Nidec

Drives

Drives in Flood Defence Systems

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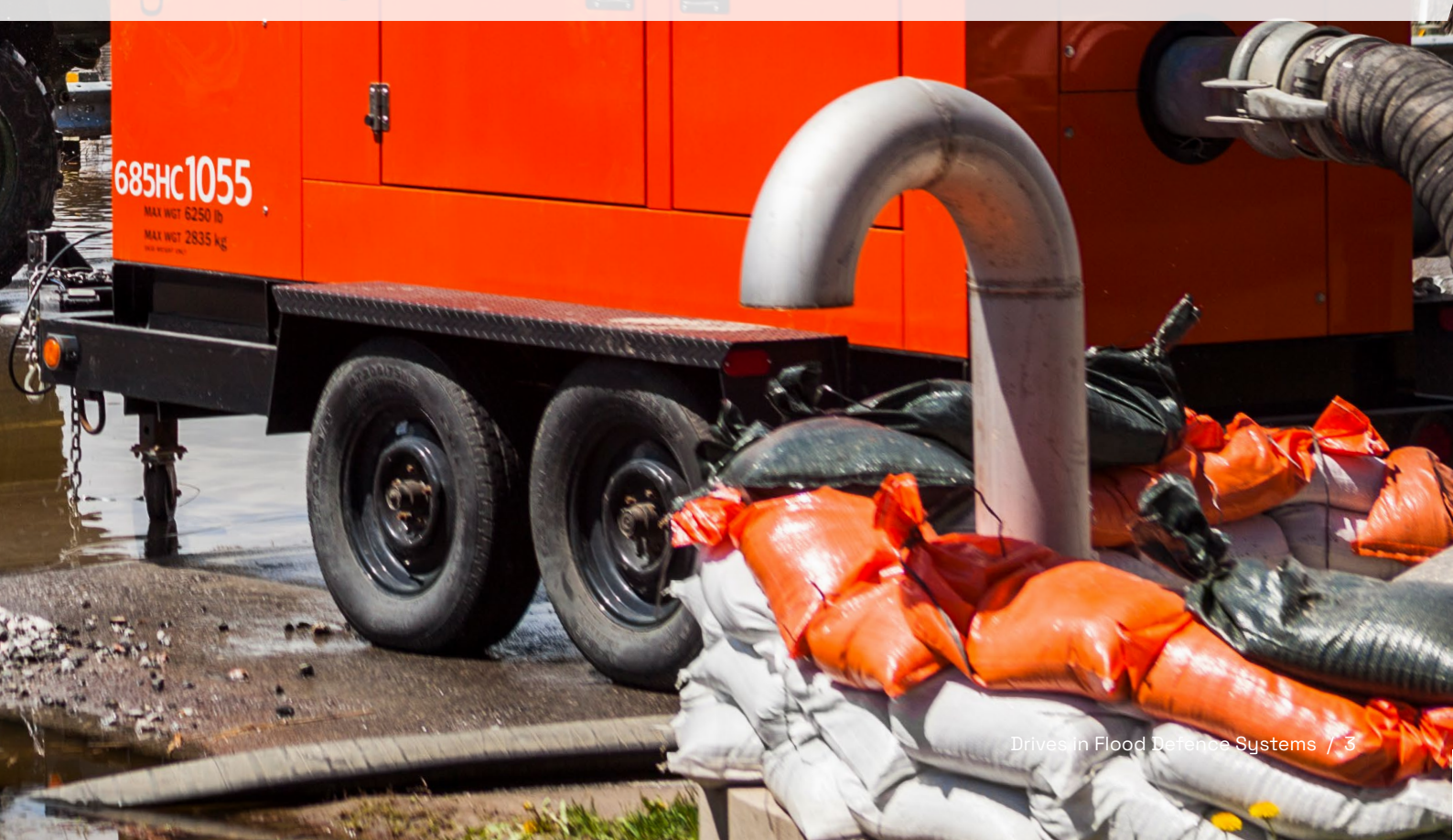
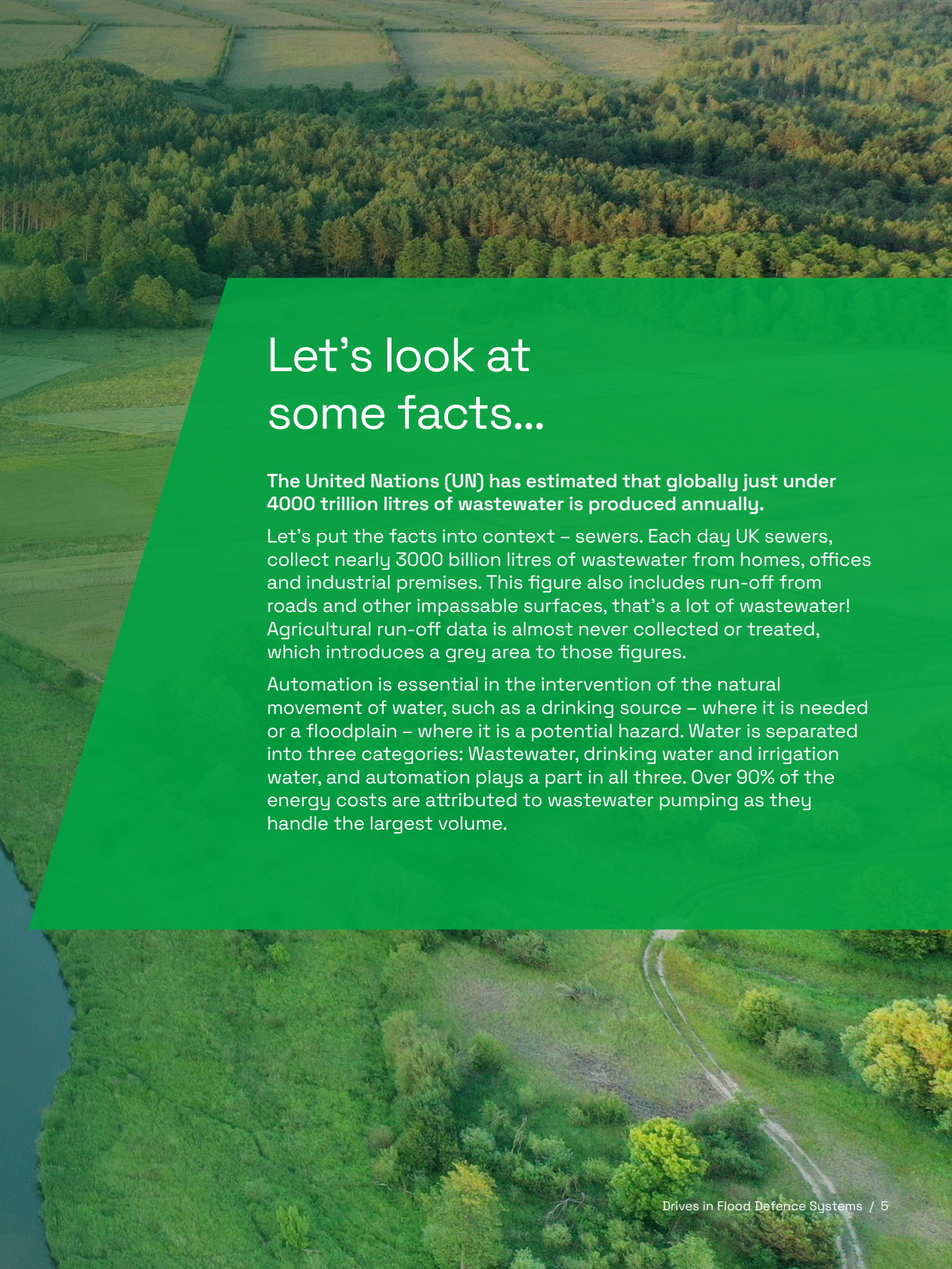


Over the last fifty years the amount of water dedicated to the world's agricultural activities has tripled in volume.

It currently represents 70% of the total water used by man and by the year 2050 it is forecast to increase a further 20% - basically

water is in demand.



Let's look at some facts...

The United Nations (UN) has estimated that globally just under 4000 trillion litres of wastewater is produced annually.

Let's put the facts into context – sewers. Each day UK sewers, collect nearly 3000 billion litres of wastewater from homes, offices and industrial premises. This figure also includes run-off from roads and other impassable surfaces, that's a lot of wastewater! Agricultural run-off data is almost never collected or treated, which introduces a grey area to those figures.

Automation is essential in the intervention of the natural movement of water, such as a drinking source – where it is needed or a floodplain – where it is a potential hazard. Water is separated into three categories: Wastewater, drinking water and irrigation water, and automation plays a part in all three. Over 90% of the energy costs are attributed to wastewater pumping as they handle the largest volume.

Flood Defence & Water Pumps

Since the earliest days of mechanisation, the water pump has been the frontline weapon in combating flood disasters and thanks to the use of variable speed motors and drives its effectiveness is the greatest it has ever been.

Between 1998 and 2017 The World Health Organisation has estimated that over two billion people globally have been affected by floods. And on top of the immediate danger to human life, flooding can devastate agricultural land and wreak havoc on both the structural and architectural assets of built-up areas.

With climate change being an unescapable reality, rising sea levels, intense downpours and severe flooding is expected to become more common in the short and long term at minimum.

So, what's the challenge for Water Pumps?

By definition floodwater is unpredictable. Look at this example; on a potentially inordinate scale, if flooding occurred after a long dry period, pumps that haven't been used in some time need to be activated instantly, efficiently and powerfully to be able to transfer large volumes of water at continuously altering flow rates.

In the first instance, different strengths of response to the flood are achieved by varying the number of pumps in action.

Secondly, multiple pumps are a must in flood defence systems, even in the smallest designs a duty pump must have a backup. Now, you want these pumps to be safe and controlled, and the first step in ensuring this would be to; distribute work over numerous smaller pumps as opposed to lots of bigger ones.

And lastly the smaller the pump used, the less vulnerable it is to stress from problems with floating debris, vortices and trapped air.

Did you know?

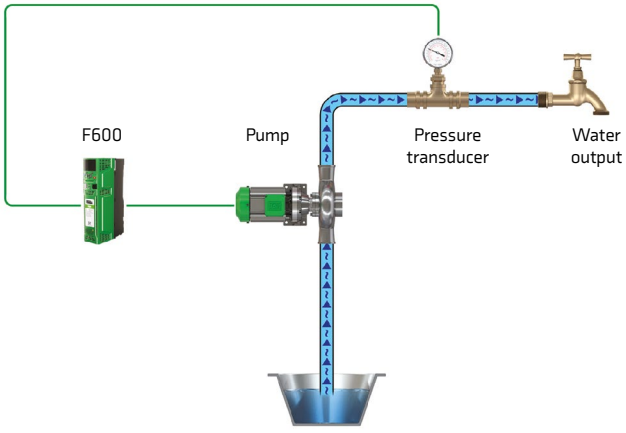
Outside New Orleans sits the world's largest pumping station; it can move 150,000 gallons of floodwater per second!

Let's take about
Pump Specifications

Single pump

Control Techniques' Single Pump mode is an effective and versatile variable speed control solution for maintaining a constant set-point in a single pump configuration.

Fire mode allows the drive to disable trips and to continue to run uninterrupted during emergency events if the application requires.



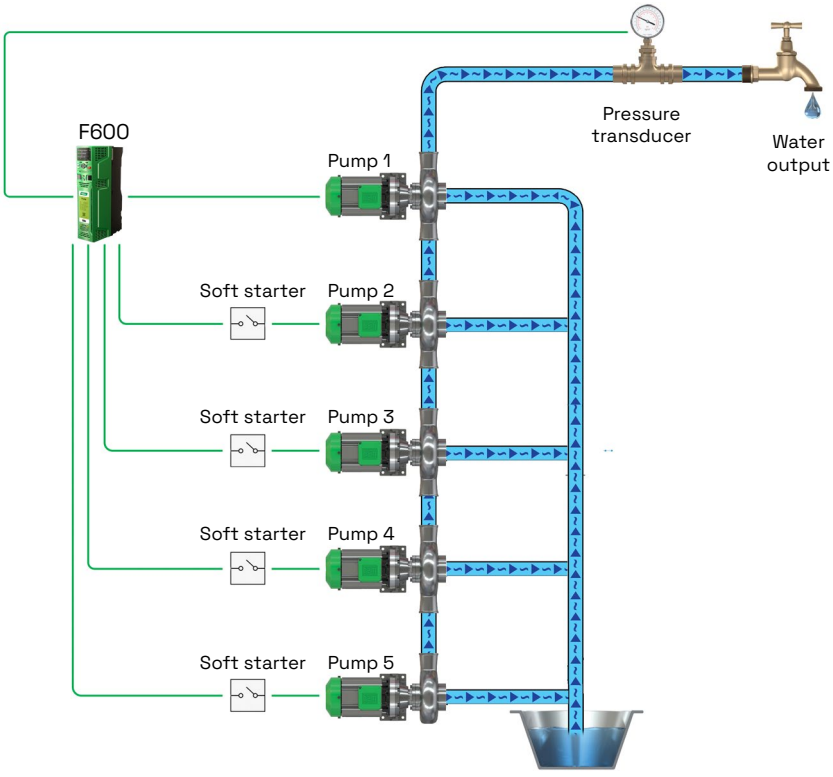
Cascade duty assist

Cascade duty assist mode allows the F600 to operate with up to 4 assist pumps to aid the primary pump when required.

Energy usage is optimised whereby the assist pumps are only enabled when demand reaches sufficient levels.

Assist pumps are used alternately to apply uniform wear and increase pump availability.

Over-cycling protection for assist pumps to control the number of starts and stops per hour.



Multi-leader

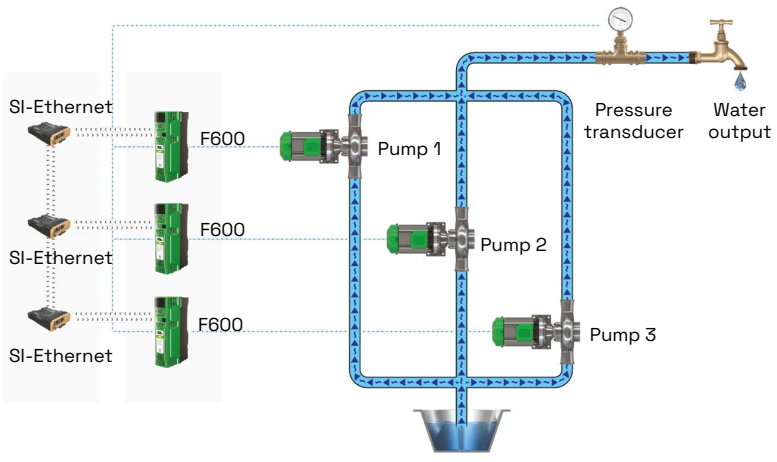
Complete control of your application with up to 3 x F600 drives and maximum energy savings with these variable frequency drives running parallel.

The Multi-leader drive configuration provides redundancy and removes the need for a PLC.

The “lead” drive is automatically cycled to apply uniform wear.

If the “lead” drive loses its transducer, it can access the transducer feedback from another F600 in the system over Ethernet.

Dynamic re-selection of “lead” pump if a pump is taken out of service or develops a fault.



We've mentioned them a few times now, let's discuss...

The role of variable frequency drives

Variable speed control is essential if pumps in any configuration are to engage with the distinctive dynamics of floodwater behaviour with optimum efficiency.

The direct starting and stopping of a floodwater pump is likely to cause water hammer, following the abrupt change in flowrate through the pipe. The lifespan of the equipment is shortened by these hydraulic shocks and lead to leaks at joints and burst pipes.

Using soft-starters or variable frequency drives (VFDs) ensures a gentle acceleration of the pump's rotation up to rated speed; with VFDs offering the added advantage of fully regulated motor speed thereafter.

Sound simple?

Unfortunately, though desirable in principle, achieving an efficient speed regulation of floodwater pump motors can be a complex affair.

For example, looking at it from an energy-consumption point of view, for a variable speed motor to run no faster than is strictly called for, pumps and pipes that deal with large volumes of floodwater may be vulnerable to a build-up of sediment.

This, however, is dependent on the design. For those systems that find this an issue, running the systems on a consistently high speed may help to keep sediment build-up at a minimum.

Determination of the most appropriate flow can be a multi-variate problem. In rivers, for example, water levels have to be managed to allow for navigation, a balancing act must be struck to ensure neither underdrains nor overdrains.

Water Levels & Motor Speed

With under-draining and overdraining firmly in mind, the flood defence system designer must carefully work out target water levels in the environment to be protected. These are the collection points for the data that the drives will use to determine motor speed: the higher the water rises above a target level, the faster the pump will work; the lower the water falls, the more the pump will slow down.

Beyond this, the more programmable the system, the more opportunities exist for different kinds of efficiency. Whether through a standalone PLC or utilisation of programmable features built into the VFD, pre-set values can be made to change with the calendar so that seasonal variations in water level can be taken into account. And, complementing real-time operations, supervisory control and data acquisitions systems (SCADA) may be used to supply information about incoming weather developments.

Centrifugal pumps are favoured in flood defence systems because of their power, simplicity and relatively small size. Thanks to the centrifugal pump and affinity laws, there are significant energy savings to be made following motor, and hence pump, speed reduction.

Environment & Economical

What's a hot topic right now?

Energy savings.

Reduced motor speed is important when considering the generally high running costs of a pumping station, some of which still favour diesel engines for economic reasons.

And so, when it comes to building new (or refitting old) floodwater pumping stations, variable speed electrical systems are generally now also favoured. Besides the standout dividends of controllability, efficiency and economy, they are also comparatively quiet - an important design consideration for systems in more populated environments.

The future demands the marrying of more complex automation with increasingly accessible interfaces. The objective must be for ever more efficient and reliable systems; which, in the context of flood defence, means ever safer environments.

Pump Drive F600

from Control Techniques

The F600 brings not only reliability to water control management, but also the most efficient use of energy.

The new F600 forms part of Control Techniques' new Specialist category of industry-specific drives.

F600's wide power range, from 1.1kW all the way to 2.8MW, makes it ideal for all water-related applications at any power. The range builds on five decades of specialist drives expertise from Control Techniques, delivering dependable control to where it is required.

Energy savings
Unlocking the potential

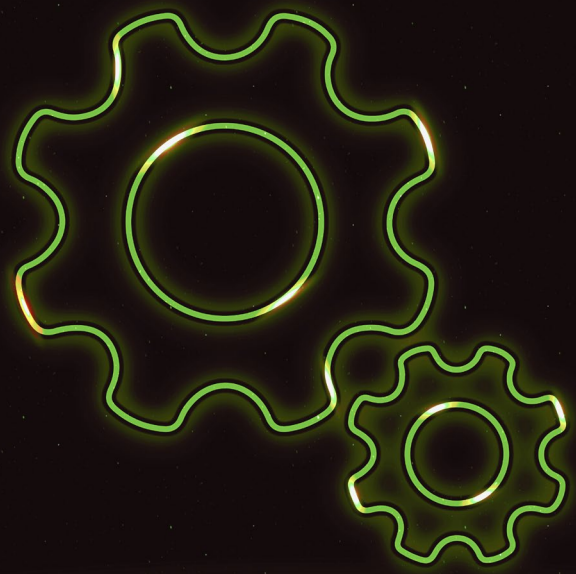
The F600 helps maximise energy savings when demand is low. Activating Control Techniques' leading-edge Low Load Power Saving function: the drive dynamically reduces the voltage applied to reduce losses in the motor and make the system more efficient.

On average, 85% of a pump's life cycle cost is attributed to its energy consumption, so optimising the energy usage greatly reduces the total cost of ownership. Sleep mode automatically engages when demand falls below a specified set-point and restarts once demand rises above the set-point. This greatly reduces the amount of energy consumed and prolongs the lifetime of the pump.

Simple commissioning

The F600 is designed for simple installation and commissioning, with core functionalities for pump applications readily available, meaning optimum performance can be achieved straight out of the box, with minimal set-up.

Users also gain access to Control Techniques' suite of PC tools, with dedicated pump setup screens guiding you through every step of the process. The drive's onboard parameters have also been grouped within a single menu, designed specifically with pump applications in mind, making installation, setup and operation as simple as possible.



Pump specific tools

F600 has been designed and engineered from the ground up with the tools, features and functionality demanded by users in industries reliant on pumps. Users can access dedicated features covering pipe fill, pipe cleaning, over-cycling protection, dry-run prevention and level switch control, while a host of control modes covering single pumps, cascade, and multi-leader pump systems make Nidec Drives' F600 an effective and versatile variable speed control solution.

Free five-year warranty

All drives in the F600 range up to 55kW are eligible for Control Techniques' free 5 year warranty, at no extra cost.

Features of the F600

Guided commissioning tool

Gain complete control of your drive with Control Techniques' Connect PC Software. The dedicated Pump Drive setup screens guide you through every step of quickly getting your drive up and running. Everything is covered in a simple, logical format, from configuring your multi-pump system, through the input of motor characteristics, to setting up the PID process control loop.

All the pump features are also readily available, providing intuitive setup with contextual help through a single tool.

Dry-run prevention

Prevents the pump running dry by checking the load against a threshold; with flexible configurations to adjust output, set an alarm or stop the pump.

Over-cycling protection

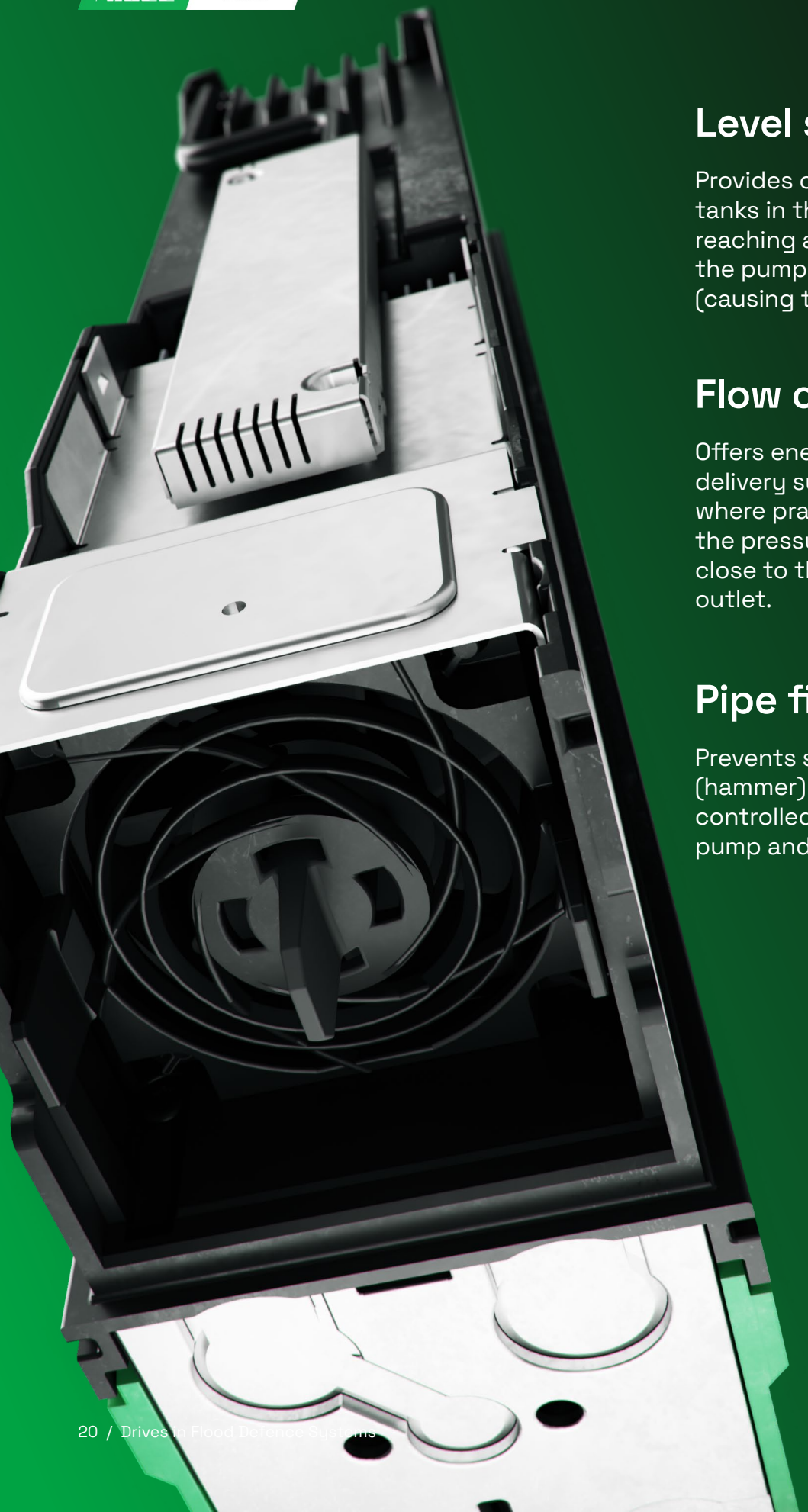
Optimises drive, motor and pump sizing, and also regulates pump wear by limiting the number of start-stops per hour. Flexible configurations allow dynamic alteration of cycling reference limits by setting an alarm or stopping the drive when a limit is reached.

No-flow detection

Where there is no-flow or low-flow, the F600 drive can automatically enter sleep mode to save energy: this is achieved by the feedback of a pulsed flow transducer, the trigger of a flow-switch, or detection by software alone.

Cleaning Live

Continuous monitoring triggers an automatic drive-based cleansing cycle to clear the pump impeller, helping prevent pump blockages and reduce maintenance costs.



Level switch control

Provides critical protection for tanks in the event of the level reaching a “high” switch (causing the pump to stop) or a “low” switch (causing the pump start).

Flow compensation

Offers energy savings in large water delivery systems; e.g. irrigation where practicality necessitates the pressure sensor must be fitted close to the pump, but far from the outlet.

Pipe fill

Prevents spikes in pressure (hammer) at start-up using a controlled ramp, to protect both pump and piping.

Stave off the elements

Providing protection from dust and water from any direction, rated to IP65, the F600 High IP drive is the right choice for harsh environments.

Offering the same dedicated pump features and capabilities as the standard models, the F600 High IP has been designed to enable customers to use both standard and high IP drives for the same project. This means no more headaches with mixing-and-matching vendors or product feature sets, making project qualification straightforward.

The F600 High IP drive is enclosed in a sturdy, protective yet light casing, providing a compact solution. This not only allows easy integration in harsh environments but wall mounting close to the pump reduces installation costs, through:

- **No cabinet required**
- **Shorter cable lengths**
- **Less labour time/cost to install drive**

DFS
Free standing drive

Control Techniques' Free Standing Drive optimises motor energy efficiency and comes ready to use, pre-assembled in its own industry-standard cabinet with all necessary system components included.

The Pump Drive F600's Free Standing Drive variant complements and extends the product range, while having all of the core product's capabilities and features.

Large frame power module in pre-assembled cabinet

Light weight, but no light weight!

The F600 is also available with Control Techniques' largest frame, which not only offers 500 kW of power in a single module, but at 130 kg is up to 60 kg lighter than competitor drives. Its small footprint and pre-engineered accessories make it easy to install or retrofit in industry-standard cubicles. Please see the Drive Free Standing brochure for more information.

No extra engineering required

The Free Standing Drive fits a small footprint, and it's easy to integrate with common cubicles, including as standard: load switch, fuses, fan, line and sharing chokes and cabling. The cabinet can also come with a doormounted HMI with Real-Time Clock, for easy set-up and maintenance. Thanks to the dedicated online configurator, getting a quote and ordering is as simple as can be. Even more, we can ship your Free Standing Drive to you at very short lead times, saving weeks on typical industry standards.

Nidec
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WP_Flood Defence Systems_Iss 02_EN 03/25