CONTINUOUS INNOVATION

IT STARTS WITH INTECMA.

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INTECMA

SIMPLY SMART POWER TECHNOLOGY

INTRODUCTION

At Intecma, continuous innovation is key. In this trend paper, we focus on an important new development: the inverter VFD 230V 6-16A, developed in-house by Intecma. This innovative variable frequency drive addresses the complex challenges of the energy transition and the increasingly stringent requirements for heat pumps. The new VFD is designed with advanced technologies in energy management, efficiency, and power control. These innovations significantly impact the performance of heat pumps and the sustainability of energy use in both residential and commercial applications. The VFD's design not only offers a reliable solution for the current demand for sustainable energy but is also future-proof, meeting upcoming European directives and environmental standards that will become more stringent.

The introduction of this new VFD (variable frequency drive) strengthens Intecma's position as a pioneer in power electronics and demonstrates how advanced technology can contribute to a sustainable future without overloading our power grid. The variable frequency drive optimizes the operation of heat pumps by precisely adjusting the motor to the required power, significantly reducing energy consumption and increasing overall efficiency. This is essential at a time when the electricity grid is increasingly burdened by the growth of electrical devices, renewable energy sources, and electrification of various sectors. Moreover, the new VFD reduces peak loads, enhancing the stability of the power grid and preventing electricity demand from exceeding supply.

Intecma has ensured that this VFD is widely applicable across different types of heat pumps, from small residential systems to large commercial and industrial applications. This makes the VFD not only versatile but also appealing to a broad range of manufacturers and end users looking for ways to optimize energy consumption while complying with increasingly stringent environmental and energy efficiency regulations. By emphasizing flexibility and adaptability, the new VFD is a sustainable investment for both current and future energy needs.

In addition, Intecma has conducted extensive testing to ensure that the VFD meets the highest standards for reliability, safety, and performance. These tests include both functional and environmental trials to guarantee optimal operation of the VFD under varying conditions. The result is a variable frequency drive that is not only highly efficient but also robust and durable, even in demanding environments. This makes it possible to extend the lifespan of heat pumps, improve operational reliability, and reduce maintenance costs. With this VFD, users can rely on long-term performance, less downtime, and lower costs over the entire system lifecycle.

Intecma continues to focus on innovation and technological advancement, and this new VFD is an excellent example of that commitment. We are proud to bring this solution to the market and contribute to a future where sustainable energy solutions are the norm. By continuously investing in research and development, we strive to create technologies that not only meet current market demands but also anticipate future trends and needs within the energy transition. Intecma believes that collaboration with partners, end users, and governments is essential to accelerating the shift to sustainable energy and making a lasting positive impact on society and the environment.

Enjoy your reading!

Marieke van Walsum-Peele & Matthijs Peele

THE ROLE OF VARIABLE FREQUENCY DRIVES IN THE ENERGY TRANSITION

Many heat pump manufacturers are now implementing modulating heat pumps for residential use. Where a simple on/off mechanism was previously used, modern heat pumps now feature a smooth regulation of heating and cooling capacity. This ensures that the heat pump's output is continuously adjusted to the actual heating demand, resulting in much more efficient energy generation.
As a result, no large buffer tank is needed, the seasonal efficiency improves, and the wear on components is reduced, leading to lower maintenance costs and a longer lifespan.

An additional advantage of modulating heat pumps is their ability to maintain a much more stable indoor temperature, providing greater comfort in the home. The constant switching on and off of the compressor, as is the case with traditional on/off systems, is a thing of the past. Instead, the heat pump can smoothly adjust between different capacity levels, which not only increases efficiency but also reduces noise.
This is especially important in residential settings where noise reduction is crucial.

The only downside to this modulating technology is the complexity involved in accurately regulating temperature and power, which increases the need for a variable frequency drive (VFD). The VFD ensures that the speed of the compressor motor can be precisely adjusted to the heating demand. This means that the compressor needs to start and stop less frequently, contributing to lower energy consumption and reduced wear. Therefore, the VFD is essential for efficient heat pump operation and for optimizing comfort and system durability.

TECHNOLOGICAL INNOVATIONS IN INTECMA'S NEW VFD

With the development of the new inverter VFD 230V 6-16A, Intecma has responded directly to recent technological and regulatory changes. The VFD consists of three main components: a rectifier bridge, a capacitor bank, and a switching bridge. One of the key innovations in the new VFD is the addition of an active Power Factor Correction (PFC) circuit after the rectifier bridge. This circuit ensures that the current drawn from the power grid is sinusoidal and in phase with the grid voltage, reducing harmonic distortion and improving the power factor. This helps avoid excessive grid congestion and meets the latest regulations. Additionally, the PFC technology optimizes energy consumption, reducing energy loss in the form of heat and increasing the overall system efficiency. This not only reduces the burden on the grid but also improves the sustainability of the entire installation.

The capacitor bank also plays a crucial role in maintaining a stable DC voltage, which is essential for VFD performance. By using high-quality capacitors, the voltage can be kept stable even during fluctuating loads. This ensures more reliable operation of the heat pump, with less risk of malfunctions or unexpected shutdowns. The stability of the DC voltage extends the lifespan of electronic components, further reducing maintenance needs and contributing to the overall cost-efficiency of the system.

Moreover, the control of the switching bridge is optimized for the latest generation of Brushless Direct Current (BLDC) motors used in heat pumps. BLDC motors offer higher efficiency, a more compact design, and a longer lifespan. The new VFD uses 'sensorless field-oriented control,' a technology that eliminates the need for external sensors to determine the rotor position. This reduces costs and complexity while enhancing the efficient and smooth control of the motor. The sensorless technology utilizes advanced algorithms to infer rotor position from the current and voltage in the motor windings, resulting in highly accurate control. This allows the heat pump to smoothly adjust between different power levels, further optimizing energy savings and reducing grid load.

The new VFD is also equipped with an advanced thermal management system that ensures internal component temperatures remain within safe limits, even during prolonged high loads. This thermal management employs both passive and active cooling techniques, such as heatsinks and fans, to effectively dissipate heat. This maintains the VFD's reliability, even under extreme conditions, making it suitable for a wide range of applications, from residential to industrial heat pumps, where durability and reliability are of utmost importance.

Thanks to these extensive optimizations, the new VFD not only meets current efficiency and performance requirements but is also prepared for future market developments. The integration of these technologies means that the VFD contributes to lower operational costs, an improved environmental impact, and a better user experience for end users. This makes Intecma's VFD an essential component in modern heat pump technology, elevating both energy savings and user convenience.


YASKAWA MOTOMAN

TRANSITION TO NATURAL REFRIGERANTS

With the European Union's decision to phase out F-gases, heat pumps are increasingly required to use natural refrigerants such as propane and CO_2. This transition is essential for reducing the environmental impact of refrigerants, with propane playing a key role in this process. Additionally, CO_2 as a natural refrigerant offers specific benefits. It has no flammability risk like propane and is particularly suitable for high-temperature applications, making it an interesting option for poorly insulated buildings that require higher supply temperatures. The new VFD from Intecma supports this transition by efficiently controlling BLDC motors, which is crucial for heat pumps using propane or CO_2 as refrigerants. Thanks to the precise control of the compressor speed, heat pumps using propane and CO_2 can operate more efficiently and reliably, even under variable conditions.

Propane has a low Global Warming Potential (GWP) of only 3, making it an environmentally friendly alternative to synthetic refrigerants such as R134a and R410a, which have much higher GWPs. Using propane helps reduce CO_2 emissions and contributes to the overall sustainability of the heating sector. Although extra safety measures are required due to the explosive nature of propane, such as special leak detection systems and additional ventilation requirements, it is increasingly becoming the standard for residential heat pumps. These safety measures ensure that propane can be used safely, both inside and outside homes.

Furthermore, propane is a natural refrigerant that is widely available and relatively inexpensive, making it an attractive choice for manufacturers and consumers. With the support of innovative solutions like Intecma's new VFD, propane is being used more frequently in heat pumps. Intecma is committed to facilitating the implementation of natural refrigerants, enabling heat pumps to operate more efficiently, extend system lifespans, and reduce energy consumption. These advantages make propane one of the most promising alternatives for the future of heat pumps, with Intecma's technology playing a crucial role in facilitating this transition.

MARKET TRENDS AND CHALLENGES

The heat pump market is under pressure. Sales in the Netherlands and Europe dropped significantly in the first half of 2024 due to changing policies and economic conditions. This decline is partly due to uncertainties surrounding subsidy schemes and stricter regulations for the installation of new heat pumps. As a result, consumers and businesses have become more hesitant in their investment decisions, leading to a decrease in demand for both hybrid and all-electric systems. Additionally, high energy prices have negatively impacted the willingness to invest in sustainable technologies.

Despite these challenges, Intecma's new VFD offers a promising solution to some of the most pressing issues in the sector. One of the main problems is the increasing grid congestion resulting from growing electricity demand. Intecma's innovative VFD helps regulate the load on the power grid, reducing consumption peaks and contributing to better network utilization, preventing overloading during periods of high demand. Moreover, the VFD offers improved energy management capabilities, allowing heat pumps to operate more efficiently and better align energy consumption with the availability of renewable energy.

The new VFD also plays a crucial role in optimizing the performance of heat pumps that use natural refrigerants, such as propane. These refrigerants are becoming increasingly important as the European Union phases out F-gases. The VFD's precise compressor control not only reduces energy consumption but also improves the reliability and lifespan of heat pumps, making the transition to more environmentally friendly alternatives more attractive for manufacturers and end users.

The technological advances represented by this VFD help reduce the load on the power grid and contribute to a stable and reliable energy supply during the energy transition. Intecma is committed to making a significant contribution to the sustainability of the heating sector, where innovation and reliability go hand in hand with the growing need for sustainable energy solutions.

CONCLUSION

The energy transition demands innovative solutions to support the growing need for sustainable heating and cooling systems. At Intecma, we strongly believe in developing technologies that not only meet current needs but also address future challenges. Intecma remains committed to addressing these challenges with advanced technologies such as the new inverter VFD 230V 6-16A.
This development not only ensures more efficient heat pump operation but also helps minimize the impact on our power grid and comply with the strictest European regulations. The VFD makes a crucial contribution to improving energy efficiency by optimizing energy consumption and reducing peak loads. This leads to a more stable power grid, which is essential as electricity demand continues to grow due to increased electric vehicles and renewable energy sources.

Additionally, the new VFD allows heat pumps to better match the specific heating and cooling needs of both residential and commercial buildings. This means that systems can operate more flexibly and reliably, even under changing conditions. Our VFD technology contributes to extending the lifespan of equipment and reducing maintenance costs, ultimately resulting in lower total cost of ownership for the end user.
These benefits make the technology appealing not only to manufacturers but also to end users who strive for sustainability and cost savings.

Intecma works closely with various partners in the sector to ensure that our technology is widely applicable and meets the needs of a growing market for sustainable solutions. Together with our partners, we continue to build a sustainable and future-proof energy supply, focusing on innovation, reliability, and energy efficiency. By focusing on collaboration and knowledge sharing, we can jointly accelerate the energy transition and contribute to a cleaner future for everyone.

MORE INFORMATION?

Contact one of the Intecma specialists for more information about our products and solutions.

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