



Tecumseh

FIC•FRIO

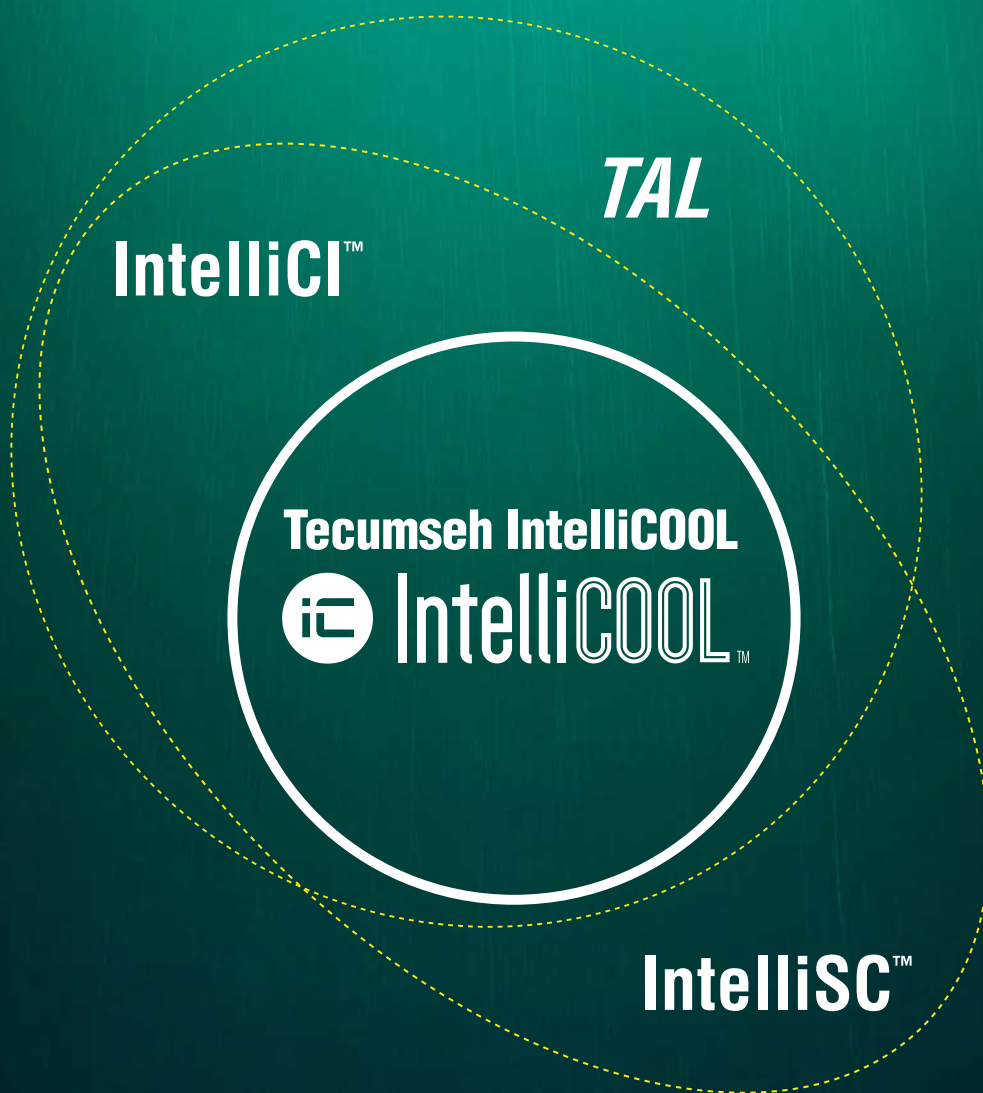


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INTELLIGENCE AND SUSTAINABILITY

Natural refrigerants, IntelliCOOL technology and the broadest portfolio on the market are featured at Febrava 2019

PAGES 12 AND 13



REVERSE TECHNOLOGY
PAGES 6 AND 7

R-290
PAGES 8 AND 9

ENVIRONMENTAL COMMITMENT
PAGES 22 AND 23

TECHNOLOGY AND SUSTAINABILITY

Combining performance and energy savings.

The development of high efficiency solutions powered by refrigerants with low or no global warming potential obtained through research and innovation.

Designing and creating new successful product lines, seeking a better future for the generations to come.

The power of the machines must support the environment and the people.

This is technology. This is sustainability. This is Tecumseh.

BUILT FOR TODAY. READY FOR TOMORROW.



Cooling For a Better Tomorrow™

www.tecumseh.com

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Tecumseh

MASTHEAD

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ADAPT AND SPREAD

Fiat lux. This is the Latin expression used by God during the creation of the universe, described in Genesis. In the beginning there was nothing, and then God created the world through an act of language: "let it be light." And this is not the only founding theory that associates the origin of the world with verbal language - after all, it is what allows us to create and transform the real universe as well as the imaginary.

Language is, therefore, a way of interpreting and categorizing the world and is what permeates and allows socializing in society through communication. In this context, propagating safe and quality information, Tecumseh also brings **Fic Frio** in English and Spanish versions.

And many, and important, is the alert information we receive from the media on various subjects, such as environmental destruction indexes. In another sphere, also directly linked to human development, there is an alarming prospect: 90% of the world's spoken languages could be extinct by 2100, according to US linguist John McWhorter in the book "The Power of Babel - A Natural History of Language".

One movement that relates to language by providing integration between different localities that speak different languages is globalization, which allows information to be disseminated quickly and flexibly, especially over the internet.

And Tecumseh takes advantage of this movement to spread its products and technologies around the world, with the necessary adaptations for each market - just as translation allows this magazine to be read in other countries. The products present at this year's Febrava, an international event, show this, as the condensing unit PAC3, a product of Asian origin that has just arrived in Brazil, with launch at the fair. In addition, the company's e-commerce makes its products available throughout Brazil, and the company's environmental commitment remains inalienable.

Despite the different languages present in the world, language is common to all human beings, and through it we can communicate, dialogue, fight for various causes - from environmental guidelines to the preservation of linguistic diversity and share knowledge, which you find in this magazine. Tecumseh was already global. Now **Fic Frio** is too. Have a good read.

IT IS WORTH CHECKING OUT

TECUMSEH TECNOLOGY

Inverter Compressors with **Tecumseh IntelliCOOL** controller make even more complete cooling system

PAGES 6 AND 7

Embedded technologies deliver innovative features





TECUMSEH ANNOUNCES LAUNCHES AT FEBRAVA

Present at the fair with an extensive portfolio, the company also takes part at Conbrava

Bringing high technology, energy efficiency and constant environmental concern, Tecumseh is present in another edition of the International Fair of Refrigeration, Air Conditioning, Ventilation, Heating and Air Treatment (FebraVA), the most

important event of the sector, which happens from September 10th to 13th, 2019.

The 21st edition of the fair is the ideal place for retailers, distributors, engineers, installers, designers and technicians to improve their knowledge, keep up with technological innovations and trends

and conduct business. With expanded programming compared to other editions, the event will be attended by over 300 brands and about 25,000 professionals and buyers in the industry - more information available on the site www.febrava.com.br.

The fair is an excellent opportunity for exhibiting companies to share their knowledge through high technical content, interaction with innovative and sustainable products and services, stimulating new solutions in the area.

Tecumseh Participation

With an even broader product portfolio, new compressors and condensing units that cater to the light commercial application, commercial air conditioners and AC and DC variable speed solutions segments, Tecumseh is present at the 21st edition of the fair bringing news.

Attentive to the continuous evolution process of the refrigeration industry, Tecumseh seeks to adapt and meet the main needs of the market. "Whether it's energy-efficient solutions, such as the growth in the use of variable speed compressor technology, or in combination with refrigerants that have the least impact on global warming, we are looking to bring a whole new twist on compressors, condensing units and solutions with R-290 fluid", comments Homero Busnello, Director of Marketing and Institutional Relations.

One of the major releases presented at Febrava is the **new IntelliCOOL variable speed technology**, developed by Tecumseh research centers to equip VTC inverter compressors, which uses R-290 refrigerant and has up to 30% energy savings. A special product announcement will also be held at the Brazilian Congress of Refrigeration, Air Conditioning, Ventilation, Heating and Air Treatment (Conbrava), which occurs concurrently with the fair.

Another highlight is the complete portfolio of **hermetic compressors adapted for use with the R-290 fluid**, which are growing in the industry for their environmentally safe characteristics. These compressors bring the most advanced on the market: lower power consumption; lower refrigerant charge; and lower environmental impact due to its low GWP - being able to equip a wide range of products, such as beverage displays, horizontal and vertical freezers, frozen islands, cold chambers, among others.

As for **CRS (Complete Cooling System) condensing units**, the news is that they come with factory-loaded gas, have a unique design and can be

equipped with TC, AE² or variable speed compressors using the IntelliCOOL VTC compressor. The easy to install, quiet CRS units can reduce power consumption by up to 30% in the variable speed version and are ideal for medium temperature application.

To complete the portfolio, the new PAC³ **outdoor low-temperature condenser unit**, designed for low to medium evaporation temperatures and with a capacity of 1 to 12 HP, can be fixed to the floor or walls. Also at the fair are the VR² variable speed rotary compressor and the Atlas and Mesa mini-rotors.

Tecumseh has a historic presence in the various editions of Febrava, since the first events. "This year, we aim to bring products that reinforce our goal of transforming the refrigeration industry by using smart and simple solutions," adds Busnello.

Conbrava

Held simultaneously with Febrava, Conbrava is considered the largest congress in the South American refrigeration sector and its main objectives are to exchange experience, update and disseminate knowledge in the segment.

Bringing together renowned professionals, this is an opportunity for participants to have access to the most current, nationally and internationally, in the sector. Tecumseh attends the congress with a presentation on **Inverter Technology**, addressing in more detail Tecumseh Adaptive Logic **TAL** a solution for variable speed compressors in applications using on-off thermostats.

INFORMATIONS

Febrava | 21st International Refrigeration, Air Conditioning, Ventilation, Heating and Air Treatment Fair

From September 10th to 13th, 2019 - From 1:00 to 8:00 PM São Paulo Expo Exhibition & Convention Center Rodovia dos Imigrantes, km 1,5 - Água Funda São Paulo (SP) - ZIP Code: 04329-900

Tecumseh Booth | B-74

Conbrava | Brazilian Congress of Refrigeration, Air Conditioning, Ventilation, Heating and Air Treatment

Tecumseh Lecture | Inverter technology, assisted by Tecumseh Adaptive Logic - TAL Tecumseh September 11th, 2019 (at 5:45 PM) **Room AB**

VARIABLE SPEED COMPRESSORS

To meet the main needs of the market, Tecumseh invests in inverter technology in different segments

The pursuit of lower energy consumption is not new in the commercial refrigeration industry, especially in energy-conscious manufacturing in the US, Europe, Brazil, and Asia, which are more energy-conscious, which encourages their purchasing decisions. Tecumseh, aiming to offer the best efficiency in the industry, designed the VTC inverter variable speed compressor platform using the eco-friendly R-290 (Propane) refrigerant.

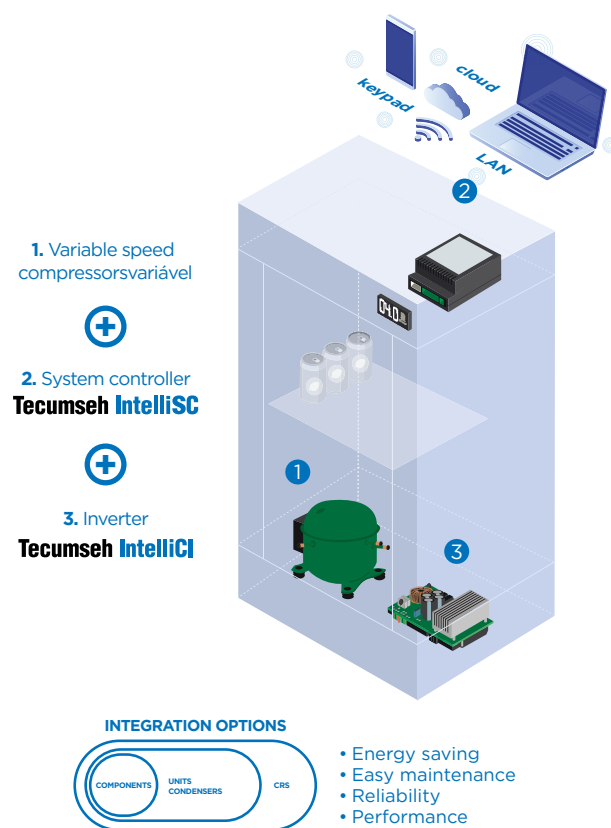
With the industry's best efficiency, smallest size and extended application envelope (L/MBP), the Tecumseh IntelliCOOL controller is a key differentiator of this technology. This new platform for smart solutions encompasses Tecumseh's latest innovations in variable speed, intelligent control, power management and connectivity.

Using **Tecumseh IntelliCOOL** components with variable speed compressors, inverters and system controllers, it is possible to flexibly design optimal commercial refrigeration systems. Innovative features such as electronic protection, error diagnostics, and remote communications provide technicians with the information they need to ensure equipment operates at peak performance and the highest level of reliability. These compressors are also adapted for the use of hydrocarbon fluids, making for environmentally friendly and safe systems.

Other embedded technologies that can be interconnected are also incorporated: **IntelliCI**, which is linked to the controller with main function in intelligent logic for frequency variation control; and **IntelliSC**, which brings a complementary equipment control solution more precisely, especially when there is no control on the equipment, as **shown next**.

Tecumseh IntelliCOOL

TECHNOLOGY PLATFORM FOR SMART COOLING SOLUTIONS



Tecumseh archive

The technology also incorporates logic known as **TAL** (Tecumseh Adaptive Logic), a solution for using variable speed compressors in applications that use on-off thermostats - which can be an electromechanical or electronic relay output thermostat to control the compressor -so that the thermostat signal, when connected to the inverter, will allow the **TAL** logic to calculate the best running speed, allowing the compressor to make a rapid temperature drop (fast pull-downs) and arrive at the slowest speed. based on load (optimal efficiency), thus bringing a reduction in energy consumption.

VTC R-290 COMPRESSORS APPLICATION TABLE (LBP-L/MBP)													
Model	Test condition	Refrigeration capacity (3600 RPM)		Efficiency (EER /COP)		Minimum rotation 2500 RPM		Maximum Rotation 4500 RPM		Voltage/ Frequency	Displacement		Oil
		Btu/h	W	Btu/Wh	W/W	Btu/h	W	Btu/h	W		(cm³)	(in³)	
VTCX330U-MD5C	1	303	50	5.06	0.84	202	59	377	66	220/60	1.83	0.11	POE
	2	655	195	8.09	2.37	445	130	824	241				
VTCX360U-MD5C	1	622	182	5.96	1.74	432	126	768	225	220/60	3.14	0.19	POE
	2	1279	375	8.8	2.58	879	257	1615	473				
VTCX410U-MD5C	1	1199	351	6.13	1.8	848	248	1410	413	220/60	6.06	0.37	POE
	2	2465	722	8.88	2.6	1725	505	3032	888				
VTCX415U-MD5C	1	1495	438	5.97	1.75	1093	320	1826	535	220/60	7.84	0.48	POE
	2	3126	915	8.6	2.52	2210	647	3908	1144				
VTCX419U-ME5C	1	1865	546	5.86	1.72	1163	341	2241	656	220/60	9.74	0.59	POE
	2	3891	1139	8.42	2.47	2279	667	4827	1414				
VTCX424U-ME5C	1	2437	714	5.76	1.69	1482	434	2961	867	220/60	12.47	0.76	POE
	2	4977	1457	7.69	2.25	2893	847	5492	1608				
VTC1424U-MD5C	1	2505	734	5.35	1.57	1818	533	3126	916	220/60	12.47	0.76	POE
	2	-	-	-	-	-	-	-	-				

(1) Ambient test condition: 32.2 °C (90 °F); Gas Return: 32.2 °C (90 °F); Liquid: 32.2 °C (90 °F); Evaporation temperature: -23.3 °C (-10 °F).

(2) Ambient test condition: 32.2 °C (90 °F); Gas Return: 32.2 °C (90 °F); Liquid: 32.2 °C (90 °F); Evaporation temperature: -6.7 °C (20 °F).

Note: Results shown in **red color** have a minimum speed of 2000 RPM. Results shown in **green** have a maximum speed of 4000 RPM. Results shown in **blue** are for reference only and may change without notice.

Model	Controller						
	030F0207	030F0216	030F0217	030F0218	030F0222	030F0223	030F0228
Voltage	Bivolt	127 V	220 V	Bivolt	220 V	220 V	Bivolt
VTCX330U-MD5C	X	X	X	X	-	-	-
VTCX360U-MD5C	X	X	X	X	-	-	-
VTCX410U-MD5C	X	X	X	X	-	-	-
VTCX415U-MD5C	X	X	X	X	-	-	-
VTCX419U-ME5C	-	-	-	-	X	X	-
VTCX424U-ME5C	-	-	-	-	X	X	-
VTC1424U-MD5C	-	-	-	-	-	-	X

Note: Bivolt = 127/220 V. 50/60 Hz. controllers. Data may change without notice.

VR² Compressor Line - Air Conditioners

The electric motor of the VR² BLDC compressors has higher energy efficiency than the conventional ones, as well as the first generation VR's were developed to serve the Brazilian market, which usually works with refrigeration capacity of 9,000 Btu/h and 12,000 Btu/h.

Another highlight is the algorithm developed by the Tecumseh Brasil Research and Development Center (R&D), which allows electronic control of compressor operation, providing a substantial increase in energy efficiency.

Masterflux Line

Sierra, Cascade, Atlas and Mesa models can be applied in various segments: large vehicles, boats, agricultural machines as well as medical applications. The differential of this line is batteries and solar energy - except the Mesa model, which can be powered by DC and AC., can power the motor with BLDC technology, which runs on direct current in an electronic switching system.

Learn more about products in the adjacent QR code.



HYDROCARBONS COOLING FLUIDS: R-290 AND R-600a

Thinking about the future of the planet, Tecumseh bets on the use of natural refrigerants

Refrigerants are a recurring concern regarding the environmental issue. Many fluids that are still in cooling systems can affect the environment because of their chemical properties, with high potential for ozone depletion (ODP) and global warming potential (GWP).

Aware of its social and environmental role, Tecumseh is attentive to market demands and seeks to develop solutions that use environmentally safe and natural refrigerants such as R-600a (isobutane) and R-290 (propane), which are already available on the market. The R-600a stands out for use in home refrigerators, while

the R-290 in commercial applications.

Importantly, these fluids are hydrocarbons, meaning they are not ozone depleting substances (SDO) and have low GWP, but are highly flammable and therefore require safety precautions - for more information on hydrocarbons and other safety tips, see previous editions of **Fic Frio** through the website www.ficfrio.com.br.

Tecumseh offers a range of products suitable for the use of hydrocarbon fluids with the families TH, TC, AE², AJ², AK² and VTC (*inverter line*). Check out more details of this and other products at www.tecumseh.com and in the following table.

APPLICATION TABLE - R-290 COMMERCIAL COMPRESSORS (LBP/MBP)

Fluid refrigerant	Model	Test condition	Ventilation	Refrigeration capacity		Efficiency (EER/COP)		Voltage	Displacement		Oil
				Btu/h	W	Btu/Wh	W/W		cm ³	in ³	
R-290	AK2424U	1	F	2500	732	4.71	1.38	127	17.45	1.07	POE
	AK2431U	1	F	3360	984	5.00	1.46	127/220	20.43	1.25	POE
	AK4482U	2	F	4632	1356	7.00	2.05	127/220	15.63	0.95	POE
	AK4492U	2	F	5050	1446	7.00	2.05	127/220	17.45	1.07	POE
	AK4511U	2	F	6406	1876	6.40	1.87	127	20.43	1.25	POE
	AK4514U	2	F	7940	2325	6.90	2.02	220	25.68	1.57	POE
	CAJ2446U	1	F	4502	1319	4.65	1.36	127/220	26.20	1.60	POE
	CAJ2464U	1	F	6208	1819	4.72	1.38	127/220	34.50	2.11	POE

(1) Ambient test condition: 32.2°C (90°F); Gas Return: 32.2°C (90°F); Liquid: 32.2°C (90°F) and Evaporation temperature: -23.3°C (-10°F).

(2) Ambient test condition: 32.2°C (90°F); Gas Return: 32.2°C (90°F); Liquid: 32.2°C (90°F) and Evaporation temperature: -6.7°C (20°F).

(N) Natural Ventilation/(F) Forced Ventilation.

APPLICATION TABLE - R-290 FRACTIONAL COMPRESSORS (L/MBP)

Fluid refrigerant	Model	Test condition	Ventilation	Refrigeration capacity		Efficiency (EER/COP)		Voltage	Displacement		Oil
				Btu/h	W	Btu/Wh	W/W		cm ³	in ³	
R-290	TCW330U	1	F	300	88	4.20	1.23	127	1.83	0.11	POE
		2		650	190	7.03	2.06				
	TCW350U	1	F	500	147	4.90	1.44	127/220	2.72	0.17	POE
		2		1050	308	7.89	2.31				
	TCW360U	1	F	600	176	4.76	1.39	127	3.14	0.19	POE
		2		1235	362	7.55	2.21				
	TCW380U	1	F	845	248	5.12	1.50	220	4.19	0.26	POE
		2		1675	491	7.61	2.23				
	TCW390U	1	F	880	258	5.30	1.55	127/220	4.75	0.29	POE
		2		1840	539	7.76	2.27				
	TCW410U	1	F	1150	337	5.45	1.60	127/220	6.06	0.37	POE
		2		2330	683	7.90	2.31				
	TCX413U	1	F	1310	384	5.39	1.58	127/220	6.93	0.42	POE
		2		2700	791	7.72	2.26				
	TCX415U	1	F	1490	437	5.21	1.53	127/220	7.84	0.48	POE
		2		3000	879	7.45	2.18				
	AEX417U	1	F	1540	451	4.89	1.43	127	8.02	0.49	POE
		2		3120	914	7.45	2.18				
	AEX419U	1	F	1770	519	4.85	1.42	127	9.35	0.57	POE
		2		3530	1034	7.26	2.13				
	AEX424U	1	F	2400	703	5.30	1.55	127	12.01	0.73	POE
		2		4650	1362	7.52	2.20				
	AEX428U	1	F	2550	747	5.20	1.52	127	13.24	0.81	POE
		2		5150	1509	7.65	2.24				
	AEX433U	1	F	3010	882	5.27	1.54	127	15.09	0.92	POE
		2		5945	1742	7.53	2.21				

(1) Ambient test condition: 32.2°C (90°F); Gas Return: 32.2°C (90°F); Liquid: 32.2°C (90°F) and Evaporation temperature: -23.3°C (-10°F).

(2) Ambient test condition: 32.2°C (90°F); Gas Return: 32.2°C (90°F); Liquid: 32.2°C (90°F) and Evaporation temperature: -6.7°C (20°F).

(N) Natural Ventilation/(F) Forced Ventilation. Data may change without notice.

COMPRESSORS DIFFERENTIALS USING R-290 FLUID

Images: Tecumseh archive

Performance: Excellent thermal and physical characteristics, cooling capacity similar to current refrigerants

Eco-Friendly: Fluid natural refrigerant, lower energy consumption than traditional fluids

Good TEWI (Total Equivalent Warming Impact): Because it is a natural refrigerant, it has less energy consumption than traditional fluids

Easy to use: no temperature glide, low maximum pressure, available fluid refrigerant and low cost

Proven reliability: Leverage robust design attributes built on decades of commercial refrigeration experience

Note: VTC variable speed compressors are designed for R-290 fluid, more information on pages 6 and 7.



COMPLETE CONDENSING UNITS

Applying variable speed technology, Tecumseh introduces new CRS condensing units

The new line of light commercial condensing units developed by Tecumseh seeks to bring more convenience to its customers. Utilizing the well-known conventional and variable speed compressors of the VTC family (inverter), the **CRS (Full Refrigeration System) line of condensing units** and the **fractional line of condensing units** bring a new platform and new design, mainly benefiting the ease of installation and maintenance.

As a complete refrigeration system, CRS comes standard with a refrigerant charge no fluid is required during the unit installation in the cabinet. This makes it a safer product especially when it comes to flammable fluids, and it also has the ability to quickly replace the entire cooling system.

In case of failure, replacement will be per-

formed by another system of the same specification, without product loss due to possible temperature increase during equipment maintenance.

In addition, condensing units using VTC inverter compressors employ the highest technology in the industry, bringing more efficiency and energy savings to their commercial applications. The key differentiator of this line is the **IntelliCOOL system**, Tecumseh's new technology platform, which encompasses product innovations and initiatives in variable speed, intelligent control, power management and connectivity - learn more about this system in **variable speed compressors**, pages 6 and 7 of this issue of **Fic Frio**.

The following table shows the available options for CRS fractional condensing units with inverter technology.

APPLICATION TABLE CRS CRS-VTC INVERTER R-290 CONDENSING UNITS (L/MBP)

Model	Test condition	Refrigeration capacity (3600 RPM)		Efficiency (EER/COP)		Minimum rotation (2500 RPM)		Maximum Rotation (4500 RPM)		Voltage/ Frequency	Displacement		Oil
		Btu/h	W	Btu/ Wh	W/W	Btu/h	W	Btu/h	W		(cm³)	(in³)	
VTCX415U-MD5C	1	1495	438	5.97	1.75	1093	320	1826	535	220/60	7.84	0.48	POE
	2	3126	915	8.6	2.52	2210	647	3908	1144				
VTCX424U-ME5C	1	2437	714	5.76	1.69	1482	434	2961	867	220/60	12.47	0.76	POE
	2	4977	1457	7.69	2.25	2893	847	5492	1608				

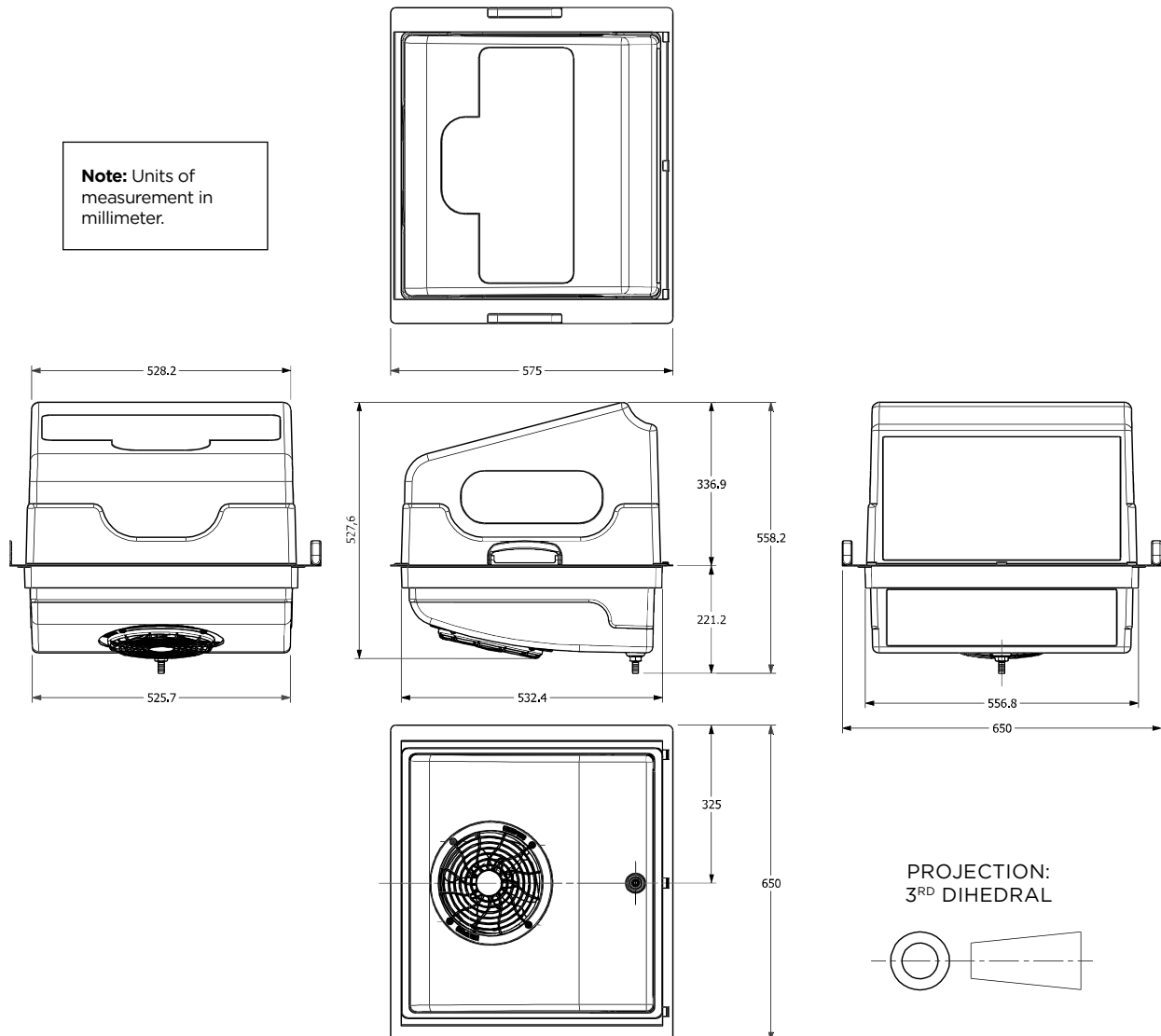
(1) Ambient test condition: 32.2 °C (90 °F); Gas Return: 32.2 °C (90 °F); Liquid: 32.2 °C (90 °F); Evaporation temperature: -23.3 °C (-10 °F).
 (2) Ambient test condition: 32.2 °C (90 °F); Gas Return: 32.2 °C (90 °F); Liquid: 32.2 °C (90 °F); Evaporation temperature: -6.7 °C (20 °F).

Note: Results shown in **red color** have a minimum speed of 2000 RPM. Results shown in **green** have a maximum speed of 4000 RPM.

Model	Controller						
	030F0207	030F0216	030F0217	030F0218	030F0222	030F0223	030F0228
Voltage	Bivolt	127 V	220 V	Bivolt	220 V	220 V	Bivolt
CVTX415U-MD5C	X	X	X	X	-	-	-
CVTX424U-ME5C	-	-	-	-	X	X	-

Note: Bivolt = 127/220 V. 50/60 Hz. controllers. Data may change without notice.

CRS DIMENSIONS



A COMPLETE RANGE OF PRODUCTS TO MEET MARKET DEMAND

Learn more about Tecumseh highlights
and releases at Febrava

RELEASES

VTC COMPRESSOR

Compact and energy-efficient, the VTC features global voltage stabilization and temperature control - at high rpm offers a fast pull-down and at low rpm maintains cabinet temperature with minimal power consumption. In addition, it is optimized for use with R-290 fluid.



CASCADE COMPRESSOR

With its robust reciprocating motor design and integrated electronic controller, it is compact and economical as it does not require forced ventilation. It operates with two voltage ranges: 12 and 24 V dual voltage models (24 and 48 VDC).



ATLAS AND MESA COMPRESSORS

Compact, about a quarter the size of a conventional compressor and quietly operating, these compressors still deliver energy savings by combining high efficiency motors with optimized pumping mechanisms and are available in voltage ranges from 24 to 48 VDC and 100 to 220 VAC.



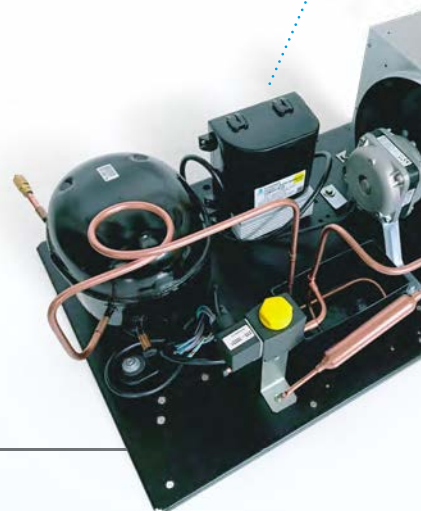
VR² COMPRESSOR

With precision mechanics and algorithm technology, the VR² features quiet operation and reduced power consumption when using the BLDC electric motor, which gives the rotor greater energy efficiency and mechanical robustness.



VTC INVERTER CONDENSING UNIT

Compact, quiet and efficient, it uses IntelliCOOL technology.



IntelliCI™

Tecumseh
iC IntelliCI™

TAL

PRODUCT LINE

MARKET NEEDS

SIERRA COMPRESSOR

The robust and compact design makes this compressor ideal for mobile and transport applications. It has wide application range, with voltage range from 12 to 600 VDC, TWIN compressor configurations and energy saving.



UAW, UAJ² and UVS CONDENSING UNITS

With high efficiency, commercial condenser units are quiet as well as versatile - for low and high temperature applications, capacitors are suitable for different types of environment due to their compact size and are also equipped with compressors for low, medium and high pressure applications and designed for R-22 and R-404A fluid applications.

TAL



CRS-VTC CONDENSING UNIT

The new fairing design facilitates maintenance and installation and can be applied to complete refrigeration systems and provides energy savings through the use of high speed fixed efficiency compressors and variable speed technology.

IntelliCOOL
IntelliCOOL™



USH CONDENSING UNIT

It features more efficient and lighter performance than most competitors, reliable performance and condenser unit base with room to add other components.

IntelliSC™



PAC³ CONDENSING UNIT

Compact, the new housing is 913 mm long to optimize spacing and functionality. It is also weather resistant and features easy installation and maintenance.

APPLICATION

By Akash Bhatia,

Director of Systems Engineering, Tecumseh North America

COMPARISON OF CRS CONDENSING UNITS

Case study demonstrates possibilities and advantages of complete variable speed refrigeration systems

For over 85 years, we have been known for our wide range of refrigeration compressors. Today, in addition to compressors, we design and manufacture a number of value-added systems such as indoor and outdoor condensing units, rack systems, and mini-chillers. A system increasingly gaining attention from our OEM customers is a self-contained complete refrigeration system (CRS) often referred to as a 'cassette'. In some regions, we custom-design CRS based on our OEM customer's unique application requirements.

Our custom CRS is a 'plug and play' system that usually uses R-290-based fixed-speed or variable-speed compressors and come in three mounting formats: top mount, bottom mount and side mount. This is a very easy way for OEM customers to make their R-290 transition as they simply 'plug-in' our CRS into their cabinets. Our energy efficient and low charge CRS not only reduces installation and replacement cost but also saves space for the system and increases merchandise storage capacity.

Case Study Scope

In this case study, we developed a CRS with our Series VTC, R-290 variable speed compressor to achieve the following benefits for a beverage cooler application by making minimal changes to the original cabinet design.

- Reduced energy consumption
- Improved thermal stability
- Rapid "pull-down"
- Smaller displacement compressor

- Charge reduction
- SKU reduction
- Dual voltage, soft starting
- Lower noise and vibration



Figure 1:
Existing cabin designs



Figure 2:
With new CRS (R-290, variable speed)

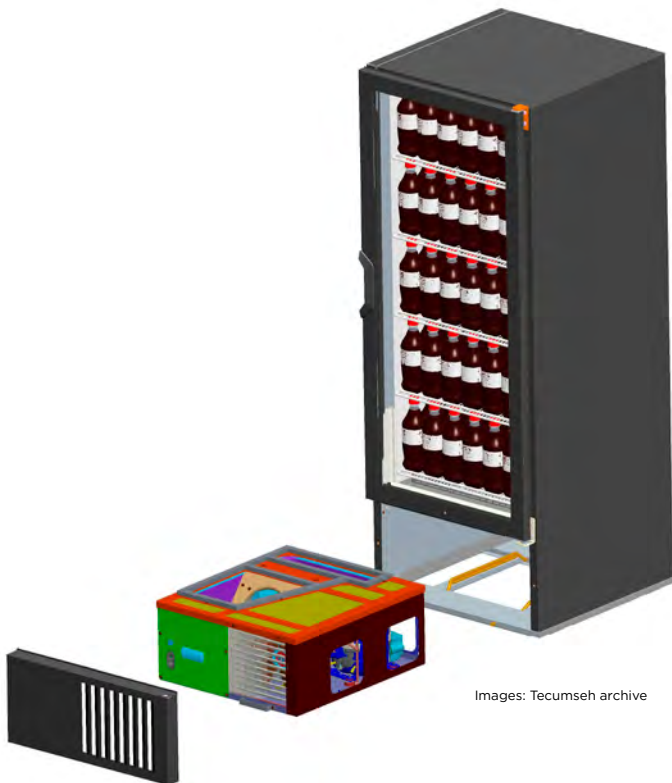
CRS Development

As we designed the new CRS solution we also considered the following:

- Significantly smaller cooling deck than most comparable 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.
- 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.



Testing & Validation

We compared the system performance between the new CRS against the baseline CRS with a R-134a fixed-speed compressor:

Testing plan

1. For the baseline R134a CRS
 - a) Measure energy consumption and pull down time at no load, full load and half reload
 - b) Measure DOE & Energy Star 4 tests
2. Then replace the baseline CRS with the new R290 variable-speed CRS and conduct the same tests
3. Compare results

Results

Compared to the baseline CRS with R-134a fixed speed compressor, the new CRS with R-290 variable-speed compressor has a significant improvement in energy consumption with many other benefits: shorter pull down, lower refrigerant charge and increased merchandising space. The new Tecumseh CRS makes OEM customer's R-290 transition easier, simplifies contractor's service and maintenance and reduces end-user energy consumption.

			Fixed speed (ON/OFF)	Variable speed	Improvement vs baseline
			Baseline THA0412Y (R-134a)	VTCX 360 U (R-290)	
			Test results	Test results	
1	Temperature Lowering (No Load) Temp. of the refrigerator 4.4 ° C Temp. ambient 32 ° C	Pull down time (PDT)	66 min	49 min	26%
		Energy consumption PDT	0.32 kWh	0.14 kWh	56%
2	Lowering of temperature (under load) Temp. of product 3.3 ° C (± 1 ° C) Temp. ambient 32 ° C	Pull down time (PDT)	17h, 27 min	15h, 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	Temperature recovery after half load recharging Temp. of product 3.3 ° C (± 1 ° C) Temp. Environment 32 ° C	Pull down time	10h, 43 min	10h, 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%

Note: Data may change without notice.

SHARE KNOWLEDGE

rebecacometerra

THE INTERMEDIATE LEVEL FACE-TO-FACE COURSE,
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CONDENSING UNIT PAC³

Sustainable, compact and easy to maintain, the product launched in Brazil is featured at Febrava 2019



The growth and development of cities has generated new forms of occupation of geographical spaces, bringing residential and commercial areas closer together. In this context, adaptations are required in many ways, including in the refrigeration sector. And Tecumseh is aware of these demands. More compact refrigeration products with sound comfort become decisive points in the choice of equipment. To meet these new needs, Tecumseh launches, in Brazil, its new line of PAC³ condensing units, an evolution of the already widely used in Asia and Oceania, PAC².

PAC³ Benefits and Differentials

Highlighting sustainability and flexibility, the focus of PAC³ design is ease of maintenance. This differential allows the use of equipment even where there is not much space or mechanical rooms, as condensing units can be installed outdoors in weathered conditions, fixed to the floor or on walls.

The line is also equipped with reciprocal and scroll compressor technology, available for low and medium evaporation temperature applications and with a nominal capacity range of 1 to 12 HP. The main recommended fluids are R-404A

and R-22, currently most commonly used in Latin America, but some models are approved for applications with the new R-449A, R-448A and R-452A fluids.

Tecumseh will also offer additional components to meet different applications: liquid accumulator, oil separator, contactor and breaker electrical panel, phase fault relay and solenoid valve.



Imagens: Arquivo Tecumseh

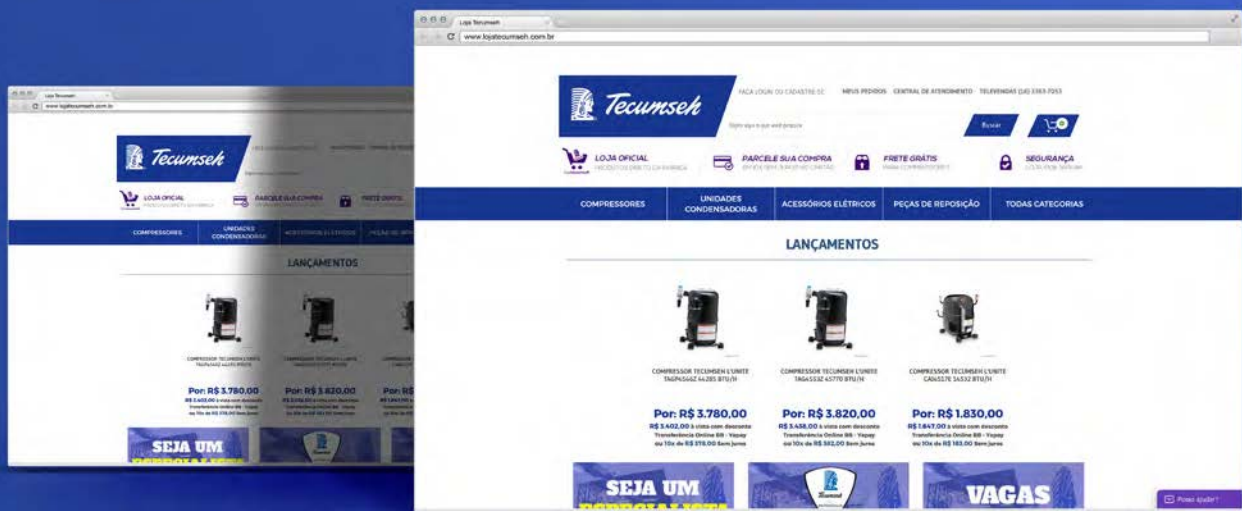
TECHNICAL SPECIFICATIONS					
Tecnology	Application	Model	HP	Btu/h*	Refrigerants fluids
RECIPROCAL	LBP	Mini	1 - 1 1/2	4600 - 6200	R-404A
		Small	2 - 3	8900 - 12700	R-404A
		Medium	4 - 6	17600 - 25600	R-404A
	M/HBP	Mini	1 - 1 1/3	7800 - 13700	R-404A/R-22
		Small	1 1/2 - 2 1/2	14500 - 29500	R-404A/R-22
		Medium	3 - 4	37800 - 54000	R-404A/R-22
		Large	5 - 6 1/2	59000 - 75000	R-404A/R-22
SCROLL	M/HBP	Large	5 - 7	60000 - 80000	R-404A/R-22
		Extra large	8 - 12	85000 - 150000	R-404A/R-22

Application	LBP	M/HBP
Evaporation (°C)	-23.3	7.2
Ambient (°C)	32	32
Return (°C)	20	20
Subcooling (°C)	3	3

*Capacity data at 60 Hz.

CONNECTION DIAMETER (mm)					DIMENSION (mm)		
Cabinet	Fan (s)	Liquid tank	Suction	Liquid	Length	Width	Height
Mini	1 x 350 mm	2.35 L	15.9 (5/8")	15.9 (5/8")	913	416	532
Small	1 x 450 mm	3.9 L	15.9 (5/8")	15.9 (5/8")	913	416	638
Medium	1 x 500 mm	3.9 L	22.2 (7/8")	22.2 (7/8")	913	416	792
Large	2 x 450 mm	9.5 L	22.2 (7/8")	22.2 (7/8")	913	416	1149
Extra large	2 x 500 mm	9.5 L	28.6 (1 1/8")	28.6 (1 1/8")	913	416	1271

Note: Data may change without notice.



TECUMSEH STORE

With extensive catalog, Tecumseh e-commerce completes two years of sales

The purchase and sale of products from various segments through the internet has been gaining more space nowadays. Known as E-commerce, this e-commerce began to be used by Tecumseh Brazil in August 2017 - but its history predates that.

In 2015, **Tecumseh Store** began a testing phase, in which brand gifts were sold only to employees and their families. This moment was important for the definition of the product portfolio that would be offered later, as well as providing knowledge and experience regarding product offering protocols, technical description, prices and billing methods for when the store was also intended for external audiences.

With this new sales format, Tecumseh started to operate the unitary supply of products, one of the store's differentials, which has a sales index pattern of a dozen units. The major modifications required by this new model were the suitability of the product packaging - hermetic compressors, for example, originally supplied on 120-unit industrial pallets, are now delivered in individual cardboard packaging - and also the adequacy of the billing system, with the possibility of payment via bank slip or credit card (up to 10 installments without interest), so that the traditional credit approval no longer exists, since the sale was practically in sight.

Tecumseh Store was created, and continues

to expand, with the objective of offering products without borders, throughout the national territory, with purchase facilities. When accessing the site **www.lojatecumseh.com.br**, the customer simply select the desired product, enter their registration details and destination address, and then the sales team takes care of all the logistics of delivery, with the transportation done by courier or carriers - and free shipping for compressors and condensing units.

In addition, the company's online technical support is complete and critical to successful product selection. Any questions are answered by email or WhatsApp before the purchase is made, thus ensuring the customer the right product and best suited to his/her needs.

The **Tecumseh Store** also offers a portfolio with items of lower circulation in the market. If any product is not available from one of our distributors, please contact us via online chat or email us at **ecommerce@tecumseh.com**.

Navigating the **Tecumseh Store** website is simple and intuitive, access the QR code next door and make your purchases.



COMMERCIAL CONDENSING UNITS

Further enhancing its presence in the refrigeration market, Tecumseh expands its commercial product line



Prioritizing the needs and demands of the Brazilian and Latin American markets, Tecumseh expands its portfolio of commercial condensing units, exhibited in this edition of Febrava.

This line of condensing units employ compressors that use reciprocal and scroll hermetic and reciprocating semi-hermetic mechanisms from the following families: AJ², AWS and AG, ranging from 1 to 12 HP; VS (scroll) from 4 to 12 HP; and SH (in-

COMMERCIAL CONDENSING UNITS (LBP)

Fluid refrigerant	Model	Cooling Capacity - Evaporation									
		-35°C (-31°F)			-30°C (-22°F)			-25°C (-13°F)			
		Btu/h	Kcal/h	Watt	Btu/h	Kcal/h	Watt	Btu/h	Kcal/h	Watt	
R-404A	T / AJ2464Z	3247	818	951	4371	1101	1281	5696	1435	1669	7
	T / FH2480Z	4413	1112	1293	6257	1577	1833	8366	2108	2451	10
	T / FH2511Z	6370	1605	1866	8958	2257	2625	11860	2989	3475	15
	TAG2516Z	8820	2223	2584	12494	3148	3661	16787	4230	4919	22
	TAG2522Z	11759	2963	3445	16584	4179	4859	22129	5577	6484	28
	TAGD2532Z	16462	4148	4823	24370	6141	7140	33574	8461	9837	44
	TAGD2544Z	23517	5926	6890	33168	8358	9718	44259	11153	12968	56

COMMERCIAL CONDENSING UNITS (MBP)

Fluid refrigerant	Model	Cooling Capacity - Evaporation									
		-15°C (5°F)			-10°C (14°F)			-5°C (23°F)			
		Btu/h	Kcal/h	Watt	Btu/h	Kcal/h	Watt	Btu/h	Kcal/h	Watt	
R-404A	T / CAJ4519Z	8263	2082	2421	10465	2637	3066	12925	3257	3787	18
	AWS4522Z	6810	1716	1995	9190	2316	2693	11913	3002	3491	18
	AWS4532Z	9893	2493	2899	12837	3235	3761	16191	4080	4744	24
	AWS4538Z	13334	3360	3907	17373	4378	5090	21895	5518	6415	32
	TAG4546Z	13858	3492	4060	19481	4909	5708	25719	6481	7536	40
	TAG4568Z	24222	6104	7097	31522	7944	9236	39999	10080	11720	59
	TAG4573Z	26943	6790	7894	34300	8644	10050	42653	10749	12497	63
	TAG4581Z	28764	7249	8428	36886	9295	10808	45912	11570	13452	67
	TAGD4590Z	27717	6985	8121	38962	9818	11416	51438	12962	15071	81
	TAGD4612Z	42238	10644	12376	54394	13707	15937	68329	17219	20020	100
	TAGD4614Z	48443	12208	14194	63045	15887	18472	79997	20159	23439	110
	TAGD4615Z	53887	13580	15789	68599	17287	20100	85306	21497	24995	120



Tecumseh archive

verter semi-hermetic), from 5 to 70 HP. Moreover, they present as differentials the energy efficiency and low noise of the compressors used.

VOLTAGES AND FREQUENCIES

AJ²/FH/AG family

208-220 V 60 Hz	HZ	single-phase
220-240 V 50 Hz	FZ	single-phase
440 V 60 Hz	TZ	three-phase
400 V 50 Hz	TZ	three-phase
220 V 60 Hz	KZ	three-phase
220 V 50 Hz	KZ	three-phase

AWS family

208-230 V 60 Hz	XN	single-phase
200-220 V 50 Hz	XN	single-phase
380-420 V 50 Hz	XG	three-phase
460 V 60 Hz*	XG	three-phase
350-440 V 60 Hz	LZ	three-phase
340-440 V 50 Hz	LZ	three-phase
220 V 60 Hz	KZ	three-phase
220 V 50 Hz	KZ	three-phase

EN12900 Application Conditions

LBP

Condensation Temperature: 50°C (122°F)

Gas Return Temperature: 20°C (68°F)

Liquid Temperature: 49.7°C (121°F)

MBP

Condensation Temperature: 40°C (104°F)

Gas Return Temperature: 20°C (68°F)

Liquid Temperature: 39.6°C (103°F)

									60 Hz			
Temperature (EN12900)									Voltage			
-20°C (-4°F)			-15°C (5°F)			-10°C (14°F)			KZ	HZ	TZ	FZ
Btu/h	Kcal/h	Watt	Btu/h	Kcal/h	Watt	Btu/h	Kcal/h	Watt				
295	1838	2137	9165	2310	2685	11331	2855	3320	X	X	X	X
0758	2711	3152	13450	3389	3941	16459	4148	4822	X	X	X	X
5407	3883	4514	19668	4956	5763	24605	6200	7209	X	X	X	X
2085	5565	6471	28127	7088	8241	34960	8810	10243	X		X	
3483	7178	8346	35732	9004	10469	43966	11079	12882	X		X	
4170	11131	12942	56253	14176	16482	69919	17620	20486	X		X	
6966	14355	16691	71464	18009	20939	87932	22159	25764	X		X	

									60 Hz			
Temperature (EN12900)									Voltage			
5°C (-41°F)			10°C (50°F)			15°C (59°F)			KZ	HZ	TZ	FZ
Btu/h	Kcal/h	Watt	Btu/h	Kcal/h	Watt	Btu/h	Kcal/h	Watt				
3487	4659	5417	21517	5422	6304	24653	6213	7223		X		X
3645	4699	5463	22782	5741	6675	27517	6934	8063	X	X	X	
4438	6158	7160	29485	7430	8639	35250	8883	10328	X	X	X	
2781	8261	9605	39342	9914	11527	46777	11788	13706	X	X	X	
0530	10214	11875	49349	12436	14459	59272	14937	17367		X		X
0463	14985	17423	69943	17626	20493	80584	20307	23611		X		X
3108	15903	18491	76202	19203	22327	91361	23023	26769		X		X
7167	16926	19680	79829	20117	23390	94137	23723	27582		X		X
1061	20427	23751	98698	24872	28919	118545	29873	34734		X		X
3930	26190	30451	123783	31193	36268	144679	36459	42391		X		X
8925	29969	34845	139886	35251	40987	161168	40614	47222		X		X
6215	31806	36981	151172	38095	44293	179635	45268	52633		X		X

Note: All information in this table is composed of reference values and may be changed at any time without prior notice. The letter "T" in the initials of models AJ² and FH indicates that the condenser units have three-phase power.

COMMITMENT

By Hiroshi Saito,
Global Marketing Director, Tecumseh North America

PURSUIT OF THE GREENER WORLD

Tecumseh bets on solutions that combine technology, energy efficiency and low environmental impact

Environmental sustainability is not an option to Tecumseh. We are global citizens and innovation is engrained in our culture. Our employees are committed to engineering solutions that reduce carbon dioxide emissions and utilize low GWP solutions and preserving the environment for the next generation. Tecumseh has dedicated considerable resources toward the evaluation of low GWP refrigerants.

With deep expertise in the refrigeration industry that has accumulated over 85 years, Tecumseh is committed to developing highly energy efficient systems across the globe that reduce overall energy consumption. Most recently, Tecumseh introduced value-added systems such as **Infinee**, a R-290-based mini-chiller for European market, **ARGUS**, a series of condensing

units that meet AWEF efficiency for North American market, **PAC³**, a sophisticated condensing unit with **Tecumseh IntelliCOOL** platform for Asian market, and **CRS** (self-contained complete refrigeration systems) for OEMs to plug into their various commercial refrigeration applications. Each of these applications is engineered to apply Tecumseh's latest technology to reduce energy usage across a variety of low GWP refrigerants.

On the compressor side, Tecumseh continues to expand its variable-speed technology portfolio which includes **Tecumseh IntelliCOOL** and **VTC Series**, an intelligent technology platform with **A/C-powered compressors**, and **Masterflux**, **D/C-powered micro-rotary compressors**. Variable-capacity cooling systems are highly energy efficient, particularly when com-



Images: Tecumseh archive



bined with a natural refrigerant such as R-290, and provide substantial energy savings to users. Interest in these technologies from OEMs continues to grow throughout the world.

When it comes to refrigerant, Tecumseh has dedicated considerable resources in evaluating low GWP refrigerants that are less harmful to the environment than HFC refrigerants. For example, when considering new installations, Tecumseh recommends the natural refrigerant R-290, when system size and location allow.

Fluorinated gas substances are harmful to the environment, and in the coming years they will be limited on all applications globally. Although the timeline to adopt certain refrigerants varies by region or country, Tecumseh has a global vision of refrigerant transition to pursue increasingly less GWP.

In the short-to-medium term, local regulations will significantly reduce or ban the usage of HFC refrigerants with high GWP in refrigera-

tion applications. In the long term, the requirements around refrigerant choice for commercial refrigeration will be natural refrigerants, with extremely low GWP, or low-GWP synthetic refrigerants. To ensure we support our customers and their dynamic needs throughout these transitions, Tecumseh will guide customers with promising choices of refrigerants and will work closely with them to successfully develop efficient and environmentally conscious long term solutions.

Tecumseh has been a global leader in commercial refrigeration but has never stopped its innovation for the greener world. Today, Tecumseh is pursuing the greener world with innovative variable-capacity cooling capability, low GWP refrigerant and highly efficient value-added system development.

Tecumseh offers Guidelines for the application of these refrigerants in the adjacent QR code.



PAC³:

TECHNOLOGY AND VERSATILITY

TECUMSEH'S PRODUCT CATALOG IS INCREASINGLY BROAD AND GLOBAL WITH ASIAN DESIGN AND WITH APPROPRIATE ADJUSTMENTS TO NATIONAL NEEDS, THE OUTDOOR CONDENSING UNIT **PAC³** HITS THE LATIN AMERICA MARKET BRINGING INNOVATION AND SUSTAINABILITY.

**COMPACT, QUIET, WITH NOMINAL CAPACITY RANGE
FROM 1 TO 12 HP, EASY MAINTENANCE
AND AVAILABLE FOR MANY APPLICATIONS.**

**FLEXIBILITY BROKE DOWN
BARRIERS AND WENT AROUND
THE WORLD.**



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