



NPO PASSAT



DESIGN AND MANUFACTURE OF
PROCESS EQUIPMENT FOR MINING
AND CHEMICAL INDUSTRY



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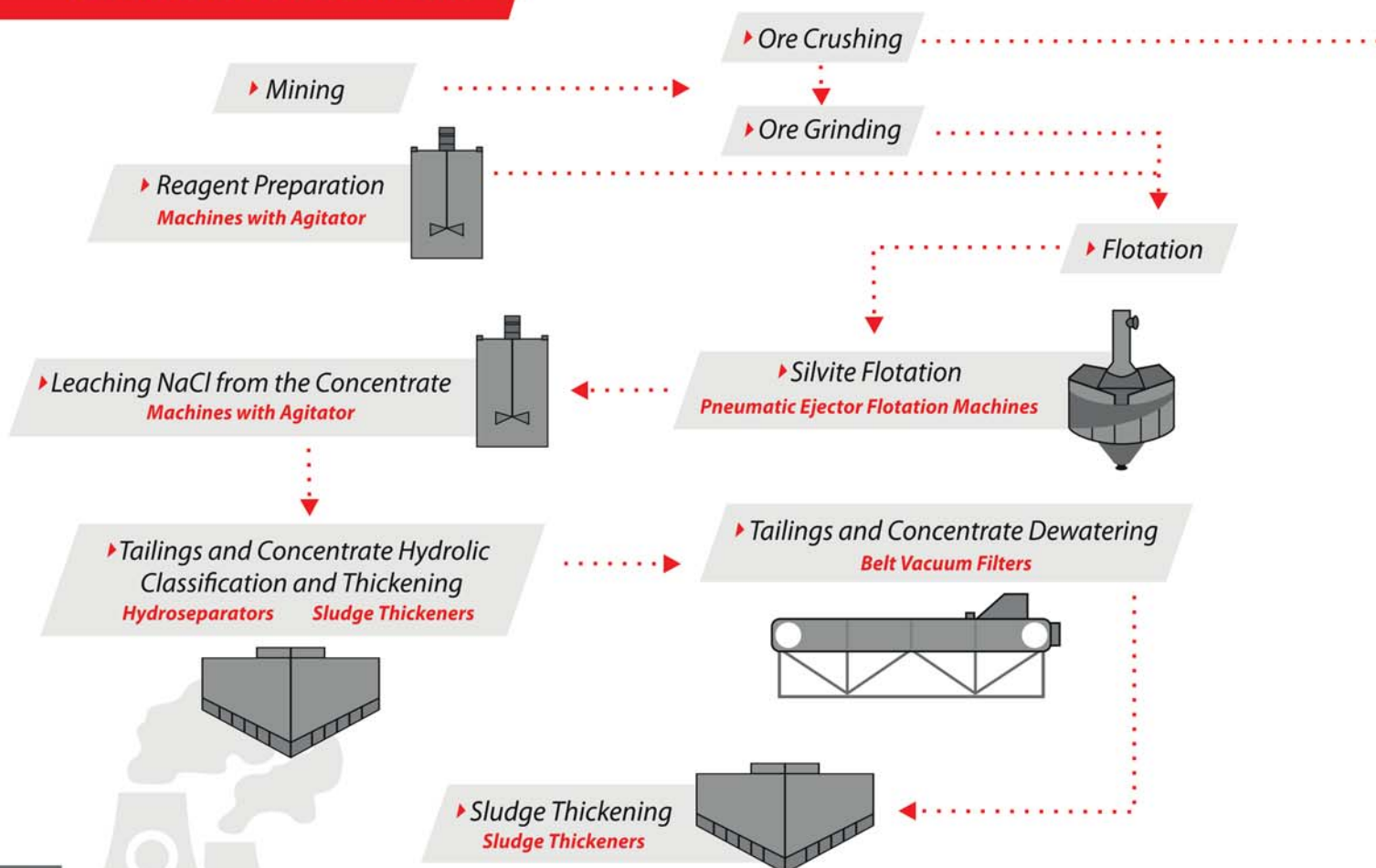
About NPO Passat

NPO «Passat» (holding «PASSAT») is focusing on design and manufacturing processing equipment, including carrying out turn-key projects. We used the best word experience and our results of academic and research work to deliver dozens of projects in mineral raw materials processing and enrichment, mainly in potash ore field.

Where we fit into the KCL production line

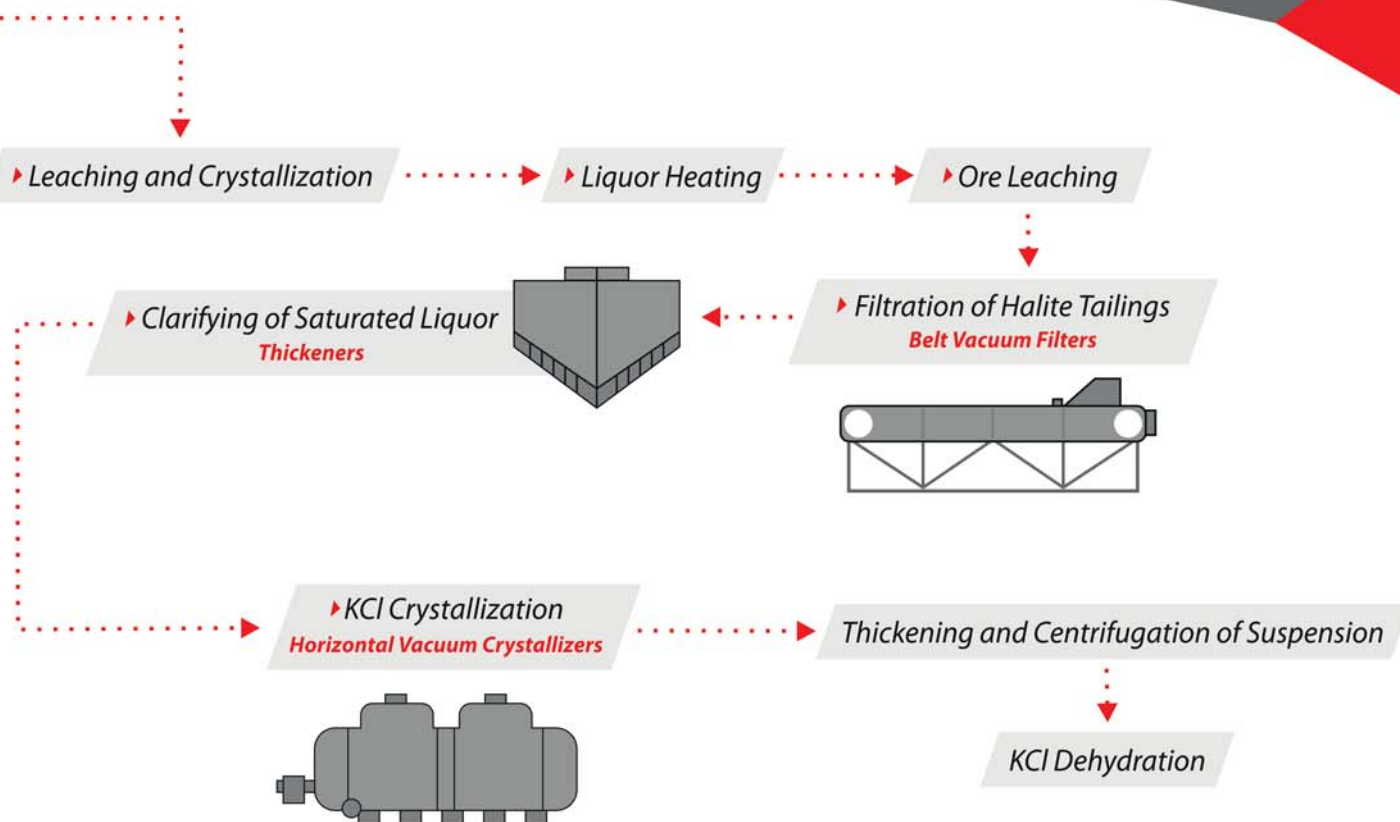
As the KCL processing experts, we supply equipment for almost all the phases of the process.

KCL BENEFICATION TECHNOLOGY



Our company has the full mechanical engineering cycle for producing of processing equipment: plasma arc cutting, chiseling, bending process, rolling of metals, welding procedures qualification GMAW/SMAW, MIG/MAG, TIG, automatic submerged arc welding of bodies of rotation with the diameter up to 4000mm, turning process with center-to-center distance of 8000 mm, CNC milling, shot-peening, powder coating, chemical analysis of alloy steels.

The staff of the enterprise is 185 employees, while the total staff of the PASSAT holding exceeds 2000 employees. The company's own developments are carried out in the chemical engineering and design departments in close cooperation with the enterprises of the PASSAT holding and our partners: Metso Minerals, Ercosplan, Famako, Ebner, Corrosioneering Group, Maelgwyn Mineral Services, AKW Apparate + Verfahren, Mechanical Engineering Department HÖINK, Perm National Research Polytechnic University, Institute of General and Inorganic Chemistry of the National Academy of Sciences of Belarus.



Highly Productive Compact Thickeners

Highly productive compact thickeners can be used for thickening (dehydrating) and clarification, as hydroseparators, tailings thickeners in mining and chemical industry as well as for sewage purification. In potassium industry they are used for thickening sludge and saline product with getting of filtered spent liquor.



We manufacture the hydroseparators and tailing thickeners with the diameter of 10 and 18 meters are used.



Flotation pulp thickeners has a system of foam removal. They include a vessel for deaerating pulp, which is also designed for mixing pulp and its contact with flocculant. Flocculant is served in portions. It forms large and porous floccula, that decay and form solid floccula, which assures their high rate of deposition. In thickeners pulp is served directly to the concentration area, under a layer of flocculated solid particles, which ensures filtration of discharge and additional flocculation. The implemented technical solutions provide high throughput per unit area.

Thickeners are equipped with a central driving gear of a mechanical rabble for effective removal of liquid and air.



The control system of a thickener is designed for operating the process of saline solutions purification. Solutions are then returned into the technological process.

The control system consists of the following units:

- Electromagnetic systems for measuring consumption of the initial product, flocculant, discharge and other products;
- Probes of the upper and lower levels of thickened sludge and several calculators;
- An inductive sensor located on the electric motor of the stirrer;
- Temperature-sensitive resistors built into electric motors of stirrers and pumps;
- Tracking pneumatic driving gears aggregated with a ball cock;
- Sound and light emitters;
- A control cabinet.



Modern materials used for chemical protection of the vessel of thickeners allow using the machine for clarification and thickening of hot pulps at temperatures up to 105 °C.

ADVANTAGES OF HIGHLY PRODUCTIVE COMPACT THICKENERS:

- High specific output;
- High density of thickened sludge;
- Possibility of adjusting and maintaining the clarified layer and full automation of the thickener;
- Minor production area necessary for their installation.

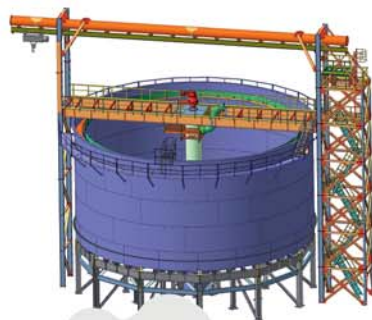
After implementing minor construction modifications thickeners can be used as hydroseparators for pulp desludging.



Sludge Thickeners

Sludge thickeners are designed to clean the salt liquor and thicken the sludge.

To intensify the clarification process the supply of an aqueous solution of a flocculant and a mixed reagent is provided.



BASIC TECHNICAL SPECIFICATION

INDICATOR	VALUE
Inner diameter of the barrel, m	18
Taper angle, degree	165
Nominal settlement area, m ²	508
Work volume, m ³	2145
Power of motor, kW	1,5
Working pressure	atmosphere
Operating media	corroding
Operating mode	pauseless
Aerial temperature, °C	-24...+24
Unrefined salt liquor, m ³ /h	120
Chemical compound (%)	
NaCl	25,0
Ca(HCO ₃) ₂	0,003
CaSO ₄	0,13
MgSO ₄	0,041
Na ₂ SO ₄	0,627
H ₂ O	74,198
Specific density t/m ³	1,2
Temperature, °C	13-40
Media PH	6-7
Relative air humidity, %	60-75
Climatic category	M (moderate)
Dimensional specifications, m:	
length	27,5
width	20,3
height	21,4
Thickener's net weight, t:	
nonloaded	201
uploaded	2775

Hydroseparators

Hydroseparator is designed for pulp deslimation in mineral fertilizer manufacturing.



BASIC TECHNICAL SPECIFICATION

INDICATOR	VALUE
Inner diameter of the barrel, m	18
Taper angle, degree	150
Nominal settlement area, m ²	254
Work volume, m ³	1138
Rotational frequency of revolving arms, R.P.M	Δo 1
Driving torque, kg/m	185,66
Working pressure	atmosphere
Operating media	corroding
Temperature of operating media, maximum°C	15-40
PH media	6,5-7,5
Operating mode	pauseless
Suspension capacity, m ³ /h	1475
Power of motor, кВт	11,0
Dimensional specifications, m:	
length	18,4
width	18,4
height	10,8
Thickener's net weight, t:	
nonloaded	109
uploaded	1568
Life expectancy, years	15

Belt Vacuum Filters

Belt vacuum filter is designed for filtrating quickly-precipitating suspensions with heterogeneous solid phase in chemical and other industries except food industry.



Filtering surface for belt vacuum filters is defined according to specified productivity, that depends on particle size composition, feed supply density, liquid phase viscosity and the end product characteristics. Belt vacuum filters are working at tails and float concentrate filtration in potash industry. Steaming operation and elutriation are possible.

TECHNICAL SPECIFICATION:

- the capability of filter cake layer automatic upkeep, and as a result low wastage of the valuable component containing with tailing,
- low capital costs;
- high specific productivity;
- automatic flow quantity upkeep on vacuum pump.



AS A RESULT OF IMPLEMENTATION THE CUSTOMER IS GETTING:

- high efficiency;
- low filter cake humidity;
- the possibility of process automation;
- the work control algorithm, that provides predetermined filter cake layer;
- the reduction of capital costs during construction.



Machines with Agitator

Possible fields of application of machines with agitator are mining processing and chemical industries:



- equipment the reagent department with the mechanical mixers for different reagent solutions preparation,
- usage of this machines for pulp conditioning with reagents,
- for deslimation and dilution processes,
- application in the function of attrition process vessel.

The capacity and machine construction and the type of agitator should be chosen depending on productivity, operation time, properties of mixing media. In case of need the machines are provided with heating devices of different type (at the customer's request).



THE MATERIALS FOR MANUFACTURING OF BULK CAPACITY VESSEL AND MIXER:

- carbon steel,
- stainless steel,
- titanium,
- usage of several coatings.

OUR CONDITIONING MACHINES WITH MIXERS PROVIDE:

- equilibrium distribution of input reagents in pulp bulk and over the phase interface surface because of their diffusion from aqueous phase bulk to the surface of mineral particles, that is finishing with formation of sorbate layers of optimal density,
- ideal mixing and equilibrium distribution in the bulk of modifying agents to applied reagents, reducing solution preparation time,
- effective deslimation (dilution) all grade classes of leach,
- minimal energy consumption in comparison with traditionally using mechanical mixers,
- applicability of different dimensions (correlation of tank's height and diameter) during reconstruction of factories during the process of production,
- optimal flows hydrodynamic, that eliminate coarse particles at the bottom of tank.

Type of agitator should be chosen depending on properties of mixing components (density, viscosity, superficial tension, grade and concentration). It may be low-speed and high-speed mixers, rotary-vane and turbine.

Vacuum Crystallizers

Vacuum crystallizer is designed for KCL crystallization by cooling a hot concentrated solution while boiling it under vacuum and evaporating part of the dissolving liquor.



BASIC TECHNICAL SPECIFICATION

INDICATOR	NORM
Operating media characteristics	
Potassium chloride pump with the content:	
KCL, %	11-20
NaCL, %	13-17
MgCL + CaCL, %	5
CaSO, %	≤ 0,1
Density of liquid phase, kg/m ³	1250
Dinamic viscosity, Pas	0,8 - 2,5x10 ⁻²
Temperature of parent solution, °C	112
Temperature of mother solution, °C	20 - 30
Capacity in parent solution, t/hour	2300
Pressure, discharging (inside the vessel)	0,2x10 ⁻² - 5,8x10 ⁻²
Total storage capacity of process vessel, m ³	160
Work volume, m ³	110
Process vessel mass, kg	65000
Process vessel mass in operation condition, kg	220000
Dimensional specifications, m, not more	
Length	19898
Width	4080
High	6150

Pneumatic Ejector Flotation Machines

Pneumatic ejector flotation machines are designed for enrichment of mineral deposits at the rougher, scavenger and cleaner flotation and provide following advantages:



- high technical efficiency due to process selectivity and high foam density;
- reduction of energy consumption;
- low capital and operating costs;
- possibility of process automation.

Reduced power consumption in comparison with mechanic flotation machines is provided by the absence of moving parts and as a consequence engines. The use of non-metal structural components also ensures low capital and operational expenditures.

Pneumatic ejector flotation machines automatically sustain a specified height of the foamed layer, which ensures a higher quality of the ready product.



An important feature of ejector flotation machine is flotation process high intensity, that is given by:

- the usage of aerator ejector, that gives high pulp aeration stage both in degree of the amount of sucked in air and in the degree of air bubbles dispersion;
- significant and sudden pressure differential in the ejector aerator (from 3 atm to 0 atm)
- smooth movement of aerated pulp from the bottom upwards which accelerates the floating of mineralized bubbles and increases the efficiency of the machine.

Thus by replacing mechanic flotation machines with pneumatic ejector ones a manufacturer increases the capacity of the production area, reduces losses of flotation tailings and raises the quality of the concentrate after the main and cleaning flotation.

Our company can design and manufacture pneumatic ejector flotation machines of different sizes according to the customer's demand.



SIZE SPECTRUM

PARAMETER NAME	EFM-25	EFM-30	EFM-35	EFM-38	EFM-41	EFM-45	EFM-52	EFM-60	EFM-65
Nominal diameter, mm	2 500	3 000	3 500	3 800	4 100	4 500	5 200	6 000	6 500
Diameter with froth-overflow channel, mm	3 000	3 560	4 100	4 400	4 700	5 200	5 900	6 800	7 300
Approximate flow rate, min.-max. m ³ /h	145-210	225-320	310-470	420-605	515-740	660-950	925-1330	1300-1870	1600-2300
Flotation volume with raised regulating cone, m ³	7,67	12,3	18,3	23,7	30,5	38,7	54,7	81	100
Flotation volume with a suppressed regulating cone, m ³	6,75	10,6	15,7	20,8	27,2	33,7	48,2	70	86

Optional equipment

To meet our Customer's demands NPO Passat is manufacturing following optional equipment:



■ GATE VALVES AND VALVING BOXES

Gate valves and valving boxes are designed for using as stop valves on pipelines of large diameters.



■ TECHNOLOGICAL SUMPS

Technological sumps are designed for collecting and dispensing a slurry of thickener discharge.



■ SCRUBBER FILTERS

Scrubber filters are designed for flushing with liquids of gases to purify them from polluting components (dust, resins, sulfur dioxide, hydrogen sulfide, ammonia, etc.).



■ BAROMETRIC JET CONDENSERS

Barometric jet condenser is designed for water vapor condensation which entering the apparatus with gases formed by hydrocarbons and air.

This products can be made both by black and stainless steels.

This optional equipment may be manufactured from carbon and stainless steel.

Complex Supply of Reagent Preparation Lines for Eurochem-Usolsky Potash Plant, LLC

GOAL AND OBJECT'S PURPOSE: supply of the nine technological lines for the reagent department of potassium chloride processing plant of Usolsky Potash Plant.



1. binding agent preparation,
2. dispersing agent preparation,
3. slurry collecting agent preparation,
4. amino-n-butyric mixture preparation,
5. polyacrylamide flocculant
6. dust suppressant anti-clodding agent
7. slurry depressant preparation
8. sylvite collector emulsion preparation,
9. warm and hot water preparation.

This project contains new development of main agents preparation for potash industry:

- sylvite collector emulsion preparation with optimum dispersion of modifying additives,
- slurry depressant preparation on mother solution,
- Preparation of concentrated solutions of non-ionic flocculants without the "ripening" stage and working solutions by dilution with the mother liquor.

All the stages of process are carried out on the equipment of Research and Production Association «Passat». The main type of equipment is the mechanical mixer with agitator. The type of agitator was chosen depending on mixing components qualities (density, viscosity, surface

tension, size, concentration of solids and others). Low speed and high speed mixers, rotary-vane, turbine and gate agitator were applied. If necessary, in addition to vessels with agitator special optional equipment were putted to use (pump-gelatinizer, dilution device, discharge system, static mixer and others).

Any reagent preparation process represents the complete cycle. It equipped with all necessary machines: agitator with vessels, pumps, valves and piping, automation system with working places, control system. Delivery package also includes: commissioning, starting-up, acceptance trials, customer's specialists training.



Process Vessels for KCl Dilution for 1 Production Unit of Belaruskali, JSC

These process vessels are designed for KCl dilution in pulp of discharge of sludge thickeners by solution to its enrichment at operating temperature and brightening of mother liquid.



BASIC TECHNICAL SPECIFICATION

INDICATOR	NORM
Volume, m ³	188
Inner diameter of the barrel, m	6
Working pressure, Mpa	running
Placement location	In an exposed position
Feed rate, m ³ /hour	225
Sludges	65 ... 75
Solution	150
Sludge characteristic:	
Weight content of KCl, %	12 ... 15
Density, g/l	650 ... 700
Temperature, °C	+15 ... +40
Solution characteristic:	
Density of solution, g/l	1160 ... 1220
Weight content of KCl, %	5,5 ... 7,5
Temperature, °C	-5 ... +35
Agitator	Frame mixer 2-bladed 2-level
Diameter of mixer, mm	4000
Rotational frequency of agitator, R.P.M	4,2
Voltage and supply frequency, V, Hz	380 ± 38, 50 ± 1,25
Power of drive unit motor of agitator, kW	7,5
IP Code of agitator's drive unit, not more then	IP 54
Dimensions, mm, not more then	
Length	7100
Width	7030
High	13330
Weight of process vessel with agitator in operation condition, kg	334000

DELIVERY PACKAGE INCLUDES:

- process vessel with agitator,
- pumps,
- valves and piping,
- automation and control system,
- commissioning, training and starting-up of a11 the equipment complex, acceptance testing and putting into operation.

The Construction of Adjustable Vacuum Crystallizer Installation for Crystallization of KCL for Forth Production Unit of Belaruskali, JSC



Goal and object's purpose: construction of new technological line for production of coarse crystalline halurgical potassium chloride with capacity of at least 1,500,000 tons per year.

This project we realizing by research and production consortium including: holding «Passat» (general contractor), Ebner GmbH & Co KG (Germany), Famako Anlagenexport GmbH (Germany), Ercosplan Ingenieurburo Anlagentechnik GmbH (Germany).

Method of production: potassium chloride vacuum-crystallization from hot saturated liquors. Selected process of obtaining coarse crystalline potassium chloride consists of seven stepwise evaporation liquor under the vacuum at the apparatus, consisting of seven evaporates. For the purpose of maximum energy efficiency in installation provides the recovery of thermal energy when cooling of mother liquor by titanium surface heat exchangers and mixing condensers. To reduce foaming the installation equipped with automotive preparation and dozing system of antifoam agent.

Final product: coarse crystalline potassium chloride, chemical formula – KCl, average size of cluster crystals of round shape $d_{cp}=0,6 - 0,8$ mm. The production of coarse crystalline potassium chloride with useful component content in conversion to K_2O not less than 62,0%.

Project implementation terms: 20 month.

Delivery package includes the basic technical project with technological solutions and constructional and architectural tasks for designing the production building, three dimensional modeling of the installation.



BASIC PROJECT'S CHARACTERISTICS:

- dimensions of engineering building (l*w*h) 80*40*45 meters (height of upper principle building level+ 24,00 m);
 - equipment overall weight is about 2 000 ton;
 - materials of production of crystallizer is steel clad with nickel-copper alloy 400 (2.4360), surface condenser material - titanium, mixing condensers are made from stainless steels;
 - project components are: Sultzer pumps (Switzerland), Egger pumps (Switzerland), SPX Lightnin (Great Britain), valves and piping of Sistag WEY (Switzerland), instrumentation of Endress+Hauser (Switzerland);
 - technological pipelines from stainless steel with protective vinylester-acrylic coatings;
-
- Delivery package includes process automation to the operator's console.
 - Delivery package includes commissioning, training and starting-up of all the equipment complex, acceptance testing and starting up.



Installation of Flotation of Fine-grained Fraction KCl for 1 Production Unit of Belaruskali, JSC

DELIVERY PACKAGE OF INSTALLATION INCLUDES:

- two pneumatic ejector machines of the rougher flotation type EFM-41;
- one pneumatic ejector machines of cleaner flotation type EFM-35;
- apparatus for conditioning pulp with reagents (with a depressor and with a collector);
- deaeration vessel;
- leaching apparatus;
- pumps;
- valves and piping;
- automation and control system;
- commissioning, training and starting-up all the complex of equipment, acceptance tests and putting into operation.



ADVANTAGES RECEIVED BY CUSTOMER IN THE RESULT OF EJECTOR FLOTATION MACHINE IMPLEMENTATION:

1. load to the section at the same production area increased;
2. reduction of losses with flotation tails;
3. quality of concentrate after flotation increased;
4. electric power consumption increased to 130kW/h to every section;
5. reduce maintenance costs.

Installation of Scavenger Flotation for 3 Production Unit of Belaruskali, JSC

DELIVERY PACKAGE INCLUDES:

- pneumatic ejector machines type EFM-41;
- apparatus for contacting pulp with reagents before rougher flotation;
- deaeration vessel;
- pumps;
- valves and piping;
- automation and control system;
- commissioning, training and starting-up of all the equipment complex,



ADVANTAGES RECEIVED BY CUSTOMER IN THE RESULT OF EJECTOR FLOTATION MACHINE IMPLEMENTATION:

1. the quality of scavenger flotation of concentrate increased in 1%(quality of concentrate from scavenger flotation was at least 91%, while the quality of the three cleaner flotation was no more than 89%);
2. electric power consumption increased to 130kW/h to every section;
3. reduce maintenance costs;
4. production areas for cleaner flotation were reduced;
5. costs for construction of machines were reduced.

Reference-list

SUPPLIED EQUIPMENT	YEAR	QUANTITY	CUSTOMER
Cone thickener bottom (for Brandes)	2017	1	Belaruskali, JSC
Salt slurry thickener (Dorr type)	2017	1	Belaruskali, JSC
Salt slurry thickener (Brandes type)	2017	2	Belaruskali, JSC
Machines with agitator, V=5 m ³ , 6,3m ³ , 10m ³	2017	5	Belaruskali, JSC
Delivery of leaching apparatus for processing plant	2016	28	EuroChem-Usolsky Potassium Plant, LLC
Red water tank V=50m ³	2016	1	Passat, LLC
Optical belt scales	2016	2	Belaruskali, JSC
Red water tank V=50m ³	2016	2	Passat, LLC
Optical belt scales	2016	6	Belaruskali, JSC
Barometric Jet Condensers V=1,8m ³	2016	1	Belaruskali, JSC
Barometric Jet Condensers V=1,7m ³	2016	1	Belaruskali, JSC
Barometric Jet Condensers V=0,2m ³	2016	1	Belaruskali, JSC
Revolving arms	2016	1	Belaruskali, JSC
Adjustable vacuum-crystallizer installation for crystallization of KCL for Forth Processing Plant of Belaruskali, JSC	2015	1	Belaruskali, JSC
Vacuum crystallizer	2015	2	Belaruskali, JSC
Apparatus for KCl dilution in slurry	2015	1	Belaruskali, JSC
Leaching apparatus	2015	1	Belaruskali, JSC
Pneumatic ejector flotation machines EFM-3500 complete	2015	2	Belaruskali, JSC
Belt vacuum filter 17m ²	2015	2	Belaruskali, JSC
Belt vacuum filter 35m ²	2015	1	Belaruskali, JSC
Equipment for reagent preparation lines	2015	24	EuroChem-Usolsky Potassium Plant, LLC
Barometric Jet Condensers V=1,8m ³	2015	1	Belaruskali, JSC
Barometric Jet Condensers V=0,06m ³	2015	2	Belaruskali, JSC
Barometric Jet Condensers V=1,65m ³	2015	2	Belaruskali, JSC
Barometric Jet Condensers V=0,1m ³	2015	2	Belaruskali, JSC
Intermittent-thickener	2015	1	Belaruskali, JSC
Belt-conveyor automatic continuous weigher	2015	1	Belaruskali, JSC
Sump V=23m ³	2015	1	Belaruskali, JSC
Optical belt scales	2015	1	Mozyrsalt, JSC
Sump	2014	4	Belaruskali, JSC
Sump	2014	2	Belaruskali, JSC
Optical belt scales	2014	8	Belaruskali, JSC



Reference-list

SUPPLIED EQUIPMENT	YEAR	QUANTITY	CUSTOMER
Mining optical belt scales	2014	2	Belaruskali, JSC
Optical belt scales	2014	1	«Metso Minerals» for Belaruskali, JSC
Optical belt scales	2014	2	Belaruskali, JSC
Laboratory flotation unit IMF V06	2014	1	Institute of General and Inorganic Chemistry of the National Academy of Sciences of Belarus
Highly-productive thickener with the diameter of 10m	2014	4	Passat, LLC
Thickener 18000 (Dorr type)	2014	1	Mozyrsalt, JSC
Revolving arms	2014	1	Belaruskali, JSC
Optical belt scales	2014	1	Belaruskali, JSC
Optical belt scales	2013	2	Belaruskali, JSC
Leaching apparatus	2013	7	Belaruskali, JSC
Belt vacuum filter	2013	1	
Ejector flotation machine EFM-4100	2013	1	Belaruskali, JSC
Mechanical mixer for depressor $V=10m^3$		1	
Mechanical mixer for collector $V=5m^3$		1	
Leaching apparatus		1	
Control system		1	
Vessel for lamella thickener of Metso IPS LTC 2200-15 outfit	2012	1	Belaruskali, JSC
Clay-salt slurry thickener	2012	1	Belaruskali, JSC
Salt slurry thickener	2012	1	Belaruskali, JSC
Hydroseparator with the diameter of 18m	2012	2	Belaruskali, JSC
Hydrocyclone unit		1	
Control system		1	
Installation for flotation of fine-grained fraction	2012	1	AAT Belaruskali, JSC
Thickener for thickening of fine fraction of flotation tails	2012	2	Belaruskali, JSC
Apparatus for conditioning pulps with reagents $V=5m^3$	2011	7	Belaruskali, JSC
Apparatus for conditioning pulps with reagents $V=10m^3$		7	
Belt vacuum filter	2011	2	Belaruskali, JSC
Vacuum crystallizer with two steam heaters DU1020/DU2400	2011	2	Belaruskali, JSC
Compact thickener with the diameter of 10m	2010	1	Uralkali, OJSC
Highly-productive thickener with the diameter of 10m	2010	19	Belaruskali, JSC



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