



Market Unit brochure



AIRPORTS

Cavotec is a leading engineering group that designs and manufactures automated connection and electrification systems for ports, airports and industrial applications worldwide.

Our innovative technologies ensure safe, efficient and sustainable operations.



Our Markets

Ports & Maritime

Electrification and automation from berthing to shipping.

Cavotec develops and manufactures innovative automation and electrification technologies for the global ports and maritime sectors.

We continually innovate and develop our technologies to ensure that we deliver the levels of operational performance, safety and sustainability that our customers demand at all types of ports and terminals.

Cavotec is the global leader in automated mooring, shore power, crane electrification, and connection and charging systems.

Airports

Powering, cooling and fuelling aircraft.

Cavotec is a leading Ground Support Equipment (GSE) specialist, developing state-of-the-art systems for gates, remote aprons and Maintenance Repair & Overhaul (MRO) hangars for commercial and military applications.

Cavotec's comprehensive range of systems includes 400Hz and 28VDC Ground Power Units (GPU), Pre-Conditioned Air (PCA) systems, wet services and fuel systems integrated under passenger boarding bridges (PBB), as well as in-ground and tunnel systems.

Industry

Connecting, powering and controlling industry and mining equipment.

Cavotec develops technologies that drive productivity and contribute to customers' operational efficiency. We improve existing systems, and bring new technologies to the market to meet the cost and operational challenges our customers face. We support customers in a wide variety of industrial sectors, such as cranes, energy, processing and transportation, surface and underground mining, and tunnelling.

Our solutions for the Industry & Mining sector include motorised cable and hose reels, Human Operator Interface (HOI) systems, Radio Remote Controls (RRC), power connectors, slip rings and spring driven cables and hose reels.

AIRPORTS

Cavotec is a leading GSE specialist, developing state-of-the-art systems for gates, remote aprons and MRO hangars for commercial and military applications.



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Who works with us:

Aircraft manufacturers

- Airbus
- Boeing Corporation
- Bombardier
- Dassault Aviation
- EADS
- Lockheed Martin
- Shaanxi Aircraft Company

Airports

- Bahrain
- Barcelona
- Beijing
- Chicago O'Hare
- Dubai Airports
- Frankfurt Airport
- Heathrow International Limited
- Hong-Kong International Airport
- Los Angeles
- Miami
- Paris Charles de Gaulle Airport
- Phoenix
- Shanghai Pudong International Airport
- Singapore
- Soekarno-Hatta

OEMs

- Adelte
- CIMC TianDa
- ShinMaywa
- ThyssenKrupp



OUR OFFERING

Cavotec is a leading GSE specialist, developing state-of-the-art systems for gates, remote aprons and MRO hangars for commercial and military applications.

Working closely with customers and industry bodies, we develop fully integrated gate and remote apron systems that minimise the use of Auxiliary Power Units (APU), thereby reducing fuel costs and emissions. We act as a solution integrator to deliver turnkey systems.

Cavotec's comprehensive range of systems meet all aircraft requirements including the New Aircraft Generation (NGA) such as A380, B787 and A350.

Our innovative systems include:

- 400Hz and 28VDC Ground Power Units (GPU)
- Pre-Conditioned Air (PCA)
- In-ground utility pits
- Wet services
- Fuelling

Our solutions are engineered based on Point of Use or Central systems and integrated above ground, as well as in-ground and tunnel systems.

Cavotec E³ Gate

Cavotec E³ Gate is a fully integrated design that minimises APU usage and increases operational efficiency by providing 400Hz power, PCA, wet services and fuelling services via in-ground pits.



Gates

The airports sector continually looks for ways to improve airport capacity and connectivity, reduce environmental impact, and improve the service it offers to airlines and passengers. Cavotec supports these aims with systems that ensure critical aircraft services are available directly at the gate, guaranteeing that aircraft are serviced quickly and efficiently.

Cavotec offers decades of expertise in providing design and engineering turnkey solutions for Point of Use or Central 400Hz GPUs, PCA and fuelling.

Remote aprons

Cavotec's advanced 400Hz, PCA, wet services and fuelling systems ensure safe and efficient aircraft servicing at passenger, cargo and military remote aprons. We seek to reduce the amount of mobile equipment present on the apron, thereby improving service of aircraft, reducing maintenance and operating costs and ultimately improves airports profitability.

Our in-ground pit systems minimise tarmac congestion, improve efficiency and reduce environmental impact. This helps airlines and airports to enhance passenger movement and achieve safety and environmental targets.

In addition, in-ground pit systems reduce the incidence of collisions between mobile GSE and aircraft, which represents a substantial risk for high cost for the industry.

Hangars

Cavotec offers unrivalled expertise and an extensive systems portfolio for commercial and military MRO hangars. Our advanced GSE systems support modern facilities to provide a full spectrum of maintenance and overhaul services for fixed and rotary-wing aircraft.

We also support a wide variety of customers with the design and engineering of maintenance base layouts, including Point of Use or Central 400Hz ground power, PCA handling units and fuel exhaust systems.

Cavotec holds one of the largest customer base of commercial and military MRO facilities and assembly lines. Our systems are used in Airbus A350 and A380 and Boeing 787 hangars and assembly lines, at Lockheed Martin and Eurocopter assembly lines, and by air forces and naval bases.

Design support for Special Aircraft Services (SAS)

- Feasibility study and ROI.
- Gate and hangar layout - aircraft accommodation by type, now and in the future.
- Planning, design and system integration.
- System validation.

For Ground Power, PCA, wet services, fuelling, in-ground pits, delivery hoses and cables, connectors.



Design

Cavotec's Airports Market Unit offers expert Airport Electrical & Mechanical Design Services.

We design advanced, specialised systems - including 400Hz, PCA, wet services, fuel hydrant and tank farm systems - for airports and MRO hangars for all types of operations and aircraft.

Cavotec consulting services provide advice on in- and above-ground GSE systems, and plays a key role in reducing operational costs, improving ramp safety, and reducing environmental impact.

Cavotec E³ Gate

Integrated ramp design to minimise APU usage and reduce ramp equipment clutter.

The Cavotec E³ Gate System is based on more than 135 years' combined experience of Cavotec Fladung, Cavotec Dabico and Cavotec INET.

E³ stands for: Ergonomics, Economy, Environment.

We have designed the E³ Gate System in response to increasingly exacting performance standards set out by airports, airlines, aircraft manufacturers and aviation authorities. The industry is required to service aircraft more safely and efficiently, with a quicker return on investment than ever before, while minimising environmental impact.

Benefits of Cavotec E³ Gate System

- Represents substantive progress towards sustainable, highly efficient airports.
- Reduce OPEX and maintenance costs.
- Improved ergonomics, economy and reduced environmental impact.
- A unique tool with which to drive gates efficiently.
- Reduced Airport congestion.
- Faster turnaround times (TAT).
- Reduced use of APU and GSE vehicles.
- Reduced incidence of mobile GSE accidents.
- Reduced damage to aircraft, lower airport premiums.
- Improved efficiency and safety of ground operations.
- Fewer personnel required on the tarmac improves safety around aircraft.





POWER CONVERSION SYSTEMS – 400Hz, 28VDC

Cavotec has been at the forefront of innovative Central and Point of Use 400Hz systems, including Solid State Frequency converters, Rotary Motor Generators, in-ground 400Hz utility pits and cable coilers for 50 years.

This diversity of experience with systems and products has made us the leader in power distribution and delivery.

The Group designs and engineers turnkey 400Hz solutions from the 50/60Hz converter input power up to aircraft 400Hz connection points, 400Hz in-ground pits and cable coilers that deliver required power through Cavotec 400Hz jet cables.

More than 10,000 Cavotec 400Hz systems are installed worldwide. Our equipment has been in operation at international hubs, in the harshest of ambient environments for many years. Our systems meet the power requirements of new generation aircraft (A350, A380, and B787).

Cavotec's 400Hz Power System complies with the all relevant industry standards, including DFS-400, MIL-STD- 704F, and exceeds ISO-6858. Cavotec guarantees complete system performance at the aircraft connector for its turnkey solution.



Cavotec's 2500+ Series 400Hz ground power units integrate outstanding electrical performance with advanced communication capabilities.



400Hz GPU – Point of Use Solid State Frequency converter

Cavotec 2500+ Series

Cavotec 400Hz solid state GPUs are based on its advanced 2500+ Series. A self-contained unit designed to global standards for a global market, the 2500+ Series is a single product that meets the needs of airports, airlines and ground handlers. These units are installed at gates, remote aprons or MRO facilities, and in fixed or mobile configurations.

Electrical performance

Cavotec 2500+ standard technical characteristics:

- 90kW GPU.
- Up to 500 per cent overload capacity.
- Continuous power factor 1.
- Operational temperature up to 60°C/140°F, ambient at all load conditions.

Cavotec 2500+ PowerPack I-Connect

The Cavotec 2500+ PowerPack I-Connect is a complete 400Hz system fixed on PBB to power parked aircraft at the gate.

The integrated 400Hz system is a stand-alone unit including the unique technologies of Cavotec Series 2500+ converter and a motor-driven reel, distributing 400Hz power to aircraft with automatic reeling of the 400Hz aircraft cable.

Cavotec 2500+ Combi

A Solid State Frequency converter that integrates a 28VDC/600A rectifier to service regional aircraft.

Cavotec 2500+ Converter caddy

The Cavotec Converter Caddy is a mobile unit on which the 2500+ GPU is mounted with 50/60Hz input cables and 400Hz jet cables and plugs. The caddy is either manual or battery-driven to reduce operational costs and emissions.

The 2500+ technology platform ensures our customers can use one standard solution at their facility and for their various operations:

- Horizontal design mounted under the PBB or on a cart for mobile applications.
- Vertical design mounted on the ground.
- Horizontal design integrated with a 400Hz cable coiler (PowerPack I-Connect).

Advanced communication

Featuring Cavotec intuitive Skyway Interface and communication platform, the 2500+ helps airports to make considerable improvements in operational efficiency and data collection. It provides operators with easy access to the procedures that they use most frequently and increase the product serviceability.

Cavotec's Central Motor Generator (MG) systems offer simplicity, longevity, scalability, and low operating costs.



400Hz GPU – Central system Rotary Motor Generators

Series RVA

Cavotec designs fully integrated 400Hz centralised systems. Our strong R&D capabilities gave powerful added applications to the original MG set designs as we developed the first vertical synchronous MGs for greater power, smaller size, higher efficiency, longer life and reliability and the first automatically paralleable 400Hz vertical synchronous MG.

Our 400Hz MGs can be supplied with 50Hz or 60Hz power input, 60kVA to 450kVA 400Hz and output voltages are available at 200V, 575V, 960V and 2,400V.

The long life synchronous vertical motor generator sets are configured for precision aircraft ground power systems and include a transformer at each gate (gate box) that steps down the voltage to the required 115/200V power.

Our 400Hz MGs meet all power requirements of the latest aircraft, as well as 400Hz avionics and radar equipment. To date, we have delivered more than 3,000 MGs, representing a total capacity of more than 600 megawatts.

Cavotec advanced control panel, equipped with a touch screen, ensures a live monitoring of the central 400Hz plant and can be interfaced with the airport BMS and SCADA systems.

Benefits of Central system

- The equipment is protected from environmental factors.
- Reduce the total installed base according to the planned utilisation of the power therefore reducing the CAPEX and OPEX.
- Easier access to equipment for maintenance or repair, limiting disruption of airport operations.
- The Central system offers the possibility to easily upgrade the power output by adding more units as the airport capacity requirements increase.

400Hz GPU – Gate service boxes

Series ASC

Cavotec Series ASC gate service cabinets are designed for use with the company's centralised 400Hz ground power systems that use a distribution voltage of up to 960V.

Each unit includes a continuously-rated step-down transformer to 200/115V, optional line drop compensator (LDC) and controlled outputs up to 90kVA each. The outputs have a contactor,

E&F interlock and a full protection/alarm circuit. Units are available in continuous ratings of 45kVA, 90kVA, 140kVA and 180kVA, as used in labs, test stands and for certain military applications.

No-Break Power Transfer (NBPT) features on modern aircraft are fully supported and tested. RS485 remote monitoring is also available.

Cavotec's in-ground power utility pits are designed and positioned to service all types of aircraft, and to allow for future flexibility. Our pit systems also reduce the incidence of vehicle collision with aircraft. Direct costs of ground collisions and ramp accidents amount to several billion dollars annually¹.



400Hz in-ground connection systems

Cavotec is the worldwide leader of in-ground pit systems.

Our in-ground pop-up and hatch pit systems are user friendly storage units for 400Hz jet cables and plugs (up to four), and other facilities such as 50/60Hz outlets. Located very close to aircraft 400Hz receptacles, they are the optimum solution for reducing APU use at parking positions.

Benefits of Cavotec in-ground 400Hz pit systems

There are a number of operational advantages to installing 400Hz power supply pit systems in the apron in the vicinity of the aircraft service connection point:

- Easy, ergonomic access of the 400Hz connector due to the pit's high operating position, limiting physical effort for ground operators and reducing accident risks.
- Reduced maintenance costs, extended service life for the 400Hz cable and aircraft connector.
- Only one Pop-up pit is required for Code F aircraft, (A380-800 is serviced with one pop-up pit including four connectors or 2 hatch pits). Load class EN124 Class F900
- A gate can be provisioned for aircraft upgrades: e.g. one Pop-up pit with 2x400Hz plugs for Code E can be upgraded for Code F with the addition of two connectors.
- No need to lay 400Hz cable between the PBB and the aircraft 400Hz receptacles: longer service life for cables, improved safety for ground operators, eliminating the issue of the 400Hz cables blocking the path between the PBB and the aircraft (on the left-hand side).
- A 400Hz pit can be provisioned with 1x125A socket for B787 in order to connect Cavotec 2500+ 90kW mobile Solid State Frequency converter in case of starting the APU with the third 90kVA aircraft plug located under the aircraft.

Tunnel systems

Existing aircraft parking areas at terminals and hangars typically have not been designed for optimal use of ground support services.

When using a full-scale tunnel system with in-ground services from Cavotec, all essential ground support services are available close to parked aircraft. 400Hz GPU, PCA, Wet Services are located inside the tunnel below the aircraft body and connected via in-ground pits.

These systems offer airports improved operational efficiency and reduced environmental impact. Our tunnel systems also allow additional services to be added over time, i.e. potable water and blue water reducing the number of vehicles around the aircraft.

¹ According to: Flight Safety Foundation (FSF) - Ground Accident Prevention (GAP) program at https://flightsafety.org/wp-content/uploads/2016/09/asw_may07_p20-24.pdf; and Twiga Aero, IATA strategic partner at [http://magazine.groundhandling.com/article-images/155744/WhitepaperSolutionstotheHighCostsofAircraftGroundDamage\(1\)%20\(1\)%20BRENDA.pdf](http://magazine.groundhandling.com/article-images/155744/WhitepaperSolutionstotheHighCostsofAircraftGroundDamage(1)%20(1)%20BRENDA.pdf)

Cavotec's extensive range of 400Hz ground connector solutions are used by all types of airports, airlines and ground handling companies worldwide. Cavotec supplies solutions based on specific client requirements and budgets.



400Hz above ground connection systems

400Hz cable coilers

Cavotec 400Hz modular coilers are motorised reeling systems fixed either under the PBB or on the ground. They ensure fast and ergonomic reeling and storage of 400Hz cables and plugs. Our user friendly cable coilers improve the safety of ground handling, and are equipped with 28m of usable 400Hz service cable.

400Hz cable reelers

Cavotec 400Hz cable reeler connect and power parked aircraft. Integrated on the side of PBB, the units are a new solution for operators wanting to create space underneath PBB, and improve ground level clearance.

400Hz cable hoists

Cavotec cable hoists provide elevated stowage for 400Hz and 28.5VDC load cables and connectors, thereby removing cables from the tarmac and away from ramp operations. Using an included limit switch, hoists can be interlocked with PBB to prevent bridge movement until 400Hz cable is fully elevated.

Caddies

Cavotec caddies are mobile manual or battery driven carts equipped with or without a 400Hz Solid State Frequency converter. They can either be used as a cable extender when connected to a converter or as a mobile electrical 400Hz GPU when equipped with a converter. They provide a unique mobile zero emission solution for airports.

400Hz jet cables and plugs

Cavotec 400Hz plugs have changeable nose and contacts for a longer service life and reduced maintenance costs. Our popular SP model can be integrated with our 400Hz in-ground pits or cable coilers.





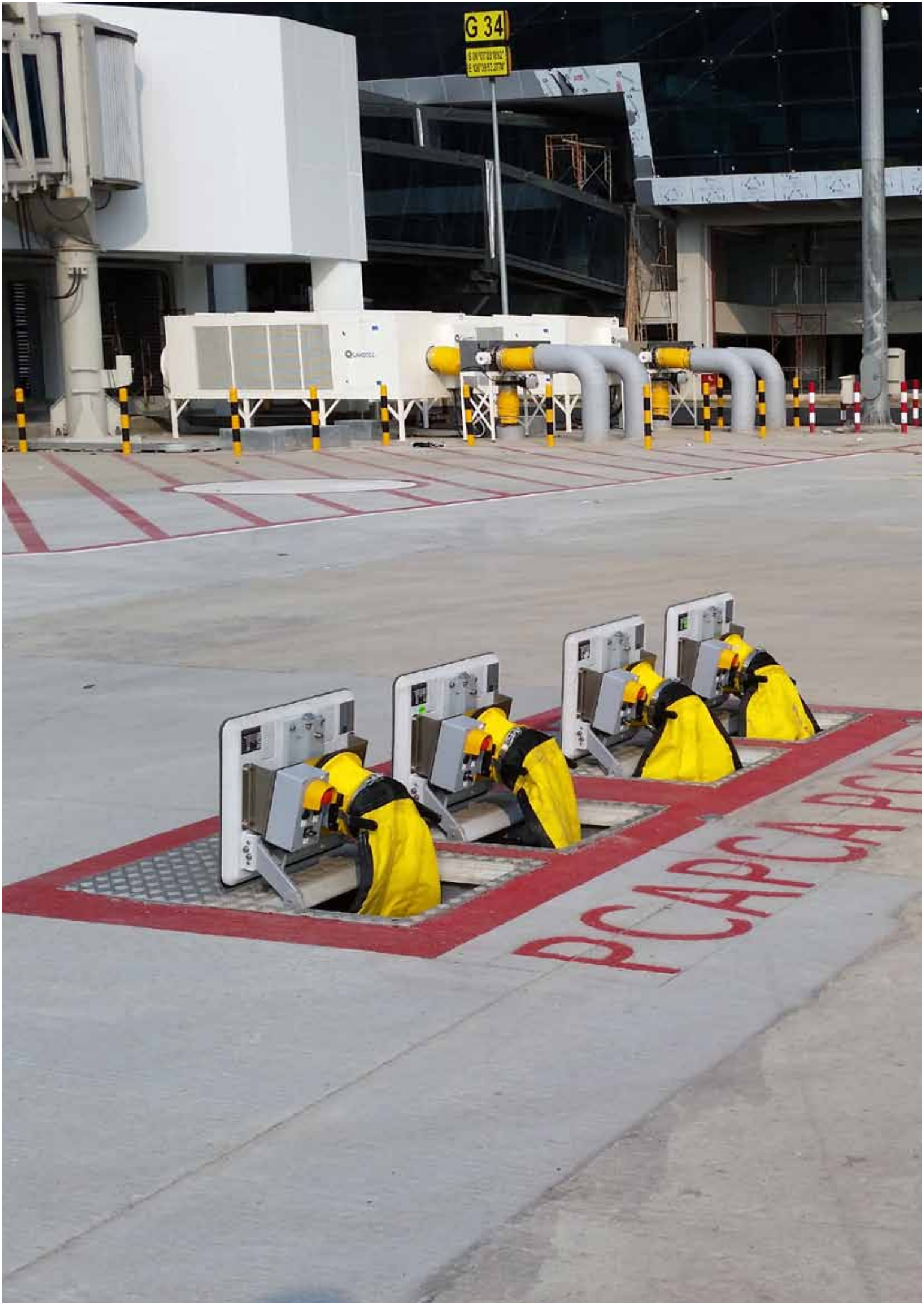
GROUND COOLING SYSTEMS – PCA

Cavotec is the only supplier of fully integrated PCA systems, and has led the development of ground cooling systems for five decades.

We offer one of the broadest ranges of Central, (AHU and DX Boost), and Point of Use, (DX PCA), PCA systems, in full compliance with IATA AHM974, AHM997, ASHRAE. Indeed, our PCA systems were the world's first to gain AHM997 approval.

With 8,500 PCA units installed worldwide, Cavotec helps ensure that all types of aircraft APU - including on the Airbus A380 - can be switched off even in harsh ambient conditions in Asia and the Middle East.

Cavotec engineers optimise entire system design, including power requirement, air flow distribution, and temperature from PCA outlets to aircraft inlets.



Cavotec manufactures a wide variety of Central and Point of Use PCA systems, including fixed, mobile, above-, in-ground, and subfreezing, all of which meet or exceed performance requirements.



PCA systems – AHM974

Cavotec has been at the forefront of airport PCA technologies for decades. Based on IATA AHM974, Cavotec designs and manufactures two types of systems: PoU, based on Direct Expansion (DX), and Central systems incorporating two technologies: DX Boost and Air Handling Units (AHU).

Integrated with Cavotec PCA in-ground pits, these systems ensure highly efficient aircraft cooling.

PoU PCA – Direct Expansion (DX)

Cavotec Series DX PCA are self-contained fixed or mobile electrical air handlers with vapour cycle direct expansion. Ranging from 30T to 120T, they are in compliance with AHM974 and designed for cooling up to A380 under the Middle East ambient conditions with multiple cooling stages. Mounted on a simple chassis for towing, or truck-mounted, they can also be used on remote aprons.

Central PCA – DX Boost

Cavotec Series PAC DX Boost PCA are hybrid air handlers with two cooling stages, (water circuit with central chilled water plant and vapour cycle direct expansion). Designed according to AHM974 ratings from 30T to 90T, these units service a full range of aircraft, from narrow-body to the A380 configuration.

Central PCA – Air Handling Unit (AHU)

Cavotec Series PAC are lightweight air handlers, connected to a centrally chilled water plant with one or two water circuits (EGW or CW+EGW). Designed according to AHM974 ratings from 30T to 90T to service a full range of aircraft from narrow-body to the new A380 configuration.





PCA systems – AHM997

Working closely with the industry, Cavotec has improved the performance of PCA cooling in demanding ambient conditions.

Cavotec was instrumental in the development of the IATA AHM997 standard; and our PCA systems installed at Bahrain International Airport in 2009 were the first in the world to be approved under the standard.

Our subfreeze PCA systems have opened new scope for efficient aircraft cooling, including A380 Code F aircraft in warm climates.



Central PCA – DX Boost Sub-Z

Cavotec Series PAC DX Boost Sub-Z are Hybrid Air handlers with multiple cooling stages (water circuit with central chilled water plant and vapour cycle direct expansion).

Designed as per AHM997 in ratings to service a full range of aircraft from narrow-body up to the A380 configuration with a minimum discharge temperature of -25°C (-13°F).

Located on the apron and connected to Cavotec PCA in-ground pits, Cavotec PCA technologies play a pivotal role in cooling aircraft in order to achieve the highest levels of service, readiness and passenger comfort.



Central PCA – Pre-compressed Air (PCAir)

Cavotec Series PCAir are engineered based on the Brayton cycle with expanded pre-compressed air system generated from a central compressed air central room and distributed to PCA expanders.

Designed as per AHM997 and with less than 1.7g water/kg dry air and in ratings to service a full range of aircraft from narrow-body up to the A380 configuration with a minimum discharge temperature of -25°C (-13°F). A further advantage of the system is the use of air as a working medium, environmentally benign as opposed to refrigerants, totally safe and non-toxic.



Cavotec PCA pits are designed and positioned to service all types of aircraft up to Code F, and allow for future flexibility.



PCA in-ground connection systems

Cavotec's in-ground PCA systems are a proven and cost effective collision avoidance solution. Whether at single-aircraft or Multiple Aircraft Ramp System (MARS) gates, our in-ground pits protect PCA hoses and reduce airflow losses. They can also be adapted for future configurations, reducing capital expenditure.

These systems also store up to two PCA hoses and other facilities, such as potable water supply. Located close to aircraft PCA inlets, these systems reduce cooling losses and the incidence of pressure drops, ensuring a faster and efficient aircraft cooling.

Cavotec's in-ground PCA technologies are a key way for operators to cut TAT times, eliminate emissions, improve safety, and reduce the risk of accidents.

Benefits of Cavotec PCA in-ground pits

Cavotec PCA in-ground pits installed at the apron in the vicinity of aircraft service connection points, improve ground handling operations in the following ways:

- Reduced hose length reduces heat gain and airflow loss.
- Improved air quality for passengers in the cabin due to vertical PCA hose storage in the pop-up pit. Vertical storage enables efficient draining of condensed water and ventilation of the hose, avoiding potential sanitary risks such as fungus and bacteria growth inside the hose.
- Vertical storage of the PCA hose allows efficient storage of flexible hoses with a steel spiral, this guarantees a constant cross section in bends thereby eliminating loss of mass flow due to stalling blowers.
- Storage of flexible PCA hoses in pit- systems minimises contamination risk and FOD entering the hose.
- Reduces the sanitary risk for aircraft passengers.
- Pit systems provide efficient and safe operation for MARS compliant with the new AHM-997 Subfreezing ground cooling standard.
- Option to include potable water for refilling aircraft, (no need for potable water trucks). The system also improves the quality of water discharged to aircraft, (circulating water loop permanently chemically treated).
- Collision avoidance for Wet Services (potable/ blue water and sewage).



PCA above ground connection systems



PCA hose reel

Cavotec PCA hose reel is a motorised device that connects PCA to parked aircraft. These units are mounted on PBB or pillars. Their design ensures optimal PCA flow and limits air loss, thereby improving PCA cooling. The motor-driven coiling drum is equipped with insulated 14" Layflat PCA hose, and is operated by Radio Remote Control of bridge panels.

Telescoping Air Duct (TAD)

Cavotec Series Telescoping Air Duct (TAD) transports hot and cold PCA across telescoping sections of apron-drive PBB. The duct is fully insulated, flame-proof and smoke retardant, and prevents air loss and drops in pressure. TAD is comprised of sections of fibreglass and internal insulating urethane foam.



PCA connector/nozzle/hose

Cavotec manufactures customised PCA hoses and connectors that maximise the cooling effect between PCA handling units and aircraft inlets.

Cavotec's patented sub-freeze PCA connector, designed according to AHM997, allows monitoring of temperature and pressure at the aircraft inlet. Our PCA hoses can be insulated or non-insulated, and our connectors feature handles to speed ground operations.





WET SERVICES SYSTEM

Cavotec's Wet Services pit system is engineered in partnership with Aqseptence Group and Roediger Vacuum.

The system manages potable and blue water, and sewage, via in-ground pits and connected to aircraft.

The system comprises two main parts: a central treatment plant - (including potable and blue water generation and storage, and a sewage vacuum system) - connected to Cavotec in-ground pit systems, they avoid the use of three sets of mobile GSE vehicles, thereby improving safety.



Cavotec's Wet Services System has been adopted by several airports. Its implementation has resulted in more efficient ground handling, reduced emissions and TAT.

The Wet Services System is based on a central plant with three services provided to aircraft via in-ground pits:

- Potable water – for cabin drinking water.
- Blue water – for flushing of aircraft toilets.
- Toilet sewage removal.

Main components

- A central treatment plant where potable and blue water is generated and stored before distribution.
- Sewage is discharged from the aircraft by vacuum and subsequently either collected in storage tanks or discharged directly to the airport or municipality network.
- Potable and blue water is distributed to each aircraft parking position through underground pipes from the central wet services plant.
- At each aircraft parking position, there are one or two pits: one for potable water, (included in the PCA pit), and one for sewage and blue water. Flexible hoses are stored in the pit, and are connected to the aircraft as required.

Benefits

- Improved flight punctuality due to no longer relying on service vehicle availability.
- Reduced noise and emissions from the electrically driven system.
- Security and safety: reduced security and safety issues and indirect investment to control heavy flow of personnel working at gates or aprons.
- Reduced risk of collision: reduction of insurance premiums as underground pits reduce incidence of collision between mobile wet services GSE and aircraft.
- Faster TAT: increased gate utilisation with faster aircraft TAT and services already available at the gate.
- Prevents runway incursion as no mobile GSE are required.
- Reduced operational and maintenance due to fixed systems and one ground operator in contrast to mobile GSE.
- No requirement of mobile GSE capital investment for servicing aircraft wet services.
- No fleet management system investment required.





AIRPORT FUELLING SYSTEMS

Cavotec's engineering and systems integration expertise has seen the Group lead the development of aviation ground fuelling solutions for military and civil applications for many years.

Cavotec Dabico revolutionised the aviation sector with its introduction of the fuel hydrant pit box that enables refuelling via an underground fuel hydrant line. All major airports have adopted the fuel hydrant system, improving productivity, reducing airport congestion and improving safety.

Cavotec E³ Fuelling illustrates our wide fuelling portfolio engineered and manufactured based on the highest industry standards (API, TÜV, STS-M, MIL-N-5877).



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wines

L-15

L-15

Cavotec is an advanced fuel system designer, integrator, and commissioner.



Commercial fuelling

Fuel System Design and Integration

Cavotec Meyerinck and Cavotec Dabico commercial and military hydrant systems have been in use in the industry for more than 40 years.

We work closely with major oil companies, airports and defence organisations to test innovations, and meet and exceed customer requirements and standards.

Commercial fuel hydrants

Cavotec Dabico commercial fuel hydrant pit assemblies provide on/off and pressure/flow control for a wide variety of commercial applications.

These units are available in one and two-piece (environmental) designs, with bottom or side entry pipe-work, and pits manufactured in either high-grade fibreglass GRP, fabricated, coated or steel.

All our fuel hydrant pit systems comply with relevant JIG standards, including JIG 90 Bulletin.

Pantographs

Cavotec Meyerinck Pantographs are compatible with military and commercial aircraft, and perform fuselage and under-wing refuelling operations.

Our pantograph systems service all types of USAF, USN and NATO military aircraft, and can be operated by a single person. The innovative design eliminates the need for hoses, and it allows refuelling with engines running and hot brakes.

High-/Low-Point pit assemblies

Cavotec Dabico Low-Point drain pit assemblies remove any non-fuel fluids and other contaminants from fuel lines.

Our High-Point vent pit assemblies remove air pockets from fuel lines, thereby preventing compressed air build-up.





Military fuelling

Military Fuel Hydrant pit assemblies

Cavotec's innovative military fuel hydrant pit assemblies efficiently dispense fuel to tactical and strategic aircraft. The assemblies provide on/off or pressure/flow control.

Unique waterproof covers and frame assemblies, fitted with aluminium doors, prevent fluids and debris from entering pits when closed. Patented torsion spring actuated covers maximise available workspace within the pit assembly. These assemblies are also spring actuated or have counter weighted covers.

Aviation Fuelling Arms

Cavotec Meyerinck fuelling arms are hose free pantographs that refuel aircraft safely, quickly and efficiently without the need for dispensers or tanker trucks. Our fuelling arms directly refuel wide-body aircraft, tactical aircraft, helicopters and tanker vehicles at airports and airfields throughout the world.

Since 1980, Meyerinck's stainless steel fuelling arms have seen service in military and commercial applications around the globe. Cavotec also manufactures a comprehensive range of fuelling equipment accessories such as flow meters, including venturi mechanisms, filters and hydrant couplers.





Isolation valve chambers

Cavotec isolation valve chambers are pre-fabricated and aircraft load rated - to a maximum of 900kN - and are sand-, dust-, and water-proof.

Their unique cover design provides full overhead access, allowing one hand opening, (without the need for any electric, hydraulic or external mechanical lifting equipment), and enable easy on-site installation.

Unique design features ensure long-term mechanical protection for valves in the pit assembly. They are also compatible with military and commercial fuel systems.



Vault Access Pit Covers

Prefabricated vault access pit covers provide easy access into prefabricated fibreglass vaults or concrete chambers for operational and maintenance requirements of in-ground systems. The covers are dimensioned for easy entrance and exit of personnel (max. cover lift weight 12kg), allowing for easier routine maintenance access or emergency access for removal of personnel overcome by fumes.

Cavotec Dabico vault access covers have a waterproof cover frame preventing fluids and dirt/debris from entering the vault/pit area.

All Cavotec Dabico covers are aircraft load rated with a 4:1 safety factor.



Fuel Isolation Valve Pit Assembly

Cavotec's fuel isolation valve pit assemblies house isolation valves - DBBV, butterfly, ball, gate - valves up to 600mm (24") in diameter. They allow routine and emergency shut-off.

A unique waterproof cover and frame assemblies, with aluminium covers, prevent fluids and debris from entering the pit once the cover is closed.





DEFENCE SYSTEMS

Cavotec's innovative GSE technologies are used in defence applications world-wide.

We design, make, integrate and support with the aim of ensuring mission success. Air forces, navies, and domestic defense services trust Cavotec for quality of service, engineering excellence, and flexibility and reliability.

We support our customers around the world.



Powering and cooling



Solid State Frequency converters

Cavotec manufactures advanced solid state frequency converters for defence applications. Our systems can be designed with single or double output power. Our converters can either be fixed or mobile, and have 50Hz or 60Hz input power.

Motor Generators (MG)

Cavotec developed the first vertical synchronous MG for greater power, reduced size, improved efficiency and reliability, and longer service life.

There are currently several thousand of Cavotec MG in use worldwide, by services such as the US Navy.

In-ground pits

Cavotec in-ground pits are in use around the globe for supporting defense operations. Located either on the aprons or inside MRO hangars, they ensure a fast connection and service to aircraft.

PCA

Cavotec PCA systems can either be designed as Point of Use or Central systems.

We engineer DX-Boost or High and Low pressure central systems that operate under harsh ambient conditions and guarantee optimal cooling performance.

Our PCA units are electrically driven, fixed or mobile. Cavotec PCA AHU and in-ground pits are already in use with a variety of aircraft, including the F-35 Lightning.



Service

Our sales offices around the world provide customers with local expertise backed by our global network of Centres of Excellence.



Service is a key component of Cavotec’s customer offering. Our sales offices, located around the world, are backed by world class expertise from our research and engineering Centers of Excellence.

Cavotec offers installation and maintenance support for all its equipment, including preventive, repair and breakdown maintenance on or off site.

We also provide on-site commissioning and training, as well as dedicated training classes at our own Centres of Excellence. Using in-depth manuals and system documentation and our fully qualified staff can provide all levels of training and maintenance instruction, in-line with your operational requirements.

References

Aircraft manufacturers

Airbus France, Toulouse
Airbus Germany, Hamburg
Airbus China, Tianjin
Boeing Assembly lines
Seattle
Dassault Aviation, France
EADS Spain, Sevilla
Eurocopter France
Eurocopter Germany
Lockheed Martin Assembly
Lines
Shaanxi Aircraft
Corporation, China

MRO hangars

Air France A380, Paris
Aeromexico, Mexico
AMECO A380, Beijing
AMMROC, UAE
DHL Leipzig
Emirates Airline A380,
Dubai
Fedex, Memphis
Lufthansa A380, Frankfurt
Newark
Qatar Airways A380, Doha

Quantas A380, Sydney
Oman Air, Oman
Riyadh & Jeddah MoF
US Airways, Philadelphia

Airports

Anchorage, Alaska
Atlanta, Georgia
Athens Airport
Bangalore Airport
Bahrain Airport
Barcelona Airport
Beijing Airport
Brasilia Airport
Buenos Aires Airport
Charlotte, North
Carolina
Chicago (O’Hare), Illinois
China Eastern Airlines,
Shanghai
Dalian Airport
Dallas / Ft. Worth, Texas
Dakar New Airport
Denver, Colorado
Detroit (Metro),
Michigan
Dortmund Airport

Dubai DXB Airport
Dubai JXB Airport
Fiumicino Airport
Frankfurt Airport
Guangzhou Airport
Helsinki-Vantaa Airport
Hong Kong Airport
Hongqiao Airport
Houston
(Intercontinental)
Hyderabad Airport
Kunming Airport
Las Vegas, Nevada
Leipzig Airport
London Heathrow
Airport
Los Angeles Airport
(International)
Macau Airport
Madrid Airport
Manchester Airport
Miami, Florida
Minneapolis / St. Paul,
New York (JFK), New
York
Mumbai Airport
Munich Airport

New Dehli Airport
New Doha International
Airport
New Islamabad Int’ Airport
New Oman Airport
Noi Bai Airport, Vietnam
Orlando, Florida
Paris CDG Airport
Philadelphia, Pennsylvania
Phoenix, Arizona
Qingdao Airport
San Francisco, California
Santiago de Chile Airport
Sao Paulo Airport
Seattle (Seatac), Washington
Singapore Airport
Shanghai Pudong Airport
Shenzhen International
Shermetjevo Airport
Soekkarno Hatta Airport
Stockholm Arlanda Airport
Sydney Airport

We are present in:

Argentina	France	Norway	Switzerland
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Bahrain	Hong Kong	Russia	UAE
Brazil	India	Singapore	UK
Canada	Italy	South Africa	USA
China	Japan	South Korea	
Denmark	The Netherlands	Spain	
Finland	New Zealand	Sweden	



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Disclaimer: specifications are subject to change without notice



System flyer



GOING BEYOND
THE HORIZON
WITH **CAVOTEC**
SKYWAY

SERIES 2500+
THE ULTIMATE
GROUND POWER UNIT

 **CAVOTEC**
Inspired Engineering



GOING BEYOND THE HORIZON WITH CAVOTEC SERIES 2500+ GPU

Airports are an integral part of national and global transport infrastructure. The aviation industry needs to plan for its future development in this context. Key issues facing the sector include improving turnaround times, reducing emissions, operational expenditures, and enhancing safety.

With the Cavotec 400Hz Ground Power Units Series 2500+, we are launching the ultimate 400Hz solid state frequency converter integrating the highest electrical and communication performances.



The 2500+ meets the needs of today's and tomorrow's demanding aviation industry.

- **3G Ready:** Global design for Global clients in a Global market.
- **NGA Ready:** New Generation Aircraft (A380, B787, A350), ISO6858 Ready, 500% overload.
- **90kW (PF 1):** continuous load at 60°C ambient temperature.

Enhanced with Cavotec Skyway, Cavotec Series 2500+ combines increased reliability, optimizes ground handling operations and maximizes profitability.

- At the forefront of the energy savings with **>94% overall efficiency**.
- Cavotec Skyway Interface: **visualization of diagnostics, connections and operations remotely.**
- Interconnected digital technologies with data collection for preventive maintenance for a **reduced OPEX**.
- Durable design for **maximizing gate utilization** and **Return On Investment**.

Clean, reliable and sustainable 400Hz power.



Series 2500+
PowerPack I-Connect



Cavotec Skyway Interface



Clean, reliable, sustainable, and secured 400Hz electricity delivery

Cavotec Series 2500+ GPU offers with its **pulse-width modulated** proven technology an advanced 400Hz power solution ensuring the unique 400Hz power will be delivered **reliably without unforeseen changes in quality**.

Designed for **all ambient conditions** and aircraft types including **New Generation Aircraft (NGA)**, the Series 2500+ delivers **90kW PF 1 continuous at 60°C** and can go **up to 500% overload** bringing **peace of mind** to airlines and ground handling operators.



3G ready: Global design for Global clients in a Global market

Cavotec 2500+ solid state frequency converter can service all types of aircrafts (up to A380, including B787 & A350) under the **most severe ambient conditions** (-40°C to +60°C at PF 1) with a **continuous 90kW** output power and around the globe with 50/60Hz input and dual output.

The unit complies with the highest industry standards of which **DFS-400, MIL-STD-704F & exceeds the ISO-6858**.

ONE technology providing **ALL solutions** to **ALL** types of **airport** designs and configurations.

>94% Efficiency



Allocating the right investment for reducing operating expenses and maximizing the revenue streams

We value the importance of providing a **sustainable solution** where the **lower energy associated with a reduced consumption (overall efficiency of >94%), maintenance and downtime** bring **considerable savings and an unprecedented reduced Total Cost of Ownership** to the industry.



Technology integration

Cavotec Series 2500+ has been engineered and **pre-programmed** for all types of 400Hz power **distribution systems** such as **400Hz coilers and pit systems**. The **embedded functions** in the **system logic** enable a **fast site deployment** and **wiring for trouble free 400Hz system start-up**.

Cavotec, world's leading Ground Support System provider



Series 2500+
Vertical ground mounted



Series 2500+
Horizontal PBB mounted



Series 2500+
PowerPack I-Connect



400Hz Centralized MGs



Digitising the 400Hz Ground Power Unit

Cavotec Series 2500+ equipped with **Cavotec Skyway (5.7" sunlight readable multicolour display) and Cavotec Skyway Operator Terminal** provide a new way of operating. The addition of the **remote operation** enhances the **operations safety** and **the real time system monitoring**.

The **multiple functionalities and flexibility** of the Cavotec Skyway provide **digital information** that will guarantee **live information on the GPU, proactive maintenance** plans for **maximizing the gate utilization and revenues**.

Updates can be done in two ways: Basic mode with a **USB/Flash drive**, and Advanced mode with an ethernet connection.

500%
overload

90kW
PF 1



Advanced manufacturing

Engineered and manufactured in **Centre of Excellence, Cavotec INET (USA)**, Cavotec offer clients the possibility to **have factory tested products on two continents** (Cavotec Fladung Germany assembly) but also the complete 400Hz system (i.e. Test of 400Hz system including the GPU connected to a pit system) ensuring the **total reliability** of the **system performance** before shipment. Our products are **serviced** by **Cavotec local sales offices** located in **over 30 sales companies** for a **professional and reliable** local after sales service.

The world's largest in-house 400Hz versatile system offer



400Hz Pop-up Pit



400Hz Coiler



400Hz Power Converter Caddy



400Hz aircraft Plugs

Technical information - 2500+ Series

Input Power

Voltage range:	3 x 400-480V ±15%
Frequency:	50/60 Hz ±5 Hz
Rectification:	Active PFC
Rated current:	115A @ 480VAC AND 90KW (1.0PF) 138A @ 400VAC AND 90KW (1.0PF) 92A @ 480VAC AND 90KVA (0.8PF) 111A @ 400VAC AND 90KVA (0.8PF)
Line current distortion:	<2% @ full load*
Power factor:	1 @ any load*
Inrush current:	None

Output Power

Rated Power:	90kVA/90kW
Voltage:	3 x 115/200 V
Frequency:	400 Hz ± 0.01%
Power factor:	0.5 lagging to 0.8 leading*
Voltage regulation:	<0.5% for balanced load & up to 40% unbalanced load
Voltage recovery:	U <2% and rec. time <10 ms at 100% load* change
Total harmonic content:	<2% at linear load (typ. 1.5%) <2% at non linear load according to ISO1540
Crest factor:	1.414 ± 3%
Voltage modulation:	<1.0%
Phase angle symmetry:	120° ± 1° for balanced load 120° ± 2° for 30% unbal. load
Voltage Drop Compensation:	>20V phase to neutral

Efficiency

Overall efficiency:	>94% 90kVA at 0.8PF
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Overload Capacity

	125% for 600 seconds 150% for 90 seconds 250% for 30 seconds 300% for 15 seconds 400% for 3 seconds 500% for 1.5 seconds* Follows I ² t curve
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Environmental

Operating temperature:	-40°C to +60°C for all load conditions
Relative humidity:	10 to 100% non-condensing
Noise level:	<65 dB(A)@1m

Norms and Standards

MIL-STD-704F:	Aircraft Electrical Power Characteristics.
DFS-400:	400 Hz aircraft ground power.
ISO-6858:	Aircraft Ground Power Supplies
ATA-101:	Ground equipment technical data
NFPA 70:	National Electrical Code
UL 1012:	Under Writers Laboratories, INC. (UL)
BS 2G 219:	General Requirements for Ground Support Equipment
EN-62040 1.1:	Uninterruptible power systems (UPS) –Part 1-1: General and safety requirements for UPS used in operator access areas
IEEE STD 127:	Aerospace Equipment and Frequency Rating.
ISO-461:	Connectors for Ground Electrical Supplies.
ISO-1540:	Aerospace. Characteristics of Aircraft Electrical Systems.
SAE-ARP-5015:	Ground Equipment 400Hz Ground Power Performance Requirements
EN-1915-1:	Aircraft ground support equipment. General requirements. Basic safety requirements
EN-12312-20:	Aircraft ground support equipment. Specific Requirements. Part 20. Ground Power Equipment.
Others:	MIL-S-19500 – IEC-60146 – ST-20-1972(R-1978) – IEC-60310 – EN-50124 EN-61000 IEC-60529 – BS-EN-61558 – IEEE STD 500 – MIL HDBK-217F – MIL HDBK-472

Protection

Protection class: IP55	Control voltage error
No break power transfer	Short circuit at output
Over/under voltage at in/output	Neutral voltage supervision
Overload	
Internal high temperature	

Miscellaneous

	MTTR: max. 20 minutes Colour: RAL 9010 (standard)
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Weight

	Fixed & PBB units: 570 kg / 1,257lbs Mobile units: 770 kg / 1,698lbs
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Dimensions

	48x30x30 in / 1220x760x760 mm
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Warranty

	Standard 12 months warranty
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*All characteristics are valid for an altitude up to 3000m (10000 ft)



3G and NGA Ready



90kW, 500% overload



Remote monitoring with Smartphones and tablets

Optional Features

- Dual 400Hz output
- Terminal extension for output distribution
- Remote HMI with Cavotec Skyway Interface
- Cover for instrumentation
- TCP/IP Modbus ready
- Military interlock
- GPU user enable
- Energy Management
- Leakage current supervision
- 90% switch interlock
- Cavotec Skyway service tool
- BMS integration
- Portable trailer/cable kit
- 180kVA Kit

Cavotec Skyway

Cavotec Skyway is a modern and easy system visualization which has been developed with the aim of offering extensive connectivity, easy-to-read displays, and remote connectivity via Ethernet/Internet Remote Connectivity.

We bring you the information in real time wherever you are and on various interfaces (Smartphones, Tablets...) for ensuring an instant system information.

The 5.7" High Brightness TFT Graphical Touch Screen will allow you to "communicate with" your 2500+ 400Hz Solid State Frequency Converter and offers our customers extensive, built-in, time-saving features that help customers develop fast and consistent GSE in operation. Extend the system to other Cavotec GSE (i.e. Cavotec PCA) and you will complete the winning combination with a unique Gate Vision System.

Installation data

Cavotec Series	Continuous Rating (kVA) / (kW)	Input Amps with full load (90 kVA) at the output 0.8 PF / 1.0 PF		Dimensions W x D x H		Installed Weight	
		@ 400V input	@ 480V input	(inches)	(millimeters)	(lbs)	(kg)
2500+	90/90	138A @ 400VAC AND 90KW (1.0PF) 111A @ 400VAC AND 90KVA (0.8PF)	115A @ 480VAC AND 90KW (1.0PF) 92A @ 480VAC AND 90KVA (0.8PF)	48 x 30 x 30	1220 x 760 x 760	1257	570

Model numbers

	Output	Continuous Rating (kVA) / (kW)	Bridge mounted (Horizontal)	Ground mounted (Vertical)	Mobile (Horizontal)
2500+	Single	90/90	25C90S-HB	25C90S-VG	25C90S-HM
	Dual	90/90	25C90D-HB	25C90D-VG	25C90D-HM
2500+ PowerPack I-Connect	Single	90/90	25P90S-HB	25P90S-VG	25P90S-HM

We are present in:

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Canada	Italy	South Africa	USA
China	Japan	South Korea	
Denmark	The Netherlands	Spain	
Finland	New Zealand	Sweden	



info@cavotec.com
cavotec.com