

Thru-Tubing Turbodrill

Efficient mechanical power output for harsh-environment milling.

APPLICATIONS

- Coiled tubing, spaghetti pipe, snubbing unit, and workover rig operations in harsh temperature or fluid environments
- Milling operations in High-Pressure, High-Temperature (HPHT) environments
- Underbalanced milling in N₂, CO₂, and air environments
- Acidizing and associated harsh chemical environments
- Milling operations in scale, cement, barium, and sand

BENEFITS

- All-metallic construction that endures exotic drill fluid combinations and HPHT conditions
- All-metallic construction that is not susceptible to gas attack on elastomer components
- Durable design for acids and temperatures up to 572 degF [300 degC]
- Ability to adapt to pressure fluctuations and stalls without tool damage or pipe fatigue
- Ability to operate near the upper pressure limit of the rig without exceeding it, allowing a higher operating flow than a motor
- High and consistent mechanical power output due to all-metallic design
- Manageable cuttings resulting from high speed for improved hole cleaning
- Highly reliable turbine system to facilitate multiple runs
- Efficient turbine system for single- and dual-phase milling fluids without sacrificing output power

Designed to run in high-temperatures and harsh-fluid environments

The 2 $\frac{7}{8}$ inch OD Thru-Tubing (TT) Turbodrill provides the highest downhole mechanical power output for harsh-environment milling by efficiently converting hydraulic energy into mechanical energy.

The all-metal TT Turbodrill is immune to temperature and acid that typically degrade stator elastomers in positive displacement motors. The turbine drive train is ideally suited for two-phase, gas-cut mud systems regardless of gas-cut percentages. Frequent trip outs to change motors are avoided since the turbine can stay in hole for extended periods in high-temperature and harsh-fluid environments.

The system is based on a concentric design with a fluid connect rotor and stator-power drive that produce less reactive drilling torque than conventional positive displacement motors, protecting downhole tools and coil from extended torsional stress. The concentric design ensures significantly less destructive vibration for the turbine and the BHA. The one-piece design incorporating all operational characteristics in a 12- to 15-ft turbine produces a power range for various downhole conditions.

Engineered to improve hole cleaning and produce small cuttings

The TT Turbodrill comprises a system turbine and the i-MILL TT* intervention mill. The mill was developed using an integrated drill bit design platform to ensure a balanced and consistent milling profile capable of efficiently clearing cement and scale from tubing or liners. For application flexibility, the mill can be fitted with appropriate inserts to mill the restricting material.

The i-MILL TT intervention mill on a TT Turbodrill is the most effective mill for harsh environments where clearing cement or scale from tubing or liners to advance production or return flow to acceptable levels is required. The mill operates at a high rotation speed while delivering low torque. It provides extended gauge protection for completions, while producing small, uniform cuttings and increasing hole-cleaning effectiveness.



The TT Turbodrill and i-MILL TT intervention mill provide an effective milling system for harsh environments.

Thru-Tubing Turbodrill

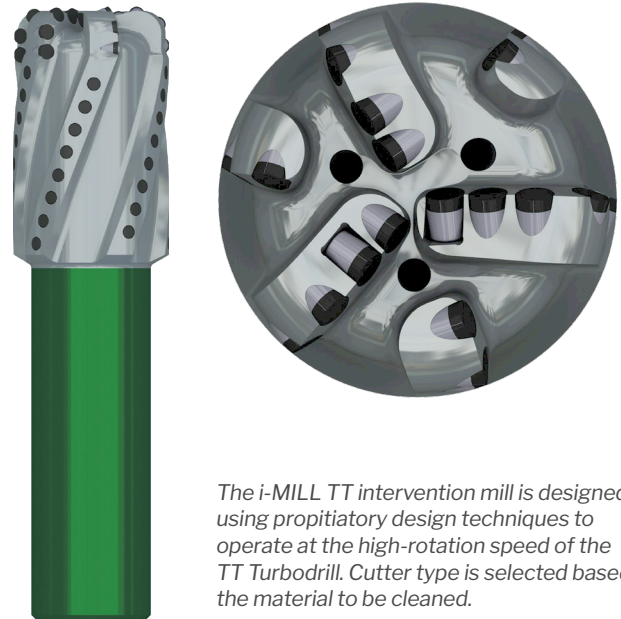
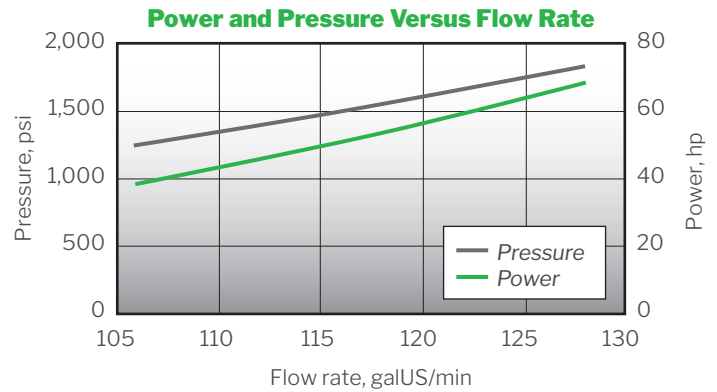
2 7/8 IN. TT TURBODRILL SPECIFICATIONS

Flow rate, galUS/min	100–120
Stall torque, ft.lbf @ 65 galUS/min	150
Operating speed, rpm	2,000–2,500
Max. speed, rpm	4,000–4,500
Mill revolutions per flow rate, rpm/galUS	20.4
Overpull capacity, lbf†	60,000
Overall length, ft	15.92
Max. OD, in	2.875
Shipping weight, lbm	284
Connections (bottom and top)	2 3/8 in. PAC (pin and box)
Max. mud weight, lbm/galUS	18

† Subsequent service in shop is recommended when an excess of 30,000 lbf is applied to the string.

APPLICATIONS

Cutter Type	Milled Material			
	Cement	Scale	Barium Scale	Sand
Impact resistant	■	■		■
Abrasion resistant			■	



The i-MILL TT intervention mill is designed using proprietary design techniques to operate at the high-rotation speed of the TT Turbodrill. Cutter type is selected based on the material to be cleaned.