Using Zoom!	
Mute yourself! Have a question? Use the chat Controls accessed at the bottom	feature.
Rename yourself: "Name (Company)" Right click on your picture or 3 dots OR Controls accessed at the right after clicking 'Participants' at bottom.	Performent 3     Monard Kalls (Mar)     Mark Kalls     Mark
For Tyson renaming! Tyson - Fresh Meats Tyson - Prepared Foods Tyson - Poultry	All and a second
Access Chat at the bottom	those not in attendance!













#### Today's Agenda – Session 1

- Welcome & Intros
- Opportunity tracking
- Energy basics
- Fundamentals of refrigeration
- Compressor Basics
- Compressor Lift
- Compressor Part LoadCompressor Homework

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## Benefits of Energy Efficiency

- Lower your energy costs
- Reduce maintenance costs
- Identify capital projects
- Increase employee satisfaction
- Improve customer satisfaction

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## Opportunity Ideas

- Note opportunity ideas as they pop into your head.
- Use the Better Plants Opportunity Ideas pages.
- We'll flesh these out more in sessions 2 and beyond.

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Activity – Sketch Your System	X
1. Suction vessels	
2. Loads	
3. Compressors	
4. Condensers	
5. Liquid path	
Email a picture, screen snap, etc. to steve.koski@cascadeenergy.com	
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Type	Max HP	Pres.		Typical Type	
		Ratio	Booster	High	Single
Reciprocating	300	8:1	х	х	
Rotary Screw	1,500	20:1	х	х	Х
Rotary Vane	400	5:1	х		



















#### What's the Ideal?

- Minimal Lift (max suction, min discharge)
- Slide Valve Properly Functioning
- Minimal Inefficient Unloading
- Correct Volume Ratio
- Controls Telling the "Truth"

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Rules of Thumb	
<b>2%</b> compressor savings per °F of increase in <b>suction</b> temperature	
<b>1.5%</b> compressor savings per °F of decrease in <b>condensing</b> temperature	
(Must work in saturated temperature, not pressure.)	
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Capacity in Graphic Form Frick RWB II-134 Rated Capacity 250 200 1 → TR @ 85.0°F 150 1 Ħ 100 50 ---TR @ 105.0°F 0 -25 10 -20 -15 -10 -5 5 Suction Temperature (°F) Better Plants ENERGY

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#### Compressor Lift Question 1



- 6 psig = -15°F
- 6°F increase in suction temp
- 6°F x 2% = 12%
- 12% x 3,000,000 kWh = 360,000 kWh
- 360,000 kWh x \$.10 = \$36,000/year

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#### What is Limiting Your Suction?

- Pick your coldest zone
- Assume a 12°F evaporator TD
- Estimate what suction your equipment is rated for

Workbook – Page 8

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Common Barriers to L Pressure	ower Condensing
<ul> <li>Hot gas defrost</li> <li>Heated zones</li> <li>Icing or other winter issues</li> <li>Water defrost and common sump</li> <li>Oil separator performance</li> <li>Gas-powered valves or unloaders</li> <li>Liquid injection oil cooling</li> <li>Screw compressor oil carryover</li> <li>Underfloor heating</li> </ul>	<ul> <li>Control Pressure Receiver setup</li> <li>Pumper drum setup</li> <li>Direct-expansion coils</li> <li>Process or door hot gas</li> <li>Inadequate liquid pressure to serve loads</li> <li>Concerns about condenser fan and pump energy</li> <li>Misperceptions about volume ratio and efficiency</li> <li>Tradition</li> </ul>
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How are Compr	ess	sor	s S	eqı	ien	cec	?	
Hig	h Stag	ge Com	presso	r Sequ	encer			
Stage:	1	2	3	4	5	6	7	
HSTG 1 (350-hp)	Т		Т		В		В	
HSTG 2 (500-hp)		Т	В	В	В	В	В	
HSTG 3 (350-hp)					Т	Т	Т	
HSTG 4 (500-hp)				Т		В	В	
Online HP:	350	500	850	1,000	1,200	1,350	1,700	
	T= t	rim, B	= Base	oaded				
		C	R					
Hig	h Stag	e Com	presso	r Sequ	encer			
St	age:	1	2	2	3	4		
HSTG 1 (350-h	p)	Т	E	3	В	В		
HSTG 2 (500-h	p)		1	1	в	В		
HSTG 3 (350-h	p)				т	B		
HSTG 4 (500-h	p)					T		
Online	HP:	350	85	i0	1,200	1,70	0	
	T=1	trim, B	- Base	loaded	1			
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#### Slide Valve Calibrations

- Does slide valve (SV) indicator gauge match control panel reading?
- Do amps increase after SV already shows 100%?
- Does the control panel never reach 100% SV reading?
- Does the control panel ever reach below 0% or above 100% SV reading?

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#### **Current Limiting**

**Definition:** The compressor forces itself to unload, or is unable to fully load due to an indication of excessive motor current.

**The concern:** Compressors can't fully load, or additional compressors may start. Inefficiency results from multiple unloaded compressors.

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#### **Current Limiting Causes**

- Improper VI
- Amp reading out of calibration
- Improper amp limiting settings in microprocessor
- Too much, oil or refrigerant injection?
- Some compressors have adjustable oil feed valves that should be properly tuned
- Over cooling with liquid injection will increase compressor power

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Compressor Cooling Methods	X
Screw compressors • Liquid injection • Water/glycol • Thermosiphon	
Reciprocating compressors <ul> <li>Water in cylinder and head jackets–most common</li> <li>Refrigerant in jackets</li> </ul>	
Rotary vane • Liquid injection • Water cooling	
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Suction 04.0 9 -000°F	Disch Disch 115 9 168°F	0il 105 9 122°F	Filter 02PSID	Compre Man M Runnin	H:EI SSOI ode 9
V Ratio 2.8 Man	S U Pos 095% Auto	s Pump off F Unl	NFLA 104%	Sep 132 HTR off	2" F







## Activity—Compressors

#### Brainstorm:

- 1. The ways the compressor could be operating inefficiently
- 2. How you identify the symptoms
- 3. How you fix it

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# End of Session 1