

FIC-FRIO

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IT'S TIME TO TAKE CARE OF OUR PLANET

Committed to provide sustainable refrigeration solutions, Tecumseh continues to devise alternatives for an environmentally safer future

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REFRIGERANT FLUIDS PAGES 4 AND 5 APPLICATION LAB PAGES 10, 11 AND 12 MAINTENANCE TYPES PAGES 16 AND 17 SAFETY PRECAUTIONS PAGE 18

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.

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MASTHEAD

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COOPERATION

June has arrived with the mid-year mild temperatures and the reflection upon the progress of the goals set in early 2019. If, on the one hand, it is more difficult to take care of the physical health due to cooler temperatures — one of the main New Year's resolutions — on the other hand, this moment of introspection can be destined for the mental health, which is as important as the physical one, but often ignored. After all, the body is a unique system in which the physical and the emotional parts are not disassociated, conversely, one interferes with the other.

Anxiety disorder is the second most common mental illness on the planet, with 264 million people being affected, according to data from the World Health Organization (WHO), and depression, in turn, reaches more than 300 million people in the world and is known as the disease of the 21st century. Brazil is considered the most anxious and stressed country in Latin America, with 5.8% of its inhabitants suffering from these problems.

This, added to stress, generates a host of other diseases that affect the body as a whole. In addition, the environmental settings in which people are inserted affect their behavior, their personality building and also their health. The pollution level, for example, is one of these external factors — it is estimated that 92% of the planet's population is exposed to alarming pollution levels — according to the WHO.

Climate issues seem to draw more attention to this practical perspective when people realize how their lives can be directly impacted. Heat waves, reduced water availability, changes in the pattern of diseases caused by the climate, sea level rise, among other direct drivers, as well as the bad effects on the mental and physical health.

The cover story of this issue deals precisely with the impacts of the climate change and how the Paris Agreement offers the world viable options for minimizing impacts and preserving the environment. The constant search for knowledge and optimization through research and the development of technologies is essential and shows how global cooperation and commitment can make a difference — not just regarding environmental issues. Have a good read.

IT IS WORTH CHECKING OUT VARIABLE SPEED

COMPRESSOR Cooling solution for lowtemperature cabinets uses inverter technology

PAGE 14 Researches promote the improvement of products



EUROPEAN UNION (EU)

Economic and political union with unique characteristics, **created in 1992**, to establish cooperation between European countries. It is made up of 28 member states, and it is the largest and one of the most advanced economic blocks in the world.

- It is the main **trading block** in the world. It is the world's largest exporter of goods and services and the largest import market for more than 100 countries.
- It provides **humanitarian aid** to disaster victims around the world, supporting more than 120 million people each year.
- It plays an important diplomatic role, seeking to promote fundamental freedoms and the rule of law at the international level.
- In 2012, the EU was granted the Nobel Peace Prize for its efforts for peace, reconciliation, democracy and human rights in Europe.

CHALLENGES IN THE TRANSITION OF REFRIGERANT FLUIDS

The European environmental concern leads the way in the search for solutions to combat the climate change



any human activities result in the release of greenhouse gases into the environment. Refrigeration is one of such activities, especially through refrigerant fluids.

One of the main authoritative enforcers of climate actions and compliance with the protocols is the European Union, which seeks to build a secure, viable and affordable energy union.

Tecumseh Europe Technical Program Director Régis Leportier is a representative on European committees, such as the European Commission, and explains a bit about the environmental regulatory processes in the sector.

What are the main activities of the European Commission?

Since 1958, its main role has been to promote the general interest of the European Union (EU) by proposing and implementing the EU legislation,

policies and budget. A team of commissioners, one from each member country, makes this commission work.

At Tecumseh, we have a long tradition of participating in important international or regional associations. I am representing the company in public affairs, at European level, in national or European trade associations.

Fluorinated gases, such as HFCs, PFCs and SF_6 , are often used as substitutes for industrial applications because they do not harm the ozone layer. However, they have high Global Warming Potential (GWP) and their emission should be reduced by 2/3 by 2030 in the EU. What are the impacts of this for the refrigeration industry?

The regulation on fluorinated gases was revised in 2014 and implemented some guiding measures to reduce CO_2 emissions. In addition to the ban on the use of HFCs in specific applications, it introduced as a main measure a mechanism for their progressive reduction on the market. This phenomenon gives the industry enough time to develop alternatives, according to the proposed schedule.

To reach the goal by 2030, although all sectors are concerned, the refrigeration and air-conditioning industry has the greatest impact on this achievement, which will boost the use of a new generation of refrigerants with a GWP of less than 150.

Limited solutions for commercial refrigeration may be hydrocarbons (R290), CO_2 (R744) or a synthetic refrigerant, such as R454C or R455A, designed to comply with such regulations.

Can companies and people contribute to and comment on regulations regarding the use of fluorinated gases?

To some extent, both can contribute at the commission level through specific class associations. Tecumseh Europe took part in one of such associations, representing the Heating, Ventilation, Air-Conditioning and Refrigeration (HVACR) industry from 2012 to 2017 and followed the possible measures proposed before their final implementation. Generally, the final decision still falls on the parliament and the Member States votes.

Should all EU Member States follow the same regulation, or is there adaptations depending on the country? Can some measures be effective for developing countries such as Brazil?

An EU regulation is mandatory and turns applicable when each Member State incorporates it into their legal system. Some countries may interpret the text and propose additional, stricter measures at the national level through its official journal.

Being an active member of the national association can be helpful to avoid misinterpretations.

Tecumseh Europe is a member of one of these associations related to the Member States and the Ministry of Defense, in order to properly implement the national interpretation of the EU measures.

These measures could be useful in other regions of the world, as well as for OEMs exporting to Europe. Likewise, Brazil must be concerned with its exports to the US at a state level, because some of the states also take inspiration on EU regulations, prohibiting or limiting the use of HFCs.



Régis Leportier, Technical Program Director, Tecumseh Europe

How does the quota allocation system work? What is the consequence of the UK's Brexit for this system?

The reduction of HFCs began in 2016, with a 7% market decrease. However, a retrogression has been implemented through quotas, leaving 63% of HFCs available for new installations and maintenance.

A real challenge is predicted until 2021, where only 45% of the total needs will be available.

In 2018, the main impact was a significant price raise and an illegal import issue across Europe.

However, at this stage, it appears that low-GWP refrigerants are available in bulk to cover this transition period.

We are not yet certain about the UK's Brexit and the consequences for the EU, but it seems that in regard to refrigerant quotas, they will be "reintroduced" as available to EU members.

ENVIRONMENTAL CONSERVATION REQUIRES COOPERATION AND COMMITMENT

The search for solutions that minimize the impact of the climate change shakes the refrigeration industry

> n March 15, protesters from all over the world took to the streets to protest against the climate change. The act, Fridays for Future — or Strike for the Future

or Strike for the Global Climate, as it is being called in Brazil — is a student movement started in August 2018 by the Swedish students Greta Thunberg, who proposed a boycott of classes on Fridays to warn about the impact of environmental issues on the future of young people, inspiring student movements in various countries.

In Brazil, around 20 cities took part in the strike that occurred in more than 100 countries, with thousands of students taking to the streets to protest for effective measures to fight the climate change, demanding the governments' compliance with their commitments set out in the Paris Agreement.

As the refrigeration industry is responsible for the emission of gases that affect the ozone layer and influence global warming, discussions on climate guidelines continue on the table. Being aware of the need for change, Tecumseh continues its quest for sustainable development. "We are involved with environmental issues. Wellness and health are important to us and our mission is to effectively provide refrigeration solutions for a better tomorrow. We have been seeking and delivering solutions on this topic for more than 30 years," says the Global Platform Director at Tecumseh, Lionel Audouy.

Environmental protocols are the main drivers for climate change regulations, especially the Paris Agreement and its predecessor, the Kyoto Protocol. Based on them, each country should regularly determine, plan and report on its contribution to mitigating global warming. "One of the main actions is the reduction of energy consumption. That is why in refrigeration, application by application, there are more and more specific regulations to improve efficiency. These performance limits can be combined with mandatory labeling, which allows visibility for the final customers to select the best products," explains Audouy.

Another focus of the industry is to curb the possibility of using modified fluorocarbons such as HCFCs and HFCs. According to the country

"WELFARE AND HEALTH ARE IMPORTANT TO US AND OUR MISSION IS TO EFFECTIVELY PROVIDE REFRIGERATION SOLUTIONS FOR A BETTER TOMORROW."

> LIONEL AUDOUY, GLOBAL PLATFORM DIRECTOR AT TECUMSEH

and applications, some fluorocarbons are prohibited and there is also a quota limitation to reduce the total amount of CO, within the market.

Environmental overview

With the signing of the Montreal Protocol in 1987, an international treaty to protect the ozone by eliminating the production and consumption of ozone-depleting substances (ODSs), it is estimated that between 2050 and 2075 the layer on Antarctica will return to its 1980 levels.

In 2018, the Scientific Assessment of Ozone Depletion report showed that the efforts are already yielding results: the concentration of ODSs has decreased in the atmosphere, leading to a recovery of the ozone layer since the last evaluation in 2014, and the stratospheric ozone has recovered at a rate of 1% to 3% since 2000.

The first result obtained by the Montreal Protocol was the elimination of chlorofluorocarbons (CFCs), which were no longer produced in 1999 and were actually phased out in 2010. Since then, updates and new treaties have been developed according to the demands of each period. In 1992, for example, the Copenhagen Amendment directed the Montreal Protocol for the control and elimination of hydrochlorofluorocarbons (HCFCs), which are substances conveying Global Warming Potential (GWP). In 2016, with the adoption of the Kigali Amendment, hydrofluorocarbons (HFCs) were also included on the list for the same reason.

It is possible to further reduce the impacts of climate change on the planet, says the latest special report of the UN Intergovernmental Panel on Climate Change (IPCC) on the impacts of temperature rises in the world, released in October 2018. Keeping global warming at no more than 1.5 °C above the pre-industrial average level may prevent more devastating damage. The UN estimates that 420 million fewer people could be affected by the climate change if the temperature rise does not reach 2 °C.

This limit of the temperature rise to 1.5 °C is the main objective of the Paris Agreement, which was ratified by 184 countries and has been in force since November 2016, being the most viable option to deal with the climate change today.

In December 2018, a work program was established for the implementation of the commitments set out in the Paris Agreement. World leaders and experts have come together to rethink not only environmental measures, but also economic and political development models that are sustainable and fair.

COMMITMENTS AGREED UPON IN THE PARIS AGREEMENTS

 \bullet To continue efforts to limit global temperature rise by up to 1.5 °C;

• To ensure funding for climate action, including annual budget of US\$100 billion from donor states to low-income countries;

- To develop national climate plans by 2020, including country-specific targets and objectives;
- To protect beneficial ecosystems that absorb greenhouse gases, including forests;

• To strengthen resilience and reduce vulnerability to climate change.

International and Brazilian environmental context

While CFCs are no longer in use, the phaseout of HCFCs is underway, with the schedule anticipated in 2007. For developing countries, the first step defined the consumption freeze in 2013 and the 10% reduction in consumption by 2015. By 2020 and 2025, the reduction in consumption should be 35% and 67.5%, respectively, until, by 2030, the elimination of 97.5% of the consumption of HCFCs in developing countries and the elimination in developed ones. The total elimination is envisaged for 2040.

Some countries have created their own legislation to speed up this process. In the European Union, for example, HCFCs have been banned in new systems since the beginning of 2004.

Brazil, in turn, already had documents to restrict the consumption of ODSs in 1988, before joining the Montreal Protocol. In 1991, the Ozone Working Group was established, which established guidelines for the elimination of CFCs and created the Brazilian Program to Eliminate the Production and Consumption of Ozone-Depleting Substances (PBCO).

In 2009, another Brazilian environmental legislation was defined. Brazil's National Policy on Climate Change confirms the country's voluntary commitment to the UN Framework Convention on Climate Change in the reduction of greenhouse gas emissions between 36.1% and 38.9% of the projected emissions by 2020.

As Brazil is one of the most biodiverse countries on the planet, its commitment to environmental issues remains critical. The actions implemented by the Brazilian Program for the Elimination of HCFCs have already yielded results: 36.92% of the consumption of these substances have already been eliminated, well above the 16.6% stipulated until 2019.

Tecumseh's responsibility

Committed to sustainable alternatives, Tecumseh conducts constant research for the development of technologies that meet the market's demands.

In addition to measures within the company, such as conducting training, lectures and campaigns to raise employee awareness on environmental impacts, the search for alternative and organic refrigerant fluids is one of the objectives.

Aiming to reduce carbon dioxide emissions, several fluids are being restricted and replaced globally. In this transition, the pursuit is for low--GWP fluids and high performance solutions, always keeping in mind the decision making process that is environmentally conscious in the long run. "We have been working closely with all chemical manufacturers for many years. Most of the solutions we found have already been tested internally and different communications have been made to give visibility to our choices," says Audouy.

In this context, the so-called natural fluids, such as hydrocarbons (HCs), carbon dioxide (CO_2) and ammonia (NH₃), are gaining more prominence. Hydrocarbons are non-ODSs and have low GWPs, but are highly flammable, requiring a number of safety precautions that are reinforced by the development of standards and regulations for the safe use and enhancement of skills to use them. In addition, Tecumseh aims to provide a complete line of products suitable for the use of hydrocarbons in accordance with local regulations.

Meanwhile, CO_2 (R744) and ammonia (R717), refrigerants used in large capacity systems, also have peculiarities and special care needs. With the same refrigeration architecture, CO_2 will provide less efficiency compared to hydrocarbons, i.e., to achieve comparable performance, solutions are more complex and the total cost may be a problem; the ammonia, in turn, besides being flammable, is also toxic. Therefore, companies and technicians need to be informed, trained and certified to properly use these refrigerant fluids.

Tecumseh markets products around the world that are developed in compliance with local regulations for use with the best available refrigerants. "For the moment, in the small range of refrigeration capacity, flammable hydrocarbon refrigerants such as R600a or R290 are the best solutions. Non-flammable low-GWP fluids (such as R452A or R513A) provide a significant environmental step with minor system modifications. And for customers who would like to go even further with the very low- GWP solution, R455A, R454C and R1234yf are ideal for the refrigeration market," recommends Tecumseh's Global Platform Director.

Hence, commitment to investing in the development of effective measures to reduce greenhouse gas (GHG) emissions increasingly requires.

LEARN MORE



RESEARCH AND TESTING FOR PRODUCT OPTIMIZATION

Get to know Tecumseh's Application Lab and learn more about the optimization of refrigeration systems

ust as the Brazilian Institute of Metrology, Quality and Technology (Inmetro) is responsible

for verifying and standardizing the quality of products and services, Tecumseh also has an accredited lab to test and certify its products, the Application and Development Lab (LAD, in its abbreviation in Portuguese), in accordance with worldwide standards to guarantee the safety of the user regarding electrical risks.

Another specialty of the LAD is the support to the development of refrigeration systems of its clients. Tecumseh receives refrigeration systems from large and small companies, which are willing to evaluate and develop their products in search of better quality, productivity and safety. For this purpose, lab professionals develop a series of tests to find the best combination of thermodynamic performance and energy efficiency for each case, according to customer needs.

Lab structure

The LAD's application area has more than 10 chambers for different types of tests in refrigerators, considering the conditions of air distribution, balance and thermal homogeneity, among others.

The chambers present adequate conditions for each type of refrigerated equipment and for storage of different products — for breweries, for example, the ideal temperature ranges from -4 °C to -6 °C, while for refrigerants the storage ranges between 5 °C and 6 °C — and simulate the Brazilian climatic conditions, a tropical country with temperatures that can vary from 16 °C to 40 °C, according to the region.

Among the tests carried out, there are those that evaluate the compressor alone and also those that comprise the entire refrigeration system, with measurements capable of analyzing the performance from the fairing, insulation and peripherals, to the refrigeration system. Thereupon, the ideal thermal balance will be sought by choosing a compressor that is best suited to the requirements of the product and the customer, gas load balancing, expansion device adjustment and heat exchangers.

The main tests carried out by Tecumseh are on products from the commercial sector, supermarkets, convenience stores and other establishments that use display counters (island freezers) and beverage displays, for example, as well as home products, such as air conditioners, household refrigerators and water dispensers. These tests last on a case by case basis, and can take from weeks to months for the development of a good refrigeration system.

Driven by the large number of people living in cities and with a lifestyle where there is less and less time to prepare meals, the commercial refrigeration segment has shown growth. And so, testing on systems that meet these demands of modern life are also growing importance for keeping the quality of frozen and chilled foods and beverages that will reach the final consumer.

Another important issue that interferes with the quality of life is noise pollution, which can be harmful to health. In order to offer solutions to minimize the noise. Tecumseh's lab has a reverberant acoustic chamber with a structure compliant with international regulation standards (ISO) for testings to be performed. With high density walls, acoustic attenuators and underground shock absorbers to avoid any noise and vibration, one of the chambers simulates a kitchen without utensils and has high-precision microphones that measure the noise dispersed in the environment by the refrigeration system. Therefore, it is possible to evaluate if the product does not exceed the limits established by norms and if the acoustic comfort for the consumer will be provided.

In addition, there is another semi-anechoic chamber with the same structure for investigative noise tests. The researchers and technicians aim to analyze, find and optimize possible sources of propagation of unwanted noise from the refrigeration system.



Acoustic performance testings are the last step of the process. Therewith, the application development brings together and evaluates the thermodynamic, energetic and acoustic performances.

Energy efficiency

According to climatologists, some of the hottest years already recorded occurred after 2011. This spike in global temperatures boosted the use of air conditioners and turned thermal comfort into an increasingly important issue of quality of life. In addition, it is essential for certain activities and locations, such as the manufacture and preservation of food and medicine and in environments such as hospitals, industries, among others.

In this context, the search for energy efficiency is also a growing concern. In Brazil, household electric power consumption has more than trebled in the last 12 years and, according to the International Energy Agency (IEA), the energy consumed by these appliances is expected to triple by 2050.

Concern about energy consumption has been around for a long time, especially for "white goods" household appliances. "In order to regulate this issue, there is the Procel Seal, which assesses and certifies the energy efficiency of these products," explains the lab supervisor Flávio Rios.

To make these systems more effective, technology development is critical. In addition to assisting companies and customers, Tecumseh also has chambers for testing air conditioners, which simulate the internal and external environment in which the equipment is operating.

The energy concern goes beyond the residential issue. "As the concern about consumption has also been growing significantly in the supermarket sector as well as in small local markets and other consumers of refrigeration products known as 'light commercial', testing is a great option for the search for greater energy efficiency," adds Rios.



SHARE KNOWLEDGE

THE TECUMSEH CORPORATE UNIVERSITY (UCT) UPDATES THE SKILLS OF REFRIGERATION PROFESSIONALS SINCE DECEMBER 2017. THE INTERMEDIATE IN-CLASS AND HANDS-ON COURSE, TECUMSEH REFRIGERATION SPECIALIST, CONVEYS INFORMATION ON PRODUCTS AND APPLICATIONS, BOTH THEORETICALLY AND PRACTICALLY, THUS ENHANCING THE KNOWLEDGE FOR MARKET USE, IN ADDITION TO ALLOWING A DIRECT CONTACT WITH TECUMSEH.

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CORPORATIVA

APPLICATION

VARIABLE SPEED COMPRESSORS TECUMSEH ON THE LATIN AMERICAN MARKET

Tecumseh do Brasil Application Engineering Department develops a product enhancement solution for a light commercial refrigeration company

rom analysis and market research, Tecumseh is able to keep an eye on the current demands of the refrigeration area. The company's Application Engineering Department develops refrigeration solutions and supports businesses.

In 2018, Tecumseh completed an application development project within the light commercial segment for a Latin American client with whom Tecumseh had already worked before. The refrigeration solution was developed for a low-temperature cabinet (freezer for frozen foods) from an application with an already existing variable speed compressor that did not meet their needs.

The client sought a solution that employed high technology, an environmentally friendly fluid and cost-effectiveness. So, a premium condenser unit, which received the VTCX415U--MD5C variable speed compressor was then developed.

Demand for high-end products has driven the commercial refrigeration segments to use variable speed compressors. These applications seek to achieve high levels of energy efficiency, requiring a complex temperature control, use of environmentally friendly refrigerants and a low sound level.

Thus, the customer's requirements have been met, with lower minimum temperature, reduction of energy consumption by more than 26% and temperature decrease by around 17% faster, explains the refrigeration specialist of the Application Engineering Department at Tecumseh do Brasil, Plínio Ferreira. "It was possible not only to achieve performance in terms of temperature, but also to reduce power consumption, lower temperatures faster and classify the cabinet in the most critical case. The numbers are staggering," he says.

This solution provided by Tecumseh offers versatility, being feasible for use in several commercial products, which can be used in the long-term by the customer.

The project, in addition to strengthening the partnership and the personal contact with customers, has expanded Tecumseh's sales range, especially in the market of variable speed compressors, bringing the VTC premium compressor platform to meet new needs, adding even more value to the end customer's product. "This interaction strengthens Tecumseh's brand, improves techniques and delivers something even more robust to the customer," says Ferreira.



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PREDICTIVE, PREVENTIVE AND CORRECTIVE **MAINTENANCE**

Modern maintenance techniques are increasingly important and beneficial for the refrigeration segment

s an increasingly important issue on the market, proper maintenance of a refrigeration system is responsible for avoiding problems and allowing the proper functioning of the equipment, providing even more quality for the system.

Tecumseh was able to prove this in practice, within the company itself, with one of its refrigeration equipment. Recently, a cold water unit had its operating life extended due to the predictive maintenance performed.

In operation since 2002, with 119,232 machine hours, R\$308,000 in preventive maintenance was saved by performing the predictive maintenance. There are three types of maintenance that can be done in a refrigeration equipment: the predictive, the preventive and the corrective. Predictive maintenance is intended to be performed only when the facilities need it. It is carried out through the assessment of wear and tear of parts or components of critical equipment by means of symptom analysis or estimation made by statistical evaluation, estimating the problem evolution path detected in the equipment and the time that it can last without risk to the machine or to the production, aiming to use the maximum service life of the components without affecting their efficiency.

Thus, predictive maintenance is the best case scenarios regarding costs, because it is only performed on the spots needed for the equipment to maintain a reliable operation.



BENEFITS OF PREDICTIVE MAINTENANCE

• To avoid emergency stops;

• To reduce machine stops and openings for inspection;

• To support the preventive maintenance;

• To increase the equipment uptime for production;

• To reduce the extent of damage;

• To optimize machine operating methods;

• To recommend spare parts;

• To reduce the amount of spare parts stored;

• To extend the service life of components to the maximum;

• To propose improvements regarding maintenance;

- Reduction of overtime;
- Reduction of maintenance costs.

The **preventive maintenance** is performed based on the equipment operating time, and not on its current efficiency, thus it is more costly than the predictive one. **Corrective maintenance**, in turn, is done when the equipment has a problem that needs to be corrected in order for it to work again.

The best time for technical intervention is when the system presents a potential failure, that is, an initial failure symptom, as indicated in **figure 1**. Once this symptom has been identified, it is possible to detect the component and safely schedule the replacement without downtime, and avoid the exchange of functional parts. On the other hand, if maintenance is performed close to the functional failure, equipment breakdown, unexpected production stoppage and part disposal may occur. In order to warn about the subject relevance, there are safety regulations that regulate the cleaning and maintenance of refrigeration systems. The Regulatory Standard 32, for example, requires that preventive and corrective maintenance be carried out to preserve the integrity and efficiency of the system's componentes, which must be in perfect working conditions, in addition to determining that the appliances are in proper cleaning conditions.

In addition, as of January 2018, Law 13,589 establishes a Maintenance, Operation and Control Plan (PMOC, in its abbreviation in Portuguese) in public buildings with acclimatized environments, to ensure air quality and prevent or minimize health risks for the occupants — learn more in the interview with the engineer and VP of Marketing and Communications VP at the Brazilian Association of Refrigeration, Air Conditioning, Ventilation, and Heating (Abrava), Arnaldo L. Parra, on **Fic Frio's issue no. 104**.

Therefore, it is increasingly necessary to develop and apply modern maintenance techniques. "It is critical to pursue engineering strategies and maintenance management with a focus on business competitiveness to achieve increased availability and reduced maintenance costs," explains Anderson Marcato, Utilities Supervisor at Tecumseh do Brasil.

Tecumseh performs preventive and predictive maintenance on its equipment and advises its clients on the importance of the procedure. Condensing units, for example, must be cleaned annually under normal operating conditions, however, it is recommended that cleaning be carried out more frequently to avoid the accumulation of dirt. The company provides an installation manual on the website, **www. tecumseh.com**, which covers and guides the maintenance and cleaning of equipment.

MYTH OR FACT

Safety precautions and regulatory compliance prevent accidents in the refrigeration sector

he Internet and social networks eased the dissemination of content in different formats. Thus, sharing news of dubious origin has become usual.

Some of the videos circulating on social networks earlier this year involved accidents in the refrigeration sector. One of them portrays a man in a convenience store, barefoot and with a child on his lap. When opening the establishment's refrigerator, he keeps his hand stuck in the door due to the force of the electric shock. Another video shows a technician climbing a ladder leaning on the front of a store, carrying an air conditioner to perform the installation. The ladder breaks in half and results in the fall of the man.

To avoid and prevent accidents such as those portrayed in these videos, Tecumseh do Brasil Application Engineer, Mário Berti, recommends some safety measures. "Certified and well-maintained equipment must be used and household tools should not be used in professional activities. Suitable PPE for the work to be performed and compliance with established safety standards are critical," says Berti. "In addition, for the end-user's safety, installation and maintenance need to be performed correctly," he adds.

Electrical installations

The electric shock of the first video was probably caused by an insulation failure in some connection or cable, possibly due to wear or poorly executed procedures.

In this particular case, even with the insulation failure, if the product was properly grounded, the shock would not occur. A network with a residual-current device (RCD) would also prevent an electric shock.

The NBR-5410 is one of the most comprehensive standards for electrical installations, which stipulates the proper conditions for the safe operation of low-voltage installations, aimed at public and commercial environments. The IEC-60335, in turn, covers domestic refrigeration equipment that does not have nominal voltage greater than 250 V for single-phase and 480 V for three-phase devices, determining the leakage current limits and minimum insulation for each case.

Falls

In Brazil, accidents related to falls killed 161 workers in 2017, according to the Ministry of Labor. To prevent this, important safety standards for portable ladders are the NR-18, RTP-4 and NBR16308. In addition to reinforcing the use of safety equipment and establishing conditions of use, according to these standards, ladders must be supported in structures with an angle of between 65° and 80° — if it is greater than 80°, the ladder is very close to the wall and there may be a fall, if it is less than 65°, the ladder may bend.





TECUMSEH'S CROSS REFERENCE FH FAMILIES FOR AWS

Application in LBP							
Refrigerant Fluid	Reference (HP)	FH Family	AWS Family	AWS Family Voltages			
				XN	KZ	XG	LZ
R404A	2	FH2480	AWS2495	х	х	х	
	3	FH2511	AWS2512	х	х	х	

Application in M/HBP							
Refrigerant Fluid	Reference (HP)	FH Family	AWS Family	AWS Family Voltages			
				XN	KZ	XG	LZ
R22	1 3/4	FH4524	AWS4522	Х	х		Х
	2 1/2	FH4531	AWS4532	Х	х		Х
	3	FH4540	AWS4538	Х	х		Х
R404A	1 3/4	FH4524	AWS4522	х	х	х	
	2 1/2	FH4531	AWS4532	х	х	х	
	3	FH4540	AWS4538	х	х	х	

Voltages and Frequencies							
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					

Application: LBP (Frozen) / M/HBP (Refrigerated) / HBP (Air-conditioned)

SMALL SIZE AND HIGH EFFICIENCY



DEVELOPED WITH A ROBUST DESIGN, THE INVERTER HERMETIC ROTARY ATLAS AND MESA ARE MICRO ROTARY COMPRESSORS SUITED FOR REFRIGERATION OF INDEPENDENT DEVICES. USING R134A FLUID AND BLDC ENGINE, THEY PRESENT LOW VIBRATION AND NOISE, HIGH CAPACITY AND POSSIBILITY OF USING CLEAN AND RENEWABLE ENERGY. INNOVATION AND EFFICIENCY IN A COMPACT FORM.



