



## V-CLASS WATER-COOLED CHILLERS

WB design series



**SMARTD**  
GLOBAL #1 IN OIL-FREE CHILLERS

# **SMART**

## **V-CLASS CHILLERS**

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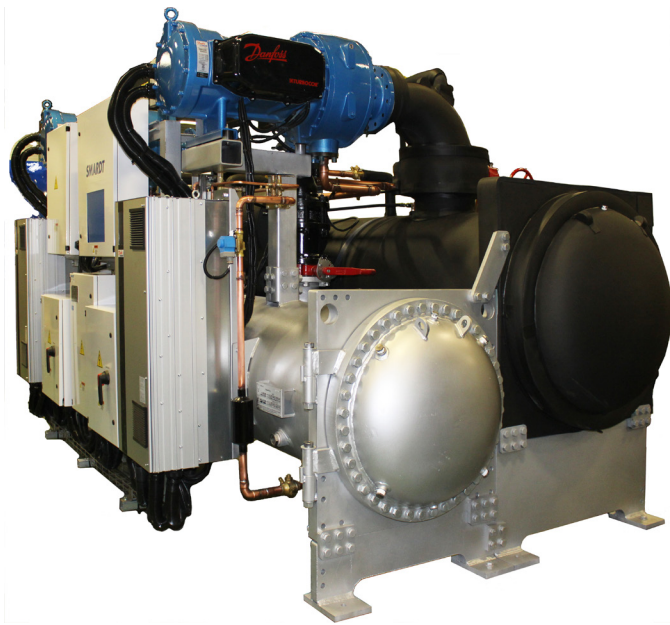
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All Smardt chillers are ETL-listed. Electrical safety for the life of the chiller is a fundamental requirement throughout the company. Smardt evaporators and condensers conform to the ASME pressure vessel codes.

Smardt V-Class energy efficiency performance is certified according to AHRI standard 551/591, as is confirmed by AHRI on its website [www.ahrinet.org](http://www.ahrinet.org). The IPLV performance of its chillers always exceeds minimum levels set out by ASHRAE standard 90.1, CSA 743, Eurovent, Australia's MEPS, China's CRAA and others, usually by a very considerable margin. Smardt, in company with the majority of the HVACR industry's leading engineers, considers the use of full-load energy efficiencies to predict any chiller's actual year-round energy-efficiency under US comfort-cooling conditions to be totally misleading, and therefore discourages their use.

Witness tests can be arranged on appropriate notice and for an appropriate fee on Smardt's AHRI-certified test stands in Montreal, Canada; Melbourne, Australia; Plattsburgh, USA and Guangzhou, China.



## V-CLASS OVERVIEW

**Smardt's range of V-Class water-cooled chillers has been designed to reliably deliver high efficiencies across a wide range of operating conditions.**

Smardt has brought its extensive experience in oil-free chiller development, sales and service into designing a range of water-cooled chillers that delivers the highest level of reliability, outstanding efficiency and the lowest total cost of ownership.

- All Smardt chillers are designed to optimize the superior performance of oil-free compressors from Danfoss Turbocor®.
- Our class-leading performance and quality design ensure the best results for total equipment lifecycle operation and reliability.
- Smardt's V-Class range comes with the same benefits as all Smardt chillers, such as ease of installation, simplicity of operation and maintenance, and lower operating and maintenance costs.

## HIGHLIGHTS

- LARGEST CAPACITY RANGE IN OIL-FREE WATER-COOLED CHILLERS.
- TYPICALLY SMALLER FOOTPRINT WHEN COMPARED WITH CHILLERS OF A COMPARABLE CAPACITY.
- RESPONSIVE CHILLED WATER CONTROL IN ALL CONDITIONS.
- INBUILT REDUNDANCY AND FLEXIBILITY WITH MULTIPLE COMPRESSORS.
- CLASS LEADING PART-LOAD EFFICIENCIES, ACHIEVING THE OPTIMUM IPLV IN TOTAL CAPACITY RANGE.
- DESIGNED FOR EASE OF MAINTENANCE AND SERVICEABILITY, FEATURING FIELD-SERVICEABLE COMPRESSORS.
- DUAL-TURBINE COMPRESSION TECHNOLOGY, COUPLED WITH AN ECONOMIZER, DELIVERING CLASS-LEADING PERFORMANCE.
- SMARTD QUALITY, ACCEPTANCE TESTED AND PRECOMMISSIONED PRIOR TO DELIVERY ENSURING TROUBLE-FREE START-UP ON EVERY PROJECT.

**SMARTD**



## DESIGN FLEXIBILITY

### SMARTD WATER-COOLED RANGE - 284-3200 TR (1000 - 11250 KWR)

#### OIL-FREE COMPRESSOR TECHNOLOGY

At the core of all Smartd chillers is an oil-free Danfoss Turbocor® compressor, featuring magnetic bearing technology. With no oil to compromise heat exchanger performance, and no friction losses associated with conventional compressor bearings, Smartd chillers are able to achieve exceptional full- and part-load efficiencies. This technology eliminates up to 99% of compressor-induced vibrations, and dramatically reduces the sound levels emitted by the chiller.

#### LARGEST CAPACITY RANGE

Smartd has reset the boundaries - now offering the largest capacity range of water cooled oil-free chillers in the world, with the V-Class able to achieve capacities exceeding 3200 TR (11 MW) of cooling, while continuing to exceed MEPS (Minimum Energy Performance Standard) efficiency requirements. Turbocor® VTT compressors are oil-free, variable-speed, magnetic bearing centrifugal compressors ideal for commercial air-conditioning or process cooling chillers reaching up to 3200 TR (1250 kWR) or more.

#### HIGH EFFICIENCY

All Smartd chillers use premium flooded shell and tube heat exchangers which have superior efficiency and reliability, compared to plate and frame or DX heat exchangers.

#### FLASH TANK ECONOMIZERS

Economizers are a proven key to boosting chiller efficiency and capacity, but can only be used with two-stage compressors - as found on all Smartd chillers. Every V-Class chiller features high performance flash tank economizers, as standard.

#### COMPACT DESIGN

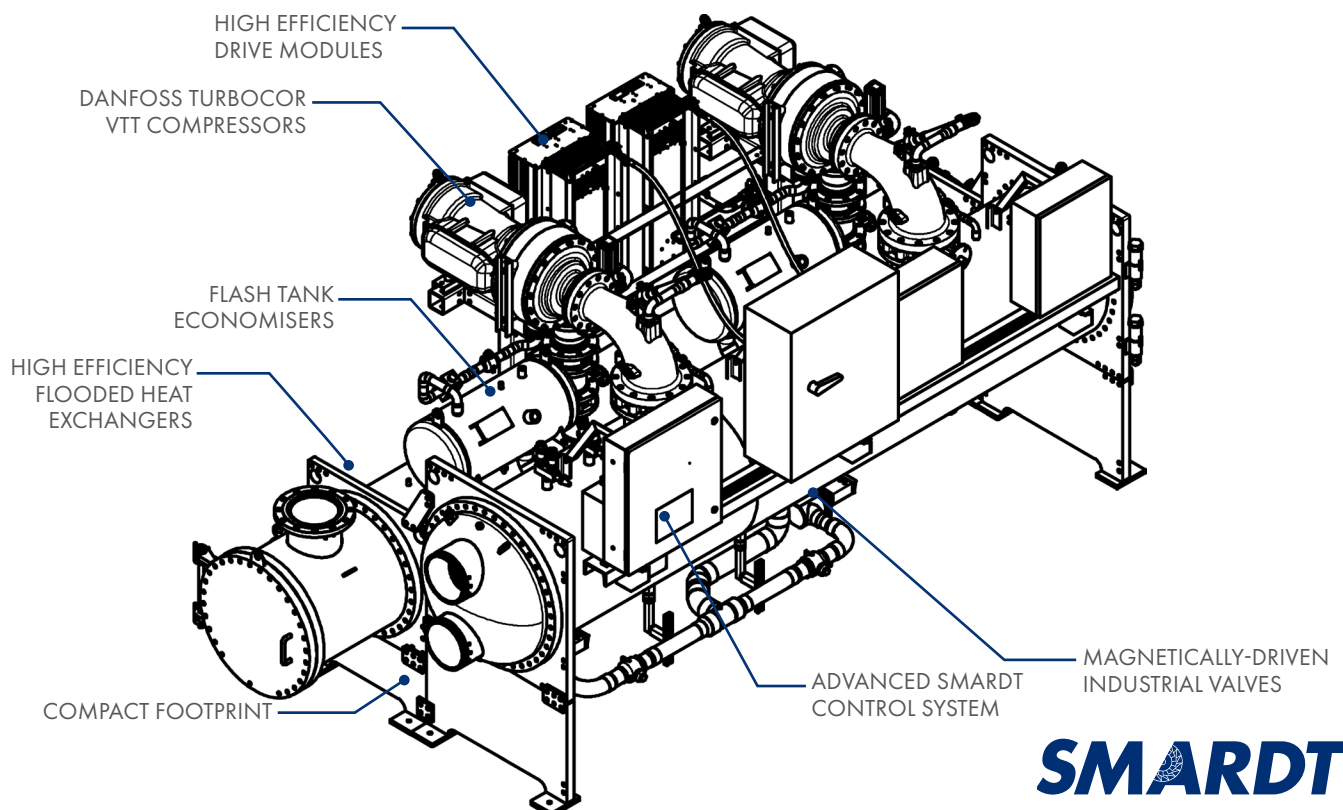
V-Class chillers offer a small footprint, when compared with oil-free chillers of a comparable capacity. Through the use of larger capacity compressors, in place of multiple smaller compressors, chilled water plants can now experience the efficiency of oil-free chillers without sacrificing space.

#### CONTROL SYSTEM

Proven across years of industry experience in oil-free chiller operation, Smartd's advanced chiller controller is designed to optimize the performance and capabilities of the WB chiller ranges. Capacity can be reduced to as little as 10% of full-load capacity (for some models). Simple integration with building management systems via Modbus RTU is provided as standard.

#### ENVIRONMENTALLY RESPONSIBLE

All V-Class chillers use R134a refrigerant as standard, which has no ozone-depletion potential, is non-toxic, non-harmful and has no phase-out schedule per the Montreal Protocol.



# SMARTD

## WEB-BASED CONTROL PANEL

The Smardt Control provides a web-based alternative to traditional hardware controls. Using the HTML-based web panel software in combination with the local touchscreen interface display gives the customer both ease-of-use of a traditional control panel and the flexibility of a web panel. The web panel software is installed on any digital device (e.g., cell phone, tablet or computer) running a web browser with access to the local network or via a secure VPN connection. The interface software is installed on the chiller controller. Switching between different control panels is as easy as following a web link. Smardt offers a modem connection option so any device connected to the internet can remotely access the chiller via a secure password protected connection.

## INTRAFLOW™ TECHNOLOGY

Danfoss Turbocor's patented IntraFlow™ technology provides enhanced capacity turndown on all V-Class chillers, effectively eliminating surge constraints, and the energy wasted through the use of hot gas bypass. IntraFlow™ technology meters high velocity discharge gas into the impeller housing to manipulate its aerodynamic conditions. This removes the need for complex inlet guide vanes and mechanical/variable geometry diffusers to throttle the incoming vapor and eliminates the leak potential of external actuators. The result is an extended stable operating envelope, especially at lower capacities, where compressor speed and the IntraFlow™ are balanced to meet any cooling demand in the most efficient way.

## INDEPENDENT POWER MODULES

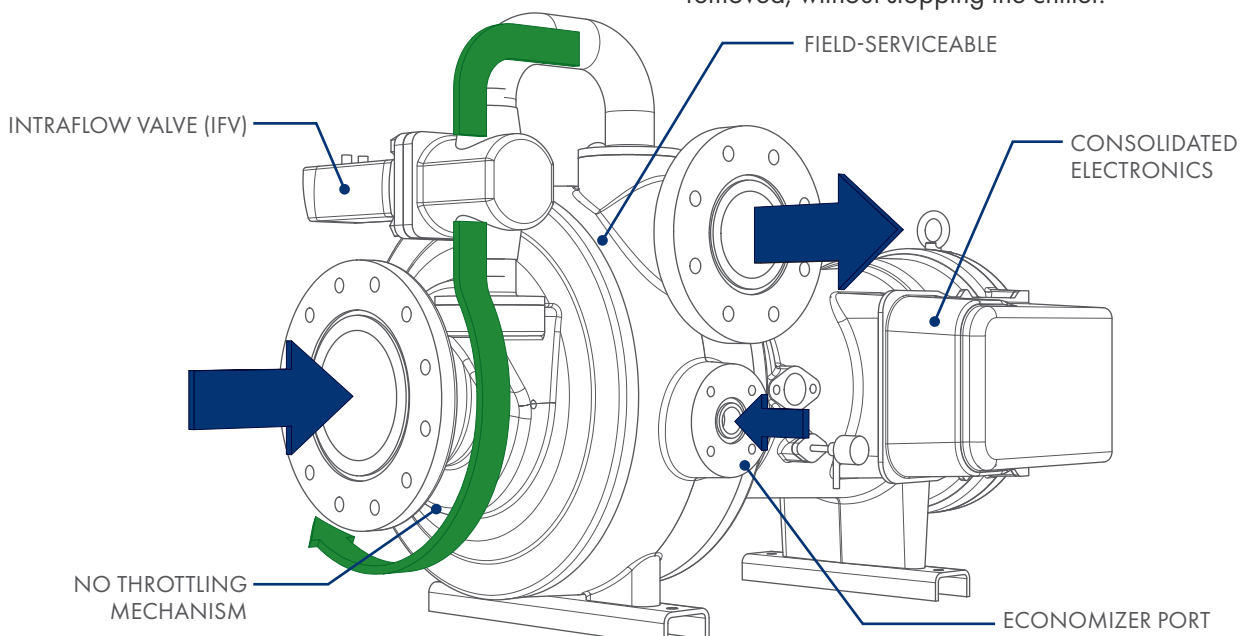
High efficiency drive modules are independent of the compressor, simplifying the compressors' on-board electronics. These drives are based on Danfoss' proven and reliable platform of HVAC variable frequency drives, while being the first to feature the combination of air and refrigerant cooling, providing enhanced redundancy.

## SERVICEABILITY

All Smardt V-Class chillers include refrigerant isolation valves on both sides of all serviceable components as standard. This facilitates servicing without the need to pump down the entire unit, and in most cases can be undertaken while the chiller remains operational. Field-serviceable compressors are a unique feature of the V-Class range, effectively eliminating the time, cost and difficulty of removing large compressors. The V-Class range utilizes hermetically sealed industrial valves for its expansion and IntraFlow™ valves, which feature magnetic actuators that can be removed without compromising the refrigerant circuit.

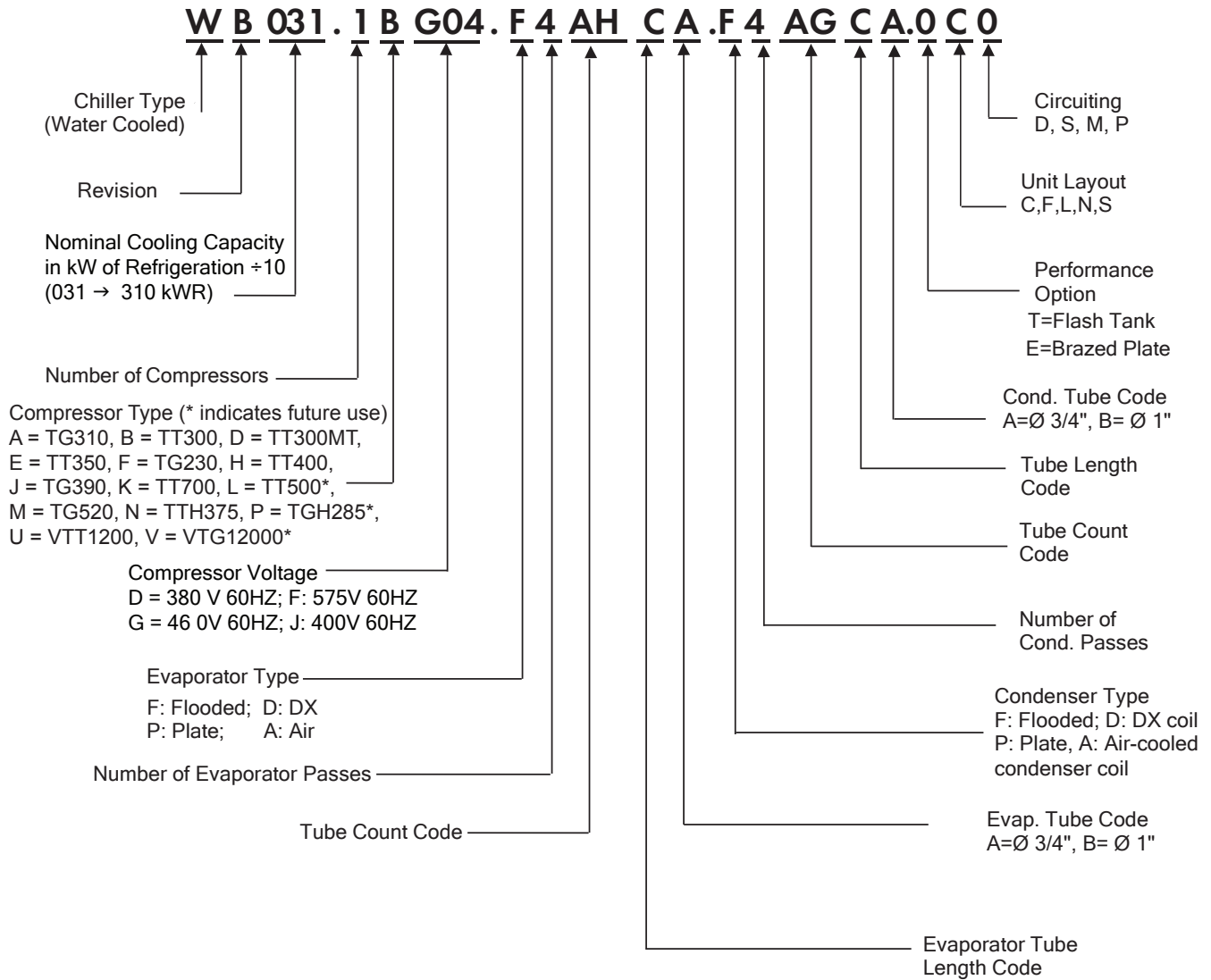
## RELIABILITY & REDUNDANCY

With the experience of more than 8000 oil-free centrifugal chillers now installed worldwide, Smardt chillers offer outstanding reliability - unsurprising when an estimated 80% of all chiller field problems relate to failures in the compressor oil-return. On multiple-compressor models, mechanical and electrical isolation provides significant redundancy and failsafes. In the event of a compressor outage, Smardt's controller will automatically adjust its logic to continue serving the chilled water load with the remaining available compressors. Should a compressor require servicing, it can be quickly and easily isolated, even removed, without stopping the chiller.



# SMARDT

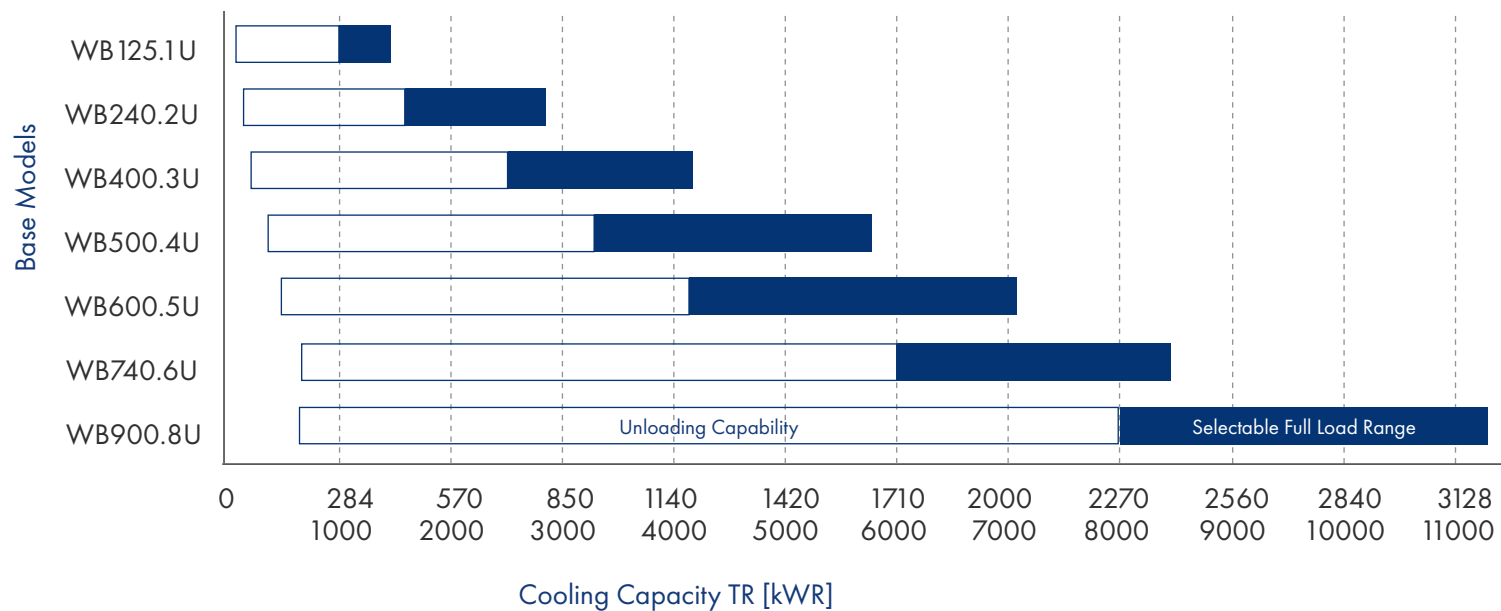
# CHILLER NOMENCLATURE





# CAPACITY RANGE

The V-Class range has been designed to meet a wide variety of applications, with full load capacities ranging from 284 to 3200 TR (1000 to 11250 kWR).



Note: Available cooling capacity will vary with operating conditions and chiller configuration. Capacities shown are based on standard AHRI conditions. Capacity can increase significantly with higher leaving chilled water temperatures, such as those found in data centre applications.

## OPTIONAL FEATURES

### CONDENSER PROTECTION

Stainless steel tubesheets and water boxes are available to extend the service life of every chiller, even in severe environments. For extreme environmental conditions, Copper/Nickel and Titanium heat exchanger tube materials can also be specified. Anodic and cathodic protection options are also available.

### ALTERNATIVE INSULATION

All evaporators are fitted with ¾" (19 mm) closed-cell rubber, wrapped in 1/8" (3 mm) thick UV stabilized insertion rubber, as standard. Aluminum cladding, 1 ½" (38 mm) rubber, 2" (50 mm) polystyrene and 2" (50 mm) polyurethane options are also available.

### WATER CONNECTIONS

Grooved connections are supplied as standard on all models. Flanged options, including AS Table 'E' and ANSI #150, are available upon request. Marine water boxes are also available on all V-Class units.

### RAPID RESTART

Designed for critical installations, Rapid Restart allows the chiller to resume operation in as little as 20 seconds following power supply restoration.

### HIGH-LEVEL COMMUNICATIONS

Modbus RTU high-level communication is installed as standard across all models. BACnet MSTP/IP, Modbus TCP/IP, and LonTalk® communication options are also available.

### POWER MONITORING

An integrated monitoring system which provides absolute power usage and quality in real time over HLI.

### THE "PONY EXPRESS" CHILLER

The most versatile large capacity chiller on the market Smardt's "Pony Express" oil free centrifugal chillers introduce an unprecedented level of flexibility and versatility to large capacity central plants. They are equipped with a combination of multiple large capacity compressors in addition to a single low capacity compressor, all of which are independently equipped with variable speed drives.

This design eliminates the need for additional low load chillers, as they are able to meet both day and night, peak and off-peak demands without compromise, running efficiently and reliably even at extremely low load conditions.

The "Pony Express" chiller is suitable for any application that has diverse cooling loads, which typically would require the installation and use of dedicated low load chillers; e.g., data centres with variable usage, office buildings with mixed tenancies, higher education with seasonal loading, hotels with variable occupancy, etc. Available in chiller models ranging from 350 TR to 3200 TR (1230 kW to 11250 kW) cooling capacity.



## APPLICATION CONSIDERATIONS

### CHILLED WATER REQUIREMENTS

All external pipework must be self-supporting, and aligned to prevent strain and distortion on the chiller's headers and couplings.

### EVAPORATOR WATER CIRCUITS

The chiller performance and efficiency can be adversely affected by contaminants in the water circuit. As such, strainers should be located on the inlet side of the evaporator.

The water circuit should be arranged so that the pumps discharge through the evaporator, with the return water to the chiller connected to the lower connection of the evaporator.

### CHILLED WATER TEMPERATURE LIMITS

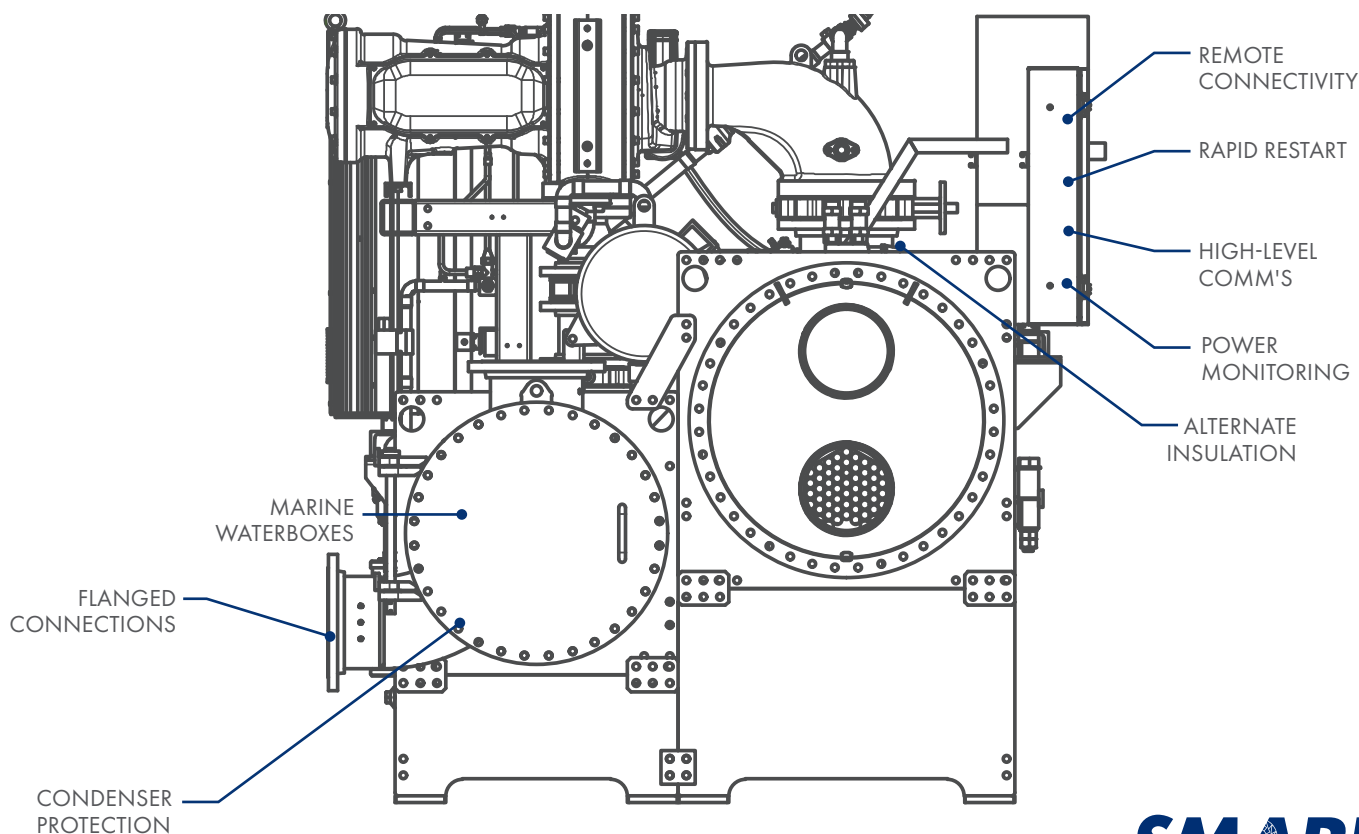
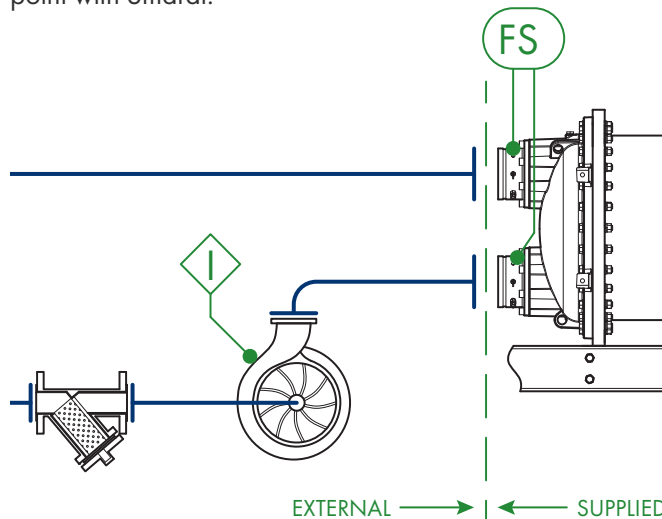
V-Class water-cooled chillers are optimized for chilled water temperatures between 40 °F (4 °C) and 71 °F (22 °C). For applications outside this range, please consult your local sales representative.

### FLOW SAFETY INTERLOCKS

Flow switches (FS) are fitted as standard on all Smardt chillers, which enable the chiller to shutdown in the event of low flow through the evaporator/condenser.

An additional field-supplied chilled water pump interlock, or a VSD interlock signal is required on all installations.

If the chiller is intended for an application using variable chilled water flow, please confirm the appropriate cut-off point with Smardt.



# SMARDT

## INSTALLATION REQUIREMENTS

### SIDE CLEARANCES

A nominal clearance of 48" (1220 mm) around all four sides of the water-cooled chiller and 36" (915 mm) above the chiller is required.

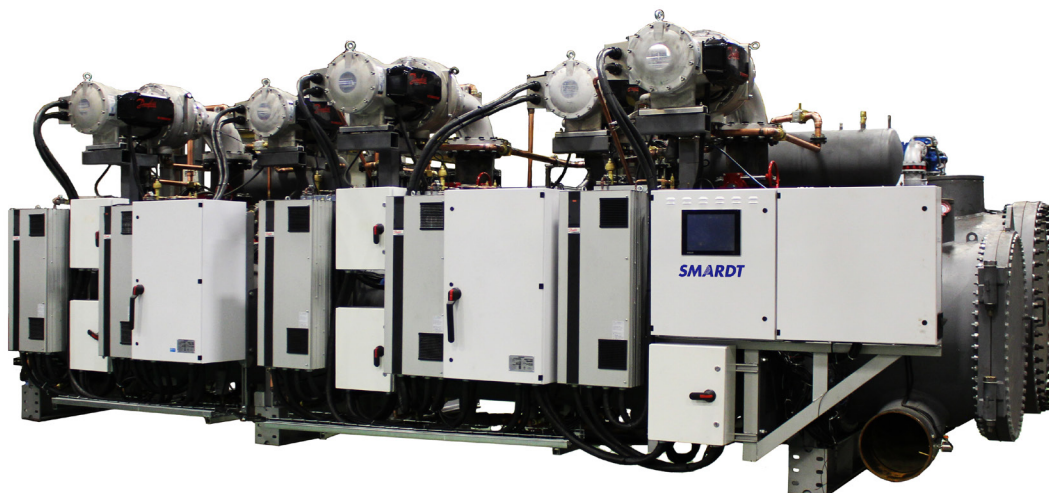
A clearance equal to the length of the evaporator is recommended at either end of the vessel for service access requirements.

Refer to the chiller outline drawing supplied with your chiller. Contact Smardt for recommendations on restrictive installations.

### MOUNTING REQUIREMENTS

The chiller shall be installed on a flat surface, with a minimum of 3" (75 mm) flange width around the perimeter of the base frame. Refer to individual product information for these dimensions.

Waffle pads can be used in place of spring mounts for most installations requiring structural isolation.



## ENGINEERING SPECIFICATIONS

### DESCRIPTION

Each unit shall include one or more Turbocor® VTT magnetic bearing, variable speed centrifugal compressor(s). Integrated variable frequency drive shall operate with inlet vanes. Each chiller shall operate with R134a refrigerant not subject to phase-out by the Montreal Protocol and U.S. EPA Phase-out schedule.

### QUALITY ASSURANCE

Construction shall comply with relevant country codes; vessels shall be manufactured in accordance with PED code, CE, and ASME section VIII. Units shall be run tested at the factory prior to shipment as part of commissioning process).

### COMPRESSOR(S)

Compressors shall be of semi-hermetic centrifugal design and operate oil-free with 2 or more compressors or have N+1 redundant chiller, two-stages of compression, magnetic bearings, IntraFlow™ valves and integrated variable frequency drive system. Dual circuits with split shells are available depending on the application. Automatically controlled IntraFlow™ valves shall operate with compressor speed controls.

Compressor(s) shall be equipped with discharge and suction shutoff (isolating) valves for mechanical isolation as standard.

Capacity control shall be provided by variable speed drive and inlet guide vanes, capable of reducing unit capacity to below 15% of full load.

Compressor(s) shall start unloaded and current inrush shall be limited by control to less than 5 Amps.

Motor cooling shall be provided by an integrated liquid refrigerant injection system controlled by the compressor(s). The compressor(s) shall require no oil lubrication.

### EVAPORATOR AND CONDENSER

Shell and tube design shall be provided with seamless copper tubes mechanically expanded into boiler quality mild steel tube sheets with mild steel water boxes.

The shell shall be formed from carbon steel plate, designed, tested and stamped in accordance with PED, CE and ASME safety codes for unfired pressure vessels. The water tubes shall be rated to a pressure to suit the installation but in any case be not less than 145 psi (10 bar). The shells shall be insulated with ¾" (19 mm) insulation covered with UV protectant.

A water drain connection and single bulb well shall be provided for low temperature cutout, load limit thermostat and temperature controller.

### REFRIGERATION COMPONENTS

Pressure relief valves shall be provided on the evaporator in a paired assembly to allow for either to be isolated without the introduction of any safety hazard. Each compressor shall be fitted with discharge and suction isolation valves. Electronic expansion and level sensors valves shall be provided.

Evaporator shall be fitted with a sight glass to allow for visual inspection of the tubes. Isolatable components shall be accompanied by a service port to allow for localized refrigerant reclaim.

### STANDARD CONTROLS, INTERLOCKS & SAFETIES

Provide and mount in the chiller control cubicle, the interlocks, time delays, capacity control, safety controls, relays, connections for interlocks with external pumps and flow switches necessary for safe and satisfactory operation and for restarting the chiller set immediately upon restoration of interrupted power supply.

Unit controls shall include the following minimum components:

- Microprocessor control with non-volatile memory
- Power and control circuit terminal blocks
- ON/OFF control switch
- Temperature sensors installed to measure cooler entering and leaving fluid temperatures
- Sensors for suction and discharge pressure and temperature

Unit controls shall include the following functions as standard:

- Capacity control based on leaving chilled water, entering chilled water, heat recovery (cw out or a heat recovery dual bundle temperature) or suction pressure control.

Unit controls shall include the following display variables as part of the user interface:

- General operational data including entering and leaving chilled water temperatures, chilled water set point, ambient air temperature, time and date, active timers, system demand, chiller status, active faults and alarms.
- Compressor data including communication integrity, active alarms, actual compressor(s) demand, impeller speed, IGV position, active pressure ratio, suction pressure, discharge pressure, active power input, desired power input, 3 phase amps, surge RPM, choke RPM.
- Control system shall allow software upgrade without the need for new hardware.
- Controller shall include contacts for interfacing to the BMS via optional high level standard communication protocol interface: Modbus™ TCP/IP native, Modbus™ RTU R-485, LonTalk®, FT-10 module, BACnet™, MSTP, BACnet™, IP, for the following functions: Summary fault, Start/Stop, Chilled water flow interlock, Chiller water reset and Demand limit.

Unit shall be equipped to provide the following protection:

- Low chilled water temperature
- Power supply error
- Compressor motor thermal or electrical overload
- Phase loss
- High and low pressure
- Loss of chilled water flow

### ELECTRICAL

Primary electrical power supply shall enter the unit at a single location. Unit shall operate on 3-phase power at 460 volts, 60 Hz. Control voltage shall be 24 VDC. Unit shall be shipped with factory control and power wiring installed. Power factor shall be greater than 0.9 (compressors only) at full design load. High impedance reactors providing enhanced low frequency harmonic mitigation shall be provided.





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