THE TRUSTED ADIABATIC COOLER AND CONDENSER
The origins of the SPARTIUM® industry trace back to 1962 when it joined the small cluster at that time of the European air conditioning manufacturers. During 1967 it established its first manufacturing facility in Thessaloniki, Greece. To safeguard the integrity of its equipment performance, SPARTIUM® was one of the first 32 companies in 1993 to participate in EUROVENT’s initially established Certification Programme. That was the time when U.S.A. was the only available source of know-how in the air-conditioning field and reliable supplier of HVAC equipment world-wide.

During the turn of the 20th century the company made an innovative breakthrough in designing, manufacturing and testing the SPARTIUM® Adiabatic Cooler and Condenser. The prototype Adiabatic Fluid Cooler won the Innovation Award at the 2006 Interclima Exhibition in Paris and it was selected as a top innovation product for its impressive water saving features, combined with a unique safety operational concept. The greatest success feature of that new product was its hygienic characteristics and the ability to contain the risk of Legionellosis, associated with water systems in buildings. It was the only product in the evaporative cooling industry that could meet legionellosis risk management requirements by complying to the strict legislation enforced in France, the United Kingdom and Spain.

SPARTIUM® achieved reliable manufacturing excellence at every time and all the times through a vertically integrated manufacturing process, allowing quick response and adaptations to market’s needs. Its manufacturing applies a strict Quality Management System as per EN ISO 9001:2015 in accordance with the procedures of the Certification Body TÜV NORD CERT GmbH and a Quality System for ‘Pressure Equipment Manufacturer’ according to the EU Directive. Its product certification includes the high level technical expertise of UL® for the markets of U.S.A. and Canada and it is entitled to affix the UL® mark.
Why Adiabatic Cooling

The Adiabatic Process

SPARTIUM® Adiabatic Cooling includes machines for water or glycol solution cooling, or for condensing hydrofluorocarbon and ammonia refrigerants. In all such systems water is evaporated into the air stream via an engineered pad, where it is chilled. The colder air as it passes in turn through a finned heat exchanger cools the hot process fluid to a much lower temperature or pressure level, increasing its heat rejection capacity up to 40% than that achieved by a dry cooler or air-cooled condenser.

FEATURES OF THE SPARTIUM® ADIABATIC COOLING

Water Saving

Compared to cooling towers or evaporative condensers which must operate continuously, SPARTIUM® intelligent operational control of the pad wetting cycles results to more than 80% annual water saving. Such a saving is accomplished due to the following features:

The SPARTIUM® Adiabatic coolers and condensers do not use re-circulated water and therefore no bleed-off is required. Any risk of water droplets entrained in the air stream as it passes through a cooling tower or evaporative condenser, is totally eliminated in the SPARTIUM® Cooler. This is because during the humidification of the air through the wetted pads at a low velocity, no aerosols are produced, as the transfer of humidity takes place at molecular level.

During the annual operation of a SPARTIUM® Adiabatic machine, but even during its daily thermal loading, the entering ambient air dry-bulb temperature may often drop below the depressed air temperature coming out of the pad section of the unit. During all such periods the unit’s logic control system cuts off the wetting of the pads and the system runs dry.

On the other hand, during off season the pads can be easily removed and the unit’s dry operation can be further enhanced by the increased air flow, thus saving water.

Limited Maintenance Requirements.

Due to its concept, design and construction the SPARTIUM® equipment require limited maintenance and there is no need for any water treatment. By its factory adjusted calibrated metering devices, the wetting of the pads with city water is secured and a certain amount of excess water is continuously flashing dirt and debris from the surface of the pads, prolonging their useful life.

A tough and resilient edge treatment applied to the entering face of the pads allows frequent surface cleaning without damaging the pad and routine maintenance can be performed while the unit is still operating.

Electricity Saving

The SPARTIUM® controller’s software modulates the speed of the fans via their electronically commutated (EC) motors according to the load demands, before the pad wetting is energized. In locations where water is abundant, pad wetting can be energized earlier and keep the fans operating at lower speeds. This fan speed modulation results to appreciably low energy consumption, due to the spectacular electricity saving of EC motors operating at reduced speeds.
Control Logic and Choice of Operational Predominance

The SPARTIUM® units are factory prepared for ready use once they are connected to the plant for which they are destined. Their operation is controlled by a sophisticated pre-programmed microprocessor of the latest state-of-the-art, providing BMS communication with all common protocols. The fan speed is controlled on the basis of the actual fluid leaving temperature, or pressure, at the exit from the heat exchanger of the unit, and the design process fluid temperature, or pressure, ensuring minimum electrical consumption and noise level. The adiabatic pre-cooling will be activated and stopped on the basis of a programmed logical combination of the fan speed and the ambient temperature.

The SPARTIUM® family of products are ideal for installation in areas of water scarcity, against other types of cooling equipment, due to their minimal water consumption and considerable higher thermal performance. If water saving is the predominant objective, default settings for water saving will not activate adiabatic pre-cooling unless the fans are running at maximum permissible speed and the dry-to-adiabatic switch point has been reached. On the contrary in areas where water is no issue, the software of the units allow more extensive use of the pre-cooling of the air and thus operation at lower fan speeds at considerable reduced electricity consumption.

The control system also provides night operation during which the maximum allowable speed of the fans is reduced by energizing pre-cooling earlier, achieving also a lower noise level.

Operational Safety - Legionella and the prevention of legionellosis.

Legionellosis infections were identified in the second half of the 20th century, caused by the legionella bacteria. The severity of the infections varies from mild febrile illness to a potential fatal form of pneumonia (Legionnaires’ disease) that can affect anyone in the vicinity.

Water is the major natural reservoir for legionella bacteria. The bacteria are found worldwide in many different natural and artificial aquatic environments such as water systems in hotels, hospitals, ships and factories. Water temperature above 25°C is a crucial factor for the bacteria colonization, when stagnant in equipment and in water distribution systems.

Cooling towers and evaporative condensers have historically been implicated in numerous outbreaks of Legionnaires’ disease. Surveillance for Legionnaires’ disease is now a statutory notifiable disease in most industrialized countries.

The SPARTIUM® family of products are specifically designed to restrain legionella’s colonization:

- unlike a cooling tower, they have no sump, where the legionella bacteria can proliferate at the commonly encountered temperatures in such equipment of 25°C and above.
- in the case when the adiabatic process is interrupted, the unit incorporates an intelligent control system that drains the water in its pre-cooling pad distribution system via an automatic operation of valves, through the inclined gutter system, so that no stagnant water remains at any time in any part of the unit.
- because of the adopted low air velocity through the cooling pads and their design and construction, there is no water carry over, or aerosol generation.
Technical data of Adiabatic Coolers

### Heat Exchangers in “V” Configuration with 5/8” & 1/2” Copper Tubes

<table>
<thead>
<tr>
<th>Configuration</th>
<th>“V” - 5W coil arrangement</th>
<th>“V” - 4W coil arrangement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process Fluid</td>
<td>Water or glycol solution</td>
<td>Water or glycol solution</td>
</tr>
<tr>
<td>Nomenclature</td>
<td>SPV-FC-5W-06-EC91-F-04+14</td>
<td>SPV-FC-4W-06-EC91-F-04+14</td>
</tr>
<tr>
<td>Nominal Capacity (*)</td>
<td>280 kW to 1050 kW</td>
<td>270 kW to 1030 kW</td>
</tr>
<tr>
<td>Number and Type of Fans</td>
<td>4 to 14 / “EC”</td>
<td>4 to 14 / “EC”</td>
</tr>
<tr>
<td>Dimensions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length</td>
<td>2.84 m to 8.34 m</td>
<td>2.84 m to 8.34 m</td>
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<tr>
<td>Width</td>
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<tr>
<td>Height</td>
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<td>2.74 m</td>
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<tr>
<td>Shipping Weight</td>
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<td>1,520 kg to 4,500 kg</td>
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<tr>
<td>Sound Power</td>
<td>95 dB(A) to 100 dB(A)</td>
<td>95 dB(A) to 100 dB(A)</td>
</tr>
</tbody>
</table>

(*) Nominal Capacities based on 35°C / 29°C inlet/outlet water temperature, and 35°C db / 21°C wb entering ambient air.

### Heat Exchangers in Vertical Configuration with 1/2” Copper Tubes

<table>
<thead>
<tr>
<th>Configuration</th>
<th>“H” - 4W coil arrangement</th>
<th>“H” - 4W coil arrangement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process Fluid</td>
<td>Water or glycol solution</td>
<td>Water or glycol solution</td>
</tr>
<tr>
<td>Nomenclature</td>
<td>SPV-FC-4W-06-EC91-F-02+07</td>
<td>SPV-FC-4W-06-AC125-F-02+05</td>
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<td>Nominal Capacity (*)</td>
<td>210 kW to 810 kW</td>
<td>380 kW to 970 kW</td>
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<tr>
<td>Number and Type of Fans</td>
<td>2 to 7 / “EC”</td>
<td>2 to 5 / “AC”</td>
</tr>
<tr>
<td>Dimensions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length</td>
<td>2.84 m to 8.34 m</td>
<td>4.12 m to 8.52 m</td>
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<tr>
<td>Width</td>
<td>2.04 m</td>
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<tr>
<td>Height</td>
<td>2.53 m</td>
<td>2.60 m</td>
</tr>
<tr>
<td>Shipping Weight</td>
<td>1,270 kg to 3,650 kg</td>
<td>1,950 kg to 4,330 kg</td>
</tr>
<tr>
<td>Sound Power</td>
<td>87 dB(A) to 92 dB(A)</td>
<td>97 dB(A) to 101 dB(A)</td>
</tr>
</tbody>
</table>

(*) Nominal Capacities based on 35°C / 29°C inlet/outlet water temperature, and 35°C db / 21°C wb entering ambient air.
### Technical Data of Hydrofluorocarbon Adiabatic Condensers

#### Hydrofluorocarbon (HFC) Condensers with 1/2” Copper Tube Exchangers

<table>
<thead>
<tr>
<th>Configuration</th>
<th>“V” - 4Z coil arrangement</th>
<th>“H” - 4Z coil arrangement</th>
<th>“H” - 4Z coil arrangement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Refrigerant</td>
<td>R134a</td>
<td>R134a</td>
<td>R134a</td>
</tr>
<tr>
<td>Nomenclature</td>
<td>SP-CH-4Z_-06-EC91-F-04+14</td>
<td>SPH-CH-4Z_06-EC91-F-02+07</td>
<td>SPH-CH-4Z_06-AC125-F-02+05</td>
</tr>
<tr>
<td>Nominal Capacity (*)</td>
<td>406 kW to 1421 kW</td>
<td>328 kW to 1149 kW</td>
<td>547 kW to 1314 kW</td>
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<tr>
<td>Number and Type of Fans</td>
<td>4 to 14 “EC”</td>
<td>2 to 7 “EC”</td>
<td>2 to 5 “AC”</td>
</tr>
<tr>
<td>Dimensions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length</td>
<td>2.84 m to 8.34 m</td>
<td>2.84 m to 8.34 m</td>
<td>4.12 m to 8.32 m</td>
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<td>Width</td>
<td>2.82 m</td>
<td>2.04 m</td>
<td>2.35 m</td>
</tr>
<tr>
<td>Height</td>
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<td>2.53 m</td>
<td>2.60 m</td>
</tr>
<tr>
<td>Shipping weight</td>
<td>1,573 kg to 4,692 kg</td>
<td>1,270 kg to 3,650 kg</td>
<td>1,950 kg to 4,330 kg</td>
</tr>
<tr>
<td>Sound Power</td>
<td>95 dB(A) to 100 dB(A)</td>
<td>87 dB(A) to 93 dB(A)</td>
<td>97 dB(A) to 101 dB(A)</td>
</tr>
</tbody>
</table>

(*) Nominal Capacities refer to R134a, as a reference medium, based on 40°C condensing temperature and 35°C db / 21°C wb entering ambient air

### Technical Data of Ammonia Adiabatic Condensers

#### Ammonia Refrigerant (NH3) Condensers with 5/8” Stainless Steel Tube Exchangers

<table>
<thead>
<tr>
<th>Configuration</th>
<th>“V” - 5Z coil arrangement</th>
<th>“H” - 5Z coil arrangement</th>
<th>“H” - 5Z coil arrangement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Refrigerant</td>
<td>Ammonia</td>
<td>Ammonia</td>
<td>Ammonia</td>
</tr>
<tr>
<td>Nomenclature</td>
<td>SPV-CA-SZ-04-EC91-SST-F-04+14</td>
<td>SPH-CA-SZ-04-EC91-SST-F-02+07</td>
<td>SPH-CA-SZ-04-AC125F-SST-F-02+05</td>
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<tr>
<td>Nominal Capacity (*)</td>
<td>457 kW to 1634 kW</td>
<td>378 kW to 1321 kW</td>
<td>629 kW to 1511 kW</td>
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<tr>
<td>Number and Type of Fans</td>
<td>4 to 14 “EC”</td>
<td>2 to 7 “EC”</td>
<td>2 to 5 “AC”</td>
</tr>
<tr>
<td>Dimensions</td>
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<tr>
<td>Length</td>
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<td>2.88 m to 8.38 m</td>
<td>4.16 m to 8.56 m</td>
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<tr>
<td>Width</td>
<td>2.82 m</td>
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</tr>
<tr>
<td>Height</td>
<td>2.74 m</td>
<td>2.53 m</td>
<td>2.60 m</td>
</tr>
<tr>
<td>Shipping weight</td>
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<td>1,442 kg to 4,306 kg</td>
<td>2,544 kg to 5,455 kg</td>
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<tr>
<td>Sound Power</td>
<td>95 dB(A) to 100 dB(A)</td>
<td>87 dB(A) to 93 dB(A)</td>
<td>97 dB(A) to 101 dB(A)</td>
</tr>
</tbody>
</table>

(*) Nominal Capacities based on 40°C condensing temperature and 35°C db / 21°C wb entering ambient air
Standard & Optional Components

**Electrical & Electronic Support**

The SPARTIUM® cooler is a ‘plug-and-play’ unit fully wired and programmed at the factory, ready to be connected to the electrical and hydraulic grids. It consists of a complete combination of operational and protective gear complying to the European or U.S.A. standards. For safety purposes it provides separate compartments for the Power electrical section and the low voltage Control section, in IP67 enclosure. The Power panel includes a main power switch, emergency stop, power failure reset, individual fan motor circuit breakers. The low voltage Control panel includes the microprocessor controller and display with optional communication cards for all common protocols.

Optional items include a General Contactor Relay; an inverter by-pass switch (for units with AC fan motors); an Electric Internal Heater for extreme cold climates; a Fan and Filter unit thermostatically controlled, for dissipating heat loads.

The electronic support includes an ambient air sensor, fluid inlet and outlet immersion sensors, or pressure sensor for condensers. The EC fan motors are piloted by the controller over an RS485 bus system, whilst in the case of AC fan motors the controller regulates the main inverter located in the Power panel.

**Internal Fan Compartment Partitions**

Supplied as standard, ensure a uniform and swirl free flow of the air to each individual fan, reducing noise vibration and eliminating flow obstacles. In case of an idle fan the partitions prevent air bypassing the heat exchangers.

**Pad Edge Treatment**

Supplied as standard, a tough and resilient pad edge treatment applied to the air entering face of the pads. It was constructed to withstand repeated cleaning without damaging the pad and prevents algae and minerals from anchoring into the substrate of the pad.
Pad Wetting Metering Devices

As a standard item, they perform one of the most essential functions of the unit. The anticipated city water flow for the wetting of the pads is accurately controlled by these metering devices equipped with calibrated water scale in l/min. They supply the necessary water quantity for the adiabatic cooling of the air and the excess quantity needed to remove debris from the surface of the pads. They are pre-set at the factory according to the size of the unit and its anticipated performance, but they can be re-adjusted in the field depending on local conditions.

Service Switch

If local regulations warrant it, a Service Switch can be installed next to each fan, as an optional item, allowing the interruption of the power supply before any intervention is needed to a particular fan. The switch is supplied in an IP65 enclosure.

Fin Epoxy Coating

If resistance to corrosion in aggressive environments is needed, then, as an optional feature, the heat exchangers can be constructed with aluminium finstock coated on both sides with epoxy lacquer.

Sloping Fully Drainable Gutter

Any excess city water after wetting the pads cleans them from any debris and drains itself through fully drainable sloping gutters ensuring that no stagnant water remains behind.

Pre-cooler Frame in Stainless Steel

As an option, the pre-cooler frames can be furnished in heavy gauge stainless steel construction.
General Specifications

HEAT EXCHANGERS

The Finned Coil Heat Exchangers of the Coolers and Hydrofluorocarbon refrigerant Condensers consists of SF-Cu seamless tubes and aluminium fins. Staggered tube construction provides substantially higher capacity since more tubes are exposed to the air stream. The advanced rippled-corrugated fin design creates a state of continuous turbulence, which effectively reduces the boundary layer formation that could otherwise reduce the rate of heat exchange. Fins have full drawn collars to maintain fin spacing and provide a continuous surface cover over the entire tube. The tubes are mechanically expanded into the fin collars to provide a continuous primary to secondary compression bond over the entire finned length for maximum heat transfer rates. Headers are made of seamless copper tubing and the coils are circuited for counter-flow heat transfer to provide the maximum mean effective temperature difference. The headers have steel flanged connections. The entire coil block is air pressure tested under warm water.

The Finned Coil Heat Exchangers of the Adiabatic Ammonia Condensers consists of Grade TP304L stainless steel tubes and aluminium fins. Headers are made of stainless steel Grade TP304L tubes and the coils are circuited for counter-flow heat transfer. The headers have stainless steel flanged connections, as standard. The entire coil block is air pressure tested submerged in warm water.

The Condenser Finned Coil Heat Exchangers are manufactured in strict accordance to the ‘Quality System Manufacturer’ of the EU Directive for Pressure Equipment under the inspection of TÜV NORD.

AIR MOVEMENT

The Air Movement Package combines premium aerodynamic and acoustic performance with innovative design to offer a compact fan and motor as an integrated product. It heralds a new era in fan design and technology, extending and setting new standards of innovation, performance and reliability. The fans have been designed and tested by the fan manufacturers to the SPARTIUM® specifications as their proprietary component. Furthermore, increased electricity savings are achieved by the use of fan motors with permanent-magnet rotors, due to their higher efficiency. Motors with this technology are primarily known as ‘EC motors’, or as ‘soft commutation’ motors. The result for the customer is low-noise operation. With the selected fans there is no motor noise variation across the entire speed range. The advantage is that when demand for cooling is low, such as during operation at night, very low operating speeds can be selected, resulting to extremely reduced absorbed power.

Motor Electrical Details

- **Electrical characteristics**
  - EC’ motors: 380...480 VAC 3 ph 50/60 Hz
  - AC’ motors: 400 VAC – 3 ph – 50 Hz
- **Protection category**: IP55
- **Insulation Class**: F
- **Power rating**
  - EC’ motors: 3450 W
  - AC’ motors: 6600 W
- **Nominal Speed**
  - EC’ motors: 1190 rpm
  - AC’ motors: 955 rpm
- **Continuous running from**
  - –40°C to +60°C
- **Overall Efficiency**
  - ≥50% (required 2015 36.9%)*
- **Efficiency Grade N**
  - ≥51 (required 2015 N=40)*

*Data according to European Commission Regulation [EU] 327/2011
Depending on the location of the installation, or local codes, the SPARTIUM® units can be equipped with the following optional items:

- Pre-cooler frames in stainless steel
- Service switch for each fan
- Fin epoxy coating of the heat exchangers
- Electrical Heater in the electrical panels
- Controller communication cards for all common protocols
- Cloud based remote monitoring and intelligent diagnostics

**STEEL SUPPORTING FRAME**

Structural elements and panel enclosure are constructed by using heavy gauge hot dip galvanized steel with an innovative metallic coating on both sides that offers protection in the harshest environments. The coating consists of a metallic chemical composition of zinc with aluminium and magnesium, which creates a stable and durable layer across the entire surface and gives a far more effective corrosion protection.

**ADIABATIC PRE-COOLER**

The cooling pad section serves as an adiabatic saturator to cool the incoming air. It consists of specially impregnated and corrugated cellulose paper sheets with flute angles that have been bonded together. It provides high evaporation efficiency while still operating with a very low pressure drop. The impregnation procedure for the cellulose paper ensures a strong self-supporting product, with high absorbance, which is protected against decomposition and rotting. A piping circuit supplies the evaporative fluid, such as city water, to a distribution manifold and the rate of the water flow is initially regulated by a special metering device which throttles the correct flow rate. An inlet air edge coating developed specially for harsh and tough conditions prevents the pad surface from extreme environmental hazards, such as dirt, sand storm, and risk of bacterial and algae growth.

A distribution pad on the top of the cooling pad ensures an even water distribution and minimizes the risk of dry spots. The water flows down the corrugated surface of the evaporative cooling pad. The incoming warm and dry air that passes through the pad evaporates most of the water. Any remaining water assists in washing the pad, and is drained to the gutter through a sloping pan. The air that leaves the pad is therefore cooled and humidified simultaneously without any external energy supply, thus adiabatically.

**ELECTRICAL & CONTROL PANELS**

The SPARTIUM® Adiabatic Cooler is delivered complete with an Electrical Power panel section and an Electrical Control panel section, all fully wired. The complete Electrical Power panel consists of an IP66 protection category to IEC60.529, NEMA 4, enclosure, with a main power switch, an emergency cut-out switch, a circuit breaker for each fan and a 400V/230V/24V transformer with auxiliary fuses. For units with AC fan motors, a Frequency Converter is installed in the Power panel together with a fan and filter unit for dissipating its heat load, and as an optional equipment a converter by-pass Switch is available.

For extreme cold climates an Electrical Panel Heater thermostatically controlled is also offered.

The electrical Control panel section is supplied with 24V and includes:

- Its own Main Switch
- A microprocessor controller with display, wired to an ambient air sensor, immersion entering and leaving fluid temperature sensors, or pressure sensor in the case of condensers.
- A Pad Maintenance Switch

The intelligent logic of the unit provides for Day/Night operation to keep lower sound levels; a free-cooling pre-programmed set-point; ‘ban water’ operation in case of water usage prohibition; automatic periodical cleaning cycle of the pads; BMS communication with all common protocols.

In the case of a multiple unit installation special software allows the possibility of a Master/Slave configuration of the entire installation.

**OPTIONAL COMPONENTS**

Depending on the location of the installation, or local codes, the SPARTIUM® units can be equipped with the following optional items:

- Pre-cooler frames in stainless steel
- Service switch for each fan
- Fin epoxy coating of the heat exchangers
- Electrical Heater in the electrical panels
- Controller communication cards for all common protocols
- Cloud based remote monitoring and intelligent diagnostics
Manufacturing Excellence

SPARTIUM® has achieved manufacturing excellence over half of a century in the HVAC industry by applying vertically integrated methods in manufacturing using the latest state-of-the-art production machinery. It applies a strict Quality Management System as per EN ISO 9001:2015 in accordance with TÜV NORD CERT procedures, and a Quality System for ‘Pressure Equipment Manufacturer’ according to the EU PED Directive, authorizing to affix the CE sign. The SPARTIUM® equipment are accompanied by a Declaration of Conformity to EU Standards and Directives. In order to meet requirements of international standards in the global markets, U.S.A. and Canada in particular, SPARTIUM® obtained certification by UL® following testing of its products in the UL® laboratories.

Sound Performance

In today’s dense populated cities low sound levels are strictly enforced and a main criterion for equipment selection is their sound propagation. The design of the SPARTIUM® equipment and the procurement of their components is concentrated on the lowest possible level of noise emission. Although the production cost of any equipment is inversely proportional to its noise level, in the case of the SPARTIUM® units there is no compromise between the material cost involved and the achieved benefit in terms of noise reduction. Since the fan operation is the main source of noise, the fan and motor development is hinged on their sound performance. Furthermore the operational logic software of the units takes advantage of every possible opportunity of noise reduction, such as during night operation, or lower fan speeds, by timely adiabatic application during the operation cycle of the units. The units are sporadically tested for their sound performance using the most advanced instruments, according to the ‘sound intensity’ method and ISO 9614-1 standard.

Pressure Tests for Leakage

Each complete heat exchanger after its final fabrication is tested for leakage. The test is carried out by air pressure in warm water for sufficient time to ensure that there is no leakage. The test pressure is in conformity to the latest EU Directive for pressure equipment and the UL® specific standards.