

SINTRA – AMBIENT AIR PULSION

A “ONE OF A KIND” TECHNOLOGY

Italian-French SINTRA (Innovative Systems for Air Treatment) is the leader manufacturer in Europe for perforated ducts for ambient air Pulsion and for supply air diffusion, for all kind of applications. Back to the genesis of a proven innovative technology.



The training room in SINTRA's research and product development factory has a capacity of 80 people. It is equipped with patented TWIN-VARIBOOST® technology, with double compensated gathering ring.

It all begins in 1981. After several experiences in the design and installation of technological systems and heat recovery on industrial plants, Marco Zambolin, SINTRA's current president, files the first patent for what will become the MIX-IND® technology for the Pulsion of the ambient air. The idea is born by analysing stratification issues on a large volume building, the Pirelli factory in Milan Bicocca. Between 1982 and 1983, some experiments were carried out with the contribution of the CNR – ENEA, after which SINTRA designs, develops and tests the basic principles of this technology with particular attention to issues related to large-volume buildings. Over the next decade, SINTRA deepens the development by implementing extreme applications of the technology, supplying turnkey plants for important industrial process infrastructures in Europe. *“MIX-IND® technology was born by analysing mainly the stratification and depression problems of large volume industrial buildings, in particular those with specific pollution”,* says Marco Zambolin.

THE BEGINNINGS IN THE AUTOMOBILE INDUSTRY

This technology has been used first of all in the automobile industry both in Italy and France (PSA group, Fiat, Iveco, etc.). Thanks to a specific design, it is able to solve complex problems of temperature homogeneity, while maintaining perfect control of air speed in buildings with very diversified environmental requirements (ultra-clean environments, with specific pollution, high endogenous heat, great height, small volume...). For this type of installations, SINTRA uses perforated ducts, called “PULSERS” or “Linear Pulsion Devices” (DLP®). The society has been constituted in 1995 in order to ensure production and marketing of these devices. Between 2009 and 2012, SINTRA creates SPIROPACK™, a green technology for the production of metallic DLP® with an open circumference, and it inaugurates in the same occasion its research and product development factory, which houses a very powerful production line (1.000 m/day and up to ø3.000 mm), which is fully automated.

“SPIROPACK™ revolutionizes the world of circular metal ducts by producing them open, with a programmed diameter warpage, asserts Marco Zambolin. Thanks to this long research journey, we can state that MIX-IND® technology is unique in its genre. It has evolved using research criteria and calculation methods which are very different from those traditionally used. For this reason, it is essential to inform our customers about our technologies. For this purpose, we regularly organize training and technical update days on three levels, entirely dedicated to HVAC professionals ”

ASSISTED DESIGN

For the design of an installation that uses the patented MIX-IND® systems, it is necessary to resort to SINTRA's technical support. Assisted design is a rapid and effective method which allows the customer to choose the solution that best meets their needs, both technical and economic. After having gathered the main available technical data, together with drawings of the building or traditional plant which has been foreseen, SINTRA carries out an environmental diagnosis of the project, in order to elaborate some technical solutions before the Technical Orientation meeting. *“After this meeting the customer, or “applicant” is therefore able to choose the technical solution(s) he considers best suited to his project, clarifies Marco Zambolin. It will be up to SINTRA to verify that, for each technical solution, the customer can appreciate at their right value any compromise condition that may be imposed by architectural or economic necessities ”.*

The chosen technical solution(s) are then treated more in depth by SINTRA, in order to analytically evaluate the “Kr risk coefficient” for each Pulsar ($Kr < 0,8$ = risk of stratification; $Kr > 1,2$ = risk of air drafts), and the “Kp performance index”, which will allow the customer to technically compare the different proposed solutions as best as possible.

TWO KINDS OF PERFORATED DUCTS

Today, SINTRA proposes two kinds of perforated metallic ducts: perforated SPIROJET ducts and patented MIX-IND® systems. Perforated SPIROJET ducts (product in free competition) are constituted by a set of modules with a length of 1 m, each comparable to a high induction diffuser. The diffusion element is represented by the perforation, which can be applied to any module regardless of its diameter or material. The air coming out from the perforation recalls by induction a quantity of ambient air which is generally 30 times higher than that coming out of the holes. By increasing the air output speed from the holes, it is possible to easily increase the induction, even at more than 50 Vol/h, but this would reduce the diffusion duct's performances. The diameter and quantity of the holes applied to each SPIROJET module define both its ability to launch the air at a given distance and its operating characteristics. *“The design of a plant*

using SPIROJET perforated ducts is carried out in a traditional way, says Marco Zambolin, *distributing the perforated ducts evenly in the room, according to the air flow and air throw distance of each module, just like any other type of diffuser*". In normal working conditions, the ambient air which is induced by the holes causes a continuous ventilation of the external surface of the duct, preventing the formation of condensation. Perforated SPIROJET ducts give maximum performances with no stratification and no air drafts under the following operating conditions:

- Maximum installation height recommended for heating: 5 m.
- Maximum recommended air throw distance: 7 m.
- Optimal air speed inside the duct: 5 m/sec.
- Maximum ΔT for heating: 10 °C.
- Minimum air supply temperature: 12 °C.

PULSION AND PRESSURE FIELD

Perforated ducts with MIX-IND® technology, or PULSER®, do not "throw" the supply air into the area that needs to be treated as all diffusers do, but they create a "pressure field" on their axis, able to set in controlled motion the totality of the ambient air mass. *"The design of a MIX-IND® Pulsion plant cannot rely on CFD models, as all other traditional air diffusion plants do"*, says Marco Zambolin. For an ambient air Pulsion system, the number and position of each PULSER®, according to unit air flow, have a capital importance for its performances. For this reason, the design of this kind of plant requires SINTRA's technical support, through the Assisted Design service (see framed text).

Compared to traditional air diffusion systems, which use perforated ducts type SPIROJET or similar, the systems with the base MIX-IND® technology, defined "simple Pulsion", have the following advantages:

- Homogeneity of the temperatures, both vertical and horizontal, of $\pm 1^\circ\text{C}$, independently from the building's height
- Maximum comfort with the control of the residual speed in the occupied area
- Total destratification even for great height buildings, even higher than 40 m
- Suppression of the return air ducts with less pressure drops for the fans, lower maintenance costs, less encumbrances and a reduced cost for the ducts
- Total recovery for all internal heat produced in the room (motors, lighting, etc.)
- Possibility to introduce air at very low temperatures without causing discomfort or condensation phenomena
- Ability to achieve large air throws (up to 100 m), therefore less ducts to install, less weight on the structures, less encumbrances in the room and a lower total cost of the ducts.

New branches and Pilot Plant

SINTRA has just opened a new branch in Reno (United States), and the opening of new branches in Ireland and England is foreseen for the next year. In preparation for the 25th anniversary of its establishment (1995-2020), SINTRA has invested about 6 million euros for the realization of a new research and product development factory called "Pilot Plant". The project foresees the realization this year of a first 4,500 m² span (150 m length, 30 m width and 14 m height), which will expand to 15,000 m² in the next few years, with 2,000 m² of offices. A full-scale research laboratory, which will allow to develop new energy technologies, particularly applicable to large volume buildings. This building will be mainly dedicated to the training of HVAC technicians and to the continuous research program, particularly for Advanced Pulsion New Generation plants, using the patented MIX-IND® technologies.



Decathlon's warehouse is equipped with a MIX-IND® Auto-Pulser® which integrates the patented BOX-IN-BOX technology.

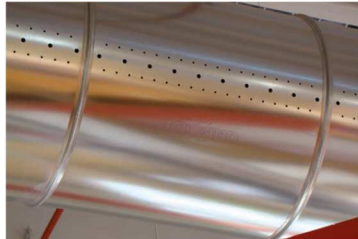
ADVANCED PULSION NEW GENERATION PLANTS

"New Generation plants are multifunction MIX-IND® plants which use the patented QPE® technologies (Quality, Performances, Efficiency), with very high performances both in terms of energy and comfort", continues Marco Zambolin. For each project, different functions are given to each Pulser® according to the kind of application and/or activity which is carried out in the room, taking also into account any specific needs. The system's operation is therefore customized thanks to an "Environmental Diagnosis" which identifies the customer's needs. These plants guarantee the following performances:

- Variable air flow up to 20-100% on the AHU's fans, with no performance loss. This allows:
 - Up to 80% savings in the fan's electricity consumption, since they will be able to use only the air flow necessary to transport the power required by the environment,
 - A consequent saving on the costs of filter replacement, with a smaller quantity of air to be filtered,
 - An increase in the efficiency and performance of the filters, thanks to the reduction of the air speed on them,
 - Limited mechanical wear, hence greater longevity of the AHUs or more functioning hours for the Roof-Tops
- Possibility to run more AHUs or Roof-Tops on the same aeraulic circuit, in order to obtain a variable air flow system through the discharge of fixed speed ventilation units.
- Variable comfort: a new concept of comfort which allows the user to choose and modify, easily and at any time, the residual speed in the occupied area, according to the circumstances.

- Rapid temperature recovery time, with consequent significant energy savings, as well as the possibility of reducing, if not completely eliminating, night-time attenuation.
- Possibility of total energy requalification of any type of existing obsolete plant, without the need to replace it.
- Extreme winter free-cooling which allows to introduce external non-heated air directly in the room (up to -15 °C) with no risk of condensation or discomfort, suitable in particular for systems characterized by important internal heat loads.
- Possibility to further reduce the plant's air flow with the "Ice Cold Air" technology, which allows to lower the summer supply air temperature only in peak conditions.
- Elimination of the post-heating battery for a more precise control of relative humidity in the environment.
- Maximum operational safety in case of failure of one of the AHUs or one of the Roof-Tops.

To this day, more than 15,000 plants have been conceived and realized in the industrial and tertiary sectors. Through the development of these innovative technologies, SINTRA has set as its main objective the constant search for maximum energy efficiency, made possible by an innovative approach to the design of HVAC systems, based on the transfer of experience.



Example of perforation on a SINTRA duct.