# Computerised Banana Ripening – doc D103Y1 Rev 08

## 1. Content



## 2. Introduction

### 2.1. Room application

- ripening and storage of banana boxes on pallets for a wide range of formats
- ripening with closed or perforated bags and for every kind of box
- standard range from 10 to 24 pallets on one level per room
- bigger rooms and two layer storage on request
- partial ripening load from 4 pallets till the maximum capacity



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- ripening time from three to six days and ripening stage from two to six

## 2.2. Main advantages

- perfect and uniform ripening in every box and every pallet
- minimum weight loss
- no manual box handling
- energy efficient operation
- consumption reduced for partial load
- PC ripening operation allowed from home or remote connections
- alarm forwarding by e-mail and SMS
- immediate refrigerant migration just by software programming
- heavy-duty equipment and 3 year ex work guarantee
- ISO 9001 quality system certification
- banana ripening leadership since 1965

## 2.3. Differences with similar ripening system

Common banana ripening rooms are built using technology bought from several vendors, then sold by a third company acting as a contractor or as an engineering. For instance, electronic controller can be from a vendor, curtain and/or shelving from another vendor, while engineering and installation can be performed by a local (national) company acting as integrator of different technologies.

The main limit of this approach is that local company usually has just a limited knowledge about component details while vendors have often no information at all about how the local installer is using their technology.

MICHELETTI IMPIANTI instead of integrating third party technology has developed every component from scratch thanks to banana ripening experience lasting since 1965.

The electronic controller named MI 1000 and the underlying software has been developed just to serve banana ripening rooms as built by MICHELETTI IMPIANTI . For this reason the final result is a perfectly integrated ripening room, with commands put on single slave panel to control not just ripening functions but also door, light and curtain. As an example of software integration and features usually not found in common ripening rooms, it is possible to control the following options

- multiple ethylene injections and air renew synchronised to get a more stable ethylene concentration and to perform ripening and degreening of every fruit
- humidity level during ripening
- humidity level during storage
- ReFreeX operation can be performed (see more about ReFreex later)
- the number of depressure fans activated during ripening
- the number of depressure fans activated during storage
- door opening can be enabled or disabled from the slave panel
- door flashing light can be enabled in case of room alarm
- door opening response can be delayed
- door can be automatically close after a preset delay
- cooling, depressure and every other ripening function can be disabled with open door
- door can be locked after ethylene injection and before first air renew
- light can be activated during door movement
- light can be activated when door is open and deactivated with a delay after door closure
- curtain operation can be enabled or disabled from the slave panel



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- curtain operation can be disabled when door is not completely open

Every control is performed by master electric boards located inside the room electric board.
The controllers can be programmed by the local slave panel located near the room door, by a local PC usually located in the ripener office and by a remote PC connected to the local PC via Windows XP Professional “Remote Desktop” feature.
In case of fault of PC or fault of local slave panels, the masters continue to operate correctly without any ripening interruption. Moreover master controllers are not weared by contact with operator hands.

The ripening system is perfectly integrated with the revolutionary ReFreeX that allow an 80% refrigerant reduction and several other advantages detailed in the specific literature.
The ReFreeX technology is protected by following patents

- European patent is pending with number 04425426.6.
- USA patent is pending with number US10/956,297.
- World patent will soon follow

## 2.4. Naming convention: rooftop/Chiquita – curtain/Del Monte

Ripening rooms are sometimes classified accordingly to the depressure method.
Our method of using a corridor, a covering curtain and a depressure box can be called “curtain” method. A competing method using roof top evaporator along all of the room length is called “rooftop” method.
Originally “curtain” method was also known as “Del Monte”, while “rooftop” was also known as “Chiquita”. However curtain and rooftop is a more appropriate name because Chiquita and Del Monte companies are not necessarily committed to the method named after them.

## 2.5. Pallet format and preparation

The MICHELETTI IMPIANTI banana ripening system adapts itself to the pallet shape to ensure perfect ripening for every format.
The ripening data of this document refer to the standard pallet as follows

- standard dimensions (including wood): m 1.23 x 1.02 x 2.15 h / 2.40 h
- number of boxes: 6 x 8 = 48 or 6 x 9 = 54
- box weight: 18 / 20 Kg

For pallet height between 1.90 m and 2.40 m you can reach optimal result with the standard system arrangement. The pallet length and width are not critical.
Different pallet height and extreme formats on request.
For perforated box bags no pallet preparation is required.
For closed bags it is necessary to extract a small piece of bag from the box accessible window and to cut a hole in it.
At the end, each box closed bag will have just one hole on the outer side of the pallet.

## 2.6. Room loading

The ripener loads the room using a small lift truck, better if with side shifter.
The pallets are to be lined to the two room sidewalks to create two pallet rows with two empty side corridors and an inner one.



ReFreeX
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Then the ripener put the two banana probes inside the banana pulp or simply inside the banana boxes and covers the pallets using the curtain and the electric roller.
One expert ripener can prepare 24 closed bag pallets and load the room in about one hour.
Now the room is ready and the computerised system takes care for the ripening procedure.

### 2.7. What more to turn the key

Starting from the MICHELETTI IMPIANTI supply, you need

- labour for fitting
- alloy to solder the refrigeration line piping
- lighting
- electric wiring
- connection of the electrical power supply to
  - each room ripening electric board
  - the central unit electric board
- water drain from each room evaporator
- two concrete sidewalks for each room
- a PC with Windows XP Professional to be located in the office
- network connection between the office PC and the nearest banana ripening room

## 3. Supply repeated for each room

### 3.1. Ripening room electric box

The room electric box is located near the door on the room front and contains

- master switch
- the three SMD electric board of the computerised control system
- two door switches
- depressure fan switches
- depressure fan thermal relays
- fuses separated for each power line

### 3.2. Computerised control system

For each room there is a stand alone microprocessor control system located inside the room electric box. The microprocessor system controls every phase of ripening. The system can be programmed by the local keyboard-display “slave” modules, by the office PC or from a remote location connected to the office PC via Windows XP remote desktop.
In case of fault of the office PC or of the local slave modules, the stand alone microprocessor control system continues to operate correctly, so the control system is highly reliable.
The control system is made by

- 1 “master” (main) SMD electric board, located inside the room electric box and controlling
  - cooling
  - heating
  - humidification
  - ethylene injection
  - air renew
  - evaporator fans



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- 1 “auxiliary” SMD electric board, located inside the room electric box and controlling
  - door opening, closure and flashing light
  - curtain rolling and unrolling
  - room lighting
- 1 “auxiliary” SMD electric board, located inside the room electric box and controlling the depressure fans
- 2 “slave” modules with keyboard and display located near the room door, each one with
  - 6 push button keyboard performing
    - light switching
    - door opening, closure and stop
    - curtain rolling, unrolling and stop
    - full programming through a three-level branched menu
    - shortcut for temperature set point modification
    - shortcut for ripening – storage switching
    - shortcut for forced air renew
    - shortcut for forced ethylene injection
  - 3 digit + minus sign display showing
    - temperature
    - humidity
    - alarms
    - door operation
    - curtain operation
  - 7 high efficiency yellow LED’s indicating
    - cooling
    - depressure
    - humidity
    - air renew
    - heating
    - ethylene
    - lighting

The control system receives every relevant information by following probes and signals

- nr. 2 banana temperature NTC probes located inside two opposite banana boxes near the depressure box inside the room. The ripener is free to decide which box to control and can put the probe into the banana pulp or simply inside the box
- air temperature NTC probe located near the door inside the room
- humidity probe located near the door inside the room
- optional ethylene 4…20 mA probe located near the door inside the room
- refrigerant low pressure 4…20 mA probe located on the suction piping outside the room
- suction pipe temperature NTC probe located on the suction piping outside the room, to regulate refrigerant overheating
- door opening and closure limit switches
- door spring break safety switch

Supported instrument features that can be software enabled or disabled:

- room storage temperature control by cooling and heating with neutral zone



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- room temperature safety
- room storage humidity control by humidification
- room air renew
- scheduled ripening start
- nr. 5 room temperature levels during ripening with duration freely programmable from 1 second up to ten days
- room ripening humidity control by humidification
- room ripening ethylene concentration control by optional ethylene probe
- first ethylene injection delay by timer and by minimum temperature
- first ethylene injection duration
- further ethylene injection duration, period and number
- forced ethylene injection duration
- first air renew delay
- air renews duration, period and number
- forced air renew duration
- door automatic closure delay
- system pause in case of door opening
- light on in case of door opening
- light automatic switch off delay
- curtain operation
- refrigerant overheating control performing as electronic expansion valve
- expansion valve MOP-like control
- room temperature alarm

### 3.3. Door

The door allows easy operation for room loading, unloading and checking.
The door slides vertically inside the room leaving a clearance of m 2.67 x 2.60 h.
The door is built by 40 mm thick horizontal panels with stainless hinges and rubber gaskets.
The door is provided with:

- 2 oval windows
- electric opening with three phase motor
- electronic control integrated with the computerised ripening control
- external open-close-stop control buttons on the “slave” module
- internal light / door opening / man-in-room-alarm push button
- software door lock after the ethylene injection and before the first air renew
- flashing light
- photoelectric cells and other safety devices
- internal and external unlocking to use in case of electric opening failure or black-out

### 3.4. Depression system

The depression system forces air to flow from the outer side to the inner side of the pallet, to get a uniform ripening in each box.
The depression system includes:

- depression box
- high pressure fans
- pvc curtain
- electric roller



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- horizontal sliding frame supporting the electric roller
- external roll-unroll-stop control buttons on the “slave” module
- internal unroll push button located near the depressure box
- air inlet compensation valve
- air outlet compensation valve

### 3.5. Ethylene injection system

The ethylene injection starts the optimal banana ripening.
The system manages the injection of the nitrogen - ethylene inert blend.
The inert blend is absolutely and intrinsically safe because it is impossible to reach the ethylene burst concentration.
The computerised system manages the injections. It is possible to schedule a first injection and further periodic injections to hold a stable ethylene concentration.
The standard injection time for a 24 pallet room is about 40 minutes, the consumption is about 1080 litres, while each ethylene tank (not provided) contains about 8000 litres.
The system includes

- copper pipe branch line
- shut-off valve
- injecting solenoid valve
- electronic control integrated with the computerised ripening control
- keyboard shortcut for forced ethylene injection on the “slave” module

### 3.6. Air renewal system

The air renewal provides oxygen and removes excess ethylene to ensure optimal ripening.
The computerised system manages the air renew.
It is possible to schedule periodic air renew during the ripening cycle or during storage as well.

- air inlet valve – the same used for air inlet compensation
- air outlet valve – the same used for air outlet compensation
- ejecting fan
- electronic control integrated with the computerised ripening control
- keyboard shortcut for forced air renew on the “slave” module

### 3.7. Room heating system

The heating is needed mostly during the initial phase of the ripening, to increase the banana temperature before injecting the ethylene.
The heating capacity is guaranteed to rise the temperature at a rate of about 0.5 °C each hour.
Heating is performed by hot gas provided by the central unit or by the stand alone refrigerating unit.
The heating system includes:

- hot gas solenoid
- shut-off valve
- mechanical filter

As an option we can provide heating by stainless steel resistances.
The stainless steel sheath of the resistance and the vulcanisation of the endings ensure long lifetime and reduced overheating.
The resistance heating system includes:


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- set of resistances with stainless steel sheath
- safety thermostat
- galvanised frame

### 3.8. Room refrigeration system – direct expansion option

The refrigeration is needed mostly after the ripening to bring back the banana temperature to the storage condition.
The refrigerating capacity is guaranteed to lower the temperature at a rate of at least 0.5 °C each hour or quicker.
The expansion valve function is performed pulsing the solenoid valve by the computerised control, so the system is able to manage all the common refrigerant like R22, R134a, R404A, R407A, R410A and R507A. The system is able to migrate effortlessly from old refrigerant like R22 to new refrigerants like R404A, simply changing a software parameter inside the menu.
The room refrigeration system includes:

- LUVE-Contardo brand evaporator, EUROVENT certified
- solenoid valve - brand DANFOSS
- shut-off valves
- expansion valve function performed pulsing the solenoid under microprocessor control

### 3.9. Room refrigeration system – water and glycol option

The refrigeration is needed mostly after the ripening to bring back the banana temperature to the storage condition.
The refrigerating capacity is guaranteed to lower the temperature at a rate of at least 0.5 °C each hour or quicker.
Refrigeration is performed by refrigerant fluid made by water and 20% glycol.
The fluid is produced by an outer water chiller not described in this document.
The rooms requires about 200 litres per pallet and per hour of fluid entering at –4° C; different flows and inlet temperatures are available on request.
The room is provided with connections left over the ceiling for fluid inlet and outlet.
The room refrigeration system includes:

- LUVE-Contardo brand evaporator, EUROVENT certified
- three-way refrigeration regulation valve
- inlet and outlet shut-off valves

### 3.10. Consumption comparison among direct expansion and water option

We claim that direct expansion has an energy cost advantage over water and glycol circulation. Usually the –4° C fluid of water option is produced by a chiller with –10° C evaporation, while in the direct expansion the evaporation is around 0° C. Usually for each degree lost in the evaporation there is a 3% lost on energy consumption, so, for instance, COP at –10°/+45° C is about 2.88 while COP at 0°/+45° C is about 2.23. If we calculate refrigeration requirement of about 2000 kwh per year per pallet just for keeping depressure and maintaining temperature, then energy requirement for the compressors is 694 kwh/y/pallet with direct expansion and 897 kwh/y/pallet with water and glycol. So with water and glycol there is a consumption increase around 203 kwh/y/pallet.
In a concrete example of 24 pallet room, 0,10 Euro/kwh and 10 years of usage, the energy cost is increased by 203*24*0,10*10=4872 euro.



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It should be mentioned that usually water chillers require circulation pumps that absorb about 5% of refrigerating capacity but this term has been compensated with inefficiencies of direct expansion regulation to get a fair comparison between direct expansion and water.

### 3.11. Branched refrigeration circuit

For rooms connected to a common central refrigeration unit, the branched circuit is needed to connect the room evaporator to the main refrigeration circuit placed over the room ceiling and described in the paragraph 4.5.
For stand alone room connected to a single refrigeration unit, the branched circuit is needed to connect the room evaporator to the unit placed over the ceiling.
The circuit length is 5 meters and includes:

- liquid line, hot gas line and suction line copper pipe
- joints, bends and elbows
- CARPANETO U bolts and channel iron to fix the pipe
- ARMAFLEX-like insulant

### 3.12. Humidification

The room humidity is constantly monitored on a “slave” module display by a current probe located near the door. Room humidity is an important tool to guess about the banana ripening phase after the ethylene injection and before the first air renew. During this time, lasting usually 24 hours, door opening is not allowed and so it is impossible to touch and smell bananas to ensure that ripening is in progress. So a humidity rise on the slave display is a clear indication of ripening start.
Depressure ripening on pallet as opposed to box by box ripening, usually does not need humidification, because the weight loss on pallet is reduced. However higher humidity improves ethylene absorption by the bananas. For this reason a simple humidification system is provided as follows. The water drain piping from the evaporator has a branched line leading inside the depressure box. A water solenoid valve is kept open when the humidity is under the set point, bringing water on the depressure box floor. The depressure fans helps this water to evaporate from the floor. This system is cheap, energy efficient and simply maintainable.
The humidification includes:

- water solenoid valve
- shut-off valve
- water filter
- 5 m of copper drain line
- T junction to connect water drain to the room outside (the outside line is not provided)

### 3.13. Option for a separated compressor for each room

A group of several rooms is usually better served by a central refrigeration unit, due to non contemporaneous refrigeration requirement of the rooms. One, two or even three rooms are instead well refrigerated using a dedicated compressor for each room, as described in this paragraph.
Following components are repeated for each room and replace the components of paragraphs 4.2 to 4.6 :

- Bitzer semi-hermetic compressors
- crankcase oil heating



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- safety pressure limiter
- shut-off valve
- discharge line vibration isolator
- suction line vibration isolator
- electronic low pressure probe
- electronic high pressure probe
- electronic oil pressure probe (for models with oil pump)
- liquid line filter dryer
- LUVE-Contardo brand condenser, Eurovent certified
- electric board driving the compressor and the condenser by pump-down logic
- master electronic controller
- slave electronic controller
- 10 m suction line copper pipe (in addition to 5 m on the room side)
- 10 m room liquid line copper pipe (in addition to 5 m on the room side)
- 10 m hot gas line copper pipe
- 15 m discharge line copper pipe
- 15 m condenser liquid line copper pipe
- joints, bends and elbows
- CARPANETO U bolts and channel iron to fix the pipe

## 4. Supply common to all the rooms

### 4.1. PC software for ripening and monitor

All the banana ripening room microprocessor systems and the refrigeration central unit are connected together on a common network. The end of the network is linked to a PC interface. So all the rooms and the central unit can be programmed and monitored by a software to be installed on a PC located near to the rooms or in the ripener's office. MICHELETTI IMPIANTI provides for free the software, the interface and the network connection up to the room proximity. The eventual network link from the room proximity to the ripener's office is not provided but can be realised by the Customer using an AWG 24 cable with two wires, twisted and shielded. The maximum network length is 1000 meters.

The PC minimum requirement is Windows 2000, two serial ports and a dial-up internet connection for alarm sending. Advised requirement is Windows XP professional with remote desktop feature activated and a static IP address for full remote management from home or other remote locations. In case the dial-up phone line is not used, a single serial port is enough.

The PC software allows to manage all banana ripening parameters and central unit as well.

In case of alarm the software send one or more e-mails and one or more SMS. To send the alarms it is necessary to have an internet connection, a free dial-up internet connection is the cheapest option. SMS can be sent by e-mail using service provided by most telecom operators or by independent providers. Some telecom companies allow each day a certain number of free SMS to be sent by e-mail. In any case there are several independent companies that provide this service at a cost of about ten euro cents per SMS.

To manage or monitor the ripening from a remote location it is necessary to activate the "remote desktop" feature of Windows XP Professional. The cheapest option to connect from a remote PC is by a modem and normal phone dial-up line. A quicker option is to use internet connection by a static IP address or by VPN.



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Supported features on PC software

- Custom monitor of selected parameters among all of instrument parameters like temperatures, pressures, alarm, …
- Periodic registration of all parameters
- Periodic custom print of selected rooms and selected parameters plot
- Alarm management by modifiable batch file for multiple e-mail and eventually SMS sending
- Minimum requirement is a dial-up internet connection, two serial ports (COM1 and COM2) and Windows XP or 2000, advised requirement is Windows XP professional with remote desktop feature activated and a static IP address or VPN connection.

## 4.2. Central refrigeration unit

The central unit provides the refrigeration capacity and is the most critical component, because its correct working is essential for all the rooms.
That is why the MICHELETTI IMPIANTI central unit is the state of the art, having the best components united to redundant safety devices, to ensure smooth and continuous running all over the years and to perform in an energy efficient way.
The central unit should be placed in a dedicated room kept between +20°C and +40°C.
The unit is fully assembled and includes:

- Frascold semi-hermetic compressors - each one with:
  - electronic oil pressure probe
  - safety high pressure controller
  - oil pressure gauge
  - crankcase oil heating
  - discharge line check valves - brand Danfoss
  - discharge line vibration isolator
  - suction line vibration isolator
- pressure control panel provided with:
  - electronic low pressure probe
  - electronic high pressure probe
- oil separator provided with:
  - check valve - brand Danfoss
- liquid line manifold provided with:
  - liquid line filter dryer with interchangeable solid core
  - liquid line shut-off valve
  - liquid line sight glass
- suction line manifold performing as liquid trap and oil equalizer, provided with
  - suction line connections
  - suction line shut-off valve

## 4.3. Remote condenser and connecting circuit

The remote condenser should be placed in an open space near the central unit.
When possible it should be protected from rain and direct sunshine to reduce consumption and increase lifetime.
MICHELETTI IMPIANTI provides:

- LUVE-Contardo brand condenser, Eurovent certified
- 15 m discharge line copper pipe



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- 15 m condenser liquid line copper pipe
- joints, bends and elbows
- CARPANETO U bolts and channel iron to fix the pipe

### 4.4. Central unit electric box

The central unit electric box is the second most critical component after the unit itself. To improve serviceability and reduce faults, Micheletti Impianti substituted the traditional electronic compressor controller with a custom microprocessor controller.
Moreover the compressor contactors are heavy-duty relays generously 60% oversized, to increase safe lifetime.
The board includes:

- master switch
- compressor switches 60% oversized
- compressor thermal relays and alarm dial lamps
- fuses separated for each power line

The microprocessor controller includes:

- SMD master electric board
- Microprocessor with 64 kb flash memory
- EEPROM 2 kb
- Real time clock
- Phase monitor
- Primary RS485 serial I/O for PC communication
- Secondary RS485 serial I/O for local slave communication
- Slave instrument with keyboard and display located in the engine room.
- TRIAC condenser fan speed regulation
- Oil receiver temperature probe
- Discharge pipe temperature probe
- Condenser air inlet temperature probe
- Oil pressure probe for each mc with oil pump
- Discharge pressure probe
- Suction pressure probe
- Supported instrument features that can be software enabled or disabled:
  - Suction low pressure regulation with dead band and differential
  - Discharge pressure limit forcing the compressor unload
  - High and low pressure safety stop with independent differentials
  - Oil low pressure safety stop with independent differentials for each mc
  - Minimum oil receiver temperature
  - Manual override of each mc
  - External override with adjustable delay
  - Condenser fan speed regulation
  - Condenser fan enabling in case of high pressure alarm
  - Nr. 3 condenser fan relays with independent high pressure set point and differentials
- Supported alarms
  - Programmable delayed safety alarm for each mc



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- Programmable delayed external override alarm
- Programmable delayed thermal overload relay alarm
- Oil low pressure alarm

### 4.5. Refrigeration main circuit

The main circuit starts from the central refrigerating unit, reaches the nearest room ceiling, and runs over each room ceiling to connect to the branched circuits, described in the paragraph 3.10.
The circuit length provided by MICHELETTI IMPIANTI is sufficient as long as the central unit can be reached by a 30 m piping from the nearest room ceiling.
The circuit includes:

- copper pipe for the main suction line and the main liquid line
- joints, bends and elbows
- CARPANETO U bolts and channel iron to fix the pipe
- ARMAFLEX-like insulant for the suction line

### 4.6. Oil and refrigerant charge

MICHELETTI IMPIANTI provides oil and refrigerant charge to operate correctly all the rooms.
The standard refrigerating gas is R404A, CFC and HCFC free. R22 and other refrigerants are available on request.

### 4.7. Ethylene main circuit

The ethylene main circuit provides the supply for each room injection system described in the paragraph 3.5.
The ethylene tanks should be located close to the last room of the cluster. The line starts from the tanks and runs over each room ceiling.
*Please use inert blend and factory filled tanks to avoid explosion risk.*
The circuit includes:

- decompression manifold with 2 tank connections and shut-off valves
- distribution fluximeter
- distribution line copper pipe
- CARPANETO U bolts and channel iron to fix the pipe

## 5. Panels

### 5.1. Room arrangement

MICHELETTI IMPIANTI provides prefabricated panels to build the rooms and the depression boxes described in the paragraph 3.4.
In the standard arrangement the rooms share the long side wall and are supposed to form a single cluster with a common door front.
Every other arrangement available on request.

### 5.2. Panel data

Panels are galvanised and painted on both faces for longer lifetime.

- panel thickness 80 mm
- panel joint tongue & groove



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- panel sheet data
  - material — steel
  - thickness — 0,5 mm accordingly UNI 5753
  - zinc-plating — Sendzimir 200 g/ $m^2$
  - cladding — white painted
- panel polyurethane data
  - conductivity — 0,023 Watt/ °K m
  - average density — 40 kg/ $m^3$
  - compressive strenght — 1,4 / 1,8 kg/ $cm^2$
  - close cells — 95 %
  - combustibility — ISO 3582 - 60 mm - 60 s

### 5.3. Panel accessories

MICHELETTI IMPIANTI provides every accessory to complete the rooms:

- PVC ground “U” sections
- ground plugs to fix “U” sections
- connecting sections galvanised and white painted
- rivets
- silicon

## 6. Room data table

| Pallet | Boxes | room inner dimension length | width | height | air flow $m^3$/ h | depression fan nr. | pressure Pa | absorption running | heating |
|---|---|---|---|---|---|---|---|---|---|
| 10 | 480 | 7,53 | 3,31 | 3,39 | 20.200 | 2 | 200 | 2,6 | 6,2 |
| 12 | 576 | 8,76 | 3,31 | 3,39 | 20.200 | 2 | 200 | 2,7 | 7,1 |
| 14 | 672 | 9,99 | 3,31 | 3,39 | 20.200 | 2 | 200 | 2,7 | 8,2 |
| 16 | 768 | 11,22 | 3,31 | 3,39 | 30.300 | 3 | 200 | 4,0 | 9,5 |
| 18 | 864 | 12,45 | 3,31 | 3,39 | 30.300 | 3 | 200 | 4,0 | 10,6 |
| 20 | 960 | 13,68 | 3,31 | 3,39 | 30.300 | 3 | 200 | 4,1 | 11,8 |
| 22 | 1.056 | 14,91 | 3,31 | 3,39 | 30.300 | 3 | 200 | 4,1 | 12,9 |
| 24 | 1.152 | 16,14 | 3,31 | 3,39 | 30.300 | 3 | 200 | 4,1 | 14,0 |

Notes:
- running absorption does not include the central refrigeration unit

## 7. Options

- transport
- fitting and start-up
- wiring
- three year on site guarantee extension (three year ex work it is already standard)
- programmed maintenance periodic visits
- two layer storage
- adaptation of existing rooms and central units



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