

## Appendix 6. Technical Specifications

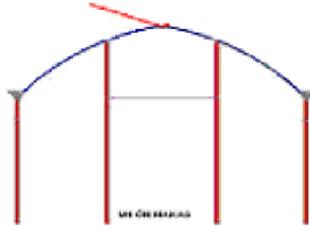
### **TECHNICAL SPECIFICATIONS FOR SEYHAN - YENIMAHALLE DISTRICT FLOWER GERMINATING AND GROWING GREENHOUSE (CLOSED AREA)**

1. The greenhouse shall be built on the site allocated within the framework of the agreement signed between Adana Metropolitan Municipality (“**ABB**”) and GOAL Turkey (“**GOAL**”).
2. The CONTRACTOR must undertake at least 3 years of warranty on strength and material fatigue related to the greenhouses to be established and all the materials used in them, and 10 years of maintenance and repair service. There should be warranty; 10 years for greenhouse metal construction, 3 years for greenhouse cover, 15 years for SES (SOLAR ENERGY SYSTEM), 10 years for automation and control units and 10 years for service and technical maintenance.
3. The greenhouses to be established by the CONTRACTOR should be 10 units of Gothic greenhouse type side by side, each 9.6 meters wide and 104.16 meters long. In the first stage, 5 tunnels corresponding to 5000m<sup>2</sup> will be planned, and a greenhouse area will be planned to consist of 10 tunnels lined up in total of 10000 m<sup>2</sup> to create 5 more tunnels that will correspond to a separate 5000 m<sup>2</sup> to be added next to these tunnels in the second stage. All connections shall be made with fasteners such as bolts, nuts, etc. and will be in a modular greenhouse concept. Connections will not be welded under any circumstances.

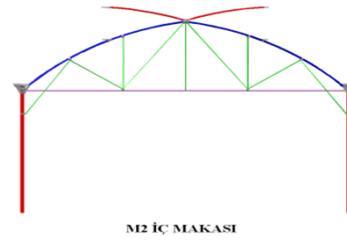
Total Area	10.000 m <sup>2</sup>
Type of Greenhouse	Gothic Greenhouse - sides and roof polyethylene
Length of Tunnel	104.16 meters
Number of Tunnels	10 pcs
Width of Tunnel	9.6 meters
Height of Side Wall under gutter	4.0 meters
Height of top line of Construction	6 meters
Type of Gutter	2 mm of 40 galvanized steel
Type of Gutter Drainage	Pipe end gutter drainage of 150
Greenhouse Door	At least 2.30 m x 3m
Side Columns	80 x 80 x 2.0 mm 4,000 mm
Front and Back Columns	80 x 140 x 2.5 mm 4,000 mm
Middle Columns	80 x 80 x 2.0 mm 4,000 mm
Fron Facade Columns	80 x 140 x 2.5 mm 4,000 mm
Anchorage	70 x 70 x 2.5 mm 1200 mm

## GOTHIC ROOF COMPONENTS

FRONT and BACK TRUSS (M1), MIDDLE TRUSS(M2)



**FRONT and BACK TRUSS (M1)**



**MID TRUSS (M2)**

While designing the truss, the plant suspension axis is divided into 4 equal parts for a balanced distribution of static loads and all of the connections are knotted at the load balance points. Truss profiles are Ø60 mm - Ø27 mm according to load balance calculations and shadow ratios.

<b>For M1 Truss</b>	
Truss ARC Tube	Ø 42 x 1,5 mm Galvanized Pipe
Roof Ridge	T: 1 mm Galvanized Sheet
<b>For M2 Truss</b>	
Truss ARC Tube	Ø 42 x 1,5 mm Galvanized Pipe
Truss Bonding Connection Pipes	Ø 27 x 1,5 mm Galvanized Pipe
Truss Beam Tube	Ø 42 x 1,5 mm Galvanized Pipe

## SIDE AND TOP CONNECTION PROFILES

Rain gutters are made of 2mm galvanized sheet. The grooves will be processed straight and then the clip bed will be assembled separately.

Self-Circling Rain Gutter	400 x 2 mm galvanized sheet
32 Peak Profile	32 x 1.2 mm galvanized sheet
Ventilation Box Profile	32 x 1.2 mm galvanized sheet
Side Double Border	50 x 1..2 mm galvanized sheet
Front Double Border	50 x 1.2 mm galvanized sheet
Double Butt Spring Profile	50 x 2 mm galvanized sheet

## WIND TENSIONERS

M1- M2 Wind Connection	Ø 27 x 1.5 mm galvanized pipe
Face Cross Tension	Ø 42 x 1.5 mm galvanized pipe
Side Column Tensioners	Ø 27 x 1.5 mm galvanized pipe

## VENTILATION

- Considering the weather conditions in Adana, in order to minimize the energy consumption for air conditioning; Greenhouses should be manufactured and installed to provide more natural air circulation.
- Each tunnel will be ventilated from the top in the opposite direction of the prevailing wind.
- Toothed racks used in ventilaiton will be operating silently.
- The profiles to be used will be hot dip galvanized steel.

Switch Reducer Set	0.55kw/h 50 Hz 380 V
Rack Gear Set	2.5 mm galvanized sheet
Bear Shaft Bearing	1.5 mm galvanized sheet
Ventilation Shaft Tube	Ø 34 x 2.0 mm galvanized pipe
Ventilation Profile	30 x 50 x 1.5 mm

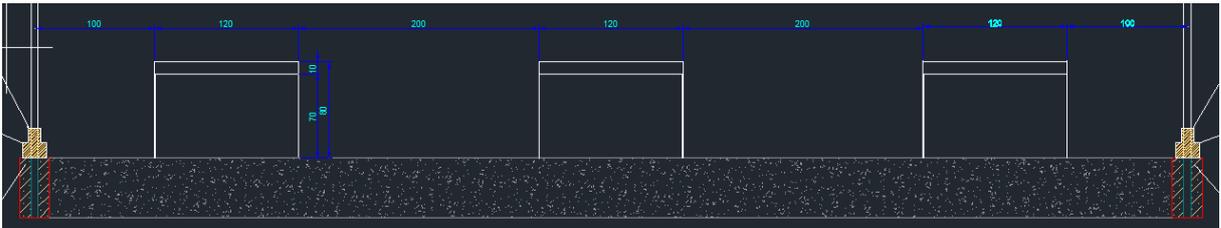
## WATER BASEMENT and SURROUNDING WALL

4. A retaining / border wall made of C 25/30 concrete and 8 - 12 ribbed iron in accordance with TS EN 206 and TS 13515 standards with a width of 20 cm and height of 50 cm (bootm 25 cm of the height will be enlarged to 40 cm of width to become a footing ) shall be placed on four sides of the greenhouse and the retaining/lot-line wall shall protect against floods. At the same time, the greenhouse environmental poles will remain within this reinforced concrete structure.

## INTERIOR LAYOUT DESIGN of GREENHOUSE

5. For each greenhouse 9.6 meters width,
  - The training and circulation area inside the greenhouse will be planned with a width of 1 meter on the left and right sides and 2 meters between the stands, and concrete walkways will be prepared for training and circulation throughout the greenhouse (104,16m) with a maximum of 25 meters of castings.
  - 3 pieces of 1.20 m wide and 80 cm ground height stand will be placed from galvanized coated 30 box profiles and angle brackets. Stands are detachable and will be designed as modular. Each piece will be placed in a maximum length of 6 meters.

- Perforated trays (flower pots) will be placed on the stands planned to be placed, with a width of 1.20 meters and approximately 100 meters along the greenhouse.



-Tunnel greenhouses will be cleared of weeds and fungal diseases by putting compressed gravel under these trays and black plastic cover over them.



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6. Greenhouse sides and greenhouse upper ridge as mentioned in the first article; will be covered with polyethylene material with at least 3 years warranty.

***GREENHOUSE PLASTIC COVER***

- The greenhouse will be covered with a single layer of 180 micron polyethylene cover.
- The greenhouse cover specification will be as 36 month UV + IR+ LD + AF + Amist +EVA + AntiDust +Diffused film
- PVC clips will be mounted as snap ring clips

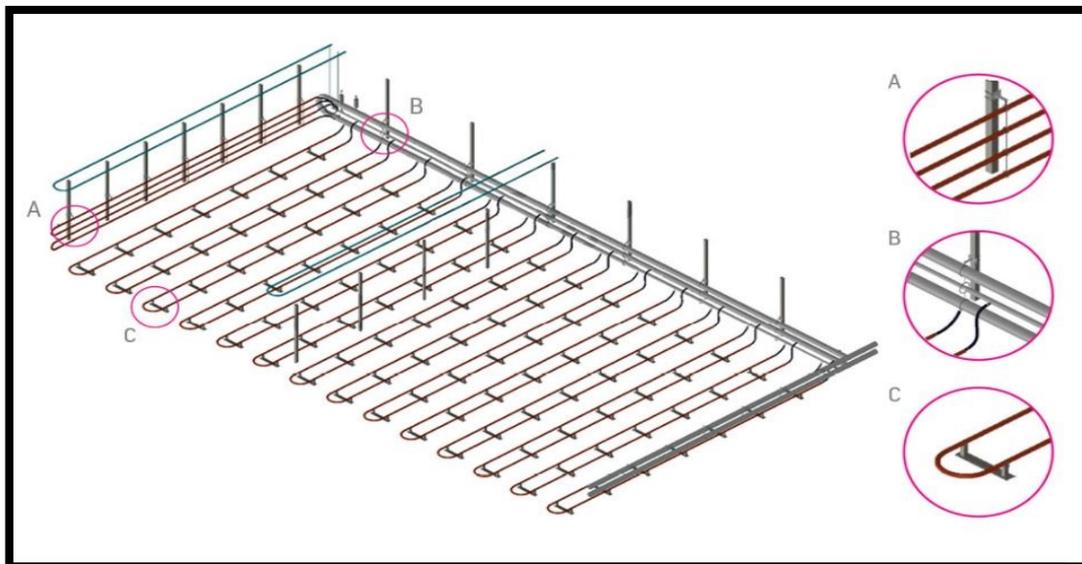
7. At least two PVC COMPOSITE pipes shall pass under all pots (trays) for the purposes of heating and cooling.

***Minimum Technical Specifications of the PVC Composite Pipe***

- The PVC Composite water pipes shall be produced with the combination of PP-R (Polypropylene Random Copolymer) raw material and glass-fibre reinforced polypropylene raw materials
- Each tunnel in the greenhouse shall have independent heating and cooling systems
- Shall be at least Class B2 according to DIN 4102 standard
- Shall be resistant to corrosion, calcification and rusting.



*Representative Image*



*Representative Image*

8. The pipes mentioned in the previous article will be connected to the electric heaters inlets and outlets in each tunnel greenhouse; As will be mentioned in the following articles, the desired air temperature will be designed to be different or the same in each tunnel greenhouse by the control units (PLC-Artificial Intelligence Controllers) located in the main control center in order to control these electric heaters.

9. At least 2 circulation fans calculated using fluid mechanics method will be placed in each tunnel greenhouse (1000m<sup>2</sup>) for cooling, air conditioning and air circulation, and the electrical connections of these fans will be made as specified in this technical specification. Again, these fans will be designed to be controlled by the control units (PLC-Artificial Intelligence Controllers) in the main control center in such a way that the desired air temperature-circulation is different or the same in each tunnel greenhouse so that they can be controlled like heaters.

***Minimum Technical Specifications of the Circulation Fans:***

- Shall have a capacity of at least 7,400 m<sup>3</sup> / 0.4 kwh.
- Shall have at least 900 RPM nominal blade velocit.
- Shall operate with three-phase electricity.
- Shall be at least IP 55 protected.
- The fan blades shall be galvanized.
- There shall be an electricity panel operating manually or with automation.



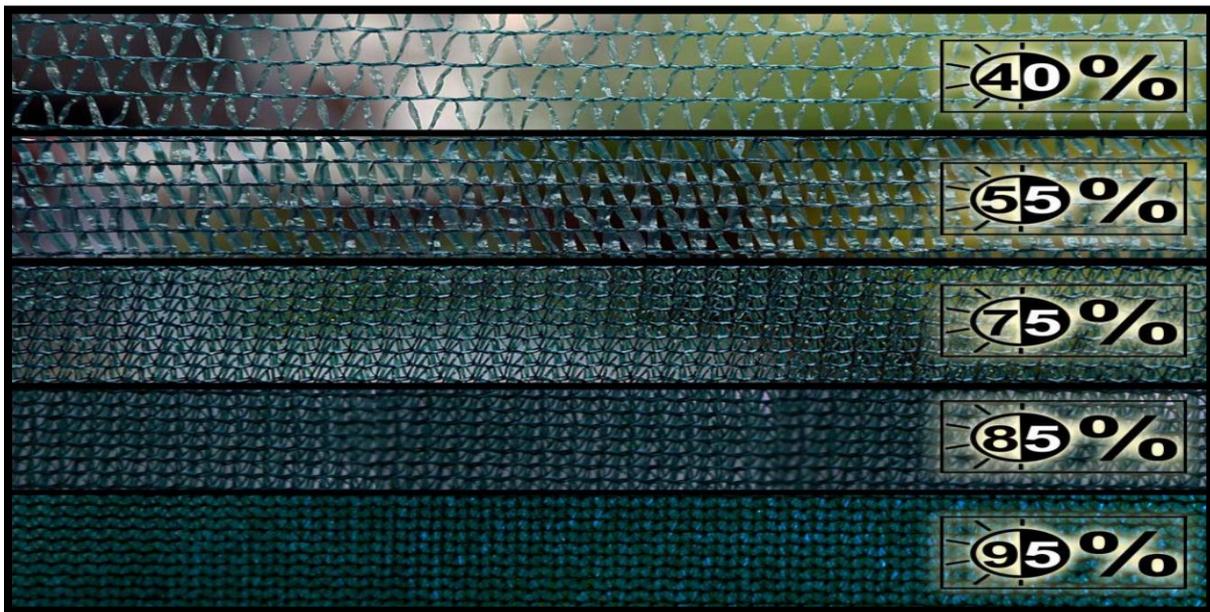
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10. There will be shading nets that can be opened and closed throughout the whole greenhouse ceiling, 3-year guaranteed shading nets as mentioned in the first item.

***Minimum Technical Specifications of the Shadow Net:***

- Shall be produced in accordance with ISO 9001, CE and Food Contact Compliance (EU and USA) certificates;
- UV protection additives shall be available;
- Shall be produced with 100% HDPE (High Density Polyethylene) Monofilament yarn
- The shading net shall provide a green colour and 55% shading.

- It will be placed in each greenhouse tunnel with PUSH-PULL System.
- The system will be in the structure of a mechanism that moves by means of shaft pipes and toothed rack-gears that are driven by self-switching gearmotors.
- The mentioned PUSH\_PULL system shading net mechanism should be designed as to be controlled by the control units (PLC-Artificial Intelligence Controllers) in the main control center so that it can be controlled like electric heaters and fans for each tunnel.



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11. There will be a fogging system installation over the benches along all the greenhouse tunnels to provide irrigation of the trays placed over the benches with drip-free, 0.2 mm diameter fogging nozzles.

***Minimum Technical Specifications of the Fogging System Installation;***

- Shall be operating with an operating pressure of 4 bars at least.
- Shall have filtration in the installation.
- Shall have special installation pipes (such as flexible hoses resistant to high pressure) as well as special installation materials compatible for high-pressure operations.
- Shall have the ability to adjust the flow rate over the pump when requested.
- Shall have nozzles made of stainless steel that do not wear at high pressure.
- Shall operate with no single drip at the inlet and outlet of the circuit by means of a drip protection system.
- Shall have an automation panel integrated with the pump.

- Shall operate with different automation options to be selected according to the implementation.
- Shall have the specification to operate/stop time-dependent.
- Shall have the specification to operate/stop according to the lower and upper humidity values desired in the environment.
- Shall have the specification to operate/stop according to an outside command;
- All connections of the irrigation systems shall be made and the system shall be delivered operating after performing all leak and leakage checks.
- The multiple pump systems shall have the specification to operate coordinated.
- The mentioned FOGGING system should be designed as to be controlled by the control units (PLC-Artificial Intelligence Controllers) in the main control center so that it can be controlled like electric heaters and fans for each tunnel.



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12. There shall be 7-9 litre/minute water pumps inside the greenhouse for the fogging mentioned above.

***Minimum Technical Specifications of the Fertilization and Pest Control System:***

- The irrigation intervals and amounts, pest control and fertilizer dosages, pH levels shall be adjustable manually and with automation by means of the electro valves of the irrigation system.
- The fertilization and pest control system shall be controlled manually and automatically as to control the operation of the dosing and system by means of the fertilization and pest control computer.

- The system for each tunnel shall consist of two groups of fertilizer tanks (liquid fertilizer and water-soluble granular fertilizer tanks shall be separate), one pest control tank and one pH tank.
- All tanks shall have a capacity of 100 litres.
- The placement of the tanks will be planned within the GREENHOUSE area for each tunnel.
  
- All connections of the fertilization and pest control systems shall be made and the system shall be delivered operating after performing all leak and leakage checks.

13. The CONTRACTOR is liable to install one manual seeding machine in the greenhouse.

***Technical Specifications of the Manual Seeding Machine:***

- Shall have a vibrating seed hopper made of stainless steel.
- Shall have a vacuum rod with holes for taking the seeds.
- After the seeds are taken, they shall be placed in the desired order on the tray and shall be put into the hubs of the tray.
- To seed the next row, the tray shall be manually pushed and the processes shall be repeated.
- The vibration of the seed hopper and force of the vacuum on the rod shall be easily adjustable for seeds of different sizes and weights.
- Shall have 3 (three) seed catching rods in different sizes suitable for the seeds to be preferred/determined by the administration.
- For the smaller seeds (lobelia and pansy), the hole diameter on the tube shall be maximum 0.3 mm.
- For the larger seeds (clipped marigolds and etc.) the hole diameter on the tube shall be maximum 0.5 mm.
- There may be more holes on the tube as requested by the administration.
- The machine shall be supplied as a set with a small compressor that can be easily carried everywhere.

14. There shall be entrance cabins ensuring full disinfection at the entrance and exit doors of each greenhouse for the prevention of the spread of viral, bacterial or fungal diseases by the trainees or employees entering the greenhouse.

***Technical Specifications of Entrance Cabins:***

- It will consist of 2 doors with 250cm width \* 250cm height \* 100cm depth. One of the doors will be placed at the entrance of the mentioned dimensions and the other one at the exit side, creating an air insulation zone in between.
  - The cabins will be covered with the same polyethylene material.
  - For the purpose of disinfection of personnel or materials entering or exiting at the bottom of the cabins; there will be a chlorinated water pool with a vertical depth of 20 cm in the bottom area at a depth of 100 cm as cabin itself.
15. All electrical equipment and connections that will operate in the tunnel greenhouses and main control center will comply with the relevant standards and specifications of Turkish EPDK (EMRA-Energy Market Regulatory Authority), TEDAŞ, TOROSLAR EDAŞ and EMO.
16. All the top and side covers of the greenhouse will be controllable with gearmotors. The position information indicating the position of each of the covers will continuously flow information to the controllers in the main control center and it will also be controllable from this control center.
17. The heating, cooling and ventilation processes of the greenhouse shall be done by an Artificial Intelligence implementation and additionally, it shall be performed manually and by PLC control for precautionary purposes.
18. In order for the artificial intelligence module to obtain proper data and save energy, there shall be heat, CO<sub>2</sub> (carbon dioxide), CO (carbon monoxide) and humidity sensors on the tray benches as one in every 10 meters and wind direction and intensity sensors outside the greenhouse.
19. The artificial intelligence module shall decide whether to open or close the doors, to heat or cool, to ventilate, to pest control, to irrigate or to fog the greenhouse as a result of the deep-learning obtained from the relevant data.

20. The artificial intelligence module shall be delivered as open source. The system shall be available for any addition, removal or modification with the developing technology.
21. The artificial intelligence module shall be capable of collecting and classifying the data, making valuable data selection and performing a deep learning (self-learning) process.
22. The artificial intelligence module shall have minimum 2 TB (terabyte) internal and 50 TB external storage in order to perform all the relevant operations. The processor and display card shall be capable of processing the data. Considering that it will warm up a lot while performing the relevant operations, a cooling system shall be integrated to the system internally and externally. All the mentioned electrical or electronic components data will be combined in a wired or wireless way in a main control center, at this point it can be both controlled by manual buttons as well as PLC automation.
23. Greenhouse heating, cooling, ventilation, fogging, energy curtain opening / closing and fertilization processes will be done by PLC automation. In order for the automation to work properly, temperature, humidity, light, carbon dioxide and photosynthetic active radiation (PAR) sensors will be placed in each 1000 square meter area. In addition, a meteorology station will be placed outside the greenhouse. All automation materials, software and sensors will consist of internationally accepted products that are actively used in greenhouse cultivation.
24. Following the installation, the CONTRACTOR shall be liable to provide sufficient level of training with respect to the use of all machinery and equipment to the staff of the organization.
25. Heating of the greenhouse will be done with industrial water heaters based on the conversion of electrical energy to heat energy. 10 industrial type electric water heaters will be installed, 5 in the first phase (5 tunnel) and 5 in the second phase (additional 5 tunnel). Each individual heater will be placed in the greenhouse tunnel which needs to be heated. Each tunnel's heater should be controllable separately for the greenhouse and their working principles should allow to be controlled by the automation systems mentioned above. All communication connection will be made to these automation systems.

***Specifications of the Industrial Type Electric Heaters:***

- Each heater shall have a minimum capacity of 1000 litres.
- Each heater shall have the option to operate independently from each other.
- The user shall have the option to adjust the temperature between 30 - 90 °C.
- The thermosyphon shall work automatically with the digital thermostat and shall have a stainless inner tank.
- The electrical resistance power selection range shall be tree phase 9-240 kW.
- Shall be rock wool insulated.
- There shall be a safety thermostat against scalding.
- There shall be a safety valve against excessive pressure.
- Shall have cathodic corrosion protection.
- There shall be a liquid level relay against the burning of the resistances due to working without water.
- Silicone cables shall be used.
- Shall have an alarm system to operate in case of any emergency.
- Shall have flanged connection.
- Shall have a thermostatic safety valve.
- Shall have an overflow bowl.
- Shall have extra fixing apparatus.
- Shall have a panel cooling fan.
- Shall have circulation pump automation.
- Shall have 2-year warranty and 10-year service support at least.

**26. Solar Energy**

Due to the estimated electricity consumption for 10000 m<sup>2</sup> GREENHOUSE will be 41kw/h by making use of natural ventilation and circulation (Solar panels are not considered to be placed on greenhouse roofs, and will work with maximum efficiency since solar panels will be placed over administrative buildings), a Solar Energy System (GES) will be established using a solar panel produced with Monocrystalline-PERC (Passivated Emitter and Rear Cell) technology (architecture) that can generate DC electricity from at least 250 Watt / hour solar energy with a minimum performance ratio of 0.19.

***Technical specifications for the panels and inverters to be used:***

- Shall have the specification to reflect the light.
- The photovoltaic panels shall have warranty for 10 (ten) years at least in terms of product and physical strength and for 25 (twenty-five) years in terms of linear energy.

The linear energy warranty shall ensure at least 90% of the panel power at the end of 10 (ten) years and at least 80% at the end of 25 (twenty-five) years.

- The panels shall comply with TS EN 61215, TS EN 61730-1 and TS EN 61730-2 standards.
- The connection box of the panels shall be IP 65 protected at least.
- All panels shall be of the type and power specified in the project and panels of different models and powers shall not be used in the same system.
- The instantaneous power output tolerance of solar panels shall be within the range of 0-5w.
- The panel frames shall be pressed and punched as well. There shall be a drain hole, grounding hole and mounting holes on the frame. The frames mounted with bolts shall not be accepted.
- The frame shall be made of corrosion-resistant material and shall be stainless. The frame shall be assembled without any drilling etc.
- The glass/plastic covering the solar panels shall not reflect sunlight. The glass shall be tempered according to EN 12150 standards and shall have 92% permeability at least. The strength of the glass calculated according to EN 12150 standard shall be 90 N/mm<sup>2</sup>
- The solar panels and connection elements shall have resistance to 130 km/h or 2400 Pascal wind speed at least.
- The panels shall smoothly operate within a range of -40 °C to + 85 °C and at the height where the SES is to be built and at a relative humidity of 0 - 85%, and the conformity of the panels to the relevant conditions shall be guaranteed by the manufacturer in written.
- Inverter input voltage range should be kept wide (250V - 1000V).
- Shall be accessible from any portable device via standard Wi-Fi and shall be configured using the inverter interface.
- Shall meet the energy quality and safety requirements (islanding mode) of the mains;
- Shall have network support mode (reactive power support mode and etc.) to be requested by the network operators in the future.
- Shall have remote monitoring, display and communication features and shall be tracked locally or over the internet and shall provide data as web and graphics.
- The efficiency of the inverter to be selected shall be 99% and more.
- The total harmonic distortion of the inverter to be selected shall be 3% and less.

- The inverter to be selected shall have a nominal power factor of 0.995 and more. Additionally, it shall be adjustable within 0.95 capacitive and 0.95 inductive ranges according to the reactive power to be provided.
  - It will be provided with all interconnection cables and equipment that will be needed in the relevant SES system.
27. A minimum of 328 square meters of building roof and facade area (as indicated in the draft drawing annexed) will be allocated by the CONTRACTOR; In these areas, the company will fix the latest technology solar panels with the minimum performance values specified above with steel constructions and install them in the direction and angle that will use the sun most efficiently (in accordance with the instructions of the consultant assigned by GOAL Turkey and Adana Metropolitan Municipality).
28. In case of failure of panels receiving insufficient or excess photon energy; and in order not to adversely affect the system, power optimizers with a minimum value of 650 watts will be used, one for each solar panel.
29. The required amount of solar cables and solar connectors will be used depending on which area, building or roof the system will be installed on.
30. One [AC] collection panel shall be installed and the power generated from the panels will enter the inverters, and the power from the inverters will enter this panel to the AC collecting panel. In this process, all the necessary AC cables and connectors will be supplied and installed by the CONTRACTOR.
31. Two [DC / AC] inverters with a minimum value of 27.6 kW or inverter with multiple independent maximum power point tracker inputs shall be used.
- Shall be On-Grid (connected to the mains).
  - Shall convert the DC current obtained from solar energy panels into full sinusoidal AC current.
  - Shall be wired up to the main panels of the building and greenhouse with the AC cables required for use in the greenhouses and/or buildings.
  - If the electrical energy used in the greenhouses and/or buildings is more than the amount generated by the system, shall receive electricity from the mains and in

the contrary case, shall transmit the electrical energy to the mains in the forms and amounts permitted. In both cases, it shall instantly measure the electrical energy sold or purchased from the mains by means of the counters and report the total expenditures or the electrical energy sold (transmitted) to the system in kW at any time.

- Shall have EN 50438 certificate.
- Shall have LCD setting and configurable input voltage for home appliances and personal computers.
- Shall be compatible with the voltage of the mains or generator power.
- There shall be a circuit protection against Overload/Over Temperature/Short Circuit activating in 0.5 seconds maximum and afterwards, shall report the relevant situation as an error code to the automation devices to which the entire system is connected.
- Shall be accessible from any portable device via standard Wi-Fi and shall be configured using the inverter interface.
- Shall meet the energy quality and safety requirements (islanding mode) of the mains.
- Shall have network support mode (reactive power support mode and etc.) to be requested by the network operators in the future.
- Shall have remote monitoring, display and communication features and shall be tracked locally or over the internet and shall provide data as web and graphics.
- A station for measuring the atmospheric data shall be included in the SES as to support the future researches and developments. The data obtained shall be recorded and accessed remotely.
- Shall have 3 phase output.

32. In all cabling for solar energy system, aboveground cable ducts will be hot-dip galvanized cable trays which is suitable for heavy use. DC cables to be laid underground will be laid by passing through HDPE corrugated pipes in appropriate sizes. In addition, all cable channels will be made in accordance with "TEDAŞ / Electricity Distribution Networks / Energy Cables Installation (Application) Procedures and Principles".

33. LCD screen will be placed to monitor the SES system in the main control center for which the establishment conditions are specified in Article 38. Inverters will be installed in the structures where SES panels have been installed.
34. All project design, engineering and Turkish Electricity Distribution Corporation **TEDAŞ** /**EPDK** acceptance contracts and plans of the relevant SES shall be carried out by the CONTRACTOR.
35. If the connection agreement is approved as LV (Low Voltage) from Turkey TEDAŞ/EPDK, it shall be LV; but if not approved, the MV (Medium Voltage) revision shall be requested by the CONTRACTOR from TEDAŞ/EPDK and again all engineering, project design and TEDAŞ/EPDK acceptance procedures shall be carried out by the CONTRACTOR.
36. All transportation, installation, electrical and mechanical mounting of the SES mentioned above shall be carried out by the CONTRACTOR.
37. The relevant SES and all materials (cable, cable clips, connectors and etc.) to be used for the integration of the system to the building and greenhouses shall be supplied by the CONTRACTOR and their distribution to the buildings and greenhouses shall be made through the underground cable channels according to EPDK standards and regulations.
38. The CONTRACTOR will establish a Main Control Center with a total area of 15 square meters, 3 meters wide, 5 meters long and 2.65 meters height, outside the greenhouse for the automation of all these systems that need to be controlled and monitored from a single point. Main Control Center structure should be established in the outer area of the GREENHOUSE as Ready Structure or Prefabricated building type as the type of construction deemed appropriate by the CONTRACTOR.
- As 10 tunnel establishment will be planned in the two-stage construction design, although only 5 tunnels will be established in the first phase of the construction, the CONTRACTOR should ensure that Main Control Center has been positioned at mid-point of the 10 planned tunnels in the prepared design.
39. The CONTRACTOR shall comply with the Occupational Health and Safety Management System Standards of the Republic of Turkey.

40. The CONTRACTOR is liable to directly fulfil the conditions stated above as well as the conditions stated within the framework of the administrative specifications during the construction of the smart greenhouse system producing its own energy and also ensure the issues stated below:

- All panels shall have power supplies to be activated in case of power failure and ventilation or air conditioning as a precaution to heating.
- All cables and components shall be labelled according to the name given in the schema. The error code shall indicate the name of the sensor or cable. In case of any malfunction, the errors shall be easy to detect.
- The CONTRACTOR shall have access and intervene in the entire system with the permission of GOAL and Adana Metropolitan Municipality.
- The CONTRACTOR shall prepare a list of spare parts recommended for the equipment/system and periodically provide checklists for the system components.
- The CONTRACTOR shall submit the calibration procedure for all equipment used to GOAL and Adana Metropolitan Municipality.
- In case of any malfunction arising from the failure of the system, the COMPANY shall notify GOAL and Adana Metropolitan Municipality its authorized technical contact person as to consult and solve problems.
- The CONTRACTOR shall comply with the safety specifications and in terms of safety, the risk analysis of all machinery and equipment shall be conducted by the CONTRACTOR. The CONTRACTOR can have the audit done by a third-party company/institution which shall prepare the compliance report and sign it as the responsible party. The CONTRACTOR shall take the necessary safety measures according to the relevant analyses and reports. The CONTRACTOR shall also notify GOAL and Adana Metropolitan Municipality about the signboards to be hung.
- The mechanical, mounting, electrical, pneumatic, lubrication, foundation and conditions and schematic drawings of the facility shall be submitted to GOAL and Adana Metropolitan Municipality within two weeks as of the signing of the agreement. The relevant presentations shall include the items listed below:
  - A hard copy of each drawing

- An electronic copy of each drawing in DWG format (ACAD compatible).
  - A specially designed system, fixture and etc. shall be fully comprehensive and become the intellectual property of GOAL.
  - The List of Consumables and Spare Parts required for two years of operation and standard maintenance (if possible, the file format shall be presented both in .xls and .pdf). The relevant list shall include the recommended suppliers and current pricing as well as delivery times. A spare part offer shall be attached to the final offer as an option.
  - Each interface and document shall be submitted to GOAL in Turkish by the CONTRACTOR (Touch screens, reports and etc.)
  - The software files shall be submitted to GOAL in full and in the format of CD or external disk by the CONTRACTOR.
  - Every machinery, equipment, and component to be used in the systems mentioned above by the CONTRACTOR shall have CE declaration. Any non-conformity with CE should be made up immediately under the responsibility of CONTRACTOR.
- Upon the installation of the Entire System or intermediate systems by the CONTRACTOR, GOAL and Adana Metropolitan Municipality shall carry out the final tests together with the current supplier representatives. If the test is deemed successful, the supplier representatives shall train GOAL and Adana Metropolitan Municipality personnel.
  - Before the training, the list of periodical checks related to the system shall be submitted to GOAL and Adana Metropolitan Municipality;
  - In case of failure to complete any of the issues in the timeline according to the schedule, GOAL shall be immediately notified.
  - All deliveries within the framework of the system shall be made by the CONTRACTOR after being confirmed;
  - In case of a SUBCONTRACTOR, the installation costs such as the time and expenses of the SUBCONTRACTORS including but not limited to the travel costs shall be covered by the CONTRACTOR;
  - The CONTRACTOR shall cover all costs related to the installation inspection;
  - The CONTRACTOR shall cover all risks directly related to the installation under the scope of its own insurance;

- A training session shall be held during pre-acceptance. The training session shall be held with the participation of the project manager/process engineer and possibly the production manager and a maintenance staff. The training session shall include general operation, maintenance, minor repair and troubleshooting of the equipment. The session shall be primarily for the operator and include operation and minor troubleshooting;
- Following the installation, the training documents shall be prepared by the CONTRACTOR and delivered to GOAL and Adana Metropolitan Municipality;
- The CONTRACTOR shall assign a main point of contact (a project manager). The relevant contact shall directly communicate with the project leader of GOAL and Adana Metropolitan Municipality as to provide the project updates;
- The comprehensive technical specifications are the priority. In case of any conflict, the comprehensive specifications shall be complied. The project manager of GOAL and Adana Metropolitan Municipality shall list all exceptions and confirm in writing in the form of a document to be signed by both parties. The supplier shall present the relevant lists of exceptions (one for each General and Comprehensive Specifications) in the offer as separate pages;
- During the warranty period, the CONTRACTOR (not the component supplier) shall be responsible (free of charge) for the prompt repair or replacement of the defective material including but not limited to the parts and labour/travel costs. In case of the failure of the employee of GOAL to correct the problem on the phone, the supplier technicians shall be provided on-site by the CONTRACTOR to correct the problem within 48 hours at supplier's own cost;
- The CONTRACTOR shall be responsible for finding a solution to the problem or supplying spare parts within 48 hours for a fee outside the warranty period;
- Any machine problem interrupting the production shall be displayed on the control panel as an error code;
- The alarms and system interruption control shall be provided to prevent unwanted system operation;
- The price offer for all Equipment shall include the equipment price, delivery schedule and exceptions to the specifications;
- The CONTRACTOR shall comply with the New Machinery Directive 2006/42/EC entered into force on December 29, 2009 as well as, Low Voltage Directive 2006/95/EC and Electromagnetic Compatibility Directive 2004/108/EC.

***New Machinery Directive 2006/42/EC:***

- In general, the Directive determines the free trade conditions for machines, interchangeable equipment, safety components, chains, ropes and unfinished machinery.
- The following points are very important for any type of machine project and form the basis of the involvement of the project manager during the target planning, pre-acceptance and final acceptance:
  - a) The risk assessment obligation of the manufacturer,
  - b) CE mark and declaration of conformity of the manufacturer,
  - c) Providing the user manual and
  - d) Sequence of the protective measures (elimination of the risks by means of design).
- The Low Voltage Directive and Machinery Directive do not compete. In case of a risk, the assessment indicates a higher electrical risk and afterwards, the Low Voltage Directive shall be implemented or vice versa. The electromagnetic compatibility always requires implementation;
- The Facility/Machine shall have CE mark. The supplier company shall take all necessary precautions. The issues not specified in the specifications are the basic reference point of CE standards. The declaration of conformity and risk analysis result report shall be attached to the file;
- All components used in the system shall primarily be guaranteed by the SUBCONTRACTOR who the component has been purchased from by the CONTRACTOR
- All suppliers of the spare parts, order codes, quantities, specifications, sizes, hardness and etc. shall be defined in the list of spare parts;
- All preventive and planned maintenance activities shall be listed and scheduled on a timetable for a period of 10 years. The replacement periods and active replacement times of the critical spare parts shall be listed;
- The access to all parts shall be easy for the autonomous and planned maintenance activities. The designing shall be in such a way that fewer parts (time saving) are removed during the maintenance activities;

- All filters, seals, O-rings and etc. required to be changed periodically shall be demonstrated in the drawings and coded appropriately. The replacement and cleaning periods shall be specified in a list;
  - The sections within the safe working limits shall be specified in green colour while the extreme values shall be specified in red colour;
  - All definitions, instructions and labels on the machinery, equipment and components shall be in Turkish language;
  - The start-up instructions, autonomous maintenance instructions, periodic maintenance instructions, diagnostic feedback as well as troubleshooting and repair instructions shall be prepared and submitted in triple electronic and hard copy;
  - All operating pressures shall be displayed on the machine;
  - There shall be a flow meter or indicators on the inlet and outlet of the system in order to measure the heat, gas, oil, water and all other liquid consumptions;
  - The SUBCONTRACTOR shall guarantee the supply of spare parts and service for at least 10 years;
  - The chains, gears, belts, reducers and other transmission systems shall be closed securely; however, all shall be visible to the naked eye for control;
  - For systems with intense lubrication periods, there shall be self-lubricating systems, whether automatic or manual;
  - The sustainability of the system shall be taken into consideration in the designing phase of the project and optimal design solutions shall be provided;
  - The control areas shall be visualized;
  - The rotation direction of the engines and inlet and outlet directions of all pipelines shall be labelled. The colours shall be selected as red for hot water lines, blue for cold water lines and black for returning arrows and
- The mounting of the panels and field shall be made according to the standards mentioned below:
    - Energy feeding for phases 400 volt, phase neutr 230 volt AC, 50 Hz
    - The power supply between the phases shall be 400 volts and neutral phase shall be 230 volts AC, 50 Hz.
    - The Machine/Equipment shall have CE mark. The supplier company shall take all necessary precautions. The issues not specified in the specification are the basic reference

point of CE standards. The declaration of conformity and risk analysis result reports shall be attached to the file.

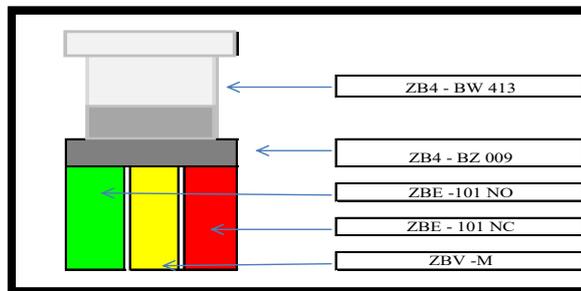
- The machine shall be designed in accordance with the 2006/42/EC AT (machine directives), 2004/108/EC EMC (electromagnetic compatibility) and 2006/95/EC LVD (low voltage directive).
- Unless otherwise specified, the power and control cabinets shall be mounted either on the floor or on the wall depending on the usage;
  - IP55 Safety class
  - DKP plate product
  - Electrostatic powder paint shall be used.
- The Electricity panel shall include the appropriate black and yellow colour labels indicating the voltage level and lightning flash as shown below.
- The wall cabinets shall be made of 1.5 mm thick sheet metal and the mounting plate shall be galvanized. The floor cabinets shall be made of 2 mm thick sheet metal and the mounting plate shall be galvanized.
- When required, the cabinets smaller than 40 \* 60 cm may be made of polyester.
- In each independent cabinet, there shall be a separate main switch for power supply and protection fuse for short current.
- Every machine/equipment with an installed power of 10 kw or more shall have an Entes MPR63 type, electronic, three-phase electricity meter and the pulse ends shall be connected to the terminals.
- When distributing the bars in the cabinet, they shall be labelled as stated below:
  - L1 bar shall be red, L2 bar yellow, L3 bar purple and Neutral bar white;
  - The insulated bars shall be labelled and the labels shall be 2 cm wide;
  - The vertical mounting bars from left to right shall be L1, L2, L3 and neutral from front to back and horizontal mounting shall be L1, L2 and L3;
  - The grounding bars shall be 5 cm wide and yellow-green striped and the grounding symbol shall be demonstrated;
  - The bars shall be covered with plexiglass against contact by unauthorized persons;
  - On the plexiglass cover, there shall be a standard voltage label showing the voltage level and
  - When required, the phase numbering relays shall be available.

- The black wire shall match with L1, brown with L2, black with L3, and yellow-green with grounding at the inlet of the main wire.
- The main grounding wire shall be cabled with an insulate outer cable in yellow-green colour up to a cross section of 70 mm<sup>2</sup> while a grounding rope shall be used in sections higher than 70 mm<sup>2</sup>.
- The neutral and grounding lines shall never come together.
- The grounding terminals shall be in the standard norms in the cabinet and all peripheral equipment shall be grounded.
- All cable colours in the cabinet shall meet the standards in terms of colour and insulation. "Unit E - displays the electrical circuit wiring colours".
- There shall be a phase separation between the phase plates in the terminal connections; the end plates shall be located at the end of the groups. The terminals shall be numbered and the relevant numbers shall be written on the circuit diagram.
- The power components and control components (PLC, converter and etc.) shall be installed in separate sections in the cabinet and EMC protection shall be successful.
- The interior cooling shall be performed by means of ventilation through the fans in wall cabinets. The cabinets fixed to the floor shall be cooled and shall meet the heat flow requirement. If AC is not mounted in the first installation, GOAL shall reserve the right to have the supplier install the AC when required later on.
- The lighting shall start automatically when the door is opened in floor cabinets.
- The control cabinets shall be designed with a 25% back-up space for other needs.
- The rail mounted mono-phase Turkish standard sockets fed with a separate fuse shall be used.
- The control circuit shall be designed for 24 VDC.
- All AC motors shall be protected by circuit breakers as a standard.
- AC motor drivers shall be filter-supply.
- All cables shall be selected as h: 6cm or h: 4cm according to the duct and all ducts shall be closed.

- The cables in the rollover paths shall be protected by interlocking fittings and spiral cable hoses.
- All cable ends shall be insulated with cord end terminal.
- All screw connections shall be fitted with washer;
- All end effectors shall be labelled at both ends and the labelling shall be the same as shown in the schema.
- The standard AC motors cable connections shall be 4X2,5 mm<sup>2</sup> Fvv-n and speed control motor connections shall be 4X2,5 mm<sup>2</sup> EMC shielded cables.
- All sensor types (photocells, inductive sensors and limit switches) shall be protected against crashes, jams and knocks.
- All sensor types shall have plug connections.
- All valve and sensor sockets shall have LED indicators.
- There shall be enough emergency stop buttons meeting the Turkish safety rules (with labels of "Emergency Stop").
- All security equipment (e-stops, fence switches, light barriers and etc.) shall meet the safety standards and norms.
- The labels on the cabinets and peripheral equipment shall correspond to the schema and all schemas shall be updated due to the revisions.
- When required, the distribution box shall only be used in accordance with IP66 norms and all connections shall be made with terminals
- I/O units shall be as shown below as to be more visual.



- The validation buttons for the lines shall be as shown below and the lamp shall be green.



- Special attention shall be paid to sudden impacts for the moving parts connected with cables.
- The entire project shall be carried by focusing on sustainability. GOAL reserves the right to have the supplier company make the requested changes free of charge until the pre-acceptance date.
- There shall be audible warnings and light status indicators and mode switches on the cabin (Telemecanique XVB series).
- The cables on the stationary side of the facility shall be laid on a rollover path and the cable on the mobile side shall be protected by hoses and interlocked fittings as shown below.



***Wrong******Right***

- There shall be 15% extra free I/O space for PLC implementations.
- The SUBCONTRACTOR shall present the electrical schemas in three copies as hard and soft. The electrical projects shall include the items listed below:
  - Outer dimensions of the cabinet,
  - Power circuit schema,
  - Cabinet scheme (terminals, all equipment shown in relay and layout form),
  - Control circuit schema,
  - Terminal plans,
  - Power plant electrical scheme,
  - Locations of end effectors, actuators and sensors I/O,
  - List of spare parts defining the details and order codes,
  - Installation instructions,
  - List of spare parts,
  - CE declaration,
  - Risk analysis report,
  - 10-year timetable for the planned maintenance and
  - Autonomous maintenance periods and regions.
- All programs and parameters shall be presented to the maintenance department as soft copies on DVD. All programming shall be open source; there shall not be any party in the program specifically or totally blocked.
- The facility/machine shall be designed based on the margin of energy efficiency.
- The documentation shall consist of the items listed below:
  - The tree schema of the components shall be prepared as to demonstrate the "sub-facilities, sub-stations and sub-components";
  - The electrical, pneumatic and hydraulic circuit schemas shall be prepared both in printed and electronic copies. (Electrical schemas shall be both in ".pdf" and "e-plan project" formats);
  - In case "vector" drive is to be used in AC motor drives, there shall be the relevant scope showing the Speed-Scope curves including the entire cycle within a single

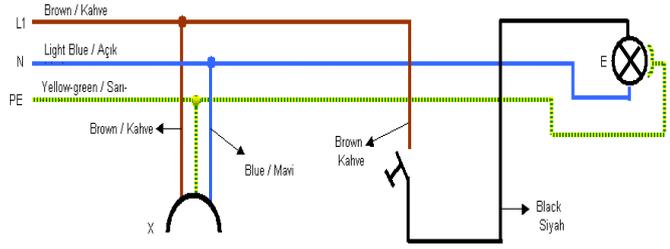
scope. It shall be considered that the relevant system does not exceed 150% of the motor nominal current for the relevant drive conditions;

- A list of required parts and their periods shall be prepared periodically and
  - A list of the points required to be checked periodically and their norm values (location, temperature and etc.) and their timelines shall be prepared. All checkpoints shall be visualized according to the concern of TPM.
- The machine operating training for the operators and machine/facility maintenance and installation training for the maintenance technicians shall be provided and all necessary documentation shall be prepared as a part of the project acceptance term.
- The button colors required to be used in the cabinets and control boxes shall be as shown in the below schemas:

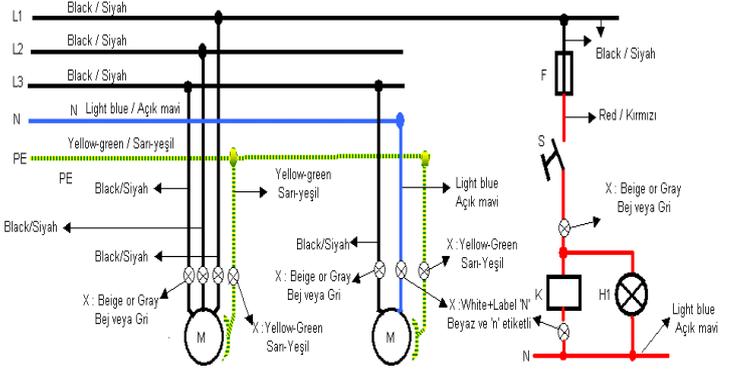
BUTTON COLORS USED ON BOARDS PANOLARDA KULLANILAN BUTONLARIN RENKLERİ	
Button type Buton tipi	Color Renk
Start	Green Yeşil
Stop	Red Kırmızı
Emergency stop (w. yellow label) Acil stop (sarı etiketli)	Red on yellow back ground Sarı etiket üzerinde kırmızı renk
RESET included stop function RESET (Stop fonksiyonlu)	Red Kırmızı
RESET excluded stop function RESET (Stop fonksiyonsuz)	White or blue Beyaz veya Mavi
Other function buttons Diğer fonksiyon butonları	Black or white Siyah veya beyaz

SIGNAL LAMP COLORS ON BOARDS (-IEC73-) PANOLARDA İKAZ LAMBALARI RENKLERİ (-IEC73-)	
Color Renk	Meaning Anlam
Red Kırmızı	Alarm (Urgent action warning) Alarm (Acil durum veya hareket uyarısı)
Yellow Sarı	Attention (Stuation warning just before alarm) Dikkat (Henüz alarma geçmemiş durum uyarısı)
Green Yeşil	Safe+Normal operation Emniyet ve normal operasyon
Blue Mavi	Special information Özel durum/işlev veya bilgi uyarısı
White Beyaz	Other information Diğer durumlar/işlev veya bilgilerin uyarıları

CABLE COLORS AT 230 V CONTROL CIRCUITS				
Symbols and definitions Semboller ve tanımlar	L1 : Phase 1	L2 : Phase 2	L3 : Phase 3	N / Notr
Cable colors Kablo renkleri	Red Kırmızı	Red Kırmızı	Red Kırmızı	Blue Mavi
Terminal colors Klemens renkleri	Beige or Gray Bej veya Gri	Beige or Gray Bej veya Gri	Beige or Gray Bej veya Gri	White with label 'N' Beyaz ve 'N' etiketli



1 PHASE SYSTEMS AT HOMES  
EVLERDE 1 FAZLI SİSTEMLER



3 PHASE SYSTEMS  
3 FAZLI SİSTEMLER

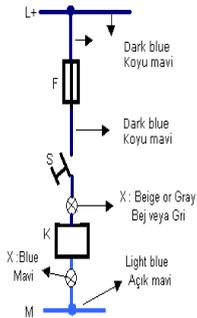
1 PHASE SYSTEMS  
1 FAZLI SİSTEMLER

230 V. AC. CONTROL CIRCUITS  
230 V. AC. KUMANDA DEVRELERİ

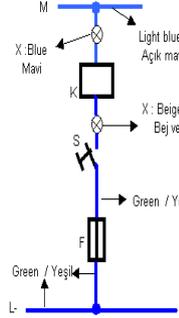
SIGNAL LAMP COLORS ON BOARDS (IEC73) PANOLARDA İKAZ LAMBALARI RENKLERİ (IEC73)	
Color Renk	Meaning Anlam
Red Kırmızı	Alarm (Urgent action warning) Alarm (Acil durum veya hareket uyarısı)
Yellow Sarı	Attention (Situation warning just before alarm) Dikkat (Henüz ala)
Green Yeşil	Safe+Normal operation Emniyet ve normal operasyon
Blue Mavi	Special information Özel durum/ışlev veya bilgi uyarısı
White Beyaz	Other information Diğer durumlar/ışlev veya bilgilerin uyarıları

BUTTON COLORS USED ON BOARDS PANOLARDA KULLANILAN BUTONLARIN	
Button type Buton tipi	Color Renk
Start	Green Yeşil
Stop	Red Kırmızı
Emergency stop (w. yellow label) Acil stop (sarı etiketli)	Red on yellow back ground Beyaz veya mavi
RESET included stop function RESET (Stop fonksiyonlu)	Red Kırmızı
RESET excluded stop function RESET (Stop fonksiyonsuz)	White or blue Beyaz veya mavi
Other function buttons Diğer fonksiyon butonları	Black or white Siyah veya beyaz

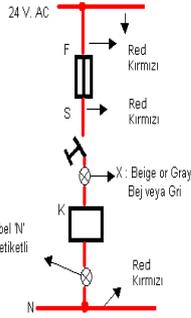
24 V. DC.			24 V. AC.		
Symbols Semboller	L+ +24 V.	M Common end Ortak uç	L- -24 V.	24 V. AC.	N / Notr
Cable colors Kablo renkleri	Brown Kahve	Light blue Açık mavi	Green Yeşil	Gray/Gri	Light blue Açık mavi
Terminal colors Klemens renkleri	Beige or gray Bej veya gri	Blue Mavi	Beige or gray Bej veya gri	Beige or gray Bej veya gri	White + label 'N' Beyaz ve 'N' etiketli



24 V. DC CIRCUITS  
24 V. DC DEVRELERİ



-24 V. DC CIRCUITS  
-24 V. DC DEVRELERİ



24 V. AC CIRCUITS  
24 V. AC DEVRELERİ

