SPECIFICATIONS FOR BORING AND SUBSURFACE EXPLORATION TRACK-MOUNTED DRILL MACHINE

Acceptable Brands/Models: CME-55/300, Acker Rebel, Diedrich D-50 or approved equal.

ALL SPECIFICATIONS ARE CONSIDERED MINIMUM UNLESS OTHERWISE NOTED

ITEM: One combination auger, core, rotary type boring and subsurface exploration drilling machine built into a specially designed remote-controlled high flotation rubber track carrier.

INTENT: These specifications describe salient features that shall be required in a combination auger-core-rotary type track carrier mounted drilling unit. The unit shall be completely assembled and ready for operation when delivered.

PURPOSE: This equipment shall be used for soil sampling, foundation testing, monitoring well installation and subsurface exploration work. The drill machine shall be capable of performing auger borings in unconsolidated formations with conventional flight or hollow-stem augers. The drill shall have the capability of productively using currently popular geoeexploration methods and techniques that include shelby tube or continuous tube sampling and standard penetration testing. The drill shall be capable of coring or rotary drilling applications. The unit shall be self-contained with rough terrain capabilities allowing access to off-road sites.

GENERAL SPECIFICATIONS: The drill unit shall be an integral part of a track carrier having a single engine power source. The power shall be appropriately directed to the carrier, hydraulic system and mechanically or hydraulically driven drill head. A hydraulically actuated folding upright drill frame with twin hydraulic feed cylinders shall be supplied. The drill and carrier shall have been in production for at least 2 years and shall be manufactured by one supplier to insure one-source parts responsibility. The track carrier and drill shall meet the following specifications:

TRACK CARRIER: The carrier shall have a rugged structural steel frame designed to resist bending and twisting when drilling or traversing rough terrain. The following specifications shall apply:

1- Tracks are driven by individual high efficiency two-speed hydraulic motors coupled to heavy-duty direct drive planetaries.
2- Brakes shall be coupled to the planetaries that are static parking type, spring applied-pressure released.
3- Steel drive sprockets shall be furnished for driving the tracks.
4- Two continuous track belts shall be furnished (18” min each).
5- The tracks shall be adjusted for tension and supported at the front by steel idler sprockets. Track tension and shock cushioning shall be controlled automatically by the hydraulic system and gas filled accumulators or adjustable by grease fittings.
6- The underside of the carrier shall be protected by a belly pan with removable sections.
7- The steering and engine throttle and two-speed track drive shall be controlled by a wireless radio control. A manual back-up system shall be provided on the carrier or hardwired to the carrier. The radio controller shall have adequate safeguards to prevent other radio frequencies from engaging movement of the carrier.
8- The carrier shall have a maximum tractive effort capable of traversing rough terrain.
9- Four 6-1/2 ton anchor shackles shall be mounted on the carrier.
10- The machine shall be able to negotiate a 50 percent grade on a straight ahead climb.
11- The machine shall be able to negotiate a 36 percent grade on a side hill traverse.
12- The carrier shall be able to attain "0" turning radius.
13- Speed of the carrier shall range from a minimum 0 to 1.4 MPH in low range and 0 to 2.3 MPH in high range.
14- The carrier shall be rust proof undercoated beneath the platform and all non-painted areas of the carrier frame.

**ROTARY DRIVE**: Mechanical or hydraulically driven rotary drive is acceptable

**Mechanical drive**: The drill transmission shall have at least four speeds forward and one speed reverse. The transmission shall be mounted stationary on the drill main base frame. The maximum drill spindle torque shall exceed 6,930 foot-pounds in first gear. Rotational speeds of the drill spindle shall range from at least 70 RPM in first gear to more than 550 RPM in fifth gear at 2,500 engine RPM. The spindle shall be hollow with at least a 2-3/4 inch ID. The output of the transmission shall power a single speed right angle drive. The right-angle drive output shall turn a rotary drive bar that has a square cross section of at least 1.75 inches a side and shall be made of heat-treated alloy steel. The rotary drive bar shall power a rotary box that has flange type bearings that can be greased. The rotary box shall be grease packed and shall not run in oil and shall have removable access panels on the front and rear to facilitate inspection and maintenance procedures.

**Hydraulic drive**: The drill head rotation shall be driven by closed loop hydrostatic hydraulic transmission. The prime mover shall power a fully-reversible variable displacement hydraulic piston pump with integral charge pump. The control handle shall incorporate a neutral lockout collar designed to prevent accidental actuation as well as rapid reversal of direction and shall also assist in quickly and accurately returning the control to the neutral position from either direction.

The drill head drivetrain shall consist of a selectable two-speed bent-axis variable displacement piston motor. Motor speed shall be actuated by electro-hydraulic solenoid valve and selectable via a weather-resistant 2-positon maintained electrical switch conveniently located at the operator control panel.

The motor shall be mounted atop a four-speed mechanical transmission resulting in a total of 8 discrete speed ranges. The final drive shall consist of quadruple strand, 3/4” pitch roller chain.
Drill head output in each speed range shall be as follows:

*All gears have full power in forward and reverse.*

**Low range:**
- 1st gear (0-60 rpm @ 5300 lb-ft torque)
- 2nd gear (0-126 rpm @ 2565 lb-ft torque)
- 3rd gear (0-231 rpm @ 1392 lb-ft torque)
- 4th gear (0-398 rpm @ 809 lb-ft torque)

**Hi range:**
- 1st gear (0-155 rpm @ 2079 lb-ft torque)
- 2nd gear (0-324 rpm @ 994 lb-ft torque)
- 3rd gear (0-597 rpm @ 539 lb-ft torque)
- 4th gear (0-1027 rpm @ 314 lb-ft torque)

**VERTICAL DRIVE:** Can consist of one- or two-cylinder systems:

**One-cylinder system:**
The drill head carrier shall mount to and travel along two steel guide rails rigidly affixed to the mast frame. All sliding surfaces shall be fitted with replaceable low-friction UHMW polyethylene wear strips. Heavy-duty roller-bearing cam rollers with grease fittings shall be fitted in each corner of the carrier base plate and roll against the guide rails for added stability.

The drill head carrier shall be driven by one double-ended hydraulic cylinder with 4” internal bore and 36” stroke. The cylinder rams shall be rigidly fixed at each end to the mast frame, causing the cylinder body to move when actuated. The cylinder body shall be fitted at each end with two leaf chain sheaves. The sheaves shall incorporate appropriately sized needle bearings to withstand forces imposed by the feed system. The sheave bearings shall be adequately sealed from the elements and provisions for lubricating the sheave bearings without disassembly or removal from the machine shall be provided. Four lengths of high-strength leaf chain shall be affixed to an anchor point on the drill head carrier. Each chain will extend from the anchor point, around its respective cylinder body sheave, and anchor to a central point on drill mast frame, resulting in a 2:1 ratio between drill head carrier and cylinder movement. Provisions for individual feed chain tension adjustments shall be furnished in a location easily accessible to maintenance personnel.

**Hydraulic controls** shall be furnished at the operator’s control panel to modulate both the downward feed cylinder hydraulic pressure as well as the rate of movement.
Two-cylinder system:
The vertical drive shall consist of two double-acting hydraulic feed cylinders with an overall stroke or travel of at least 72 inches. The feed cylinders shall have a point of thrust centered upon the axis of the drill spindle. The feed slide bushings shall be split for ease of removal and replacement. The vertical drive shall have a maximum downward thrust of not less than 14,450 pounds and an upward or retract force of not less than 22,000 pounds (if hydraulic drive, a minimum retract of 15,000 pounds allowable). The feed cylinders shall have a minimum piston rod diameter of 1.75 inches to withstand compressive forces when retracting augers from the ground without rotation. Hydraulic gauges shall be provided on the control panel at the left rear of the drill to indicate in pounds per square inch the hydraulic feed pressure and system pressure. Hydraulic controls shall be furnished for varying the feed rate and down pressure. The maximum rate of feed shall not be less than 55 feet per minute down and 35 feet per minute up.

A rapid retract capability shall be furnished to increase the rate of retract to a maximum of not less than 90 feet per minute. Two feed levers shall be provided. One feed lever shall be of the spring return type permitting standard rates of feed and retract. The first feed lever shall not be affected by the dial control settings used with the second feed lever. The second feed lever shall have a detent position and be used for drilling when a controlled rate of feed is required as well as the rapid retract feature. Feed rate, once set, shall not be affected by changes in engine RPM nor by changes in formation resistance unless the adjusted down pressure setting is reached. A feed rate control shall be furnished for changing the rate of feed. A pressure control shall be furnished for changing the maximum bit pressure. The feed rate and pressure controls shall be operated by dials located on the front of the control panel within easy reach of the operator.

DRILL POWER UNIT
The power unit shall be a self-contained electric starting, liquid-cooled, heavy-duty 4-cylinder turbocharged and charge-air cooled industrial type diesel engine, having not less than 119 cubic inch displacement and a minimum 74 gross horsepower for hydraulic driven equipment and a minimum of 110 horsepower for mechanical driven equipment. The engine shall meet U. S. EPA Tier 4 emission certification. The unit shall be equipped with a 15.2 CFM/125 PSI air compressor with dryer, heavy-duty dry type two-stage replaceable element air cleaner (or oil bath style air cleaner), electronic governor and a replaceable full flow oil filter. The unit shall have a 12-volt electric starting system consisting of a starter, alternator, battery and regulator. The unit shall have a keyed ignition switch, starter switch, and throttle switch on the drill control panel.

Mechanical drill drive line:
The power unit shall be equipped with a dry disc clutch not less than 13 inches in diameter and a transmission having not less than five speeds forward and one reverse. When coupled with the drill unit, the engine shall have sufficient power to meet all requirements listed elsewhere in this specification. The fuel tank shall have a capacity of not less than 25 gallons and shall have level indicator sights, and clean-out hatch. Fuel for the drill shall come from the fuel tank on the carrier.
Hydraulic drill drive line:
The power unit shall be equipped with pumps capable of producing a three (3) independent hydraulic circuits:

A variable displacement fully reversible over-center closed circuit hydraulic piston pump shall be provided for the rotation drill drive.

A fixed-displacement gear pump shall be provided to provide flow to the water pump circuit.

A fixed-displacement gear pump shall be provided to provide flow to all remaining setup, drilling, and accessory functions.

The two fixed-displacement pumps flows are to be combined to power the track drives.

UPRIGHT DRILL FRAME WITH ANGLE-HOLE FEATURE: The upright drill frame shall be hydraulically actuated permitting 90-degree fold over for traveling. The drill frame movement shall be controlled by two 3 inch minimum ID double-acting hydraulic cylinders that have a minimum of 1.375 inch diameter piston rods. The drive train to the rotary shall not have to be disconnected when folding the upright drill frame over to a horizontal travel position. The depth of the upright part of the base frame shall be at least 10 inches for rigidity.

The angle-hole feature shall be a direct coupled mechanical drive system. The drill rig shall be capable of drilling holes from vertical to 35 degrees from horizontal. Quick disconnect telescoping braces shall be provided for support of the upright drill frame in angle-hole positions.

AUGER AND ROD GUIDES FOR ANGLE DRILLING: Telescoping auger and rod guides shall extend from the bottom of the upright drill frame to stabilize augers and drill rods during angle drilling. Pins shall secure the telescoping guide supports in a stored position or at the desired amount of extension.

HYDRAULIC SYSTEM: This system shall have a heavy-duty engine driven tandem hydraulic pump run independently of the gear train with a capacity of not less than 13.50 GPM at 2,000 PSI. The system shall be equipped with a full- flow replaceable hydraulic oil filter in the low pressure return line. A third pump run independently of the gear train delivering 21.0 gpm maximum at 2,000 PSI shall provide flow and pressure to the safety system circuit and front carrier winch. The third pump’s (21.0 gpm) circuit shall be equipped with a full-flow replaceable element hydraulic oil filter in the high-pressure line from the pump and shares the full-flow replaceable hydraulic oil filter in the low pressure return line. A high-pressure hydraulic oil filter and a hydraulic oil cooler shall be furnished. The hydraulic oil reservoir shall have adequate capacity and shall be equipped with level indicator sight eyes, a vented filler cap, a magnetic drain plug and clean-out hatch. The hydraulic pumps shall be driven from a point in the line of power transmission so that hydraulic power will be available whenever the engine is running.
DRILLER’S CONTROL PANEL:

Mechanically driven drill:
All controls and gauges needed for the various drilling operations shall be placed in such a manner as to be easily accessible and convenient for the drill operator, while allowing for a view of the drilling operation at all times. The driller’s control panel shall be mounted on the left rear of the drill and shall include the following instrumentation and controls:

1- Keyed ignition switch, starter switch, and engine ECM reset switch.
2- Push-button emergency engine shut-off switch.
3- Engine throttle switch.
4- Transmission gear selector, a lock-out clutch handle and auxiliary spindle brake set valve.
5- Gauges with lights: Engine tachometer, engine oil pressure, engine coolant temperature, voltmeter, and engine ECM diagnostic module to monitor engine parameters (engine speed; engine oil pressure; engine coolant temperature; system voltage; machine hours). Gauges and diagnostic module shall be housed inside a sealed enclosure with latching cover. Cover shall be lockable for vandalism protection.
6- Hydraulic gauges for systems pressure and pull-down pressure.
7- Feed rate and feed pull-down pressure controls.
8- Feed lever and detented feed lever.
9- Hydraulic controls for all standard and provided optional components.

The drill controls shall be arranged in groups and situated for convenience according to frequency of use. For safety and convenience, the hydraulic levers shall have directional control that corresponds with cylinder movement. For example, moving the feed lever up shall extend the feed cylinders.

Hydraulically driven drill:
For hydraulically driven drill controls, an operator’s control panel shall be located conveniently at the rear of the machine, to the left of and within view of the drill string centerline. The control panel shall contain all necessary controls to operate all setup, drilling, and accessory functions of the machine, and shall contain all engine monitoring gauges or displays as well as engine start/stop and throttle controls.

Hydraulic control valves shall be manually operated full-flow valves. Controls shall be ergonomically grouped and arranged to put the most frequently used controls within easiest reach of the operator. Setup functions including leveling jack and mast positioning controls shall be grouped separately to lessen the likelihood of accidental actuation during routine drilling operations.

The control panel shall contain hydraulic pressure gauges to monitor the following circuits: feed cylinder downward pressure, rotation circuit pressure, water pump hydraulic circuit pressure, and tram circuit pressure.
The control panel shall incorporate a folding operator’s platform for standing. The platform shall incorporate a heavy-duty non-slip surface. The platform shall fold to stow easily away during transport and shall unfold to the horizontal position for drilling operations.

**SAFETY AND EMERGENCY SHUT-DOWN SYSTEM:** Push-button emergency shut-off switches shall be located on the control panel and on the right side of the main drill frame. Two emergency multi-directional wobble shut-off switches with extended levers shall be located near the bottom of and parallel to the feed cylinders. When any emergency shut-off switch is activated, a driveline brake is engaged to stop the spindle rotation in less than one revolution, the clutch is released, and the engine is shut down. The system shall also include a lock-out type clutch handle that positively locks the clutch handle in the down or disengaged position and a auxiliary spindle brake set valve. A neutral start switch is to be included that only allows the engine to start when the clutch is disengaged. A mast-raising alarm shall be included to alert the drill crew to look for overhead obstructions.

**MAST:** The following two Mast configurations are acceptable:

The mast shall be secured by bolts or quick connect pins to the upright drill frame and shall be removable from the drill when not needed. With the mast in a vertical position, the sheaves shall be not less than 17 feet from the base of the drill main frame. The maximum line pull of the draw works shall be evenly distributed on four cross-braced tubular members with an adequate margin of safety. Pairs of 8 inch diameter sheaves shall be aligned with the rope or wire rope they carry. The mast shall be a tapered design with a depth at the base of at least 9 inches. Two hydraulic cylinders shall be provided to raise and lower the upright drill frame and mast.

The mast frame shall be constructed rectangular steel tubing sized to withstand the combined loading of drill rotation, feed, and hoisting components. The frame shall guide and position the drill head centrally at the rear of the machine. The mast shall collapse into a horizontal travel position and shall be positioned by two double acting hydraulic cylinders with internal bore not less than 3”. The cylinders shall be furnished with orifice fittings to ensure slow, controlled movement. The mast shall be capable of drilling at any angle from 45 degree to 90 degree vertical and shall include provisions to prevent collapse in the event of hydraulic system failure at any angle within this range.

**DRAW WORKS:** The draw works shall include a minimum of two hydraulic hoists, and a hydraulic wireline hoist.

The first hydraulic hoist shall have a maximum pulling capacity of not less than 8,500 pounds. Maximum line speed up shall be not less than 60 feet/minute and maximum line speed down shall be not less than 270 feet/minute. One hydraulic lever shall be furnished for controlling hoisting or lowering and rotation speed. A hydraulic brake release valve shall be furnished that permits wire rope to lead off the drum when the hoist control lever is positioned to suspend a
load. The hoist shall include 1/2 inch diameter wire rope and a safety Shur-Lok hook.

The second hydraulic hoist shall have a maximum pulling capacity of not less than 1,800 pounds. Maximum line speed shall be not less than 200 feet per minute. One hydraulic lever shall be furnished for controlling hoisting or lowering and rotation speed. The hoist shall include 3/8 inch diameter wire rope and a safety Shur-Lok hook. A cable guide shall be provided.

A third hydraulic hoist is optional and shall have a maximum pulling capacity of not less than 1,800 pounds. Maximum line speed shall be not less than 200 feet per minute. One hydraulic lever shall be furnished for controlling hoisting or lowering and rotation speed. The hoist shall include 3/8 inch diameter wire rope and a safety Shur-Lok hook. A cable guide shall be provided.

The hydraulic wireline hoist shall have a maximum pulling capacity of not less than 800 pounds. Maximum line speed shall be not less than 200 feet per minute. One hydraulic lever shall be furnished for controlling hoisting or lowering and rotation speed. The hoist shall be capable of holding up to 900 feet of 3/16 inch diameter wireline cable. Cable shall not be included.

SLIDING BASE, IN-OUT: A sliding base shall be furnished for moving the drill in and out so that the drill spindle can be positioned to facilitate alignment of augers and drill rods and to provide clearance from the hole for handling augers, casing and other down-hole tools. With the slide base extended, the center of the drill spindle shall be at least 10 inches from the rear of the carrier to provide ample working room. The in-out slide base shall have sufficient travel and shall be hydraulically operated. The in-out slide base shall have a replaceable nylatron (or approved equal) wear plate between the metal slide surfaces.

SLIDING BASE, SIDEWAYS: A sliding base shall be furnished for moving the drill to either side so that the drill spindle can be positioned to facilitate alignment of augers and drill rods when starting or drilling a hole. The sideways slide base shall have at least 6 inches of travel and shall be hydraulically operated. The sideways slide base shall have nylatron (or approved equal) wear plate between the metal slide surface.

A hydraulically actuated sliding drill head is also acceptable provided the head will clear the area above the drill string.

SPINDLE ADAPTOR ASSEMBLY: A spindle adaptor assembly shall be furnished. The spindle adaptor shall have a 3-1/4” hollow-stem auger box down with an NWJ drill rod pin centered inside. The spindle adaptor shall have a tubular extension through to the top of the spindle with a 1-1/2 inch left-hand box thread on top for attaching a water swivel. The spindle adaptor assembly shall include a large auger drive universal joint with a 3-1/4” hollow-stem auger pion up and 1-5/8” hexagon socket down.

A chuck style spindle is also acceptable.
**MUD PUMP ASSEMBLY:** The mud or water pump shall be a progressive cavity type pump (Moyno 3L6 or equal) and shall have an infinitely adjustable output of 0 to 36 gallons per minute and a maximum pressure of 225 PSI. Pump output shall not be affected by changes in engine RPM. Power for the mud pump shall be supplied by a hydraulic motor operated from the drill hydraulic system. The assembly shall include a pressure gauge, a 1-1/2 inch pressure port with sufficient 1-1/2 inch high pressure hose to connect to the control panel, service tee with 1 inch bypass at the operator’s panel and a 2 inch suction port. Provisions shall be made for drainage of the mud pump and lines.

**STANDPIPE WITH HOSE TO CONTROL PANEL:** A 1-1/2 inch diameter standpipe shall be mounted on the upright drill frame and connected by a 1-1/2 inch high pressure hose to the mud pump output at the control panel. A 1-1/2 inch high pressure hose shall connect the standpipe to the water swivel utilizing cam-type quick disconnect fittings.

**HYDRAULIC HAMMER:** A hydraulic hammer system shall be furnished that will lift a 140 pound drive weight 30 inches and completely release the weight for a 30 inch free fall. No rope or cable shall be attached to the weight that might impede free fall. The system shall have a minimum rate of at least 50 blows per minute. The hammer shall be preset at the factory for a consistent weight fall height using adjustable priority hydraulic control valves. Once the valves are set, the fall height of the hammer weight shall not be affected by engine throttle adjustments. The fall height shall have an adjustable tolerance of plus or minus ½ inch. A method for visual verification of the fall height of the weight while the hammer is in operation shall be provided. The hammer shall be mounted on one single-acting hydraulic cylinder which is dedicated to the operation of the hammer device and shall be attached to the upright drill frame. The hammer device shall be hydraulically raised or lowered by this hydraulic cylinder through a minimum of 72 inches of vertical travel. A 140 pound drive weight shall be furnished. A safety feature shall be furnished that will prevent the hammer from operating if the anvil is not in place.

**HYDRAULIC ROD HOLDER AND BREAKOUT DEVICE:** A hydraulic rod holder operated by at least one hydraulic cylinder that will clamp up to 4.5 inch OD drill rod or pipe between two replaceable jaws shall be furnished. The device shall be capable of moving on and off the drill string. The hydraulic extension or retraction of the rod holder shall permit centering of the rod holder jaws on tools that are aligned with the vertical axis of the drill spindle. The rod holder shall store flush with the rear of the carrier and out of the way when drilling with auger tools. A hydraulic breakout wrench shall be mounted on the rod holder. Three sets of rod jaws shall be furnished (AW rod, NQ rod and NW casing).

**HYDRAULIC LEVELING JACKS:** Heavy-duty hydraulic leveling jacks shall be furnished that are individually operated from the control panel at the left rear of the drill. The jacks shall provide adequate leveling capability and shall be strong and rigid enough to easily support the total weight of the machine plus the loads generated when retracting drilling tools. Check valves shall be furnished in the hydraulic lines to prevent leakage or slippage of the jacks while the drill is set up on a site. The chrome-plated jack piston rods shall be completely enclosed to safeguard them from damage.
Two jacks shall be mounted at the rear of the carrier, one on each corner. The maximum cylinder travel shall not be less than 36 inches. Two jacks shall be mounted at the front of the carrier, one on each corner. The maximum cylinder travel shall not be less than 36 inches.

**CARRIER BODY**: The carrier deck shall be constructed of steel members and safety tread plate. Deck plating shall be provided over the tracks. The carrier shall be undercoated below the deck. The platform shall be furnished with the following features:

1- A minimum of three tool boxes shall be provided on the carrier with lockable doors.
2- An above deck drill rod storage for 100 feet of 10 foot AW drill rods.
3- An auger storage area for at least 80 feet of 3.25 inch ID hollow-stem augers on the carrier.

**BACK UP ALARM**: A carrier back up alarm shall be provided.

**CARRIER WINCH**: A hydraulic winch with a maximum pulling capacity of 11,000 pounds shall be furnished for pulling the carrier and drill. The winch shall be powered by a two-speed hydraulic motor. The winch assembly shall include 100 feet of 9/16 inch wire rope with hook and roller guides for the front. The hydraulic system shall be designed so that the winch is capable of operation independently of the track drive system.

**IDENTIFICATION**: CME-55/300, Acker Rebel, Diedrich D-50 or approved equal.

**DRILL AND CARRIER DIMENSIONS**

1- The maximum length of the carrier from bumper to bumper shall not be more than 14 feet.
2- The maximum length of the unit with the mast in travel position shall not be more than 24 feet.
3- The maximum width of the unit shall not be more than 7 feet 5 inches.
4- The maximum height of the unit shall not be more than 9 feet 6 inches.
5- The ground clearance under the belly pan shall not be less than 12 inches.
6- The height of the deck shall accommodate easy access of tools.

**VANDALISM PROTECTION**: A vandalism protection group shall be provided including as a minimum: a locking instrument panel cover, a locking battery cover, locking filler caps for the fuel tank and hydraulic tank. Filler caps located behind locked covers do not require locking caps. All locks shall be keyed to the same key. A minimum of 2 sets of keys shall be supplied.

**COLOR**: The drill unit, carrier and all parts normally painted shall be primed and painted a color complying with specifications.

All exposed hydraulic cylinder piston rods shall be covered to prevent over spray during painting.
**MISCELLANEOUS:** The component parts of the unit shall be of proper size and design to safely withstand maximum stresses imposed by a capacity load, and the manufacturer's rated loads for chains, bearings and universal joints shall not be exceeded when the unit is loaded with such loads.

**Dealer or vendor modifications to a non-conforming model for the express purpose of meeting minimum specification requirements will not be acceptable.** All parts, materials and workmanship shall be of the highest quality recognized by the trade. The drill unit shall be thoroughly field tested and ready for immediate and continuous operation at time of delivery. The equipment proposed must be a current model under standard production, being produced in quantity for national distribution. Parts and accessories shall be stocked and readily available from the winning bidder. The drill unit shall be furnished with all standard equipment advertised unless certain options and requirements are specifically required herein.

The torque capacity of each driven part shall be equal to or exceed the torque capacity of its driving member.

This machine is to be delivered in first-class operating condition with acceptance subject to inspection and approval. The successful bidder, at a time designated, shall provide 2 day(s) training to familiarize personnel with the correct operation and servicing procedures for the equipment delivered.

All items which require periodic lubrication shall be provided with a suitable lubrication fitting.

Two (2) copies—one hard copy and one electronic—of the manufacturer's service manual containing operating instructions, maintenance instructions and a bill of material or parts list shall be furnished by the manufacturer.

All pressure systems shall be provided with suitable pressure relief valves. With the exception of the drill rotary box, spindle and drilling tools, all moving parts which are so located as to be a hazard to operating or maintenance personnel shall be fully enclosed or properly guarded. Protective devices shall not impair the operating functions.

**WARRANTY:** The equipment to be furnished under these specifications shall be warranted against defective design, materials and workmanship for a minimum of 2 years after full payment is made to the manufacturer.