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# LS™ 600 SONIC DRILL

Product Overview

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Following its tradition of innovative drilling solutions, Boart Longyear is proud to offer the most advanced Sonic drill on the market. With innovative designs and patented technologies, the LS™ 600 drills deeper, produces more accurate samples and serves more markets than any other Sonic rig to date.

## Advanced Design

The LS600 features a pneumatic isolation system inside the head, preventing resonant energy from transmitting to the drill rig. This directs the maximum amount of energy down the drill string to the face of the bit for improved penetration rates. Our advanced design allows heads to last longer, drill faster and go deeper.

## Greater Depths

A turbo-charged 6.6 liter Caterpillar® engine with 228 horsepower fuels the LS600's Sonic head, allowing drillers to reach depths of up to 600 feet.

## Superior Information

The LS600 drills through and samples overburden and soft rock formations at or near 100% core recovery without the risk of refusal and without the use of fluids. In addition to producing a relatively undisturbed sample, the LS600 drills with as little as one percent deviation to depth enabling the driller to pinpoint exact sampling locations. More information with fewer holes — that's the power of Sonic.

## DIVERSE MARKETS SERVED

Due to its innate ability to penetrate fast, produce a nearly undisturbed sample to depth while using little or no fluid and its unique casing advancement system, the LS600 is ideal for several industries.

### Mining

The mining industry benefits from the LS600's extremely accurate sampling of unconsolidated formations. Applications include:

- Heap Leach and tailing pad sampling
- Monitoring well installation and water sampling
- Dewatering applications
- Wireline sampling

### Environmental

By continually casing the borehole and using little to no fluid, the LS600 eliminates the risk of cross contamination and is ideal for environmental and geotechnical work.

### Infrastructure

The LS600 is ideal for infrastructure projects with its ability to drill precise straight holes with less than one degree of deviation at varying angles. In addition, it can be equipped with an SPT hammer for added versatility.



For more information on the LS™ 600 scan with a QR code reader on your smart phone.



### **DRILL ROD AND CASING MANAGEMENT SYSTEM**

The LS™600 features a finger board for vertical storage of rods next to the mast, a patented spring-loaded Clam Shell for safe rod management to and from the finger board, a 90 degree head tilt for tripping of rods/casing and a full support vehicle system with a Gantry crane for presenting rods to the head. This advanced management system improves driller's productivity and safety.

### **SIMPLE HYDRAULIC DESIGN**

The manual hydraulic system is easy to operate and maintain.

### **INTERLOCKED ROTATION BARRIER**

Interlocked rotation barrier slows rotation when barrier is open, providing additional operator safety.

### **RUBBER TRACKS**

Low ground pressure rubber tracks avoid damage to asphalt and unstable ground.

### **GREASE PISTON PRE-LOAD SYSTEM**

The grease piston system maintains bearing pre-load with grease pressure. In the event of lost grease pressure, the head automatically shuts down to avoid damage.

### **ROBUST ROTATION AND OSCILLATION ASSEMBLIES**

The LS600's rotation and oscillation assemblies are created using premium materials and advanced designs to improve life and performance.

## DEVELOPED IN THE FIELD

Today's LS™600 is a culmination of nearly 20 years of hands-on experience, advanced engineering and field-testing. The LS600 is capable of drilling to depths of over 600 feet and offers casing diameters of up to 12 inches. In addition to its drilling capacity, the LS600 is track-mounted, offering improved site access.





## BENEFITS OF SONIC

**< 1%**  
**DRILL**  
**DEVIATION**

### **Superior Information**

Sonic drilling provides a continuous, relatively undisturbed core sample of unparalleled quality and accuracy through any type of formation. With less than 1% drilling deviation, drillers know exactly where a sample is coming from.

**80%**  
**REDUCED**  
**WASTE**

### **Waste Reduction**

Sonic drilling reduces waste by up to 80% relative to conventional methods, reducing the expensive disposal of contaminated waste.

**2x**  
**FASTER**

### **Performance**

The LS™600 is twice as fast as conventional overburden sampling methods.

### **Superior Well Construction**

Sonic drilling causes minimal disturbance to the surrounding borehole wall, resulting in more efficient well development and performance.

### **Flexibility**

Sonic drilling advances a temporary outer casing as the borehole is drilled, allowing more to be achieved within a single borehole.

### **Risk Minimization**

Sonic drilling greatly reduces the risk of project failure due to unknown or difficult subsurface conditions.

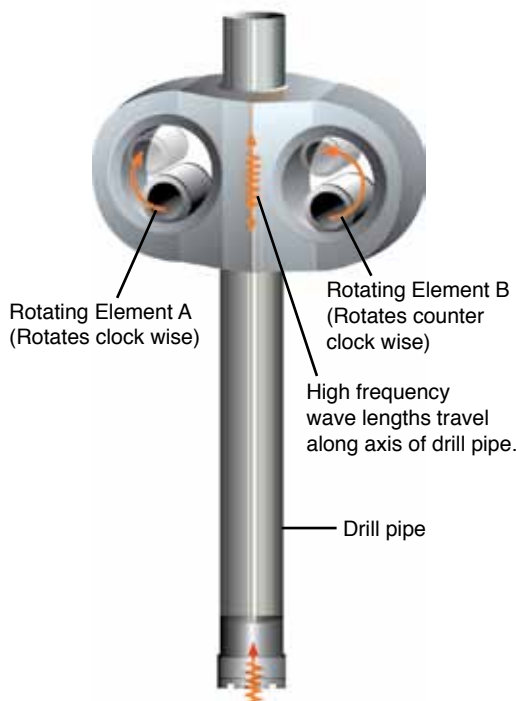
# HOW SONIC DRILLING WORKS

Sonic is an advanced form of drilling which employs the use of high-frequency, resonant energy generated inside the Sonic head to advance a core barrel or casing into subsurface formations. During drilling, the resonant energy is transferred down the drill string to the bit face at various Sonic frequencies. Simultaneously rotating the drill string evenly distributes the energy and impact at the bit face.

The resonant energy is generated inside the Sonic head by two counter-rotating weights. A pneumatic isolation system inside the Sonic head prevents the resonant energy from transmitting to the drill rig and preferentially directs the energy down the drill string.

The driller controls the resonant energy generated by the Sonic head's oscillator to match the formation being encountered to achieve maximum drilling productivity. When the resonant Sonic energy coincides with the natural frequency of the drill string, resonance occurs. This results in the maximum amount of energy being delivered to the face. At the same time, friction of the soil immediately adjacent to the entire drill string is substantially minimized, resulting in fast penetration rates.

## SONIC OSCILLATOR DIAGRAM



# SONIC DRILLING PROCEDURE

While there are several ways to drill using Sonic (depending upon site-specific conditions and project objectives), the most common means involves advancing a core barrel, which is overridden by a larger diameter drill string that cases the open borehole and prevents collapse.

## STEP 1 - CORE BARREL ADVANCEMENT

The core barrel is advanced using sonic frequencies. When necessary this step can be performed using no fluids, air, or mud.



## STEP 2 - CASING OVERRIDE

After the core barrel is in place, casing is sonically advanced over the core barrel, protecting the borehole's integrity in loose unconsolidated ground.

## STEP 3 - CORE RETRIEVAL

The core barrel is retrieved, producing a relatively undisturbed sample with near 100% core recovery.



## STEP 4 - REPEAT CORE ADVANCEMENT

Steps 1-3 are repeated to depth, producing a continuous core sample through unconsolidated formations with less than 1% deviation.

# SONIC EQUIPMENT AND TOOLING OFFERINGS



## RODS AND CASING

Casing in diameters of 4.75" - 12", core barrels in diameters of 3.75" - 10.5" and drill rods in 3.5" upset and standard diameters.



## BITS AND SHOES

A full line of bits and shoes to complement varying ground conditions and applications.



## SUPPORT VEHICLES

Support vehicles are track-mounted, carry the necessary rods/casing and tooling for projects and are designed to perfectly pair with the LS™ 600.



## TOOLING AND ACCESSORIES

A full line of tooling and accessories to complement the LS600 Sonic rig. Among this product offering is Boart Longyear's patented Clam Shell drill rod management system.

# TECHNICAL INFORMATION

General Performance Rating		
	Metric	U.S.
Drilling Depth	152 mm - 182 m	6 in - 600 ft
Max Drilling Diameter	305 mm	12 in
Pull Back	67.5 kN	15,175 lbf
Down Force	40.5 kN	9,105 lbf
Max Casing Length	6 m	20 ft

Sonic Head		
	Metric	U.S.
Drill Head Type	BL-150	
Vibration Motors	Fix displacement piston motors	
Frequency range	0-150 Hz	
Output Force @ 150 Hz	222 kN	50,000 lbs
Rotation Motor	Charl-Lynn Gerotor hydraulic motor - reversible	
Maximum Torque	3,660 Nm	2,700 ftlb
Rotation Speed	0-70 RPM	

Prime Mover		
	Metric	U.S.
Engine - Standard Unit	Caterpillar C6.6, liquid cooled, turbo charged, charge air cooled engine.	
Displacement	6.6 L	402.8 in <sup>3</sup>
Power (maximum) at 2,200 RPM	168 kW	225 hp
Emissions	Stage™ III	tier 3
Fuel Tank Capacity	156 L	41.2 gal

Engine - High Altitude Unit	Caterpillar C7, liquid cooled, turbo charged, charge air cooled engine.	
Displacement	7.2 L	439 in <sup>3</sup>
Power (maximum) at 2,200 RPM	223 kW	300 hp
Emissions	Stage™ III	tier 3
Fuel Tank Capacity	240 L	63.4 gal



<b>Hydraulic System</b>		
	<b>Metric</b>	<b>U.S.</b>
Primary Pumps	Variable Displacement axial piston close loop pumps	
Max flow	2x240 lpm	2x63.4 gpm
Maximum Pressure (factory setting)	27.5 MPa	4,000 psi

Secondary Pumps	Gear pumps	
Max flow	114+114+60+60 Lpm	30+30+15+15 gpm
Maximum pressure (factory setting)	20.5 MPa	3,000 psi

Auxiliary Pump	Gear pumps	
Max flow	60+114+114+35 Lpm	15+30+30+9 gpm
Maximum pressure (factory setting)	20.5 MPa	3,000 psi
Hydraulic Oil Tank Capacity open loop	333 L	88 gal
Hydraulic Oil Tank Capacity close loop	208 L	55 gal

<b>Drill Mast System</b>		
	<b>Metric</b>	<b>U.S.</b>
Overall Length		
Drilling Angle	45° off horizontal to 90° vertical down	
Rod Pull	6 m	20 ft
Head Tilt	0 - 90 Degrees	

<b>Drill Feed System</b>		
	<b>Metric</b>	<b>U.S.</b>
Feed stroke	7.47 m	24.5 ft
Feed pull	67.5 kN	15,175 lbf
Feed Thrust	40.5 kN	9,105 lbf
Feed speed back-fine	25 m/min	82 ft/min
Feed speed down-fine	42 m/min	138 ft/min
Feed speed back-fast	50 m/min	164 ft/min
Feed speed down-fast	84 m/min	275 ft/min
Drilling Angle	45° off horizontal to 90° vertical down	

# TECHNICAL INFORMATION

Main Winch		
	Metric	U.S.
Line Pull		
Bare Drum	9,650 N	2,169 lb
Full Drum	7,145 N	1,606 lb

Rope speed		
Bare Drum	41 m/min	134 ft/min
Full Drum	56 m/min	183 ft/min
Main line winch cable dia.	6 mm	1/4 in
Minimum breaking strength	23,90 kN	5373 lb
Rope length	65 m	213 ft

Wireline Hoist		
	Metric	U.S.
Line Pull		
Bare Drum	9,650 N	2,169 lb
Full Drum	7,145 N	1,606 lb

Rope speed		
Bare Drum	41 m/min	134 ft/min
Full Drum	56 m/min	183 ft/min
Main line winch cable dia.	6 mm	1/4 in
Minimum breaking strength	23.9 kN	5,373 lb
Rope length	152 m	500 ft

Foot Clamp/Breakout System		
	Metric	U.S.
Rod Clamps	2 (dual cylinders - top and bottom)	
Max clamping diameter (clamp/breakout tool)	305 mm	12 in
Range of clamping diameter w/std jaws	76 mm - 267 mm	3 in - 10.5 in
Range of clamping diameter w/ optional jaws (casing)	267 mm - 305 mm	10.5 in - 12 in
Clamping force	129 kN	29,000 lb
Max breaking torque	23 kNm	16,964 lbft
Max breaking angle	39 deg	

<b>Undercarriage</b>		
	<b>Metric</b>	<b>U.S.</b>
Crawler - Standard Unit	Morooka 1500VD	
Max speed, 1st gear	7.6 km/h	4.7 m/h
Max speed, 2nd gear	11 km/h	6.8 m/h
Track width:	700 mm	27.5 in
Ground pressure	0.041 MPa	5.9 PSI

Crawler - High Attitude Unit	Morooka 2200VD	
Max speed, 1st gear	8 km/h	5 m/h
Max speed, 2st gear	12 km/h	7.5 m/h
Track width:	750 mm	29.5 in
Ground pressure	0.046 MPa	6.6 PSI

<b>Compressor</b>		
	<b>Metric</b>	<b>U.S.</b>
Type	Hydraulic driven piston type	
Max flow	400 lpm	105 gpm
Max pressure	8 bar	115 PSI

## **Options**

<b>Mud Pump</b>		
	<b>Metric</b>	<b>U.S.</b>
Type	Triplex FMC L1622BCD with Ball Valves	
Max flow	190 lpm	50 gpm
Max pressure	60 bar	870 PSI
Tank capacity	1,135 L	300 gal

<b>Grout Pump</b>		
	<b>Metric</b>	<b>U.S.</b>
Type	Screw Pump, Moyno 3L6	
Max flow	102 lpm	27 gpm
Max pressure	15 bar	225 PSI
Grout mixer tank capacity	52 L	14 gal

# TECHNICAL INFORMATION

## Additional Options

Welder Generator		
	Metric	U.S.
Type	Hydraulic driven Getec	
Generator		
Voltage	120 V	
Frequency	60 Hz	
Power	4,000 W	5.36 hp
Welder		
Current	200 A	
Voltage	12-30 V	
Duty cycle	68%	

Welder Generator - European Version - Hydraulic driven Dynaset		
	Metric	U.S.
Generator		
Voltage	230 V / 400 V	
Frequency	50 Hz	
Power 230 V	3,500 W	4.7 hp
Power 400 V	6,500 W	8.7 hp
Welder		
Current	180 A	
Voltage	22-32 V	
Duty cycle @ 180 A	50%	
Duty cycle @ 110 A	100%	

Autohammer (Standard Penetration Test)		
	Metric	U.S.
Impact rate	1-30 blows/minute	
Hammer size	63,5 kg	140 lb
Hammer drop height	762 mm	30 in
Max pressure	124 bar	1800 PSI
Max flow	60 lpm	15.9 gpm
All up weight	226 kg	498 lb
Certified Hammer efficiency	64-72%	64-72%

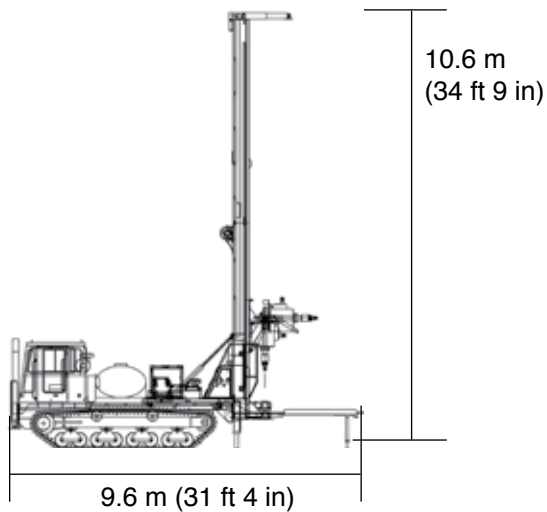
## Measurements

### Mast up - Drilling position

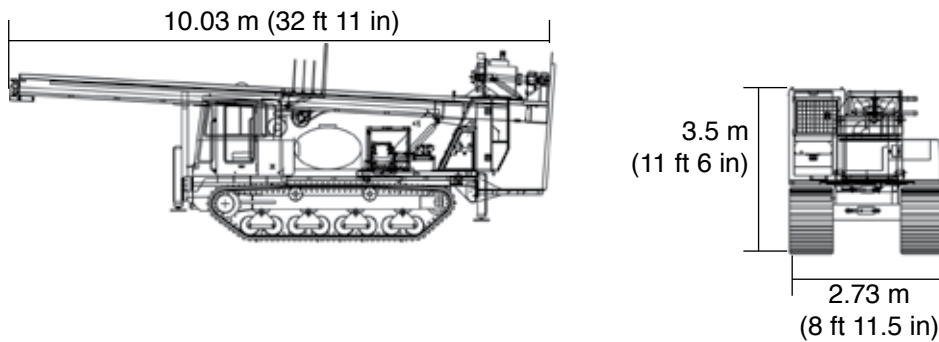
Wet Weight = 17,700 kg (39,000 lbs)

Consisting of:

- Morooka undercarriage 1500VD
- Hydraulic Module
- Main winch and wireline
- Hydraulic mast raising
- Sonic head type: BL-150
- Base frame
- Hydraulic leveling jacks / outriggers
- Foot clamps
- Rod rack for vertical rod storage
- Grout pump + grout barrel
- Compressor
- Welder-generator
- Water tank (dry)
- Hydraulic mud pump



### Mast Down - Travel position



A technician in a blue uniform and safety glasses is working on a large, cylindrical metal component in a workshop. The technician is using a power tool to work on the component. The background shows a workshop environment with various equipment and a red fire extinguisher.

## AFTERMARKET SPARES AND SERVICES

One of Boart Longyear's leading advantages is its aftermarket spares and services. Not only do we offer the most innovative products in the industry, but we also offer the best aftermarket spares and services. Our customers benefit from the ability to quickly and efficiently receive the spares that delay projects.

Untrained drillers and mechanics can be a significant expense to our clients. This is why we've developed aftermarket services that offer hands-on training for drillers and in-house and on-site repairs and services. By increasing the knowledge of our client's drillers and properly maintaining their equipment, we are able to reduce costs, keep fleets drilling longer and ultimately increase productivity.

# BOART LONGYEAR™ FINANCIAL SERVICES

Flexible and competitive financing solutions are available for the LS™600 Sonic rig through Boart Longyear™ Financial Services.

Boart Longyear Financial Services offers:

- One-stop access to a global preferred funding network
- Greater financial flexibility
- Enhanced purchasing power

To learn more about financing options with Boart Longyear, please contact a local sales representative or visit:

[www.BoartLongyear.com/leasing](http://www.BoartLongyear.com/leasing)





### Global Headquarters

Boart Longyear  
10808 South River Front Parkway  
Suite 600  
South Jordan, Utah 84095  
United States of America  
info@boartlongyear.com

Tel: +1 801 972 6430  
Fax: +1 801 977 3374

### Canada

Boart Longyear  
2442 South Sheridan Way  
Mississauga, Ontario  
Canada L5J 2M7  
info@boartlongyear.com

Tel: +1 905 822-7922  
Fax: +1 905 822-7232

### Asia Pacific

Boart Longyear  
26 Butler Boulevard  
Adelaide, 5950  
Australia  
info\_au@boartlongyear.com

Tel: +61 8 8375 8375  
Fax: +61 8 8375 8497

### Latin America

Boart Longyear  
Portal Riesco  
Av. El Salto 4001, Huechuraba  
Santiago, Chile 858 0641  
infochile@boartlongyear.com

Tel: +56 2 595 3300  
Fax: +51 242 671

### Europe

Boart Longyear  
12 Avenue des Morgines  
CH1213 Petit-Lancy,  
Geneva, Switzerland  
infoEU@boartlongyear.com

Tel: +41 22 709 0800  
Fax: +41 22 709 0801

### Sub-Saharan Africa

Boart Longyear  
Cycad House, Constantia Office Park  
Cnr 14th Avenue and Hendrik Potgieter  
Weltevreden Park, 1709  
Gauteng, South Africa  
infosasa@boartlongyear.com

Tel: +27 11 767 9300  
Fax: +27 11 767 9301

## SONIC DRILLING PRODUCTS



Bits and Shoes



Rods and Casing



In-hole Tooling and  
Accessories