Integra Group of Companies

2014
1. Integra Group company structure, Products & Services
2. VNIIBT-Drilling Tools company history, structure, manufacturing centers & products
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INTEGRA is one of the leading companies in the oilfield services sector of the Russian market

Established in March 2004

Employees — nearly 9000 people
Companies of Integra Group provide full range of solutions for oil&gas exploration and production

**Products and Services**

- Manufacturing, sale and rental of downhole motors and drilling tools
- Manufacturing and sale of completion equipment
- PCP pumps
- Directional drilling (MWD, LWD)
- Drill bit service
- Open and cased hole logging, perforation, mud logging
- Exploration & Development drilling
- Turn key well construction IPM
- Primary & Remedial cementing
- Coiled tubing services
- Workover
- Slickline equipment manufacturing, sales and services, well testing
- FDP and reservoir consulting services
was established in 2003 from Perm Branch of the Russian Research Institute of Drilling Technologies (VNIIBT) founded on November 26, 1963

1966: First time in the world developed and tested downhole positive displacement motor (PDM) with multi-lobe power section

1979: Commercial manufacturing of geared turbodrills started. Drilling depth record was established in 1983 when Kola superdeep well was drilled using geared turbodrill

1980-1984: during this period 4 licenses were sold to Drillex company transferring PDM technology

Since 2005 we are incorporated into Integra Group of Companies.

Under brand name our products present in international oil & gas market
MANUFACTURING FACILITIES

- Head office
- Manufacturing sites

- Pavlovsk: Turbines, Bearing sections, Rotor & Stator, Test & Assembly
- Kotovo: Coring tools, Fishing tools, Milling tools, Jars

Distance from Perm: to Pavlovsk – 100 km, to Kotovo 2000 km

Share in the Russian market: 40%

Other share in the Russian market
4 Service centers
Usinsk workshop is under construction
UAE workshop is in planning stage

3 Representative offices

Overall Russian rental fleet is over 900 tools* (*end of 2013)

Share in the Russian market
40%
Overall Russian rental fleet is over 90 Turbodrills*  

(*end of 2013)
Quality system of VNIIBT-Drilling Tools Ltd. is certified in accordance with ISO 9001:2008 and API (American Petroleum Institute)
Currently our Company has 92 patents to inventions, useful models and industrial samples.

VNIIBT-Drilling tools was the first one in the world who developed the multilobe PDM and geared Tubodrill.
VNIIBT-Drilling Tools

- PDM **SIBER MOTOR**
- Turbodrills **SIBER TURBINE**
- PC pumps
- Multi-phase pumping units
- Down hole tools rentals and services
- Coring services

VNIIBT-Drilling Tools, Kotovo branch

- Packers
- Fishing tools
- Coring equipment
- Drill string components
- Casing accessories
- Sidetracking system
- Shock absorbers
- Jars **SIBER JAR**
- Milling tools

In 2013 our Company produced 536 PDM, 11 turbodrills, and 1345 Power sections
▪ Unique experience in design and production of turbodrills since 1965

▪ Since company foundation we have designed, produced and put in operations over 30 models and 60 modifications of turbodrills including geared turbodrills

▪ Kola super-deep well (SG-3, 12 263m deep) was drilled with turbodrills of VNIIBT

▪ Today our Company is capable to produce over 100 turbodrills per year.

▪ Turbodrills in Russian service fleet count 90 ps.

▪ Main users of turbodrills in Russia: Rosneft, Surgutneftegaz, Orenburgneft, Tatneft
- Modern machining centers
- High-precision investment casting of turbines
- 4 service centers to perform maintenance of turbodrills
- Unique test bench (Dynamometer) to measure turbine stages power characteristics
1 Right selection of turbodrill:
- bit to rock drilled
- type and size of the turbodrill according to selected bit type and size
- turbodrill characteristics based on flow parameters
- turbodrills equipped with stabilizers and centralizers

2 Right operational parameters:
- correct selection of drilling parameters
- compliance with operations manual requirements
- in time maintenance

3 High-quality maintenance:
- compliance with requirements of parts and spares replacement
- compliance with requirements of repair manuals
SIBERTURBINE HS is a high speed turbodrill for the optimal performance while drilling hard and highly abrasive formations with impregnated bits

- The hydrodynamic principle of fluid circulating in turbine stages energy conversion allows to achieve unprecedented output rotating frequency, up to 2000 RPM
- Our experience shows that in specific conditions ROP was 2-3 times higher with this technology compared to standard
- This significantly reduces well construction time

The main competitive advantage is a patented design of the turbine stage blading

- The use of special configuration provides for improved power characteristics with minimum pressure loss
MAIN ADVANTAGES OF TURBODRILLS

- Modern turbodrills have combination of high speed and torque that is effective in operations with impregnated bits when drilling through extremely hard rocks.

- All turbodrill parts are manufactured of steel that allows to use turbodrills in wells with up to 250°C downhole temperature.
MAIN ADVANTAGES OF TURBODRILLS

- Low vibration level by means of co-axial rotation of turbodrill shafts provides for smooth well bore of high quality and more power delivered for rock cutting

- Absence of direct contact between turbine rotor and stator improves their life time and provides for stable output parameters for longer operations time

- Bearings with PDC inserts provides downhole operation for over 400 circulation hours without need to pull out BHA
MAIN ADVANTAGES OF TURBODRILLS

- Weight on bit with turbodrill is not defined by differential pressure, but by the maximum rate of penetration.

Depending on main turbodrill parameters to calculate in field conditions:

Recalculation formulas:

\[
\begin{align*}
Q_2/Q_1 &= n_2/n_1 \\
(Q_2/Q_1)^2 &= M_2/M_1 \\
(Q_2/Q_1)^2 &= P_2/P_1 \\
\rho_2/\rho_1 &= n_1 = n_2 = \text{const} \\
\rho_2/\rho_1 &= M_2/M_1 \\
\rho_2/\rho_1 &= P_2/P_1
\end{align*}
\]

- To avoid turbine sludging, rig has to be equipped with good mud cleaning system.

- It is possible to pump LCM materials through turbodrills.

- When losses are expected it is recommended to use circulating sub that guides LCM materials to the annular space bypassing the turbodrill.
Top sub with shaft locking mechanism

Turbine stage

Rotor

Stator

Torsion shaft

Upper TC radial bearing

Lower TC radial bearing

Bearing section

Place of centralizer

Turbine section

PDC axial bearing

DRILLING TOOLS
<table>
<thead>
<tr>
<th><strong>Main specifications</strong></th>
<th><strong>ST675AHS.T5</strong></th>
<th><strong>ST475AHS.T1</strong></th>
</tr>
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<tbody>
<tr>
<td><strong>Product code</strong></td>
<td>ST675AHS.T5</td>
<td>ST475AHS.T1</td>
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<tr>
<td><strong>Housing OD, mm</strong></td>
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<td><strong>Overall length, m</strong></td>
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<td><strong>Number of stages, pcs</strong></td>
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<td><strong>Pressure drop, MPa</strong></td>
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<td>4,0 - 6,4</td>
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<td><strong>No-load RPM</strong></td>
<td>1890 - 2160</td>
<td>1860-2480</td>
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<td><strong>Stall torque, N·m:</strong></td>
<td>2415 - 3150</td>
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<td><strong>Max power, kWt</strong></td>
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<td><strong>WOB, ton</strong></td>
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<td><strong>Life time, hours</strong></td>
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</table>
Relation between turbodrill torque to shaft rpm

Relation between turbodrill pressure drop to shaft rpm
Relation between turbodrill torque to shaft rpm

Relation between turbodrill pressure drop to shaft rpm
A unique experience in design and manufacturing of turbodrills since 1965

- Turbodrills design using computer programs for 3-D modeling
- Use of new technologies in development and manufacturing
- Gain all experience in actual wells drilled
- Specially designed thrust bearing to ensure highest reliability
- Turbine stage design modelling using special hydrodynamic software
- High-precision wax casting of turbine stages and quality control on specially designed test stand
- Loads and shaft dynamics modelling
## Development history of turbodrills thrust bearing

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
<th>Diameter and Regions</th>
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</thead>
<tbody>
<tr>
<td>1965</td>
<td>Ball multi-row thrust bearing</td>
<td>Used in USSR on all standard turbodrills</td>
</tr>
<tr>
<td>1999</td>
<td>PDC bearings development of its own production with inserts made in Russia</td>
<td>Used in Turbodrills 127 and 178 mm Dia for drilling in Siberia and Tatarstan</td>
</tr>
<tr>
<td>2001</td>
<td>Use PDC inserts manufactured in China reliable supplier</td>
<td>Used in 127 and 178 mm Dia for drilling in Siberia, Orenburg region, Tatarstan, China and Kazakhstan</td>
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<tr>
<td>2012</td>
<td>PDC bearings with stages made in USA</td>
<td>SIBERTUBINE 4 ¾” and 6 ¾” OD</td>
</tr>
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</table>
Best result of using turbodrill 178 mm Dia in China

Turbodrill drilling time

ROP before using turbine

ROP with turbine

ROP was increased more than 2 times
Turbodrill line **ST675HS** (TSSH-178). China, Daqing

Interval: 2900 – 3628m.

Arrangement: Bit 215.9K705 (Smith) + **ST675HS**

Operation time = 330 hours, of them mechanical drilling time = 293.5 hours

Penetration = 728 m

Mean ROP = **2.48 m/hour**

Mean ROP of the same interval with previous technology and rock bit – **1.5 m/hour**

**Turbodrill with impregnated bit saved 8 drilling days**
Turbodrill line **2ST675HS (2TSSh-178T)** Dolan-Erdniev field, Kalmykia

Intervals: 4899 – 4977m, 5069 – 5157m

Arrangement: Bit 215,9 DDR3560-A1 (ReedHycalog) + **2ST675HS** + KLS215,9 (integral spiral blade stabilizer) + UBT178 (drill collars) (54,5 m)

Drilling time = 96 hours, time of circulation = 150 hours. Penetration = 166 m. Q=23-24 l/sec. P=23-24MPa

Mean ROP = **1,73 m/hour**

Mean ROP with previous technology was **0,5 m/hour**
Turbodrill line 2ST675HS (2TSSh-178T). Zhanazhol field, Kazakhstan, Great Wall

Interval: 2740 – 3192m
Arrangement: Bit 215,9 K707 (Smith) + 2ST675HS + UBT159 (9 m) + stabilizer KLS 215,9 + UBT 159 (213 m)

Drilling time = 134,3 hours, circulation = 145,8 hours. Penetration = 452m. Q = 25-32 l/sec. P = 15-22 MPa

Mean ROP = 3,37 m/hour

Mean ROP when drilling in same interval by PDMs was 1,7 m/hour

Turbodrill with impregnated bit saves 7 drilling days
Turbodrill **ST962AHS.TV2** (TO3-240)

Uighur region, China

Drilling interval: 4386 – 4406m

Arrangement: Bit 311 Ti3205 (China) + **ST962AHS.TV2** + UBT229

Running time = 152.7 h

Mud flow-rate =50-55 l/sec

Operation pressure =24-30 MPa

Penetration = 130 m

Mean ROP = **0.97 m/hour**

Mean ROP of an analogous interval with previous technology 0.7 m/hour

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Turbodrill with impregnated bit saves 2.2 drilling days
SIBERTURBINE GR is turbodrill with planetary gear reducer, is the only real alternative to drill high-temperature wells and in cases when high-value torque PDC bits are used.

- RPM is decelerated multiply due to a special planetary gear reducer that is able to withstand extremely high loads.
- Additionally downhole torque increases multiply which is passed downhole to drive highly aggressive PDC bits.
- All parts of the bearing section are oil filled.
- Relit (TC)-face seals provides reliable sealing.
<table>
<thead>
<tr>
<th>Main specifications</th>
<th>ST962GR.TS</th>
<th>ST675GR.T2/T5</th>
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<td>- bit box</td>
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<td>WOB, ton</td>
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<tr>
<td>Life time, hours</td>
<td>1200</td>
<td>1200</td>
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</tbody>
</table>
Relation between turbodrill torque to shaft rpm

Drilling range

- 3900 lpm (1030 gpm)
- 2400 lpm (634 gpm)

Relation between turbodrill pressure drop to shaft rpm

Drilling range

- 3900 lpm (1030 gpm)
- 2400 lpm (634 gpm)
Relation between turbodrill torque to shaft rpm

Relation between turbodrill pressure drop to shaft rpm
CONTINUOUS IMPROVEMENT

2009 development of multi-row design with ball thrust bearings
- provides greater durability

2000 developed a new design of turbodrills with adjustable bent housing
- provides for drilling directional wells

1997 developed a new design bearing section for size 240 mm
- improved protection system oil from mud

1994 developed a new planetary gear for size 240 mm
- provides greater load capacity

1990 first design of geared turbodrill TR-240
- bearing section consists of single part

1965 first design of geared turbodrill TRM-195
- bearing section consists of three different parts
- Drilling Kola super-deep borehole SG-3 depth of 12,263 m
- Work in Western Siberia for 30 years
Geared turbodrill line ST675GR (TRO5-178) Orenburgneft, March 2009

Interval: 1200 – 1740 m
Arrangement: PDC bit FMHX 215,9 + turbodrill ST675GR + DC UBT165 (9 m) + stabilizer KLS 215 + DC UBT165 (40 m) + Jar + DC UBT165 (59 m) + TBPK
Drilling time = 24,3 hours
Penetration = 540 m
ROP = 22.2 m/hour.

Geared turbodrill line ST675GR (TRO5-178) Rosneft-Drilling Nefteyugansk, July 2009

Interval: 1295 – 2763 m.
Arrangement: PDC bit FD266SM 215,9 + TRO5-178 + UBT 178 + lightweight drillpipe LBT
Drilling time = 38,2 hours
Penetration = 1468 m
ROP = 38.3 m/hour
Geared turbodrill line ST962GR (TRO-240). Rosneft, March 2010
Arrangement: Bit FX55 295,3 + ST962GR + UBT203 (8m) + KLS292
Interval: 305-1100 m
Drilling time = 17,6 hours
Penetration = 795 m
ROP = 45.2 m/hour

Turbodrill saves 3.2 drilling days

Geared turbodrill line ST962GR (TR-240) Rosneft, March 2010
Interval: 245 – 1170m
Arrangement: Bit FX55 295,3 + ST962GR + UBT203 (9,5 m) + KLS 292 + UBT203
Drilling time = 23 hours
Penetration = 925 m
ROP = 40.2 m/hour

Turbodrill saves 2.8 drilling days
INTEGRA-Drilling Tools have long history and experience in manufacturing and services provision with its in-house downhole drilling technologies and we are ready to supply, rent and provide services to Oman market with high tech most powerful turbodrills

High performance positive displacement motors manufactured by INTEGRA-Drilling Tools can also be used in different wells and with any type of drill bits, both under standard and harsh drilling conditions such as high depth, high temperature, aggressive muds

With our integrated QMS we provide excellent service quality ensuring fit for purpose technology is utilized downhole in wells of our customers

VNIIBT Drilling Tools Ltd./INTEGRA-Drilling tools

24 Karpinskogo Str., Perm, 614022, Russia

Phone: + 7 (342) 211 13 11
Fax: + 7 (342) 280 17 67
Email: reception-bi@integra.ru

www.integra.ru
www.vniibt-bi.ru