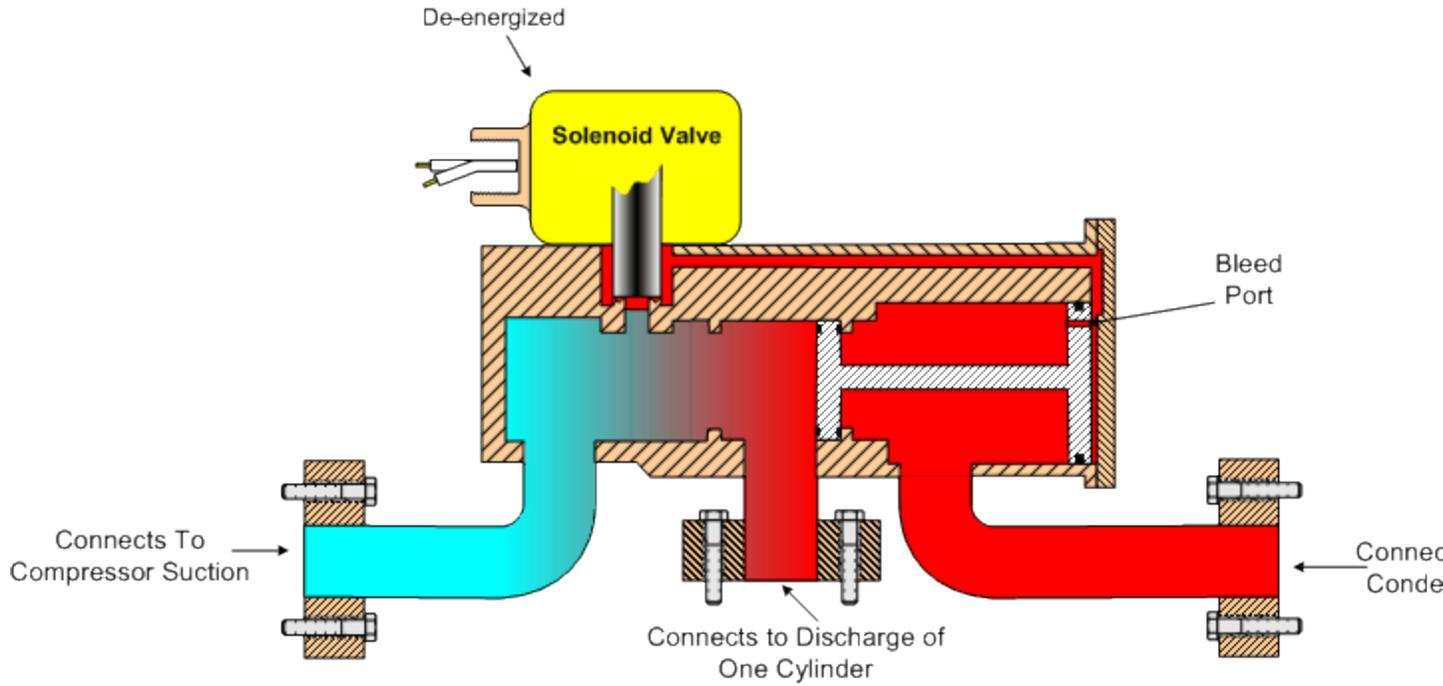
Unloader Piston in Unloaded Position



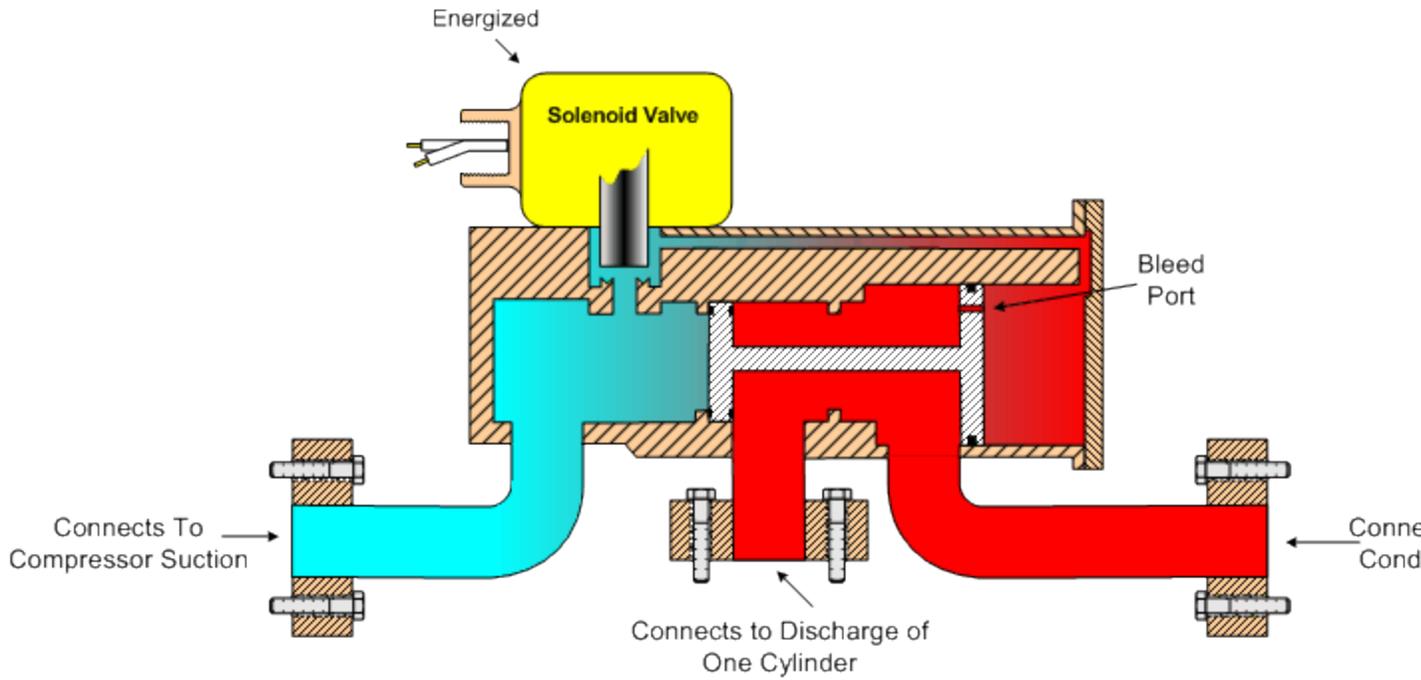
Copeland 9

The Copeland 9R and 9D compressors use an external hot gas by-pass system. When the solenoid is de-energized the by-pass valve directs the gas from one cylinder to the condenser. When energized the the gas is directed back into the suction of the compressor.

Compressors equipped with this type unloading must have it installed. There is no internal provision to send the gas from one cylinder to the discharge or suction, this is done with the external solenoid and piping. To operate these compressors without the unloader the compressor head must also be changed. Failure to do so could result in equipment damage and/or personal injury.



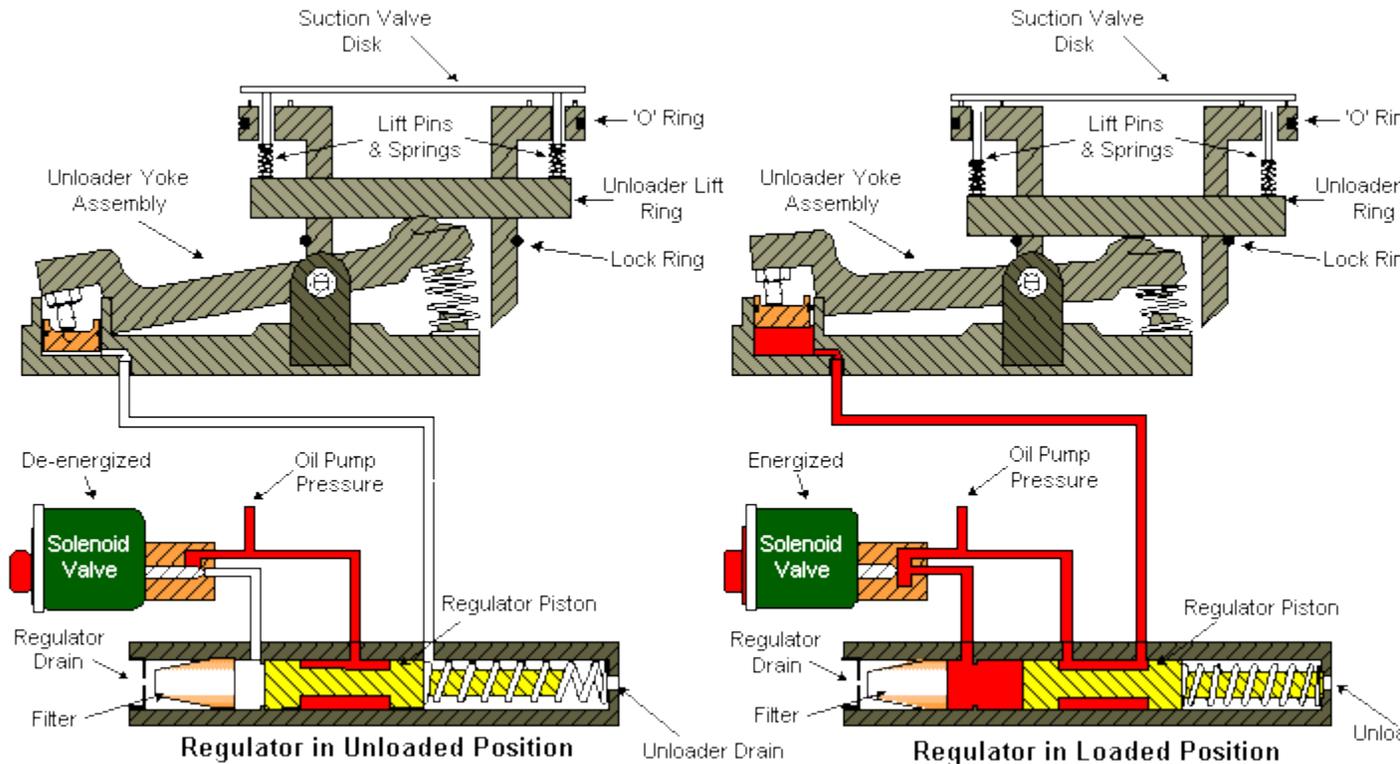
Unloader Valve in Unloaded Position



Unloader Valve in Loaded Position

Chrysler 2000-3000 Electric

Capacity Control on the Chrysler 2000 and 3000 series compressors is accomplished by mechanically lifting the suction valve disks off the suction seats. When the valve is lifted all refrigerant in the cylinder is pumped back into the suction side of the compressor on the piston up stroke. There are two types of unloading on these compressors, suction controlled or electric unloading.

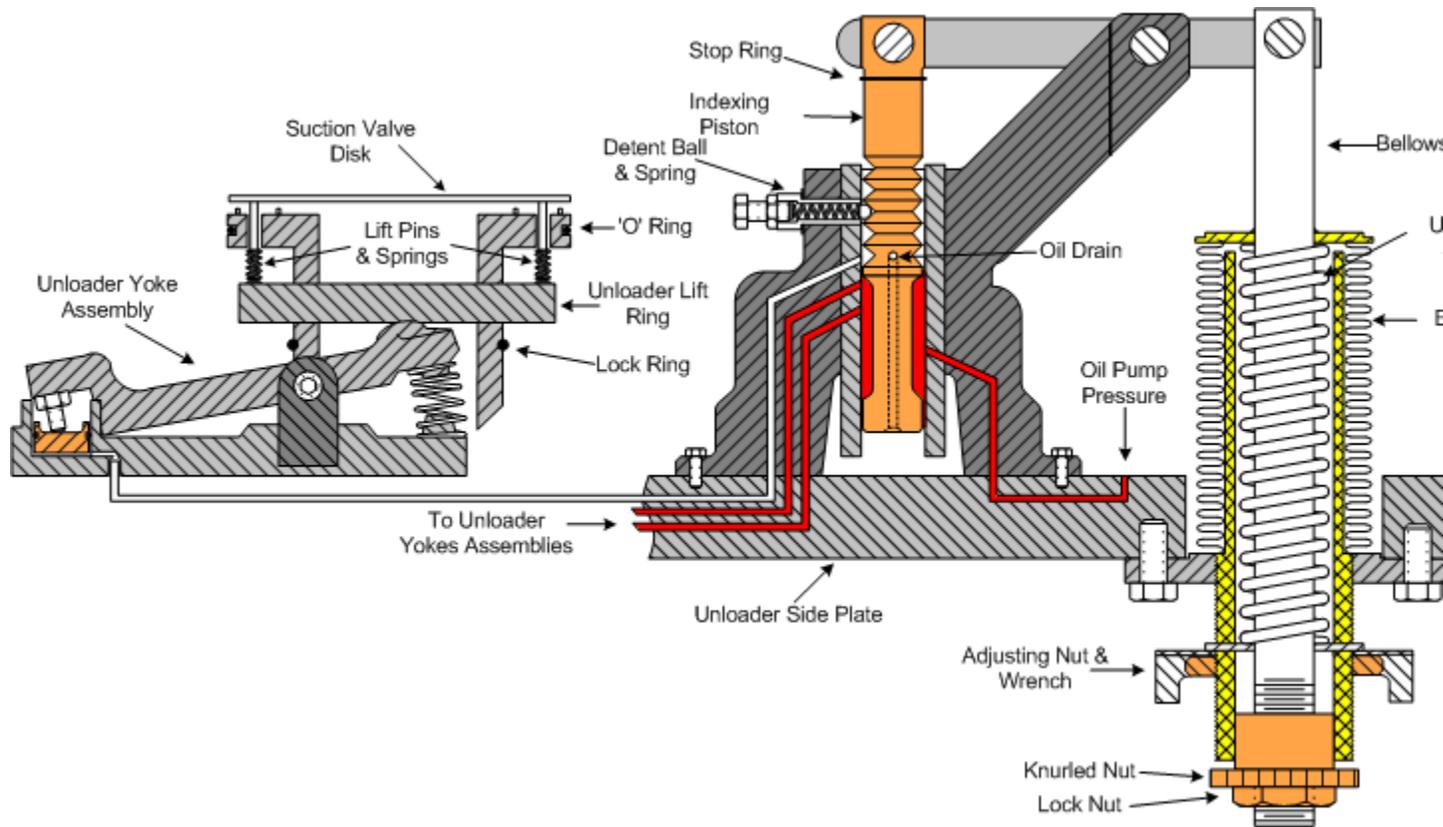


The electric unloader models are normally three steps of unloading. These can be identified by three electric solenoids mounted on the capacity control cover. 100% unloading is also available and these models have four solenoids. 100% models are fully unloaded on startup only. The first step of capacity control loads as soon as oil pressure is established. There are three main components in this system, the unloader regulator assembly, the solenoids and the unloader yoke or power assemblies.

The regulator assembly controls the oil supply from the oil pump to the yokes by opening or closing the supply oil lines to the yokes. The regulator has an internal piston for each step of capacity control, either three or four. Each piston is controlled by an electric solenoid. When energized the piston moves to open supply oil pressure to the unloader yoke. When de-energized, oil is bleed off the piston and the return spring closes the oil ports.

Chrysler 2000-3000 Pressure

Capacity Control on the Chrysler 2000 and 3000 series compressors is accomplished by mechanically lifting the suction valve disks off the suction seats. When the valve is lifted all refrigerant in the cylinder is pumped back into the suction side of the compressor on the piston up stroke. There are two types of unloading on these compressors, suction controlled or [electric unloading](#).



The suction pressure unloader controls are the same on all models. There are three main components in this system, the unloader body and piston assembly, the unloader bellows and spring assembly, and the unloader yoke or power assemblies.

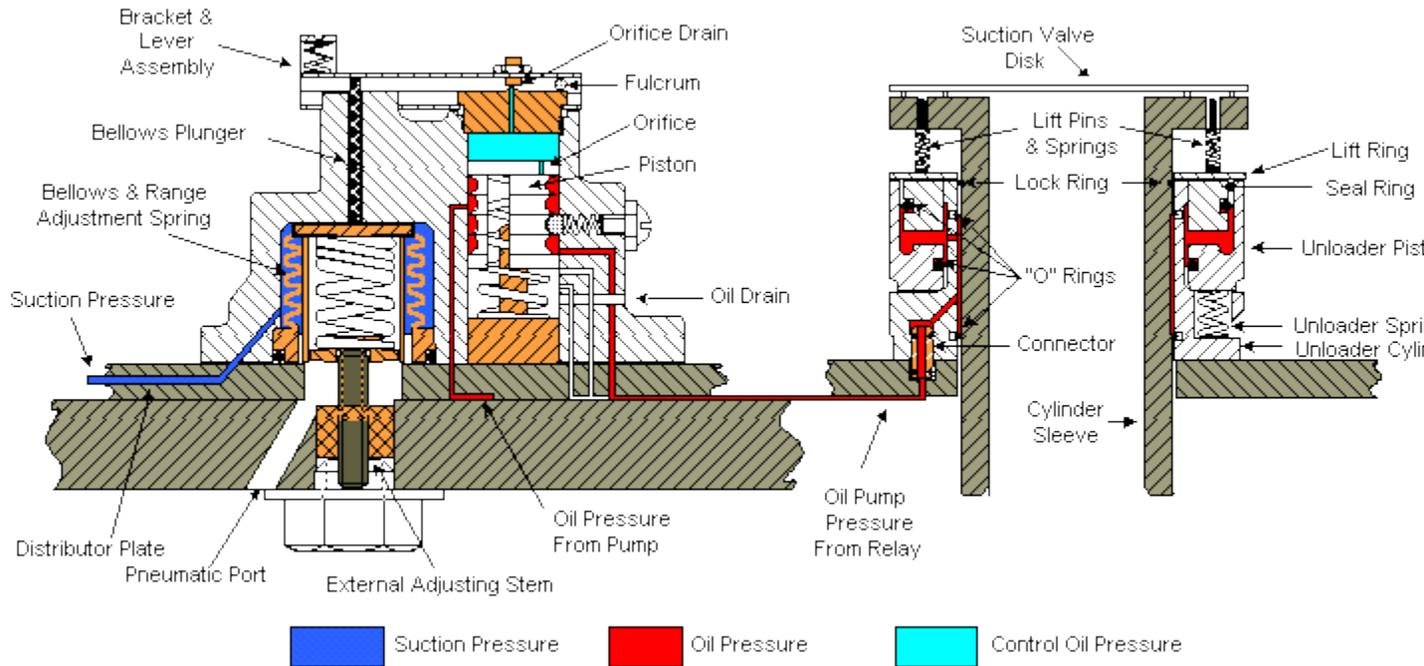
The bellows and spring assembly control the position of the unloader body piston. This is done with a mechanical linkage between the two assemblies. Three forces control the position of the bellows rod, suction pressure in one direction and the range adjustment spring plus external air pressure or atmospheric pressure in the other direction. A balance to maintain a desired suction pressure is achieved by changing the spring pressure using the external adjusting nut. The knurled nut and lock nut are used to prevent a step from unloading if this is needed.

The unloader body and piston assembly controls the oil supply from the oil pump to the yokes by opening or closing the supply oil lines to the yokes. Two detent balls and springs in the unloader

body give each step a positive action. All the compressors with suction unloading have three steps.

A, B, E & F Trane

Capacity Control on the Trane models A, B, E & F is accomplished by mechanically lifting the suction valve disks off the suction seats. When the valve is lifted all refrigerant in the cylinder is pumped back into the suction side of the compressor on the piston up stroke. Trane offers three types of unloading on these compressors, suction unloading, electric unloading and electric unloading with remote mounted solenoids.



Electric unloading or remote electric unloading does not use the bellows and relay assembly but directs oil pump pressure directly to the power elements thru electric solenoids mounted either directly on the compressor hand hole cover or remotely on the unit.

The suction unloader control is basically the same on all models. There are two main components in this system, the hydraulic relay and bellows assembly and the power elements.

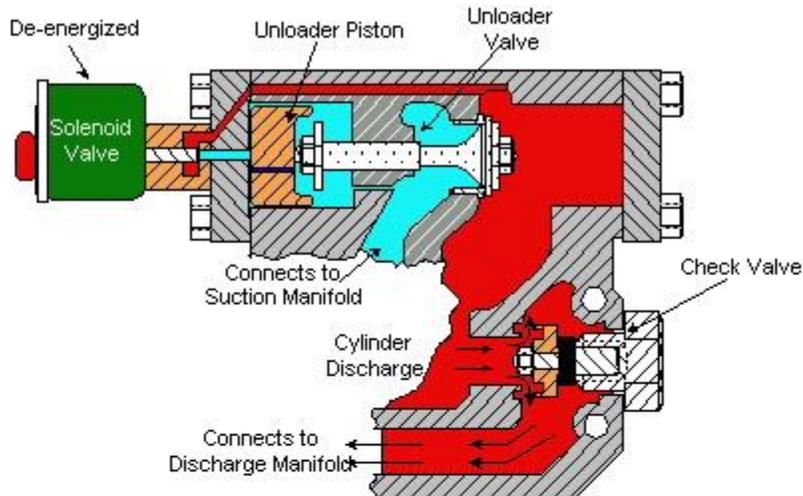
The bellows and range adjustment spring control the position of the hydraulic relay piston by varying the oil pressure on top of this piston. This oil pressure is referred to as the “control oil pressure” and is the oil that comes thru a small orifice in the top of the relay piston. Pressure is varied by a controlled dumping of this oil back into the crankcase thru an orifice drain. Three

forces control the orifice drain, suction pressure in one direction and the range adjustment spring plus external air pressure or atmospheric pressure in the other direction. A balance to maintain the desired suction pressure is achieved by changing the spring pressure using the external adjusting stem.

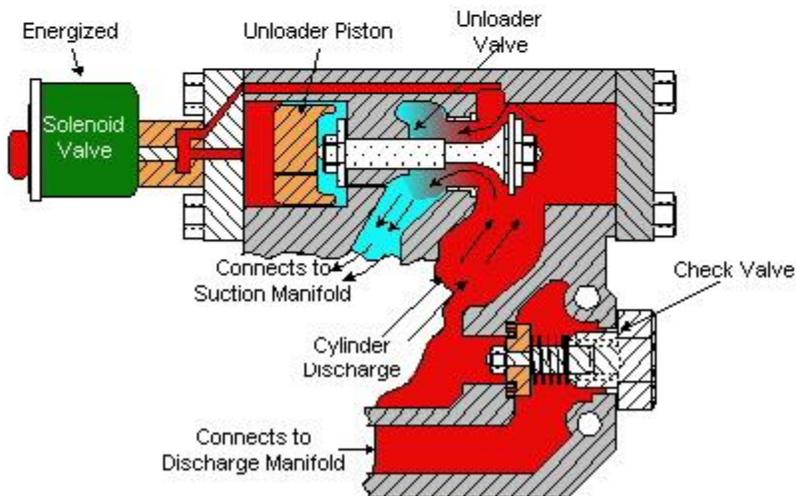
The hydraulic relay controls the oil supply from the oil pump to the power elements by opening or closing the supply oil lines to the power elements. Detent balls and springs in the relay control the steps of the relay piston. All the compressors have three steps of capacity control, each step may control one or two cylinders depending on the model and number of cylinders the compressor has

M Trane

Capacity Control on the Trane models M & R are electrically controlled hot gas by-pass unloaders. Both models consist of the same parts though they have a slightly different design. The main parts are the solenoid valve, unloader piston, unloader valve and the check valve. There are two unloader head available, one that unloads both cylinders on the bank and one that unloads only one of the cylinders. Various combinations of the two heads and non-unloading heads make possible a wider variety of capacity control steps.



Unloader Piston & Valve in Loaded Position

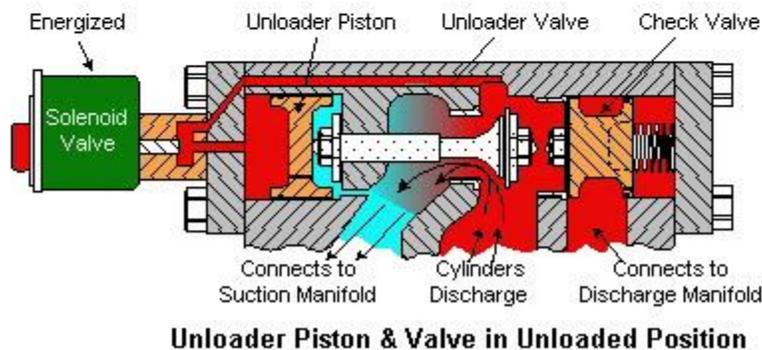
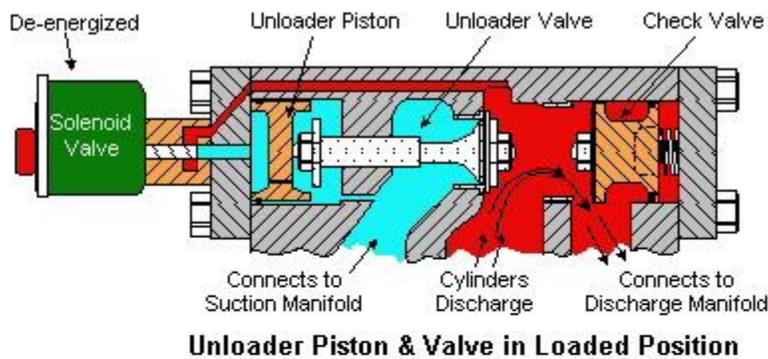


Unloader Piston & Valve in Unloaded Position

The solenoid valve controls operation, hi pressure gas through this valve to the unloader piston opens the unloader valve. The position of the unloader valve determines the route of the cylinder discharge. When closed all gas is sent thru a check valve to the discharge manifold, when open

its sent back to the suction side of the compressor. The check valve is necessary to prevent a direct connection between the discharge and suction sides of the compressor when the unloader valve is open. Since all cylinder banks connect to the discharge manifold, a direct connection would result in the compressor trying to unload all cylinders when the unloader valve opens, not just the cylinders within the unloader head.

R Trane



Capacity Control on the Trane models M & R are electrically controlled hot gas by-pass unloaders. Both models consist of the same parts though they have a slightly different design. The main parts are the solenoid valve, unloader piston, unloader valve and the check valve.

There are two unloader head available, one that unloads both cylinders on the bank and one that unloads only one of the cylinders. Various combinations of the two heads and non-unloading heads make possible a wider variety of capacity control steps.

The solenoid valve controls operation, hi pressure gas through this valve to the unloader piston opens the unloader valve. The position of the unloader valve determines the route of the cylinder discharge. When closed all gas is sent thru a check valve to the discharge manifold, when open its sent back to the suction side of the compressor.

The check valve is necessary to prevent a direct connection between the discharge and suction sides of the compressor when the unloader valve is open. Since all cylinder banks connect to the discharge manifold, a direct connection would result in the compressor trying to unload all cylinders when the unloader valve opens, not just the cylinders within the unloader head.