



Modulation Technology FAQs

What differentiates modulating systems from fixed capacity systems?

Fixed capacity systems are typically sized for peak load days and usually have more capacity than is required for normal everyday usage. This means the unit will turn on and off frequently causing things like temperature swings and poor humidity control as well as decreases in efficiency due to the starting and stopping. Modulating compressors, on the other hand, give systems the ability to adjust capacity to match the load and this results in longer run times at higher efficiency to maximize both comfort and energy savings.

What is capacity modulation?

Capacity modulation refers to the system's ability to vary the capacity of a compressor to achieve longer, high efficiency run times at lighter loads which improves both comfort and energy efficiency. By contrast, fixed capacity machines will only run at one, full load capacity for shorter periods of time.

Which compressors can provide modulation?

Emerson Commercial and Residential Solutions has four types of compressors that achieve varying amounts of capacity modulation. Two platforms can provide "stages" of modulation, Copeland™ two-stage scroll compressors provides two stages of modulation and multiples (e.g. tandems and trios) which provide three or more stages of modulation. The other two platforms can provide continuous capacity modulation throughout a wide capacity range and these are digital and variable speed Compressors. These four types of compressors within the Emerson modulation line up were designed to meet the needs of certain applications to achieve maximum comfort and cost savings. To learn more about which technology is best for your application please [click here](#).

Don't modulating systems cost more?

Yes, typically the initial cost of a modulating system is greater when compared to a fixed capacity system; however, the increased efficiency of modulating systems leads to not only improved operating costs over time, but also increased comfort. What many homeowners are unaware of when purchasing new HVAC equipment is that a low initial cost doesn't always mean the most cost-effective option. Homeowners need to also look at long term savings when purchasing new equipment because a higher upfront cost for a modulating system can lead to decreased electric bills and better comfort for many years after it has been installed.

What if my customers say they can't afford a high efficiency system with a modulating compressor?

There are a number of state and local incentives and rebates that are designed specifically to help make high efficiency systems become more affordable. These rebates can be found online on websites like dsireusa.org and www.energystar.gov/rebate-finder or by contacting utility companies in your own area. State and local utility rebates may change the mind of price-oriented customers and can give them the added push needed to become interested in the benefits modulating systems can provide.

How do modulating systems provide more temperature control and decreased humidity?

Modulating systems can add increased benefits of temperature and humidity control as compared to a fixed capacity system for a couple of reasons. While a fixed capacity system only has a choice of “on” (at full capacity) or “off”, a modulating system can run at lower capacity without stopping which keeps air flowing over the coil and the filter. This yields important benefits in humidity reduction and air quality while consuming less energy at light loads and by avoiding the costly stops and starts which also use more energy. A fixed capacity system will run at full capacity until it reaches the desired temperature then shuts off until its next cycle. The stoppage in air flow through the home can cause large temperature swings and increased humidity as well as potentially poor air filtration. As homeowners become more aware of the comfort that modulating systems can offer, we expect their popularity will continue to increase.

How can I improve my comfort when I upgrade to the new efficiency standards?

Many homeowners are choosing to improve their comfort when they upgrade their HVAC systems by investing in 16 SEER or higher systems instead of just the minimum 13 or 14 SEER systems. This equipment features outdoor units with capacity modulation and variable indoor air flow to improve humidity and temperature control at night and in the “shoulder” seasons of fall and spring. With the best systems your customers can expect to save up to 40 percent on their annual energy costs when upgrading from their old system to variable speed technology. These systems can also deliver even more enhanced temperature control and decreased relative humidity since they can achieve longer run cycles.

How do I sell a modulating system based on efficiency standards?

Now that the minimum efficiency standards are so high, it is becoming difficult to sell a premium system based purely on the energy savings versus the base, minimum efficiency models. Still, when the topic of efficiency regulations comes up you should inform your customers of the full range of system options available and the other benefits, they can provide besides just energy savings. Things like comfort, indoor air quality and environmental responsibility when paired with the higher efficiency of these premium systems should give you some good reasons for your customers to consider better alternatives. Modulating systems can also help reduce hot and cold spots throughout the home, a common problem with many homes and systems today. Your superior technical service capabilities should also be stressed as you are selling premium systems in case customers are concerned about the newer technology.

With all the new technology that goes along with new modulating systems will it be hard for me to communicate these features with customers?

Education is key for both contractors and customers for the selling process to be successful. Contractors need to really prepare before they can inform clients about the benefits of using a modulating system in their home. Having this conversation with homeowners can be difficult however as many customers know only the most basic elements of HVAC systems. This is why contractors need to not only be experts at their trade, but they also need to be experts at explaining how a modulating system can improve their customers' comfort and health. Contractors can learn more about capacity modulation at www.emerson.com/en-us/industries/commercial-residential/residential-construction/technology/designer-air.

I heard these residential modulating systems are hard to install. Do I need special training?

Contractors in the U.S. have installed over four million Copeland™ two-stage scroll compressors. The installation is similar to a fixed capacity system but if you are replacing a fixed capacity system, you might need to use a different thermostat and you might need to pull some additional wire. The variable speed systems are newer but they are also similar to two-stage for installation. These also have more sophisticated diagnostics for troubleshooting if problems come up in the future. The OEMs also do a very good job with training for all these modulating systems so you might want to check out their training material as well.

Why do many of my customers ask about premium systems, but end up purchasing low-end baseline models?

Emerson has noticed a similar trend. About 70 percent of customers polled said that they would consider purchasing premium systems on factors such as comfort, economic payback, energy savings and reliability however, in reality, only about 30 percent actually purchase these types of systems. There are several factors that contribute to these results and many contractors already know some of these. Timing, education, and price all play big roles in why customers change their minds in the last minute when purchasing new HVAC equipment. In an effort to sell more high efficiency modulating systems contractors need to stress the planning of HVAC replacement early rather than waiting until it breaks down. Also, it is important to educate consumers on the increases in comfort, energy savings, and environmental impact modulating systems can provide. The initial sticker shock of these high efficiency systems is only part of the story. While it may result in higher upfront costs, the cost savings down the road and the comfort and health benefits are what many customers fail to see.

How do I upsell without confusing the customer or ultimately driving them away from a high efficiency system?

Upselling can sometimes be difficult when the customers' main priority is price, but there are some techniques to get the customer interested in higher efficiency models without promoting only the more expensive options. Discuss topics like comfort (the effects of humidity and air movement), long term cost savings through decreased energy bills, and local rebates and incentives that will make a high efficiency modulating system more affordable. Discussing a range of options which includes the highest efficiency, variable speed modulating systems, the lowest efficiency fixed capacity systems and the mid-range 16 SEER, two-stage systems should allow customers to make an informed decision without feeling like they are being pushed into only considering the most expensive unit available.

Where can I get more information about compressor modulation?

There are several resources available to find more information about compressor modulation:

- [Comfort with Modulation](#)
- [AC-heatingconnect.com](#)
- [Modulation Webinars](#)
- [Compressor Modulation eBook](#)

How is the trend toward greater efficiency continuing to impact compressors? What are the most important parameters for measuring and maintaining compressor efficiency (part-load, etc.)?

Our industry continues to develop system technologies that simultaneously meet the needs of high ambient efficiency ratings and those that are more moderate or tend to be designed to meet a weighted average across high and moderate ambient load conditions. In response, several different compressor capacity modulation technologies have been developed in both residential and commercial applications such as two-stage, continuous digital, variable speed, and multiple-manifolded compressors. While fixed capacity systems will continue to play an important role within the U.S. air conditioning space, our industry's ability to apply the right modulation technologies to certain higher efficiency application needs will garner much focus. We will continue to provide a variety of cost-effective compressor modulation solutions to meet the needs for both regulation compliance as well as other key benefits including comfort, indoor air quality and the need to keep end-user costs low.

What other trends do you currently see gaining momentum that will impact compressors?

One other important area is the use of electronic sensors and controls on the compressor to improve system performance and reliability. The compressor as a "prime mover" of fluid in the system and is similar to the "heart" in the human system. Monitoring the compressor can yield tremendous insight into what is going on in the system and can warn of and prevent certain situations from occurring that can damage both the compressor and the system. Understanding the predictive algorithms associated with how the compressor interacts with certain system conditions will continue to be an important part of taking system and compressor technology to the next level of reliability and performance. Emerson is providing this important technology, called "CoreSense™ technology" on all of our major Copeland™ scroll compressor platforms including our variable speed line up for both residential and commercial applications.

What are some of the latest developments your company has rolled out in your compressor offering in response to any of the above trends?

For residential applications, Emerson has launched a complete new high efficiency Copeland™ scroll compressor line up for fixed capacity – known by the model name “K6” and we have also launched our 2nd generation variable speed compressors and drives for the highest efficiency OEM product lines. For commercial applications we also have a broad variable speed line up as well as our mechanical modulation offerings of Copeland™ scroll digital, two-stage and a full line up of tandem compressor and other configurations to meet the ever-increasing efficiency standards facing our commercial customers. We also recently launched a new line of low condensing optimized compressors specifically designed to improve part load efficiency in water-cooled chiller applications.

Tips for Explaining and Selling Comfort to your Customers

1. **Define comfort** – Ask your customers if they have noticed temperature fluctuations and some discomfort or problems with allergies on humid days and nights. Ask them if they have noticed hot and cold spots in the home, or have trouble sleeping in the summer when the air conditioner comes on and off frequently. These could be signs of problems that could be addressed by capacity modulation.
2. **Introduce concept of air quality** – Properly sized, modulating systems enable air flow within homes to remain fresh and well ventilated even on “light load” days in the spring and fall and at night.
3. **Discuss efficiency standards** – Tell them about minimum SEER standards and what higher efficiency means. Explain the whole range of efficiency options that are available. Remind them that a 16 SEER or higher modulated system will not only improve their energy savings versus their old system but will also provide better comfort in the home.
4. **Connect the dots between efficiency and comfort** – Explain how superior comfort, humidity control and better indoor air quality help them feel better and save them money. Selling premium systems is not just about selling efficiency.
5. **Define different tiers of systems in terms of comfort** – When explaining differences between 13 SEER and 18 SEER systems, for example, focus on comfort factors rather than just cost, energy savings or system performance differences.