



**AGRISOVGAZ**  
GROUP OF COMPANIES

## GREENHOUSE COMPLEXES

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GREENHOUSE STRUCTURES  
AND UTILITY EQUIPMENT SYSTEMS

GREENHOUSE AND GREENHOUSE  
COMPLEX ENGINEERING





# GREENHOUSE COMPLEXES

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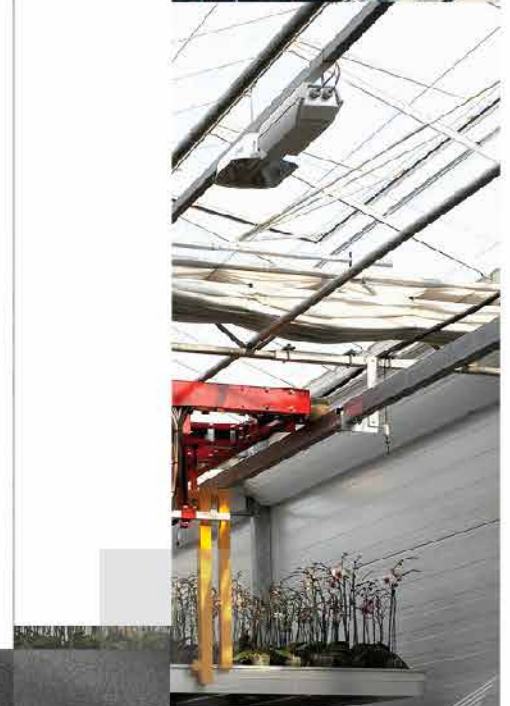
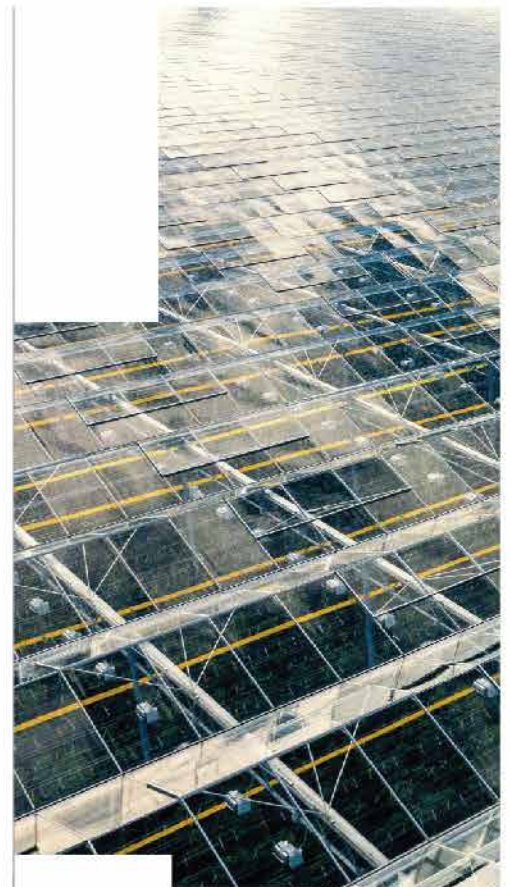
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**ASG**  
**Fe** steel  
construction





FRESH VEGETABLES  
FROM RUSSIA  
ALL YEAR ROUND!



125 thous. m<sup>2</sup> TOTAL AREA

240 thous. tons OF PRODUCTS PER YEAR

1600 EMPLOYEES

7 AGRISOVGAZ LLC was founded in 1990 as a joint Soviet and Dutch enterprise to produce structures and systems and to construct the industrial greenhouse complexes.

The company is a specialized Russian manufacturer of industrial, farm and garden greenhouses. The engineering, technological and production base of Agrisovgaz LLC enables the production of all types of metal structures and systems for industrial complexes such as VENLO of the 4th and 5th generations.

## THE COMPANY EQUIPS THE GREENHOUSE COMPLEXES WITH:

- ✦ the microclimatic cell with adiabatic system;
- ✦ the system of assimilation lighting (supplementary lighting);
- ✦ the small window ventilation and phytoprotection system;
- ✦ the nutrient solution preparation and drip watering system;
- ✦ the system of transformable curtain screens;
- ✦ the climate control systems;
- ✦ the heating system;
- ✦ the boiler and generating equipment as a part of power park;
- ✦ the evaporation and additional moistening system;
- ✦ the power supply systems;
- ✦ the system of growing different types of photocultures;
- ✦ the small-scale mechanization equipment;
- ✦ the system of growing seedlings and herbaceous crops;
- ✦ the administration and amenity buildings.



## TERRITORY OF VALUE-ENHANCING INVESTMENTS



### WHY CUSTOMERS CHOOSE US

The policy of our company is to use only optimal, advanced project, engineering and technological solutions. This is what enables a significant reduction in investment expenditures and efficient use thereof.

Structures, equipment and systems that are produced and used by our company allow you to get the guaranteed harvest with minimum consumption of energy, water and material resources.

1

AGRISOVGAZ is the largest domestic manufacturer of industrial greenhouses using the Dutch technologies, which are fully adapted to operation in all climatic zones.

2

We have developed the microclimatic cell allowing the creation of unique conditions in the greenhouse in any climatic zone.

3

We help investors in developing the prospective, high-yield business and ensure the full-fledged project support.

4

You may select the required package of options and create your own unique greenhouse.

5

At your request, we will provide the greenhouse complexes with planting stock, substrate and process inventory and will arrange training for the personnel.

## COMPREHENSIVE SUPPORT IN GREENHOUSE COMPLEXES CONSTRUCTION



AGRISOVGAZ is the leading manufacturer and integrator of greenhouse complexes of the 4th and 5th generations, that performs all types of works connected with project concept development, preliminary calculation, designing, construction, installation, start-up and adjustment of the greenhouse complex and power park.

The company production capacity is based on three enterprises — the structural aluminum plant, the steelworks plant and the hot galvanizing plant; their technical capabilities cover the full cycle of production of the greenhouse structures and systems of any size and configuration.





## FROM IDEA TO HARVEST



AGRISOVGAZ acts as a system coordinator for the agroindustrial construction of greenhouse complexes; it pools together the research and production resources of the industry.

Our partners are institutions of the Russian Academy of Agricultural Sciences, large Russian banks and manufacturers of engineering and process equipment.

The advanced technologies require highly qualified specialists with knowledge in the field of crop agronomy, climate control, plant protection and nutrition, and engineering production management. Within its walls AGRISOVGAZ gathered the best specialists in greenhouse engineering: designers, project support managers, engineers, builders and power engineers. The greenhouse sector staff has extensive experience in implementation of various large and successful projects in the Russian greenhouse industry.

**WE UNITE EXPERIENCE AND TECHNOLOGIES FOR THE SAKE OF SUCCESSFUL IMPLEMENTATION OF THE IMPORT SUBSTITUTION PROGRAMS AND FOOD SECURITY OF RUSSIA.**





# CONSTRUCTION SCHEDULE

# > 30%

OF THE GREENHOUSE COMPLEXES IN THE RUSSIAN FEDERATION WERE BUILT USING THE COMPANY'S STRUCTURES



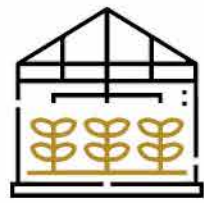
## STAGE-BY-STAGE CONSTRUCTION SCHEDULE



## GREENHOUSE COMPLEX COMPOSITION

- 1 Production greenhouses and blocks of greenhouses with seedling sections
- 2 Power parks with power generation by gas powered electrical generator
- 3 Multifunctional logistics centre
- 4 Warehouses for fertilizers and agricultural materials
- 5 Biolaboratory
- 6 Artesian wells





- 7 Emergency hot water tanks
- 8 Boiler room
- 9 Service units
- 10 Storage pond



## DESIGN AND FRAME

INDUSTRIAL GREENHOUSES MADE BY AGRISOVGAZ ARE OF VENLO TYPE IN MULTISPAN (MODULAR) DESIGN

### SUPPORTING FRAME

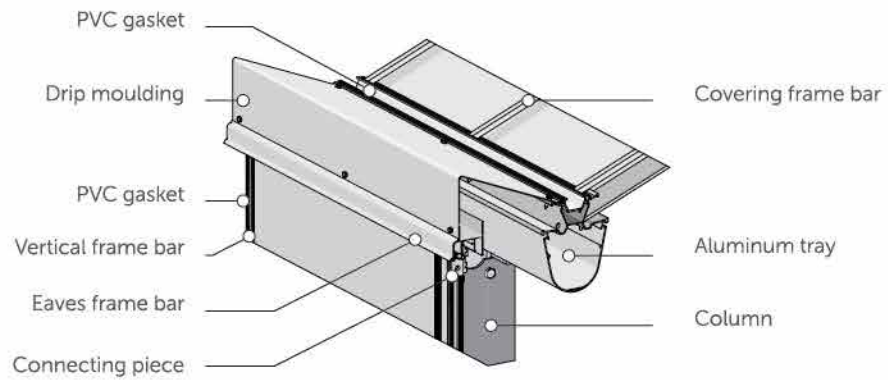
The supporting frame is produced with different span width and column height; it is made with the use of steel structures with anticorrosion protection by hot galvanizing and painted white for better light reflection.

Span width: 4; 6,4; 8; 9,6; 12; 12,8 and 16 meters.

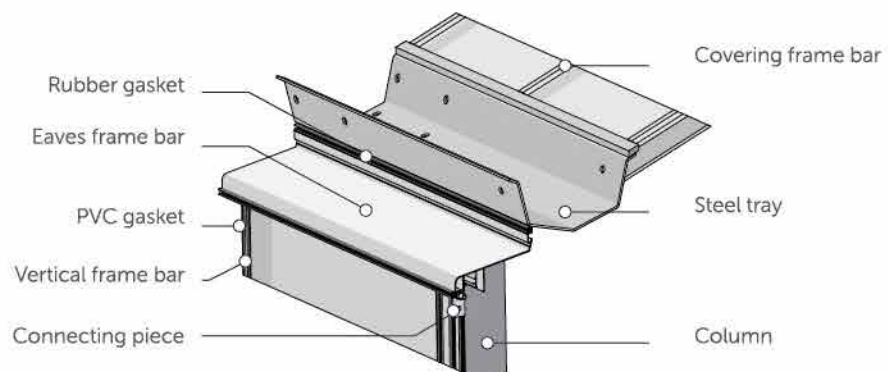
Frame column height: 4,5; 5; 6; 6,5; 7 meters and above, with the spacing of 4; 4,5 and 5 meters between regular frame columns on metal foundation posts

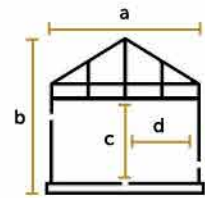
The roof tray can be made of steel and aluminum.

#### Aluminum tray diagram



#### Steel tray diagram





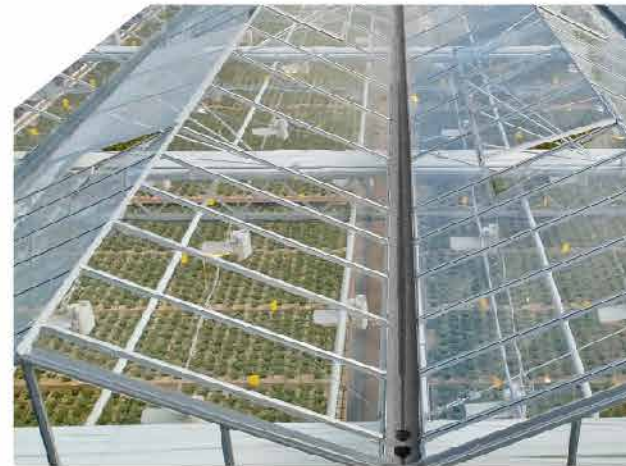
Frame columns are installed on metal posts in bored foundation.

The structure of VENLO type greenhouses for construction in Russia and for foreign countries is produced in several modifications adapted to requirements of the national standards in the field of construction of protected ground structures.

## ENCLOSING STRUCTURES

Include vertical, horizontal, sill and roof frame bars and small windows (with the option of mosquito net installation) made of aluminum alloys of construction grade using the extrusion method. The design of vertical and roof enclosure provides for PVC profiles used to pack the joints between the glass and frame bars.

Double trays are used for more efficient collection and diversion of waste water.



## COVERING

Both glass and polymeric sheet covering may be used for a greenhouse. The glass joints are packed with weatherproof rubber or clamping PVC profiles of polycarbonate on vertical walls — the prefabricated connectors.





## ALUMINUM DOOR AND GATES

All greenhouses are equipped with aluminum doors and gates for the passage of personnel and equipment

Standard gates dimensions are 3,000 x 3,000 mm; the gates can be suspended, sliding, with or without a wicket door. At customer's request, the gates may be of different size in compliance with requirements of the production technology used in greenhouses.

The greenhouse walls and corridors may also be equipped with lifting steel shutters having manual and electric drive (automatic where necessary) or with the required openings for the above gate.

The doors are equipped with handles, brushes on movable sections of the framing, rubber gaskets along the joints. In standard modification, the external doors are supplied with locks.

For the purpose of designing the metal frames for greenhouse structures, we use the SCAD Office certified licensed software by SCAD SOFT LLC, Moscow.

All basic versions of VENLO greenhouses manufactured at the enterprise are developed according to requirements of regulatory documents:

- ▼ SP 20.13330.2011 Loads and Impacts
- ▼ SP 16.1333.2013 Aluminum Structures
- ▼ SP 16.1333.2011 Steel Structures
- ▼ SP 107.13330.2012 Greenhouses and Hothouses

The stability of the frame metal structures in each specific case for a construction site located in the corresponding climatic region is determined taking into account the engineering surveys of the site.

## SERVICE LIFE

**30** years

of steel galvanized and aluminum structures of the supporting frame and enclosure of the greenhouses is at least.

**25** years

of rubber and PVC profiles in packing is at least



## CURTAIN SYSTEMS



Are used to reduce the heat losses and to shade the plants in hot periods as well as to control humidity.

The structures may be equipped with two horizontal screens with rack or rope system for screen opening and closing

Vertical screens are produced either with a light-reflecting screen (for greenhouses with artificial lighting for plants) or as energy-saving screens.

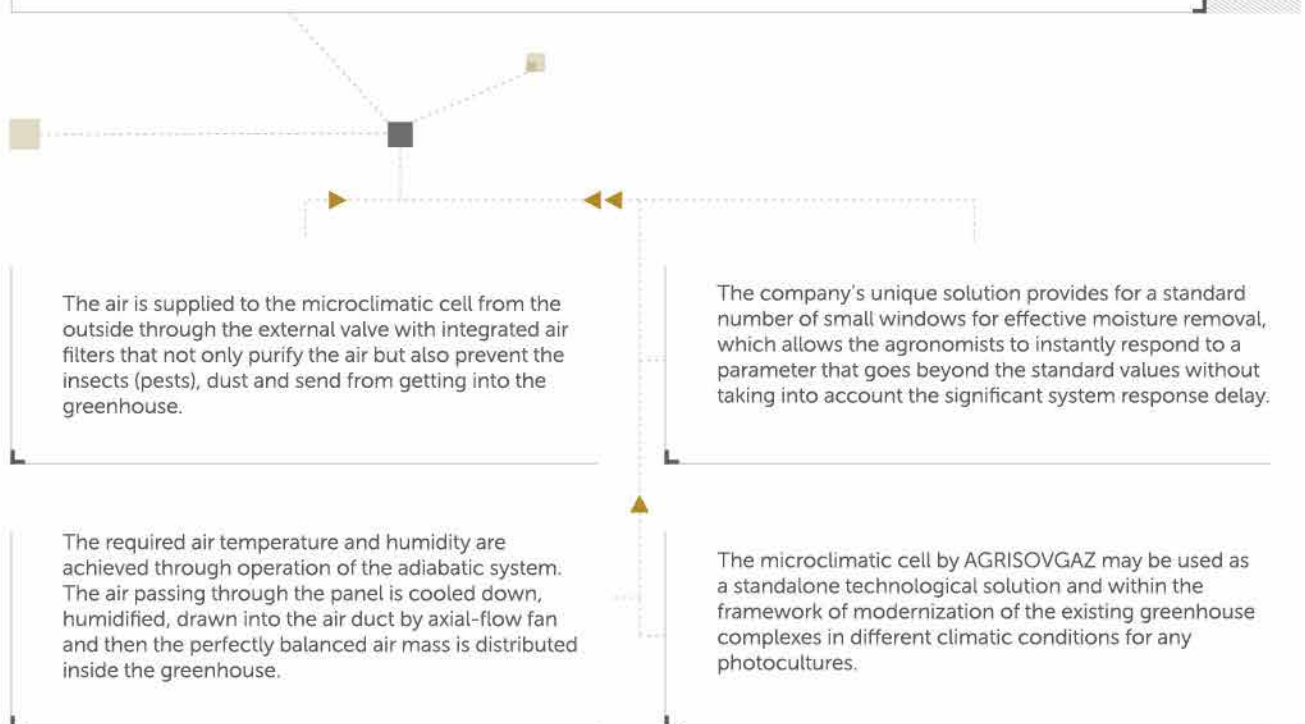


## MICROCLIMATIC CELL

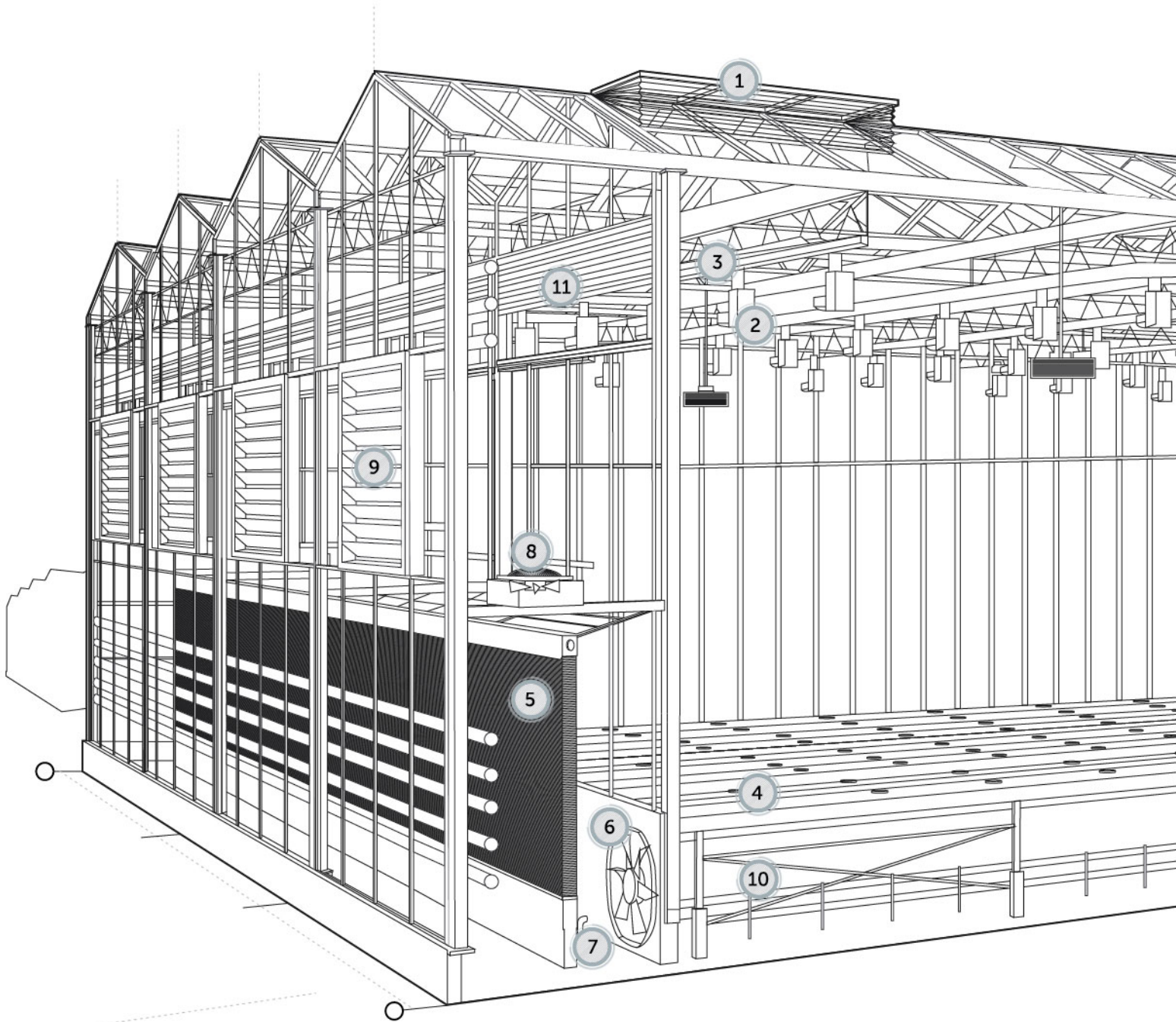
AS OF TODAY, AGRISOVGAZ OFFERS THE DEVELOPMENT OF OWN SYSTEM FOR CLIMATE CONTROL WITH THE HELP OF SPECIAL SECTION IN THE GREENHOUSE COMPLEX — THE MICROCLIMATIC CELL.

### THE MAIN ADVANTAGE AS COMPARED TO THE 4TH GENERATION GREENHOUSES

is the closed loop of air recirculation inside the hothouse unit, which results in efficient energy saving and precise control of temperature and humidity parameters inside the greenhouse.







- 1 Small window ventilation
  - 2 Artificial lighting system
  - 3 Horizontal curtain system
- 4 Tray for cultivation
  - 5 Adiabatic panel of pad and fan cooling
  - 6 Axial-flow fan of air duct
  - 7 Carbon dioxide controller
- 8 Air-heating fan
  - 9 External valve for air intake
  - 10 Perforated air duct
  - 11 Guillotine curtain

## SMALL WINDOW VENTILATION SYSTEM



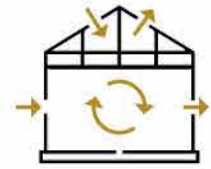
The small window ventilation system of industrial greenhouses is designed for natural exchange of the greenhouse enclosed air volume and the outside air through the vents in the roof of the transparent enclosure for the 4th generation complexes.

The opening is ensured automatically and remotely. The small window links for opening are attached to a galvanized tube, which moves in holders along the upper rail of the truss. For the projects we mainly use drives, gear boxes and chain couplings produced by RIDDER (Netherlands) or those of own production.

The total area of vents in the greenhouse roof is 24% of the greenhouse area. The small window opening angle is 41°.

This area of vents ensures the entry of the necessary volume of outside air into the greenhouse to maintain the optimal temperature parameters during the periods of excessive solar insolation.

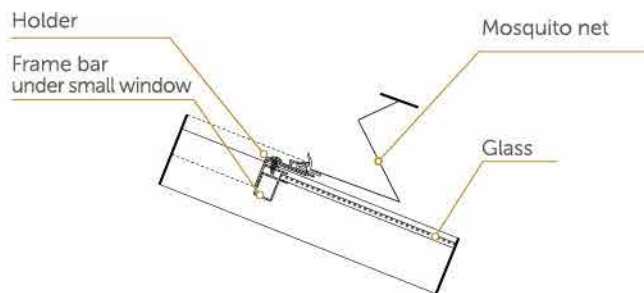
The design of opening and closing mechanism of the greenhouse small windows with a drive ensures their simultaneous lifting or lowering over the entire area of each climatic zone; the allocation of zones is carried out taking into account the provision of uniform microclimate parameters in the controlled volume. The small windows have a rack, push and pull opening system.



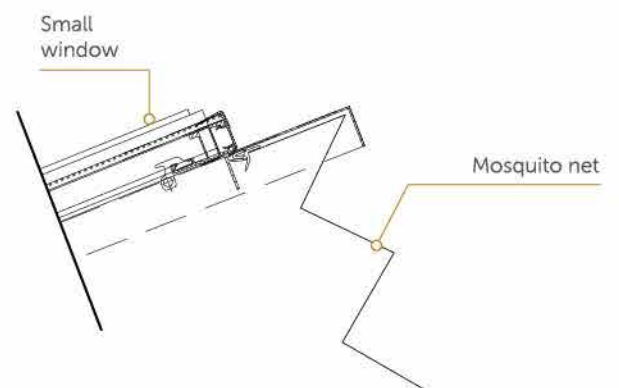
## SYSTEM OF ALUMINUM PROFILES FOR INSTALLATION OF MOSQUITO NETS ON SMALL WINDOW VENTILATION SYSTEM OF VENLO GREENHOUSES

The system is fully adapted to a standard roof, which became possible due to the development of new profiles and small windows. This enables easy installation of cassette-type mosquito nets with different cell size.

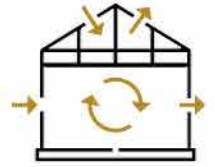
Bottom and side holder attached to the frame bar under the small window and covering frame bar.



Mosquito net holder being a part of the small window structure



## SMALL WINDOW VENTILATION SYSTEM



The holder has a box shape, which, when the small window is closed, allows the mosquito net to be protected from precipitation and atmospheric influences. For normal operation of the small windows and adaptation to the existing roof, a new ridgy frame bar was developed.

The installation of mosquito nets on small windows of the production greenhouses — vegetable, seedling, flower, bio-greenhouses etc. — prevents flying pests from entering into the cultivation volume, occupied by phytocoenosis. In summer, pest populations (in particular, whiteflies and aphides) can form on wild plants. If they get into a greenhouse, they cause significant damage to cultivated plants, reducing their productivity and marketable yields.

The installation of mosquito nets on small windows in greenhouses of production bio-laboratories that use in the production process the uterine populations of harmful flying and crawling insects and mites, prevents them from entering through the window openings outside the bio-greenhouses into the territory of greenhouse enterprises and further into production greenhouses.

The mosquito nets are also very efficient on small windows of research, selection and demonstration greenhouses, in which, due to the specifics of production, the technological process must be reliably isolated from the environment so that flying insects could not get into or out of the greenhouses.

Equipping the industrial greenhouses with small windows of a special design that allows the installation of cassette-type mosquito nets is a reliable method of protecting plants from harmful flying insects in open ground and isolating the environment from similar pathogenic sources that are the product of technological processes in greenhouses.



## GREENHOUSE CLIMATE CONTROL SYSTEM



**THE SYSTEMS FOR WATERING AND SUPPLYING NUTRIENTS TO PLANTS USING THE SOLUTIONS OF MINERAL FERTILIZERS** in greenhouses are applied depending on the technology for the production of plant products adopted for a particular facility: by the method of low-volume hydroponics, on the soil, on hydroponic tables, on hanging or support trays, on lettuce lines, for main or backup irrigation.

1

REVERSE DRAINAGE AND NUTRIENT SOLUTION  
DISINFECTION SYSTEM

2

IRRIGATION SYSTEM

3

PAD AND FAN COOLING  
AND HUMIDIFICATION SYSTEM

## GREENHOUSE CLIMATE CONTROL SYSTEM

### REVERSE DRAINAGE AND NUTRIENT SOLUTION DISINFECTION SYSTEM

A constructive addition (option) to a modern system for watering plants in greenhouses, which is designed to save water and mineral fertilizers, to reduce the discharge of polluted effluents and improve the environmental friendliness of greenhouse production. Drainage effluents from drip irrigation of plants (up to 40% of the outflow) flow by gravity through the collector system into an intermediate tank; and then, under pressure, into the storage tanks of fertigation and irrigation units. Then — through thermal and/or UV disinfectors — into the storage tanks of the fertigation and irrigation units, after which — again as an additive (up to 40%) to a fresh solution of mineral fertilizers — into the mixer for preparing nutrient solutions and then back to the greenhouses. If necessary, the watering system on hydroponic tables using the "ebb and flow" method is also equipped with a similar system.





## IRRIGATION SYSTEM

All irrigation systems are equipped with fertigation and irrigation units of the appropriate capacity with tanks for storing water, nutrient solutions, containers for dissolving mineral fertilizers with mixers, storing consumable volumes of concentrated solutions of mineral fertilizers, acid and alkali tanks, mixer for preparing the working solutions, pumping group for collecting and supplying nutrient solution to and from the greenhouse sections, automatic control unit for unit and system operation.

For the modern standard version of growing vegetables in hanging trays using the low-volume hydroponics method in containers with artificial or natural substrate, a drip irrigation system is used with a distribution pipeline along each tray and capillary tubes with droppers for each plant in the tray.

The system allows by securely fixing the droppers by each plant to supply water and nutrient solutions directly to the plant root zone considering the limited area of this zone. The water supply is easily transformed when crops change according to the approved crop combinations. Where necessary, certain droppers or distribution pipe strings on separate trays may be dismantled and replaced. The system is easily adaptable to various types of tray installation in the greenhouse passages and plants in a row, including the case of growing plants using the interplanting technology.



Greenhouses with soil cultivation technology are used for small-scale production in individual, farm enterprises, and homestead properties. They are equipped with drip irrigation systems with individual droppers for each plant or an economical irrigation option using the integrated drip lines that provide moisture to a continuous strip of phytocoenosis. This is important for growing the thick-sown plants. Moreover, the greenhouses are equipped with sprinkler systems designed for growing the dwarf plants in rooting beds: seedlings, nursery plants, ornamental plants etc. For the above-mentioned technologies of growing plants in rooting beds in small-area greenhouses for small commodity production, the overhead irrigation is quite productive and economical. The overhead irrigation using hoses with fog nozzles is a reserve method for industrial greenhouses with drip and hydroponic irrigation.

## PAD AND FAN COOLING AND HUMIDIFICATION SYSTEM

Standard process engineering system for the greenhouses of AGRISOVGAZ LLC is supplied in modifications with higher (more than 100 atm) and medium (more than 60 atm) supply pressure. The system nozzles are equipped (if necessary) with anti-drip devices. They have plunger-type pumps and high-pressure nozzles. The system is effective when growing tropical climate plants, including cucumbers. In the high-pressure modification, the adiabatic process of evaporation of finely dispersed moisture with heat absorption helps to reduce the air temperature in greenhouses by 7-8°C.





## ARTIFICIAL LIGHTING SYSTEM FOR PLANTS

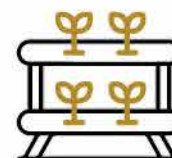
### THE ARTIFICIAL LIGHTING LEVEL

(from 100 to 260 W/sq.m – to be determined in the design) is selected according to the crop cultivation technology and variety for the purpose of ensuring the maximum yield.

We calculate the lighting level, supply the lamps and bulbs, electrical boards and wires for the supplementary lighting system as well as transformers and medium voltage systems for connection with the gas powered electrical generators and network.







## PLANT CULTIVATION SYSTEM

THE AGRISOVGAZ COMPANY MANUFACTURES AND SUPPLIES EQUIPMENT FOR GROWING CROPS IN INDUSTRIAL GREENHOUSES.

### SEEDLING TABLES (RACK TECHNOLOGY IN INDUSTRIAL GREENHOUSES)

The agricultural technology for growing seedlings in industrial greenhouses on racks with mobile platforms is currently economically justified and highly-demanded.

A single-storey rack is designed as a frame with a mobile platform. The frame consists of welded aluminum structures with the posts securely attached to the concrete floor, and ties. The platform made up of aluminum profile along the perimeter moves on the galvanized steel pipes and is equipped with the anti-tripping supports.

In the process of seedling production (between crop rotations), green crops or lettuce can be grown on racks in cassettes, cubes and pots.

The plastic tray and solution supply valve, implementing the "ebb and flow" method of plant nutrition, lean against the aluminum profiles of the platform.

The platform width is standard — 1,807 mm (1,837 mm with supports), the length is variable depending on whether the racks are installed across or along the greenhouse passage. The rack height to the top of the aluminum profile may be adjusted within the range from 784 mm to 860 mm from the floor level.



### TECHNOLOGICAL TRAY SYSTEM FOR PLANT CULTIVATION

AGRISOVGAZ supplies trays for cultivation of plants of various shapes and sizes, depending on the crop to be grown. The trays may be supplied in supporting and hanging modifications, complete with floor supports and items used to suspend the trays on the greenhouse trusses, as well as with parts for laying and supporting the stem of lowered plants and end caps — blind and with drainage outlets.





The heating system design is based on the climatic conditions of the greenhouse complex location according to SP and SNiP. Compensation of heat losses is provided by the circuits of heating systems with separate regulation of each circuit. The heat carrier quantity for each heating circuit is calculated automatically, taking into account the temperature and time limits set pursuant to requirements of the plant growing technology.

The initial heat carrier is supplied from the boiler house or power park through the system of external and internal main heating networks laid overhead and (or) underground as a guarded construction with leakage control to the heating control units located in the connecting corridors of the greenhouse blocks, in process rooms and (or) directly in greenhouses (determined as per the design for each facility).

In heating control units, the heat carrier is prepared separately for each heating circuit with the help of multiway mixing valves and supplied by the network pumps through the distribution pipelines to the tubular heat registers located in greenhouses and other heated premises of the greenhouse block.

The number, diameters and layout of pipes are determined as per the design for each facility for heating air, substrate and soil in greenhouses and process rooms of the greenhouse blocks. If necessary (as per calculation), the air heating using various heat units — a part of the heating system — electric, gas, water etc., may serve as an additional (peak) heat source. The bottom and top heating pipes can be used as pipe rails for moving the handling trolleys and mobile plant care equipment.

For the purpose of climate alignment in the greenhouse, the axial-flow fans are used, and the air volume is divided into climatic zones with separate control of microclimate parameters. Most parts of the metal structures of the greenhouse heating systems — pipes, supports, U-bends, brackets, suspensions, hooks — are manufactured by AGRISOVGAZ LLC.



## AUTOMATIC CONTROL SYSTEM



ALLOWS THE AUTOMATION OF ALL PROCESSES IN THE GREENHOUSE COMPLEX:

1

MICROCLIMATE CONTROL

2

POWER PARK CONTROL

3

ACCOUNTING FOR LABOUR COSTS  
AND PRODUCT YIELD, OPTIMIZATION  
OF PROCESSES IN THE COMPLEX

4

PRODUCTION MANAGEMENT WITH THE HELP  
OF SELF-ENGINEERED CLIMATIC COMPUTERS.

## SERVICE UNITS, BOILER HOUSES, POWER PARKS

**WITHIN THE FRAMEWORK OF TURNKEY CONSTRUCTION OF GREENHOUSE COMPLEXES,** the buildings and structures of service units and sections, detached and integrated boiler houses and power parks with equipment are developed, supplied and constructed. The buildings of the aforementioned infrastructure facilities for greenhouse complexes may be produced either from greenhouse-type metal structures with transparent or combined glass panel enclosure or building-purpose lightweight metal structures (LMS) with sandwich panel enclosure.

### SERVICE UNITS AND SECTIONS

May include administrative, office and amenity premises, sections for water treatment with fertigation and irrigation units, commodity processing, including sorting and packing, and product temporary storage, including cold stores and handling boxes, warehouses for operational stock of consumable and other materials, parking and areas for materials-handling transport and equipment.

### BOILER HOUSES

Gas-operated boilers are developed with consideration for the greenhouse complex heat energy requirements. There are two types of boiler houses: with integrated amenity premises (if necessary) or automatic with scheduled maintenance performed by outsourced personnel without organization of workplaces. The boiler houses are equipped with water treatment units and hot water boilers by Crone, NKV, Viessmann with burners produced by Zantigh, Puripher and other specialized manufacturers. Some boilers (as per the design) are equipped with condensers for CO<sub>2</sub> drawing from exhaust combustion gases with adjustment of the harmful impurity content. The design of the main distribution heating unit of the boiler house is determined based on the calculation of the approved heat supply scheme for the greenhouse complex, taking into account the range, capacity and placement of heat consumers.





## POWER PARKS

May be of two types: with centralized power generation or combined. The latter (mini-TPP) generate heat and electric power and are developed based on custom-made design for a specific greenhouse complex as a basic or additional source of energy.

They are as close as possible to the consumers — production greenhouses — and operate in optimal modes. Crone, NKV, Viessmann hot water boilers with Zantingh, Puripher burners, Jenbacher, MVM, Caterpillar gas powered electrical generators and equipment from other specialized manufacturers are used as equipment for power generation according to efficiency calculation for each facility.

The efficiency of own power generation is especially significant for greenhouse complexes of a large area, as well as those that specialize in photocultures, requiring significant amounts of heat and electricity with stable supply during cultivation periods. Such mode of power supply is ensured by individual power parks integrated in the greenhouse complex structure.

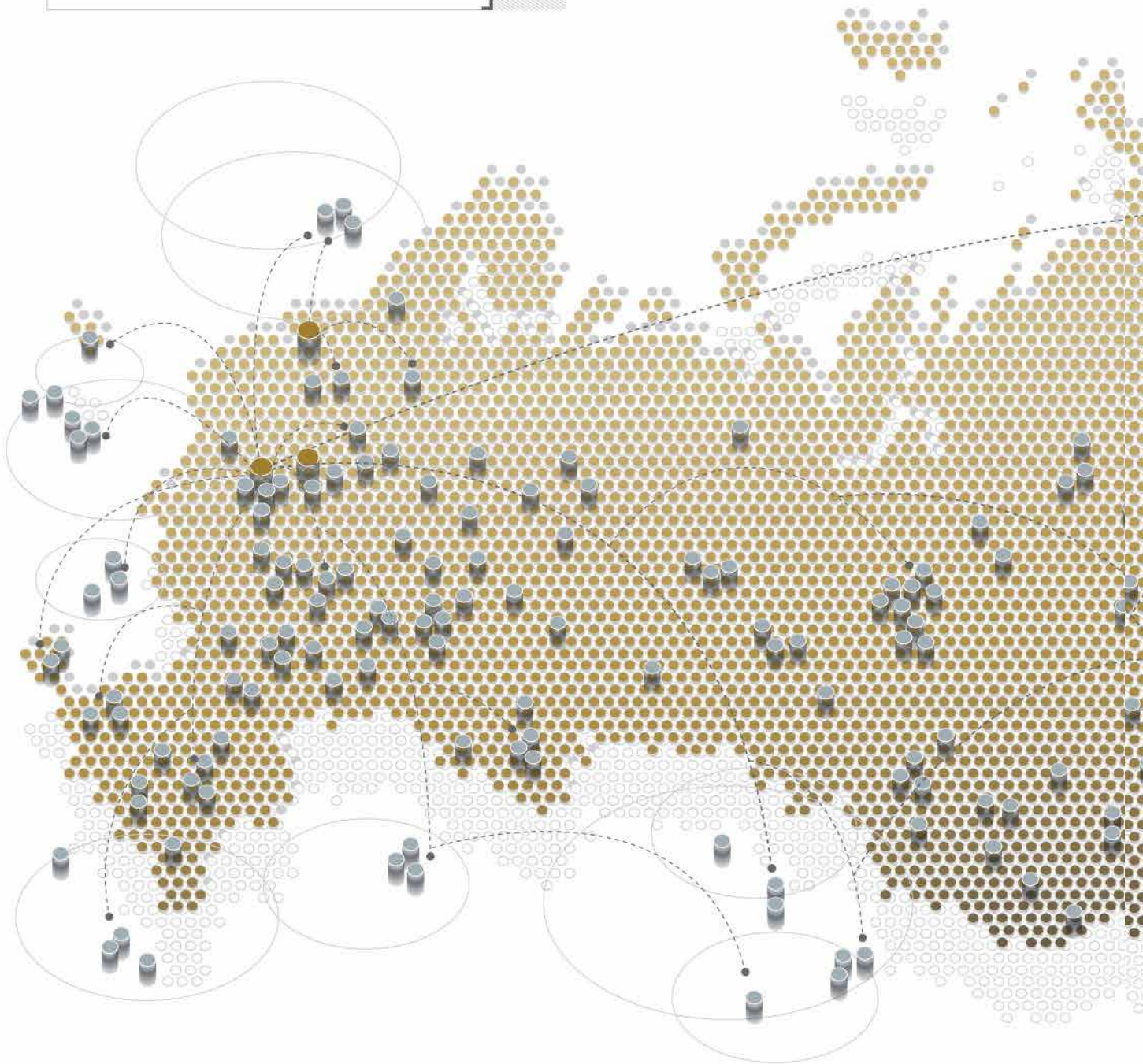




## CONSTRUCTION GEOGRAPHY

WE HAVE BEEN BUILDING UP  
THE GREENHOUSE INDUSTRY  
IN RUSSIA FOR 30 YEARS ALREADY.

THE GEOGRAPHY OF OUR FACILITIES  
PROVES THAT GREENHOUSE BUSINESS  
CAN BE SUCCESSFULLY DEVELOPED  
IN ANY REGION OF THE COUNTRY







3 Mirnaya st., Maloyaroslavets,  
Kaluga Region, 249092



+7 495 647-04-44

[agrisovgaz.com](http://agrisovgaz.com)

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