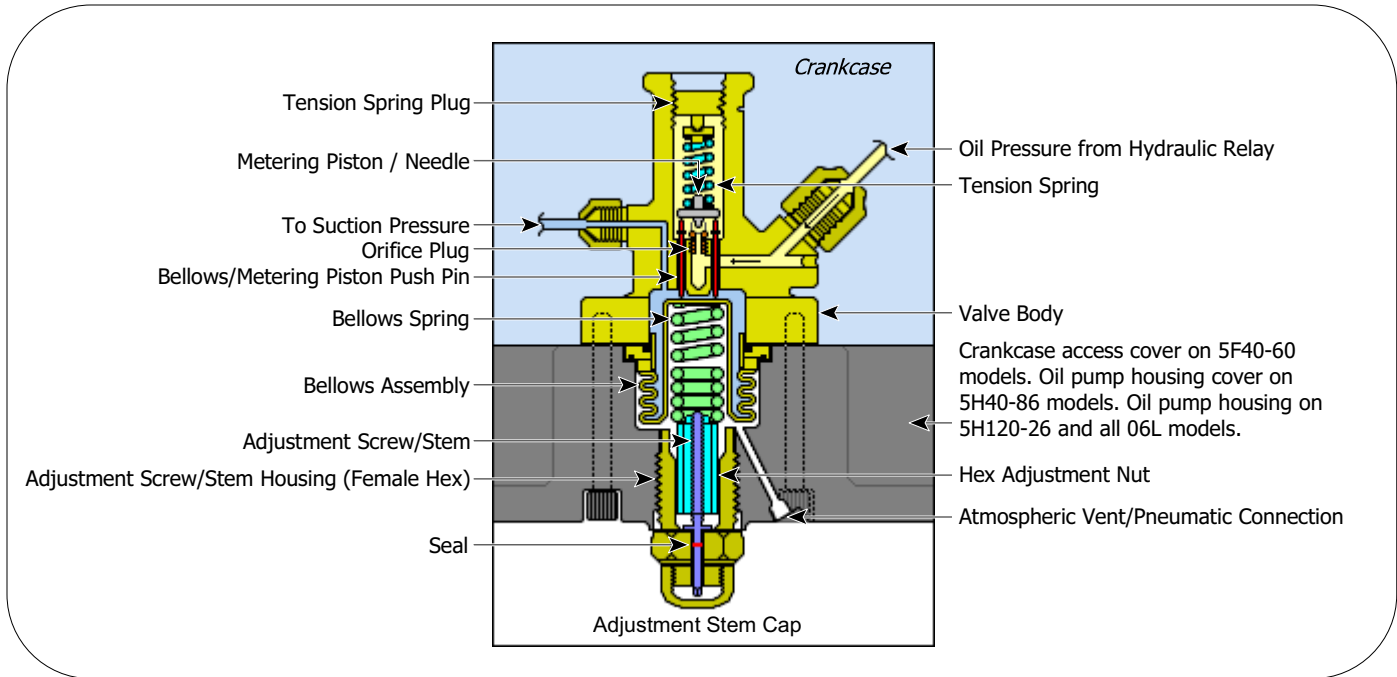
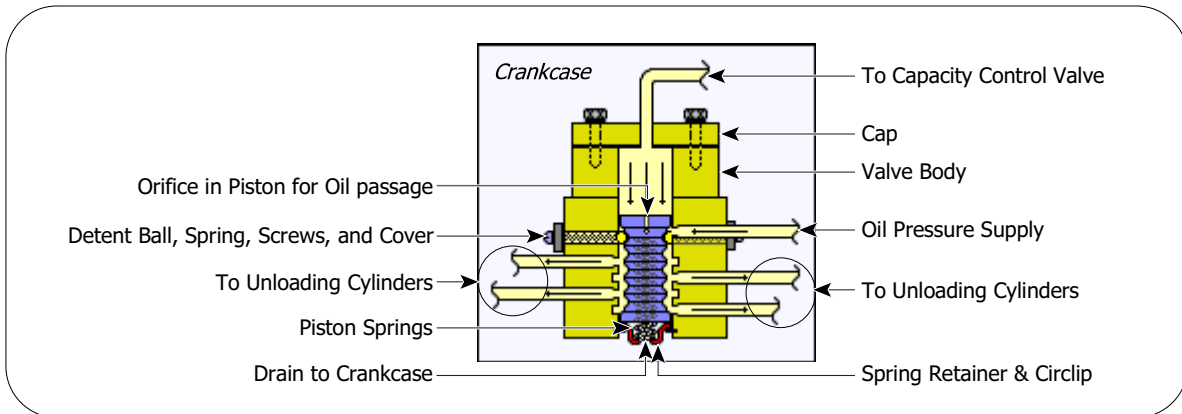


**Carrier/Carlyle  
5F/5H/06L Compressors  
Unloading Characteristics  
Capacity Control Valve**



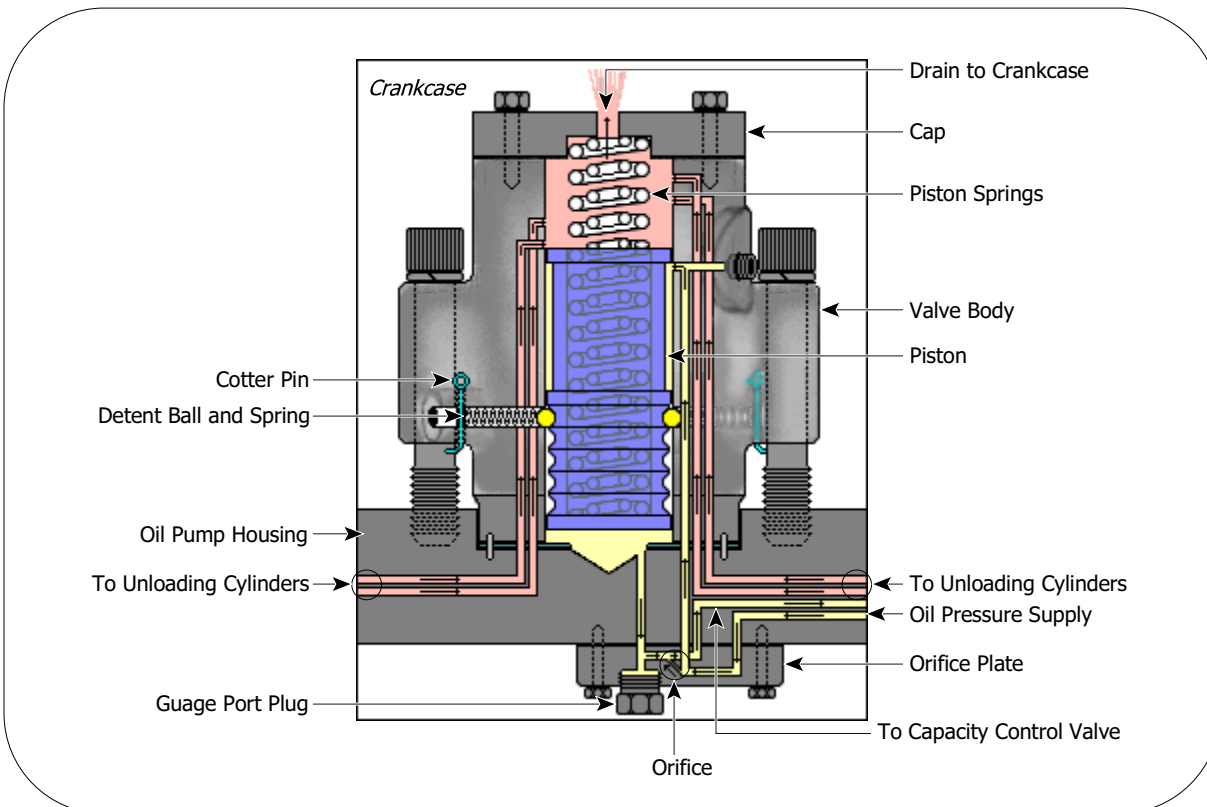
The capacity control valve consists of a bellows, bellows spring and adjustment assembly, metering piston assembly, metering piston spring, orifice plug, and push pins. The bellows has suction pressure imposed on its inner surface and atmospheric or pneumatic pressure on its outer surface. The bellows has a spring within it whose tension can be adjusted by an external adjusting assembly. The bellows contacts push pins which contact the metering piston assembly. The metering piston has a needle attached to it which seats into the orifice plug. Oil pressure from a hydraulic relay is controlled by the orifice plug and metering piston needle. When the suction pressure rises above the set point of the bellows spring and adjustment assembly it forces the bellows towards the control cover. The push pins are then forced towards the control cover by the metering piston tension spring. The metering piston needle then seats in the orifice plug and stops oil flow from the hydraulic relay. Oil pressure builds up in the hydraulic relay causing oil pressure to be fed to the unloader power elements. This loads the cylinders allowing them to pump. Eventually the suction pressure drops to the set point of the bellows spring and adjustment assembly. The bellows spring pushes the bellows towards the crankcase. The push pins force the metering piston towards the crankcase moving the needle off of its seat in the orifice plug. This allows oil to flow from the hydraulic relay into the crankcase. This causes the hydraulic relay to stop oil flow to the unloader power elements and allows the oil pressure built up in the unloader power elements to drain to the crankcase causing the cylinders to unload. Eventually the suction pressure rises again to the setpoint and the process starts over. The control valve, hydraulic relay, power elements, and cylinders are fashioned so that once the control point is set the suction pressure is maintained automatically in a narrow range.

**Carrier/Carlyle  
5F/5H Compressors  
Unloading Characteristics  
Hydraulic Relay 5F/5H 4 - 8 Cylinders**



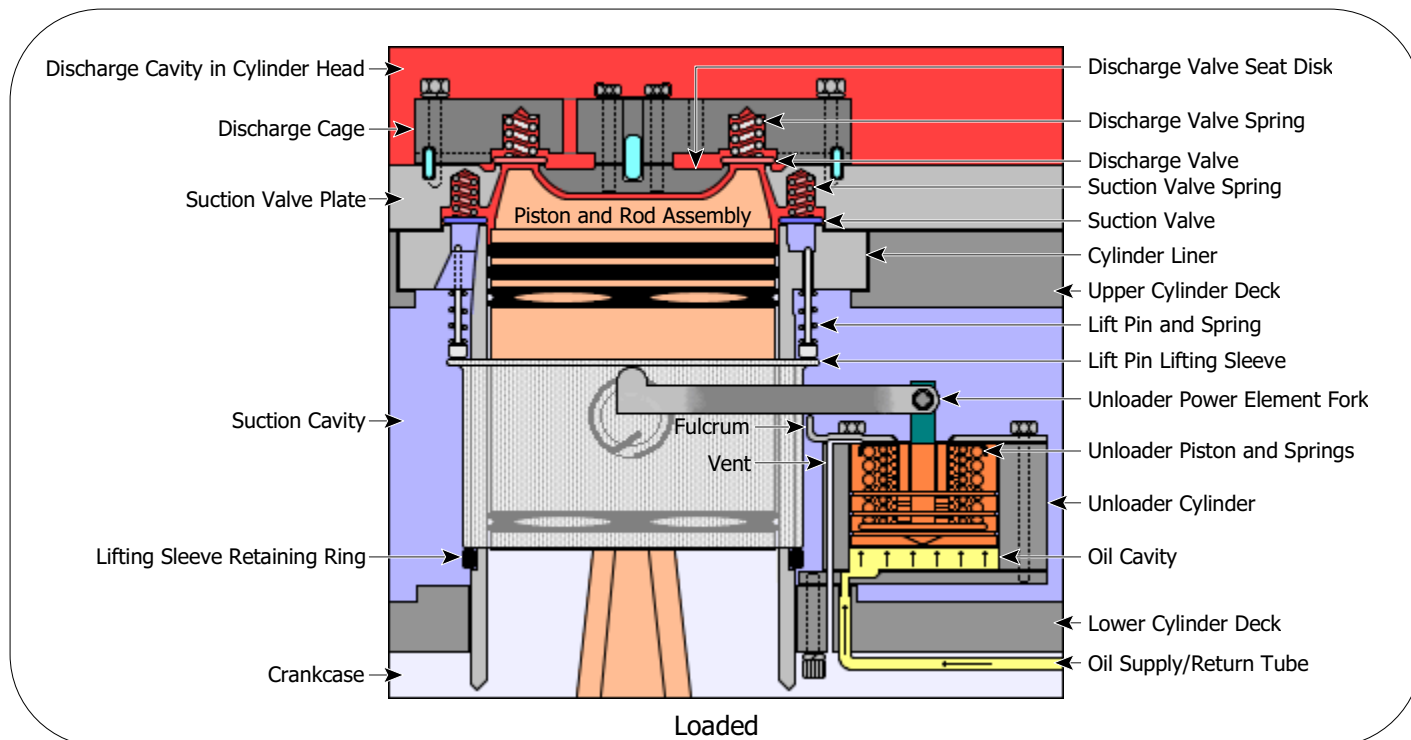
The hydraulic relay for the 5F and 5H models (4 through 8 cylinders) consists of a brass cylinder body, steel piston and springs, and detent balls and springs. Tubes leading to the unloader power elements are ported to the cylinder. A tube supplying oil pressure is also ported to the cylinder. A cap bolted onto the top of the cylinder has a tube attached to it which leads to the control valve assembly. The steel piston is fitted into the cylinder and is held in place by springs which fit into its inner bore. The springs are held in the cylinder by a cup shaped retainer, with a hole in it, and a circlip. The detent balls are held against the grooves in the piston by springs and allow the piston to move in steps. When oil pressure is applied to the hydraulic relay cylinder it is allowed to bleed through an orifice drilled in the piston. This oil is conducted through the tube at the top of the hydraulic relay to the control valve. In the fully unloaded state the piston is forced to the top of the cylinder by the springs beneath it. When the control valve closes allowing oil pressure to build up on top of the hydraulic relay piston it is forced down, in steps. Each step opens a port in the cylinder to oil pressure which flows to the unloader power elements. This action loads the cylinders. When the control valve begins to open and allows oil pressure to bleed off of the top of the hydraulic relay piston it is forced upwards, in steps. Each step closes off the power elements from oil pressure and allows the oil pressure built up in them to drain to the crankcase through the hydraulic relay cylinder. This unloads the cylinders.

**Carrier/Carlyle**  
**5F/5H/06L Compressors**  
**Unloading Characteristics**  
**Hydraulic Relay 5H 12 Cylinders & all 06L Models**



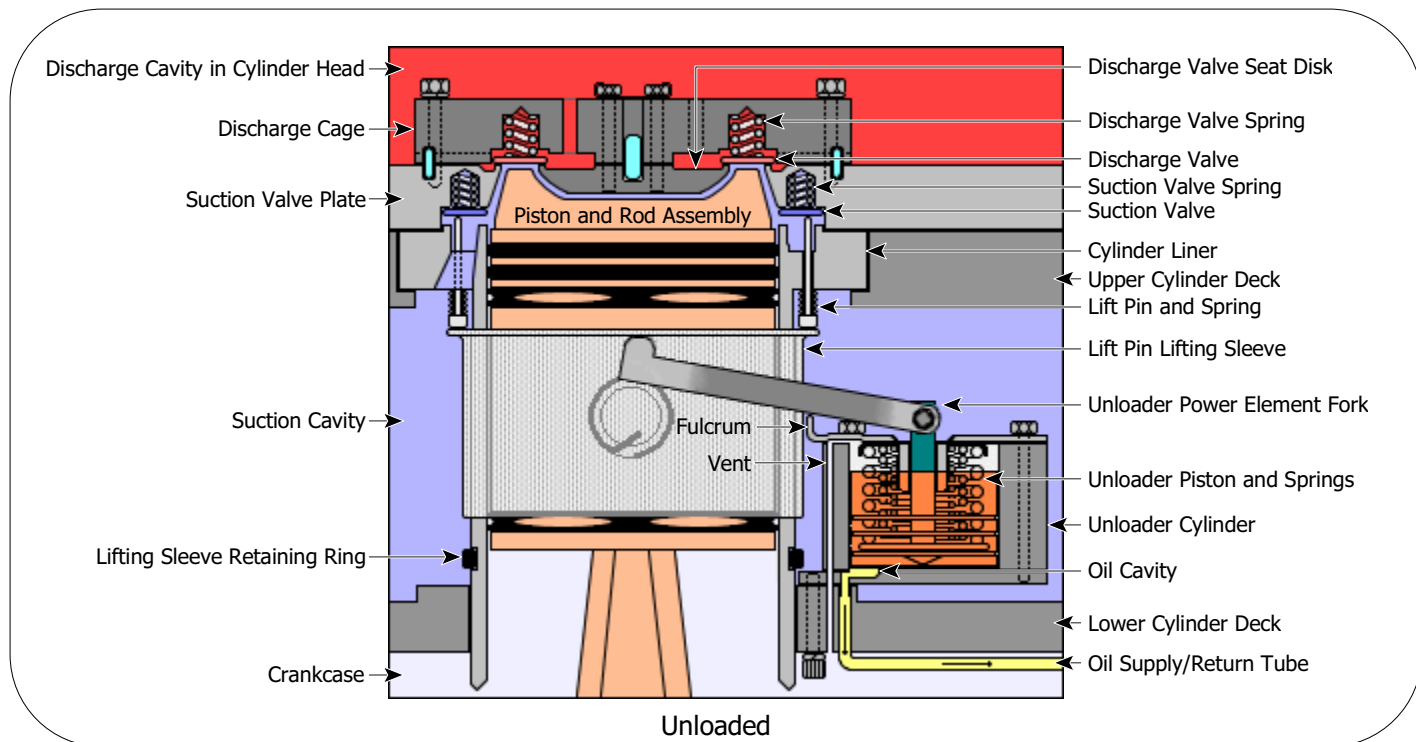
The 5H 12 cylinder and 06L hydraulic relay consist of a cast iron cylinder, a steel piston and springs, a cap with a hole in it, detent balls and springs, and an orifice plate. Ports are drilled into the cylinder which communicate to the unloader power elements, oil pressure, and control valve. Oil pressure is admitted to the bottom of the piston through an orifice drilled in an external orifice plate. In the fully unloaded state the piston is forced down by the springs above it. When the control valve begins to close it allows oil pressure to build up beneath the hydraulic relay piston and force it upwards, in steps. Each step opens ports, leading to the unloader power elements, to oil pressure. This causes the cylinders to load. When the control valve begins to open it allows oil pressure to bleed to the crankcase and the hydraulic relay piston springs force the piston downward, in steps. Each step closes off oil pressure to the unloader power elements and allows the oil pressure built up in them to drain to the crankcase through the hydraulic relay cylinder and hole in the cap above it. This unloads the cylinders.

**Carrier/Carlyle  
5F/5H/06L Compressors  
Unloading Characteristics  
Unloading Cylinder**



When oil pressure is applied to the unloader power element its piston is forced upwards against its springs. The connected end of the power element fork moves upwards and the opposite ends (the fork is shaped like a horseshoe and contacts the lift pin sleeve on opposite sides) move downward. This lowers the lift pin lifting sleeve allowing the lift pins to drop. In turn the suction valve is allowed to contact its seats ground onto the cylinder. When the piston travels downwards the pressure in the cylinder becomes lower than the pressure in the suction cavity. The suction gas in the suction cavity forces the suction valve open against its springs and fills the cylinder. When the pressure in the cylinder is equal to suction pressure the suction valve springs force the suction valve against its seats. When the piston travels upwards and the pressure in the cylinder becomes greater than the discharge pressure in the cylinder head the discharge valve is forced open against its springs. The pressure in the cylinder flows into the discharge cavity in the cylinder head. When the pressure in the cylinder becomes equal to discharge pressure the discharge valve springs force the discharge valve against its seats. When the piston begins to travel downwards the cycle repeats.

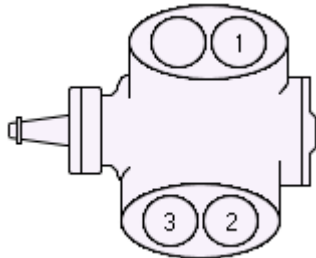
**Carrier/Carlyle  
5F/5H/06L Compressors  
Unloading Characteristics  
Unloading Cylinder**



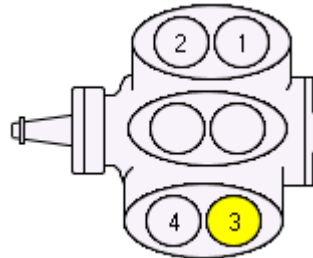
When oil pressure is allowed to drain from the unloader power element the power element piston springs force the piston downwards. The connected end of the unloader fork moves downward. The opposite ends of the fork move upwards which also moves the lift pin lifting sleeve upwards. The lift pins are lifted against their springs. The lift pins contact the suction valve and move it upwards to the fully open position against its springs. Since the suction valve remains open, in this state, the suction gas flows in and out of the cylinder as the piston travels up and down. Since no compression takes place the discharge valve remains closed and the cylinder is effectively unloaded.

**Carrier/Carlyle  
5F/5H Compressors  
Unloading Characteristics**

**5F40 - 60 Compressors**

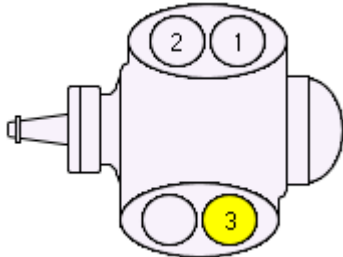


5F40

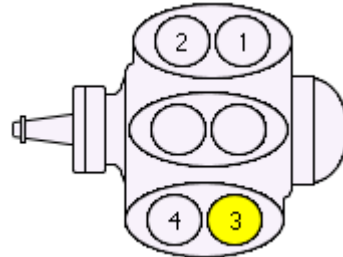


5F60

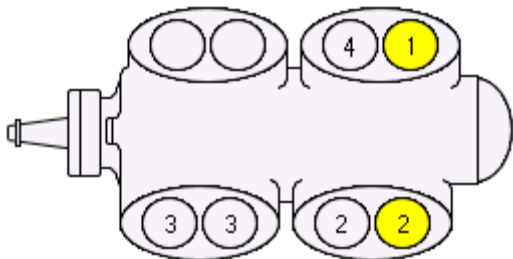
**5H Compressors**



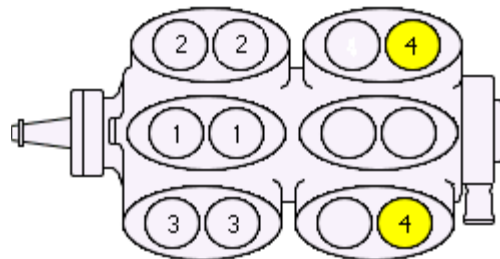
5H40/46



5H60/66



5H80/86



5H120/126

Numbers indicate the unloading sequence and the number of cylinders that unload with each step.  
Highlighted cylinders indicate cylinders that may be permanently unloaded where necessary (by removing the suction valve).

## Carrier/Carlyle 5F/5H/6L Compressors Unloading Characteristics

TO ADJUST CONTROL POINT (5F40 - 60, 5H40 - 120, All 06L)

1. Impose an artificial load on the compressor until the suction pressure exceeds the control point.
2. Slowly close the suction service valve to lower the compressor suction pressure to control point pressure.
3. When at control point pressure, turn the external adjusting stem clockwise until the first step of unloading takes place, as indicated by changes in the control oil pressure, current draw, and sound of the compressor.

Control point is now set. Open the suction service valve.

The control point is adjustable as follows:

R-22, R-502	0 to 85 psig
R-12	0 to 50 psig

One full clockwise turn of the adjusting stem will raise the control point approximately 6 psig with R-12, or 10 psig with R-22 and R-502.

A control spring is installed underneath the external adjusting stem assembly for the proper range. A 7 pound spring is used for R-12 and an 11 pound spring is used for R-22 and R-502. The springs are physically different. The complete external adjusting assembly may be removed from the compressor without losing refrigerant.

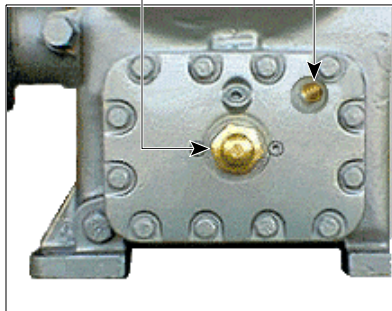


7 pound spring for R-12

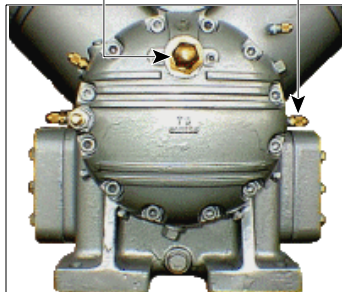


11 pound spring for R-22 & R-502

5F40-60 Capacity Control Adjustment  
Control Oil Pressure



5H40-86 Capacity Control Adjustment  
Control Oil Pressure



5H120-126 & All 06L Capacity Control Adjustment  
Control Oil Pressure

