

Getting Comfortable with Designer Air

WEBINAR SERIES



Bart Powelson

Director – Commercial Air
Conditioning Marketing
Emerson Climate Technologies



Ken Monnier

Vice President – Air Conditioning
Engineering, Technology Business
Leader Emerson Climate Technologies

Four Things You Need To Know About Modulation Technologies

Today's Presenters



Bart Powelson

- Director - Commercial Air Conditioning Marketing
- 20+ Years Experience in HVACR Industry
- Responsible for Monitoring Industry Trends/Standards And Specifying and Launching New Compressor and Compressor Electronics Products for Commercial Air Conditioning Applications



Ken Monnier

- Vice President - Air Conditioning, Engineering, Technology Business Leader
- 30+ Years Experience in HVACR Industry
- Responsible for New Product Engineering and Engineering Management; Instrumental in Design and Technical Leadership of Various Fixed Capacity and Modulating Scroll Platforms and Compressor Electronics

Agenda

- 1 The Role Of Modulation Technologies**
- 2 The Benefits Of Modulation Technologies**
- 3 The Applications Best Suited For Modulation Technologies**
- 4 The Types Of Modulation Technologies**

Agenda

1 The Role Of Modulation Technologies

It's Not Just A Want—It's A Need

2 The Benefits Of Modulation Technologies

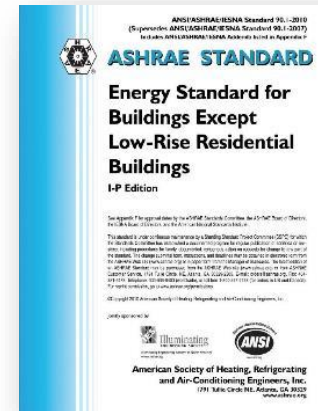
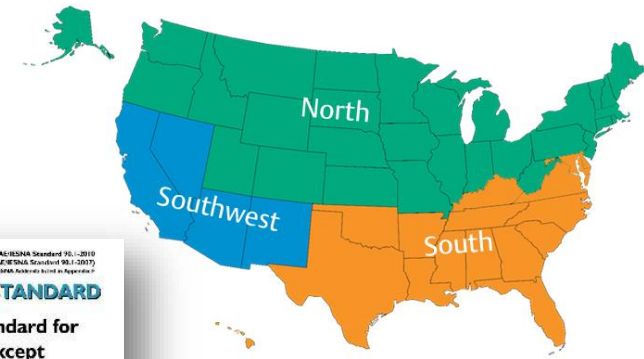
3 The Applications Best Suited For Modulation Technologies

4 The Types Of Modulation Technologies

Role Of Modulation Technologies

Changing Regulatory Landscape

- 2015 Regional Standards
- ASHRAE 90.1-2013
- Department of Energy Proposals
- Voluntary Standards (Energy Star, CEE, DOE Challenge)



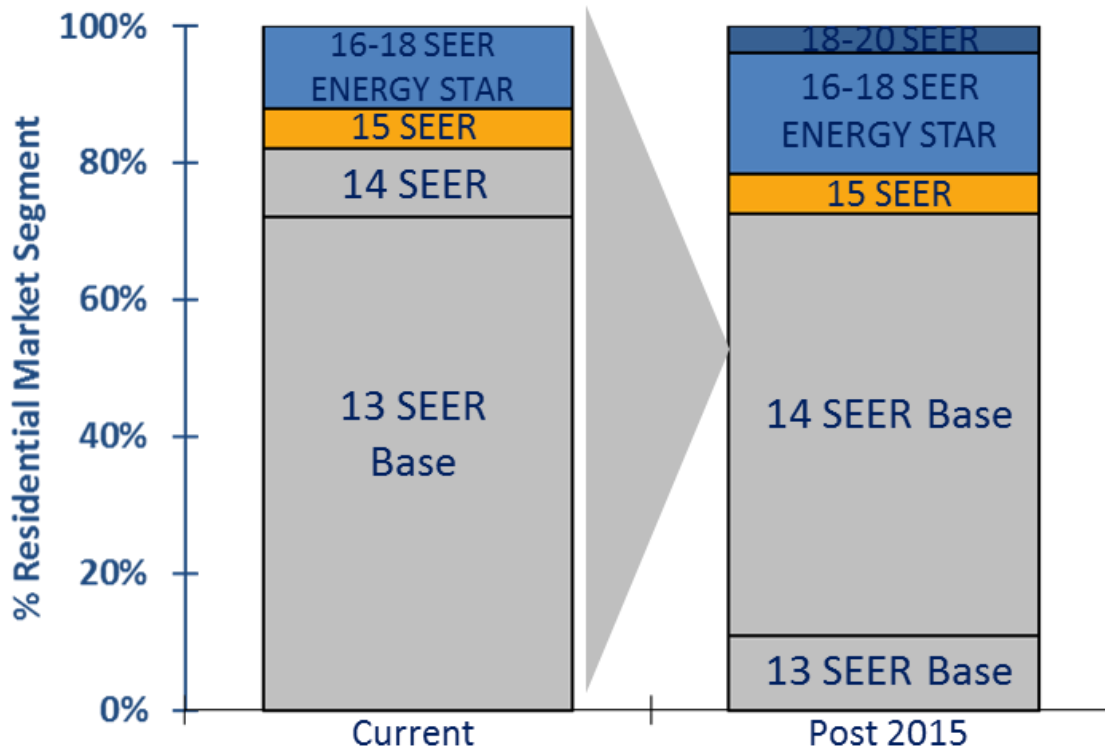
Customer Preferences

- Enhanced Comfort
- Reduced Energy Costs
- Premium Technology
- Overall System Value



U.S. DEPARTMENT OF
ENERGY

Impact Of 2015 Residential Regional Standards



- Growing Mid-Tier & Premium Tier
- Modulation Technologies Prevalent Above 14 SEER
- Enables Higher Efficiency And Differentiation

20 STATES 
will be impacted by the **REGIONAL EFFICIENCY STANDARDS**, increasing demand for 14 SEER A/C systems.

ASHRAE 90.1-2010/13 vs. DOE Proposed Levels IEER For Commercial Air Cooled Packaged/Split Systems

Efficiency Standards	6 – 10 Ton	11 – 20 Ton	21 – 60 Ton	>60 Ton
ASHRAE 90.1-2010	11.2 IEER	11.0 IEER	9.9 IEER	9.6 IEER
ASHRAE 90.1-2013 (As Of 1/1/2016)	12.7 IEER +13% IEER	12.2 IEER +11% IEER	11.4 IEER +15% IEER	11.0 IEER +15%
DOE Proposed IEER Levels (9/18/14) ~Effective Dec. 2018	14.6 IEER	14.0 IEER	13.3 IEER	N/A
Change	+30% Avg. IEER	+27% Avg. IEER	+34% Avg. IEER	N/A

Note: Add +0.2 EER/IEER For Electric Resistance Heating

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1 The Role Of Modulation Technologies

2 **The Benefits Of Modulation Technologies**

It's Not Just About Comfort

3 The Applications Best Suited For Modulation Technologies

4 The Types Of Modulation Technologies

Enhanced Comfort

Precise Climate Control

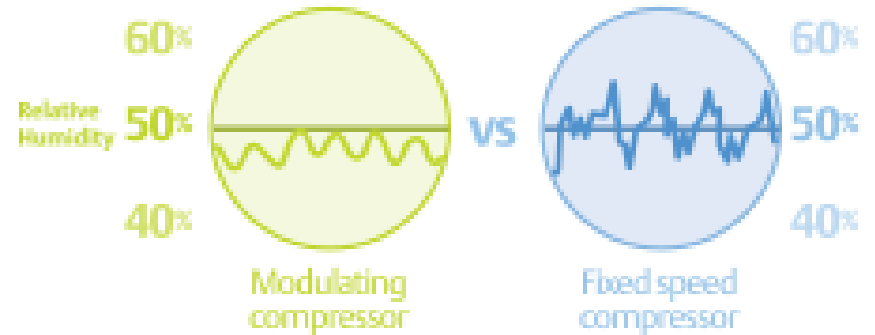
Temperature Control



- Variable speed compressor
- Standard Air Cond./Heat pump

Maintain More Even Temperature

Humidity Control



Decrease Relative Humidity With Systems That Can Achieve Longer Run Cycles

Cooling Efficiency Definitions

Energy Efficiency Ratio (EER)

- Measure Of Full Load System Efficiency Calculated As Cooling Capacity (Btu/h) Divided By Energy Consumption (Watts) At A Given Operating Condition, Usually Full Load Or 95°F

Integrated Energy Efficiency Ratio (IEER)

- Measure Of Part Load Efficiency Using A Weighted Average Of Efficiencies At Various System Capacities And Conditions

$$\text{IEER} = (0.02 * A) + (0.617 * B) + (0.238 * C) + (0.125 * D)$$

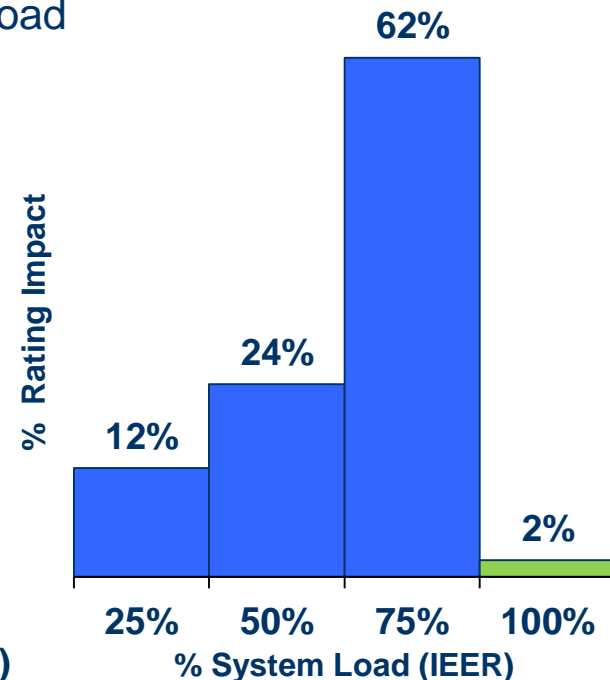
Where As:

A=EER At 100% Net Capacity At AHRI Standard Condition (95 deg F)

B=EER At 75% Net Capacity And Reduced Ambient (81.5 deg F)

C=EER At 50% Net Capacity And Reduced Ambient (68 deg F)

D=EER At 25% Net Capacity And Reduced Ambient (65 deg F)



Enhanced Energy Efficiency

ENERGY EFFICIENT



SAVE UP TO

40%

by upgrading to systems with
variable speed technology



REDUCE ENERGY CONSUMPTION BY

30-40%

with systems using
digital technology

Proven Reliability

- **Reduced Compressor Cycling Improves Reliability**
- **CoreSense Technology Integrated Into Drives And Controls Optimizes Operation And Enhances Reliability**
- **Multiples Offer Greater Degree Of Redundancy**



Agenda

1 The Role Of Modulation Technologies

2 The Benefits Of Modulation Technologies

3 **The Applications Best Suited For Modulation Technologies**

It's Not Just For Premium Systems

4 The Types Of Modulation Technologies

Ideal Applications For Modulation Technologies

Residential

- Mid-Tier And Premium Systems



Commercial

- Load Matching And Varying Loads
- Precise Temperature/
Humidity Control



Applications for Modulation Technologies

Residential

- Mid-Tier Systems
(14 SEER Featured And Above)
- Premium Efficiency Systems
- High Comfort Applications
- Geothermal



Applications for Modulation Technologies

Commercial

- Need For Load Matching

- Restaurant Kitchens And Dining Rooms
- Classrooms
- Retail Stores
- Conference Rooms
- Theaters



- Need For Precise Temperature/ Humidity Control

- Data Centers
- Hospitals And Healthcare Facilities
- Museums



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3 The Applications Best Suited For Modulation Technologies

4 **The Types Of Modulation Technologies**

It's Not "One Size Fits All"

Types Of Modulation Technologies

Mechanical Modulation

- Multiple Compressors → Tandems/Trios
- Stepped/Two-Step → UltraTech
- Continuous → Digital

Speed Control

- Variable Speed
- Tandems With Variable Speed + Fixed



Tandem / Trio



**Copeland Scroll
UltraTech**



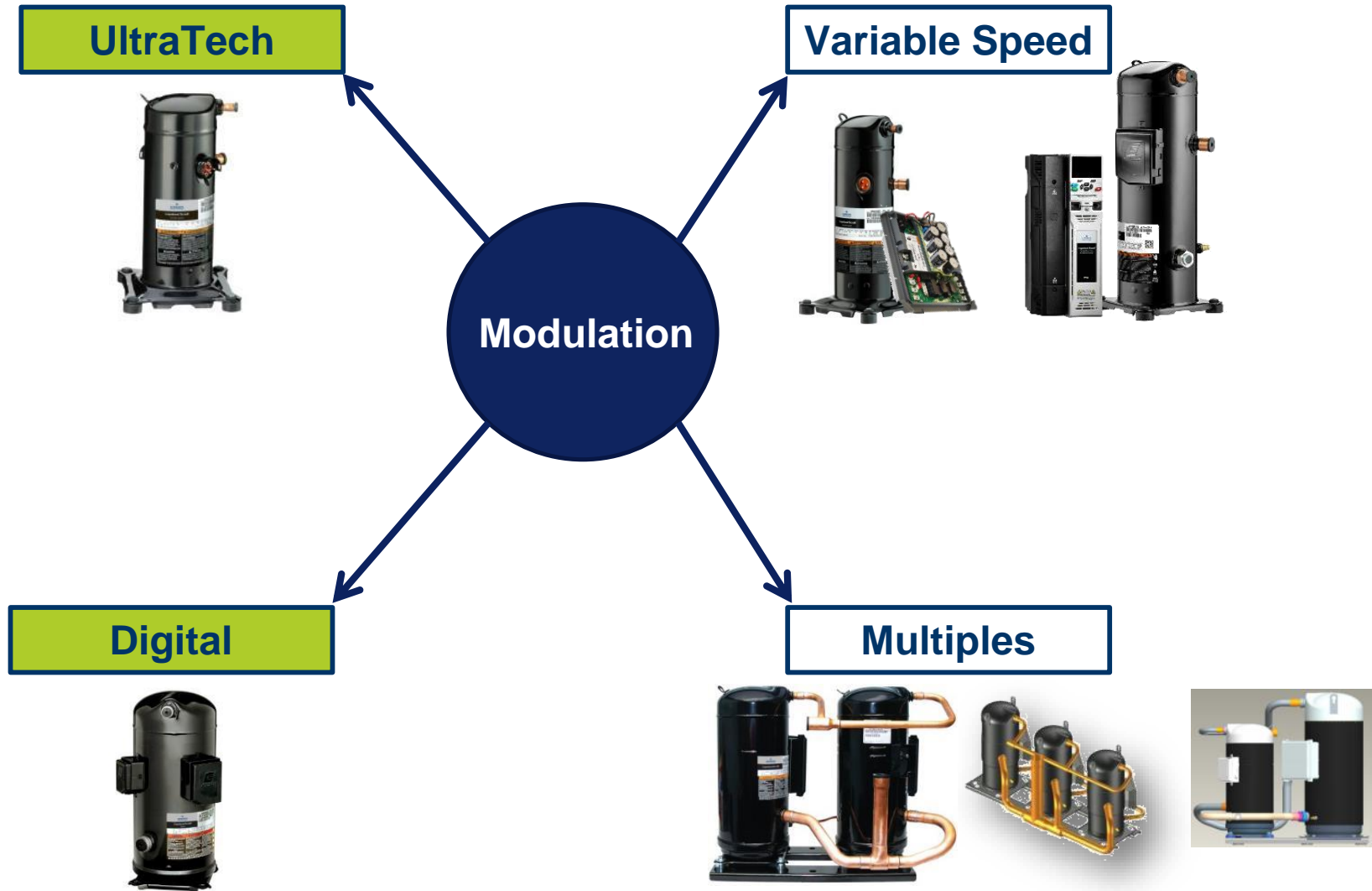
**Copeland
Scroll Digital**



Copeland Scroll Variable Speed

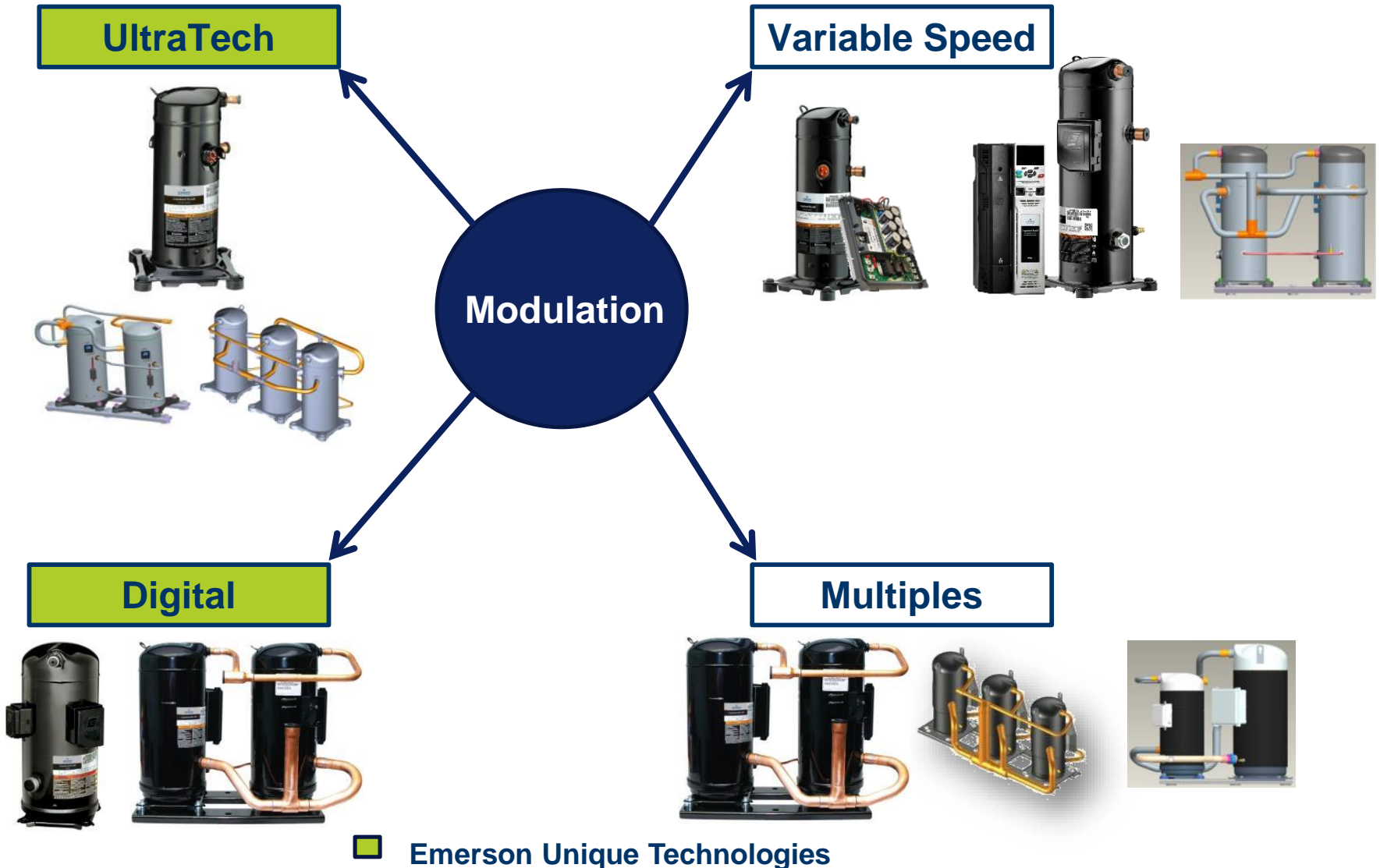


Multiple Modulation Technologies Available



■ Emerson Unique Technologies

Multiple Modulation Technologies Available



Copeland Scroll Ultratech™

Two-Step Modulation

- By Mechanically Unloading, Compressor Operates At 67% And 100%
- Optimized For High Part-Load Efficiency
- Offers Improved Temperature And Humidity Control
- 2-5HP Range
- Ideal For 14+ SEER Residential And Light Commercial Split And Package Applications



Part-Load Capacity



Full-Load Capacity

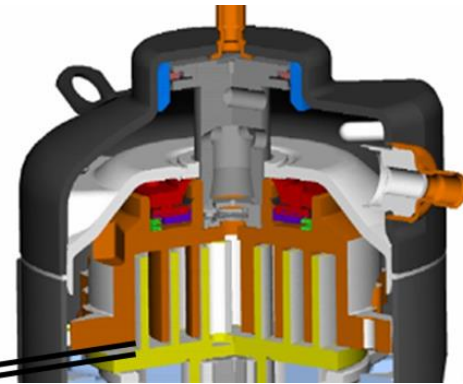


Copeland Scroll Digital™

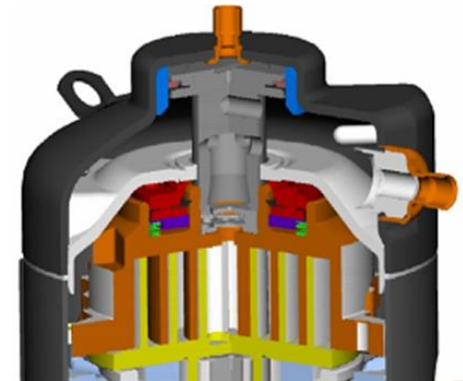
Continuous Modulation

- Separation Of Scroll Elements Alternately Loads And Unloads Compressor
- By Controlling Separation Times, Compressor Is Precisely Operated Between 10-100%
- Power Linearly Related To Capacity
- Precise Temperature & Humidity Control
- 3-15HP Range (Tandems Up to 30HP)
- Ideal For Light Commercial Split, Package And Chiller Applications

1.0 mm Scroll Separation



Unloaded State



Loaded State



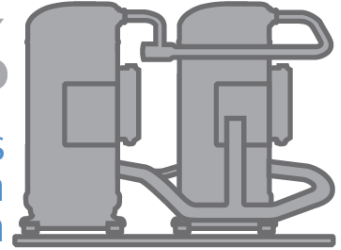
Tandems And Trios

Multiple Compressors

- Multiple Steps Of Capacity
- Independent Operation – No Lead/Lag
- Extensive Reliability Testing In Every Design
- Over 150 Even And Uneven Combinations
- High Part-Load And Full-Load Efficiency
- 3-120HP Range
- Ideal For Commercial Splits, Rooftops And Chillers

As a result of new efficiency regulations,

45%
of contractors
expect an
increase in
SALES OF TANDEM/TRIOS.



Copeland Scroll™ Variable Speed

Next Generation Variable Speed

- Variable Frequency Drive Dynamically Controls Compressor Motor Speed
- High Efficiency Embedded Magnet Motor Delivers Breakthrough Part-Load Efficiency
- Wide 20-120% Speed Range Provides Superior Temperature And Humidity Control
- Proven Reliability Enhanced With CoreSense™ Technology In Drive
- 2-10T Range
- Ideal For Premium Residential A/C & Heat Pump, Geothermal, Light Commercial Rooftop And Chiller Applications



**2-5 Ton
Copeland Scroll
Variable Speed**



**10 Ton
Copeland Scroll
Variable Speed**

Compressor Modulation Technology Comparison

Modulation Technology	Products	Range	Part Load Efficiency	Full Load Efficiency	Comfort	Applied Cost
UltraTech (Two-Step)		2-5HP	High	Medium	Medium	Best
Digital (Continuous)		3-15HP	Low	High	High	Better
Variable Speed		2-10HP	Highest	Low	Highest	Good
Multiples		3-120HP	High	High	High	Best

Summary

1 The Role Of Modulation Technologies

It's Not Just A Want—It's A Need

2 The Benefits Of Modulation Technologies

It's Not Just About Comfort

3 The Applications Best Suited For Modulation Technologies

It's Not Just For Premium Systems

4 The Types Of Modulation Technologies

It's Not "One Size Fits All"

Summary



Understand Efficiency Standards And Tiering Options

- Impact Of SEER/IEER Requirements



Consider How Modulation Benefits Can Satisfy Customer Needs

- Comfort, Energy Efficiency, Reliability



Identify Applications Best Suited For Modulation Solutions

- Mid-Tier/Premium Residential, Commercial Load Matching, High Or Precise Comfort Applications



Understand Technology Options Available To You

- Variable Speed Systems Deliver Excellent Efficiency At High Applied Cost
- Mechanical Modulation Can Affordably Provide Significant IEER Improvement



Thank You For Attending!

Join Us For Our Second Webinar In The
“Getting Comfortable With Designer Air”
Webinar Series

Modulation Technologies: Designing Great
Commercial Atmospheres

May 26th 2:00PM EST