

## Milling Tool

### ReSOLVE iX extreme-performance instrumented wireline intervention service

Intelligent tractor-powered milling tool to eliminate obstructions

-  **Temperature rating:**  
350 degF [177 degC]
-  **Pressure rating:**  
20,000 psi [138 MPa]
-  **Certification:**  
NACE MR0175 compliant
-  **MillOptimizer\* autonomous milling system:**  
Dynamic orchestration of milling tool and TuffTRAC iX\* extreme-performance wireline tractor actions

#### Applications

- Remove scale and other tubular deposits
- Mill completion accessories

#### Benefits

- Regain well access without introducing potentially formation-damaging fluids
- Access wells with hostile conditions, including sour fluids and high temperatures
- Improve operational efficiency with high-speed, maneuverable, bidirectional, intelligently tractor-powered milling
- Eliminate surface control latency through downhole autonomous milling operations to
  - Conduct reliable, effective, and efficient milling operations
  - Alleviate dependency on personnel expertise and manual monitoring and control
  - Reduce the risk of toolstring or bit sticking
  - Minimize the occurrence and effects of stalling events

#### Features

- Combinability with TuffTRAC iX tractor and high-strength WiRED\* wireline inline release device
- Downhole monitoring by the MillOptimizer system of the head voltage, relative bearing, temperature, torque, and speed to orchestrate interaction between the tractor and milling tool for autonomously performing milling operations
- Real-time measurement of milling progress
- Sour service qualification
- HPHT rating

#### How it improves well intervention

The milling tool component of ReSOLVE iX\* extreme-performance instrumented wireline intervention service enables regaining well access without introducing potentially formation-damaging fluids into the well. Whether in HPHT, deviated, restricted access, or sour well conditions, the instrumented ReSOLVE iX service tools provide real-time monitoring, dynamic tool control, and verified downhole actuation to set new standards for success in well intervention operations. Sensors incorporated in the ReSOLVE iX service tools enable the engineer to monitor tool activity and the progress of downhole operations while responsively controlling the tool for optimal performance. By integrating monitoring and control, ReSOLVE iX service eliminates the reliance on estimates and assumptions that is typical with conventional winch-controlled intervention methods. Conveyance is on wireline by gravity or on tractor in highly deviated and horizontal wells.

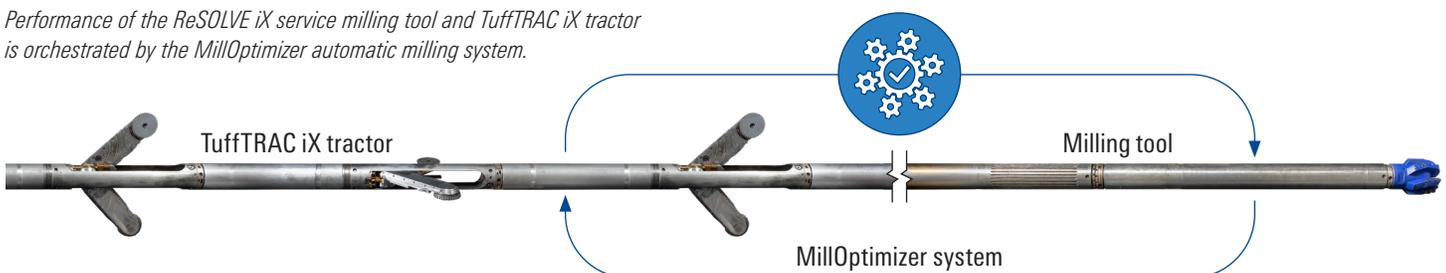
#### How it works

ReSOLVE iX service milling tool mills through debris, scale buildups, tubing restrictions, and any downhole obstruction. The TuffTRAC iX tractor is seamlessly integrated to autonomously drive the toolstring forward and resist rotation while the milling tool's rotating bit engages the obstruction.

Unlike when deploying conventional uninstrumented milling tools, the engineer is fully informed of the tool's performance status through real-time monitoring while dynamically controlling the bit speed and weight on bit (WOB). The MillOptimizer milling system autonomously adjusts the WOB to achieve a particular torque. Bit torque and WOB are constantly monitored to guide adjusting the WOB to maintain a constant bit speed. Through the MillOptimizer system's coordinated control, the tractor and milling tool operate as a single intelligent robotic system to maximize milling efficiency. Bit stalling is also minimized and immediately detected by the MillOptimizer system, which autonomously controls WOB and can stop the tool, disengaging the milling target by reversing the bit and the tractor, and then resumes milling autonomously.

ReSOLVE iX service milling capabilities are easily configurable to adapt to all potential downhole conditions. The wide variety of milling bits and accessories has been engineered and qualified to suit any well configuration and element to be milled. For unique applications, including any metal milling, brushing, and honing, a dedicated Schlumberger wireline engineering team, working together with

*Performance of the ReSOLVE iX service milling tool and TuffTRAC iX tractor is orchestrated by the MillOptimizer automatic milling system.*



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experts across the Schlumberger product lines, can design and qualify a custom milling application upon request.

## What it replaces

Conventional winch-operated milling tools do not collect or use downhole measurements within an in-tool hierarchal control ecosystem. ReSOLVE iX service milling tool seamlessly integrates with the TuffTRAC iX tractor and MillOptimizer system to resolve this gap. Increased operational efficiency and reduced operational risks result as follows:

- Faster ROP is achieved by milling at higher bit torques, which are enabled by the ability of the automated system to prevent bit seizure and motor stall events. If these

do occur, an automated backoff sequence reduces recovery time.

- The service quality of prolonged milling operations is augmented through the engineer's full awareness of tool status.
- Operational risk is reduced through advanced diagnostics triggering tool hardware protection actions for tool rotation, temperature, and overcurrent, based on real-time data rates that are unachievable manually. The head-voltage stabilization controller continuously adjusts the surface power supply to prevent voltage spikes to the downhole tool and overvoltage occurring, assuring maximum milling power availability.

## What else I should know

The milling tool's novel PDC bit is designed and manufactured by Lyng Drilling, a Schlumberger company. Optimized for maximum rate of penetration (ROP) when milling hard scale buildup, this groundbreaking mill bit achieves the highest rate of scale volume milled within the power limits of electric wireline.

## Technical details

For more information, read [SPE-194232](#).

## Specifications

	ReSOLVE iX Service Milling Tool <sup>†</sup>
Output	Milling torque, weight on bit, milling bit speed (rpm), relative bearing (tool orientation) Milling motor temperature Head tension Casing collar locator (CCL) and optional gamma ray Wellbore pressure Wellbore temperature
Milling tool	Milling torque adjusted and managed by the MillOptimizer system in real time using WOB generated by the TuffTRAC iX tractor Max.: 200 lbf.ft [271 N.m] Resolution: 0.5 lbf.ft [0.68 N.m] Milling bit speed adjusted and updatable in real time in acquisition software Max.: 50 rpm Resolution: 0.5 rpm
Mud type and weight	All
Pressure rating	20,000 psi [138 MPa]
Temperature range	32 to 350 degF [0 to 177 degC]
Hole size—min.	2.2 in [55.9 mm]
Tractoring hole size—max.	10.5 in [266.7 mm]
Outside diameter <sup>‡</sup>	2½ in [53.97 mm]
Length—min.	7.83 ft [2.38 m]
Weight <sup>‡</sup>	79.11 lbm [35.88 kg]
Tension	25,000 lbf [111,205 N]
Compression	25,000 lbf [111,200 N]
Special applications	NACE MR0175 compliant for H <sub>2</sub> S and CO <sub>2</sub> resistance Custom bits on request Complete range of standard brushes, hones, and other accessories Fishing capability: Optional 3½- or 2½-in [79.38- or 53.97-mm] WReD devices above and below tractors

<sup>†</sup> All values are for standard specifications and are subject to change without notice. A dedicated engineering team is available for customizing tools to address your challenges.

<sup>‡</sup> Values dependent on configuration.

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