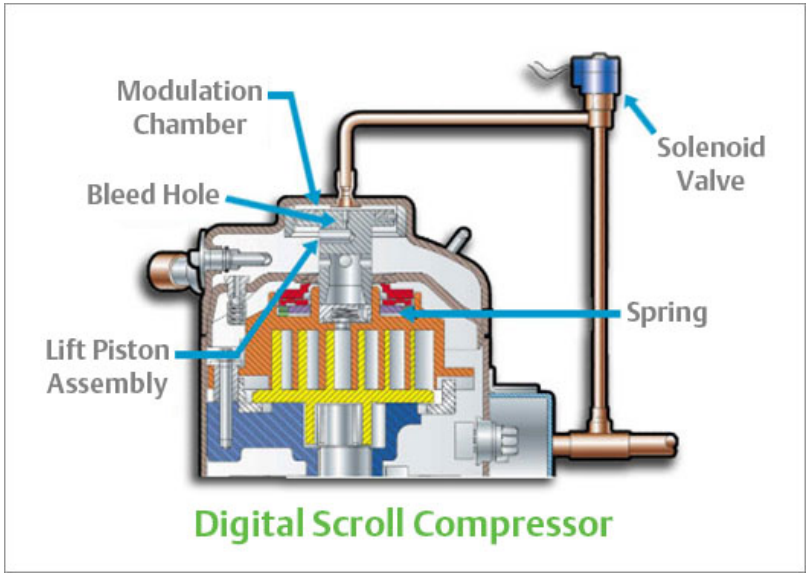
How Copeland Scroll Digital™ Works

The beauty of this technology is its inherent simplicity. The standard Copeland Scroll™ has a unique feature called axial compliance. This allows the fixed scroll to move slightly in the 'ection to ensure that the fixed and orbiting scrolls are always engaged together with mal force.

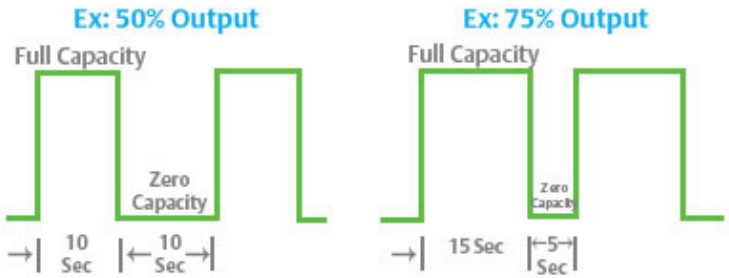
timal force, which holds the two Scrolls together at all operating conditions, ensures iciency of Copeland Scroll. The Copeland Scroll Digital operation builds on this e.

n is fixed to the top scroll to ensure that when the piston moves up, the top scroll also up. There is a modulation chamber at the top of the piston that is connected to the ge pressure through a bleed hole of diameter 0.6 mm. An external solenoid valve ts the modulation chamber with the suction side pressure. When the solenoid valve is losed position, the pressure on either side of the piston is discharged and a spring force ensures that the two scrolls are loaded together. When the solenoid valve is energized, the discharge gas in the modulation chamber is relieved to the low pressure. This causes the piston to move up and consequently the top scroll also moves up. This action separates the scrolls and results in no mass flow through the scrolls. De-energizing the external solenoid valve again loads the compressor fully and the compression is resumed. The movement of the top scroll is only about 1.0 mm, which means that the amount of pressure that bleeds from the high side to the low side is very low.



The Copeland Scroll Digital operates in two stages - the "loaded state", during which the solenoid valve is normally closed and "unloaded state", during which the solenoid valve is open. During the loaded state, the compressor operates like a standard scroll and delivers full capacity and mass flow. However, during the unloaded state, there is no capacity and no mass flow through the compressor.

At this stage, let us introduce the concept of a cycle time. A cycle time consists of a "Loaded State" time, and an "Unloaded State" time (Figure 2). The duration of these two-time segments determines the capacity modulation of the compressor. For example, in a 20-second cycle time, if the loaded state time is 10 seconds and the unloaded state time is 10 seconds, the compressor modulation is (10 seconds x 100% + 10 seconds x 0%)/ 20 = 50% (Figure 3). If for the same cycle time, the loaded state time is 15 seconds and the unloaded state time is 5 seconds, the compressor modulation is 75%. The capacity is the time averaged summation of the loaded state and the unloaded state. By varying the loaded state time and the unloaded state time, any capacity between 10% and 100% can be delivered by the compressor.


Ex: 50% Output
Full Capacity
Zero
Capacity
10
Sec
10
Sec
Ex: 75% Output
Full Capacity
15 Sec
5
Sec