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JSC «SMNPO - Engineering»

CNG VEHICLE REFUELING GAS COMPRESSOR STATIONS



 **FRUNZE**
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Catalog
of products



THE HISTORY OF DEVELOPMENT OF CNG VEHICLE REFUELING GAS COMPRESSOR STATIONS

In 1986 JSC "SMNPO - Engineering" mastered the manufacturing of modular automatic gas refueling compressor stations for CNG vehicle refueling. The prototype of modular CNG vehicle refueling gas compressor station BKI-250 with three compressors was presented at the Exhibition of Economic Achievements in Moscow, where it was awarded a gold medal. Since 1987 the serial manufacturing of these stations has begun. 30 items had been delivered by 1990.

In the course of mastering the serial production of CNG vehicle refueling stations with different parameters the Company has manufactured nine types and twenty-two modifications of these stations including the following items with one compressor: modular CNG vehicle refueling station BKI-40/25-1 (small-sized type), modular CNG vehicle refueling station MBKI-125/25-1 (for Argentina), modular CNG vehicle refueling station BKI-50/2.5...7.5/25 (trunk type), modular CNG vehicle refueling station MBKI



The first modular CNG vehicle refueling station BKI-250 is at the test bench, 1987



Testing of modular CNG vehicle refueling station MBKI-125/25-1 (delivered to Argentina), 1994

In 1989 in parallel with the manufacturing of the first model of CNG vehicle refueling gas compressor station the Company started the manufacturing of updated modular CNG vehicle refueling station MBKI-250 with three compressors of improved technical and operational performance. 110 stations of this modification had been delivered to different regions of CIS by 1994.

0.05...1.7/125...350/25-1 (municipal type) as well as the following items with two compressors: CNG vehicle refueling station BCI-75/25-2 (small-sized type), modular CNG vehicle refueling station MBKI-125/25-2 and modular CNG vehicle refueling station MBKI 0.05...1.7/250...700/25-2 (municipal type). The stations are produced as ready-for-use container modules that ensures their quick installation and commissioning.



Up-dated modular CNG vehicle refueling station MBKI-250 in Shostka, 1989



Testing of small-sized modular CNG vehicle refueling station BKI-4/25-1 (delivered to Russia), 2000

THE HISTORY OF DEVELOPMENT OF CNG VEHICLE REFUELING GAS COMPRESSOR STATIONS

Process equipment of the stations is designed for gas using both from municipal gas mains and main pipelines. High efficient moisture-and-oil separators and deep adsorption dehydration is used for removal of drop oil and moisture. The reliable automatic control system provides control of the station operation.

Until the mid -1990s the reciprocating compressors were manufactured on opposite base M2.5 with piston force of 2.5 tons. Subsequently the Company has applied

High-efficient air coolers of interstage gas with cooling flow control, as well as available free access and servicing platforms in the ventilated and heated compressor room ensure station operation in different climatic zones.

All CNG vehicle refueling stations manufactured by JSC "SMNPO - Engineering" successfully operate in Ukraine, Russia, Turkmenistan, Bulgaria, Georgia, Kazakhstan, Uzbekistan, Argentina, etc.



Modular CNG vehicle refueling station MBKI-125/25-2 in Tbilisi, 2000



Modular CNG vehicle refueling station MBKI-125/25-2 in Ryazan', 2003

shortened base M2.5U of our own design (the metal consumption is 35% less than that in comparison with M2.5 base). With this shortened base our experts have designed, tested and implemented the series of compressors for different suction pressure: from 0.5 kgf/cm² to 17 kgf/cm² (gauge), with final pressure of 250 kgf/cm² and rated capacity of 480 Stm³/h to 1,200 Stm³/h.

Full load string testing of every CNG vehicle refueling station at the Company unique test benches guarantees high quality of delivered process equipment.



Modular CNG vehicle refueling station MBKI-125/25-2 in Chernigov, 2002



Modular CNG vehicle refueling station MBKI-125/25-2 in Novomoskovsk, 2005

Specification

Description	One-compressor modular CNG vehicle refueling stations MBKI				Two-compressors modular CNG vehicle refueling stations MBKI			
	0.05-0.3/125/25-1	0.3-0.6/150/25-1	0.6-1.2/200/25-1	1.2-1.7/350/25-1	0.05-0.3/250/25-2	0.3-0.6/300/25-2	0.6-1.2/400/25-2	1.2-1.7/700/25-2
Operating medium	Natural gas at inlet as per State Standard GOST 5542, at outlet as per State Standard GOST 27577							
Quantity of compressors, pc.	1				2			
Gas pressure range at station inlet, MPa	0.05 ÷ 0.3	0.3 ÷ 0.6	0.6 ÷ 1.2	1.2 ÷ 1.7	0.05 ÷ 0.3	0.3 ÷ 0.6	0.6 ÷ 1.2	1.2 ÷ 1.7
Inlet nominal pressure, MPa	0.18	0.5	1.0	1.5	0.18	0.5	1.0	1.5
gas pressure after compression, MPa, not more	25				25			
Gas supply station capacity (in normal conditions)								
at inlet nominal pressure, m ³ /h	500 ¹	600 ¹	850 ¹	1200 ¹	1000 ¹	1200 ¹	1700 ¹	2400 ¹
Quantity of fuelling per day, pc.	125 ²	152 ²	200 ²	350 ²	250 ²	300 ²	400 ²	700 ²
Driving motor power, kW	132	160	200	200	132	160	200	200
Dehydration type	Long cycle, at low pressure with heated recovery				Short cycle, at high pressure with unheated recovery			
Moisture content of dehydrated gas, g/nm ³	0.009				0.009			
Total installed power of electricity consumers, kW, not more	162	190	260	260	324	380	460	460
Overall dimensions of process unit (as to assembled container), mm								
length		6260				11050		
width		5190				5190		
height		3700				3700		
Weight of standard set of equipment as to delivery scope, kg, no more		36000				46800		

Note: 1. Gas supply station capacity is given including gas extraction for adsorbent regeneration in dehydration system (not more 10% of compressors capacity);
2. During calculation the unit volume of fuelling is 60 nm³.

In 2005 JSC "SMNPO - Engineering" started to manufacture new generation of one-compressor CNG vehicle refueling stations for 125, 150, 200, 350 fuelings per day as well as two-compressors CNG vehicle refueling stations for 250, 300, 400 and 700 fuelings per day.

JSC "SMNPO - Engineering" has available the license of "Gostehnadzor" (Russia) for design, manufacture and installation of process equipment of new CNG vehicle refueling gas compressor stations. The compressor units manufactured at the Company are certified for compliance with Russian and Ukrainian Safety rules.

Distinctive features of new generation of CNG vehicle refueling gas compressor:

- reliable high speed opposed compressor;
- improved systems of gas dehydration;
- system preventing gas return during shutdowns;
- high maintainability of compressor;
- 1 stage discharge pressure maintaining
- automatic system;
- smooth start of driving motor;
- modern design;
- high level of automation of technological process.



The first one-compressor CNG vehicle refueling station constructed on turnkey basis



Two-compressors modular CNG vehicle refueling station MBKI is at the testing bench

5 PROCESS EQUIPMENT

Process equipment of one-and two-compressors modular CNG vehicle refueling stations are operated in climatic zones with ambient temperature from -50°C to $+45^{\circ}\text{C}$ and in regions with seismicity up to 6 on the Richter scale.

Process equipment of CNG vehicle refueling station can be delivered both as separate modules and as ready-for-use units.

- interunit gas piping according to the project of station location;
- automatic protection and control system (placed in special cabinets);
- fire alarm;
- sets of spare parts.



Modular CNG vehicle refueling station MBKI-0.5-0-30/125/25-1 in Sumy, 2006



Line for assembly of process equipment units

Before shipping to the Client each product undergoes acceptance tests on natural gas under operating conditions.

To form complete process system the delivery scope of CNG vehicle refueling station includes the following units:

- process unit with compressor plants and dehydration system;
- inlet valves unit;
- expansion vessels;
- gas storage vessels;
- drain vessel;

The following equipment can be supplied additionally:

- gas commercial metering system (GCMS) with dispensers;
- inlet gas metering device (flow-meter) with filter;
- refueling manifold (without GCMS) with reduction unit, cut-off stand and with single or double hose dispensers;
- hygrometer for determination of moisture content in gas after drying unit;
- inter-unit cable route.



Gas storage vessels



Opposite compressor

Automatic Control System (ACS) is designed for local and remote monitoring of parameters, control, protection and regulation of CNG vehicle refueling station operation modes as well as for measuring and accounting of gas quantity at the CNG Station inlet.

Power equipment is supplied from three-phase network of AC with voltage 380/220 V, frequency 50 Hz; control loops and working lighting are energized from AC network with voltage of 220 V and frequency of 50 Hz.

- list of conditions preventing start-up of controlled equipment;
- information about CNG vehicle refueling station current operating mode and about change of modes
- retrospective of analogous parameters values, switching over of actuating mechanisms
- acknowledgement and cancellation of signal and mode messages as well as pre-starting conditions.



The operator's room at the Station



Operator's workstation

Logical-program control and remote control of CNG vehicle refueling station parameters is performed by microprocessor-based software.

Operator's workstation is provided with personal computer. Input of control commands and displaying of required information on operator's initiative are carried out from operator's panel or with mouse type manipulator.

The following information is displayed:

- current values of analogous parameters and parameters of actuating mechanisms condition;
- the list of active at a particular moment emergency and warning messages;

Used in ACS information about technological process, condition of equipment and mechanisms, position of electrically actuated ball valves and pneumatic distributor comes from measuring transducers and position sensors mounted directly on controlled equipment.

Thermal transducers of TSMU type, pressure gauges of MIDA DI - VN type, fire and gas detectors, level switch of ASL-440 type are used as primary detectors.

To start compressors drive motors device Altistart-48 for reduced-current start and stop is provided, thus allowing to perform soft starting of compressor and to reduce value of starting current.



Displaying of technological process

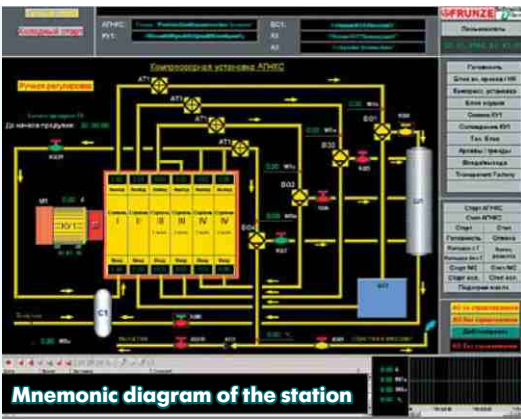


Pressure gauges

ACS performs the following functions:

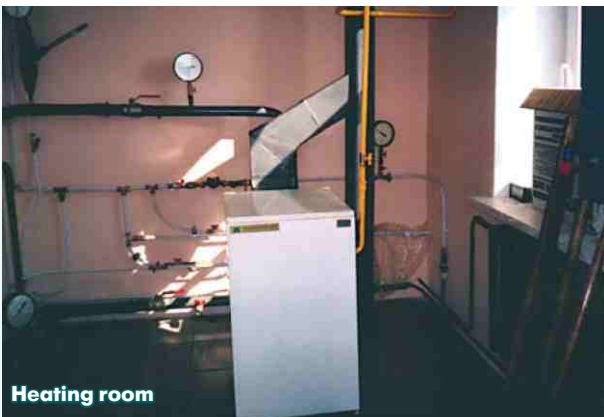
- automatic control of compressor unit according to approved algorithms of start, shutdown and emergency shutdown;
- automatic control of dryer unit operation;
- maintaining of gas pressure settings in storage vessels and vehicle refueling line;
- automatic control of electrically actuated ball valves of CNG vehicle refueling station process piping;

Gas metering at CNG vehicle refueling station is carried out by independent from ACS gas commercial metering system with 2 – 8 dispensers. The supplied dispensers can be both manufactured by JSC "SMNPO - Engineering" and purchased. The Customer specifies dispensers type and quantity.



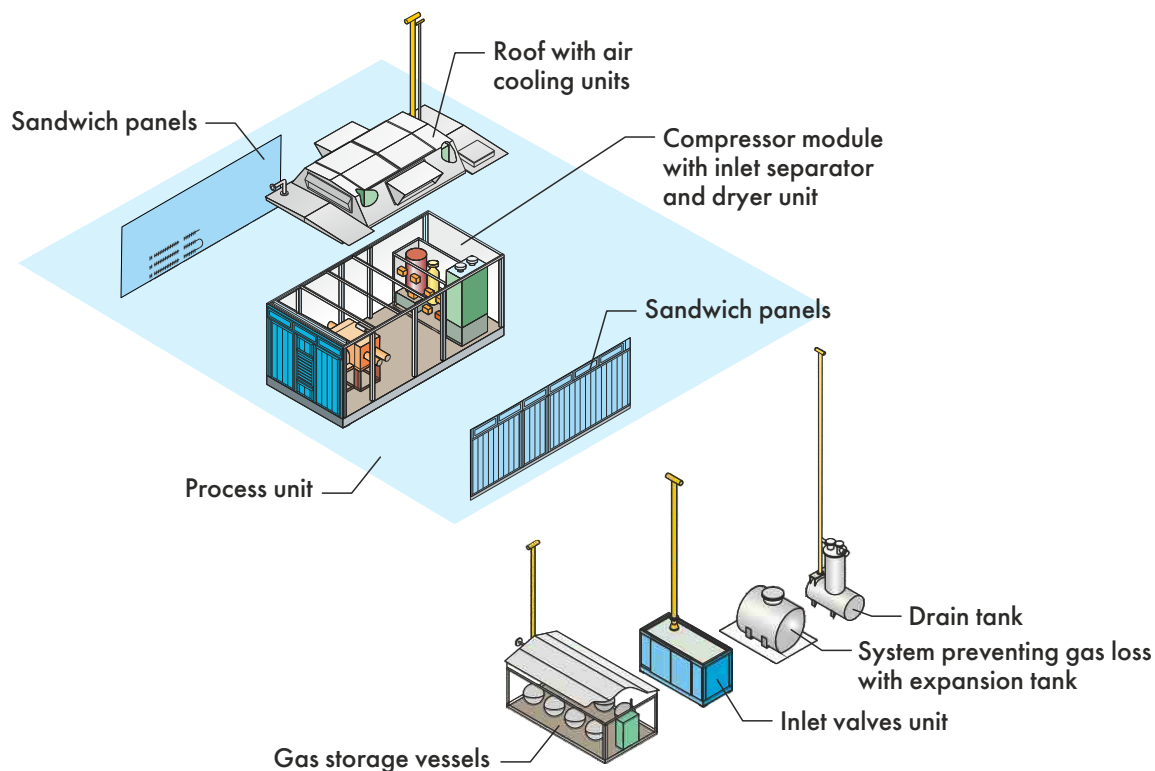
- monitoring of controlled equipment position and condition;
- monitoring of technological process parameters with light and sound warning at deviation of controlled parameters from limit values;
- control of fire and gas content in process unit;
- maintaining of emergency lighting in case of power supply failure;
- local and automatic control of process unit exhaust fans;
- local control of compressor unit mechanisms in adjustment mode.

The Company offers the delivery of refueling manifold with single or double hose dispensers for the Customers which need the installation of refueling devices without gas commercial metering system. Gas metering at inlet of CNG vehicle refueling gas compressor station is carried out by purchased set of devices with mass or volume flow meter.



ONE-COMPRESSOR CNG VEHICLE REFUELING GAS COMPRESSOR STATION

Standard set of Equipment (as to Delivery Scope)

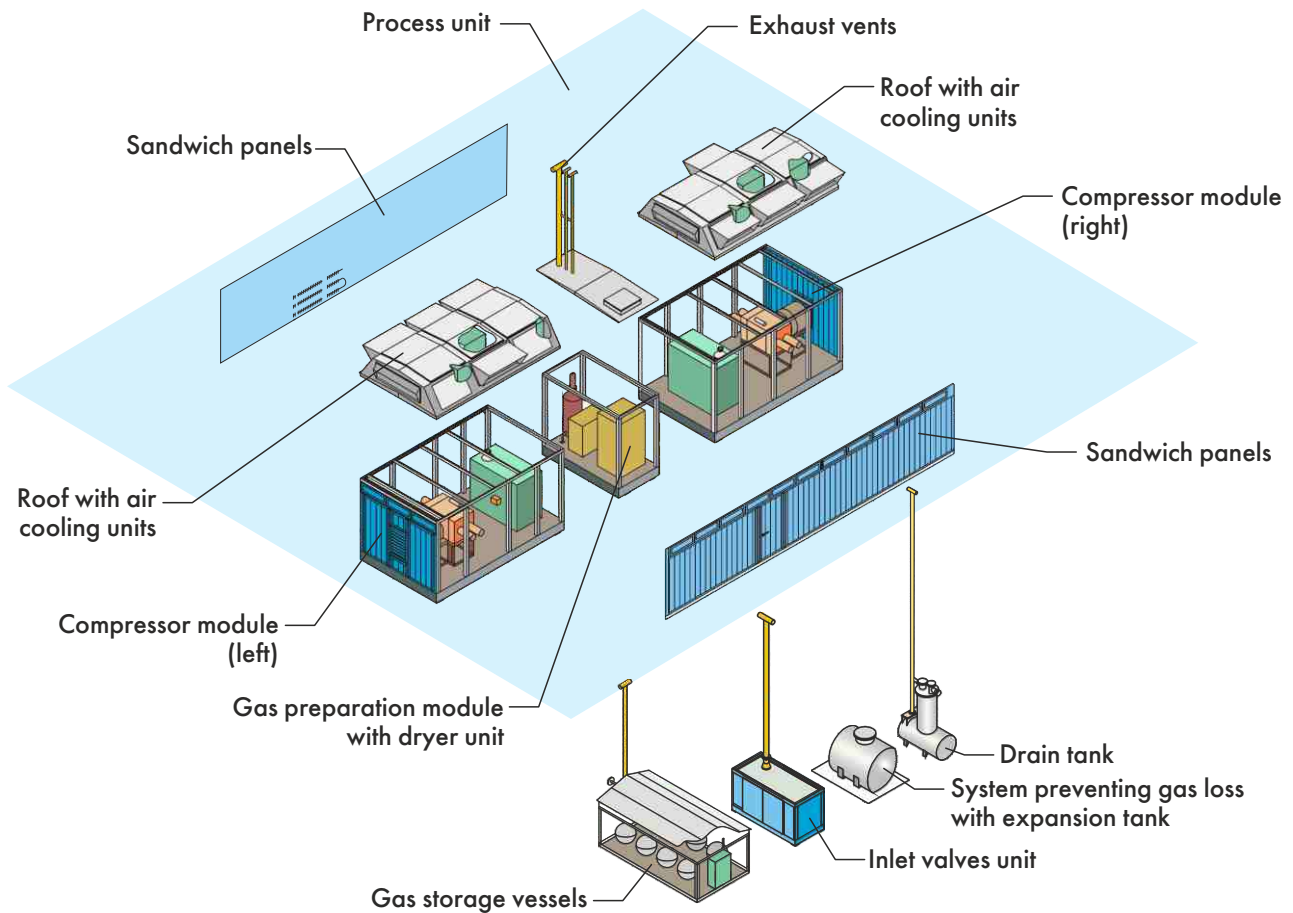


For enhancement of one-compressor station functional capacities, the Company offers the following set of equipment:

- inlet gas metering unit with filter and mass or turbine flow meter
- system of step-by-step compressorless refueling of vehicles with additional gas storage vessels of volume which is multiple 2 m^3 ;
- inter-unit gas piping with valves;
- gas commercial metering system (GCMS) with dispensers and piping;
- refueling manifold (without GCMS) with single or double hose dispensers and piping
- device automatically controlling the speed of compressor electric drive motor;
- other equipment, adapted to Customer requirements.

TWO-COMPRESSORS CNG VEHICLE REFUELING GAS COMPRESSOR STATION

Standard set of Equipment (as to Delivery Scope)



For enhancement of two-compressors station functional capacities, the Company offers the following set of equipment:

- inlet gas metering unit with filter and mass or turbine flow meter
- system of step-by-step compressorless refueling of vehicles with additional gas storage vessels of volume which is multiple 2 m³;
- inter-unit gas piping with valves;
- gas commercial metering system (GCMS) with dispensers and piping;
- refueling manifold (without GCMS) with single or double hose dispensers and piping
- device automatically controlling the speed of compressor electric drive motor;
- other equipment, adapted to Customer requirements.

JSC "SMNPO - Engineering" carries out the development (Design Institute "Neftekhimproekt") and binding of process equipment of CNG vehicle refueling gas compressor station to definite site.

Construction and installation contractors which are the parts of the Company fulfill construction, installation, precommissioning and commissioning on turn-key basis. The considerable scientific and technical potential of our specialists, close cooperation with leading science firms, application of advanced technology and high-efficient

equipment, testing of products at the unique test benches under operating conditions ensure high quality of delivered gas refueling equipment.

The experts of JSC "SMNPO - Engineering" are ready to perform complete services not only for new construction projects, but also for the reconstruction, expansion and technical upgrading of operated stations manufactured both by the Company and other suppliers of similar equipment.



Construction of one-compressor CNG vehicle refueling gas compressor station in Sumy



Mounting of process unit on the foundation



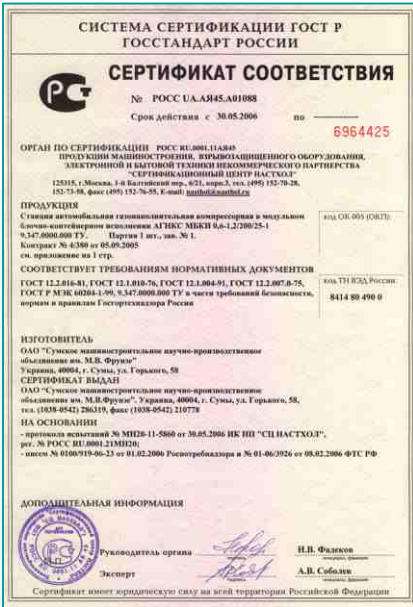
Construction of two-compressors CNG vehicle refueling gas compressor station on turn-key basis in Khmelnytsky



Installation of additional gas storage vessels

JSC "SMNPO - Engineering" has available the approvals issued by Gosgornadzor of Ukraine, Gostech-nadzor of Russia, Promatomnadzor of Belarus

for manufacturing, installation and application of process equipment of CNG vehicle refueling gas compressor station.





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