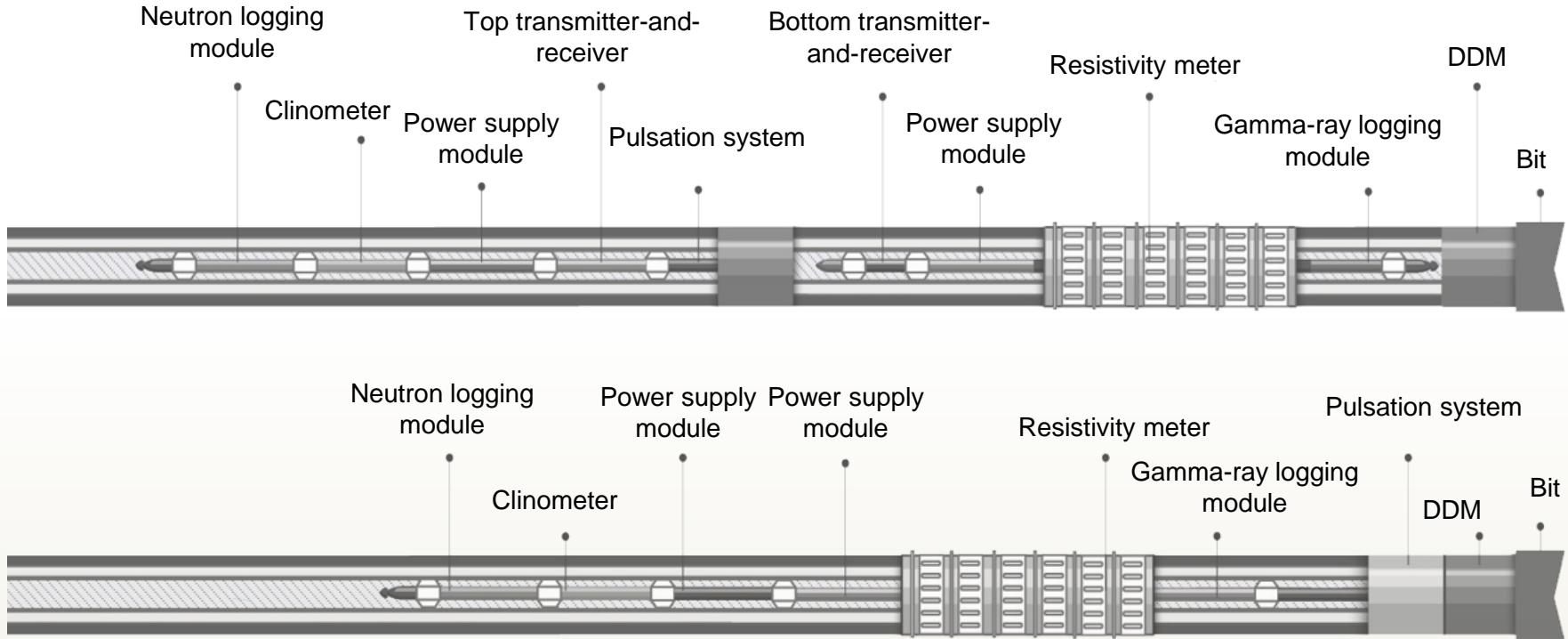




# TECHNICAL CHARACTERISTICS OF M/LWD EQUIPMENT





# TECHNICAL SPECIFICATION



| Parameter  | Meas. units | Value |       |       |        |        |        |
|--|-------------|-------|-------|-------|--------|--------|--------|
|  |             |       |       |       |        |        |        |
| Diameter   | mm          | 73    | 89    | 106   | 120    | 170    | 203    |
| Maximum operating temperature                                    | degr, C°    | 150   |       |       |        |        |        |
| Maximum operating pressure                                       | MPa         | 100   |       |       |        |        |        |
| Maximum torque   | kN*m        | 9     | 11    | 14    | 16     | 27     | 27     |
| Maximum allowable spacial intensity at rotary drilling           | degr/m      | 16/10 | 13/10 | 10/10 | 4.9/10 | 3.3/10 | 2.6/10 |
| Maximum allowable spacial intensity at controlled-angle drilling | degr/m      | 32/10 | 27/10 | 20/10 | 9.8/10 | 6.9/10 | 4/10   |
| Maximum rotor speed  | rpm         | 80    |       |       |        |        |        |
| Flow rate  | l/s         | 6     | 8     | 8–12  | 9–18   | 9–28   | 25–50  |
| Maximum sand content   | %           | 1     | 1     | 2     | 2      | 3      | 3      |
| Continuous run time  | hour        | > 200 |       |       |        |        |        |
| Maximum peak loads   | g           | 500   |       |       |        |        |        |
| Maximum vibration loads  | g           | 30    |       |       |        |        |        |



# REAL-TIME MEASUREMENT DATA



| Parameter                                   | Meas. units | Value                      |
|---|-------------|----------------------------|
| Drill pipe pressure at drilling             | MPa         | 0 to 100                   |
| Pressure at drilling – Annulus              | MPa         | 0 to 100                   |
| Three impact and vibration axes             |             | Low low, low, medium, high |
| BHA behavior – Stick-lip (Stick-Slip Level) |             | Low low, low, medium, high |
| BHA torque                                  | kN*m        | 0–30                       |
| Weight per bit                              | kN          | 0–30                       |
| Rotary speed                                | rpm         | 0–300                      |
| Circulation determination                   |             |                            |

## CLINOMETER

|                               |      |          |
|-------------------------------|------|----------|
| Zenith angle                  | degr | 0–120    |
| Azimuth                       | degr | 0–360    |
| Deflecting device position    | degr | 0–360    |
| Gravity field status (GTotal) | g    | ±2       |
| Magnetic field intensity      | nT   | ±100,000 |



# REAL-TIME MEASUREMENT DATA



## GAMMA-RAY LOGGING MODULE

|                            |       |            |
|----------------------------|-------|------------|
| Gamma-ray logging          | mcR/h | 0.2–250    |
| Gamma-ray spectral logging |       |            |
| Weight content: Potassium  | %     | 0.1 to 20  |
| Thorium                    | ppm   | 0.1 to 200 |
| Uranium                    | ppm   | 0.1 to 200 |

## MPK48-ПБ

|   |        |      |
|---|--------|------|
| Water-filled porosity according to 2HHKт                              | % abs. | 0–40 |
| Water-filled porosity according to the neutron gamma-ray logging data | % abs. | 0–40 |

## RESISTIVITY METER

|  |       |            |
|--|-------|------------|
| Angular phase difference as per 11", 22", 27", 36" sonde; frequency of 2 mHz and 400 kHz | Ohm*m | 0.1–10,000 |
| Amplitude as per 11", 22", 27", 36" sonde; frequency of 2 mHz and 400 kHz                | Ohm*m | 0.1–200    |



# MWD CLINOMETER MODULE



- ▶ The CM-DOZ clinometer module is used as part of the DTS-48 downhole telemetry system in order to measure angular parameters, when drilling horizontal and directional oil and gas wells. It allows conducting researches under high temperatures, increased pressures, high impact loads.
- ▶ The instrument measurement results are transmitted to the surface and received by the gathering network for decoding and further processing.

| Parameter                        | Meas. units | Range    | Absolute precision | Permit   |
|----------------------------------|-------------|----------|--------------------|----------|
| Zenith angle                     | degr        | 0–120    | ±0.1               | 0.1      |
| Azimuth                          | degr        | 0–360    | ±1                 | 0.1      |
| Deflecting device position       |             |          |                    |          |
| Magnetic                         | degr        | 0–360    | ±1.5               | 1.0      |
| Gravity                          |             |          | ±0.5               |          |
| Magnetic field inclination angle | degr        | 0.4      | ±0.3               |          |
| Gravity field status             | g           | ±2       | 0.001              | 0.000050 |
| Magnetic field intensity         | nT          | ±100,000 | 100                | 3        |
| Operating temperature            | C°          | -20 +150 |                    |          |



# DRILLING ELECTROMAGNETIC LOGGING MODULE «RESISTIVITY LWD»



| TOP    |        |        |        | MEASUREMENT POINT |        | BOTTOM |        |        |        |
|--------|--------|--------|--------|-------------------|--------|--------|--------|--------|--------|
| T1     | T2     | T3     | T4     | R1                | R2     | T5     | T6     | T7     | T8     |
| 36"    | 27"    | 22"    | 11"    | 4"                | 4"     | 11"    | 22"    | 27"    | 36"    |
| 910 mm | 690 mm | 570 mm | 280 mm | 100 mm            | 100 mm | 280 mm | 570 mm | 690 mm | 910 mm |

Compensated borehole sonde 36" – T1+T8  
Compensated borehole sonde 27" – T2+T7

Compensated borehole sonde 22" – T3+T6  
Compensated borehole sonde 11" – T4+T5





# LWD DRILLING ELECTROMAGNETIC LOGGING INSTRUMENT «RESISTIVITY LWD»



| $R_F = 1 \text{ OHM} \cdot \text{M}$      | Logging depth |         |         |         | Vertical resolution** |
|---|---------------|---------|---------|---------|-----------------------|
| $R_{XO} = 0.5 \text{ OHM} \cdot \text{M}$ | 11"           | 22"     | 27"     | 36"     |                       |
| 2 MHz phase shift                         | 442 mm        | 579 mm  | 630 mm  | 711 mm  | 203 mm                |
| 400 kHz phase shift                       | 642 mm        | 819 mm  | 885 mm  | 991 mm  | 305 mm                |
| 2 MHz amplitude decay                     | 742 mm        | 932 mm  | 1003 mm | 1118 mm | 203 mm                |
| 400 kHz amplitude decay                   | 1151 mm       | 1415 mm | 1515 mm | 1676 mm | 305 mm                |

| $F = 1 \text{ OHM} \cdot \text{M}$        | Logging depth |         |         |         | Vertical resolution** |
|---|---------------|---------|---------|---------|-----------------------|
| $R_{XO} = 0.5 \text{ OHM} \cdot \text{M}$ | 11"           | 22"     | R27"    | 36"     |                       |
| 2 MHz phase shift                         | 442 mm        | 579 mm  | 630 mm  | 711 mm  | 203 mm                |
| 400 kHz phase shift                       | 642 mm        | 819 mm  | 885 mm  | 991 mm  | 305 mm                |
| 2 MHz amplitude decay                     | 742 mm        | 932 mm  | 1003 mm | 1118 mm | 203 mm                |
| 400 kHz amplitude decay                   | 1151 mm       | 1415 mm | 1515 mm | 1676 mm | 305 mm                |