TuffTRAC and TuffTRAC Mono
Cased hole services tractors
TuffTRAC and TuffTRAC Mono

**Applications**
- Production logging
- Logging while tractoring
- Perforating
- Cement and corrosion evaluation
- ReSOLVE* instrumented wireline intervention services
  - Nonexplosive plug setting
  - High-force axial shifting
  - Selective shifting with a universal shifting tool (UST)
  - Milling
- ABC* analysis behind casing services

**Benefits**
- Reduces fishing risk with reverse tractoring capability
- Reduces slippage by using active traction control
- Conveys tools in complex wellbores more cost effectively than coiled tubing or drillpipe
- Enables efficient rig up and rig down
  - Not limited by short rig-up heights
  - Built-in critical systems
- Acquires data quicker for operations with multiple logging passes, both up and down
- Operates without interruption because no cool-down stops are required
- Combines with any wireline cased hole service

**Features**
- Shortest tractor available for greater accessibility
- Reverse tractoring and active traction control for improved maneuverability and reduced slippage
- Modular design with up to eight TuffTRAC* or six TuffTRAC Mono* drive sections
- Logging while tractoring with the TuffTRAC Mono system
- Significantly reduced power requirement and more efficient operations than conventional systems
- Low sensitivity to wellbore conditions
- Versatility to run on any wireline cable
- Simple and robust design
- Built-in critical systems

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*ReSOLVE* and *ABC* are trade names of Halliburton, a subsidiary of the National Oilwell Varco Corporation.
Modular TuffTRAC tractor service is the shortest tractor available and the only tractor with reverse tractoring and traction control capability. The TuffTRAC Mono system conveys logging while tractoring with precise speed control up- and downhole.
Powered conveyance
TuffTRAC powered conveyance brings speed and versatility to high-angle wells, eliminating the conventional reliance on coiled tubing and drillpipe conveyance to reduce cost, time, and risk and simplify operations. The bidirectional, high-speed tractor provides large pull and push forces that are precisely controlled from the surface. Sensors incorporated in the TuffTRAC tractors enable the engineer to monitor tractor response and the progress of downhole operations while responsive controlling the tractor for optimal performance. In combination with a telemetry cartridge, TuffTRAC Mono service delivers logging-while-tractoring functionality to greatly increase the efficiency of production logging and well-integrity monitoring operations.

Responsive control
Engineered to withstand the impact of perforation gun detonation, the TuffTRAC and TuffTRAC Mono tractors have low sensitivity to well conditions and can deploy any Schlumberger cased hole service, including perforating, production logging, cement and corrosion evaluation, ReSOLVE instrumented wireline intervention, plug setting, and ABC analysis behind casing services. Despite its short modular configuration, built in to the tractor are critical systems for perforating operations: electrical release, head tension, shock absorption, casing collar log (CCL), and addressable tractor perforating safety switch.

Although the TuffTRAC tractor has low power requirements, all TuffTRAC modular configurations can achieve a maximum speed of 3,200 ft/h [975 m/h]. It is compatible with all multiconductor wireline cables. With similar low-power requirements and a maximum speed of 2,400 ft/h [731 m/h], the TuffTRAC Mono tractor can also be run on monocable for ready combination with a telemetry cartridge to convey both up and down while-tractoring passes of logging toolstrings.
Reverse tracting and active traction control provide precise speed control, improve maneuverability, and minimize slippage.
## TuffTRAC Mono Configurations

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<tbody>
<tr>
<td>2 Drive</td>
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<tr>
<td>6-Drive Tandem</td>
<td>Length:† 42.97 ft [13.09 m]</td>
<td>Weight: 746 lbm [338 kg]</td>
<td>Typical application: heavy loads, difficult completions, 1,800-lbf [8,000-N] push</td>
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</table>

†Including a 2.8-ft [0.85-m] logging head and 1.3-ft [0.4-m] adapter
Modular versatility
The two-drive TuffTRAC configuration, incorporating the perforating systems, is only 14.2 ft [4.3 m] long. TuffTRAC configurations typically employ two to four drive sections. The addition of a tandem sub increases functionality by enabling independent surface control of the drives above the tandem sub from those below. Up to eight drive sections can be run to pull long cables and push heavy loads in difficult completions. The TuffTRAC Mono tractor can accommodate up to six drive sections.

Efficiently powered
The electromechanically driven TuffTRAC wheels optimize available surface power, achieving more than 45% conversion efficiency from the supplied electrical power. Conventional continuous-drive tractors have high power requirements, with only 10% to 20% efficiency. The low power requirements of the TuffTRAC tractor mean that auxiliary systems are not additionally stressed, and the TuffTRAC tractor does not have to be stopped to cool down, even in dry gas wells.

Unparalleled maneuverability
Two exclusive features of the TuffTRAC tractor are reverse tractoring and active traction control. Traction control enables continuous control of the radial force applied by the tractor arms. If slippage is detected, the radial force can be increased to increase the traction. Once the difficult section of the well is successfully traversed, the radial force can be decreased to avoid unnecessary wear of the wheels and other drive components and to conserve energy. Because the radial force that the arms apply to the walls of the well is independent of the wellbore size, the TuffTRAC drives can achieve the same tractoring force in well IDs from 3.4 to 10.6 in [8.6 to 26.9 cm].

Compatible with all multi-conductor cables, the TuffTRAC tractor does not require specialized cable for deployment. The TuffTRAC Mono tractor can also be run on monocable for perforating and while-tractoring logging operations.
Integrated systems reliability

Despite its compact length, the TuffTRAC tractor incorporates multiple systems that increase the safety and reliability of tractor operation. The tension load cell located in the TuffTRAC upper head provides valuable real-time information about tool motion, slippage, and additional loading caused by the winch. An addressable cable-release device prevents unintentional pull-off when gun firing causes the toolstring to jump. It also enables reliable cable release if the tool is stuck in an extended-reach horizontal well and the tension force available at the head by pulling on the cable is insufficient to break the weakpoint. Perforation safety components prevent accidental application of the high voltage used for the drive motors to the perforating guns. Other safety features are the multiple-use shock absorber and fail-safe opening system, which automatically closes the arms if power is lost.

The TuffTRAC tractor is a CE certified tool that meets the Low Voltage, Machinery, and Pressure Equipment Directives of the European Union.

The simple, robust TuffTRAC cased hole services tractor is the only tractor that provides reverse-tractoring capability in highly deviated wells.
TuffTRAC Mono logging while tractoring enables acquiring down passes of Flow Scanner® production logs for low flow rates and in gas wells.
Case Studies

Up to 300% injectivity increase from 66 reperforating runs on TuffTRAC tractor in four horizontal wells

Cook Inlet Natural Gas Storage Alaska (CINGSA) had drilled and completed five horizontal natural gas storage wells in the Kenai gas field. When initial flow tests came in below expectations after tubing-conveyed perforating at high overbalance, CINGSA decided to increase the reservoir pressure and reperforate at balanced pressure. This remediation strategy would minimize perforation damage to produce more efficient perforation tunnels for injection.

PowerJet Omega* deep penetrating perforating shaped charges were chosen to deliver the deep penetration needed to bypass the existing damage zone. The TuffTRAC tractor is ideal for conveying the perforating systems in the horizontal wells because it is engineered to withstand the impact of the gun detonations and it also has low sensitivity to well conditions. The durable TuffTRAC tractor made 66 trouble-free descents, totaling 47,132 ft, to shoot 1,790 ft of perforating guns using PowerJet Omega charges.

Reperforating conveyed by the TuffTRAC tractor delivered the results CINGSA wanted: injection rate increases of 50% to 300% for the four wells that were worked on.

An engineer prepares the TuffTRAC tractor before a job.
When a third-party plug became stuck in a Talisman Energy Inc. well in Malaysia, it was successfully fished and lowered to a hang-up depth of 2,754 m. At this depth the well inclination was too high for the braided line to move it any farther. Unless the plug could be pushed to depth with a tractor, Talisman would have to mobilize a coiled tubing unit before the well could be returned to production and to provide access for perforating operations.

Conditions in the well are extreme: 45-ppm H$_2$S and 45% CO$_2$. To ensure that the performance of the TuffTRAC cased hole services tractor would not be impeded by the high H$_2$S and CO$_2$ levels, the TuffTRAC tractor team at the Schlumberger Houston Conveyance & Surface Equipment Center developed a maintenance plan to minimize any exposure effects. The tractor force required to push the plug to bottom was modeled with the tool planner, which recommended using three drive sections.

The TuffTRAC tractor was run to the depth of the plug and the drive sections were engaged to push the plug to bottom. Tractoring speed was initially 1,800 ft/h and then increased to 2,100 ft/h for the remainder of the 799-m descent. More force was applied in several intervals in the well to keep the plug continuously moving to the required TD.

Because the TuffTRAC tractor could successfully operate in these extreme well conditions to move the plug and return the well to production, Talisman saved USD 300,000 by not having to conduct the operation on coiled tubing.
An operator in Myanmar needed to set a plug on wireline in a gas well to shut off water production. The well deviation was too high to run in hole by gravity alone, and a 1-ft-long gap in the tubing made it difficult to enter the section below the gap and also presented a risk of hanging the tool against the upper section when pulling out. Because of these challenging conditions, the first deployment attempt on slickline and a second one on coiled tubing had both failed.

The 1-ft gap in the tubing posed conveyance risks during both descent and pulling out.
Unlike these previous conveyance attempts, the TuffTRAC tractor successfully negotiated the tubing gap and other restrictions to tractor the ReSOLVE nonexplosive setting tool 3,000 ft to the designated depth for the plug. The ReSOLVE tool was fitted with a custom sleeve to cover the dimension change at the extension piston, which prevented hanging on the tubing ends around the gap. The instrumented ReSOLVE tool measured and reported the compressive force applied to set the plug to provide a distinct plug signature that directly confirmed operational success in real time.
An operator had multiple operations to conduct in an extended-reach well offshore Newfoundland: log for well integrity, perforate, and release and pull a plug. In addition to the well’s challenging geometry, the completion included gas lift mandrels (GLMs), which would have to be navigated by the tools and conveyance method.

The TuffTRAC tractor was configured using a tandem sub for independent control of the tractor drives above the sub from those below. This functionality in combination with the tractor’s active traction control and reverse tractoring capability enabled the TuffTRAC tractor to successfully navigate the GLMs in the completion. Nineteen descents were made over 38 days, totaling a record-setting 85,987 m. Wireline acoustic and cement evaluation services, perforating gun runs, and deployment of a mechanical intervention platform for releasing and pulling a bridge plug were efficiently executed.
## Specifications

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<th>TuffTRAC Tractor</th>
<th>TuffTRAC Mono Tractor</th>
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<tbody>
<tr>
<td><strong>Applications</strong></td>
<td>Cased hole perforating, logging, and intervention</td>
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<tr>
<td><strong>Maximum speed, ft/h [m/h]</strong></td>
<td>3,200 [975]</td>
<td>2,400 [731]</td>
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<tr>
<td><strong>Temperature, degF [degC]</strong></td>
<td>350 [177]</td>
<td>302 [150]</td>
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<tr>
<td><strong>Pressure, psi [MPa]</strong></td>
<td>20,000 [138]</td>
<td>20,000 [138]</td>
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<tr>
<td><strong>Hole size—min., in [cm]</strong></td>
<td>3.4 [8.6]</td>
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<tr>
<td><strong>Hole size—max., in [cm]</strong></td>
<td>10.6 [26.9]</td>
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</tr>
<tr>
<td><strong>Outside diameter, in [cm]</strong></td>
<td>3.125 [7.94]</td>
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<tr>
<td><strong>Maximum pull per drive section, lbf [N]</strong></td>
<td>300 [1,330]</td>
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<tr>
<td><strong>Maximum force, lbf [N]</strong></td>
<td>2,400 [10,680]</td>
<td>1,800 [8,010]</td>
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<tr>
<td><strong>Power, cable compatibility</strong></td>
<td>AC, heptacable</td>
<td>DC, mono- and heptacable</td>
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*Depending on the configuration, excluding the 2.8-ft [0.85-m] logging head and 1.3-ft [0.4-m] adapter. The incorporated CCL, head tension cell, addressable cable-release device, and shock absorber are standard features that do not add extra length.*
TuffTRAC and TuffTRAC Mono

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Schlumberger