



Schlumberger



Production Services Tractor System



A versatile approach
to horizontal
conveyance

Applications

- Production logging
- Analysis behind casing
- Cement and corrosion evaluation
- Perforating and plug setting
- Openhole logging
- Pipe recovery

Benefits

- Acquires more accurate flow data by logging on downpass
- Reduces health, safety, and environmental risk
- Reduces fishing risk with look-ahead capability
- Conveys tools in complex wellbores less expensively than coiled tubing or drillpipe
- Reduces personnel and equipment costs
- Enables fast rig-up, operation, rig-down
- Avoids extra trips to change tools because one tool design works in a wide range of borehole sizes and conditions
- Acquires data more quickly when multiple logging passes are required
- Operates at pressures to 15,000 psi and temperatures to 302°F
- Operates without interruption since no stops are required for the tractor to cool down

Features

- Lower power requirement and more efficient operation than conventional systems
- Inchworm traction system with continuous motion
- Greater reliability than conventional systems
- Ability to log on downpass while tracting
- Minimal borehole contact
- Low sensitivity to borehole conditions
- Versatility to run on any cable

Intelligent tractor traverses complex completions and long horizontal sections

The MaxTRAC* downhole well tractor system is an efficient, intelligent conveyance tractor that permits well data to be acquired during downward, as well as upward, passes; traverses changes in hole diameter and straddles washouts; and negotiates complex completions. Because the tractor is automatically monitored and controlled at surface, it achieves much greater flexibility than traditional systems. It significantly extends the operating window of tractor systems.

This advancement in tractor technology is extremely versatile. The tractor can be used simply to convey logging and perforating tools or to gather detailed information about downhole conditions.

It is engineered to be used in high-angle and horizontal wells to deploy downhole tools that previously had to be conveyed by coiled tubing or drillpipe. Further, the MaxTRAC tractor is simpler to handle and use, has much longer reach, and is far less expensive than either of those conventional conveyance options when conducting completion or intervention programs.

Additionally, since the MaxTRAC tool can log on the downpass, it provides a look-ahead capability to identify and avoid problem areas, rather than tractor into them. Compared with conventional conveyance options, this tractor system significantly reduces the risk of a toolstring becoming stuck in a horizontal well.

The MaxTRAC system integrates with the new generation of production logging tools from Schlumberger to enable real-time surface readout while tracting. Because it enables logging against flow on the downpass, the flow data are of higher quality. And when multiple passes are required, data acquisition is faster with the MaxTRAC system than with conventional tractors, which can log only on up-passes.

A design that is both efficient and flexible

The MaxTRAC tractor's patented, highly efficient design employs an inchworm grip that ensures limited physical contact with the wellbore and reduces sensitivity to debris, rugosity, perforations, slotting, and scale compared with conventional systems.

The MaxTRAC tractor works on an inchworm principle, using two or more tractor sections. As one section grips the casing or formation, the next is resetting.



The MaxTRAC design uses gripping cams to minimize wellbore or formation damage and counteract lift forces prevalent in high-flow-rate wells. The cams lock the toolstring in place even when the tool is stationary and high lift forces are trying to carry the tool and cable uphole.

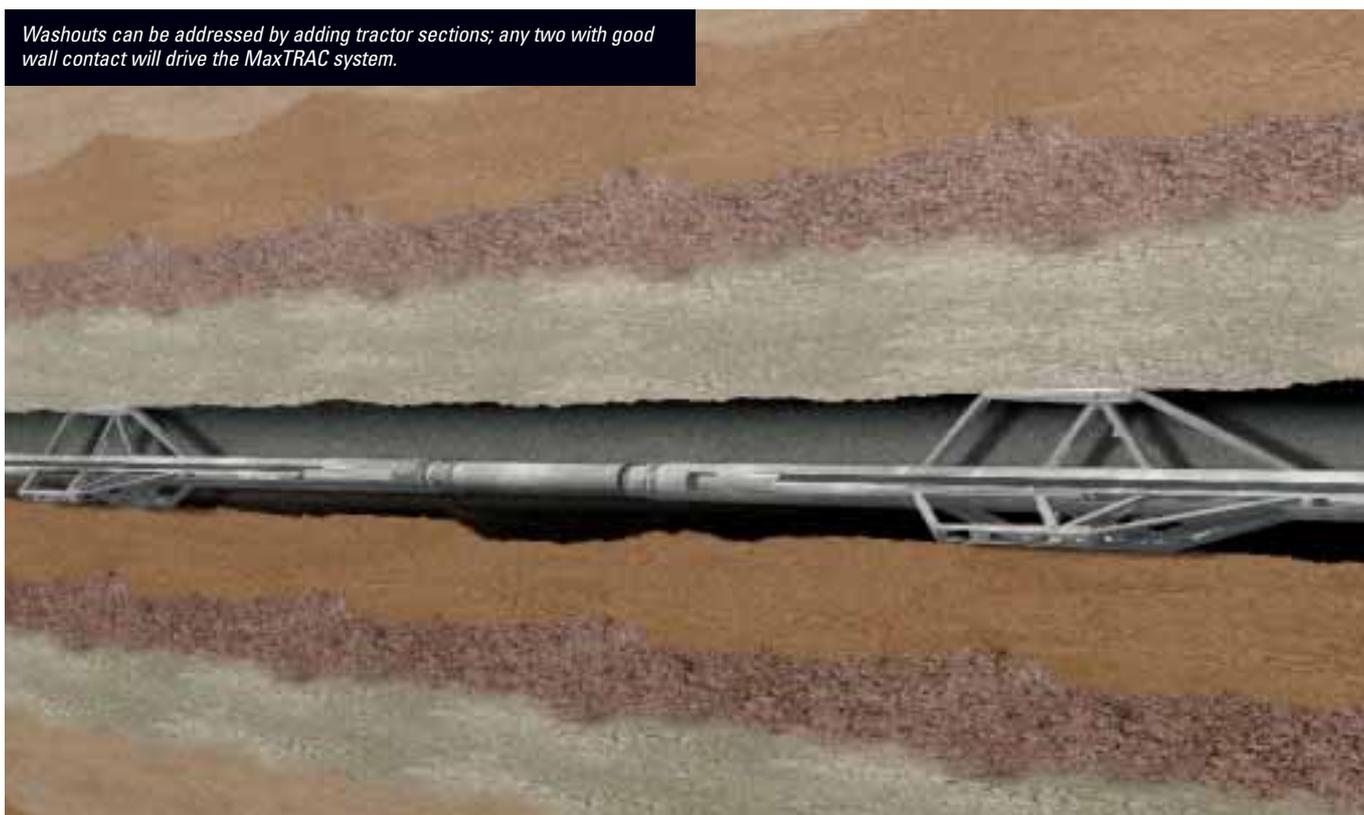
The system's modular design allows operators to space multiple drive sections to straddle diameter changes and washouts. Up to four tractor sections can be used in tandem and are driven by any two that have good borehole contact. Insensitive to borehole irregularities and compatible with standard wellsite equipment, the technology can be used for tractoring in 2.4- to 9.625-in. holes and can tractor through 2.21-in. restrictions without changing tool parts or running tandem tractors.

The MaxTRAC system can be equipped with an electrically releasable weak point. This feature can extend the reach of operations if well trajectory and friction-coefficient input to the model indicate that the tractor may be required to travel beyond the safe distance for a mechanical weak point.

The collapsible arms of the tractor allow passage through restrictions such as a screen assembly.



Washouts can be addressed by adding tractor sections; any two with good wall contact will drive the MaxTRAC system.



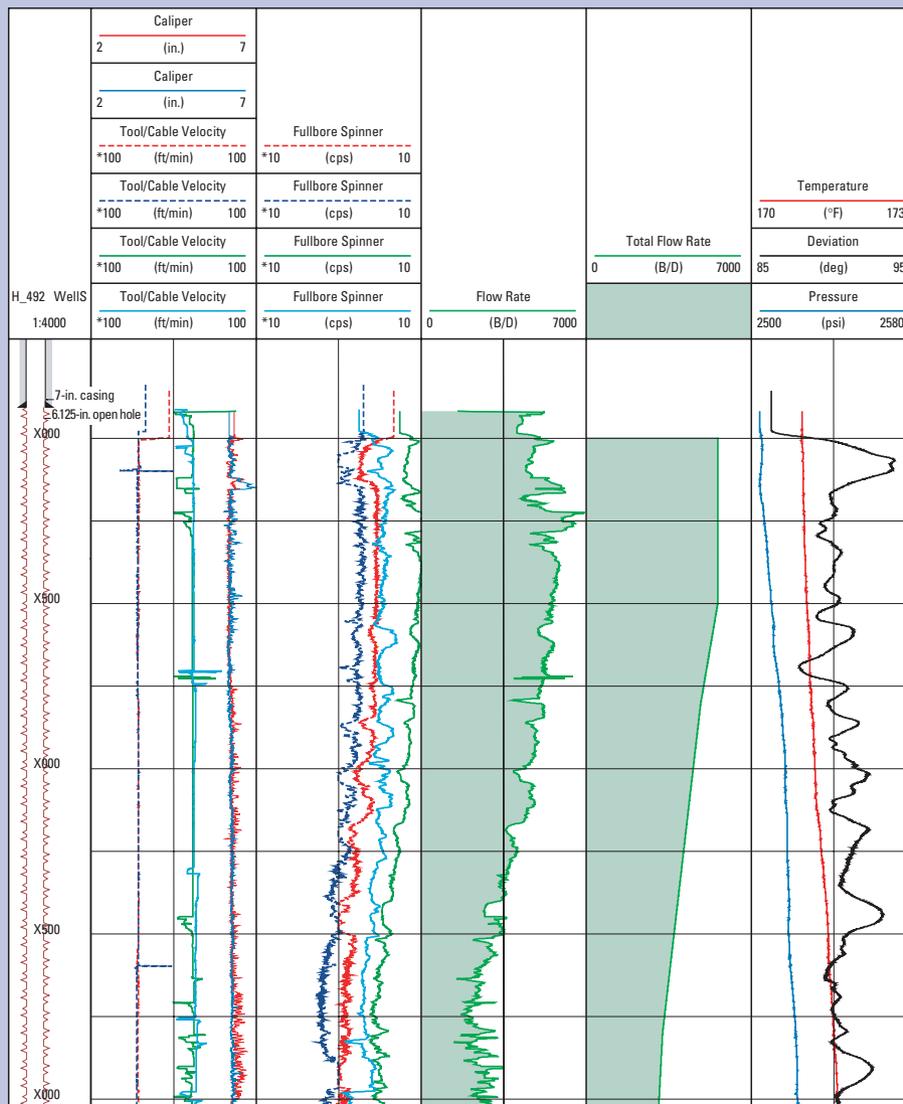
A formation-friendly traction system

The gripping cams of the MaxTRAC system contact the wall only at three discrete points every 2 ft. The arm linkage and cam design allow a constant radial force to be applied to the borehole wall, regardless of the well diameter, ensuring the tool can produce its full motive force in whatever size hole it is tractoring. Casing damage is minimized by the use of a unique cam gripping system, which is also particularly well suited to consolidated formations in open hole.



The cams used by the inchworm traction system to grip the borehole wall minimize borehole damage.

The MaxTRAC system can transmit tool operating data and well measurements in real time while logging, such as these from the PS Platform* production logging sensors. This information allows the wireline engineer to fine-tune tractor control and optimize data acquisition.



Intelligent operation

The MaxTRAC tool sends a constant stream of real-time information to the surface that operators can use to control its operation. In addition to motor current, motor torque, and computed speed for each tractor section, the MaxTRAC system records cable head tension, casing collar location, deviation, and relative bearing.

The MaxTRAC tractor can convey most Schlumberger tools to facilitate formation evaluation, analysis behind casing, perforating and production services, reservoir pressure measurement, and sampling services. Its compatibility with the full range of PS Platform production logging tools enables data to be acquired on the downpass, a capability previously available in horizontal sections only with coiled tubing.

Power optimization

Hydraulic tractors operate at high power levels that can cause auxiliary systems such as heads, collectors, rope sockets, and cables to fail.

MaxTRAC tractors optimize power available from the surface. Whereas conventional tractor systems offer 10 to 20% efficiency, the MaxTRAC system delivers more than 40% efficiency. It requires less power under all conditions, and it never has to stop to cool down—even in dry gas wells.

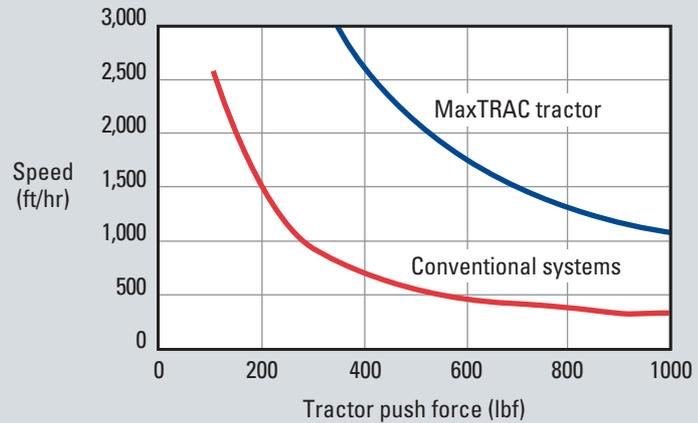
Greater reach—with any cable

Tractor depth can extend to over 30,000 ft, cable strength being the only limitation, and the MaxTRAC tractor can be run on all readily available cable types. The expenses of having to mobilize another type cable and the associated equipment are eliminated. Since it is not limited to helical lockup, tractor reach can often extend beyond the maximum depth achievable with coiled tubing logging.

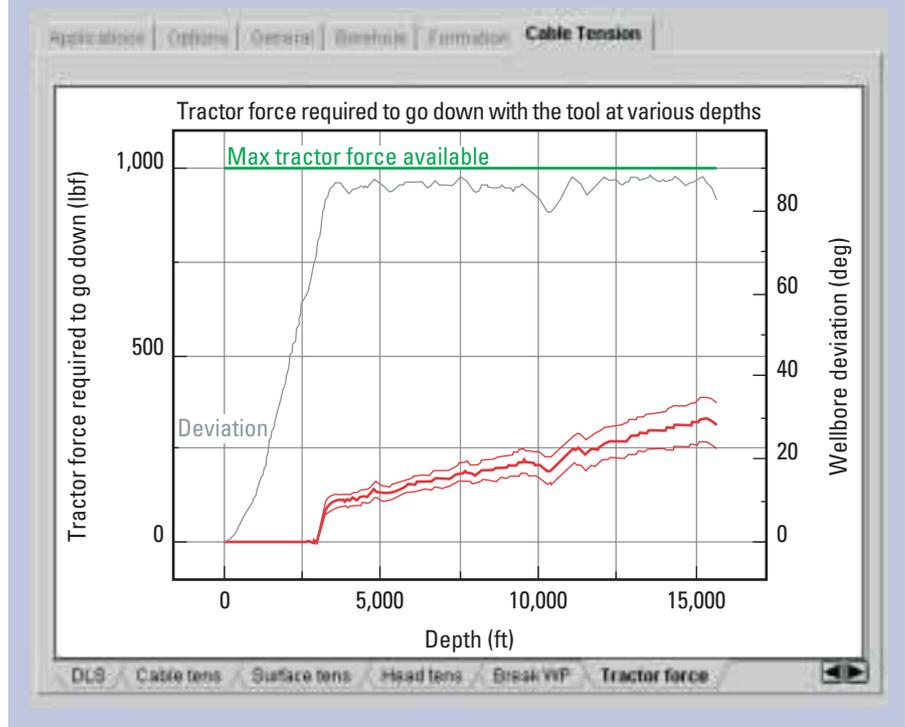
System reliability

Using its logging-while-drilling (LWD) tool technology as a benchmark, Schlumberger designed the MaxTRAC system to perform reliably in demanding environments. It operates smoothly at pressures to 15,000 psi and temperatures to 302°F.

Speed is inversely related to the load capacity of the tractor, given a constant surface power. Since the MaxTRAC system is two to four times more efficient than conventional systems, it can accomplish much more with available surface power.



Proprietary software supports job planning, real-time monitoring, and postjob analysis.



Data reliability

The smooth, continuous motion facilitated by the cam system and the MaxTRAC tractor's ability to accommodate variable hole sizes enhance the quality of data acquired while tractoring. Internal diagnostics and surface control capabilities permit evaluation of such complex completions as Y-tools, gravel packs, screens, and perforated and slotted liners.

Minimal wellsite logistics

The MaxTRAC system is light and heliportable. Its operation requires no manpower or equipment mobilization beyond what is customary for a standard wireline job, and it is rigged up quickly, like wireline. Further, the MaxTRAC system can be used with Schlumberger wireline systems for total solutions in long horizontal sections and complex completions.

Reduced risk

The MaxTRAC system also reduces health, safety, and environmental risk by using proven wireline pressure control equipment; simplifying pressure testing procedures; eliminating handling of heavy equipment; requiring fewer personnel on site; and reducing the time needed to rig up, operate, and rig down.

Software for planning and enhancing operations

Schlumberger has developed proprietary software for job planning, real-time monitoring, and postjob analysis.

With well trajectory and friction coefficient inputs, the software allows fine-tuning of the model while running in hole. This helps to avoid tractoring to a point from which pulling back could be a problem, and it is especially important since friction coefficient, or drag, can be difficult to predict.

MaxTRAC system saves an operator the cost of mobilizing a workover rig

A MaxTRAC tractor successfully conveyed a production logging string through a Y-tool to total depth in an extended-reach horizontal well in the Middle East.

A MaxTRAC tractor was used to log over 16,000 ft of openhole completion.



Flowing and shut-in passes were completed in conjunction with a submersible pumping system.

Using the MaxTRAC system instead of coiled tubing eliminated the need for a workover rig to pull the completion string. There were additional benefits. Since the well was not logged conventionally, nitrogen was not needed to lift production. The expense of nitrogen and the environmental impact of flaring it were both avoided.

Over 14,000 ft of open hole logged in a completion well

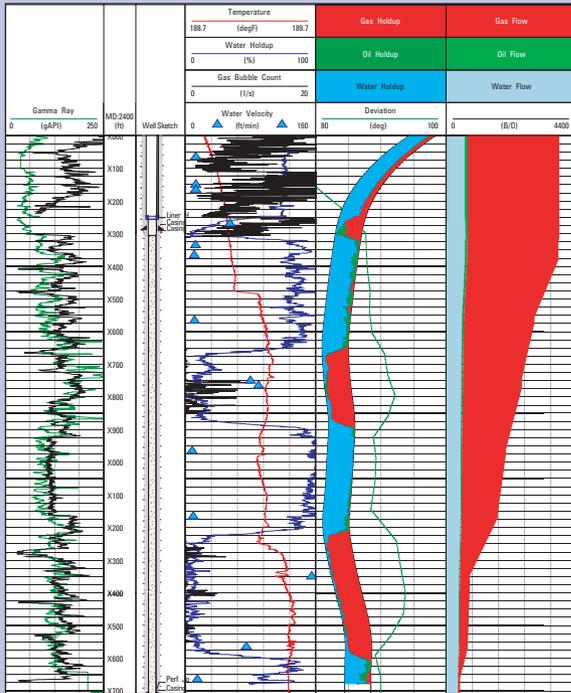
A MaxTRAC tractor, in conjunction with a test separator unit, was used to complete flowing, shut-in, and stationary passes at different flowing rates in a Middle Eastern well.

This operation marked the first time a horizontal section of this length was reached and logged. A conveyance limit of only 3,000 ft had been accepted in coiled tubing operations. Continuous speeds of 1,800 ft/hr were maintained while tractoring and obtaining down-log data.

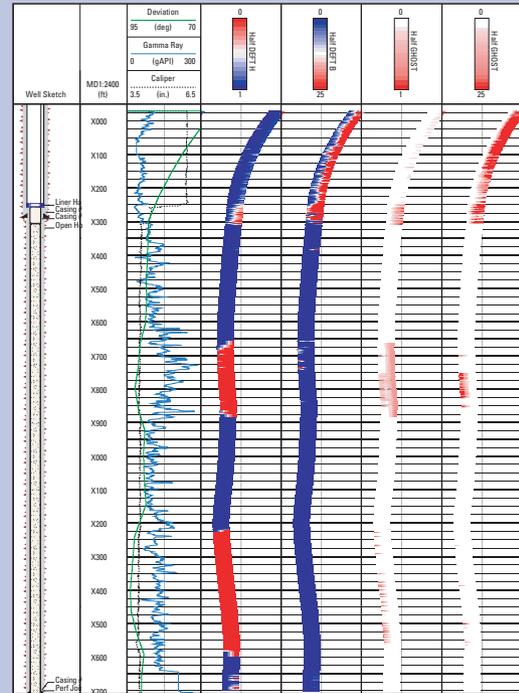
Time saved by acquiring data during tractoring

Concerned about choking well production and destabilizing rates prior to obtaining the production log, an operator in California decided to use the MaxTRAC tractor to log a 1,400-ft horizontal section with a 10°/100-ft dogleg severity through 3½-in. tubing and a 2,200-ft horizontal section with a 17° dogleg severity through 2⅞-in. tubing.

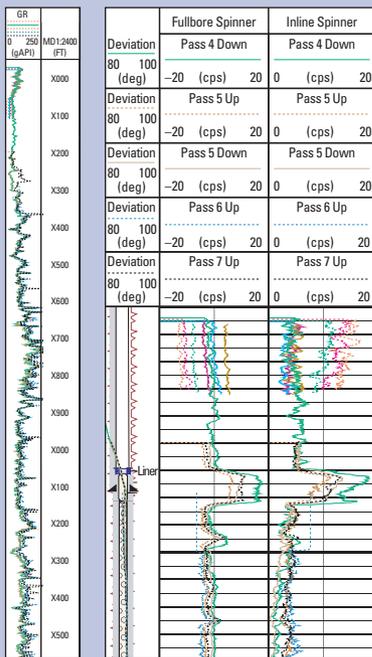
In the first well, the intelligent tractor successfully conveyed the logging string through 7⅝-, 5-, and 4½-in. casing. During its successful run in the second well, the tractor conveyed the logging string through 5- and 4½-in. casing. Four up- and downpasses were made across the entire horizontal section on both wells. The tractor maintained excellent depth control and constant speed on the downpasses, and it saved time since it is uniquely able to acquire data during tractoring passes.



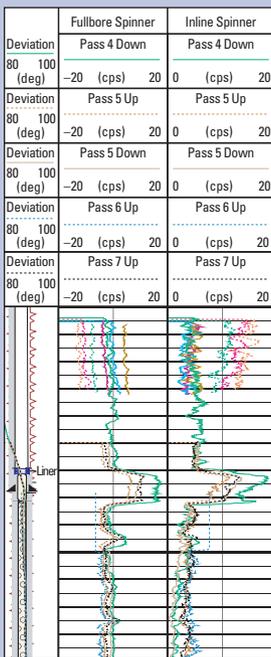
Production logging with the MaxTRAC tractor provides flow profile answers in horizontal wells and reduces run-in-hole concerns.



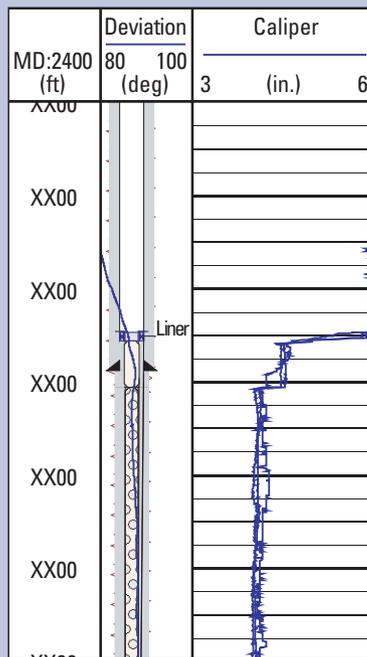
Logging against flow while tracting into the hole provides better flow measurements than logging while pulling out of hole. An interval of over 1,700 ft with deviations up to 95° was logged in this well.



A



B



C

- A. Multiple gamma ray passes showed very good depth control during logging while tracting.
- B. Logging during downpasses in addition to up-passes provided better spinner calibration data.
- C. Borehole diagram software and caliper measurements confirmed that production logging data were successfully acquired while tracting through 4½-in. slotted liner, as well as through 5- and 7-in. casing.

MaxTRAC Operating Specifications

Nominal speed	2,200 ft/hr at 500 lb [671 m/h at 227 kg]
Maximum pull	1,000 lbf [454 kg]
Casing range	2.4–9.625 in. [6.1–24.4 cm] for tractoring
Minimum restriction while tractoring	2.21 in. [5.6 cm]
Maximum reach	Well dependent; must be modeled
Maximum dogleg	45°/100 ft [45°/30.5 m] in 7-in. casing for passage (Tractoring may be less.)
Cable	All readily available types
Motion	Continuous
Completion types	Cased hole, perforated, slotted liner, consolidated open hole

MaxTRAC Mechanical Specifications

Maximum diameter	2.125 in. [5.4 cm]
Length	32 ft [9.8 m] for two tractor sections and a cartridge
Maximum temperature	302°F [150°C]
Maximum pressure	15,000 psi [1,034 bar]
