

PROJECT:

BANANA RIPENING AND STORAGE ROOMS

RIPENING ROOMS:

1. DOORS

For the banana ripening rooms will be installed automatic (motor drive) gas tight sectional doors, dim. 3,2 x 5,4 m, with one PVC safety window in the second section.



Automatic gastight sectional doors

2. REFRIGERATION EQUIPMENT

To achieve high performance, functionality, reliability and efficiency for refrigeration technique are predicted two independent refrigeration power pack units.

As refrigerant, at primary side, is predicted natural refrigerant ammonia which assures high efficiency and has no bad influence on environment (no ozone depletion and no global warming potential) and furthermore, is technically more demanding regarding assuring safety operation, but manageable.

➤ **HIGH TEMPERATURE SYSTEM +7°C:**

Main point outs:

- ✓ ammonia (natural refrigerant)
- ✓ open screw compressors BITZER
- ✓ frequency driven compressors from min. 1.450 min⁻¹ up to 3.500 min⁻¹ to assure highest efficiency also at part load operation (with this method loss is only approx. 3% versus classic slide control where losses in efficiency are also up to 200% and more) and further more assure also some additional margin in refrigeration capacity
- ✓ condensing pressure (temperature) control is predicted with “sliding” set point regarding outdoor air (wet bulb) actual temperature to assure refrigeration system high efficiency (with achieving optimal/lower condensing temperature)
- ✓ number of compressors (4) assures sufficient operation reliability in case of failure one of them

Regarding to the technological parameters of the cooled places it is foreseen to install two independent refrigeration units.

Refrigeration power pack units are predicted for cooling of the banana ripening rooms 1 to 28, manipulation corridors for ripening rooms and green banana storages, reception and expedition area.

On the primary side of the refrigeration system will be used the refrigerant R717 (ammonia) with evaporation in the heat exchanger and condensation in the evaporative condenser.

On the secondary side we foreseen indirect refrigeration ethylene glycol. As secondary refrigerant (brine) is predicted water - **ethylene glycol** mixture (hereinafter indicated as: glycol).

Brine is pumped from the heat exchanger to the glycol accumulator (cold tank) and over the main pump distribution station is delivered to the air coolers in banana ripening other places.

To achieve optimal parameters for storage or cooling of fruits is foreseen:

- All the cooled places are equipped with the control valves that control the required glycol temperature for the coolers in the conditioned places. With this control system

is possible to ensure optimal working parameters for the economical cooling and minimal dehumidification in the conditioned places.

- For heating of the rooms are included also electric in-line glycol heaters or air electrical heaters in banana ripening rooms.

Refrigeration units will be compound with the Bitzer open screw compressors, completely equipped with **frequency driven refrigeration capacity regulation**, heat exchanger, with the required fittings and automatic devices that enable the required functional and safe operation. Refrigeration units are factory produced and tested. Refrigeration power pack units will be connected to the evaporative condensers and the glycol accumulator with the primary pump distribution station.



Refrigeration unit with screw compressors



Evaporative condenser

In the heat exchanger is cooled glycol and over the pump station is delivered to the glycol air coolers in the banana ripening rooms and other places. The rooms are equipped with the control valves that control the required glycol temperature for the coolers in the conditioned places. With this control system is possible to ensure the optimal working

parameters for the economical cooling and minimal dehumidification in the conditioned places.

Accumulation vessels for the glycol accumulation



Accumulation vessel for the glycol

Air coolers are designed for different applications with axial fans for indoor operation. The fins are made with pure aluminium and the tubes from INOX. The casing is designed from metal sheet and finally coated, condensation drainage made of polyamide and brackets for ceiling installation made pure aluminium. **All fans for special coolers in banana ripening rooms are in high energy efficiency execution with EC motors.**



Air coolers for the manipulation corridors, expedition and reception area are designed for different applications with axial fans for indoor operation. The fins are made with pure aluminium and the tubes from high grade copper. The casing is designed from metal sheet and finally coated, condensation drainage made of polyamide and brackets for ceiling installation made pure aluminium. In the quotation is also included fresh air ventilation system.



Coolers for places

Refrigeration units operation is controlled by the industrial microprocessor device and computer control system EHO (specially programmed according to the project installation requirements), that enable:

- automatic refrigeration systems operation,
- constant supervision of the operation and the signalization of the possible faults in the operation,
- simple set-up of the working and protection parameters.

For the refrigeration systems construction will be used the quality parts of the recognized producers of the refrigeration equipment such as: Bitzer, Danfoss, Siemens, Esk, Guntner and our own constructed products. The foreseen equipment is functionally tested in our installations that are running already over 35 years.

Refrigeration system equipment is constructed and executed according with the latest contemporary refrigeration systems technologies and valid European standards (European directive PED 97/23/EC).

3. ADDITIONAL EQUIPMENT IN THE ROOMS

3.1. BANANA RIPENING ROOMS

It is foreseen the installation of so called "SIDE CURTAINS" system which enables:

- high quality ripening,
- easy handling of goods,
- small usage of energy and ripening gas,
- easy and clear management and maintenance and
- almost unlimited length of ripening room.

The ripening process is ensured mainly by the:

- system of the uniform forced air circulation through all banana boxes,

- special execution of the pallet supporting construction,
- multiple measuring and control of fruit and air temperatures (4 air temperature sensors, 4 working fruit temperature sensors),
- adjusting of heating and cooling capacity to momentary ripening phase and
- special customized computer control system EHO for the banana ripening process.



Banana ripening rooms are constructed for the pallet ripening system for the pallets dimensions from 1,00 x 1,20 m to 1,08 x 1,23 m and the height from h=2,05 to 2,40 m. All banana ripening rooms are constructed for the two layers system, means that the pallets in the rooms are loaded in two layers.

Banana ripening rooms nr. 1 to 15 enables ripening of **48 pallets, 48/54 boxes per pallet** (maximum full load of the each ripening room). The ripening capacity could be reduced in steps 48, 44, 40, 36, 32, 28 till minimum of 24 pallets.

Ripening process is ensured mainly by the: system of the uniform forced air circulation through all banana boxes, special execution of the pallet supporting construction, more measuring points for the temperature control (4 air sensors and 4 product sensors per each ripening room) and specially customized computer control system EHO for the banana ripening process.

Beside the refrigeration equipment is in the ripening rooms installed also the next equipment:

- "SIDE CURTAINS" system for the forced way of the air circulation,
- supporting construction for the second layer of the pallets with bottom metal guide lines,
- **high efficiency EC fans with plastic blades** (fans on the reversible plate) for air circulation,
- multiple measuring and control of fruit and air temperatures (4 working air temperature sensors, 4 fruit temperature sensors),
- electric heaters for the banana preheating process,
- ethylene sensors,
- fresh air ventilation system.

4. ELECTRICAL EQUIPMENT AND COMPUTER CONTROL SYSTEM EHO

4.1. ELECTRIC SWITCHBOARDS

Electric power, control and distribution switchboards for the refrigeration equipment consists the elements for the power supply, protection devices and control equipment. Electrical switchboards are an industrial product, tested under valid regulations and rules. For the refrigeration systems control with the working and protection parameters control will be installed in the electrical switchboards the industrial microprocessor with the corresponding application control software. The refrigeration systems operation will be controlled with the pressure and temperature probes and with the other regulation, operation and protection devices of the refrigeration systems. Microprocessor controls all important working parameters and faults that might affect the operation of the refrigeration systems.



Main electrical switchboards

Computer control system EHO enables the automatic operation on the base of the customized software and the set working parameters.

For the electrical switchboard construction will be used the quality parts of the recognized producers of the electric equipment such as: SIEMENS and Schneider. The foreseen equipment is functionally tested in our installations that are running already over 37 years.

4.2. ELECTRICAL INSTALLATIONS

Electrical installations of the refrigeration equipment with control, operation and protection elements will be done by the cables of the corresponding section surface that will be laid to the galvanized cable trays and into the protection tubes.

Electrical installations and main electric power supply cable to the electrical switchboards is not included in this quotation.

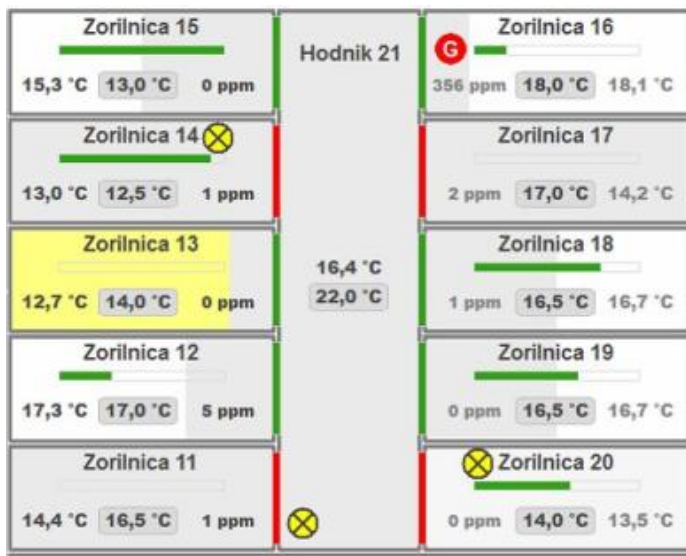
4.3. GROUNDING SYSTEM

Grounding system of the refrigeration equipment will be done by the galvanized stripes and copper wires with the connection boxes and will be connected to the main grounding installations of the building. **Main grounding installations of the building are not included in this quotation.**

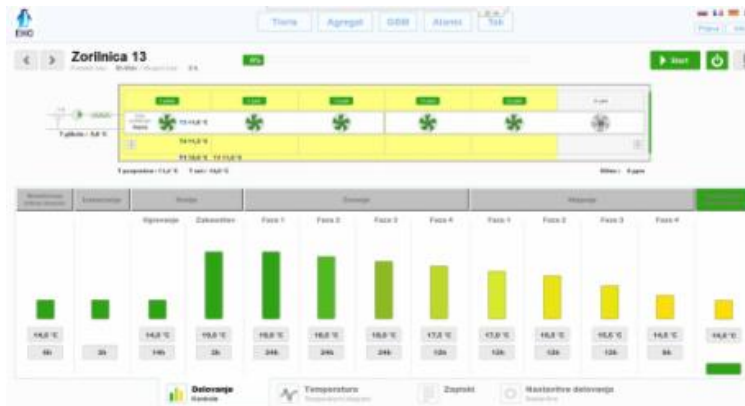
4.4. COMPUTER CONTROL SYSTEM EHO

SCADA (supervisory control and data acquisition) system will be done on one PC computer with the customized software that enables a complete overview over the refrigeration systems operation in all rooms including the set-up and control of the important technological working parameters:

- setup of the refrigeration system working parameters,



- data logging of the temperatures, pressures and possible faults,
- data storage print out in the shape of tables or charts and
- visualization of the actual values of important working and control parameters,



- visualization and signalization of the possible faults in the refrigeration systems operation also sending the SMS of faults to responsible person.

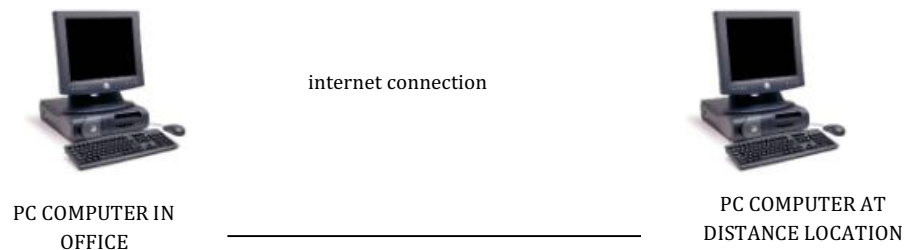
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PC computer will be connected over the Ethernet communication to the microprocessor of the ripening rooms that controls the operation of the refrigeration system. Visualization on the computer control system enable overview of all rooms and adjustment with the needs and requirements of the customer. The usage of the computer control system will be protected with the users' passwords. Visualization and descriptions on the computer control system will be done on English language.

Also it is possible to connect to the computer control system from another computer at distance location via internet connection to office. The customer should assure the internet connection to the PC computer in storages office.

- internet connection or intranet connection.



STORAGE ROOMS:

1. REFRIGERATION EQUIPMENT

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- For heating of the rooms are included also electric in-line glycol heaters or air electrical heaters in banana ripening rooms.

Refrigeration units will be compound with the Bitzer open screw compressors, completely equipped with **frequency driven refrigeration capacity regulation**, heat exchanger, with the required fittings and automatic devices that enable the required functional and safe operation. Refrigeration units are factory produced and tested. Refrigeration power pack units will be connected to the evaporative condensers and the glycol accumulator with the primary pump distribution station.



Refrigeration unit with screw compressors



Evaporative condenser

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Accumulation vessels for the glycol accumulation



Accumulation vessel for the glycol



Pump stations with control valves and pumps

Air coolers are designed for different applications with axial fans for indoor operation. The fins are made with pure aluminium and the tubes from high grade copper. The casing is designed from metal sheet and finally coated, condensation drainage made of polyamide and brackets for ceiling installation made pure aluminium. **All fans for special coolers in green banana storage rooms are in high energy efficiency execution with EC motors.**



Special air coolers for green banana storage rooms

Refrigeration units operation is controlled by the industrial microprocessor device and computer control system EHO (specially programmed according to the project installation requirements), that enable:

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For the refrigeration systems construction will be used the quality parts of the recognized producers of the refrigeration equipment such as: Bitzer, Danfoss, Siemens, Esk, Guntner and our own constructed products. The foreseen equipment is functionally tested in our installations that are running already over 35 years.

Refrigeration system equipment is constructed and executed according with the latest contemporary refrigeration systems technologies and valid European standards (European directive PED 97/23/EC).

2. ADDITIONAL EQUIPMENT IN THE STORAGE ROOMS

In the green banana storage rooms will be installed ethylene sensors and fresh air ventilation with fans and flaps.



3. ELECTRICAL EQUIPMENT AND COMPUTER CONTROL SYSTEM EHO

3.1. ELECTRIC SWITCHBOARDS

Electric power, control and distribution switchboards for the refrigeration equipment consists the elements for the power supply, protection devices and control equipment. Electrical switchboards are an industrial product, tested under valid regulations and rules. For the refrigeration systems control with the working and protection parameters control will be installed in the electrical switchboards the industrial microprocessor with the corresponding application control software. The refrigeration systems operation will be controlled with the pressure and temperature probes and with the other regulation, operation and protection devices of the refrigeration systems. Microprocessor controls all important working parameters and faults that might affect the operation of the refrigeration systems.

Computer control system EHO enables the automatic operation on the base of the customized software and the set working parameters.

For the electrical switchboard construction will be used the quality parts of the recognized producers of the electric equipment such as: SIEMENS and Schneider. The foreseen equipment is functionally tested in our installations that are running already over 35 years.



Main electrical switchboards

3.2. ELECTRICAL INSTALLATIONS

Electrical installations of the refrigeration equipment with control, operation and protection elements will be done by the cables of the corresponding section surface that will be laid to the galvanized cable trays and into the protection tubes.

Electrical installations and main electric power supply cable to the electrical switchboards is not included in this quotation.

3.3. GROUNDING SYSTEM

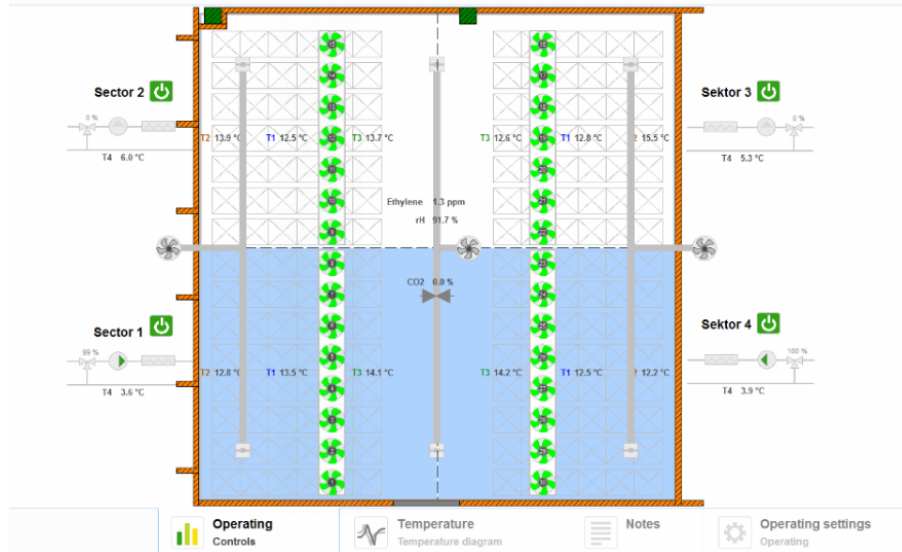
Grounding system of the refrigeration equipment will be done by the galvanized stripes and copper wires with the connection boxes and will be connected to the main grounding installations of the building. **Main grounding installations of the building are not included in this quotation.**

3.4. COMPUTER CONTROL SYSTEM EHO

SCADA (supervisory control and data acquisition) system will be done on one PC computer with the customized software that enables a complete overview over the refrigeration systems operation in all rooms including the set-up and control of the important technological working parameters:

- setup of the refrigeration system working parameters,

Green ban. storage 23



- data logging of the temperatures, pressures and possible faults,
- data storage print out in the shape of tables or charts and
- visualization of the actual values of important working and control parameters,
- visualization and signalization of the possible faults in the refrigeration systems operation also sending the SMS of faults to responsible person.

PC computer will be connected over the Ethernet communication to the microprocessor of the storage rooms that controls the operation of the refrigeration system. Visualization on the computer control system enable overview of all rooms and adjustment with the needs and requirements of the customer. The usage of the computer control system will be protected with the users' passwords. Visualization and descriptions on the computer control system will be done on English language.

Also it is possible to connect to the computer control system from another computer at distance location via internet connection to office. The customer should assure the internet connection to the PC computer in storages office.

- internet connection or intranet connection.

