



Business Case for
Natural Refrigerants

Tecumseh **IntelliCOOL**

*Energy Savings Using IntelliCOOL Cassette
Smart Integrated Variable Speed Cooling System*

Beverage Cooler Case Study

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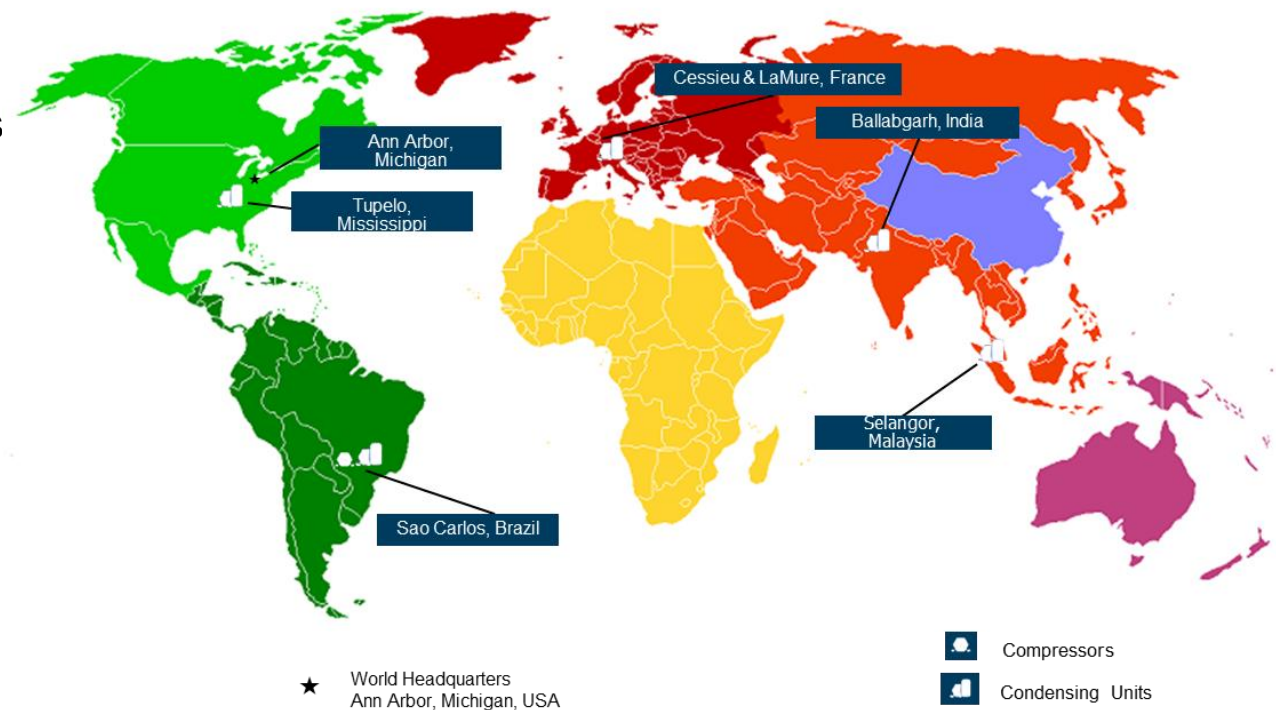
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Cooling for a Better Tomorrow™

About Tecumseh

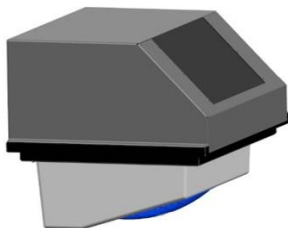
- ▶ Founded in 1934 - revolutionized the industry with the first hermetically sealed compressor
- ▶ Global customer base serviced from manufacturing and technical support facilities on four continents
- ▶ Full line of compressors, condensing units and complete refrigeration systems applicable to numerous industries.
- ▶ Tecumseh is committed to R290 and has made investments in design, development and manufacturing at our facilities globally.

Compressor & Condensing Unit Manufacturing



Customized Complete Refrigeration Solutions

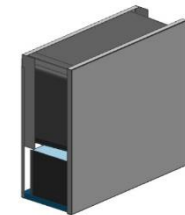
- Plug and play concept
- Simple transition to R290
- Custom design solutions
- Fixed speed and variable speed
- Low installation and replacement costs
- Low charge, energy efficient, compact design



**Tecumseh top
mount CRS**



**Tecumseh bottom
mount CRS**



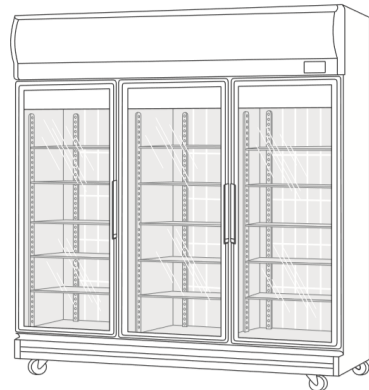
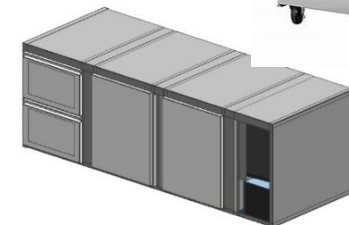
**Tecumseh side
mount CRS**



- Beverage Solid door
- Beverage glass door
- Spot merchandizers
- Small open front units



- Prep tables
- Back of bar



- Reach-in solid door
- Reach-in glass door
- Beverage solid door
- Beverage glass door
- Ice machines
- Pharma cooling

Case Study: *Customer Rationale, Test Plan, Methodologies*

Customer rationale:

“Using variable speed technology, achieve benefits...

- ✓ Reduced energy consumption
- ✓ Improved thermal stability
- ✓ Rapid “pull-down”
- ✓ Smaller displacement compressor
- ✓ Charge reduction
- ✓ SKU reduction
- ✓ Dual voltage, soft starting
- ✓ Lower noise and vibration

...with compact IntelliCOOL cassette and minimal changes to existing cabinet.”

Test plan:

Select customer cabinet currently using R134a fixed speed cooling cassette:

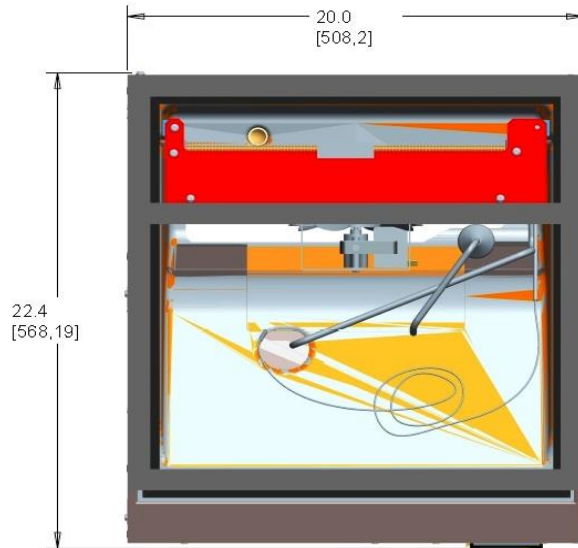
1. Baseline R134a cooling cassette –
 - a) Measure energy consumption and pull down time at no load, full load and half reload
 - b) Measure DOE & Energy Star 4 tests
2. Replace with IntelliCOOL R290 variable speed cassette and repeat baseline tests
3. Don’t make any changes to cabinet except adapting interface to new cassette.
4. Compare results / make conclusions.

Test Methods:

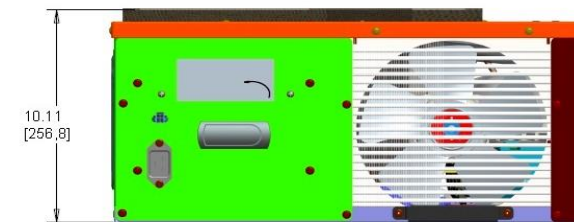
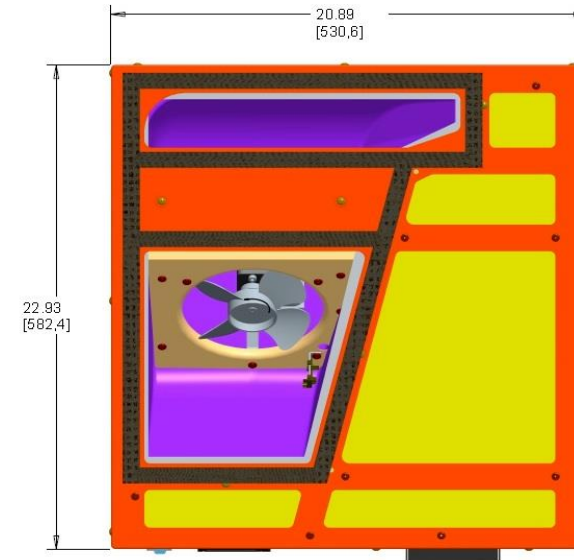
- Pull down test ambient: 90F
- Product set temp: 38F
- 2 hour stabilization time before test start
- DOE and Energy Star 4 tests – as per ASHRAE 72
- Same cabinet used in all tests

Case Study: *Baseline vs Proposed Cassette*

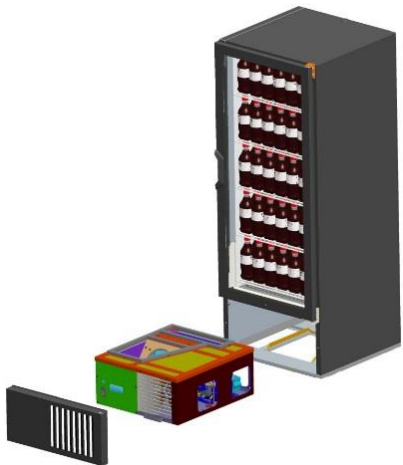
Baseline Cassette



IntelliCOOL VTC Cassette



Case Study: Baseline vs. Proposed Cassette



Baseline Cassette	
~Size (L)	300L
Application	Beverage Cooler
Power Supply	120 VAC, 60 Hz
Expansion Device	Capillary Tube
Condenser	Copper Alu (3/8")
Evaporator	Copper Alu (3/8")
Door	Yes – Glass
Cond Fan	Shaded Pole
Evap Fan	Shaded Pole
Refrigerant	R134a – 123 (gm)
Benchmark Compressor	THA0412YXA
Temp Controller	Electronic

IntelliCOOL Cassette	
~Size (L)	300L
Application	Beverage Cooler
Power Supply	120 VAC, 60 Hz
Expansion Device	EXV
Condenser	Copper Alu (5mm)
Evaporator	Copper Alu (5mm)
Door	Yes – Glass
Cond Fan	ECM Fixed speed
Evap Fan	ECM Fixed Speed
Refrigerant	R290 – 65 (gm)
Benchmark Compressor	VTCX-360U
Temp Controller	Electronic

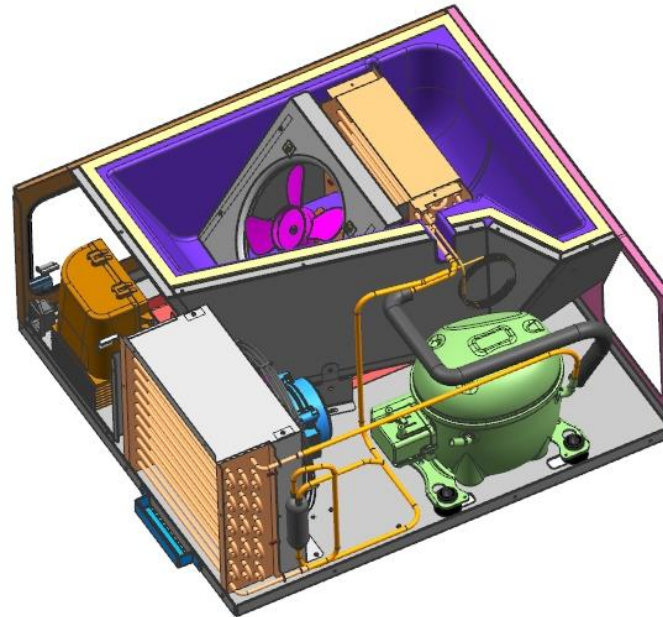
Case Study: *Proposed Solution* Tecumseh IntelliCOOL

Significantly smaller cooling deck than most existing similar designs.

Electronic controls and variable speed compressor for energy management & defrost control.

5mm Copper Alu grove condenser coil for high efficiency and low charge.
5mm Copper Alu Evaporator

Better component layout and improved volume efficiency.



VTCX-360U variable speed compressor

Fast pull down and best-in-class energy performance to meet future Energy Star requirements.

Service friendly design with easy access to critical components.

Light yet solid design that makes handling and maintenance easy.

Case Study: Testing at our Ann Arbor, Michigan laboratories



Test cabinet



Pull down
test setup



Energy consumption
test setup

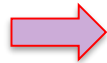
Case Study: Test results – Pull down tests

			Fixed speed (ON / OFF)	Variable speed	Improvement vs baseline
			Baseline - THA0412Y** (R134a)	VTCX - 360U (R290)	
			Test results	Test results	
1	No load pull down - slug temps 40F+/-1 (Amb 90F)	Pull down time (PDT)	66 min	49 min	26%
		Energy consumption for PDT	0.32 kwh	0.14 Kwh	56%
2	Full load pull down - product temps 38F +/- 1 (Amb 90F)	Pull down time (PDT)	17 hrs, 27 min	15 hrs, 12 min	13%
		Energy consumption for PDT	4.52 kwh	3.04 kwh	33%
		Product temp span at stabilization	7.2	6.8	6%
3	Half re-load pull down product temps 38F +/- 1 (Amb 90F)	Pull down time	10 hrs, 43 min	10 hrs, 07 min	6%
		Energy consumption	3.48 kwh	1.89 kwh	46%
4	Energy Star 4 Test ASHRAE 72	Energy consumption	3.46 kwh	1.24 kwh	64%

Case Study: *Results – Increased merchandising space*



Existing cabin designs



IntelliCOOL
cassette proposal



Existing cabin designs



IntelliCOOL
cassette proposal

Conclusions

The Tecumseh Complete Refrigeration System provides numerous advantages including:

- ▶ Increased merchandising space
- ▶ Lower refrigerant charge
- ▶ Reduced energy consumption
- ▶ Rapid pull down
- ▶ Simple transition to R290





THANK YOU



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