



## REVOLUTIONARY ENERGY SAVINGS FOR THE BUILT ENVIRONMENT

The world-proven range of oil-free centrifugal chillers from Smardt

**SMARTD**



The Group now has well over 2000 operating chiller installations across the world – all delivering high reliability, outstanding part-load efficiencies and the overall lowest cost of ownership to owners. Achieving these goals as consistently and simply as possible remains the Group’s core purpose, and clearly differentiates it from competitors with conventional machines.



Advanced electronics mean that mechanical forces can be managed with extraordinary tolerances, achieving very high reliability. Not a surprise, when shaft position is automatically measured and adjusted 120 times per revolution.



Smardt chillers optimize the benefits of the revolutionary Turbocor oil-free centrifugal technology. The TT300 compressor delivers 60 to 90 TR while the TT400 delivers 120 to 150 TR and the TT500 up to 190 TR.

## THE SMARTD CHILLER GROUP

### WORLD LEADER IN OIL-FREE CHILLER EFFICIENCY

The PowerPax and Smardt companies joined forces in 2005 to merge their global operations in engineering development, testing and certification, supply chain, technical service and customer support.

PowerPax, based at Melbourne, Australia was founded in 2000 by a team of HVAC industry veterans to specialize in high-efficiency shell-and-tube heat exchangers and their optimization in oil-free centrifugal chillers.

Smardt, based at Montreal, Quebec was founded in 2005 by a team of Turbocor veterans to produce chillers which optimized the energy efficiency potential of the Turbocor compressor technology.

The Group now has well over 2000 operating chiller installations across the world.

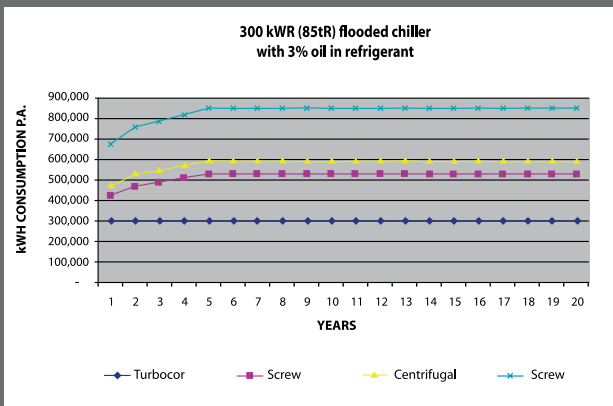
## A QUANTUM LEAP

### IN ENERGY EFFICIENCY

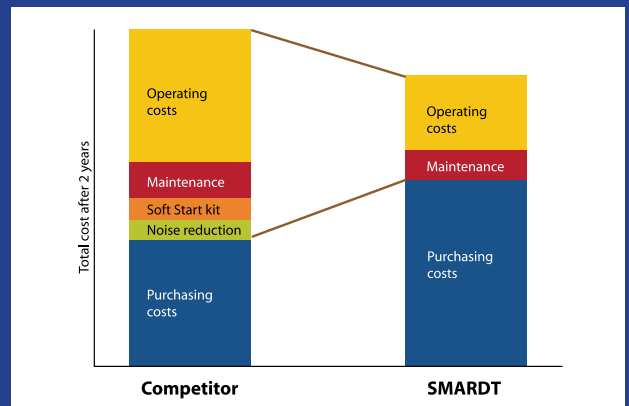
All Smardt chillers, whether water-cooled or air-cooled, are designed to optimize the performance of oil-free centrifugal compressors from Danfoss Turbocor Compressors Inc. These use oil-free magnetic bearings and variable-speed drives to deliver better IPLV efficiencies than conventional oil-lubricated centrifugal, reciprocating, scroll and screw compressors. They are also high-speed – up to 48,000 rpm, very compact, very quiet, rugged and reliable. Power factor is a high .92.

Proprietary magnetic bearings replace conventional oil-lubricated bearings, eliminating high friction losses, mechanical wear and high-maintenance oil management systems to deliver chiller energy savings of 35 percent and more over conventional chillers while ensuring long-term reliability. Over 75,000 magnetic bearing machines are operating in the field, mainly in high-end vacuum pumps and CNC spindles – any innovation risk has been long overcome.

Turbocor’s one main moving part (rotor shaft and impellers) is levitated during rotation by a digitally-controlled magnetic bearing system. Position sensors at each magnetic bearing provide real-time feedback to the bearing control system, 120 times each revolution, ensuring constantly centered rotation.



As this comparative ASHRAE study showed, over 20% of a lubricated chiller's operating efficiency is routinely lost in its early years as a result of oil clogging of heat transfer surfaces.



2-year cost comparison, San Diego, CA. This decision between two different chillers has long-term positive consequences for the hotel which made it. The left-hand option is a low-cost lubricated screw chiller. The right-hand option is a 300 TR Smardt water-cooled chiller.

### Oil-free design optimizes heat transfer

The well-known ASHRAE study (Research Project 361) concluded that typical lubricated chiller circuits show reductions in design heat transfer efficiency of 15-25%, as lubricant accumulates on heat transfer surfaces, denatures and blocks normal thermodynamic transfer processes. Logically, no oil in your chiller means no oil contamination over time, so design efficiency is maintained effortlessly.

### Extraordinary soft-start efficiency

The compressor's power electronics, further enhanced by Smardt's chiller controllers, require only 2 amps for start-up, compared with 500-600 amps in conventional machines. Further savings for owners, who can reduce maximum power loads and reduce backup generator size, cost and capacity.

### Rugged and built-in defense against power failure

Each compressor has a bank of capacitors for energy storage and to filter DC voltage fluctuations. In case of a power failure, the capacitors provide continuity power to the bearings to keep the shaft levitated, allowing the motor to turn into a generator and to power itself down to a stop. Extended life testing confirms the system's remarkable durability.

### HFC-134a refrigerant

R134a has no Ozone Depletion Potential and no phase-out schedule under the Montreal Protocol. It has an A1 rating under ASHRAE standard 34 (no flame propagation, lower toxicity). Positive pressure chiller designs (compared with negative pressure designs using R123, for example) enhances sustainable performance, as neither air nor moisture can leak into the chiller. No purge unit is required – a further saving. Liquid R134a refrigerant is used in Smardt chillers to cool critical electronic and electromechanical components to assure maximum efficiency and safe operation.

### Very quiet

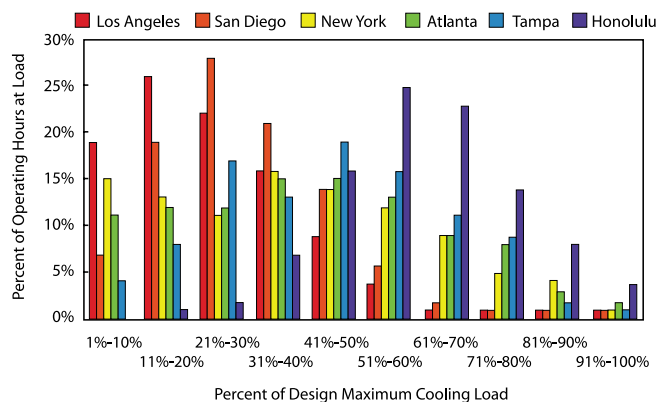
Very low sound and vibration levels, because there is no physical contact between moving metal parts, eliminate the need for expensive attenuation. Smardt chillers are typically so quiet, in fact, that a novice cannot tell whether they are actually operating. Testing of Smardt water-cooled chillers with reference to AHRI standard 575 yields readings as low as 77 dBA at 1 meter.

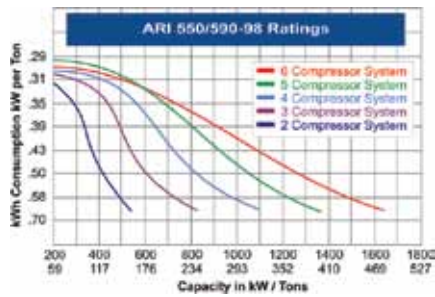
### Energy cost savings can be spectacular

Compared with a new screw chiller, Smardt IPLV energy efficiency is routinely more than 32% better. Compared with older lubricated reciprocating, screw, scroll or centrifugal chillers, year round savings with a Smardt can be spectacular, with well over 50% savings. Under AHRI conditions, Smardt IPLV performance can be as low as .33 kW/TR while part-load efficiency can be under .30 kW/TR.

### Why part loads are critical

The graph below (data source: AHRI, 2005) shows very simply that a wide range of large US cities all demand the vast bulk of their chiller operations at part load – enabling much lower operating costs from a Smardt chiller than from a lubricated alternative.

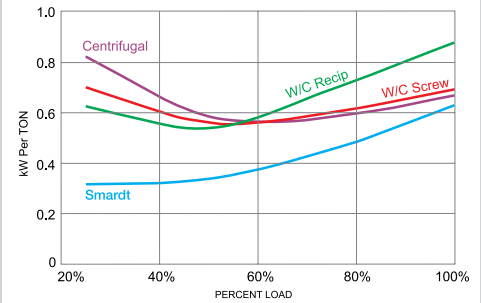




The test data above, from a 480 TR water-cooled chiller using 2-6 TT300 compressors on a single pair of shell and tube vessels, shows clearly how best-in-class energy efficiencies are routinely delivered.



This standard design 350 TR water-cooled chiller uses a flooded shell and tube evaporator with shell and tube condenser to achieve an approach of 1 deg. K, allowing high IPLV efficiencies.



This simple comparison uses generic industry performance data for 250 TR water-cooled chillers (data source: AHRI) to plot the relative efficiencies of different compressor modalities as they unload.

## WATER-COOLED CHILLER RANGE 60 TR THROUGH 1100 TR

### Lowest lifetime operating costs

Smartt works hard to minimize complexity in chiller design and operation – Smartt simplicity is reflected in low Smartt operating costs. The thinking makes simple sense – with no oil, flooded shell-and-tube evaporation, soft start, low power consumption, low maintenance costs and high reliability with only one main moving part.

*Smartt field reliability* has been outstanding – not surprising when you consider that some 80% of all chiller problems in the field are due to failures in compressor oil return. And Smartt chillers use no oil.

The growing fraternity of Turbocor-trained engineers and technicians often suggests that total maintenance costs for oil-free chillers run at well under half the costs of traditional lubricated chillers. This may be conservative.

### Serviceability

Always important in minimizing operating costs, service access is swift and simple, as is access to operating history through remote monitoring. Operating history, compressor and chiller set points are all accessible remotely by trained and authorized service personnel.

### Simple BAS integration

Integration with Modbus, Bacnet and LONworks building management systems is standard, as is connectivity with most industry-standard protocols.

### Custom design and problem solving

The group's design engineers are happy to resolve special equipment design challenges for you, but please allow some extra time and, possibly, some extra cost for these. For example, high-efficiency heat recovery and free-cooling applications can all be supplied competitively. Corrosion protection and other options are available and can be explored on request.

### Redundancy

Use of multiple compressors allows unusual redundancy safeguards; however, if multiple circuits are indicated, these can be designed in and supplied. Smartt's redundancy potential can offer system designers unique opportunities to eliminate multiple chillers, multiple controls and multiple pumps. More savings for owners.

Multiple compressors also allow system designers to save on low-load or pony chillers, because with a VFD integrated into each compressor control, a chiller which uses multiple compressors can be efficiently driven right down below 10% or even 5% load.



## COMPACT MODULAR AND SPLIT CHILLER RANGE 60 TR THROUGH 900 TR

Smardt's Compact Modular and split-vessel chillers elevate the modular chiller into the high-efficiency, low-operating-cost world. No longer does modularity have to be compromised by efficiency sacrifices.

Now you can use the modularity concept to upgrade plant operating efficiency while minimizing plant room access costs – saving high costs of demolition, rigging and craneage. Savings can be enormous, because the Smardt Compact Modular range is designed to move through a standard elevator and a standard door, through to a footprint smaller than any other high-efficiency chiller.

Over only 5 days, 400 TR of high-efficiency cooling was installed, commissioned and running at a fully tenanted downtown Toronto complex, using access only through standard doorways, stairs and elevators. Access savings – demolition, craneage and the costs of closing a busy downtown street – were enormous.



This standard 90 TR Compact Modular chiller can be doubled up with the same footprint, then expanded by up to 5 further modular steps, allowing a wide range of high-efficiency modular options.



The Compact Modular range delivers high IPLV efficiencies in capacities up to 900 TR while minimizing access, rigging and other site costs.



## AIR-COOLED PACKAGED CHILLER RANGE 60 TR TO 540 TR

The Smardt air-cooled range offers the smallest footprint, the quietest operation and the highest air-cooled operating efficiencies on the market.

Condenser coils use either a V or a W configuration to optimize heat rejection and footprint. Coils are baked and double-coated as standard with sealed edges as standard, to extend the coil's physical protection from environmental corrosion.

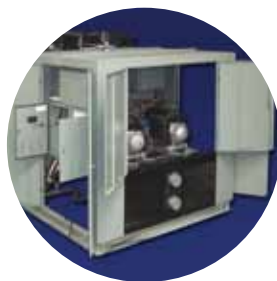
### Remote air-cooled condensing

Remote location of the condenser can be a preferred option in some applications. Smardt can supply a full package if desired, or on a condenser-less basis.

Use of evaporative pre-cooling to minimize air-cooled power consumption can be very efficient from an operating cost perspective. Smardt's reference sites show further savings of over 30% for evaporative pre-cooling compared with normal Smardt air-cooled operation



Smardt air-cooled chillers offer the smallest footprint on the market.



Service access is outstandingly simple.



Smardt air-cooled performance at this Florida university delivered the expected 40% energy savings.



Smartt chiller controllers have been developed from the ground up using primary compressor performance maps, maximizing the performance potential within these, then optimizing the whole chiller's operation to minimize energy consumption.

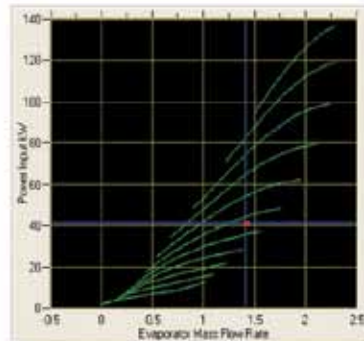
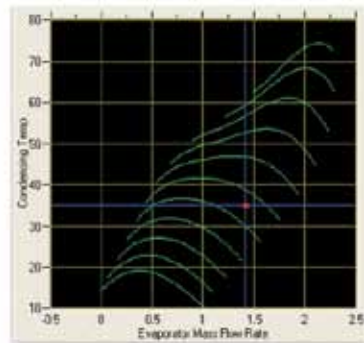
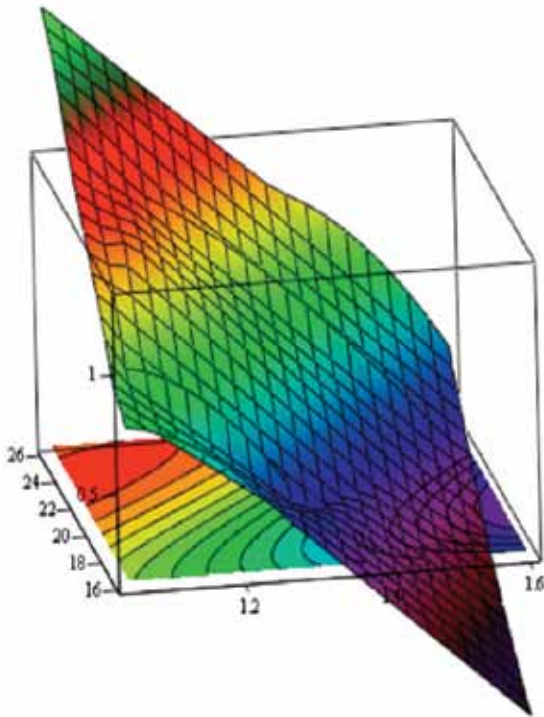
## USER-FRIENDLY CONTROLS

Smartt's Kiltech controller is very user-friendly, highly intuitive and allows optimization of both single compressor operation and multiple compressor operation while enabling a rich array of communication options.

The compressor's onboard digital controller proactively manages compressor operation while allowing external control and web-enabled monitoring of performance and reliability information.

The PowerPax microprocessor system has been used on many chiller sites, and that experience has generated the state-of-the-art controls software that maximizes operating efficiencies and minimizes maintenance and operating costs. Two tiers of controls options are available.

This system provides several access levels for plant operators and commissioning, and offers a wide variety of options for flexible operation and optimization of power consumption, maximizing time spent operating at compressor sweet spots.



## CERTIFICATION

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 naturally conform to the ASME pressure vessel codes.



Their energy efficiency performance is certified according to AHRI standard 500/590, 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 the use of them.

Witness tests can be arranged on appropriate notice and for an appropriate fee on Smardt's AHRI-certified test stands in Montreal, Quebec and Melbourne, Victoria.

## STRONG LEED CONTRIBUTION

Smardt technology can be very useful in achieving LEED certification for your building, whether in existing buildings, core and shell or new construction, because it can help win critical points in the Energy & Atmosphere category. Market research by the US Green Building Council finds that the streamlined LEED process is second only to rising energy costs as a driver for stronger adoption of green building practices and the transformation of the built environment to sustainability. Smardt is a member of the USGBC.

## STRONG SUPPORT FOR THE EPA'S RESPONSIBLE USE VISION

The EPA's Responsible Use vision encourages manufacturers, system designers and owners to invest in products and technologies which document sustainability of the highest efficiencies in tandem with lowest emissions. Smardt is a strong supporter of the vision, and the EPA.

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