

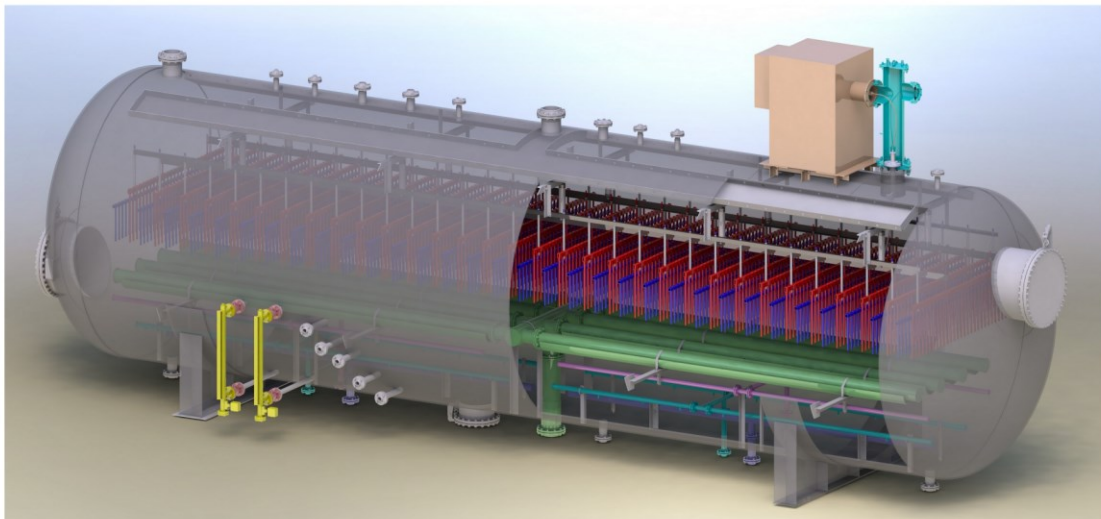


# CATALOGUE

## OIL & GAS EQUIPMENT

### (PART II)

# ELECTRODEHYDRATORS & ELECTROCOALESCING UNITS





Closed Joint Stock Company

**NEFTECH**

TECHNIQUE FOR OIL & OIL REFINING INDUSTRY

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Rev. 1.3



## CATALOGUE OF ELECTRODEHYDRATOR FOR DEHYDRATION AND DESALTING OF OIL

*Quality management system of CJSC "Neftech"  
is in accordance with ISO 9001:2008*

Kazan  
May 2017

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## Introduction

CJSC “Neftech” engineering company is a developer and supplier of equipment for preparation of oil for more than 30 years.

“Neftech” company is a leading enterprise in Russia and CIS countries in the field of design, manufacture and supply of electrodehydrators and electrocoalescing units for dehydration and desalting of oil at the crude processing facilities (CPF) of oil companies and electrical desalting plants (EDP) of oil refineries.

“Neftech” group also includes companies "Neftegazmash", "Neftechimmash", "Neftechproekt", "Neftechimlab". In addition, CJSC “Neftech” is the official and exclusive dealer of JSC “Ruzkhimmash”.

CJSC “Neftech” manufactures electrodehydrators (up to 200 m<sup>3</sup>) in the factories “Ruzkhimmash” and “Neftegazmash” and equips them with electrode systems, manifolds, high voltage input units, local automation systems, local control panels of our production, as well as with high voltage power supplies and insulators from foreign companies. All products have explosion-proof design, certificates of compliance and approval.

CJSC “Neftech” also reconstructs and upgrades existing outdated and unsatisfactory operating electrodehydrators. This involves designing, engineering, manufacturing and installation of high-performance electrode and manifold systems and equipping them with top quality high voltage power supplies, bushing and handing insulators, local automation systems and local control panels in existing housings for the electrodehydrators.

Usage of new and innovative composite electrodes and technological solutions in electrodehydrators and electrocoalescing units can significantly improve the efficiency and stability of their work, the depth of dehydration and desalting of crude oil, increase their productivity by two to three times and reduce consumption of demulsifier, heat and energy.

CJSC “Neftech” also executes a design of technological scheme and local systems of automation, supervises installation and commissioning of the electrodehydrators and electrocoalescing units, their production output in operating mode and post-sales servicing.

Equipment developed by CJSC “Neftech” described in this catalogue, have innovative electrode systems, including ones made of composite materials. Their structural elements, equipment and automation allow electrodehydrators and electrocoalescing units to be superior to their world counterparts and form equipment of the new generation.

# 1. Electrodehydrators

## 1.1. Technological section

For the usage of the electrodehydrators developed by CJSC “Neftech” at crude processing facilities (CPF) for preliminary preparation of oil and at electrical desalting plants (EDP) of oil refineries there are three options of electrodehydrators being offered, which differ in electrode systems, the design of the internal devices and high-voltage power supplies.

For desalting of crude oil wash water needs to be applied before the electrodehydrators. To ensure dispersion of the wash water and mixing of it with oil, it is recommended to use a special dispersing and mixing devices which can accompany the electrodehydrators according to Customer's requirements.

In the case of high salt content in the crude oil during its field processing or deep desalting of oil at the electrical desalting plants of the refinery it is required to use of two-stage scheme, with two consequently installed desalters equipped with wash water supply in front of them.

Table.1.1.1. Electrodehydrator types

|   | Electrodehydrator types, electrode system         |   |   |
|---|---|---|---|
|   | Three-row horizontal, steel. CPF option           | Composite, vertical. CPF option                   | Three-row horizontal, steel, Option for EDP of oil refinery |
| Technological process parameters                          |   |   |   |
| Production output of the electrodehydrators for crude oil | Up to 2 volumes per hour*                         | Up to 2 volumes per hour*                         | Up to 2 volumes per hour*                                   |
| Total water content at entry (oilfield + washing)         | Up to 7%  | Up to 20%   | Up to 6%  |
| Crude oil specifications                                  |   |   |   |
| Oil density   | On the basis of initial data provided by customer | On the basis of initial data provided by customer | On the basis of initial data provided by customer           |
| Oil viscosity   | On the basis of initial data provided by customer | On the basis of initial data provided by customer | On the basis of initial data provided by customer           |
| Oilfield water content in oil                             | On the basis of initial data provided by customer | On the basis of initial data provided by customer | Up to 0.5% mass   |
| Initial content of chlorine salts in oil                  | On the basis of initial data provided by customer | On the basis of initial data provided by customer | Up to 100 mg/dm <sup>3</sup>                                |
| Oilfield water density                                    | On the basis of initial data provided by customer | On the basis of initial data provided by customer | –   |
| Mineralization of oilfield water                          | On the basis of initial data provided by customer | On the basis of initial data provided by customer | –   |
| Wash water mineralization                                 | On the basis of initial data provided by customer | On the basis of initial data provided by customer | On the basis of initial data provided by customer           |
| Commercial oil quality requirements                       |   |   |   |
| Residual water content in oil                             | Not more than 0.5% mass                           | Not more than 0.5% mass                           | Not more than 0.1% mass                                     |

|   |                                     |                                     |                                 |
|---|-------------------------------------|-------------------------------------|---------------------------------|
| Residual content of chlorine salts in oil | In accordance with calculations *** | In accordance with calculations *** | Up to 3 mg/dm <sup>3</sup> **** |
|---|-------------------------------------|-------------------------------------|---------------------------------|

**Note:**

\* – The range of the technological parameters was calculated for two options of typical oils (first type: density at 20<sup>0</sup>C – 840 kg<sup>3</sup>/m<sup>3</sup>, viscosity at 50<sup>0</sup>C – 10 cSt; second – density at 20<sup>0</sup>C – 930 kg<sup>3</sup>/m<sup>3</sup>, viscosity at 50<sup>0</sup>C – 15 cSt). In case of amendment of crude oil parameters, technological parameters must be reviewed.

\*\* – Presence of the gas phase inside the electrodehydrator is forbidden. To eliminate the presence of the gascap inside the electrodehydrator, it is required to keep the pressure at sufficient level. Working pressure should be higher than the pressure of enriched oil vapors by 0.2-0.3 MPa (at working temperature), and the oil must be free of gas.

\*\*\* – Residue content of the chlorine salts in the oil is calculated on the basis of the initial water content of the oil, quality and volume of the wash water supplied.

\*\*\*\* – when using two stage desalting system.



## 1.2. Electrodehydrators with three-row horizontal steel electrode system

### 1.2.1. Electrodehydrators ED-V-NT

Electrodehydrator with three-electrode horizontal system designed by CJSC “Neftech” ED-V-NT (hereinafter - V the volume of the electrodehydrator in cubic meters) with a high voltage power supply NWL OILPRC is one of the most effective for dehydration and desalting of crude oil at CPF and EDP of oil companies and refineries.

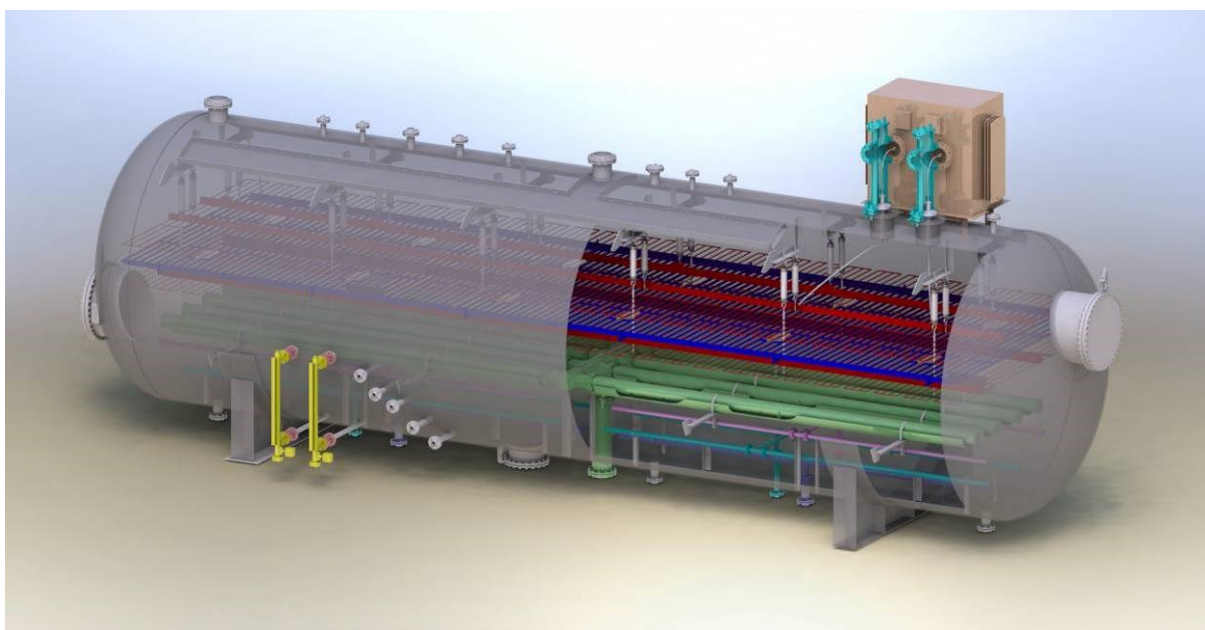
Technical solutions used in the development and manufacture of electrodehydrators are protected by patents (Annex 1).

Electrodehydrator ED-V-NT represent a horizontal capacitive apparatus with elliptical bottoms, internal devices, fittings for inlet and outlet of working mediums for safety valves, sampling, drainage and removal of sludge, steaming and blowing, for installation of metering devices, bushing insulators of high voltage, with ventilation hatches and manholes, pads for mounting thermal insulation and execution of maintenance.

A specialized anti-corrosion coating is applied on the outer and inner surface of the vessel and manifold system of electrodehydrator in the factory. It is possible to equip the vessel of the dehydrator with cathodic protection.

The volume of electrodehydrator can be determined by the Customer or by process calculations for each specific case taking into account the physical and chemical parameters of oil, water, water content at the inlet, working pressure, temperature of the crude oil at input and the required quality of the oil treatment.

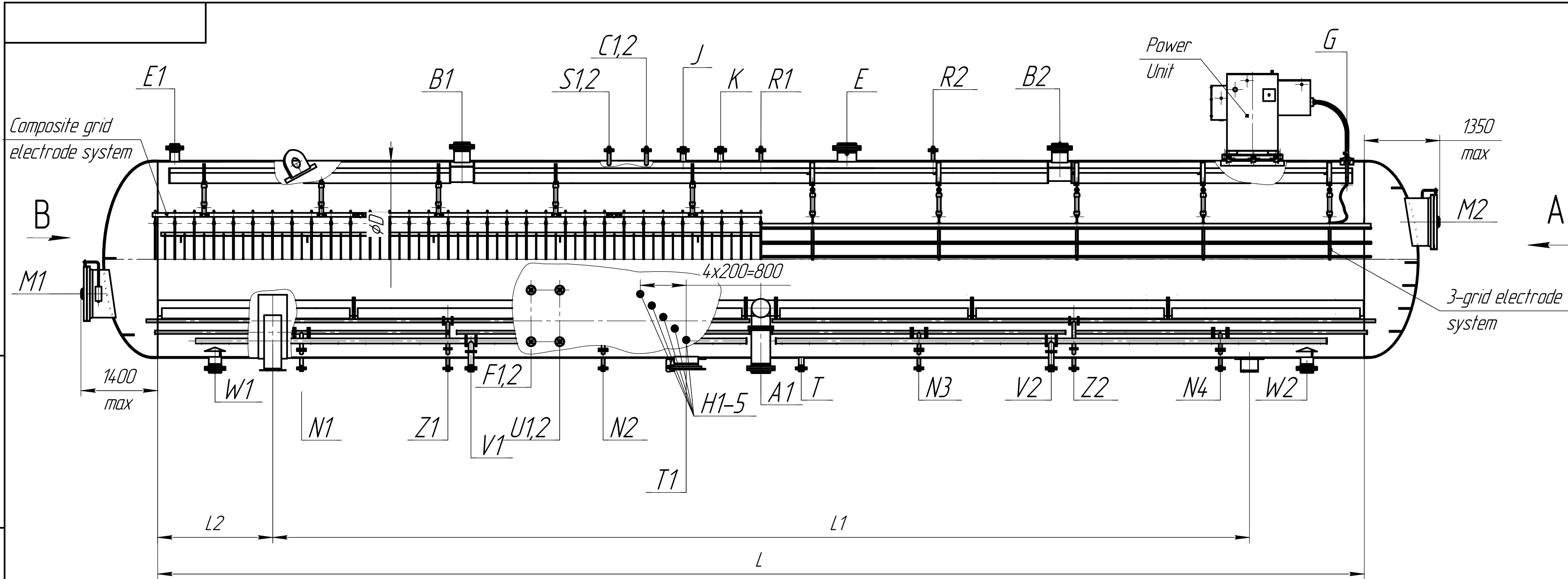
Annex 2 provides a model questionnaire for electrodehydration units.



*Puc.1.2.1. Typical Electrodehydrators with three row electrode system ED-V-NT*

### 1.2.2. Electrodehydrators EDV-8-NT

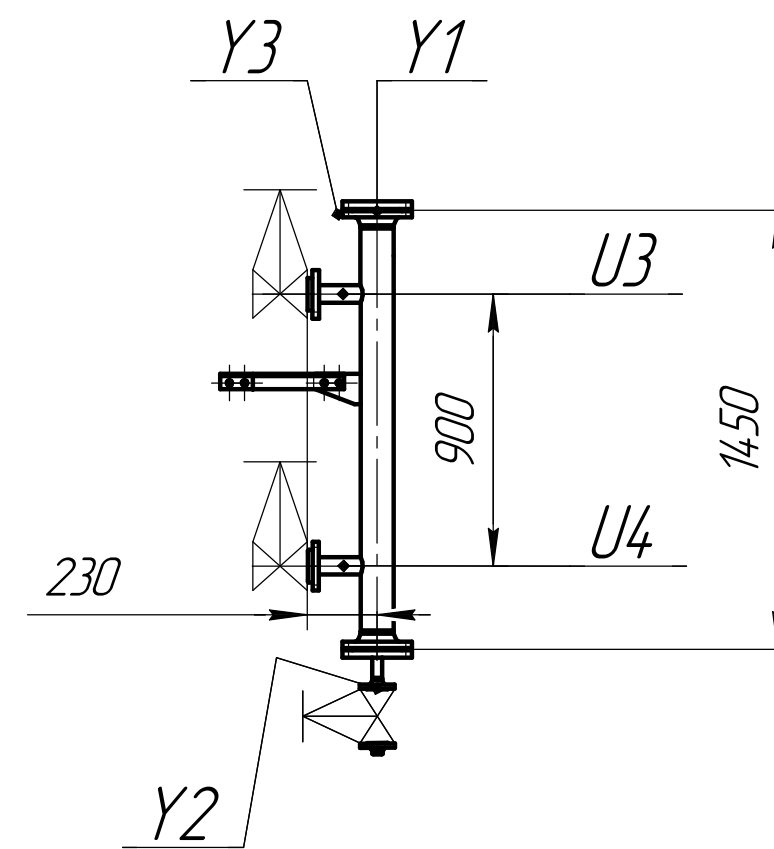
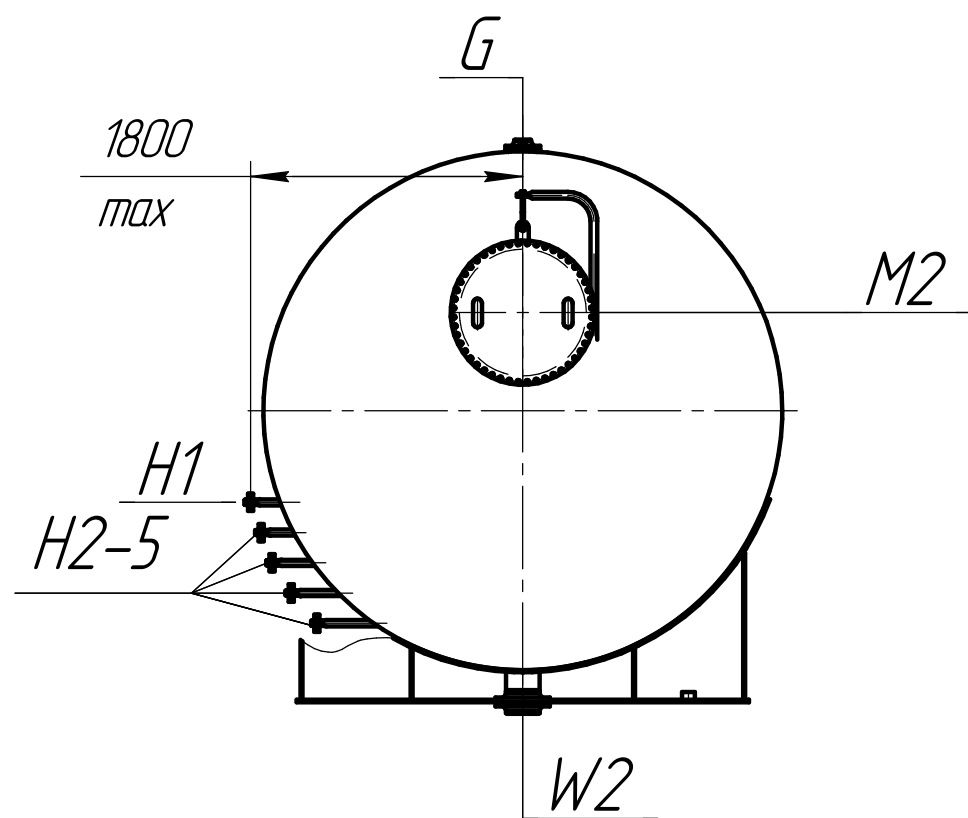
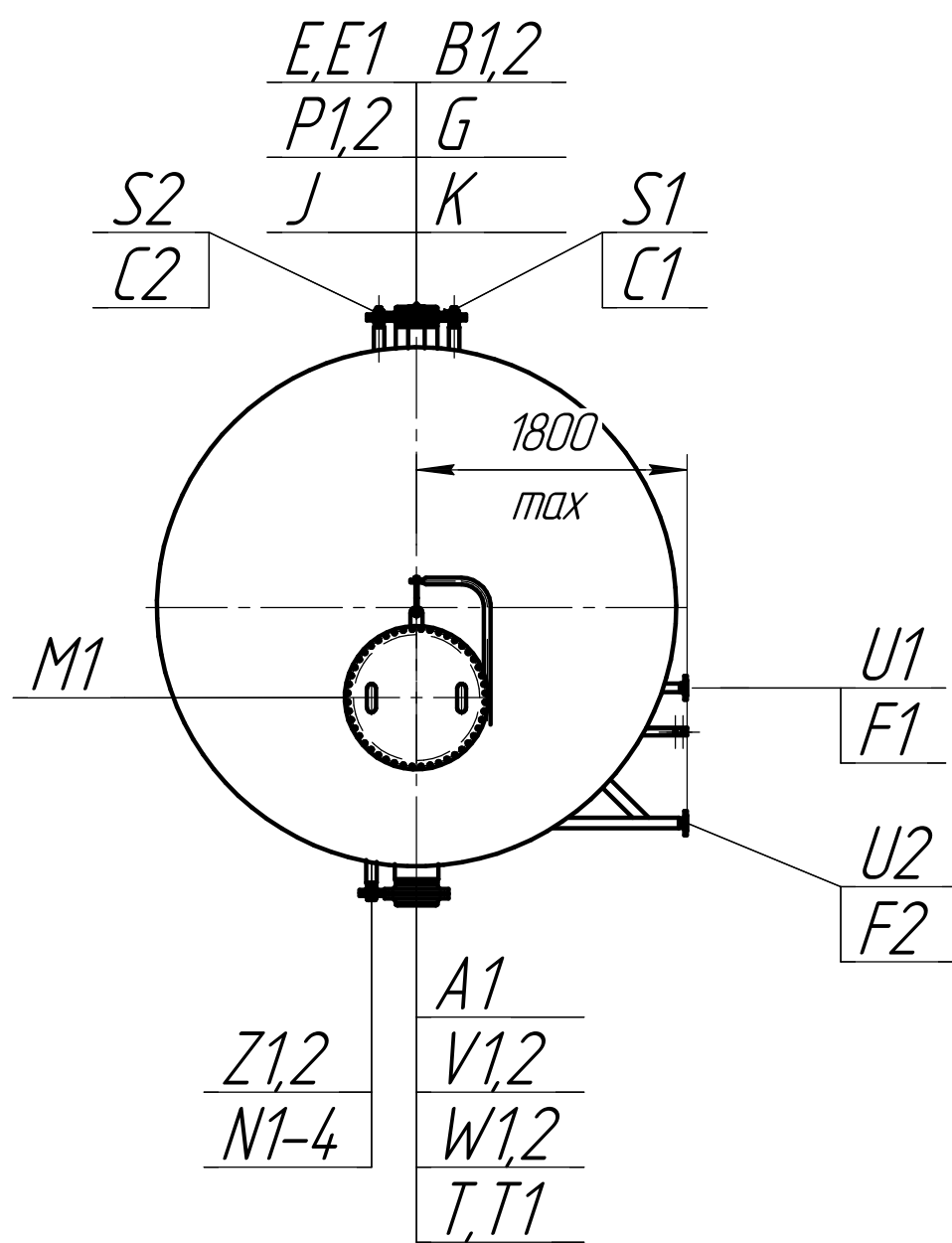
Electrodehydrator EDV-8-NT, its internal devices and working principle is similar to horizontal electrodehydrators of ED-V-NT type, except the fact that they are placed vertically.



**View on arrow B**  
(the rest are not shown)

**View on arrow A**  
(the rest are not shown)

*External column for nozzles U1,2 (1:25)*



|           |          |       |      |                   |        |          |         |
|-----------|----------|-------|------|-------------------|--------|----------|---------|
| Изм. Лист | № докум. | Подп. | Дата | Electrodehydrator | Лист   | Масса    | Масштаб |
| Разраб.   |          |       |      |                   | Лист 1 | Листов 2 |         |
| Проб.     |          |       |      |                   |        |          |         |
| Т.контр.  |          |       |      |                   |        |          |         |
| Н.контр.  |          |       |      |                   |        |          |         |
| Утв.      |          |       |      |                   |        |          |         |



Nozzle shedule

| Nozzle                            | Service                           | Q-ty |
|-----------------------------------|-----------------------------------|------|
| *A1                               | Crude Oil inlet                   | 1    |
| *B1,2                             | Desalted Oil outlet               | 2    |
| V1,2                              | Salt water outlet                 | 2    |
| G                                 | For Entrance bushing              | 1    |
| T1                                | Mud out                           | 1    |
| T                                 | Drain                             | 1    |
| E1                                | Utility                           | 1    |
| E                                 | Pressure safety valve             | 1    |
| W1,2                              | Utility (Steam out)               | 2    |
| J                                 | For pressure release              | 1    |
| K                                 | Vent                              | 1    |
| S1                                | Temperature gauge                 | 1    |
| S2                                | Temperature transmitter           | 1    |
| C1                                | Pressure gauge                    | 1    |
| C2                                | Pressure transmitter              | 1    |
| H1-5                              | Sample collection                 | 5    |
| P1,2                              | Vapour switch                     | 2    |
| M1,M2                             | Manways                           | 2    |
| U1,2                              | Interface level transmitter       | 2    |
| F1,2                              | Interface level gauge             | 2    |
| N1-4                              | Mud wash inlets                   | 4    |
| Z1,2                              | Interface draw-off                | 2    |
| <i>Nozzles on external column</i> |                                   |      |
| Y1                                | For Interface level transmitter   | 1    |
| Y2                                | Drain                             | 1    |
| Y3                                | Vent                              | 1    |
| Y3,4                              | Connection to vessel (nozz. U1,2) | 2    |

\* Size of nozzles depends on the capacity of the vessel

Typical sizes of electrodehydrator depending on capacity

| Vessel volume, m <sup>3</sup> | D, mm | L, mm | L1, mm | L2, mm |
|-------------------------------|-------|-------|--------|--------|
| 25                            | 2800  | 3100  | 2100   | 500    |
| 50                            | 3200  | 5300  | 3600   | 850    |
| 100                           | 3400  | 10800 | 8000   | 1400   |
| 160                           | 3400  | 16400 | 10600  | 2900   |
| 200                           | 3400  | 21000 | 17000  | 2000   |

Equipment supplied by CJSC "Neftech"

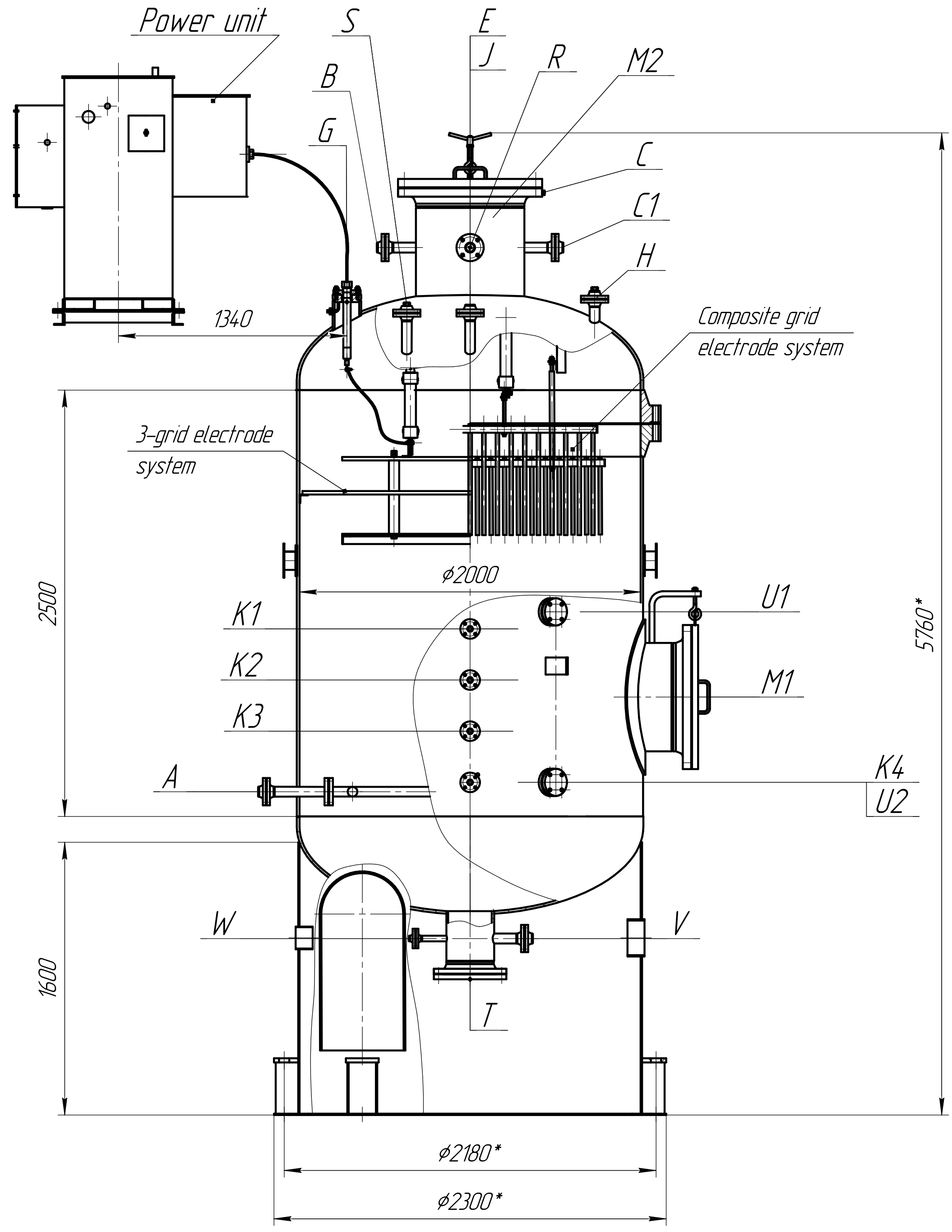
vessel, according to the drawing capacity, including:

- crude inlet header
- crude outlet header
- salt water outlet header
- mud wash header with nozzles
- interface draw-off header
- external column for interface level transmitter
- nozzles for instrumentation
- vertical composite electrode system or horizontal 3-grid electrode system (depends on questionnaire)
- high voltage power supply
- power unit support plate

**NOTE:**

composite electrode system is supplied separately from vessel

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*Equipment supplied by CJSC "Neftech":*

- vessel, according to the drawing capacity, including:
- crude inlet header
- crude outlet nozzle
- salt water outlet nozzle
- nozzles for instrumentation
- external column for interface level transmitter
- vertical composite electrode system or horizontal 3-grid electrode system (depends on questionnaire)
- high voltage power supply
- power unit support plater

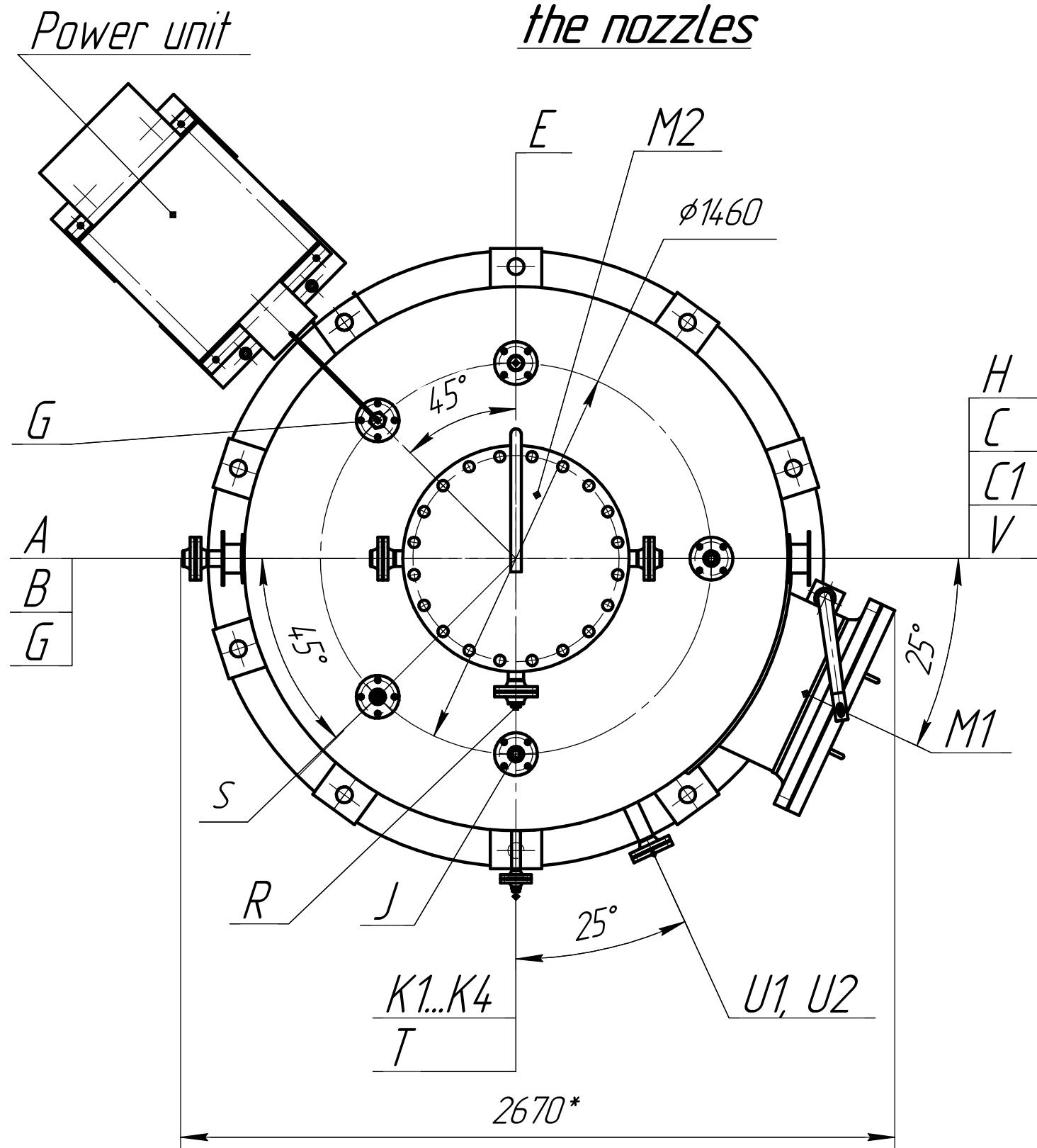
**NOTE:**

*composite electrode system is supplied separately from vessel*

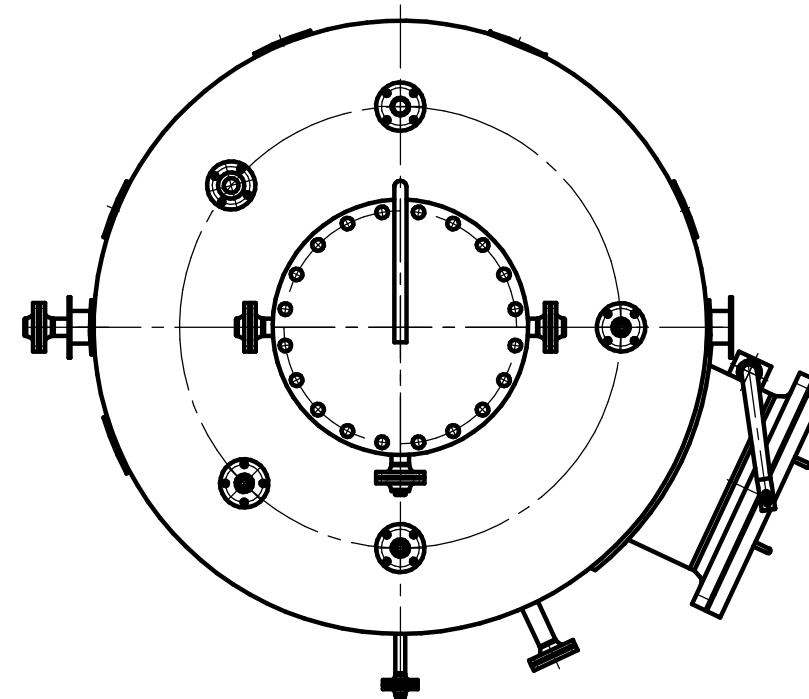
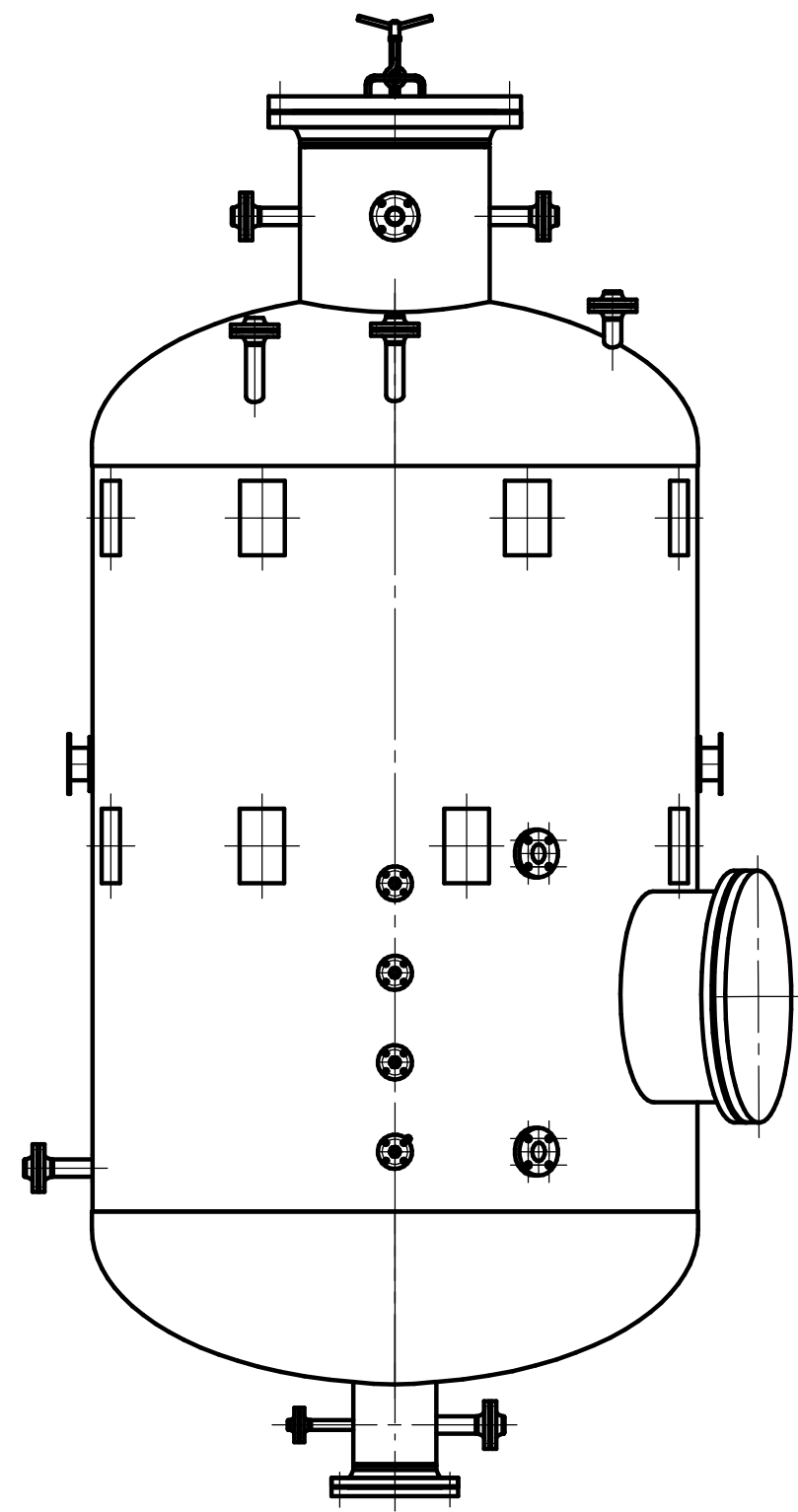
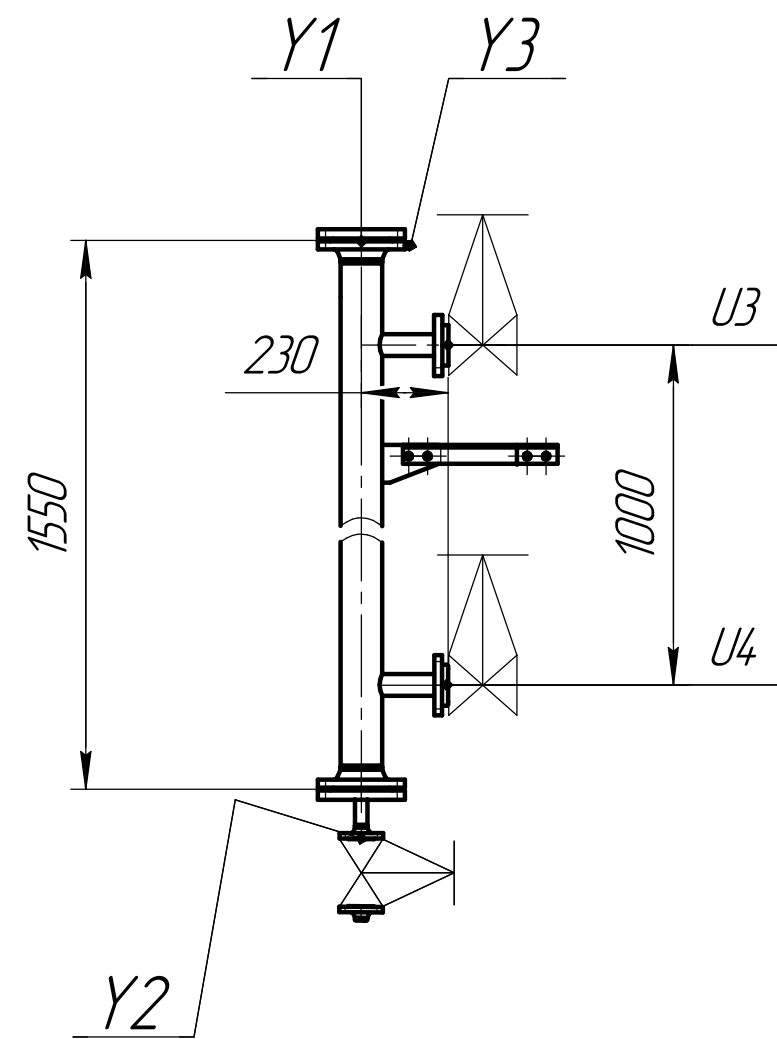
|          |      |          |       |      |                            |                |          |         |
|----------|------|----------|-------|------|----------------------------|----------------|----------|---------|
| Изм.     | Лист | № докум. | Подп. | Дата | Vertical Electrodehydrator | Лит.           | Масса    | Масштаб |
| Разраб.  |      |          |       |      |                            |                |          | 1:20    |
| Проб.    |      |          |       |      |                            | Лист 1         | Листов 2 |         |
| Т.контр. |      |          |       |      |                            | CJSC "NEFTECH" |          |         |
| Н.контр. |      |          |       |      |                            |                |          |         |
| Утв.     |      |          |       |      |                            |                |          |         |

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*The true location of the nozzles*



*External column for nozzles U1,2*



*Nozzle schedule*

| Nozzle                            | Service                          | Q-ty |
|-----------------------------------|----------------------------------|------|
| A                                 | Crude oil inlet                  | 1    |
| B                                 | Crude oil outlet                 | 1    |
| V                                 | Emergency drain                  | 1    |
| G                                 | Entrance bushing                 | 1    |
| T                                 | Mud out                          | 1    |
| E                                 | Pressure safety valve            | 1    |
| W                                 | Salt water outlet                | 1    |
| S                                 | Temperature gauge                | 1    |
| J                                 | Pressure gauge                   | 1    |
| K1..K4                            | Sample collection                | 4    |
| M1                                | Manway                           | 1    |
| M2                                | Manway                           | 1    |
| C                                 | Vent                             | 1    |
| C1                                | Pressure release                 | 1    |
| H                                 | Vapour switch                    | 1    |
| U1,U2                             | External column                  | 2    |
| R                                 | Pressure transmitter             | 1    |
| <i>Nozzles on external column</i> |                                  |      |
| Y1                                | Interface level transmitter      | 1    |
| Y2                                | Drain                            | 1    |
| Y3                                | Vent                             | 1    |
| U3,4                              | Connection to vessel (nozz.P1,2) | 2    |

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Формат А2

Лист 2

## 1.3. Electrodehydrators with composite electrode system

### 1.3.1. Electrodehydrators ED-V-CE

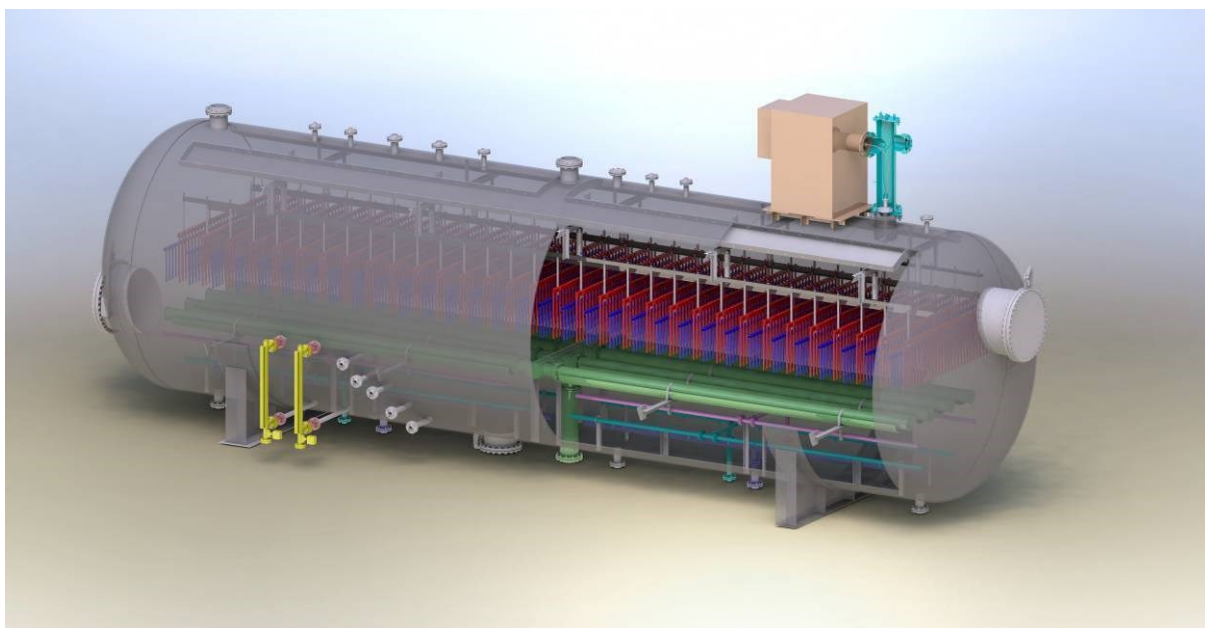
Electrodehydrator ED-V-RE offered with an innovative electrode system made of composite material and power supply NWL OILPRC with all of its structural elements, equipment and automation is superior to foreign analogues. Electrodehydrator ED-V-CE is a dehydrator of the new generation, which in 2013 received the 1st degree diploma of the Tatarstan petrochemical forum. The dehydrator usage for operation on the crude oil with input water content of 20%. Imposes special requirements to the process of electrical dehydration of oil and requires the use of innovative technical solutions in the design of electrode systems as well as of their material and high voltage power supplies.

“Neftech” company developed an innovative technical and technological solutions of the electrode system for the electrodehydrators of the new generation. Vertical composite electrodes are made of material with the special physical and technical and electrophysical properties which have the optimum ratio making the electrode system truly unique in its functionality.

The use of new composite electrodes allows to:

1. Virtually eliminate the risk of short circuits and power supply shutdowns.
2. Successfully dehydrate oil with water content up to 20% or more.
3. To ensure the stability of the dehydrator in a wide range of the properties of oil emulsion and parameters of the technological mode.
4. Reduce operating costs through low energy consumption and possibility to equip the new electrodehydrators with high voltage power supply of lower power and cost.
5. To improve the performance of the electrodehydrators and depth of dehydration and desalting of crude oil.

The properties of the material of the composite electrodes provide the maximum electric field occurring between the upper ends of electrodes, and the minimum between the bottom ones. Consequently, it allows to create a system with increasing electric field intensity in the direction of movement of the emulsion with decreasing size and concentration of drops towards the top of the apparatus and accordingly, with decreasing electric field intensity in the direction of movement of drops increasing in size and number to the bottom of the apparatus.



*Puc.1.3.1. Typical Electrodehydrators with composite electrode system ED-V-CE*

This alignment change of the electric field corresponds to the dynamical improvement of the efficiency of the dehydrator and the depth of dehydration and desalting of crude oil by 2-3 times. The electrode system of the dehydrator unit consists of alternating rows of vertical cylindrical electrodes one row – potential made of composite material, and the other made of grounded steel.

The rest of the design of the dehydrator ED-V-CE with the electrode system made of composite material is similar in design to the electrodehydrators ED-V-NT with a three-row metal electrode system.

### **1.3.2. Electrodehydrator EDV-8-CE**

Electrodehydrator EDV-8-CE, its internal devices and working principle is similar to electrodehydrators of ED-V-RE type, except the fact that EDV-8-CE is vertical vessel.

## 1.4. Electrodehydrators with gas section

In exceptional cases (possible presence of small amounts of gas in oil which was not removed during previous stages of gas separation) it is possible to manufacture two-section electrodehydrator, consisting of degassing section and section of electrical treatment of oil.

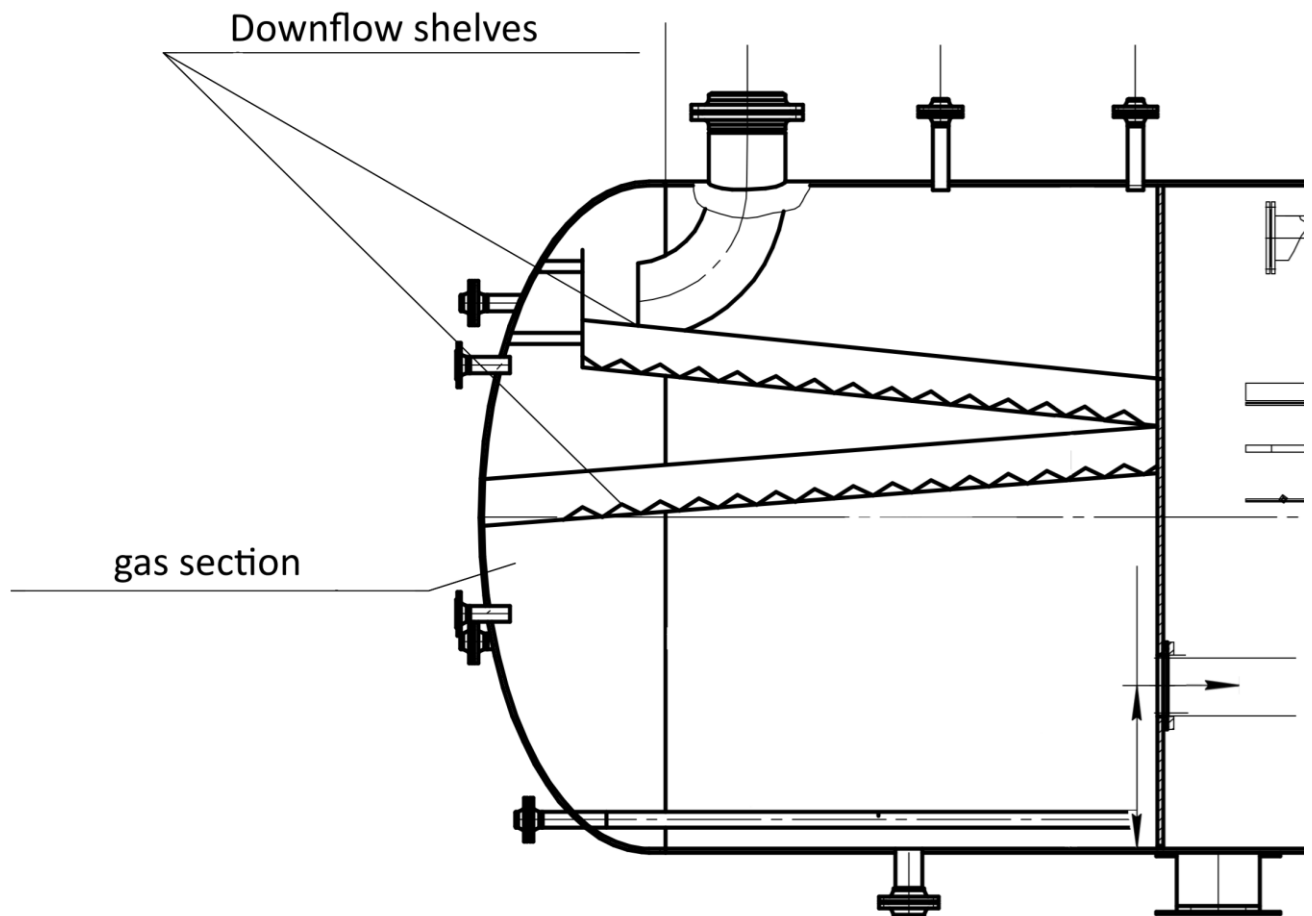
Section of the degassing is designed for efficient removal of gas from the crude oil at the inlet and is equipped with specially designed internal devices. The internal devices and the size of the gas section are selected based on the parameters of crude oil. One of the options of the gas section is shown in Fig.1.4.1.

The degassing section is separated from the electric treatment section with solid vertical partition, which has a hole for the flow of degassed oil from the first section to distribution intake manifold of the second section.

The oil is fed to the degassing section, where on a specially designed internal devices gas is separated and is then passed to the output of the device. Then the oil through the manifold enters the section of electrical treatment, where it is dewatered under the influence of an electric field, similar to the previously described electrodehydrators.

When designing such kind of apparatus, it should be noted that the volume of the section of electrical treatment is less than the nominal volume of the dehydrator and this leads to decreased overall productivity.

The degassing section is equipped with additional measuring devices.



*Fig.1.4.1. Design of the degassing section of the electrodehydrator*



## 1.5. Block-modular electrodehydrators

It is possible to produce dehydrators in block-modular performance. In this case, all associated equipment, such as wash water input device, a static mixer, valves, control valves, instrumentation control and automation, cable lines and terminal boxes are located within the boundaries of the skid and maintenance area. Technological scheme also reflects the boundaries of the equipment, located within the module.

Block-modular performance allows to reduce the volume of installation works on remote construction sites. It is also possible to locate the main part of measuring equipment in a heated block-box with support and alarm systems.

## 2. Electrocoalescing units

### 2.1. General Data

CJSC "Neftech" has developed electrocoalescing units with capacity of up to 200 m<sup>3</sup>/h. These units are equipped with innovative composite electrodes.

Electrocoalescing units are designed for oil-water emulsion breakdown and agglomeration of the droplets of the aqueous phase. Electrocoalescing units are installed before existing settlers and allow to significantly increase their effectiveness and the depth of oil dehydration.

Use of innovative composite electrodes allows their operation at all stages of oil preparation, up to pre-release of the water where the concentration of the aqueous phase could reach 50% and above.

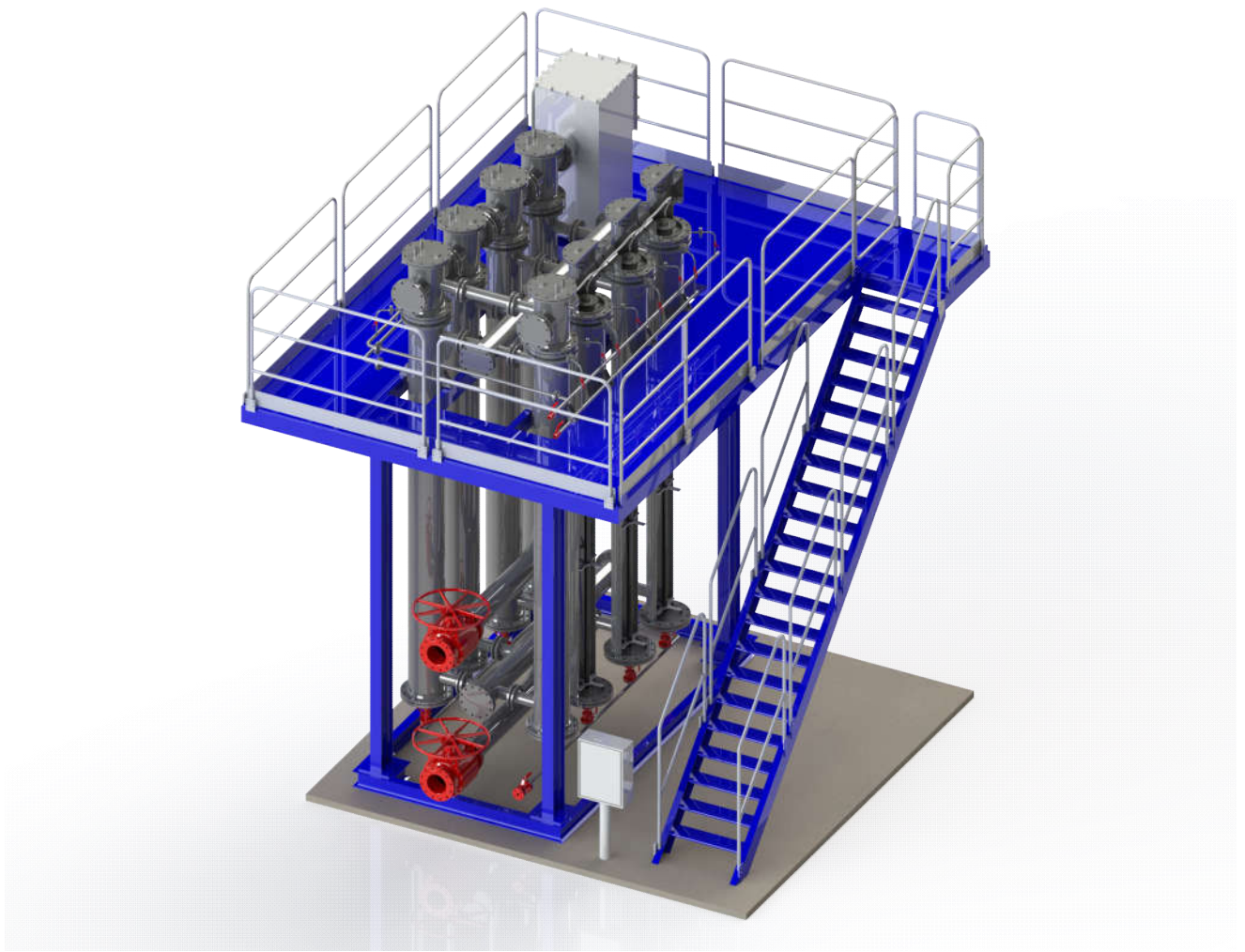
New electrocoalescing units are highly demanded by oil companies and can be used not only on new sites, but also where it is impossible due to lack of funds or space to install additional settling equipment for solving problems associated with increasing water cut and volumes of oil production.

Use of electrocoalescing units with electrodes will reduce operating costs by reducing the temperature of the heating of oil and amount of demulsifier.

### 2.2. Electrocoalescing unit ЭKY-K-8-200

New design of the electrocoalescing unit was developed, with production capacity of up to 200 m<sup>3</sup>/hour.

Questionnaire for electrocoalescing unit is provided in Annex 3.



*Fig.2.1 Electrocoalescing unit ECU-K-8-200*

## 3. Electrodehydrators automation equipment

### 3.1. General data

CJSC “Neftech” develops projects of automation for the electrodehydrators, equips the dehydrators with necessary measuring instrumentation, designs and manufactures automation systems for the electrodehydrators.

### 3.2. Recommended measuring devices

On the dehydrator vessel:

- Indicator of the interfacial oil-water level (level gauge) of the section of oil-water phases. It is recommended to use Rosemount 5302 or Kuebler BNA devices in the external columns on the side of the apparatus for correct operation of gauges because of formation of stagnant zones in the region of the bottom of the vessel.
- Gas cap sensor. It is recommended to use Rosemount 2120 devices (two pieces).
- Pressure sensor in the vessel.
- Pressure gauge.
- Temperature sensor in the vessel.
- Thermometer.

### 3.3. Process automation systems

The local automation system (LAS) created on the basis of a programmable industrial controller is designed for operational control, management and technological protection of the electrodehydrator. It features functional data exchange with external systems via standardized Protocol, visualization, historical trending and event recording.

Minimum list of controlled parameters:

- The presence of a gas cap in electrodehydrator;
- Pressure, temperature, interfacial level in electrodehydrator;
- Opening the gate of the fence of the transformer;
- Buttons being pushed on the local transformer control panel;
- Current, voltage, level and temperature of the oil in the transformer;
- The presence of the operating voltage
- The state of the transformer (on/off).

The list control actions:

- Discrete signals to switch on the light and sound alarm;
- Discrete signals control the enabling/disabling of the transformer EDH.

The proposed technical description of the control system is not final, set and means of implemented functions of control and management can vary according to the requirements of the Customer.

LAS is supplied with the documentation according to GOST 34.201-89.

## 4. High voltage power supplies

### 4.1. General data

The most important part in ensuring the smooth and efficient operation of the dehydrator is high voltage power supply.

For the electrodehydrators of different volumes depending on the physical, chemical and electro-physical properties of crude oils we offer a wide range of high voltage power Ex e o IIB T4 Gb with a capacity of 25; 37,5; 50; 75; 100 and 150 kVA in two versions. Recommended parameters of high voltage power supplies for the electrodehydrators of various sizes and designs are given in Table.4.1.1.

Table.4.1.1. Recommended types and power capacity of high voltage power supplies

| Volume of the electrodehydrator, m <sup>3</sup> | Electrode system                         |  |                        |
|---|--|--|------------------------|
|   | Horizontal, three-row, steel. CPF option | Horizontal, three-row, steel, Option for EDP of oil refinery | Composite, CPF option  |
| 8   | Scott scheme, 25 kVA                     | One phase, 25 kVA  | One phase, 25 kVA      |
| 25  | Scott scheme, 25 kVA                     | One phase, 25 kVA  | One phase, 25 kVA      |
| 50  | Scott scheme, 50 kVA                     | One phase, 50 kVA  | One phase, 50 kVA      |
| 100   | Scott scheme, 100 kVA                    | One phase, 100 kVA   | One phase, 75÷100 kVA  |
| 160   | Scott scheme, 150 kVA                    | One phase, 150 kVA   | One phase, 100 kVA     |
| 200   | Scott scheme, 150 kVA                    | One phase, 150 kVA   | One phase, 100÷150 kVA |

High voltage power supplies are equipped with flexible explosion-proof input node of the high voltage on the base of the bushing TS-75 or vertical oil filled explosion-proof input node of the high voltage on the base of the bushing EB3-300.

Input node of high voltage with bushing is designed to supply a high voltage from a high voltage supply to the potential grids in electrodehydrator.

### 4.2. High voltage power supply NWL OILPRC

The proposed power supply is specifically designed and patented with 100% reactivity. High voltage power supply is selected on the basis of electro-physical, physical and chemical properties of water-oil emulsions and process parameters. Power supply is sealed and filled with oil, with natural cooling. The top is screwed with the lid.

|   |                                   |
|---|-----------------------------------|
| Maximum output voltage, kV                  | 25                                |
| Capacity, kVA                               | <b>25, 37.5, 50, 75, 100, 150</b> |
| The AC voltage of the primary winding, V    | 380..420±5%                       |
| The AC voltage of the secondary winding, kV | (12/16,5/20/23/25)±5%             |
| The AC voltage of the tertiary winding, V   | 100±5%                            |
| Safety valve                                | 1                                 |
| Oil temperatures sensors                    | 1                                 |
| High temperature power supply cut-off relay | 1                                 |
| Transformer low oil level relay to cut-off  | 1                                 |

|                            |                     |
|----------------------------|---------------------|
| power at low oil level     |                     |
| Drainage valve             | 1                   |
| Lifting clamps             | 2                   |
| High voltage output device | 2                   |
| Ground connection          | 1                   |
| Oil level indicator        | 1                   |
| Terminal box               | 1                   |
| Voltage switch             | 12/16,5/20/23/25 kV |

|                              |                  |
|------------------------------|------------------|
| Certification                | TRAC12ATEX0044X  |
| Explosion protection marking | Ex e o IIB T4 Gb |
| Casing protection type       | IP66             |
| Operating temperature, °C    | from -45 до +50  |

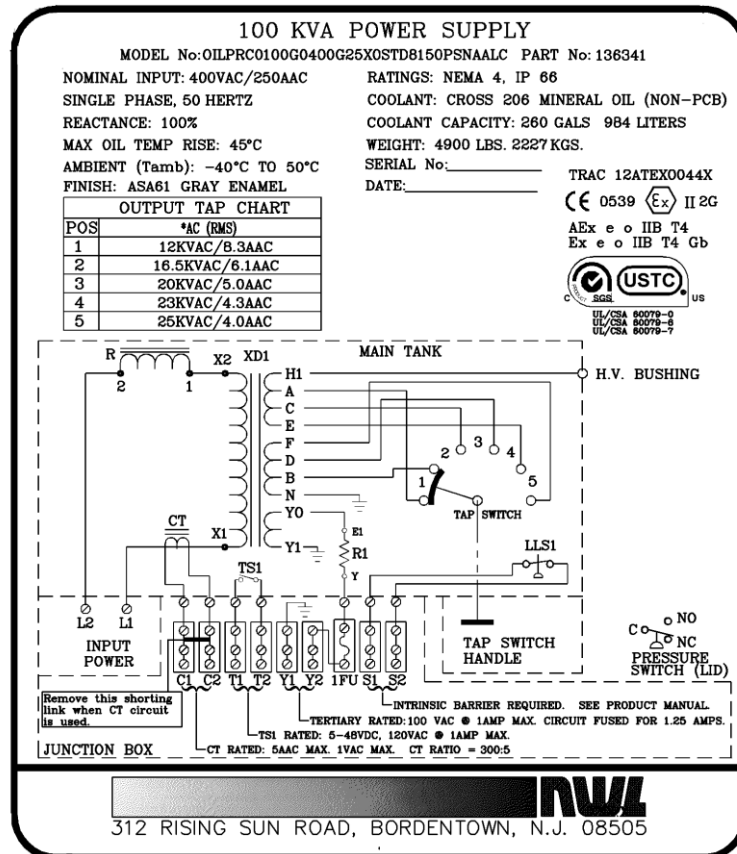
#### ADVANTAGES OF NWL HIGH VOLTAGE POWER SUPPLIES (HVPS):

- for the electrodehydrators of different volumes depending on the physical, chemical and electro-physical properties of crude oils, we offer a wide range of power supplies with a capacity of 25; 37,5; 50; 75; 100 and 150 kVA that allows to use only one HVPS on the electrodehydrator, to optimize its design and to reduce the cost;
- have 100% reactivity and are not critical to overloads at short circuits of electrodes;
- provides a choice of values of the output voltage in a wide range (12; 16,5; 20; 23; 25 kV AC) through the use of a switch;
- have the version with the output of high DC voltage with the same option of a discrete change of its value, which provides additional efficiency to the electrodehydrators used on EDP of the refineries, where greater depth of dehydration and desalting of crude oil is required;
- reliable design providing high tightness of the housing of the power supply, high stable dielectric properties of oil transformer and its long service life;
- vacuum impregnation of the windings with oil according to IEC/IEEE standards;
- well established production technology using the know-how, system of tough factory tests in vacuum and under pressure to ensure long-term operation;
- has all necessary means to control temperature, level and pressure of oil, as well as for heating the latter during stops to save its dielectric properties in cold climates.

Power supplies have two important design features which provide flexibility and reliability of power supply system: full reactivity and adjustable output voltage. Power supply is specially designed and patented with 100% reactivity, which provides automatic maintenance of the required level of the secondary voltage, depending on the composition of the emulsion. 100% reactivity eliminates the possibility of overloading of the power supply and the power supply system even in the complete circuit of the electrodes. This means that the electrodehydrator can stay in operation under adverse or abnormal operating conditions. In such circumstances, the water or the emulsion may be supplied to the electrode system, causing a temporary short circuit. Reactive coil limits the voltage on the output winding and eliminates the possibility of overloading; after the return to normal operating mode automatically adjusting the level of the voltage supplied to the electrodes.

The second feature of the power supply is the presence of the selector switch of the load reducing mode to regulate the voltage on the electrode system. This feature allows you to select the optimal voltage level on the electrodes and thus the electric field strength in oil, that feature provides an effective dehydration with minimal energy consumption.

Together, these two features of the system provide the possibility of dehydration of emulsions of crude oil and water even at high electrical conductivity and, consequently, increase the level of operational flexibility dehydration unit.



*Fig.4.2.1. Electrical scheme of the connections of the high voltage power supply  
 NWL OILPRC 100 kVA*

The working life of high voltage power supply NWL OILPRC is 25 years. High-voltage power supply NWL OILPRC is warranted for 36 months from the date of installation and commissioning, but not more than 42 months from the date of shipment to the Customer.

“Neftech” company is the official dealer and representative of an American company “NWL Transformers Inc.” in Russia and the CIS. “NWL Transformers” is producing high voltage power supplies with features listed above for all known manufacturers of electrodehydrators for over half a century.

### 4.3. High voltage power supply NWL OILPRC with phase converter (3:2) of Scott scheme

General description is similar to the single-phase power supply, but in this case it has a high voltage power supply conversion phase (3:2). It consists of two single-phase transformers or reactive coils situated in a common housing and connected via the Scott scheme with two high-voltage terminals. These high voltage leads are connected to the upper and lower electrode arrays.



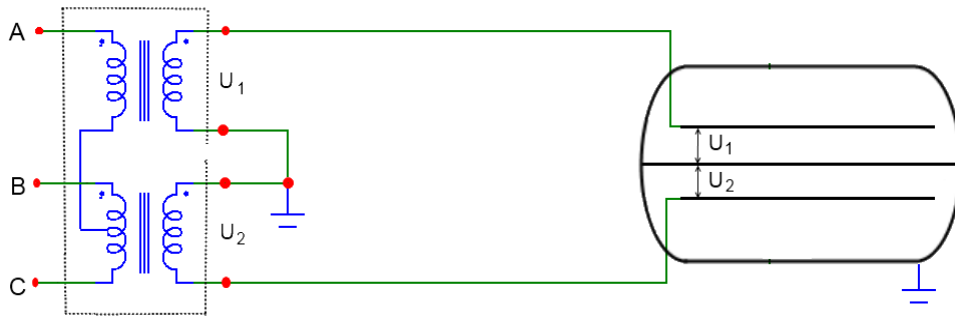


Fig. 4.3.1. Scott scheme (three phase to two phase conversion 3/2)  
it is used for levelling of the loads of the phases:

$U_1$  - output voltage of transformer 1

$U_2$  - output voltage of transformer 2

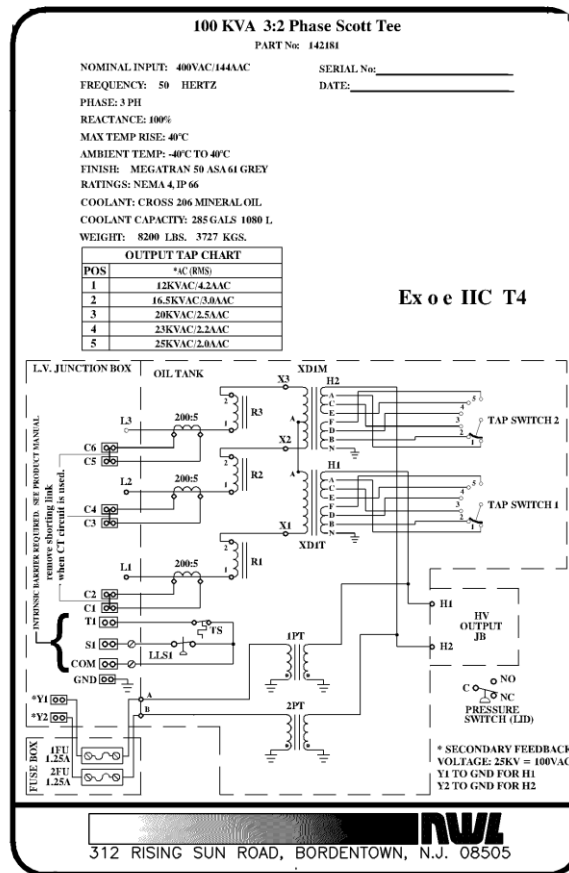


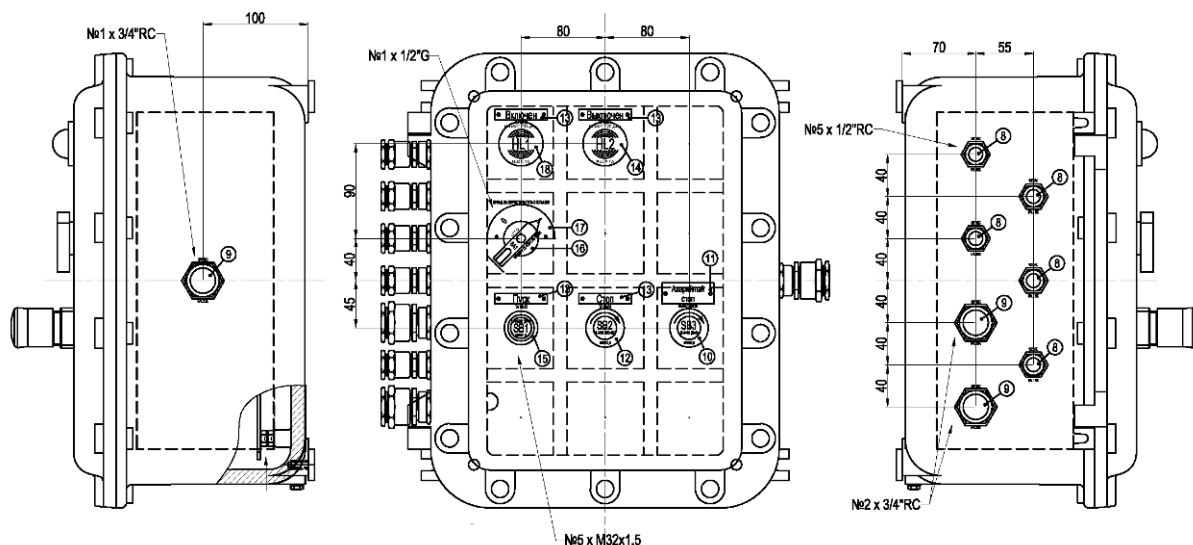
Fig. 4.3.2. Electrical scheme of the connections of the high voltage power supply NWL OILPRC 100 kVA of Scott scheme (three phase to two phase conversion 3/2)

The use of transformers of optimal power with the Scott scheme connection provides the following additional advantages compared with single-phase transformers:

1. Ensures the symmetry of the input loads of phases three-phase network even if there is the inequality of load in the secondary circuit.
2. Enables you to separately regulate and control currents and output the high voltage electrodes. This is important when using three-electrode system in electrodehydrators and allows you to create more effective modes of electric de-emulsifying in the electrode areas in accordance with the distribution of the concentration of the aqueous phase of the oil emulsion in height.

## 4.4. Power supply local control panel (LCP)

Control of the high voltage power supply NWL OILPRC is performed through local control panel (LCP).



*Fig.4.4.1 Draft of the Local control panel*

LCP is installed in the vicinity of the dehydrator and has explosion-proof casing of “Exd” category and degree of protection from external influences of IP66. The location of the LCP is selected near the site of dehydrator taking into account the convenience of the staff. LCP may feature a panel showing the instruments – ammeter and voltmeter showing the voltage and current in the output winding of the transformer. Inside the case of LCP there are converters of voltage and current for transfer to the automation system via standardized Protocol are installed. Also the LCP indicates the emergency level of oil in the transformer and emergency temperature in the transformer by means of the signal lamps. The operator can operate the transformer at the place of buttons "start", "stop". "Start" and "stop" buttons can be connected directly to the power management scheme of the transformer, and the automation system, which issues a corresponding control signal. For emergencies, there is an "Emergency stop", which is connected directly to the power management scheme of the transformer.

LCP is equipped with anti-condensation heater, which can be switched on by pushing the button.

## 5. Additional information

CJSC “Neftech” executes commissioning and supervision works on electrodehydrators in accordance with the Certificate of SRO allowing to execute commissioning works on objects of petrochemical complex.



Fig. 5.1. Certificate of SRO CJSC “Neftech”

Quality management scheme of CJSC «Neftech» is in accordance with requirements of ISO 9001:2008



Fig. 5.2. Certificate ISO 9001:2008 (GOST ISO 9001-2011 2011)



## Patents for technologies used in electrodehydrators





## Patents for technologies used in electrocoalescing units



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22-05-2017 Rev. 1.3

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|  | C l o s e d J o i n t S t o c k C o m p a n y<br><b>NEFTECH</b>   |
|   | T E C H N I Q U E F O R O I L & O I L R E F I N I N G I N D U S T R Y   |
|   | ☒ JSC NEFTECH Sh. Usmanova 32a, Kazan, RUSSIA, 420095 www.neftech.ru<br>Tel. +7 (843) 554 56 90, Fax +7 (843) 554 57 41 E-mail: mail@neftech.ru |

## QUESTIONNAIRE

for electrodehydrator

| Questions   | Answers |
|---|---------|
| Technological Part  |         |
| 1. Appointment  |         |
| 2. Place of installation (refinery, production field)             |         |
| 3. Feed capacity, m <sup>3</sup> /hour,<br>possible deviations, % |         |
| 4. Operating pressure, MPa  |         |
| 5. Estimated Pressure, MPa  |         |
| 6. Operating temperature, ° C                                     |         |
| 7. Estimated temperature, ° C                                     |         |
| 8. Environment  |         |
| 9. Density (at 20 ° C), kg/m <sup>3</sup><br>- oil                |         |
| - salt water  |         |
| 10. Oil viscosity , cSt<br>- at t=20 ° C                          |         |
| - at operating temperature  |         |
| 11. Specific oil electric conductivity, Ncm/m<br>- at t=20 ° C    |         |
| - at t=50 ° C   |         |
| 12. Saturated vapour pressure during operating temperature, kPA   |         |
| 13. Fractional oil content  |         |
| 14. Oil content at input<br>- water, %                            |         |
| - salts, mg/dm <sup>3</sup>                                       |         |



|  |  |
|--|--|
| - total sulfur, % (mass.)  |  |
| - H <sub>2</sub> S, % (vol.)                                       |  |
| - mechanical solids % (mass.)                                      |  |
| - paraffine, % (mass)  |  |
| 15. Chloride salt concentration in sweet water, mg/dm <sup>3</sup> |  |
| 16. Required residual content in the oil at output                 |  |
| - water, % vol.  |  |
| - salts, mg/dm <sup>3</sup>  |  |
| 17. Seismic intensity, score                                       |  |
| 18. Corrosion compensation allowance, mm                           |  |
| 19. Average temperature of the coldest five-day period, °C         |  |
| 20. Service life, years,   |  |
| diagnostics frequency, years                                       |  |

Complete Set

|  |  |
|--|--|
| 21. Quantity of ordered apparatus  |  |
| 22. Nozzles availability for samplers  |  |
| 23. Power supply NWL, explosion-proof, 100% reactance with output voltage 25 kV (with discrete setting 12; 16,5; 20; 23;25) power 25; 37,5; 50; 75; 100; 150; 200; 250 kVA   |  |
| - one-phase output   |  |
| - 3/2 phase output ( Scott Scheme)   |  |
| 23.1 - local control panel for the transformer, explosion-proof (execution Exd)  |  |
| 24. High voltage input device (HVID):  |  |
| - oil-filled T-bend (HVID)   |  |
| - flexible cable gland   |  |
| 24.1. Suspended insulators and entrance bushings   |  |
| Electrical strength 80 kV/mm, Maximal operating temperature 200 <sup>0</sup> C, Load capacity at temperature 150°C no more than 400 kgf, Maximal operating voltage 35kV, Maximal Pressure 100 kg/cm <sup>2</sup> , Diagnostics frequency and maintenance 5 years |  |
| 25. Automation equipment (necessity, type)   |  |
| - gas cap annunciator (2pcs.)  |  |

|   |  |
|---|--|
| - pressure gauge in the vessel  |  |
| - temperature gauge in the vessel   |  |
| - indicative thermometer  |  |
| - indicative manometer  |  |
| - phase interface level gauge   |  |
| - indicative phase interface level gauge  |  |
| - oil level annunciator in HVID   |  |
| - pressure gauge in HVID  |  |
| - bypass valve in HVID  |  |
| 26. Local automation system (LAS) based on Rockwell equipment for operating supervision, management and technological protection of ED, with functional exchange of data with external systems by standardised protocol, visualisation, historical trending and events record.<br>Minimal schedule of controlled parameters:<br>- Presence of the gas cap<br>- Pressure, temperature, interface level in electric dehydrator<br>- Gate of the guard of electric dehydrator opening<br>- Button pressing on the local control panel on a transformer.<br>- Current, voltage, oil level and temperature in a transformer.<br>- Presence of control voltage<br>- Transformer's mode (on/off) |  |
| 27. Type of electrodes:<br>- Horizontal three row.<br>- Vertical composite.   |  |
| 28. Necessity for control cabinet of transformers power supply<br><br>28.1. Completing of power supply cabinet with electric supply meter   |  |
| 29 Comments and additional requirements:<br>- necessity for the system of periodical washing bottom sediments and their takeout from the apparatus without stopping it.<br><br>- Necessity of manifold installation for taking out the interlayer (in case its formation) from the apparatus.<br><br>- Necessity for completing the apparatus with wash water input device.<br><br>- Necessity for completing the apparatus with static mixer oil-water.<br><br>- Necessity for completing the apparatus with   |  |

|   |  |
|---|--|
| elements of cathodic protection                         |  |
| - Demand for factory internal anti-corrosive protection |  |
| 30. Demand for supervision and commissioning works      |  |
| 31. Additional requirements                             |  |

Name, postal address, telephone of the company filled in the data sheet.

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Position, Family name and Given name of responsible person.

Contact tel. number of responsible person \_\_\_\_ (\_\_\_\_) \_\_\_\_\_

E-mail of responsible person \_\_\_\_\_

\_\_\_\_\_ Signature \_\_\_\_\_ Date

## Place Seal

Specifications, drawings, passports, data sheets, technical assignments, technical requirements and other documents prepared by third parties have to be enclosed to this data sheet.

When making calculations the priority is given to this data sheet. The specialist from JSC "Neftech" may request an additional information if necessary.

|  |   |
|--|---|
|   | C l o s e d J o i n t S t o c k C o m p a n y |
|  | <b>NEFTECH</b>                                |
|  | TECHNIQUE FOR OIL & OIL REFINING INDUSTRY     |
| <input checked="" type="checkbox"/> <b>JSC NEFTECH</b> Sh. Usmanova 32a, Kazan, RUSSIA, 420095 www.neftech.ru<br>Tel. +7 (843) 554 56 90, Fax +7 (843) 554 57 41 E-mail: mail@neftech.ru |   |

**QUESTIONNAIRE**  
for electrocoalescing unit

| Questions  | Answers |
|--|---------|
| Technological Part   |         |
| 1. Appointment   |         |
| 2. Place of installation (refinery, production field)  |         |
| 3. Feed capacity, m <sup>3</sup> /hour,<br>possible deviations, %  |         |
| 4. Operating pressure, MPa   |         |
| 5. Estimated Pressure, MPa   |         |
| 6. Operating temperature, °C   |         |
| 7. Estimated temperature, °C   |         |
| 8. Environment   |         |
| 9. Density (at 20 °C), kg/m <sup>3</sup><br>- oil<br>- salt water  |         |
| 10. Oil viscosity , cSt<br>- at t=20 °C<br>- at operating temperature  |         |
| 11. Specific oil electric conductivity, Ncm/m<br>- at t=20 °C<br>- at t=50 °C  |         |
| 12. Saturated vapour pressure during operating temperature, kPA  |         |
| 13. Fractional oil content   |         |
| 14. Oil content at input<br>- water, %<br>- salts, mg/dm <sup>3</sup><br>- total sulfur, % (mass.)<br>- H <sub>2</sub> S, % (vol.)<br>- mechanical solids % (mass.)<br>- paraffine, % (mass) |         |
| 15. Chloride salt concentration in sweet water, mg/dm <sup>3</sup>   |         |
| 16. Seismic intensity, score   |         |
| 17. Corrosion compensation allowance, mm   |         |
| 18. Average temperature of the coldest five-day period, °C   |         |
| 19. Service life, years,   |         |

|   |    |
|---|----|
| diagnostics frequency, years  |    |
| 20. The type end volume tank equipment, which will be submitted to the ECU prepared for future oil sludge   |    |
| Complete Set  |    |
| 21. Quantity of ordered apparatus   |    |
| 22. Power supply NWL, explosion-proof, 100% reactance with output voltage 25 kV (with discrete setting 12; 16,5; 20; 23;25) power 25 kVA (50 Hz, 380 V) | Да |
| 23. local control panel for the transformer, explosion-proof (execution Exd)  | Да |
| 24. Necessity for control cabinet of transformers power supply  |    |
| 24.1. Completing of power supply cabinet with electric supply meter   |    |
| 25. . Automation equipment (necessity, type)  |    |
| - pressure gauge  |    |
| - temperature gauge   |    |
| - indicative thermometer  |    |
| - indicative manometer  |    |
| - inlet sampling device   |    |
| - outlet sampling device  |    |
| - gas cap annunciator   |    |
| 26. Demand for supervision and commissioning works  |    |
| 27. Additional requirements   |    |

Name, postal address, telephone of the company filled in the data sheet.

\_\_\_\_\_

\_\_\_\_\_

Position, Family name and Given name of responsible person.

\_\_\_\_\_

Contact tel. number of responsible person \_\_\_\_ (\_\_\_\_)

E-mail of responsible person \_\_\_\_\_

\_\_\_\_\_ Signature \_\_\_\_\_ Date

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