IVS102 Series

ARMSTRONG

HVAC Variable Speed Drives

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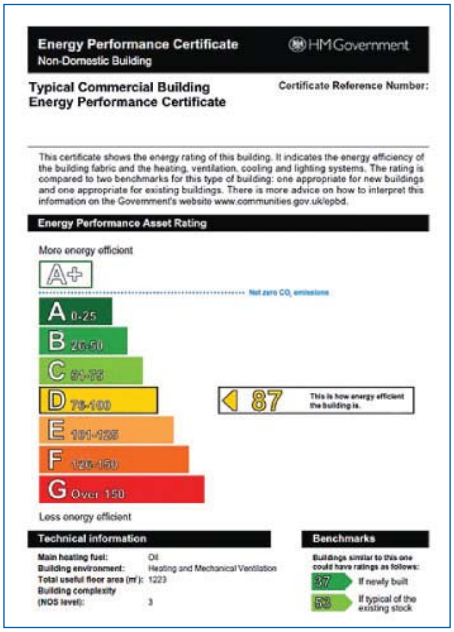
Meeting your Sustainability Objectives for New and Existing Buildings.

Sustainable Building Challenges

Sustainable buildings, whether new or existing, are a higher priority than ever before. The need for better energy performance in buildings is driven not only by individual concerns for the environment but also by increasing legislative pressures such as Part L of the building regulations and the EU Energy Performance of Buildings Directive. The challenges that face building services professionals include the need to achieve good EPC (Energy Performance Certificate) and BREEAM ratings while designing heating and cooling systems that meet occupancy comfort needs.



Energy Performance Certificate
Non-Domestic Building
HM Government

Typical Commercial Building
Energy Performance Certificate

Certificate Reference Number:

This certificate shows the energy rating of this building. It indicates the energy efficiency of the building fabric and the heating, ventilation, cooling and lighting systems. The rating is compared to two benchmarks for this type of building: one appropriate for new buildings and one appropriate for existing buildings. There is more advice on how to interpret this information on the Government's website www.communities.gov.uk/epbd.

Energy Performance Asset Rating

More energy efficient

A+

Net zero CO_2 emissions

A 0-25

B 26-50

C 51-75

D 76-100

E 101-125

F 126-150

G Over 150

87 This is how energy efficient the building is.

Less energy efficient

Technical information

Main heating fuel: Oil
Building environment: Heating and Mechanical Ventilation
Total useful floor area (m²): 1223
Building complexity (NOS level): 3

Benchmarks

Buildings similar to this one could have ratings as follows:

37 If newly built

58 If typical of the existing stock

The Implications of Poorly Performing Buildings

Designing and operating buildings using practices and technologies of the past will have major implications for your business regardless of whether you are a system designer, contractor, end user or any other profession involved with building services systems. Poorly designed and inefficient buildings lead not only to higher utility bills but also to dissatisfied occupants and high maintenance costs. Low building energy ratings will likely impact the sale or rentable value of the building. For organisations with highly visible CSR (Corporate Social Responsibility) programs, low energy ratings can also have a negative impact on brand image and customer retention and acquisition.

Improved Performance in Heating and Cooling Systems

Traditional heating and cooling systems were designed such that at part load conditions, where heating or cooling demand is reduced, control valves would divert the flow of water around the heating or cooling load, leaving the system pump to continue producing full design flow even though the system didn't require it. This design, incorporating constant speed pumps, results in significant energy wastage. Life cycle cost analysis identifies that typically 95% of the lifetime cost of a pump is energy cost, which makes a clear case for investing in a more efficient pump design.

In recent years the reduced cost and improved reliability of variable speed drives (VSD) has led to changes in design approach where the pump speed is adjusted in response to changes in demand. This in turn leads to significant energy savings, improved occupancy comfort, better plant control and reduced maintenance.

Armstrong has many years of experience in the area of variable speed pumping and offers significant added value to designers, installers and end users through product solutions such as the award-winning IVS Sensorless range of integrated variable speed pumps. Armstrong IVS102 variable speed drives can be used with all centrifugal pump types fitted with motors to 450kW, in either new or existing heating and cooling applications.

Dedicated HVAC variable speed drives designed to reduce system complexity and capital cost in both new and existing heating and cooling systems

▶ Capital and Installation Cost Reduced:

- Reduced capital cost - in-built features reduce the need for ancillary components
- Reduced installation cost - features such as the in-built mains isolator option and flow compensation reduce wiring and time on site
- Reduced commissioning cost - intuitive interface and menu structure makes setup easy
- Reduced plant room space cost - compact size and IP55 enclosure availability means the IVS102 can be installed in the smallest of plant rooms

▶ Increased Energy Savings:

- IVS102 has a basic energy efficiency of 98%
- Paybacks lower than 12 months are possible in retrofit applications
- Automatic Energy Optimisation function accurately tunes the drive to the pump
- Flow compensation eliminates the energy loss caused by an incorrectly placed sensor

▶ Project Risk Minimisation:

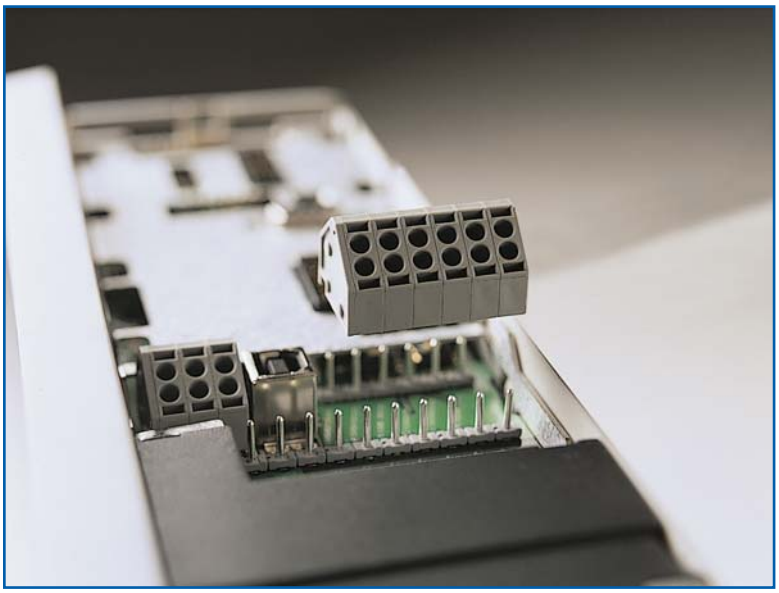
- High quality product with EMC filtering and in built harmonic mitigation
- Units are easily matched to the pump, reducing commissioning delays
- Single source responsibility for complete variable speed pumping unit
- Easily connects to Building Management Systems (BMS)

▶ Ease of Maintenance:

- All components are accessible from the front of the drive
- Modular design makes replacing sub-assemblies easy
- Removable terminal blocks makes disconnecting cables simple

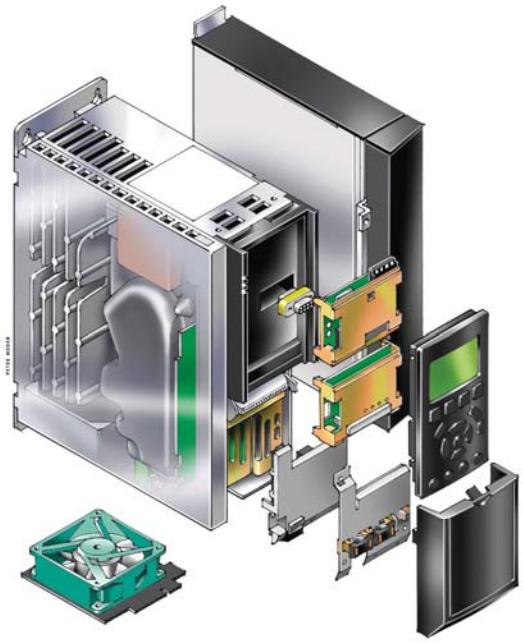
Extended Drive Lifetime

The unique cooling system prevents dusty and aggressive ambient airflow from damaging the electronics.



Terminal blocks unplug easily, should you need to disconnect control cables.

The Intelligent Solution for Variable Speed Pumping with High Level Features as Standard



▶ Modular Design

Modularity of design allows the Armstrong IVS102 to work seamlessly with most HVAC systems. Plug and play expansion options provide for simple upgrades to meet current and future requirements.

▶ Harmonics Control

All Armstrong IVS102 drives have dual DC-link reactors, which provide a reduction in input harmonics equal to a 5% AC line reactor without the voltage drop and efficiency losses associated with AC line reactors.

▶ EMI/RFI Control

All IVS102 drives are designed to contain and control EMI and RFI to EN 61800-3 with additional filtering options available for even the most sensitive installations.

Dedicated Features for Energy Conservation in HVAC Systems

▶ Automatic Energy Optimisation

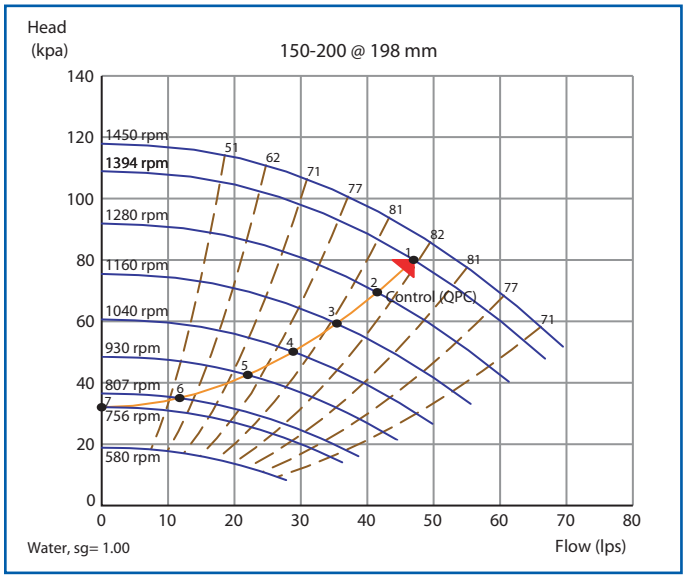
AEO continuously monitors the pump motor speed and load and adjusts the applied voltage to maximise energy savings. Even at full speed, voltage will be reduced if the load is less than 100%. This feature automatically compensates for oversized motors or systems that are not fully loaded.

▶ Energy Monitoring

The IVS102 drive provides a complete range of energy consumption information. Users can choose to divide absolute energy consumption into hours, days or weeks, and can choose to monitor a load profile for the application.

▶ Flow Compensation

Many variable flow, variable speed pumping systems are installed with a differential pressure (DP) sensor mounted close to the pump, such that when demand for heating and cooling changes, the pump can adjust speed accordingly. With many variable speed drive designs this would result in full pump design head being maintained at all flows. The ideal system design is to monitor the pressure further out in the system, as this allows for a reduction in pump head with reducing flow and subsequently results in significantly greater energy savings. Flow compensation is a setting in the IVS102 software that allows the system sensor to be located close to the pump, without compromising on potential energy savings. When this parameter is set in the software, the IVS 102 factors this into calculations, and adjusts the flow settings according to a 'Control Curve', as would be the case with a remotely installed sensor.



System Control Curve using Flow Compensation

▶ Multi-zone Control

Larger heating and cooling systems with diverse loads in multiple zones perform better when multiple DP sensors are installed at strategic locations in the system. This design approach allows the variable speed pumps to better satisfy the needs of the whole system whilst at the same time optimising energy savings. When fitted with an I/O expansion module, the Armstrong IVS102 has the capacity to handle three feedback signals, each with their own set point. This removes the need for external controls and results in significantly reduced installation costs. For systems requiring control of more than three zones an Armstrong IPS Controller can be used in conjunction with IVS102 drives.

▶ Duty/Standby Operation

Where two IVS102 drives are installed in a duty/standby pump application, it is possible to interconnect the drives to provide automatic changeover in the event of duty pump failure. The interconnected drives will alternate the system load between the two pumps at pre-set intervals, to even out pump wear. The drives can also send pump failure alarms to the BMS. This again reduces the need for external controls and reduces capital and installation costs.

▶ Pump Protection

The IVS102 is supplied with many standard pump protection features, including preventative maintenance scheduling such as mechanical seal replacement. Other features include dry pump and end of curve protection, both of which help to prevent pump damage and improve pump longevity.

▶ Easy to Use Graphical Keypad

All IVS102 drives are supplied with intuitive and easy to use interface. The keypad is used for changing parameters, fault finding and diagnostics and monitoring operating variables such as power consumption. Alarms and warnings are displayed in easy to understand terminology, eliminating the need for decoding or referring to tables in manuals.

▶ **User Friendly Display:**
- ▶ Back-lit display
- ▶ On-screen scroll bars and graphs
- ▶ International letters and signs
- ▶ Four meters can be displayed simultaneously

▶ **User Friendly Keypad**
- ▶ Removable during operation
- ▶ IP65 Rating
- ▶ Easy access to all parameters
- ▶ On-board memory allows upload from one drive and download to another

▶ **Illumination**
- ▶ Important buttons are illuminated when active

▶ **Flexible, Easy Menu Structure**
- ▶ Intuitive navigation
- ▶ Four independent setups for unmatched flexibility
- ▶ Multiple menus including a personalised quick setup menu
- ▶ Logging menu provides access to operation history
- ▶ Changes Made log identifies previously modified parameters
- ▶ Two-level password protection

▶ **On-board Manual**
- ▶ Info key provides access to help information with on-board user manual

Technical Information

Building Management System Connectivity

The IVS102 variable speed drive offers unrivalled communication capabilities that reduce or eliminate the need for external devices. The drives communicate seamlessly on a serial communications network via a simple two-wire connection. The drive can be programmed either through the network or through the drive keypad.

Standard Protocols:

- Modbus RTU
- Johnson Controls Metasys® N2
- Siemens Apogee® FLN

Optional Protocols:

- LonWorks®
- BACnet™
- DeviceNet
- Profibus
- Modbus TCP

Environmental

- Temperature: 0 - 45°C
- Maximum Relative Humidity: 95%

Enclosure Ratings:

- IP20: 1.1 - 90kW
- IP21: 1.1 - 1400kW
- IP54: 110 - 1400kW
- IP55: 1.1 - 90kW
- IP66: 1.1 - 90kW

IVS102 Variable speed drive in IP55 enclosure

Inputs/Outputs

- Programmable digital inputs: 6

Used for external signals such as start/stop or interlocks.

Two of the six ports can be re-programmed to serve as digital outputs.

Relay Outputs:

- Programmable relay outputs: 2
  (240 VAC, 2A and 400 VAC, 2A)

Used for alarm and drive/pump status communications.

Analogue Output:

- Programmable analogue output: 1
  (Current range 0/4–20mA)

Can be used to indicate operating status such as power, current or motor speed.

Analogue Inputs:

- Analogue inputs: 2
- Modes: Voltage or current
- Voltage Level: -10 to +10V (scalable)
- Current Level: 0/4 to 20mA (scalable)

Used for feedback signals from field sensors or speed reference from BMS.

Options and Accessories

▶ Power Options:

- ▶ **Advanced Harmonic Filters -** For critical demands on harmonic distribution
- ▶ **dv/dt Filters -** For special demands on motor insulation protection
- ▶ **Sine Filters (LC Filters) -** For noiseless motor
- ▶ **In-built Mains Isolator -** Reduces requirement for external equipment and saves installation time and cost

▶ Control Options:

- ▶ **Relay Option Card -** Adds 3 additional relay outputs. These can be used for alarms, warnings, drive status (hand/auto) or a number of other programmable functions.
- ▶ **General Purpose I/O Option Card -** Adds 3 digital inputs, 2 digital outputs, 1 analogue current output, 2 analogue voltage inputs.
- ▶ **Analogue I/O Option Card -** Adds 3 analogue outputs and 3 pt1000/Ni1000 inputs.
- ▶ **External 24 VDC Supply Option -** A 24 VDC external supply can be connected to supply control and option cards in the event of a drive power supply failure.
- ▶ **Battery Backup Card -** Provides power for the real-time clock during power loss.

Many option cards simply plug into slots under the drive keypad

▶ Other Armstrong Variable Speed Pumping Solutions

▶ IVS Sensorless Series Pumps

Armstrong offers a range of variable speed pumps with integral drives for motors up to 55kW. This type of solution offers a unique value proposition in variable speed pump solutions. The Sensorless control functionality allows pressure control in heating or chilled water systems without the need to install a DP sensor anywhere in the system. Armstrong IVS Sensorless pumps offer the best space utilisation, and the lowest installed cost of any variable speed solution available.

▶ Multi-pump, Multi-zone Controls

For systems requiring greater than 3 zone control, the Armstrong range of IPS controllers can be used in conjunction with the IVS102 drives to provide sequencing of up to 6 pumps and 18 remote system zones.

Series 4300 IVS

Series 4302 IVS *dual*ARM

IPS 5000

IPS 9000

Typical Specification

Provide Armstrong IVS102 Series variable speed drive (VSD) with specification as per the following:

The VSD shall be of the VVC-PWM type, providing near unity displacement power factor (cos phi) without the need for external power factor correction capacitors at all loads and speeds. The VSD shall incorporate DC link chokes for the reduction of mains borne harmonic currents to aid in compliance with the Electricity Council's Engineering Recommendation G5/4 Stage 2 and to reduce the DC link ripple current. The product shall be CE marked, showing compliance with both the EMC Directive 89/336/EEC and the Low Voltage Directive 72/23/EEC. RFI filters shall be fitted as standard to ensure the VSD meets the emission and immunity requirements of EN61800-3.

VSD and motor protection shall include: motor phase to phase fault, motor phase to earth fault, loss of supply phase, over voltage, under voltage, motor over temperature, inverter overload and over current.

The VSDs shall be available in IP20/21 enclosures for incorporation into control panels or IP55 for plant room wall mounting. Output frequency range shall be adjustable between 0-120Hz. The VSD shall be capable of riding through a control power loss of up to 300ms to eliminate nuisance tripping and shall include auto-ramping feature for automatic adjustment of the acceleration and deceleration ramp times to help prevent nuisance trips. The VSD shall provide PID three term control for closed loop control of pressure or flow without the need of an external regulator. The VSD shall provide Programmable Skip Frequencies with adjustable bandwidths to help overcome any mechanical resonances. The motor circuit shall be capable of unlimited switching by either a contactor or an isolator without causing damage to the VSD. The VSD shall feature an on-board time clock.

The VSD shall provide an Automatic Energy Optimiser (AEO) function to maximise energy savings by automatically matching the U/F curve to the load requirements, increasing energy efficiency by 5 -15% at partial loads. An Automatic Motor Adaption function shall match the VSD with the associated motor installation to optimise performance. This feature shall operate without spinning the motor and without the need to decouple it from it's load. The VSD shall provide set point 'Flow compensation'. If a pressure sensor is mounted close to the pump this feature shall constantly adjust the reference to follow the system curve. A complete range of energy monitoring information shall be provided to divide absolute energy consumption into hours, days or weeks, or to monitor a load profile for the application. kWh's shall be displayed as standard on the alphanumeric keypad.

The VSD shall provide dry pump and end of curve protection to prevent the pump from operating without creating the desired pressure. Under these circumstances, the drive shall stop the pump or perform another programmed action i.e. raise an alarm.

The VSD shall incorporate the following I/O:

- Six programmable digital inputs
- Two programmable 0-10v DC, 0/4-20mA analogue inputs
- One programmable 0/4-20mA analogue outputs for remote monitoring of:
  - Motor current
  - Motor power
  - Output frequency
- Two programmable volt free relays for remote monitoring of VSD status including:
  - Running
  - Alarm
  - Standby

Our policy is one of continuous improvement. We reserve
the right to alter our dimensions and specifications without notice.

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