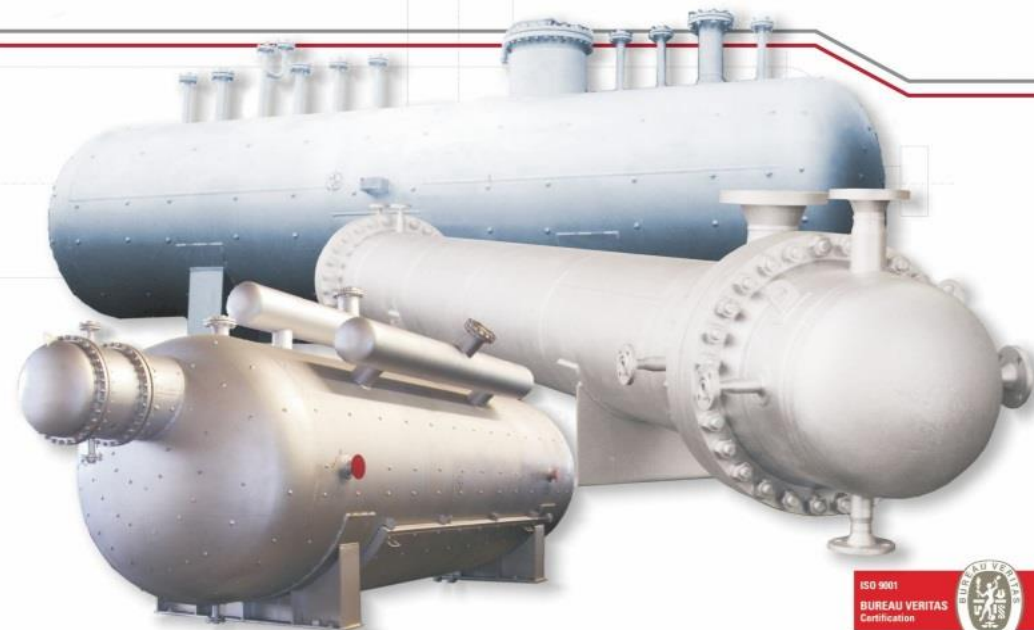


EQUIPMENT FOR OIL AND GAS INDUSTRY

“SMNPO - Engineering” JSC

*Technical catalogue*

# EQUIPMENT FOR OIL AND GAS INDUSTRY



General & Head office:  
[info@sumy-frunze.com](mailto:info@sumy-frunze.com)

Technical details for new project or spare parts solution  
[Technical@sumy-frunze.com](mailto:Technical@sumy-frunze.com)

Purchasing Products and spare parts  
[sales@sumy-frunze.com](mailto:sales@sumy-frunze.com)

Counseling about Guarantee ,Warrantee Criticism and suggestion  
[Customers@sumy-frunze.com](mailto:Customers@sumy-frunze.com)

ISO 9001  
BUREAU VERITAS  
Certification



Introductory part	2
Scrubber	3
Separators	5
Air cooling equipment	7
Shell and tube heat exchangers with U-tubes of TU type	10
Shell and tube heat exchangers with stationary tube sheet of TN type	12
Shell and tube heat exchangers with floating head of TP type	14
Absorbers	16
Adsorbers	18
Underground horizontal drain vessels	20
Aboveground horizontal vessels	22
Tanks	25
Fuel gas heating units	27
Gas heaters (electric)	29
Process heaters	31
Instrument air compressor unit	33
Oil supply system units	36
Flare unit	38
Reduction unit	40
Filter separator unit	42
Oil gas separators (bullets)	44
Certificates and Approvals	46

This catalogue gives information on the oil and gas equipment, manufactured by “SMNPO - Engineering” JSC that is successfully operated for many years in different regions of the world with various climatic conditions. It is one among many catalogues of JSC products, presenting only plant process equipment. Being a heavy machine-building enterprise fitted with advanced equipment for complete process manufacturing cycle for the most difficult items and facilities – from making of any steel grade and to complex tests under simulated operation conditions, the Company has all opportunities for manufacture and supply of any equipment for oil and gas, oil and gas processing and power industry facilities in the shortest time possible. Having high scientific and technological and production potential, the Company can ensure construction of industrial turn-key projects with a complete delivery, both of process equipment as well as of infrastructure equipment.

The primary focus of this catalogue is the maximum reduction of time limits for designing of the new industrial oil and gas facilities, their construction and commissioning by means of providing data sufficient for selection of required equipment and for start of design works. Besides the equipment (unit and complete) supply, the Company is ready to provide its installation, pre-commissioning and service maintenance throughout the operation period.

As far as the project engineers and prospective customers get familiarized with the catalogue, the last will be added with the new information both on the given equipment and the new one.

The JSC prime advantage is a long-standing work in oil and gas industry in close contacts with the operating staff, large experience in solving any technical problems in emergency situations, collected data base regarding the failures and faulty operation with the change of facility production conditions and experience in their solving within the shortest possible time without any significant material costs.

The current JSC quality management system fully conforms to the international standard ISO 9001-2008, that is constantly confirmed with regular audits by Bureau Veritas.

Besides the equipment represented in the catalogue, we can supply any other equipment for innovative techniques or for modernization of existing productions.

JSC specialists are open for cooperation to create state of the art process equipment with regard to the long perspective, necessary studies and all tests and adjustment works. This cooperation will not oblige the partners to withdraw tenders, though it will allow obtaining equipment with higher performance characteristics within the shortest time.

## 3 Scrubbers

**PURPOSE** Natural gas purification from mechanical impurities and drop liquid at compressor stations and main gas pipelines.

**LAYOUT** The unit consists of the following: scrubber, shut-off valves and set of instrumentation and controls.  
 The scrubber is a vertical apparatus with gas inlet and outlet nozzles. Separating elements are located in the upper part of the scrubber. The bottom part of the scrubber represents a tank of mechanical impurities and drop liquid. The scrubber casing is provided with the nozzle for mechanical impurities and drop liquid drainage, for instrumentation connection.  
 The scrubber unit is installed outdoors and can operate in regions with different climatic conditions.  
 Base material of the unit - carbon steel,  
 Separating elements - stainless steel.  
 At the customer's request the unit can be completed with the service platforms.

**OPERATION CONCEPT** Non-purified gas enters the scrubber through the inlet branch pipe A and is distributed between the rows of centrifugal multi-cyclone elements, where it is separated from fine particles of liquid and mechanical impurities. Separated particles under action of gravity are collected in the bottom part of the scrubber and removed through the drain nozzle C. Purified gas is removed from the scrubber through the nozzle B.

**NORMATIVE BASE** TU U 29.2-05747991-002:2011 "Scrubbers. Technical specification"; OST 26.260.18-2004 "Oil and gas industry production units. General specifications";  
 STO Gazprom 2-2.1-607-2011 "Production units. General specifications".

**CONVENTIONAL SYMBOLS** **Unit**  
**PVC-1800-10.0/27.4-M-UKhL1**,  
 where:  
 PVC - vertical centrifugal scrubber;  
 1800 - scrubber internal diameter, mm;  
 10.0 - design pressure, MPa;  
 27.4 - maximum capacity, mln. nm<sup>3</sup>/day;  
 M - equipped with service platforms;  
 UKhL1 - climatic area of operation.

Designation	Unit internal diameter D <sub>internal</sub> , mm	Design pressure P <sub>p</sub> , MPa	Capacity per gas, mln.nm <sup>3</sup> /day	Branch pipe nominal diameter (in/out), mm	Weight, kg
Unit PVC-2600-5.6/18.0-UKhL1	2600	5.6	18.0	1000	34750
Unit PVC-2000-9.9/25.6-U1	2000	9.9	25.6	750	37800
Unit PVC-1800-10.0/27.4-M-UKhL1	1800	10.0	27.4	700	21415

# 4 Scrubbers

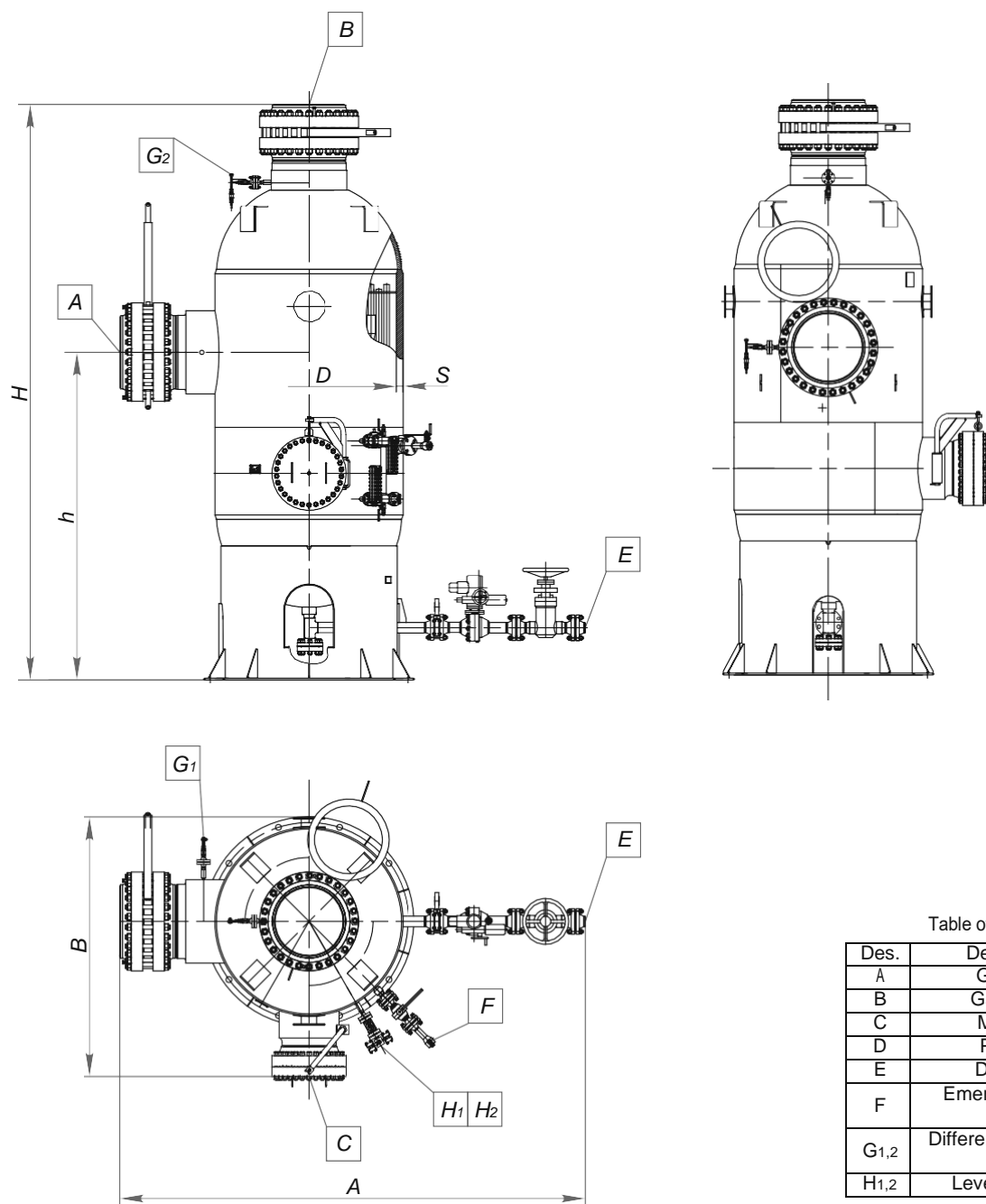


Table of nozzles

Des.	Description
A	Gas inlet
B	Gas outlet
C	Manhole
D	Process
E	Drainage
F	Emergency level switch
G <sub>1,2</sub>	Differential pressure switch
H <sub>1,2</sub>	Level indicator

Description	H, mm	h, mm	D, mm	A, mm	B, mm	Nozzles Dn, mm				
						A	B	C	D	E
Unit PVC-2600-5.6/18.0-UKhL1	8020	5045	2600	5550	3370	1000	1000	500	100	100
Unit PVC-2000-9.9/25.6-U1	7790	4670	2000	5610	3250	750	750	600	50	100
Unit PVC-1800-10.0/27.4-M-UKhL1	5945	3385	1800	4800	2765	700	700	500	100	-

## 5 Separators

**PURPOSE** Natural (associated petroleum) gas purification from mechanical impurities and drop liquid.

**LAYOUT** The unit consists of the following: vertical-type separator, valve rack with liquid drain and vent pipelines, shut-off and control valves, set of instrumentation and controls skid-mounted.

Separator is a vertical apparatus with gas inlet and outlet nozzles. Separating element is located in the upper part of the separator. The bottom part of the separator represents a tank of mechanical impurities and liquid. The scrubber casing is provided with the nozzles for liquid drainage, for instrumentation connection.

The separator unit is installed outdoors and can operate in regions with different climatic conditions.

Base material of the unit - carbon steel,  
Separating elements - stainless steel.

**OPERATION CONCEPT** Non-purified gas enters the separator through the inlet nozzle A and is distributed between the rows of centrifugal multi-cyclone elements, where the gas is separated from liquid and mechanical impurities. Purified gas is removed from the separator through nozzle B. Separated liquid enters the bottom part of separator and periodically, by ACS command, it is drained from level sensors through the drain pipeline into the station liquid collection system. Ball valves, motor operated shut-off and control valves are installed on the liquid drain pipelines. Drain pipeline is completed with hand-operated ball valves.

The unit is packaged product and is 100% ready-to-use.

**NORMATIVE BASE** OST 26.260.18-2004 "Oil and gas industry production units. General specifications"; STO Gazprom 2-2.1-607-2011 "Production units. General specifications".

**CONVENTIONAL SYMBOLS** **Separator unit SMC-1400-2.25/1.6-UKhL1**,  
where:  
SMC - centrifugal multi-cyclone separator;  
1400 - separator internal diameter, mm;  
2.25 - capacity, mln. nm<sup>3</sup>/day;  
1.6 - design pressure, MPa;  
UKhL1- climatic area of operation.

Designation	Unit internal diameter D <sub>internal</sub> , mm	Design pressure P <sub>p</sub> , MPa	Capacity per gas, mln.nm <sup>3</sup> /day	Branch pipe nominal diameter (in/out), mm	Weight, kg
Separator unit SMC-1400-2.25/1.6-UKhL1	1400	1.6	2.25	500	5560
Separator unit SMC-1400-1.46/1.9-KhL1	1400	1.9	1.46	400	6500
Separator unit SMC-1400-1.8/2.5-KhL1	1400	2.5	1.8	400	6500
Separator unit SMC-1200-2.25/4.0-UKhL1	1200	4.0	2.25	300	5350
Separator unit SMC-1200-2.25/4.6-U1	1200	4.6	2.25	300	6420
Separator unit SMC-1400-7.5/6.5-UKhL1	1400	6.5	7.5	500	14000
Separator unit SMC-1200-2.21/7.5-UKhL1	1200	7.5	2.21	400	9000
Separator unit SMC-1400-5.75/7.6-UKhL1	1400	7.6	5.75	400	12500

# 6 Separators

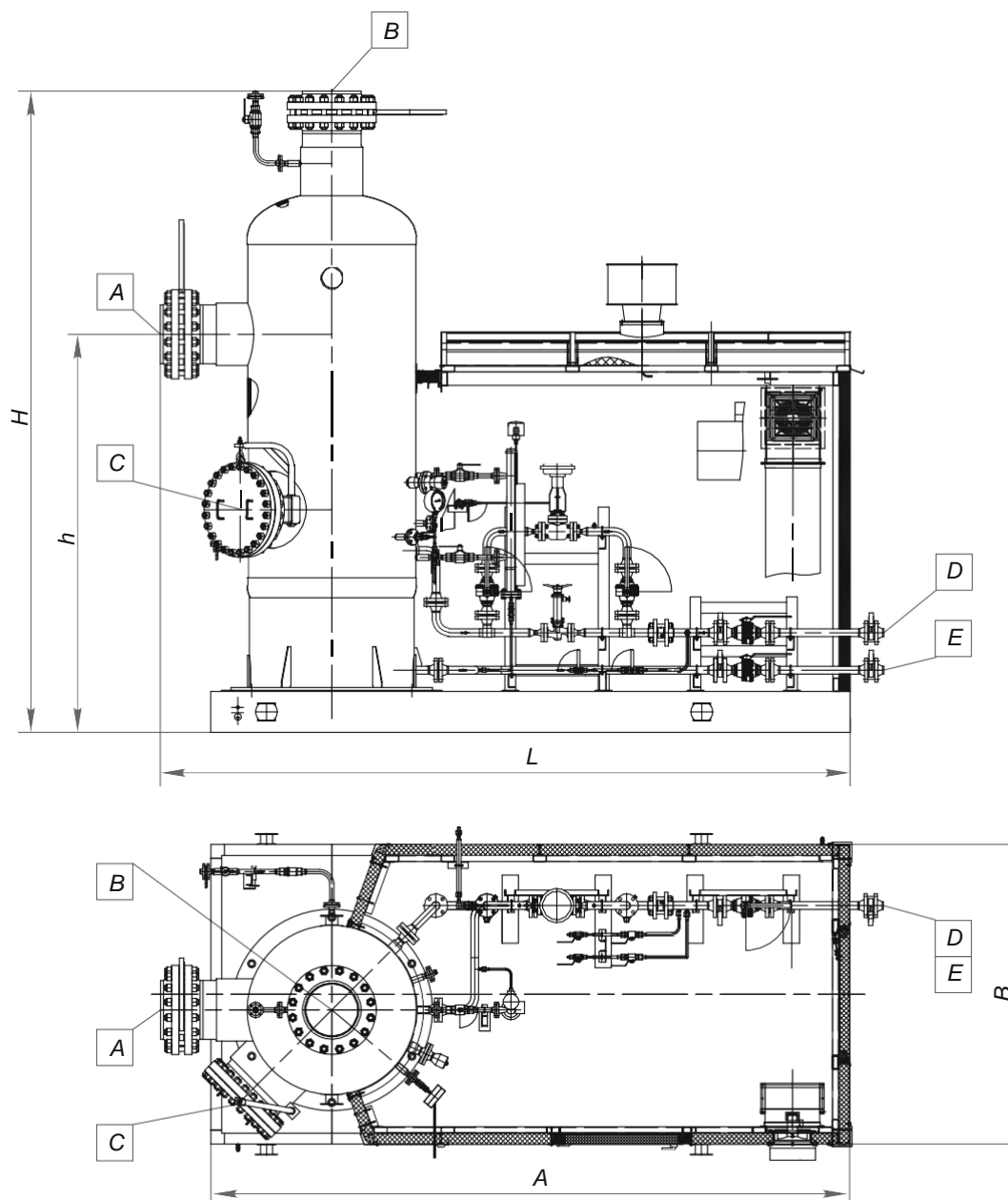


Table of nozzles

Des.	Description
A	Gas inlet
B	Gas outlet
C	Manhole
D	Condensate drain
E	Drainage

Наименование	L, mm	H, mm	h, mm	D, mm	A, mm	B, mm	Nozzles Dn, mm				
							A	B	C	D	E
Separator unit SMC-1400-2.25/1.6-UKhL1	3475	3785	2705	1400	3340	1720	500	500	500	50	50
Separator unit SMC-1400-1.46/1.9-KhL1	4585	4100	2620	1400	4450	2030	400	400	500	50	50
Separator unit SMC-1400-1.8/2.5-KhL1	4710	4100	2620	1400	4450	2030	400	400	500	50	50
Separator unit SMC-1200-2.25/4.0-UKhL1	3410	3815	2705	1200	3140	1720	300	300	500	50	50
Separator unit SMC-1200-2.25/4.6-U1	3410	3815	2705	1200	3140	1720	300	300	500	50	50
Separator unit SMC-1400-7.5/6.5-UKhL1	4925	5875	3185	1400	4450	2030	500	500	500	50	50
Separator unit SMC-1200-2.21/7.5-UKhL1	4670	4155	2825	1200	4450	2030	400	400	500	50	50
Separator unit SMC-1400-5.75/7.6-UKhL1	3960	5330	2870	1400	3340	1720	400	400	500	50	50

<b>PURPOSE</b>	<p>Cooling of natural gas and other gaseous and liquid media.</p>		
<b>LAYOUT</b>	<p>Depending on the operation conditions there are air-cooling units (hereinafter - ACU) with recirculation chambers (RC) and ACU without RC.</p> <p>ACU with RC consists of ACU section (one or several), fan unit, recirculating unit and protective shutters.</p> <p>ACU without RC consists of ACU section (one or several), fan unit (without shields). Depending on the operation conditions, ACU without RC can be completed with protective shutters.</p> <p>ACU section consists of the bundle of bimetal finned tubes with external circumferential aluminium finning, connecting the chambers. ACU section depending on the number of tubes rows can be four-, six- and eight-rowed, depending on the number of passes - single-, two- and three-pass.</p> <p>Fan unit for ACU without recirculation chambers consists of diffuser (one or several) and a fan (one or several), located on the supporting metalworks.</p> <p>Fan unit for ACU with RC consists of diffusers and fans, located in a container on the short walls of which adjustable shutters are located; through them cooling air enters to the fans inlet.</p> <p>RC is a carcass with side walls covered with metal shields, the bottom part is open, and the upper one is closed with the adjustable shutters.</p> <p>Fan impeller diameter can be 0.8 and 2.7 m, motor power - 7.5; 13 and 15 kW.</p> <p>At the customer's request, ACU can be completed with product inlet and outlet headers and the service platforms. The equipment is installed outdoors and can operate in regions with different climatic conditions.</p> <table border="0" style="margin-top: 20px;"> <tr> <td style="vertical-align: top;"> <p>Base material of air cooler supporting pipe material finning diffusers material fan impeller material</p> </td> <td style="vertical-align: top;"> <p>- carbon steel, - carbon or stainless steel, - aluminium alloy, - carbon steel or composite material, - composite material or aluminum alloy.</p> </td> </tr> </table>	<p>Base material of air cooler supporting pipe material finning diffusers material fan impeller material</p>	<p>- carbon steel, - carbon or stainless steel, - aluminium alloy, - carbon steel or composite material, - composite material or aluminum alloy.</p>
<p>Base material of air cooler supporting pipe material finning diffusers material fan impeller material</p>	<p>- carbon steel, - carbon or stainless steel, - aluminium alloy, - carbon steel or composite material, - composite material or aluminum alloy.</p>		
<b>OPERATION CONCEPT</b>	<p>Through inlet branch pipes the gas enters ACU sections where it is cooled by means of air stream from operating fans. Air stream is controlled by means of shutdown of some fans or by means of rotating fan impeller blades.</p> <p>ACU with RC can regulate cooling air temperature during cold period in order to prevent hydrate formation of raw gas in the bottom rows of section tubes.</p> <p>Increase of cooling air temperature is reached due to overlapping the outlet of hot air with upper shutters and due to limitation of cold air entry to fans inlet by means of fans unit shutters. In addition, some part of hot air through non-operating fans enters at inlet of operating fans and, mixing with the cold air it increases the temperature.</p>		
<b>NORMATIVE BASE</b>	<p>GOST R 51364-99, GOST R 52630-2012, OST 26-21-01-96, PB 03-584-03, PB 03-576-03.</p>		
<b>CONVENTIONAL SYMBOLS</b>	<p><b>Air cooling unit</b> <b>AVG-B-6.3-13-1-12-UKhL1</b>, where: AVG - type of unit; B - without RC (B) or with RC (K); 6.3 - design pressure, MPa; 13 - motor power, kW; 1 - number of sections; 12 - length of finned tube, m; UKhL1- climatic version.</p>		



## 8 Air cooling equipment

Air cooling units of type AVG-B

Designation	Heat exchange surface area, m <sup>2</sup>	Design pressure, MPa	Number of ACU sections, pcs.	Tube length, m	Number of tubes, pcs.	Diameter of fan impeller, m	Number of fans, pcs.	Weight, kg
AVG-B-0.6-7.5-1-3-UKhL1	867	0.6	1	3	180	0.8	2	3715
AVG-B-1.0-7.5-1-6-UKhL1	1765	1.0	1	6	180	0.8	3	5500
AVG-B-0.6-7.5-2-4-U1	4600	0.6	2	4	360	0.8	4	9740
AVG-B-1.6-7.5-2-8-UKhL1	4650	0.62	2	8	360	0.8	8	18000
AVG-B-10-7.5-2-10-UKhL1	5954	10	2	10	360	0.8	10	23250
AVG-B-10-13-1-12-UKhL1	7646	10	1	12	356	2.7	3	28100
AVG-B-10-13-2-12-UKhL1	10280	10	2	12	522	2.7	6	42600
AVG-B-10-13-2-12-UKhL1	13260	10	2	12	672	2.7	6	44650

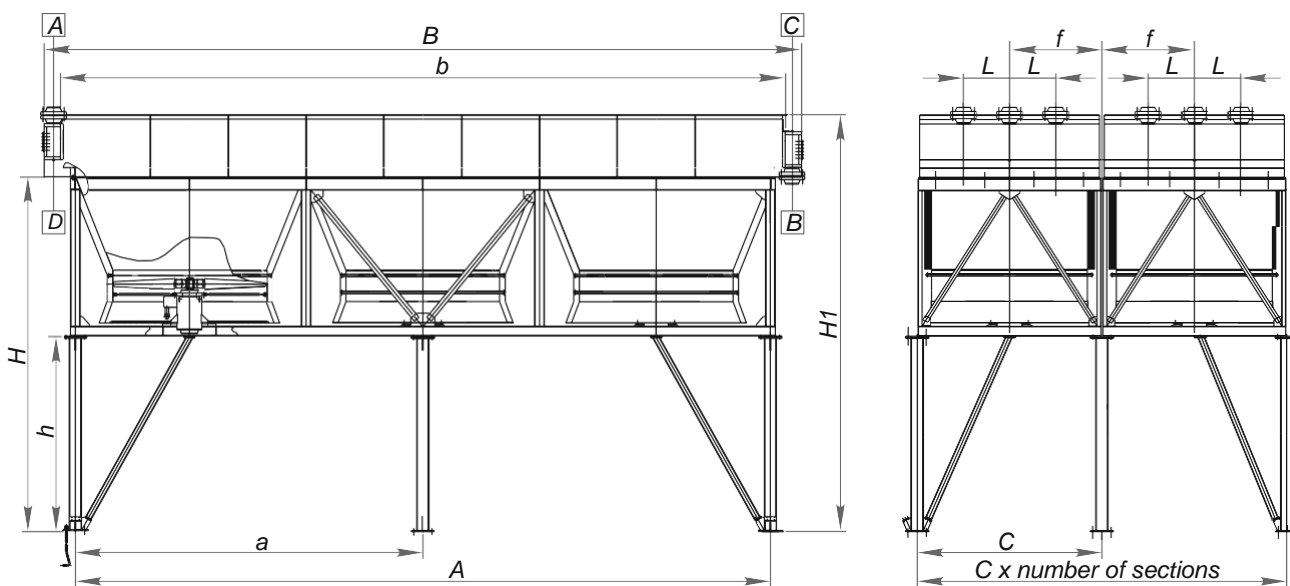


Table of nozzles

Des.	Description
A	Product inlet
B	Product outlet
C	Air discharge
D	Drainage

Designation	a, mm	A, mm	b, mm	B, mm	C, mm	h, mm	H, mm	H1, mm	L, mm	f, mm	Nozzles Dn, mm			
											A	B	C	D
AVG-B-0.6-7.5-1-3-UKhL1	-	2925	3000	3980	1500	-	1615	2595	-	750	80	80	M16x1.5	M16x1.5
AVG-B-1.0-7.5-1-6-UKhL1	-	5595	6000	6475	1350	-	2510	3450	620	750	200	200	M16x1.5	M16x1.5
AVG-B-0.6-7.5-2-4-U1	-	3925	4000	5025	1480	-	1610	2595	680	750	50	50	M16x1.5	M16x1.5
AVG-B-1.6-7.5-2-8-UKhL1	4000	8000	8000	9130	1500	-	3400	4590	-	750	200	200	M30x2	M30x2
AVG-B-10-7.5-2-10-UKhL1	4900	9600	10000	10920	1500	-	3400	4950	-	750	150	150	M20x1.5	M20x1.5
AVG-B-10-13-1-12-UKhL1	5750	11500	12000	12530	3000	2200	4200	5160	750	1500	150	150	M30x2	M30x2
AVG-B-10-13-2-12-UKhL1	5750	11500	12000	12530	3000	2200	4200	5160	900	1500	150	150	M30x2	M30x2
AVG-B-10-13-2-12-UKhL1	5750	11500	12000	12530	3000	2200	4200	5160	1000	1500	150	150	M30x2	M30x2

Air cooling units of type AVG-K

Designation	Heat exchange surface area, m <sup>2</sup>	Design pressure, MPa	Number of ACU sections, pcs.	Tube length, m	Number of tubes, pcs.	Diameter of fan impeller, m	Number of fans, pcs.	Weight, kg
AVG-K-2.5-7.5-2-4-15-UKhL1	2288	2.5	2	4.15	360	0.8	4	13150
AVG-K-8-7.5-2-10-UKhL1	5900	8	2	10	360	0.8	10	26400
AVG-K-16-22-2-12.2-UKhL1	5380	16	2	12.2	204	4.45	2	50000
AVG-K-6.3-7.5-4-12-UKhL1	11730	6.3	4	10	720	0.8	20	52800
AVG-K-2.5-13-2-12-UKhL1	13170	2.5	2	12	672	2.7	6	55400

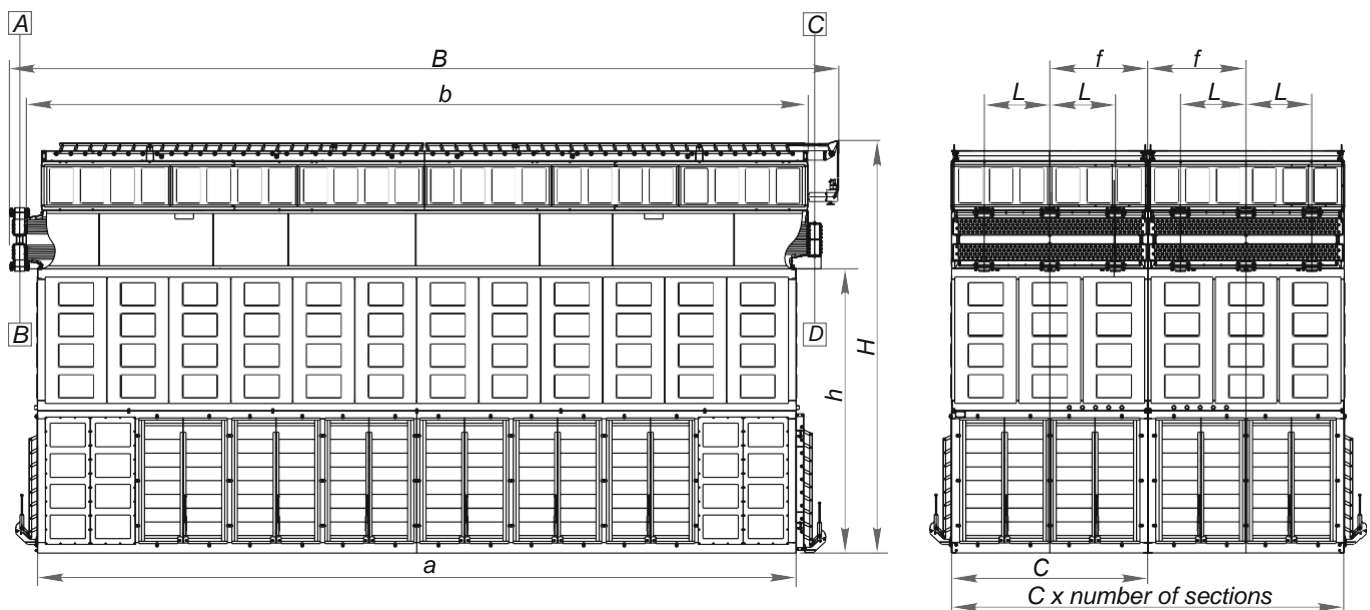


Table of nozzles

Des.	Description
A	Product inlet
B	Product outlet
C	Air discharge
D	Drainage

Designation	a, mm	b, mm	B, mm	C, mm	h, mm	H, mm	L, mm	f, mm	Nozzles Dn, mm			
									A	B	C	D
AVG-K-2.5-7.5-2-4-15-UKhL1	4050	4150	5000	1500	2300	4285	-	750	150	150	M20x2	M20x2
AVG-K-8-7.5-2-10-UKhL1	9880	10000	10600	1500	2300	4200	-	750	150	150	M20x2	M20x2
AVG-K-16-22-2-12.2-UKhL1	12160	12200	13460	3000	4700	6600	600	1500	80	80	25	25
AVG-K-6.3-7.5-4-12-UKhL1	9880	10000	10600	1500	2300	4200	-	750	150	150	M30x2	M30x2
AVG-K-2.5-13-2-12-UKhL1	11590	12000	13300	3000	4300	6200	1000	1500	150	150	M30x2	M30x2

# 10 Shell and tube heat exchangers with U-tubes of TU type

**PURPOSE** Heat exchange of liquid and gaseous media in technological processes in refinery, petrochemical, chemical, oil and gas and other industries.

**LAYOUT** TU-type heat exchanger is a horizontal apparatus, where tube bundle is located.  
Heat-exchange tubes are fixed in tube sheet, which is rigidly fastened between flanges of heat exchanger casing and distribution box. In addition heat-exchange tubes have an ability of free thermal expansion towards the casing bottom. Tubes in the tubesheet are mounted by means of expanding or seal welding with the following expanding.

There are branch pipes (nozzles) on the casing, through which heat transfer medium (operating medium) goes in the shell side. Heat transfer medium (operating medium) goes to in tubes (tube side) through the branch pipes (nozzles) on the distribution box.

The unit can be arranged as single section and multi-section.

**NORMATIVE BASE** SOUMP 11171.120-217:2009;  
GOST R 52630-2012;  
PB03-576-03;  
TR TS 032/2013.

**CONVENTIONAL SYMBOLS** **1400 TU-0.6-1.6-1/25-6-T-2**,  
where:  
1400 - shell internal diameter, mm;  
TU - heat-exchanger with U-tubes;  
0.6 - nominal pressure in tubes, MPa;  
1.6 - nominal pressure in shell, MPa;  
1 - material design:  
1 - steel 09G2S;  
2 - steel 12Kh18N10T;  
3 - tube side - steel 12Kh18N10T, shell side - steel 09G2S;  
4 - tube side - steel 09G2S, shell side - steel 12Kh18N10T.  
25 - external diameter of plain heat-exchange tubes, mm;  
6 - length of heat-exchange tubes, m;  
T - arrangement of heat-exchange tubes as per corners of equiangular triangles  
(K – as per square corners);  
2 - number of tube side passes.

Description	Internal diameter of unit D <sub>int</sub> , mm	Design pressure in tube/shell side P <sub>tube</sub> / P <sub>shell</sub> , MPa	Design temperature in tube/shell side T <sub>tube</sub> / T <sub>shell</sub> , °C	Heat-transfer surface area, m <sup>2</sup>	Size of heat-exchange tubes diameter, wall thickness, length, mm quantity of tubes	Weight, kg
400TU-0.6-0.6-1/20-4-T-2	400	0.6 / 0.6	360 / 280	39	20x2 L <sub>straight</sub> =4000 76 U-tube	1265
600TU-14.4-2.0-2/25-3-T-2	600	14.4 / 2.0	350 / 350	43.2	25x2.5 L <sub>straight</sub> =3000 87 U-tube	4661
600TU-8.0-1.6-1/25-4-T-2	600	8.0 / 1.6	80 / 150	74.6	25x2.5 L <sub>straight</sub> =4000 113 U-tube	3347
400TU-1.6-1.6-1/25-3-T-2	400	1.6 / 1.6	60 / 90	23	25x2.5 L <sub>straight</sub> =3000 47 U-tube	1055
400TU-0.6-0.6-1/25-3-T-2	400	0.6 / 0.6	160 / 160	23	25x2.5 L <sub>straight</sub> =3000 47 U-tube	1077
400TU-0.6-0.6-1/20-4-T-2	400	0.6 / 0.6	200 / 200	39	20x2 L <sub>straight</sub> =4000 76 U-tube	1360
400TU-6.3-6.3-1/20-5-T-2	400	6.3 / 6.3	60 / 60	48.8	20x2 L <sub>straight</sub> =5000 76 U-tube	2170
1200TU-1.18-1.44-1/20-6-T-2 dual	1200	1.18 / 1.44	310 / 225	1324.8	20x2 L <sub>straight</sub> =6000 1656 U-tube	32000
1200TU-10.0-10.0-1/20-9-T-2	1200	10.0 / 10.0	74 / 60	980	20x2.5 L <sub>straight</sub> =9000 828 U-tube	41275
325TU-3.6-3.6-1/20-1/57-T-2	325 external	10.0 / 10.0	150 / 40	6.7	20x2.5 L <sub>straight</sub> =1576 35 U-tube	925
325TU-3.6-3.6-1/20-1.56-T-2	325 external	3.6 / 3.6	50 / 50	6	20x2.5 L <sub>straight</sub> =560 31 U-tube	620

# 11 Shell and tube heat exchangers with U-tubes of TU type

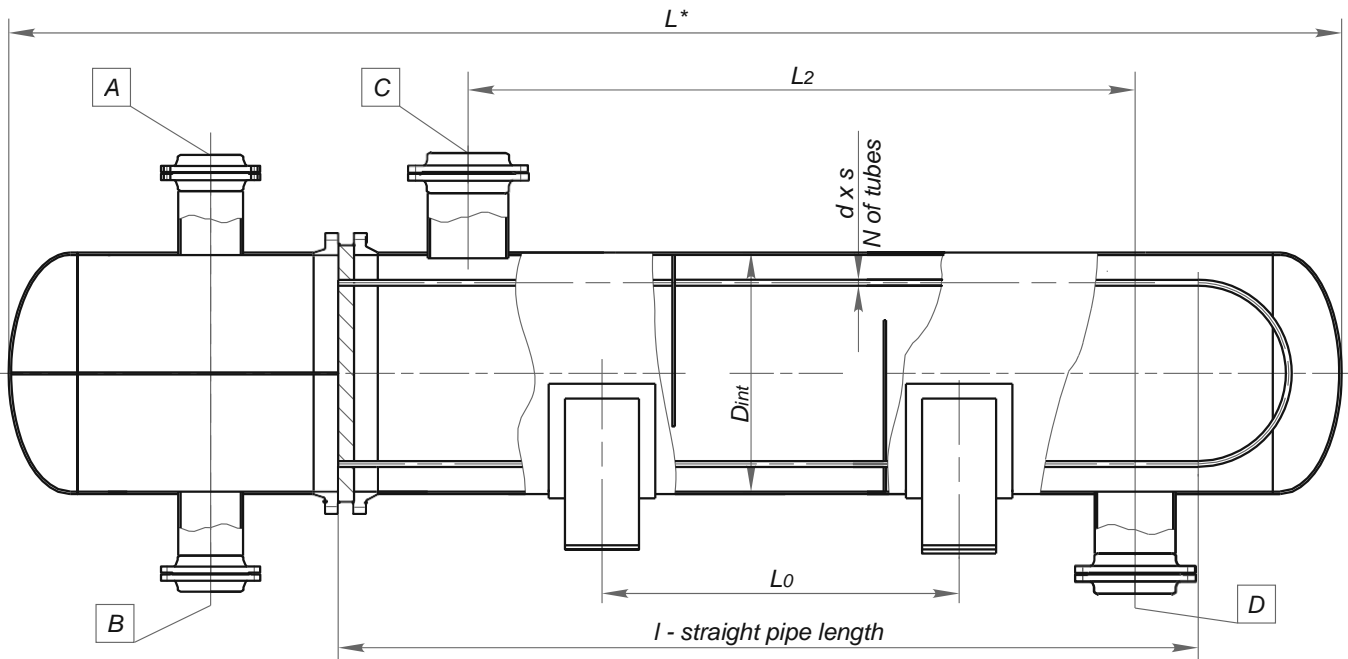


Table of nozzles

Des.	Description
A	Tube side inlet
B	Tube side outlet
C	Shell side inlet
D	Shell side outlet

Description	D <sub>int</sub> , mm	I, mm	L, mm	L <sub>0</sub> , mm	L <sub>2</sub> , mm	d x s, mm	N, pcs.	Nozzles D <sub>n</sub> , mm			
								A	B	C	D
400TU-0.6-0.6-1/20-4-T-2	400	4000	4960	2500	3500	20x2	76 U-tube	50	50	50	50
600TU-14.4-2.0-2/25-3-T-2	600	3000	4298	1500	2100	25x2,5	87 U-tube	50	50	300	300
600TU-8.0-1.6-1/25-4-T-2	600	4000	5370	2000	3360	25x2,5	113 U-tube	150	150	150	150
400TU-1.6-1.6-1/25-3-T-2	400	3000	3940	1500	2500	25x2,5	47 U-tube	100	100	100	100
400TU-0.6-0.6-1/25-3-T-2	400	3000	3940	1500	2500	25x2,5	47 U-tube	100	100	100	100
400TU-0.6-0.6-1/20-4-T-2	400	4000	4960	2500	3560	20x2	76 U-tube	150	150	150	150
400TU-6.3-6.3-1/20-5-T-2	400	5000	5952	3000	-	20x2	76 U-tube	100	100	100	100
1200TU-1.18-1.44-1/20-6-T-2 dual	1200	6000	7930	3800	5300	20x2	1656 U-tube	250	250	300	300
1200TU-10.0-10.0-1/20-9-T-2	1200	9000	12320	5400	-	20x2,5	828 U-tube	150	150	200	150
325TU-3.6-3.6-1/20-1/57-T-2	325 external	1576	2296	1015	1100	20x2,5	35 U-tube	50	50	50	50
325TU-3.6-3.6-1/20-1.56-T-2	325 external	1560	2300	760	1100	20x2,5	31 U-tube	200	200	100	100

**PURPOSE** Heat exchange of liquid and gaseous media in technological processes in refinery, petrochemical, chemical, oil and gas and other industries.

**LAYOUT** TN type heat exchanger is a horizontal or vertical apparatus, where tube bundle is located. Heat-exchange tubes are fixed in tube sheet, welded to heat-exchanger casing. Tubes in the tubesheet are mounted by means of expanding or seal welding with the following expanding.

There are branch pipes (nozzles) on the casing, through which heat transfer medium (operating medium) goes in the shell side. Heat transfer medium (operating medium) goes to in tubes (tube side) through the branch pipes (nozzles) on the distribution box.

**NORMATIVE BASE** SOUMP11171.120-217:2009;  
GOST P52630-2012;  
PB03-576-03;  
TR TS 032/2013.

**CONVENTIONAL SYMBOLS** **1000 TNG-1.6-2.5-1/20-6-4**,  
where:  
1000 - internal diameter of shell, mm;  
TNG - heat-exchanger with stationary tubesheet, horizontal (TNV- vertical);  
1,6 - design pressure in tubes, MPa;  
2,3 - design pressure in shell, MPa;  
1 - material design:  
1 - steel 09G2S;  
2 - steel 12X18H10T;  
3 - tube side - steel 12Kh18N10T, shell side - steel 09G2S;  
4 - tube side - steel 09G2S, shell side - steel 12Kh18N10T.  
20 - external diameter of plain heat-exchange tubes, mm;  
6 - length of heat-exchange tubes, m;  
4 - number of passes per tube side.

Description	Internal diameter of unit $D_{int}$ , mm	Design pressure in tube/shell side $P_{tube} / P_{shell}$ , MPa	Design temperature in tube/shell side $T_{tube} / T_{shell}$ , °C	Heat-transfer surface area, $m^2$	Size of heat-exchange tubes diameter, wall thickness, length, mm quantity of tubes	Weight, kg
325TNG-0.6-2.2-1/25-3-2 dual	325	0.6 / 2.2	60 / 100	15.08	25x2x3000 64 tubes	1450
800TNG-0.6-2.2-1/25-6-2	800	0.6 / 2.2	60 / 100	180.39	25x2x6000 383 tubes	5410
800TNG-0.6-2.2-1/25-6-2	800	0.6 / 2.2	60 / 100	180.39	25x2x6000 383 tubes	5430
325TNG-1.0-0.8-1/25-2-2	325	1.0 / 0.8	100 / 160	9.7	25x2x2000 62 tubes	472
1200TNG-4.6-4.6-1/20-9-2	1200	4.6 / 4.6	80 / 80	972	20x2x9000 1722 tubes	26970
325TNG-11.0-11.0-1/20-1.5-1	325	11.0 / 11.0	70 / 70	8.6	20x2x1500 92 tubes	1250
325TNG-0.9-0.8-2/20-2.5-1	325	0.9 / 0.8	75 / 200	10.1	20x2x2500 78 tubes	600
325TNG-0.9-0.8-1/20-2.4-2	325	0.9 / 0.8	28 / 158	11.2	20x2x2400 86 tubes	630
450TNG-0.8-0.85-2/20-6.97-2	450	0.8 / 0.85	75 / 160	101	20x2x6970 233 tubes	2895
600TNG-9.9-9.9-1/20-4.7-1	600	9.9 / 9.9	60 / 80	105	20x2.5x4700 373 tubes	6850
600TNG-8.0-0.6-1/20-6-1	600	8.0 / 0.6	50 / 120	146	20x2.5x6000 401 tubes	6460
800TNG-6.3-2.5-1/20-9-2	800	6.3 / 2.5	100 / 100	400	20x2x9000 708 tubes	10520
600TNG-18.7-9.3-1/20-6.4-1	600	18.7 / 9.3	100 / 100	150	20x2.5x6400 397 tubes	11900
1000TNG-10.0-3.6-1/20-9-1	1000	10.0 / 3.6	80 / 20	672.4	20x2x9000 1189 tubes	19400
700TNG-11.5-12.1-M1/25-4.34-1	700	11.5 / 12.1	50 / 80	116.5	25x2.5x4340 371 tubes	11600
600TNG-6.2-6.8-1/25-4.19-1	600	6.2 / 6.8	50 / 80	85.1	25x2.5x4190 271 tubes	5400

# 13 Shell and tube heat exchangers with stationary tube sheet of TN type

Fig. 1. Heat-exchanger of TNG-type (single-pass through tubes)

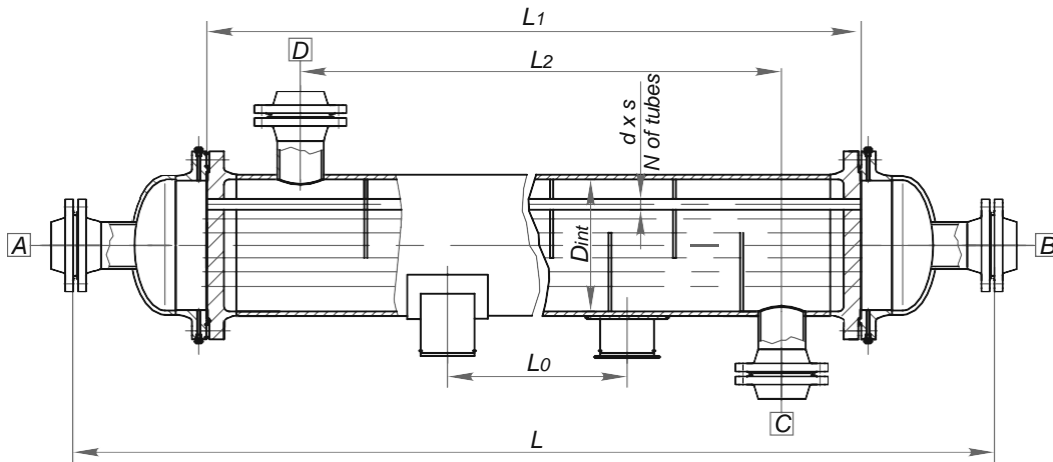


Table of nozzles

Des.	Description
A	Tube side inlet
B	Tube side outlet
C	Shell side inlet
D	Shell side outlet

Fig. 2. Heat-exchanger of TNG-type (multi-pass through tubes)

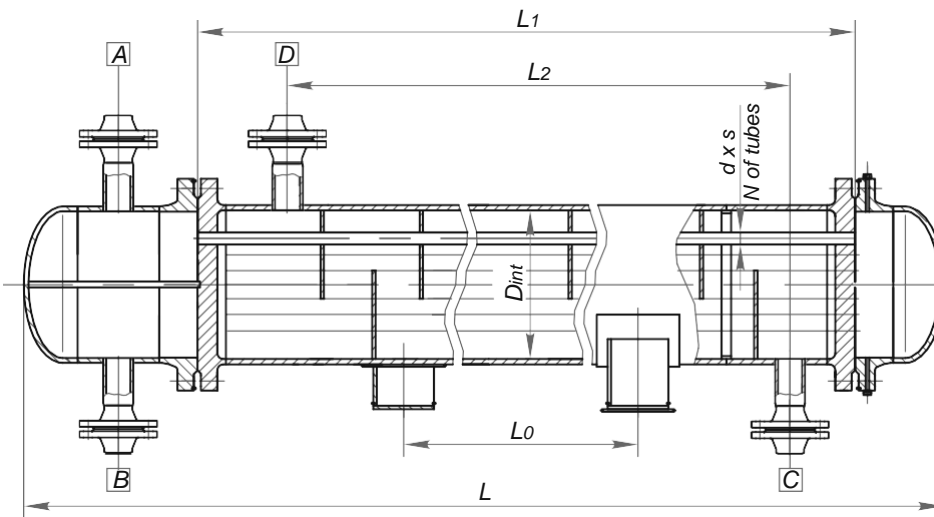


Table of nozzles

Des.	Description
A	Tube side inlet
B	Tube side outlet
C	Shell side inlet
D	Shell side outlet

Description	Fig.	Dint, mm	L1, mm	L, mm	L0, mm	L2, mm	d x s, mm	N, pcs.	Nozzles Dn, mm			
									A	B	C	D
325TNG-0.6-2.2-1/25-3-2 dual	2	325	3000	3640	1500	2550	25x2	64	50	50	80	80
800TNG-0.6-2.2-1/25-6-2	2	800	6000	7020	3000	4690	25x2	383	150	150	150	150
800TNG-0.6-2.2-1/25-6-2	2	800	6000	7020	3000	4690	25x2	383	150	150	150	200
325TNG-1.0-0.8-1/25-2-2	1	325	2000	2620	800	1550	25x2	62	50	50	50	50
1200TNG-4.6-4.6-1/20-9-2	1	1200	9000	10740	6000	7900	20x2	1722	300	300	400	400
325TNG-11.0-11.0-1/20-1.5-1	1	325	1500	2542	600	946	20x2	92	100	100	100	100
325TNG-0.9-0.8-2/20-2.5-1	2	325	2500	4150	1500	2198	20x2	78	80	80	40	40
325TNG-0.9-0.8-1/20-2.4-2	2	325	2400	2745	1500	2098	20x2	86	80	80	40	40
450TNG-0.8-0.85-2/20-6.97-2	1	450	6970	8725	4500	6424	20x2	233	200	200	80	80
600TNG-9.9-9.9-1/20-4.7-1	1	600	4700	6312	2700	4035	20x2.5	373	300	300	80	80
600TNG-8.0-0.6-1/20-6-1	1	600	6000	7610	3000	5335	20x2.5	401	300	300	80	80
800TNG-6.3-2.5-1/20-9-2	1	800	9000	10370	6000	7830	20x2	708	140	140	250	250
600TNG-18.7-9.3-1/20-6.4-1	1	600	6400	8675	3400	5240	20x2.5	397	150	150	200	200
1000TNG-10.0-3.6-1/20-9-1	1	1000	9000	11680	5000	8022	20x2	1189	150	150	200	200
700TNG-11.5-12.1-M1/25-4.34-1	1	700	4340	6347	2000	3420	25x2.5	371	400	400	50	50
600TNG-6.2-6.8-1/25-4.19-1	1	600	4190	5641	2000	3540	25x2.5	271	400	400	50	50

**PURPOSE** Heat exchange of liquid and gaseous media in technological processes in refinery, petrochemical, chemical, oil and gas and other industries.

**LAYOUT** TP-type heat exchanger is a horizontal or vertical apparatus, where tube bundle is located. Heat-exchange tubes are fixed in tube sheets, one of which is fastened between flanges of heat exchanger casing and distribution box and is stationary, and the other one is able to move freely inside the casing under the action of thermal expansions. Tubes in the tubesheet are mounted by means of expanding or seal welding with the following expanding.

There are branch pipes (nozzles) on the casing, through which heat transfer medium (operating medium) goes in the shell side. Heat transfer medium (operating medium) goes to in tubes (tube side) through the branch pipes (nozzles) on the distribution box.

**NORMATIVE BASE** SOUMP11171.120-217:2009;  
GOST R 52630-2012;  
PB03-576-03;  
TR TS 032/2013.

**CONVENTIONAL SYMBOLS** **1000 TPG-1.6-2.5-1/20-6-T-4**,  
where:  
1000 - internal diameter of shell, mm;  
TPG - heat-exchanger with floating head, horizontal (TPV - vertical);  
1,6 - design pressure in tubes, MPa;  
2,5 - design pressure in shell, MPa;  
1 - material design:  
1 - steel 09G2S;  
2 - steel 12Kh18N10T;  
3 - tube side - steel 12Kh18N10T, shell side - steel 09G2S;  
4 - tube side - steel 09G2S, shell side - steel 12Kh18N10T.  
20 - external diameter of plain heat-exchange tubes, mm;  
6 - length of heat-exchange tubes, m;  
T - arrangement of heat-exchange tubes as per corners of equiangular triangles (K – as per square corners);  
4 - number of passes per tube side.

Description	Internal diameter of unit $D_{int}$ , mm	Design pressure in tube/shell side $P_{tube} / P_{shell}$ , MPa	Design temperature in tube/shell side $T_{tube} / T_{shell}$ , °C	Heat-transfer surface area, $m^2$	Size of heat-exchange tubes diameter, wall thickness, length, mm quantity of tubes	Weight, kg
800TPG-6.3-6.3-1/20-6-T-2	800	6.3 / 6.3	350 / 350	226	20x2x6000 645 tubes	18680
325TPG-0.6-1.9-3/25-6-K-2	325	0.6 / 1.9	60 / 60	20.7	25x2x6000 44 tubes	1160
325TPG-0.6-1.9-3/25-6-K-2 dual	325	0.6 / 2.3	60 / 60	41.4	25x2x6000 88 tubes	2340

# 15 Shell and tube heat exchangers with floating head of TP type

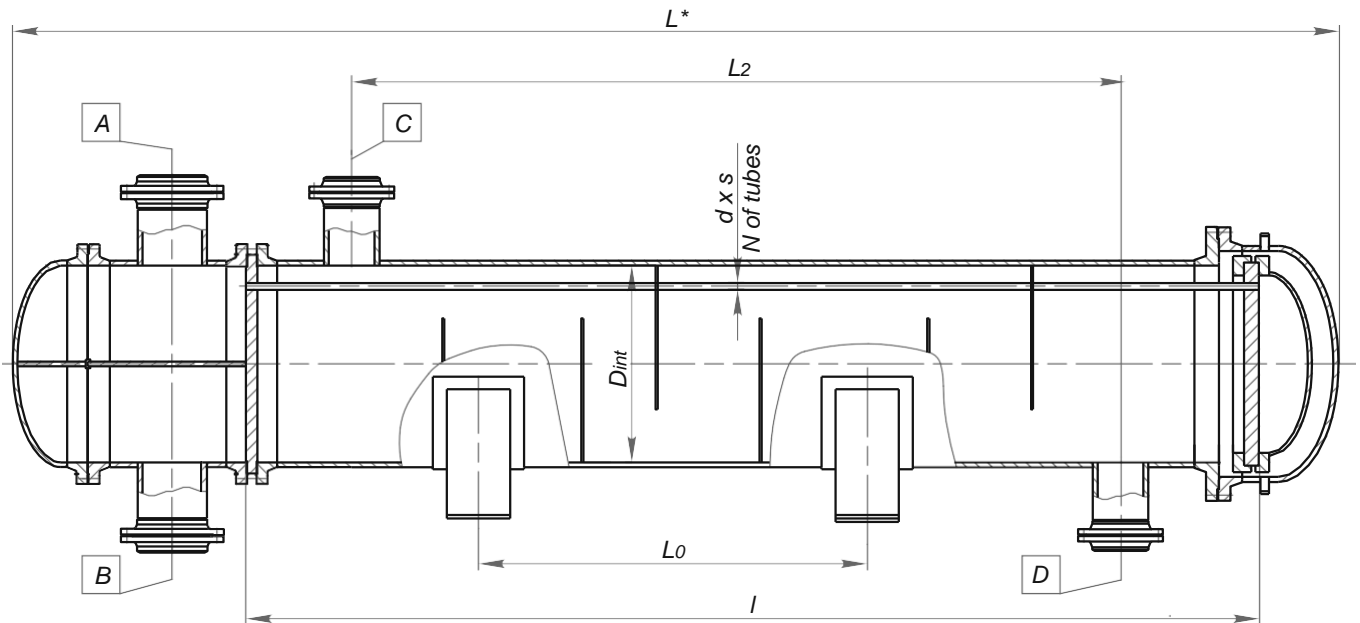


Table of nozzles

Des.	Description
A	Tube side inlet
B	Tube side outlet
C	Shell side inlet
D	Shell side outlet

Description	D <sub>int</sub> , mm	I, mm	L, mm	L <sub>0</sub> , mm	L <sub>2</sub> , mm	d x s, mm	N, pcs.	Nozzles D <sub>n</sub> , mm			
								A	B	C	D
800TPG-6.3-6.3-1/20-6-T-2	800	6000	7960	3200	3954	20x2	645	300	300	300	300
325TPG-0.6-1.9-3/25-6-K-2	325	6000	6760	3000	5350	25x2	44	100	100	100	100
325TPG-0.6-1.9-3/25-6-K-2 dual	325	6000	6760	3000	5350	25x2	88	100	100	100	100



## 16 Absorbers

**PURPOSE** Dehydration of natural gas by means of glycol in natural gas liquid dehydration unit.

**OPERATION CONCEPT** process principle consists in liquid intake from gaseous mixture with absorption liquid.

**LAYOUT** Absorber is a vertical welded cylindrical vessel, installed on the skirt-type support. The apparatus is equipped with manholes and process nozzles. For absorption process the apparatus is equipped with mass-transfer elements: bubble-cap trays. In order to reduce absorbent loss, there are mesh demister and filtering elements unit installed in upper part of absorbers.

The apparatus can be equipped with instruments for monitoring absorbent level in cubic part, pressure, differential pressure and gas and liquid temperature.

Operating medium natural gas.  
Item base material steel 09G2S.

**NORMATIVE BASE** SOUMPP 71.120-217:2009,  
GOST R 52630-2012,  
PB03-576-03,  
TR TS 032/2013.

**CONVENTIONAL SYMBOLS** **Ab 2800-6.3**  
where:  
Ab - absorber;  
2800 - absorber internal diameter, mm;  
6.3 - design pressure, MPa.

Designation	Unit internal diameter, mm	Design pressure, MPa	Capacity per gas, mln. nm <sup>3</sup> /day	Nominal diameter of gas inlet/outlet nozzles, mm	Weight, kg
Ab 2000-8.25	2000	8.25	5	400/400	47200
Ab 2000-11.0	2000	11.0	5	400/400	70600
Ab 2800-5.5	2800	5.5	5.4	400/400	73530
Ab 2800-6.3	2800	6.3	10	400/400	80400

# 17 Absorbers

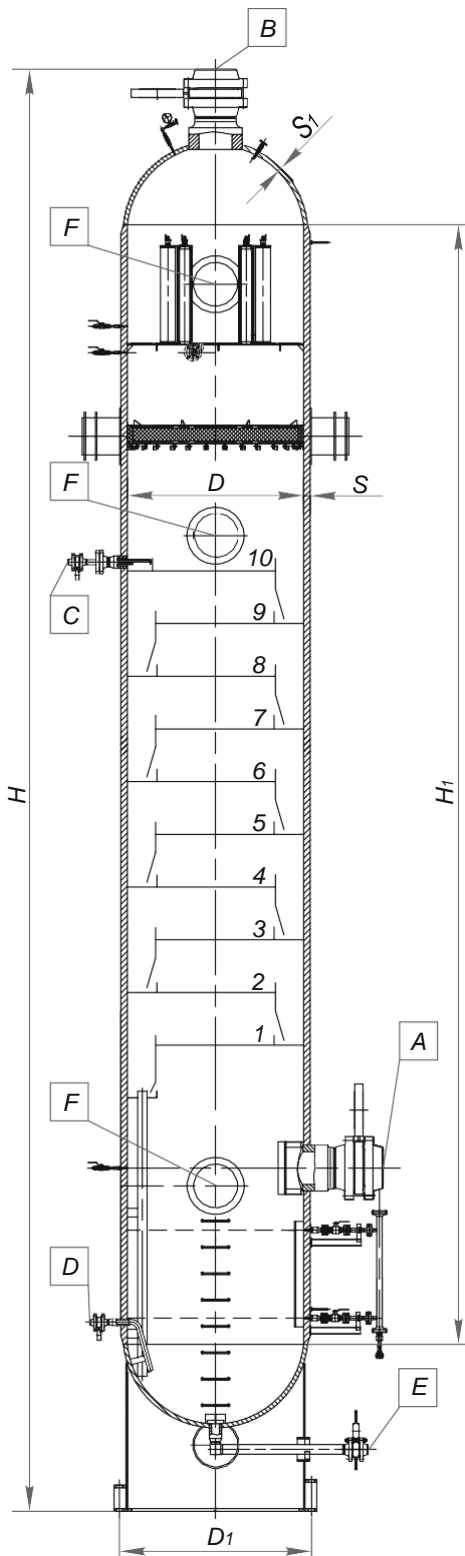


Table of nozzles

Des.	Description
A	Gas inlet
B	Gas outlet
C	Refluxing inlet
D	Discharge
E	Drainage
F	Manhole

Designation	D, mm	H, mm	H <sub>1</sub> , mm	D <sub>1</sub> , mm	S/S <sub>1</sub> , mm	Nozzles Dn, mm					
						A	B	C	D	E	F
Ab 2000-8.25	2000	15505	11980	2350	55 / 36	400	400	50	50	100	500
Ab 2000-11.0	2000	16620	12945	2300	75 / 45	400	400	50	50	100	500
Ab 2800-5.5	2800	17480	13640	3140	55 / 26	400	400	100	100	50	500
Ab 2800-6.3	2800	17480	13440	3140	60 / 36	400	400	100	100	50	500

## 18 Adsorbers

**PURPOSE** Dehydration of associated petroleum gas from residual moisture by means of adsorption

**OPERATION CONCEPT** Adsorption process is based on the absorptive capacity of solid adsorbent to intake molecular liquid from gas.

**LAYOUT** Adsorber is a vertical steel welded cylindrical vessel, installed on the skirt-type support. The apparatus is equipped with manholes and process nozzles. For adsorption process the apparatus is filled with consumables: zeolite laid onto the porcelain balls.

The apparatus is equipped with instruments for monitoring pressure, differential pressure and gas temperature.

Operating medium natural gas.

Item base material steel 09G2S.

**NORMATIVE BASE** SOU MPP 71.120-217:2009,  
GOST R 52630-2012,  
PB03-576-03,  
TR TS 032/2013.

**CONVENTIONAL SYMBOLS** **Ad 3000-16.0**  
where:  
Ad - adsorber;  
3000 - adsorber internal diameter, mm;  
16.0 - design pressure, MPa.

Designation	Unit internal diameter, mm	Design pressure, MPa	Design temperature, °C	Capacity per gas, mln. nm <sup>3</sup> /day	Nominal diameter of branch pipes (in/out), mm	Weight, kg
Ad 300-6.3	300	6.3	320	0.05	50/50	425
Ad 1400-14.4	1400	14.4	350	4.3	300/300	38260
Ad 2400-10.0	2400	10.0	350	3.5	200/200	67900
Ad 2800-7.5	2800	7.5	300	3.75	250/250	64356
Ad 3000-8.0	3000	8.0	350	13.8	300/300	83100

# 19 Adsorbers

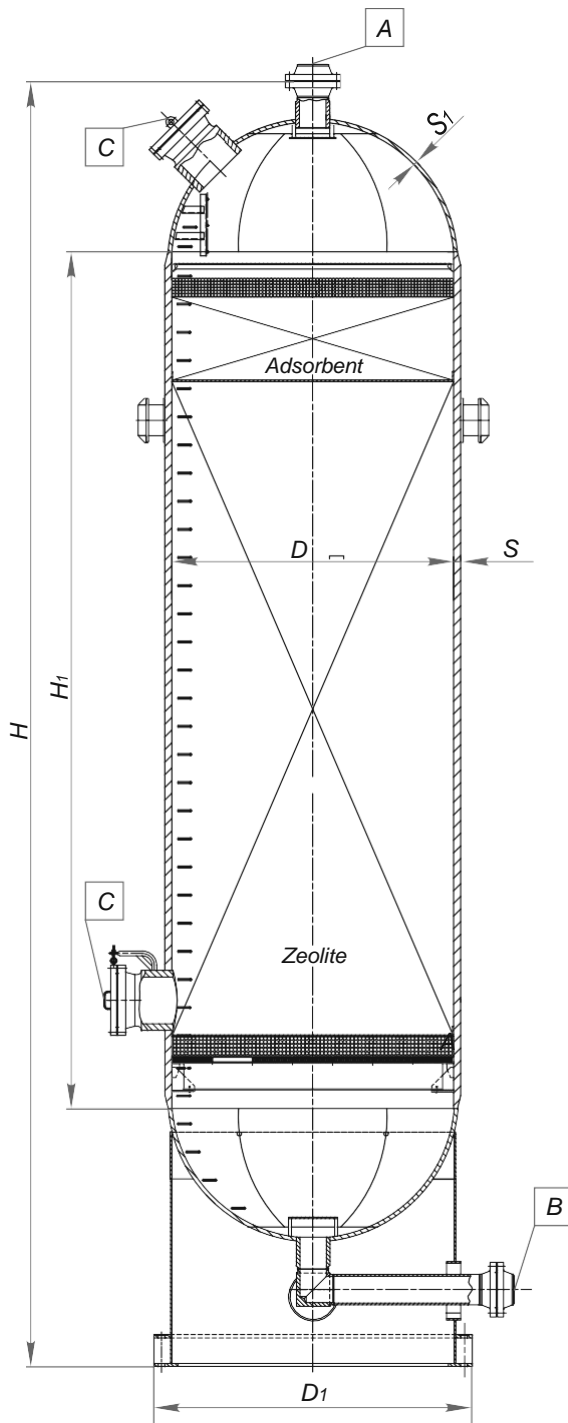


Table of nozzles

Des.	Description
A	Gas inlet (outlet)
B	Gas outlet (inlet)
C	Manhole

Designation	D, mm	H, mm	H <sub>1</sub> , mm	D <sub>1</sub> , mm	S/S <sub>1</sub> , mm	Nozzles D <sub>n</sub> , mm		
						A	B	C
Ad 300-6.3	300	3520	3085	650	12 / 16	80	80	150
Ad 1400-14.4	1400	13925	10380	1680	80 / 50	300	300	450
Ad 2400-10.0	2400	14440	9150	2800	90 / 50	200	200	500
Ad 2800-7.5	2800	12970	7150	3140	90 / 45	250	250	450
Ad 3000-8.0	3000	13710	9140	3384	90 / 45	300	300	500

## 20 Underground horizontal drain vessels

**PURPOSE** Discharge of residue of petroleum products, petroleum, oil, condensate, incl. in mixture with water from process networks (pipelines) and apparatus at refinery, petrochemical, oil and gas enterprises. They can be used for collection and temporary storage of gas condensate.

**LAYOUT** Drain vessel is a horizontal cylindrical vessel with two manholes located in the upper part of apparatus. One manhole is used for equipment repair and maintenance work, the other one – for liquid pumping down and drainage from the vessel. It can be fitted with submerged pump installed on it, which pumps off the liquid from the vessel. The vessels are also equipped with process nozzles and nozzles for instrumentation connection.

The apparatus can be equipped with coils for product heating. Coil location -inside the vessel. Heat-transfer medium – hot water or steam. Electric heating of vessel can be applied. In this case, heater location– only outdoor.

Vessel material design carbon steel.

**NORMATIVE BASE** SOU MPP 71.120-217:2009,  
GOST R 52630-2012,  
TR TS 032/2013.

**CONVENTIONAL SYMBOLS** **EP-1600-6.3/1.6-N**  
where:  
E - vessel;  
P - underground without heater or  
PPv - underground with water heater;  
PPE - underground with electric heater;  
1600 - internal diameter, mm;  
6.3 - nominal volume, m<sup>3</sup>;  
1.6 - design pressure, MPa;  
N - completed with submerged pump KhPE80-50-200-D-55 (Q=50m<sup>3</sup>; H=50 m H<sub>2</sub>O);  
without letter - without pump.

Underground horizontal drain vessels with submerged pump

Designation	Unit internal diameter, D <sub>int</sub> , mm	Design pressure, P <sub>p</sub> , MPa	Nominal volume, m <sup>3</sup>	Weight, kg
EPPv-1200-5/0.07-N-U1	1200	0.07	5	3040
EP-2000-12.5/0.07-N-UkH1	2000	0.07	12.5	4530
EPPv-2200-32/0.7-N-U1	2200	0.07	32	7650

Underground horizontal drain vessels

Designation	Unit internal diameter, D <sub>int</sub> , mm	Design pressure, P <sub>p</sub> , MPa	Nominal volume, m <sup>3</sup>	Weight, kg
EP-1600-10/3.0-UkH1	1600	3.0	10	6400
EPP-2000-16/0.07-U1	2000	0.07	16	4400
EPPv-2000-16/1.6-UkH1	2000	1.6	16	5601
EP-2200-25/0.2-U1	2200	0.2	25	5950

# 21 Underground horizontal drain vessels

Underground horizontal drain vessels with submerged pump

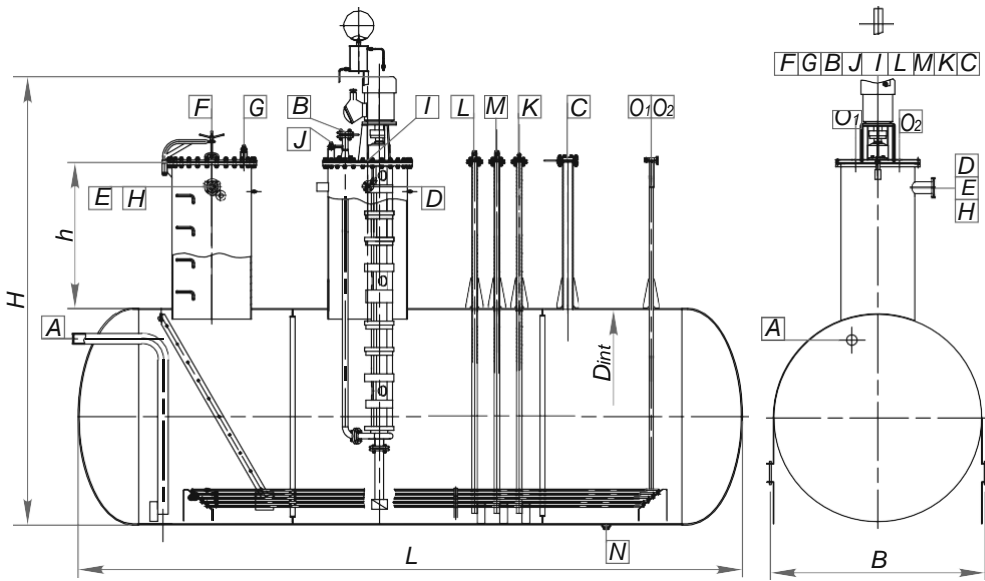


Table of nozzles

Des.	Description
A	Product inlet
B	Product outlet
C	Into atmosphere
D	Backup
E	Nitrogen (steam)
F	Manhole
G	For pressure gauge
H	Vent
I	Manhole for pump
J	For pressure gauge
K	For temperature sensor
L	For level sensor
M	For max level sensor
N	For drain after hydrotests
O <sub>1</sub>	Heat-transfer medium inlet
O <sub>2</sub>	Heat-transfer medium outlet

Designation	D <sub>int</sub> , mm	H, mm	L, mm	h, mm	B, mm
EPPv-1200-5/0.07-N-U1	1200	3900	5320	1500	1295
EP-2000-12.5/0.07-N-UKhL1	2000	4400	4346	1300	2295
EPPv-2200-32/0.7-N-U1	2200	4450	8960	1350	2300

Underground horizontal drain vessels

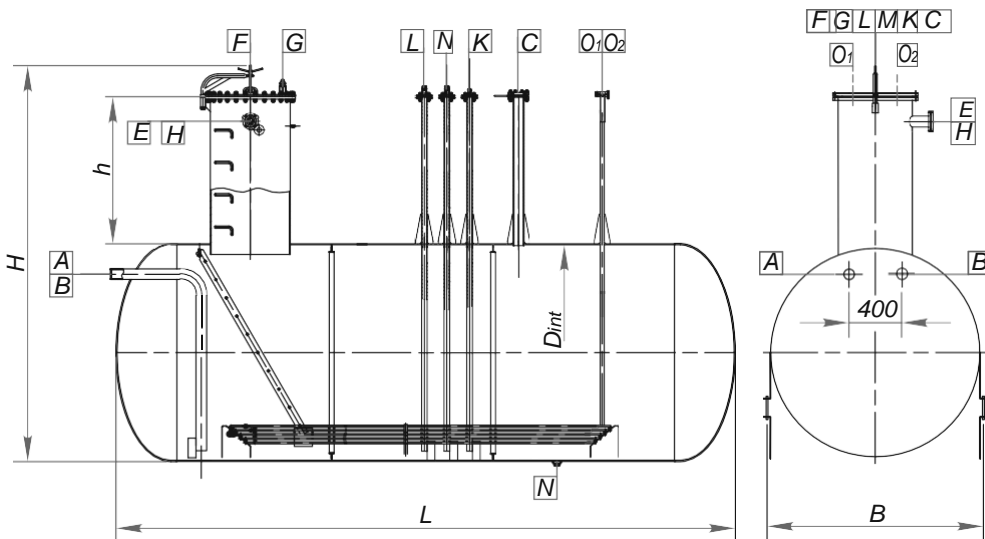


Table of nozzles

Des.	Description
A	Product inlet
B	Product outlet
C	Into atmosphere
E	Nitrogen (steam)
F	Manhole
G	For pressure gauge
H	Vent
K	For temperature sensor
L	For level sensor
M	For max level sensor
N	For drain after hydrotests
O <sub>1</sub>	Heat-transfer medium inlet
O <sub>2</sub>	Heat-transfer medium outlet

Designation	D <sub>int</sub> , mm	H, mm	L, mm	h, mm	B, mm
EP-1600-10/3.0-UKh1	1600	3640	5470	1500	1715
EPP-2000-16/0.07-U1	2000	4055	5655	1500	2100
EPPv-2000-16/1.6-UKhL1	2000	4055	5655	1500	2100
EP-2200-25/0.2-U1	2200	4255	7000	1500	2300

## 22 Aboveground horizontal vessels

**PURPOSE** For process plants of chemical and refinery industries, as well as in process plants for liquid and gaseous and hydrocarbon media. They are allowed to be applied as clarifiers and other individual vessels, not being a part of process units.

**LAYOUT** The apparatus is a cylindrical vessel with process nozzles and nozzles for instrumentation connection. The vessels are also equipped with manholes for inspection of vessel internal surface, its cleaning and repair.

The apparatus can be completed with coils for product heating. Coil location -inside the vessel or outside. Heat-transfer medium – hot water or steam. Electric heating of vessel can be applied. In this case, heater location– only outdoor.

Vessel material design carbon steel.

**NORMATIVE BASE** SOU MPP 71.120-217:2009,  
GOST R52630-2012,  
TR TS 032/2013.

**CONVENTIONAL SYMBOLS** **EGPv-2400-25.0/0.6**  
where:  
E - vessel;  
G - type of vessel:  
G - horizontal,  
M - vertical;  
Pv - type of heater:  
Pv - water heater,  
Pe - electric heater,  
Without the third letter - without heater;  
2400 - internal diameter, mm;  
25.0 - nominal volume, m<sup>3</sup>;  
0.6 - design pressure, MPa.

Designation	Unit internal diameter, D <sub>int</sub> , mm	Design pressure, P <sub>p</sub> , MPa	Nominal volume, V, m <sup>3</sup>	Weight, kg
EG-1600-6.3/1.6	1600	1.6	6.3	2605
EG-1600-10.0/0.6	1600	0.6	10.0	2590
EG-2000-25.0/2.5	2000	2.5	25.0	7500
EG-2000-25.0/6.3	2000	6.3	25.0	24800
EG-2000-25.0/8.0	2000	8.0	25.0	28000
EG-2800-50.0/0.07	2800	filling	60.0	10300
EG-3000-50.0/0.07	3000	filling	50.0	11000
EG-3000-100/1.6	3000	1.6	100.0	24100

## 23 Aboveground horizontal vessels

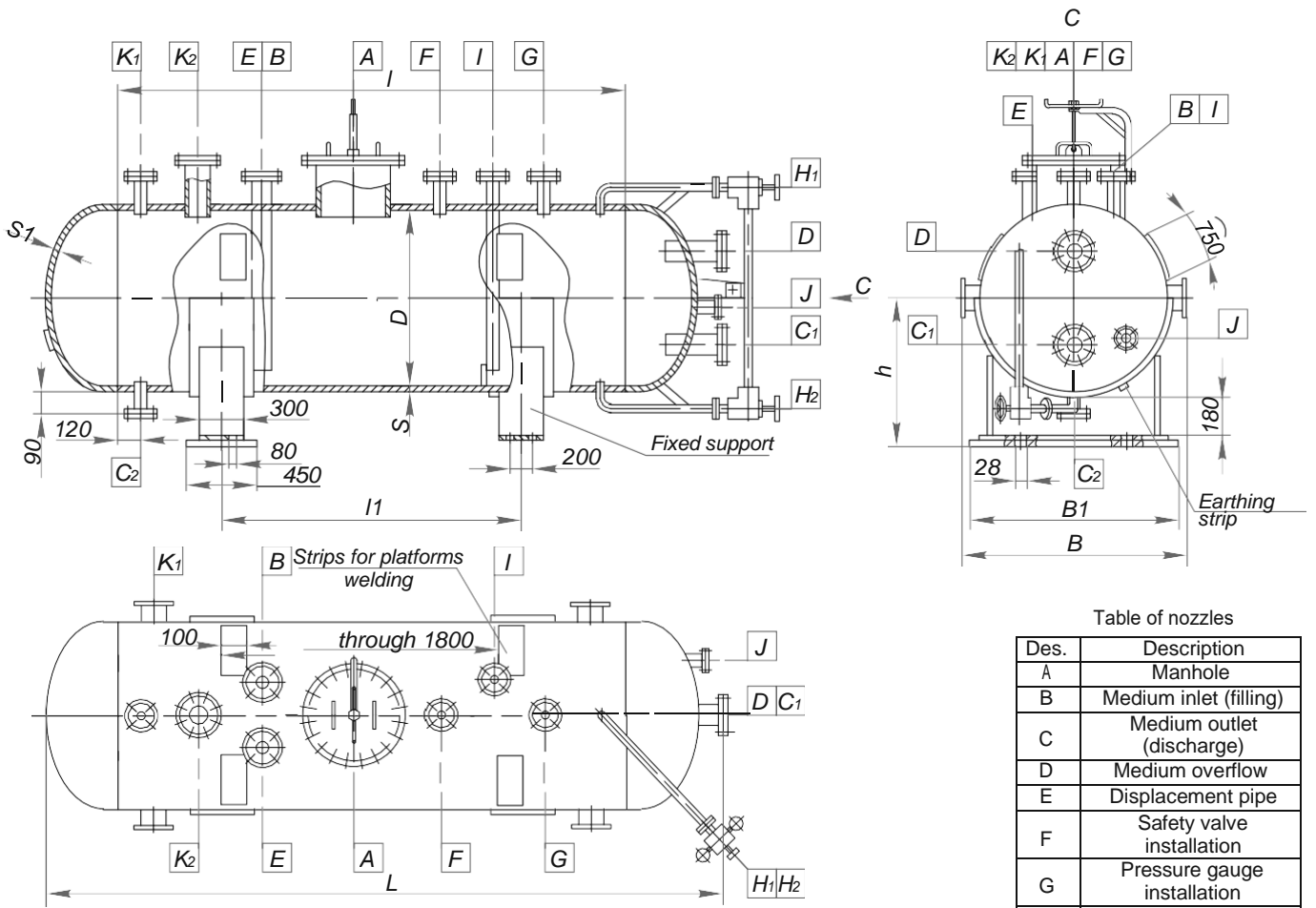


Table of nozzles

Des.	Description
A	Manhole
B	Medium inlet (filling)
C	Medium outlet (discharge)
D	Medium overflow
E	Displacement pipe
F	Safety valve installation
G	Pressure gauge installation
H	Installation of pipe-type level indicator
I	Installation of level gage of Y5-type
J	Temperature gauge installation
K	Stand-by
L	Heat transfer medium inlet
M	Heat transfer medium outlet
N	Tube bundle installation
O	Air inlet and outlet (in jacket)

Designation	D, MM	S, MM	S1, MM	L, MM	l, MM	l1, MM	B, MM	B1, MM
EG-1600-6.3/1.6	1600	12	14	3550	2500	1600	1800	1400
EG-1600-10.0/0.6	1600	8	10	5300	4400	3000	1790	1400
EG-2000-25.0/2.5	2000	14	16	8300	7000	5000	2230	1790
EG-2000-25.0/6.3	2000	40	36	10560	8500	5000	2120	1500
EG-2000-25.0/8.0	2000	50	45	10590	8500	5000	2100	1800
EG-2800-50.0/0.07	2800	10	12	10910	8750	7550	3005	2480
EG-3000-50.0/0.07	3000	12	14	7300	6600	4000	3480	2640
EG-3000-100/1.6	3000	18	20	15360	13000	11700	3480	2640



**PURPOSE** Storage of petroleum and petroleum products with density not more than 1 t/m<sup>3</sup>, as well as water storage.

**LAYOUT** Vertical steel tanks (RVS) are the most popular vessels for storage of petroleum and petroleum products and water.

Typical cylindrical vertical steel tanks can have the following volume: 100, 200, 400, 500, 700, 1000, 2000, 5000, 10000, 20000 cubic meters.

The dimensions of sheets for manufacture of tank walls and head are usually 1500x6000 mm. They are processed from four sides till the dimensions 1490x5990 mm for tank walls, and, as per cut, for the head. All factory weld connections are butt joints. Tank walls and head are made as strips which then are transported to the construction site in rolled state.

Tank cover is built-up, consisting of flat panels, laid with the slope to the central ring and tank wall. The panels are connected with each other by means of overlap assembly.

In accordance with the "Rules for design of vertical cylindrical steel tanks" for maintenance of equipment located on the cover, the tank is equipped with the platforms with protective enclosures and external stair.

Tank cover stair is angled, shaft, also used as a carcass for wall sheet welling up.

When gasoline and petroleum products with high vapour pressure are stored, pontoon is installed in the tank in order to reduce evaporation losses. Pontoon arrangement represents the steel head along the perimeter of which the tubular step is welded. Link seal between cover and body wall as performed by means of gate.

Purchased pontoon made of polymeric and other materials can also be ordered.

Purpose of the tank main equipment.

Inlet-distribution nozzles are designed for location of inlet-distribution equipment.

First ring manholes are designed for access inside the tank during repair and cleaning from accumulated dirt.

Light manhole is designed for airing during repair and cleaning.

Internal check valve with control mechanism prevents oil leakage out of tank in case of damage of inlet-distribution nozzles.

Level indicator manhole serves for product level measurement.

There are also nozzles for ventilation, installation and other process purposes.

If required, the tanks can be completed with heaters.

For safe operation of tanks they are completed with the following equipment:

- breathing apparatus;
- level controller;
- fire safety devices;
- lightning protection devices.

Breathing apparatus includes the following: flame arresters, preventing flame and sparkles from penetration inside the tank. Pressure-vacuum vent valves are installed on the tank cover for reduction of evaporation losses during storage of flammable product. Safety valves are installed in case of breakdown of pressure-vacuum vent valve or disturbance of operating regime in order to prevent tank destruction caused by over-pressure or vacuum.

The tank is provided with lightning protection system. Lightning rods are installed on the tank cover.

Level controllers shall ensure compulsory checking of product level. Maximum product level shall be monitored by level annunciator (two as a minimum), transmitting the trip signal for pumping equipment.

In accordance with requirement of regulatory documents, the tanks have fire-extinguishing equipment. Fire-extinguishing equipment are divided into external reflux devices in case of high increase of temperature or inflammation of product which supplies the water by means of perforated headers, and into indoor fire-fighting devices.

## LAYOUT

Indoor fire-fighting devices represent a header, located on a certain height from the tank head, from which the water is supplied to foam generators located in the upper part of the tank for covering with the foam the product area inside the tank. For foam generators maintenance are provided with fire-escape stair and service platforms, manholes and nozzles.

The tank is fitted with lightning protection system. Depending on the lightning protection arrangement, the tanks shall be protected against direct stroke lightning, electrostatic and electromagnetic induction, external high voltage in pipelines.

At the request of the customer the tanks can be completed with additional instrumentation:

Except the stated above level controllers and maximum level controllers, the tanks can be equipped with low level alarms, devices for measuring temperature of the medium in the tank, devices for measuring temperature of the air in the tank and other instrumentation.

Design variants:

- 1) Depending on the purpose and climatic operation conditions:
  - of carbon steel (for operation by temperature up to  $-40^{\circ}\text{C}$ );
  - of low-alloy steel (for operation by temperature up to  $-65^{\circ}\text{C}$ ).
- 2) Depending on the arrangement, based on the product parameters:
  - without pontoon (RVS);
  - with pontoon (RVSP).

## CONVENTIONAL SYMBOLS

### **RVS-5000**

where:

RVS - vertical steel tank (RVSP - with pontoon);  
5000 - nominal volume,  $\text{m}^3$ .

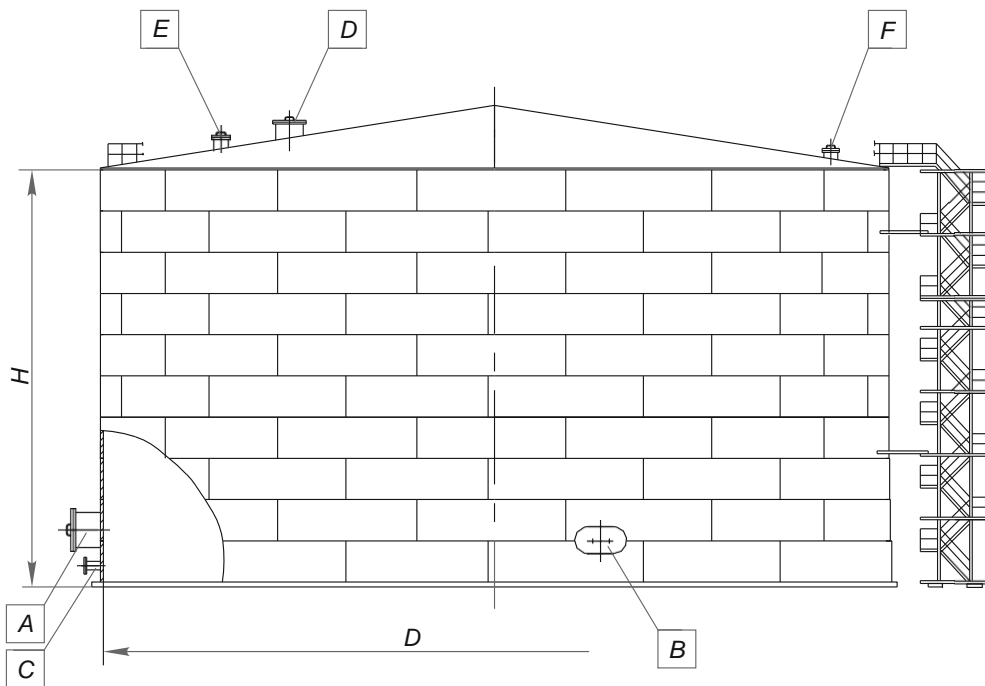


Table of nozzles

Des.	Description
A	First ring manhole
B	Oval first ring manhole
C	Inlet transfer nozzle
D	Light manhole
E	Mounting manhole
F	Vent nozzle

Location of nozzles and manholes is according to Typical projects. Auxiliary nozzles for breathing equipment, control and measuring devices, safety control devices and other process function are performed at customer's additional request.

Basic dimensions of typical tanks

Designation	Volume, m <sup>3</sup>	H, mm	D, mm	Nozzles Dn, mm						Weight, kg
				A	B	C	D	E	F	
RVS-200 for water	200	5980	6630	500	-	150	500	500	200	15210
RVS-200 for sea water	200	5980	6630	500	-	150	500	500	200	15210
RVS-300	300	7450	7580	500	-	-	500	-	80	16575
RVS-500	500	5960	10430	500	600x900	-	500	500	100	24462
RVS-700	700	8940	10430	500	600x900	150	500	500	-	24230
RVS-1000	1000	11920	10430	500	600x900	200	500	500	-	34341
RVS-2000	2000	11920	15180	500	600x900	200	500	500	-	66000
RVS-5000	5000	14900	20520	500	600x900	200	500	500	-	142350
RVSP-10000	10000	17880	28500	500	600x900	200	500	500	-	228444
RVS-10000	10000	17880	28500	500	600x900	200	500	500	-	209269
RVS-20000	20000	17880	39900	500	600x900	250	500	500	-	408114

## 27 Fuel gas heating units

**PURPOSE** Indirect heating of natural (associated petroleum) gas.

**LAYOUT** The unit consists of gas heater and valve rack located on common frame; valve rack includes piping with shut-off control valves and instrumentation.

The heater is a horizontal double-casing apparatus; the upper casing is shell and tube U-shaped heat exchanger; the bottom casing is a cylinder shell with a flame tube and gas burners located in it. Chimney is installed on the flame tube nozzle. Interior space of the heater casing is filled with intermediate heat transfer medium. Heater and external pipelines are heat insulated.

Fuel gas heating unit is installed outdoors and can operate in areas with different climatic conditions.

Unit base material - carbon steel,

Tube bundle - stainless steel.

**OPERATION CONCEPT** Through nozzle "A" the gas is supplied to heat-exchanger circuit and piping for fuel gas supply to the gasburners.

The heat transfer medium heated in the bottom casing of heater heats the gas, circulating in the heat exchanger tube side. Chimney gases of furnace volume of the flame tube are removed outside the unit by means of chimney. Heated gas comes out of the unit through the nozzle "B". Nozzles "C" and "D" are designed for discharge and drainage of the heat transfer medium out of the heater casing.

**NORMATIVE BASE** OST 26.260.18-2004 "Process units for gas and oil industry. General specifications";  
VRD 39-18-055-2002 "Typical technical requirements to CS, BCS and UGSF CS designing".

**CONVENTIONAL SYMBOLS** **Fuel gas heating unit**  
**PGO-20-670-10.0-KhL1**,  
where:  
PGO - straight firing gas heater;  
20 - capacity, thous. m<sup>3</sup>/h;  
670 - heat power, kW;  
10,0 - design pressure, MPa;  
KhL1 - climatic area of operation.

Designation	Capacity per gas, m <sup>3</sup> /h	Heat power, kW	Design pressure P <sub>0</sub> , MPa	Climatic version	Weight (without heat transfer medium), kg
Fuel gas heating unit PGO-10-320-8.0-U1	12500	320	8,0	Y1	7800
Fuel gas heating unit PGO-20-670-10.0-KhL1	22834	670	10,0	XI1	12800
Fuel gas heating unit PGO-30-900-6.3-KhL1	30000	900	6,3	XI1	15300

## 28 Fuel gas heating units

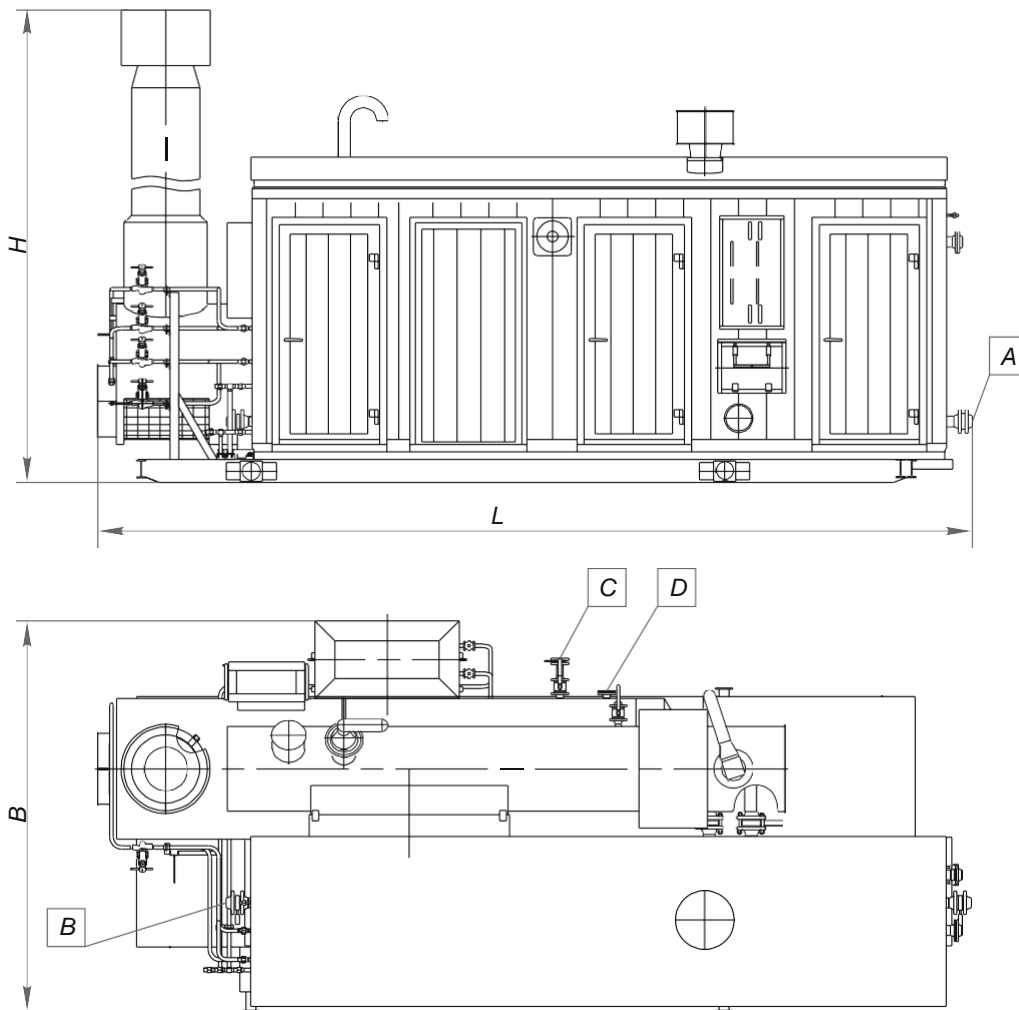


Table of nozzles

Des.	Description
A	Gas inlet
B	Gas outlet
C	Heat transfer medium drainage
D	Heat transfer medium discharge

Designation	Tube diameter, mm	Internal volume, m <sup>3</sup> tube still/casing	Length L, mm	Width B, mm	Height H, mm
Fuel gas heating unit PGO-10-320-8.0-U1	25x3	0,02/3,2	7045	2100	10000
Fuel gas heating unit PGO-20-670-10.0-KhL1	38x2	0,52/4,7	7760	2780	7765
Fuel gas heating unit PGO-30-900-6.3-KhL1	25x3	0,33/4,7	7860	3500	7955

## 29 Gas heaters (electric)

**PURPOSE** Natural gas heating.

**LAYOUT** The heater is a vertical-type heat-insulated vessel, filled with intermediate heat transfer medium. Gas heating coil is located inside the vessel; the bottom part of casing is designed for installation of electrical heater unit. Gas heater is equipped with nozzles for gas inlet/out, heat transfer medium filling and discharge, installation of instrumentation.

Gas heater can operate in areas with different climatic conditions.

Casing material - carbon steel, coil - carbon steel (stainless steel).

**OPERATION CONCEPT** The gas is supplied through the inlet nozzle "A1" and going through the heater coil is heated by the intermediate heat transfer medium. Heat transfer medium is heated by means of electric heaters unit. Nozzle "C1" serves for filling the heat transfer medium into the casing, and through the nozzle "D1" – its discharge out of the heater.

**NORMATIVE BASE** GOST R 52630-2012 "Steel welded vessels and apparatus. General specifications";  
VRD 39-18-055-2002 "Typical technical requirements to CS, BCS and UGSF CS designing".

**CONVENTIONAL SYMBOLS** **PGE-1500-5.5-60-1**,  
where:  
PGE - electric gas heater;  
1500 - capacity, kg/h;  
5,5 - design pressure, MPa;  
60 - heat power, kW;  
1 - coil material design:  
1 - carbon steel,  
2 - 12Kh18N10T.

Designation	Capacity per gas, m <sup>3</sup> /h	Design pressure P <sub>p</sub> , MPa	Heat power, kW	Nozzles nominal diameter (gas inlet/outlet), mm	Weight (without heat transfer medium), kg
PGE-3400-10.0-60-1	3400	10.0	60	50	725
PGE-2250-7.5-40-1	2250	7.5	40	40	563
PGE-1800-10.0-30-1	1800	10.0	30	25	313

# 30 Gas heaters (electric)

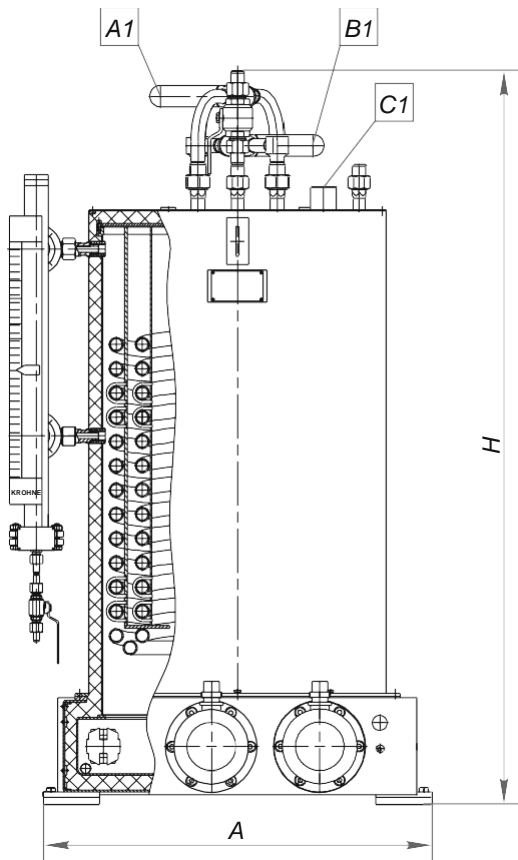
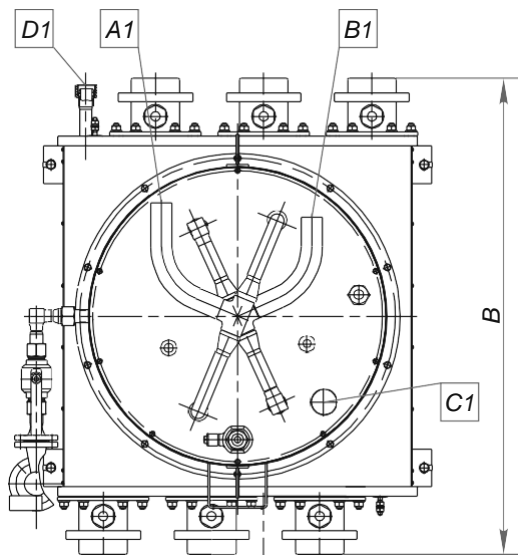


Table of nozzles

Des.	Description
A1	Gas inlet
B1	Gas outlet
C1	Heat transfer medium filling
D1	Heat transfer medium discharge



Designation	Volume, m <sup>3</sup> tube still/casing	A, mm	B, mm	H, mm	Nozzles Dn, mm			
					A1	B1	C1	D1
PGE-3400-10.0-60-1	0.038/0.65	1254	1040	1985	50	50	50	25
PGE-2250-7.5-40-1	0.024/0.45	1254	1040	1380	40	40	50	15
PGE-1800-10.0-30-1	0.01/0.19	912	744	1188	25	25	25	15

## 31 Process heaters

**PURPOSE** Heating of petroleum and natural gas in gas treatment units and oil refining units.

**LAYOUT** Process heater is a vertical apparatus, structurally consisting of two casings - radiant and convective with coils and chimneys with gate valve located inside it. Apparatus casing is lined inside. There are gas burners in the bottom part of radiant casing. Burners firing is made by means of electrical ignition system, burners flame are controlled by means of photo sensors.

The heater is equipped with service platforms.

Process heater is installed outdoors and can operate in areas with different climatic conditions.

Base material of casings, adapter, chimney - carbon steel.

Coils material - carbon steel/stainless steel.

**OPERATION CONCEPT** Through inlet nozzles "A", "B", by two parallel flows, the heated product is supplied to the convective coil, where it is preliminary heated due to temperature of exhaust gases. Then, it is supplied to the radiant coil, where it is heated to the design temperature and is removed out of the process heater through nozzles "C" and "D".

**NORMATIVE BASE** RD 3688-00220302-003-04 "Tube heating furnaces. Requirements to design, manufacture and operation"; OST 26.260.758-2003 "Metal structures. General technical requirements".

**CONVENTIONAL SYMBOLS** **TP-6.8/42563-8.0-2,**  
where:  
TP - process heater;  
6.8 - heat power, MW;  
42563 - capacity, kg/hour;  
8.0 - design pressure of heated product, MPa;  
2 - coil material design:  
1 - carbon steel,  
2 - 12Kh18N10T.

Designation	Heat power, MW	Capacity, kg/hour	Design pressure Pp, MPa	Weight (without heat transfer medium), kg
TP-1.0/2380-0.45-1	1.0	2380	0.45	18000
TP-1.29/14820-7.0-2	1.29	14820	7.0	32000
TP-2.5/8760-2.5-1	2.5	8760	2.5	69000
TP-5.78/92600-1.0-2	5.78	92600	1.0	81000
TP-6.8/42563-4.7-2	6.8	42563	4.7	82000
TP-10/55200-7.5-2	10.0	55200	7.5	105200



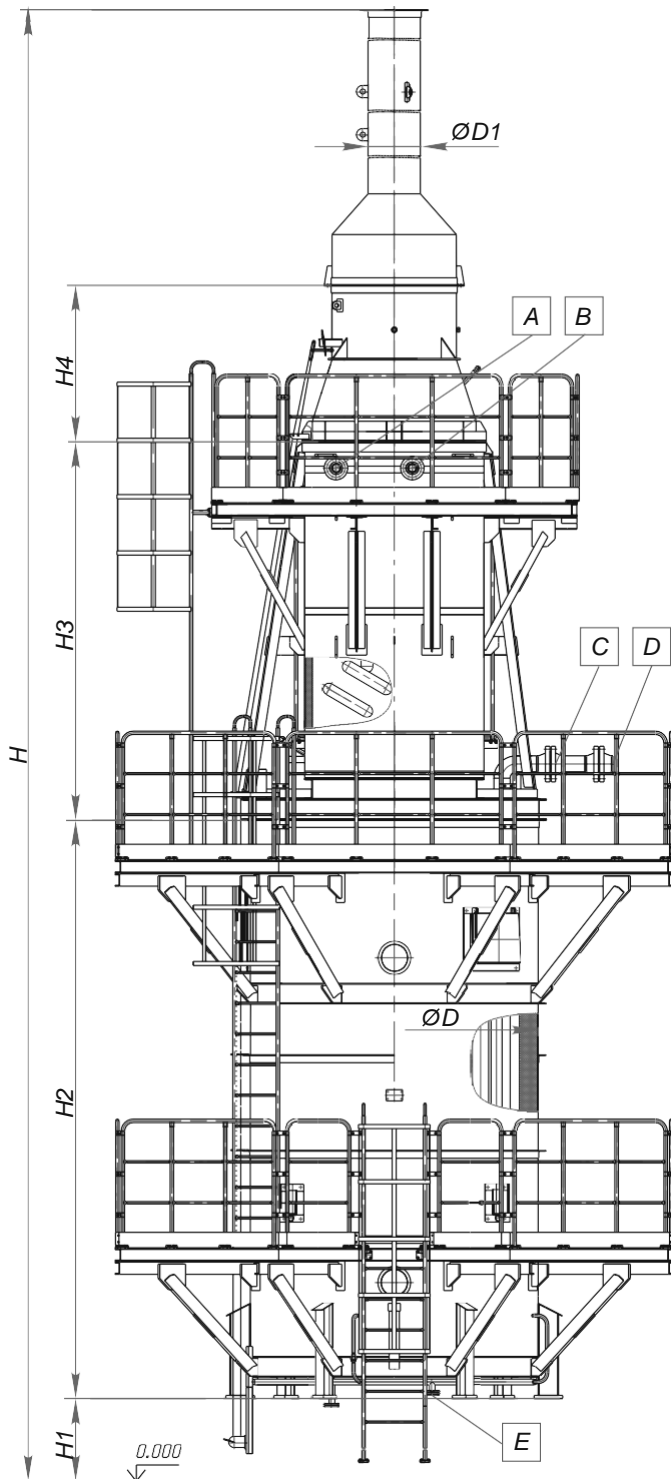


Table of nozzles

Des.	Description
A	Product inlet
B	Product inlet
C	Product outlet
D	Product outlet

Designation	D, mm	D1, mm	H, mm	H1, mm	H2, mm	H3, mm	H4, mm	Nozzles Dn, mm				
								A	B	C	D	E
TP-1.0/2380-0.45-1	2100	820	20540	2000	6140	-	1290	80	-	80	-	50
TP-1.29/14820-7.0-2	2730	1200	26045	2000	5380	3695	1500	100	100	150	150	50
TP-2.5/8760-2.5-1	3590	822	31082	2000	12650	6060	1965	200	-	200	-	50
TP-5.78/92600-1.0-2	3500	822	31200	2000	13430	5400	1965	150	150	150	150	50
TP-6.8/42563-4.7-2	3500	822	31200	2000	13430	5400	1965	150	150	150	150	50
TP-10/55200-7.5-2	5000	1200	30600	1855	10800	4450	2460	125	125	150	150	80

**PURPOSE**

It is applied as a part of compressor stations (CS) and is designed for obtaining compressed, dry and free of mechanical impurities air and for filling CS air systems with it.

The unit is rated for normal operation at the following operation conditions:

- 1) Ambient temperature from 223K (minus 50°C) to 323K (50°C);
- 2) dustiness of atmosphere air, typical for some areas;
- 3) seismic vibrations up to 9 on the Richter scale.

**LAYOUT AND OPERATION CONCEPT**

Two compressor units are applied in process unit as a source for obtaining compressed air. One of the units is in the operation mode, another one in stand-by mode. Simultaneous operation of both units is not allowed. Operation of units is completely automatic and requires no permanent occupation of operating personnel. Obtained compressed air with the pressure 25 MPa is supplied to drying unit through the ball valves.

After the drying unit, dry and free of mechanical impurities compressed air is supplied to the battery unit for storage or distribution. From the battery unit high pressure compressed air through post filter is supplied to distribution manifold, where it is throttled in the pressure regulator up to the pressure of  $P = 3.0 \cdot 8.0$  MPa and is supplied to distribution line with pressure  $3.0 \cdot 8.0$  MPa. At the same time, reduced air can also be supplied to the reducer for supply to the line with a pressure  $0.4 \cdot 1.0$  MPa.

In the distribution line  $0.4 \cdot 1.0$  MPa air bleeding is provided for humidity measurement by means of hygrometer.

In case of failure of pressure reducer the possibility of manual pressure adjustment  $P = 3.0 \cdot 8.0$  MPa is provided.

The unit has the heating system, where external heat-transfer medium is applied, as well as ventilation system. Heating system ensures the heating of air, breathed by compressor.

The unit represents a structure, consisting of transport blocks with high prefabrication, undergone shop testing, painted and prepared for the following transportation and storage.

Instrument air compressor unit consists of the following:

- |                                     |           |
|-------------------------------------|-----------|
| 1. Process unit                     | - 1 pc.;  |
| 1.1 Compressor unit 6VSh1,6-2,0/250 | - 2 pcs.; |
| 1.2 distributing manifold           | - 1 pc.;  |
| 1.3 Drying unit                     | - 1 pc.;  |
| 1.4 Electric equipment              | - 1 set;  |
| 2. Battery unit                     | - 1 pc.;  |
| 3. Control system                   | - 1 set.  |

**NORMATIVE BASE**

Instrument air compressor unit is manufactured on the modern engineering level in full compliance with Customers technical requirements and conforms to the current norms and standards, including the requirements of industrial safety national standards and rules "Safety rules in the oil and gas industry". As for the reliability and technical and economic performance the compressors unit stands side by side with the progressive equipment at similar facilities.

**CONVENTIONAL SYMBOLS**

**BKIV-2.0/250,**

where:

BKIV - Instrument air compressor unit;

2.0 - capacity, m<sup>3</sup>/min., not less;

250 - battery outlet air pressure, kgf/cm<sup>2</sup>.

## 34 Instrument air compressor unit

### EQUIPMENT TECHNICAL CHARACTERISTICS:

Compressed gas	atmosphere air
Unit capacity, m <sup>3</sup> /min (m <sup>3</sup> /h), not less	2.0(120)
Quantity of compressors	2(1 – stand-by)
Type of compressor	6VSh1.6-2.0/250
Suction pressure	atmosphere
Discharge pressure, MPa	25
Inlet air temperature, °C	
- minimum	5
- maximum	50
Permissible relative air humidity, %	100
Pressure in distribution lines, MPa	
- P <sub>instr</sub>	0.4÷1.0
- P <sub>contr</sub>	3.0÷8.0
Electric equipment power supply from network with the following parameters:	
- voltage, V	380/220
- frequency, Hz	50
Type of electric motor	4AMU250S4-8
Electric motor rated power, kW	75
Filter element from dust at compressor cooling system inlet	available
Container framing devices	heat-sound-insulating wall panels
Fume exhaust system of process unit	fan VKR-3.15
Quantity of fans, pcs.	2
Drying unit:	
a) continuous operation period of one adsorber required for moisture adsorption, hours, not less	24
b) heating period (regeneration) of one adsorber required for reaching outlet air temperature of 100°C, hours, not more	4
c) cooling period (by regeneration) of one adsorber by means of purging for reaching outlet air temperature of 30°C, hours, not more	4
d) cooling period (by regeneration) of one adsorber without purging, hours, not more	8
e) composition and quantity of adsorbent in one adsorber:	
upper layer - silica-gel GOST 3956-76, kg	5.0 ± 1.0
bottom layer - zeolite TU 95400-81, kg	7.6 ± 0.5
Air dew point temperature after drying, °C, not more	minus 55
Instrument for measuring dried air humidity	hygrometer IVG-1
Lifting facility	hobbing lifting tackle Q=0.5τ
Availability of gates for repair of compressor units	available
Process unit overall dimensions (per container), mm:	
- length	8210
- width	3150
- height	2880
Weight of Instrument air compressor unit, kg, not more	15000
Reliability indices (per compressor):	
- average overhaul life, running hours	40000
- mean time between failures, running hours, not less	4000
- technical operating life from the beginning of operation, running hours	100000
Weight of the heaviest shipping package, kg	12600
Gross installed capacity of electric users, kW, not more	160

# 35 Instrument air compressor unit

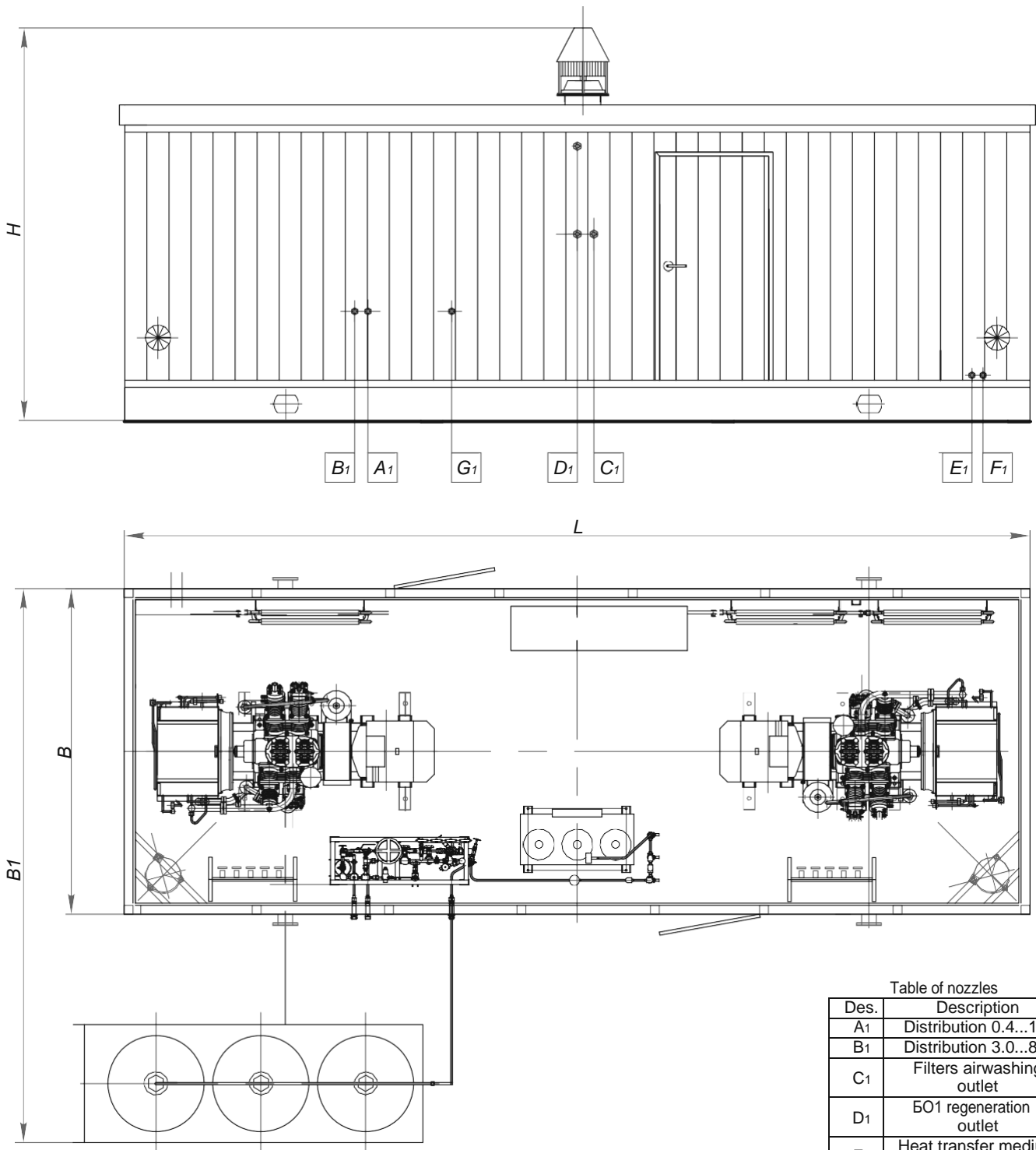


Table of nozzles

Des.	Description
A <sub>1</sub>	Distribution 0.4...1.0
B <sub>1</sub>	Distribution 3.0...8.0
C <sub>1</sub>	Filters airwashing outlet
D <sub>1</sub>	EO1 regeneration outlet
E <sub>1</sub>	Heat transfer medium inlet
F <sub>1</sub>	Heat transfer medium outlet
G <sub>1</sub>	Battery unit inlet

Designation	L, mm	B, mm	B <sub>1</sub> , mm	H, mm	Nozzles D <sub>n</sub> , mm						
					A <sub>1</sub>	B <sub>1</sub>	C <sub>1</sub>	D <sub>1</sub>	E <sub>1</sub>	F <sub>1</sub>	G <sub>1</sub>
BKIV-2.0/250	8210	2950	5020	3580	10	10	25	25	20	20	15

**PURPOSE** Purification (separation) of oil from station oil supply system unit (compressor) from mechanical impurities and water, as well as oil pumping from tank into oil storage vessel.

**LAYOUT** The units have modular-container structure.

Container is a metal heat and sound insulated shelter. Container walls are made of 3-layer sandwich panels filled with heat and sound insulating material. Panels thickness is 80 mm. Container top is 2-layer and heat insulated basalt fibre acoustic mattresses.

Container is divided into two sections: the 1st section - oil pump unit section for location of the main equipment and piping arrangement, the 2nd section – for location of fire-fighting system.

Oil pump unit section located in the 1st section includes three units electric driven pumps Sh15,50-4, two separators SCR321U-01 and pipelines with shutoff valves. Spectacle blinds are installed on its outlet nozzles (obturators).

Fire-fighting system installed in the 2nd section includes two gaseous fire suppression batteries and liquid carbon dioxide supply pipelines and pipeline with extension tubes turned to oil pump unit section.

In face walls of section the following is provided: pressure relief valve for air supply, check valve through which excess of ventilation air is discharged. For access to section heat-insulated door is provided.

For access to sections heat-insulated doors are provided.

To ensure normal temperature conditions for operation of instruments, equipment and maintenance personnel during repair and maintenance works, the unit has a heating system, registers of which are installed vertically on the walls and baffle of container sections. Hot water is used as a heat transfer medium. Heating system consists of registers, inlet and outlet pipelines, shut-off valves, bleed-off valves.

Plenum and exhaust system consists of forced ventilation with explosion-proof radial fan and natural ventilation due to two holes in container and deflector boards, installed on the cover.

The unit has installed in it automatic switchboard and instrumentation A (outside next to the inlet to oil pump unit section) designed for automatic control and monitoring of unit parameters.

For unit slinging during loading-unloading operations and during installation on the unit frame, special slinging devices are provided.

For repair works the unit is provided with travelling hand-operated crane with a lifting capacity Q=1 t.

Operating medium of units turbine oil TP-22S.

Unit base material carbon steel.

**OPERATION CONCEPT** The oil out of tank (nozzle "A") is supplied to unit by means of pump and then is directed into the neat oil vessel (nozzle "B") for storage and (or) into unit tank, from where it is supplier for lubrication of compressor units.

Used contaminated oil out of used oil vessel (nozzle "F") is supplied to separators where it is purified, then mixing with neat oil which is supplied from neat oil vessel (nozzle "H") it is supplied to unit tanks (nozzle "I").

Drained oil and condensate (nozzles "M<sub>1,2</sub>") is collected in drain vessel, from where oil is pumped out with a pump (nozzle "B" into the tank and then is supplied for purification and recovery.

**CONVENTIONAL SYMBOLS** **BSM** - Oil supply system unit;  
**BSM-N** - Oil supply system unit with boost air charging into fire-fighting system.

Designation	Oil supply, m <sup>3</sup> /h	Discharge pressure, MPa (kgf/cm <sup>2</sup> )	Weight, kg
BSM-N	15.5	0.4 (4)	12000
BSM	15.5	0.4 (4)	11600

# 37 Oil supply system units

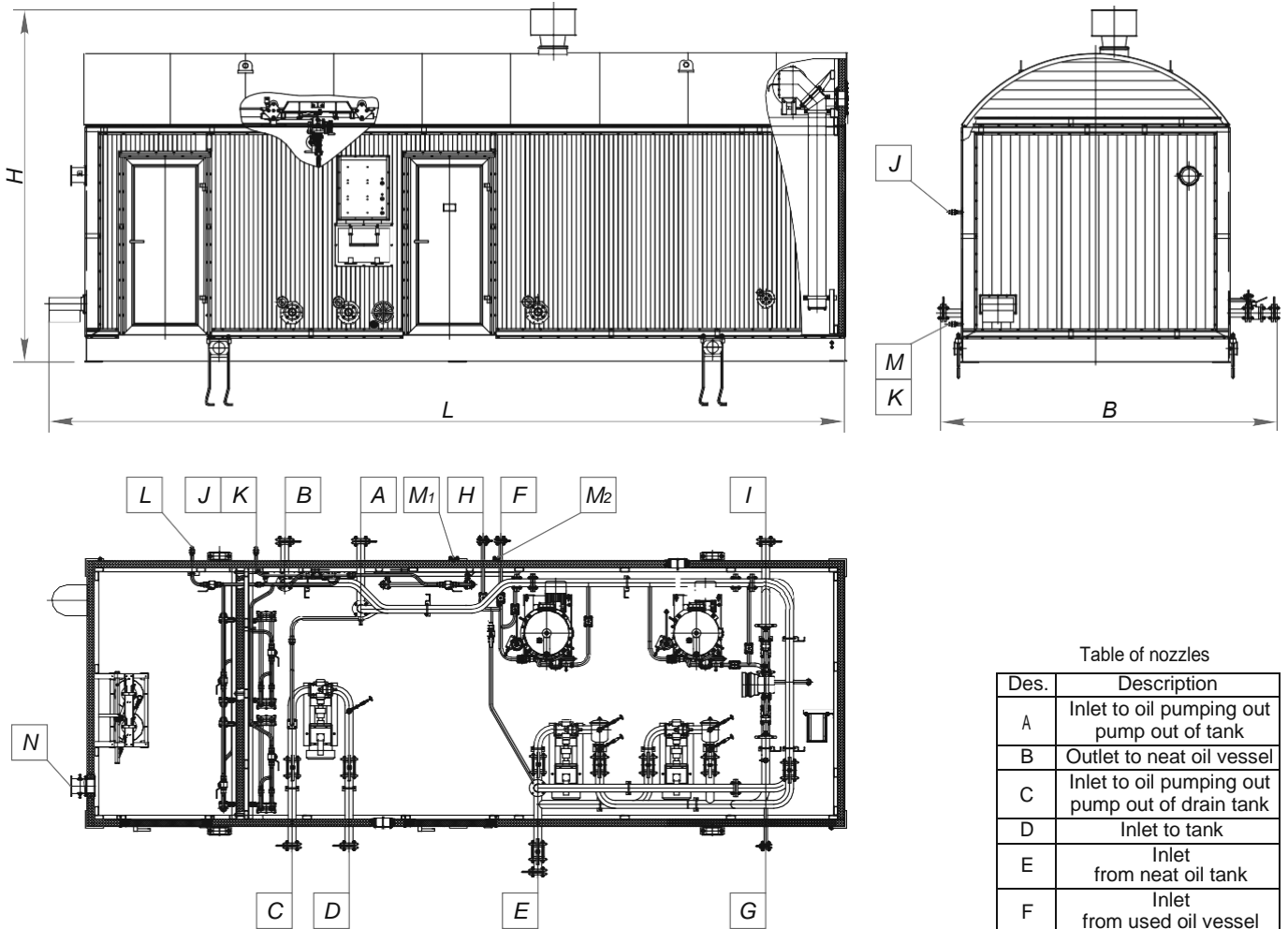


Table of nozzles

Des.	Description
A	Inlet to oil pumping out pump out of tank
B	Outlet to neat oil vessel
C	Inlet to oil pumping out pump out of drain tank
D	Inlet to tank
E	Inlet from neat oil tank
F	Inlet from used oil vessel
G	Outlet to neat oil vessel
H	Inlet from neat oil vessel
I	Oil outlet to unit tanks
J	Heat transfer medium inlet to unit
K	Heat transfer medium outlet out of unit
L	Heat transfer medium discharge
M <sub>1,2</sub>	Oil drainage
N	Air supply to unit

Designation	L, mm	B, mm	H, mm	Nozzles Dn, mm														
				A	B	C	D	E	F	G	H	I	J	K	L	M <sub>1,2</sub>	N	
BSM-N	9006	3990	3807	80	80	80	80	80	32	32	32	80	25	25	25	50	160	
BSM	8612	3480	3770	80	80	80	80	80	32	32	32	80	20	20	-	40	-	

## 38 Flare unit

- PURPOSE** Burning of combustible gases and vapors during emergency, continuous and intermittent discharges, equipment failures, scheduled repairs.
- LAYOUT** Flare unit includes the following: flare stack, flare tip, flare ignition system, service platforms.  
Flare unit is a vertical cylindrical stack, with a gas seal installed in the upper part, flare pilot burners with integral ignition electrode. For inspection of internal cavity of flare stack, inspection hole is provided. Ignition of flare pilot burners is performed from electronic control unit, burners flame is monitored flame sensor. For operation of flare pilot burners are fuel gas supply pipelines provided.  
Flare unit can be installed outdoors and can operate in areas with different climatic conditions.  
Base material of flare unit - carbon steel,  
Flare tip material - heat-resistant steel.
- OPERATION CONCEPT** Through inlet nozzle A gas is supplied to flare stack, goes through gas seal, then gas is supplied to flare tip, where ignition from flare pilot burners is performed.
- NORMATIVE BASE** GOST R 52630-2012 "Steel welded vessels and apparatus. General specifications";  
"Flare system safety manual", approved by Order of Federal Service for Ecological, Technological and Nuclear Supervision, No. 779 dd. December 26, 2012 A.V. Ferapontov.
- CONVENTIONAL SYMBOLS** **FU-21-300/20.5-Э-UKhL1**  
where:  
FU - flare unit;  
21 - gas capacity, thous. nm<sup>3</sup>/hour;  
300 - gas inlet nominal diameter, mm;  
20.5 - flare unit height, m  
E - electrical ignition;  
UKhL1- climatic version per GOST 15180-79.

Designation	Gas capacity, nm <sup>3</sup> /hour	Inlet nozzle nominal diameter, mm	Ignition type	Weight, kg
FU-10-700-KhL1	10000	700	Electric	19000
FU-21-300-E-UKhL1	21000	300	Electric	7550

# 39 Flare unit

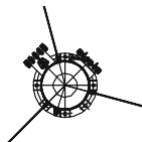
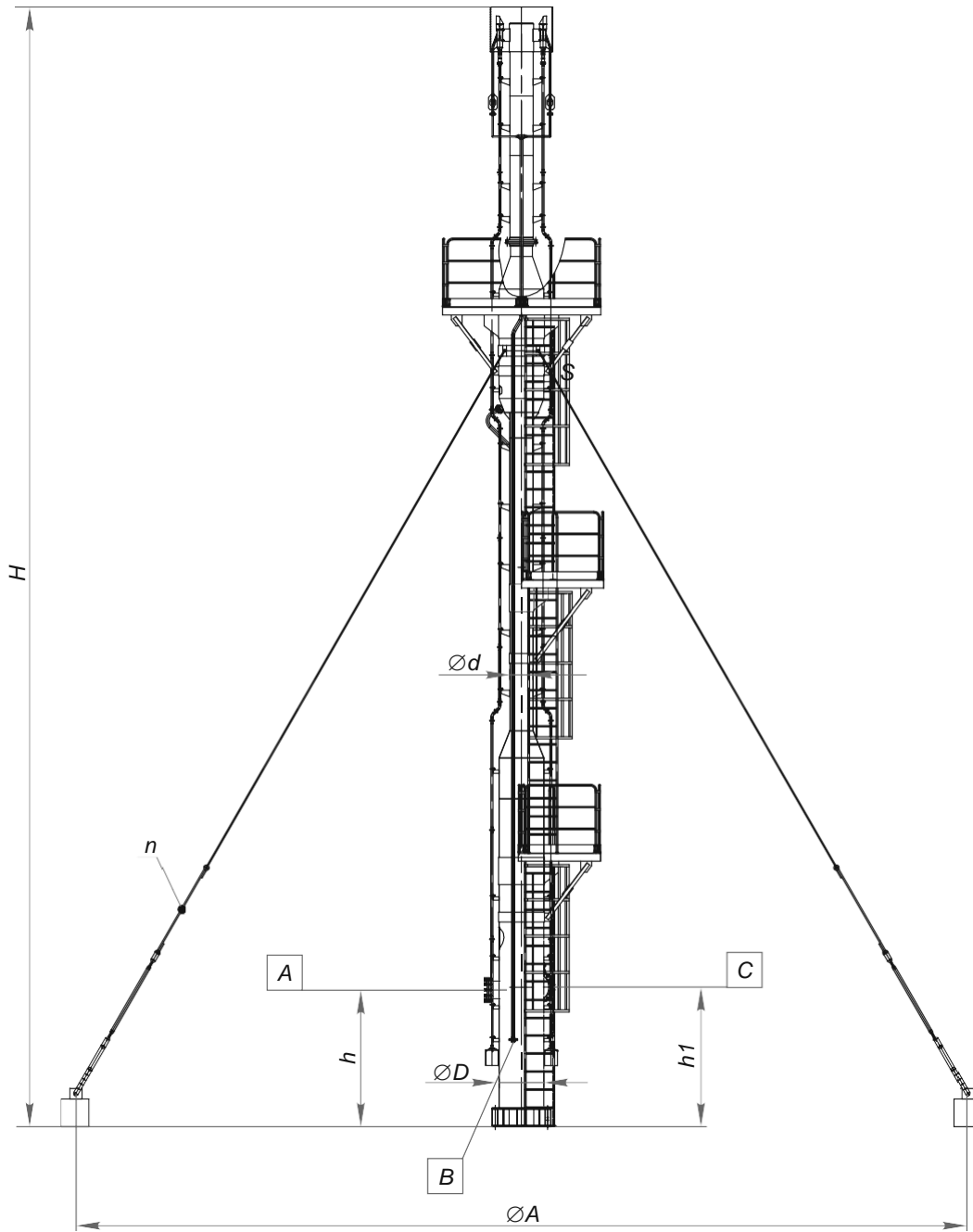


Table of nozzles

Des.	Description
A	Gas inlet
B	Gas inlet to burners
C	Manhole

Designation	H, mm	h, mm	h <sub>1</sub> , mm	A, mm	D, mm	d, mm	n, pcs.	Nozzles D <sub>n</sub> , mm		
								A	B	C
FU-10-700-KhL1	30045	5525	21325	30000	1220	820	3	700	50	400
FU-21-300-E-UKhL1	20500	2500	2555	17000	820	426	3	300	50	400



## 40 Reduction unit

- PURPOSE** For reduction and maintenance of given pressure of fuel and start-up gas for own needs of compressor station.
- LAYOUT** Reduction unit includes two gas reduction lines (main and stand-by) with shut-off control valves, instrumentation, safety valves on each reduction line, pipelines for gas discharge from safety valves, installed on the common frame.
- The unit can operate in areas with different climatic conditions.
- Unit base material -carbon steel.
- OPERATION CONCEPT** Through inlet nozzle "A" gas is supplied to unit reduction line, then reduced to the given pressure going through direct-acting pressure reducing valve and then through nozzle "B" it is removed from the unit. Pneumatic valves are installed on the reduction lines for switching between operating and stand-by modes. For overpressure protection, there are safety valves installed on each reduction line with gas discharge pipelines.
- Reduction unit is a 100% ready-to-use packaged product.
- NORMATIVE BASE** OST 26.260.18-2004 "Oil and gas industry process units. General specifications";  
STO Gazprom 2-2.1-607-2011 "Process units. General specifications";  
VRD 39-1.8-055-2002 "Typical technical requirements to CS, BCS and UGSF CS designing".
- CONVENTIONAL SYMBOLS** **URG-4.55-8.0/4.0-UKhL1**  
where:  
URG - gas reduction unit;  
4,55 - capacity, thous. kg/h;  
8.0 - inlet gas pressure, MPa;  
4.0 - outlet gas pressure, MPa;  
UKhL1- climatic version per GOST 15180-79.

Designation	Capacity, kg/h	Inlet pressure, MPa	Outlet pressure, MPa	Weight, kg
URG-4.55-8.0/4.0-UKhL1	4550	8.0	4.0	2200
URG-6.6-8.4/4.0-U1	6600	8.4	4.0	2250

# 41 Reduction unit

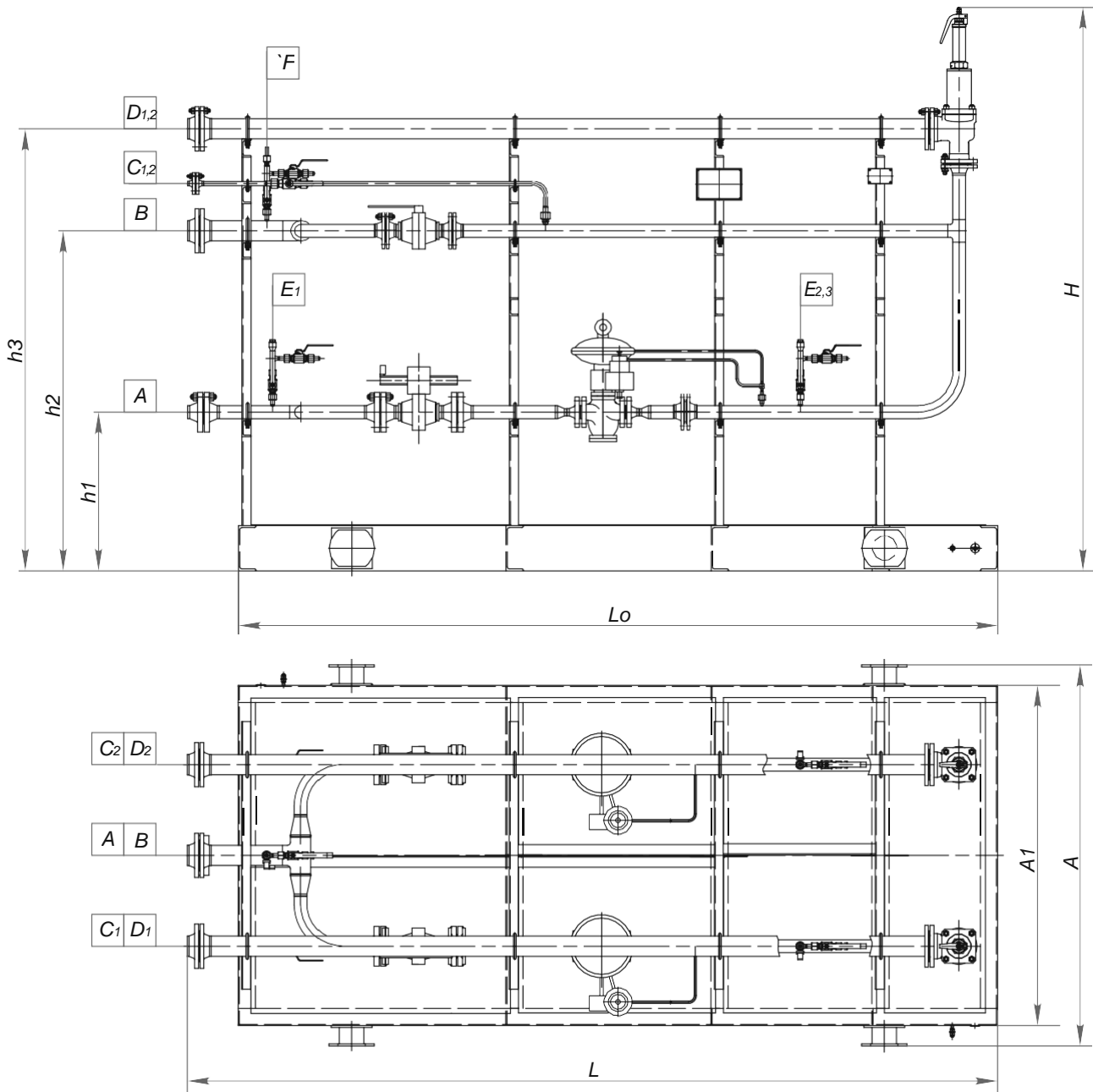


Table of nozzles

Des.	Description
A	Gas inlet
B	Gas outlet
C <sub>1,2</sub>	Gas relief to flare
D <sub>1,2</sub>	Discharge from safety valve
E <sub>1-3</sub>	For pressure gauge
F	For pressure sensor

Designation	Lo, mm	L, mm	A, mm	A1, mm	H, mm	h1, mm	h2, mm	h3, mm	Nozzles Dn, mm	
									A	B
URG-4.55-8.0/4.0-UKhL1	3250	4260	1700	1500	2690	700	1405	2080	80	100
URG-6.6-8.4/4.0-U1	3250	4250	1700	1500	2725	700	1410	1995	80	100

## 42 Filter separator unit

**PURPOSE** Separation of drop liquid and mechanical impurities from natural gas.

**LAYOUT** Filter separator unit consists of filter separator with condensate collection tank, valve unit, service platforms, instrumentation. Filter separator is a horizontal cylindrical welded vessel, installed on saddle supports. Filter elements and preliminary separation section are installed inside the filter separator casing. Condensate collection tank is an individual horizontal vessel, located in the bottom part of filter separator and designed for separated liquid collection. Filter separator is equipped with process nozzles, maintenance manholes and nozzles for instrumentation connection. In case of process need, filter separator is equipped with clamp seal which enables to speed up the replacement of filter elements.

Valve unit can be located both on the common frame with filter separator, as well as it can remote (free standing). It consists of process pipelines with shut-off control valves. It also has instruments, equipment for automation and control of condensate filtration and removal process.

For inspection and maintenance of internal and external devices, filter separator unit is equipped with service platforms.

Operating medium	natural gas.
Item base material	steel 09G2S.

**OPERATION CONCEPT** Gas to be purified is supplied to inlet through nozzle "A". At first gas is purified in preliminary separation section a from large liquid droplets and mechanical impurities, and then going through filter elements gas is purified from mechanical impurities and drop liquid of size above 5 µm. Liquid with mechanical impurities collected in the filter separator is discharged into condensate collection tank, from which it is discharged through nozzles "D". Purified gas is discharged through nozzle "B".

**NORMATIVE BASE** SOU MPP 71.120-217:2009,  
GOST R 52630-2012,  
OST 26.260.18-2004;  
TR TS 032/2013.

**CONVENTIONAL SYMBOLS** **FS 2000-16.0-BK (K)**  
where:  
FS - filter separator;  
2000 - filter separator internal diameter, mm;  
16.0 - design pressure, MPa; B  
- modular construction;  
BK - modular construction with remote valve unit in container.

Designation	Unit internal diameter, mm	Design pressure, MPa	Gas capacity, mln. nm <sup>3</sup> /day	Nominal diameter of inlet/outlet nozzles, mm	Weight, kg
FS 1800-8.5-B	1800	8.25	24.0	600	34230
FS 1000-16.0-BK KhL1	1000	16.0	0.72	100	29155
FS 1400-10.0-B U1	1400	10.0	5.0	400	14148
FS 1000-7.5-BK U1	1000	7.5	0.045...0.205	400	16325
FS 2200-5.6-BK U1	2185	5.6	12...18	1000	31230
FS 2200-3.2-BK U1	2200	3.5	13.5...15	800	19800
FS 2600-1.0-B U1	2600	1.0	0.033...0.13	700	14820

# 43 Filter separator unit

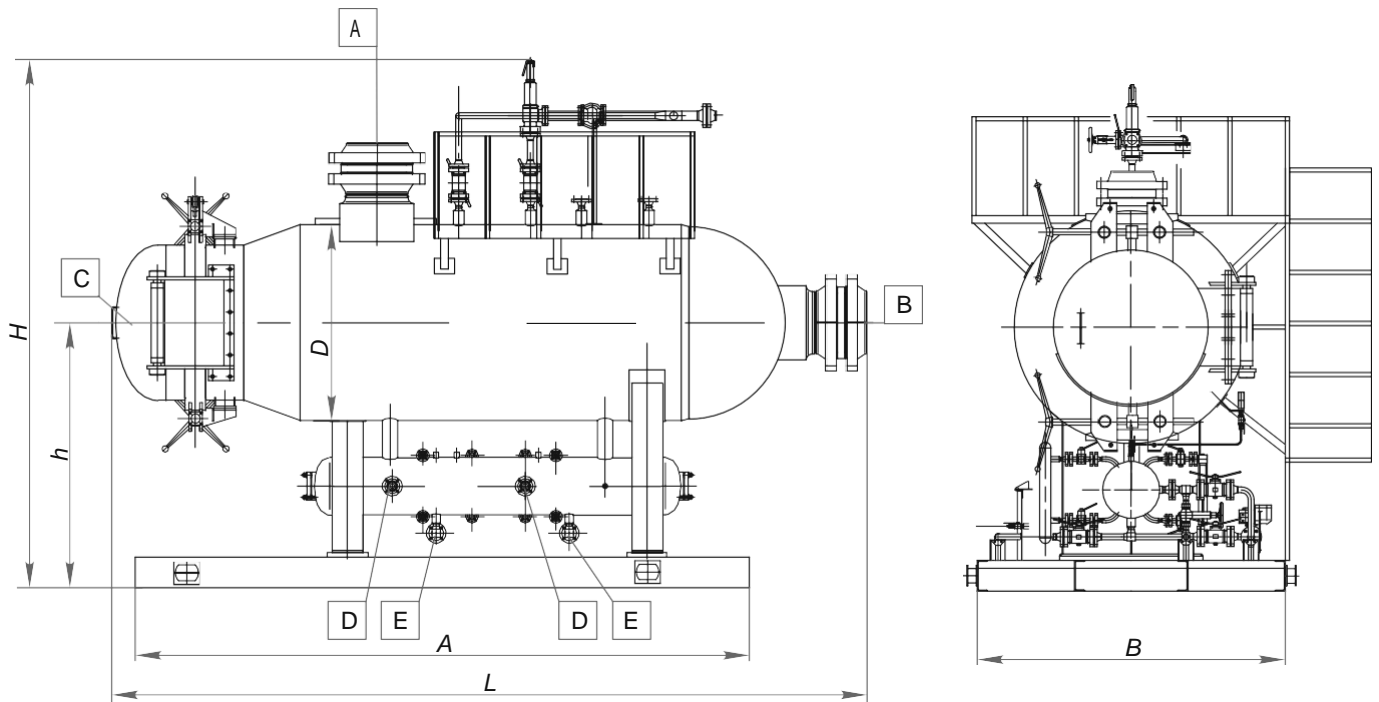


Table of nozzles

Des.	Description
A	Gas inlet (outlet)
B	Gas outlet (inlet)
C	Manhole
D	Condensate discharge
E	Drainage

Designation	L, mm	H, mm	h, mm	D, mm	A, mm	B, mm	Nozzles Dn, mm				
							A	B	C	D	E
FS 1800-8.5-B	73000	4140	2690	1800	6000	3010	600	600	1400	50	50
FS 1000-16.0-BK KhL1				1000			100	100			
FS 1400-10.0-B U1	4868	3505	2080	1400	2260	1270	400	400	500	50	50
FS 1000-7.5-BK U1	7460	3710	2300	1000	5000	2450	400	400	1000	50	50
FS 2200-5.6-BK U1	10410	4935	2754	2185	4900	2056	1000	1000	600	50	50
FS 2200-3.2-BK U1	9000	4529	2744	2200	4900	2056	800	800	600	50	50
FS 2600-1.0-B U1	8680	5685	2970	2600	7695	2890	700	700	600	50	80

## 44 Oil gas separators (bullets)

**PURPOSE** Separation of mechanical impurities and drop liquid from gas at CS inlet, as well as damping of pressure pulsations and differential pressure. They function as a buffer capacity by peak liquid flows.

**LAYOUT** Oil gas separator is a horizontal vessel installed on two saddle supports with devices located inside - knock-out drums, grate and demister. For internals inspection and repair stair is provided.

Depending on the climatic operation area, the unit is equipped with outdoor coil and, if necessary, service platforms.

Oil gas separator is installed outdoors and can operate in areas with different climatic conditions.

Base material of the unit, internals and coil - carbon steel.

**OPERATION CONCEPT** Through inlet nozzle "A" gas enters separator, where separation of drop liquid and impurities is performed on the internal devices of the unit. Purified gas goes out through nozzle "B", and collected the liquid collected in the bottom part is discharged through nozzle "H".

**NORMATIVE BASE** GOST R 52630-12 "Steel welded vessels and apparatus. General specifications".

**CONVENTIONAL SYMBOLS** **NGS-6.3/80-1.6-KhL1**  
 where:  
 NG - oil and gas;  
 S - separator;  
 6.3 - capacity,  $\times 10^6$ , m<sup>3</sup>/day;  
 80 - volume, m<sup>3</sup>;  
 1.6 - design pressure, MPa;  
 KhL1 - climatic version per GOST 15150.

Designation	Volume, m <sup>3</sup>	Capacity, $\times 10^6$ , m <sup>3</sup> /day	Design pressure P <sub>p</sub> , MPa	Climatic version per GOST 15150	Weight, kg
NGS-0.535/12.5-1.6-UKhL1	12.5	0.535	1.6	UKhL1	4000
NGS-5.575/25-8.0-U1	25	5.575	8.0	U1	31000
NGS-3.0/50-1.6-UKhL1	50	3.0	1.6	UKhL1	16600
NGS-3.0/50-2.5-UKhL1	50	3.0	2.5	UKhL1	21900
NGS-2.21/50-3.0-UKhL1	50	2.21	3.0	UKhL1	24000
NGS-6.3/80-1.6-KhL1	80	6.3	1.6	KhL1	27970
NGS-4.5/100-1.0-UKhL1	100	4.5	1.0	UKhL1	18500
NGS-4.5/100-1.6-U1	100	4.5...3.0	1.6	U1	28355

# 45 Oil gas separators (bullets)

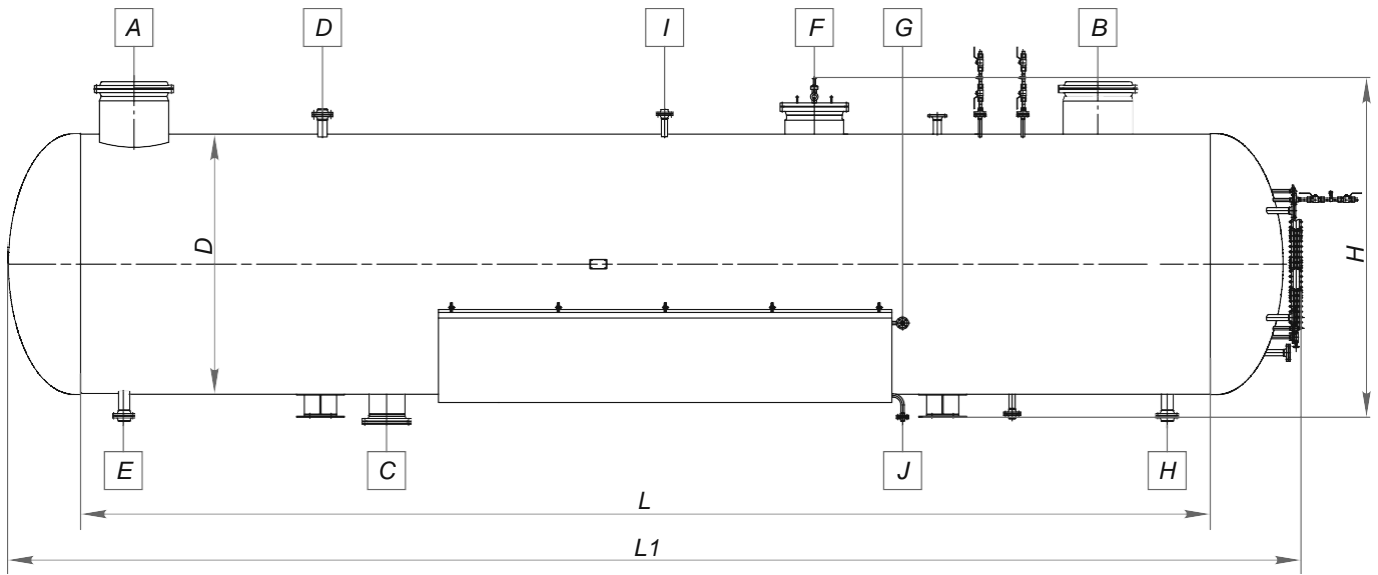


Table of nozzles

Des.	Description
A	Product inlet
B	Product outlet
C	For purification
D	For safety valve
E	For drainage
F	Manhole
G	Heat transfer medium inlet
H	Liquid discharge
I	To flare
J	Heat transfer medium removal

Designation	D, mm	H, mm	L, mm	L 1, mm	Nozzles Dn, mm	
					A	B
NGS-0.535/12.5-1.6-UKhL1	1600	-	6800	8100	300	300
NGS-5.575/25-8.0-U1	2000	-	8500	11100	400	400
NGS-3.0/50-1.6-UKhL1	2400	3175	11000	12540	600	600
NGS-3.0/50-2.5-UKhL1	2400	3175	11000	12590	600	600
NGS-2.21/50-3.0-UKhL1	2400	3185	11000	13300	700	700
NGS-6.3/80-1.6-KhL1	3000	3700	10000	13250	1000	1000
NGS-4.5/100-1.0-UKhL1	3000	3785	13000	15150	1000	1000
NGS-4.5/100-1.6-U1	3000	4050	12900	15155	1000	1000

**Certificates of compliance:**

- Certificate of quality management system compliance with ISO 9001:2008 standard;
- Certificate of compliance of industrial health and safety management system with OHSAS 18001-2007 standard;
- Certificate of compliance of environmental protection management system with ISO 14001-2004 standard.