

# Tecumseh provides OEM solution to achieve energy savings and faster pull-down in an existing horizontal Commercial Freezer Utilizing Environmentally friendly R290 and Elements from its *IntelliCOOL™ Technology Platform*

Combining various components of its *IntelliCOOL Technology Platform*, Tecumseh has provided an OEM customer an integrated-condensing-unit solution allowing them to achieve energy savings in an existing horizontal commercial freezer. In addition to reduced energy consumption, the platform also results in faster pull-down, environmental-friendliness, manufacturing, and serviceability.



## Original Configuration

The application was a 2-door horizontal commercial freezer with a bottom mounted refrigeration system. The cabinet was equipped with a variable speed compressor (10.61 cm<sup>3</sup> displacement) running at fixed speed of 4100rpm's. Thermostat, (on/off relay digital controller), capillary tube, and utilized ~535g of R134a refrigerant.

## The Challenge

Since this was an existing cabinet and not a new development, the challenge, was to convert the cabinet from R134a to R290, while simultaneously reducing the energy consumption. This was to be done without making any significant structural changes to the cabinet and minimizing any changes to the existing refrigeration system.

## The Baseline

1<sup>st</sup> step was to subject the original cabinet to pull-down and Power consumption tests per ISO5155/1995 and ISO15502/2005 testing standards, measure the performance and achieve a baseline for the application, this resulted in the following:

- Recorded capacity of 1386 btu/hr. with an EER of 5.55 at 4100 rpm's
- Pull-down test was 144min. to -21.5°C
- Power consumption of 264 Wh/h
- Additionally, we ran a storage test per ISO standards, cabinet did not pass

## An *IntelliCOOL Technology Platform* Based Solution

Utilizing the laboratories at Tecumseh's Brazilian Engineering Center, a series of development and testing activities were conducted to produce a system that could achieve the desired results. These activities included iterations of development, performance testing, and energy consumption testing.

Ultimately, the following changes were made to the "baseline" system to achieve the desired results.

- Replaced competitors variable speed R134a compressor (10.61 cm<sup>3</sup>displacement) condenser and fan motor with Tecumseh's newly released **UVTCX415U variable-speed R290 condensing unit** (7.84 cm<sup>3</sup>displacement) and associated **IntelliCI Inverter**. The compressor maintained a fixed speed of 3600 rpm's
- Optimized the R290 refrigerant charge.
- Maintained existing low-side components; evaporator coil and fan
- Maintained existing defrost operations
- Verified refrigeration system performance and robustness in the application

Final solution consisted of an integrated-condensing-unit package that incorporated the new *IntelliCOOL* components

## Results

The pull-down, power consumption and storage tests results:

Operation	Tecumseh Application	Competitor Application	Comparison ratio	Tecumseh's solution
Pull-down time	121 min	144 min	-17.1%	<b>Faster</b>
Pull-down min. temp.	-28.5°C	-21.5°C	-7.0°C	<b>Colder</b>
Power consumption	195W	264W	-26.2%	<b>Less Power Used</b>
Storage test	Pass	Not pass	—	—
EER	5.91 @3600 rpm's	5.55 @ 4100 rpm's	+0.36	<b>More EER @ Less rpm's</b>

## Conclusions

The final solution, an integrated-condensing-unit that incorporates various components from Tecumseh's IntelliCOOL Technology Platform, has many benefits for the OEM:

- ✓ 26.2% Less power compared to original configuration that was using R134a
- ✓ Recorded capacity of 1495 btu/hr. with an EER of 5.91 at 3600 rpm's using R290
- ✓ 17.1% faster pull down
- ✓ 7.0°C colder pull down
- ✓ The application is suitable for usage in higher ambient temperatures (tropical regions)
- ✓ Ability to pass ISO15502 and ISO5155 storage tests when original configuration did not
- ✓ 54% reduction on charge
- ✓ Smaller displacement compressor
- ✓ Full integrated condensing unit solution to improve manufacturing and serviceability
- ✓ Enhanced alarms and diagnostic port / fault codes to improve serviceability