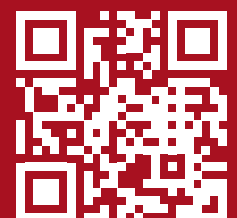


AGES – AIRCRAFT GROUND ENERGY SYSTEM



THE INNOVATIVE
PCA SOLUTION
FROM A SINGLE
SOURCE

SWISS
MADE



We are IST.

We create innovative solutions in stainless steel – with passion, team spirit and a real can-do mentality. Because we love what we do!

For over 50 years, IST-Edelstahl-Anlagenbau AG has been your experienced partner for complete solutions in the field of process plant engineering – we are innovative, reliable and focused on our customers.

From the initial idea to successful commissioning

We provide tailor-made services for process plant engineering – combining experience with high quality standards.

Planning and engineering

Our experienced team assists you throughout the project life cycle, from the initial idea to the final launch. On request, we can also take care of the complete planning and construction of your system.

Production

Using modern production methods and certified technology, we process high-quality materials precisely and efficiently according to your requirements.

Assembly and service

Our highly qualified assembly teams ensure smooth installation on site and provide a comprehensive service to guarantee the continuous operation of your system.

General contractor

As general contractor, we take overall responsibility for your project – from the planning stage right through to turnkey handover. You can take advantage of clear processes and have a contact person you can rely on at all times.

Andrea Zimmermann, CEO / Kurt Zimmermann, BoD / Frédéric Lorenz, COO



What we stand for.

- Authentic**

We are genuine and transparent in everything we do. We put our words into practice – both within the company and in our dealings with customers.
- Partner-like**

We treat our customers and employees as equals. We develop solutions together and grow alongside one another.
- Passionate**

We are passionate about our work and our solutions. We channel our enthusiasm into our everyday work and positively influence those around us.
- Trustworthy**

Our commitments are binding. We establish trust through reliability, honesty and consistent quality.
- Flexible**

We adapt quickly to changing requirements and develop innovative solutions – pragmatically and purposefully.
- Personal**

We foster a corporate culture that is based on respect, mutual support and appreciation.



Turnkey systems for a wide range of industries.

Whether it's highly complex pharmaceutical systems, food hygiene pipes, robust industrial equipment or innovative airport facilities – we develop and manufacture stainless steel solutions that are precisely tailored to the demands of your industry. Our know-how makes the difference – ensuring efficiency, safety and quality in every project.

Infrastructure and transportation

We develop, design and implement infrastructure systems for municipalities and public institutions. We are pioneers and recognized specialists, especially when it comes to aviation – for airports and airlines alike.



Pharmaceuticals



Chemicals



Water supply



Food and beverages



Energy



istinox.ch



Efficient and sustainable energy supply at airports.

With its Aircraft Ground Energy System (AGES), IST-Edelstahl-Anlagenbau AG provides the world's first efficient complete system to supply air-conditioning to aircraft on the ground. As an experienced complete system supplier, IST delivers a seamless, innovative solution that harmonizes environmental aspects with operational factors and profitability. This benefits airports, airlines and the environment.

Whether it's pre-conditioned air (PCA) units, telescopic tubes or hose reels – IST equips bridges from A to Z and guarantees compliance with all current machine guidelines and safety regulations.



Sustainable investment in airport infrastructure.

With the complete AGES from IST, airports can make targeted investments in environmental protection, economic efficiency and sustainability. The modular, adaptable solution covers all the requirements of modern ground power supply and helps to ensure the long-term competitiveness and attractiveness of airports.

Expertise and innovation: what IST-Edelstahl-Anlagenbau AG promises you

- | | |
|---------------------------------|---|
| ■ Extensive experience | Decades of expertise in the field of passenger boarding bridges and energy supplies for airports. IST is the market leader in Switzerland and coordinates large numbers of international projects. |
| ■ Individual system integration | Each passenger boarding bridge can be perfectly equipped for all types of aircraft up to the Airbus A380. The solutions developed by IST meet the highest requirements in terms of safety, functionality and flexibility. |
| ■ Professional support | From technical planning and project management to commissioning – IST offers everything from a single source and guarantees professional coordination with all project participants. |
| ■ Innovative technology | In-house developments in PCA units and high-performance cooling systems ensure state-of-the-art, reliable air-conditioning in all weather conditions. |

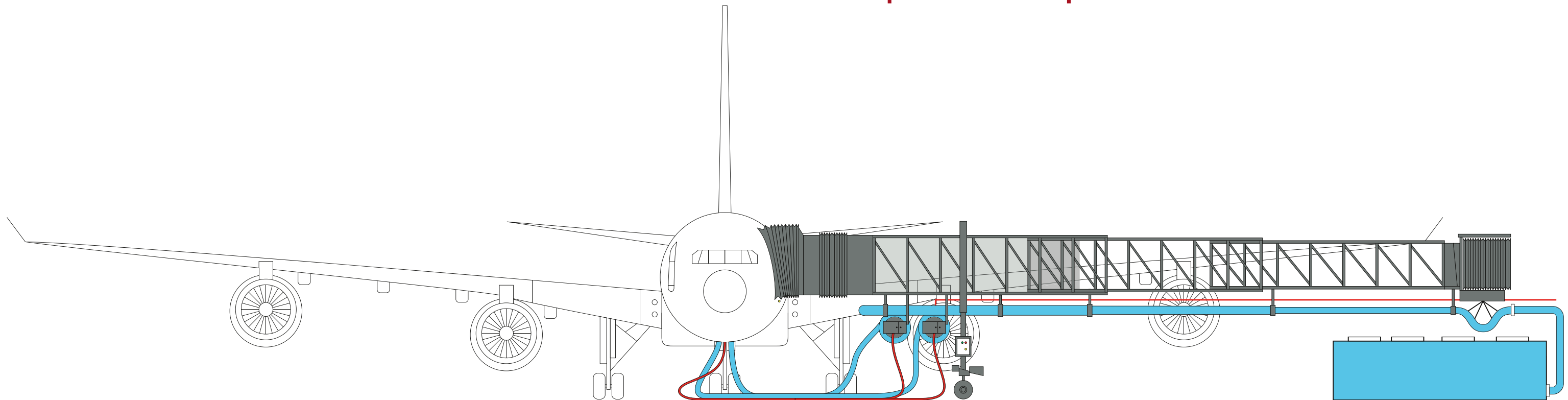
Fewer emissions, more comfort and maximum efficiency for airports and airlines.

Imagine an airport where airplanes on the ground are supplied almost silently – with fresh, perfectly tempered air and reliable electricity. Modern PCA units from IST make it possible: instead of having a noisy, inefficient Auxiliary Power Unit (APU), you benefit from a pioneering technology that saves up to 90 % of fuel compared to an APU supply, drastically reduces emissions and protects the environment.

AGES at a glance

- Up to 90 % lower fuel consumption and emissions than an APU
- Much less noise pollution on the apron
- Economical operating costs and attractive Return on Investment (ROI)
- Robust, durable stainless steel system components
- Simple interfaces, one contact person – one complete system
- Compliance with the strictest environmental standards and promotion of sustainable airport development
- Maximum operational reliability and system availability
- Tailor-made, flexible solutions for every airport and aircraft type

**AGES – your path to greater efficiency,
sustainability and profitability in airport
operations. Shape the future now.**



Climate protection thanks to an innovative ground supply.

By switching operations entirely to AGES, CO₂ emissions can be reduced by up to 90 % compared to the emissions released when using an APU. This significant reduction underlines the potential of stationary systems for sustainable flight operations and makes an important contribution to meeting environmental targets in air traffic.

	APU kg CO ₂ /h	Diesel GPU kg CO ₂ /h	PCA kg CO ₂ /h
Short-haul aircraft	337	19.1	0.7
Long-haul aircraft	758	38.2	1.2

Source: Zurich Airport, Aircraft Ground Energy Systems at Zurich Airport, 02.2018

CO₂ emissions and economic efficiency

A comparison of specific CO₂ emissions per hour shows the huge advantage of using stationary systems (AGES/PCA) compared to an APU or diesel-powered GPU (Ground Power Unit).

With AGES/GPU, only 8,945 tons of CO₂ are emitted per year instead of 50,066 tons without the system. When making maximum use of AGES, emissions can even be reduced to 2,131 tons of CO₂. NO_x emissions also decrease: from 128 tons to 20 tons with the current system, and to just 5 tons with full use of AGES per year.

Noise pollution and occupational safety

Another key advantage of AGES is that it enhances occupational safety at airports. The much lower noise level from 95–105 dB(A) with APU operation to 70–75 dB(A) with AGES considerably reduces noise pollution for staff and the local population.

Think economically – act sustainably.

Opting for AGES is an efficient and economically sustainable investment. The calculation of ROI for an AGES at Zurich Airport is an impressive example.

■ Investment costs for AGES	The investment for installing PCA systems is between CHF 340,000 per Code C gate and CHF 1,000,000 per Code F gate.
■ Operating income and ROI calculation for the airport	From the airlines' perspective, the focus is on savings, while income for the airport is calculated on the basis of the charges for the installation of AGES.

ROI calculation for AGES

Key figure / gate	Code C gate (A321)	Code F gate (B788)
Investment (CHF)	322,000	950,000
Cost of AGES (CHF)	55	276
Turnarounds per day	5	2
Income per day (CHF)	275	552
Income per year (CHF)	100,375	201,480
ROI (years)	3.2	4.7

Assumptions based on average turnarounds per gate. Prices in Swiss francs (CHF).
Source: Zurich Airport, Aircraft Ground Energy Systems at Zurich Airport, 02.2018

Installing AGES (400 Hz/PCA) incurs high investment costs, but these costs can be amortized within a few years thanks to the income generated from turnaround charges.

Airlines that opt for AGES enjoy multiple benefits.

- Significant cost savings

The use of AGES rather than an APU significantly reduces kerosene consumption. Taking an Airbus A330 as an example, the cost for three hours of stationary energy supply with AGES is around CHF 370, while the same supply with an APU costs around CHF 820. Airlines benefit from lower operating costs, less wear and tear on the APU, and lower maintenance and servicing costs as a result.

Source: Zurich Airport, Aircraft Ground Energy Systems at Zurich Airport, 02.2018
- Compliance with environmental standards

By reducing emissions and switching to an external energy supply, airlines can meet increasingly stringent environmental regulations safely, efficiently and cost-effectively thanks to the AGES/PCA system.
- Comfort for crew and passengers

AGES ensures a reliable and efficient supply for all types of aircraft – regardless of weather conditions or aircraft size. The system guarantees constant temperatures in the cabin, thereby increasing passenger comfort and improving the working conditions of the crew.



Significant savings thanks to a PCA and 400 Hz compared to APU operation

Example of operating costs for a stationary supply (AGES/PCA) and an APU for various types of aircraft.

Key figure	B764 (Pier E)	B788 (Pier E)	A321 (Stands D)	B739 (Pier B)
400 Hz time (mins.)	240	300	80	210
PCA time (mins.)	120	180	80	60
Total cost of AGES/PCA (CHF)	173	276	55	270
Total cost of APU (CHF)	710	890	147	385
Savings (CHF)	540	614	92	115

Prices in Swiss francs (CHF). Source: Zurich Airport, Aircraft Ground Energy Systems at Zurich Airport, 02.2018

The table shows that depending on the type of aircraft, the use of a PCA and an external power supply can save several hundred francs per turnaround. The operating costs for an APU are much higher than for the AGES/PCA solution.

Environmental friendliness at the highest level.

■ Huge reduction in emissions

AGES reduces CO₂ and NOx emissions by around 90 %. Fuel consumption and environmentally harmful emissions are drastically reduced when providing electricity and preconditioned air – making a vital contribution to sustainable airports.

■ Less noise

The noise level on the apron is much lower when using AGES, which not only improves the working conditions for airport staff, but also reduces the impact on the surrounding area.

■ Minimal maintenance costs

Robust stainless steel components, high system availability and a durable design ensure low maintenance and maximum operational reliability.

AGES – the environmentally friendly solution

■ Significant cost savings for airlines

By using AGES, airlines benefit from fuel savings of around 90 %, compared to the use of a conventional APU. The tariffs for AGES are much lower than APU operating costs.

■ Life cycle costs as the key to profitability

Life cycle costs are significantly reduced thanks to the service life of over 20 years and minimal maintenance requirements. This makes AGES the most economical solution for airports and airlines looking to invest in the long term.

■ Compliance with the strictest environmental standards

By opting for AGES, airports can be sure to meet modern environmental regulations, thereby strengthening their role as sustainable, responsible locations.



Kerosene is intended for flying, not for supplying energy on the ground.

Airports and airlines benefit from greater efficiency, environmental friendliness and future-proof technology – a real win-win solution!

Full cooling capacity – even when deicing.

With our new DXi units, we are redefining cooling for docked aircraft, thanks to a constant volume flow and precise temperature control – even during the deicing process.

Our PCA units deliver a PCA volume of up to 18,000 kg/h and have a corresponding cooling capacity. Both make our PCA units the world's first Code F air-conditioning units that can efficiently supply all aircraft types up to and including the Boeing 747-8 with conditioned air. The two independent cooling circuits ensure exceptionally energy-efficient, permanent cooling, even during deicing.

- Continuous cooling capacity – even during deicing
- Demand-based control instead of fixed time cycles
- Two cooling circuits for maximum availability
- Constant outlet temperature of below 5.5°C
- For extreme ambient air temperatures: +50°C to –30°C

Instead of relying purely on standard solutions, ISTinox provides PCA units that adapts precisely to the needs of modern airports and a wide variety of aircraft types. Each system is individually designed – options range from a compact machine for regional aircraft to a high-performance solution for wide-body jets such as the Boeing 747-8. For the very first time, our innovative control technology makes it possible to supply two Code C aircraft with different air volume requirements simultaneously and precisely with one PCA unit. This globally unique flexibility and efficiency make ISTinox a pioneer in aircraft air-conditioning.



ISTinox product range (Europe)

Unit	DXi 100-36 C	DXi 380-36 E	DXi 420-36 F
Compatible aircraft types	Code C Typically the A321, B737	Code C to E Up to the A 350-1000 or the B 777-300 ER	Code C to F Up to the B 747-8
Supply	One aircraft only	1 × Code C to E or 2 × Code C	1 × Code C to F or 2 × Code C
Max. PCA volume (kg/h)	5,000	15,000	18,000
Max. cooling capacity (kW)	100	380	420

ISTinox product range (Middle East)

Unit	DXi 140-46 C	DXi 460-46 E	DXi 540-46 F
Compatible aircraft types	Code C Typically the A321, B737	Code C to E Up to the A 350-1000 or the B 777-300 ER	Code C to F Up to the B 747-8
Supply	One aircraft only	1 × Code C to E or 2 × Code C	1 × Code C to F or 2 × Code C
Max. PCA volume (kg/h)	5,000	15,000	18,000
Max. cooling capacity (kW)	140	460	540

Other versions can be individually designed to meet the specific requirements of each airport.

By using AGES, airlines benefit from fuel savings of around 90 %, compared to the use of a conventional APU. The tariffs for AGES are much lower than APU operating costs.



Strong partnership with Mountair

We work with Mountair to develop high-performance air-conditioning units that meet Swiss quality standards – our products are energy-efficient, precise and tailored to the aviation industry.

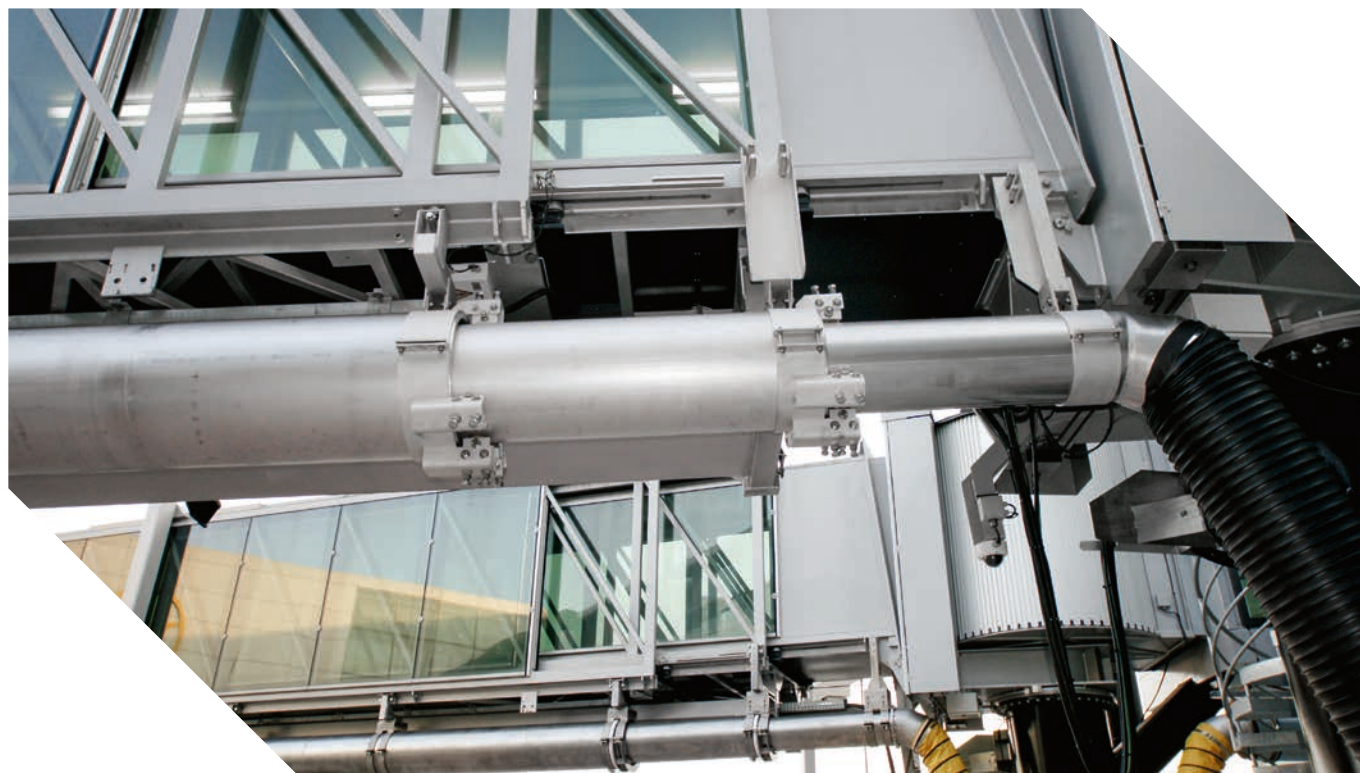


Maximum service life – minimum maintenance

The double or triple telescopic, insulated double casing tube made of stainless steel boasts a long service life, excellent stability and minimal maintenance requirements – and ensures maximum efficiency with low pressure loss.

**Our patented telescopic tubes at Zurich Airport
have been in operation virtually without maintenance
since 1999.**

- Low maintenance requirements and durable
- Self-supporting and compatible with all passenger boarding bridges
- Allow flexible movement thanks to internal/external bearings
- Resistant to temperatures of -40°C to $+80^{\circ}\text{C}$
- Minimal pressure loss due to low surface roughness
- Special sandwich insulation for maximum energy efficiency



More flexibility – less wear and tear

The ISTinox “Elephantino” stainless steel hose funnel provides exactly the right hose length – tailored to every type of aircraft. This minimizes pressure losses, damage and unnecessary costs.

- Exact hose length for every aircraft type
- Minimized pressure losses and optimized air flow
- Less hose wear
- Fewer tripping hazards on the apron
- Individually customizable controls



The durable solution for easy hose handling.

Our automated hose reel facilitates the handling of heavy PCA hoses – and minimizes wear, maintenance and costs at the same time.

Our patented reel at Zurich Airport Terminal E has been in operation since 1999.

- Robust stainless steel construction
- Simple operation via remote control
- Minimized hose and coupling wear
- Individually programmable controls
- Low maintenance requirements and many years of proven operation



Safe docking made easy.

To complement our product range, we offer both PCA hoses and associated aircraft couplings for optimum connection to the aircraft. The components are precisely tailored to each other and to the specific requirements, ensuring an efficient and reliable supply to the aircraft.

- Insulated PCA hoses and aircraft couplings for reliable, efficient aircraft supply
- Particularly robust and durable thanks to high-quality, temperature-resistant materials
- Easy handling by means of ergonomic handles, swivel joints and a self-leveling locking mechanism
- Perfect impermeability ensured by integrated replaceable seals for maximum security



References

■ Zurich Airport

- Terminal A, 18 gates, 1983–1984**
Central compressed air system as an alternative to an APU supply.
- Terminal A, 18 gates, 1998**
Initial installation of the patented telescopic tube and hose reel from IST.
- Terminal E, 27 gates, 2000–2003**
Installation of a complete air-conditioning and power supply system by IST as general contractor, with telescopic tubes, hose reels and 400 Hz cable reels.
- Terminal A, 17 gates, 2012–2013**
Installation of a new PCA distribution system incl. 400 Hz supply in connection with new passenger boarding bridges.
- Terminal B, 8 gates, 2019**
Replacement of aluminum telescopic tubes.
- Terminal E, 1 gate, 2021**
Initial installation of the newly developed ISTinox “Elephantino” hose funnel system.

■ Munich Airport

- Terminals 1 and 2 and satellite (new building), 64 gates, 2015–2016**
Installation of 64 air distribution systems consisting of telescopic tubes and hose reels.
- T1 new construction project, 7 gates, 2025**
Complete installation of the PCA system at seven new gates as part of a new construction project. Development of an air-conditioning unit with separate roof heat exchangers and special control technology for the simultaneous supply of two Code C aircraft with different air flows.

■ Frankfurt Airport

- Terminal A, 2 gates, 2025**
Installation of the first Code F system that can provide air-conditioning for aircraft of all sizes up to and including the Boeing 747-8 with just one unit – and even supply two Code C aircraft in parallel thanks to its intelligent controls.
- Terminal 3, 24 gates, 2025**
Installation of 24 PCA systems for the new terminal 3 building.

■ Hamburg Airport

- Terminal 1 and 2, 16 gates, 2015–2023**
Complete equipment with ISTinox hose reels, 2015–2018; initial installation of the new “Elephantino” system, 2023

■ Additional references

- Bilbao, Madrid, Mallorca, Fuerteventura, Geneva, Ibiza, Heathrow Airports and many more; complete list of references available on request.**

Stainless steel, Swiss-made components

All the components of our PCA systems are made of stainless steel and are manufactured in Switzerland. This stands for durability, corrosion protection and the highest quality standards.

