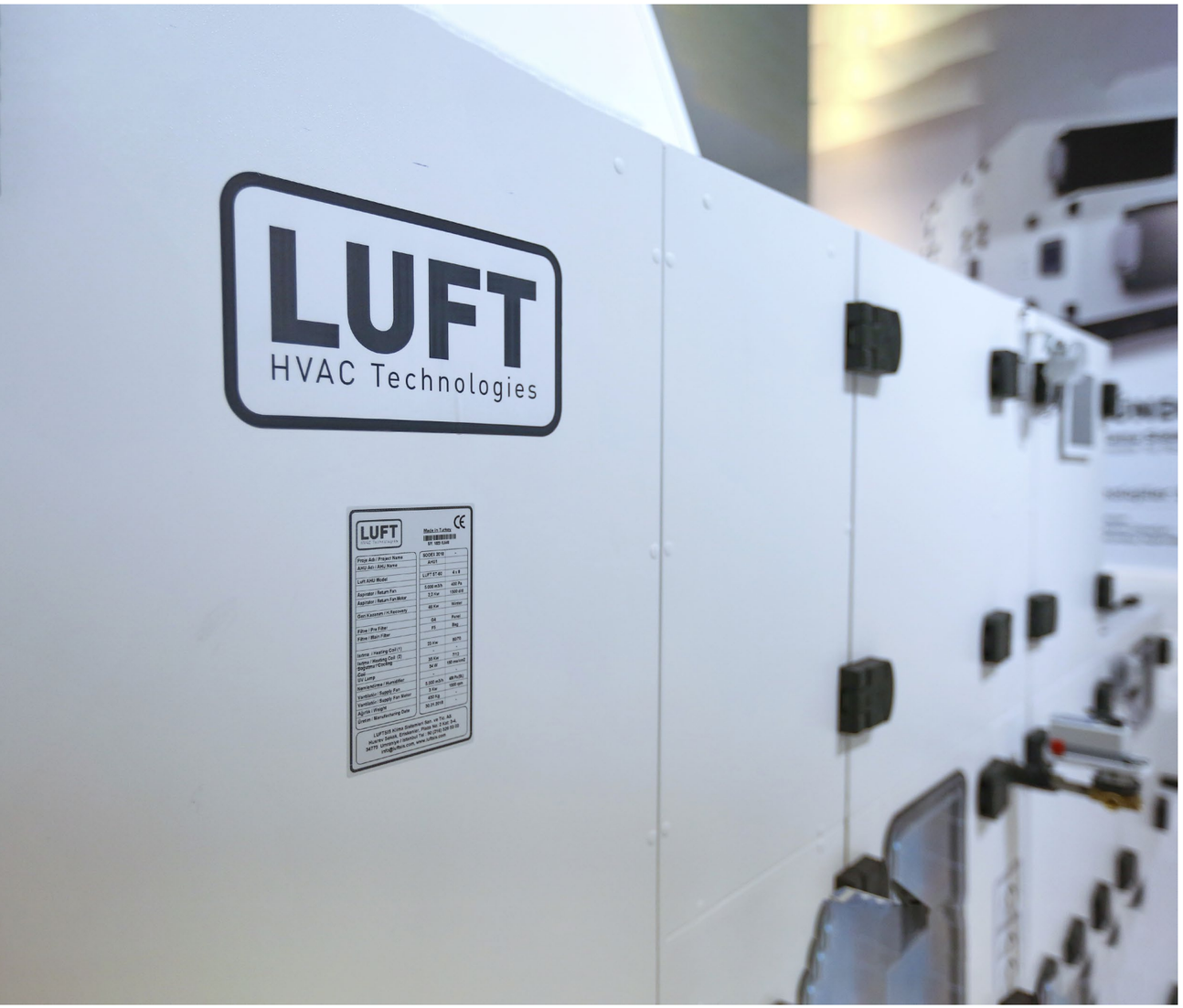
LUFT
HVAC Technologies

LUFT
AIR HANDLING UNIT

Comfort, Hygiene and Industrial Type

www.**luftsis**.com



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About **LUFT**

LUFT AŞ manufactures air handling units and systems under the “LUFT” brand at high technology and in conformance with international standards at its plant in Balıkesir, Turkey with an enclosed manufacturing space of 25,000 m2 and its R&D center. Utility models and patents of all product designs are registered to Luftsis AŞ.

LUFT air handling units are designed with innovative technologies and manufacturing standards, on the basis of the “EN 1886 Ventilation for buildings. Air handling units” standard.

The designs were based on the EN 13053, EN 13779 standards, the requirements of “ECO-DESIGN in ventilation units” of the European Union energy commission criteria.

Luftsis AŞ is the main implementation distributor of the BLYGOLD corrosion prevension systems of Dutch origin, and has embraced as its vision the manufacturing of durable units with high corrosion resistance for all its products and services.

The software, hardware, and platforms required for LUFT automation and IOT - Internet of Things systems are manufactured by the company in-house. The control and calibration of IOT and Automation systems are carried out by TESTO Ltd. within the framework of the 2020 Strategic collaboration agreement between the two companies.

- **Comfort, Hygiene, and Industrial Modular Air Handling Units**
- Compact Air Handling Units
- **Industrial Paint Shop Air Handling Units**
- Heat Recovery Units
- **Kitchen Ecology Units**
- Packaged Pool De-Humidifier Units

LUFT Air Handling Unit / About LUFT

The Lean Manufacturing Method

LUFT Air Handling Units are manufactured at our Bandırma factory with an indoor area of 25,000 m², based on Lean Manufacturing Techniques. Lean Manufacturing is a manufacturing philosophy which aims to systematically eliminate those activities that consume time and resources during manufacturing processes, but generate no added value in exchange. In the lean manufacturing philosophy, all operations without added value are considered wasteful.

The aim is to eliminate or minimalise this waste. In general terms, these wasteful operations can include defective manufacturing, over-production, inventory, unnecessary work, transportation, motion, and waiting.

According to lean philosophy, all work that does not create value for the customer, or in other words, all work that the customer does not want to pay for should be eliminated or minimised.

__LUFT__ Air Handling Unit manufacturing methods include manufacturing processes planned on the basis of the __Lean Manufacturing Method__. This enables the manufacture of products __that fully meet the customer's requirements__, that are delivered on time, and that have a __maximum price/performance__ value to be manufactured with a minimum waste objective.

Trouble-Free Manufacturing

The objective is to manufacture products without any problems. Defective manufacturing and/or repair of products is wasteful. When a manufactured product does not conform to technical specifications, it must be scrapped. In case of defective manufacturing, the product requires repair. Both result in loss of time and money for companies.

Order-Based Manufacturing

Manufacturing more than the required quantity of products or manufacturing products earlier than needed is wasteful. Manufacturing more than customer demand leads to increasing stocks. Furthermore, more information and documents than are needed, that do not create value for the customer are also a waste of manufacturing.

Minimum Stock

Anything stored in larger quantities than needed for manufacturing is a waste. Stocks of excess raw materials, semi-finished products, and products cause costs to increase due to storage operations, as well as a failure to detect errors in time. Collection of semi-finished products in work stations, and discovering them to be faulty in the subsequent work station causes loss of time and money.

Efficient Operations

The objective is to maintain high efficiency in each work step. Work steps that do not create added value and/or transactions that do not add value for the customer are wasteful. All work carried out during the process of manufacturing the unit and delivering it to the customer should be cleared of unnecessary operations. The complexity of processes should be eliminated as well as excessive control and approval steps.

Minimum Transportation

Transport of unnecessary equipment, raw materials, semi-finished products, and products is wasteful. Unnecessary conveyance of materials and information between locations, excessive transport distances caused by incorrect design of manufacturing space, and circulation of documents frequently and over long distances are among significant items of waste.

Planned Motion

Unnecessary movement of people that are caused by a poorly organized work environment is wasteful. Keeping frequently used materials far from the work space, actions that are not included in the work description, and searching for misplaced files and tools needed in the office environment are a waste of motion.

Zero Waiting Time

Waiting for the machine to finish its task and/or waiting for repairs is wasteful. It is also wasteful to wait for information or wait for a person. The preparation times prior to start of manufacturing are also examples of wasteful waiting.

LUFT Air Handling Unit manufacturing methods include manufacturing processes planned on the basis of the Lean Manufacturing Method. This enables the manufacture of products that fully meet the customer's requirements, that are delivered on time, and that have a maximum price/performance value to be manufactured with a minimum waste objective.

Quality Policy

The **LUFT** air handling unit factory and all manufacturing processes have been certified as meeting all current requirements of ISO 9001 – 2015.

ISO 9001 Management System

The ISO 9001 standard is the norm regulating the conditions that must be implemented while establishing the Quality Management System, where the enterprise implementing its processes in conformance with the specified conditions are subjected to certification audits.

The ISO 9001 system is reviewed by ISO (The International Organization for Standardization) every 5 years. After the parties reach a decision based on thoughts, opinions, and needs, the standard is published once again with the necessary revisions.

The ISO 14001 Environmental Management System

All products manufactured at the LUFT air handling unit factory are ISO 14001 certified as minimising environmental damage, reducing consumption of natural resources, and constantly improving environmental performance in manufacturing operations within the framework of compliance requirements.

Benefits of the ISO 14001 Environmental Management System:

- Increasing compliance with national and/or international legislation
- Improving environmental performance
- Providing benefits for competition in internal markets
- Improving the company's reputation and market share
- Reducing costs and increasing efficiency through development of cost control
- Reducing events which result in liability through preparedness in the face of emergencies and accidents
- Taking pollution under control starting from the source
- Facilitating the process of acquiring permits and authorizations
- Ensuring acceptance in the global market, since ISO 4001 is a common language that is known and used in the whole world
- The environmental impact of the company's operations and environmental risks can be determined and kept under control, thus reducing factors which have a detrimental effect on the environment.
- Costs resulting from environmental impacts are reduced.
- Compliance with relevant laws and legislation is achieved.
- Environmental effects that can occur during emergencies are reduced or completely eliminated.
- The environmental management system can be demonstrated to be compliant with legislation and regulations to legal authorities by virtue of the ISO 14001 Certificate.
- Environmental awareness of employees increases through training.
- Resources are used efficiently.

ISO 18001 OHSAS

ISO 18001 OHSAS (Occupational Health and Safety System) is used as a tool to systematically address and constantly improve occupational health and safety operations in manufacturing processes of products manufactured in the LUFT air handling unit factory, in accordance with our company's general strategies. With the OHS system, the responsibilities of our employees, management, and auditors have been clearly identified, and the participation of employees was achieved. LUFT has fulfilled these requirements and been awarded ISO 18001 OHSAS certification.

Benefits of the OHSAS 18001 Occupational Health and Safety Management System

- Provides a framework for the management of Occupational Health and Occupational Safety responsibilities
- Employees are trained on occupational health and safety and their awareness of the subjects is raised
- Authorities and responsibilities within the company are identified
- Ensures your compliance with relevant labor laws
- Identifies areas of risks which impact health and safety in your company
- Reduces work accidents, creates a safe work environment
- Plans and procedures are developed for emergencies
- Ensures constant improvement
- Has an international management system
- Provides a better work environment
- Raises efficiency
- Enables demonstrating the company's awareness of occupational safety to authorities

ISO 10002 OHSAS

LUFT has established a management system in its manufacturing plant which regulates how to manage the process after receiving a customer complaint, the ways of transforming a customer dissatisfaction arising from the complaint to satisfaction, and which aims to serve the customer beyond the customer's expectations; and has been awarded this certificate.

Benefits of ISO 10002

- The information which is obtained through handling complaints can lead to improvement of products and processes, and when complaints are addressed in a suitable manner, the company's reputation can be improved regardless of its size, venue, and industry. The value of this standard becomes even more evident since it assures the market of consistent handling of complaints.
- An effective and efficient process of handling complaints reflects the needs of companies and of buyers purchasing these products.
- Handling of complaints through a process can raise customer satisfaction.
- In cases where the customer is not satisfied, encouraging feedback including complaints can offer opportunities for preserving or increasing customer loyalty and approval and increase international competitive capacity.
- It can give the complainant access to an open and responsible process for handling complaints.
- It can increase the company's ability resolve complaints in a consistent and systematic manner, and in a fashion that will satisfy the complainant and the company.
- It can increase the company's ability to identify complaints and eliminate the causes leading to the complaints, and thus improve company operations.
- It can assist the company in developing a customer-oriented approach for resolving complaints, and for encouraging its employees to develop their capabilities of working with customers.
- It provides a foundation for constant review and analysis of processes of handling complaints, resolving complaints, and process improvements.

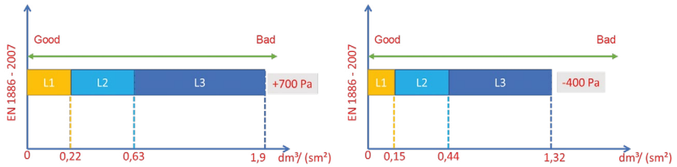
Mechanical Performance Specifications of Air Handling Units According to EN 1886

Mechanical Strength of Casing

Mechanical strength of the air handling unit frame is measured in terms of deflection (mm/m) at design conditions. This test measures permanent deformation. Products are classified as D1<4<D2<10<D3 (mm/m) according to measured results. D1 is the best class.

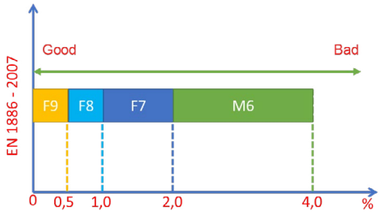
Casing Air Leakage

These are tests where the amount of possible air leakage from the air handling unit casing under 400 Pa negative and 700 Pa positive pressure is determined and classified. The classes are L1<0.15<L2<0.44<L3<1.32 (l/sm²) under 400 Pa negative pressure, and L1<0.22<L2<0.63<L3<1.90 (l/sm²) under +700 Pa positive pressure. L1 is the best class.



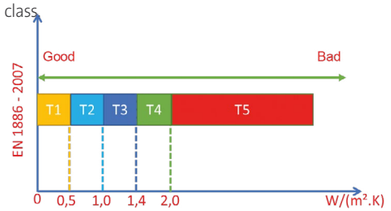
Filter Bypass Leakage

Classification is made on the basis of the percentage of the air flow passing unfiltered from the air handling unit filter frame under 400 Pa positive pressure to total air flow. The classes are F9<0,5<F8<1<F7<2<F6<4<F5<6 (%k). F9 is the best class.



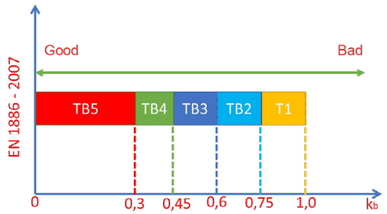
Thermal Transmittance Test

This is the test and classification for determining the thermal transmittance of the air handling unit casing and panel structure. Tests are carried out by maintaining a temperature difference of 20 K between the air handling unit interior and exterior, and a 0.1 m/s air velocity over the exterior surface. The classes are T1<0.5<T2<1<T3<1,4<T4<2<T5. T1 is the best class.



Thermal Bridging Test

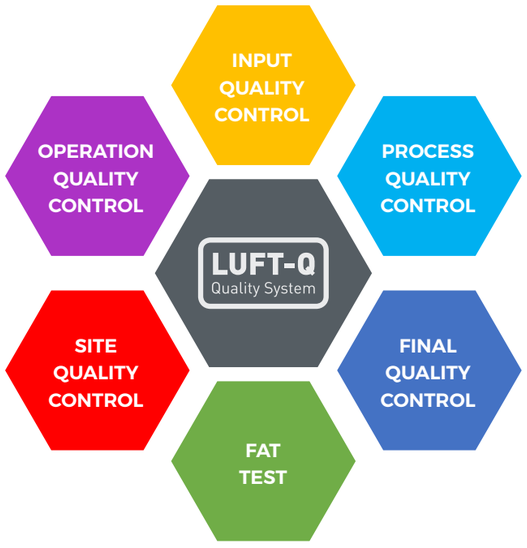
This is a test which determines and classifies thermal bridges that may occur between the interior and exterior environment of the air handling unit casing. The calculation is based on those points with the highest temperature on the exterior surface where the temperature difference between the internal and external environment is 20 K. A good class indicates a low condensation risk on the air handling unit casing. The classes are TB5<0.3<TB4<0.45<T- B3<0.6<TB2<0.75<TB1<1. TB1 is the best class.

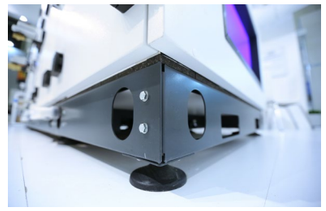


LUFT-Q Quality Brand

All manufacturing processes for LUFT Air Handling Units are secured under quality processes which can be monitored. The process begins with raw material controls, and concludes with a Field Quality Control performed after the products have been installed on site. Products in projects which have successfully completed this process fulfill the requirements of the LUFT-Q Quality Brand, and are placed within the scope of a full scale warranty for 5 years.

LUFT-Q Quality System





Input Quality Control

All materials used in the manufacturing of LUFT Air Handling Units have Technical Specifications that meet the requirements of the LUFT-Q Quality Brand. These specifications stipulate all Technical Specifications of the products that are covered by the 5 Year Warranty. Products that do not meet these criteria are not used in LUFT Air Handling Units. All products are subjected to Input Quality Control on an individual basis before entering the warehouse. Products that fail to meet criteria can not enter the factory.

Input Quality Control Points:

- Check of whether the ordered product has arrived
- Check of whether all of the product's technical specifications have been met
- Quantity check
- Check of physical damage
- Check of mechanical damage
- Check of bill

LUFT Air Handling Unit / About LUFT

Process Quality Control

LUFT Air Handling Unit manufacturing stages comprise three main stages which are the Raw Materials Handling Process, Intermediate Product Preparation Process, and the Final Assembly Manufacturing Process. Process Quality Control Procedures have been defined for all these main stages, and their subordinate stages, with controls being implemented at each stage, which prevent the product from entering a subsequent stage in case of any failure to meet criteria. In this way, the manufacturing is completed by achieving the optimum point in the Quality - Time - Cost triangle as the process reaches the end product.

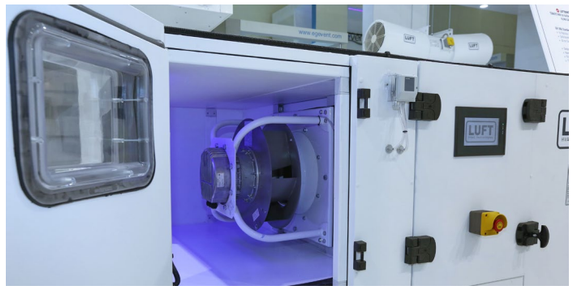
Process Quality Control Points:

- Check of whether sheet metal parts have been manufactured within tolerance limits
- Check of whether semi-finished products have been manufactured within tolerance limits
- Check of whether the fan-motor assembly has been manufactured within tolerance limits
- Check of whether Air Handling Unit Sections have been manufactured within tolerance limits
- Check of whether sections have been manufactured in compliance with the directions and technical specifications stated with the order.

Final Quality Control

Products that pass through the Input Quality Control and Process Quality Control points without any problems are checked while they are in operation at the Final Quality Control point. These operational tests check the following points.

- Mechanical checks are conducted on the Fan Motor block.
- Working pressure values are formed, and the current drawn by the air handling unit is checked.
- Vibration balance controls are performed.
- Mechanical checks are conducted on the filter mechanisms.
- Air handling unit sections are placed under positive and negative pressure, and checked for air leaks using smoke tests.
- The product's brand and labels are checked.



Process Quality Control

As per the standards of the 5 year warranty of the LUFT-Q Quality Brand, on site installation of all LUFT Air Handling Units are performed by LUFT-AS teams or teams authorized by LUFT-AS. After the installation, both the air handling unit, and the air handling unit support systems installation are checked. Products that complete all these processes without problems are given the LUFT-Q Quality Brand and are covered by a 5 year full range warranty. Field Quality Control Points:

- Check of adequate maintenance clearances required for servicing the unit
- Check of assembly clearances required for air ducts to be connected to air intake and discharge points
- Check of whether the pipework for the conditioned water supplied to heating and cooling systems have been connected properly
- Check of whether the floor on which the unit will be installed is level
- Check of suitability of the system supplying the Air Handling Unit with power
- Check of suitability of the control unit of the Air Handling Unit automation system
- If the unit is equipped with an Electrical Heater, check of whether the suitable safety measures have been taken in the supply system

Operation Process Quality Control

Quality Control Procedures that are to be performed during operational processes must proceed without problems for LUFT-Q 5 year full warranty to continue. The most important point in this process is the timely execution of periodical maintenance, and the spare parts that meet technical values specified in the LUFT-Q Quality Brand.

Unit data are constantly relayed to LUFT IOT platforms over the LUFT Automation and the IOT system, and reports are tracked.

Furthermore, periodical maintenance data are logged on the chip equipped service cards found on unit, and automatic reporting is performed for imminent service times and equipment which need replacing.

Factory Acceptance Test (FAT)

LUFT guarantees that LUFT air handling units shall be manufactured to meet all customer requests and all project details. To this end, the FAT test is carried out for products when requested, to ensure customer satisfaction. Detailed tests are performed under the following headings as part of the FAT test, and the results are reported.

- Air Flow Rate - External Pressure Test
- Vibration Test
- Test of Materials According to Design and Selection Outputs
- Test of Dimensions of Units According to the Approval File
- Run Test
- Checks of Warning, Information, and Directional Labels
- Packaging and Shipping Checks
- Checks of Accessories and Special Customer Requirements
- Automation System Checks

Software Infrastructure

All processes pertaining to the design, manufacture, and shipment of the LUFT air handling unit are carried out over integrated software systems.

LUFT AHU Selection Software

LUFT Air Handling Unit designs can be performed in an easy, quick, and trouble-free way using the LUFT AHU Selection Software. General Features of the LUFT AHU Selection software are as follows:

- The ability to access the software online from anywhere in the world
- The sketch of the designed air handling unit is created simultaneously, and can be printed afterwards in dxf or 3D format.
- A technical report is prepared describing all technical specifications of the air handling unit selected.
- Using the selection software, selection and design can be carried out for fan, motor, water coil, gas coil, plate type heat recovery, rotor heat recovery, runaround heat recovery, filter, electrical heater, steam humidifier, water humidifier, and silencer sections.
- Air handling units with dimensions outside the normal manufacturing range can be selected.
- Multi-language support: Turkish, German, English, Russian
- The ability to select LUFT Air Handling Units that conform to ErP 2018 directives.
- Automation selections can be carried out.

PTC CREO

All designs for the LUFT Air Handling Unit are prepared parametrically in a 3D environment. The conformity of all parts with other parts is analyzed following the design. After the analysis, manufacturing images of the parts are created, and delivered online to the cutting and bending center integrated through software.

FloEFD Menter Graphics

Flow analyses have been conducted at points of cross sectional change within the LUFT air handling unit, and the design of relevant parts were modelled for minimum pressure drop using Mentor Graphics software. This has made possible the design of an air handling unit with minimum internal pressure drops.

Solid Works and Simulation

Design of frame properties of the LUFT air handling unit have been modelled and tested on a virtual environment as per the EN 1886 standard, using the Solid Works and Simulation software. These testing and development efforts have led to the most suitable model cross sections, and frame design.

The ERP System – Dolibarr - NETSİS

Corporate resource planning (ERP - Enterprise Resource Planning) is used in LUFT Air Handling Unit manufacturing facilities. By use of ERP, efficient utilization of the labor, equipment, and materials resources required for manufacturing is ensured, and these resources are managed in an integrated management system. The objective is to provide stakeholders with the following benefits through the use of the LYFT ERP system:

- Integrated Financial Information
- Integrated Customer Order Information
- Increase in the Process Speeds of Standardization and Manufacturing
- Inventory Optimization
- Standardization of HR Information

LUFT AIR HANDLING UNIT

AREAS OF USE

LUFT AIR HANDLING UNIT

AREAS OF USE

Industrial Applications

The LUFT Air Handling Unit was designed by prioritizing the high technological needs of industrial paint facilities in particular. Continuity, quality and technical qualification, traceability, and efficiency are high priority issues for industrial applications. Most industrial facilities are planned for continuous operation except during general maintenance requirements. The cost of unplanned stoppages will lead to substantial financial loss for these businesses. The LUFT Air Handling Unit was designed in consideration of these needs.

Continuity

The operation of LUFT Air Handling Units is constantly monitored with the patented LUFT-IOT system, and the operational data of the air handling unit are recorded. Algorithms developed using the records obtained make it possible to predict future malfunctions and to take measures before any malfunction has occurred. This prevents air handling unit downtimes and ensures continuity in the system. The chip equipped recording and monitoring system enables unit performance and service requirements to be monitored regularly.

Traceability

All manufacturing processes of the LUFT Air Handling Unit have a system allowing traceability, measuring, and reporting under the assurance of the ISO 9001 2015 management system. In addition, by virtue of the LUFT-Q quality system, records are made of each control point activated during the Input Quality Control, Process Quality Control, Final Quality Control, Field Quality Control, and Operational Process Quality Control processes. This integrated system allows all processes in the manufacturing of the product to be recorded on an individual basis, and all records are shared with our customers when requested.

Quality and Technical Qualification

LUFT Air Handling Units have technical specifications capable of accommodating the requirements of tough industrial applications, and are covered by a 5 year warranty under the LUFT-Q Quality System. Components that conform to current ErP norms can be selected over the LUFT AHU Selection air handling unit design software at the design stage. This makes it possible to provide and report similar technical qualification values for every product that is manufactured.

LUFT Air Handling Units are superior units; Class T3 Thermal Transmittance, Class TB2 Thermal Bridging, Class L1 Air Leakage, Class D1 Casing Strength, and class F9 filter leakage according to the EN 1886 standard.

Efficiency

LUFT AHU Selection software facilitates design of units in compliance with current ErP standards. Design of products in accordance with the current ErP standards which are based on product efficiency guarantees the design of high efficiency air handling units to meet requirements. Selections that are in compliance with current ErP standards are reported with technical outputs and this information is shared with our customers.

Our ISO 9001 2015 management system and Lean Manufacturing Method guarantee the manufacturing of traceable products with a high price/performance value.

Blygold CORROSION PROTECTION · erp Ecodesign Ready · LUFT IOT and Automation

LUFT OFFSHORE Design

LUFT AIR HANDLING UNITS

OFFSHORE Special Design (C5-M Corrosion Protected)

C5-M Corrosion Protected

- **Blygold "CasingGuard"** Coated C5-M Class Casing Design
- **Blygold "PoluAL MB"** Microbiolojic Anti corrosion Coated Coils
- **Ebm / Comefri** EC/AC Fans
- ErP 2016/2018 **Ecodesign Energy Class** Selections
- **Siemens** Automation System (Optional)
- **LUFT-IOT** Internet Of Things System (Optional)
- **5 Years** Corrosion Warranty

LUFT HVAC Technologies

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//Luft Klima Sistemleri
//Luft Klima

Comfort Applications

The Luft Air Handling Unit has test results certifying compliance with T3, TB2, L1, F9, and D1 classification according to the EN 1886, and a steel frame with technical specifications that can accommodate all air conditioning processes that can be required by comfort applications under tough climate conditions without any problems. These processes include

- Heating-Cooling
- De-Humidification – Humidification
- Dust Filtration
- Odor and Grease Filtration
- General Purpose Ventilation
- Heat Recovery
- The ability to operate in the 1000 – 150000 m^3/h air flow rate range
- The option of shipping in disassembled form when required.

Hygiene Applications

The LUFT hygiene air handling unit has a design that will meet requirements of the most stringent of hygiene conditions from operating rooms to pharmaceutical manufacturing.

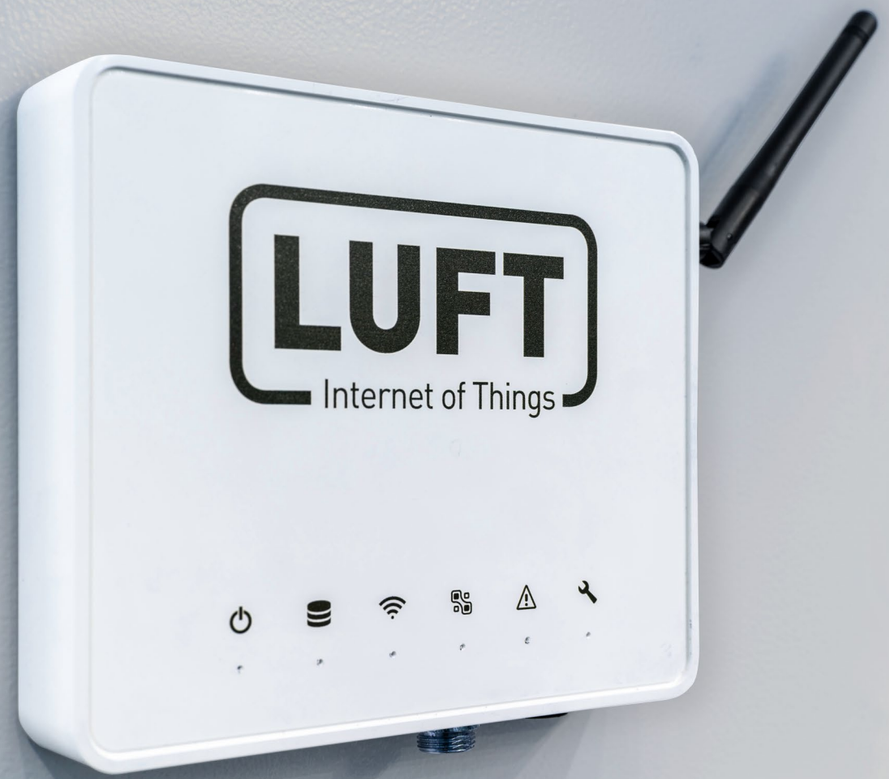
The LUFT Air Handling Unit has technical specifications that are capable of meeting all requirements of the updated DIN 1946 – 2018 standard. These properties are primarily.

- The unit has technical specifications which conform to the EN 1886 standard.
- The entire interior surface is smooth and easily cleaned.
- The drain pan has a special design with no thermal bridging and with fast drainage.
- Plastic equipment used on internal surfaces that come into contact with air have antibacterial test results from accredited laboratories.
- There are no sharp edges anywhere.
- The unit has high corrosion resistance (BlyGold coating).
- The unit intakes and discharges are shut off by fully hermetic air dampers.
- The coil is designed for easy water drainage.

LUFT AIR HANDLING UNIT

DESIGN DETAILS

LUFT HVAC Technologies



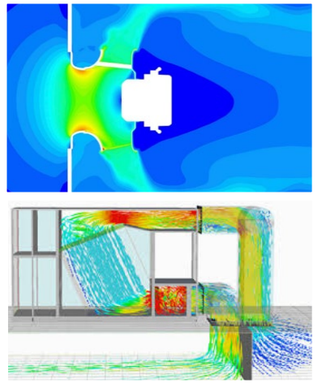
DESIGN DETAILS

Computer Aided Product Design

The LUFT Air Handling Unit is designed with the aid of a computer, with design optimization of every part. These steps can be outlined as such: All parts have been designed in 3D on the SolidWork Parametric design program. The most suitable model designs were achieved through load analyses and flow analyses in SolidWork Simulation.

Detailed internal flow analyses and positioning of parts of air handling units are modelled using the FloEFD Menter Graphics software, and the designs of parts which increase internal pressure drop such as bypass sheets, silencer air directors, fan hood sheets, and positioning of filters were examined and adjusted to yield minimum pressure drop.

As a result of these efforts, some design improvements were made regarding parts such as a bypass sheet placed at an angle, the optimum filter intake distance, directors at air intake and discharge points of silencers, and the use of perforated sheets before the fan hood sheet.

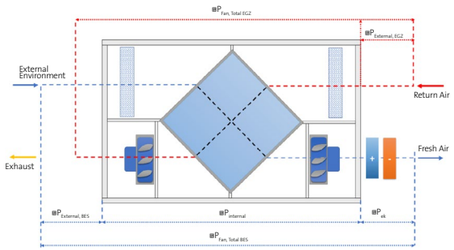


Design of Products with ErP 2018 Conformity

ECO Design Directives comprise all of the legislation which determine and limit consumption criteria for energy-expending products, with which manufacturers of these products must legally abide.

These directives cover all product groups. LOT6 Criteria covering ventilation and air handling units were accepted and took effect in 2013, under the directive number EU1254/2014. ECO Design directives that were prepared based on energy efficiency has been recognized as a pre-condition for CE certification of products. The circulation of products that do not conform to this condition in EU countries has been restricted.

ErP			ErP-2018
Necessity of a System Where a Thermal Bypass Can Be Implemented			**Required**
Minimum thermal efficiency of HRS BVU Heat Recovery		**Run Around Type**	**68**
		Plate Type Drum Type	**73**
Filter Differential Pressure Switch			**Required**
Minimum Fan Efficiency UVU ηsys(%)		**Psys ≤ 30 kW**	**6.2 x ln(Psys)+42**
		Psys > 30 kW	**63.1**
Variable Speed Controlled Fan			**Required**
SFPint Value [W/(m³/s)]	BVU		
	Run Around System	q_nom<2m^3/s	1600+E-300xqnom/2-F
		q_nom≥2m^3/s	1300+E-F
	Plate Type, Drum Type	q_nom<2m^3/s	1100+E-300xqnom/2-F
		q_nom≥2m^3/s	800+E-F
	UVU		230
HRS Efficiency Add-On Value E [W/(m³/s)]		Run Around Sistem	(η-0,68) x 3000
		Plate Type, Drum Type	(η-0,73) x 3000
Filter Correction Factor F [W/(m³/s)]		Reference Type	0
		For M5 Filter	150
		For F7 Filter	190
		For F7 + M3	360



How to calculate SFP Value

$$SFP_{internal} = 100 * \left(\frac{\Delta P \text{ internal, nom, BES}}{\eta \text{e, BES}} + \frac{\Delta P \text{ internal, nom, EGZ}}{\eta \text{e, EGZ}} \right)$$

High Corrosion Resistance

Thanks to the use of Cataphoretic coating and Blygold coating methods, LUFT air handling units offer a 5 year no corrosion warranty.

Cataphoretic coating is a fully automated immersion coating process based on the principle of charging the part with a continuous negative electrical charge and the bath with positive electrical charge. High corrosion resistance is achieved through attraction of paint particles to the surface resulting in an even film of paint.

Cataphoretic coating is a cathodic process involving immersion, which furnishes the sheet metal parts of the air handling unit with exceedingly high corrosion resistance. This pioneering technology is an indispensable method used by automobile and white appliance manufacturers throughout the world.

In our company's manufacturing plant which are equipped with this facility, all sheet metal parts of LUFT Air Handling Units are treated with the cataphoretic method, guaranteeing 5 year corrosion free operation. This method offers

- Excellent coating of corners, enclosed spaces, and welded joints,
- Minimum wastage,
- Environmentally friendly application (water based and low solvent content),
- Low fire risk
- Excellent adhesion and adaptation with final layer coating applications,
- And high resistance to corrosion.

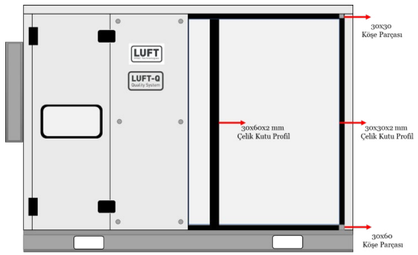
Blygold Coating

Heat exchangers are subject to high corrosive effects throughout their useful life. Corrosion on exchangers and the consequent pollution has a direct influence on performance. Unless these corrosion risks are prevented, there is the risk of the exchanger becoming inoperable in the medium run. BlyGold coating for class C5-M exchangers conforming to the ISO 12944 standard provides long term protection against corrosion without effecting the heat transfer and air side pressure drops of exchangers. Blygold Coating; the aluminum pigmented Polyurethane corrosion coating system called BlyGOLD PoluAlt XT is globally patented under its own name.

This revolutionary product prevents up to 20% of capacity losses which occur in time due to corrosion in heat exchangers and on metal surfaces. Thanks to the aluminum pigments in its content, it minimizes coil capacity losses (test values range between 0 and 3% depending on fin geometry). Air side pressure drops range between 0 and 5% depending on fin geometry. Its ASTM B17 Neutral-Salt spray resistance is 11,000+ hours, ASTM B287 Acid-Salt Spray resistance is 4000+ hours. The application thickness is 25-30 microns, and the product has excellent UV resistance.

High Strength Frame Design

The carcase of the LUFT Air Handling Unit comprises 30x30x2 mm and 30x60x2 mm steel box profiles. These 30x30 and 30x60 steel box profiles are connected to each other with angle fittings with no thermal bridging, creating the carcase framework of the air handling unit. The carcase framework is class D1, the highest strength class according to the EN 1886 standard. 30x30x2 steel box profiles constitute the general carcase framework, while 30x60x2 mm steel box profiles are used as supporting profiles that will provide the minimum deflection conditions for class D1.



Panel Design Without Thermal Bridging

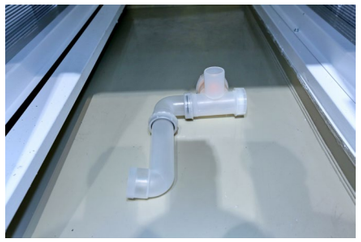
The Luft panel door has a LUFTSİS AŞ patented design with standard 1 mm thick external and 1 mm thick internal sheet metal with A1 fire class rock wool insulation with a density of 70 kg/m3 and a thickness of 60 mm between the internal and external surface. Galvanized sheets conforming to EN 10142-Fe PO2G are used in manufacturing the panels as standard material. Following the sheet metal processing, panel corner joints are Argon welded, shutting the panel off completely, and ensuring a fully hermetic seal on the enclosed form. The internal and external sheets of the door are designed with no thermal bridges, and no contact with 8 mm thick thermal insulation with low thermal transmittance between them.

Panels are fixed on the frame using hidden type steel screws with special Geomet 321 coating, with 720 hour salt spray test. Screws that are embedded in the panel are designed in a way that will not cause thermal bridging inside the panel, and they are protected from the elements by fully closed and insulated special protective caps. EPDM/EVA gaskets with exceedingly high thermal and water transmission resistance are used in joints between panel and frame.

Non-Condensing Drain Pan Design

The LUFT air handling unit with its pan design that is registered no thermal bridge design is distinguished from conventional sheet metal pan designs, offering the following properties and benefits.

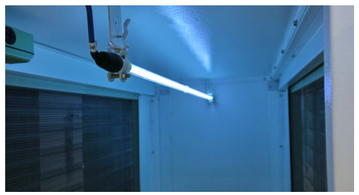
- Since it is manufactured of PP material it has a much lower heat transfer coefficient than pans manufactured of conventional steel, which leads to lower heat leakage.
- Thanks to the low heat leakage value, there is no need for additional insulation below the pan, and condensation does not occur on the pan's exterior surface.
- The 10 mm wall thickness furnishes the drain pan with a more rigid structure to withstand loads and prevents plastic deformations.
- Since it is manufactured of PP material, there is no corrosion problem.



Casing Design in Conformance with the DIN 1946-2018 Hygiene Standard

The unit has a casing design capable of meeting all requirements of the updated DIN 1946-2018 standard. These properties are:

- Steel carcase framework with D1 frame strength class, and with cataphoretic coating,
- Casing design with classes T3, TB2, L1, D1, F9 according to the EN 1886 standard,
- Stainless pan design manufactured of PP material,
- The use of plastic parts with antibacterial test certificate from accredited lab,
- Heat exchangers with raised corrosion resistance through BlyGold coating.



Casing With 5 Year No-Corrosion Warranty

LUFT Air Handling Units offer 5 year no-corrosion warranty, as a first in the sector. This warranty can be offered by virtue of the following superior properties:

- Steel carcase framework with cataphoretic coating,
- Raised corrosive resistance of all wet surfaces within the air handling unit thanks to BlyGold coating,
- All metal parts painted after completion of sheet metal working processes,
- Drain pan manufactured of PP material.

Luft Automation Control Systems

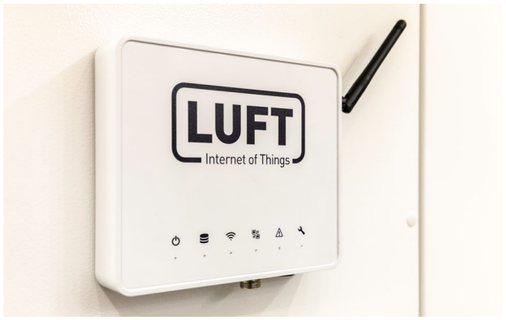
The air handling unit must be controlled by an automation system to ensure that the unit maintains the desired comfort conditions for the room efficiently and that the unit can be monitored. The following controls can be carried out in air handling units with automation systems.

- The ability to adjust room conditions
- Control of air flow rate, hot-cold water flow rate, refrigerant flow rate
- Pressure control
- Temperature and humidity control
- Variable capacity control
- Fan vibration control
- Free Cooling control
- Defrost control
- Filter dirtiness control
- Malfunction and alarm control
- Noise control
- Drainage control
- Instantaneous and scheduled data control
- Scheduled programming
- Fire scenario

LUFT-IOT Internet of Things System

LUFT-IOT is the entirety of the efforts whereby data regarding the air handling unit's operational performance, alarms and malfunction codes generated are recorded and made smarter by the system to ensure more efficient operation of the air handling unit. Data is collected from the air handling unit at 6 second intervals via 11 sensors positioned on the air handling unit and their associated contacts.

- 3 temperature sensors; outdoor air temperature, return air temperature, supply air temperature
- 3 pressure differential sensors
- 3 humidity sensors; outdoor air humidity value, return air humidity value, and supply air humidity value
- 2 current sensors
- 3 empty contact sensors
- The GSM IOT Module, the Luft IOT Platform



In addition to these sensors, additional sensors can be added such as Air Quality Sensor, Vibration Sensor, Acceleration Sensor, Pressure Sensor, Weight Sensor, Fire Sensor, and Movement Sensor, and data can be collected over these sensors.

Functional Hinge Lock System

The locking mechanism and hinges are capable of maintaining design criteria when exposed to outdoor conditions, and have a thermal bridge-free hinged and locked design, and their installation can be adjusted on 3 axes. This feature enables the doors to allow both RIGHT- and LEFT-handed opening. The door can be completely removed if needed. Functional hinge-locks are fixed to mechanically supported panels with corrosion resistant Geomet coated screws. The screws are covered with protective plastic caps to prevent thermal bridges. The access door is designed to allow full closure and exert exert sufficient pressure on the seals.

Electrostatic Powder Paint

Internal and external surfaces on Luft air handling units, including bypass sheets, bases, and coil collectors are treated with electronic powder paint with a thickness of 100 micro, as a STANDARD. Following the processing of metal surfaces and drilling of holes, and the surface washing, and degreasing processes, the painting process is carried out in climate-controlled painting cabins, which prevents galvanized steel surfaces from exposure to corrosion after processing and shaping.

RAL 9007
Panels interior and exterior surfaces, Bypass plates RAL 9007 (Silver Gray)

RAL 7016
Chassis and pedestals, flanges, dampers RAL 7016 (Anthracite)

Air Control Dampers

The frame and blades of air control dampers are manufactured of extruded aluminum with eloxal in order to protect against the corrosive effects of the outdoor environment, and treated with electrostatic powder paint, and have a leakage class conforming with the NI EN 1751: 2003. The dampers in hygiene applications are Class 4. Fins are double walled and aerodynamic for minimum resistance. Blade rims and frames are insulated with hermetic seals. Damper blades move with an internal hidden gear mechanism to avoid dust accumulation and deformation. Dampers are suitable for manual or servomotor control. Dampers are equipped with an adjustment mechanism and position indicator.

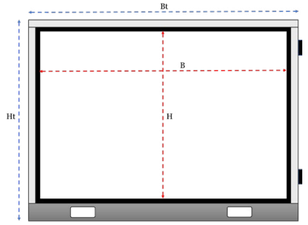
Modular Section Design

Luft Air Handling Unit cross section dimensions are based on an increasing and decreasing logic. Module measurements were adjusted as multiples of 153 mm.

Model No
LUFT 4 X 6

- Width Module
- Height Module

Cross - Section Height Calculation (H): 153 x 4 = 612 mm
Cross - Section Width Calculation (B): 153 x 6 = 918 mm
Total Width Calculation (Bt): B + 2*60 = 1038 mm
Total Height Calculation (Ht): H + (90+150) = 852 mm



Model No				Cross-Section Dimensions (Height x Width)		Air Flow Rates (m³/h) by Speed Classification According to the EN 13053 Standard					
						V1 (m/s)	V2 (m/s)	V3 (m/s)	V4 (m/s)	V5 (m/s)	V6 (m/s)
						1,6	1,8	2	2,2	2,5	3
LUFT	4	x	4	612	612	2157	2427	2697	2966	3371	4045
LUFT	4	x	6	612	918	3236	3641	4045	4450	5056	6068
LUFT	4	x	8	612	1224	4315	4854	5393	5933	6742	8090
LUFT	6	x	6	918	918	4854	5461	6068	6674	7585	9101
LUFT	6	x	8	918	1224	6472	7281	8090	8899	10113	12135
LUFT	6	x	10	918	1530	8090	9101	10113	11124	12641	15169
LUFT	6	x	12	918	1836	9708	10922	12135	13349	15169	18203
LUFT	8	x	8	1224	1224	8629	9708	10787	11866	13484	16180
LUFT	8	x	10	1224	1530	10787	12135	13484	14832	16854	20225
LUFT	8	x	12	1224	1836	12944	14562	16180	17798	20225	24270
LUFT	8	x	14	1224	2142	15102	16989	18877	20765	23596	28316
LUFT	8	x	16	1224	2448	17259	19416	21574	23731	26967	32361
LUFT	10	x	10	1530	1530	13484	15169	16854	18540	21068	25282
LUFT	10	x	12	1530	1836	16180	18203	20225	22248	25282	30338
LUFT	10	x	14	1530	2142	18877	21237	23596	25956	29495	35394
LUFT	10	x	16	1530	2448	21574	24270	26967	29664	33709	40451
LUFT	10	x	18	1530	2754	24270	27304	30338	33372	37923	45507
LUFT	10	x	20	1530	3060	26967	30338	33709	37080	42136	50563
LUFT	12	x	12	1836	1836	19416	21843	24270	26697	30338	36406
LUFT	12	x	14	1836	2142	22652	25484	28316	31147	35394	42473
LUFT	12	x	16	1836	2448	25888	29125	32361	35597	40451	48541
LUFT	12	x	18	1836	2754	29125	32765	36406	40046	45507	54609
LUFT	12	x	20	1836	3060	32361	36406	40451	44496	50563	60676
LUFT	12	x	22	1836	3366	35597	40046	44496	48945	55620	66744
LUFT	12	x	24	1836	3672	38833	43687	48541	53395	60676	72811
LUFT	14	x	14	2142	2142	26428	29731	33035	36338	41293	49552
LUFT	14	x	16	2142	2448	30203	33979	37754	41529	47193	56631
LUFT	14	x	18	2142	2754	33979	38226	42473	46721	53092	63710
LUFT	14	x	20	2142	3060	37754	42473	47193	51912	58991	70789
LUFT	14	x	22	2142	3366	41529	46721	51912	57103	64890	77868
LUFT	14	x	24	2142	3672	45305	50968	56631	62294	70789	84947
LUFT	14	x	26	2142	3978	49080	55215	61350	67485	76688	92025
LUFT	14	x	28	2142	4284	52856	59463	66070	72677	82587	99104
LUFT	16	x	16	2448	2448	34518	38833	43147	47462	53934	64721
LUFT	16	x	18	2448	2754	38833	43687	48541	53395	60676	72811
LUFT	16	x	20	2448	3060	43147	48541	53934	59328	67418	80902
LUFT	16	x	22	2448	3366	47462	53395	59328	65261	74160	88992
LUFT	16	x	24	2448	3672	51777	58249	64721	71193	80902	97082
LUFT	16	x	26	2448	3978	56092	63103	70115	77126	87643	105172
LUFT	16	x	28	2448	4284	60406	67957	75508	83059	94385	113262
LUFT	16	x	30	2448	4590	64721	72811	80902	88992	101127	121352
LUFT	16	x	32	2448	4896	69036	77665	86295	94924	107869	129442
LUFT	18	x	18	2754	2754	43687	49148	54609	60069	68261	81913
LUFT	18	x	20	2754	3060	48541	54609	60676	66744	75845	91014
LUFT	18	x	22	2754	3366	53395	60069	66744	73418	83430	100116
LUFT	18	x	24	2754	3672	58249	65530	72811	80092	91014	109217
LUFT	18	x	26	2754	3978	63103	70991	78879	86767	98599	118318
LUFT	18	x	28	2754	4284	67957	76452	84947	93441	106183	127420
LUFT	18	x	30	2754	4590	72811	81913	91014	100116	113768	136521
LUFT	18	x	32	2754	4896	77665	87374	97082	106790	121352	145623
LUFT	18	x	34	2754	5202	82520	92834	103149	113464	128937	154724
LUFT	18	x	36	2754	5508	87374	98295	109217	120139	136521	163826
LUFT	20	x	20	3060	3060	53934	60676	67418	74160	84272	101127
LUFT	20	x	22	3060	3366	59328	66744	74160	81576	92700	111240
LUFT	20	x	24	3060	3672	64721	72811	80902	88992	101127	121352
LUFT	20	x	26	3060	3978	70115	78879	87643	96408	109554	131465
LUFT	20	x	28	3060	4284	75508	84947	94385	103824	117981	141578
LUFT	20	x	30	3060	4590	80902	91014	101127	111240	126409	151690
LUFT	20	x	32	3060	4896	86295	97082	107869	118656	134836	161803
LUFT	20	x	34	3060	5202	91688	103149	114610	126072	143263	171916
LUFT	20	x	36	3060	5508	97082	109217	121352	133487	151690	182028
LUFT	20	x	38	3060	5814	102475	115285	128094	140903	160118	192141
LUFT	20	x	40	3060	6120	107869	121352	134836	148319	168545	202254

LUFT AIR HANDLING UNIT

SECTION DETAILS

Fan Section

EC Fan Section

EC fans are compact fan systems which combine all functional necessities in a single product. As compared to conventional plug fan applications, they take up less space and are assembled in a shorter period of time since they do not require additional equipment such as frequency converter, sinus filter, motor protection, grounding, and bandaged cables. Thanks to these properties, there is no need for electrical control panel materials and other accessories needed for grounding and display which require additional labor and expense.

The blade geometry has an airfoil design. It has an external rotor and the motor is directly coupled with the fan frame. EC Plug fans raise system efficiency by eliminating balance problems through simultaneous static and dynamic balancing of the blade, rotor, and motor system.

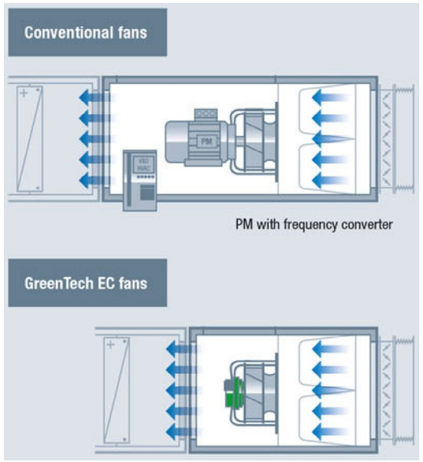
Efficiency is addressed in 3 separate ways in classic plug fan applications, which are motor efficiency, fan efficiency, and inverter efficiency. In EC fans, system efficiency is taken into consideration, which furnishes EC fans with higher efficiency since all components are housed in a single casing. With the increased capacity ranges and improved availability of EC fans, the transition from plug fans to EC plug fans is in full swing.

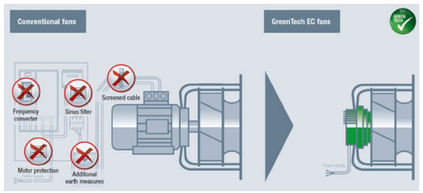
Plug Fan Section

The fan section that is formed by combining the Motor, Plug Fan, and Frequency Inverter. It does not require a system such as conventional belt and wheel systems for transmission of power from the motor to the fan. The motor is connected directly to the fan bearing. In this way, power transmission losses that occur around 15-20% in conventional belt and wheel systems are reduced to 1-3%.

In belt and wheel systems, the proportion of motor rpm to fan rpm can be adjusted via bearing measurements, however, since the motor shaft of plug fan systems is directly coupled to the fan bearing, the motor's rpm is equal to that of the fan. Rpm control is performed by adjusting motor rpm through a frequency inverter.

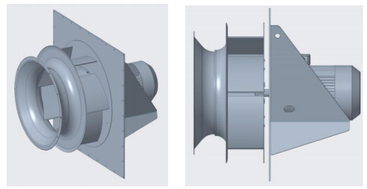
EC Plug fans have varied applications such as in general ventilation, comfort air handling units, hygiene air handling units, and industrial air conditioners. They are certainly preferred particularly for hygiene applications where precise control and being easy to clean are requirements.





Industrial Fan Section

In special baking and drying rooms in industrial applications, the generated hot air must be circulated within the oven. Since standard fan solutions used in air handling units are not capable of creating these special conditions, the industrial fan section was designed, which has high temperature resistance, where the electrical motor is left outside the air flow, and which is equipped with mechanical components which prevent the formation of sparks. Plug Fans are used as standard equipment. They can be manufactured in direct coupled types or with conventional belt and wheel power transmission system as required. Industrial fans are ATEX certified.



The DX / Cooling Coil Section

The section in air handling units where heating, cooling, and de-humidification are performed. There are two types of coils according to the type of refrigerant used for cooling: water and gas. In water systems, the conditioned water needed for heating and cooling are provided by the boiler and chiller. In gas systems, the air handling unit is connected to a VRF unit. Depending on the type of application, the VRF unit can be a separate unit or be positioned within the same casing as the air conditioning unit. The structural properties of coils can be listed as the casing, fin surface, collector, exchanger geometry, the number of rows and circuits, and pitch.

Casing

Casing can be defined as the sheet metal parts that constitute the main frame of the coil. It is manufactured in various sheet metal properties and thicknesses depending on type of application. In terms of sheet metal properties, it has a thickness ranging between 1.0 - 1.2 mm, and is galvanized, painted, Magnelis, stainless, and Blygold coating. Particularly in cooling coils where condensation occurs, the use of sheet metal with increased corrosion resistance or Blygold coated casing is recommended.

Fin Surface

Surfaces manufactured of aluminum, steel, or copper, which constitute the heat transmission surface of the coil. Since these surfaces have a direct effect on coil performance, protection of surfaces from corrosion is very important. Surface coating types for coils include the main groups of Blygold coating, Hydrophilic coating, and Epoxy coating.

Blygold Coating:

The aluminum pigmented Polyurethane corrosion coating system called BlyGOLD PoluAlt XT is globally patented under its own name. This revolutionary product prevents up to 20% of capacity losses which occur in time due to corrosion in heat exchangers and on metal surfaces. Thanks to the aluminum pigments in its content, it minimizes coil capacity losses (test values range between 0 and 3% depending on fin geometry). Air side pressure drops range between 0 and 5% depending on fin geometry. Its ASTM B17 Neutral-Salt spray resistance is 11,000+ hours, ASTM B287 Acid-Salt Spray resistance is 4000+ hours. The application thickness is 25-30 microns, and the product has excellent UV resistance.

The Collector

The collector is the assembly of connecting pipes where refrigerant input and discharge in the coil are made. It can be manufactured in copper or steel material.

Number of Rows and Number of Circuits

The number of rows indicates the number of pipes that will be placed in the air flow direction of the coil. The number of circuits indicates the total number of inputs and discharges based on a certain flow rate of refrigerant within the coil and on pressure loss.

Pitch:

Pitch indicates the spacing between the fins of the coil. Lowering this spacing causes the coil to have a higher surface area for heat transmission while raising air side pressure loss.

Coil Geometry:

Coil Geometry describes the diameters of pipes which facilitate the flow of refrigerant within the coil, as well as the dimensions of the placement of these pipes in the coil cross-section.

Geometry	Measurement X	Measurement Y	Pipe Diameter
32x28 1/2	27,5 mm	31,75	1/2
38x33 5/8	33	38,1	5/8
25x22 3/8	21,65	25	3/8

Water Coil Section

Coil sections which use conditioned water as fluid for heating and cooling purposes. The hot water for heating is supplied by the boiler, while the cold water for cooling is supplied by the Chiller.

A drop eliminator, drain pan, and ball siphon are applied as standard equipment in the section. Drop eliminators are manufactured of profiles of special design, manufactured from ABS. Special drop eliminators manufactured of aluminum are offered as optional equipment. Aluminum drop eliminator is standard equipment in industrial applications.

Coil Section with Ultraviolet Lamp

The percentage of wet spaces due to condensation is higher in coil sections as compared to other sections. Unless the moisture formed on section surfaces is removed within the adequate time and using the appropriate measures, the surfaces offer conditions that are amenable for bacterial growth. In this case, a UV lamp is installed to prevent the growth of bacteria.

UV lamps placed between the heating-cooling coils service the coils as well as drain pans of cooling coils.

The Blygold Coil Section

The aluminum pigmented Polyurethane corrosion coating system called BlyGOLD Refamac 3509 / 3800 is globally patented under its own name. This revolutionary product prevents up to 20% of capacity losses which occur in time due to corrosion in heat exchangers and on metal surfaces. Thanks to the aluminum pigments in its content, it minimizes coil capacity losses.

The Blygold metallic surface protection ensures 7500 hours in the Salt resistance test.

Drainage System

The drain pan is manufactured with an angle of inclination from PP material. The material is naturally insulated by virtue of its technical properties. In this way, the bottom of the drain pan does not need to be insulated, and condensation does not occur underneath the pan.

Advantages offered by pan manufactured of PP material, as compared to conventional sheet metal pans:

- Since it is manufactured of PP material, no additional thermal insulation is needed.
- Its 10 mm wall thickness prevents it from deforming under human loads to which it is subjected.
- Additional insulation below the pan is not necessary.
- Fast drainage system thanks to the angle of inclination in the design
- It meets hygiene requirements thanks to its antibacterial property.

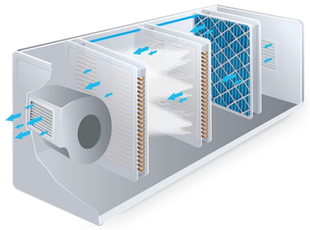
LUFT Air Handling Unit / Section Details

Humidification Section

Keeping humidity under control in air conditioning processes is important for human health. Maintaining a humidity level of 40-60% in comfort applications will eliminate the conditions for many illnesses such as asthma, allergic rhinitis, skin disorders, etc..

Aside from comfort applications, humidity is also important for industrial process applications. High or low humidity levels can be required depending on the type of application.

Humidification systems are generally manufactured in three types which are High Pressure Humidification, Steam Humidification, and Evaporative Humidification. In addition to these, there are also special applications where the steam already available in industrial facilities is used within the air handling unit.

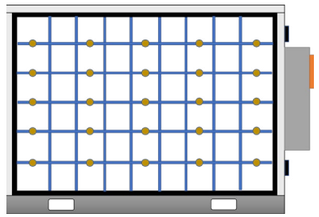


High Pressure Humidifier Section

A system which operates on the principle of separating highly pressurized water to small particles via the nozzle system, to be vaporized due to the latent heat of the air.

System components are:

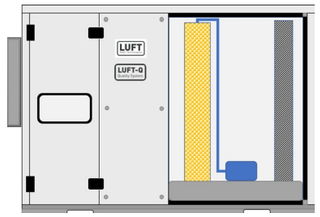
- Pressurization Pump
- Nozzle Network System
- Drain Pan
- Control Unit, Capacity Control Unit



Evaporative Wick Humidification Section

Humidification system employing the latent heat in the air. System components are the wick system, circulation pump, water reservoir, water pipework, dirt catcher, drop eliminator, and spray system.

The water reservoir is manufactured of special PP stainless material, while water distribution nozzles and fittings are manufactured of grade 316 stainless material.

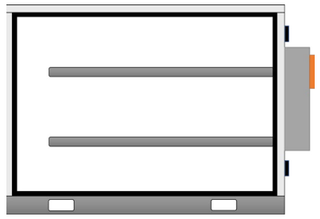


Steam Humidifier Section

Implemented in package type units and positioned inside the air handling unit. There are types with electrodes and heater, that generate steam from water. The steam generated in the units is transferred to the air via a diffuser.

Consists of a water cylinder and electrodes placed within it. When the water within the cylinder comes in contact with electrodes, the electrical circuit closes, and the water begins heating due to ensuing resistance. This is followed by the generation of steam.

Steam Humidifier with Heater: Operates on the principle whereby the heating elements placed within the steam unit heat up the water.

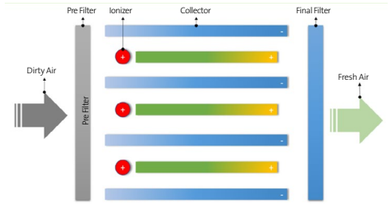


Filter Section

Electrostatic Filter Section

In industrial kitchen applications with intense grease and odor generation, this grease and odor should be removed from the air before it is released to the atmosphere.

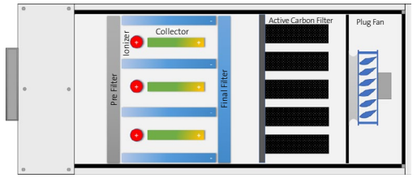
The operating principle of the electrostatic filter is to filter out visible particles in the pre-filtration section. 0.3 micron particles in the air are given a positive load in the highly charged ionizer section. Positively charged particles passing over the collector surface which has a positive charge on one side and a negative one on the other, are drawn to and stick to these negatively charged surfaces. In this way, the grease particles in the air are removed. The final filter section prevents the accumulated particles from being dislodged and transferred to the fan section when the unit has stopped or during unit start-up.



Active Carbon Filter Section

Used for the chemical elimination of odor molecules in the air. Active carbon surfaces comprise hundreds of small pores. Odor particles in the air enter a chemical reaction inside these pores, which eliminates odor from the air.

Active carbon cartridges can be replaced or refilled.



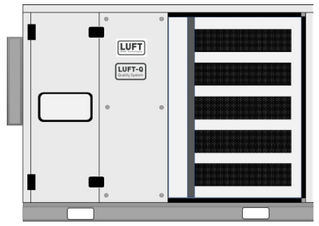
Bag Filter Section

Used for fine filtration in the air handling unit. Named as M5, M6, F7, F8, and F9 according to the EN 779 standard. Standard filter cross section measurements are 592x592 mm (Full Filter) and 592x287 mm (Half Filter). It has 300 and 600 mm pocket size alternatives. The use of a Panel Filter is recommended to extend the useful life of filters.

The pressure loss calculation is performed as below in accordance with the updated filter standard. Whichever is the lower of the two values found as a result of the following calculations is accepted as the final pressure loss value of the bag filter.

- DPinit + 100 Pa
- Dpinit x 3

DPinit : Initial pressure loss of filter (Pa)

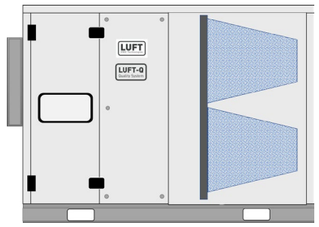


Panel Filter Section

Used for pre-filtration in the air handling unit. Named as G3, and G4 according to the EN 779 standard. Standard filter cross section measurements are 592x592 mm (Full Filter) and 592x287 mm (Half Filter). It has who alternatives with a thickness of 42 mm and 48 mm. Care should be taken to ensure that the panel filter has been installed before the air handling unit is commissioned, and the panel filter should be replaced after additional commissioning. The pressure loss calculation is performed as below in accordance with the updated filter standard. Whichever is the lower of the two values found as a result of the following calculations is accepted as the final pressure loss value of the bag filter.

- DPinit + 50 Pa
- Dpinit x 3

DPinit : Initial pressure loss of filter (Pa)



Heat Recovery Section

Heat recovery; The quality of indoor air on which one or more air conditioning processes are applied suffers after a while, which leads to a need for fresh air in the environment. As the indoor air is charged with heating or cooling energy, heat transfer is made through full or partial mixture with fresh air, before this indoor air is expelled to the outdoor environment. This helps reduce the heating or cooling load required by fresh air. This is called the heat recovery process in air handling units. There are four types of heat recovery in air handling units, depending on the type of application: Plate Type Heat Recovery, Rotor Heat Recovery, RunAround Heat Recovery, and Heat Pipe Heat Recovery.

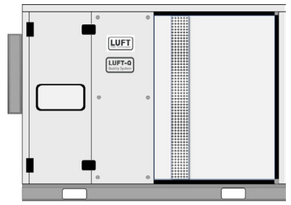
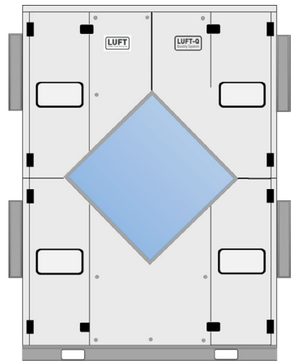


Plate Type Heat Recovery Section

Heat recovery units comprising aluminum boards with different cross sections of flow for exhaust and fresh air, allowing them to flow without mixing. They can be used with counter and cross flow depending on the type of flow. Since the rate of leakage between the fresh air and exhaust air lines, this method is preferred often, particularly in hygiene applications. Average efficiency ranges between 55 to 75 %. There is the risk of condensation on the section depending on operating conditions. Drain pans are used on air discharge sides as required by these conditions.

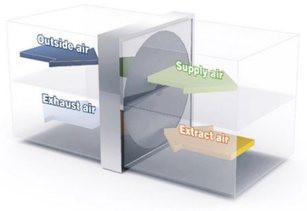
It is recommended for efficiency purposes that a minimum G4 class filter is used as a standard in air intakes.

Free Cooling; the desired room conditions during times of seasonal transitions are close to outdoor air conditions. During these periods, air conditioning can be performed by using minimum energy by applying minimal heating or cooling to the outdoor air. The heat recovery type where the Free Cooling is easiest to apply and control is plate type heat recovery.



Rotary Heat Recovery Section

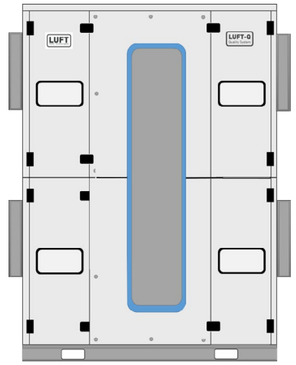
Rotary heat recovery systems are high efficiency systems that are formed of a combination of corrugated aluminum boards where heat transfer occurs between warm and cold air that pass over separated surfaces of exchangers with circular cross sections. They can reach an efficiency of up to 85% depending on type of application. In cases where measures are not taken to prevent it, around 5% air leakage can occur from exhaust air to fresh air. Since they take up less space and have higher efficiency than plate type heat recovery systems, rotary heat recovery systems are more advantageous.



The rotation is 10-20 rotations per minute. The rotation occurs as a result of the rotational force supplied by the rotor being transmitted to the rotor via a belt and wheel system.

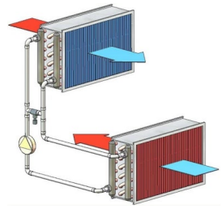
The implementation of a Swept Area can be made to prevent mixing exhaust air with fresh air. For the fresh air to be able to sweep the exhaust air, a higher pressure must be created at the fresh air side than the exhaust side. The swept area that must be applied depending on these pressure values are as follows:

- Between 0-200 Pa, no sweeping area is needed
- Between 200-500 Pa, sweeping area is applied as 2 x 5 degrees
- Between 200-500 Pa, sweeping area is applied as 2 x 2.5 degrees

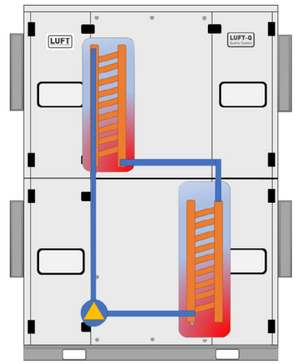


Runaround Heat Recovery Section

These are systems which facilitate heat recovery between the fresh air and exhaust air lines, via water that is passed over a closed circuit within water type heat exchangers, with the aid of a circulation pump. System components are:



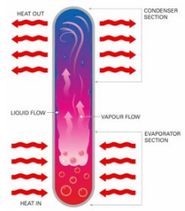
- Water type heat exchanger for fresh air line
- Water type heat exchanger for exhaust air line
- Circulation Pump
- Service Valves
- Dirt catcher
- Expansion tank
- Air purger.



Depending on the area of application, 10-35% glycol is added to the water in the system to prevent freezing. In this system, the fresh air line and exhaust line can be housed inside the casing of a single unit or the two can be located in different areas. This offers a significant advantage as compared to rotary and plate type heat recovery systems. The system operates with an efficiency range of 30-55%. Therefore the percentage of leakage is very low in this system as it is in plate type heat recovery. For this reason, it is a popular choice in hygiene applications.

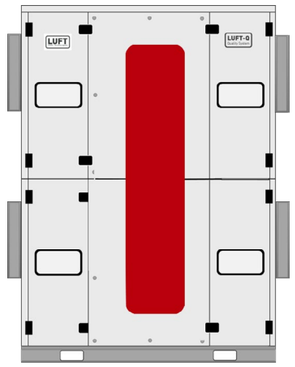
Heat Pipe Heat Recovery Section

The Heat Pipe Heat Recovery system comprises a closed circuit heat exchanger and a coolant placed inside it under pressure. The system does not include any additional energy generating or consuming equipment.



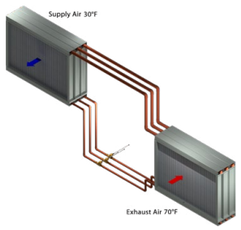
The operating principle is the one where the coolant absorbs heat from the high temperature air passing over it and vaporizes, and the vaporized coolant returns the heat to the low temperature air condensing, and completing the cycle. Efficiency values around 55% can be achieved.

The determining factor here is the temperature values of high and low temperature air, and the correct dimensioning of the heat pipe exchanger. It is a popular system since it takes up small space like the rotary heat recovery system, and requires little maintenance.

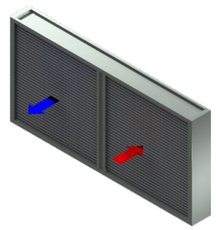


Heat Pipe Application Types

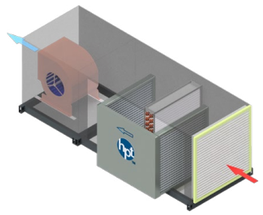
Separate Heat Recovery Application



Stand-Alone Heat Recovery Application



De-Humidification Heat Recovery Application (Horseshoe)



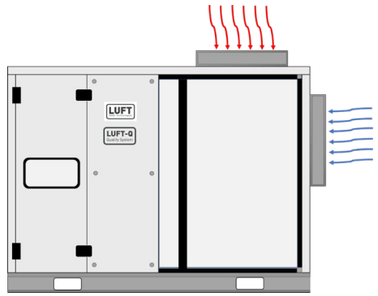
Mixing Section

Mixing sections are used for mixing fresh air with exhaust air that is not of poor air quality in pre-determined proportions. This helps reduce fresh air heating and cooling loads by making use of the energy of the conditioned exhaust air. In cases where the exhaust air contains elements that negatively impact comfort conditions such as odor, grease, etc. the practice of mixing exhaust air with fresh air is not recommended.

Single Fan Mixing Section

Single fan mixing sections are systems where a single fan is used for the return air and fresh air. They do not include an exhaust fan. Dampers are controlled manually, or proportionally, or on/off with a damper motor.

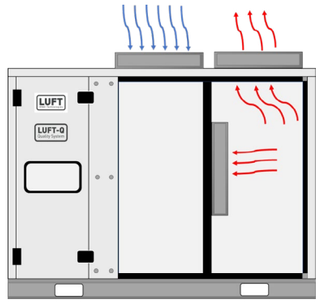
Dampers are selected based on 100% air flow rate through each damper. Maximum air velocity on dampers is 5 m/s.



Double Fan Mixing Section

Double fan mixing sections are systems where two separate fans are used for exhaust air and fresh air. Mixing is performed by adding a specified portion of exhaust air to fresh air. The system includes 3 dampers. These dampers are controlled manually or proportionally or on/off with damper motors, in sync with each other.

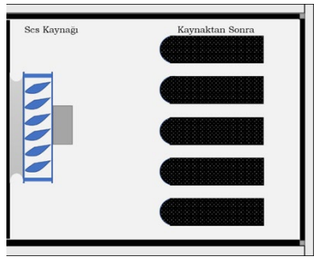
The most important point that should be considered in the double fan mixing section is having the return air section at constant positive pressure as compared to the fresh air section. Otherwise, fresh air will leak into exhaust air and the system will not operate at the desired values.



Silencer Section

The main source of noise in air handling units is the fan and motor group. This sound that is issued from the source needs to be absorbed before it reaches receiving environments. Silencer sections are used for this purpose in air handling units. In some cases, silencers can be placed not inside the air handling unit, but in ductwork systems in proximity of the receiving environment. Silencers are manufactured of rock wool which has high sound attenuating properties filled into sheet metal boxes we call coullisses. The quantities, lengths of these coullisses and their placement within the section can vary according to the required sound attenuation value.

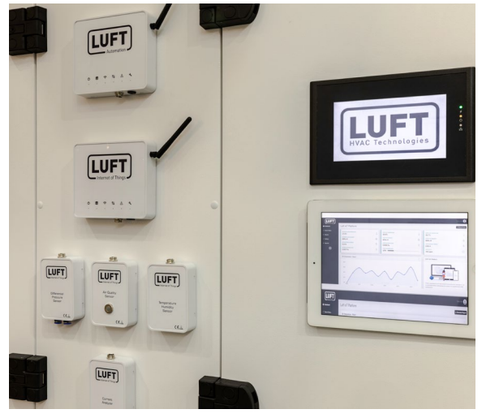
Coulisses treated with a special silver coating are used in hygiene applications.



LUFT-Control Systems

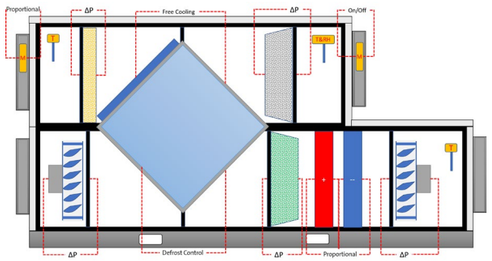
LUFT Control systems are packaged control systems which include automation systems with full control to maintain the ambient conditions required in the most efficient way. All LUFT air handling units are manufactured with LUFT Control systems depending on their type of use. The following controls can be carried out via the LUFT Control system. It is possible to connect to LUFT Automation and IOT units from smart phones via Bluetooth and monitor all operating data in real time.

- Humidity and Temperature control
- Constant and Variable flow rate control
- Fire Scenario control
- Filter Dirtiness control
- Proportional or On/Off coil capacity control
- Control of scheduled operation
- Damper control
- Air quality control
- Fan malfunction alarm, motor malfunction alarm, filter dirtiness alarm, fire alarm, freeze alarm, electrical heater malfunction alarm, vibration alarm



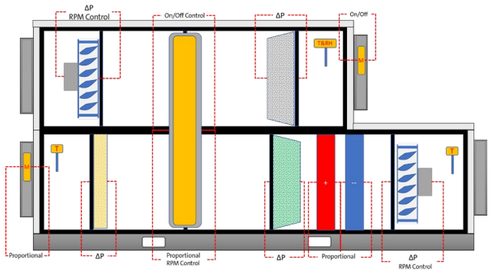
Automation of Unit with Plate Type Heat Recovery

- Humidity and temperature control
- Fan RPM Control (constant pressure - constant flow rate)
- Filter Dirtiness control
- Proportional, On/Off damper control
- Free Cooling control
- Proportional, On/Off damper control coil capacity control
- Freeze Control



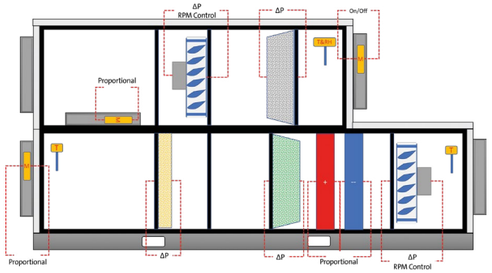
Automation of Unit with Rotary Heat Recovery

- Humidity and temperature control
- Fan RPM Control (constant pressure - constant flow rate)
- Filter Dirtiness control
- Proportional, On/Off damper control
- Proportional, On/Off coil capacity control
- Rotor On/Off and Proportional rpm control



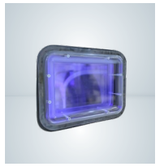
Automation of Unit with Mixing Section

- Humidity and temperature control
- Fan RPM Control (constant pressure - constant flow rate)
- Filter Dirtiness control
- Proportional, On/Off damper control
- Free Cooling control
- Proportional, On/Off coil capacity control
- Mixing Ratio Proportional and On/Off control



LUFT Air Handling Unit / Section Details

ACCESSORIES



Inspection Window
Used to view the interior of the air handling unit section.

Sections Where It is Used:
Fan Section, Filter Section, Humidifier Section

Maintenance Switch
Used to cut off power supply to the air handling unit or to the relevant section during maintenance.

Sections Where It is Used:
Used in fan sections.

Led Lighting
Used to illuminate the interior of the air handling unit section. 300 x 300 mm, 25 Watt.

Sections Where It is Used:
Can be used fan, filter sections.

Differential Pressure Switch
Used to receive information that the set pressure value has been reached at the desired point within the air handling unit. Can be set to values ranging between 0 and 500 Pa.

Sections Where It is Used:
Used in the fan and filter sections.

Door Protection Switch
Used to relay location information indicating whether the service door is open or closed.

Sections Where It is Used:
Can be used in all sections.

Damper Motor
Used to adjust openings of dampers. They are available in types with on/off or proportional control. There are two types which are Spring Return or Non-Spring Return with respect to their operation.

Sections Where It is Used:
Used on all sections with dampers

Door Stopper
Used to mechanically prevent the service door from closing during service.

Sections Where It is Used:
Can be used in all sections.

Freeze-free thermostat
Used to protect the coil from freezing in water coil sections.

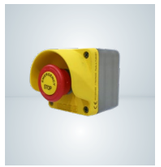
Sections Where It is Used:
Used in coil sections.

Coil Valve
Use to regulate the flow rate of water that will be sent to coils. Can be controlled proportionally or on/off. 2-way and 3-way alternatives are available.

Sections Where It is Used:
Used in water coil sections.

Humidity and Temperature Sensor
Used to take a real-time reading of the relative humidity and dry bulb thermometer value of the environment in which it is located.

Sections Where It is Used:
Can be used in all sections.

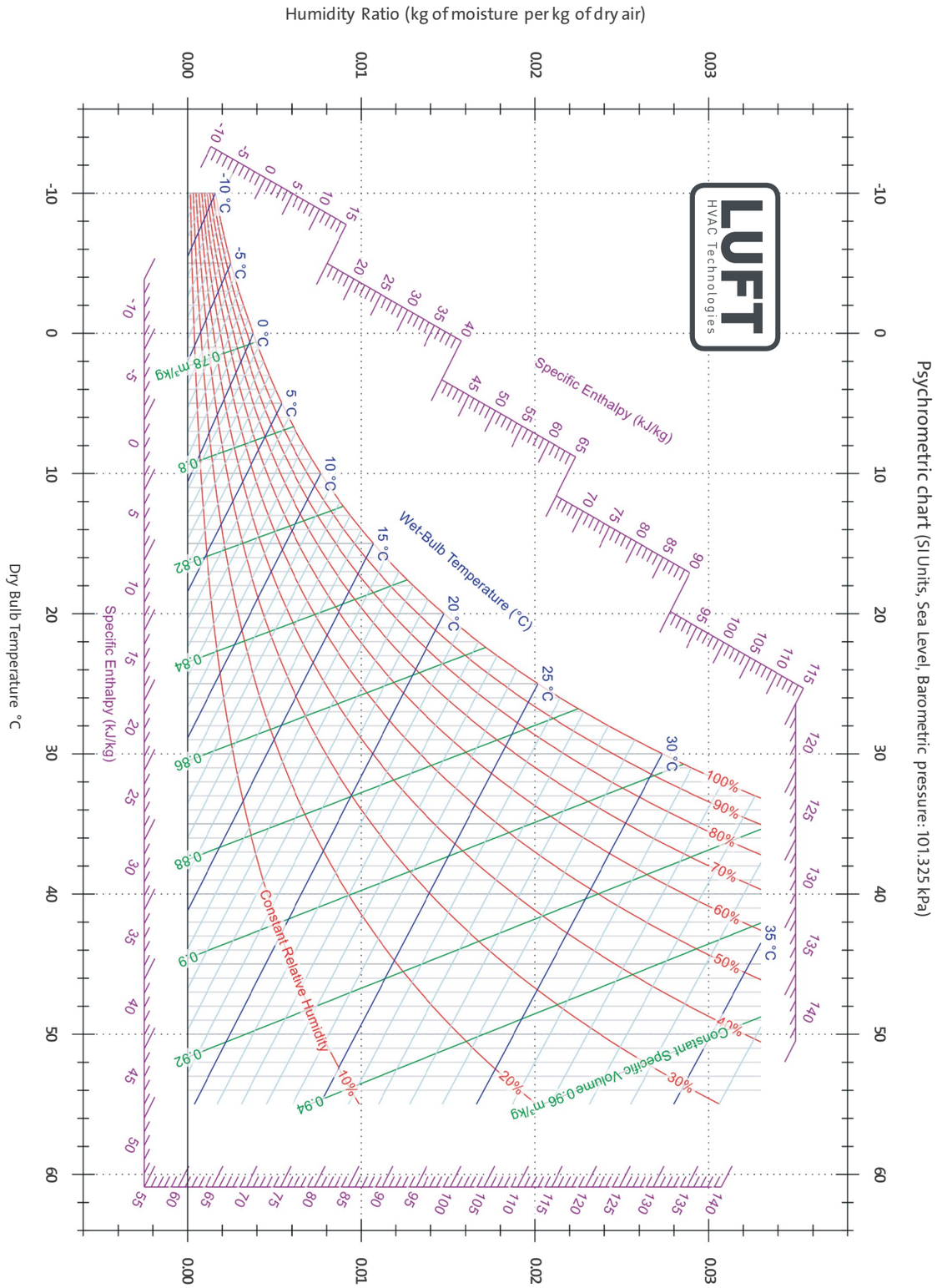


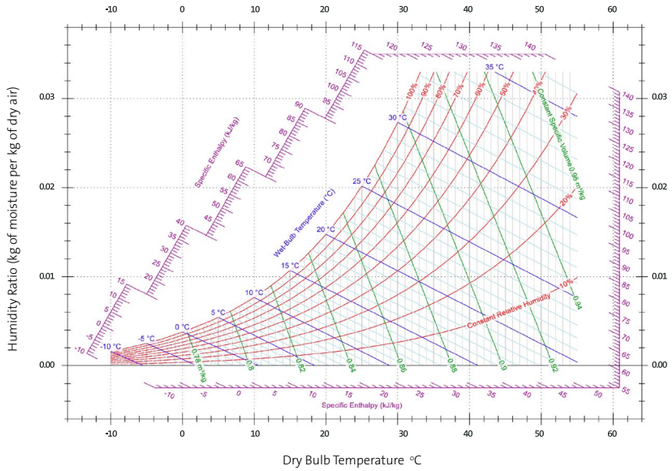
Emergency Button
Used to cut off main power supply to the air handling unit in case of emergencies

Sections Where It is Used:
Used in fan sections.

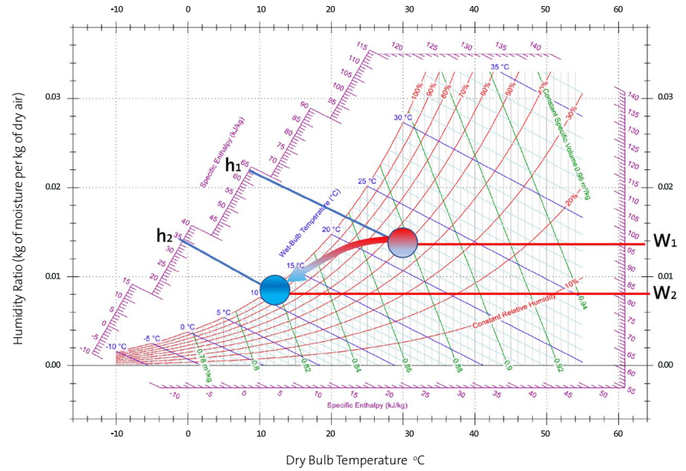
Frequency Converter
Used for the proportional control of motor rpm

Sections Where It is Used:
Used in fan sections.





- Relative Humidity (%)
- Specific Volume (m^3/kg)
- Wet Bulb Temperature (°C)
- Enthalpy (kJ/kg)
- Specific Humidity (kg/kg)
- Dry Bulb Temperature (°C)



Cooling Capacity

Q = V x ⧈ x Δh **W** = V x ⧈ x ΔW

Volumetric Air Flow Rate = 9000 m^3/h
Outdoor Air Temperature and Relative Humidity = 30 °C, %50
Desired Discharge Temperature and Relative Humidity = 12,5 °C, %98

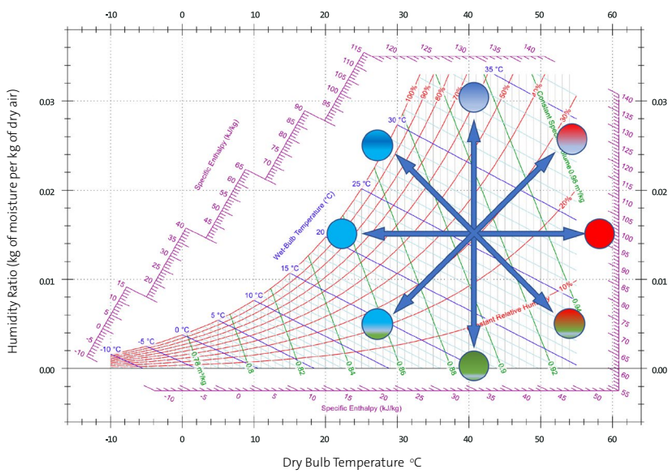
What is required:
- Total actual cooling power
- Actual amount of condensation

Point of Entry:
Enthalpy: 64,32 kj/kg
Specific Humidity: 13,37 g/kg
Specific Volume: 0,877 m^3/kg

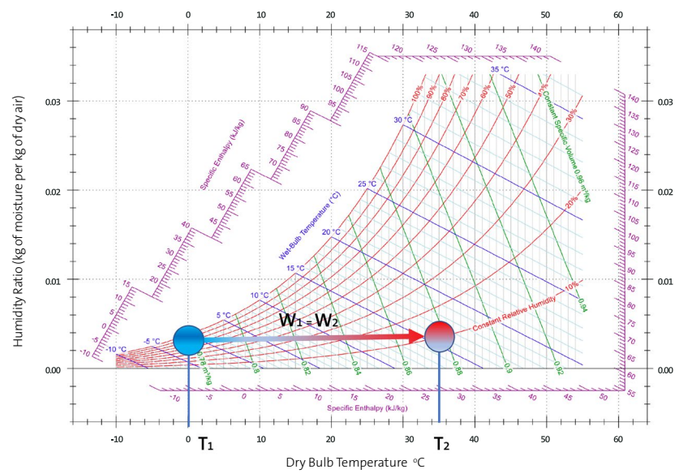
Point of Exit:
Enthalpy: 34,97 kj/kg
Specific Humidity: 8,88 g/kg

Q = [(9000/3600)/0,877] * (64,32-34,97)
= 83,6 kW Cooling Capacity

W = [(9000/0,877)/1000] * (13,37-8,88)
= 46 kg/h Moisture Removed (Drainage)



- Steam Humidification
- Heating + Humidification
- Sensible Heating
- Chemical Dehumidification
- De-humidification
- Cooling + Dehumidification
- Sensible Cooling
- Water Humidifier



Sensible Heating Capacity

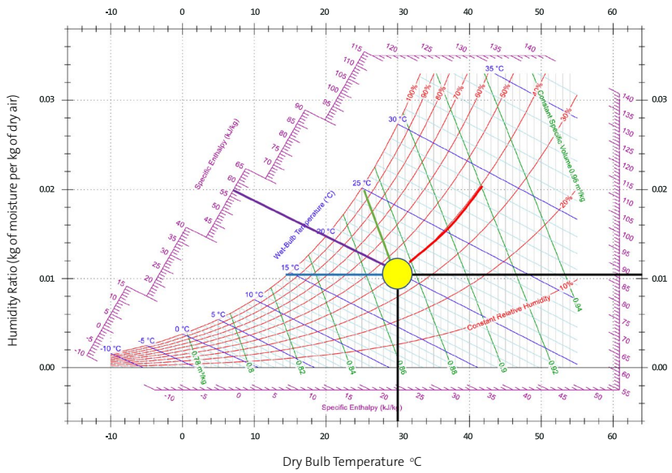
Qd = V x ⧈ x Cp x ΔT

Volumetric Air Flow Rate = 8000 m^3/h
Outdoor Air Temperature and Relative Humidity = 0° C, %85
Desired Discharge Temperature and Relative Humidity = 35° C

What is required:
- Actual Sensible Heating Capacity

Point of Entry:
Specific Volume: 0,778 m^3/kg

Qd = [(8000/(3600 * 0,778] * 1,005 * (35-0)
= 100,5 kW Heating Capacity

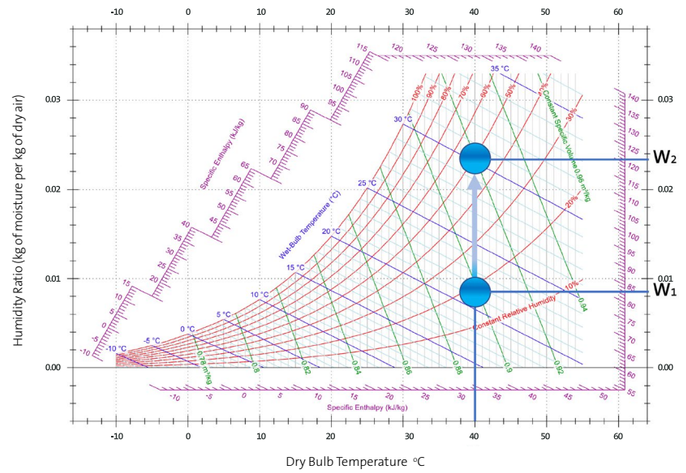


Point Analysis

Determining teh other properties of air using two given properties:

Wet Bulb Temperature = 30 °C
Wet Bulb Temperature = 20 °C

Values Read from the graph:
Relative Humidity = %39,2
Enthalpy = 56,81 kj/kg
Specific Humidity = 0,01042 kg/kg
Specific Volume = 0,873 m^3/kg
Dew Point Tempature = 14,6 °C



Steam Humidification

W = V x ⧈ x ΔW

Volumetric Air Flow Rate = 8000 m^3/h (2,468 kg/s)
Outdoor Air Temperature and Relative Humidity = 40 °C, %20
Desired Discharge Temperature and Relative Humidity = 40 °C, %50

What is required:
- Actual total de-humidification capacity

Point of Entry:
Specific Humidity: 0.00924 kg/kg

Point of Exit:
Specific Humidity: 0,02362 kg/kg

W = 2,468 * 3600 * (0,02362 – 0,00924)

W = 127,76 kg/h Steam Requirement

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