

MK40T-20 Coiled Tubing Unit

MK40T (MK40T-20) Coiled Tubing Unit (hereinafter - Unit) mounted on all-wheel drive chassis (10x10) represents a complete set of equipment for operation with coiled tubing diameter 2". Together with special downhole tools the Unit can be used for sand and paraffin removal, cementing operations, isolation of water-sources, acid treatment and well completion, other repair and research works on all types of wells under pressure on the sealed wellhead. The unit is designed for operation at ambient temperatures from -20°C to +50°C per U1 GOST 15150.



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Technical specification:

Max injector pulling force, kg/lbs	45 900/100K
Speed of CT movements, m/s (m/min):	
– minimum	0,015 (0,9)
– maximum	0,60 (36)
CT diameter, mm	up to 50.8
Max CT length on the reel, f	
– 44.45 mm (1.75") CT	22 965 f
– 50.8 mm (2") CT	18 100 f
Max CT weight allowed by design, kg	23 000
Max wellhead pressure, MPa	70
Max pressure of pumping of technological fluid allowed by design, MPa (max pumping pressure during operation is determined based on CT strength parameters)	70
Overall dimensions, mm, not more:	
– Length	16 500
– Width	2 550
– Height	4 500
Full weight, kg (without fluid in CT), not more	68 000

1. TRUCK CHASSIS

- 1.1. The unit is mounted on all-wheel drive chassis VOLAT (10x10).
- 1.2. The chassis has Volat of fluid cooling with turbocharge, rowed, 6-cylinder, 450 h.p. at 1900 rpm; torque 2200 Nm at 1050-1550 rpm per Euro-2 requirements.
- 1.3. Exhaust system equipped with spark arrestor with GOST certificate.
- 1.4. VOLAT transmission, 10+2 gears, synchronized.
- 1.5. VOLAT transfer case.
- 1.6. Single tires Michelin 16R20. One spare wheel with mechanic hoist.
- 1.7. First and second axles steering.
- 1.8. Suspension on the first and second axles with multilayer springs and telescoping hydraulic type dampers. Medium axle has pneumatic suspension with dampers. The rear axles gas multilayer spring suspension. Stabilizer of transversal stability on the 3rd axle.
- 1.9. Block on interaxle and inter-wheel differentials on rear axles.
- 1.10. Fuel tanks of 900 liters combined capacity.
- 1.11. Cab over engine AD series, 2 seats, no sleeper. Driver's seat on air suspension, adjustable, with head support and safety belt; passenger's seat adjustable with safety belt. Cabin is painted RAL 9006.
- 1.12. Truck electrical equipment 24V, two AC batteries 225 Ah each.
- 1.13. Fluid engine heater Eberspaecher. Heated fuel filter. Heated fuel intake.
- 1.14. Heat insulator in the engine chamber.
- 1.15. Autonomous air heater Eberspaecher in the driver's cabin.

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- 1.16. Air-conditioner.
- 1.17. AC heating with air from under hood.
- 1.18. Engine control switch “Cabin – Deck”.
- 1.19. Era-Glonass emergency call device.

2. HYDRAULIC SYSTEM

- 2.1. Pumps drive from truck chassis engine through drive shaft and power take off gearbox.
- 2.2. Pump №1 – axial-plunger variable with hydraulic control for injector drive.
- 2.3. Pump №2 – axial-plunger variable, drives the following:
 - CT reel drive;
 - Cabin lift;
 - BOP rams control;
 - Reel brake control;
 - Injector speed control;
 - Injector chains traction and tension cylinders control;
 - Control of pump #1.
- 2.4. Pump №3 – vane double, installed on the pump #2, drive the following:
 - Reel levelwind control;
 - Power hose reels drive;
 - Injector raise.
- 2.5. For emergency pressure supply to BOP hydraulic cylinders there are four 35 l air-hydraulic accumulators installed.
- 2.6. Hydraulic tank for 550 liters with visual level indicator, thermometer, filling neck with breather and drain filter. Emergency alarm when hydraulic fluid level drops below minimum allowable level.
- 2.7. Hydraulic oil cooler with electric motor on fan drive.
- 2.8. Discharge hydraulic filters in injector drive circuit.

3. OPERATOR’S CABIN

- 3.1. Lifting heat insulated operator’s cabin.
- 3.2. Scissors lifting mechanism providing lifting to 1020 mm with mechanic fix in raise position.
- 3.3. One entrance door.
- 3.4. Autonomous diesel air heater installed in the box whose top cover serves as an additional seat.
- 3.5. Air-conditioner.
- 3.6. Window over the control console, “triplex” type glasses to the whole width of the cabin, with water drain, electrical screen wiper, glass blowing with fans and removable guard grating.
- 3.7. One side window with shifting vent with mosquito net on the wall opposite to entrance.
- 3.8. LED lamps for internal lighting 24V. All wiring is ducted.
- 3.9. Six 24V diode lights of external lighting switched from inside the cabin from control console. One yellow flushing light.

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- 3.10. The cabin has one mobile office height adjustable operator's chair with armrests. In transport position this chair is fixed to the cabin wall.
- 3.11. One folding seat mounted on the rear cabin wall.
- 3.12. In the front part of the cabin there is located a removable panel for access to hydraulics of control console.
- 3.13. Control console has the following installed:



- 3.13.1. Control handles for quad BOP and auxiliary single BOP. Controls for blind and shear rams of quad BOP and auxiliary BOP have red handles, all other handles are black. Blind and shear rams controls and auxiliary BOP control handles have lock preventing accidental switch.
- 3.13.2. BOP control pressure gauge.
- 3.13.3. BOP pressure supply valve.
- 3.13.4. CT stripper control valve and pressure gauges. Stripper pressure adjusting reducing valve. Hydraulic liquid is supplied to stripper from high-pressure hand pump with air drive.
- 3.13.5. Each of three injector traction system circuits, chain tension circuit has a valve which isolates the circuit or connects it to pressure supply line, which is previously adjusted with reducing valve, or drain valve. Each circuit has its own pressure gauge.
- 3.13.6. Panel computer of data acquisition systems.
- 3.13.7. Injector speed and direction control block.
- 3.13.8. Adjusting valve for working volume of hydraulic motors of injector drive with pressure gauge.
- 3.13.9. Injector low speed control valve.
- 3.13.10. Injector control pressure gauge.
- 3.13.11. Injector drive regulator with pressure gauge.
- 3.13.12. Control valves for injector chains lubrication and CT spooled on the reel lubrication.
- 3.13.13. Reel drive pressure regulator with pressure gauge.
- 3.13.14. Reel brake control valve with pressure gauge. Hydraulic lock preventing injector movements at activated reel brake.
- 3.13.15. CT reel drive pump pressure gauge.
- 3.13.16. 4-way valve for CT reel control (reel on/off, raise of levelwind and levelwind manual override). Levelwind override control handle is longer than others. Reel direction control handle has a block for reel on from accidental activation.

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- 3.13.17. Injector emergency brake valve painted red.
- 3.13.18. Engine parameters panel display.
- 3.13.19. Hydraulic liquid temperature indicator.
- 3.13.20. Engine speed, stop and emergency kill controls.
- 3.13.21. Electric horn.
- 3.13.22. Switch panel for lighting, screen wiper and fans.
- 3.14. All pressure gauges are liquid filled and have dual scale (psi/bar).
- 3.15. Pressure gauges have highlighted pressure zones prohibited for operation.
- 3.16. Control panel is made from stainless steel and has inscriptions engraved in Russian and English languages.
- 3.17. Diode lighting of control panels.
- 3.18. On the cabin wall there is a plate with recommended pressure values for injector drive, tension and traction.
- 3.19. Inside and outside the cabin there is installed a powder fire extinguisher.

4. DATA ACQUISITION SYSTEM (DAS)



- 4.1. Designed for measurement, control, registration on electronic source, display and visualization of technological parameters during operation of coiled tubing unit.
- 4.2. DAS provides the following:
 - Reading and transfer into digital code of data received from physical values transducers (pressure, temperature, weight etc.) and their calibration;
 - Reading of depth value with the help of increment counter and calculation of round-trip speed;
 - Display of physical values (round-trip speed and depth – constantly, other data can be displayed on request);
 - Warning when established limit values of measured parameters are reached;
 - Automatic switch off of injector drive when allowable loads are exceeded;
 - CT fatigue data acquisition;
 - Registration of parameters on inbuilt memory device;
 - Data transfer to PC with the help of USB flash memory devices;
 - Review and printing of saved data in the form of tables and charts through applied program on any available PC;
 - Possibility of data transfer via Wi-Fi and Ethernet.

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4.3. Registered parameters:

- Time;
- CT depth;
- Round-trip speed;
- Injector load (tubing weight) during pull out of the hole and run in hole;
- Pumping pressure (circulation pressure) of technological fluid;
- Wellhead pressure;
- Injector drive pressure;
- Injector blocks traction pressure (top, middle, bottom);
- Injector chains tension pressure;
- Stripper pack pressure;
- BOP hydraulic line pressure;
- Reel drive pressure;
- Reel drive hydraulic motor pressure;
- Annular pressure;
- Current and total flow of FIDMASH fluid pumping unit;
- Current and total flow of FIDMASH nitrogen pump unit;
- CT run (bar chart for CT sections 1 m long);
- Equipment run (running hours).

4.4. Technical specification:

Power source voltage, V	18 to 36
Current, A, max	2,5
Quantity of measurement channels, ea.:	
- analogue	16
- impulse	1
- frequency	4
Range of input analogue signal, mA	from 4 to 20
Range of input frequency signals, kHz	to 10
Limits of allowable measurement error for analogue channels, %	±2,0
Limits of allowable measurement error for frequency channels, %	±2,0
Limits of allowable absolute depth measurement error, m	±1,0
Registration period, hours, min	840
Data registration discreteness, seconds	1

4.5. Scope of supply:

- Panel computer – provides display and storage of data from control block, has input and output data ports: CAN, USB for USB flash, Wi-Fi for wireless connection to PC; the front panel accommodates sensor display, power and display lighting control buttons, indicator diode;

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- Control block provides connection and power of transducers with unified signal 4-20 mA, with impulse and frequency signals 0-32 V, data processing and transfer to panel computer via CAN bus through cable connected to PC socket, control of CTU protection elements from operation in emergency modes;
- Connection cables;
- Memory module is a 16 Gb USB flash disk for transfer of registered information to any PC with USB port;
- Software provides review on PC in MS Windows XP/VISTA/WIN7 of data saved on USB flash disk in the form of tables, charts and diagrams; printing of reports and charts;
- Operational documents: passport, manual;
- Set of transducers.

5. CONTROL AND MEASUREMENT COMPLEX SKR45 (FIDMASH)

- 5.1. Designed for measurement, control, registration on electronic source, display and visualization of technological parameters during operation of coiled tubing unit
- 5.2. Provides the following:
- Reading and transfer into digital code of data received from physical values transducers (pressure and load) and their calibration;
 - Reading of depth value with the help of increment counter and calculation of round-trip speed;
 - Display of physical values;
- 5.3. Registered parameters:
- Time;
 - CT depth;
 - Round trip speed;
 - Load on injector (pipe load) during lifting and snubbing of CT;
 - Pumping pressure (circulation pressure) of technological fluid;
 - Wellhead pressure;
- 5.4. Data is received from transducers installed on the unit.
- 5.5. Technical specification:

Power source voltage, V	from 18 to 36
Consumer current, A, max	1,5
Quantity of measurement channels, ea.: - analogue - impulse	5 1
Range of input analogue signal, mA	from 4 to 20

5.6. Content:

- Panel computer – provides display of data from control block. The front panel accommodates sensor display, power and display lighting control buttons, indicator diode;
- Control block – provides connection and power of transducers with unified signal 4-20 mA, with impulse and frequency signals 0-32 V, data processing and transfer to panel computer via CAN bus through cable connected to PC socket;

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- Connection cables;
- Set of operation documentation: passport, operation manual.

6. CT REEL

- 6.1. Reel drum has geometric capacity of 5500 m of 2" (50.8 mm) / 7000 m of 1.75" (44.45 mm) coiled tubing.
- 6.2. The reel is installed on the steel frame with a tray with plugged drain holes.
- 6.3. Reel drive is performed from hydraulic motor with planetary gearbox with in-built brake.
- 6.4. Reel has a mechanism of smooth laying of CT which is synchronized with reel turning through chain gear with manual adjustment from hydraulic motor through adjustable friction coupling. Levelwind is raised into working position by hydraulic cylinders with locks for maintaining necessary position.
- 6.5. Levelwind head can be adjusted for various CT size.
- 6.6. Levelwind is equipped with mechanical depth counter (indication in meters).
- 6.7. CT reel has 45 mm (1.75") ID swivel installed on the reel shaft for supply of working liquid into CT, rated for 70 MPa pressure. The swivel is protected from the edge by a thick steel bolted plate.
- 6.8. External manifold has two inlets with 2" (50 mm) ball or plug valves. Electronic pressure transducer of circulation pressure indication system. The readings from pressure transducer go to data acquisition complex.
- 6.9. Internal manifold has one 2" (50 mm) plug valve installed between the reel shaft and CT. Manifold design allows dropping the ball into CT string and installing equipment for operation with cable in the CT.
- 6.10. For reel dismantling there is a beam with shackles that allow to lift the reel by two points.
- 6.11. Reel has four turnbuckles for its fixation during transportation.
- 6.12. All high-pressure hoses are led to a single bulkhead and have QD connections.
- 6.13. Lubrication points of all bearings (except for levelwind car and head) are led to two panels located on the reel frame on both sides for access from the ground.
- 6.14. All chains and sprockets have protective guards.

7. INJECTOR FM245



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- 7.1. Maximum injector pulling capacity 45 900 kgf. (100,000 lbs)
- 7.2. Maximum snubbing capacity 22 940 kgf. (50,000 lbs)
- 7.3. Maximum CT speed 0,60 m/sec (36 m/min). Minimum stable CT speed 0,015 m/sec (0,9 m/min).
- 7.4. Injector drive is performed from two axial-plunger variable hydraulic motors through brakes, planetary gearboxes and timing gear. Multidisk brakes normally closed are released automatically when pressure is supplied to drive hydraulic motors.
- 7.5. Both hydraulic lines of pressure supply to hydraulic motors are protected with internal high-pressure filters installed between QD couplings and brake valves. Filters have visual indicators.
- 7.6. Injector incorporates roller chain links with carriers. The tubing grippers are half segment grippers grooved and hardened, elastomerically balanced for optimum tubing grip. Each of the carriers is supported by dual heavyduty bearings.
- 7.7. Tubing traction system incorporates three independent circuits of two hydraulic cylinders each. Tubing traction is applied to the chain blocks through a pair of single piece reversible thru hardened steel skates.
- 7.8. Chain tension is provided by hydraulic cylinders pulling down.
- 7.9. Three air hydraulic accumulators in chain tension lines.
- 7.10. Injector hydraulic system has pressure gauges (chain tension system – 1; chain traction system - 3; drive pressure – 2; brake release pressure – 1).
- 7.11. Injector chains lubrication system represents a system of pressurized spray system with a reservoir and air-driven pump mounted on the injector.
- 7.12. Guiding arch 1830 mm diameter with profile steel rollers and flared fold under tail is fastened on the injector frame on adjustable base.
- 7.13. Guiding arch is equipped with electronic depth indicator driven from measuring wheel. Electronic depth indicator readings go to data acquisition system.
- 7.14. Injector is equipped with electronic load cell. Electronic load cell readings go to data acquisition system.
- 7.15. Injector is equipped with adapter flange for CT stripper mounting.
- 7.16. For lifting of injector, guiding arch, stripper and BOP there is supplied a 4-leg sling with load capacity of 10 000 kg.
- 7.17. The frame has four eyelets over the top operator's platform for lifting of the injector. There are envisaged loops on the frame for fastening of safety belts of maintenance staff.
- 7.18. Injector control high-pressure hoses are led to a bulkhead and have QD couplings.
- 7.19. One set of telescoping supports with screw adjustment for installation of the injector on the platform. Middle section of supports serves for installation of injector with CT stripper on the wellhead platform.
- 7.20. Injector chains have removable guards.
- 7.21. Fall protection device and folding walkways for maintenance.

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- 7.22. Chain plumbing to the wellhead and 4 (four) bracings for injector fastening on the wellhead (included into spares kit).

8. HIGH-PRESSURE HOSES

- 8.1. On the rear platform there are installed three high-pressure hose reels driven by hydraulic motors through a chain gear.
- 8.2. One reel for spooling injector drive hoses.
- 8.3. The second reel for spooling injector and stripper control hoses.
- 8.4. The third reel for spooling BOP control hoses.
- 8.5. All hoses have QD couplings with protective covers and marking.
- 8.6. Length of hoses on the reels is 35 m.

9. PRESSURE CONTROL EQUIPMENT



- 9.1. GT100-70 CT side-door stripper is mounted onto the injector base with the help of a flange.
- 9.2. Bottom connection – QD (CB44).

CT stripper technical specification:

ID, mm/inch	100/4,06"
Working wellhead pressure, Bar	700
Size of sealed CT, mm	Up to 50,8

- 9.3. BP100-70 quad blowout preventer with blind, shear, slip and pipe rams. BOP provides sealing of the wellhead with or without tubing inside the well, hanging the tubing string on rams and support of the string with rams from blowing out by well pressure. Hydraulic rams control with manual fixation in closed position.

BOP technical specification:

ID, inch	4,06
Max working pressure, Bar	700
Temperature of working fluid, °C, max	80
Hydraulic drive pressure, Bar	
– Nominal	160

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|---|-------------------------|-----------|
| – | Maximum | 210 |
| | Size of sealed CT, inch | Up to 2 " |

9.4. BOP consists of the following:

- Integral forged steel body, 100x70 flanges, BX155 GOST 28919 washer;
- Blind rams preventer;
- Shear rams preventer;
- Slip rams preventer;
- Pipe rams preventer;
- Top adapter flange for CT stripper QD connection (CB44);
- Bottom adapter flange with QD (CB44);
- Counterbalance valves on blind and pipe preventers;
- Lateral 50 mm ID with a plug. Connection thread type 1502, 2"

10. ARRANGEMENT

- 10.1. Injector is located in the rear part of the unit tilted for transportation. Guiding arch is constantly fixed on the injector. Injector is raised into vertical position with hydraulic cylinders.
- 10.2. The unit is equipped with aluminum ladders 0,65 m wide with handrails to access the rear platform on both sides and aluminum ladder 0,65 m wide with handrails to access operator's cabin, ladders are transported on the unit.
- 10.3. The Unit has two diode explosion proof rotating fender lights installed on the rear platform.

11. BASIC SPARES KIT**11.1. Basic kit of spare parts includes the following:**

- Hydraulic cylinders spares kits;
- CT stripper spares kit;
- BOP spares kit;
- Seal kit for hydraulic system;
- Set of hoses;
- Bench tools, special tools for maintenance of coiled tubing unit;
- Spare parts for purchased assemblies;
- Flexible rod for CT fitting.

12. MISCELLANEOUS

- 12.1. Unit parts contacting with well environment are supplied in K2 GOST 13862 performance (H2S up to 6%).
- 12.2. The unit is prepared and painted in accordance with NOV Fidmash standards. Color – blue RAL5005.
- 12.3. One set of operating manual in Russian (English available upon request) language in printed form supplied along with the unit, hydraulic and electric schematics.