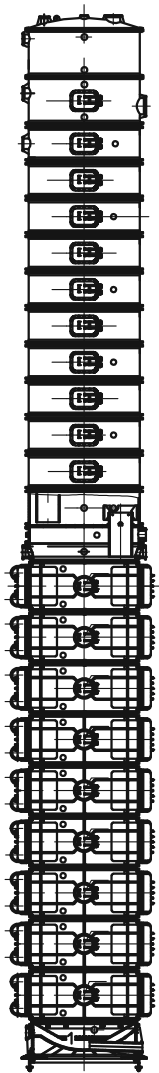
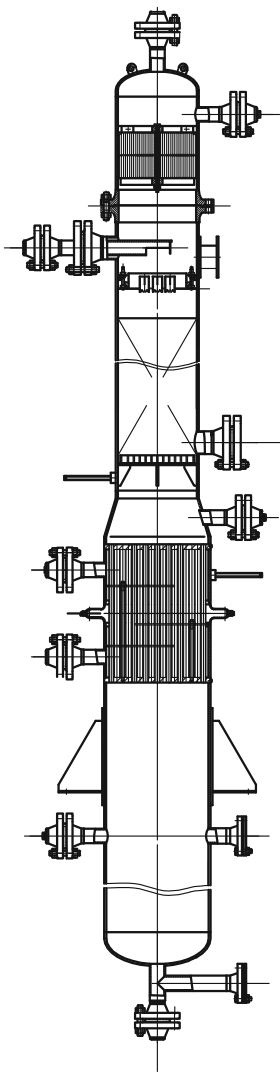


# Columns



Columns are used for heat- and mass-transfer processes: rectification, absorption, distillation, adsorption etc. in various branches of industry.

The Company manufactures an entire spectrum of columns, stipulated by the following normative basis:

SOU MPP 71.120-217:2009 "Steel welded vessels and apparatuses";

GOST R 52630 "Steel welded vessels and apparatuses";

OST 26-01-151-82 "Steel welded vessels and apparatuses for low-temperature gas separation";

STO 00220575.063-2005 "Vessels, apparatuses and process blocks of treatment and processing packages for oil and gas containing hydrocarbon and causing hydrocarbon cracking";

OST 26-01-382-79 "Cast iron column apparatuses";

TR TS 032/2013 Technical regulation of the Customs Union "On the safety of equipment operating under excessive pressure".

Columns are installed indoors or outdoors with the average temperature of the coldest five-days period down to minus 60°C and seismicity value up to VIII. Climatic make of the columns is according to GOST 15150-69.

Columns are manufactured for operation under vacuum pressure (with the residual pressure of at least 665 Pa (5 mm Hg), under atmospheric pressure and under the pressure above atmospheric up to 16 MPa (160 kgf/cm<sup>2</sup>), with the operating medium temperature of up to 350°C.

Depending on the production capacity and technological process, it is possible to manufacture columns from Ø600 mm to Ø4000 mm according to GOST21944-76 with complete factory assembly, more than Ø4000 mm with additional assembly at the installation site (due to transportation conditions). The height of the column is determined by the design quantity of mass-transferring devices. The shell and internals materials are chosen based on corrosion resistance to the processed product. The type of internals is chosen during the process design.

The enterprise possesses the technological capabilities for designing and manufacturing the following types of trays:

1. Bubble-cap trays per OST 26-01-66-86 with caps per GOST 9634-80.

2. Direct-flow valve collars per ATK26-02-1-89.

3. Multi-flow valve collars ATK26-02-2-89 and ATK26-02-4-89.

4. Sieve-valve collars per OST26-01-108-85.

5. Sieve trays per ATK26-02-3-39.

6. Grid trays per OST26-645-78.

7. Distributor trays per OST26-01-705-73 for packed columns.

Trays are made of steels Ст3сп; Ст3пс per GOST380-88; 08X13; 08X18H10T; 10X17H13M2T and others per GOST5632-72, as well as titanium and Hastelloy.

It is possible to use other steels, justified by the corrosion resistance to the processed medium.

The following packing types are used for packaging of packed columns: rhomboid, plane-parallel, Pall rings, Raschig rings, and others chosen by the design organization.

When ordering a column, a customer needs to submit a filled-out data sheet (see the Annex), on the basis of which the process and strength design will be carried out. According to the design, the internals type and the most optimal column dimensions will be determined. In order to increase the technical and economic parameters, the columns are equipped, besides mass-transferring devices, with additional components reducing product entrainment on the outlet, load-lifting devices, instrumentation, ladders and maintenance platforms for manholes and process nozzles.

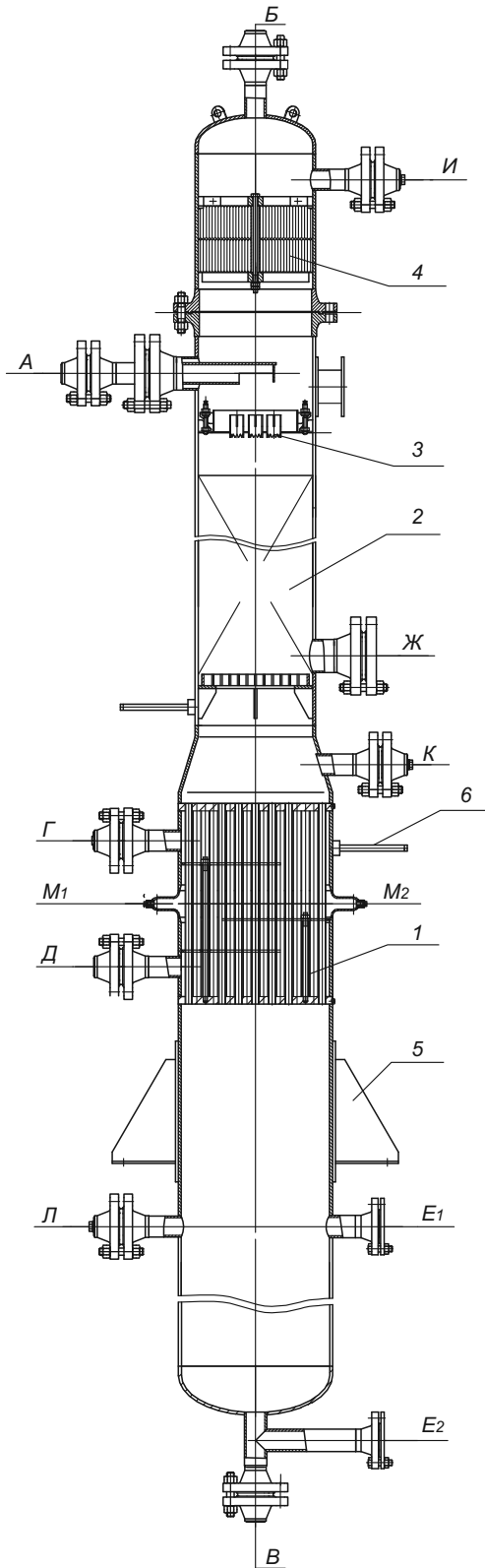
Columns are mounted on support legs per GOST 26296-84 for installation on bridgings of metal structures, as well as on cylindrical or conical vertical supports per ATK24.200.04-90.

During the manufacture, calculations are done for the columns with regard to strength, seismic and wind load resistance. The calculations are attached to the vessel's passport.

Per the Customer's requirement, columns are packaged with a jib-crane with the lifting capacity of up to 1 tf.

The following are the sketches of typical columns manufactured at the enterprise.

# 135 Stripping Columns

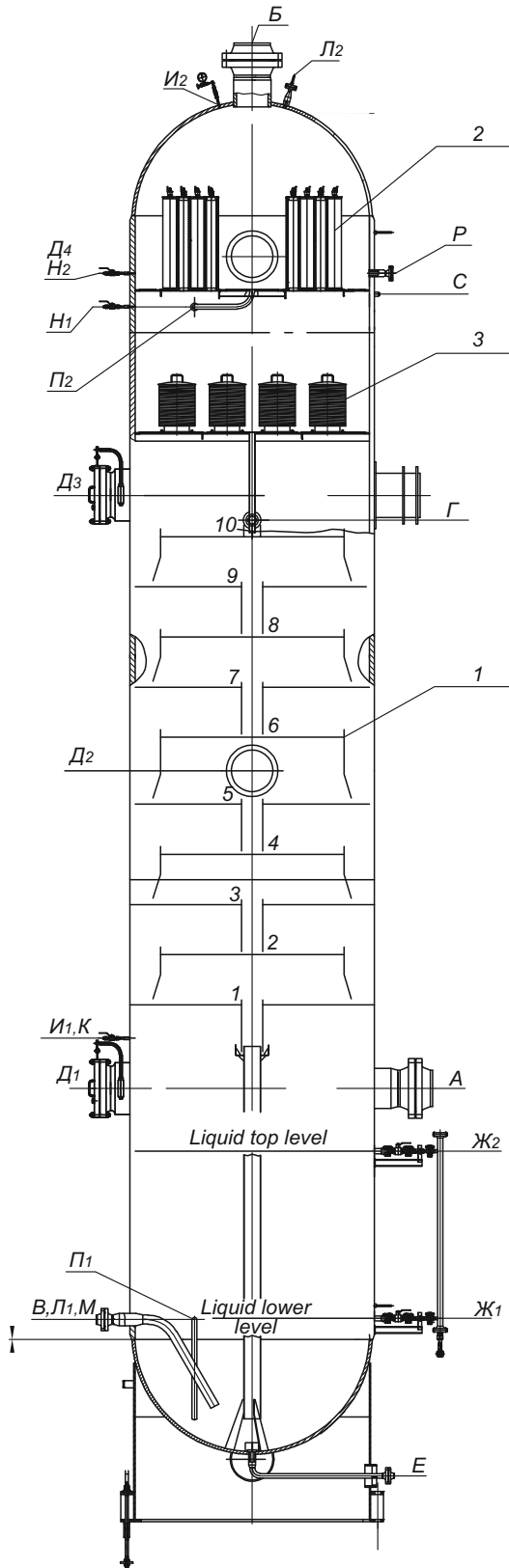


- 1 – Built-in heat exchanging device
- 2 – Mass-transferring device
- 3 – Distributor plate
- 4 – Mesh demister
- 5 – Support
- 6 – Verticality checking device

Designation	Description	Quantity
A	Feed inlet	1
Б	Petrol vapors return	1
B	Diesel fuel outlet	1
Г	Heavy residue inlet	1
Д	Heavy residue outlet	1
E <sub>1,2</sub>	For level gauge	2
Ж	Manhole	1
И	For pressure measurement	1
К	For temperature measurement	1
Л	For temperature control	1
M <sub>1,2</sub>	Process	2
H <sub>1,2</sub>	Process	2

Nozzles diameters are determined via process design.

# 136 Absorption Column

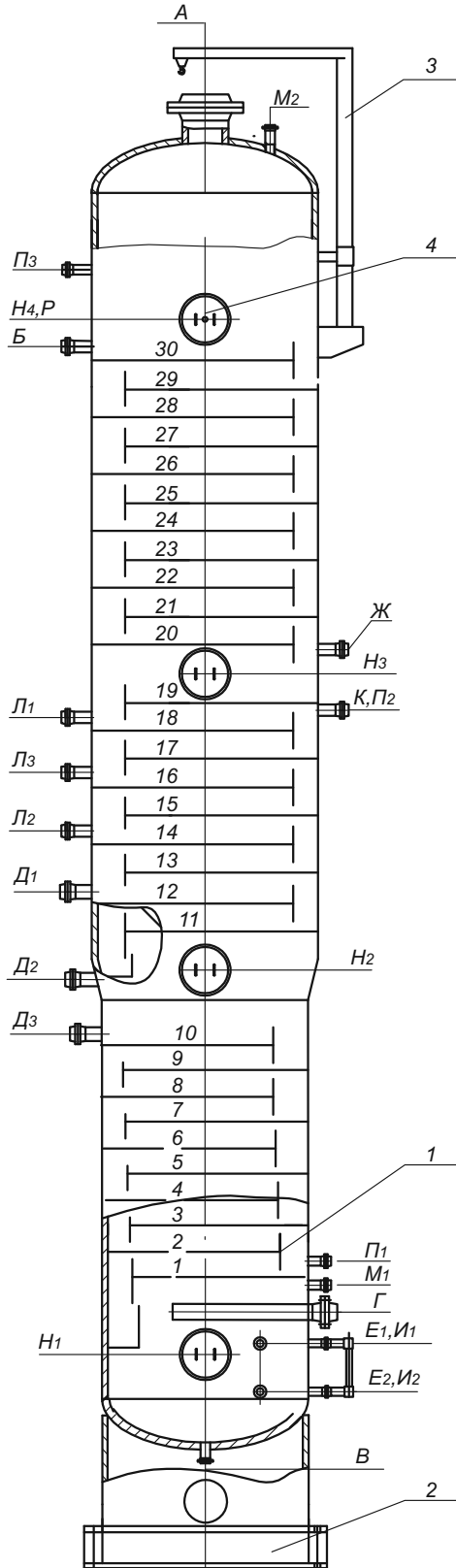


- 1 – Bidirectional bubble-cap tray
- 2 – Cartridge demister
- 3 – Cartridge filter with coalescers

The column is fitted with level, temperature, pressure, pressure drop visual control devices and equipment for transferring the signal to the control panel

Designation	Description	Quantity
A	Gas inlet	1
Б	Gas outlet	1
B	TEG drain	1
Г	TEG inlet	1
Д1-4	Manhole DN500	4
E	Drain	1
Ж1,2	For level bridle	2
И1,2	For pressure gauge	2
K	For pressure measurement	1
Л1,2	For thermometer	2
M	For temperature measurement	1
Н1,2	Pressure drop measurement	2
П1,2	Condensate drain	2
P	Process	1
C	Process	1
T	Drain	1

Nozzles diameters are determined via process design.

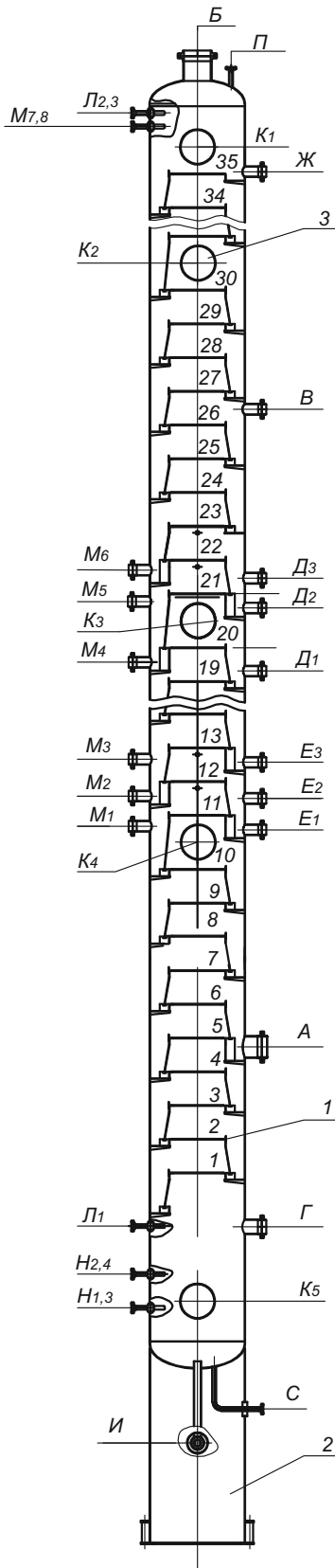


- 1 – Valve collar
- 2 – Support
- 3 – Load-lifting jib-crane for trays installation
- 4 – Manhole

Designation	Description	Quantity
A	Petro vapors outlet	1
Б	Reflux inlet	1
В	Fuel oil outlet	1
Г	Steam inlet	1
Д1-3	Feed inlet	3
Е1,2	For level gauge	2
Ж	Inlet from the stripping column	1
И1,2	For level regulator	2
К	Withdrawal to the stripping column	1
Л1,2,3	Feed inlet	3
М1,2	For pressure gauge	2
Н1,2,3,4	Manhole DN500	4
П1,2,3	For thermocouple	3
Р	Process	1

Nozzles diameters are determined via process design.

# 138 Rectifying Column



Consists of the following components:

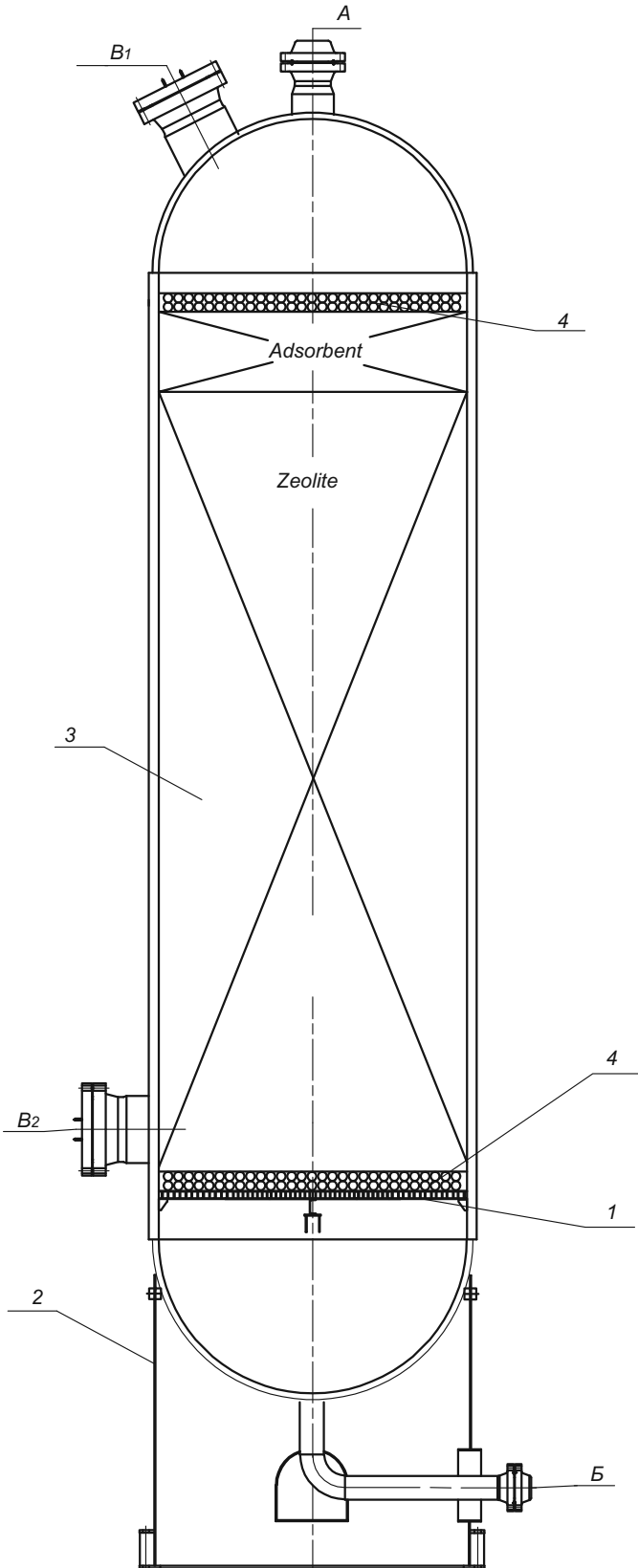
- 1 – Shell
- 2 – Trays
- 3 – Support
- 4 – Manholes
- 5 – Process nozzles

The column is fitted with level, temperature, pressure control devices.

Designation	Description	Quantity
A	Raw materials inlet	1
Б	Petrol vapors outlet	1
B	Petrol vapors inlet	1
Г	Water steam inlet	1
Д1-3	Diesel fraction withdrawal	3
Е1-3	Diesel fraction withdrawal	3
Ж	Petrol refluxing inlet	1
И	Fuel oil outlet	1
К1-5	Manhole	5
Л1-3	For pressure measuring	3
М1-8	For temperature measuring	8
Н1-4	For level measuring	4
П	Air tap	2
С	Drain	1

Nozzles diameters are determined via process design.

# 139 Adsorption Column



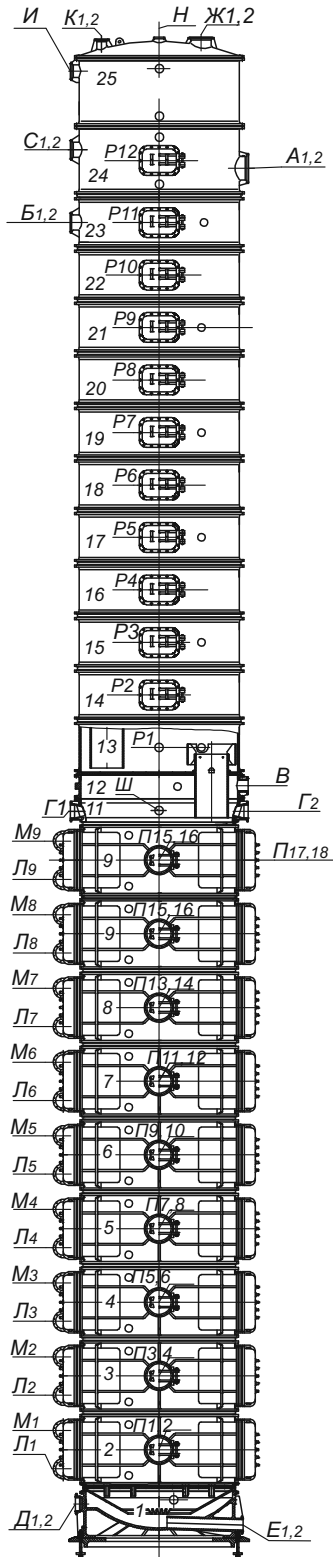
Meant for drying gas from residue liquid via adsorption.

- 1 – Dismountable grid (2 pcs.)
- 2 – Support
- 3 – Zeolite
- 4 – Manhole

Designation	Description	Quantity
A	Gas outlet to drying	1
Б	Dried gas outlet	1
B1,2,3	Manhole DN500	3

Zeolite grade and amount is chosen based on the process composition of gas.

Nozzles diameters are determined via process design.



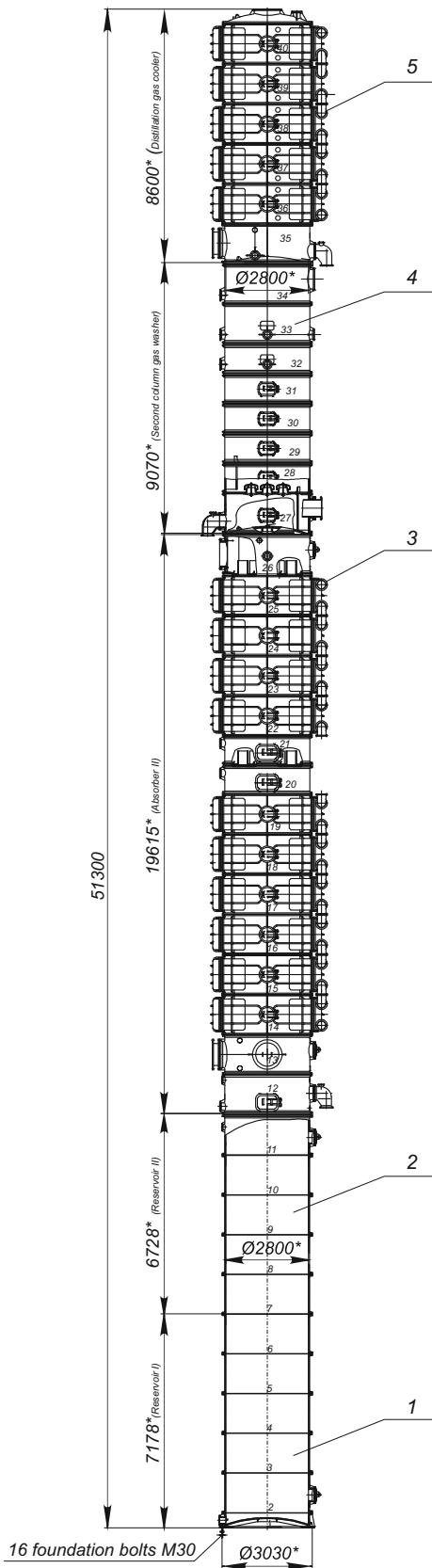
Aside from steel columns, a wide range of combined column-type equipment is produced for specialized productions: sodium, cake and by-products, hydrolytic etc.

Carbonization column Ø2800/Ø3000 mm consists of a cooling, mass-transferring and separation parts. The column is made of alloyed cast iron. Heat exchanging tubes – BT1-0 alloy. In the column's shell – pressure of 0.3 MPa temperature - 70°C. In the tube side – pressure of 0.35 MPa temperature - 30°C. The weight of the column is 201000 kg.

Designation	Description	Quantity
A1-2	Liquid inlet	2
Б1-2	Liquid inlet	2
В	Stand-by	1
Г1-2	Gas inlet	2
Д1-2	Gas inlet	2
Е1-2	Suspension outlet	2
Ж1-2	Gas outlet	2
И	Stand-by	1
К1	For safety valve	1
К2	Stand-by	1
Л1-9	Water inlet	9
М1-9	Water outlet	9
П1-18	Manhole	18
Р1-12	Manhole	12



# 141 Ø2800 mm Absorption Column



Comprises of apparatuses stacked on top of each other:

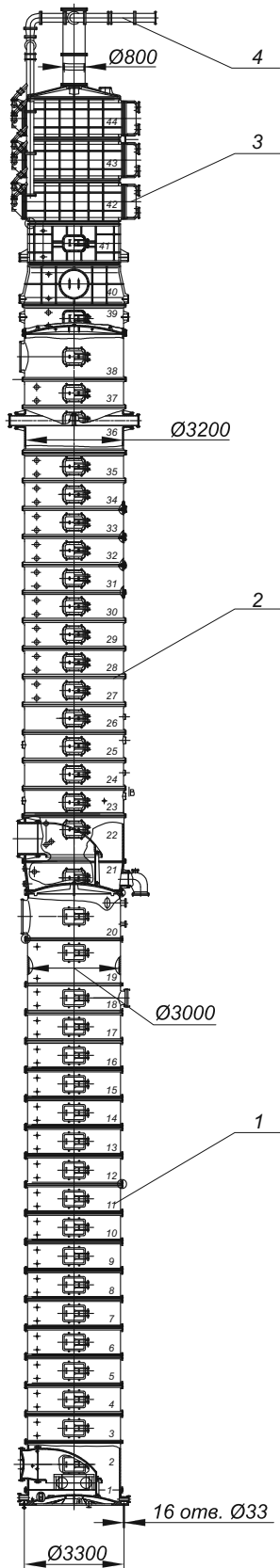
- 1 – Reservoir I
- 2 – Reservoir II
- 3 – Absorber II
- 4 – Second column gas washer
- 5 – Distillation gas cooler

Bubble-cap trays are installed in the washer.

The cooler is equipped with cooling pipes made of BT1-0 titanium alloy.

The absorption column shell is made of alloyed cast iron C425 and assembled from separate rings on flanged slots.

# 142 Distillation Column



Comprised of apparatuses stacked on top of each other:

- 1 – Distiller Ø3000
- 2 – Distillation heat exchanger Ø3200
- 3 – Condenser
- 4 – Gas ties piping

The column is manufactured of alloyed cast iron C425, assembled from separate rings on flanged slots.

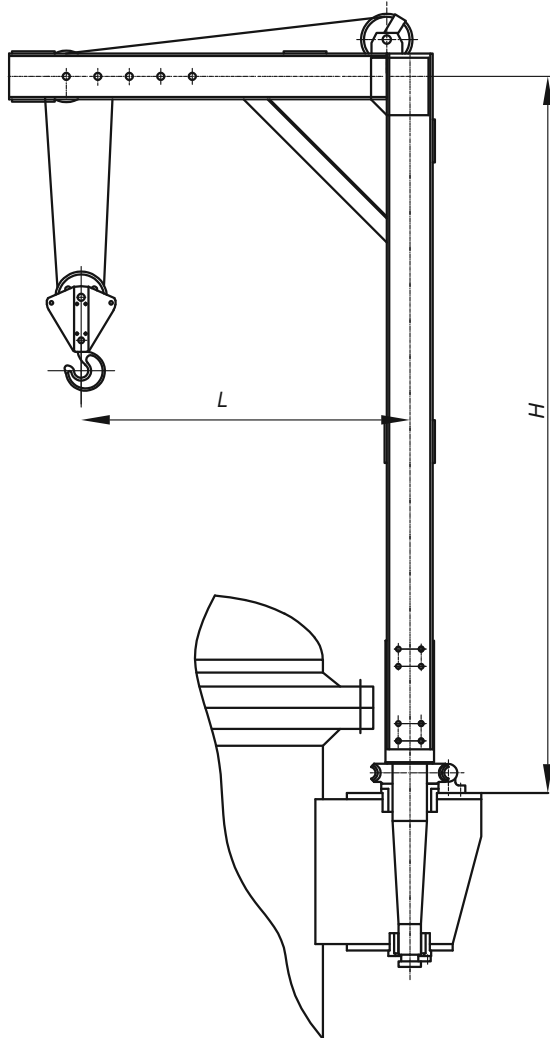
The distiller is meant for complete ammonia stripping from the mixer liquid using steam.

The distillation heat exchanger is meant for desorption of carbon dioxide from the filter liquid.

The condenser is meant for ammonia, carbon dioxide regeneration from the filter liquid and other sodium production liquids.

Weight of the column – 272350 kg.

## 143 Jib-Crane



Jib-crane is used for mounting the internal components of columns.

Jib-cranes are fitted with a worm feeder facilitating lifting of loads.

Per the customer's decision, a jib-crane is supplied with various lifting capacities, with manual or electric drive.

Main jib crane with a manual drive parameters are given in the table.

**Main jib crane with a manual drive parameters**

Lifting capacity, t	Crane radius, mm	Height H, mm	Weight, kg
0.5	800	1600	177
	1200	2400	216
	1600	3200	250
	2000	4000	283
	2500	5000	325
1.0	1200	2500	384
	1600	3000	413
	2000	4000	456
	2500	5000	507
3.0	1600	3000	1300
	2000	4000	1405
	2500	5000	1511

# 144 Data Sheet for Column Order

Name and address of organization that filled out the data sheet:

Name of the enterprise, for which the column is developed:

Scheduled deadline for the development of the technical project, manufacture, installation and testing of the column:

No.	Questions	Units	Answers
1	2	3	4
1	Name of the apparatus; position NoNo. per the process diagram.	-	
2	Purpose of the apparatus		
3	Material balance of the column with mention of the physical state (liquid, steam), amount and composition of the separated liquid (feed), distillate, bottom liquid, intermediate bleeding and refluxing (for fractionating and distillation columns); the amount and composition of vapors (gases) and liquid on the apparatus inlet and outlet (for absorption column). Molecular weight of components to be stated in the material balance. Balances may be separated into a designated annex to the data sheet.		
4	Temperatures:		
	of column feed at the inlet	°C	
	of intermediate bleeding	°C	
	of vapors on top	°C	
	of the column	°C	
	of intermediate refluxing at the bottom of the column	°C	
	maximum allowable of the column bottom. (Specified in cases where it is limited.)	°C	
5	Absolute pressure:		
5.1	of the column top	mm Hg (kgf/cm <sup>2</sup> )	
5.2	of the column bottom	mm Hg (kgf/cm <sup>2</sup> )	
5.3	allowable pressure of the column bottom. (Specified in cases where it is limited.)	mm Hg (kgf/cm <sup>2</sup> )	
6	Type of trays, column packing of an existing equivalent industrial package.		
7	Type of process mixture: ideal, non-ideal. (Ideal mixture acts according to the Raoult's law.)		
8	Physical and chemical properties of: the processed mixture (feed), distillate, bottom liquid, reflux, intermediate bleeding and refluxing or their components under temperatures of feeding into the column and bleeding, the top and the bottom of the column:		
8.1	Density in liquid state.	kg/m <sup>3</sup>	
8.2	Heat capacity in liquid state.	kcal/kg	
8.3	Liquid vaporization or vapors condensation heat (see notes).	kcal/kg	
8.4	Liquid viscosity.	cPs	
8.5	Pressure of saturated vapors of components.	mm Hg (kgf/cm <sup>2</sup> )	
9	Total packing height.	m	
10	Location of the feed point per the packing height.	m	

# 145 Data Sheet for Column Order

1	2	3	4
11	Polymerization or thermal decomposition tendencies of processing products; possibility of sediments deposition on the columns' surfaces. Special requirements to the column design, resulting from polymerization, depositions and sediments, heating, cooling etc.		
12	Maximum allowable temperature and staying time of the product in the column cube (if limited).	°C	
		minutes	
13	Column installation location (indoors, outdoors, on an individual foundation, bridging, rack).		
14	Recommended material for the column parts in contact with the process medium, corrosion rate. Please specify whether or not the processing products cause the metal corrosive cracking.		
15	Installation location and types of embedded parts for instrumentation, short description, sketch.		
16	Location of sampling points in the column (NoNo. of trays, column cube etc.) and nozzles diameter.		
17	Possible fluctuations of the column load in % of the mean value (no more than ±30%).	± %	
18	Support type (skirt, suspension).		
18.1	Column skirt support height needed for normal drain of liquid from the column cube.	mm	
18.2	Installation height of suspension supports.	mm	
19	Climatic and special conditions in the construction location:		
	average temperature of the coldest five-days period	°C	
	design barometric pressure	mm Hg	
	wind pressure on the 10 m height	kgf/m <sup>2</sup>	
	seismicity	value	
20	Thickness and specific weight of heat insulation.	meter	
		kg/m <sup>3</sup>	
21	Location, dimensions and weight of maintenance platforms and other equipment attached to the column.		
22	Nozzles binding in the plane and per the height of columns.		
23	Coil, jacket surface area and purpose.	m <sup>2</sup>	
24	Foaming capacity of working mixtures: no, low, high foaming.		
25	Number of working days per year.		
26	Design pressure (absolute) and design temperature. Confirm if coincide with the operating values.	mm Hg (kgf/cm <sup>2</sup> )	
		°C	

**NOTE:**

- All answers in the data sheet and other data that the customer deems necessary to provide, can be attached in separate tables, a diagram or a text material.
- If processed liquids contain dissolved solids, or they are present as suspension, then the density, heat capacity, viscosity and vaporization heat shall be indicated for the mixture, not for individual components.

Signature of an authorized person

### **Certificates of Conformity:**

- ISO 9001:2015 Quality Management Certificate;
- OHSAS 18001:2007 Occupational Health and Safety Management Certificate;
- ISO 14001:2015 Environmental Management System Certificate.
- Certificates of Compliance with the requirements of ASME standards:
  - Manufacture Approval Certificate.