Digital Scroll

Design Features
- Simple Internal Capacity Control
- Can Vary Infinitely 10-100%
- Long Life Solenoid

Performance Features
- Nearly Linear Power Reduction When Unloaded
- Precise Temperature Control

Control Features
- Simpler Control Than Other Modulation Schemes
- 20 Second Total “Cycle Time” Is Adequate For Most Systems

- High Pressure Gas
- Low Pressure Gas
- Solenoid (Open)
- Solenoid (Closed)
- 1 mm Gap Between Fixed & Orbiting Scrolls
- Fixed Scroll Contacts Orbiting Scroll
- Unloaded
- Loaded
Digital Scroll

1.0 mm Scroll Separation

Loaded (1)
Full Capacity

Unloaded (0)
Zero Capacity

20% Output

50% Output

Full Capacity
Zero Capacity

4 Sec 16 Sec

10 Sec 10 Sec
In Multiple Compressor Applications......

Install An External Check Valve On The Digital Scroll’s Discharge Line
• Copeland Scroll Digital Controller Checks For Cooling Demand
• Controller Then Sends Capacity Requirements To Compressor
  - Run Loaded For 8 Seconds (Compressor Output = 10HP)
  - Run Unloaded For 12 Seconds (Compressor Output = 0HP)
• Over 20 Second Cycle, Average Compressor Output Is 4HP
• At End Of 20 Second Cycle, Controller Checks For Demand & Adjusts
  Loaded/Unloaded Time Accordingly
• Any Capacity Requirement Over 10% Can Be Achieved
  - Infinite Modulation
• Easy-To-Apply Digital Compressor Control

• Relieves System Designers From Developing Special Controllers
  • Faster Time To Market

• Digital Controller Functions
  Controls
  - Capacity Modulation Solenoid
  - Compressor Contactor

Diagnostics
- 9 Codes Indicating Faults

Protection
- Excessive Discharge Temperature
- Low Flow Conditions
- Operation Under Fault Conditions
• Capacity Solenoid Control
  – Controller “Modulates” Solenoid Based On Capacity Demand
  – Demand Is Read Once Every 20 Seconds
• Minor Alert ➔ Display Appropriate Alarm
• Major Alert ➔ De-energize Contactor To Lock Out Compressor
Digital Discus

• Digital Capacity Modulation Concept Applied To Discus Compressors

• Compressor loading is accomplished by controlling the flow of suction gas entering the cylinders

• Continuous Modulation 100% to 10%
  – 3D, 4D, & 6D Compressors

Here is How to Deliver 50% Capacity

Not Needed with ISD 2.0 Discus

System Needs 50% Capacity

IDCM

Tightens Temperature Control

Results in Narrow Operating Temperature Range
1. Enters Compressor
2. Passes Through Body
3. Into Valve Plate
4. Compressed by Pistons
5. Exits Compressor

Valve assembly routes suction gas above unloader pistons

Unloader pistons allow suction gas flow into valve plate
1. Enters Compressor
2. Passes Through Body
3. 4 Unloader Pistons Block Gas Before Entering Valve Plate

Valve assembly routes discharge gas above unloader pistons

Unloader pistons block suction gas flow into valve plate
Digital Discus

Energy Savings

Typical Modulated Power Reduction

Percentage of Full Power vs. Percentage of Full Capacity

- Percentage of Full Power: 0% to 100%
- Percentage of Full Capacity: 0% to 100%

The graph shows a linear relationship where the percentage of full power increases as the percentage of full capacity increases.
Digital Discus

Unloading Capabilities: 10% to 100%

20 Second Operating Cycle

- Digital Bank Loaded
- Digital Bank Unloaded

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<th>Load Percentage</th>
<th>Unloaded</th>
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