

2023



# DN-130V(R) Load Sensor Operation Manual

PLA 140.201.040.000 RE





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## 1. Description and work

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### 1.1. DN130V Description and work

#### 1.1.1. DN 130V Purpose

DN130V load sensor is designed to measure the tensile forces arising in the mechanisms in various sectors of industrial production and construction.

DN130V has several modifications, due to the various options for installing the sensor and methods of communication of the sensor with the control module.

The load sensor DN130V is designed for operation:

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

#### 1.1.2. DN130V sensor modification and their technical characteristics:

DN130V is an inline load sensor, designed to measure the tension force of the rope (hereinafter referred to as “tong torque”) on the machine key of tripping systems when screwing - unscrewing the pipes. Used on wrenches equipped with ropes.



Figure 1. DN 130V inline load sensor

Table 1. DN 130V technical characteristics

No position	Technical characteristics	Value
1	Max.measurement limit, κN	50, 100, 150
2	Min measurement limit, κN	1
3	Max acceptable basic percentage error, %	1
4	Calibration interval, month	12
5	Measured load type	tensile
6	Operating temperature range, °C	-45 ... +65
7	Ex rating EAC	1ExibIIBT4Gb
8	Ex rating ATEX	II2GExibIIAT3Gb
9	Rated supply voltage	12 ... 18
10	Ingress protection GOST 14254-96	IP 65
11	Weather resistance GOST 15150-89	UHL1
12	Weight, kg	3,8
13	Dimensions, mm	215×Ø80
14	Cable length, m	1...100

DN130V(R) wireless inline load sensor is designed to measure the tension force of the rope (hereinafter referred to as “tong torque”) on the machine key of the tripping units when screwing- unscrewing pipes. Used on wrenches equipped with ropes. It can also be used to measure the load on the guy lines rig.

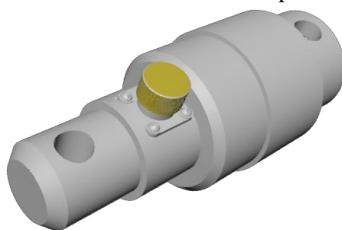


Figure 2. DN130V(R) Wireless inline load sensor

Table 2. DN130V(R) technical characteristics

№ position	Technical characteristics	Value
1	Max.measurement limit, kN	50, 100, 150
2	Min.measurement limit, kN	1
3	Max acceptable basic percentage error, %	1
4	Calibration interval, month	12
5	Measured load type	tensile
6	Peak radius operation with transmitter PS-150(RM) (guy lines), m	25
7	Peak radius operation with transmitter PS-150(R1) (tong torque) m	5
8	Operating temperature range, °C	-45 ... +65
9	Ex rating EAC	1ExibIIBT4Gb
10	Ex rating ATEX	II2GExibIIAT3Gb
11	Rated supply voltage	3,6
12	Ingress protection GOST 14254-96	IP 65
13	Weather resistance GOST 15150-89	UHL1
14	Power Supply	15
15	Weight, kg	3,8
16	Dimensions, mm	300×Ø95
17	Cable length (up to antenna m)	1...100

DN130V (Sh) inline load sensor is designed to measure the tensile / compressive force (later converted to “tong torque”) on the bar of the



suspension key, tripping devices when screwing- unscrewing pipes.

Figure 3. Inline load sensor on the bar DN130V (Sh)

Figure3. Technical characteristics DN130V(Sh)

№ position	Technical characteristics	Value
1	Max.measurement limit, κN	50, 100, 150
2	Min measurement limit, κN	1
3	Max acceptable basic percentage error, %	1
4	Calibration interval, month	12
5	Measured load type	tensile compression
6	Operating temperature range, °C	-45 ... +65
7	Ex rating EAC	1ExibIIBT4Gb
8	Ex rating ATEX	II2GExibIIAT3 Gb
9	Rated supply voltage	12 ... 18
10	Ingress protection GOST 14254-96	IP 65
11	Weather resistance GOST 15150-89	UHL1
12	Weight, kg	3,3
13	Dimensions, mm	198×Ø80
14	Cable length, m	1...100

DN130V (V) Inline load sensor with a rotator, designed to measure the load value (hereinafter referred to as “tong torque”) on the machine key of tripping systems when screwing - unscrewing the pipes. Used on tongs to prevent rope twisting.



Figure 4. DN 130V(V) Inline Load sensor with rotator

Table 4. Technical characteristics DN130V(V)

№ position	Technical characteristics	Value
1	Max.measurement limit, κN	50, 100
2	Min measurement limit, κN	1
3	Max acceptable basic percentage error, %	1
4	Calibration interval, month	12
5	Measured load type	Tensile
6	Operating temperature range, °C	-45 ... +65
7	Ex rating EAC	1ExibIIBT4Gb
8	Ex rating ATEX	II2GExibIIAT3 Gb
9	Rated supply voltage	12 ... 18
10	Ingress protection GOST 14254-96	IP 65

11	Weather resistance GOST 15150-89	UHL1
12	Weight, kg	3,3
13	Dimensions, mm	198×Ø80
14	Cable length, m	1...100

### 1.1.3. DN130V Components

DN130V load sensor consists of an enclosure with an inline tensometric bridge and an electronic circuit including:

- filters;
- analog-to-digital converter;
- microprocessor;
- non-volatile memory for recording and storing calibration data;
- supply voltage stabilization circuit;
- spark protection barrier on the power input.

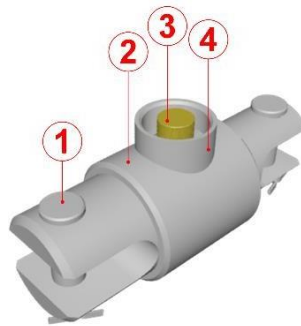


Figure 5. DN130V Components

1. Finger;
2. Enclosure;
3. Sensor slot cover;
4. Connector protection.

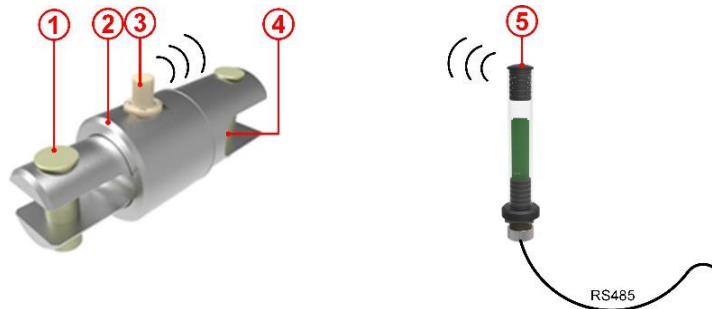


Figure 6. DN130V(R) Components (for mechanical tongs)

1. Finger;
2. Enclosure;
3. Transducer;
4. Battery;
5. Sygnal Transducer PS-150(R1).



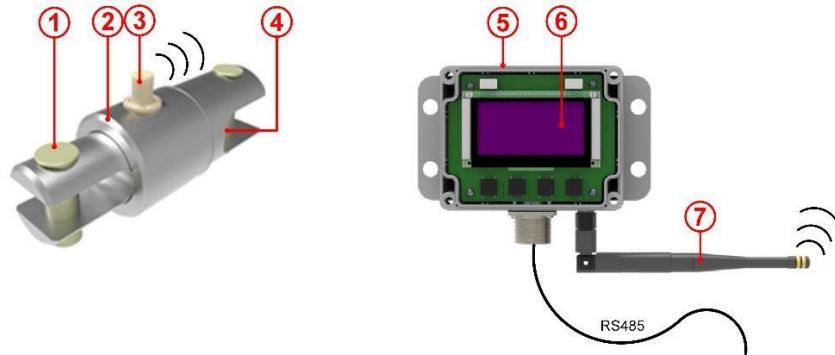


Figure 7. DN130V(R) (Guy lines)

1. Finger;
2. Enclosure;
3. Transmitter;
4. Battery block;
5. Sygnal Transducer PS-150(RM);
6. Indication;
7. Antenna.

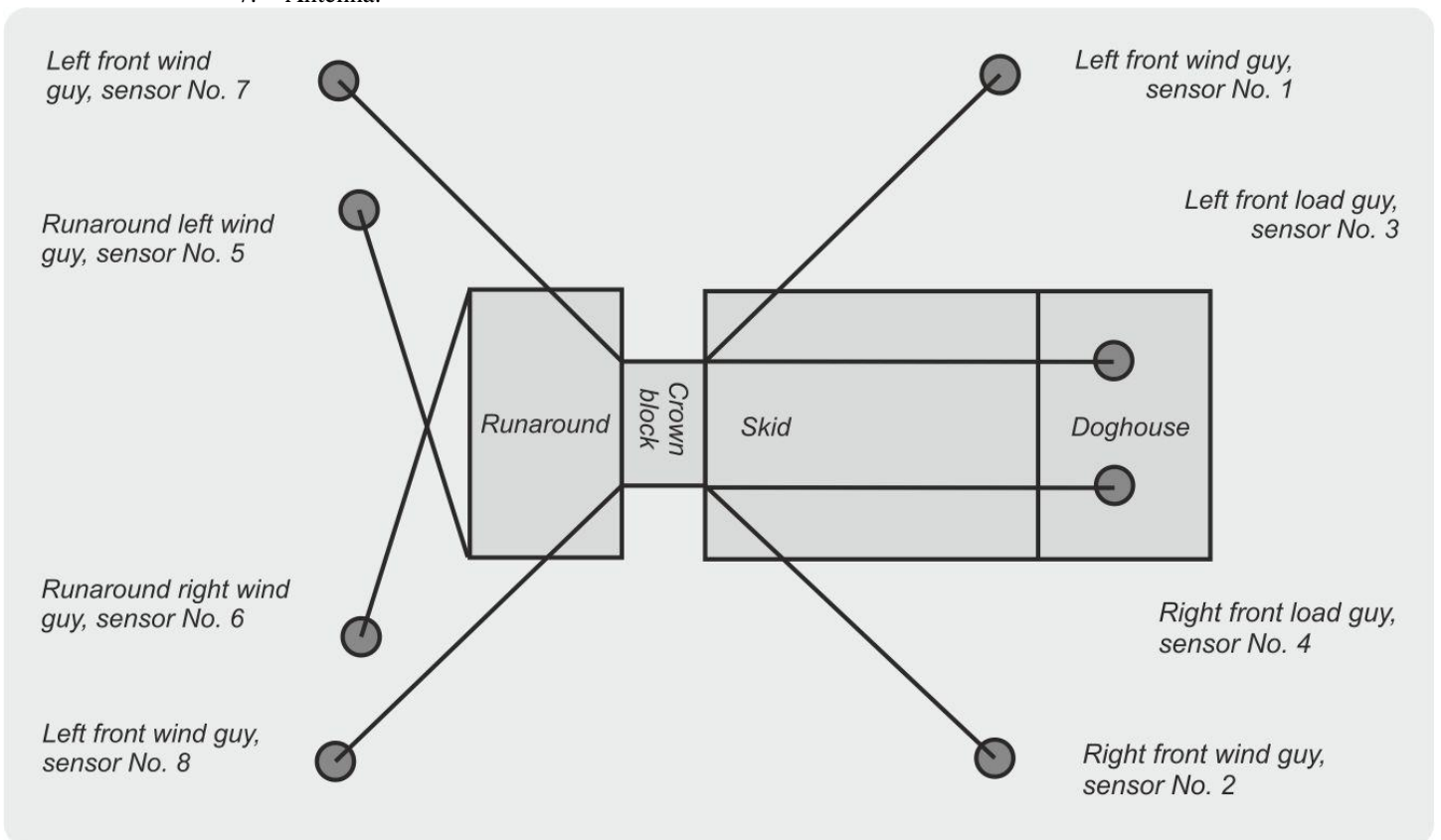


Figure 8. Example layout for load and wind guy line sensor arrangement for a mobile rig (for example BU "Idel-125")

#### 1.1.4. Device and work

The principle of the sensors is based on the conversion of the tensile (compression) force applied to the elastic element of the sensor into an electrical signal. The force causes the deformation of the elastic element of the sensor. The electrical signal proportional to these deformations created by the strain gauges, taking into account the calibration data entered into the non-volatile memory of the microcontroller, is converted into the real value of the measured force. The final measurement result is converted into a digital code and transmitted via a communication line for visual display of the measured information or further use in automated process control and management systems. The measurement and control information is transmitted via a communication cable or radio channel via the RS-485 interface using the standard MODBUS protocol.

The sensors can also be electrically powered from an independent source of electrical power. The sensors have a built-in voltage regulator; the DC supply voltage can be within  $15 \pm 3$  V.

Since the sensors are digital, for work it is enough to apply the permissible voltage to them from the power source. The sensor software performs a full cycle of calculating the magnitude of the tensile / compressive force using the calibration data and outputting the final result in digital form via the RS-485 interface using the standard MODBUS protocol.

As part of SKPB DEL-150, the measured load value is transmitted via the communication channel to the MU-150 control module for recording data and transmitting them for display on the display of the module indication.

DN130V sensors certified as a means of measurement. The verification and calibration of the load sensors DN130V is performed at the manufacturer or a specialized enterprise using certified test equipment.

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



Table 9. Certificate of verification

#### 1.1.5 DN130V Ex rating

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", have a design that maintains the level and type of explosion protection in accordance with

- GOST R 51330.0-99 (IEC 60079-0-98);
- GOST 30852.0-2002 (IEC 60079-0: 1998);
- GOST R 51330.10-99 (IEC 60079-11-99);
- GOST 30852.10-2002 (IEC 60079-11: 1999) (sign Ex).

According to the requirements, DN130V load sensor is located in Ex-area and is explosion-proof (see the Operation Manual DEL-150).

Intrinsic safety (Ex attribute) 1ExibIIBT4Gb 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.

Figure 5. Ex marking

Instrument	Ex marking
DN130V load sensor, EAC	1ExibIIBT4Gb
DN130V load sensor, ATEX	II2GExibIAT3Gb

### 1.1.6. Marking and sealing

A table with a short info and sensor number is fixed on a ready made instrument.

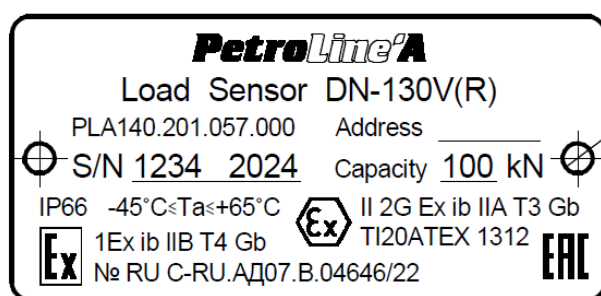


Figure 10. DN130V device table

### 1.1.7. Packaging

The package DN130V in the composition 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 dynamometer 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

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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 DN130V usage

### 2.2.1. Safety precautions at DN130V preparation

During the operation of the dynamometer, it is necessary to follow the provisions of PTEE dated March 31, 1992 and the Safety Rules in the Oil and Gas Industry, approved by the Gosgortekhnadzor of Russia in accordance with the Federal Law “Industrial Safety of Hazardous Production Facilities”.

### 2.2.2. Volume and sequence of DN130V external inspection

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. DN130V Orientation Indication

The load sensor DN130V is mounted at the point of attachment of the retaining rope or rod so that the cable is not subjected to mechanical loads. It is advisable to turn the body of the sensor with the connector downwards to eliminate damage. The entire system should form a right angle between the axis of the key and the axis of the holding device, which will allow the use of sensor readings without taking into account the sine of the angle.

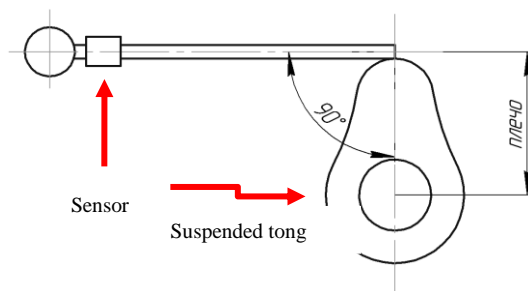


Figure 11. DN130V Installation layout



Figure 12. DN 130 V at work

### 2.2.4. DN130V connection between other instruments

The load sensor DN130V is connected by a communication line cable with the control module of the complex DEL-150. The load sensor interacts with all the control modules of the Dynamometer of the Electronic DEL produced by NPP “Petrolina-A” LLC with software versions of the main controller not lower than 5.37.

### 2.1.5. Guidelines for the inclusion and testing of the work DN130V

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 13. Load display on MU-150

## 2.3. DN130V Usage

### 2.3.1. DN130V Procedure usage

- Fasten the sensor at the point of attachment of the retaining rope (at the level with the suspension key);
- Fasten the retaining rope in the sensor eye (use thimble);



when terminating the rope, comply with the relevant standards and requirements of the industry standard and tong operation manual.

- Fix splints in the “fingers” of the sensor;
  - Connect the cable with the sensor;
  - Route the cable to the control module or switching module through cable channels or places non mechanically stressed;
  - Connect the cable to the control module or switching module;
  - Turn on the device;
  - Check the availability of the corresponding parameter in the list on the display MU-150;
  - Enter the necessary settings using the control module keyboard;
  - Reset the load;
  - Check the display of the parameter in the corresponding field of the display module.
- SKPB DEL-150 complex excludes the possibility to influence the readings of DN130V by introducing unregistered settings.

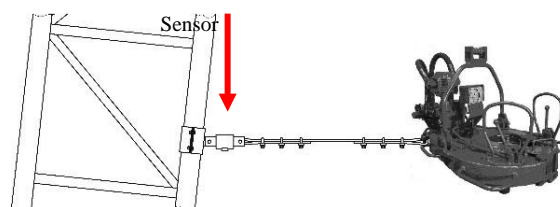


Figure 14. DN130V Installation layout

### 2.3.2 DN 130V(Sh) Procedure Usage.

For mounting the sensor it is required reworking of the retaining rod.

- Fasten the sensor "in the gap" in advance of the retaining rod;
  - Adjust the length of the rod;
  - Fix in the sensor "fingers" and splint rod;
  - Connect the cable to the sensor;
  - Route the cable to the control module or switching module through cable channels or places non mechanically stressed;
  - Connect the cable to the control module or switching module;
  - Turn on the device;
  - Check the availability of the corresponding parameter in the list on the display MU-150;
  - Enter the necessary settings using the control module keyboard;
  - Reset the load;
  - Check the display of the parameter in the corresponding field of the display module.
- SKPB DEL-150 complex excludes the possibility to influence the readings of DN130V by introducing unregistered settings.

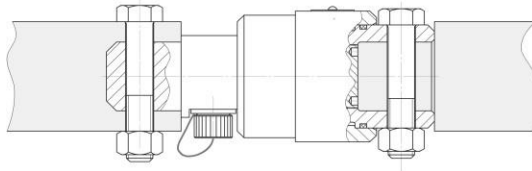


Figure 15. DN130(Sh) sensor installation on the rod

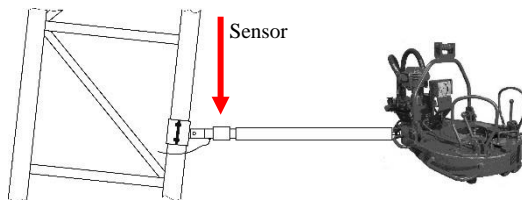


Figure 16. DN130(Sh) sensor mounting

### 2.3.3. DN130V (V) (sensor with rotator) procedure usage

- Fasten the sensor to the stem of the blower;
  - Fasten the rope in the eye of the sensor (use thimble);
  - Fix splints in the sensor "fingers";
  - Connect the cable to the sensor;
  - Route the cable to the control module or switching module through cable channels or places not subject to mechanical impact;
  - Connect the cable to the control module or switching module;
  - Turn on the device;
  - Check the availability of the corresponding parameter in the list on the display MU-150;
  - Enter the necessary settings using the keyboard of the control module;
  - Reset the load;
  - Check the display of the parameter in the corresponding field of the display module.
- As part of the DEL-150 complex, the possibility to influence the readings of DN130V by introducing unregistered settings is excluded.

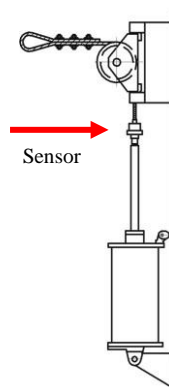



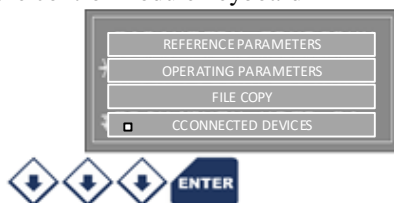


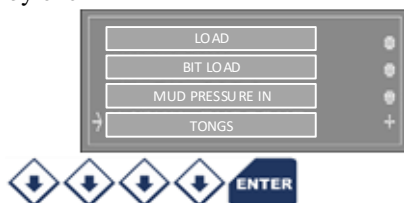
Figure 17. DN130V(V) pneumatic breakout rod

While logging to the DEL-150 control module:

1. Press on the control module keyboard   



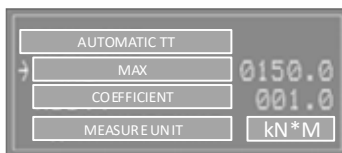
2. Press one by one



3. Press one by one



4. Enter necessary settings



5. Save

### 2.3.4. Setting “Tong Torque” parameter from the keyboard of the MU-150 control module

Setting “Tong Torque” parameter is carried out in accordance with the instructions of the DEL-150 configuration:

- Press button Enter on the keyboard of the control module sequentially;
- Select in the menu “OPERATING PARAMETERS”  “TONGS ” “ TONG TORQUE ”;
- In the parameter settings menu, enter the value in the rows: “MAX”, “COEF”.



- Go to the “ZERO” line and reset by pressing a combination of buttons:  
(the value will be displayed in the “ZERO” line and stored in the instrument's memory).

**2.3.5. The list of possible DN130V malfunctions in the process of use and recommendations for action when they occur.**

You can judge the DN130V malfunction in the complex DEL-150:

- by the presence of the parameter “TONG TORQUE” on the display of the control module;
- by indication on the display module;
- on the display of charts and the presence of error messages in the software “Drilling and repair of wells”.

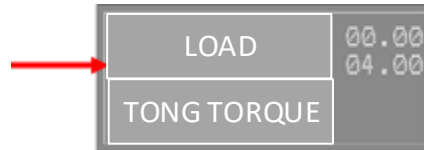


Figure 18. Indications on the display of the control module in normal mode

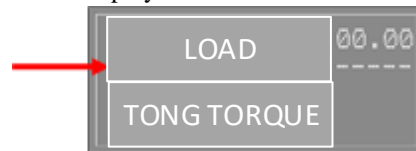


Figure 19. Indications for loss of communication with the sensor

In case of loss of communication with the sensor, to determine the source of the malfunction it is necessary to carry out the following actions in accordance of decreasing probability:

- replace the cable, poll the sensors;
- replace the signal converter (for sensors with a radio channel), poll the sensors;
- replace the sensor, poll the sensors.

**2.3.6. DN130V modes and characteristics of main operating modes**

The sensor DN130V in complex of DEL-150 can work as a sensor:

- to measure the weight of the round trip;
- to measure the torque on the pipe wrench.

The system determines the assignment of sensors to the address on the RS-485 bus.

Table 6. Device address on the RS-485 bus

Nº	Set device	Parameter	Lettering on MU-150 display	dec
1	Load sensor	Tong torque	DN130V	004
2	Load sensor	Tong torque 2	DN130V	011
3	Load sensor	Tong torque 3	DN130V	012
4	Load sensor	Guy line 1-8	Guy lines (RM)	049 (multi channel)
5	Load sensor	Guy line 1-8	Guy line 1-8	152-159

**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 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."

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## 3. Maintenance

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### 3.1. DN 130 V 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 the DN130V 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" PEEP;
- 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. DN130V 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. DN130V Work capacity check

- Turn 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**

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### **4.1. DN130V Current Maintenance**

#### **4.1.1 General information**

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

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## **5. Storage**

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### **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**

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

All types of closed transport allow packaged transportation. The load sensor DN130V in the package for transportation allows the impact of a transport shaking with an acceleration of 30 m / s<sup>2</sup> with a frequency of beats of 100 per minute or 1500 beats with that acceleration.

## **7. Disposal**

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Disposal of the load sensor DN130V is made in accordance with the requirements and standards used in the oil and gas industry.