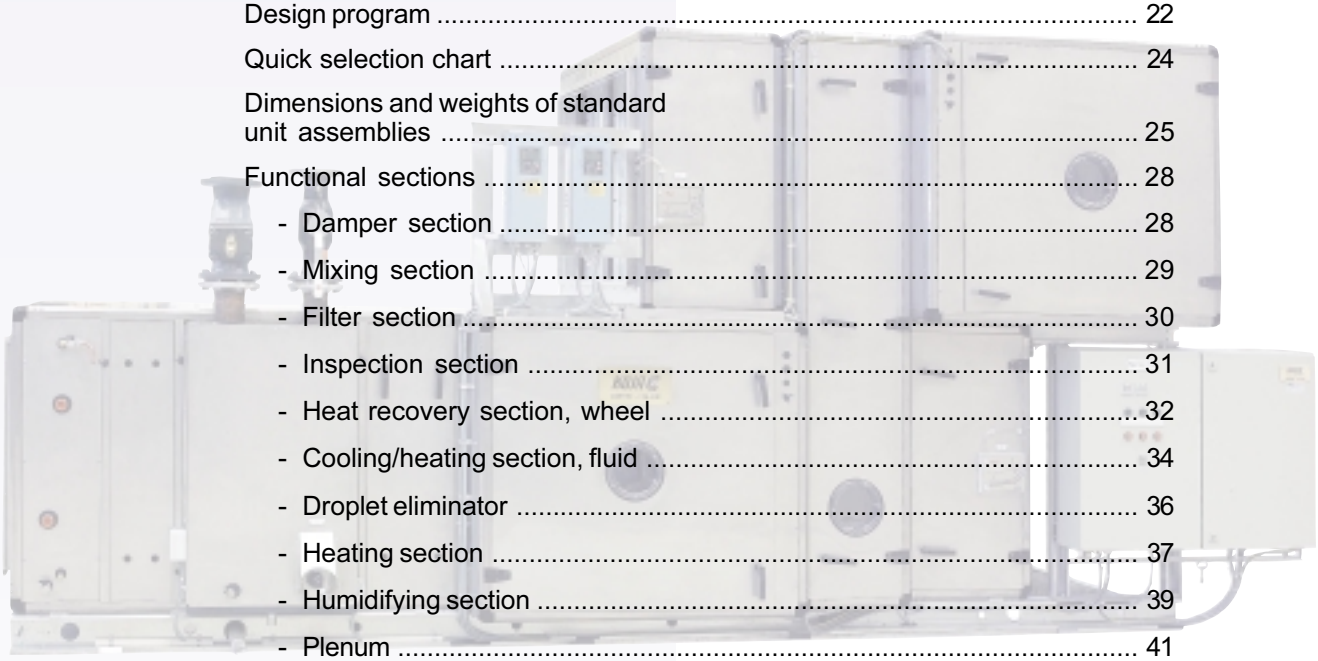
Future Marine

Air Handling Unit

KOJA

Contents



Koja Marine - fresh air on the seven seas

Koja Group has been involved in air handling since 1935. Koja Group is based in Finland and well-known in Europe.

Koja Marine specializes in the design and implementation of marine air conditioning systems and their electric and automation systems. Koja Ltd. plans, manufactures, and markets reliable and high-quality air conditioning units, fans and other ventilation equipment that meet the needs of Marine industry.

The Koja Marine product range comprises marine air conditioning equipment, such as air handling units, axial-flow fans, cabin air conditioning devices, fancoils and electric/automation equipment for air conditioning systems. Our services also include basic engineering and design, as well as comprehensive commissioning and training services. The scope of delivery varies from air conditioning system components to complete system deliveries.

Future Marine air handling unit, was developed to meet high quality standards. The units are manufactured using advanced production technology, and they are tested at our factory before delivery. The air flow rates vary from 0,32 m^3/s to 15,6 m^3/s according to unit size. The standard casing materials available are stainless steel AISI 316 and galvanized steel.

Our Marine Special Spaces Fancoil series covers cooling capacity ranges up to 162 kW. Fancoils are delivered as complete units including the filter, the cooling coil and the fan. The material is galvanized steel or stainless steel AISI 316.

Koja Marine cabin air conditioning includes a range of different systems.

Koja Marine - fresh air on the seven seas

The Koja Marine product range also includes tested fire dampers and axial-flow fans that are available in galvanized or stainless steel AISI 316.

Our product range in air devices is designed to satisfy the highest demands for indoor air quality. We offer a complete range of supply and exhaust air devices and diffusors.

Koja Marine has a worldwide service network.

Quality of products and operations in making up good air conditioning

The Future Marine air handling units and the Marine Special Spaces Fancoil units are manufactured pursuant to ISO 9001 certified quality system while regarding the specific requirements by the customer. The raw materials and components used in the units come from certified manufacturers and suppliers, and these high-quality products are inspected at Koja before manufacture and assembly.

Dimensional accuracy of the units and flawless parts manufacture receive special attention. These objectives are reached through effective quality control, supported by systematic quality follow-up.

Measurements and inspections cover the whole production process, from the receipt of materials and components to the tests made on completed products according to a predefined sampling plan. Subsequent verification of a product's manufacturing and inspection chain is made possible by recording the measurement results and making inspection markings on the products in conjunction with subassembly and final assembly.

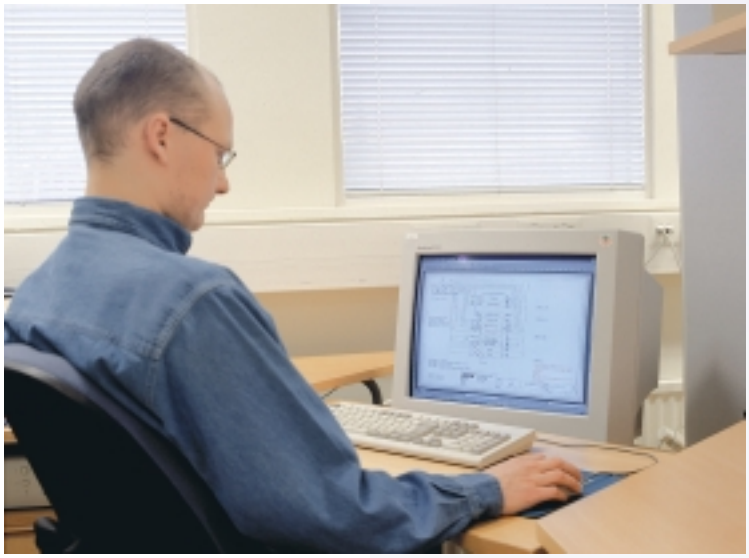
A predefined number of units that have passed the final inspection are picked out for tests that concentrate on the tightness and strength of the casing as well as the bypass flow at the filter. The test results and remarks are written down in records for later use.

The qualified personnel at Koja ensure high quality. Team working, together with high-level quality control and quality development make the manufacturing process more effective and versatile.

High quality air in accommodation areas

Good indoor air is required in ships' accommodation areas, and in the past years marine air conditioning onboard ships has developed to meet these demands. The challenges of the design are to make good indoor air out of salty sea air and to adapt air conditioning solutions to the fast shipbuilding methods. In order to manage this, the implemented systems can be different depending on the type of ship and the requirements of the owner and the shipyard. When choosing the system, the choice is affected by the size of the ship and its operating zone. The solutions presented here are passenger ship solutions, but can also be used in other type of vessels.

Three different main types of systems are traditionally used in accommodation areas: cabin systems used for cabins and the adjoining spaces, public spaces systems for restaurants, theatres, etc., and service area systems for spaces such as galleys, laundries, and food storages.



Indoor air conditions

The indoor air conditions are defined in the ship specifications between the ship owner and the shipyard. The air conditioning section of the specifications defines the indoor and outdoor air conditions (temperature, humidity, and cleanness), the technical properties of the equipment, and the design principles.

Regulations and fire protection

Irrespective of ship type, design is controlled by various agreements and regulations, including the IMO SOLAS agreement regarding fire safety, the ventilation and hygiene regulations of the flag state, regulations by classification societies, as well as ILO's occupational safety regulations concerning ship personnel.

Fire protection is the most important issue and in ducting the use of fire and smoke dampers is essential for preventing the spreading of fire and smoke. Due to fire safety arrangements, air conditioning design is based, as in many other ship systems, on the ships main fire zone divisions so that one air handling unit serves areas in one main fire zone only.

Design process

The design process usually starts with dividing every accommodation space between different air conditioning systems (cabin, public, stairs). The next step is to determine the amount of air handling units, and to allocate the spaces between the units. This is done by calculating heat loads/losses for both summer and winter conditions. The results give us the specific amounts of air flow needed for different spaces. Using this information, it is possible to determine the air capacities of the devices, and to determine the technical properties of the devices. In technical calculations for air handling units, the Future Marine design program offers great advantages.

The design continues with the planning of ducting and water piping. With the ships' general layout plan as the base, system diagrams are made for both duct and pipe systems. These diagrams present the routing and duct/pipe sizes of the network, the locations of devices, and the air and water quantities. The pressure loss and noise calculations for the ducting are also made at this stage.

In many cases, the shipyard and the owner have some additional needs for diagrams and lists not mentioned above. These diagrams/documents are usually made at the end of the system phase and agreed on separately.

After the system phase, the design process then proceeds to the workshop design phase, where the air handling diagrams are used in making the workshop drawings for air conditioning. This phase is traditionally done by the yard or its area subcontractor, but always in co-operation with the system designer. In this phase, the designer defines the interconnecting of the systems, the use of space and the necessary duct components, as well as the method of installation. The workshop drawing phase will also match the interior ceiling to the ducting. The Future Marine design program provides CAD drawings of the air handling units, which help in the design of the air conditioning room.

At the end of the workshop drawing phase, the diagrams of air conditioning are updated to comply with the workshop drawings, and the operation of the ducting and the system is checked before installation and commissioning.

Marine air conditioning systems

System for public areas

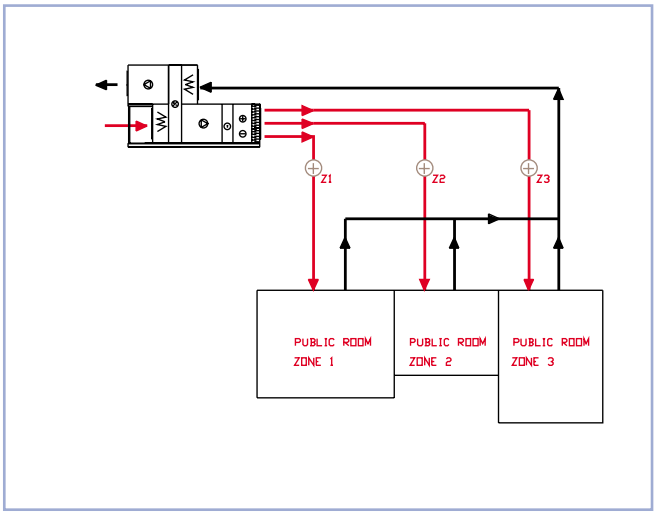
Air handling units consist of supply and exhaust sides. The supply side components are: closing damper, supply air filter, enthalpy wheel, fan, cooling/heating coil, droplet eliminator, plenum box, and reheat coils. The exhaust side consists of an exhaust air filter, a fan, and a closing damper.

Ducting from the air handling unit to the spaces is usually made using rectangular ducts equipped with reheating coils. Spaces with different uses are usually divided into different zones. In large restaurants and theaters the same space is usually also divided into zones. The temperatures in the different zones are measured using sensors, and the air handling unit/fans are regulated by an automatic air conditioning control system.

In larger spaces, the distribution of air is often implemented using a perforated ceiling system; the supply air is blown in between the interior ceiling and the deck from where it is then distributed into the space through perforations in the ceiling panels. Exhaust air is usually extracted from the ceiling level, above sources of impurities and heat. The supply and exhaust areas are limited using draught stop plates.

The perforated ceiling system is suitable for spaces with high air quantities. With this system, close cooperation is required between architects, interior designers, and air conditioning designers in order to produce a well functioning system. An important aspect of planning is to define the free area of the perforations, and the air velocity.

Another way of providing air distribution in public spaces is to provide duct outlets with normal pressure reducing boxes and air diffusers. This system is usually applied where the air quantities and the spaces are small or the perforated ceiling system is not applicable.



In staircases, air conditioning is usually arranged through a separate air handling unit in order to increase the fire safety of escape ways.

In larger public spaces, the standard air conditioning system can be complemented with a fan coil cooling system. It is suitable for theatres, restaurants, etc. where the temperature may rise exceedingly due to lighting, heat from persons and devices, and sunshine. Where this system is applied the amount of fresh air from the normal air conditioning system is set to a minimum, to provide for the need of fresh air only.

Systems for cabin areas

Air handling units consist of supply and exhaust sides. The supply side components are: closing damper, filter, enthalpy wheel, fan, cooling/heating coil, droplet eliminator, plenum box, and reheat coils. The exhaust side consists of a plenumbox, an air filter, a fan and a closing damper.

Ducting from the air handling unit to the cabins is usually implemented using round spiral ducts. The air handling unit is equipped with zone-specific reheat coils that are usually designed to serve the outside and inside cabins. The temperature regulation of reheating is based on the chosen cabin system.

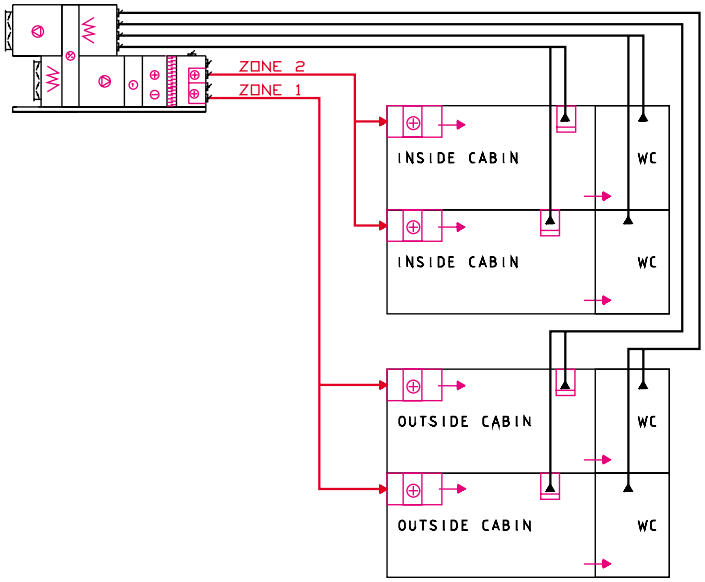
Cabins can be provided with several different types of cabin units, usually handling/regulating the supply air in different ways. The type and dimensioning of the cabin unit is based on the desired cabin system. The choice of system often depends on the climate in the ship's intended operational area, the desired indoor air conditions, the level of hygiene, the desired level of cabin automation, as well as cost aspects. Also the possibility to integrate the cabin unit in the cabin structures affects the choice.

The exhaust air from the chosen cabin system can be extracted from the cabin itself and/or its WC, or by transferring a part of the air into the cabin corridor. Usually, the cabin extraction is made separate from the cabin supply unit.

Some of the most common cabin systems are presented below.

Marine air conditioning systems

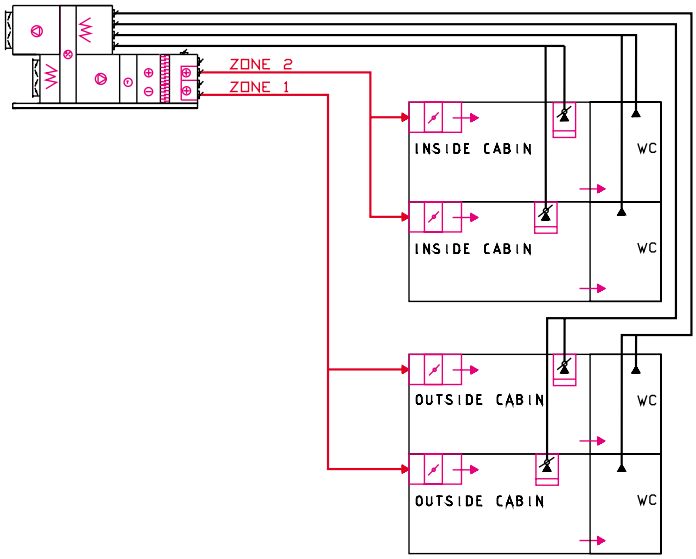
Cabin system with constant air flow and electric reheating (CAV+reheat)



This is the simplest of the cabin systems and it works well without a complicated automation system. Re-heating is separately arranged at the air handling unit for the different cabin zones and it is based on the outside temperature and a regulating curve. The cabin device always provides a constant air flow that is additionally reheated in the cabin device when needed. Electric reheating is regulated either with on/off principle or step-lessly. Reheating provides the required cabin-specific temperature rise.

Insulated supply air ducts and high cooling capacity of the air handling unit characterize this system.

Cabin system with variable air flow (VAV)



This simple cabin system is based on the regulation of air flow and it works well without a complicated auto-mation system. Temperature regulation is zone-specific in the air handling unit, which does not allow major heat load variations between the different cabins in the zone. The air flow in the cabin unit is regulated manually or using cabin automation. This cabin system is equally suitable for warm and cold operational areas.

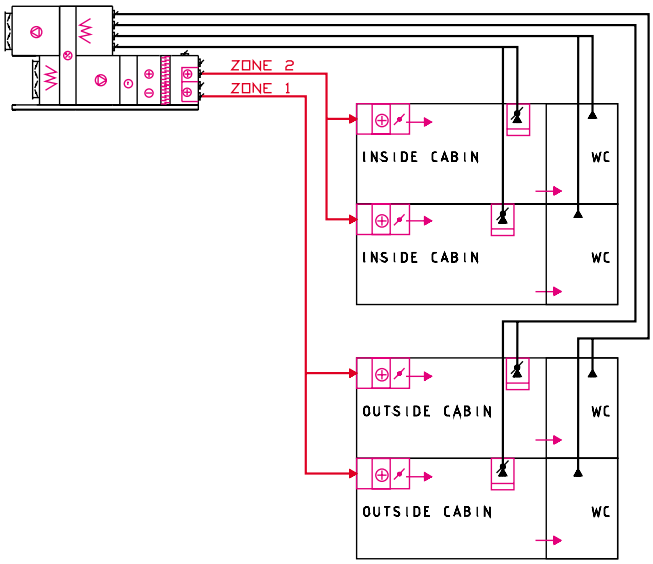
Insulated supply air ducts and high cooling capacity of the air handling unit characterize this system.

Marine air conditioning systems

Cabin system with variable air flow and electric reheating (VAV+reheat)

This is an improved version of the air flow regulated cabin system. It is based on air flow regulating and electric reheating. The extra heating makes this system very competitive for ships in colder operational areas. The electric heating coil is usually integrated with the cabin unit. Regulation can be manual, use a cabin thermostat, or a combination of these.

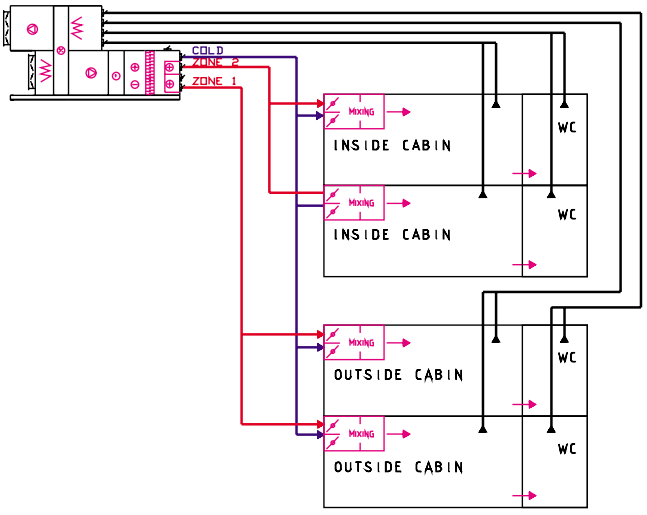
Insulated supply air ducts and required high cooling capacity of the air handling unit characterize this system.



Cabin twin duct system (Twin duct)

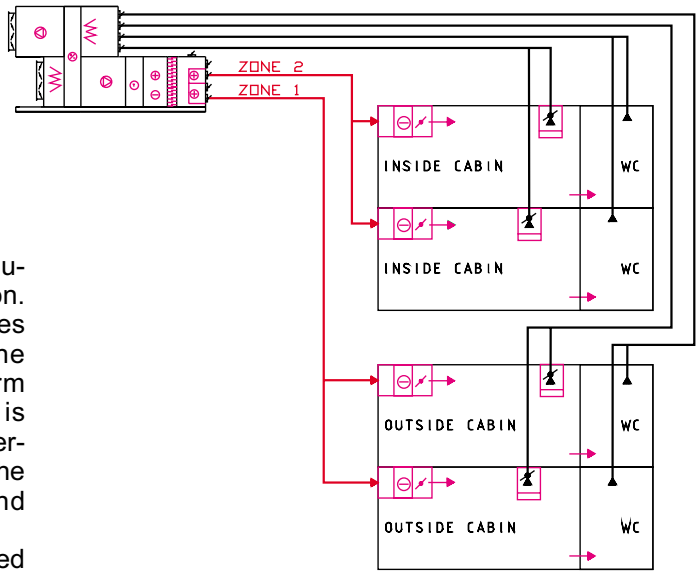
This is a traditionally used cabin system. Supply air is led into cabins through two ducts. One of them is a cold air duct and the other is provided with a reheating coil located in the air handling unit. Cabin-specific regulation is carried out by adjusting the mixing ratio of cold and warm air.

The system requires the space for twin ducting and also increases the ship's weight.



Marine air conditioning systems

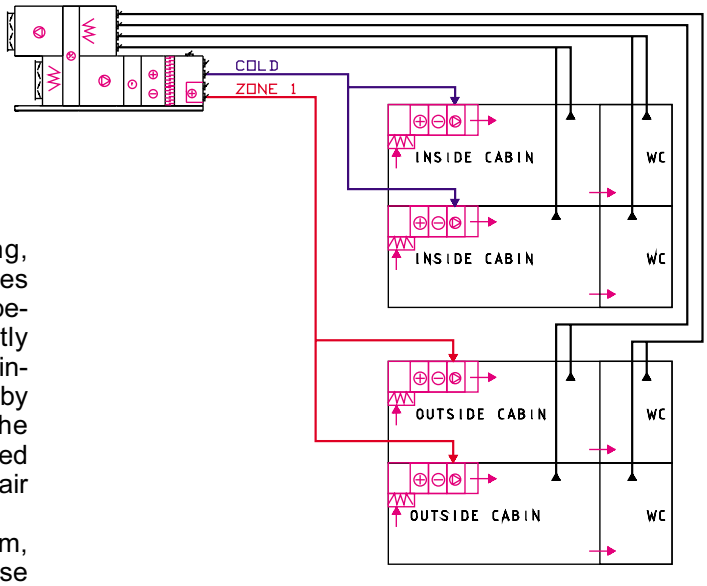
Air flow regulated cabin system with water circulation cooling (Smart air®)



The system is based on air flow regulation and cooling with water circulation. The accurate regulating system provides good cabin temperature control. The system is excellent for ships in warm operational areas. The cooling coil is integrated in the cabin unit. The temperature regulation is usually done with the aid of sensors, cabin regulators, and automation systems.

The system does not require insulated supply air ducts because cabin-specific cooling is arranged in the cabin. The system requires, however, cabin-specific water circulation piping.

Cabin-specific air recirculating unit with electric reheating and water circulation cooling (CFAF)



Fan coil includes a fan, reheating, cooling, and a filter. The fan recirculates air through the cabin unit so that a specified amount of fresh air is constantly mixed into the recirculated air. The minimum amount of fresh air is determined by the number of beds in the cabin. The conditions in the cabin can be regulated with the heating/cooling coil. Exhaust air is usually extracted through the WC.

With its accurate regulating system, this cabin system provides very precise temperature control, and it is excellent for ships with warm as well as cold operational areas. One of the benefits of the system is the small amount of fresh air, which means a reduced number of air handling units. The cabin system need a separate cooling water piping and insulated supply air ducts. The fan located in the cabin will slightly raise the noise level, but attenuation can be provided for the ducting. The use of recirculated air requires good filtering to maintain proper air quality.

Marine air conditioning systems

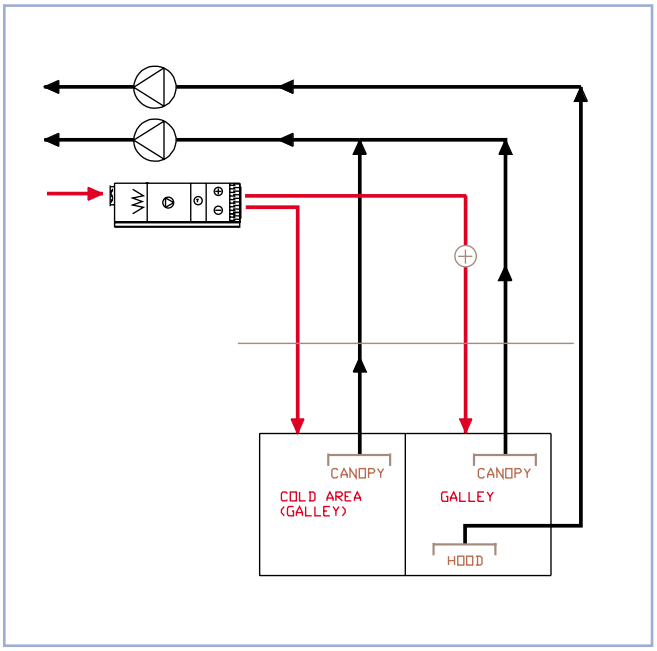
System for service areas

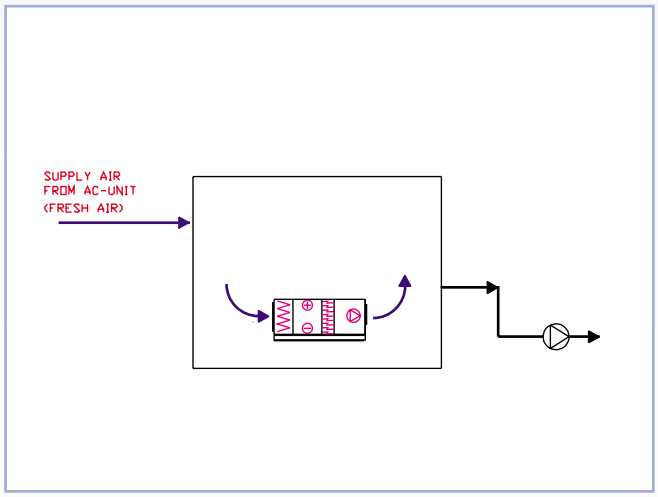
The air handling unit consists of a supply air unit only. The exhaust air is extracted with separate exhaust fans. The supply unit components are: closing damper, air filter, fan, cooling/heating coil, droplet eliminator, and reheating coil. Rectangular ducting is used between the air conditioning room and the served space. Fire prevention regulations usually require that exhaust ducting for galleys is made of 3-5 mm thick steel, and may be equipped with a fire extinguishing system, grease filters, and fire dampers.

Apart from galleys, the service system can also be used for other corresponding spaces, such as food storages, laundry rooms, food preparation areas, and also control rooms.

In galleys, food storage and laundries the air diffusers are usually of stainless steel that is easy to keep clean. In the exhaust air side of galleys grease hoods and steam canopies are primarily used.

The air quantities for galleys are usually determined on the basis of the capacity of the exhaust side hoods and the heat loads from electric appliances so that the condensation of water on the ceiling surfaces can be avoided. High equipment power in galley appliances and the amount of steam usually lead to high ventilation coefficients for galley spaces. The air quantities for galleys have therefore in recent years been increasing.





Special spaces cooling system (SSF)

The cooling system is used in spaces with high heat loads. For instance, excessive temperatures in electric rooms would compromise the operation of the equipment and, thus, the safety of the ship.

Excess heat is removed by circulating air through a system with an air filter, a cooling coil and a fan. With automation the system can be controlled so that it is constantly in operation or just momentarily on the basis of space-specific cooling needs. Supply air is always brought into the space from another air handling unit, so that the amount of harmful substances in the air can be kept low enough.

According to the customer's needs, other kinds of systems can also be designed and implemented.

Electric and automation systems for marine air conditioning

General

HVAC systems are available with factory assembled and tested electric and automation systems. The Electric and Automation Division of Koja Marine designs and implements the electric and automation systems for the Koja Marine air handling systems in close cooperation with the HVAC designers of Koja Marine. This cooperation ensures attention to every detail and produces the right control and regulating principles and functions for every application.

The electric and automation systems are always made to satisfy cuctomers needs and wishes, whatever the needs may be – now and in the future. And of course, the system also meets the authorities' requirements.

Engineering

Modern design tools and systems are used in engineering, with ACAD and MS-Office as the principal software. Competent engineers and the use of standard applications ensure a constant high quality output and the ability to re-use existing, pre-tested design investments while reducing project timescales.

Engineering produces documents for installation, use, and maintenance. These documents include flow diagrams, circuit diagrams, connection diagrams, cable diagrams, starter lay out, part list, I/O-tables, power tables, descriptions, instructions, etc.

Equipment

Koja Marine's standard delivery includes a high quality and suitable control system that effectively monitors and controls the air conditioning plant and gives the user a clear picture of the operation of the system. The latest technology incorporated in our systems is not an end in itself. It enables us to provide the optimal solution for any large or small HVAC plant, and to meet your requirements and wishes.

In standard configuration, the air handling units can be locally controlled using the push buttons on the door of the starter panel and remote controlled from the control room, if remote control and monitoring is included in the scope of supply. There can be one or more operating stations, for instance, one in the Engine Control Room (ECR) and one in the wheelhouse. The control and monitoring of fans and dampers is based on true feedback signals, and Direct Digital Controllers (DDC) are used for temperature control, which gives immediate response to rapid changes in the conditions and ensures continuous comfort.

Cooling/preheating coils are provided with freeze protection, and air-conditioned spaces with a sufficient number of temperature sensors to keep the adjustments and temperatures accurately at the desired values. The cleanness of filters is monitored by liquid column pressure gauges, and the rotation of possible enthalpy wheel with a rotation sensor. The dampers are normally opened electrically and closed by a spring.

We also have a wide range of accessories, thus the system grows with your needs.

Electric system

Starter

The starter is a single entirety where the starter and automation components for usually one air handling unit are located. The starters are equipped with a local/remote switch. In local mode the fans can be individually controlled using the push button on the door of starter panel and, in remote mode, they can be controlled through the HMI in the control room.

The starter will also be provided with all the necessary connections for external controls, such as emergency stop. The connections shall be agreed on separately.

The fan drives require 400, 440, or 690 VAC 50/60 Hz supply voltage depending on the ship's distribution network, and 230 VAC (24VDC) supply voltage for the automation equipment, preferably from a UPS (Uninterrupted Power Supply) network.

The starter is usually located at the end of the air handling unit, below the exhaust unit, and the frequency converters, protection class IP 54, are above the starter conveniently for cabling. The cables are installed to the base frame of the air handling unit, with the motor and the instrumentation cables separated, and protected against damage.

Typical starter dimensions are 800(1000)x1000x300 (210) (h x w x d). The size of the frequency converter depends on the motor's rated current.

Electric and automation systems for marine air conditioning

Components

The starter components come from well-known makers within the shipbuilding industry, which means that all spare parts are readily available even locally. All components are available from Koja Marine after sales.

All cables and conductors are rated for marine use, halogen-free according to IEC 60754, and flame retardant according to IEC 60332.

Installations

Installations will be carried out at the factory to the agreed extent, usually as far as practicable to minimize the work to be done onboard.

Onboard work will include the cabling and connecting of field equipment, power supply cables, bus cables, and external controls, such as emergency stop.

Automation

General

The automation system regulates and controls the air-conditioning processes, gives a comprehensive overview of the system's operation. The systems are constructed so that no single failure can stop the whole air handling system.

The systems can be divided, in principle, into three categories; integrated systems, building automation systems, and PLC systems. The HVAC automation system can also be a combination of these. For instance, air handling units are controlled by an integrated automation system and room controllers of building automation system are used for controlling cabin air conditioning.

The automation systems are normally constructed using standardized signal types, such as 0-10 V, 4-20 mA, or Pt 100 sensors, which makes it easier to replace a faulty component also with other than an original spare part. Automation and electronics is a rapidly developing section, and new solutions are introduced every year.

Integrated system

By integrated system we mean an arrangement where the same automation system is used for controlling the MAS (Machinery Automation System) and the HVAC plant.

The level of integration is always separately agreed according to the characteristics of the system in question. The maker of the systems is the same but the systems can be segregated. Integration can also be closer, in which case the automation system for the machinery and the AC utilizes, for instance, common operating stations.

The starters of the air handling units in the system are typically only provided with I/O cards for connections, and information is transferred through a redundant double bus to the processing stations. One processing station can cope with a large number of air handling units.

One of the benefits of the system is that no separate HVAC automation system is needed and, thus, the required amount of training and spare parts is reduced when just one larger automation system is used. In addition, the systems (hardware / operating software) are typically approved by a classification society.

Building automation system

Another alternative is building automation. By this we mean systems that are specifically designed for controlling air conditioning by makers such as Honeywell, Johnsson Controls, Siemens (Landis & Staefa). Normally Koja Marine uses systems of this category, if not otherwise agreed.

Building automation systems are usually more closed, i.e. the structure of the system, the bus protocol, the sensor types, the signal types, the user interface (HMI), etc. are determined by the characteristics of the system in question. If other automation systems are to be integrated to systems of this kind via data bus, interfacing needs to be examined in each case separately.

Usually each air handling unit in the system is equipped with its own processor (CPU), or one processor (CPU) controls a max. of 1-3 air handling units, in which case information processing takes place locally. Possible faults in bus do not stop the operation of the units; just their monitoring from the control room is lost. Local processing of information gives high reliability.

Electric and automation systems for marine air conditioning

The benefits of this type of system are lower investment costs than with an integrated system and that the systems are specifically designed for controlling HVAC. The essential flexibility for today's and tomorrow's changing needs is archieved by a large range of accessories, LONMARK compliant products and easy, user-friendly, comprehensive Windows-based user interface (HMI). The worldwide distributor network of at least the mentioned suppliers means availability of service and spare parts throughout the world and for the whole lifetime of the system.

PLC system (Programmable Logic Controller)

In this system, air conditioning is controlled using PLCs that are developed for controlling industrial processes. In this case, too, each air handling unit has its own CPU, which means processing of information locally and upper level faults, e.g. bus faults, do not stop the air handling unit. The systems have been standardized by using, for instance, standardized signal types, such as e. g. 4-20 mA, 0-10 V. Some suppliers also have classification societies' approvals for their PLCs.

Information from the PLCs is transferred directly to the operating station or via an information transfer network utilizing a server PC. Twisted pair cables can be used for information transfer on field buses and an Ethernet bus for information transfer between possible servers and operating stations. The use of fiber optic cables is also possible, in which case ring structures can be used for buses and, thus, reach high reliability.

General HMI software, such as Wonderware InTouch, is used as the user interface.

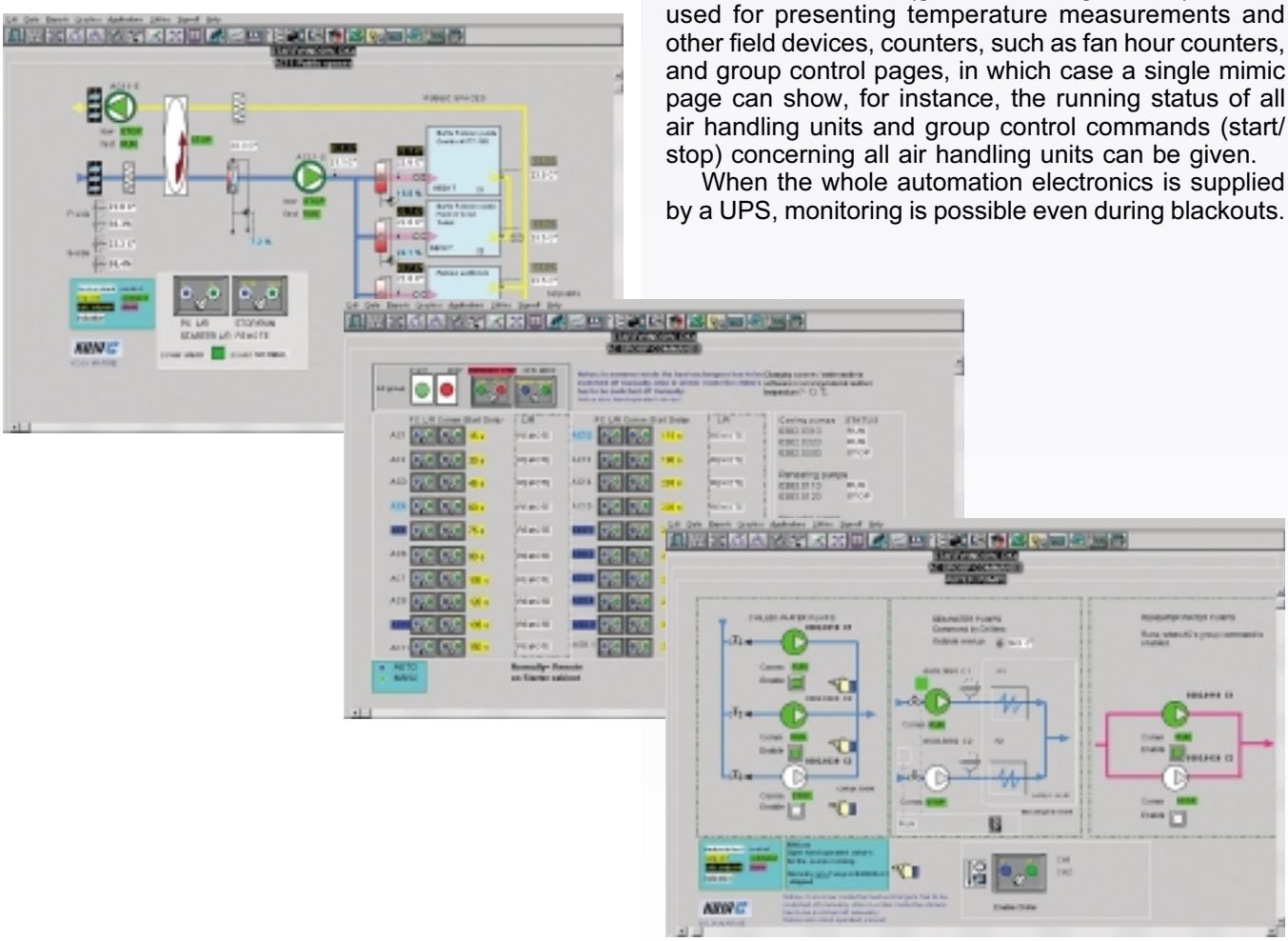
HMI (Human Machine Interface)

An operating station consists of the necessary hardware (PC, display, keyboard, mouse (tracker ball), printer, etc.) and the necessary software.

The process information is typically presented using graphic mimics, whose informative value is enhanced by the use of colours. The mimics and their hierarchy is agreed in each case separately based on the user's wishes and requirements as well as the characteristics of the system in question. Typical mimics are flow diagrams that present the operation of one air handling unit, and trend pages that present, for instance, temperature trends in the form of graphs or tables. Other mimics include alarm pages that show alarms.

Also GA mimics (general arrangements) can be used for presenting temperature measurements and other field devices, counters, such as fan hour counters, and group control pages, in which case a single mimic page can show, for instance, the running status of all air handling units and group control commands (start/stop) concerning all air handling units can be given.

When the whole automation electronics is supplied by a UPS, monitoring is possible even during blackouts.



Electric and automation systems for marine air conditioning

Scope of delivery

The scope of delivery is agreed in each case separately. Typically, Koja Marine delivers the components for the system, including starters, frequency converters, automation equipment, field equipment (e.g. sensors, damper actuators, regulating valves, etc), and installation materials at the Koja Marine's factory.

The shipyard shall provide all normal installation material, such as cables, junction boxes, etc., for installation work onboard.

Testing and commissioning

Correct operation of the electric and automation system ensures that the agreed conditions are reached. By testing the air handling units at the factory according to a predefined test procedure we are able to ensure their correct and designed operation, which reduces the amount of commissioning and testing work onboard. Written documents of the tests will also be provided.

Onboard installations will be tested in order to correct possible errors, and to ensure that the system is working properly.

Cabins

The electric and automation equipment are chosen according to the air handling system and your requirements and wishes.

Normally the system comprises a thermostat in each cabin to control the amount of air flow, heating, cooling, or a combination of these.

In more advanced systems each cabin is provided with an individual controller that is connected via a bus to the control room. In this case, it is possible from the control room to monitor the cabin temperatures, the operation of cooling/heating, the position of balcony door, etc., and to observe the trends. This enables history data of the cabin to be stored, and possible faults can be corrected promptly and a high level of services to passengers maintained.

The electric and automation connections of cabin units are made using quick couplings, which contributes to fast and error-free installation work onboard or at the cabin factory.

Other systems

If necessary, the HVAC automation can also be used for controlling and monitoring functions closely related to HVAC, such as smoke extracting, hoods, fire dampers, cooling of technical spaces (fancoils), and chillers.

The interfaces for these utilize the automation I/O connections in the air handling units or, with a larger number of I/O connections, separate I/O cabinets are made for connections.

Training

Koja Marine instructs and trains the users in conjunction with commissioning and/or according to a separately agreed training programme. This will give the user knowledge of the system and enables him/her to operate it properly and effectively.

Future Marine Air Handling Unit

The Future Marine air handling unit is the answer to the increasingly tough requirements set by the marine market and authorities. This high-quality industrial product is the result of a carefully worked-out design, consistent quality assurance, and state-of-the-art manufacturing techniques.

The most important feature of Future Marine is that it is suitable for practically any imaginable air handling purpose. The wide Future Marine selection includes an unit with a suitable size, flow rate capacity, different material and component combination for every application. The Future Marine air handling units are also available fully equipped, with the air handling unit including all necessary electric installations and automation.

The air flow rates of the Future Marine air handling units range from 0.32 m^3/s up to 15.6 m^3/s. Units with the same flow rate are available with different dimensions; low and wide units for lower spaces and narrow and high ones for greater deck heights.

Carefully selected components, incomparable mechanical, thermal and flow properties, and conformity with the design and tightness requirements of CEN standards are a guarantee that Future Marine comes up even to the highest shipowner expectations.

Functions

Closing and mixing damper

The material of the blade dampers on Future Marine air handling units is either galvanized or stainless steel. The damper blades turn against each other and silicone rubber is used as sealing. The tightness class of the blade dampers is T4 (EN 1751).

Filtering

The filter selection of Future Marine air handling units offers a wide range of alternatives for choosing the filtering class on the basis of the requirements and the cleanness of the air. Two casing lengths are available, each with a variety of filters of different filtering class, material, and filtering area.

Filtering materials: synthetic and fibreglass particle filters

Filtering classes: G3, G4, F5, F6, F7 (EN 779)

Filter module sizes: 300*600 , 600*300 , 600*600, and 600*500.

Future Marine Air Handling Unit

Heat recovery

The most significant energy saving feature of the Future Marine air handling units is the recovery equipment for the energy in the heat and humidity of exhaust air. Depending on the application or the quality of the exhaust air you can choose an enthalpy wheel suitable for the recovery of just thermal energy, or one that is suitable for the recovery of energy in both thermal and humidity (operating efficiency up to 80 %).

Heat exchangers

One of the starting points for the dimensioning of Future Marine air handling units has been the coil heat exchangers made by Koja. Due to own manufacture, the designing of the heat exchangers' dimensioning and structure has been able to seek the optimal relation between cooling power and pressure loss by choosing the ideal face area, lamella profile, as well as lamella thickness and division for each application of the heat exchangers.

For heating air, the Future Marine air handling units are provided with heat exchangers based on fluid circulation, but also electric heat exchangers are available. For air cooling purposes you can choose between fluid exchangers and, for special applications, direct-evaporation exchangers.

Fans

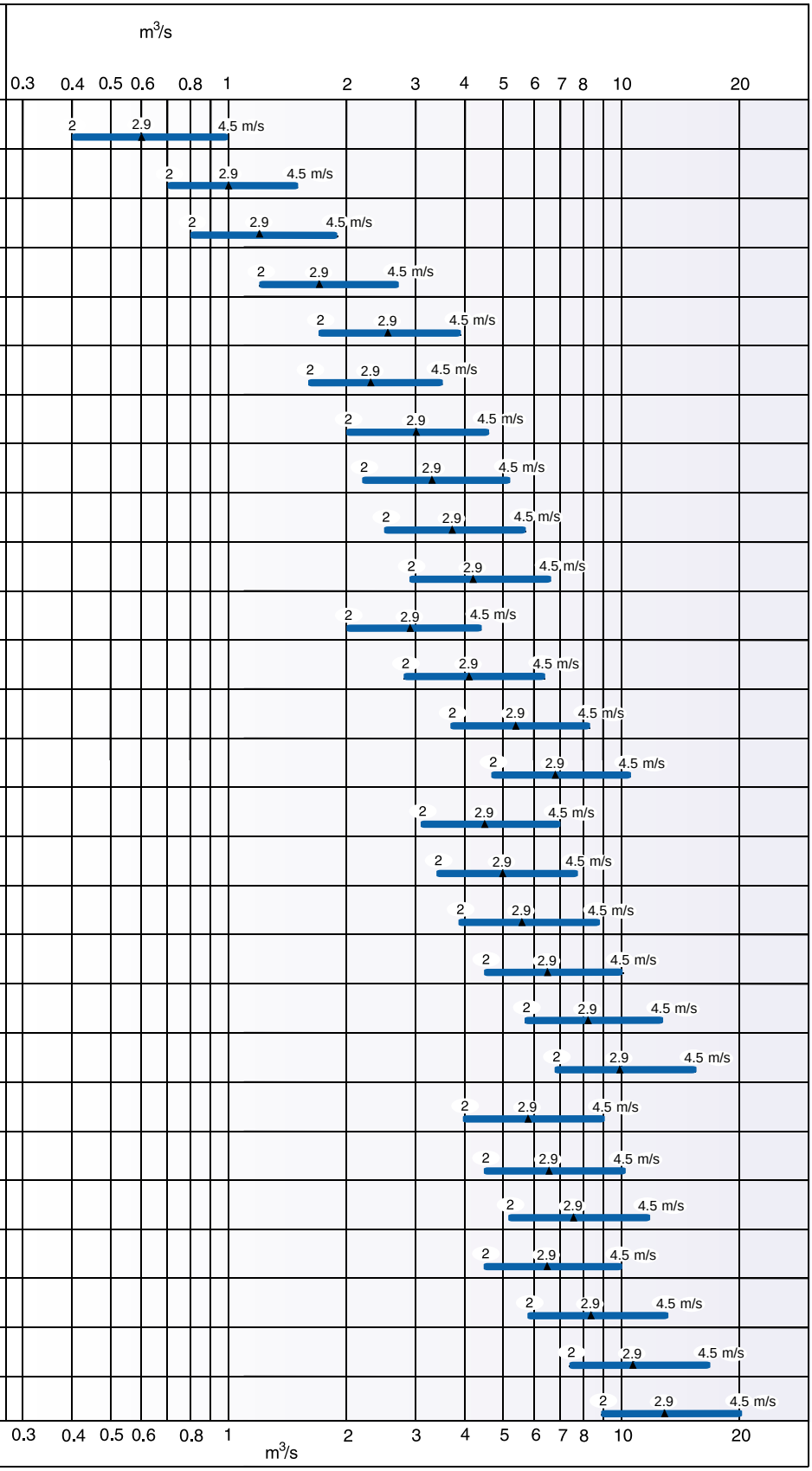
There are several alternative fan types from which the most suitable for the application in question can be chosen for the Future Marine air handling unit. Centrifugal fans with very high operating efficiencies are available with forward or backward curved blades and with coupling or belt drive. For medium pressures we have an almost maintenance-free mixed flow fan with direct drive and control by a frequency converter, which gives a high operating efficiency and a wide regulating range of flow volume and pressure.

Up to three different fan sizes of different fan types can be chosen for each unit according to application.

The fans can be equipped with a flow volume measuring device that makes it easier to adjust air flow during commissioning and helps in economically achieving the required ventilation with the aid of monitoring during operation.

Widest selection on market

Size	Width mm	Height mm	Face area m^2	Filter mod.
0603	790	470	0.21	
0605	790	670	0.34	
0606	790	790	0.42	
0906	1070	790	0.60	
0909	1070	1070	0.86	
1206	1350	790	0.78	
1208	1350	990	1.02	
1209	1350	1070	1.12	
1210	1350	1190	1.27	
1212	1350	1350	1.46	
1506	1670	790	0.99	
1509	1670	1070	1.42	
1512	1670	1350	1.85	
1515	1670	1670	2.34	
1808	1990	990	1.56	
1809	1990	1070	1.71	
1810	1990	1190	1.93	
1812	1990	1350	2.23	
1815	1990	1670	2.83	
1818	1990	1990	3.42	
2109	2310	1070	2.01	
2110	2310	1190	2.27	
2112	2310	1350	2.62	
2409	2550	1070	2.23	
2412	2550	1350	2.90	
2415	2550	1670	3.68	
2418	2550	1990	4.45	



Recommended dimensioning supply air velocity 2.9 m/s
Max. supply air velocity 3.5 m/s

Construction

The frame of the Future Marine air handling unit casing consists of closed, galvanized or stainless steel profiles and corner fittings made of aluminium with epoxy paint finish.

The casing panels and access doors are of double skin steel sheet. The panels and doors are made of 0.7 mm galvanized or stainless steel and their thickness is 50 mm with fire proof insulation of 80 kg/m^3 mineral wool, 110 kg/m^3 is also available.

The casing is put together by means of screws, so it can be dismantled and reassembled without the solidness or tightness being affected.

The construction of the frame, casing panels and access doors enables the use of double sealing in places where particularly good tightness, minimized energy losses, and low noise levels are required. EPDM sealing is used between the angle profile and the doors and panels.

Access doors have latches with detachable handles. The doors can also be provided with hinges to make handling easier. Access door seals are on the door, which prevents damage during maintenance work.

The components of Future Marine air handling units are designed so that they can be pulled out to make servicing easier.

Bolted joints are used for all connections between modules.

Base frame

The base frame made according to the unit's dimensions makes it easier to transport and move the unit and to install it in horizontal position. The base frame can be delivered assembled with the unit, or it can also be delivered separately. The standard height of the base frame is 160 mm.

Conformity with CEN standards

Tightness

All air handling units are tested at the factory for tightness before delivery.

Air handling units are divided into three categories according to their tightness (CEN Standard EN1886):

For tightness measurements pursuant to the CEN standard EN1886 an underpressure of 400 Pa and an overpressure of 700 Pa were used.

Assembled units: Tightness class CEN B

An assembled air handling unit is delivered as a single unit to which installations requiring casing perforations as well as the external connection, supply and exhaust ducts, electricity, and water, can be made at the installation site.

Tightness class	Leakage air flow rate with underpressure max $dm^3/s/m^2$	Leakage air flow rate with overpressure max $dm^3/s/m^2$	Recommended filtering class (EN 779)
3A	3.96	5.7	G1-4
A	1.32	1.9	G1-F7
B	0.44	0.63	G1-F9

Units ready for operation: Tightness class CEN B

On air handling units ready for operation, the regulating devices, measuring sensors, etc., requiring casing perforations are installed at the factory. Thus, work at the installation site is limited to making the external connection: supply and exhaust duct, electricity, and water. An air handling unit is delivered as a single unit.

Operational sections:

Tightness class CEN B, with the unit delivered in a maximum of three modules; tightness class CEN A, with the unit delivered in four or more modules, however, not more than seven.

Operational sections are delivered as separate modules that are connected together at the installation site, and to which installations requiring casing perforations as well as external connections, supply and exhaust ducts, electricity, and water, can be made at the installation site.

Heat transfer

The heat transfer coefficient U ($W/m^2°C$) indicates heat transfer through the casing. Air handling units are divided into five different classes as follows (CEN Standard EN1886):

The casings of Future Marine air handling units are of class T3, class T2 is also available.

Class	U ($W/m^2°C$)
T1	$U \leq 0.5$
T2	$0.5 < U \leq 1$
T3	$1 < U \leq 1.4$
T4	$1.4 < U \leq 2$
T5	No requirements

Sound attenuation of casing

The sound attenuation of casing is measured according to the CEN standard EN1886:

Sound attentuation of casing in octave bands (dB)							
63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz
5	6	24	31	40	43	51	54

Installation, service and maintenance

Delivery

Future air handling unit can be installed very easily and at low cost as it is delivered ready assembled and fixed to the base frame. For delivery, the unit can be packed to meet different types of requirements. Three standard types of packing are used:

- Wrapping in shrink plastic
- Plywood or hardboard protection to sensitive areas, one layer of fireproof fabric over the unit, secured with cable ties. Final layer of shrink plastic wrapping. This type of packing offers better protection against the stresses of transportation and installation work.
- As above, but fireproof fabric is aluminium coated and secured by means of tape. Unit is more air tightly packed and doesn't get spray painted, when e.g. air conditioning room is painted.

Fitting ship with Future air handling unit

Installation of a Future unit can be made at different stages of shipbuilding. The unit can be installed to ship modules or lifted onboard when the air conditioning room is not yet completed. To ensure serviceability, free space needs to be left to the service side of the unit. Service space requirement varies according to the unit size. See unit dimensional drawings for different units service space requirement.

Lifting the unit

Lifting supports: placed between lifting bands, if these are short, to avoid damages to the unit when lifting it by the base frame.
Lifting rings: fixed to the upper corners of single modules or, in the case of small units, to the base frame.
Lifting device : for case specific applications
Lifting bars: pushed through the base frame to enable lifting of the unit by means of lifting bands.

Duct connections

Round or rectangular ducting can be used according to the application. The standard Future Marine Cabin unit is equipped with supply and exhaust plenums with round connections for ducting. The inlet and outlet of Cabin unit have duct connections for rectangular ducting. For Public and Service Marine units the connection is applied both for inlet/outlet and supply/exhaust ducting.

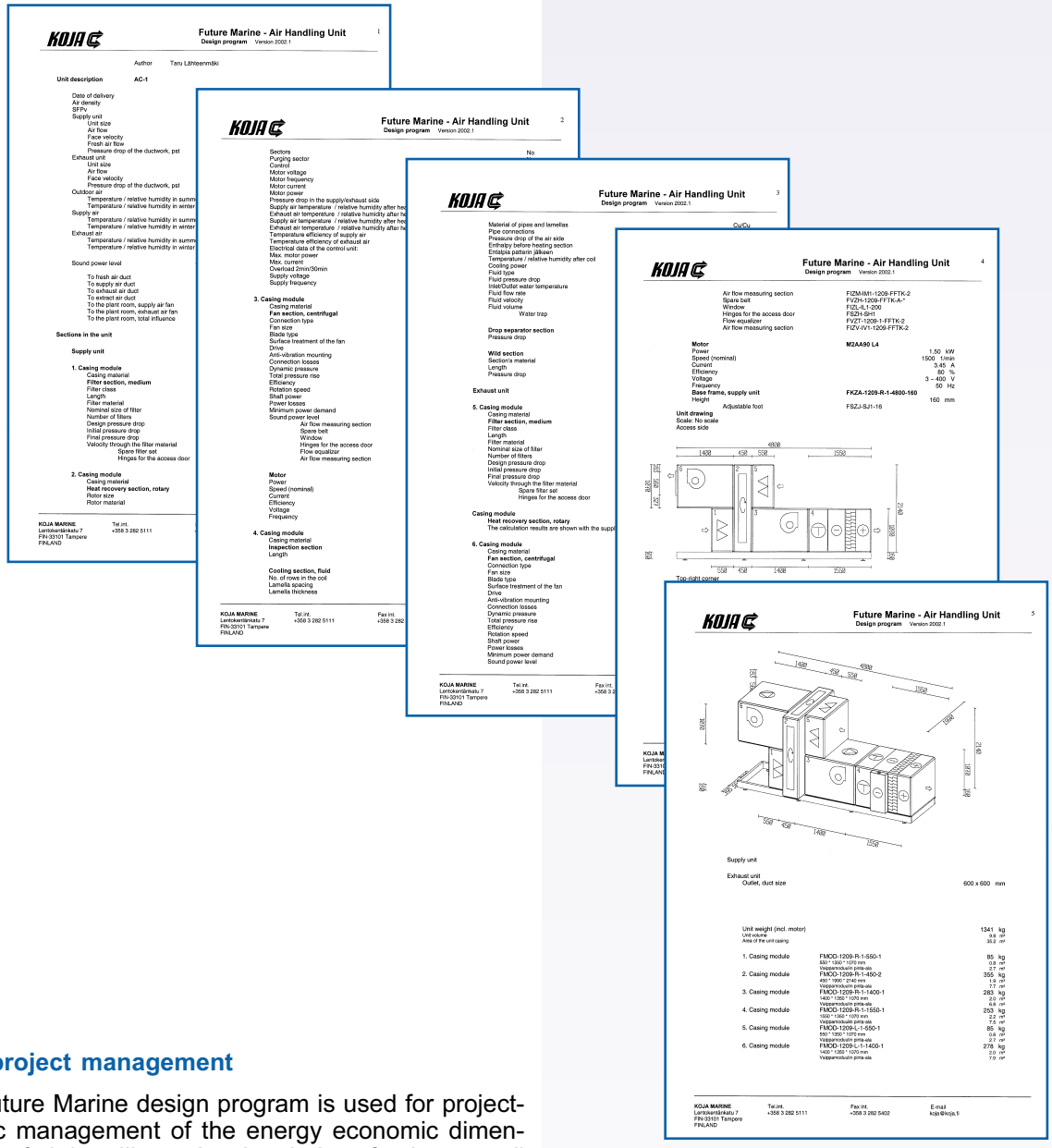
Connection to pipe network

The inlet and outlet connections of the heat exchanger have female DN 10…DN 50 pipe threads or flange connections (ISO 357) on larger units when water is used. When antifreeze is used, all sizes have flange connections. The connections are on the unit's service side and they are available directed to the side or upwards. Condensate water drain connections can be equipped with water traps (See Cooling/Heating section on page 35).

Installation of electric and automation equipment

Future Marine unit is available factory wired and tested, leaving installation work to a minimum at the site. The electrical installation work consists mainly of connecting the unit to power supply, signal bus cable and required external controls.

Design program



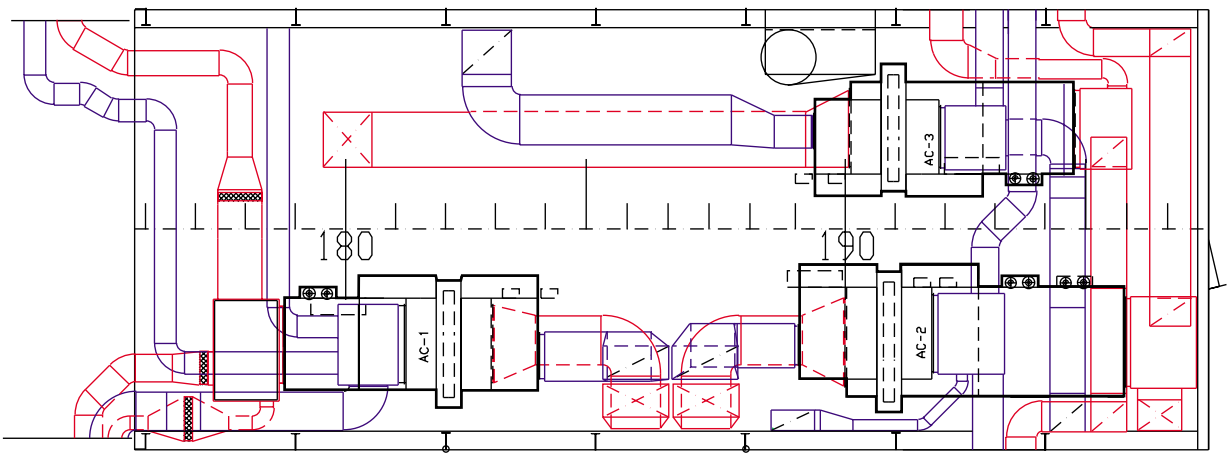
Total project management

The Future Marine design program is used for project-specific management of the energy economic dimensioning of air handling units, the choice of units, as well as information transfer in the different phases of the project.

Examples of the information the design program provides for the various interest groups in the project:

- For shipyards in basic engineering and project phases
- Dimensional drawings of air handling units for reservation of space
- For consultants and shipping companies in concept design phase
- Rated cooling and electric power for dimensioning the cooling compressors, etc.
- For workshop drawing designers in workshop drawing phase
- Dimensional drawings of air handling units for workshop drawings of air conditioning rooms
- Air volumes and duct outlet sizes on air handling unit for duct dimensioning
- Water volumes and pipe connection sizes on air handling unit for pipe dimensioning
- Electric powers for dimensioning of cables and other electric devices

Design program



Function of the program

The Future Marine design program automatically dimensions all the air handling units of the project when the basic data has been fed in. After this, different unit-specific or project-specific printouts of the air handling units can be obtained. The basic data of the project, unit type, and any single unit can be changed at any point.

The Future Marine design program includes comprehensive user instructions, instructions for problem situations, and the limit values for basic data.

Printouts from the program

The technical printout contains, according to choice, the project-specific basic data, the unit-specific basic data, the technical specifications of components including operational efficiency and pressure loss, the motors and drives of the unit, dimensions, weights, and volumes, as well as the accessories. The unit card printout contains all essential data of the air handling unit, and this printout can be used as delivery documentation.

The printing definition shall specify the data selected for printing, the air handling units to be printed, and other printing specifications.

Image files from Future Marine design program directly to CAD program

From the Future Marine design program, the drawing of an air handling unit can be transferred to a CAD program. The drawing contains symbols and other details generally used by building services designers, and it can be transferred as a 2D drawing or 3D model. The design program has a CAD application for AutoCad R14 or a recent version and AutoCad 2000 or a recent version, which can be used to open drawings from Future Marine project files as AutoCad blocks. The Future Marine design program also features a DXF translator for translating Future Marine project files into dxf-files, which can be read in different CAD applications, e.g. Auto-CAD LT.

Clear picture of space requirements

An image file of the Future Marine design program can be transferred to a CAD system as a 2D drawing or 3D model. In the case of a 2D drawing, there are 6 different projections available. To facilitate the further processing of image files, modules / functional sections and symbols are displayed on different levels. The space required by the air handling unit can be easily determined when the unit is drawn in the right place and precisely to scale.

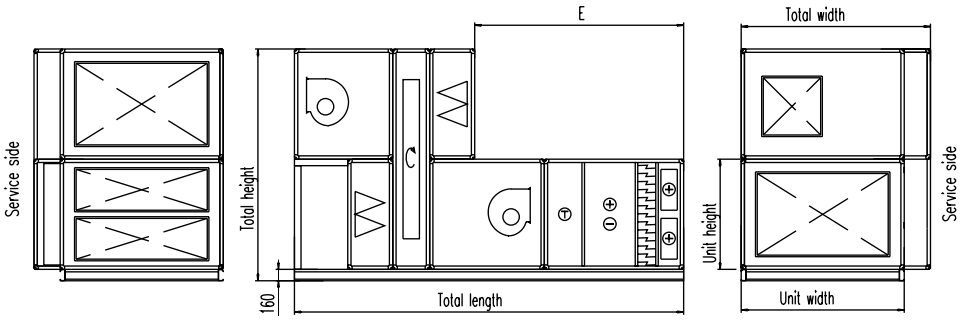
FUTURE MARINE DIMENSIONS
Quick selection chart — Air handling unit Future Marine

Unit size	Width (mm)	Height (mm)	Face Area (m^2)	Air flow rate at different face velocities (m^3/s)					
				2 m/s	2,3 m/s	2,6 m/s	2,9 m/s	3,2 m/s	3,5 m/s
0603	790	470	0,21	0,4	0,5	0,5	0,6	0,7	0,7
0605	790	670	0,34	0,7	0,8	0,9	1,0	1,1	1,2
0606	790	790	0,42	0,8	1,0	1,1	1,2	1,4	1,5
0906	1070	790	0,60	1,2	1,4	1,6	1,7	1,9	2,1
0909	1070	1070	0,86	1,7	2,0	2,2	2,5	2,8	3,0
1206	1350	790	0,78	1,6	1,8	2,0	2,3	2,5	2,7
1208	1350	990	1,02	2,0	2,4	2,7	3,0	3,3	3,6
1209	1350	1070	1,12	2,2	2,6	2,9	3,3	3,6	3,9
1210	1350	1190	1,27	2,5	2,9	3,3	3,7	4,1	4,4
1212	1350	1350	1,46	2,9	3,4	3,8	4,2	4,7	5,1
1506	1670	790	0,99	2,0	2,3	2,6	2,9	3,2	3,4
1509	1670	1070	1,42	2,8	3,3	3,7	4,1	4,5	5,0
1512	1670	1350	1,85	3,7	4,3	4,8	5,4	5,9	6,5
1515	1670	1670	2,34	4,7	5,4	6,1	6,8	7,5	8,2
1808	1990	990	1,56	3,1	3,6	4,1	4,5	5,0	5,5
1809	1990	1070	1,71	3,4	3,9	4,4	5,0	5,5	6,0
1810	1990	1190	1,93	3,9	4,4	5,0	5,6	6,2	6,8
1812	1990	1350	2,23	4,5	5,1	5,8	6,5	7,1	7,8
1815	1990	1670	2,83	5,7	6,5	7,4	8,2	9,0	9,9
1818	1990	1990	3,42	6,8	7,9	8,9	9,9	11,0	12,0
2109	2310	1070	2,01	4,0	4,6	5,2	5,8	6,4	7,0
2110	2310	1190	2,27	4,5	5,2	5,9	6,6	7,3	7,9
2112	2310	1350	2,62	5,2	6,0	6,8	7,6	8,4	9,2
2409	2550	1070	2,23	4,5	5,1	5,8	6,5	7,1	7,8
2412	2550	1350	2,90	5,8	6,7	7,6	8,4	9,3	10,2
2415	2550	1670	3,68	7,4	8,5	9,6	10,7	11,8	12,9
2418	2550	1990	4,45	8,9	10,2	11,6	12,9	14,2	15,6

Recommended dimensioning supply air velocity 2.9 m/s
Max. supply air velocity 3.5 m/s

FUTURE MARINE DIMENSIONS *PUBLIC*

Quick selection



There must be at least one unit width free space available in service side for AHU service and maintenance.

Unit size	*Unit width (mm)*	*Unit height (mm)*	*Total length *) (mm)*	*Total height (mm)*	*Total width **) (mm)*	*E (mm)*	*Weight (kg)*
0603	790	470	3350	1100	1070	1700	850
0605	790	670	3550	1500	1350	1800	1100
0606	790	790	3750	1740	1630	1900	1250
0906	1070	790	3750	1740	1970	1900	1700
0909	1070	1070	3950	2300	1970	2000	1950
1206	1350	790	3850	1740	1830	2000	1800
1208	1350	990	4250	2140	1990	2200	2150
1209	1350	1070	4450	2300	1990	2300	2200
1210	1350	1190	4450	2540	1990	2300	2300
1212	1350	1350	4450	2860	2310	2300	2600
1506	1670	790	3850	1740	1870	2000	1950
1509	1670	1070	4450	2300	2310	2300	2600
1512	1670	1350	4850	2860	2310	2500	3050
1515	1670	1670	4850	3500	2630	2500	3450
1808	1990	990	4350	2140	2190	2300	2500
1809	1990	1070	4550	2300	2310	2400	2800
1810	1990	1190	4550	2540	2310	2400	3050
1812	1990	1350	4950	2860	2590	2600	3550
1815	1990	1670	5350	3500	2830	2800	4200
1818	1990	1990	5950	4140	3470	3100	5050
2109	2310	1070	4550	2300	2510	2400	3050
2110	2310	1190	4950	2540	2510	2600	3350
2112	2310	1350	4950	2860	2550	2600	3750
2409	2550	1070	4650	2300	2750	2500	3350
2412	2550	1350	5050	2860	2750	2700	3900
2415	2550	1670	5450	3500	3190	2900	4950
2418	2550	1990	6050	4140	3510	3200	6050

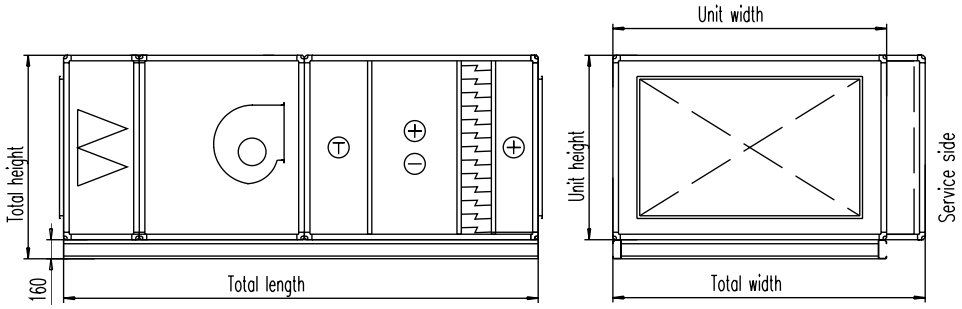
****) Total length with direct drive fans. When belt drive is used, total length is 400-1000 mm longer.***

*****) Total width with direct drive fans. When belt drive or smaller fan/motor size is used, total width is less.***

FUTURE MARINE DIMENSIONS

SERVICE

Quick selection



There must be at least one unit width free space available in service side for AHU service and maintenance.

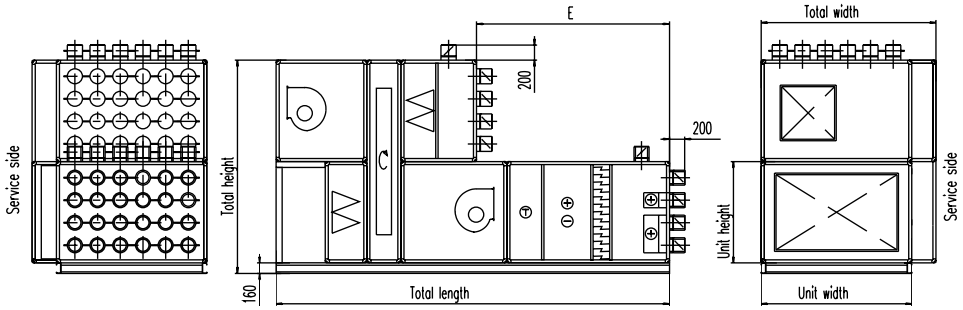
Unit size	*Unit width (mm)*	*Unit height (mm)*	*Total length *) (mm)*	*Total height (mm)*	*Total width **) (mm)*	*Weight (kg)*
0603	790	470	2700	630	990	550
0605	790	670	2800	830	1070	650
0606	790	790	2900	950	1350	700
0906	1070	790	2900	950	1670	900
0909	1070	1070	3000	1230	1670	1050
1206	1350	790	3000	950	1670	1000
1208	1350	990	3200	1150	1670	1150
1209	1350	1070	3300	1230	1670	1200
1210	1350	1190	3300	1350	1670	1250
1212	1350	1350	3300	1510	1990	1400
1506	1670	790	3000	950	1870	1100
1509	1670	1070	3300	1230	1990	1400
1512	1670	1350	3500	1510	1990	1650
1515	1670	1670	3500	1830	2310	1850
1808	1990	990	3300	1150	2190	1450
1809	1990	1070	3400	1230	2190	1550
1810	1990	1190	3400	1350	2190	1700
1812	1990	1350	3600	1510	2310	1900
1815	1990	1670	3800	1830	2550	2250
1818	1990	1990	4100	2150	3190	2650
2109	2310	1070	3400	1230	2510	1750
2110	2310	1190	3600	1350	2510	1950
2112	2310	1350	3600	1510	2510	2100
2409	2550	1070	3500	1230	2750	1900
2412	2550	1350	3700	1510	2750	2200
2415	2550	1670	3900	1830	2750	2600
2418	2550	1990	4200	2150	3190	3150

****) Total length with direct drive fans. When belt drive is used, total length is 200-500 mm longer.***

*****) Total width with direct drive fans. When belt drive or smaller fan/motor size is used, total width is less.***

FUTURE MARINE DIMENSIONS *CABIN*

Quick selection



There must be at least one unit width free space available in service side for AHU service and maintenance.

Unit size	*Unit width (mm)*	*Unit height (mm)*	*Total length *) (mm)*	*Total height (mm)*	*Total width **) (mm)*	*E (mm)*	*Weight (kg)*
0603	790	470	3750	1100	1070	1650	950
0605	790	670	3950	1500	1350	1750	1250
0606	790	790	4150	1740	1630	1850	1450
0906	1070	790	4150	1740	1970	1850	1900
0909	1070	1070	4350	2300	1970	1950	2200
1206	1350	790	4250	1740	1830	1950	2000
1208	1350	990	4650	2140	1990	2150	2350
1209	1350	1070	4850	2300	1990	2250	2450
1210	1350	1190	4850	2540	1990	2250	2600
1212	1350	1350	4850	2860	2310	2250	2950
1506	1670	790	4250	1740	1870	1950	2150
1509	1670	1070	4850	2300	2310	2250	2900
1512	1670	1350	5250	2860	2310	2450	3350
1515	1670	1670	5250	3500	2630	2450	3850
1808	1990	990	4750	2140	2190	2250	2750
1809	1990	1070	4950	2300	2310	2350	3050
1810	1990	1190	4950	2540	2310	2350	3300
1812	1990	1350	5350	2860	2590	2550	3900
1815	1990	1670	5750	3500	2830	2750	4600
1818	1990	1990	6350	4140	3470	3050	5600
2109	2310	1070	4950	2300	2510	2350	3350
2110	2310	1190	5350	2540	2510	2550	3650
2112	2310	1350	5350	2860	2550	2550	4100
2409	2550	1070	5050	2300	2750	2450	3650
2412	2550	1350	5450	2860	2750	2650	4300
2415	2550	1670	5850	3500	3190	2850	5400
2418	2550	1990	6450	4140	3510	3150	6650

****) Total length with direct drive fans. When belt drive is used, total length is 400-1000 mm longer.***

*****) Total width with direct drive fans. When belt drive or smaller fan/motor size is used, total width is less.***

Damper section MPTP

Design instructions

The damper section MPTP is used in Future Marine air handling units for preventing fresh air from entering the air handling unit when the unit is not running. This prevents harmful flow-through and the freezing of exchangers. The closing damper shall open before the fan starts and close after it has stopped. The section shall have at least 700 mm of free space on the side for maintenance. The operating temperature range is -40…+80°C, the maximum differential pressure over the closing damper is 1200 Pa, and the tightness class is T4 (EN 1751).

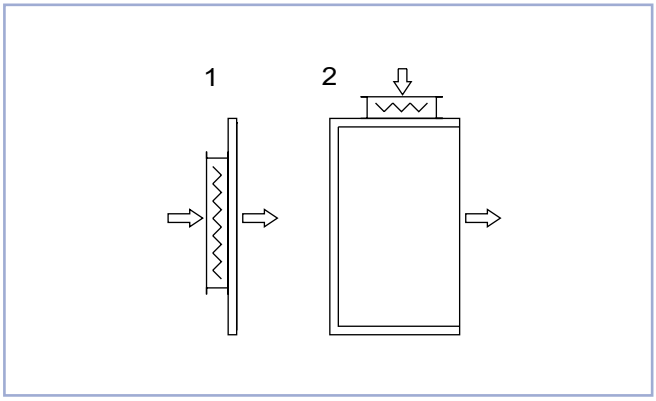
Structure

Structural alternative 1 of the damper section MPTP consists of a closing damper located at the end of the casing, while structural alternative 2 consists of unit casing with thermal insulation and a closing damper mounted at the top. The closing damper has blades that turn against one another and are provided with thermal insulation. The closing damper frame is also available with thermal insulation. The material of the blades, axles, and frame is galvanized or stainless steel (AISI 316). Mineral wool is used for thermal insulation, the sealing material is silicone rubber, and the bearings are of plastic. The actuating shaft is a 100 mm long 15 x 15 mm tube provided with a position indicator. The casing material is galvanized or stainless steel (AISI 316).

Sizes	0603..... 2418
Air flow rates	0,32.....15,6 m^3/s

Recommended actuator size at different unit size:

Unit size	Version	Motor	Pcs.
0603…1208	1	10 Nm	1
1209…1815, 2109…2409	1	15 Nm	1
1818, 2412…2418	1	30 Nm	1
0603…1509, 1808, 1809	2	10 Nm	1
1512, 1515, 1810…2418	2	15 Nm	1



Product code: **MPTP - a - b - c - d - e - f - g**

a) Unit size	0603...2418
b) Service side	R / L
c) Section material	1=galvanized, 2=stainless steel (AISI 316)
d) Damper material	1=galvanized, 2=stainless steel (AISI 316)
e) Version	1, 2
f) Frame	1=uninsulated, 2=insulated
g) Drip tray	0 = no, 1 = yes (version 2)

Accessories in Table on page 52

Mixing section MPTA

Design instructions

The mixing section MPTA is used on Future Marine air handling units when a part of the exhaust air is recirculated with fresh air back into the serviced space. In addition, the mixing section MPTA works the same way as the damper section MPTP. The blade dampers shall open before the fan is started and close after it has been stopped. The section shall have at least 700 mm of free space on the side for maintenance. The operating temperature range is -40…+80°C, the maximum differential pressure over the blade dampers is 1200 Pa, and the tightness class is T4 (EN 1751).

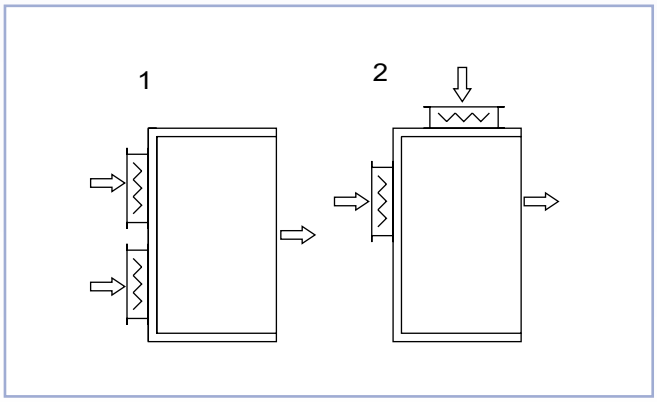
Structure

Structural alternative 1 of the mixing section MPTA consists a casing with thermal insulation and two blade dampers, one at the top of the casing and the other at the end. Structural alternative 2 consists of two blade dampers at casing ends. The blade dampers have blades with thermal insulation that turn against one another. The blade damper frames are also available with thermal insulation. The material of the blades, axles, and frame is galvanized or stainless steel (AISI 316). Mineral wool is used for thermal insulation, the sealing material is silicone rubber, and the bearings are of plastic. The actuating shafts are 100 mm long 15 x 15 mm tubes provided with position indicators. The casing material is galvanized or stainless steel (AISI 316).

Sizes	0603.....2418
Air flow rates	0,32.....15,6 m^3/s

Recommended actuator size at different unit size:

Unit size	Version	Motor	Pcs.
0605…1512, 1808…1810	1	10 Nm	2
1515, 1812…2418	1	15 Nm	2
0603…1509, 1808, 1809	2	10 Nm	2
1512, 1515, 1810…2418	2	15 Nm	2



Product code: **MPTA - a - b - c - d- e - f - g**

a) Unit size	0603...2418
b) Service side	R / L
c) Section material	1=galvanized, 2=stainless steel (AISI 316)
d) Damper material	1=galvanized, 2=stainless steel (AISI 316)
e) Version	1, 2 (version 1 0605...2418)
f) Frame	1=uninsulated, 2=insulated
g) Drip tray	0 = no, 1 = yes

Accessories in Table on page 52

Filter section MSTF

Design instructions

The filter section MSTF is used on Future Marine air handling units for maintaining the target values of indoor air and for ensuring the cleanness of other sections, such as the heat exchangers. Two casing lengths and numerous suitable filter alternatives are available in order to meet the requirements on clean air. The material of particle filters is fibreglass or synthetic. The filtering classes are defined according to the CEN Standard EN 779. The section shall have at least 700 mm of free space on the side for maintenance.

Structure

The filter sections MSTF can be chosen from two alternative lengths:
- 250 mm section, filtering class G3
- 450 mm section, filtering classes G3, G4, F5, F6, F7

The section is installed in a casing with thermal insulation. The particle filters are disposable filter cassettes of modular size. They are pushed into the mounting frame and pressed there against an EPDM sealing. The filter section is provided with connections for differential pressure measuring. The highest allowed operating temperature is +70 °C.

Unit size	B (mm)	H (mm)	No. of filter modules Module size (B, H) 287 592	592 287	592 592	592 490
0603	790	470	1			
0605	790	670				1
0606	790	790			1	
0906	1070	790	1		1	
0909	1070	1070	1	1	1	
1206	1350	790			2	
1208	1350	990		2		2
1209	1350	1070		2	2	
1210	1350	1190				4
1212	1350	1350			4	
1506	1670	790	1		2	
1509	1670	1070	1	2	2	
1512	1670	1350	2		4	
1515	1670	1670	2	2	4	
1808	1990	990		3		3
1809	1990	1070		3	3	
1810	1990	1190				6
1812	1990	1350			6	
1815	1990	1670		3	6	
1818	1990	1990			9	
2109	2310	1070	1	3	3	
2110	2310	1190				6
2112	2310	1350	2		6	
2409	2550	1070		4	4	
2412	2550	1350			8	
2415	2550	1670		4	8	
2418	2550	1990			12	

Mounting frame is 25 ±1 mm thick

Sizes	0603..... 2418
Air flow rates	0,32.....15,6 m^3/s

Filter applications

G3 and G4 (EU3 and EU4, G85 and G95)
- removes large particles of pollen, and
- to some extent smoke and staining particles.

F5 and F6 (EU5 and EU6, F45 and F65)
- removes all pollen, and
- most staining particles.

F7 (EU7, F85)
- removes, in addition to the above, oil and coal smoke, and
- to some extent tobacco smoke and bacteria.

Product code: **MSTF - a - b - c - d - e - f - g**

a) Size	0603...2418
b) Service side	R / L
c) Section material	1=galvanized, 2=stainless steel (AISI 316)
d) Filtering class	G3, G3(2), G4(2), F5(2), F6(2), F7(2), F7(2)L
e) Section length	1 = 250 mm (G3) 2 = 450 mm (G3, G3(2), G4(2), F5(2), F6(2), F7(2), F7(2)L)
f) Filtering material	1 = fibreglass (F5(2), F6(2), F7(2), F7(2)L) 2 = synthetic (G3, G3(2), G4(2), F5(2), F6(2), F7(2))
g) Drip tray	0 = no, 1 = yes

Accessories in Table on page 52

Inspection section MTTT

Unit sizes	0603...2418
Flow rate capacity	0,32...15,6 m^3/s

Instructions for design

The inspection section MTTT is designed to be used when it is necessary to have additional inspection or service facilities in the air conditioning unit, to increase the distance between two sections for the purpose of flow equalization.

Construction

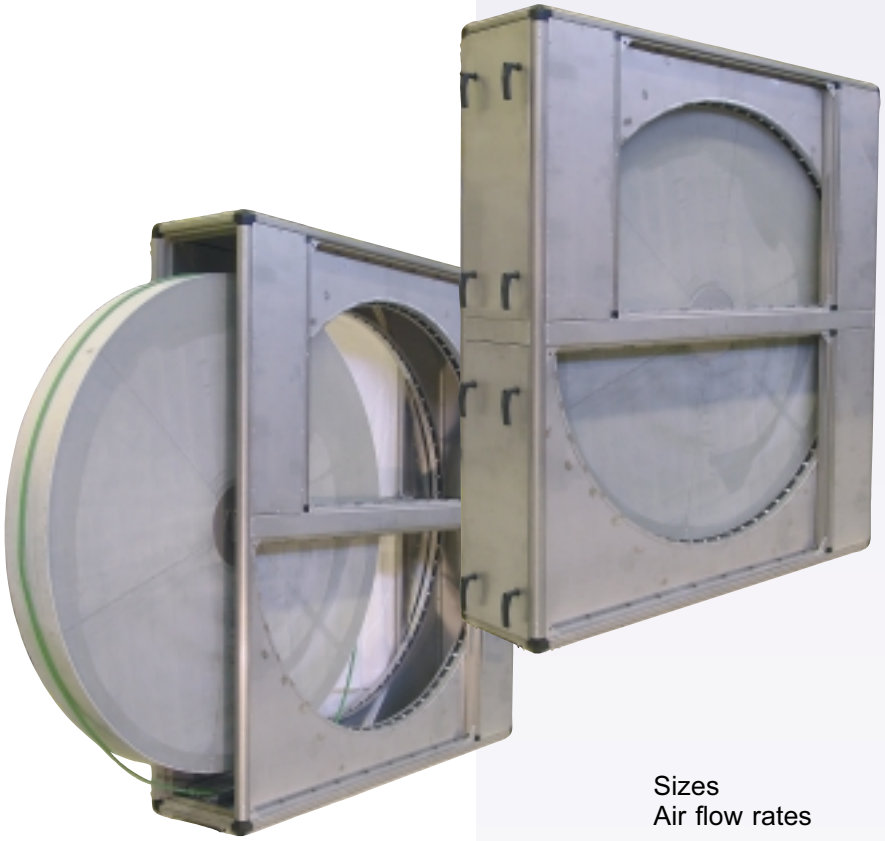
The inspection section MTTT consists of a thermally insulated casing equipped with an access door.

Product code: **MTTT - a - b - c - d - e**

a) Unit size	0603...2418
b) Service side	R / L
c) Section material	1=galvanized, 2=stainless steel (AISI 316)
d) Length	250, 300, 350, 400, 450, 500, 550, 600, 750, 850, 950, 1150
e) Drip tray	0 = no, 1 = yes

Accessories in Table on page 52

Heat recovery section, wheel MRTR



Sizes	0603.....2418
Air flow rates	0,32.....15,6 m^3/s

Design instructions

The heat recovery section MRTR is used on Future Marine air handling units for the recovery of cooling or heating energy contained in exhaust air, and for transferring the energy to supply air, when the supply and exhaust units can be located on top of one another and minor mixing of supply and exhaust air is allowed. The air flow directions through the heat recovery section shall always be opposite and the supply and exhaust fans shall always be located after the heat recovery section in the direction of the flow. In the heat recovery section the supply air and the exhaust air flow alternately along the same routes and, therefore, minor mixing is inevitable (1,5…4,0%). For rotor change, the free maintenance space on the side must be equal to the width of the section. If the rotor is of sectored type and the old rotor is disassembled when removed, the need for free maintenance space is only half of the width of the section. For the inspection and maintenance of heat transfer surfaces, unobstructed access from all directions shall be arranged, for instance, through the adjoining sections (if necessary, using the inspection section MTTT). To keep the rotor clean, we recommend that a filter of at least class F5 is placed before the heat recovery section (supply and exhaust sides).

Heat recovery section, wheel MRTR

Structure

The heat recovery section MRTR consists of a casing with thermal insulation and a rotating rotor located inside it. The rotor can be pulled out of the section for maintenance. The highest allowed operating temperature is +70 °C. Two alternative sizes are available for each unit size. The material of the rotor is aluminium or ceramics, with several coating alternatives.

Aluminium rotor ALE has epoxy-coated lamella edges. ALE transfers moisture only when there is condensation in it. This rotor has a high thermal efficiency, and withstands high environmental stresses associated with marine weather conditions.
Aluminium rotor AHEN has epoxy-coated lamella edges. AHEN copes with marine weather conditions, and is hygroscopic, transferring both heat and moisture. This rotor is highly applicable where thermal efficiency is required, and where moisture and cooling energy need to be effectively transferred in summertime.
Aluminium rotor AHEL has epoxy-coated lamella edges. AHEL copes with marine weather conditions, and is hygroscopic, transferring both heat and moisture. This rotor is highly applicable where very high thermal efficiency is required, and where moisture and cooling energy need to be very effectively transferred in summertime.

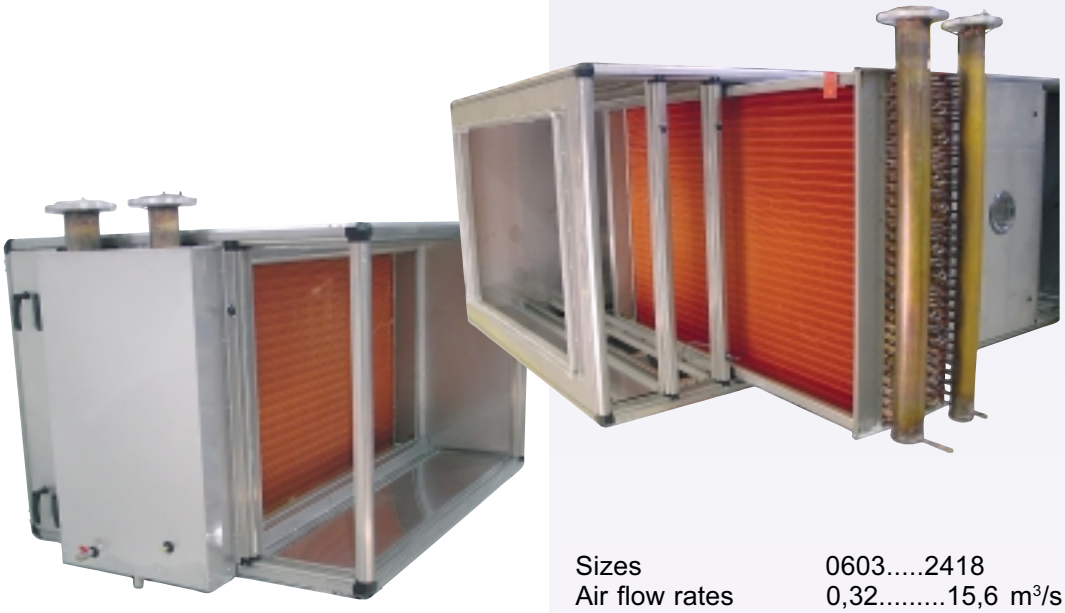
Ceramic rotor AHK/S is hygroscopic, transferring both heat and moisture. The rotor is impregnated with a salt which provides it with very high efficiency for latent heat. The rotor is highly resistant to corrosion. Ceramic rotor is always sectorised.
ALE/S, AHEN/S and AHEL/S are sectorised rotors. Rotors are available as follows:
Wound or sectorised rotor: 0603...2412 (rotor sizes 1 and 2), 2415 and 2418 (rotor size 1)
Sectorised rotor only: 2415 and 2418 (rotor size 2)

Product code: **MRTR - a - b - c - d - e - f**

a) Unit size	0603...2418
b) Service side	R / L
c) Section material	1=galvanized, 2=stainless steel (AISI 316)
d) Rotor size	1, 2
e) Construction	1 = supply unit underneath
f) Rotor type	ALE, AHEN, AHEL, AHK/S, ALE/S, AHEN/S, AHEL/S

Accessories in Table on page 52

Cooling/heating section, fluid MJTV



Sizes	0603.....2418
Air flow rates	0,32.....15,6 m^3/s

Design instructions

The cooling/heating section MJTV is used on Future Marine air handling units for cooling/heating of supply air, and it uses cold/hot water or frost-resistant liquid, such as glycol. A standard cooling/heating section must always be installed so that air flows horizontally through it.

For the cleaning or replacement of the heat exchanger in the cooling/heating section, a free space of at least the section´s width must be available on one side of the sections for the cleaning or replacement of heat exchanger, or a corresponding space must be otherwise possible to arrange. For inspection and service of the heat transfer surfaces, unobstructed access must be arranged, for instance, through the adjoining sections or by using an at least 450 mm long MTTT inspection section. There must be enough space below the cooling/heating section for a water trap that is installed to the pipe coming from the condensed water basin of the heat exchanger. The height of the water trap is defined in each case separately. If necessary, the cooling/heating section can be equipped with a droplet eliminator, usually when the humidity of the air is high and the air velocity through the heat exchanger exceeds 2,5 m/s. Due to the structure of the heat exchanger it never becomes completely drained. When water is used as the heat transfer medium there is a risk of freezing and damage to the heat exchanger if the temperature is below 0 °C.

Structure

The cooling/heating section MJTV consists of a casing with thermal insulation and a heat exchanger installed inside it. The heat exchanger can be removed from the casing without disassembling the exchanger. The heat exchanger pipes are made of copper and the lamellas of aluminium or copper. The heat exchanger frame is made of aluminium or stainless steel (AISI 316). The heat exchanger has inlet and outlet connections for fluid, air purging screw and drainage plug. There is a condensate water basin under the cooling/heating section and it leans towards the service side 1:20. The condensate water basin has a water drain connection on the service side. The condensate water basin can be hosed down and it can be checked from the outlet side.

The inlet and outlet connections of the heat exchanger have female DN 10…DN 50 pipe threads or flange connections (ISO 357) on larger units when water is used. When antifreeze is used, all sizes have flange connections. The connections are on the unit's service side and they are available directed to the side or upwards. The maximum operating pressure is 1,0 MPa and operating temperature +150 °C .

Cooling/heating section, fluid MJTV

Product code: MJTV - a - b - c - d - e - f - g - h - i - j

a) Unit size	0603...2418
b) Service side	R / L
c) Section material	1=galvanized, 2=stainless steel (AISI 316)
d) Number of rows	4, 6, 8, 10, 12
e) Pipes and lamellas	1 = Cu/Al, 2 = Cu/Cu
f) Lamella pitch	2.4 / 2.8 / 3.5
g) Number of routes	1…138
h) Fluid	1=water, 2=glycol (ethylene), 3=glycol (propylene), 4=freezium, 5=thermera
i) Antifreeze content	0, 20, 25, 30, 35, 40, 45, 50
j) Piping connections	F = front, U = up

Accessories in Table on page 52

Water trap MVZL

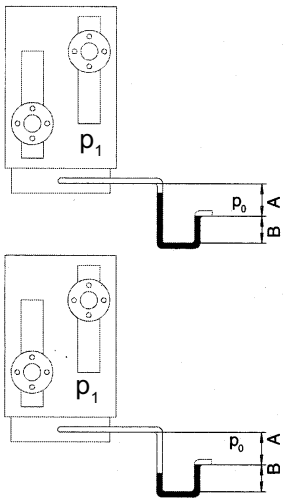
The water trap MVZL is installed to the condensate water connection and used in conjunction with sections, where condensation of water from the air occurs. The water trap enables removal of condensate water from the unit while preventing air leakage.

Sufficient space must be reserved under the unit for the water trap or sufficient difference in levels must be arranged in some other way so that the water trap can function. The height of the water trap is defined in each case separately; typical space requirement is approx. 200...350 mm.

The pipe from the water trap to the floor drain must be sufficiently inclined throughout its length (at least 1 : 100) towards the floor drain so that water is removed from the water trap. The end of the pipe to the floor drain may not be immersed in water.

The water trap MVZL consists of a connecting piece for the condensate water connection, a water trap with blocking for return flow of air and a pipe connecting piece for the pipe to the floor drain, for instance. The water trap is made of PVC and brass or AISI 316. If the water trap has dried up, water can be added from outside the unit.

Water trap is designed for each case separately.



Heat exchanger on the fan inlet side

$\Delta p = p_0 - p_1$ [Pa]

$A_{min} = \Delta p/10 + 30$ [mm]

$B_{min} = A/2 + 20$ [mm]

Heat exchanger on the fan outlet side

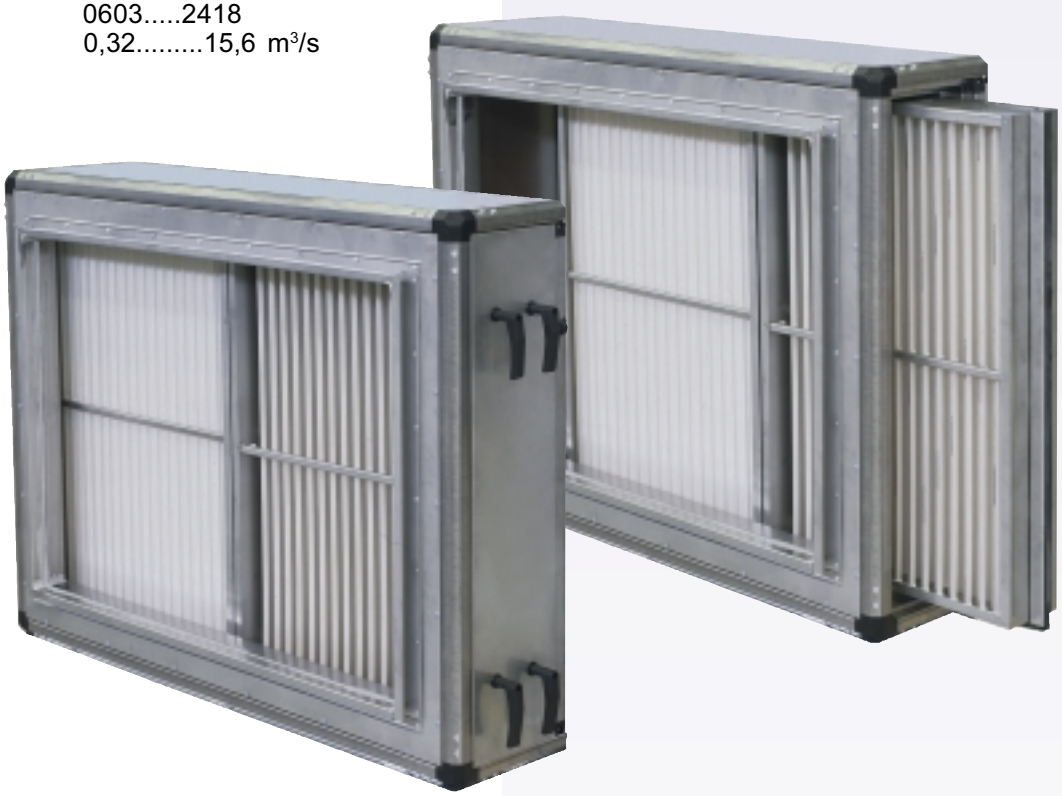
$\Delta p = p_0 - p_1$ [Pa]

$A_{min} = 20$ [mm]

$B_{min} = \Delta p /10 + 30$ [mm]

Droplet eliminator MPTE

Sizes	0603.....2418
Air flow rates	0,32.....15,6 m^3/s



Design instructions

The droplet eliminator MPTE is used in conjunction with components where the air flow carries droplets of water, usually when the air contains large amounts of humidity, the air velocity exceeds 2,5 m/s. A standard droplet eliminator must always be installed so that the air flows through horizontally. The droplet eliminator cassettes can be pulled out for inspection and service. 1000 mm of free maintenance space must be reserved on the side of the section.

Sufficient space must be reserved below the droplet eliminator for a water trap that is connected to the outlet pipe of the condensate water basin. The height of the water trap is defined in each case separately.

Structure

The droplet eliminator MPTE consists of a casing with thermal insulation and a droplet eliminator block installed inside it. The droplet eliminator has profiled blades made of PP plastic (polypropylene), glass fibre or aluminium and a frame of stainless steel (AISI 316). The allowed air temperature range is -20…+100 °C.

The condensate water basin leans towards the service side 1:20 and it has a water drain connection.

The condensate water basin can be hosed down. The droplet eliminator has its own access door.

Product code: **MPTE - a - b - c - d**

a) Unit size	0603...2418
b) Service side	R / L
c) Section material	1=galvanized, 2=stainless steel (AISI 316)
d) Cell material	4=aluminium, 8=glass fibre, 9=plastic (PP)

Accessories in Table on page 52

Heating section, water MLTV

Design instructions

The heating section MLTV is designed to be used for heating the supply air. The section must be equipped with an anti-freezing thermostat to avoid damages caused by freezing. A standard heating section MLTV must always be so mounted that the air flow that goes through it is strictly horizontal. A free space of at least the section's width must be available on one side of the section, or a corresponding space must be otherwise possible to arrange so that the heat exchanger can be replaced. The heat transfer surfaces must be accessible for inspection and service through, for example, the adjacent sections, or an inspection section MTTT provided with an access door. If water is used as the heating medium, the heat exchanger may freeze up and get damaged at temperatures below 0°C.

Sizes	0603.....2418
Air flow rates	0,32.....15,6 m^3/s

Structure

The heating section MLTV consists of a thermally insulated casing, and a built-in heat exchanger. The heat exchanger can be pulled out of the casing without dismantling. The pipes of the heat exchanger are copper, the lamellas are aluminium or copper, and the frame is galvanized or stainless steel (AISI 316). The heat exchanger has inlet, outlet, air purging screw, drainage plug, and connection for anti-freezing thermostat sensor. Both the inlet and the outlet are provided with a female pipe thread (sizes DN 10...DN 50), or a connection flange according to ISO 357. If glycol is used, all sizes are equipped with connection flanges. The max. permissible operating temperature is +150°C, and the max. permissible operating pressure is 1,0 MPa.

Product code: **MLTV - a - b - c - d - e - f - g**

a) Unit size	0603…2418
b) Service side	R / L
c) Section material	1=galvanized, 2=stainless steel (AISI 316)
d) Capacity variant	1, 2, 3, 4, 5
e) Pipes/lamellas	1=Cu/Al, 2=Cu/Cu
f) Fluid	1=water, 2=glycol (ethylene), 3=glycol (propylene)
g) Antifreeze content	0, 20, 25, 30, 35, 40, 45, 50

Accessories in Table on page 52

Heating section, electricity MLTE

Design instructions

The heating section MLTE is designed to be used in Future Marine air handling unit for heating the supply air, and to be operated by electricity. The heating section's capacity (5 capacity variants/unit size) and number of power steps are determinated separately in each case. The section must be connected to the fan in the positive mode. It is also advisable to equip the unit with a flow controller. This section must always be so mounted that the air flow goes through it via filter and strictly horizontally. A free space of at least the section's width must be available on one side of the section, or a corresponding space must be otherwise possible to arrange so that the heat exchanger can be replaced. The heat transfer surfaces must be accessible for inspection and service through, for example, the adjacent sections, or an inspection section MTTT provided with an access door. The input voltage is usually 3~400 V, 50 Hz, but other ratings are also possible. The heating power and power stages are determined separately for every individual section. The section must be connected so that the fan starts before or at the same time as heating. The fan may stop at the same time as heating or later.

The heating section with rod resistor without lamellas must be placed at least 100 mm away from any burning material, 500 mm away from supply air filter made of non-flammable material, 1000 mm away from obstacles disturbing the air flow. The supply air side must have 500 mm free space.

Structure

The heating section consists of lamella-type heat exchanger with electric heating rods inserted into pipes. The heat exchanger pipes are made of copper and the lamellas of aluminium or copper. The heating section is also available without lamellas, in which case the electric heating rods are made of stainless steel and the heating rods are situated in direct air flow.

The heating section MLTE consists of a thermally insulated casing, and a built-in electric heater, which can be equipped with rod resistor either with or without lamellas. The lamellas can be fastened to the rod resistor to intensify the heat transmission. The heating section MLTE contains all the necessary terminals and cable entry sleeves are ready installed.

Operation with lamellas

The heating section MLTE, equipped with rod resistor with lamellas, is designed for a min. air velocity of 1,5 m/s at an outlet temperature of 40 °C. As the velocity decreases, the temperature rises, and as the velocity increases, the temperature sinks. The heat exchanger features a thermostat and overheating switch. Heating is switched off by the thermostat when the temperature exceeds 75 °C and back on when the temperature falls again below 75 °C. The overheating switch is a safety device which switches off heating if the temperature rises to 147 °C. It must be reset manually, but not until the cause of overheating has been found out. The overheating switch is a safety device, and must therefore never be by-passed. If desired, an alarm can be given every time the overheating switch operates.

Sizes	0603.....1812
Air flow rates	0,32.....7,8 m^3/s
Max. heating power	260 kW

Operation without lamellas

The heating section MLTE, equipped with rod resistor without lamellas, is designed for a min. air velocity of 2 m/s at an outlet temperature of 40°C. As the velocity decreases, the temperature rises, and as the velocity increases, the temperature sinks. The heat exchanger features a thermostat and overheating switch. Heating is switched off by the thermostat when the temperature exceeds 90 °C and back on when the temperature falls again below 90 °C. The overheating switch is a safety device which switches off heating if the temperature rises to 110 °C. It must be reset manually, but not until the cause of overheating has been found out. The overheating protector is a safety device, and must therefore never be by-passed. If desired, an alarm can be given every time the over-heating switch operates.

Product code:	**MLTE - a - b - c - d - e - f - g**
a) Unit size	0603…1812
b) Service side	R / L
c) Section material	1=galvanized, 2=stainless steel (AISI 316)
d) Version	1 = with lamellas, 2 = without lamellas
e) Pipes/lamellas	1=Cu/Al (version 1), 2=Cu/Cu (version 1), 0 (version 2)
f) Capacity variant	1, 2, 3, 4, 5
g) Power steps	1…6

Accessories in Table on page 52

Humidifying section, steam MKTH

Unit sizes	0603...2418
Air flow rates	0,32...15,6 m³/s

Design instructions

The humidifying section MKTH is used for humidifying the supply air by means of water vapour with a temperature of 100°C. The desired humidity is reached by determining the steam demand (kg/h) according to the prevailing conditions. The section features connections and a supporting plate for steam pipe(s). Downstream from the section, there must be enough free space for the water vapour to be distributed evenly, and condensate water basin and water drain for possible condensation on the inner surfaces. A humidifying section MKTH must always be mounted with the steam pipe holes upwards. The air flow that goes through the section must be strictly vertical or horizontal. For service purposes, there must be at least 800 mm of free space on one side of the section. Below the section, there must be enough free space to allow the installation of a water trap (see page 52).

Structure

The humidifying section MKTH consists of a thermally insulated casing, steam pipe(s) and a supporting plate for steam pipe(s). The section casing is equipped with a condensate water basin and water drain made of stainless steel (AISI 316).

Product code: **MKTH - a - b - c - d**

a) Unit size	0603...2418
b) Service side	R / L
c) Section material	1=galvanized, 2=stainless steel (AISI 316)
d) Pipe size / pcs	D x L / pcs

Accessories in Table on page 52

Humidifying section, spray MKTS

Unit sizes	0603.....2418
Air flow rates	0,32.....15,6 m^3/s

Design instructions

The humidifying section MKTS is used for humidifying the supply air using water sprays with a temperature below 20 °C. The degree of humidification can be separately chosen by determining the required amount of water (kg/h) according to the conditions. Downstream from the section, there must be enough free space for the even distribution humidity. The humidifying section is always installed so that the water sprays point in the direction of the air flow, and the air flows either horizontally or vertically through the section. There must be at least 800 mm of free maintenance space on one side of the humidifying section, and sufficient space must be reserved below the section for the installation of a water trap, that is installed to the pipe from the condensate water basin of the humidifying section. The height of the water trap is defined separately in each case (see page 52).

Structure

The humidifying section MKTS consists of a thermally insulated casing, a support plate, and spray pipe(s). The humidifying section casing has a condensate water basin made of stainless steel (AISI 316) and a water pipe connection.

Product code: **MKTS - a - b - c - d - e**

a) Unit size	0603...2418
b) Service side	R / L
c) Section material	1=galvanized, 2=stainless steel (AISI 316)
d) Version	1= spray, 2 = compressed air spray
e) Number of nozzles	pcs

Accessories in Table on page 52

Supply plenum – reheating section MPTS

Sizes	0603.....2418
Air flow rates	0,32.....15,6 m^3/s

Design instructions

The supply plenum - reheating section MPTS is used for reheating supply air and distributing it to the served spaces.

The heat exchangers of a standard supply plenum - reheating section can be installed so that the air flows through them either horizontally or vertically. The heat exchanger is located inside the plenum box. The re-heating coil can also be installed in a duct. A free space of at least the section´s width must be available on one side of the sections for the cleaning or replacement of heat exchanger, or a corresponding space must be otherwise possible to arrange. For inspection and service of the heat transfer surfaces, unobstructed access must be arranged, for instance, through the adjoining sections or by using an inspection section MTTT. The heat exchanger can be removed from the casing without disassembling the exchanger.

Structure

The supply plenum - reheating section MPTS consists of a casing with thermal insulation and a heat exchanger installed inside, and insulated or uninsulated duct connections. Duct connections can be equipped with smoke dampers of tightness class T2 (EN 1751). Horizontally aligned smoke dampers can be inter-connected for control by a single actuator. The heat exchanger pipes are made of copper and the lamellas of aluminium or copper. The heat exchanger frame is made of galvanized or stainless steel (AISI 316). The heat exchanger has inlet and outlet connections for water, air purging screw and drainage plug. The inlet and outlet connections have female DN 10…DN 50 pipe threads or flange connections (ISO 357) on larger units. The heat exchanger connections are on the service side. The maximum operating temperature is +150 °C and the highest operating pressure 1,0 MPa.

Supply plenum – reheating section MPTS

Product code: **MPTS - a - b - c - d - e - f - g - h - i**

a) Unit size 0603...2418
b) Service side R / L
c) Section material 1=galvanized, 2=stainless steel (AISI 316)
d) Section length 3=275, 7 = 675, 11 = 1075
e) Number of spiro connection rows at the end 0…x
f) Number of spiro connection rows at the top 0…2
g) Number of single spiro connections
h) Number of rectangular duct connections
i) Drip tray 0 = no, 1 = yes

Zone coil MLZV

Product code: **MLZV - a - b - c - d - e - f - g - h**

a) Coil size b x h
b) Service side R / L
c) Frame material 1=galvanized, 2=stainless steel (AISI 316)
d) Capacity variant 1, 2
e) Pipes / Lamellas 1 = Cu/Al, 2 = Cu/Cu
f) Fluid 1=water, 2=glycol(ethylene), 3=glycol(propylene)
g) Antifreeze content 0, 20, 25, 30, 35, 40, 45, 50
h) Coil location X1…n or Y1…2

Zone coil in duct MLZVK

Product code: **MLZVK - a - b - c - d - e - f - g - h**

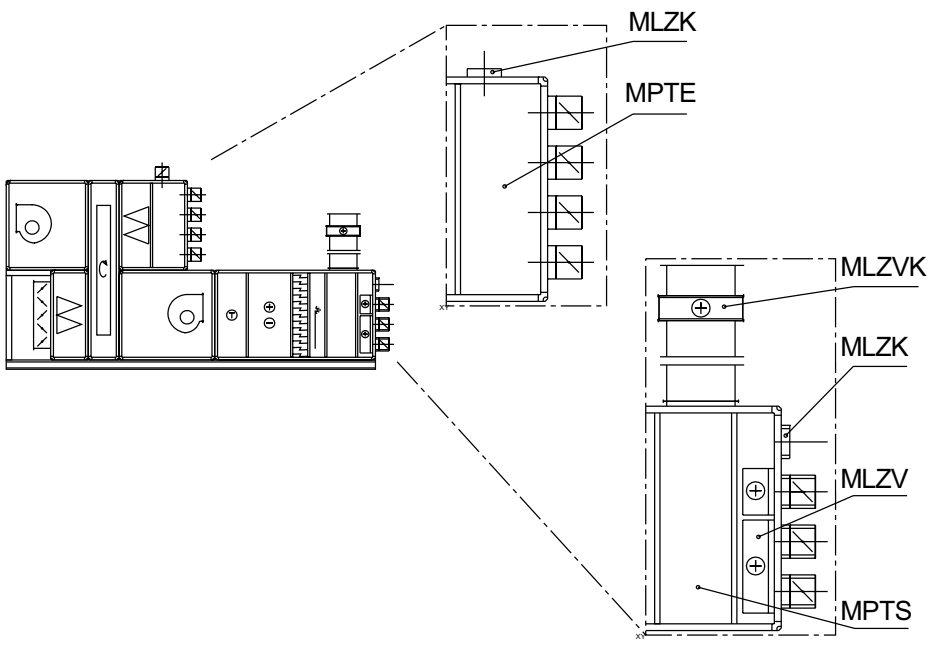
a) Coil size b x h
b) Service side R / L
c) Frame material 1=galvanized, 2=stainless steel (AISI 316)
d) Capacity variant 1, 2
e) Pipes / Lamellas 1 = Cu/Al, 2 = Cu/Cu
f) Fluid 1=water, 2=glycol(ethylene), 3=glycol(propylene)
g) Antifreeze content 0, 20, 25, 30, 35, 40, 45, 50
h) Version 1=uninsulated, 2=insulated

Duct connection MLZK

Product code: **MLZK - a - b - c - d**

a) Unit size 0603…2418
b) Duct connection size b x h, Ø200 (uninsulated), Ø160 (insulated)
c) Duct connection location E = end, U = up
d) Duct connection location coordinates X1, Y1

Accessories in Table on page 52



Exhaust plenum MPTE

Sizes 0603.....2418
Air flow rates 0,32.....15,6 m^3/s

Design instructions

The exhaust plenum MPTE is used as a gathering chamber for exhaust air before the heat recovery section.

The standard exhaust plenum allows exhaust air connections to the face and the top with ducts of different sizes. Connections to the exhaust plenum can be made using round ducts Ø200 mm or using rectangular ducts whose size and location shall be defined in each case separately.

Structure

The exhaust plenum MPTE consists of a casing with thermal insulation and duct connections. Duct connections can be equipped with smoke dampers of tightness class T2 (EN 1751) located outside the casing. Horizontally aligned smoke dampers can be interconnected for control by a single actuator.

Product code: **MPTE - a - b - c - d - e - f - g - h**

a) Unit size 0603...2418
b) Service side R / L
c) Section material 1=galvanized, 2=stainless steel (AISI 316)
d) Section length 0=0, 3=275, 5=475
e) Number of spiro connection rows at the end 0…x
f) Number of spiro connection rows at the top 0…2
g) Number of single spiro connections
h) Number of rectangular duct connections

Duct connection MLZK

Product code: **MLZK - a - b - c - d**

a) Unit size 0603…2418
b) Duct connection size b x h, Ø200 (uninsulated), Ø160 (insulated)
c) Duct connection location E = end, U = up
d) Duct connection location coordinates X1, Y1

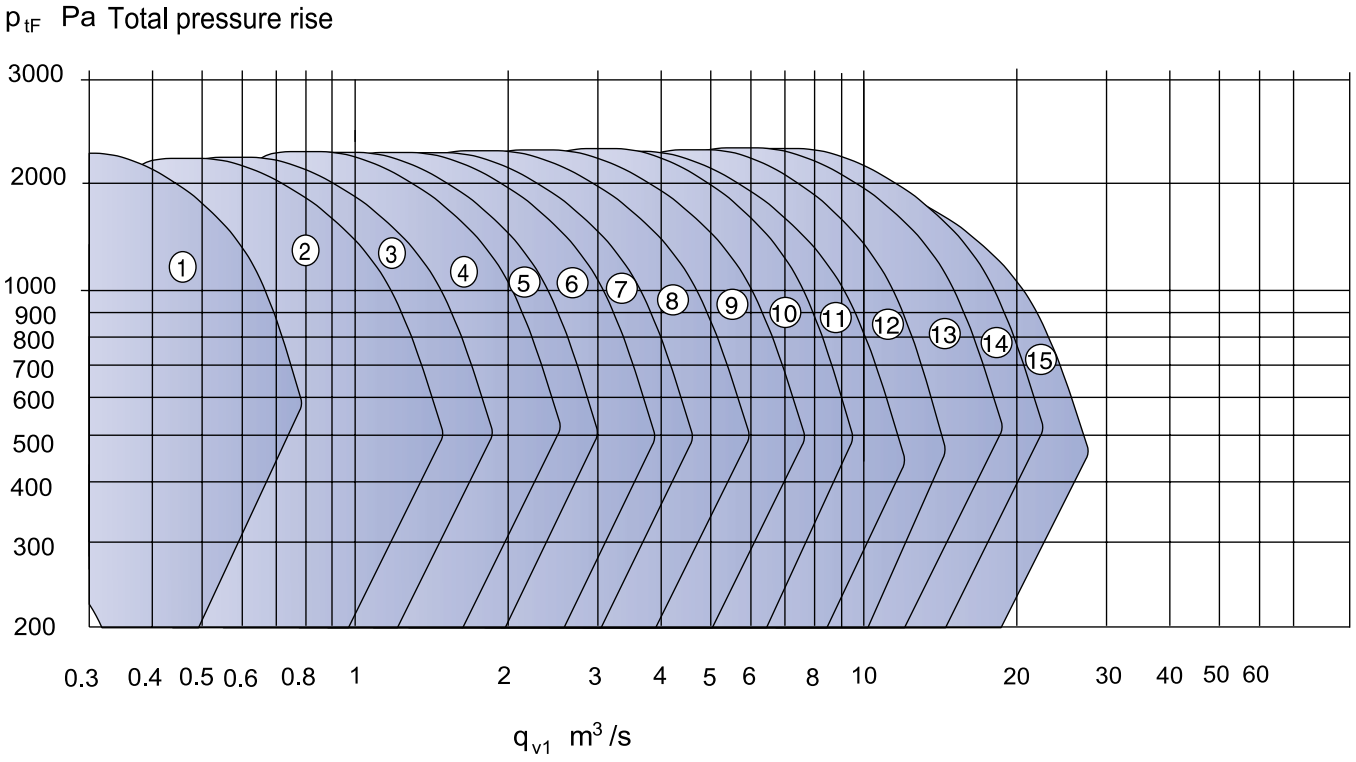
Accessories in Table on page 52

Fan selection charts

Fan selection on the basis of the flow rate capacity

Future Marine air handling units can be equipped with several types of fans, depending on the application, and the required delivery rate. The charts below show the fan-specific flow rate capacities and total pressure rises. Charts also specify the suitable fan sizes for different unit sizes, and their approximate flow rate capacities. The Future Marine design program provides more information on fans.

Mixed flow fan



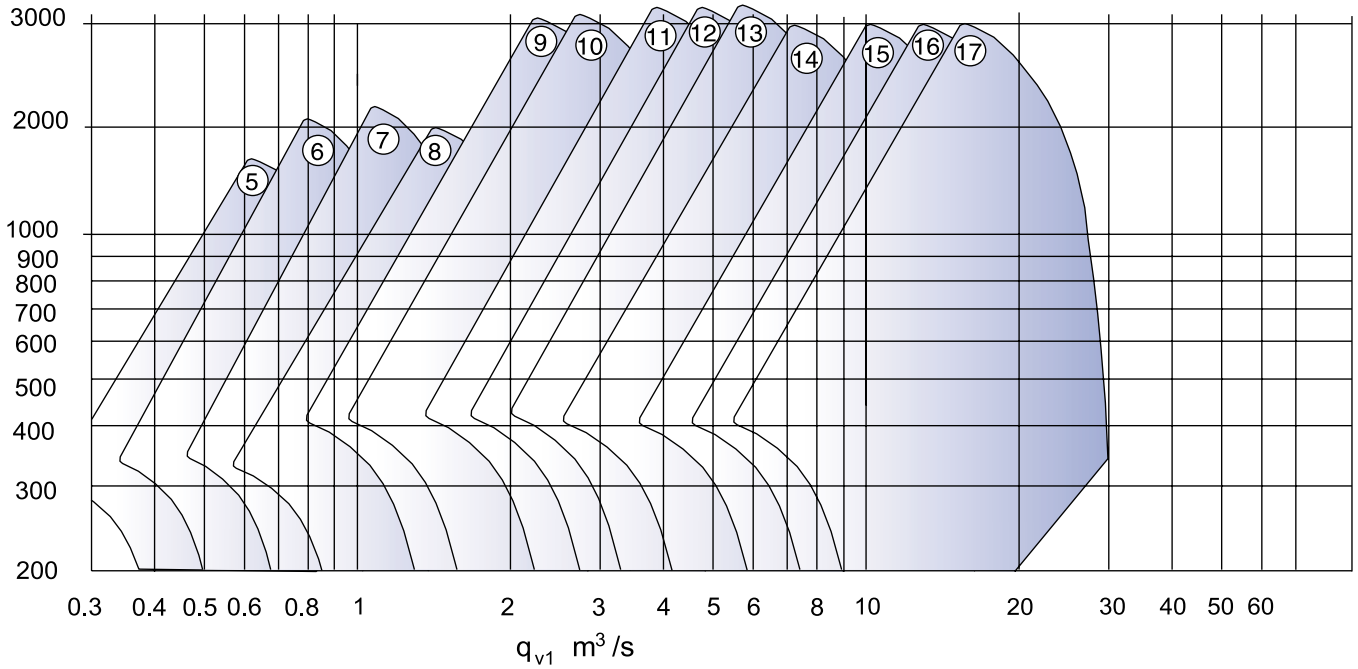
Unit size		0603	0605	0606	0906	0909	1206	1208	1209	1210	1212	1506	1509	1512	1515
Fan size	1	1	2	3	4	5	4	6	7	8	9	4	8	10	11
	2		3	4	5	6	5	7	8	9	10	5	9	11	12

Unit size		1808	1809	1810	1812	1815	1818	2109	2110	2112	2409	2412	2415	2418
Fan size	1	7	8	8	11	12	13	8	9	11	8	11	13	14
	2	8	9	9	12	13	14	9	10	12	9	12	14	15

Fan selection charts

Centrifugal fan with backward curved blades

p_{tF} Pa Total pressure rise

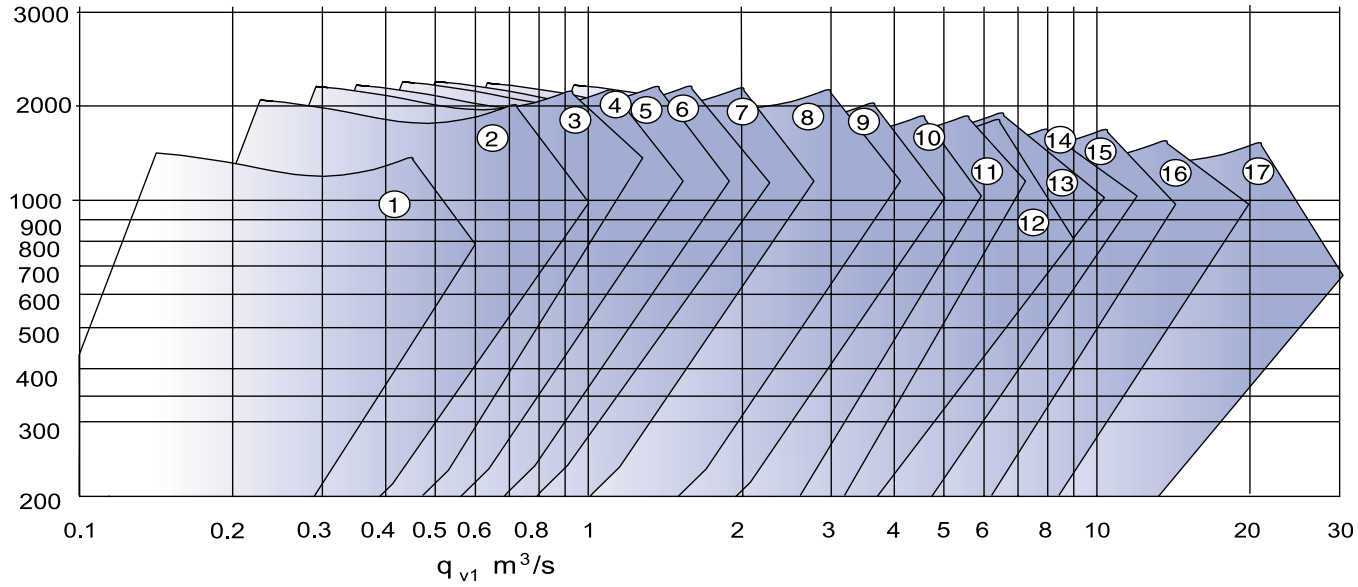


Unit size		0603	0605	0606	0906	0909	1206	1208	1209	1210	1212	1506	1509	1512	1515
Fan size	1	1		5	7	8	8	9	9	9	10	8	10	11	12
	2	2	5	6	8	9	9	10	10	10	11	9	11	12	13
	3		6	7	9	10		11	11	11	12		12	13	14

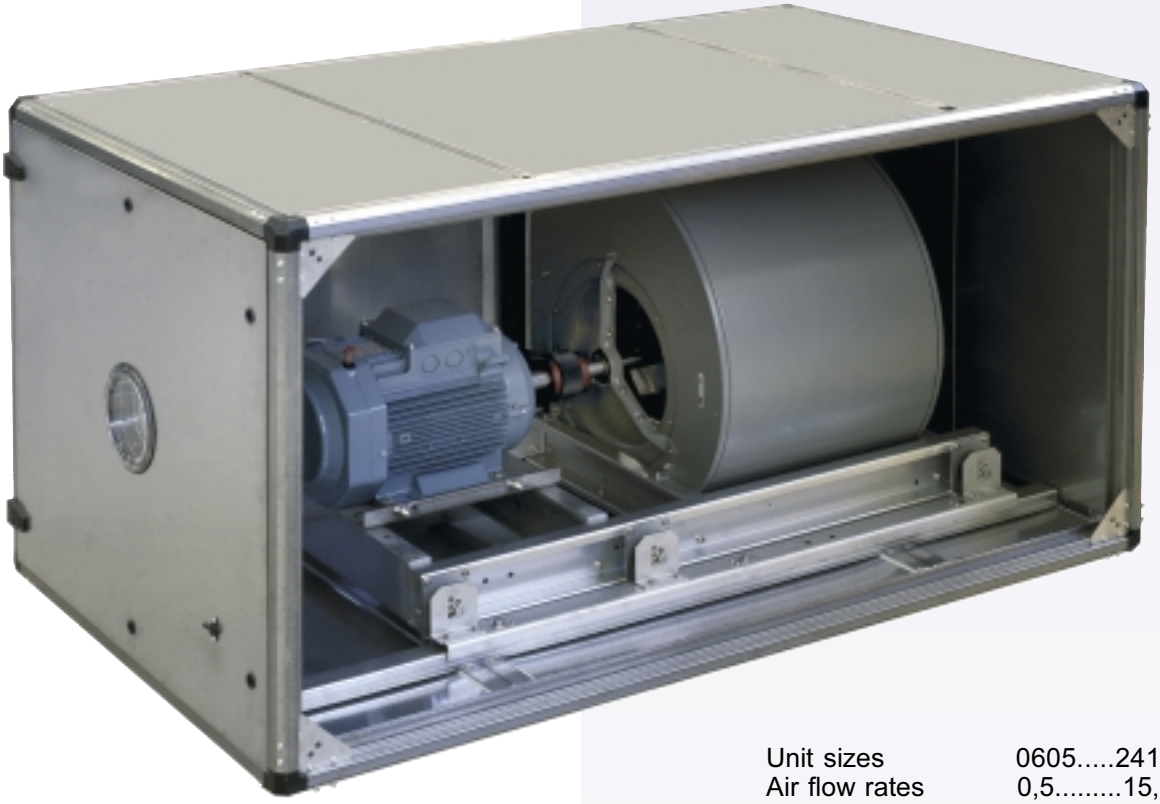
Unit size		1808	1809	1810	1812	1815	1818	2109	2110	2112	2409	2412	2415	2418
Fan size	1	10	11	12	12	13	14	11	12	13	11	13	14	15
	2	11	12	13	13	14	15	12	13	14	12	14	15	16
	3				14	15	16							17

Centrifugal fan with forward curved blades

p_{tF} Pa Total pressure rise



Fan section, centrifugal fan MFTKK, coupling drive



Unit sizes	0605.....2418
Air flow rates	0,5.....15,6 m^3/s

Design instructions

The fan section MFTKK uses a centrifugal fan. The performance characteristics of the fan are measured according to BS 848 Part 1 : 1980 and the AMCA standard 210-74, and the noise levels according to the AMCA standards 210-85 and 300-85. The fan section must always be installed in horizontal position. If any other section than MTTT is installed on the pressure side of the fan section, a flow equalizer MVZT and an inspection section MTTT is required for stabilizing the air flow. The minimum total length of these is: 325 mm (unit sizes 0605...0909), 425 mm (unit sizes 1206...1515), 525 mm (unit sizes 1808...2112), and 625 mm (unit sizes 2409...2418).

There must be a free maintenance space with at least the following width on one side of the fan section: 900 mm (unit sizes 0603…0909), 1200 mm (unit sizes 1206….1512), 1500 mm (unit sizes 1515…2418).

Structure

The fan section MFTKK has a thermally insulated casing in which a double-inlet centrifugal fan is mounted. With a common base frame, the fan and the motor rest on rubber anti-vibration mountings. The steel fan is available galvanized or with epoxy paint finish. The outlet of the fan is flexibly connected to the fan section casing. The fan is connected to the motor with a flexible coupling. The motor conforms to the IEC standard and its protection class is IP 54. Proper cooling of the motor requires that the air temperature does not exceed +40 °C. The fan section is provided with an access door. For easier servicing, the fan/motor can be pulled out.

Fan section, centrifugal fan MFTKK, coupling drive

Product code: **MFTKK - a - b - c - d - e - f - g - h - i**

a) Unit size	0605...2418
b) Service side	R / L
c) Section material	1=galvanized, 2=stainless steel (AISI 316)
d) Fan size	1, 2, 3
e) Fan type	AB, BB
f) Fan surface treatment	1= galvanized, 6=galvanized + epoxy paint 60 µm
g) Drive	7=coupling
h) Discharge direction	1=forward up, 3=upward in front, 4=upward in back
i) Anti-vibration mountings	1=rubber

Accessories in Table on page 52

Fan

Fan AB is a centrifugal fan with backward curved blades. High operating efficiency, up to 83 %. The characteristic curve is steep, which means that air flow remains fairly constant irrespective of pressure fluctuations. Maximum pressure raise 2000 Pa.
Unit sizes 0605…2418.
Fan BB is an AB type fan with reinforced structure. Maximum pressure raise 3300 Pa.
Unit sizes 1206…2418.

Choice of fan

If the operating point would be in the upper part of the AB fans' operating range, it is better to choose the BB fan so that possible deviations in pressure loss calculations can be compensated and, at the same time, be prepared for possible later need of higher flow rates or pressures.

Choice of motor size

The electric power P_A (kW) obtained from the fan design program is the fan shaft power, and the electric power P_M (kW) is the minimum recommended motor power.
When a two speed motor is used, you should make sure that the torque with the lower speed is high enough.
When a frequency converter is used, the motor and the converter must be compatible, and they must be dimensioned according to the instructions by the motor and frequency converter manufacturers.

Air flow regulating methods

1. Regulation of the speed of AB and BB fan motor using frequency converter.
2. Two-step control of two-speed motors in ratios 1 : 2 or 2 : 3 is a method that can be used with AB and BB fans.

Frequency converter drive, fans AB and BB

With frequency regulation, the fan (motor) speed is changed using a frequency converter. While the system curve remains unchanged, the flow volume changes in relation to the speed of rotation. Pressure changes to the second power of the change in rotation speed and the power demand to the third power.

If the system curve changes, flow volume and pressure loss must be specified at some operating point. After this, they can be changed to the desired setting according to the relations given above.

Fan section, centrifugal fan MFTKH, belt drive

Unit sizes	0603.....2418
Air flow rates	0,32.....15,6 m^3/s

Design instructions

The fan section MFTKH uses a centrifugal fan. The performance characteristics of the fan are measured according to BS 848 Part 1 : 1980 and the AMCA standard 210-74, and the noise levels according to the AMCA standards 210-85 and 300-85.

If any other section than MTTT is installed on the pressure side of the fan section, a flow equalizer MVZT and an inspection section MTTT is required for stabilizing the air flow. The minimum total length of these is: 325 mm (unit sizes 0603…0909), 425 mm (unit sizes 1206...1515), 525 mm (unit sizes 1808...2112), and 625 mm (unit sizes 2409...2418).

There must be a free maintenance space with at least the following width on one side of the fan section: 900 mm (unit sizes 0603…0909), 1200 mm (unit sizes 1206…1512), 1500 mm (unit sizes 1515…2418).

Structure

The fan section MFTKH has a thermally insulated casing where a double-inlet centrifugal fan is mounted. The impeller is available with either forward or backward curved blades. With a common base frame, the fan and the motor rest on anti-vibration mountings. Rubber or steel springs are used as the anti-vibration mountings. The steel fan is available galvanized or with epoxy paint finish. The outlet of the fan is flexibly connected to the fan section casing. The fan has a belt drive. The motor conforms to the IEC standard and its protection class is IP 54. For proper cooling of the motor the air temperature should not exceed +40 °C. The fan section is provided with an access door. For easier servicing, the fan/motor can be pulled out, unit sizes 0603....1206.

Product code:	**MFTKH - a - b - c - d - e - f - g - h - i**
a) Unit size	0603...2418
b) Service side	R / L
c) Section material	1=galvanized, 2=stainless steel (AISI 316)
d) Fan size	1, 2, 3
e) Fan type	AF, AB, BB
f) Fan surface treatment	1= galvanized, 6=galvanized + epoxy paint 60 µ
g) Drive	31=V-belt
h) Discharge direction	1=forward up, 3=upward in front, 4=upward in back, 7=to the right, 8=to the left
i) Anti-vibration mountings	1=rubber, 2=spring

Accessories in Table on page 52

Fan section, centrifugal fan MFTKH, belt drive

Fan

Fan AF is a centrifugal fan with forward curved blades. Maximum efficiency of fan is about 70 %. The characteristic curve is even, which means that the effect of air flow on pressure raise is small. Power demand, however, drops quickly with diminishing air flow. Maximum pressure raise 2000 Pa.
Unit sizes 0603...2418.
Fan AB is a centrifugal fan with backward curved blades. High operating efficiency, up to 83 %. The characteristic curve is steep, which means that air flow remains fairly constant irrespective of pressure fluctuations. Maximum pressure raise 2000 Pa.
Unit sizes 0605…2418.
Fan BB is an AB type fan with reinforced structure. Maximum pressure raise 3300 Pa.
Unit sizes 1206…2418.

Choice of fan

Fan AB or BB is chosen when the pressure is so high that fan AF is not suitable. If both blade types of fan are suitable for the operating range in question, the choice fan is made on the basis of the desired efficiency, noise level, and regulating needs. If the operating point would be in the upper part of the AF or AB fans' operating range, it is better to choose the BB fan so that possible deviations in pressure loss calculations can be compensated and, at the same time, be prepared for possible later need of higher flow rates or pressures.

Choice of motor size

The electric power P_A (kW) obtained from the fan design program is the fan shaft power, and the electric power P_M (kW) is the minimum recommended motor power.

When a two speed motor is used, you should make sure that the torque with the lower speed is high enough.

When a frequency converter is used, the motor and the converter must be compatible, and they must be dimensioned according to the instructions by the motor and frequency converter manufacturers.

Air flow regulating methods

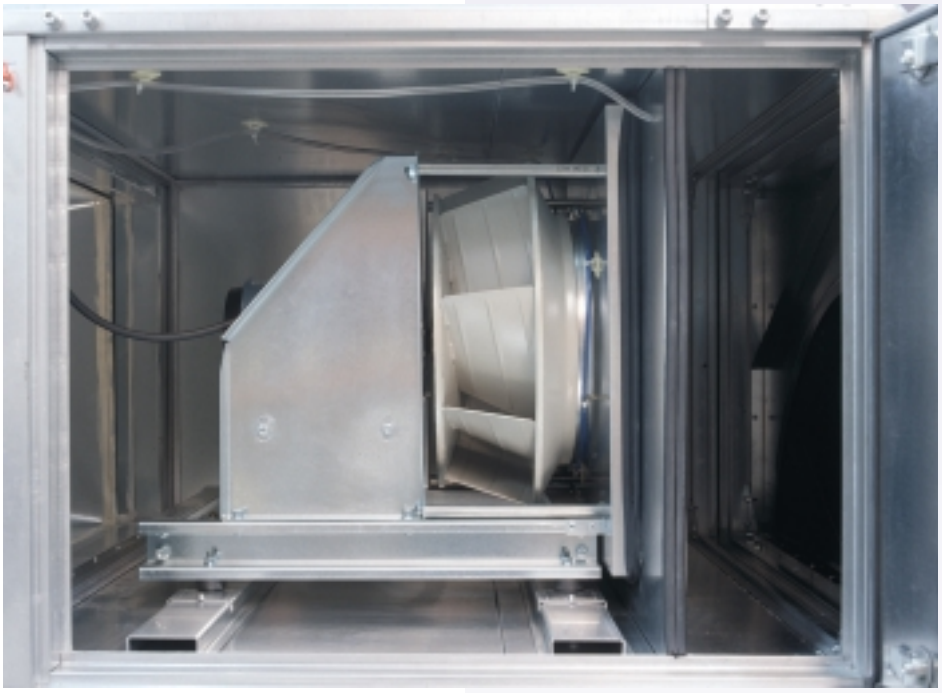
1. Regulation of the speed of AB and BB fan motor using frequency converter.
2. Two-step control of two-speed motors in ratios 1 : 2 or 2 : 3 is a method that can be used with AF, AB, and BB fans.

Frequency converter drive, fans AB and BB

With frequency regulation, the fan (motor) speed is changed using a frequency converter. While the system curve remains unchanged, the flow volume changes in relation to the speed of rotation. Pressure changes to the second power of the change in rotation speed and the power demand to the third power.

If the system curve changes, flow volume and pressure loss must be specified at some operating point. After this, they can be changed to the desired setting according to the relations given above.

Fan section, mixed flow fan MFTS



Unit sizes	0603.....2418
Air flow rates	0,32.....15,6 m^3/s

Design instructions

The fan section MFTS uses a mixed flow fan that is designed air transfer applications where an almost maintenance-free fan is desired and the required pressure raise is of medium level (below 2000 Pa). The fan reaches an efficiency of 75% (max). The performance characteristics of the fan are measured according to the standard DIN 24163 Part 2 and the noise levels according to the standard DIN 45635 Part 1. If any other section(s), such as filter, cooling, etc. is installed downstream of the fan when the blowing direction is straight ahead, the pressure opening shall equal the size of the unit's face area. With other blowing directions, a flow equalizer MVZT and an inspection section MTTT shall be used for stabilizing the air flow. The minimum total length of these is: 325 mm (unit sizes 0603...0909), 425 mm (unit sizes 1206...1515), 525 mm (unit sizes 1808...2112), and 625 mm (unit sizes 2409...2418).

There must be a free maintenance space with at least the following width on one side of the fan section: 800 mm (unit sizes 0603…1210), 1000 mm (unit sizes 1212…1812), 1200 mm (unit sizes 1815…2418).

Structure

The fan section MFTS has a thermally insulated casing where a single-inlet mixed flow fan is mounted. The impeller has backward curved blades and it is mounted directly on the motor shaft. With a common base frame, the fan and the motor rest on rubber anti-vibration mountings. The fan blows freely into the casing, in which deflectors direct the air flow towards the pressure opening. The motor conforms to the IEC standard and its protection class is IP 54. For proper cooling of the motor the air temperature should not exceed +40 °C. The fan section is provided with an access door. The material of the fan is galvanized steel or with epoxy paint finish and the impeller is painted steel.

Fan section, mixed flow fan MFTS

Product code: **MFTS - a - b - c - d - e - f - g - h - i**

a) Unit size 0603...2418
b) Service side R / L
c) Section material 1=galvanized, 2=stainless steel (AISI 316)
d) Fan size 1, 2
e) Fan SB
f) Fan surface treatment
3= galvanized + powder coating,
6= galvanized + epoxy paint
g) Drive 1=direct
h) Discharge direction 1=forwards, 3=upwards
i) Anti-vibration mountings 1=rubber

Accessories in Table on page 52

Choice of motor size

The electric power P_A (kW) obtained from the fan design program is the fan shaft power, and the electric power P_M (kW) is the minimum recommended motor power.

When a two speed motor is used, you should make sure that the torque with the lower speed is high enough.

When a frequency converter is used, the motor and the converter must be compatible, and they must be dimensioned according to the instructions by the motor and frequency converter manufacturers.

Air flow regulating methods

1. Regulation of the speed of mixed flow fan motor using frequency converter.
2. Two-step control of two-speed motors in rotation speed ratios 1 : 2 or 2 : 3.

Frequency converter drive

With frequency regulation, the fan (motor) speed is changed using a frequency converter. While the system curve remains unchanged, the flow volume changes in relation to the speed of rotation. Pressure changes to the second power of the change in rotation speed and the power demand to the third power.

If the system curve changes, flow volume and pressure loss must be specified at some operating point. After this, they can be changed to the desired setting according to the relations given above.

Accessories

FUTURE MARINE ACCESSORIES	SECTIONS																			
	Unit	Supply damper section **MPTP, version 1**	Supply damper section **MPTP, version 2**	Mixing section **MPTA**	Supply filter section **MSTF**	Exhaust filter section **MSTF**	Heat recovery section **MRTR**	Heating section, water **MLTV**	Heating section, electricity **MLTE**	Supply fan section **MFTKK, MFTKH**	Exhaust fan section **MFTKK, MFTKH**	Supply fan section **MFTS**	Exhaust fan section **MFTS**	Cooling/heating section **MJTV**	Humidifying section, steam **MKTH**	Humidifying section, spray **MKTS**	Inspection section **MTTT**	Droplet eliminator **MPTE**	Supply plenum section **MPTS**	Exhaust plenum section **MPTE**
ACCESSORIES, MECHANICAL																				
Inspection window **MIZL**			x	x	x	x	x			x	x	x	x		x	x	x			
Air flow meter **MIZM**										x	x	x	x							
Air flow measurement device **MIZV**										x	x	x	x							
Duct connection flange **MKZL**					x	x				x	x	x	x	x			x	x		x
Drive guard **MKZS**										x	x	x	x							
Lifting support **MNZT**	x																			
Lifting bar **MNZP**	x																			
Lifting ring **MNZL**	x																			
Lifting device **MNZK**	x																			
Differential pressure gauge **MPZM**					x	x	x	x	x					x				x		
Hinge for access door **MSZH**					x	x	x			x	x	x	x				x			
Protective screen for inlet **MSZI**		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x
Protective screen for outlet **MSZP**					x	x	x	x	x	x	x	x	x	x	x	x	x	x		
Air purging valve **MIZH**								x						x						
Drainage valve **MPZH**								x						x						
Water drain **MVZY**			x	x	x	x	x			x	x	x	x	s	x	x	x	x	x	x
Water trap **MVZL**			x	x	x	x	x			x	x	x	x	x	x	x	x	x	x	x
Flow equalizer **MVZT**										x	x									
Outlet damper **MPZO**											x		x							
Connection linkage **MYZV**				x																
Duct temperature meter **MLZM**			x	x						x	x	x	x	x	x	x	x		x	x
SPM vibration nipple for electrical motor **MTZA**										x	x	x	x							
Smoke damper **MSTD**																			x	x
ACCESSORIES, ELECTRICAL																				
Anti-freezing thermostat **MJZT**								x						x						
Rotation controller **MPZV**							x													
Filter alarm **MSZV**					x	x														
Sensor entry **MAZL**		x	x	x	x	x	x			x	x	x	x	x	x	x	x		x	x
Cable entry **MSZL**		x	x	x	x	x	x			x	x	x	x		x	x	x		x	x
Frequency converter **MTZM**										x	x	x	x							
Unit inside illuminating **MVZV**			x	x	x	x	x			x	x	x	x		x	x	x		x	
Condensate water level alarm **MPZH**														x				x		

x = accessories
s = standard equipment

Accessories, mechanical

Inspection window **MIZL - a - b**

a) Type IL1
b) Size 200

Window is double-glazed and is used when it is necessary to monitor the unit operation between services.

Air flow meter **MIZM - a - b - c - d**

a) Type IM1, IM2
b) Unit size 0603…2418
c) Fan type AF, AB, BB, SB
d) Fan size 1, 2, 3

Indicates the volume flow (m^3/s) of the air that passes through the unit.

Air flow measurement device **MIZV - a - b - c - d**

a) Type IV1, IV2
b) Unit size 0603…2418
c) Fan type AF, AB, BB, SB
d) Fan size 1, 2, 3

Installed on the inlet side of the fan. With pipes for connection to an air flow meter or pressure transmitter installed on the outside of the section casing.

Duct connection flange **MKZL - a - b - c**

a) Unit size 0603…2418
b) Size 1=end hatch + flange, size of the damper, 2=flange, size of the unit, 3=flange, size of the pressure opening
c) Placement 1=inlet, 2=outlet

Used for connecting a duct by means of a slide to the inlet or outlet of the unit. Made of galvanized or stainless steel according the section material.

Drive guard **MKZS - a - b - c - d**

a) Unit size 0603…2418
b) Material 1=galvanized, 6=galvanized + epoxy paint 60 µm
c) Fan section MFTKK, MFTKH, MFTS
d) Fan size 1, 2, 3

Used for preventing access inside the unit or to the moving parts.

Lifting support **MNZT - a - b**

a) Type NT1
b) Unit size 0603…2418

Used for supporting the upper frame of an air handling unit that is being lifted from the base frame with lifting bands. Placed on the top surface of the unit between the lifting bands.

Lifting bar **MNZP - a - b**

a) Type NP1
b) Size (four lifting points) 40=up to 2000 kg, 60=up to 5000 kg

Fixed to the base frame at the factory to make it possible to lift the unit with lifting bands.

Lifting ring **MNZL - a - b**

a) Type NL1
b) Size (four rings) 25=up to 300 kg, 40=up to 1000 kg

Fixed to the upper corners of a section or unit to be able to lift the section/unit by means of lifting bands or hooks.

Lifting device **MNZK - a - b - c**

a) Unit size 0603…2418
b) Material 5 = Fe/alkyd, 6 = Fe/epoxy
c) Type U = upper, D = underneath

Used especially when lifting heavy units (over 5000 kg).

Differential pressure gauge **MPZM - a - b**

a) Type PM1=fluid manometer, PM2=Magnehelic
b) Pressure area 1=0…300 Pa, 2=0…500 Pa, 3=0…1 kPa, 4=0…2 kPa

Measures the pressure difference across, for example, a filter.

Hinge for access door **MSZH - a**

a) Type SH1

Facilitates handling of large access doors. Can be used when there is enough room beside the door for opening it on hinges.

Accessories, mechanical

Protective screen for inlet **MSZI - a - b**

a) Unit size 0603…2418
b) Material 1=galvanized, 2=stainless steel (AISI 316)

Prevent foreign objects from entering the unit through inlets, and serve as protection against contact.

Protective screen for outlet **MSZP - a - b**

a) Unit size 0603…2418
b) Material 1=galvanized, 2=stainless steel (AISI 316)

Prevent foreign objects from entering the unit through outlets, and serve as protection against contact.

Air purging valve **MIZH - a**

a) Type IH1

The valve is used for air purging of heat exchangers.

Drainage valve **MPZH - a**

a) Type PH1

The valve is used for drainage of heat exchangers.

Water drain **MVZY - a - b**

a) Type VY1
b) Size NS20, NS40

Used in sections where water is separated from the air. Connected to a drip tray (NS20) or a condensate water basin (NS20 or NS40).

Water trap **MVZL - a - b - c**

a) Type VL1, VL2, VL3
b) Size NS20/NS32, NS40/NS32
c) Material 2=stainless steel (AISI 316), 9=Plastic (PVC)

Connected to a water drain to prevent air leakage.

Flow equalizer **MVZT - a - b - c - d**

a) Unit size 0603…2418
b) Material 1=galvanized, =Fe/alkyd, 6=Fe/epoxy
c) Fan section MFTKK, MFTKH
d) Fan size 1, 2, 3

Used at the outlet of a fan for flow equalization when there is another section connected on the outlet side of the fan section. Requires an inspection section MTTT with a length of at least
325 mm (unit sizes 0603….0909)
425 mm (unit sizes 1206…1515)
525 mm (unit sizes 1808….2112)
625 mm (unit sizes 2409….2418)

Outlet damper **MPZO - a - b - c - d**

a) Unit size 0603...2418
b) Damper material 1=galvanized, 2=stainless steel (AISI 316)
c) Frame 1=uninsulated, 2=insulated
d) Damper length 120, 220

Outlet damper is available in two structures: in the damper with the length of 120 mm the blades are connected with cogwheels, in the damper with the length of 220 mm the blades are connected with a lever mechanism.

Connection linkage **MYZV - a - b - c**

a) Unit size 0603...2418
b) Section MPTA
c) Version 1, 2

Used for connection the dampers of a mixing section to each other, enabling simultaneous operation.

Duct temperature meter **MLZM - a - b - c - d**

a) Type LM1
b) Temperature area -40…+60 °C
c) Material 1=galvanized, 2=stainless steel
d) Length 150, 200, 300

Material of the duct temperature meter is galvanized or stainless steel. Temperature area is -40…+60 °C.

SPM vibration nipple for electrical motor **MTZA - a - b - c**

a) Motor IEC size: 132, 160,180, 200, 225, 250
b) SPM size M8-24, M8-113
c) Material 1=galvanized, 2=stainless steel (AISI 316)

Used for controlling of vibration of electrical motor.

Smoke damper **MSTD - a - b - c**

a) Type SD 1, SD 2
b) Size b x h, ∅200 (uninsulated), ∅160 (insulated)
c) Material 1=galvanized

Smoke damper is used for preventing the smoke from spreading.

Accessories, electrical

Anti-freezing thermostat — MJZT - a - b

a) Type — JT1
b) Size — 1=R1/4 sensor 4 mm

Used in fluid heat exchangers. Gives the control system a signal when the fluid temperature falls below the setting (e.g. 8°C if water is used). The sensor of the thermostat is made of stainless steel, and has a diameter of 4 mm.

Rotation controller — MPZV - a

a) Type — PV1

Used for monitoring and controlling the rotation of a rotating heat exchanger. Can be installed at the factory or after delivery.

Filter alarm — MSZV - a

a) Type — SV1

Used for remote control. Gives an alarm if the pressure drop across the filter exceeds the setting. Delivered with the necessary installing and connecting devices.

Sensor entry — MAZL - a - b

a) Type — AL1
b) Size — 4=4 mm sensor, 6=6 mm sensor, 8=8 mm sensor

Sensor entries made in the unit casing are suitable for temperature and pressure sensors with a diameter of 4, 6 and 8 mm.

Cable entry — MSZL - a - b

a) Type — SL1
b) Size — 5 – 7, 7 – 10, 10 – 14, 14 – 20, 20 – 26, 26 – 35

The size of cable entries made in the unit casing is determined by the motor power.

Frequency converter — MTZM - a - b

a) Type — TM1
b) Size — 0,55…55 kW

To be selected according to the motor power. Delivered ready installed in the unit.

Unit inside illuminating — MVZV - a

a) Type — VV1= 9 W, IP 67, G23
VV2 = 60 W, IP 44, E27

Mounted by the inspection window inside the casing of a functional section. Bulb included. Can be delivered ready wired and with a switch.

Condensate water level alarm — MPZH - a

a) Type — PKH1

Gives an alarm if the water surface exceeds the setting.

Future Marine fancoil unit

General

Fancoils are designed for cooling/heating and cleaning of air. There are two size ranges of fancoils: small fancoils with cooling powers 13…26 kW and large fancoils with cooling powers 46…162 kW and (air 30/16 °C humidity 55% Rh, water 6/13 °C).

The Future Marine fancoil is an integral cooling/heating unit installed inside a thermally insulated integral casing, on a base made of galvanized steel profile.

Horizontal fancoils must be mounted horizontally and vertical types according to the structure, blowing either downwards or upwards.

Future Marine Fancoil, sizes 0606, 0906, 0909, 1206, 1209, and 1212

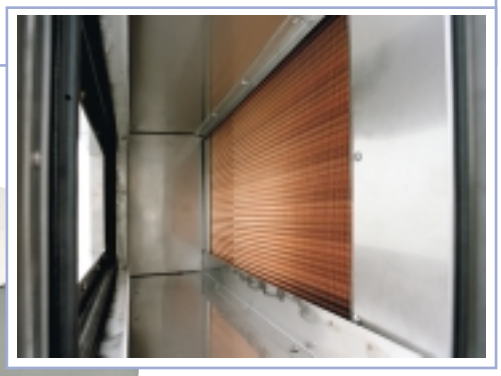
The corner and intermediate profiles of the casing as well as the panels are made of galvanized or stainless steel (AISI 316), with 50 mm thermal insulation of mineral wool (80 kg/m^3). The connecting pieces of the frame profiles are of powder painted aluminium.

The Future Marine fancoil contains the following sections: filter section, cooling section, droplet eliminator and fan section.

Product code:	**MFFC - a - b - c - d - e- f - g - h - i**
a) Unit size	0606, 0906, 0909, 1206, 1209, 1212
b) Service side	R / L
c) Material	1=galvanized, 2=stainless steel (AISI 316)
d) Version	H=horizontal, VU=vertical up, VD=vertical down
e) Fluid	1=water, 2=glycol (ethylene), 3=glycol (propylene)
f) Filtering class	G3, G3(2), G4(2), F5(2)
g) Filtering material	1 = fibreglass [(F5(2)], 2 = synthetic [(G3, G3(2), G4(2), F5(2)]
h) Droplet eliminator cell material	0=without droplet eliminator, 4=aluminium, 8=glass fibre, 9=plastic (PP)
i) Closing damper	0 = no, 1 = yes

Future Marine fancoil unit

Future Marine Fancoil, sizes 030, 045, and 060



The casing is made of galvanized or stainless steel (AISI 316) with 30 mm thermal insulation of mineral wool (80 kg/m^3).

The Future Marine fancoil contains the following sections: filter section, cooling section, droplet eliminator and fan section.

Product code: **MHFC - a - b - c - d - e - f - g - h - i**

a) Unit size	030, 045, 060
b) Service side	R / L
c) Material	1=galvanized, 2=stainless steel (AISI 316)
d) Version	H=horizontal, VU=vertical up, VD=vertical down
e) Fluid	1=water, 2=glycol (ethylene), 3=glycol (propylene)
f) Filtering class	G3
g) Filtering material	2 = synthetic
h) Droplet eliminator cell material	0=without droplet eliminator, 4=aluminium, 8=glass fibre, 9=plastic (PP)
i) Closing damper	0 = no, 1 = yes

Future Marine fancoil unit

Functional sections

The damper section is used on fancoils as the air intake section and for adjusting the desired air flow. A blade damper with tightness class T4 (EN 1751) is used in the damper section. The blade damper shall open before the fan starts and close after the fan has stopped. There must be at least 700 mm of free maintenance space on one side of the section. The blade damper is controlled manually or with an electric actuator. The operating temperature range is -40...+80 °C and the highest allowed differential pressure over the blade damper is 1200 Pa.

The damper section consists of a blade damper and a connecting plate for the unit's casing. The blade damper has thermally insulated blades that turn against one another. The material of the blades and the frame is galvanized or stainless steel (AISI 316). Mineral wool is used as the thermal insulation on the blades, the sealing material is silicone rubber, and the bearings are of plastic.

The blade damper is equipped with a position indicator. The actuating shaft is 100 mm long 15 * 15 mm tube.

Recommended actuator size

Sizes 030, 045, and 060	5 Nm
Sizes 0606, 0906, 0909, 1206	10 Nm
Sizes 1209 and 1212	15 Nm

The filter section offers four filter alternatives according to the filtering requirements: coarse filters G3 and G4, and fine filters F5. The filtering material is either synthetic or fibreglass.

The filtering classes are defined according to CEN 779.

The filter section can be equipped with a differential pressure gauge and/or a filter indicator for monitoring pressure loss. There must be at least 700 mm of free maintenance space on one side of the section.

Filter applications;

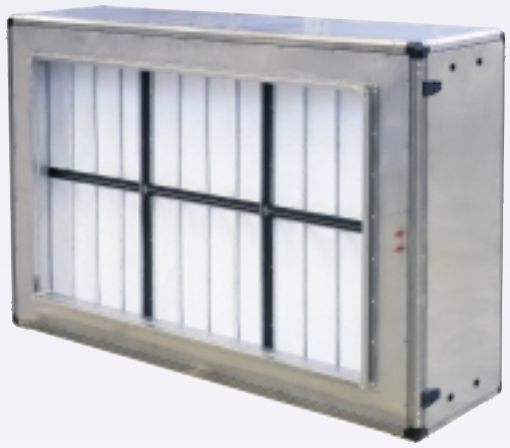
G3 and G4 filter large pollen and, to some extent, smoke and staining particles.

F5 filters most of the particles causing soiling and staining.

The filter section uses disposable cassette module filters. The filters are installed in mounting frames where the filter frame is pressed against an EPDM sealing on all sides. The filter section has connections for differential pressure measurement or a filter indicator. The highest allowed operating temperature is +70 °C.

The filter modules in use are:	592*592	592*287	287*592
Sizes 030, 045 and 060		1	
0606	1		
0906	1		1
0909	1	1	1
1206	2		
1209	2	2	
1212	4		

Mounting frame thickness is 25 +/-1 mm



The cooling/heating sections use lamella coils as heat exchangers and cold/hot water or anti-freeze (e.g. glycol) as the heat transfer medium. Sufficient space (200...350 mm) must be reserved below the horizontal cooling/heating section for the water trap that is installed to the pipe coming from the condensate water basin of the heat exchanger. The structure of the heat exchanger is such that it does not become completely drained. When water is used as the heat transfer medium, you must make sure that it is not allowed to freeze.

For the replacement of the heat exchanger in the cooling/heating section, there must free maintenance space left on one side with its width corresponding to that of the section, or a corresponding space must be otherwise possible to arrange so that the heat exchanger can be replaced.

The heat exchanger pipes are made of copper and the lamellas of aluminium or copper, and the frame is made of aluminium or stainless steel (AISI 316). The heat exchanger can be pulled out of the casing without disassembling the exchanger. The horizontally mounted fancoil heat exchanger has a downstream droplet eliminator, and they have a common condensate water basin, which is provided with a water drain pipe and inclined 1:20. The condensate water basin can be checked and cleaned from the outlet side. The material of the droplet eliminator is PP (polypropylene), glass fibre or aluminium and the frame is of stainless steel (AISI 316). The heat exchanger has inlet and outlet connections for water, air purging screw and drainage plug. The inlet and outlet connections have female DN 10…DN 50 pipe threads when water is used, or with larger sizes flange connections (ISO 357). When antifreeze is used, all sizes have flange connections. The connections are on the unit's service side and they are available directed to the side or upwards. The maximum operating pressure is 1,0 MPa and maximum operating temperature +150 °C.

Future Marine fancoil unit

The fan section uses a mixed flow fan. The maximum operating efficiency of the fan is 75%. The performance characteristics of the fan are measured according to the standard DIN 24163 Part 2 and the noise levels according to the standard DIN 45635 Part 1.

There must be a free maintenance space with at least the following width on one side of the fan section: 600 mm (sizes 030, 045, and 060), 800 mm (sizes 0606, 0906, 0909), and 1000 mm (sizes 1206, 1209 and 1212).

The fancoils have a mixed flow single-inlet fan with an impeller with backward curved blades. With a common base frame, the fan and the motor rest on rubber anti-vibration mountings. The impeller is mounted directly on the motor shaft. The material of the fan is galvanized steel with powder coating.

The motor conforms to the IEC standard and its protection class is IP 54. For proper cooling of the motor the air temperature should not exceed +40 °C. The fan section is provided with an access door.

Choice of motor

The electric power P_A (kW) obtained from the design program is the fan shaft power, and the electric power P_M (kW) is the minimum recommended motor power.

When a frequency converter is used, the motor and the converter must be compatible, and they must be dimensioned according to the instructions by the motor and frequency converter manufacturers.

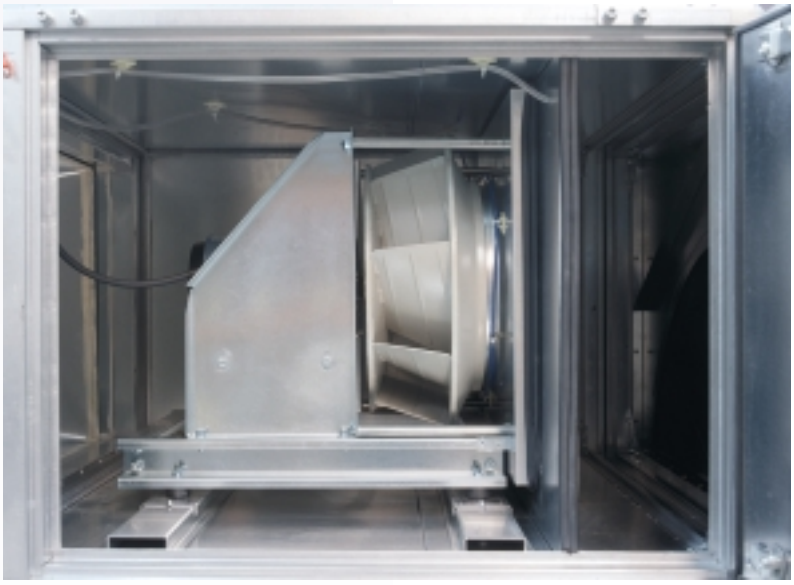
Air flow regulating methods

1. Regulation of motor speed using frequency converter.
2. Two-step control of two-speed motors in rotation speed ratios 1 : 2 or 2 : 3.

Frequency converter drive

With frequency regulation, the fan (motor) speed is changed using a frequency converter. While the system curve remains unchanged, the flow volume changes in relation to the speed of rotation. Pressure changes to the second power of the change in rotation speed and the power demand to the third power.

If the system curve changes, flow volume and pressure loss must be specified at some operating point. After this, they can be changed to the desired setting according to the relations given above.



FUTURE MARINE
Quick selection chart ***FANCOIL***

Unit size	Width (mm)	Height (mm)	*COOLING POWER (kW)* *Refrigerated room 24 -> 14 °C* *(Δt = 10°C)*		*Refrigerated room 30 -> 16 °C* *(Δt = 14°C)*	
			Water 6/13°C	Water 13/18°C	Water 6/13°C	Water 13/18°C
030	655	355	6,0	3,0	13,0	8,0
045	740	380	10,0	4,5	20,0	12,0
060	840	420	12,5	5,6	26,0	15,3
0606	790	790	23,4	11,5	46,0	27,0
0906	1070	790	35,0	17,5	66,0	40,0
0909	1070	1070	51,0	25,0	95,0	57,0
1206	1350	790	45,0	23,0	86,0	52,0
1209	1350	1070	65,0	32,0	124,0	74,0
1212	1350	1350	85,0	43,0	162,0	97,0

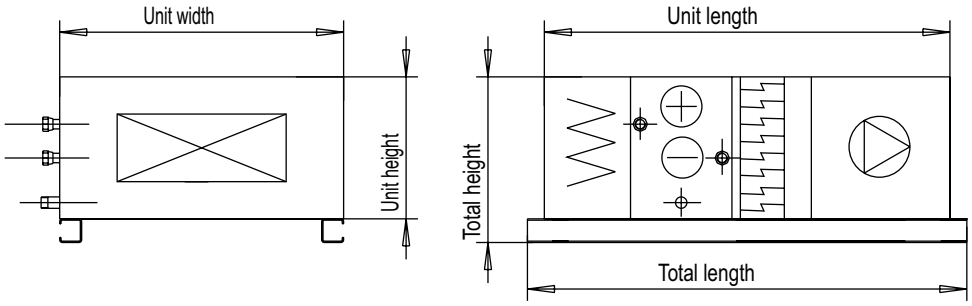
How to use the selection chart:

1. Choose the air temperature range of fancoil (difference between fancoil inlet and outlet temperature). In chart there are two possibilities shown: Room can be cooled from 24 to 14 °C (then Δt=10 °C), or 30 to 16 °C (Δt=14 °C).
2. Choose the water system the fancoil is connected to. In chart there are two possibilities shown: 6 °C /13 °C (in/out), or 13 °C / 18 °C (in/out).
3. Estimate the needed cooling power in the room. (equipment, persons, light, solar radiation, heat-transfer)
4. Choose a unit sufficiently large for your needs.

Note! The quick selection can only be used for the shown air and water temperatures. Other temperature values or cooling media to be calculated with Future Marine dimensioning program.

FUTURE MARINE — FANCOIL 030, 045, 060, horizontal H

Quick selection



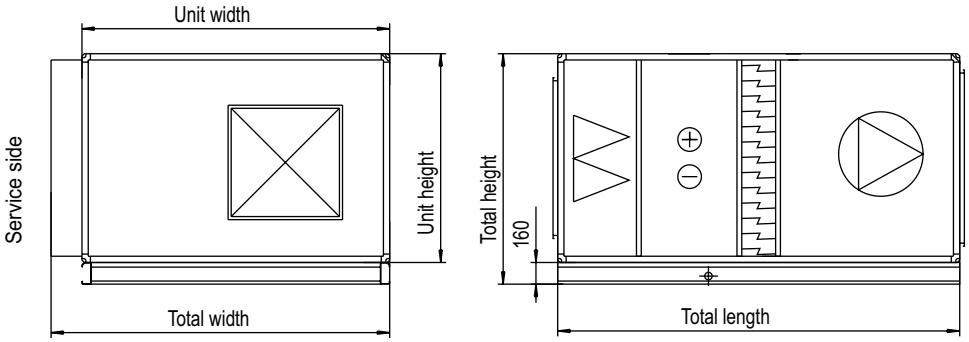
There must be at least one unit width free space available in service side for fancoil service and maintenance.

Unit size	Unit width (mm)	Unit height (mm)	Unit length (mm)	Total length (mm)	Total height (mm)	Weight (kg)
030	655	355	1200	1300	415	95
045	740	380	1200	1300	440	110
060	840	420	1200	1300	480	135

Dimensions with filter class G3.

FUTURE MARINE — FANCOIL 0606…1212, horizontal H

Quick selection



There must be at least one unit width free space available in service side for fancoil service and maintenance.

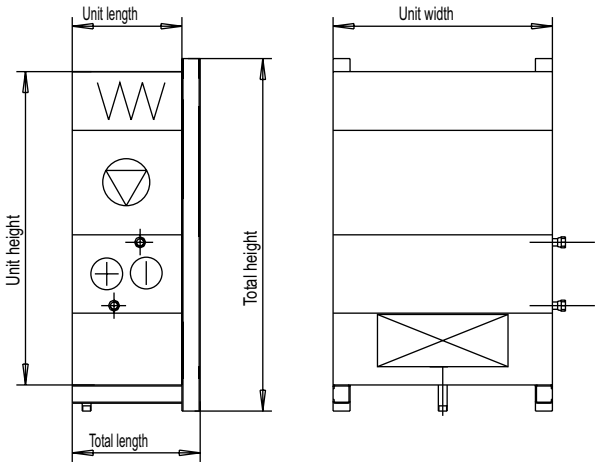
Unit size	Unit widht (mm)	Unit height (mm)	Total length (mm)	Total height (mm)	Total width (mm)	Weight (kg)
0606	790	790	2150	950	990	410
0906	1070	790	2250	950	1270	525
0909	1070	1070	2350	1230	1270	630
1206	1350	790	2250	950	1550	600
1209	1350	1070	2450	1230	1550	780
1212	1350	1350	2550	1510	1550	1040

Dimensions with filter class G4 or F5. When using filter class G3, filter section is 200 mm shorter.

FUTURE MARINE DIMENSIONS

FANCOIL 030, 045, 060, vertical down VD

Quick selection



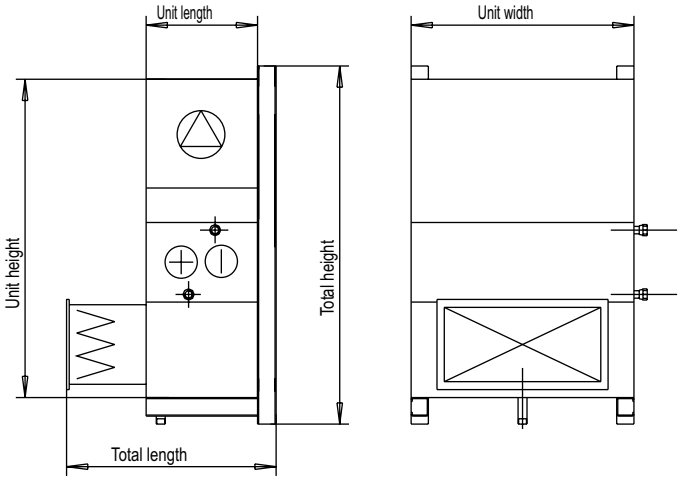
There must be at least one unit width free space available in service side for fancoil service and maintenance.

Unit size	*Unit width (mm)*	*Unit height (mm)*	*Unit length (mm)*	*Total height (mm)*	*Total length (mm)*	*Weight (kg)*
030	655	1200	355	1350	415	95
045	740	1200	380	1350	440	110
060	840	1200	420	1350	480	130

FUTURE MARINE DIMENSIONS

FANCOIL 030, 045, 060, vertical up VU

Quick selection



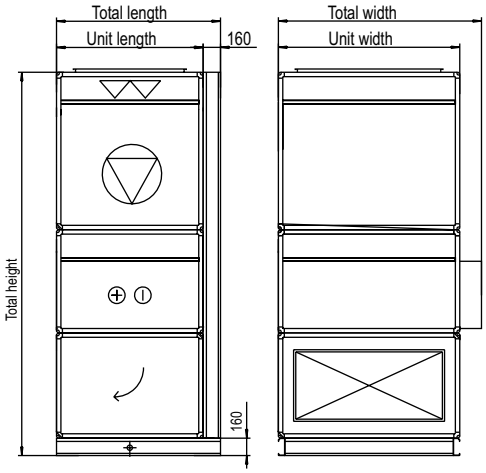
There must be at least one unit width free space available in service side for fancoil service and maintenance.

Unit size	*Unit width (mm)*	*Unit height (mm)*	*Unit length (mm)*	*Total height (mm)*	*Total length (mm)*	*Weight (kg)*
030	655	1200	355	1350	715	100
045	740	1200	380	1350	740	115
060	840	1200	420	1350	780	140

Dimensions with filter class G3.

FUTURE MARINE DIMENSIONS *FANCOIL 0606…1212, vertical down VD*

Quick selection

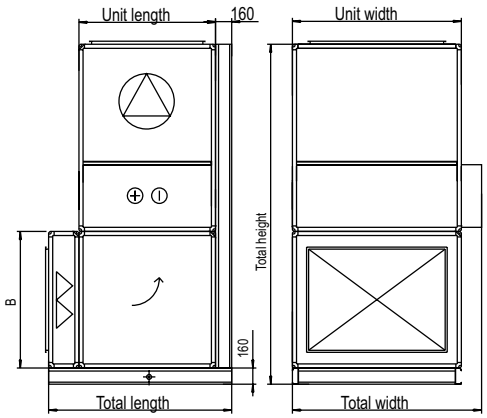


There must be at least one unit width free space available in service side for fancoil service and maintenance.

Unit size	*Unit length (mm)*	*Total length (mm)*	*Total width (mm)*	*Unit width (mm)*	*Total height (mm)*	*Weight (kg)*	
0606	790	950	990	790	2510	460	
0906	790	950	1270	1070	2660	575	
0909	1070	1230	1270	1070	2860	705	
1206	790	950	1550	1350	2760	675	
1209	1070	1230	1550	1350	3060	850	
1212	1350	1510	1550	1350	3310	1165	

FUTURE MARINE DIMENSIONS *FANCOIL 0606…1212, vertical up VU*

Quick selection



There must be at least one unit width free space available in service side for fancoil service and maintenance.

Unit size	*Unit length (mm)*	*Total length (mm)*	*Unit width (mm)*	*Total width (mm)*	*Total height (mm)*	*B (mm)*	*Weight (kg)*
0606	790	1250	790	990	2400	790	470
0906	790	1250	1070	1270	2500	790	585
0909	1070	1530	1070	1270	2600	790	685
1206	790	1250	1350	1550	2500	790	665
1209	1070	1530	1350	1550	2900	990	845
1212	1350	1810	1350	1550	3080	1070	1135

Dimensions with filter class G3. When using filter class G4 or F5, filter section is 200 mm longer.

Accessories

FUTURE MARINE FANCOIL ACCESSORIES	SECTIONS			
	Fancoil	Supply filter section **MSTF**	Supply fan section **MFTS**	Cooling/heating section **MJTV**
ACCESSORIES, MECHANICAL				
Inspection window **MIZL**		x	x	
Air flow meter **MIZM**			x	
Air flow measurement device **MIZV**			x	
Drive guard **MKZS**			x	
Lifting bar **MNZP**	x			
Lifting ring **MNZL**	x			
Differential pressure gauge **MPZM**		x		x
Hinge for access door **MSZH** size 0606…1212		x	x	
Protective screen for inlet **MSZI**		x		
Protective screen for outlet **MSZP**			x	
Water drain **MVZY** size 0606…1212 version H		x	x	s
Water trap **MVZL** size 0606…1212 version H		x	x	x
Water drain **MVZY** size 0606…1212 version VD, VU				s
Water trap **MVZL** size 0606…1212 version VD, VU				x
Water drain **MVZY** size 030…060				s
Water trap **MVZL** size 030…060				x
Air purging valve **MIZH**				x
Drainage valve **MPZH**				x
Flow equalizer **MVZT**			x	
Outlet damper **MPZO**			x	
SPM vibration nipple for electrical motor **MTZA**			x	
Duct temperature meter **MLZM**		x	x	x
ACCESSORIES, ELECTRICAL				
Anti-freezing thermostat **MJZT**				x
Filter alarm **MSZV**		x		
Sensor entry **MAZL**		x	x	x
Cable entry **MSZL**		x	x	
Frequency converter **MTZM**			x	
Unit inside illuminating **MVZV**			x	
Condensate water level alarm **MPZH** size 0606…1212 version H				x

x = accessories
s = standard equipment

After sales

Koja Marine provides after sales service that consists of servicing, spare parts and advisory help concerning the equipment and systems delivered by us.

Koja Marine has a co-operation agreement with MacGREGOR's Passenger Ship Division. MacGREGOR's worldwide service network undertakes the servicing of Koja Marine products.

Spare part inquiries and all questions concerning our products can be addressed to Koja Marine After Sales.

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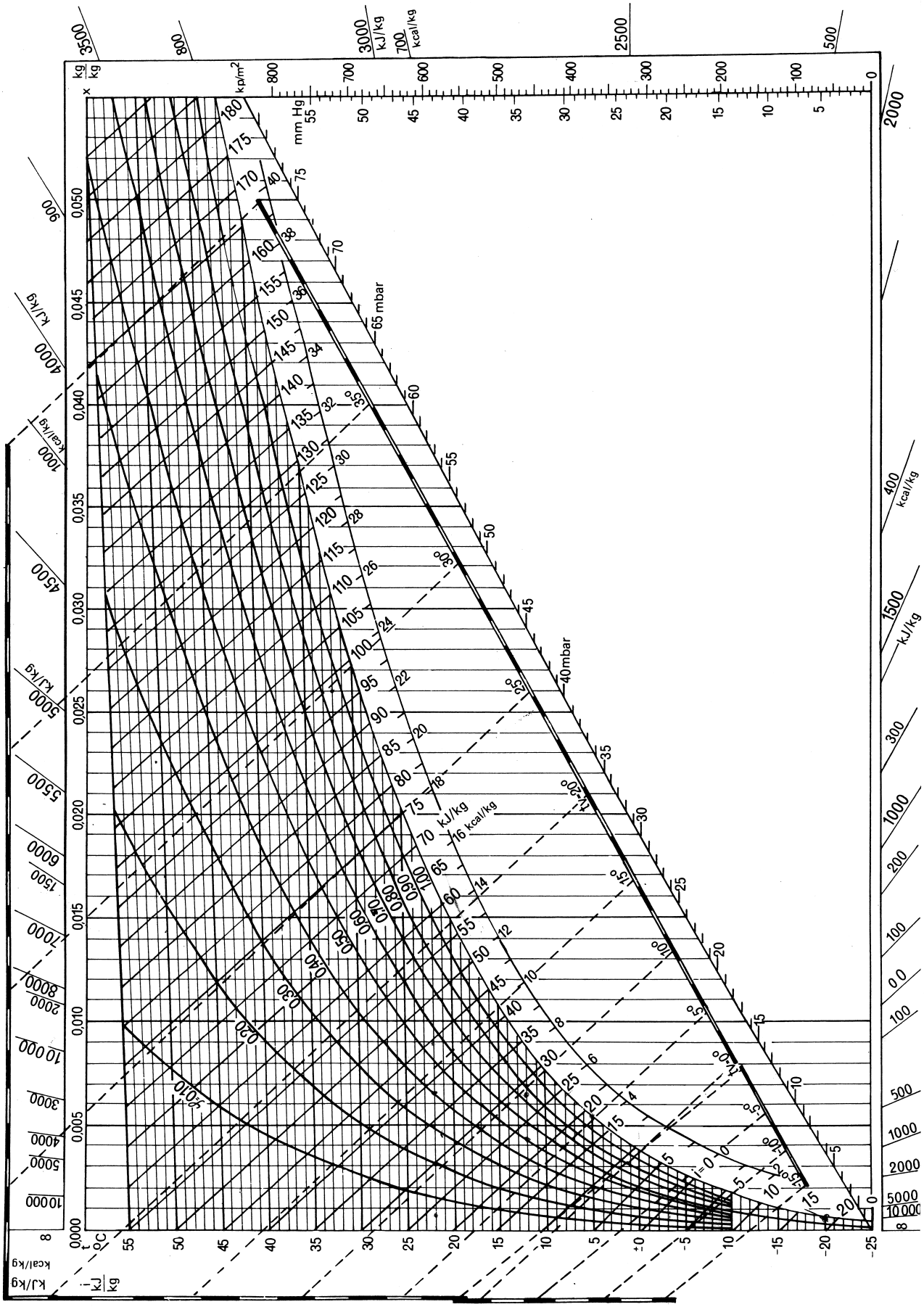
Mollier diagram



Koja Group

KOJA GROUP AT YOUR SERVICE

Koja Group is a diversified and progressive company offering its customers high-quality products and services in the air handling and building technology contracting with experience since the year 1935.

KOJA LTD

Koja Ltd masters air handling equipment used in construction and industrial processes. Koja´s industrial fans are a reliable part of production processes in numerous industrial establishments around the world. Operational environments include power plant boilers, pulp & paper engineering processes and transportation. Reliability, durable structures and economical efficiency are characteristic of Koja fans.

Koja's air handling units are used in public and industrial buildings and offices. Koja´s equipment meet the high quality requirements concerning tightness, hygiene and energy efficiency. A wide range of products and versatile construction options ensure the right solutions for every environment. Koja´s range of products covers central air handling units, air heaters, roof and flue gas extractors, air curtain units as well as a comprehensive selection of Ecofan® centrifugal and axial fans.

Koja Marine air conditioning equipment deliveries consist of air conditioning units, fancoils for special spaces, air devices, safety dampers, axial fans and cabin units, even completed with electrical and automation systems.

KOJA ENGINEERING LTD

Koja Engineering Ltd´s modern services in building technology contract work cover heating, plumbing and air conditioning, electricity, telecommunications, automation and cooling. The company has decades of experience in the implementation of large and demanding projects both in industrial environments and public, office and business buildings. Koja Engineering Ltd is a reliable and professional partner both in Finland and abroad. The Marine Department, Koja Marine, specializes in the design and implementation of maritime air conditioning systems, including electric and automatic equipment.

ISO 9001 DNV QUALITY ASSURED FIRM

KOJACOOL OY

Kojacool Oy has special know-how in cooling and refrigeration technology. Product range includes units for air conditioning and process cooling systems: water chillers, split systems, fancoils. The company provides all the related services: design, marketing, contracting, service and maintenance.

The Tampere production plant has been in operation since 1969.

The new Jalasjärvi production plant was completed in the autumn of 1998.

KOJA

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