

2023



DN-130, DN-130(A), DN-130(R)  
Load Sensor  
**Operation Manual**

PLA 140.201.000.000 RE

Ver. 2.02





<b>1.</b>	<b>DESCRIPTION AND WORK .....</b>	<b>3</b>
1.1.	DN-130, DN-130(A), DN-130(R) DESCRIPTION AND WORK .....	3
1.1.1.	<i>DN-130, DN-130(A), DN-130(R) Purpose</i> .....	3
1.1.2.	<i>DN-130 Sensor modification and technical characteristics</i> .....	3
1.1.3.	<i>DN-130</i> .....	4
1.1.4.	<i>DN-130(A) Content</i> .....	4
1.1.5.	<i>DN-130(R) Content</i> .....	5
1.1.6.	<i>Structure and functioning</i> .....	6
1.1.7.	<i>DN-130 Ex providing</i> .....	6
1.1.8.	<i>Marking</i> .....	6
1.1.9.	<i>Packaging</i> .....	7
<b>2.</b>	<b>USAGE .....</b>	<b>7</b>
2.1.	OPERATIONAL CONSTRAINTS.....	7
2.1.1.	<i>Ex rating in operating</i> .....	7
2.2.	PREPARATION OF DN-130 USAGE .....	7
2.2.1.	<i>Safety precautions at DN-130</i> .....	7
2.2.2.	<i>Volume and sequence of DN-130 external check</i> .....	7
2.2.3.	<i>DN-130 Orientation Indication</i> .....	7
2.2.4.	<i>DN-130 Connection between other instruments</i> .....	8
2.2.5.	<i>DN-130 Switching on and executing</i> .....	8
2.3.	DN-130 USAGE.....	9
2.3.1.	<i>DN-130 Usage at line while tripping rate operation:</i> .....	9
2.3.2.	<i>«LOAD» Setting parameter from MU-140 Control Module keyboard</i> .....	9
2.3.3.	<i>«LOAD» Setting parameter from MU-150 Control Module keyboard</i> .....	9
2.3.4.	<i>Checking procedure of drawworks blocking in complex of SKPB DEL-150</i> .....	9
2.3.5.	<i>Checking procedure of maximum threshold parameter «LOAD»</i> .....	10
2.3.6.	<i>DN-130 Orientation pointing on a line of suspended tongs</i> .....	10
2.3.7.	<i>Procedures at DN-130 usage on a line of suspended tongs:</i> .....	10
2.3.8.	<i>Parameter setting at «MANUAL TONG LOAD» for SKPB DEL-150</i> .....	11
2.3.9.	<i>Parameter setting at «TONG TORQUE» for SKPB DEL-150</i> .....	11
2.3.10.	<i>DN-130 malfunctions while usage and recommendations for decoupling them.</i> .....	11
2.3.11.	<i>Data reflecting in programme «Drilling and Well workover monitoring»</i> .....	12
2.3.12.	<i>List of work modes of DN-130 also the main mode works characteristics</i> .....	12
2.4.	ACTS IN EMERGENCY SITUATIONS .....	12
2.4.1.	<i>Faults that can lead to accidents</i> .....	12
<b>3.</b>	<b>MAINTENANCE .....</b>	<b>12</b>
3.1.	DN-130 MAINTENANCE.....	12
3.1.1.	<i>General information</i> .....	12
3.1.2.	<i>Safety measures</i> .....	13
3.1.3.	<i>DN-130 Maintenance procedure</i> .....	13
3.1.4.	<i>DN-130 Work capacity check</i> .....	13
<b>4.</b>	<b>CURRENT MAINTENANCE .....</b>	<b>13</b>
<b>5.</b>	<b>STORAGE.....</b>	<b>13</b>
5.1.	STORAGE CONDITIONS .....	13
<b>6.</b>	<b>TRANSPORTATION .....</b>	<b>14</b>
6.1.	TRANSPORTATION REQUIREMENTS AND CONDITIONS.....	14
<b>7.</b>	<b>DISPOSAL .....</b>	<b>14</b>

# 1. Description and work

## 1.1. DN-130, DN-130(A), DN-130(R) Description and work

### 1.1.1. DN-130, DN-130(A), DN-130(R) Purpose

The load sensor DN-130, DN-130 (A), DN-130 (R), (hereinafter - DN-130) provides the function of normalized conversion of the tension force of the line into an electrical signal. DN-130 is installed on the fixed end of the line of the lifting device or on the fixed end of the steel line of the machine key drive (to measure pipes screwing torque).

The load sensor DN-130 is designed for operation:

- in hazardous area 1 according to the classification of the “Safety Rules in the Oil and Gas Industry”;
- in the open air, in climatic conditions of macroclimatic regions with temperate and cold climates in the operating temperature range from -45 to +65 ° C.

### 1.1.2. DN-130 Sensor modification and technical characteristics

Table 1. DN130, DN-130(A), DN-130(R) Main technical characteristics

№	Technical characteristics	Value	
1	Line diameter, mm	13 - 38	
2	Max measurement limit, κN	5 - 400	
3	Max acceptable basic percentage error, no more, %	3	
4	Calibration interval, month	12	
5	Ambient temperature, °C	-45 ... +65	
6	DN-130, DN-130(A) Power voltage range, V	12,8	
7	DN130(R) Power voltage range, no more, V	3,6	
8	Ingress Protection by GOST 14254-2015	IP 65	
	Climatic factors resistance by GOST 15150-89	UHL1	
9	DN-130 Weight, kg	Ø 13-18	5,0
		Ø 22-25	8,0
		Ø 28-32	11,0
		Ø 35-38	15,5
10	DN-130(A) Weight, kg	Ø 13-18	6,5
		Ø 22-25	9,5
		Ø 28-32	12,5
		Ø 35-38	16
11	DN-130(R) Weight, kg	Ø 13-18	6,0
		Ø 22-25	9,0
		Ø 28-32	12,0
		Ø 35-38	15,5
12	Dimensions DN-130, mm	Ø 16-18	310×70×111
		Ø 22-25	420×83×124
		Ø 28-32	500×88×127
		Ø 35-38	540×100×140
13	Dimensions DN-130(A), mm	Ø 16-18	310×70×132
		Ø 22-25	420×83×146
		Ø 28-32	500×88×147
		Ø 35-38	540×100×160
14	Dimensions DN-130(R), mm	Ø 16-18	310×70×133
		Ø 22-25	420×83×146
		Ø 28-32	500×88×148
		Ø 35-38	540×100×161
15	Interface connection with Control Module	RS-485	
16	Data transfer protocol	ModBus	
17	DN-130(A) Standard analogue output mA	4 ... 20	
18	Cable line length, m	100	
19	Ex marking EAC	1 Ex ib IIB T4 Gb	
20	Ex marking ATEX	II 2G Ex ib IIA T3 Gb	

### 1.1.3. DN-130

DN-130 Load sensor consists of built-in strain gauge bridge and electronic layout which includes:

- filters;
- analogue digital transducer;
- microprocessor;
- non-volatile memory for storage of calibrated data;
- power supply stabilization layout;
- intrinsically safe block at power input.

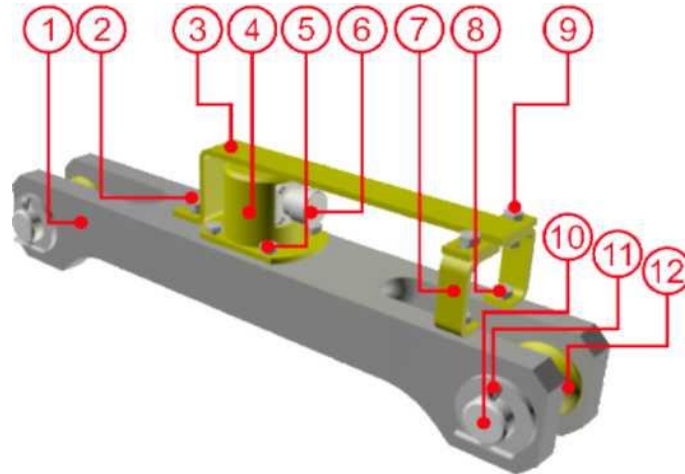


Figure1. DN-130 Components

1. Enclosure sensor;
2. Take down screw handle;
3. Protective handle;
4. Electronic module lid;
5. Lid screw of electronic module ;
6. Sensor connection (RS-485);
7. Support bracket handle;
8. Take down screw clamp;
9. Handle slip joint screw with a clamp;
10. Finger;
11. Splint;
12. Roller.

### 1.1.4. DN-130(A) Content

DN-130 Load sensor consists of built-in strain gauge bridge and electronic layout which includes:

- filters;
- analogue digital transducer;
- digital analogue transducer
- microprocessor;
- non-volatile memory for storage of calibrated data;
- power supply stabilization layout;
- intrinsically safe block at power input.

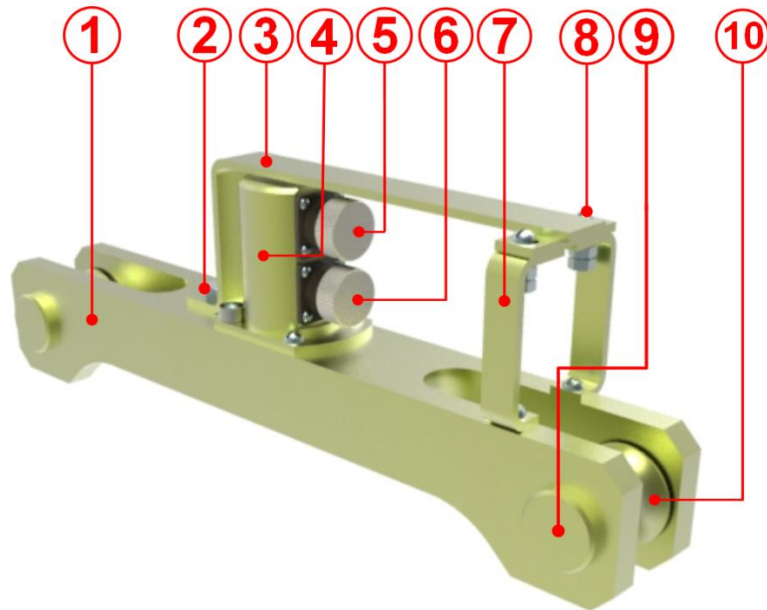


Figure 2. DN-130(A) Components

1. Enclosure sensor;
2. Take down screw handle;
3. Protective handle;
4. Lid screw of electronic module ;
5. Sensor connection (current);
6. Sensor connection (digital);
7. Take down screw clamp;
8. Handle slip joint screw with a clamp;
9. Finger;
10. Roller.

#### 1.1.5. DN-130(R) Content

DN-130 Load sensor consists of built-in strain gauge bridge and electronic layout which includes:

- analogue digital transducer;
- microprocessor;
- non-volatile memory for storage of calibrated data;
- battery block

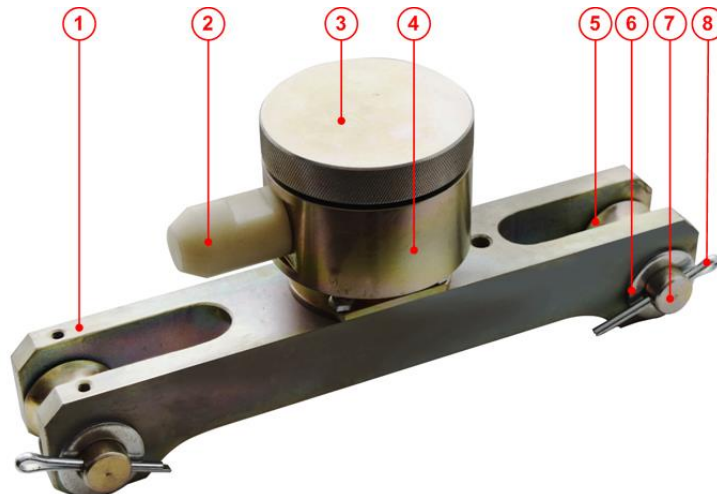


Figure 3. DN-130(R) Components

1. Enclosure sensor;
2. Antenna sensor protection;
3. Enclosure lid of electronic module;
4. Electronic module enclosure;
5. Roller;
6. Bead;
7. Finger;
8. Splint.

### 1.1.6. Structure and functioning

The load influences on the line where DN-130 is installed. The line, in turn, acting on DN-130, causes mechanical deformations in it.

Next, DN-130 converts these mechanical strains into an electrical signal proportional to the strains. Then, using the data from non-volatile memory entered during calibration, DN-130 calculates the magnitude of the load (tension force) acting on the line where it is installed. The result is converted into a digital code and transmitted over the communication line or radio channel.

The measured value of the load (tension force) is transmitted via RS-485 communication channel to MU-150 control module for recording data and transmitting them for display on the display of the display module.

Calibration interval is 12 months. After sensors checking and calibration, standardization and certification bodies issue a certificate on the calibration of an established sample:

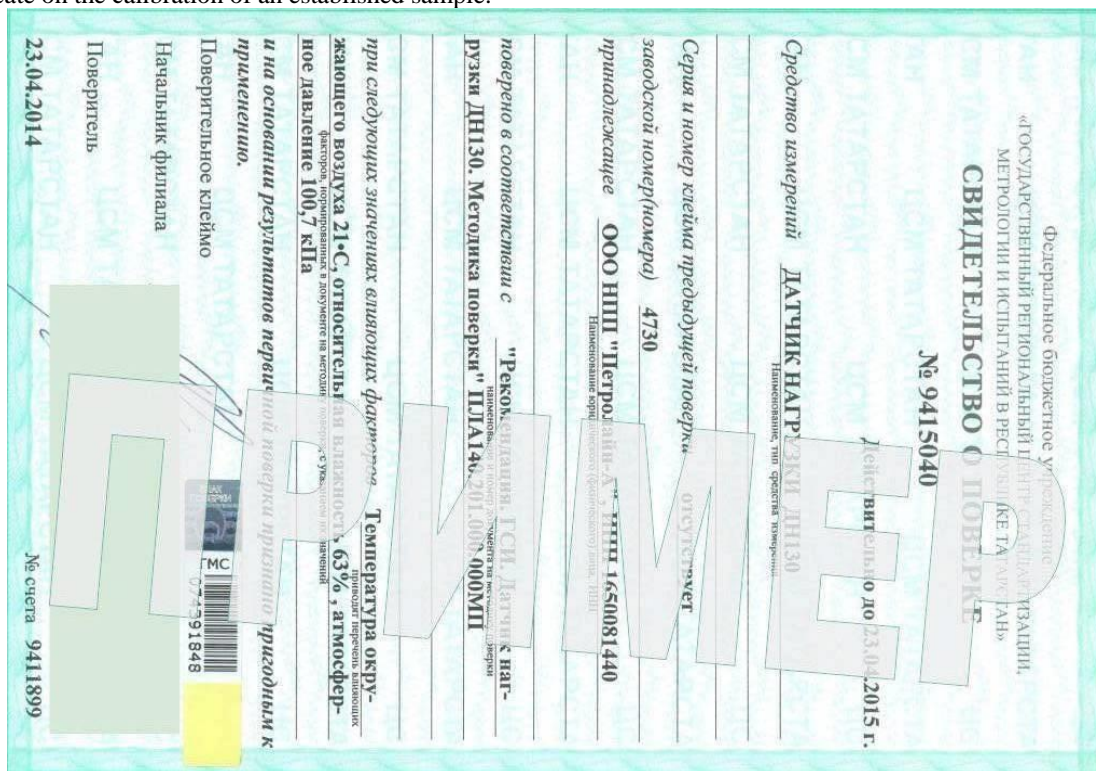


Figure 4. Certificate of verification

### 1.1.7. DN-130 Ex providing

The devices in the complex of SKPB DEL-150, are made in accordance with the requirements of the technical regulations of TR TS 012/2011 “Equipment safety for work in explosive atmospheres”.

According to the requirements, DN130 load sensor is located in Ex-area and is explosion-proof.

Intrinsic safety (Ex attribute) 1ExibIAT3Gb of the above instruments is provided with a spark-safe electric circuit(ib).

It can be used in hazardous areas of outdoor installations (Chapter 7.3 PUE) corresponds to zone 1, the group of explosion-proof electrical installations IIA, temperature class T3, the level of explosion protection Gb, according to the “Safety rules in the oil and gas industry” approved by Rostekhnadzor.

### 1.1.8. Marking

A sensor plate is fixed on a ready made equipment with a short information and sensor number.

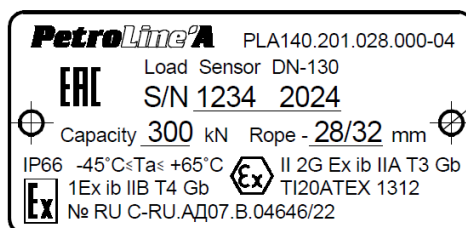


Figure 5. DN-130 Sensor plate

### 1.1.9. Packaging

DN130 package in the complex of SKPB DEL-150 is a box made of plywood with metal handles for carrying. The package with the sensor contains the documentation (passport, operating manual, certificate of verification, calibration procedure).

## 2. Usage

---

### 2.1. Operational constraints

#### 2.1.1. Ex rating in operating

The use of DN130V as part of SKPB DEL-150 is allowed for personnel who have studied this instruction, the operating instructions of DEL-150, who have received appropriate instructions and have the necessary accesses to work in hazardous areas.

During the operation it is necessary to be guided by:

- Chapter 3.4 POT R M-016-2001 "Safety Regulations for the operation of electrical installations";
- the current rules of electrical installations
- requirements of points of this guide.



**During operation, it is necessary to monitor the status of devices and communication cables. In case of any mechanical damage of the devices and communication cables between them, further operation is strictly prohibited!**

When the control module is on, it is prohibited to connect and disconnect the connectors of the connecting cables, power cable and grounding conductors.

In case of detection of malfunctions, it is necessary to turn off the device, disconnect the power cable from the power source. Then replace the faulty device with a known-good device, having connected it according to the documentation. After replacement, check the reliability of the connections and grounding of the module enclosures to the weight of the rig. During operation, periodically check the status of communication cables. If a violation of the protective layer on the cable lines is detected, immediately turn off the power supply and replace the damaged cable.

Do not allow the violation of the sealing devices. If faults are detected, turn off the power supply and replace the faulty device.

If mechanical damage is detected, remove the faulty device and send it to repair work.

### 2.2. Preparation of DN-130 usage

#### 2.2.1. Safety precautions at DN-130

При эксплуатации СКПБ следует руководствоваться положениями ПТЭЭ от 31.03.92 г. и «Правил безопасности в нефтяной и газовой промышленности», утвержденных Госгортехнадзором России в соответствии с Федеральным законом «О промышленной безопасности опасных производственных объектов».

#### 2.2.2. Volume and sequence of DN-130 external check

External examination includes checking:

- contact status, cable connection;
- availability of mounting bolts and studs;
- ease of movement and the absence of jamming and distortions in the moving finger-roller system;
- the presence of mechanical damage.

#### 2.2.3. DN-130 Orientation Indication

DN-130 Load sensor is mounted at rig's dead line with a connection downwards. Recommended mounting height is no more than 1.5 m from the line fixing. Recommended distance from analogue sensor on a line is no less than mm.

To mount a line with a diameter of 22 mm it is necessary additionally to use devise for fixing a load sensor (PUDN).





Figure 6. DN-130 at work

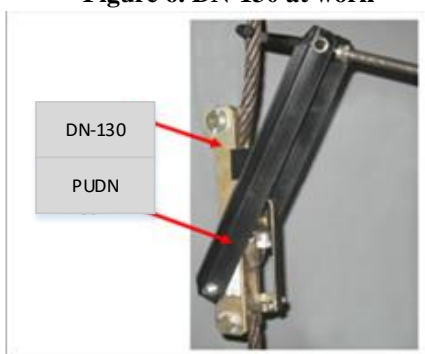


Figure 7. DN-130 Devise for fixing a load sensor (PUDN).

#### 2.2.4. DN-130 Connection between other instruments

Load sensor DN130 is connected by a communication line cable with the control module of the SKPB complex DEL-150. Load sensor interacts with all control modules of SKPB of DEL-150 produced by NPP “Petroline-A” LLC with software versions of the main controller not lower than 5.37.

#### 2.2.5. DN-130 Switching on and executing

It is recommended to connect the load cell with the off control module. Turning on the control module and rebooting starts the process of initializing the sensors.

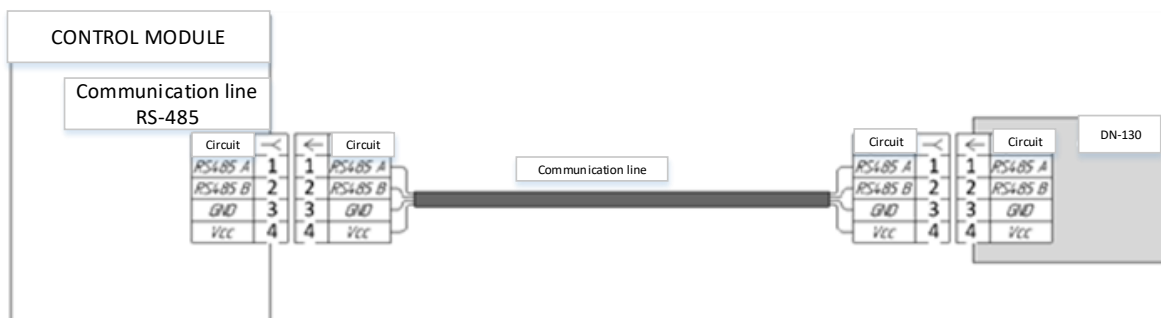


Figure 8. DN-130 Layout connection

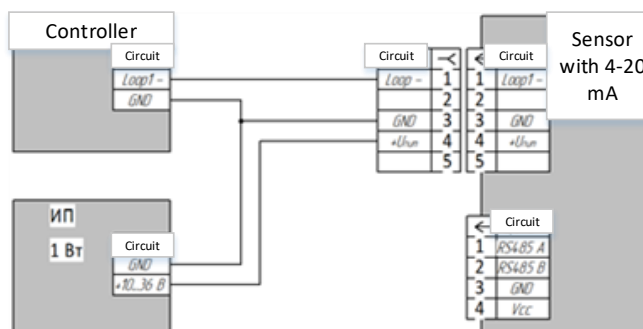


Figure 9. DN-130(A) Layout connection with output 4-20 mA to the outside controller



Figure 10. Load display at MU-150

## 2.3. DN-130 Usage

### 2.3.1. DN-130 Usage at line while tripping rate operation:

- Place the line («dead line» of travelling block) line clam to avoid sensor misalignment зажим (by a line down);
- Place the sensor on the line above the clam;
- Connect the cable with a sensor;
- Place the cable to control module or commutation module via channel cables or the places which are not under mechanical influence;
- Joint cable with Control module or Commutation module;
- Switch on the equipment;
- Check the necessary parameter in the list of MU-150 display (at MU-140 illumination of LED).
- Input necessary settings with a Control module keyboard;
- Reset fixing weight;
- Check the parameter display at Display Module indication

SKPB DEL-150 complex excludes the possibility to influence the readings of DN130 by introducing unregistered settings.

### 2.3.2. «LOAD» Setting parameter from MU-140 Control Module keyboard

“LOAD” parameter is set in accordance with the instructions for setting up SKPB DEL-150:

- In the list of operating parameters in the line "P2" enter the value of the maximum allowable hook load;
- In the list of parameters of the control system in the line "U2" enter the gear ratio of the tackle block (an even number from 2 to 18);
- Carry out the zeroing of the hook block weight (the hook block weight value is stored in the device memory).

### 2.3.3. «LOAD» Setting parameter from MU-150 Control Module keyboard

“LOAD” parameter is set in accordance with the instructions for setting up SKPB DEL-150:

- Select the "load" parameter in the "Operating Parameters" menu;
- Enter the value in the line: "MAX"

Enter the value “COEF, LINE” Example: for a 3x4 hoist system, the dead end load is six times less than hook load, the value of “COEF, LINE” is “6”.

- Go to the line “WEIGHT LINE” and reset by pressing the combination of buttons:



(value of hook block weight is displayed at «WEIGHT LINE» and stored at equipment memory).

### 2.3.4. Checking procedure of drawworks blocking in complex of SKPB DEL-150



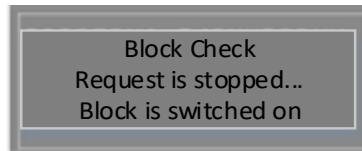
**The blocking test should be carried out only during the work stipulated by the regulations for the technical inspection and adjustment of instrumentation! Exclude unauthorized shutdown, the inclusion of technological equipment!**

- Check the connection of the cable block;
- Turn on Control module;
- Go to “block check mode”
- In the “block status” window, select the required line

- Press simultaneously on keyboard MU-150 buttons: 

Blocking state			
→	Block L	[080]	--
	Block K	[081]	05
	Block N	[082]	--

When a lock is triggered in the “block check mode”, polling of all devices is disabled;  
 - At the end of the check, the line “check completed” lights up, the survey resumes



- Move out to «operating mode».

### 2.3.5. Checking procedure of maximum threshold parameter «LOAD»

- Enter to menu setting of «LOAD» parameter;

LOAD,TS	
MAX	125.000
COEFF,TACKLE	10.0
WEIGHT,TACKLE	000.000

- In the line «MAX» enter the smallest value;
- Lift hook block to exceed this value;
- After checking passed value «MAX» make in compliance.

### 2.3.6. DN-130 Orientation pointing on a line of suspended tongs

DN-130 Load sensor is mounted on suspended tong between line clamps so that not to garble the tongs system work.

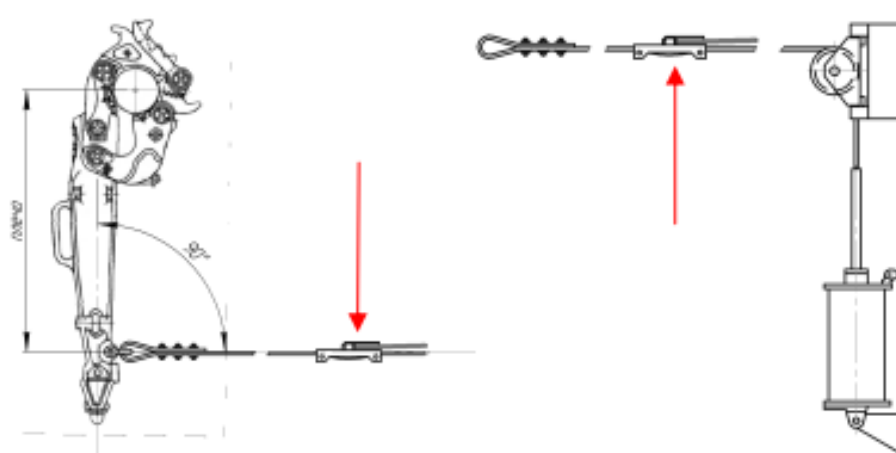




Figure 11. DN-130 at tongs line

### 2.3.7. Procedures at DN-130 usage on a line of suspended tongs:

- Install two cable clamps on the line to prevent the sensor from moving (along the line);
- Install the sensor on the line between the clamps;
- Connect the cable to the sensor;
- To prevent breakage during jerking, provide a “loop” of the required length;
- Route the cable to the control module or the switching module through cable channels or places not subject to mechanical stress;
- Connect the cable to the control module or switching module;
- Switch on the device;




- Check the availability of the corresponding parameter in the list on the display of MU-150 (on MU-140 the illumination of the corresponding LED).
- Enter the necessary settings (for “MANUAL TONG LOAD” parameter, or “TONG TORQUE”) using the keyboard of the Control module;
- Check the display of the parameter in the corresponding field of the display module.
- As part of SKPB DEL-150 complex, the ability to influence DN-130 readings by introducing unregistered settings is excluded.

### 2.3.8. Parameter setting at «MANUAL TONG LOAD» for SKPB DEL-150

- At menu «OPERATING PARAMETERS» → «DRILLING TONGS» → «MANUAL TONG LOAD»;
- At line «MAX» enter max line load at max load torque.
- Pass to «ZERO» line and press   keys (value line load will be depicted at control module and will be stored at equipment memory).

### 2.3.9. Parameter setting at «TONG TORQUE» for SKPB DEL-150

The setting of the “TONG TORQUE” parameter is carried out in accordance with the instructions for setting up DEL-150:

- Press button on the keyboard of the control module in sequence;
- Select the menu “OPERATING PARAMETERS”  “DRILLING TONGS ”   “TONG TORQUE ”;
- In the parameter settings menu, enter the value in the lines: "MAX", "COEF \*".
- Go to “ZERO” line and reset by pressing the combination of buttons: (the value will be displayed at “ZERO” line and saved at device memory).

\* COEFFICIENT of the parameter is equal to the length of the shoulder of suspended key. It is better to find this value in the documentation for tong or measure it by yourself using a tape measure (distance from the point of attachment of the line the center of the pipe).

### 2.3.10. DN-130 malfunctions while usage and recommendations for decoupling them.

About malfunctions of DN-130 as part of SKPB DEL-150 complex:

- By the value “LINE WEIGHT” with the correct value in the line “LINE COEFF”. "LINE WEIGHT" is a constant value for a specific installation.
- According to the indication on display of Control module



Figure 12. Values at Control module display at normal mode of operating

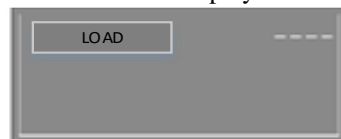


Figure 13. Values at loss with sensor connection



Figure 14. Values at normal mode of operating

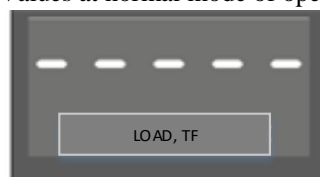


Figure 15. Values at loss with sensor connection

At loss with sensor connection it is necessary to make the following actions while descending of priorities:

- Replace the cable;

- Replace the sensor.

### 2.3.11. Data reflecting in programme «Drilling and Well workover monitoring»

To display the parameters in graphical form and create reports on measurements, there is software “Drilling and Well workover monitoring”.

To view information about DN-130 sensor (serial number, calibration date, etc.), you need to start the program, open the measurement and open the sensor passport in the "Details" tab.

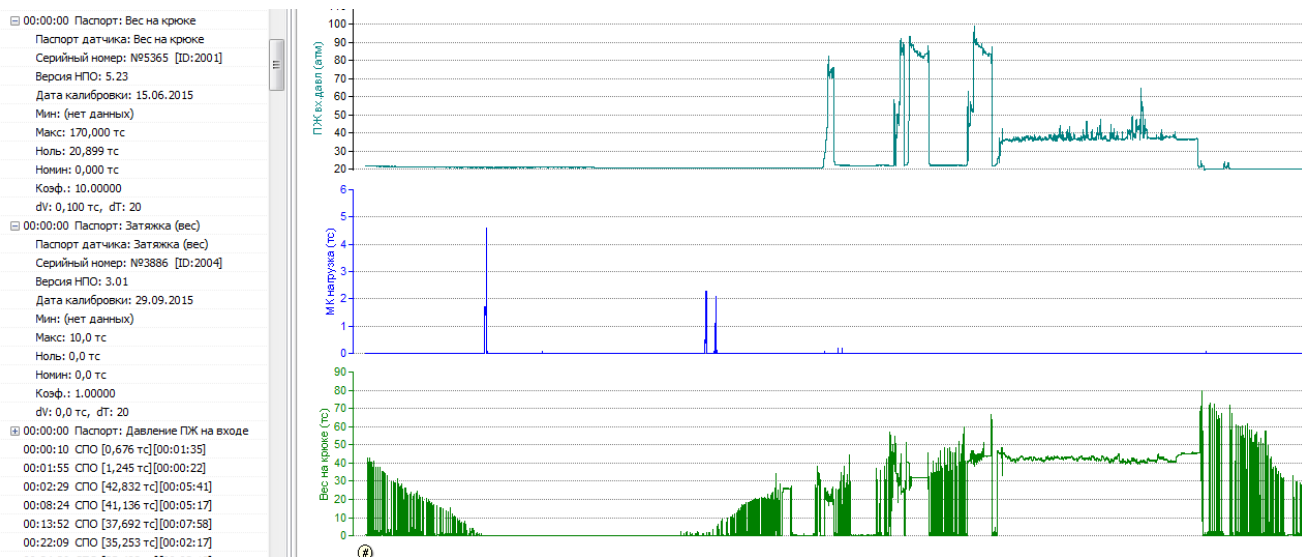


Figure 17. Window programme «Drilling and Well workover monitoring system»

### 2.3.12. List of work modes of DN-130 also the main mode works characteristics

DN-130 Sensor can work as a sensor

- Loads at tripping line;
- Loads at line tongs (as a rule, sensors are used for lines with diameter up to 22 mm);
- Tong line torque (as a rule, sensors are used for lines with diameter up to 22 mm).

The system depicts sensors' aim at address RS-485.

Table 3. Devices addresses at RS-485

№	Connected devices	Name at MU-150	dec
1	Load sensor (load at deadline drawworks)	DN-130	002
2	Load sensor (load at a manual tong)	DN-130K	003
3	Load sensor (torgue at a manual tong line )	DN-130V	004

## 2.4. Acts in emergency situations

### 2.4.1. Faults that can lead to accidents

In case of failures that can lead to emergency situations, it is necessary to replace the failed device. In all other cases not described in this manual, follow the Federal rules and regulations in the field of industrial safety "Safety rules in the oil and gas industry".

## 3. Maintenance

### 3.1. DN-130 Maintenance

#### 3.1.1. General information

Maintenance is divided into:

- daily maintenance;
- periodic maintenance performed after working off a certain time, and after moving (before installation).

Operational and routine maintenance of DN130 is performed by personnel whose responsibilities include ensuring the operability of the complex. The list of these works includes:

- check the status and control of the instrument;
- operational actions for the replacement of damaged sensors with the registration of acts;
- check the inclusion of blocking signals;
- registration in the form according to the forms recommended by the manufacturer of all recorded deviations, failures, work performed and other information.

### 3.1.2. Safety measures

When operating the complex, it is necessary to be guided by

- Chapter 3.4 "Electrical installations in hazardous areas" PEE
- the current rules of electrical installations;
- this operational documentation (ED) and other regulatory documents in force at the enterprise.

During operation, it is prohibited to open all devices that are part of SKPB DEL-150. Provide maintenance as required, but at least once a month:

### 3.1.3. DN-130 Maintenance procedure

Maintenance is carried out in the following order:

1. Cleaning the sensor body from contamination;
2. Checking the safety of seals;
3. Check the availability and strength of the installation of fasteners;
4. Cleaning of connectors and contact groups from contamination;
5. Check for the absence of visible mechanical damage;
6. Replacement and / or repair of damaged cable products;
7. Replacing damaged connectors.

Wash the contacts with alcohol-gasoline mixture (need 3 ml) with a soft brush.



**the absence of marks on the maintenance of the Form (section "Accounting for maintenance") ATTRACTS A VIOLATION OF THE OPERATION RULES, and the manufacturer has the right to withdraw from the warranty.**

### 3.1.4. DN-130 Work capacity check

- Switch on the device;
- Check the list of connected devices;
- Check, edit the operating parameters;
- Check the operation of locks and alarms;
- Check the display parameters on the indicator.

## 4. Current maintenance

---

Maintenance is carried out on manufacturing facility or a specialized factory (Appendix 6)

## 5. Storage

---

### 5.1. Storage conditions

All devices require careful treatment, storage in dry, clean rooms with a constant temperature. The optimal storage conditions are considered to be from 10 to 35 ° C, relative air humidity not more than 80%. Daily temperature fluctuations should not exceed 5 ° C.

Devices arriving at the warehouses in the packaging of the factory are not unpacked, packaged on flat pallets and stacked in a stack or in the cells of the racks.

Devices sealed by the factory cannot be opened in warehouses.

Small appliances and devices arriving in individual packaging are stored for storage in box pallets with installation in a stack.

Devices and components without individual packaging should be stored in the cells of the racks no more than 3 rows in height with the use of sealing materials between them.

Small devices and products arriving without packaging can be stored in fine-mesh racks and cabinets, while devices or products of the same type should be stored in the same cell.

## **6. Transportation**

---

### **6.1. Transportation requirements and conditions**

All types of closed transport allow packaged transportation. Load sensor DN130 in the package for transportation allows the impact of a transport shaking with an acceleration of  $30 \text{ m/s}^2$  with a frequency of beats of 100 per minute or 1500 beats with that acceleration.

## **7. Disposal**

---

Disposal of load sensor DN130 is made in accordance with the requirements and standards used in the oil and gas industry.