

# ***D60x90 Navigator®***

## ***Horizontal Directional Drill***

---

### ***Operator's Manual***



D60x90\_o1\_06  
Serial No. 101 -  
Order No. 105400BQ7  
Cabled Assembly No. 296338880



**Vermeer®**

EQUIPPED TO  
**DO MORE.™**

# Introduction

This manual explains the proper operation of your machine. Study and understand these instructions thoroughly before operating or maintaining the machine. Failure to do so could result in personal injury or equipment damage. Consult your Vermeer dealer if you do not understand the instructions in this manual, or need additional information.

The instructions, illustrations, and specifications in this manual are based on the latest information available at time of publication. Your machine may have product improvements and features not yet contained in this manual.

Vermeer Corporation reserves the right to make changes at any time without notice or obligation.

**Operation instructions are included in the two Operator's Manuals provided with the machine.** The tethered (cabled) manual must remain attached to the machine for ready reference. Store it in the manual storage box when not in use.

**Lubrication and maintenance procedures are in the Maintenance Manual provided with the machine.** Refer to it for all lubrication and maintenance procedures.

Additional copies of the manuals, and Operations and Safety video, are available from your dealer. Reorder numbers are listed on the front covers of the manuals and on the video.

Copies of this manual, and the Operations and Safety video, are available in Spanish from your dealer. Other languages may also be available.

Su distribuidor dispone de ejemplares en español de este manual y del vídeo de Operaciones y Seguridad.

## NOTICE TO OWNER

Replacement manuals are free of charge by registering your **used** Vermeer machine. Your machine's Operator's, Maintenance and Parts Manuals may be available online at [www.myvermeer.com](http://www.myvermeer.com). For questions about online or printed manuals, or to register a used machine, contact the Customer Data Department by telephone: 800-829-0051 or 641-628-3141; email: [customerdata@vermeer.com](mailto:customerdata@vermeer.com); internet: [www.vermeer.com](http://www.vermeer.com) or [www.myvermeer.com](http://www.myvermeer.com); or, letter: Customer Data Dept., Vermeer Corporation, PO Box 200, Pella IA 50219 USA.



**Orientation:** Right and left sides of the machine are determined by facing the power vises while seated at the controls.

## TRADEMARKS

VERMEER, VERMEER Logo, NAVIGATOR, and ARMOR are trademarks of Vermeer Manufacturing Company.

JOHN DEERE is a trademark of Deere and Company.

DIGITRAK, TENSITRAK, and ECLIPSE are trademarks of Digital Control, Inc.

## VERMEER NEW INDUSTRIAL EQUIPMENT LIMITED WARRANTY

(EFFECTIVE AUGUST 1, 2013)

**WARRANTY PERIOD: 12 Months / 1000 Hours**

Vermeer Corporation (hereinafter “Vermeer”) warrants each new Industrial product of Vermeer’s manufacture to be free from defects in material and workmanship, under normal use and service for one (1) full year after initial purchase/retail sale or 1000 operating hours, whichever occurs first. This Limited Warranty shall apply only to complete machines of Vermeer’s manufacture, parts are covered by a separate Limited Warranty. **EQUIPMENT AND ACCESSORIES NOT OF VERMEER’S MANUFACTURE ARE WARRANTED ONLY TO THE EXTENT OF THE ORIGINAL MANUFACTURER’S WARRANTY AND SUBJECT TO THEIR ALLOWANCE TO VERMEER ONLY IF FOUND DEFECTIVE BY SUCH MANUFACTURER.**

**EXTENDED WARRANTY OPTIONS ARE AVAILABLE FOR PURCHASE WARRANTY TERMS** During the Limited Warranty period specified above, any defect in material or workmanship in any warranted item of Vermeer Industrial Equipment not excluded below shall be repaired or replaced at Vermeer’s option without charge by any authorized independent Vermeer dealer. The warranty repair or replacement must be made by a Vermeer independent authorized dealer at the dealer’s location. Vermeer will pay for replacement parts and such authorized dealer’s labor in accordance with Vermeer’s labor reimbursement policy. Vermeer reserves the right to supply remanufactured replacement parts as it deems appropriate.

**RETAIL PURCHASER RESPONSIBILITY:** This Limited Warranty requires proper maintenance and periodic inspections of the Industrial Equipment as indicated in the Operator’s/Maintenance Manual furnished with each new Industrial Equipment. The cost of routine or required maintenance and services is the responsibility of the retail purchaser. The retail purchaser is required to keep documented evidence that these services were performed. This Vermeer New Industrial Equipment Limited Warranty may be subject to cancellation if the above requirements are not performed. Vermeer Industrial Equipment with known failed or defective parts must be immediately removed from service.



## **EXCLUSIONS AND LIMITATIONS**

The warranties contained herein shall **NOT APPLY TO:**

- (1) Any defect which was caused (in Vermeer's sole judgment) by other than normal use and service of the Industrial Equipment, or by any of the following; (i) accident (ii) misuse or negligence (iii) overloading (iv) lack of reasonable and proper maintenance (v) improper repair or installation (vi) unsuitable storage (vii) non-Vermeer approved alteration or modification (viii) natural calamities (ix) vandalism (x) parts or accessories installed on Industrial Equipment which were not manufactured or installed by Vermeer authorized dealers (xi) the elements (xii) collision or other accident.
- (2) Any Industrial Equipment whose identification numbers or marks have been altered or removed or whose hour meter has been altered or tampered with.
- (3) Any Industrial Equipment which any of the required or recommended periodic inspection or services have been performed using parts not manufactured or supplied by Vermeer or meeting Vermeer Specifications including, but without limitation, engine tune-up parts, engine oil filters, air filters, hydraulic oil filters, and fuel filters.
- (4) New Industrial Equipment delivered to the retail purchaser in which the equipment/warranty registration has not been completed and returned to Vermeer within ten (10) days from the date of purchase.
- (5) Any defect which was caused (in Vermeer's sole judgment) by operation of the Industrial Equipment not abiding by standard operating procedures outlined in the Operator's Manual.
- (6) Engine, battery, and tire Limited Warranties and support are the responsibility of the respective product's manufacturer.
- (7) Transportation costs, if any, of transporting to the Vermeer dealer. Freight costs, if any, of transporting replacement parts to the Vermeer dealer.
- (8) The travel time of the Vermeer dealer's service personnel to make a repair on the retail purchaser's site or other location
- (9) In no event shall Vermeer's liability exceed the purchase price of the product,
- (10) Vermeer shall not be liable to any person under any circumstances for any incidental or consequential damages (including but not limited to, loss of profits, out of service time) occurring for any reason at any time.
- (11) Diagnostic and overtime labor premiums are not covered under this Limited Warranty Policy. Oils and fluids are not covered under this Limited Warranty.

- (12) Depreciation damage caused by normal wear, lack of reasonable and proper maintenance, failure to follow operating instructions, misuse, lack of proper protection during storage.
- (13) Accessory systems and electronics not of Vermeer's manufacture are warranted only to the extent of such manufacturer's respective Limited Warranty if any.
- (14) Down hole toolage is not covered under this warranty.
- (15) Wear items which are listed by product group below:

**ENVIRONMENTAL:** Bearing Seals, Bearings, Belts, Brake Pads, Bolts/Torqued Parts, Chain, Clutches, Clutch Components, Curtains, Cutter Wheels, Discharge Conveyor Belts, Fuel Filters, Hammers, Hoses, Infeed Conveyor Belts, Infeed Conveyor Chains, Knives, Oil Filters, Pockets, Rods, Rollers, Rotor Plates, Screens, Service Items, Shear Bar/Bedknife, Sprockets, Teeth, Wear Blocks, Wear Strips, Tips, Tip Mounts, Track Chain, Track Rollers, Rubber Tracks, Rubber Grouser Bars, Rubber Track Bands, Track Sprockets, Track Pads, Winch Cable, Windshield Wiper Parts, Lights, Antenna.

**TRACK:** Base Plates, Boom Wear Items, Buckets, Cable Fingers, Conveyor Belts, Clutches, Cups, Digging Chain, Digging Rims, Drums, End Idler, Flashings, Pins and Bushings, Pivot Rings, Plastic Wear Strips, Rooter Bands, Scraper Knives, Sprockets, Teeth, Track Chain, Track Rollers, Trench Cleaner (Crumber), Trip Cleaners, Truck Rollers, Wear Plates.

**TRENCHLESS:** Brushes, Clamping Vise Parts, Dies, Drive Chuck, Earth Stakes, Fan Belts, Jaws, Leaf Chain, Lights On Light Kits, Packing Assemblies, Rod, Rod Loader Parts, Rollers, Tooling, Track Chain, Track Guides, Track Idlers, Track Pads, Track Sprockets, Valve Seats, Wear Bars, Wear Blocks, Water Hoses, Water Swivels, Wear Bars.

**UTILITY PRODUCTS:** Augers, Belts, Bearings, Booms, Brake Pads, Bucket, Bushings, Chains, Clutches, Conveyor Belts, End Rollers, Flashings, Pins, Pivot Rings, Plow Blades, Rubber Shielding, Sprockets, Teeth, Tires, Track Chain, Track Idlers, Track Sprockets, Trench Cleaner (Crumber).

### **PARTS WARRANTY:**

Parts replaced in the warranty period will receive the balance of the first year New Industrial Equipment Limited Warranty, during the first (12) months or 1000 hours, whichever comes first. Replacement parts after the original machine warranty, are warranted to be free from defects of material for ninety (90) days or the part will be repaired or replaced, without labor coverage for removal and reinstallation.

**EXCLUSIONS OF WARRANTIES: EXCEPT FOR THE WARRANTIES EXPRESSLY AND SPECIFICALLY MADE HEREIN, VERMEER MAKES NO OTHER WARRANTIES, AND ANY POSSIBLE LIABILITY OF VERMEER HEREINUNDER IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS, IMPLIED, OR STATUTORY, INCLUDING, BUT NOT LIMITED TO, ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. VERMEER RESERVES THE RIGHT TO MODIFY, ALTER AND IMPROVE ANY PRODUCT WITHOUT INCURRING ANY OBLIGATION TO REPLACE ANY PRODUCT PREVIOUSLY SOLD WITH SUCH MODIFICATION. NO PERSON IS AUTHORIZED TO GIVE ANY OTHER WARRANTY, OR TO ASSUME ANY ADDITIONAL OBLIGATION ON VERMEER'S BEHALF.**

**NO DEALER WARRANTY.** The selling dealer makes no warranty of its own and the dealer has no authority to make any representation or promise on behalf of Vermeer or to modify the terms or limitations of this warranty in any way.

**ELECTRONIC SIGNATURES.** Each of the parties hereto expressly agrees to conduct transactions by electronic means. Accordingly, the parties agree and intend that all electronic transmissions including, without limitation, electronic signatures, shall be considered equivalent to an original writing as provided under Iowa law, as it may be amended from time to time.

**MANUFACTURED BY:  
VERMEER CORPORATION  
Pella, Iowa 50219 USA**

# VERMEER EQUIPMENT LIFETIME LIMITED WARRANTY RIDER

## (Parts only coverage during extended term)

Vermeer Corporation (hereinafter “Vermeer”) agrees to extend only the parts coverage of the applicable Vermeer Industrial New Equipment Limited Warranty (the “Standard Limited Warranty”) for the Covered Components of the Specified Models of New Vermeer Industrial Equipment for the Lifetime of the Equipment provided that such Equipment is operated and maintained in accordance with the directions and instructions set forth in the Operator's and Maintenance Manuals. All conditions, exclusions and limitations of the Standard Limited Warranty apply.

## Models ..... Serial Numbers of Included Units

D7x11 Series II .....	464 and above	D36x50 Series II.....	143 and above
D9x13 Series II .....	101 and above	D40x55 S3.....	101 and above
D9x13 S3 .....	101 and above	D36x50DRII .....	101 and above
D16x20 Series II .....	101 and above	D60x90 .....	101 and above
D20x22 .....	143 and above	D80x100 Series II.....	122 and above
D20x22 S3 .....	101 and above	D100x120 Series II.....	123 and above
D20x22 Series II .....	101 and above	D100x140 .....	101 and above
D20x22FX Series II.....	101 and above	D100x140 S3.....	101 and above
D23x30 S3 .....	101 and above	D200x300 .....	110 and above
D24x40 Series II .....	281 and above	D220x300 .....	101 and above
D24x40 S3 .....	101 and above	D300x500 .....	111 and above
		D330x500 .....	101 and above

**Covered Components:** . . All rack gears and pinion gears. (Excludes carriage, carriage rollers and guide rollers)

**Extended Term:** ..... Lifetime of Equipment. This warranty is extended to the original purchaser only. It is not transferable.

**EXCEPT FOR THE STANDARD LIMITED WARRANTY AND THIS RIDER, VERMEER MAKES NO OTHER WARRANTIES, AND ANY POSSIBLE LIABILITY OF VERMEER HEREUNDER IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS, IMPLIED, OR STATUTORY, INCLUDING, BUT NOT LIMITED TO, ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.**

# Receiving and Delivery Report

## DEALER PREP

Check or perform the following:

- \_\_\_ Check for shipping damage or shortage.
- \_\_\_ Check that work area cones are supplied with the machine.
- \_\_\_ Check that certificates for electrically insulated gloves (1 pair) and boots (2 pairs) are supplied with the machine.
- \_\_\_ Check for loose bolts.
- \_\_\_ Check installation and condition of all shields.
- \_\_\_ Check track tension.
- \_\_\_ Check condition of all safety signs.
- \_\_\_ Check Strike Alert system.
- \_\_\_ Check rotation and thrust Neutral Start interlocks. (Engine will start with rotation and thrust handles out of NEUTRAL, but motion does not occur until handles are returned to NEUTRAL and back out of NEUTRAL.)
- \_\_\_ Check that Operator Presence system functions.
- \_\_\_ Check Remote Lockout system.
- \_\_\_ Check oil in rotation gearbox planetaries.
- \_\_\_ Check adjustment and operation of rod loader.
- \_\_\_ Check operation of drilling fluid systems.
- \_\_\_ Check operation of locator system if supplied.

## Engine

- \_\_\_ Check engine oil level.
- \_\_\_ Check condition of air cleaner.
- \_\_\_ Check air intake clamps.
- \_\_\_ Check battery charge and electrolyte level.
- \_\_\_ Check belts for correct tension.
- \_\_\_ Check coolant level and antifreeze concentration.
- \_\_\_ Check radiator hose clamps.
- \_\_\_ Check engine for correct operation.

## Hydraulics

- \_\_\_ Check hydraulic fluid level.
- \_\_\_ Check controls for correct operation.
- \_\_\_ Check all hydraulic components for leaks or damage.
- \_\_\_ Check pressure and operation of vises.
- \_\_\_ Check rotation relief pressure: 6500 psi (448 bar) at the pump; 6250 psi (431 bar) crossover relief.
- \_\_\_ Check maximum thrust/pullback pressure: 5600 psi (386 bar).
- \_\_\_ Check operation of stakedown units.

## DELIVERY

Check and perform with the customer:

- \_\_\_ Review contents of the HDD Resource Library
  - Review the DVD on Horizontal Directional Drilling
- \_\_\_ Review all sections of the *Operator's Manual*.
- \_\_\_ Grease or oil all lubrication points.

Review and demonstrate with the customer the various aspects of Navigator HDD:

- \_\_\_ overall explanation of how the machine works
- \_\_\_ directional drilling safety
- \_\_\_ preparing the Navigator HDD for operation

## DEALER/OWNER INFORMATION

---

dealer

---

address

---

city

---

state / province

---

zip / postal code

---

country

---

phone number

---

email address

---

owner

---

address

---

city

---

state / province

---

zip / postal code

---

country

---

phone number

---

email address



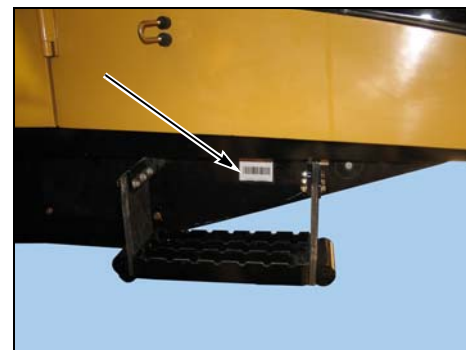
## MACHINE IDENTIFICATION NUMBER - RECORD

Model Number\_\_\_\_\_

Serial Number\_\_\_\_\_

## MACHINE IDENTIFICATION DECAL

This decal provides identification of the model and 17-digit identification number. The barcode contains the machine's VIN number and can be scanned with any barcode reading device.

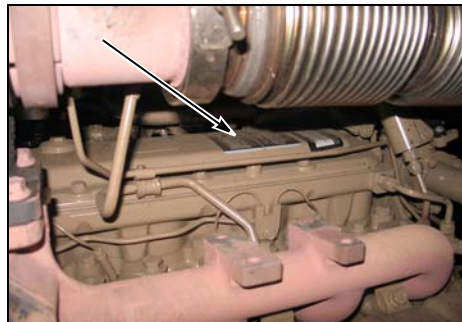


## ENGINE IDENTIFICATION NUMBER - RECORD

On top of engine

Engine Model Number\_\_\_\_\_

Engine Serial Number\_\_\_\_\_



## ENGINE CONTROL UNIT IDENTIFICATION NUMBER - RECORD

Model Number\_\_\_\_\_

Serial Number\_\_\_\_\_



## DRILLING FLUID PUMP IDENTIFICATION NUMBER - RECORD

Model Number\_\_\_\_\_

Serial Number\_\_\_\_\_



This page intentionally left blank.

# Table of Contents

<b>Receiving and Delivery Report</b> .....	<b>i</b>	Remote Control .....	20-5
Dealer Prep .....	i	Tethered Secondary Remote Control (S/N 138 -) .....	20-6
Engine .....	ii	Remote Lockout Transmitter .....	20-7
Hydraulics .....	ii	Start/Stop Buttons .....	20-7
Delivery .....	iii	Local Lockout Buttons .....	20-8
Dealer/Owner Information .....	iv	<b>Strike Alert Controls</b> .....	<b>20-9</b>
Machine Identification Number - Record .....	v	Strike Alert - Indicators and Controls .....	20-11
Machine Identification Decal .....	v	Indicators on Display Screen .....	20-11
Engine Identification Number - Record .....	vi	<b>Remote Lockout Controls</b> .....	<b>20-13</b>
Engine Control Unit Identification Number - Record .....	vi	Remote Transmitter Controls .....	20-13
<b>Safety Messages</b> .....	<b>10-1</b>	Indicator Lights .....	20-14
Safety Symbol Explanation .....	10-1	Remote Lockout Machine Controls .....	20-15
Fire Extinguisher .....	10-4	Indicator Lights on Control Panel .....	20-15
<b>Welding Precautions</b> .....	<b>11-1</b>	Indicator Lights on Display Screen .....	20-16
Welding Alert - Electronic Components .....	11-1	Remote Lockout Indicators .....	20-17
<b>Intended Use</b> .....	<b>15-1</b>	Remote Lockout Battery Charger .....	20-19
<b>Controls</b> .....	<b>20-1</b>	Non-Cab Machine .....	20-19
<b>Controls Locations</b> .....	<b>20-1</b>	Cab Machine .....	20-20
Top Panel Control .....	20-1	<b>Engine Controls</b> .....	<b>20-21</b>
Left Panel Controls .....	20-2	Engine Operation Controls .....	20-21
Right Panel Controls .....	20-3	<b>Transport Controls</b> .....	<b>20-26</b>
Right Joystick .....	20-4	Transport Remote Control .....	20-26
Left Joystick .....	20-4	Contrast .....	20-27
		Backlight .....	20-27
		Changing Radio Channel .....	20-27
		Remote Registration .....	20-28

Remote Control Operating Range .....	20-30
Transport Controls .....	20-31
Transport with Tethered Remote (S/N 138 -) .....	20-34
<b>Setup Controls .....</b>	<b>20-35</b>
Stabilizer Controls - Left Console .....	20-35
Rotary Stakedown Controls - Left Console .....	20-36
Rack and Stabilizer Controls - Remote Controls .....	20-37
<b>Drilling Controls .....</b>	<b>20-38</b>
Drilling Controls - Rotation .....	20-38
Drilling Controls - Thrust .....	20-41
AutoDrill Controls .....	20-43
Rod Loader Controls .....	20-45
Rod Handling Components .....	20-48
Greaser .....	20-50
Accumulator Gauge .....	20-50
Power Vise Controls .....	20-51
Drilling Fluid Controls .....	20-52
Wash Wand Controls .....	20-54
<b>Drill Station Controls .....</b>	<b>20-56</b>
Operator Presence/Seat Controls .....	20-56
Work Lights .....	20-57
Beacon (Option) .....	20-57
Horn Keys .....	20-58
Engine Cover Latches .....	20-58
Radiator Grille Cover .....	20-59
Auxiliary Outlets .....	20-60
Cab Controls .....	20-61
Cab Door Latch .....	20-61
Access .....	20-63

Step - Non-Cab Operator Station .....	20-64
---------------------------------------	-------

<b>Console Display .....</b>	<b>21-1</b>
Menu Screen .....	21-2
Drill Screen .....	21-3
AutoDrill Screens .....	21-6
AutoDrill Off .....	21-6
AutoDrill Speed Mode .....	21-6
Engine Screen .....	21-7
Diesel Particulate Filter (DPF) .....	21-8
DPF Controls .....	21-8
Forced Regeneration .....	21-10
Inhibit Generation .....	21-10
Auto Steer .....	21-11
Drill Setup .....	21-12
Drilling Fluid .....	21-12
Auto Stop .....	21-13
Drilling Pressure .....	21-14
Wireline/Remote Lockout .....	21-14
Units .....	21-15
Calibration Screens .....	21-16
Machine/Engine Diagnostics .....	21-17
Active Codes Screen .....	21-17
Screen Brightness Settings .....	21-19
Software Information Screen .....	21-19

<b>DigiTrak Locating Program .....</b>	<b>25-1</b>
Navigation Screen .....	25-2
Locator Setup Screen .....	25-3
Units Setup Screen .....	25-4

Locating Screens .....	25-4	Lockout Procedure - Without Remote Lockout System	30-19
Version Screen .....	25-5	Resuming Operation after Lockout .....	30-19
<b>Overview .....</b>	<b>30-1</b>	<b>Drill Rod and Tools .....</b>	<b>30-20</b>
<b>Remote Lockout Overview .....</b>	<b>30-1</b>	Drill Rod .....	30-20
Remote Lockout System Intended Use .....	30-1	Drill Tool Assemblies .....	30-21
Remote Lockout System Component Identification .....	30-3	Armor Drill Housing Assembly .....	30-21
Remote Transmitter .....	30-3	Armor Multi-Tool .....	30-23
Warning Alarm .....	30-4	Rotary Tooth Installation/Extraction - Gauntlet Bit ..	30-24
Power Button .....	30-4	<b>Locator System .....</b>	<b>30-25</b>
Run Button .....	30-5	Reamer Installation .....	30-25
Lockout Button .....	30-5	Swivel .....	30-25
Remote Lockout Indicators .....	30-6	Reamer Carrier - Intended Use .....	30-25
Fault Check/Processing Lights .....	30-6	Reamer Carrier Styles .....	30-26
Hydraulic Lockout or Engine Shutdown Option .....	30-7	Reamer Carrier Components .....	30-26
Auxiliary Engine Shutdown for Hydraulic Disable .....	30-8	Reamer Carrier - Install/Remove .....	30-27
Remote Lockout Tests .....	30-9	Reamer Carrier - Lift .....	30-27
Hydraulic Lockout Test .....	30-9	Turnbuckle - Adjust .....	30-28
Engine Shutdown Test .....	30-10	Reamer - Connect with Manually Threaded	
Remote Lockout Transmitter Registration .....	30-11	Joint and Collar .....	30-29
Loss of Remote Transmitter Signal .....	30-13	Reamer Carrier Wear Pads - Replace .....	30-29
Battery Condition .....	30-14	PVC Pipe Pulling (Option) .....	30-30
Low Battery .....	30-14	<b>Rod Loader Setup .....</b>	<b>30-31</b>
Discharged Battery .....	30-14	Rod Box - Load with Rod .....	30-31
Recharge Battery .....	30-14	Rod Box - Remove .....	30-32
Remote Lockout System - Start .....	30-15	Rod Box - Install .....	30-33
Remote Lockout System - Shut Down .....	30-15	Rod Box - Prepare .....	30-34
Lockout Procedures .....	30-16	<b>Automatic Functions .....</b>	<b>30-35</b>
Lockout Procedure - With Remote Lockout System ..	30-16	AutoDrill .....	30-35
Resuming Operation after Remote Lockout .....	30-18	AutoDrill - Set .....	30-35

AutoDrill - Pause/Resume .....	30-36
Front Vise Function in Resuming AutoDrill .....	30-36
Auto Steering .....	30-37
Carve Steering Setup .....	30-38
Zone Steering Setup .....	30-39
Rod Wrap .....	30-41
Vise Operating Guidelines .....	30-42
Antifreeze - Add to Drilling Fluid System .....	30-43
<b>Preparation .....</b>	<b>40-1</b>
<b>Preparing Personnel .....</b>	<b>40-1</b>
Operator Qualifications .....	40-1
Safety Conscious Operators and Workers .....	40-1
Training .....	40-2
Warning Safety Signs and Operating Instructions .....	40-2
Radio Communication Requirements .....	40-3
Radio Communication to Stop Drilling Operation .....	40-4
Radio Communication to Resume Drilling Operation .....	40-4
Personal Protection .....	40-5
Sound and Vibration Levels .....	40-6
Underground Utility Contact .....	40-7
Electrical Shock Protection .....	40-8
Electrocution Prevention .....	40-9
Electrically Insulated Gloves .....	40-10
Electrically Insulated Boots .....	40-12
Strike Alert System Functions .....	40-13
Soil Conductivity .....	40-13
<b>Preparing the Machine .....</b>	<b>40-14</b>
Operator Presence System .....	40-14
Remote Lockout System Preparation .....	40-14

Range - Test .....	40-14
Remote Transmitter - Prepare .....	40-14
Remote Lockout System - Test .....	40-15
<b>Preparing the Work Area .....</b>	<b>40-16</b>
Jobsite - Check .....	40-16
Power Line Locator System .....	40-16
Warning Cones .....	40-17
Laws and Regulations - Check .....	40-17
Planning the Bore .....	40-17
<b>Operation .....</b>	<b>50-1</b>
<b>Starting Procedure .....</b>	<b>50-1</b>
Before Starting .....	50-1
Accumulator Pressure - Check .....	50-1
Recharging Pressure .....	50-1
Starting the Engine .....	50-2
Cold Weather Starting .....	50-3
Engine .....	50-3
Hydraulic Fluid .....	50-3
Cold Weather Start System .....	50-3
<b>Shutdown Procedure .....</b>	<b>50-4</b>
<b>Transporting the Machine .....</b>	<b>50-5</b>
Driving the Machine .....	50-5
Backup Warning Alarm .....	50-6
Driving the Machine with Remote Control .....	50-6
Safe Operating Slope .....	50-7
Preparing for Transport .....	50-8
Driving Machine with Wireless Remote Control .....	50-9



Driving Machine with Tethered Secondary Remote Control .....	50-10
Trailing the Machine .....	50-11
Loading/Unloading .....	50-11
Retrieval .....	50-13
Lifting Machine .....	50-13
<b>Setup .....</b>	<b>50-14</b>
Bore Path - Walk .....	50-14
Drill Unit Setup .....	50-14
Strike Alert System - Test .....	50-15
Machine - Anchor with Stakes .....	50-17
Locating Equipment - Prepare .....	50-18
Drilling Fluid Setup .....	50-18
Rod Wiper - Install .....	50-19
Entrance and Exit Sites - Prepare .....	50-19
Warning Cones .....	50-20
<b>Drilling Safety .....</b>	<b>50-20</b>
Read Overview Section .....	50-20
Safety Precautions .....	50-21
Utility Line Contact .....	50-21
Electrical Line .....	50-21
After Utility Company Has Shut Off the Power .....	50-23
Gas .....	50-23
Fiber Optic Cable .....	50-23
<b>Before the Bore .....</b>	<b>50-24</b>
Diesel Particulate Filter (DPF) Safety .....	50-25
Drill Rod - Flush .....	50-28
Drill Rod - Lubricate .....	50-30
Drill Head - Connect .....	50-30

<b>During the Bore .....</b>	<b>50-31</b>
Begin Drilling .....	50-31
Drill Rods - Add to Drill String .....	50-32
Drill Rod Row - Select .....	50-35
Gauges - Monitor .....	50-36
Obstructions - Investigate .....	50-37
Plugged Drill Rod .....	50-37
<b>Exiting the Bore .....</b>	<b>50-38</b>
Changing Tools at Remote Exit Pit .....	50-38
Remote Lockout Use .....	50-39
Communication Requirements .....	50-39
Reamer Carrier Use .....	50-39
Swivel Use .....	50-40
Pullback Tool - Install .....	50-41
Resuming Operation .....	50-42
Pullback - Start .....	50-43
Drill Rod Row - Select .....	50-46
Breaking Rod Joints - Safety Considerations .....	50-47
Trailing Rod While Pre-Reaming .....	50-47
Swivel Use .....	50-48
Short-String Method of Adding Drill Rod for Pre-Reaming .....	50-48
Resuming Operation .....	50-49
Pulling Back with Trailing Rod .....	50-50
Push-Through Method of Adding Drill Rod for Pre-Reaming .....	50-51
Resuming Operation .....	50-52
Gauges - Monitor During Pullback .....	50-53
<b>After Each Bore .....</b>	<b>50-54</b>
Power Vises - Clean .....	50-54

Drill Rods - Clean and Store .....	50-55	Maintenance Intervals .....	60-3
Flushing Bentonite/Polymers from Drilling Fluid System	50-55		
Machine - Wash.....	50-56		
<b>Supplemental Operations .....</b>	<b>55-1</b>		
<b>Jump-Starting.....</b>	<b>55-1</b>		
Battery Explosion - Prevent .....	55-1		
Battery Burns - Prevent .....	55-2		
Jump-Starting Procedure .....	55-2		
<b>PBD7500 Portable Breakout Device.....</b>	<b>55-4</b>		
Intended Use .....	55-4		
Breakout Device Operation.....	55-5		
Configurations .....	55-8		
Maintenance .....	55-8		
<b>Mud Motors.....</b>	<b>55-8</b>		
<b>Replacing Broken Drill Rod Underground.....</b>	<b>55-9</b>		
<b>Drilling with Front Load Wireline Locator System .....</b>	<b>55-11</b>		
Initial Drill Rod Connection .....	55-11		
Adding Drill Rod .....	55-13		
Pullback .....	55-14		
<b>Maintenance .....</b>	<b>60-1</b>		
Safety Signs Maintenance .....	60-1		
Maintenance Manual .....	60-2		
Hourmeter - Check for Maintenance Interval .....	60-2		
Machine - Grease .....	60-2		
Recommended Fluids.....	60-2		
Engine Maintenance Intervals .....	60-2		

# Section 10: Safety Messages

General safety messages appear in this Safety Messages section. Specific safety messages are located in appropriate sections of the manual where a potential hazard may occur if the instructions or procedures are not followed.

A signal word “**DANGER**”, “**WARNING**”, or “**CAUTION**” is used with the safety alert symbol.

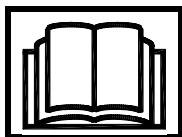
Safety signs with signal word “**DANGER**”, “**WARNING**”, or “**CAUTION**” are located near specific hazards.

<b>DANGER</b>	Indicates a hazardous situation that, if not avoided, will result in death or serious injury.
<b>WARNING</b>	Indicates a hazardous situation that, if not avoided, could result in death or serious injury.
<b>CAUTION</b>	Indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.
<b>NOTICE</b>	Indicates information considered important, but not hazard-related.

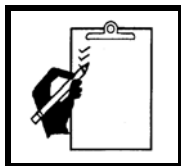
## SAFETY SYMBOL EXPLANATION



This is the safety alert symbol. This symbol is used in combination with an exclamation mark or other symbols to alert you to the potential for bodily injury or death.



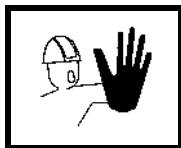
**WARNING:** Read Operator’s Manual and safety signs before operating machine.



**WARNING:** Check machine before operating. Machine must be in good operating condition and all safety equipment installed and functioning properly.



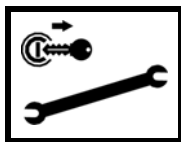
**WARNING:** Wear personal protective equipment. Dress properly. Refer to “Personal Protection,” [page 40-5](#).



**WARNING:** Keep spectators away.



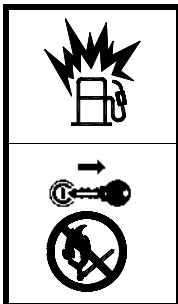
**WARNING:** Engine exhaust can asphyxiate. Operate only outdoors.



**WARNING:** Use [Shutdown Procedure](#) before servicing, cleaning, repairing or transporting machine. Refer to [page 50-4](#).



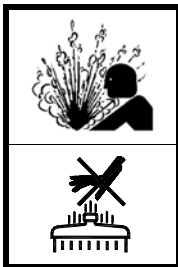
**WARNING:** Pressurized fluid can penetrate body tissue and result in serious injury or death. Leaks can be invisible. Keep away from any suspected leaks. Relieve pressure in the hydraulic system before searching for leaks, disconnecting hoses, or performing any other work on the system. If you must pressurize the system to find a suspected leak, use an object such as a piece of wood or cardboard rather than your hands. When loosening a fitting where some residual pressure may exist, slowly loosen the fitting until oil begins to leak. Wait for leaking to stop before disconnecting the fitting. Fluid injected under the skin must be removed immediately by a surgeon familiar with this type of injury.



**WARNING:** Fuel and fumes can explode and burn.



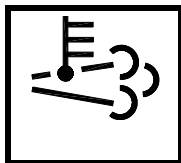
Shut off engine before refueling. No flame. No smoking.



**WARNING:** Hot fluid under pressure can scald.



Allow engine to cool before opening radiator cap.



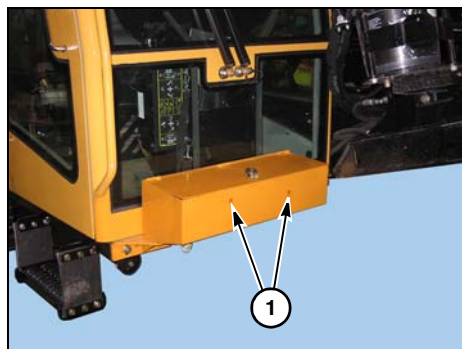
**WARNING:** When *HEST (High Exhaust System Temperature) Light* is displayed, the exhaust gas temperature could exceed 1100°F (600°C) during regeneration. High temperature may result in fire, burn, or explosion hazards, which may result in personal injury or death. Do not expose flammable material or explosive atmospheres to exhaust gas or to exhaust system components during regeneration.



**WARNING:** To prevent fires, routinely clear any combustibile material from the engine exhaust system. Tier 4 Interim / Stage IIIB emission compliant exhaust systems use extreme high temperature that can ignite combustibile material.

## FIRE EXTINGUISHER

A fire extinguisher (not supplied with machine) can be mounted to the remote control box (1).



**WARNING:** Failure to follow any of the preceding safety instructions or those that follow within this manual, could result in serious injury or death. This machine is to be used only for those purposes for which it was intended as explained in this Operator's Manual.

# Section 11: Welding Precautions

## WELDING ALERT - ELECTRONIC COMPONENTS

**NOTICE:** Electronic modules and controllers will be damaged from stray voltages and currents generated during welding if not unplugged **before welding**.

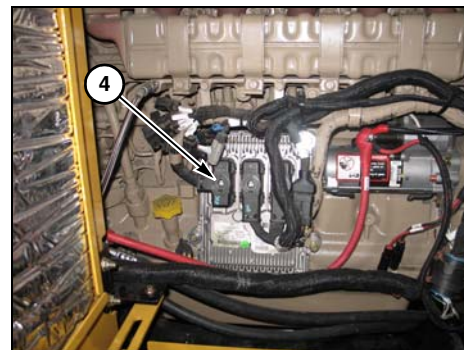
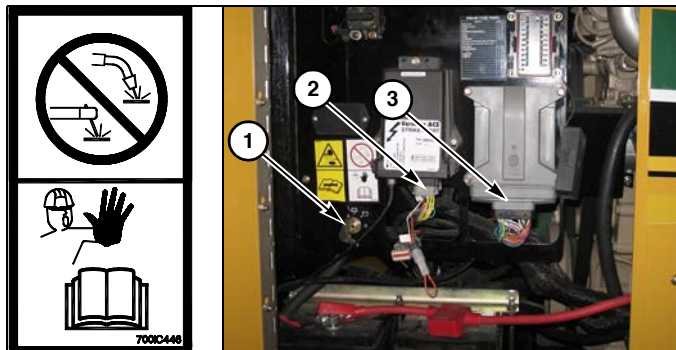
To prevent extensive and costly damage to the electrical components:

**Step 1:** Turn *Battery Disconnect Switch* (1) to DISCONNECT.

**NOTICE:** Disconnecting the battery ground with the battery disconnect switch will not prevent damage to the electronic components during welding. Each of the modules must have the electrical connector unplugged from the module.

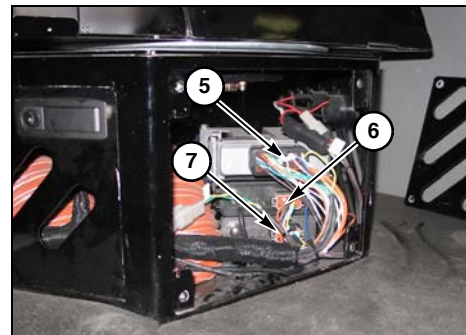
**Step 2:** Unplug Strike Alert (2) and pump controller (POM) modules (3).

**Step 3:** Unplug three engine ECUs (4).

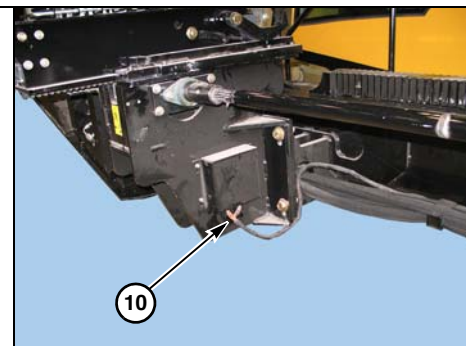
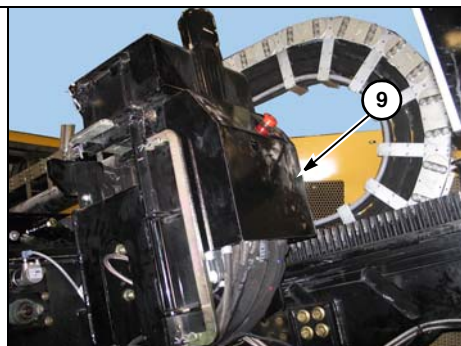
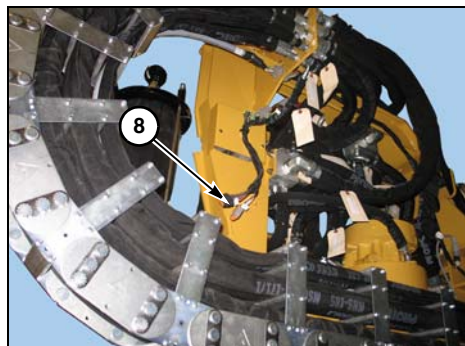


**Step 4:** Under the seat, unplug three connectors, to the cab controller (5), the Remote Lockout Controller (RLC) (6) and the DCIM module (7).

In cab machine, access through foot panel in front of operator seat; in non-cab machine, tip seat forward and lift panel.



**Step 5:** Unplug carriage control unit (CCU) (8), rack output controller (ROM) (9), and vise controller (VOM) (10).





# Section 15: Intended Use

The Vermeer D60x90 Navigator Horizontal Directional Drill is designed solely to create horizontal bores through the earth. Utilities are typically installed in these underground bores during pullback.

Always use the machine in accordance with the instructions contained in this Operator's Manual, safety signs on the machine, and other material provided by Vermeer Corporation.

Correct maintenance and repair is essential for safety, and for efficient operation of the machine. Do not use the machine if it is not in suitable operating condition.

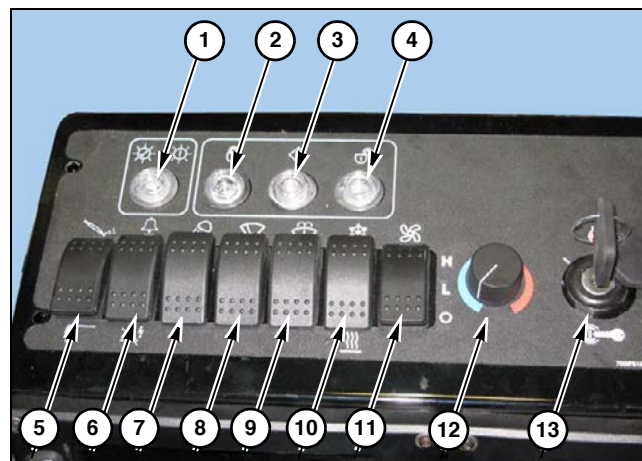
This page intentionally left blank.

# Section 20: Controls

## Controls Locations

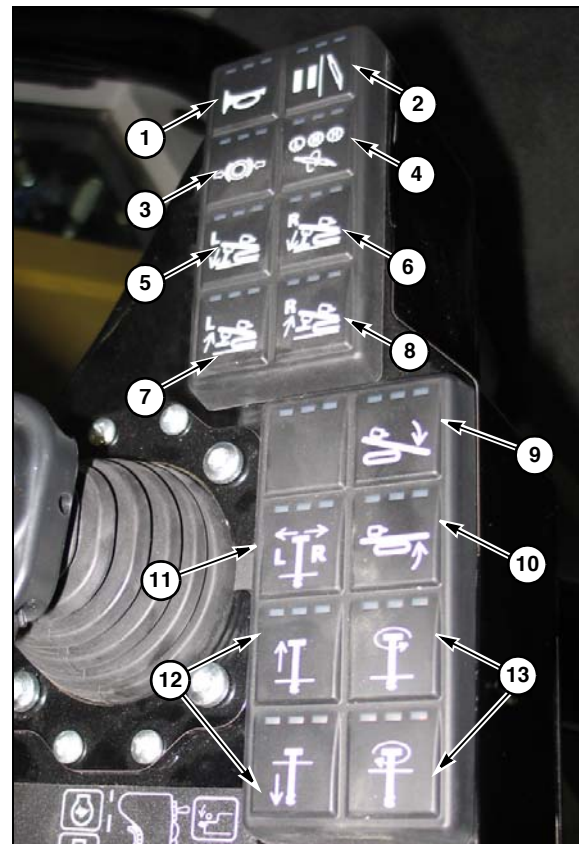
### TOP PANEL CONTROL

- (1) Strike Alert Indicator Light [page 20-10](#)
- (2) Remote Lockout LOCKOUT Mode Light (red) [page 20-15](#)
- (3) Remote Lockout Processing Light (yellow) [page 20-15](#)
- (4) Remote Lockout Run Mode Light (green) [page 20-15](#)
- (5) Wash Wand/Drill Fluid Selector Switch [page 20-54](#)
- (6) Strike Alert Switch [page 20-9](#)
- (7) Work Light Switch [page 20-57](#)
- (8) Windshield Wiper Switch [page 20-62](#)
- (9) Windshield Washers Switch [page 20-62](#)
- (10) Heater/AC Switch [page 20-62](#)
- (11) Fan Switch [page 20-62](#)
- (12) Thermostat Knob [page 20-62](#)
- (13) Ignition Switch [page 20-21](#)



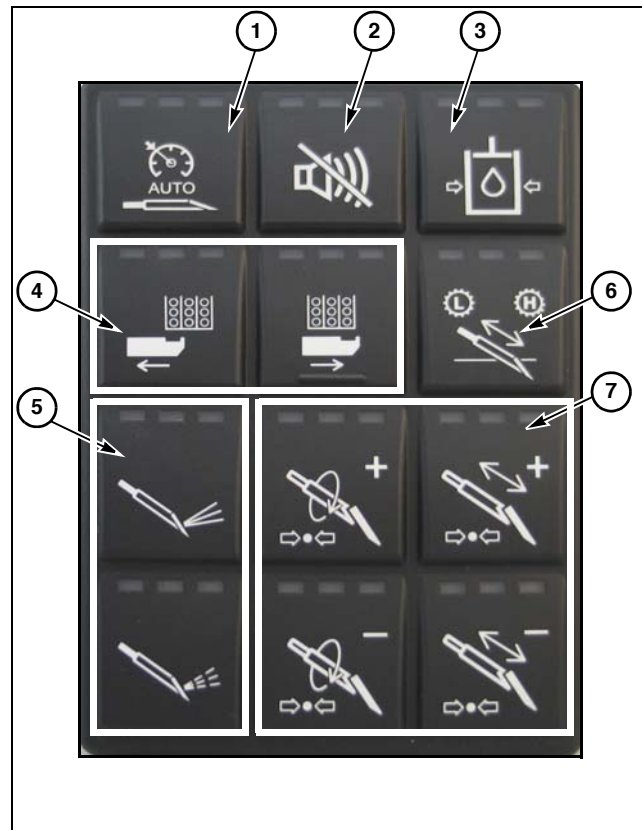
## LEFT PANEL CONTROLS

- (1) Horn Key
- (2) Drill/Transport Mode Indicator [page 20-33](#)
- (3) Rotation Brake Key [page 20-40](#)
- (4) 3-Speed Rotation Gearbox Key [page 20-39](#)
- (5) Left Stabilizer Lower Key [page 20-35](#)
- (6) Right Stabilizer Lower Key [page 20-35](#)
- (7) Left Stabilizer Lift Key [page 20-35](#)
- (8) Right Stabilizer Lift Key [page 20-35](#)
- (9) Rack Tilt Switch [page 20-36](#)
- (10) Rack Level Switch [page 20-36](#)
- (11) Power Stakedown Selector Switch [page 20-36](#)
- (12) Hydraulic Stakedown Driver Cylinder Switches [page 20-36](#)
- (13) Hydraulic Stakedown Driver Motor Switches [page 20-36](#)



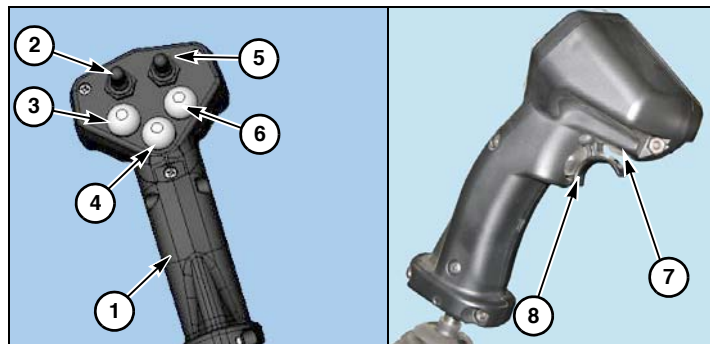
## RIGHT PANEL CONTROLS

- (1) AutoDrill Resume and Mode Select [page 20-43](#)
- (2) Remote Lockout Alarm Cancel [page 20-18](#)
- (3) Hydraulic Enable [page 20-24](#)
- (4) Rod Row Positioner [page 20-46](#)
- (5) Drilling Fluid Pump Increase/Decrease [page 20-53](#)
- (6) 2-Speed Thrust/Pullback [page 20-41](#)
- (7) AutoDrill Rotation and Thrust Increase/Decrease [page 20-44](#)



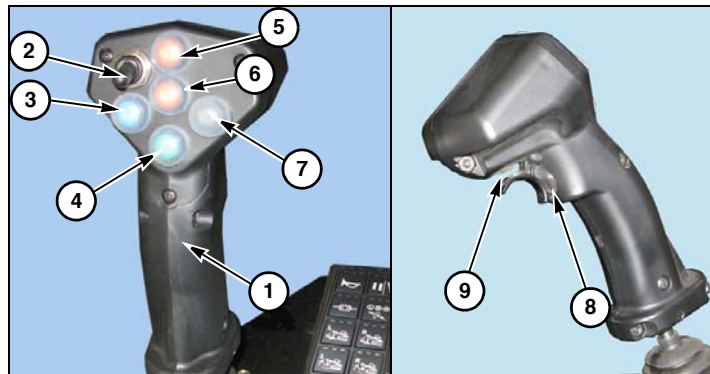
## RIGHT JOYSTICK

- (1) Thrust Joystick [page 20-41](#)
- (2) Rear Vise [page 20-51](#)
- (3) Vise Rotation [page 20-51](#)
- (4) Rod Lower [page 20-46](#)
- (5) Front Vise [page 20-51](#)
- (6) Rod Lift [page 20-46](#)
- (7) Rod Transfer Arms Retract [page 20-45](#)
- (8) Rod Transfer Arms Extend [page 20-45](#)



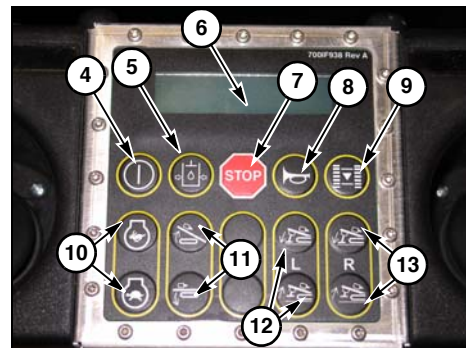
## LEFT JOYSTICK

- (1) Rotation Joystick [page 20-38](#)
- (2) Drilling Fluid On/Off [page 20-52](#)
- (3) Fluid Full Flow [page 20-52](#)
- (4) AutoDrill Set [page 20-43](#)
- (5) Throttle Increase [page 20-25](#)
- (6) Throttle Decrease [page 20-25](#)
- (7) Greaser [page 20-50](#)
- (8) Rod Gripper Release [page 20-45](#)
- (9) Auto Steer [page 30-37](#)



## REMOTE CONTROL

- (1) Left Track Joystick [page 20-31](#)
- (2) Right Track Joystick [page 20-31](#)
- (3) Ground Drive Trim Switches [page 20-31](#)
- (4) Remote Power [page 20-26](#)
- (5) Hydraulic Enable [page 20-24](#)
  
- (6) Display Screen [page 20-26](#)
- (7) Remote Control Engine Stop [page 20-22](#)
- (8) Horn [page 20-31](#)
- (9) Ground Drive Calibrate [page 20-32](#)
- (10) Throttle Increase/Decrease [page 20-25](#)
- (11) Rack Tilt [page 20-37](#)
- (12) Left Stabilizer Lift [page 20-37](#)
- (13) Right Stabilizer Lift [page 20-37](#)



## TETHERED SECONDARY REMOTE CONTROL (S/N 138 -)

- (1) **Stop Button**  
Press to stop machine. Rotate to pull button out and turn to ON.
- (2) **Signal Strength Status**
- (3) **Off/On**
- (4) **Left Track Forward**
- (5) **Left Track Reverse**
- (6) **Rack Tilt**
- (7) **Right Track Forward**
- (8) **Right Track Reverse**
- (9) **Rack Level**

The tethered remote works only when an operator is not in the seat.

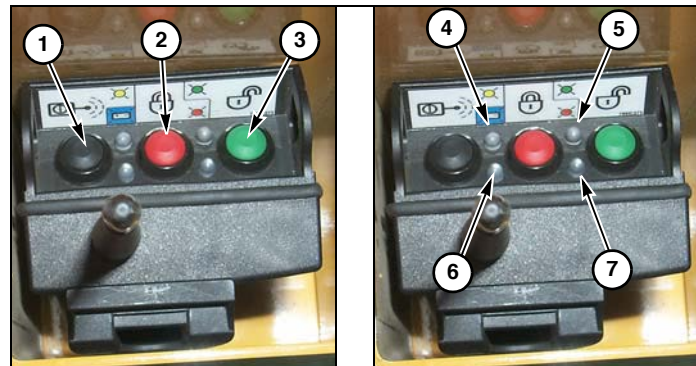
Ground drive speed controls on Tethered Secondary Remote Control are variable. Depress key slightly for slower speed, and depress farther for higher speed. Only use Tethered Secondary Remote Control when Wireless Remote Control is not available.





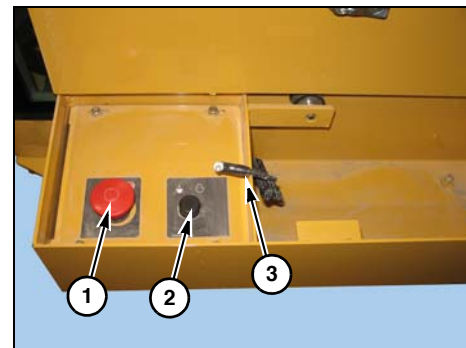
## REMOTE LOCKOUT TRANSMITTER

- (1) Power Button [page 20-13](#)
- (2) Lockout Button [page 20-13](#)
- (3) Run Button [page 20-13](#)
- (4) Yellow Processing Light [page 20-14](#)
- (5) Green RUN Mode Light [page 20-14](#)
- (6) Blue Low Battery Light [page 20-14](#)
- (7) Red LOCKOUT Mode Light [page 20-14](#)



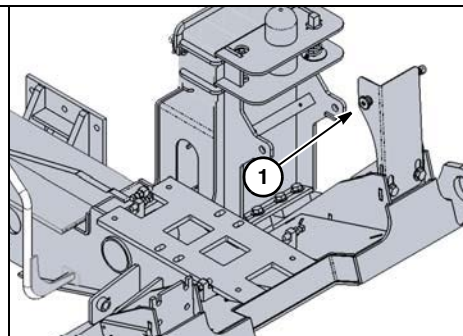
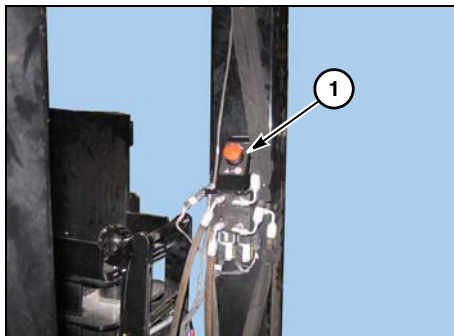
## START/STOP BUTTONS

- (1) Engine Stop Button [page 20-22](#)
- (2) Start Button [page 20-22](#)
- (3) 12v Electrical Connector [page 20-22](#)

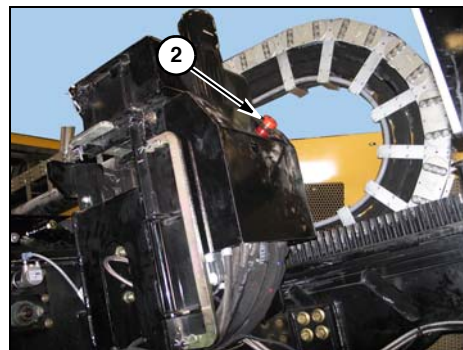


## LOCAL LOCKOUT BUTTONS

### (1) Vise Local Lockout



### (2) Carriage Local Lockout Button



# Strike Alert Controls

## (1) Strike Alert Test Switch

Push top . . . . . to test voltage and current sensing circuits.

Alarm on drill unit must sound.

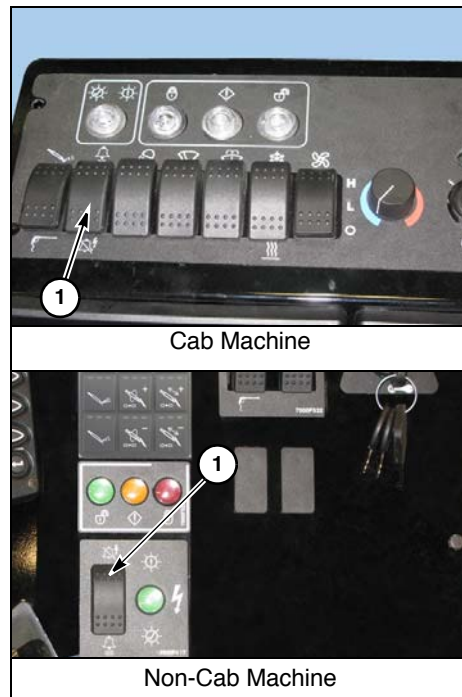
**NOTICE:** If the alarm sounds when the key is pressed, it means the system is working correctly. However, it does not guarantee that a strike has not occurred. If you suspect an electrical strike, follow the procedures in “Electrical Shock Protection.” Refer to [page 40-8](#).

Push bottom . . . . . to cancel alarm after Strike Alert alarm sounds and the cause has been corrected.

If pressing *Cancel* does not shut off alarm, do not move off machine until the cause has been identified. Refer to “Electrocution Prevention,” [page 40-9](#).

Test Strike Alert system with the voltage stake fully inserted into the ground. Do not test with stake in its storage cradle, lying on the machine, or lying on the ground.

If machine is on a dry hard surface, the auger stakes may need to be inserted into the ground, or the ground under the tracks moistened to increase electrical conductivity between machine and ground.



**(2) Green Indicator Light**

ON . . . . . Strike Alert system test passed

FLASHING . . . . . sensor failure,  
ground stake not in ground or ground stake wiring problem

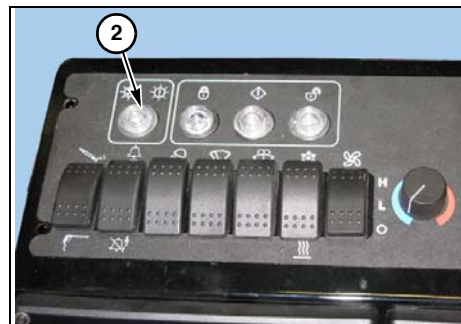
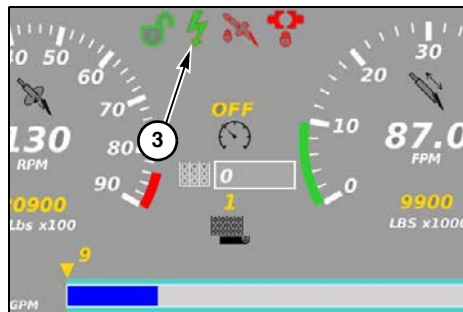
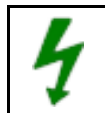
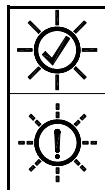
OFF . . . . . bulb burned out or problem in wire harness

**(3) Indicator Light**

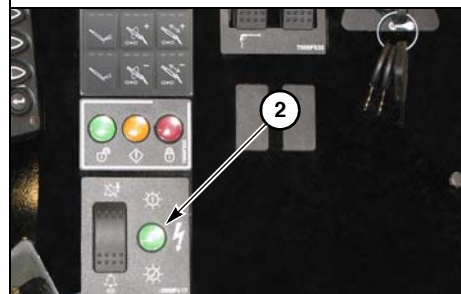
Red . . . . . strike has occurred

Green . . . . . Strike Alert system test passed; condition normal

Yellow . . . . . sensor failure,  
ground stake not in ground or ground stake wiring problem






Cab Machine





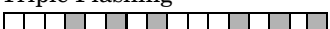
Non-Cab Machine

## Strike Alert - Indicators and Controls

INDICATOR	INDICATION	SIGNIFICANCE
Two-Tone Horn	On	Electrical strike occurred or <i>Test Key</i> pressed
	Silent	No voltage detected above threshold
Green Light	Off	Test in progress, light burned out, or wiring harness problem
	Flashing 	Voltage stake is not in the ground
	Double Flashing 	Current sensor failed
	Triple Flashing 	Voltage stake wiring problem
	<b>On</b>	Power-up check or test passed. System is ready

CONTROL	FUNCTION
Alarm Cancel Key	Turns alarm off (only when voltage and current are not present)
Test Key	Tests sensors, controller, and alarm

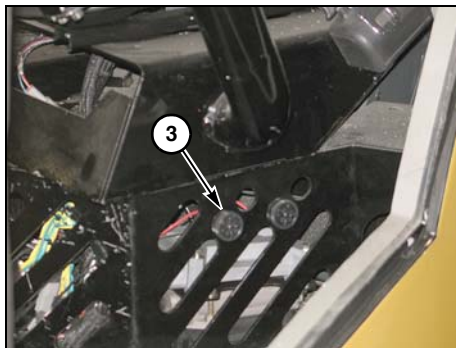
## Indicators on Display Screen

Yellow Symbol	Flashing 	Voltage stake is not in the ground
	Double Flashing 	Current sensor failed
	Triple Flashing 	Voltage stake wiring problem
Green Symbol	On	Power-up check or test passed. System is ready.

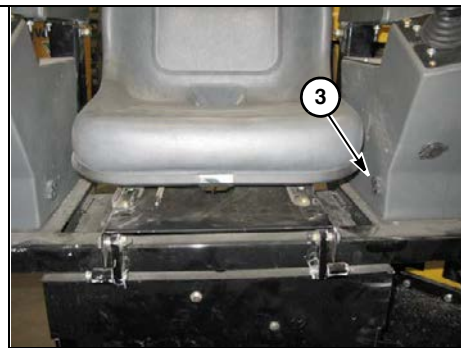
#### (4) **Strike Alert Horn**

When alarm sounds, the drill may have contacted an electrical line.

Alarm and machine horn will sound while the *Test Key* is pushed.



Cab Machine



Non-Cab Machine

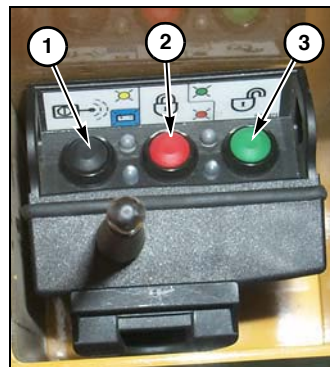
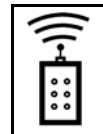
# Remote Lockout Controls

## REMOTE TRANSMITTER CONTROLS

In order for the remote transmitter to function, machine ignition key must be ON.

### (1) Power Button (black)

Press and hold until yellow light flashes . . . . . ON  
Then green light illuminates solid.  
Press and hold until all lights are off . . . . . OFF  
Remote shuts off automatically if there is no communication with machine after 20 minutes.



### (2) Lockout Button (red)

*With transmitter ON:*

Momentarily press and release . . . . . LOCKOUT mode requested  
When lockout is complete, red light will come on (takes approximately 2–5 seconds)  
and alarm sounds. Alarm shuts off after 5 seconds.

*With transmitter OFF:*

Press and hold until yellow light flashes . . . . . turns transmitter ON  
. . . . . and requests LOCKOUT mode  
When lockout is complete, red light will come on (takes approximately 2–5 seconds).



### (3) Run Button (green)

*With transmitter ON:*

Press and hold until yellow light flashes and alarm sounds . . . RUN mode requested  
When green light comes on steady, Remote Lockout system is in RUN mode.

*With transmitter OFF:*

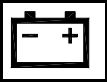
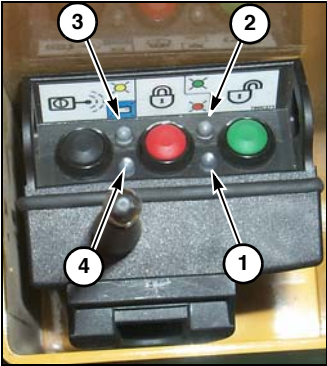
Press and hold . . . . . TEST mode  
to initiate testing of transmitter buzzer, vibrator and indicator lights



# Indicator Lights

Flashing or steady lights indicate various operating conditions

- (1) LOCKOUT Mode Light**  
Red steady . . . . . drill rotation, thrust/pullback, and fluid locked out
- (2) RUN Mode Light**  
Green steady . . . . .drill control returned to operator  
Green flashing. . . . . lockout requested, waiting for confirmation
- (3) Processing Light**  
Yellow flashing . . . . . machine state unknown; attempting  
to establish radio communication  
Double flashing. . . . . Registration mode
- (4) Low Battery Light**  
Blue flashing . . . . . battery power less than 10%





# REMOTE LOCKOUT MACHINE CONTROLS

## Indicator Lights on Control Panel

Flashing or steady lights indicate various operating conditions.

### (1) **RUN Mode Light**

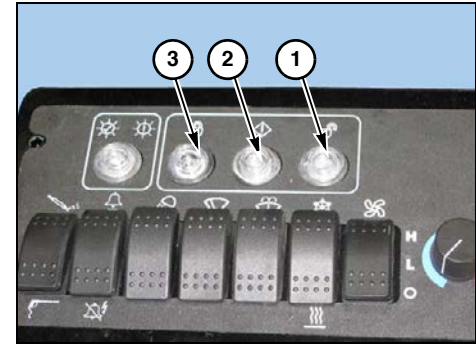
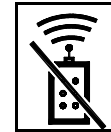
Green steady. . . . . drill control returned to operator  
Green flashing . . . . . lockout requested, waiting for confirmation

### (2) **Processing Light**

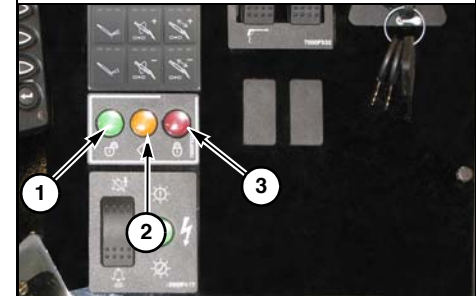
Yellow flashing . . . . . machine state unknown;  
attempting to establish radio communication  
Double flashing. . . . . Registration mode

### (3) **LOCKOUT Mode Light**

Red steady. . . . .drill rotation, thrust/pullback, and fluid locked out



Cab Machine



Non-Cab Machine

## Indicator Lights on Display Screen

Flashing or steady light (4) indicates various operating conditions. Refer to next page.

### RUN Mode Light

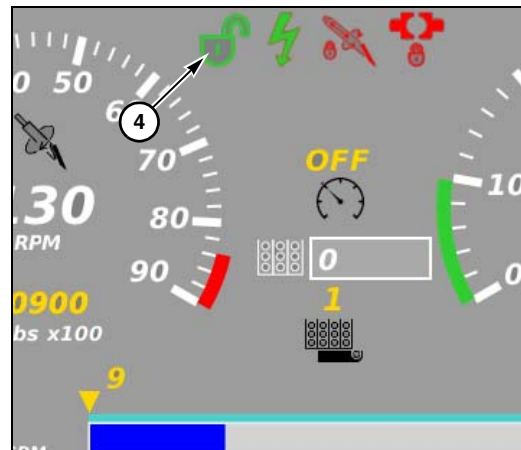
Green steady. . . . . drill control returned to operator  
Green flashing . . . . . lockout requested, waiting for confirmation

### LOCKOUT Mode

Red steady . . . . drill rotation, thrust/pullback, and fluid locked out

### Processing Light

Yellow flashing . . . . . machine state unknown;  
. . . . . attempting to establish radio communication  
Double flashing . . . . . Registration mode



## Remote Lockout Indicators

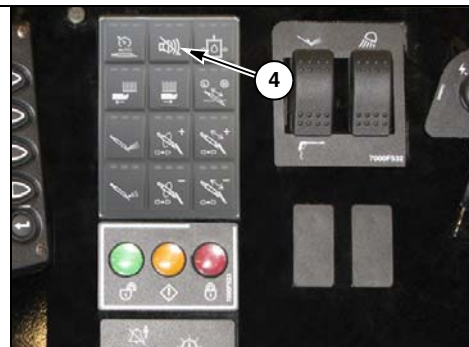
Transmitter Indicators	Indication	Function/Status
<b>Green RUN Light</b>	Steady	RUN mode. Machine not locked out.
	Flashing	Lockout requested; waiting for confirmation.
<b>Red LOCKOUT Light</b>	Steady	LOCKOUT mode. Machine is locked out.
<b>Yellow Light</b>	Flashing	No radio communication between transmitter and machine.
	Double flashing	Remote is in Registration mode.
<b>Blue Light</b>	Flashing	Battery low.
<b>Sound</b>	2 seconds	RUN mode. Machine not locked out.
	3+3+3 beeps	LOCKOUT mode. Machine is locked out.
	60 seconds	Lockout denied. Attempt to lockout machine has failed.
<b>Vibration</b>	60 seconds	Lockout denied. Attempt to lockout machine has failed.

Machine Indicators	Indication	Function/Status
<b>Green RUN Light</b>	Steady	RUN mode. Machine not locked out.
	Flashing	Lockout requested; waiting for confirmation.
<b>Red LOCKOUT Light</b>	Steady	LOCKOUT mode. Machine is locked out.
<b>Yellow Light</b>	Flashing	No radio communication between transmitter and machine.
	Double Flashing	Registration mode.
<b>Sound</b>	2 seconds	RUN mode. Machine not locked out.
	3+3+3 beeps	LOCKOUT mode. Machine is locked out.
	60 seconds	Lockout denied. Attempt to lockout machine has failed.

**(4) Alarm Cancel Key**

Press to cancel continuously sounding alarm **(5)** when radio communication is not established.

If alarm does not stop sounding, assume a strike has occurred.

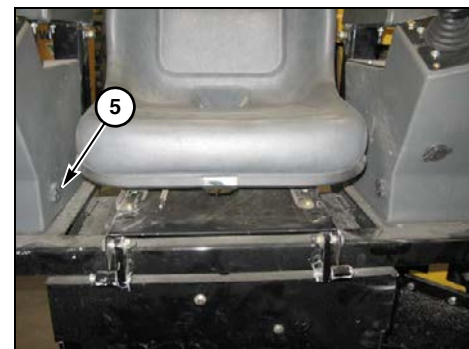
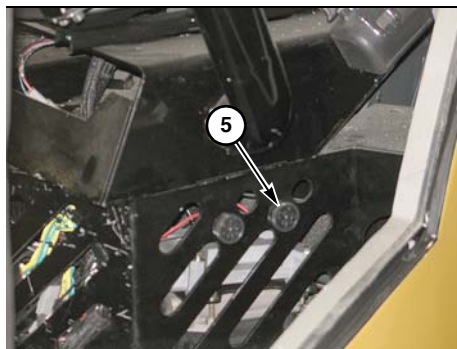


Cab Machine

Non-Cab Machine

**(5) Alarm**

Alarm sounds with a series of beeps or continuous tone to indicate various operating and Remote Lockout system conditions.



# REMOTE LOCKOUT BATTERY CHARGER

## Non-Cab Machine

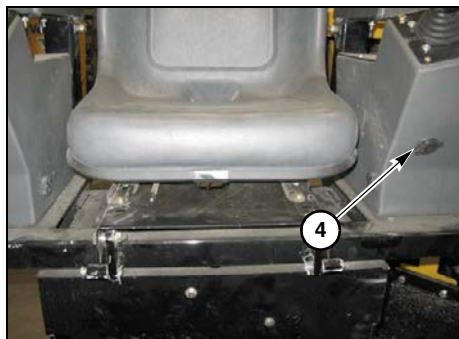
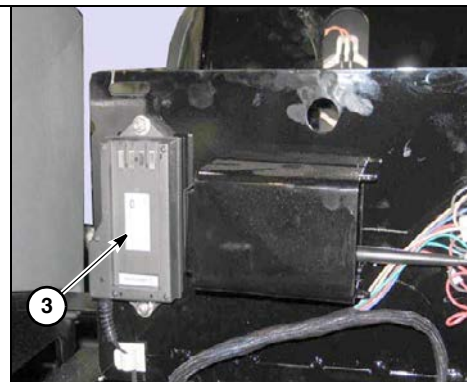
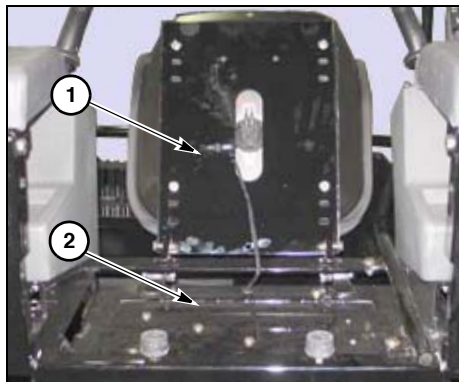
Tip seat (1) forward, then lift panel (2) to access.

Insert battery into charger (3).

Plug battery charger cord into one of the 12-volt 150-watt electrical accessory outlets (4) on operator console.

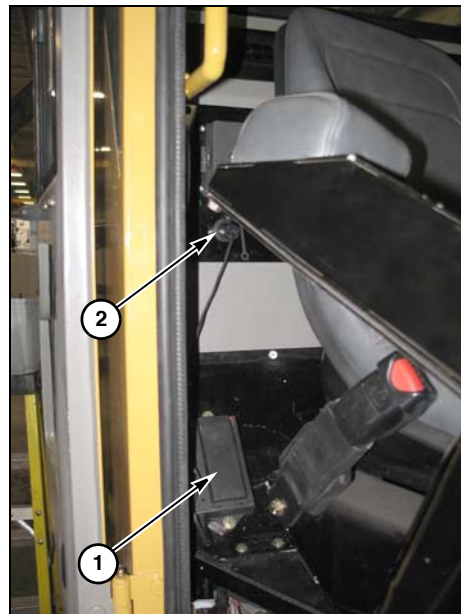
Amber light on battery flashes when battery is fully charged. Green light on battery indicates charger is receiving power.

Additional chargers may be purchased from your dealer for charging the battery in an auxiliary vehicle.



## Cab Machine

- (1) **Battery Charger**
- (2) Plug battery charger cord into 12-volt 150-watt electrical accessory outlet



# Engine Controls

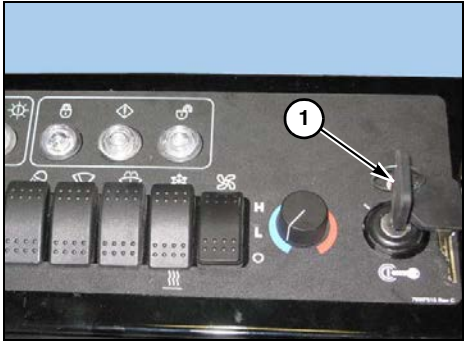
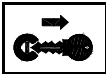
## ENGINE OPERATION CONTROLS

### (1) Keyswitch

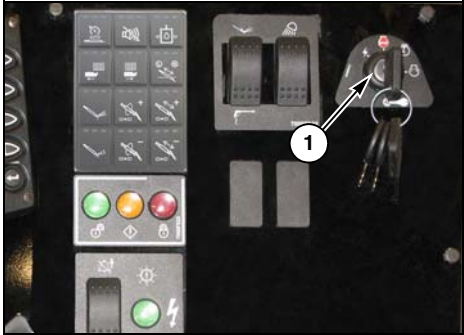
Vertical position . . . . . engine stop

1st position clockwise . . . . . engine run/electrical system ON


2nd position clockwise . . . . . engine start




Cab Machine




Non-Cab Machine

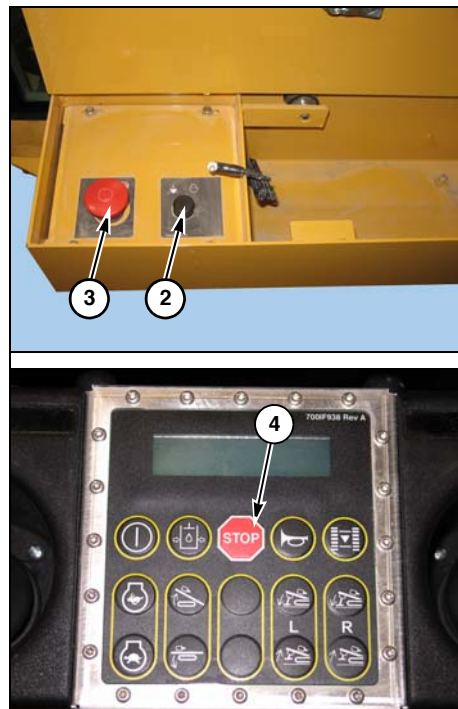
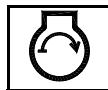
- (2) Start Button - Cab Machine**  
 For use only when keyswitch is not accessible.  
Press to start engine.  
**Keyswitch inside cab must be turned to ON position.**

Buttons (2) and (3) are located inside storage box on outside front of cab.

- (3) Engine Stop Button - Cab Machine**  
 Press to shut off engine.

-  Pull out before restarting engine.

- (4) Remote Control Stop Key**  
Press to shut off engine.

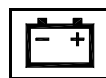




## (5) Battery Disconnect Switch

Rotate key counterclockwise .....disconnect ground

Rotate key clockwise ..... connect ground

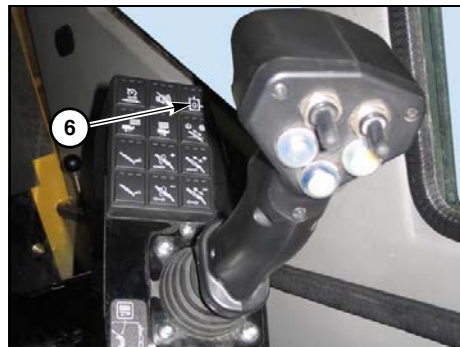


## (6) Hydraulic Enable Key

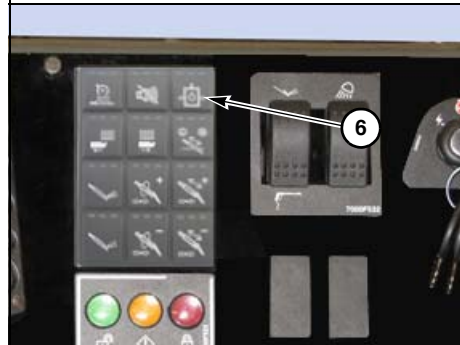
After starting, press key to enable the hydraulics for the rod loader, power vise circuits, and accessory circuits.



**WARNING:** Pressing *Hydraulic Enable Key* will result in vise movement if the vise control switch positions were changed while the engine was off. Crushing injury may result. Keep everyone clear of machine.



Cab Machine



Non-Cab Machine

- (7) **Throttle Increase Button - Drill Station, Rotation Joystick**  
 Press ..... increase engine RPM
- (8) **Throttle Decrease Button - Drill Station, Rotation Joystick**  
 Press ..... decrease engine RPM



# Transport Controls

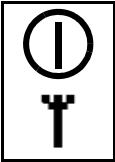
## TRANSPORT REMOTE CONTROL

Remote Control is disabled if operator is seated at controls.

- (1) **Remote Power Key**  
Press for 3 seconds . . . . . to turn Remote Control ON and OFF  
“Remote On” message appears on display screen.

Release key; display shows message “Connecting” and antenna symbol.

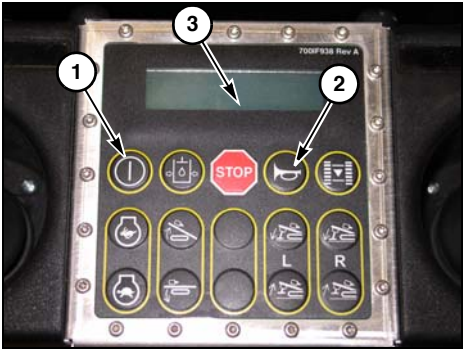
Remote turns itself off if there is no communication with base unit for 20 minutes. Control of the machine functions returns to operator station.



- (2) **Horn**  
Press . . . . . sound horn



- (3) **Display Screen**  
Displays “Enabled” when remote control is on and *Hydraulic Enable Key* has been pressed.



## Contrast

Press and hold (3), briefly press (1) . . . . . increase

Press and hold (4), briefly press (1) . . . . . decrease

## Backlight

Press and hold (2), then briefly press (1) . . . . . on

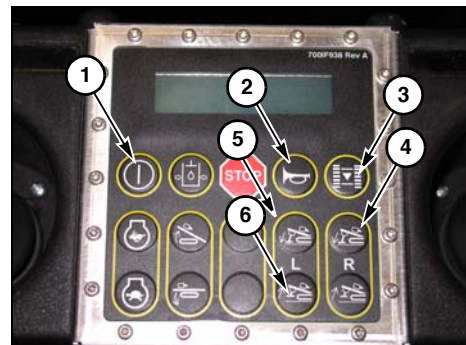
Press and hold (5), then briefly press (1) . . . . . off

## Changing Radio Channel

**Step 1:** Turn on Remote and place it near the machine.

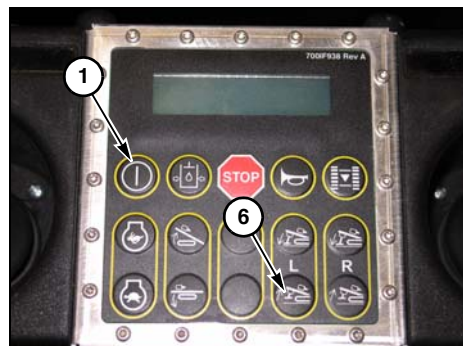
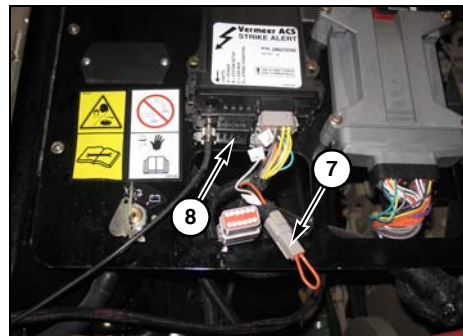
**Step 2:** Press and hold (1) and (6) simultaneously for 2 seconds, until message “Next Channel” and next channel number appear on display.

**Step 3:** Release both keys. Message “Connecting...” and new channel number appear. In 10 seconds the remote should be connected at the new channel.



## Remote Registration

- Step 1:** Turn on keyswitch. Engine need not be running.
- Step 2:** Wait 5 seconds, then remove 2-pin Deutsch “Registration/Country” jumper (7) from wire harness.
- Step 3:** Wait 3 seconds, then install jumper.  
In 3 more seconds, light B (8) on the base controller double flashes red. Base controller is in registration mode.
- Step 4:** Turn on remote. Press and hold (1) and (6) for 2 seconds or until “REGISTERING...” appears.
- Step 5:** Allow up to 2 minutes to complete registration. “Registered” briefly appears, then “RF INIT”. Several seconds later remote should communicate with base.  
If remote does not register in 3 minutes, “REG. FAILED” appears, and previous registration information remains intact. Turn off remote or attempt a new registration.

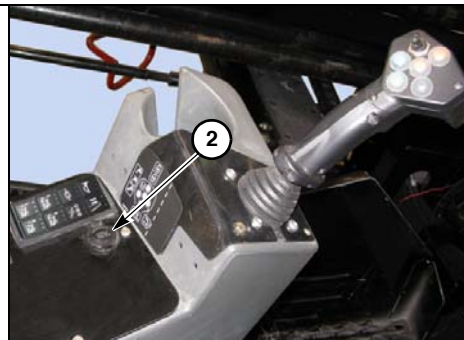
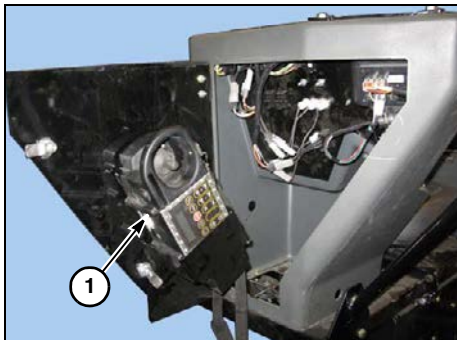


### Non-Cab Machine

- (1) Remote Control Transmitter Storage Bracket

- (2) Remote Control Battery Charger

Plug connecting cord into transmitter and charger.



### Cab Machine

- (3) 12-volt 150-watt electrical accessory outlets

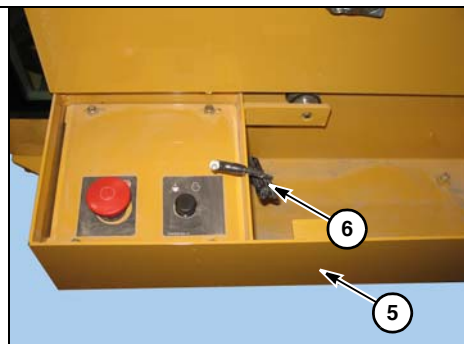
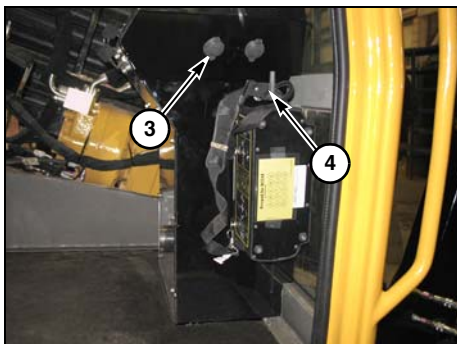
Plug connecting cord into transmitter and charger.

- (4) Remote Control Transmitter Storage Bracket

- (5) Remote Control Transmitter Transport Container - on front of cab

- (6) Computer Plug-In

- (7) 12v Electrical Socket



# Remote Control Operating Range



The following operating ranges assume the remote control system, including transmitter, batteries, and receiver, are in correct operating condition.

**Normal Range:** within 100 ft (30 m)

**Maximum Recommended Range:** up to 300 ft (91 m)

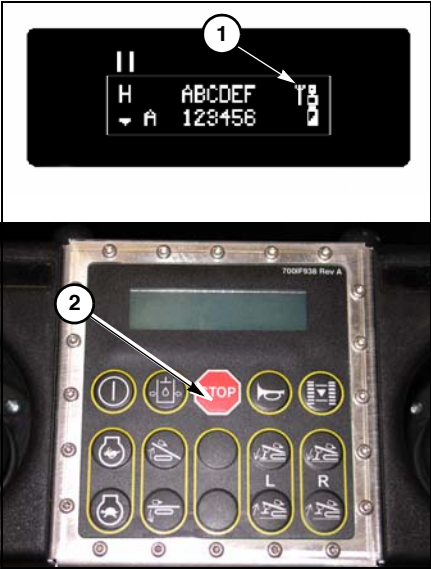
- Check range before operating machine.
- Do not exceed usable operating range.
- Recharge or replace battery if range is not at least 100 ft (30 m) (refer to [Maintenance Manual](#) for procedures).
- Range may exceed 300 ft (91 m).

An indicator symbol (1) on display indicates whether remote control is in or out of range:

	Remote communicates with the base.
	Remote does NOT communicate with the base.

Non-communication symbol displays whenever remote is out of range. While remote is out of range, track functions and any momentary switch functions on the remote control will stop. Communication symbol will display as soon as remote comes back within range.

*Engine Stop Key (2)* will not work if remote is out of range.





## TRANSPORT CONTROLS

### (1) Left Track Joystick



Push. . . . . left track FORWARD



Pull . . . . . left track REVERSE

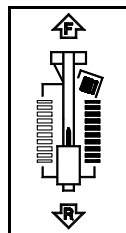
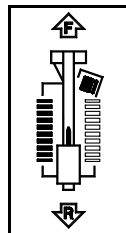
### (2) Right Track Joystick



Push. . . . .right track FORWARD



Pull . . . . .right track REVERSE



Push both joysticks forward to drive machine forward.

Pull both joysticks back to drive machine in reverse.

Steer machine by moving one joystick farther forward or back than the other.

To counter-rotate, push one joystick forward and pull the other joystick back.

The joysticks will self-center when released.

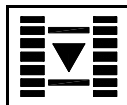
Ground drive controls do not function with an operator in the seat.

**(3) Ground Drive Calibrate Key**

Press and hold until “Enabled Trim On” appears on display.

If machine tracks to the left, press right trim switch while tracking until tracking is correct.

If machine is tracking to the right, press left trim switch until tracking is correct.



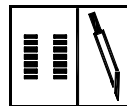
**(4) Ground Drive Trim Switches**

Press to derate left or right track to fine-tune steering.

To end calibration, place machine in Drill mode or shut off machine.

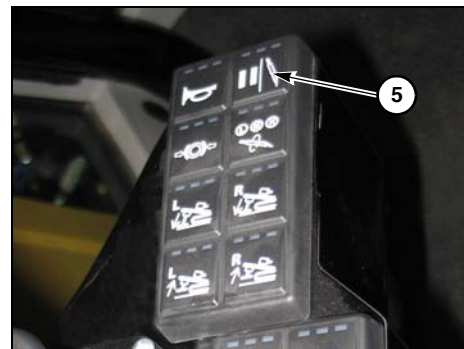
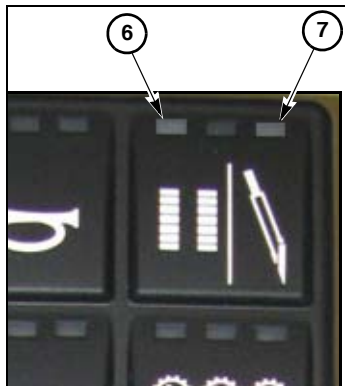


- (5) **Drill/Transport Mode Indicator** .....  
Mode automatically changes to Drill when operator is in seat.

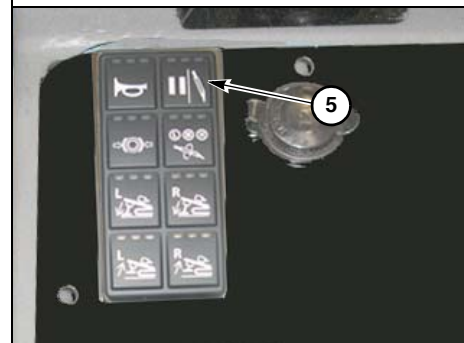


- (6) **Track Mode Indicator Light**  
Comes on when operator is out of the seat and the remote is ON.

- (7) **Drill Mode Indicator Light**  
Comes on when operator is in the seat and *Hydraulic Enable Key* has been pressed.



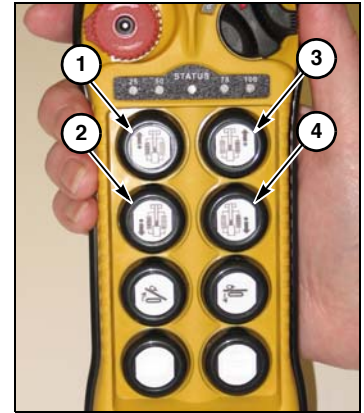
Cab Machine



Non-Cab Machine

## Transport with Tethered Remote (S/N 138 -)

- (1) Left Track Forward
- (2) Left Track Reverse
- (3) Right Track Forward
- (4) Right Track Reverse

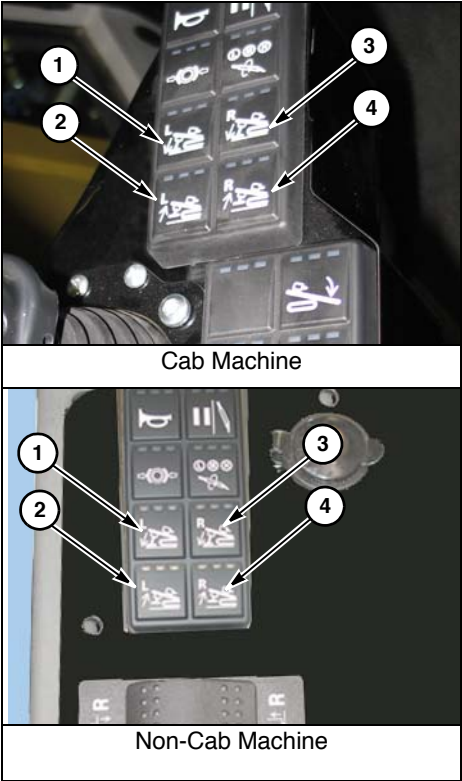
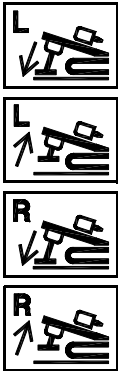


# Setup Controls

## STABILIZER CONTROLS - LEFT CONSOLE

Three lights on keys come on while pressing key.

- (1) **Left Stabilizer Lower Key** .....  
Lift left rear of machine.
- (2) **Left Stabilizer Lift Key**.....  
Lower left rear of machine.
- (3) **Right Stabilizer Lower Key**.....  
Lift right rear of machine.
- (4) **Right Stabilizer Lift Key** .....  
Lower right rear of machine.



## ROTARY STAKEDOWN CONTROLS - LEFT CONSOLE

**(1) Rack Tilt Switch**

Press.....tilt rack



**(2) Rack Level Switch**

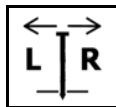
Press..... level rack



**(3) Power Stakedown Selector Switch**

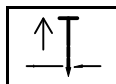
Press once ..... controls right stake, light B comes on

Press again .....controls left stake, light A comes on



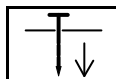
**(4) Hydraulic Stakedown Driver Cylinder Switch**

Press..... remove stake from the ground



**(5) Hydraulic Stakedown Driver Cylinder Switch**

Press.....drive stake into the ground



**(6) Hydraulic Stakedown Driver Motor Switch**

Press..... stake turns counterclockwise  
(to auger stake out of the ground)

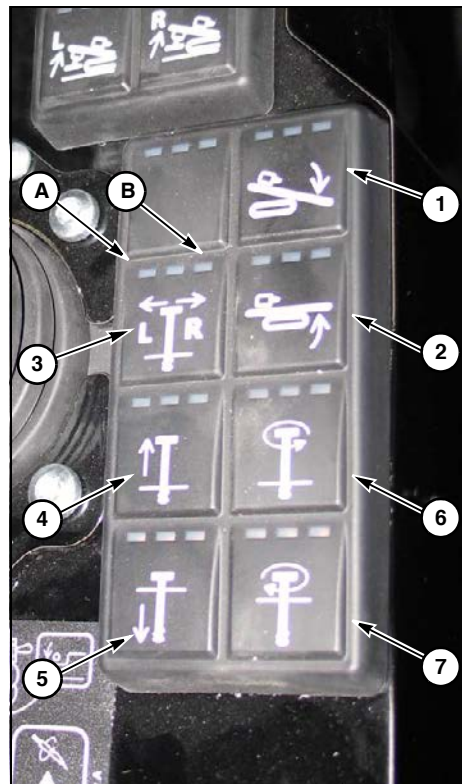


**(7) Hydraulic Stakedown Driver Motor Switch**

Press..... stake turns clockwise  
(to auger stake into the ground)



**NOTICE:** Controls (3) through (5) apply to all stakedowns. Controls (6) and (7) apply only for rotary style stakedowns (option).



# RACK AND STABILIZER CONTROLS - REMOTE CONTROLS

## (1) Rack Tilt Keys

Press upper key ..... tilt rack



Press lower key ..... level rack



## (2) Left Stabilizer Lift Keys

Press upper key ..... lift left stabilizer, lower machine



Press lower key ..... lower left stabilizer, lift machine



## (3) Right Stabilizer Lift Keys

Press upper key ..... lift right stabilizer, lower machine



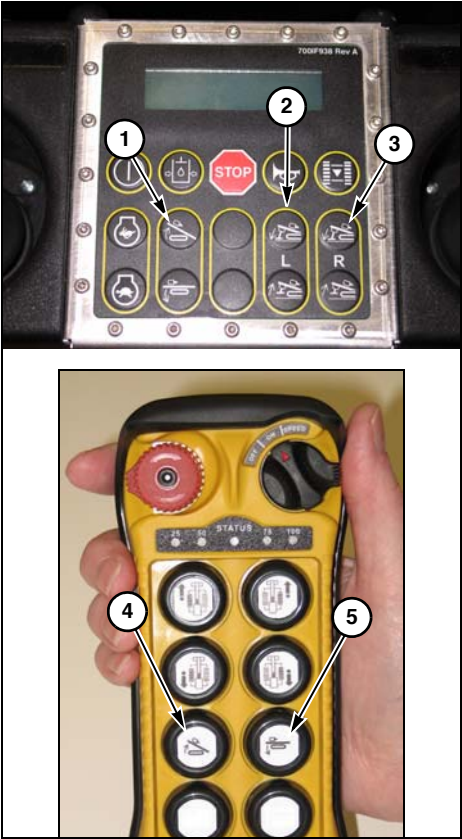
Press lower key ..... lower right stabilizer, lift machine



(4) Rack Tilt ..... tilt rack



(5) Rack Lower ..... level rack



# Drilling Controls

## DRILLING CONTROLS - ROTATION

**(1) Drill Rotation Joystick (self-centering)**



Push ..... rotate rod counterclockwise  
Use for uncoupling threaded drill rod.

Pull ..... rotate rod clockwise  
Use for drilling or backreaming.

In Manual Drill mode, releasing the *Drill Rotation Joystick* stops rotation.

In AutoDrill mode, moving either joystick out of NEUTRAL stops rotation and thrust/pullback.



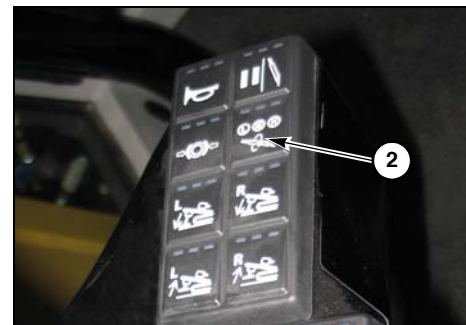
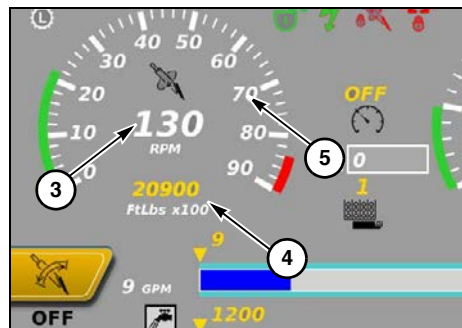
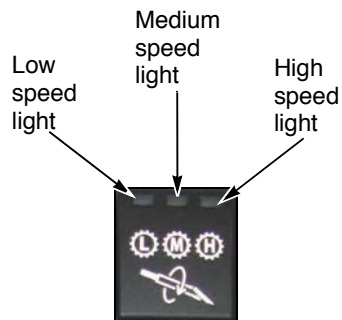


- (2) **3-Speed Rotation Gearbox Key** .....  
Controls drill rod rotation speed.  
Press to toggle through high, medium and low speeds.

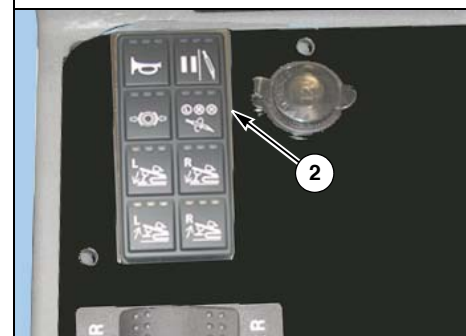


Rotation gearbox changes to LOW when front vise is on.

- (3) **Drill Rotation RPM**  
(4) **Drill Rotation Torque in FT-LB**  
(5) **Drill Rotation Pressure Gauge**



Cab Machine



Non-Cab Machine

## (6) **Rotation Brake Key**

Default..... off/disengaged  
Press once ..... engage rotation brake  
All three lights come on.

Press again ..... release rotation brake  
All three lights go off.

Used primarily with mud motor when thrust-only steering operation is used.

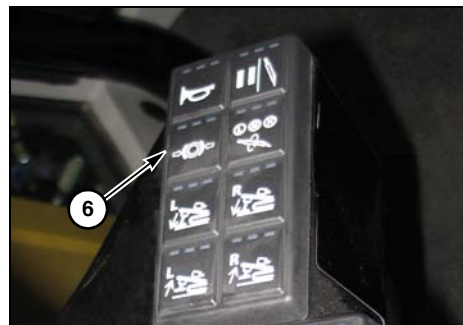
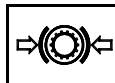
Left joystick must be returned to **NEUTRAL** position before *Rotation Brake Switch* can be engaged.

If rotation brake is engaged while joystick is out of **NEUTRAL**, rotation will stop.

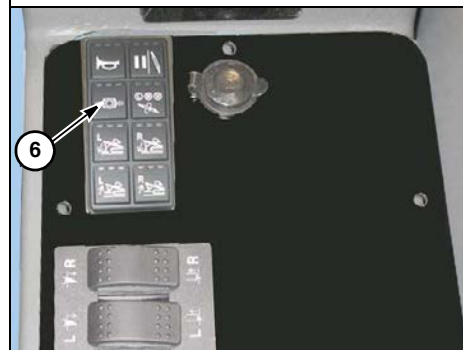
Return joystick to **NEUTRAL** and release rotation brake to restart rotation.

The following conditions will disable rotation function:

- Transport mode active/operator's seat unoccupied
- *Rotation Brake Switch* ON
- *Left Joystick* fault
- Rotation Brake output fault
- Rotation Output fault



Cab Machine



Non-Cab Machine

# DRILLING CONTROLS - THRUST

## (1) Thrust/Pullback Control Joystick (self-centering)



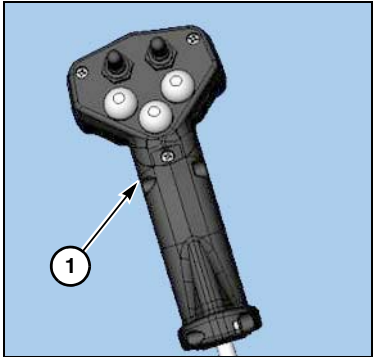
Push . . . . . thrust drill forward

Pull . . . . . pull back (retract) drill



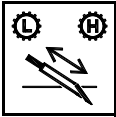
In Manual Drill mode, releasing the *Thrust / Pullback Joystick* automatically stops thrust/pullback.

In AutoDrill mode, moving a joystick out of NEUTRAL stops rotation and thrust/pullback.

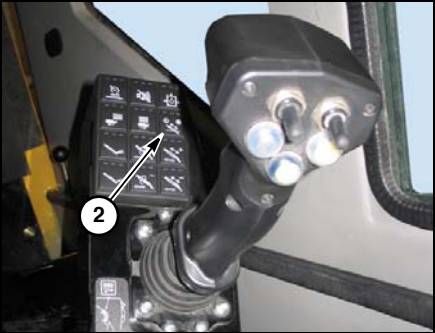
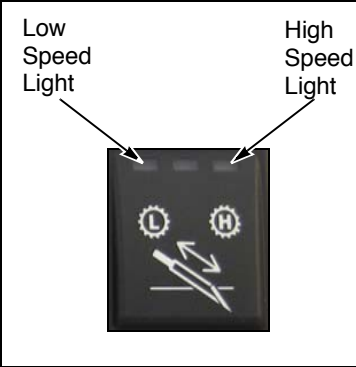


## (2) 2-Speed Thrust/Pullback Key

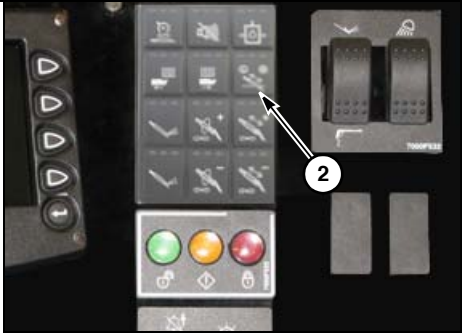
Press to toggle between high and low speeds.



**NOTICE:** When front vise is clamped, carriage speed changes to HIGH.



Cab Machine

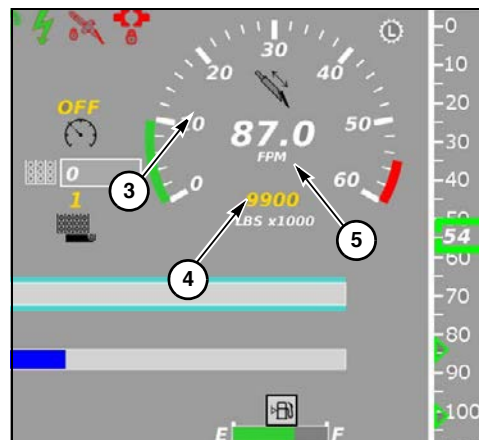


Non-Cab Machine

(3) Thrust/Pullback Pressure Gauge.....

(4) Thrust/Pullback Force in LB

(5) Actual Drilling Speed in FPM (M/MIN)



# AUTO-DRILL CONTROLS

**(1) AutoDrill Set Button**

After pressing key **(2)** to select mode:

Press and release ..... activate AutoDrill

Move either *Rotation* or *Thrust / Pullback Joystick* to pause AutoDrill mode.

**(2) AutoDrill Resume/Mode Selection Key**

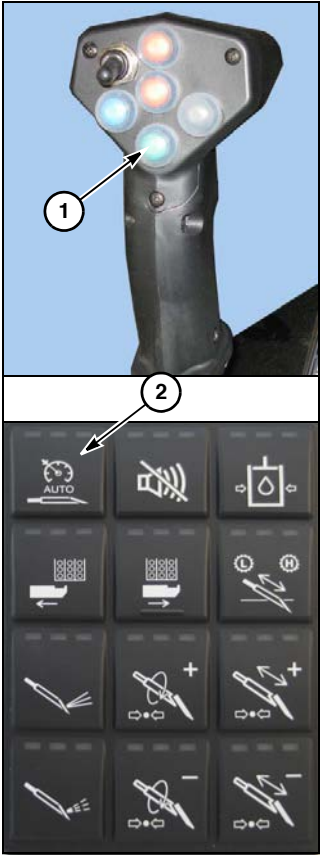
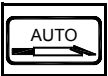
All three lights come on.

*To select mode:*

Press to toggle through SPEED, ROTATION, and THRUST, then press *AutoDrill Set Button*. DISABLE is also an option.

*To resume AutoDrill after pausing:*

Hold for 1.5 seconds. Rotation continues for 2–3 seconds before thrust or pullback starts.



**(3) AutoDrill Rotation Pressure Increase Key**

In SPEED mode..... increases speed  
In ROTATION mode.....increases pressure  
In DISABLE mode.....increases maximum rotation pressure



**(4) AutoDrill Rotation Pressure Decrease Key**

In SPEED mode..... increases speed  
In ROTATION mode.....increases pressure  
In DISABLE mode..... decreases maximum rotation pressure



**(5) AutoDrill Thrust/Pullback Increase Key**

In SPEED mode..... increases speed  
In THRUST mode.....increases pressure  
In DISABLE mode..... increases maximum thrust pressure



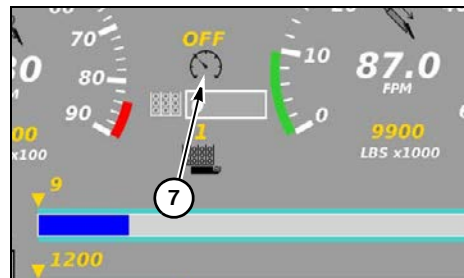
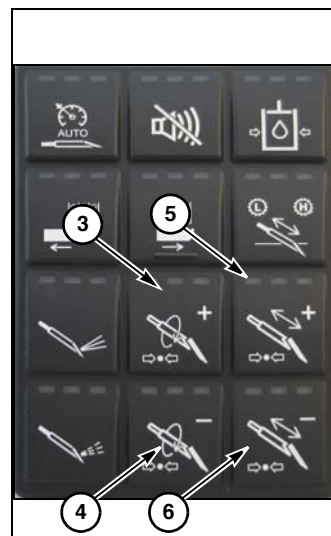
**(6) AutoDrill Thrust/Pullback Decrease Key**

In SPEED mode..... increases speed  
In THRUST mode.....increases pressure  
In DISABLE mode..... increases maximum thrust pressure



**(7) AutoDrill Indicator Symbol**

Solid green.....AutoDrill mode active  
Blinking green.....AutoDrill paused (standby mode)  
Off (gray).....AutoDrill OFF




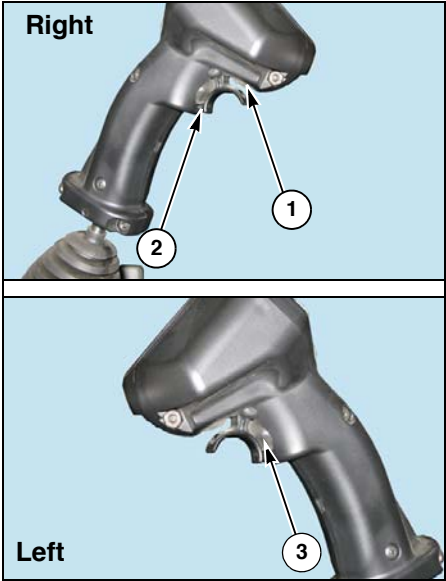
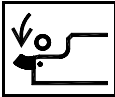
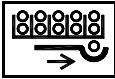
# ROD LOADER CONTROLS

(1) **Rod Transfer Arms Retract Button (right joystick)**  
Press trigger up .....  
..... move rod arms out to rod box (stow)

(2) **Rod Transfer Arms Extend Button (right joystick)**  
Pull trigger down .....  
..... move rod arms in to drill string (present)

(3) **Rod Gripper Button (left joystick)**  
  
Release ..... grip rod

  
Pull trigger down ..... release rod  
  
Gripper closes when engine is shut off.



**(4) Rod Lift Button**

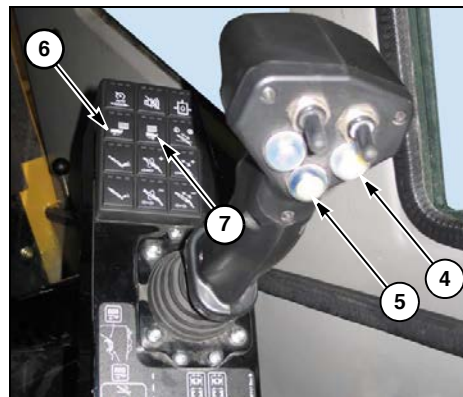
Press and hold . . . . . lift rod to rod box

Refer to “Rod Handling Components,” [page 20-48](#).



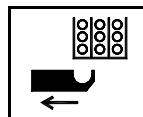
**(5) Rod Lower Button**

Press and hold . . . . . lower rod to transfer arms



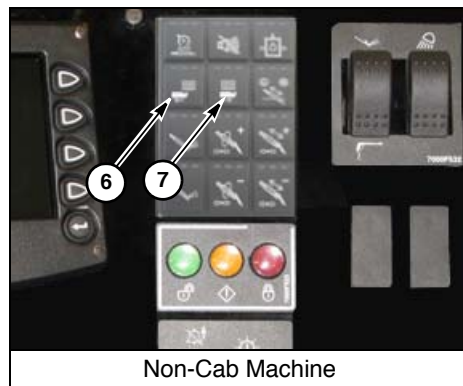
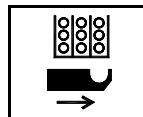
**(6) Rod Row Positioner Left . . . . .**

Select row to the left of current row



**(7) Rod Row Positioner Right . . . . .**

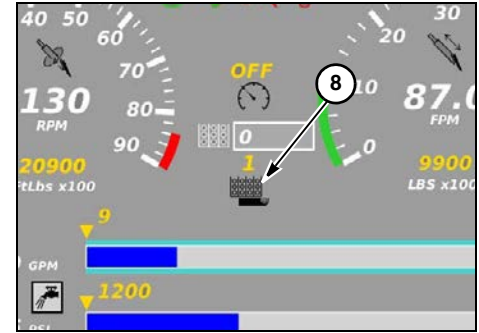
Select row to the right of current row





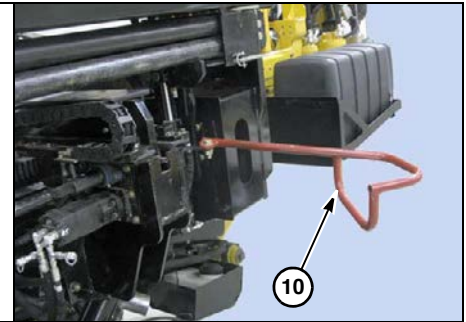
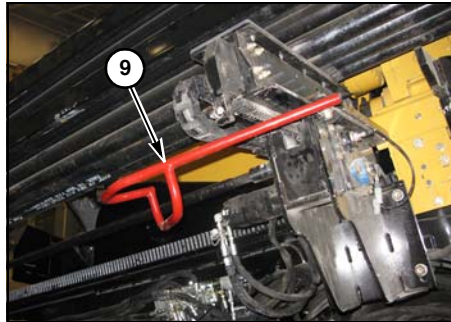
### (8) Anti-Crash Advisory

Graphic turns orange to indicate carriage will not move because rod loader arms are extended.



### (8) Rod Transfer Arm Barrier

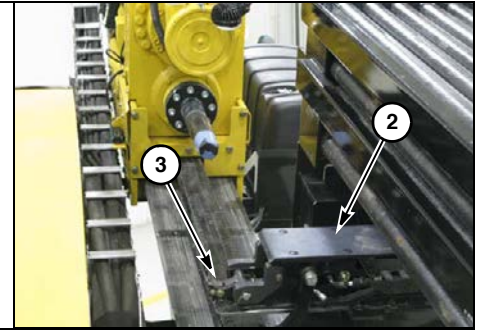
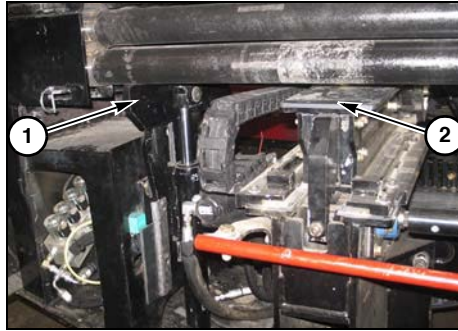
The barriers automatically move out (10) with the first movement of the rod loaders arms. Fold barriers back in manually before transporting.



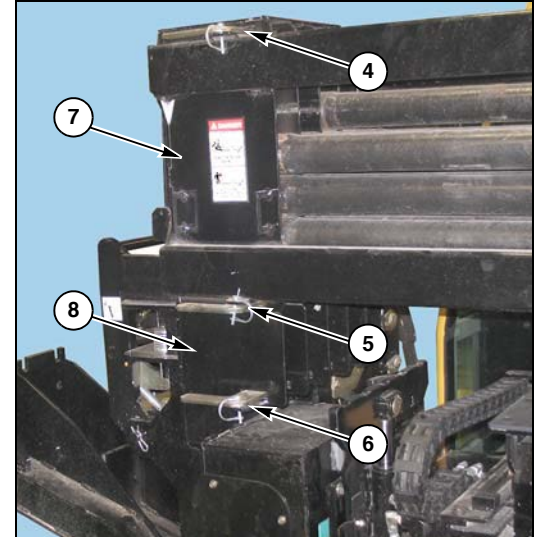
## Rod Handling Components

- (1) Rod Lifter
- (2) Rod Transfer Arm
- (3) Rod Gripper

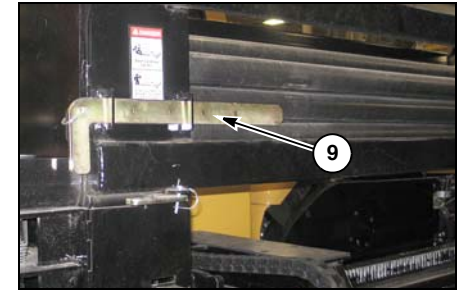
Gripper is always closed unless trigger is activated.



- (4) Top Rod Box Pin - keeps rod from being pushed out of box
- (5) Center Rod Box Pin - keeps rod in removable rod box
- (6) Bottom Rod Box Pin - keeps rod in fixed rod box
- (7) Removable Rod Box
- (8) Fixed Rod Box

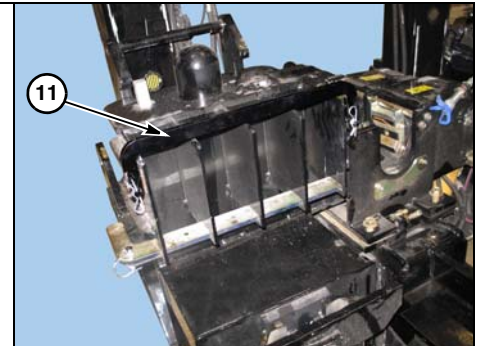
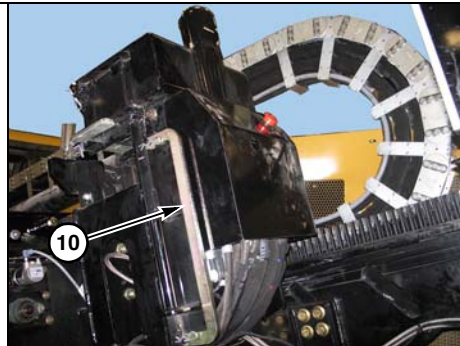
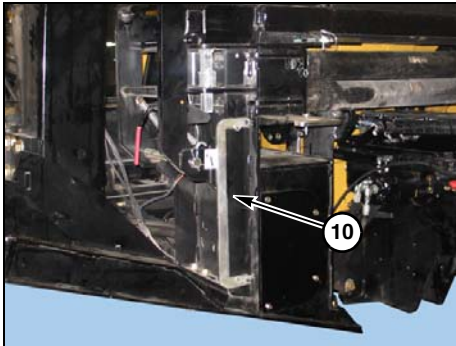


**(9) Storage Position for Rod Box Pins**



**(10) Storage Position for Pins for Fixed Rod Box - keeps rods in fixed rod box**

Install lock bar (11) on fixed rod box as needed.

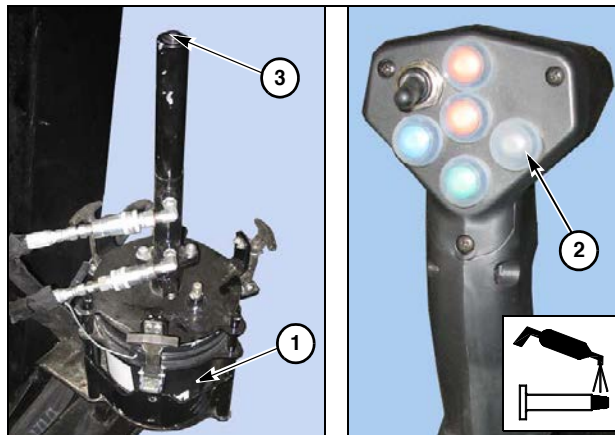


## GREASER

The greaser (1) lubricates drill rod threads. Press *Grease Button* (2) on left joystick to release grease.

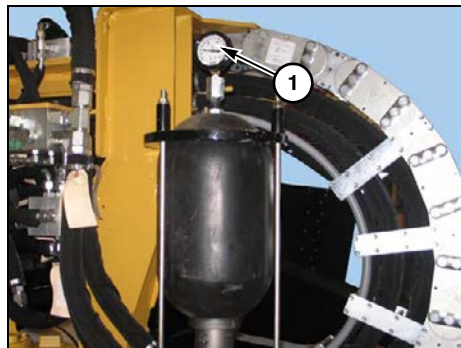
To adjust quantity of grease applied to threads, remove plug (3) at top of tube with Allen wrench, and rotate threaded screw inside in to decrease grease amount, or out to increase grease amount.

Refill or replace cartridge as needed. Refer to the [Maintenance Manual](#) for procedures.



## ACCUMULATOR GAUGE

Check accumulator pre-charge pressure on gauge (1) before starting machine each day. Refer to “Accumulator Pressure - Check,” [page 50-1](#).



# POWER VISE CONTROLS

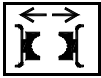
## (1) Front Vise Switch



Push up. . . . . clamp front drill rod  
Activating vise also opens gripper when rod loader is under selected row.



Push down . . . . . release front drill rod



**NOTICE:** When front vise is clamped, carriage speed changes to HIGH.

## (2) Rear Vise Switch



Push up. . . . . clamp rear drill rod  
Activating vise also opens gripper when rod loader is under selected row.



Push down . . . . . release rear drill rod

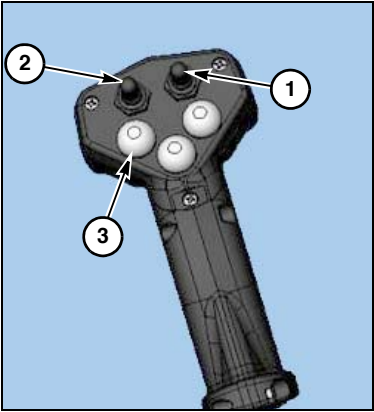


## (3) Vise Rotation Button

Press once. . . . . rotate vise to loosen rear drill rod  
to break joint between front and rear rod



Press again. . . . . rotate vise to home position



# DRILLING FLUID CONTROLS

## (1) Fluid System ON/OFF Switch



Push up . . . . . fluid system ON (variable flow)



Pull down . . . . . fluid system OFF

## (2) Fluid Full Flow Button

Press and hold . . . . . full flow

Released . . . . . full flow OFF

Control defaults to variable flow setting when button is released.



(3) **Drilling Fluid Pump Flow Increase Key**

(4) **Drilling Fluid Pump Flow Decrease Key**

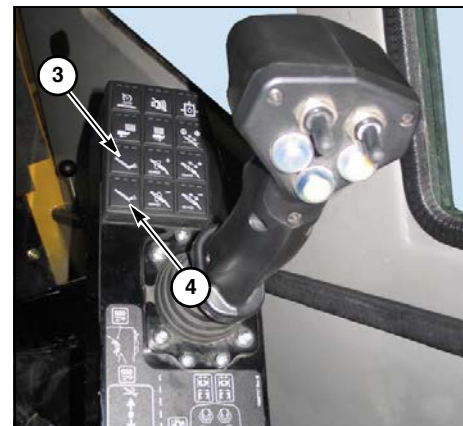
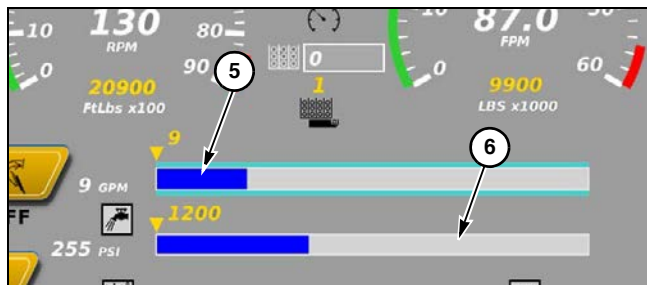
(5) **Drilling Fluid Pump Flow Rate Display**

0 ..... no flow

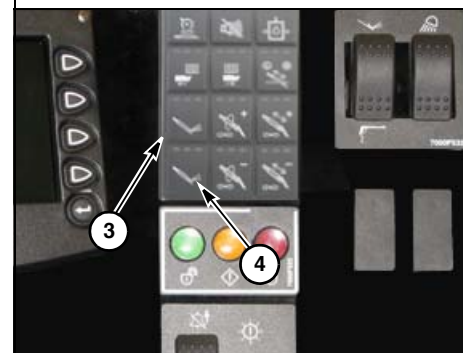
1 to maximum rated flow of pump . . . drilling fluid flow set point;  
. . . adjust with *Drilling Fluid Pump Flow Increase/Decrease Keys*

(6) **Fluid Pressure Gauge**

Displays drilling fluid pressure



Cab Machine



Non-Cab Machine



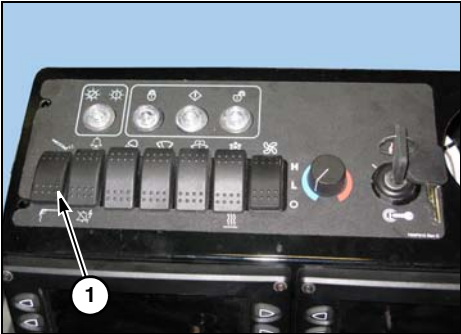
Wash Wand Controls

(1) Wash Wand/Drill Fluid Selector Switch

Push top .....drilling fluid to drill rod

Push bottom ..... drilling fluid to wash wand

While in Wash Wand mode, ball valve supplying drilling fluid to the drill rod remains closed regardless of position of *Fluid System Switch* or front vise.



Cab Machine



Non-Cab Machine



**(2) Wash Wand Quick Coupler**

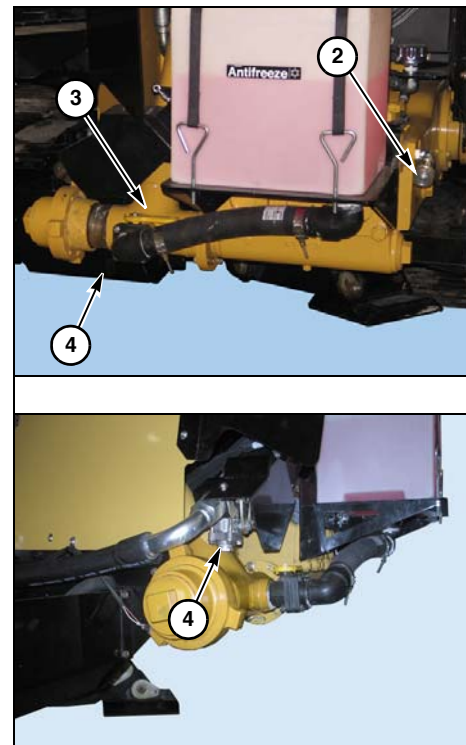
**(3) Antifreeze System Valve**

Rotate down (handle 90° to valve body) . . . . . closed

Rotate up (handle in-line with valve body) . . . . . open

**(4) Dump Valve**

Attach hose (not supplied) to release drilling fluid pressure in drill string.



# Drill Station Controls

## OPERATOR PRESENCE/SEAT CONTROLS

### (1) Operator Presence Switch

The machine is equipped with an Operator Presence system in the seat. The operator must be sitting in the seat for drill rotation and drill thrust to function.

### (2) Seat Pivot Latch (Non-Cab Machine only)

Lift rear lever or push front lever down to release seat pivot lock.

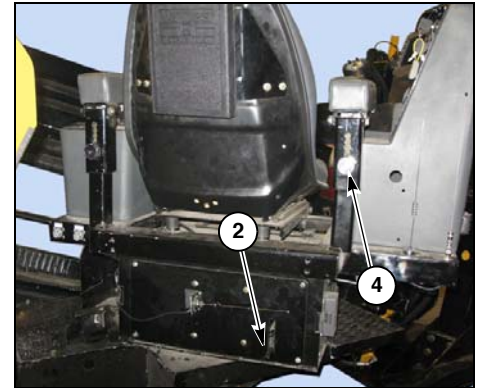
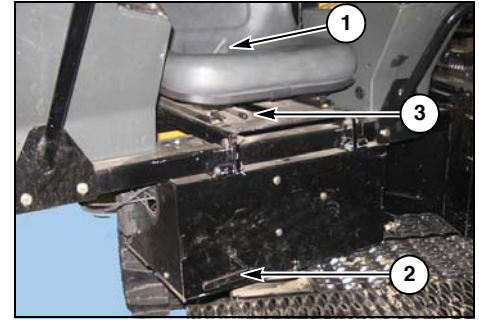
- Transporting – Rotate seat assembly fully in until pin locks.
- Operating – Rotate seat assembly out until pin locks in one of the four operating positions.

### (3) Seat Slide Lever

Push to the side so seat can be moved forward or backward.

### (4) Armrest Adjustment Knob

Loosen knobs on both sides of seat mount, tilt seat up or down. Tighten knobs.



## WORK LIGHTS

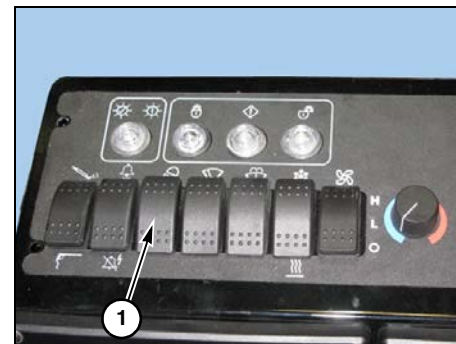
### (1) Light Switch

Press top . . . . . work lights ON

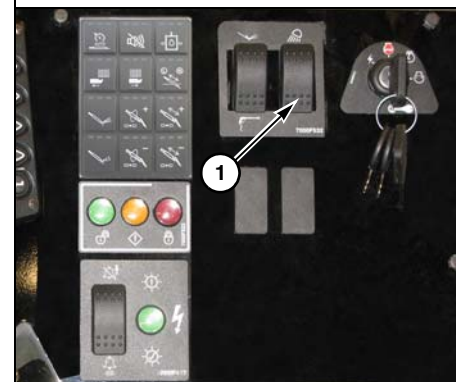
Press bottom . . . . . work lights OFF



Refer to the [Parts Manual](#) for part numbers of lights and mounting brackets, and identification of the wire harness connectors for the lights.



Cab Machine

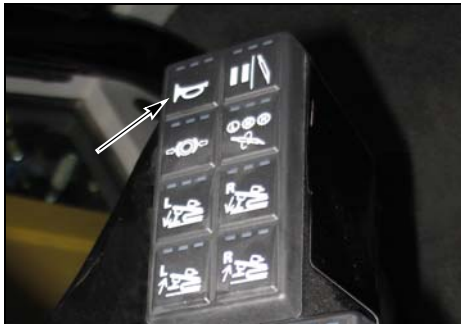


Non-Cab Machine

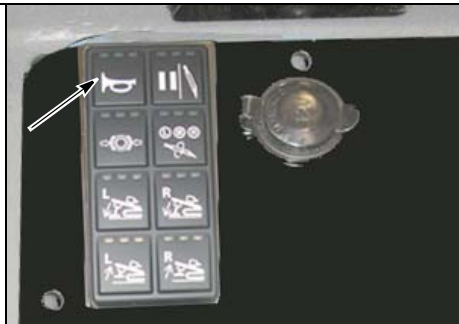
## BEACON (OPTION)

A beacon can be mounted to the top of the engine bay enclosure. Power can be supplied from the 12 vDC outlet at the operation station.

## HORN KEYS



Cab Machine



Non-Cab Machine



Remote Control

## ENGINE COVER LATCHES

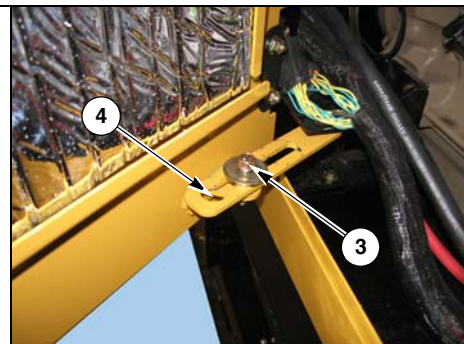
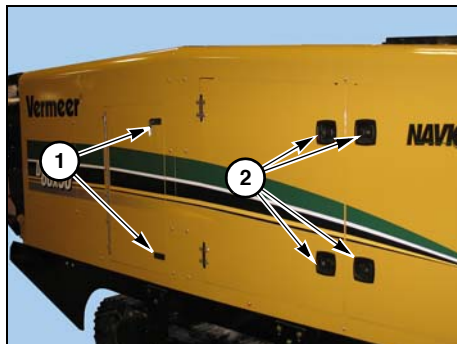
(1) **Locking Push-Button Latch Releases**

(2) **T-Handles**

Push buttons (1) to open door.

Turn handles (2) to open doors.

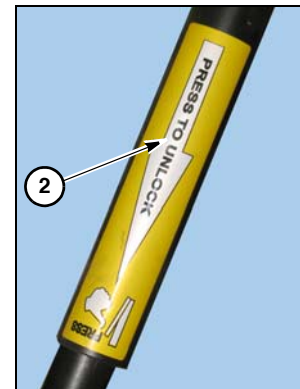
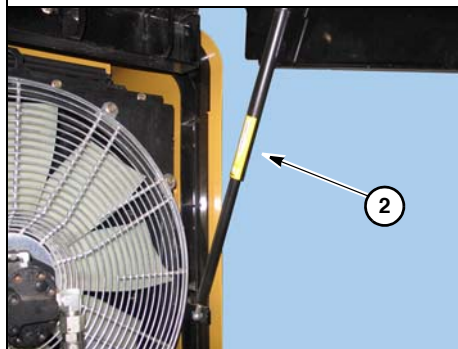
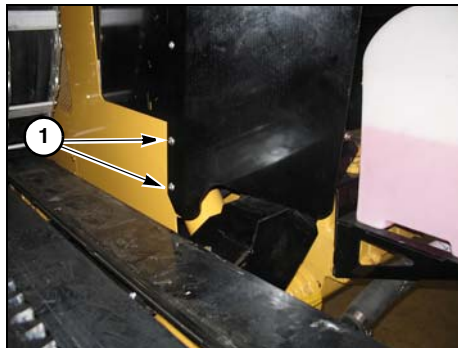
To release latches (3) and close doors, pull bar (4).



## Radiator Grille Cover

Remove three bolts (1) to swing cover up and open.

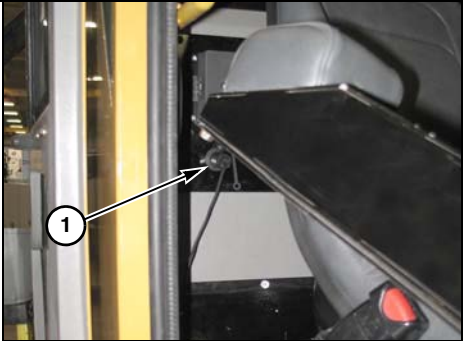
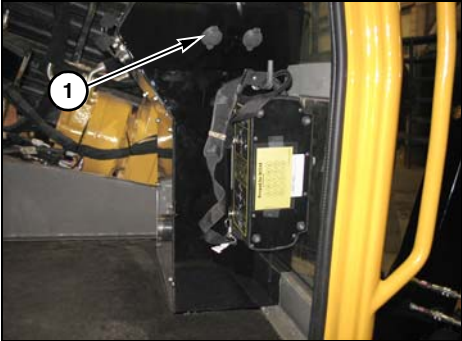
Press yellow lock on prop bar (2) to close cover.



# AUXILIARY OUTLETS

**(1) 12-Volt Accessory Outlets**

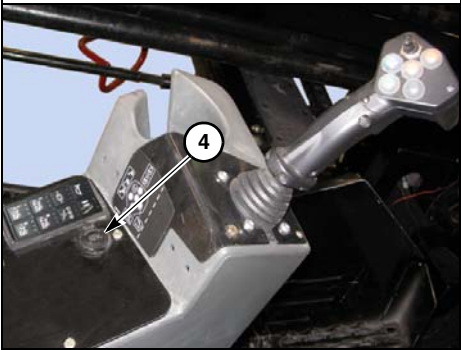
Use connectors (1) to operate 12-volt 150-watt electrical accessories.  
A 15-amp breaker protects the circuit.



Cab Machine



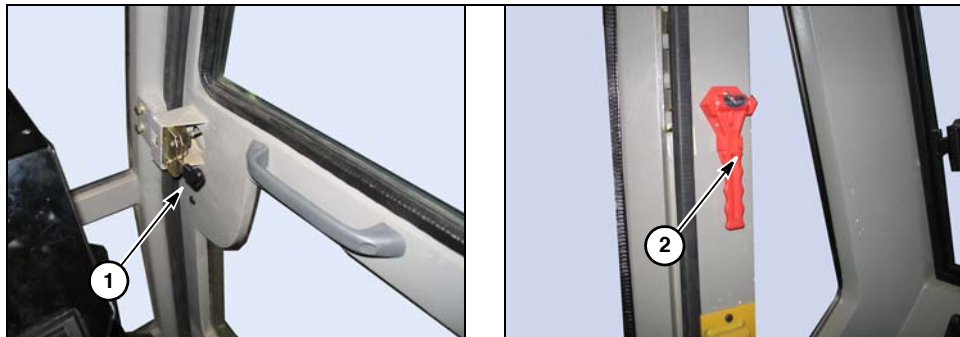
Non-Cab Machine





## CAB CONTROLS

- (1) Door Latch
- (2) Window Emergency Egress Hammer

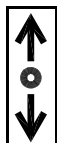


### Cab Door Latch

Cab door is held open by pressing metal loop (3) into latch (4). Pull latch release (5) to allow cab door to swing closed.



(6) **Windshield Wiper Switch**



Top ..... high  
Middle..... low  
Bottom .....OFF



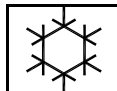
(7) **Windshield Washers Switch (momentary)**

Push top ..... ON



(8) **Heater/AC Switch**

Push top ..... cool  
Valve (11) closed (perpendicular to hose)



Push bottom ..... warm  
Valve (11) open (parallel to hose)



(9) **Fan Switch**



Push top .....high speed



Center..... low speed



Push bottom ..... off



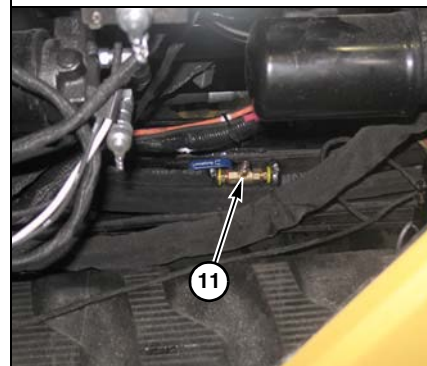
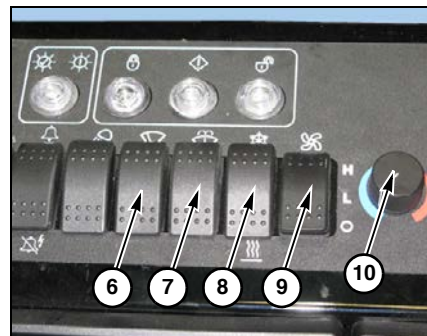
(10) **Thermostat Knob**



Turn counterclockwise..... colder

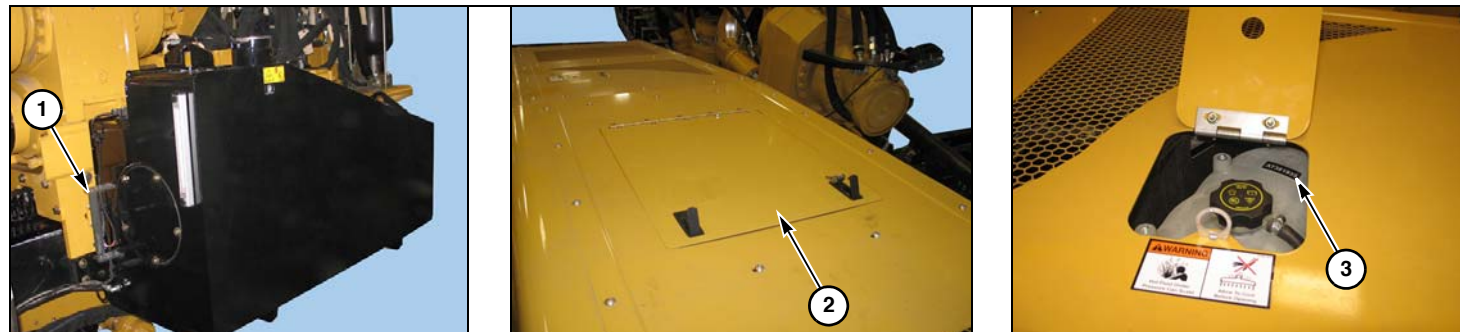


Turn clockwise ..... warmer





## ACCESS



(1) **Fuel Tank Handle**

(2) **Air Cleaner Access Door**

(3) **Radiator Access Door**

Use stepladder to access two doors on top of hood.

## STEP - NON-CAB OPERATOR STATION

*To install Operator Station Step:*

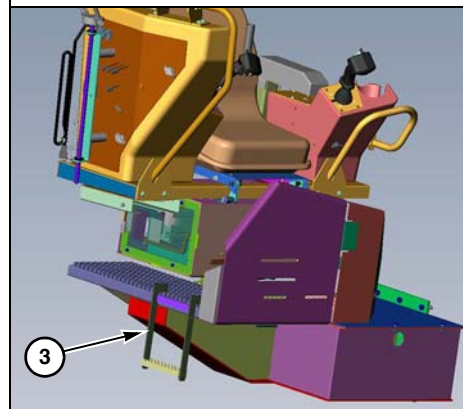
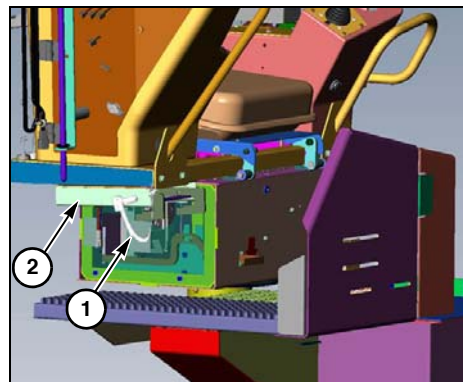
Remove retainer pin (1). Slide step from storage bin (2). Install step (3) in slots on operator platform.

Install operator station step prior to stepping onto operator platform.

*To store Operator Station Step:*

Lift step (3) from slots on operator platform. Slide step into storage bin (2). Install retainer pin (1).

Secure step in storage bin before transporting machine.



# Section 21: Console Display

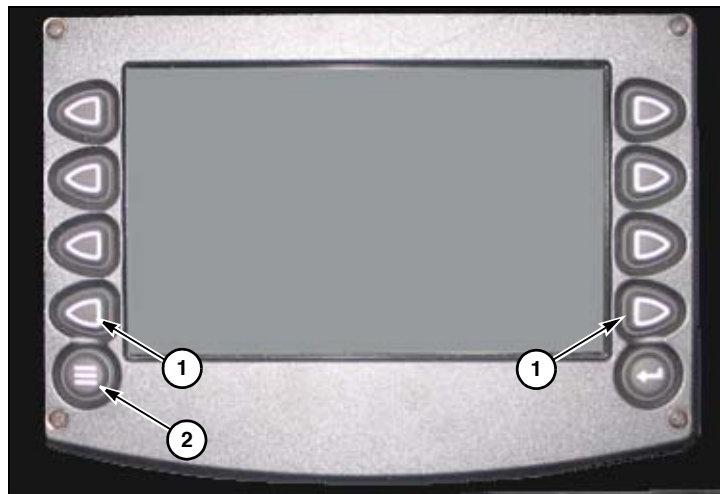
This electronic system is designed to display various machine operating parameters.

The system incorporates gauges and diagnostic indicators with an LCD (Liquid Crystal Display) of readings from which the operator may choose.

Eight arrow buttons on either side of the display correspond to different functions on different screens. If no function is shown for the bottom two arrow buttons (1), the buttons can be used to scroll through the screens.

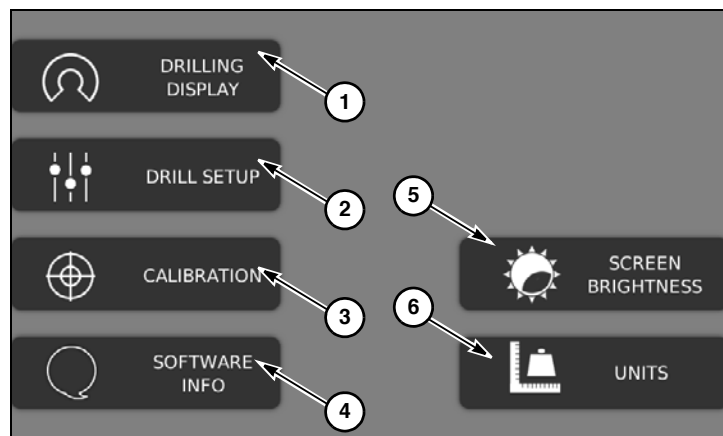
*Menu Key (2)* displays menu options on the Main Menu (refer to next page).

Press *Menu Key* from any screen to access Menu Screen.



## MENU SCREEN

- (1) **Drilling Display** [next page](#)
- (2) **Drill Setup** [page 21-12](#)
- (3) **Calibration** [page 21-16](#)
- (4) **Software Information** [page 21-19](#)
- (5) **Screen Brightness**
- (6) **User Settings (Screen Brightness Setting)** [page 21-19](#)



## DRILL SCREEN

This is the default screen at startup.

**(1) Remote Lockout Status**

*Green:* Unlocked

*Yellow:* No communication

*Red:* Locked

**(2) Strike Alert Status**

*Green:* Test passed, system ready

*Yellow:* Stake not in ground, current sensor failure, or stake wiring problem

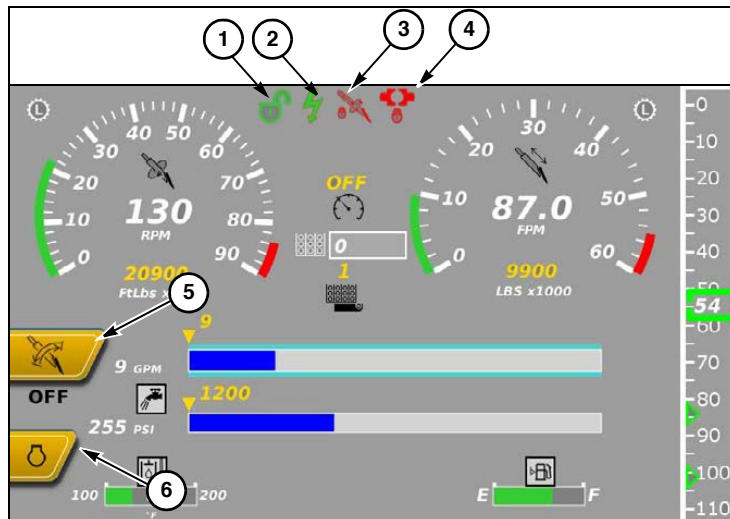
*Red:* Strike has occurred.

**(3) Rear Wireline Lockout [page 55-11](#)**

*Red:* locked

**(4) Front Wireline Lockout**

*Red:* locked



**NOTICE:** Icons for (3) and (4) indicate switch location. Both switches lock out all Drill mode functions. Both turn red if either of the two stop switches are pressed. Refer to “Drilling with Front Load Wireline Locator System,” [page 55-11](#).

**(5) To Auto Steer Screens [page 21-11](#)**

To toggle between the Auto Steer Modes. Default is OFF.

Press and hold for 3 seconds to go to Auto Steer adjustment screen.

**(6) To Engine Screen**

**(7) Rotation Gauge**

Dial shows pressure in PSI, BAR or MPA or torque in FT-LB or NM.

*Green* arc indicates current torque.

Icon above and to the left of dial (**A**) shows High, Medium or Low Speed.

*Red* arc shows adjustable rotation pressure or torque limit.

Adjustable rotation torque and speed is shown below dial.

**(8) AutoDrill Status and Mode**

Refer to “AutoDrill Screens,” [page 21-6](#).

Icon *gray* . . . . . off

Icon *green* . . . . . active

Icon *blinking green* . . . . . paused

Modes: speed, thrust, rotation, or off.

When off, AutoDrill cannot be set or resumed.

**(9) Thrust/Pullback Gauge**

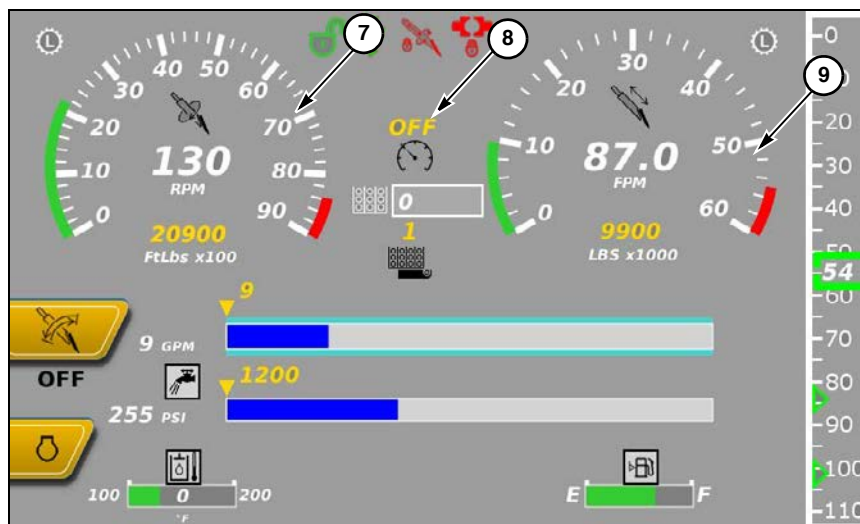
Dial shows pressure in PSI, BAR or MPA or force in LB, tonne or kilonewtons.

*Green* arc indicates current force.

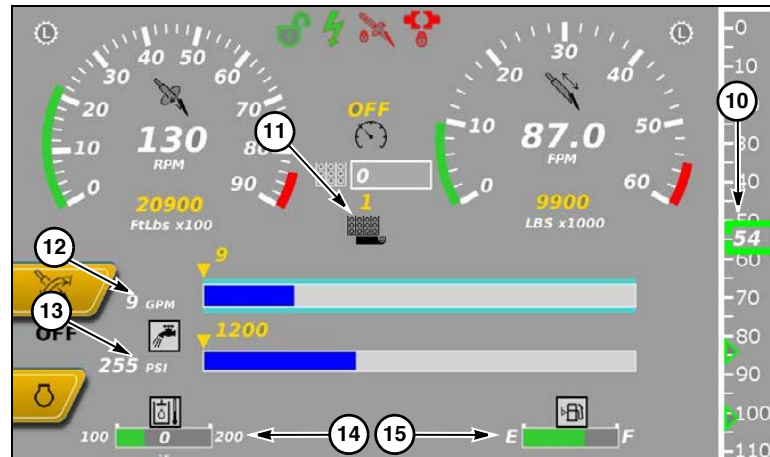
Icon above and to the right of dial shows High or Low Speed.

*Red* arc shows adjustable thrust/pullback pressure or torque limit.

Adjustable force and speed are shown below dial.



- (10) **Carriage Position Indicator**
- (11) **Anti-Crash Indicator**  
Graphic is in *orange* when anti-crash warning is in effect.
- (12) **Drilling Fluid Flow**  
*Yellow* triangle shows current set point.
- (13) **Drilling Fluid Pressure**  
*Yellow* triangle shows current set point.
- (14) **Hydraulic Fluid System Temperature**
- (15) **Fuel Gauge**



## AutoDrill Screens

Adjustment instructions are in the [Overview](#) section. Refer to “AutoDrill,” [page 30-35](#).

Symbol **(A)** turns green when mode is active, and turns black when AutoDrill is OFF. Abbreviation for mode appears above symbol.

Red arcs **(B)** indicate adjustable maximum settings.

### AutoDrill Off

AutoDrill cannot be SET or RESUMED.

**(1)** Adjustable rotation pressure limit

**(2)** Adjustable thrust pressure limit

**NOTICE:** If limits are set in Manual mode, they will remain in AutoDrill, unless AutoDrill is first set to OFF, then turned back on. In Manual Mode, set point triangles **(3)** and **(4)** are not shown.

### **(3) AutoDrill Rotation Mode**

Rotation pressure set point can be adjusted.

### **(4) AutoDrill Thrust Mode**

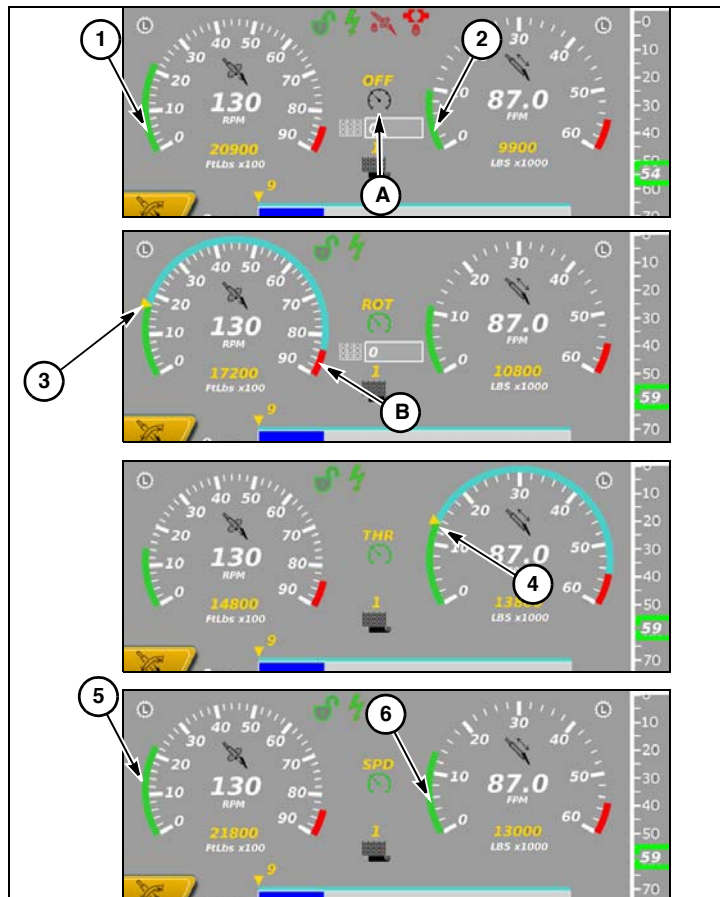
Rotation speed can be adjusted.

Thrust pressure set point can be adjusted

### AutoDrill Speed Mode

**(5)** Adjustable rotation output

**(6)** Adjustable thrust output





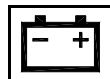
## ENGINE SCREEN

(1) Engine Oil Pressure



(2) Engine RPM

(3) Battery Voltage



(4) Press to access Drill Screen



(5) Engine Hours

(6) Coolant Temperature  
Normal operating range is from 170–200°F (77–93°C).



(7) Fuel Level  
(when rack is level)



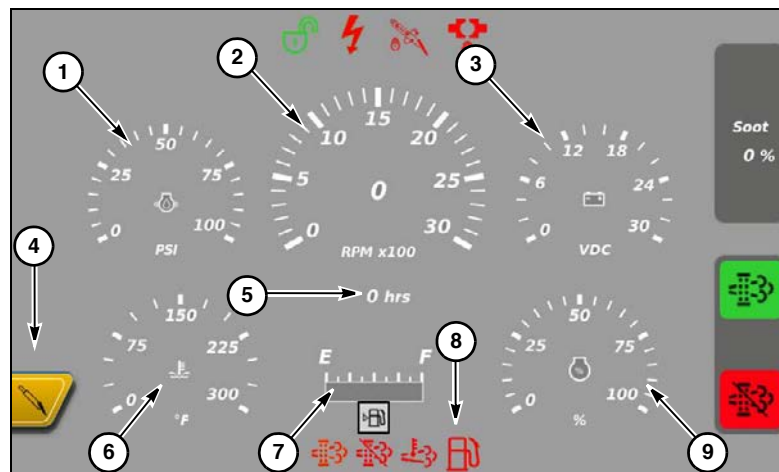
(8) Fuel Level Indicator

*Green:* OK

*Yellow:* Low, less than 20 percent

*Red:* Empty, less than 10 percent

(9) Percent of Potential Engine Power Being Used



# DIESEL PARTICULATE FILTER (DPF)

## DPF Controls

### (1) Diesel Particulate Filter Light

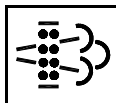
Soot load indicates filter regeneration needed.

*Gray* ..... OK

*Yellow* ..... warning: regeneration needed soon

*Red* ..... stop: service regeneration needed

Refer to next page.



### (2) DPF Regeneration Inhibited Light

*Gray* ..... cleaning enabled

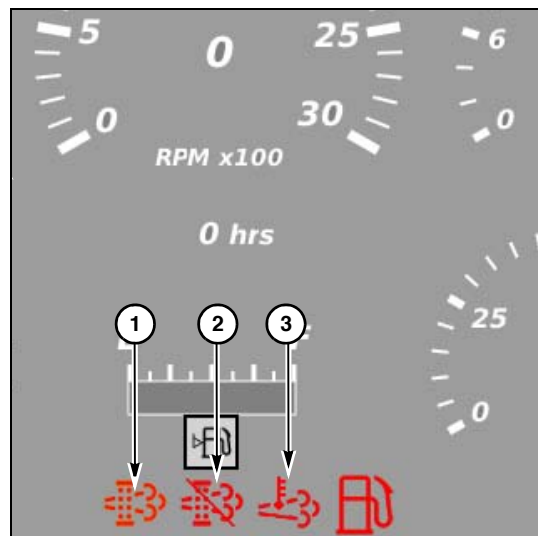
*Black* ..... cleaning inhibited



### (3) High Exhaust System Temperature (HEST) Light

*Red*: Exhaust gas temperature is high, idle is elevated, or regeneration is in progress.

*Gray* ..... regeneration not in progress



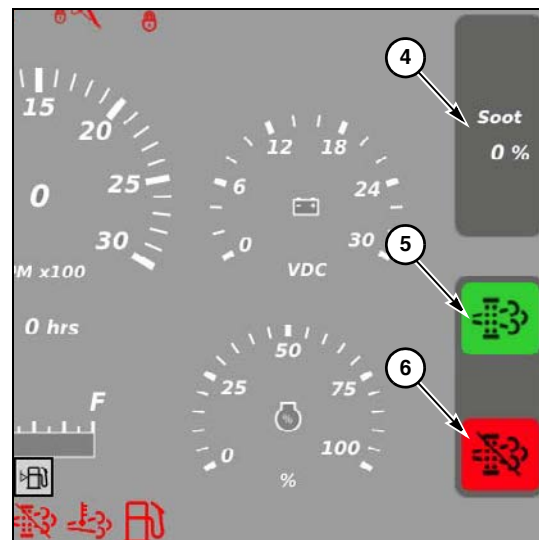
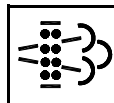
(4) **Soot Percentage Indicator**

(5) **Request Forced DPF Regeneration Key**

*Green* for 5 seconds .....regeneration requested  
*Gray* ..... cleaning not requested  
If filter does not need to be cleaned, pressing this key will not start cleaning process.

(6) **Inhibit DPF Regeneration Key**

*Red* .....DPF regeneration inhibited  
*Gray* .....Inhibit function not in progress



## Forced Regeneration

The DPF is self-cleaning and generally requires no operator action. Automatic regeneration is the standard mode. Regeneration should be disabled only if high exhaust temperatures pose a fire hazard, such as in confined spaces.

However, if the *Diesel Particulate Filter Light* (1) is yellow, a forced regeneration may be required.

Refer to the Engine Operation Manual for complete information.

**NOTICE:** Failure to follow procedures specified in the Engine Operation Manual may violate U.S. federal, state and local hazardous waste laws, and may damage the DPF resulting in potential denial of the Diesel Exhaust Filter emissions warranty. If this results in premature failure of exhaust system components, an engine service technician will be required to perform a service regeneration.

**Step 1:** Park machine in a location so exhaust is not directed at any surface or material that may become hazardous.

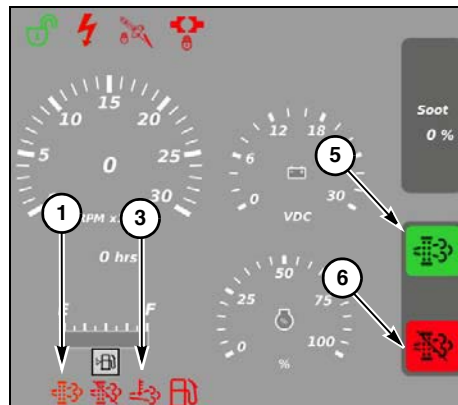
**Step 2:** Press *Request Forced DPF Regeneration Switch* (5). The *High Exhaust System Temperature (HEST) Light* (3) will illuminate, engine RPM may increase, and the sound of the turbocharger may change.

**Step 3:** Monitor machine and surrounding area for unsafe conditions. If necessary, shut off machine.

When DPF is regenerated, the engine will return to normal idle speed and HEST light will shut off. Exhaust temperatures will remain elevated for three to five minutes.

## Inhibit Generation

Press *Inhibit DPF Regeneration Key* (6) to disable regeneration. Indicator beside key is red when DPF regeneration is inhibited.

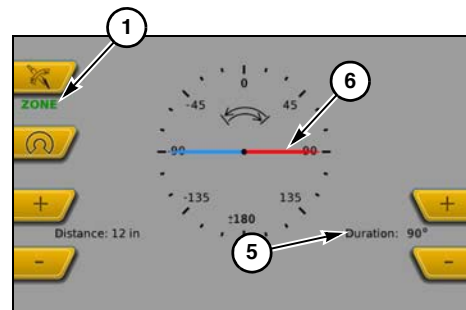
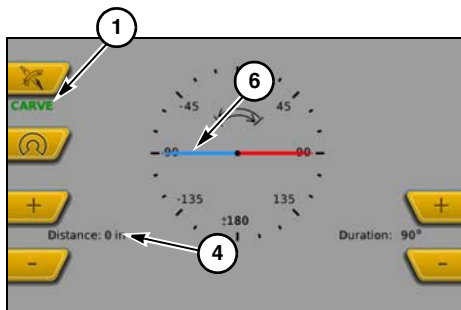
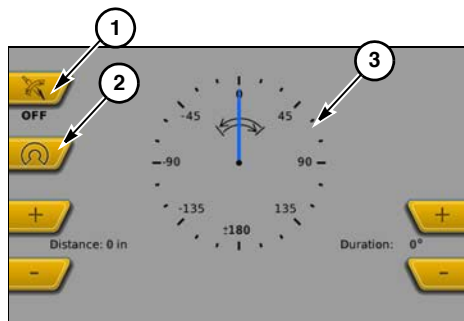
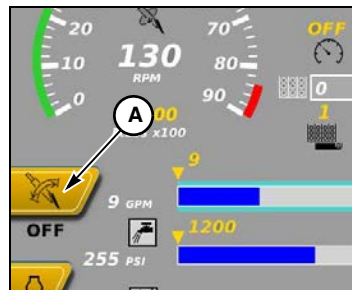


## AUTO STEER

Auto steering automates certain drill head motions. The operator sets and adjusts rotation duration and rotation direction. The bit rocks back and forth through an arc while maintaining a preset thrust pressure.

Press *Auto Steer Key (A)* and hold for 3 seconds to access Auto Steer screens. Press key again to cycle through Auto Steer modes. Default is Off; options are Zone and Carve.

- (1) **Mode Indicator**
- (2) **To Drill Screen**
- (3) **Steering Clock**
- (4) **Pullback Distance.** Use + and - keys to adjust.
- (5) **Duration Degrees.** Use + and - keys to adjust.
- (6) **Blue and Red Lines** indicate current duration



Refer to “Auto Steering,” [page 30-37](#).

# DRILL SETUP

## Drilling Fluid

This is the first screen displayed when *Drill Setup Key* is pressed. Icon (1) and top line (2) are highlighted.

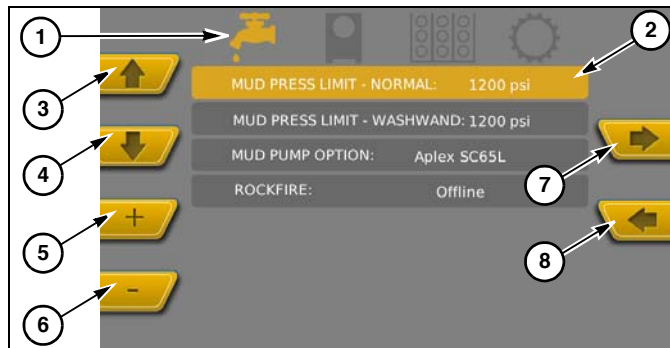
Press (3) or (4) to select parameter, which is then highlighted.

Press (5) or (6) to increase or decrease a value.

Parameters are:

- Mud Pressure Limit - Normal for drilling
- Mud Pressure Limit - Wash wand
- Mud Pump Option - Select Apex or Kerr.
- Mud Motor - Select Enabled or Disabled.

Press (7) or (8) to select next or previous screen.



## Auto Stop

This is the next drill setup screen. Icon (1) and top line (2) are highlighted.

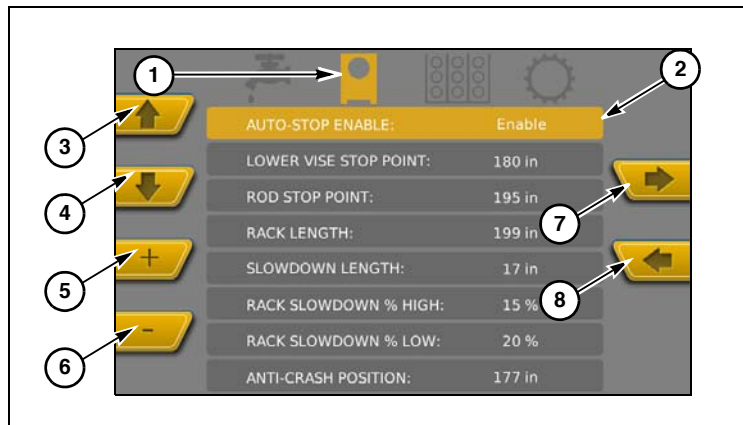
Press (3) or (4) to select parameter, which is then highlighted.

Press (5) or (6) to increase or decrease a value.

Parameters are:

- Auto-Stop Enabled or Disabled
- Lower Vise Stop Point, in inches from calibrated carriage position
- Rod Stop Point, in inches from calibrated carriage position
- Total Rack Length, in inches
- Slowdown Length, in inches from calibrated carriage position
- Rack Slowdown % High Speed
- Rack Slowdown % Low Speed
- Anti-Crash Position, in inches from calibrated carriage position

Press (7) or (8) to select next or previous screen.



## Drilling Pressure

This is the next drill setup screen. Icon (1) and top line (2) are highlighted.

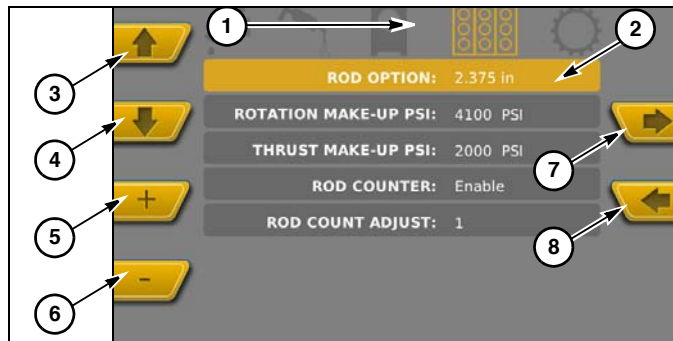
Press (3) or (4) to select parameter, which is then highlighted.

Press (5) or (6) to increase or decrease a value.

Parameters are:

- Rod size in inches
- Rotation make-up pressure in PSI
- Thrust make-up pressure in PSI

Press (7) or (8) to select next or previous screen.



## Wireline/Remote Lockout

This is the next drill setup screen. Icon (1) and top line (2) are highlighted.

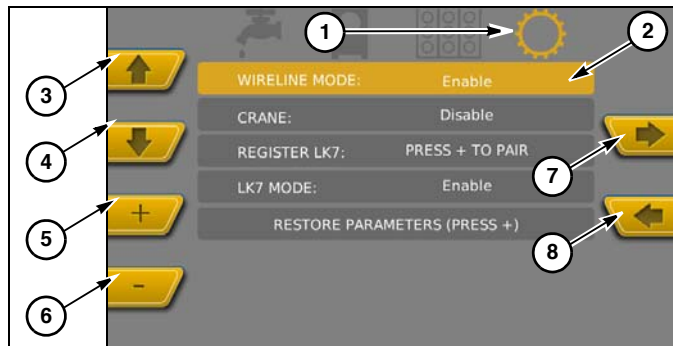
Press (3) or (4) to select parameter, which is then highlighted.

Press (5) or (6) to increase or decrease a value.

Parameters are:

- Wireline: Enable/Disable
- Crane: Disable
- LK7 (Remote Lockout) Mode: Enable/Disable
- Restore original parameters

Press (7) or (8) to select next or previous screen.





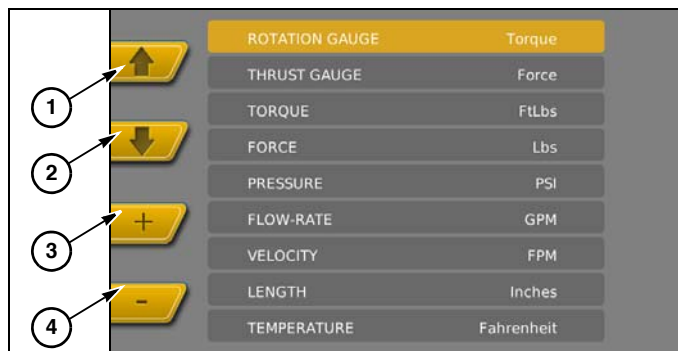
## Units

Press (1) or (2) to select parameter, which is then highlighted.

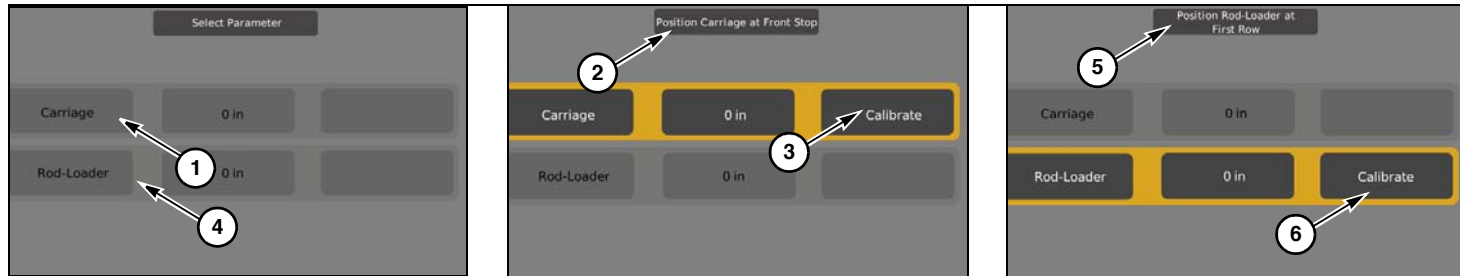
Press (3) or (4) to change units.

All other parameters can be shown in metric or English units.

- Rotation: torque or pressure
- Thrust: pressure or force
- Torque: FtLbs or NM
- Force: Lbs, tonne or KN
- Pressure: PSI, BAR or MPa
- Flow rate: GPM or LPM
- Velocity: FPM or MPM
- Length: inches or meters
- Temperature: Fahrenheit or Celsius



## CALIBRATION SCREENS



**Step 1:** Select carriage (1) and follow instructions on screen (2) to position carriage at front stop.

**Step 2:** Press key (3) to re-zero carriage.

**Step 3:** Select rod loader (4) and follow instructions on screen (5) to position rod loader at first row.

**Step 4:** Press key (6) to re-zero rod arms.

# MACHINE/ENGINE DIAGNOSTICS

## Active Codes Screen

When a machine fault occurs, a descriptive message (1) appears at the bottom of the screen.

When an engine fault appears, the message box may contain only numbered codes. Refer to Engine Operation Manual.

Press *Hide Key* (2) to remove message from screen.

The message box states when more than one fault is active (3). Press left or right arrows (4) to view other faults.

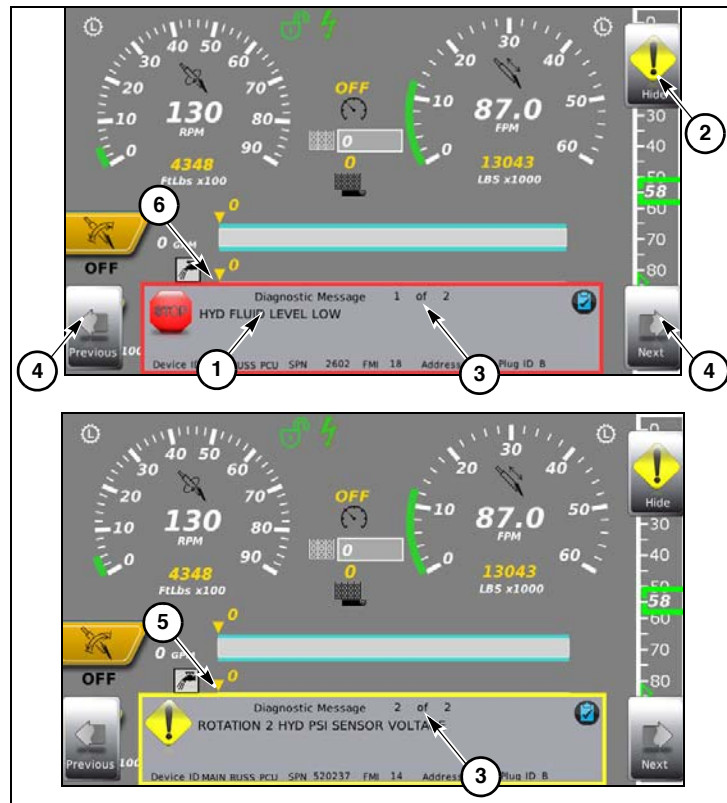
Faults appear with a yellow border (5) on message box. Stop alerts have a red border (6).

When border is green, the fault has been resolved.

When a red Stop alert appears, move the machine to a safe location as soon as possible and stop the machine. If the alert is an engine fault, the engine will eventually shut down automatically.

When the fault has been resolved, the message box border turns green, and the *Hide Key* changes to *Recall* to display messages again.

For active faults or stop alerts, consult your Vermeer dealer.

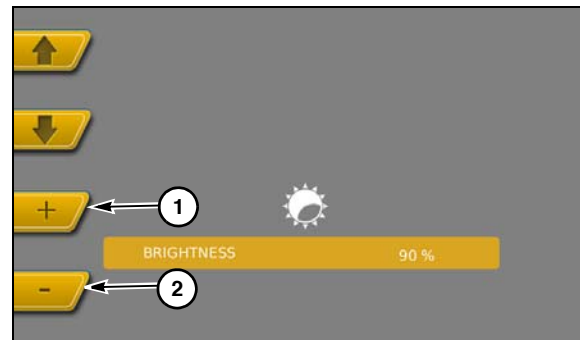


## Abbreviations and Acronyms in Fault Messages

CAB	Cab Controller
CDU	Cab Display Unit
PDM	Power Distribution Module
PCU	Pump Control Unit
POM	Pump Output Module
CRN	Crane Controller
RCU	Rack Control Unit
VOM	Vise Output Module
CCU	Carriage Control Unit
MFD	Multi-Function Display
MUD	Mud Pump Controller
RCU	Reclaimer Control Unit
ROM	Reclaimer Output Module
ECU	Engine Control Unit (on engines)
LJC	Left Joystick
RJC	Right Joystick
RKM	Right Keypad Module
LKM	Left Keypad Module 1
CKM	Center Keypad Module 1
VDC	Vehicle Display Controller
CPS	Carriage Position Sensor
RPS	Rod Loader Position Sensor
RBC	Radio Base Unit
RLC	Remote Lockout Controller (LK2)
SAC	Strike Alert Controller
NCM	Navigation Control Module
TCM	Telemetric Control Module

## SCREEN BRIGHTNESS SETTINGS

Press (1) or (2) to increase or decrease value.



## SOFTWARE INFORMATION SCREEN

Displays part numbers and version numbers for software.



This page intentionally left blank.

## Section 25: DigiTrak Locating Program

The DigiTrak Locating Program accepts telemetry signals from several systems. Refer to [page 25-3](#).

This section provides information on

- how to set up the program to receive signals from your receiver
- how to read the display screens.

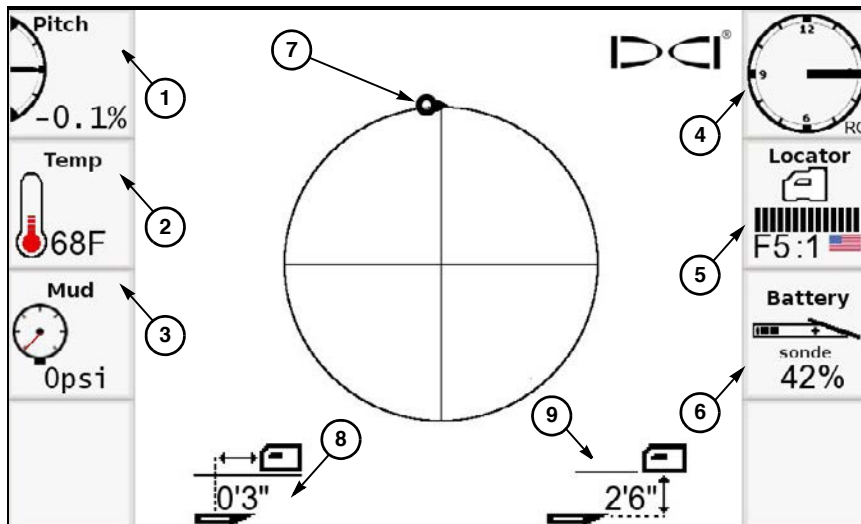
This program does not explain how to operate the locating systems; refer to the operator's manual for your locating system. For more information, call the Digital Control Inc (DCI) Customer Service Department at 425-251-0559 or 800-288-3610 (U.S. only), or email [dcidigital-control.com](mailto:dcidigital-control.com).



## NAVIGATION SCREEN

This is the first screen in Target Steering mode when not using the SE locator program. Refer to your locator operator's manual for details.

- (1) **Pitch**  
Press to switch between angle and grade views.
- (2) **Sonde Temperature**  
Press to switch between English and metric
- (3) **Drilling Fluid Pressure at drill head**  
Press to switch between psi and bar
- (4) **Roll/Clock Position**  
display only
- (5) **Locator Setup Screen**  
refer to next page
- (6) **Sonde Battery Life**  
display only
- (7) **Projected Sonde Location**
- (8) **Predicted Depth**
- (9) **Distance to Target**





## Locator Setup Screen

**(1) Choose country. Options are:**

- United States
- United Kingdom
- Australia
- Switzerland
- China
- Netherlands

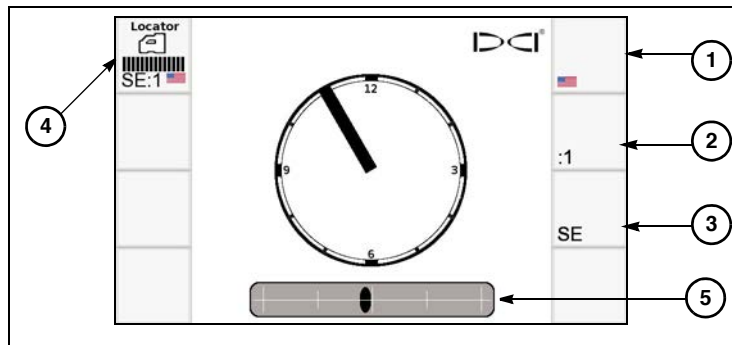
**(2) Choose DCI channel: 1–4.**

**(3) Choose type of device being communicated with:**

- Eclipse A
- Eclipse B
- SE
- F2
- F5

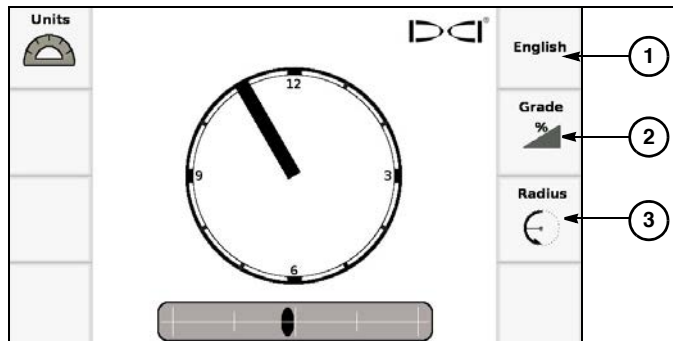
**(4) Press to toggle between locator setup and units screens.**

**(5) Appears when using target steering in SE mode only.**



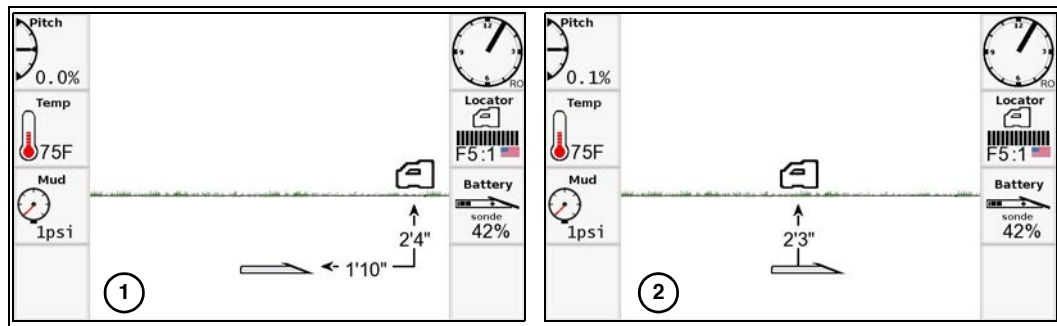
## Units Setup Screen

- (1) **Standard** - choose English (U.S.) or metric
- (2) **Grade** - percent/angle
- (3) **Radius** - choose degrees or grade



## Locating Screens

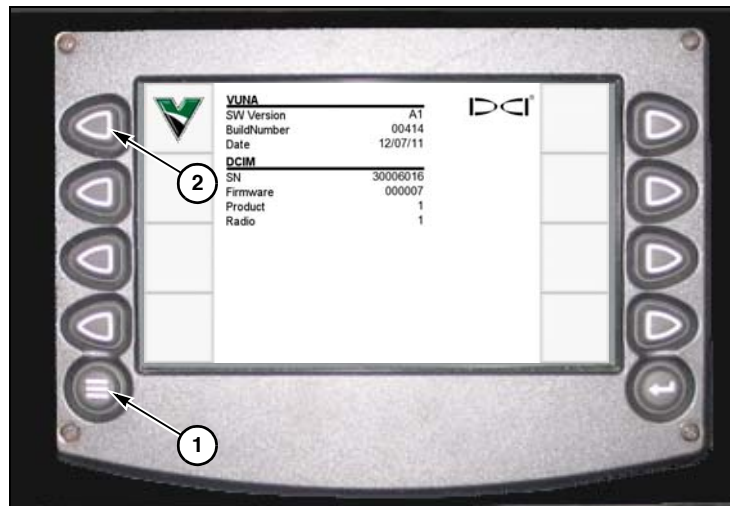
- (1) Image displayed when a locate point is taken with a DCI locator system
- (2) Image displayed when a locate line is taken with a DCI locator system.



## Version Screen

*To access:*

- Step 1:** Pressing *Menu Key (1)*.
- Step 2:** Press upper left key **(2)**, which displays Locator Setup Screen.
- Step 3:** Press key **(2)** again, which displays Version Screen.



This page intentionally left blank.

# Section 30: Overview

## Remote Lockout Overview

**NOTICE:** The Remote Lockout system is not intended to replace good spoken radio communication. Radio communication is essential to the Remote Lockout system process. Refer to “Radio Communication Requirements,” [page 40-3](#).

### REMOTE LOCKOUT SYSTEM INTENDED USE

The Remote Lockout system is a communication and control tool that allows a worker along bore path or at exit site to directly lock out:

- drill rod rotation
- thrust
- pullback
- integrated fluid flow controls

Independent fluid flow controls or air compressors must be locked out manually.

Although the Remote Lockout system can stop thrust, rotation, and fluid flow while drilling, the purpose of the system is to prevent these functions from being started in the first place.

Lights, sound, and vibration indicate different modes. The indicators tell the machine operator and remote user that the system is operating correctly and whether drilling functions are locked out.

In Transport mode, the machine will not respond to Remote Lockout system commands until machine is returned to Drill mode.

**NOTICE: Do not** rely on the Remote Lockout system as an emergency stop. Even on successful remote lockout attempts, it is very unlikely that you could disable thrust and rotation quickly enough to prevent death or serious injury.

Use the Remote Lockout system to lock out the machine before:

- approaching the drill head
- attempting any tooling change or attaching a product to be pulled in
- attempting to apply any wrench or other tool to drill string
- manually adding or removing drill rod from drill string
- entering an exit pit

## REMOTE LOCKOUT SYSTEM COMPONENT IDENTIFICATION

Refer to “Remote Lockout Controls,” [page 20-13](#).

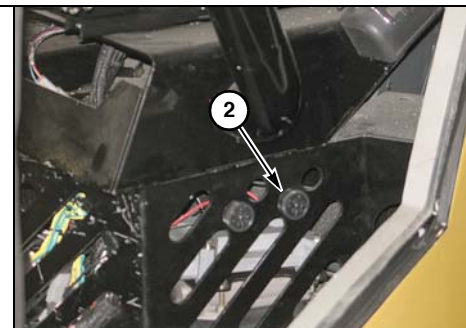
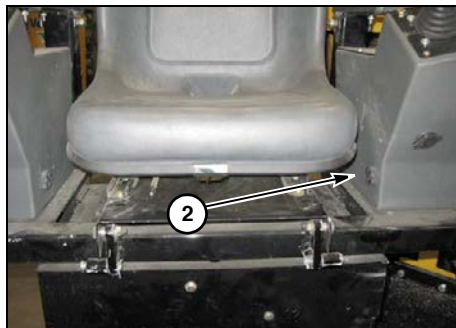
### REMOTE TRANSMITTER

The remote transmitter (1) clips onto the user’s belt and has a range of 3300 ft (1 km). Range can decrease in some weather and environmental conditions, and in urban areas.

The remote transmitter user can select either RUN or LOCKOUT mode, indicated by lights and buzzer.

A steady warning buzzer (2) will sound at the machine if radio communication is not established within 10 seconds of entering Drill mode and machine is not locked out.

The remote transmitter is stored in a compartment under the seat on the non-cab machine, and behind the operator in the cab machine.

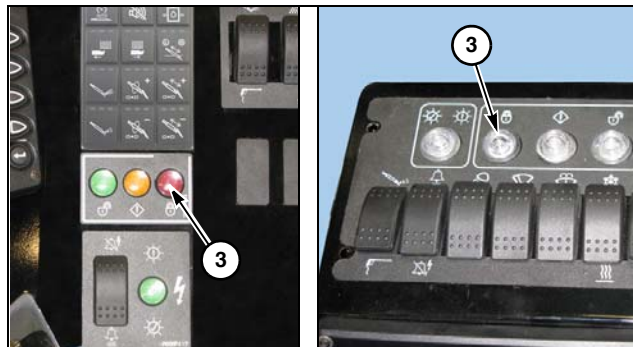


## Warning Alarm

If machine is not locked out, and if radio communication is not established within 10 seconds of entering Drill mode, a steady warning alarm sounds at the machine.

If machine is locked out, the audible lockout horn (3) sounds and lockout symbol (4) is red.

Refer to “Remote Lockout Indicators,” [page 20-17](#).



## Power Button

To turn on the Remote Lockout system:

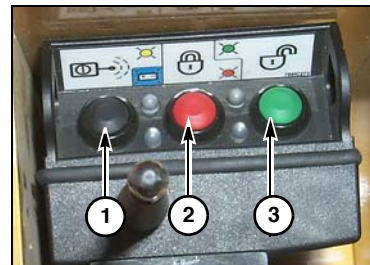
- Press *Power Button* (1) **and hold for 2 seconds**.
- or
- Press *Lockout Button* (2).

To shut off transmitter, press *Power Button* (1) **and hold for 2 seconds**.

When the remote transmitter power is on, at least one light should come on. If no lights are on, it means:

- the power is off
- the battery is dead **or**
- the remote is not functioning

Remote shuts off automatically if there is no communication with the machine after 20 minutes. Refer to “Troubleshooting” in the [Maintenance Manual](#).





## Run Button

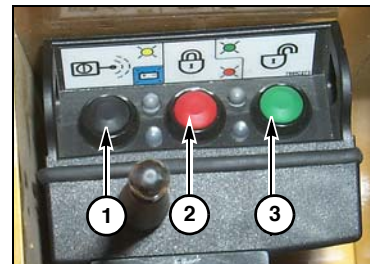
The drill unit ignition key must be ON before the Remote Lockout system is turned on. If not, a loss of radio signal will be indicated at the remote transmitter. Refer to “Loss of Remote Transmitter Signal,” [page 30-13](#).

*When transmitter is ON:*

Press green *Run Button (3)* and hold for **2 seconds** to transfer control of drilling functions to the machine operator. Green lights on transmitter and machine come on, and buzzers at each location sound for two seconds.

*When transmitter is OFF:*

Press and hold the *Run Button (3)* for 2 seconds to test the remote transmitter buzzer, vibrator, and indicator lights. Refer to “Remote Lockout Tests,” [page 30-9](#).



## Lockout Button

*When transmitter is ON:*

Press and release the red *Lockout Button (2)* to send a lockout command to stop drill string rotation, thrust and pullback, and fluid flow.

*When transmitter is OFF:*

Press and hold *Lockout Button* until the yellow light flashes. This turns on the remote transmitter, then sends a lockout command.

When the machine has confirmed successful lockout, the red light comes on steady, then three short beeps (beep, beep, beep, pause) are repeated three times (9 beeps total).

The Remote Lockout system can take up to 5 seconds to process the lockout. During this time the green lights flash. The lockout is not complete until the 9 beeps occur and the red light is on.

## REMOTE LOCKOUT INDICATORS

Lights and sounds are explained in “Remote Lockout Indicators.”

Refer to [page 20-21](#).

### Fault Check/Processing Lights

When green and/or yellow lights are flashing and buzzers do not sound, the system is processing a transition from one mode to another.

When only green lights flash on remote transmitter and machine console, the system is processing a lockout request that has not yet been confirmed.

When the yellow light flashes on the transmitter and the alarm sounds continuously at the operator station, it means either:

- the transmitter is out of range or
- no radio communication is occurring between the transmitter and the machine.

No communication means the transmitter is not turned on or not functioning.

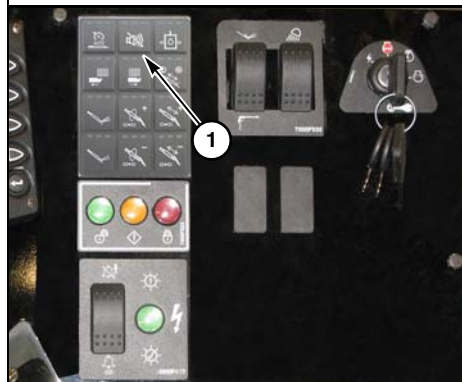
If the remote transmitter is damaged and cannot be turned on, press *Alarm Cancel Key (1)*. The yellow light will continue to flash, a reminder that the Remote Lockout is not functioning or communicating.

Contact your Vermeer dealer for repair of the lockout system.

Refer to “Troubleshooting” section in the [Maintenance Manual](#) for more information.



Cab Machine



Non-Cab Machine

## HYDRAULIC LOCKOUT OR ENGINE SHUTDOWN OPTION

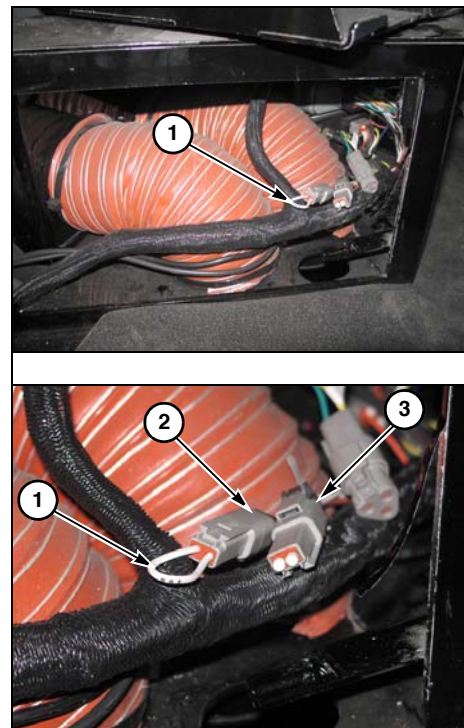
The Remote Lockout system is equipped with an option to operate as either a Hydraulic Lockout (default) or an Engine Shutdown system.

*To change the system to engine shutdown:*

- Step 1:** Move ignition key to OFF position.
- Step 2:** Open right side access panel located beneath operator seat.
- Step 3:** Remove jumper plug (1) from hydraulic shutdown connector (2) (P130 orange and white wires), and attach to engine shutdown connector (3) (P131 black and white wires).
- Step 4:** Close access panel.
- Step 5:** Follow [Starting Procedure](#), page 50-1.

When machine is in Drill mode, a lockout command will disable the fuel and start circuits. To restart machine after lockout, select RUN mode and wait for the solid green light, then turn ignition key to START position.

The engine can be started in Transport mode but will stop immediately when operator sits in seat.



*To change system back to hydraulic lockout:*

**Step 1:** Move ignition key to OFF position.

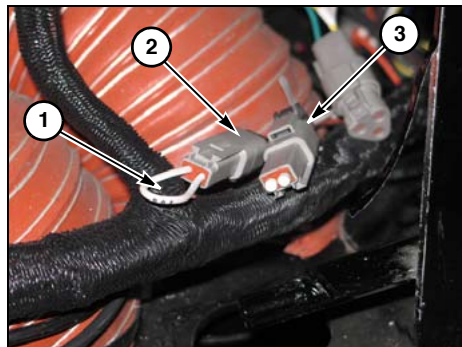
**Step 2:** Open rear access panel located beneath operator seat.

**Step 3:** Remove jumper plug (1) from engine shutdown connector (3) (P131 black and white wires), and attach to hydraulic connector (2) (P130 orange and white wires).

**Step 4:** Close rear access panel.

**Step 5:** Follow [Starting Procedure](#), page 50-1.

A lockout command will now disable hydraulic functions.



## Auxiliary Engine Shutdown for Hydraulic Disable

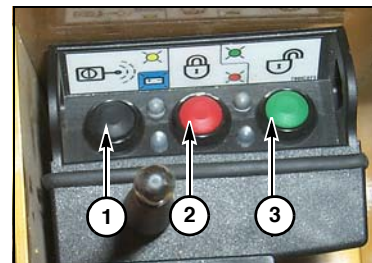
To ensure drill remains locked out during a confirmed hydraulic lockout, rotation and thrust hydraulic pressures are monitored. If any of the hydraulic pressures increase above 500 psi (35 bar), or if drilling fluid system is turned on, engine will be shut down. The engine cannot be restarted until *Run Button* on the remote transmitter is pushed.

## REMOTE LOCKOUT TESTS

Perform Remote Lockout Tests before drilling each day.

### Hydraulic Lockout Test

- Step 1: Start machine and remain in operator's seat.
  - Step 2: Press and hold black *Power Button (1)* for 2 seconds.
  - Step 3: Press and hold green *Run Button (3)* for 2 seconds. Green light will come on.  
Machine is now in Drill mode.
  - Step 4: Test thrust and rotation controls. They should work.
  - Step 5: Press and hold red *Lockout Button (2)* for 2 seconds. Red light will come on.  
Machine is now in Lockout mode.
  - Step 6: Test lockout of thrust and rotation by moving *Thrust* and *Rotation Levers* out of NEUTRAL. ***Thrust and Rotation must not function.*** If Thrust or Rotation moves, contact your Vermeer dealer.
- After successful Lockout test, press and hold the green button (3) for 2 seconds to return to Drill mode.



## Engine Shutdown Test

Perform Remote Lockout Test before drilling each day.

**Step 1:** Start machine and remain in operator's seat.

**Step 2:** Press and hold black *Power Button (1)* for 2 seconds.

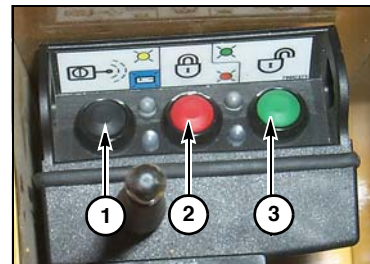
**Step 3:** Press and hold green *Run Button (3)* for 2 seconds. Green light will come on.  
Machine is now in Drill mode.

**Step 4:** Test thrust and rotation controls. They should work.

**Step 5:** Press and hold red *Lockout Button (2)* for 2 seconds. Red light will come on.

Machine is now in Lockout mode. ***Engine must shut down.*** If engine does not shut down, or if the engine can be restarted with Remote Lockout still in lockout mode, contact your Vermeer dealer immediately.

**Step 6:** After successful Lockout test, press and hold the green button (3) for 2 seconds to return to Drill mode.



## REMOTE LOCKOUT TRANSMITTER REGISTRATION

If you replace the Remote Lockout system base or transmitter, register the two components.

**Step 1:** Turn *Remote* ON.

**Step 2:** Push and hold black *Power* and red *Lock* buttons (1) simultaneously for 2 seconds until yellow “No Communications” light (2) begins to double flash. Remote is in the Registration mode.

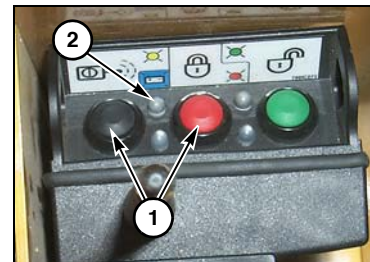
**Step 3:** Open rear and side access panels located beneath operator seat.

**Step 4:** Turn *Ignition Switch* to ON. Wait at least 5 seconds.

Engine does not need to be operating.

**Step 5:** Remove 2-pin jumper (3) engine shutdown connector (P131 black and white wires) or hydraulic connector (P130 orange and white wires). Wait for 3 seconds.

**Step 6:** Install jumper back into same connector.



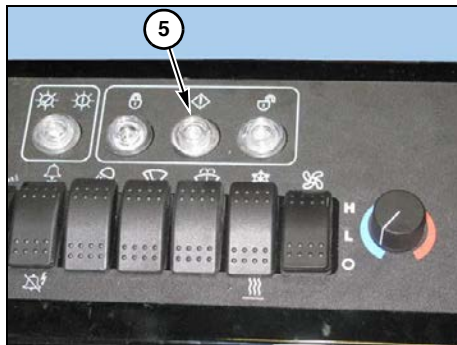
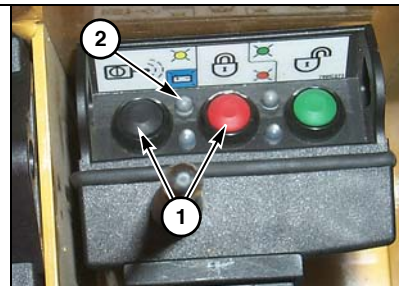
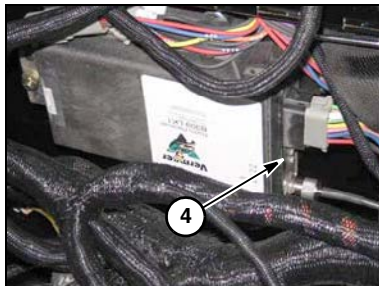


In about 3 seconds Light B on the base controller (4) begins to double flash red. Base controller is in Registration mode.

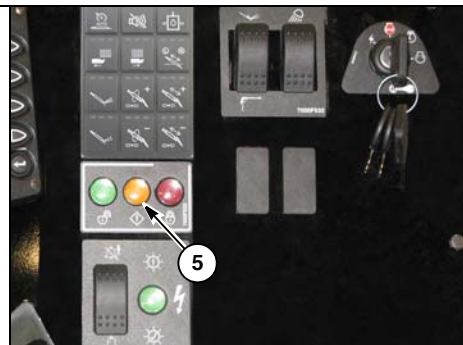
Yellow “No communications” lights on the remote (2) and machine (5) will flash

**Step 7:** Wait for registration results. Within 10 to 30 seconds, the yellow “No communications” lights on the remote and the machine should turn off. Remote is now registered to the base and all previous registration has been erased.

**Step 8:** Close access panels.



Cab Machine



Non-Cab Machine



## LOSS OF REMOTE TRANSMITTER SIGNAL

Loss of signal indicates that the remote transmitter and machine are not communicating with each other.

Reasons for a loss of signal:

- Remote transmitter is too far away from the machine.  
Range is up to 3300 ft (1 km).
- Remote transmitter signal is blocked by an obstruction between the transmitter and machine.
- Transmitter battery is fully discharged.
- Remote transmitter is turned off when machine is on.
- The system is not operating correctly.

Range of signal can be significantly affected by obstructions, such as buildings or equipment, located between the remote transmitter and machine.

When a loss of signal occurs in LOCKOUT mode and the *Run Button* is pressed, yellow light (1) flashes and the system remains in LOCKOUT mode.

When a loss of signal occurs in RUN mode, the yellow light flashes and the system continues to allow drill operation. If *Lockout Button* is pressed, a “failure to lock out” signal is given.



## BATTERY CONDITION

### Low Battery

Low battery indication is only displayed on the remote transmitter.

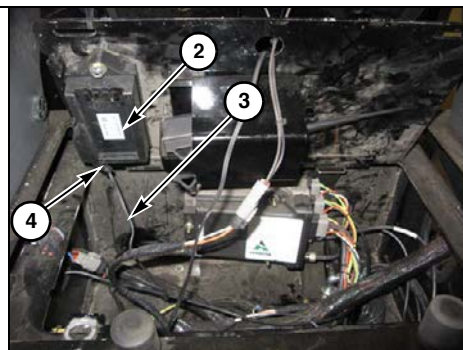
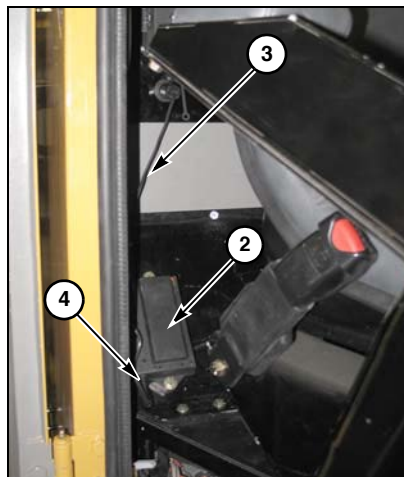
When approximately 10% of battery power is left, blue light (1) will flash.

### Discharged Battery

If battery discharges and a loss of signal occurs in RUN mode, drilling will continue uninterrupted. If battery discharges in LOCKOUT mode, a new battery must be installed and RUN mode selected before drilling can start.

### Recharge Battery

Install battery in battery charger (2) with cord (3) plugged into connector (4). Battery recharges even when machine ignition is off. It does not charge when the *Battery Disconnect Switch* is OFF.



Non-Cab Machine

Cab Machine

- Amber light on underside of charger flashes quickly when battery is fully charged.
- Amber light is solid when battery is charging.
- Amber flashes slowly when battery is present but not charging.
- Light is green and solid if charger has power (no battery present).

More chargers are available from your Vermeer dealer for charging the battery in another vehicle.

## REMOTE LOCKOUT SYSTEM - START

- Step 1:** Remove battery from charger and install in remote transmitter.
- Step 2:** Sit in the operator's seat and turn ignition key to RUN position.
- Step 3:** Turn remote transmitter on: press *Power Button* **and hold for 2 seconds**.
- Step 4:** Press and hold *Run Button* for 2 seconds to select RUN mode.
- Step 5:** Refer to "Starting Procedure," [page 50-1](#).

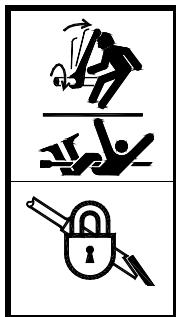
## REMOTE LOCKOUT SYSTEM - SHUT DOWN

If the machine is shut down in LOCKOUT mode, the remote transmitter must be available upon machine startup to cancel LOCKOUT mode and enter RUN mode.

- Step 1:** Shut off machine and remove key.
- Step 2:** Press *Power Button* **and hold for 2 seconds** to shut off remote transmitter.
- Step 3:** Remove battery pack from remote transmitter and install in charger.
- Step 4:** Place remote transmitter in docking station.

# LOCKOUT PROCEDURES

## Lockout Procedure - With Remote Lockout System



**DANGER:** Rotating drill string can kill. Unexpected start-up possible.

Lock out before working on drill string.

Lock out the machine before entering an exit pit, changing tools, repairing drill rod, manually adding or removing drill rod, or performing any other work on the drill string or tools.

The Remote Lockout system will not shut down the power units on stand-alone drilling fluid systems or air compressors. These external power units must be shut off manually.

The remote transmitter operator must use this Lockout Procedure.

**Step 1:** Communicate by radio with the machine operator that you intend to lock out the machine.

**Step 2:** Direct machine operator to idle engine down.

**Step 3:** Press red *Lockout Button (1)* on remote transmitter. Wait for 9 beeps to sound and red lockout light to come on, which indicates lockout is successful. Confirmation could take up to 5 seconds.

Lock out machine before entering an exit pit.

**Step 4:** If lockout is not successful, a warning alarm sounds and transmitter vibrates for 60 seconds. The green light flashes until lockout is achieved or LOCKOUT command is canceled.

**NOTICE:** **Never** approach drill string or try to apply a tool to drill string until after:

- Remote Lockout is confirmed by the 9 beeps
- red lockout light is ON **and**
- remote transmitter operator and machine operator have confirmed the lockout by radio

**Step 5:** If lockout is unsuccessful using Remote Lockout system, use “Lockout Procedure - Without Remote Lockout System.” Refer to [page 30-19](#).

When a remote lockout command is not successful, check that:

- machine is operating
- machine is in Drill mode, not Transport mode (operator seated at controls)
- transmitter is within range.

If the problem remains, contact your Vermeer dealer.

**Step 6:** When machine is successfully locked out, complete whatever work is required to change tools or repair and replace drill rod or tooling.



## Resuming Operation after Remote Lockout

- Step 1:** Verify that drill rod and cutting tools are ready for operation.
- Step 2:** Warn everyone who may be exposed to drill string or cutting tools that operation will resume.
- Step 3:** Confirm that:
- everyone has evacuated the exit pit and is away from drill string and cutting tools and
  - no wrenches or breakout tools are attached to drill string or cutting tools

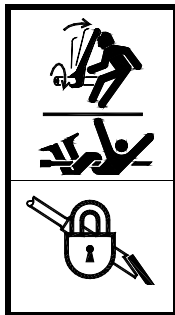
**Step 4:** Press *Run Button (2)* **and hold for 2 seconds** to return control of drilling functions to the machine operator.

**NOTICE:** If RUN command is not successful and the remote lockout transmitter is within range, communicate with the machine operator to find the cause. Remote Lockout system must be repaired before the machine can resume drilling.

**Step 5:** Communicate by radio with machine operator that normal operation can resume.



## Lockout Procedure - Without Remote Lockout System



**DANGER:** Rotating drill string can kill. Unexpected start-up possible.

Lock out before working on drill string.

Lock out the machine before entering an exit pit, changing tools, repairing drill rod, manually adding or removing drill rod, or performing any other work on the drill string or tools.

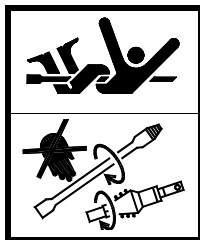
- Step 1:** Shut off machine and remove key.
- Step 2:** Take key to the location where work will be performed on drill string or cutting tools. The key must remain at this location until startup is permitted.

## Resuming Operation after Lockout

- Step 1:** Verify that drill string and cutting tools are ready for operation.
- Step 2:** Confirm everyone has evacuated the exit pit and is away from drill string and cutting tools, and that no wrenches, tongs, or breakout devices are attached to drill string or cutting tools.
- Step 3:** Warn everyone who may be exposed to the drill string or cutting tools that operation will resume.
- Step 4:** Return key to machine.
- Step 5:** Follow “Radio Communication Requirements,” before startup. Refer to [page 40-3](#).

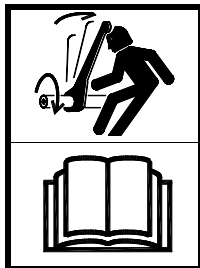
# Drill Rod and Tools

## DRILL ROD



**DANGER:** Rotating drill string or cutters can kill.

Stay away from rotating drill string and cutting tool.



**DANGER:** Wrench on rotating drill string can strike you.  
Death or serious injury will result.

Use only drill rods, drilling tools, and breakout device described in this manual or approved by Vermeer Corporation.

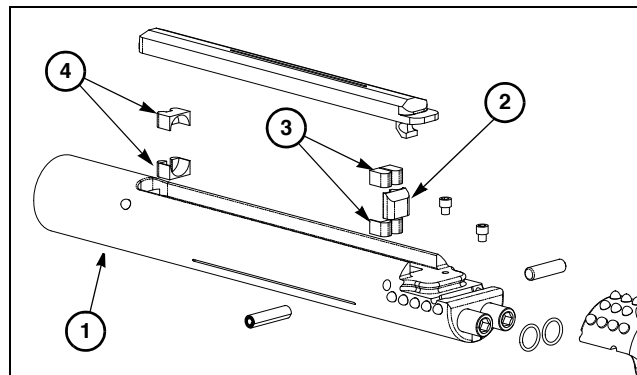
- Before using a new drill rod, tap drill rod against a hard surface, such as a wood block, to dislodge scale and rust inside. Hard pounding of the rod ends on steel or rock will damage threads.
- Protect rod interiors by installing rod box cover when shutting down for the day and during transport.
- Clean rods before use. Refer to “Drill Rod - Flush,” [page 50-28](#).
- Refer to the [Fundamentals of Horizontal Directional Drilling User's Guide](#) for tool selection guides.



## DRILL TOOL ASSEMBLIES

### Armor Drill Housing Assembly

- Step 1:** Attach housing (1) to drill string starter rod.
- Step 2:** Follow instructions of transmitter for battery installation and check function of transmitter.
- A variety of transmitters are available that fit inside the drill head cavity.
- Step 3:** Place clocking key (2) and one isolator (3) in front part of the transmitter cavity. Place one isolator (4) in rear of cavity. Isolator with larger notch goes in rear.
- Step 4:** Place transmitter into transmitter cavity, ensuring clocking key (2) engages slot in the front of transmitter.
- Step 5:** Place second half of isolators (3) and (4) onto their respective ends of the transmitter, thus isolating side load shock.

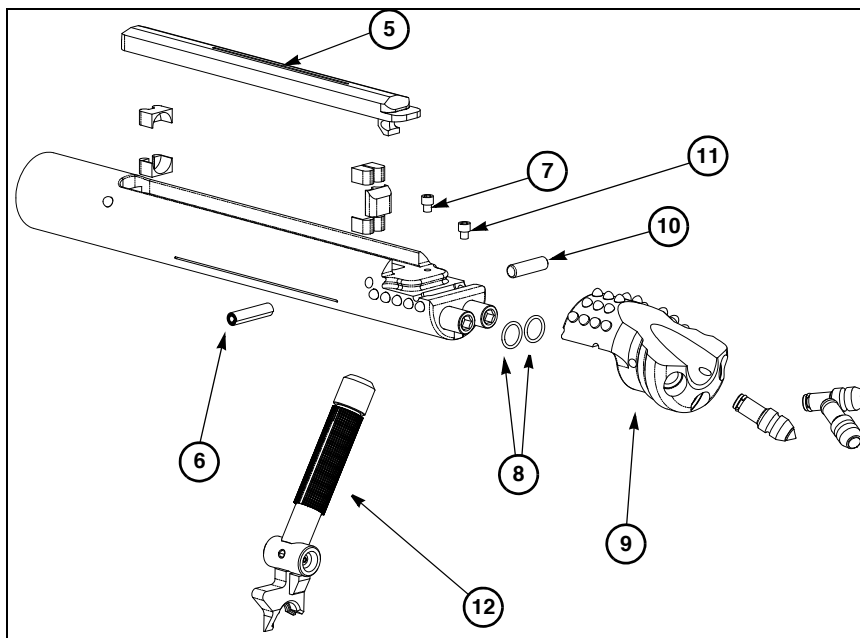


**Step 6:** Attach cover (5) with roll pin (6).  
Install one socket head cap screw (7).

**Step 7:** Install O-rings (8), then bit (9) onto housing. Insert solid cross pin (10) chamfer first. Hammer **only** on the rounded side of the pin.

**Step 8:** Install other socket head cap screw (11).

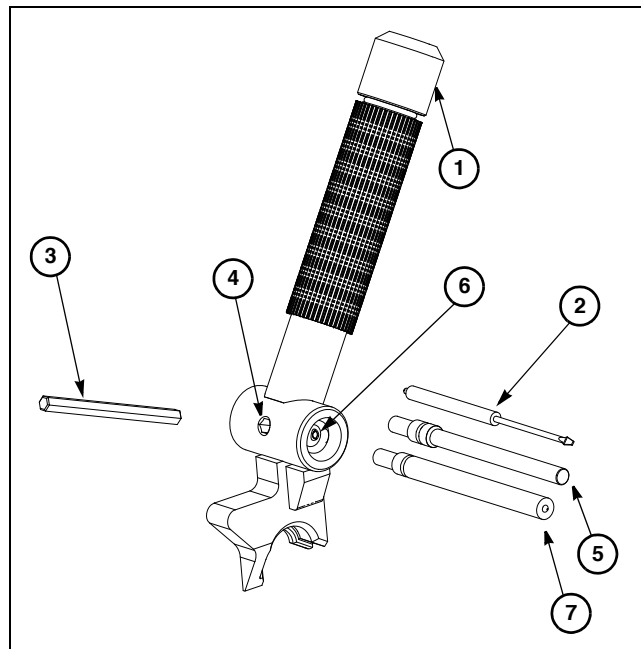
**Step 9:** The Armor housing assembly with all its components can be assembled and disassembled using multi-tool (12) and a hammer. Refer to the following section.



## Armor Multi-Tool

Remove end cap (1) from handle of multi-tool and remove components.

- **Screwdriver (2)** - Used to scrape debris from holes in housing and bit.
- **Hex Shaft (3)** - Used to install and remove socket head cap screw that secures lid and bit cross pin. Slides into hexed hole (4). Use handle and wedge section for leverage to turn hex shaft.
- **3/8" Drive Pin (5)** - Used to insert and extract bit cross pin and push out rotary teeth on Gauntlet bit. Slides into countersunk hole (6).
- **1/2" Drive Pin (7)** - Used to insert and extract 1/2" roll pin used to secure lid. Slides into countersunk hole (6).



## Rotary Tooth Installation/Extraction - Gauntlet Bit

### Installation

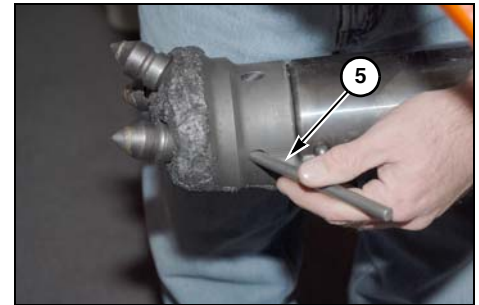
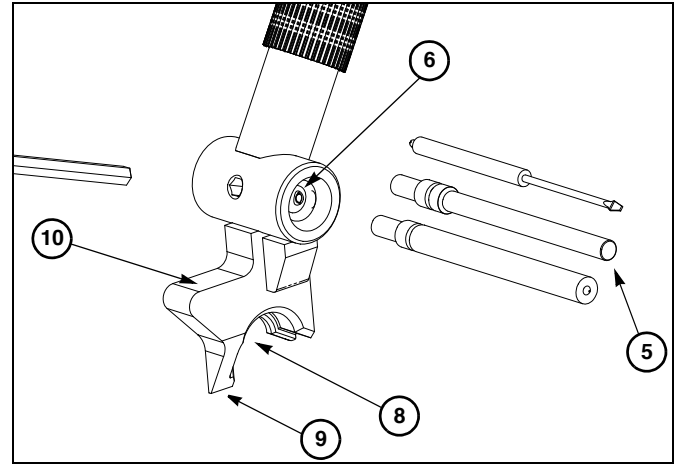
Align tooth shaft with mounting hole on bit. Place countersunk hole (6) over tooth. Hammer on back side of multi-tool, seating tooth fully.

### Extraction

Using the 3/8" drive pin (5), push teeth out from the bit, fully exposing groove on tooth. Slide U-shaped open end (8) of multi-tool onto tooth groove. Hammer on back of multi-tool.

### Front Attachment Removal

After removing socket head cap screw and solid cross pin from bit, rotate drill housing assembly so transmitter cavity is facing down. Place wedge (9) between housing and bit, and hammer on flat (10) above wedge.



# Locator System

The ability to locate the drill head is very important. Failure to use correct locating techniques can result in the drill head becoming lost, coming out in the wrong location, or missing the intended target altogether. Refer to the [Fundamentals of HDD Manual](#) for information on locator systems.

## REAMER INSTALLATION

### Swivel

The reamer must have a swivel to prevent trailed rod from turning while reaming. If reamer does not have a built-in swivel, install an external swivel. Refer to “Swivel Use” for information on swivel installation and safety. Refer to [page 50-40](#).

### Reamer Carrier - Intended Use

Vermeer reamer carriers are used to lift reamers weighing more than 50 lb (23 kg). The carrier allows you to install or remove reamers at the exit site while the machine is locked out. While holding the reamer with the carrier, you can turn the reamer by hand without rotating the drill string.



**DANGER:** Serious injury or death will result if you are struck by a wrench or entangled in the drill string or reamer. Never rotate drill string while installing or removing a reamer. Heavy reamers must be lifted using the Vermeer reamer carrier or similar device and turned by hand while the machine is locked out.

# Reamer Carrier Styles

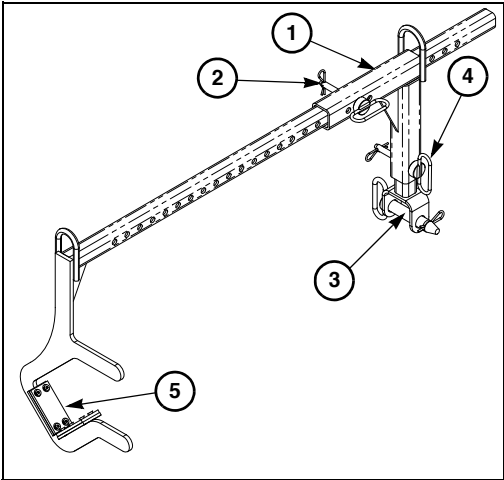
Vermeer Part Number	Weight Limit	Vermeer Part Number	Weight Limit
296255-490	1000 lb (450 kg)	296260-037	2400 lb (1100 kg)

## Reamer Carrier Components

The reamer carrier has a sliding frame (1) for adjustment to fit different size reamers and drill tools. Remove hairpin and pin (2) to adjust slide.

The pin end (3) of reamer carrier, located at bottom of sliding frame, connects to the reamer. Remove pin (4) to install other reamer types, including swivel and several threaded connections.

At the opposite end of the carrier, the reamer connector rests in a cradle with replaceable wear pads (5).

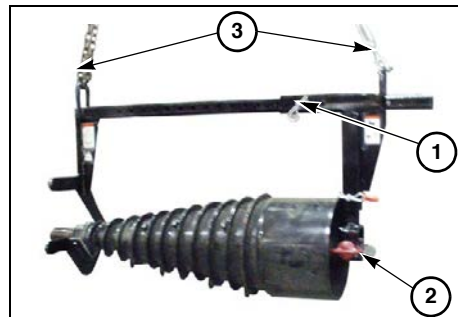


## Reamer Carrier - Install/Remove

Using the reamer carrier requires two persons, one to attach and guide the carrier, and one to operate the lifting device. Use the correct reamer carrier connector for the reamer. Refer to previous page.

*To install the reamer carrier:*

- Step 1:** Remove hairpin (1) and pin. Remove sliding frame from end of reamer carrier.
- Step 2:** Remove pin (2). Attach back side (often swivel end) of reamer to connector and reinsert pin.
- Step 3:** Slide frame bar into sliding frame, inserting cradle underneath reamer as shown.
- Step 4:** When cradle is positioned securely beneath connector end of reamer, install pin and hairpin (1).



## Reamer Carrier - Lift

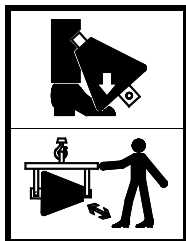
- Step 1:** Lock out drill.
- Step 2:** Attach chain to lift points (3) on reamer carrier.
- Step 3:** Securely attach chain to hook on a suitable lifting device, such as an excavator.
- Step 4:** Carefully lift reamer carrier and position reamer to align reamer with drill rod/starter drill rod.

## Turnbuckle - Adjust

A turnbuckle (1) may be used for angular adjustment of reamer to drill string. Use appropriate-sized chain and turnbuckle for reamer and reamer carrier weight.

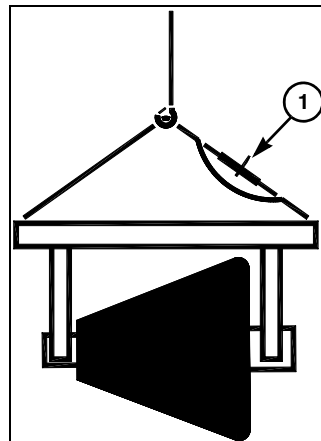


**WARNING:** Do not lift a reamer that exceeds the weight limit of the carrier.



**WARNING:** Falling load can injure you.

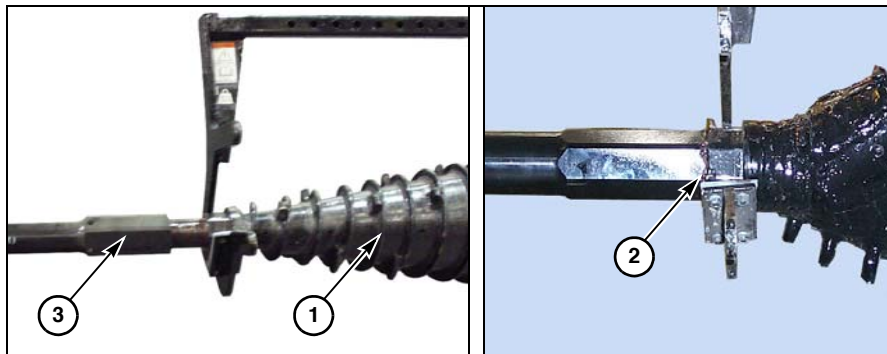
Do not work under raised load.





## Reamer - Connect with Manually Threaded Joint and Collar

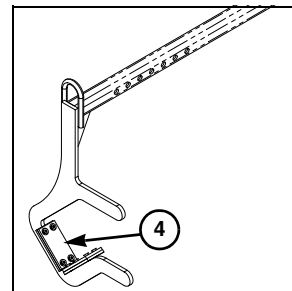
- Step 1:** Lock out drill.
- Step 2:** Clean all components.
- Step 3:** Lubricate threaded end of reamer (1).
- Step 4:** Align reamer with drill string and manually turn reamer by hand until reamer is completely threaded onto drill string.
- Step 5:** Continue manually threading reamer onto rod until shoulders touch. Then back off to align to the nearest flat (2).
- Step 6:** Slide collar over the connection, then install cap screw (3). Torque to 35 ft-lb (47.5 Nm).
- Step 7:** Use Portable Breakout system to tighten connection. Refer to “PBD7500 Portable Breakout Device,” [page 55-4](#), for procedures. The chart in that section displays correct makeup torque.



## Reamer Carrier Wear Pads - Replace

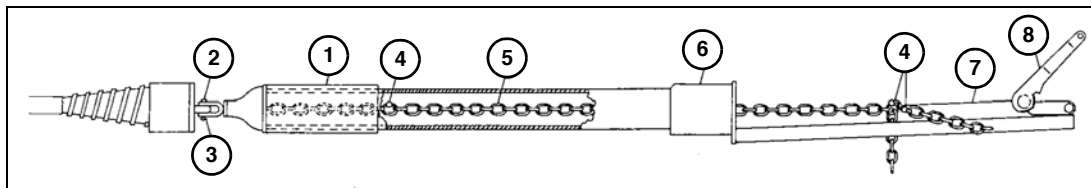
Replace wear pads (4) when worn.

- Step 1:** Remove four bolts and worn pad.
- Step 2:** Install new pad. Install bolts.



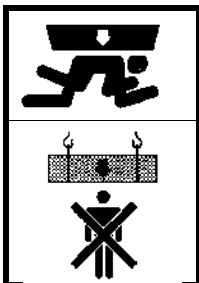
## PVC PIPE PULLING (OPTION)

The PVC puller assembly is used to pull PVC pipe back through the bored hole. Three different sizes of PVC pipe can be pulled by using the respective size pulling kits for 2", 3", or 4" PVC pipe.



- Step 1:** Assemble pipe lengths (if more than one) with the PVC puller (1).
- Step 2:** Pass pull chain (5) through pipe.
- Step 3:** Assemble PVC puller to backreamer with a clevis pin (2) and cotter pin (3).
- Step 4:** Connect pull chain to PVC puller with a quick link (4).
- Step 5:** Pull chain tight between the puller and tensioner (6) with nylon strap (7) and ratchet (8).
- Step 6:** Connect tensioner anchor chain to pull chain with a quick link (4).
- Use caution when tensioning pipe together to prevent pipe from breaking.
- Step 7:** Release ratchet.
- Step 8:** Pull pipe into the bore.
- Step 9:** After backreaming is complete, release tension on quick link with the ratchet. If ratchet will not release tension, cut the link with a saw or bolt cutters.

# Rod Loader Setup



**WARNING:** Falling load can crush. Never lift rod box over people.

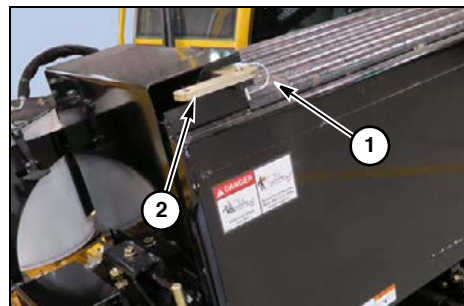
Do not stand or work under raised rod box.



**WARNING:** Pinch points can result in serious crushing injuries. Keep hands and feet away from pinch points of rod loader. Keep red awareness bars lowered during rod loader operation.

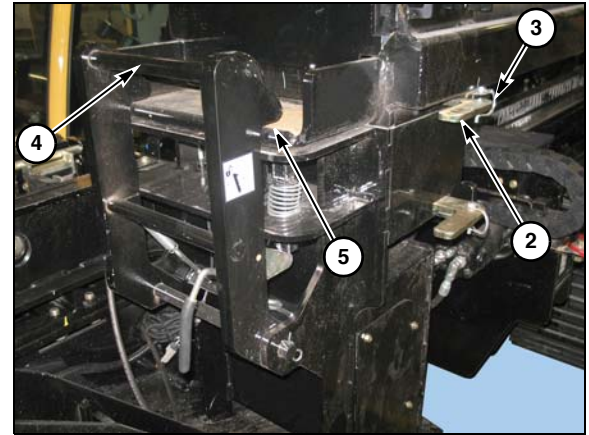
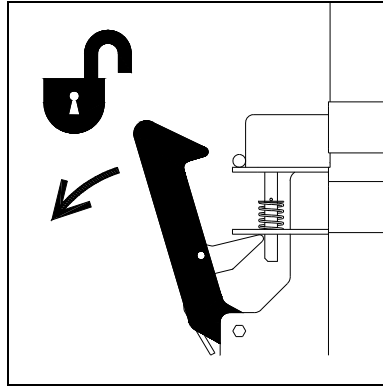
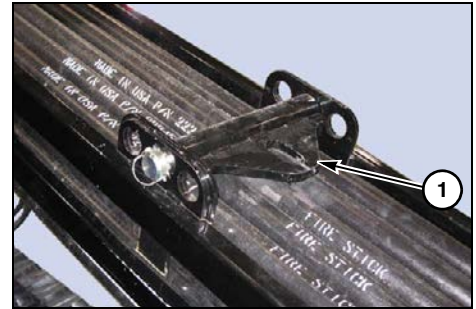
## Rod Box - Load with Rod

Remove keeper pins (1) and upper rod box retainer plates (2) at each end to load rods manually into rod box. Load rods with male threads to the front.



## Rod Box - Remove

- Step 1:** Move rod loader to first row.
- Step 2:** Fully retract rod transfer arm under rod box.
- Step 3:** If removing rod box with rods, raise rod lifter to push rods into rod box.
- Step 4:** Install two center rod support plates (2) and linch pins (3), one at each end of rod box, to hold rod in rod box.
- Step 5:** Lower rods and shut off engine.
- Step 6:** Connect chain to rod box lift bar (1).
- Step 7:** Pull forward on bar (4) to unlock latch (5).
- Step 8:** Remove rod box.
- Step 9:** If not immediately installing removable rod box, install fixed rod box pin. Refer to next page.



## Rod Box - Install

**Step 1:** Lower rod lifters and shut off engine.

**Step 2:** Connect hoist chain to lift eye (1).

**NOTICE:** Lift rod box by top lift eye only.

**Step 3:** Ensure male threads are at front of rod box.

**Step 4:** If fixed rod box pin (2) was installed, remove it and place in storage position.

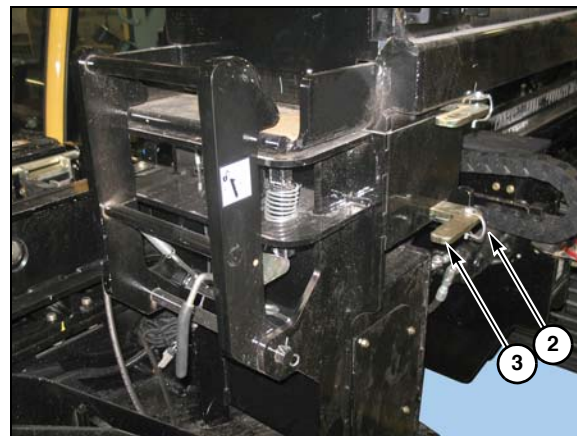
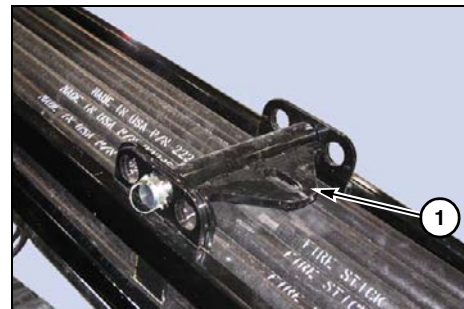
**Step 5:** Carefully lower rod box onto guide pins, back end first. Latch at front will automatically engage when rod box is lowered.

**Step 6:** Verify that latch has locked.

**Step 7:** Remove hoist chain.

**Step 8:** If installing rod box with rods, raise rod lifter to lift rods off of rod box pins.

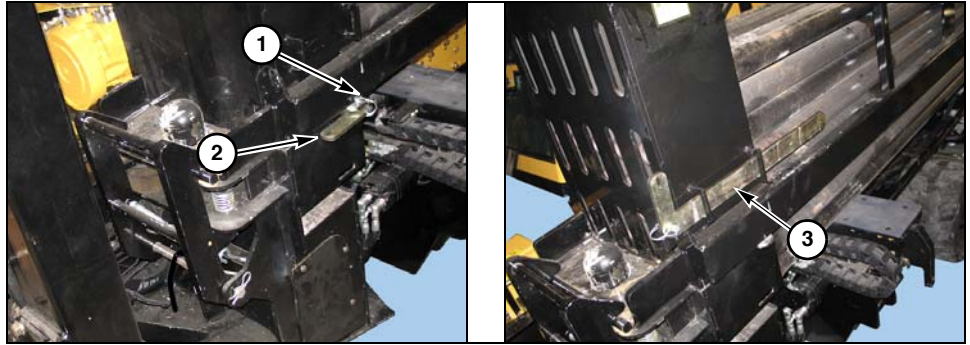
**Step 9:** Remove both rod box lynch pins (2) and plates (3) before drilling. Refer to “Rod Loader Setup,” [page 30-31](#).



## Rod Box - Prepare

- Step 1:** Push and hold up rods with rod lifter.
- Step 2:** Remove two retainer pins (1) and two rod box pins (2).
- Step 3:** Store rod support pins in their storage location (3).

Rod can now be added or removed from the rod box.



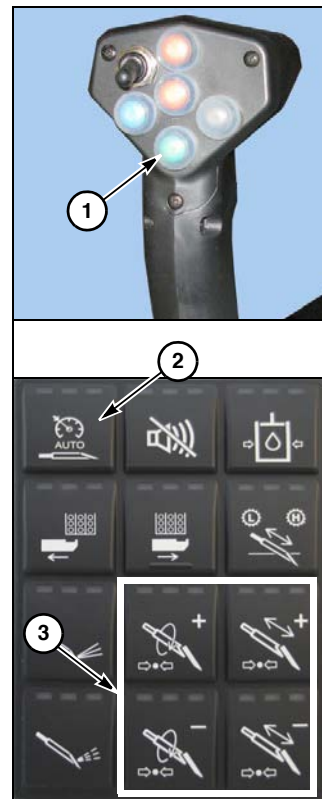
# Automatic Functions

## AUTODRILL

AutoDrill acts as a cruise control by recording actual speeds and pressures when the *AutoDrill Set Button (1)* is pressed. This allows the operator to perform repetitive drilling functions automatically.

### AutoDrill - Set

- Step 1:** Press *AutoDrill Resume / Mode Selection Key (2)* to select the appropriate AutoDrill mode.
- Step 2:** Move the joysticks to manually set the rotation speed/direction and thrust/pullback speed/direction.
- Step 3:** Press *AutoDrill Set Button (1)* and release it. Return both joysticks to NEUTRAL within 1.5 seconds.
- Step 4:** Use AutoDrill increase/decrease keys **(3)** to adjust.
- In Speed mode, rotation keys affect rotation speed, and thrust keys affect thrust speed.
  - In Rotation mode, rotation keys adjust rotation pressure, thrust keys do not function.
  - In Thrust mode, thrust keys affect thrust/pullback pressures, and rotation keys do not function.



## AutoDrill - Pause/Resume

To pause AutoDrill, move either joystick out of center for at least 1/2 second.

To resume:

**Step 1:** Press and hold *AutoDrill Resume Key (2)* for 3 seconds.

**Step 2:** When rotation starts, release *Resume Key*.

Thrust/Pullback starts in 2–3 seconds, and AutoDrill is active.

If thrust or rotation has not been active for 5 minutes, AutoDrill mode cannot be resumed, but must be reset. Return to Step 3 on previous page.



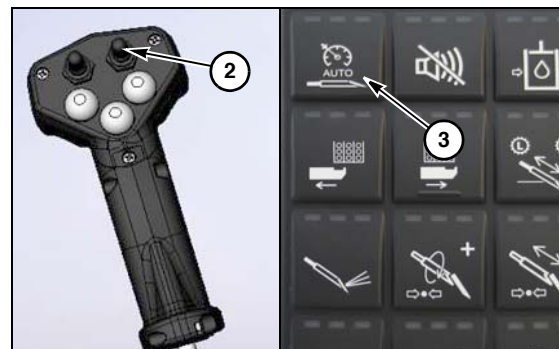
## Front Vise Function in Resuming AutoDrill

Resuming AutoDrill is only possible if the *Front Vise Switch (2)* is in the RELEASED position.

If the front vise is clamped and the operator tries to resume, AutoDrill will remain paused until the operator moves the *Front Vise Switch* to the RELEASED position.

When front vise is released, AutoDrill can be restarted by pressing the *Resume Key (3)* for 1.5 seconds.

The rear vise has no effect on AutoDrill.





## AUTO STEERING

Auto steering automates certain drill head motions. The operator sets and adjusts rotation duration and rotation direction.

Two options are available:

In **Carve** steering, the bit rocks back and forth through an arc while maintaining a preset thrust pressure. In Carve mode, the *Rotation Joystick* functions only as a switch to turn rocking motion on and off. For manual rotation control, set mode to OFF.

In **Zone** steering, the bit:

1. Thrusts into the ground until correct pressure is achieved.
2. Cuts through an arc (duration).
3. Pulls back the specified distance.
4. Rotates back to starting point and starts again.

## Carve Steering Setup

Use this procedure once at start-up.

**Step 1:** Rotate drill head to starting position, the center of the duration of the sweep (1).

**Step 2:** Move both joysticks to NEUTRAL.

**Step 3:** From Drill Screen, press *Auto Steer Key* (2) to access Steering Setup Screen. Press key again until CARVE appears (3).

**Step 4:** Set duration using *Increase/Decrease Keys* (4).

**Step 5:** Pull rotation joystick. Rotation will sweep the two set points (1).

**Step 6:** Return to Drill Screen to monitor thrust pressure.

**Step 7:** Begin thrusting.

- Operator can use manual drilling
- or AutoDrill, when thrust pressure has been reached

The drill string will automatically be rotated through the specified arc set by the duration, centered on the set direction.

This calibrated HOME direction will remain accurate as long as the rotation gearbox is connected to the drilling head.

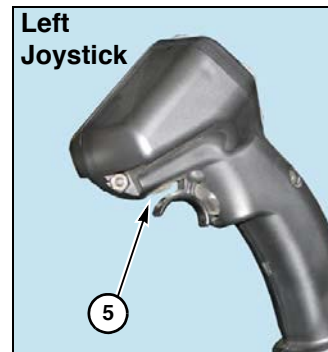
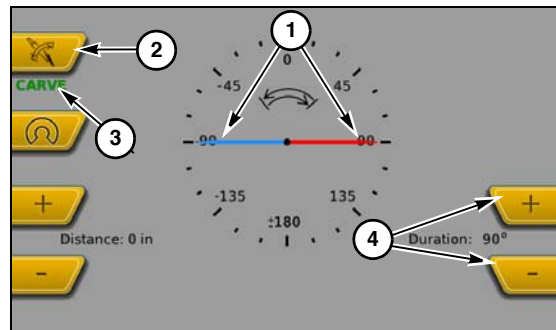
**Step 8:** When desired pressure is reached, AutoDrill function can be used.

**Step 9:** During drilling, use keys (4) to adjust arc duration if needed.

To exit Carve Steer, move joysticks to NEUTRAL, then press button (5).

To restart Carve Steer with the same settings, move joysticks to neutral and press (5) again. Then repeat Steps 5–7.

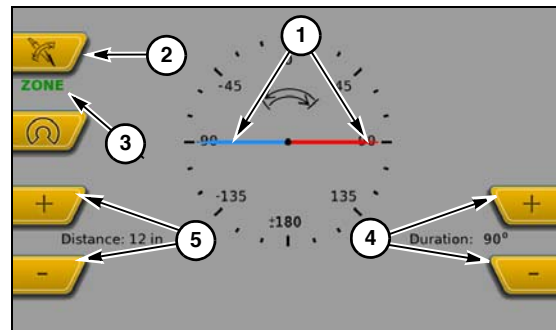
To restart Carve Steer with new settings, begin with Step 1.



## Zone Steering Setup

Use this procedure once at start-up.

- Step 1:** Rotate drill head to starting steering position, the center of the duration of the sweep (1).
- Step 2:** Move both joysticks to NEUTRAL.
- Step 3:** From Drill Screen, press *Auto Steer Key* (2) to access Steering Setup Screen. Press key again until ZONE appears (3).
- Step 4:** Set duration (sweep) using *Duration Increase / Decrease Keys* (4).
- Step 5:** Set distance of pullback after sweep using *Zone Increase / Decrease Keys* (5).
- Step 6:** Return to Drill Screen to monitor thrust pressure.
- Step 7:** Begin thrusting and rotating. Rotation will not move, but joystick must be pulled back.



**Step 8:** When desired pressure is reached, AutoDrill function can be used. After pressing the AutoDrill button, these actions should occur:

- a. Rotation will sweep to right side set point (end of sweep).
- b. Carriage will pull back the set distance.
- c. Rotation will reset to left side set point (start of duration).
- d. Thrust will start until set thrust pressure is reached.
- e. Rotation will do a full sweep.
- f. Actions b–e will repeat.

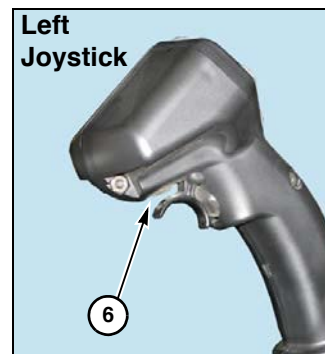
This calibrated HOME direction will remain accurate as long as the rotation gearbox is connected to the drilling head.

To exit Zone Steer, move joysticks to NEUTRAL, then press button **(6)**.

To restart Zone Steer with the same settings, move joysticks to neutral and press **(6)** again. Then repeat Steps 7 and 8.

To restart Zone Steer with new settings, begin with Step 1.

**NOTICE:** Steps 1–7 must be repeated after every rod change.

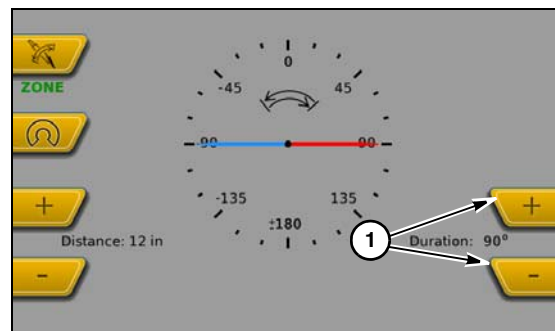


## Rod Wrap

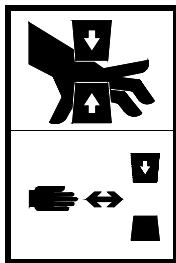
As drilling distance increases and the drill string lengthens, the drill head rotates fewer degrees than the drive chuck. This is rod wrap. It varies with drilling conditions and drill pipe diameters.

To compensate, increase angle with *Increase/Decrease Keys (1)*.

Failure to adjust may result in decreased productivity. Depending on soil condition, forward movement may stop.



## VICE OPERATING GUIDELINES



**WARNING:** Pinch points in vise can crush.

Keep hands away.



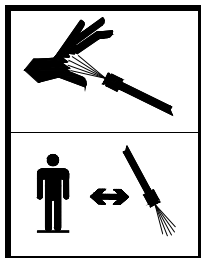
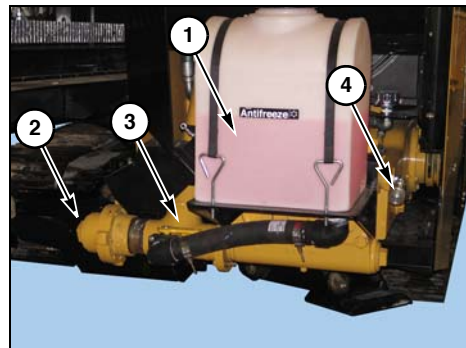
**DANGER:** Wrench on rotating drill string can strike you. Death or serious injury will result. Always use the power vise to make or break joints at the machine.

- Inspect vise jaws and grips and replace worn or damaged components before drilling.
- Stake drill unit down securely. If rack shifts during drilling, the rod will become misaligned between the jaws. Check alignment to prevent jaw or rod damage.
- Do not rotate a clamped rod.
- Do not thrust a rod through a closed vise.
- Keep rod centered between guide rollers. Do not continue the bore unless rod is centered between rollers.

## ANTIFREEZE - ADD TO DRILLING FLUID SYSTEM

Store antifreeze in tank (1). It can be reused as necessary. Replace antifreeze when it is too diluted to protect system.

- Step 1:** Drain and flush drilling fluid hoses and water pump. Refer to “Flushing Bentonite/Polymers from Drilling Fluid System,” [page 50-55](#).
- Step 2:** Fill tank (1) with RV-type antifreeze. Use at full strength; it will become diluted as it is used.
- Step 3:** Install cap (2) on coupler,.
- Step 4:** Open yellow valve (3), and operate fluid system at lowest possible flow setting until antifreeze comes out of drive chuck.
- Step 5:** Shut off drilling fluid system.



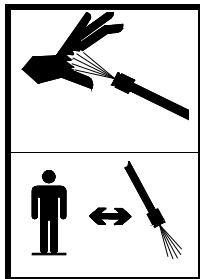
**WARNING:** High pressure water can penetrate skin. Serious injury possible. Fluid injected under the skin must be removed immediately by a surgeon familiar with this type of injury.

Keep nozzles away from body.

- Step 6:** Connect wash wand to quick coupler (4).

**Step 7:** Select *Wash Wand / Drill Switch (5)* on control panel to WASH WAND position.

**Step 8:** Start engine.



**WARNING:** High pressure water can penetrate skin. Serious injury possible. Fluid injected under the skin must be removed immediately by a surgeon familiar with this type of injury

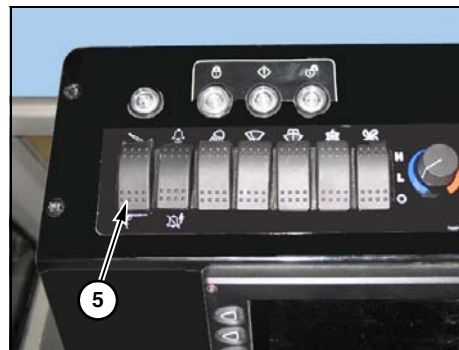
Keep nozzles away from body.

**Step 9:** Spray fluid until antifreeze is visible in the spray from wand.

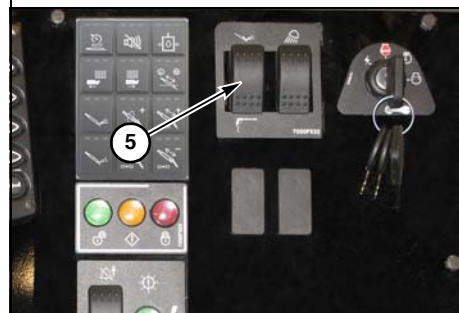
**Step 10:** Close valve. Follow [Shutdown Procedure](#), page 50-4.

**Step 11:** Point wash wand away from people and squeeze handle to release pressure remaining in wand.

**Step 12:** Remove wash wand from drilling fluid pump quick coupler and store wash wand.



Cab Machine



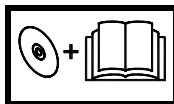
Non-Cab Machine



# Section 40: Preparation

## Preparing Personnel

### OPERATOR QUALIFICATIONS



**WARNING:** Read Operator's Manual and safety signs, and watch the operations and safety video, before operating machine.

Allow only responsible, correctly instructed individuals to operate machine.

Become familiar with the controls, operation, and use of the machine under the supervision of a trained and experienced operator.

The operator must be familiar with the workplace's safety rules and regulations, and must be mentally and physically capable of operating the machine safely.

### Safety Conscious Operators and Workers

Operators and workers must use reasonable accident-prevention measures. This includes correctly locating all underground utilities.

## TRAINING

Before operating the drill unit, the operator and crew should be trained in the operation of horizontal directional drills. Initial training should be conducted at a site free of underground utilities and should cover:

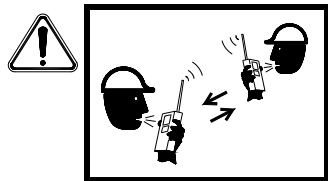
- all sections of this manual
- processes and procedures used to locate underground utilities
- jobsite safety, including safety barriers and protective clothing, as well as operating and emergency procedures
- machine lockout procedure and Remote Lockout system
- two-way radio communication
- transportation of the drill unit
- setup of the drill unit
- drilling and backreaming, including selection and installation of tools

## WARNING SAFETY SIGNS AND OPERATING INSTRUCTIONS

Warning safety signs and operating instructions provide information on potential safety hazards and safe operating instructions.

## RADIO COMMUNICATION REQUIREMENTS

The Remote Lockout system is not intended to replace good verbal radio communication. Radio communication is essential to the Remote Lockout system process.



**WARNING:** Proper communication is essential to prevent unplanned start-up of the drill string and/or tool. Serious injury or death could result. Always follow communication requirements as explained below.

Use good quality two-way radios with sufficient range to provide clearly understood communication. Test radios at the site to ensure communications can be heard above background noise.

The radio at the exit location must be assigned to one designated person. This person will always communicate with the machine operator.

When sending a message, identify yourself and the receiver by name. This prevents confusion if more than one machine is operating on a jobsite.

All radio messages must be confirmed by the receiver. Confirmation from the receiver must acknowledge that the message was received and correctly understood. Correct understanding must be demonstrated by repeating the original message back to the sender. The sender must always require confirmation of the message.

## Radio Communication to Stop Drilling Operation

When crew at the location of exposed drill rod or tool requests the operator to stop operation:

- Step 1:** The crew must communicate a stop command to the operator.
- Step 2:** When stop command is received, the operator must immediately stop the machine. After machine has stopped, the operator must return a message confirming that the message was received and understood.

## Radio Communication to Resume Drilling Operation

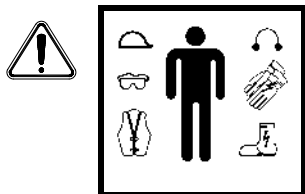
*If start-up is requested by the machine operator:*

- Step 1:** The operator must request authorization from the crew at the location of exposed drill rod or tool to resume rotation or thrust.
- Step 2:** The crew at the location of exposed drill rod or tool must respond as appropriate, but must not give authorization to resume until everyone is away from drill string or cutting tool and everyone has been informed that start-up will occur.
- Step 3:** If authorization to resume has been received by the machine operator, the operator must require confirmation for start-up from the crew at the exit location.
- Step 4:** When confirmation is received, the operator may resume operation.

*If start-up is requested by the crew at the location of the exposed drill rod or tool:*

- Step 1:** After checking that everyone at the location of exposed drill rod or tool is away from the cutting tool and everyone has been informed that start-up will occur, a start-up command may be sent to the operator.
- Step 2:** When the start-up command is received, the operator must return a message confirming that the message was received and understood.
- Step 3:** The crew at the location of exposed drill rod or tool must respond by providing confirmation of the machine operator's intention to start-up.
- Step 4:** When confirmation is received, the operator may resume operation.

## PERSONAL PROTECTION



**WARNING:** Wear personal protective equipment. To reduce the risk of being caught and entangled in moving components, wear close-fitting clothing and confine long hair. Do not wear jewelry, such as rings, wristwatches, necklaces, or bracelets.

Working around the machine requires you to wear protective equipment. Always wear a hard hat, wraparound eye protection or goggles, and electrically insulated boots. If working near traffic, you may need to wear reflective clothing.

Anyone working on the ground around the machine is required to wear electrically insulated boots. If on the ground and in contact with the machine, then you are required to also wear electrically insulated gloves. This includes crew members loading or unloading drill rod.

The operator is not required to wear electrically insulated gloves while seated on the machine. However, the operator must always wear electrically insulated boots to protect against electrical shock in case of inadvertently stepping off the machine during an electrical strike.

Hearing protection must be worn by machine operator. Other crew members may need to wear hearing protection when working close to the machine and/or support equipment.

Other workers in the immediate area must also wear a hard hat, eye protection, and electrically insulated boots. The drilling tool locator must wear electrically insulated boots. The ground may become electrically charged if a strike occurs.

Wear close-fitting clothing and confine long hair.

Do not wear jewelry, such as rings, wristwatches, necklaces, or bracelets.

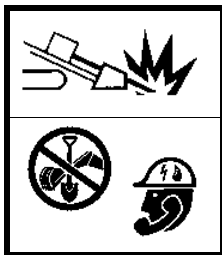
**Sound and Vibration Levels**

The stated sound levels are representative for a given operating condition. Operating conditions may vary at each jobsite. The actual sound levels for your application and operating conditions may be different.

Equivalent Continuous A-Weighted Sound Pressure at Operator’s Ear as specified by directive 2000/14/EC, ISO 3744, and ISO 11201 .....	85 dB(A)
Guaranteed Sound Power Level as determined by directive 2000/14/EC .....	118 dB(A)
Hand/Arm Vibration Level as determined by ISO 5349 .....	less than 2.5 m/s <sup>2</sup>
Whole Body Vibration Level as determined by ISO 2631-1 .....	less than 0.5 m/s <sup>2</sup>



## UNDERGROUND UTILITY CONTACT



**WARNING:** Electricity or gas explosion can kill. Laser light in cut cable can result in eye damage.

Locate utilities before drilling. Call 811 (U.S. only) or 1-888-258-0808 (U.S. or Canada) or local utility companies or national regulating authority.

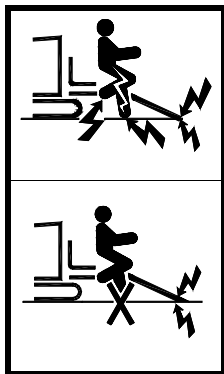
Before you start any digging project, do not forget to call the local One-Call system in your area and any utility company that does not subscribe to the One-Call system. For areas not represented by One-Call systems International, contact the appropriate utility companies or national regulating authority to locate and mark the underground installations. If you do not call, you may have an accident or suffer injuries; cause interruption of services; damage the environment; or, experience job delays.

The One-Call representative will notify participating utility companies of your proposed digging activities. Utilities will then mark their underground facilities by using the following international marking codes:

Red	Electric	Green/Brown	Sewer
Yellow	Gas, Oil or Petroleum	White	Proposed Excavation
Orange	Communication, Telephone, TV	Pink	Surveying
Blue	Potable Water		

**OSHA CFR 29 1926.651** requires that the estimated location of underground utilities be determined before beginning the excavation or underground drilling operation. When the actual excavation or bore approaches an estimated utility location, the exact location of the underground installation must be determined by a safe, acceptable and dependable method. If the utility cannot be precisely located, it must be shut off by the utility company.

## ELECTRICAL SHOCK PROTECTION



**DANGER:** Electric shock can kill.

If strike occurs, do not step off.



**DANGER:** Contact with the drill rack, power supply, drilling fluid systems or operator station while standing on the ground could result in electrocution if an electrical strike occurs. Do not touch the drill rack, power supply, drilling fluid systems or operator station while drilling or after an electrical strike occurs. See other portions of this manual regarding procedures and personal protection equipment to avoid electrocution.



## Electrocution Prevention

Electrocution is possible. Serious injury or death may result if the drilling tool strikes an energized power line. Refer to the operating instructions, and take the following precautions to prevent electrocution:

- Call your One-Call system, and any utility company that does not subscribe to the One-Call system, before the start of your drilling project. Locate underground utilities by qualified persons.
- When drilling operation approaches the estimated location of a utility, the exact location of the underground installation must be determined by safe and acceptable means.
- Always wear the necessary electrically insulated gloves and boots that are required for each job function. Refer to “Electrically Insulated Gloves” and “Electrically Insulated Boots” on the following pages.
- Never stand on the ground and touch metal parts on drilling unit when operating.
- If a strike occurs, never leave the cab or step off the drill rack or other equipment connected to the rack.
- Anyone standing on the catwalk for the drill rack must never step off the catwalk if electric strike occurs. Never step onto the machine if electrical strike occurs.
- Always test Strike Alert system before the start of every bore. Refer to “Strike Alert System - Test,” [page 50-15](#). Never operate if Strike Alert system is not in operation and tested.
- Disconnect from public water supply before drilling where electrical cables may be buried.

If a strike occurs while you are touching the ground, you could be electrocuted when your body becomes a direct current path to the ground.

Anyone assisting the operator while standing on the ground and in contact with the machine during the bore must wear electrically insulated gloves and boots.

If using a walk-over locating system, the drilling tool locator must wear electrically insulated boots. The ground may become electrically charged if a strike occurs.

## Electrically Insulated Gloves

If electrically insulated gloves are not available locally, they can be obtained through Vermeer Corporation. A one-pair purchase voucher is supplied with the machine.

Rubber electrically insulated gloves, when in good condition and correctly used, help protect the wearer from serious injury, death, and electrical burns. Gloves must be at least Class 2, with a voltage rating of 17,000 volts or more. Wear leather protectors over gloves. They protect the gloves, but do not protect against serious injury, death or other potential dangers from electric shocks or burns.

The operator is not required to wear electrically insulated gloves. Anyone on the ground and in contact with the machine during drilling, or anyone loading drill rod or inserting the voltage stake must wear electrically insulated gloves and boots.

Correct care of gloves is essential to wearer safety.

- Visually inspect gloves and leather protectors prior to each use. Refer to instructions on this page.
- Do not fold gloves. Folding causes dangerous cracking damage. Store gloves in glove bag when not in use.
- Do not store gloves inside out. This causes damage from ozone and severely strains the rubber.
- Keep gloves clean. The gloves will be more comfortable to wear, and any damage will be more visible.
- Prevent snags. Do not wear rings, watches, jewelry, or other sharp objects on hands or arms when wearing gloves.
- Prevent contact with wood or metal splinters or other sharp objects which may damage gloves.
- Prevent contact with chemicals, which can damage gloves. If gloves contact chemicals, wipe gloves off immediately. Clean gloves with a mild soap, then rinse with clear water and let them air dry.

The ASTM In-Service specifications call for an electrical retest of gloves at a test lab every 6 months. This test is to recertify the non-conductivity of the gloves. Contact your Vermeer dealer for the location of the test lab in your area or a listing of the test labs.

## Electrically Insulated Gloves - Inspect

Visually inspect insulated gloves and leather protectors before each use.

- Check for signs of physical damage or chemical deterioration such as swelling, softness, hardening, stickiness, ozone deterioration, or sun-checking from prolonged exposure to sunlight.
- Check whether red or yellow inner layer shows through black outer layer, indicating gloves have been cut or snagged. If damaged at all, do not use them.
- Check leather protectors. Look for metal particles, imbedded wire, abrasive materials, or other substance that could cause puncture, abrasion, contamination, or deterioration. Maintain adequate flashover distance of 2" (5 cm) between the top of protector and the bead of rubber glove. Minimum uncovered distance is 1" (2.5 cm) above the protector cuff top for each 10,000 volts.
- Check insides of each glove and air test for pinholes:

**Step 1:** Place glove on your hand, and pull cuff up over your fingers, turning glove inside out.

**Step 2:** Holding glove downward, grasp cuff and twirl it upward to close the cuff.

**Step 3:** Squeeze rolled cuff into a "U" shape to trap air inside glove. Hold cuff with one hand and squeeze glove with your other hand. Hold glove near your ear and listen and feel for air escaping through a hole. Pop out glove fingers by squeezing inflated glove and check for damage.

**Step 4:** Turn glove right side out.

**Step 5:** Repeat with other glove.

## Electrically Insulated Boots

If electrically insulated boots are not available locally, they can be obtained through Vermeer Corporation. A two-pair purchase voucher is supplied with the machine.

Rubber electrically insulated boots, when in good condition and correctly used, also help protect the wearer from serious injury, death, and electrical burns. The boots must meet or exceed electrical hazard protection requirements when tested at 14,000 volts.

Inspect boots before each use. Check for cracking, holes, and unusual wear on the sole. If there is damage, discard boots. Damaged boots do not provide adequate electrical protection.

After each use, rinse boots with water to remove mud, chemicals, and debris. It is very important to use a rubber protectant or furniture polish to keep rubber soft and help prevent pinholes, stress cracks, dry rotting, and ozone deterioration.

## Strike Alert System Functions

The Strike Alert is only a warning device, not a protective device.

The Strike Alert system detects voltage on the machine and/or current running through the drill string in the event of drill striking an underground power line. An alarm sounds alerting operator and other personnel of a potentially dangerous situation.

The Strike Alert will not be set off by coming near a power source. If the *Strike Alert Horn* sounds, the drill may have contacted an energized electrical line. Other indications of an electrical strike are electrical arcing, explosion, smoke, or popping noises.

When an electrical strike occurs, large voltage differences may exist on the ground surface near machine and along drill string. Standing or walking in these areas may cause electrical shock from the difference in voltage between your feet. Anyone in the work area, including walk-over locator, must wear electrically insulated boots. Keep all other personnel away from work area.

## Soil Conductivity

For the system to function correctly, the voltage stake must be fully inserted in soil through which a current can pass. If the machine is on asphalt or concrete, the voltage stake still must be inserted into the ground. You may need to cut a small hole for the stake, and moisten the soil around the stake.

If the machine is on a dry hard surface, or on loose sand, insert the auger stakes into the ground, or moisten the ground under the tracks, to increase electrical conductivity between machine and ground.

# Preparing the Machine

## OPERATOR PRESENCE SYSTEM

The Operator Presence system prevents track drive function if the operator is seated at the controls. Thrust and rotation will not function if these controls are pushed when the operator is not in the seat. This system is intended for your safety and must be maintained in good functional condition.

## REMOTE LOCKOUT SYSTEM PREPARATION

### Range - Test

Test range of radios and remote lockout transmitter along bore path. Good communication must be available between the operator, locator, and other crew members throughout the bore.

### Remote Transmitter - Prepare

- Step 1:** Charge transmitter battery fully at the start of the day. Approximate operational time for the battery is 30 hours. If you are unsure of remaining battery charge time, install a fully charged battery in the transmitter.
- Step 2:** Press *Power Button* to turn on the remote transmitter.
- Step 3:** Test Remote Lockout system at the machine. (Refer to next page.)
- Step 4:** Clip remote transmitter onto user's belt. Keep the transmitter ON throughout the bore.

## Remote Lockout System - Test

Test Remote Lockout system at least once daily and at the start of every bore. Machine operator must be seated.

Do this test with transmitter located near the machine.

**Step 1:** Start engine and turn on remote transmitter.

**Step 2:** Press and hold *Lockout Button* on remote transmitter. The red light must come on, and buzzer must sound 9 beeps to indicate that the machine is locked out.

**Step 3:** Machine operator must try to begin drilling. Drilling functions should remain stopped (locked out).

**Step 4:** Press *Run Button* **and hold for 2 seconds**. Green light comes on, and buzzer sounds for 2 seconds. Operator will be able to resume drilling.

If test is not successful, check that:

- transmitter is within range
- machine is operating and
- Drill mode is active, with the operator seated at controls.

If a problem remains, contact your Vermeer dealer, and use the “Lockout Procedure - Without Remote Lockout System” until the Remote Lockout system is repaired. Refer to [page 30-19](#).

# Preparing the Work Area

## **JOBSITE - CHECK**

The operator or job foreman should inspect the jobsite for:

- notices of underground placements
- manhole covers
- drop boxes
- recent trenching activity
- evidence of possible underground placements

Examine work area for obstructions, conditions, or situations which may impair machine operation or create a safety hazard. Use information in this manual and your own good judgment to identify and prevent these hazards.

## **Power Line Locator System**

A locator system to locate underground power lines is not included with the system but may be purchased from Vermeer dealerships.



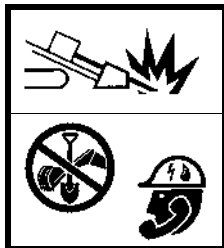
## Warning Cones

Check that orange warning cones with warning safety signs are available for placement around drill unit work area. Four orange warning cones are provided.

## LAWS AND REGULATIONS - CHECK

Know and obey all federal, state, and local laws and regulations that apply to your work situation.

## PLANNING THE BORE



**WARNING:** Electricity or gas explosion can kill. Laser light in cut cable can cause eye damage.

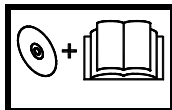
Locate utilities before drilling. Call 811 (U.S. only) or 1-888-258-0808 (U.S. or Canada) or local utility companies or national regulating authority.

Carefully plan the bore before drilling. Refer to the [Fundamentals of Horizontal Directional Drilling User's Guide](#) for more information on bore planning.

This page intentionally left blank.

# Section 50: Operation

## Starting Procedure



**WARNING:** Read Operator's Manual and safety signs, and watch the operations and safety video, before operating machine.

### BEFORE STARTING

#### Accumulator Pressure - Check

**Step 1:** Check pre-charge pressure on gauge (1).

Correct pre-charge pressure is 230–250 psi (16–17 bar)

**Step 2:** If pressure is too low, recharge with dry nitrogen gas before operating the machine.

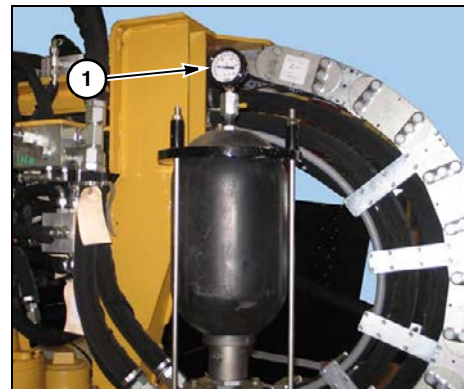
If pressure is too high, open the appropriate bleeder valve to reduce the pre-charge pressure.

**Step 3:** Close valve by turning clockwise before starting engine.

**NOTICE:** Operation of accumulator without sufficient pre-charge can cause bladder failure.

#### Recharging Pressure

Contact your Vermeer service dealer for recharging.



## STARTING THE ENGINE

**Step 1:** Shut off drilling fluid pump.

**Step 2:** Connect battery.

**Step 3:** Put *Rotation* and *Thrust/Pullback Joysticks* in NEUTRAL.

**Step 4:** Turn remote lockout transmitter on.

- The Remote Lockout system self-tests upon start-up, indicated by two short beeps. It then enters whatever mode it was in when the machine was shut down.
- If machine was shut down in Lockout mode, press *Run Button* **and hold for 2 seconds** to select RUN mode.

**Step 5:** Start engine. Fault light will be yellow if oil pressure is low. If light is red, stop engine and contact the engine manufacturer.

**NOTICE:** Never operate starter motor for more than 30 seconds at a time. Allow starter motor to cool 2 minutes between attempts.

**Step 6:** Adjust *Throttle* to get an even idle speed and allow engine to warm up for 3–5 minutes.

**NOTICE:** After engine reaches operating temperature, do not operate engine at idle for more than 5 minutes. Low combustion chamber temperatures can dilute crankcase oil because fuel does not burn completely. Low temperatures also permit formation of gummy contamination on valves, pistons, and piston rings.

**Step 7:** Press *Hydraulic Enable Key*.



---

**WARNING:** Pressing *Hydraulic Enable Key* will result in vise movement if the vise control switch positions were changed while the engine was off. Crushing injury may result. Keep everyone clear of machine.

---

# COLD WEATHER STARTING

## Engine

Before operating in cold weather, refer to the Engine Operation Manual for recommended engine oil, fuel, and starting procedures.

## Hydraulic Fluid

Refer to [Specifications](#) section, “Lubricants,” in the [Maintenance Manual](#) for recommended hydraulic fluids.

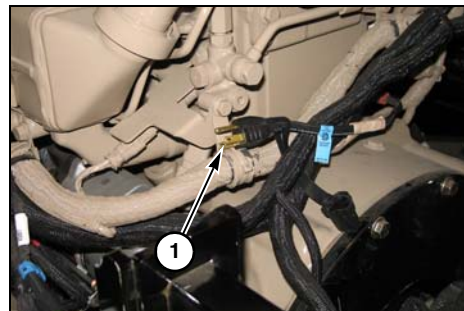
When using ISO 64 hydraulic fluid for temperatures as low as -22°F (-30°C), ISO 68 hydraulic fluid below +23°F (-5°C) or ISO 100 hydraulic fluid below +41°F (+5°C):

- Warm up engine.
- Gradually increase engine RPM for up to 30 minutes to allow hydraulic oil to warm up. Partially engage hydrostatic circuits to slowly turn the hydrostatic motors while warming the oil.
- Slow down engine if hydraulic pump makes a high-pitched noise because it does not get enough oil.

For frequent starts below 10°F (-12°C), consult your Vermeer dealer.

## Cold Weather Start System

The engine is equipped with an engine block heater. Plug connector (1) into electrical source.



# Shutdown Procedure

**Step 1:** Shut off drilling fluid pump.

**Step 2:** Reduce engine speed to idle.

**Step 3:** Wait 2 minutes to shut off engine when shutting down after operating at full power.

**Step 4:** Shut off engine and remove key.

For your safety and the safety of others, use shutdown procedure before working on the machine for any reason, including servicing, cleaning, unplugging, or inspecting.

**NOTICE:** If working on the drill string or drill tools at a remote location away from the machine, follow correct lockout procedure.

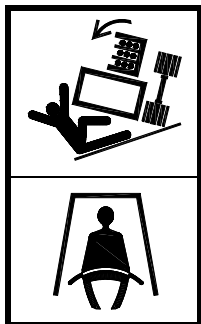
- “Lockout Procedure - With Remote Lockout System,” [page 30-16](#)
- “Lockout Procedure - Without Remote Lockout System,” [page 30-19](#)

A variation of the above procedure may be used if instructed within this manual or if an emergency requires it.

# Transporting the Machine

## DRIVING THE MACHINE

Survey area around machine for persons and obstacles before driving or moving machine.



**WARNING:** Rollover possible. Be alert and use extreme caution when operating on hillsides, or near ditches, gullies, holes, or obstructions where rollover could occur. Serious injury or death can result if crushed under the machine. Never allow anyone to be on the downhill side of the machine.

Fasten seat belt.

Drive machine at a speed suitable for the terrain. Never operate machine faster than you can comfortably walk. Keep feet clear of the track when driving. Do not stop, start or turn suddenly unless it is necessary. Always drive machine with rack parallel with tracks and with carriage at back of machine.

## Backup Warning Alarm



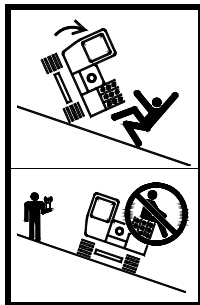
**WARNING:** Before backing, clear area and warn others to stay away. Serious injury or death could result if a person is struck or run over by the machine.

---

Have a spotter direct the operator while moving the machine.

Whenever machine is in REVERSE, backup warning alarm will sound. Use the forward travel horn to further alert ground personnel when necessary.

## Driving the Machine with Remote Control



**WARNING:** Rollover can crush.

Stay uphill. No riding.

---

- Survey area around machine before driving.
- Maintain clear visual contact with the machine and the direction of travel.
- Stay a safe distance away while driving and loading or unloading on a trailer.



## Safe Operating Slope

Safe operating slope depends on many factors, including:

- Machine weight distribution, including front loading or absence of load
- Height of load
- Even or rough ground conditions
- Potential for ground giving way, causing unplanned forward, reverse, or sideways tilt
- Nearness of ditches, ruts, stumps, or other obstructions and sudden changes in slope
- Speed
- Turning
- Braking performance
- Skill of operator

These conditions make it impractical to specify a maximum safe operating slope. Adjust operation accordingly.

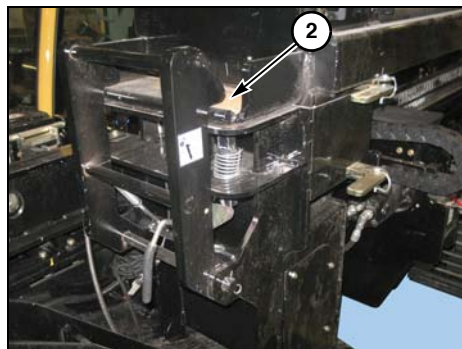
Maximum engine angle and braking performance also affect safe operating slope:

- Maximum engine lubrication angle – 20° all directions
- Service brake retarding force – equal to traction of both tracks
- Secondary brake – equal to traction of one track
- Park brake holding force – equal to traction of both tracks

However, these are design limits, not operating limits. They do not establish safe operating slope when used alone. Consider the varying factors also.

## PREPARING FOR TRANSPORT

- Store cable and voltage stake (1) on storage bracket at back of rack.
- Install rod retainers in top of rod box to prevent drill rods from coming out of rod box during trailering.
- Put front rod box latch in locked position (2) to secure rod box to machine.
- Rotate operator console fully towards drill rack.
- Extend rod transfer arms toward drill rack (non-cab machine).
- Fold red rod transfer arm barrier in to prevent damage to the barrier.
- To position rod transfer arm to the extended position if transporting with carriage centered on rack:
  1. Retract rod transfer arms. Refer to [page 20-45](#).
  2. Position carriage in center of rack so that rod transfer arms will not hit carriage.
  3. Extend rod transfer arms and hold *Extend Button* for 5 seconds.



## Driving Machine with Wireless Remote Control

**Step 1:** Turn ignition key to ON.

**Step 2:** Raise rack to level position.

**Step 3:** Press *Remote Power Button* (1).

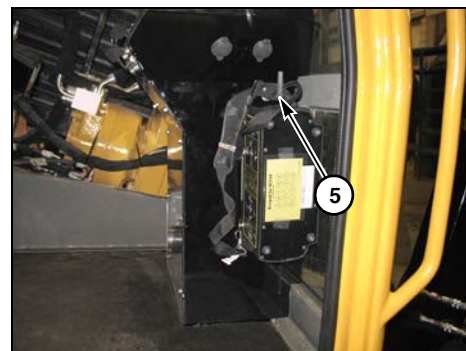
**Step 4:** Push *Left Track Joystick* (2) and *Right Track Joystick* (3) forward to drive machine forward. Pull joysticks to drive machine in reverse. Steer machine by pushing one joystick forward, and pulling the other lever rearward.

**NOTICE:** To prevent damage to track pads, steer only when both tracks are moving.

**Step 5:** Adjust throttle with keys (4).

**Step 6:** When finished driving, press *Power Button* (1).

**Step 7:** Put remote control unit on storage hook (5).



## Driving Machine with Tethered Secondary Remote Control

This control overrides Wireless Remote Control.

- Step 1:** Turn ignition key to ON.
- Step 2:** Plug pendant connector in at toolbox.
- Step 3:** Turn power button (1) to ON.
- Step 4:** Press forward and reverse buttons as needed.
- Step 5:** When finished, turn power button to OFF.

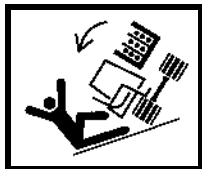
Ground drive speed controls on Tethered Secondary Remote Control are variable. Depress button slightly for slower speed, depress farther for higher speed. Only use Tethered Secondary Remote Control when Wireless Remote Control is not available.



# TRAILERING THE MACHINE

## Loading/Unloading

Before transporting machine on a truck or trailer, read truck or trailer manual for safety precautions and information. Clear trailer bed and ramps free of debris that will interfere with the loading process.



**WARNING:** Machine may slide down loading ramps or off trailer deck. Serious injury or death can result if struck or crushed by machine. Do not load onto slick trailer surface.

---

Gross weight of the machine must be within gross weight limits of the trailer and towing vehicle. Load and unload machine with the trailer on a level surface and attached to towing vehicle.

**Step 1:** Insert upper and lower rod keeper pins before trailering machine with rods in rod box.

**Step 2:** Align centerline of machine with centerline of trailer to minimize steering while loading.



**WARNING:** Do not attempt to steer machine while its weight is balanced on the end of the trailer. Slight steering changes may cause the machine to turn abruptly and slide back down the loading ramps. Serious injury or death can occur if crushed by the machine.

---

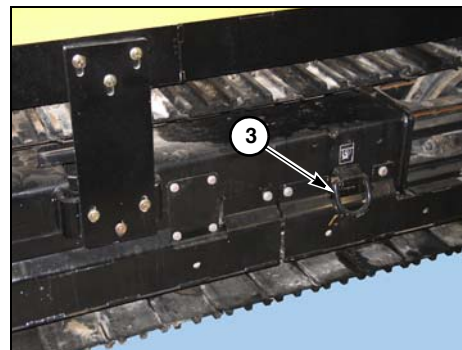
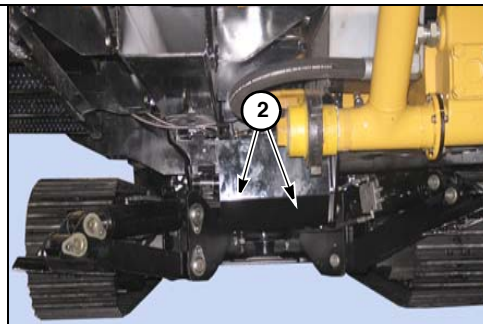
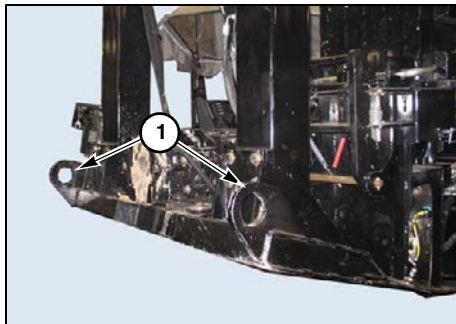
**Step 3:** **SLOWLY** drive machine squarely onto trailer.

**Step 4:** Stop machine when tie-down position is reached. The tie-down position distributes machine weight on the trailer as recommended by trailer manufacturer.

**Step 5:** Lower rear stabilizers and drill rack frame.

**Step 6:** Follow *Shutdown Procedure*, page 50-4.

**Step 7:** Use tie-down points on front (1), rear stabilizers (2), and sides (3) to secure drill to trailer with chains and binders.



## RETRIEVAL

Use this procedure when towing a machine which has become mired or disabled.

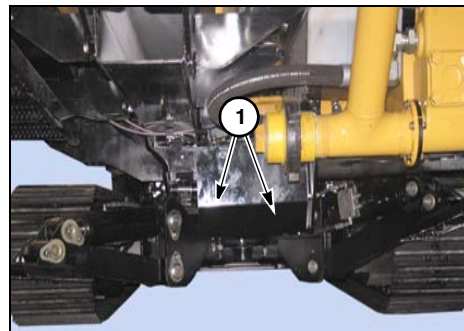
Never tow a disabled machine farther than is required. Only move the machine far enough to get out of traffic and to where repairs can be performed safely.



**WARNING:** Serious injury or death could result when retrieving or towing a disabled machine incorrectly.

- Step 1:** Connect tow chain/cable around rear stabilizers (1).
- Step 2:** Disengage park brakes and bypass ground drive pump to allow hydraulic fluid to circulate. Contact your Vermeer dealer for instructions.

**NOTICE:** Towing device (chain, cable, or strap) must have a minimum working load of 150% of towing machine weight. Do not tow machine more than 500 ft (150 m), and do not exceed 1 mph (1.5 km/h).



## LIFTING MACHINE

No provisions are made for lifting the machine. If transport requires that machine be lifted, it must be loaded onto an appropriate skid.

# Setup

## BORE PATH - WALK

Walk the bore path and look for signs of utility lines, potential causes of locator interference, and general assessment. These signs could indicate presence of utility lines:

- Ditch lines or depressions where the ground has settled from previous excavation.
- Buildings that have lights but no overhead wires; the power lines may be buried in the bore path.
- Patch repairs in the street, which could indicate digging to bury or repair a utility line.
- Poles with wires extending into the ground, which might power traffic-sensing loops or traffic lights.
- Manholes, which can be used for utility line connections, as well as sewer connections.
- Water and gas shutoff valves, likely indicators of utility lines in the area.

## DRILL UNIT SETUP

**Step 1:** Move drill unit to site and position it for drilling.

**Step 2:** Lower front of rack onto ground.

**Step 3:** Lower rear stabilizers until rack is at desired angle.

**Step 4:** Inspect power vise jaws and grips. Replace worn or damaged components before drilling. Refer to “Maintenance - As Required” section in [Maintenance Manual](#).



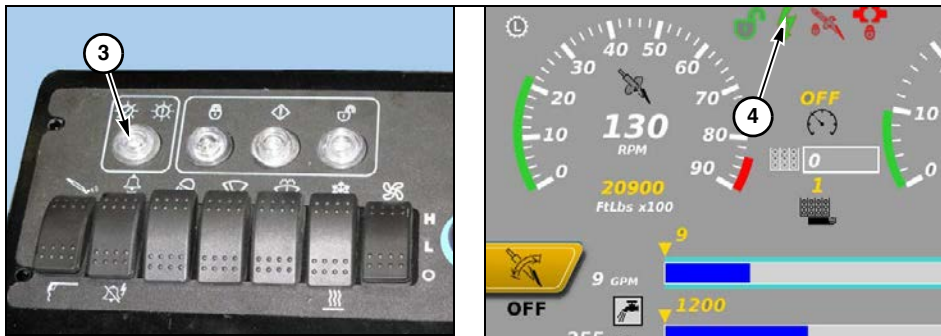
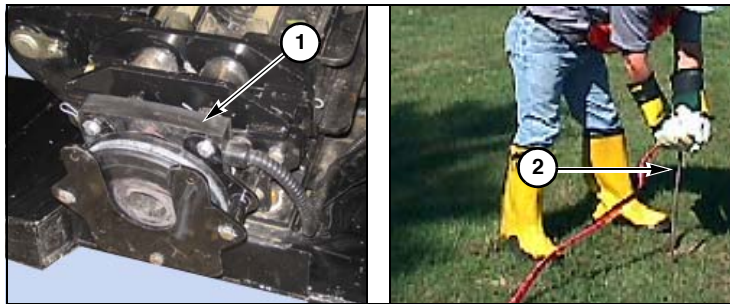
## STRIKE ALERT SYSTEM - TEST

Test the Strike Alert system before operating the drill unit. Do not operate drill unless the Strike Alert test confirms the system is operational.

- Step 1:** Ensure current sensing coil (1) and coil connectors are not damaged.
- Step 2:** Unwind voltage stake cable. Clean cable and connections, and check for damage.
- Step 3:** Insert voltage stake (2) into the ground at least six ft (2 m) away from machine and not over the drill string.

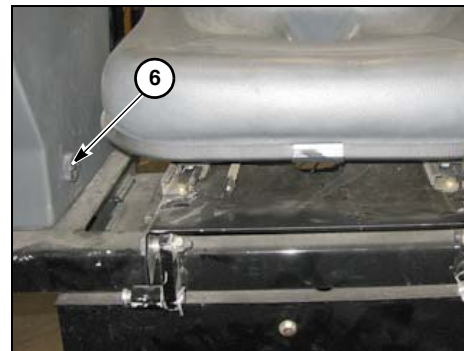
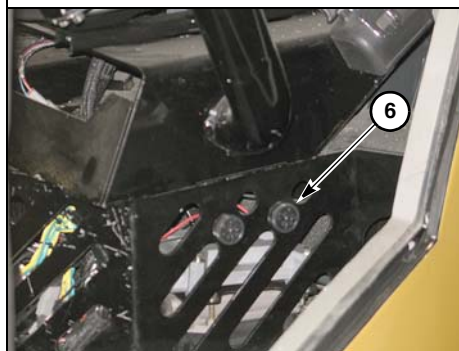
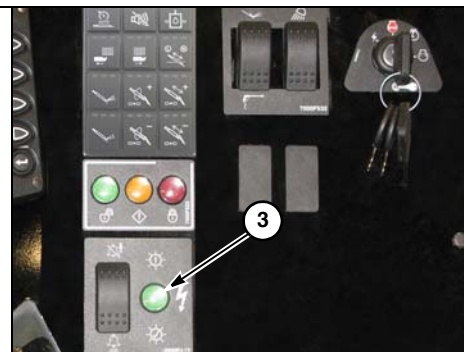
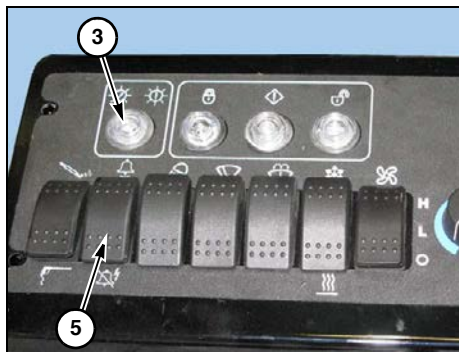
The voltage stake must be inserted in the ground for Strike Alert system test to pass. The stake checks for voltage differential between ground and machine

When the stake is in the ground and machine is running, light (3) is solid green and icon (4) turns green, indicating system is functioning correctly.



**Step 4:** Press top of *Test Key* (5). The Strike Alert alarm (6) must sound. Press bottom of test key to silence alarm.

The Strike Alert system is not functioning correctly if there is a flashing green light (3) after releasing the test key, or if icon (4) on screen turns yellow.



Cab Machine

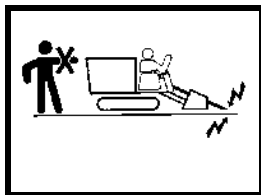
Non-Cab Machine

**Step 5:** If the test fails, confirm the voltage stake is fully inserted into the ground. The soil at the stake may need to be moistened to improve conductivity of the earth.

**Step 6:** Retest the system. If the test fails again, contact your Vermeer dealer.

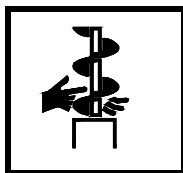
**NOTICE:** The Strike Alert system automatically runs a system check whenever the machine is powered up (ignition key turned from OFF to RUN). The alarm does not sound during the power-up system check.

## MACHINE - ANCHOR WITH STAKES



**WARNING:** Contact with drill unit while standing on the ground may result in serious injury or death from electrical shock if anchor stakes make contact with underground electric power.

- Drive anchor stakes only while seated at controls with both feet on platform.
- Keep everyone away from machine when anchors are being installed.



**WARNING:** Contact with moving anchor stakes can result in serious injury. Stay away from rotating stakes. Ensure anchor stake shields are closed and everyone is away from anchor stakes before operating.

Drive stakes completely into the ground.

## LOCATING EQUIPMENT - PREPARE

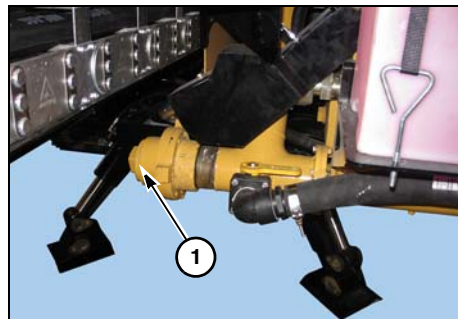
Fully charge locator batteries or install new batteries in the transmitter every day. Standard “C” batteries usually last up to 15 hours.

Some locating systems require calibration before drilling. Failure to do so could result in inaccurate depth readings on the locator. Refer to instructions provided with locator device.

It may be necessary to calibrate the locator while the drill head is lying on the ground with the transmitter in it.

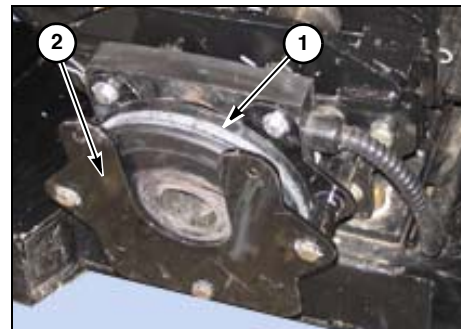
## DRILLING FLUID SETUP

Connect drilling fluid hose from mixing systems to coupler (1) on fluid pump.



## ROD WIPER - INSTALL

Use rod wiper (1) to clean drill rod when drilling. Install rod wiper into rod wiper holder (2).



## ENTRANCE AND EXIT SITES - PREPARE



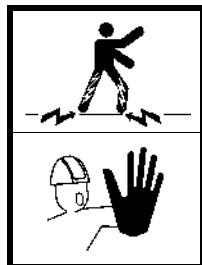
**WARNING:** Do not work in trench with unstable sides which could cave in. Specific requirements for shoring or sloping trench walls are available from several sources, including federal and state O.S.H.A. offices. Be sure to contact suitable authorities for these requirements before working in the trench.

If needed, dig entry and exit pits at the correct location and depth to correctly complete the bore.

## WARNING CONES

Check that orange warning cones with warning safety signs are available for placement around drill unit work area. Four orange warning cones are provided.

Set up orange cones around the machine with warning safety signs facing outward before starting operation. The safety sign warns unauthorized persons to stay away.



**DANGER:** Electrically charged ground surface can kill.

Unauthorized persons must stay away.



Place pedestrian and traffic warning barriers around the jobsite in accordance with Federal, State, and local laws and regulations.

## Drilling Safety

### READ OVERVIEW SECTION

Read and become familiar with the [Overview](#) section before drilling; it contains important information which is not repeated here. Refer to [page 30-1](#).

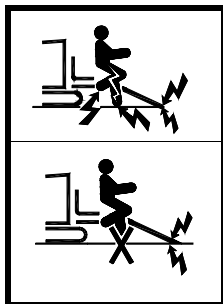
## SAFETY PRECAUTIONS



**DANGER:** Contact with the drill unit while standing on the ground could result in electrocution if an electrical strike occurs. Do not touch the drill unit or remote fluid mixing system while drilling or after an electrical strike occurs. See other portions of this manual regarding procedures and personal protection equipment to avoid electrocution.

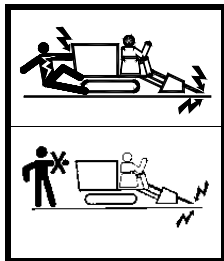
### Utility Line Contact

#### Electrical Line



**DANGER:** Electric shock can kill.

If strike occurs, do not step down. Keep feet on platform while operating.



**DANGER:** Electric shock can kill.

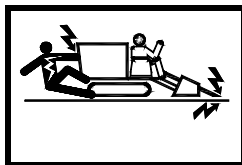
Workers standing on the ground must not touch machine when alarm sounds.

**NOTICE:** If a strike occurs, **do not** allow anyone to approach machine. The machine and ground will be electrically charged.

*If seated on the machine:*

- **Do not get off machine.** Contacting the machine and ground while stepping off may result in injury or death.
- Fully retract drill or extend backreamer to try breaking contact with the electrical power line.
- Have someone who is clear of the work area contact the utility company to shut off electrical power.
- Do not shut off Strike Alert until utility company has confirmed that electrical power has been locked out.

**Do not** continue drilling until utility company has declared the area safe to resume operation.



**DANGER:** If the power has not been properly shut off, an automatically resetting circuit breaker could re-energize the power line, causing the equipment and ground to again become charged if the drilling tool is close to, or in contact with, the power line.



## After Utility Company Has Shut Off the Power

**Step 1:** Press Strike Alert *Alarm Cancel Key* to shut off alarm.

**Step 2:** Press Strike Alert *Test Key* to test Strike Alert system. If alarm sounds while key is pressed and green light remains ON steady when the key is released, the Strike Alert system is undamaged. Release key to silence alarm.

**NOTICE:** The Strike Alert may not sense an electrical strike if the cutter shorts out a live voltage phase directly to the ground wire of the same power line. The only indication that a strike has occurred may be loss of power in the area.

If you strike an underground power line, it is possible to trip the power line circuit breaker, which will interrupt electrical power to that line. Many circuit breakers automatically reset and will re-energize the line.

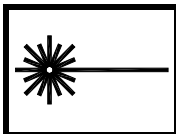
If the horn has sounded, and you have pressed the *Cancel Key*, the horn will stop if the circuit breaker has not yet reset automatically. Do not assume that power to the line has been permanently disconnected until you have confirmed that the utility company has locked out power to that line.

### Gas



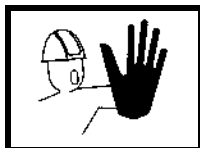
**DANGER:** Gas explosion can kill. If you strike a gas line, shut off engine and evacuate area immediately. Contact utility company and do not return until the utility company gives permission to do so. Do not attempt to disengage drill tool from buried line.

### Fiber Optic Cable



**WARNING:** Fiber optic cables carry laser light which may damage your eyes. Do not look into the end. If you are not sure what kind of cable it is, do not look into the end. Contact appropriate utility company for assistance.

# Before the Bore



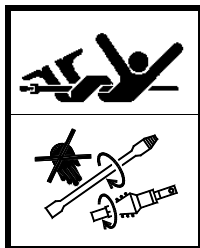
**WARNING:** Keep spectators away.



**WARNING:** Do not work in trench with unstable sides which could cave in. Specific requirements for shoring or sloping trench walls are available from several sources including federal and state O.S.H.A. offices. Be sure to contact suitable authorities for these requirements before working in the trench.



**DANGER:** Wrench on rotating drill string can strike you. Death or serious injury will result. Always use the power vise to make or break joints at the machine.



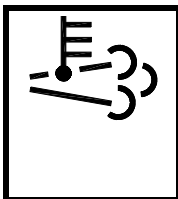
**WARNING:** Rotating drill string or cutters can kill.

Keep away.

If the drill is starting at a shallow angle or the ground is hard, dig a small hole so drill bit can start drilling perpendicular to the soil.

If drilling fluid additives are used, refer to manufacturer's recommendations for handling precautions.

## DIESEL PARTICULATE FILTER (DPF) SAFETY

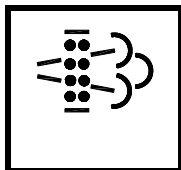


**WARNING:** When *HES (High Exhaust System Temperature) Light* is displayed, the exhaust gas temperature could exceed 1100°F (600°C) during regeneration. High temperature may result in fire, burn, or explosion hazards, which may result in personal injury or death. Do not expose flammable material or explosive atmospheres to exhaust gas or to exhaust system components during regeneration.

The *HES Light* does not signify the need for engine service; it merely alerts the operator to high exhaust temperatures. The *HES Light* turns on and off during normal machine operation as the engine completes regeneration.

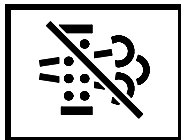


**WARNING:** To prevent fires, routinely clear any combustible material from the engine exhaust system. Tier 4 Interim / Stage IIIB emission compliant exhaust systems use extreme high temperature that can ignite combustible material.

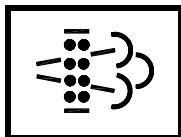


**WARNING:** The *DPF Light* indicates a need for a forced regeneration, due to engine or operator conditions being outside the range for automatic regeneration. Move machine to a safe location and press *Request Forced DPF Regeneration Key*. After regeneration, follow these guidelines to reduce soot buildup in the DPF:

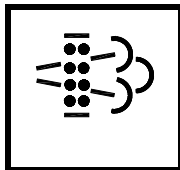
- Only inhibit DPF regeneration when necessary due to fire hazard.
- Limit idling time.
- Operate engine at higher load.
- Use correct engine oil. (See engine oil specifications in the [Maintenance Manual](#).)
- Use only ultra low sulfur diesel fuel.



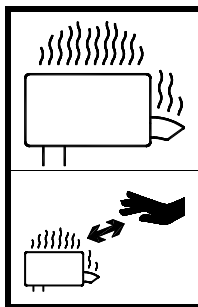
**WARNING:** When *DPF Regeneration Inhibited Light* is black, the *Inhibit DPF Regeneration Key* has been pressed. If regeneration is inhibited for too long, more warning lights will illuminate and eventually the engine will derate.



**WARNING:** When *DPF Light* is yellow, DPF is completely plugged, causing engine to derate. Perform a DPF forced regeneration at the earliest and safest opportunity.



**WARNING:** When *DPF Light* is red, machine operation has continued after *DPF Light* was yellow. Engine derates further, and may shut down. If this results in premature failure of exhaust system components, an engine service technician will be required to perform a service regeneration.



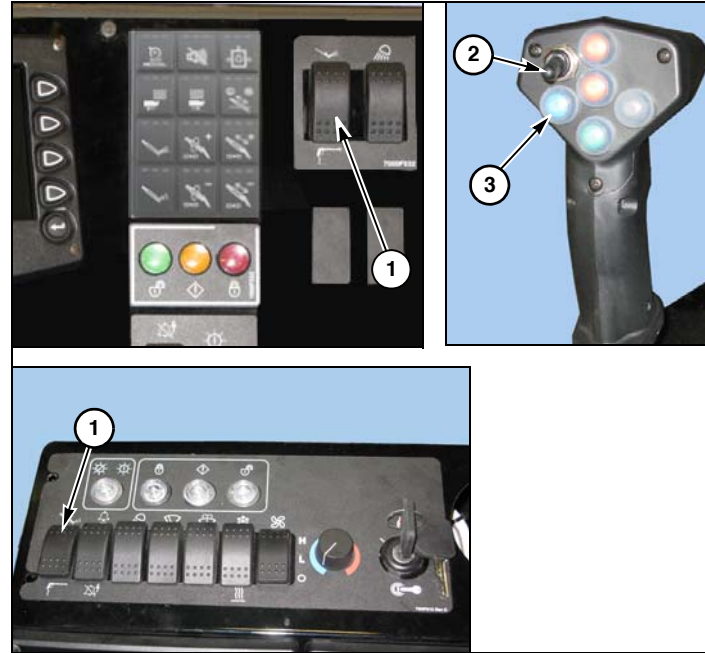
**WARNING:** Hot muffler can burn.

Stay away.

## DRILL ROD - FLUSH

If the drill rod has not been used within the last 24 hours, or if there is debris inside the drill rod, slowly rotate rod and flush it with drilling fluid before connecting it to the drill head.

- Step 1:** Move *Wash Wand / Drill Rod Selector Switch (1)* to DRILL RODS.
- Step 2:** Push *Flow Control Switch (2)* to center position to turn drilling fluid system ON for variable flow.
- Step 3:** Press and hold *Drilling Fluid Full Flow Key (3)* to quickly fill drill rod with fluid and keep nozzle from plugging.
- Step 4:** Ensure drill string is filled with drilling fluid and the necessary fluid pressure is available before rotating, thrusting, or pulling back. Failure to do so may plug the drill head or reamer nozzles.

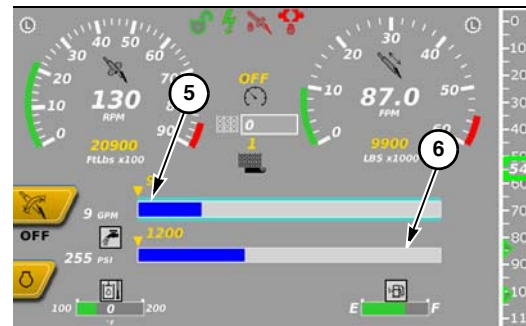
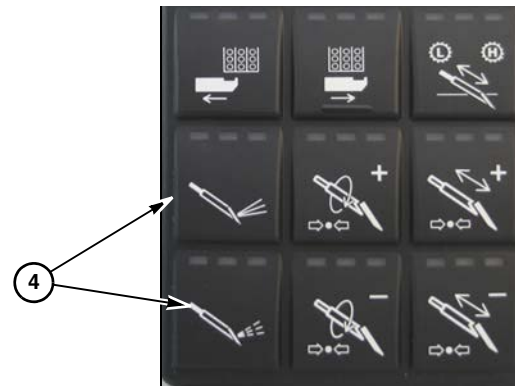


**Step 5:** Use *Drilling Fluid Increase/Decrease Keys* (4) to increase or decrease drilling fluid flow. Monitor drilling fluid flow rate on display (5).

**Step 6:** Monitor drilling fluid pressure on gauge (6).

**Step 7:** If the drill becomes plugged:

- either dig down to the drill head,
- back out the drill rod and the drill head, or attempt to
- Use fluid pressure to force out the plug. Refer to “Plugged Drill Rod,” [page 50-37](#).



## DRILL ROD - LUBRICATE

Press *Grease Button (1)* on left joystick to release grease.

Refer to [Specifications](#) section “Lubricants” in the [Maintenance Manual](#) for specifications.

Lubricate male rod threads and shoulders. Apply lubricant to clean, dry threads.

**NOTICE:** Keep electrically insulated gloves from coming in contact with lubricant. Petroleum-based products will chemically damage gloves.

**NOTICE:** Do not thin lubricants to make them easier to apply. Thinning reduces the amount of available metal filler and makes lubricant ineffective.



## DRILL HEAD - CONNECT

**Step 1:** Connect drill head to starter rod.

**Step 2:** Lubricate drive chuck threads and starter rod threads.

**Step 3:** Slide starter rod into front vise and clamp.

**NOTICE:** When front vise is clamped, carriage speed changes to HIGH.

**Step 4:** Thread drive chuck into starter rod. Refer to gauge and tighten joint to 4000 psi (276 bar). Disengage front vise.

**Step 5:** Disengage front vise.



# During the Bore

## BEGIN DRILLING

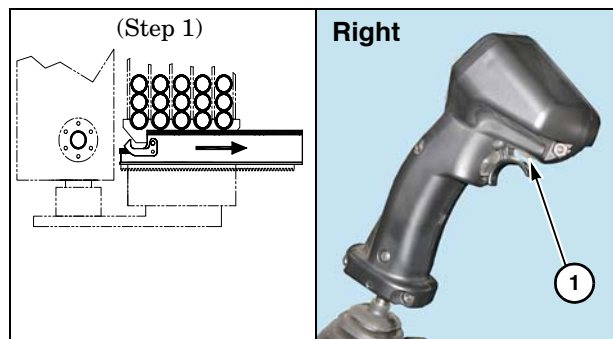
- Step 1:** With bill at 6:00 position, thrust until drill rod just enters the ground.
- Step 2:** Stop pushing
- Step 3:** Rotate drill head until rod is centered in the rod guide rollers.
- Step 4:** When centered, rotate and push remainder of drill rod into the ground.
- If drill rack moves during drilling, reposition rack so drill rod is centered in rod guide rollers before continuing.
  - To prevent rod joint from pulling apart, never rotate drill rod counterclockwise while drilling, pulling back, or backreaming.
- Step 5:** Stop rotation.
- Step 6:** Engage front vise to clamp rod.  
Fluid automatically shuts off when front vise closes.
- Step 7:** Clamp front vise and rotate drive spindle in reverse to unthread from drill rod. The drive chuck will move backward as rod unthreads.
- NOTICE:** When front vise is clamped, carriage speed changes to HIGH.
- Step 8:** Move drive chuck fully back.
- Step 9:** Lubricate drive chuck threads.

## DRILL RODS - ADD TO DRILL STRING

Rows must be emptied sequentially, from first through last row, to prevent rods from being dumped out of the rod box.

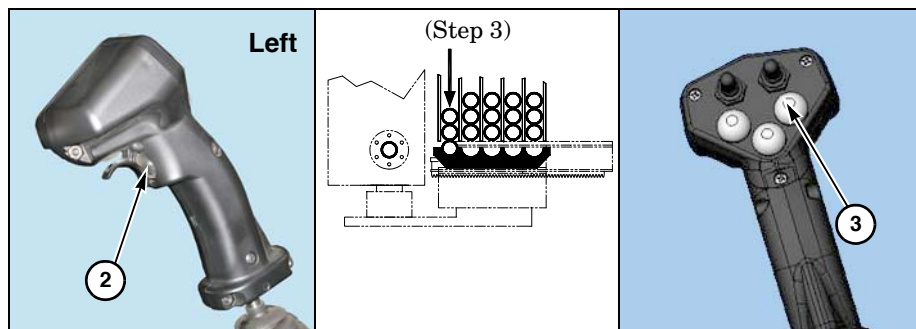
As each row is emptied, move the transfer arm to the next row.

**Step 1:** Press up and hold *Rod Transfer Arm Retract Button (1)* to move rod transfer arm to the selected row for removing rod.



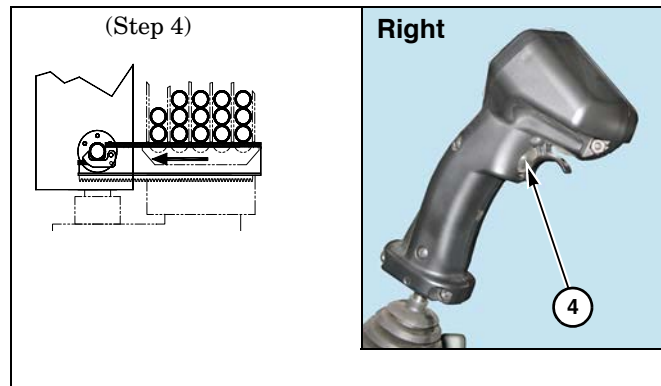
**Step 2:** Open rod gripper with button (2).

**Step 3:** Press down and hold *Rod Lower Button (3)* to lower rod lifter to load a rod into transfer arm.



**Step 4:** Press down and hold *Rod Transfer Arm Extend Button (4)* to move rod transfer arm to drill string.

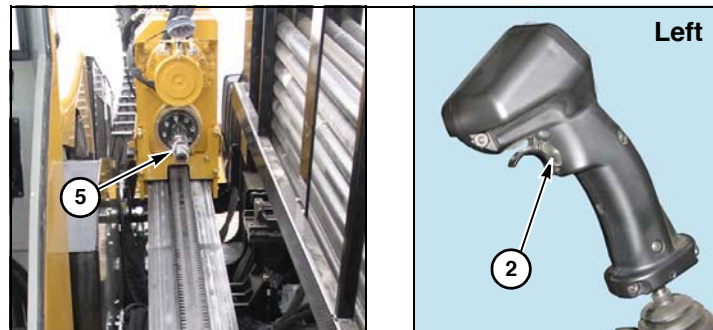
**Step 5:** Release button **(2)** to close gripper.



**Step 6:** Insert drive chuck **(5)** into rear rod end.

**Step 7:** With minimum thrust and **full rotation**, begin to thread rear end of rod.

**Step 8:** While rear end is threading, slowly thrust rod forward until pin end is entered into box end of downhole rod.



**Step 9:** Release rod gripper: press and hold *Rod Gripper Button (2)* and move rod transfer arm **(6)** back under rod box.

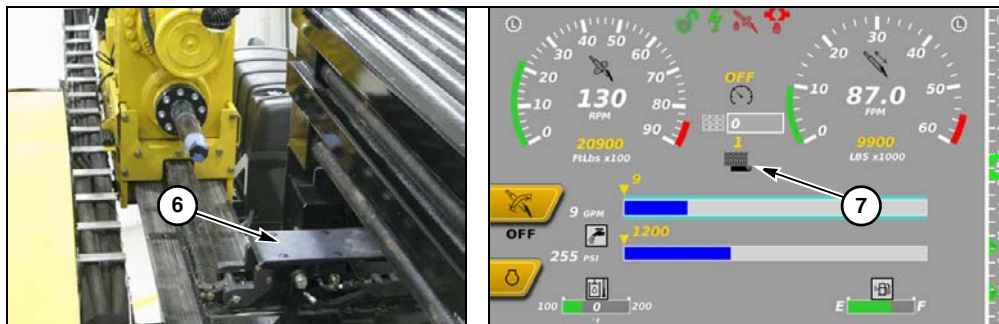
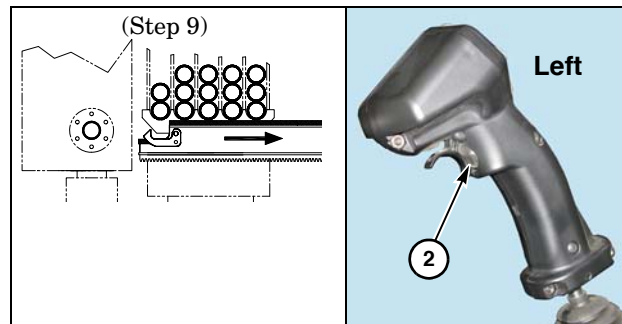
**Step 10:** With minimum thrust, full rotation, and with front vise clamped on downhole rod, thread rear rod into downhole rod and tighten to 3700 psi (255 bar). Check torque on display screen.

**NOTICE:** When front vise is clamped, carriage speed changes to HIGH. Torque is limited to 3700 psi (255 bar) by a torque limiter that is enabled when front vise is clamped.

**NOTICE:** Failure to fully move rod transfer arm back under rod box will damage rod transfer arm. If arm is not stowed, the anti-crash warning will appear on screen and icon **(7)** will be orange.

**Step 11:** Unclamp and drill rod into ground.

**Step 12:** Repeat previous steps to drill in additional rod.



## Drill Rod Row - Select

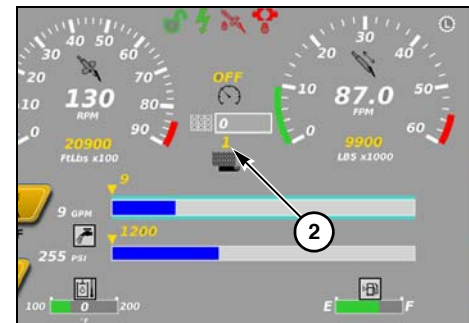
Move to next row when row has been completely emptied.

**Step 1:** Extend rod transfer arm.

**Step 2:** Raise rods with rod lifter.

**Step 3:** Use *Rod Row Select Left Key* (1) to move rod transfer arms to next row.

Current row (2) is shown on screen.



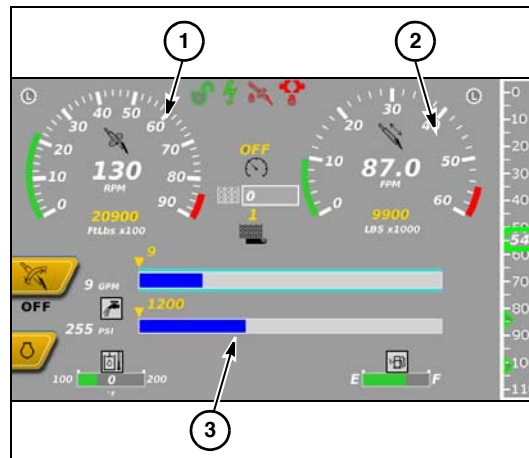
## GAUGES - MONITOR

Monitor gauges to establish a baseline for rotation and thrust/pullback pressures. Try to keep rotation and thrust/pullback pressures as low as possible throughout the bore.

**Rotation Pressure (1)**–Rotation pressure rises as the bore progresses, due to friction on the increasing length of the drill string. But if rotation pressure rises substantially, even when not trying to make forward progress, it could mean that soil is taking on water and swelling around the drill string. If this happens, reevaluate drilling fluid additives, increase flows, or redrill the pilot bore.

**Thrust/Pullback Pressure (2)**–Thrust/pullback pressure can be affected by product size and weight, bore path lubrication, soil conditions, and bends in the bore. If the pullback gauge reaches the maximum pressure, maximum pullback force is being exerted, and the bore will be unable to continue.

**Drilling Fluid Pressure (3)**--The drilling fluid pressure gauge reads fluid pressure at the drilling fluid pump. Pressure can vary based on flow rates and nozzle sizes used in the tooling. A maximum pressure on this gauge could mean that flow has become restricted.



## OBSTRUCTIONS - INVESTIGATE

Closely monitor the drilling rate and investigate any obstruction to determine if it might be hazardous. Check to ensure tool is not in contact with a gas line, water line, electrical line, or some other underground obstruction that can be damaged or result in personal injury.

## PLUGGED DRILL ROD

If a drill rod becomes plugged, use correct lockout procedures:

- “Lockout Procedure - With Remote Lockout System,” [page 30-16](#)
- “Lockout Procedure - Without Remote Lockout System,” [page 30-19](#)

Then use one of these methods:

- dig down to drill head,
- back out drill rod and drill head, or
- try to use fluid pressure to force out the plug

Break drill rod joint to relieve drilling fluid pressure in the drill string before unclogging or removing nozzle.



**WARNING:** Relieve drilling fluid pressure in the drill string before cleaning out nozzles with a tip cleaner. Drilling fluid under pressure can penetrate body tissue and result in serious injury or death. Fluid injected under the skin must be removed immediately by a surgeon familiar with this type of injury.

Clean drill head nozzle with a tip cleaner. A plugged drill can become too hot and damage the drill head transmitter.

# Exiting the Bore

It is critical to maintain good communication between the machine operator and locator operator. When the bore reaches the exit point, crew must ensure everyone is clear of the area.

The operator should be ready to turn off drilling fluid pump as drill head exits the ground. When the drill head exits the ground, use correct lockout procedures to prevent inadvertent startup and rotation during the tooling change.

- “Lockout Procedure - With Remote Lockout System,” [page 30-16](#)
- “Lockout Procedure - Without Remote Lockout System,” [page 30-19](#)

## CHANGING TOOLS AT REMOTE EXIT PIT

Be very careful when changing tooling on the machine. Clear and understandable communication between members of the drill unit crew is required for correct, complete, safe, and efficient installation of the utility. The distance between the drill unit and the drill string exit location may prevent visual contact and direct voice communication between the crew at the exit location and the machine operator



**DANGER:** Rotating drill string can kill. Unexpected start-up possible.

Lock out before working on drill string.

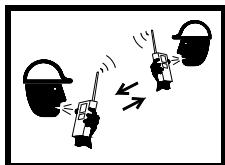


## Remote Lockout Use

Always use correct lockout procedures before changing tools. Refer to:

- “Lockout Procedure - With Remote Lockout System,” [page 30-16](#)
- “Lockout Procedure - Without Remote Lockout System,” [page 30-19](#)

## Communication Requirements



**WARNING:** Proper communication is essential to prevent unplanned start-up of the drill string and/or tool. Serious injury or death could result. Always follow communication requirements as explained in “Radio Communication Requirements.” Refer to [page 40-3](#).

## Reamer Carrier Use

If using a reamer carrier to remove drill head and install pullback tool, follow instructions in “Reamer Installation.” Refer to [page 30-25](#).

## Swivel Use

The reamer must be equipped with a swivel to prevent trailed rod or product from turning while reaming. If reamer does not have a built-in swivel, install an external swivel. Refer to the [Fundamentals of Horizontal Directional Drilling User's Guide](#), "Pullback Tips," for additional information on reamer selection and swivels.



**DANGER:** Entanglement in rotating drill string can result in death or serious injury. Rotating trailed string could whip and strike you. A properly functioning swivel is necessary to prevent the trailing drill string or product being pulled in from turning.

- Step 1:** Grease swivel and check that it turns freely by hand. A tool can be used to initially loosen swivel rotation. If swivel does not turn freely by hand after loosening, repair or replace it. If the product attached to the swivel rotates along with the reamer, replace swivel.
- Step 1:** Use correct lockout procedures.
- "Lockout Procedure - With Remote Lockout System," [page 30-16](#)
  - "Lockout Procedure - Without Remote Lockout System," [page 30-19](#)
- Step 2:** Turn drilling fluid system OFF.
- Step 3:** Remove drill head from the drill string.

## Pullback Tool - Install

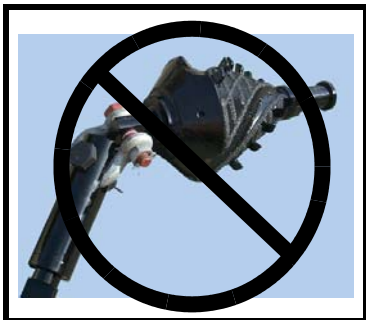


**DANGER:** Wrench on rotating drill string can strike you. Death or serious injury will result. Never install tooling that requires the use of pipe wrenches or tongs.

---

Use communication procedures. Refer to “Radio Communication Requirements,” [page 40-3](#).

**Step 1:** Install backreamer.

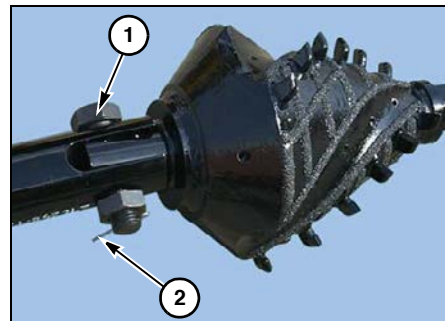


**WARNING:** Death or serious injury could occur if you are struck by whipping pipe or product. Never use a shackle when attaching swivel to backreamer. Shackle will not keep the swivel aligned with the reamer and may result in whip and rotation of trailing drill string or product.

---

**Step 2:** Attach swivel to reamer as shown, by inserting bolt (1) through clevis end of swivel. Secure with pin (2). Swivel must be aligned with the reamer before rotating the reamer.

Vermeer double-eye swivels are designed for use with Vermeer reamers to limit the angle between the reamer and swivel. Vermeer swivels and reamers aligned within this limited angle will reduce the possibility of whipping and rotation of the trailed product. Other swivels and reamers may not provide this inherent benefit.



## Resuming Operation

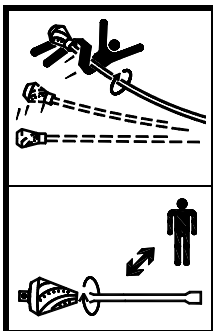
- Step 1:** Verify drill string and cutting tools are ready for operation.
- Step 2:** Confirm everyone is away from exit pit, drill string, and cutting tools, and that no wrenches or tongs are attached to the drill string or cutting tools.
- Step 3:** Warn everyone who may be exposed to the drill string or cutting tools that operation will resume.
- Step 4:** Press and hold *Run Button* on transmitter **for 2 seconds** to enable drilling operation.
- Step 5:** Follow all communication requirements before resuming operation.

## PULLBACK - START

**NOTICE:** Never rotate drill rod counterclockwise while pulling back or backreaming. Counterclockwise rotation will uncouple the drill string.



**WARNING:** Backreamer may not follow the bore path exactly. Because of increase in bore size and change in bore path, the backreamer may make contact with underground hazards that were missed during drilling.



**DANGER:** Drill string and tooling can rapidly move sideways along the ground at the exit location if rotation is started when drill rod or tooling is on the ground, away from the exit hole. The larger the diameter of the reamer and the more drill string exposed the faster and farther the reamer and drill string can travel. Death or serious injury will occur if anyone is entangled or struck by drill string or tooling.

Pull tooling up to exit hole before rotating. Everyone must be well away from exposed drill string and tooling before rotation is started.

Each rotation of the drill rod can cause an 8" (20 cm) diameter reamer to rapidly travel 2 ft (60 cm) and a 16" (41 cm) reamer to travel 4 ft (1.2 m).

- Step 1:** Turn on drilling fluid.
- Step 2:** To prevent reamer from moving sideways, pull tooling up to exit hole before rotating.
- Step 3:** Pull drill string from ground until rod joint is centered between front and rear vises.
- Step 4:** Stop pullback and rotation.

**Step 5:** Push *Front Vise Switch* (1) up to clamp onto downhole rod.

**NOTICE:** When front vise is clamped, carriage speed changes to HIGH.

**Step 6:** Push *Rear Vise Switch* (2) up to clamp onto rod to be removed.

**Step 7:** Press *Vise Rotation Button* (3) to break joint. Open rear vise and rotate back to home position.

**Step 8:** Using only rotation, unthread joint fully.

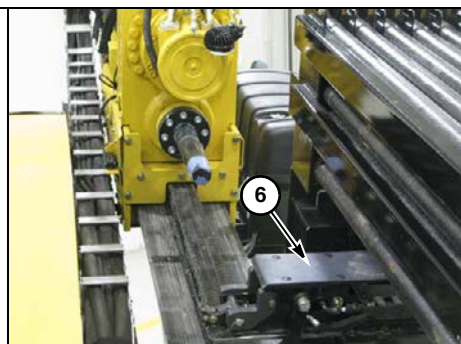
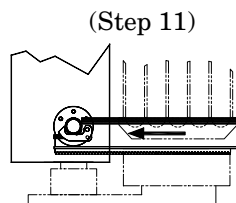
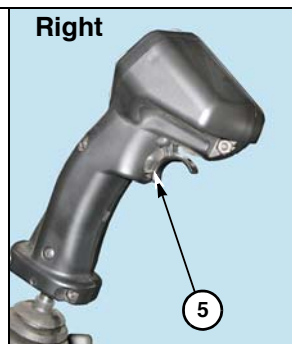
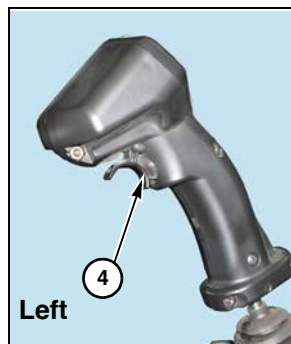
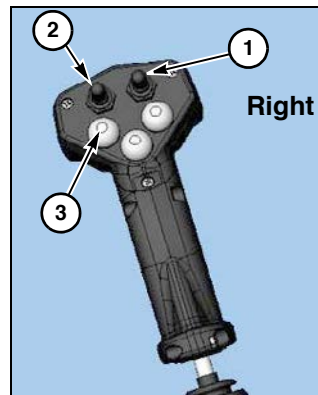
**Step 9:** Stop rotation.

**Step 10:** Open rod gripper: press *Rod Gripper Release Button* (4).

**Step 11:** Press down and hold *Rod Transfer Arm Extend Switch* (5) to move rod transfer arm (6) from under rod box to rod in the drill string.

**Step 12:** Grip rod: release button (4).

**Step 13:** Clamp rear vise.



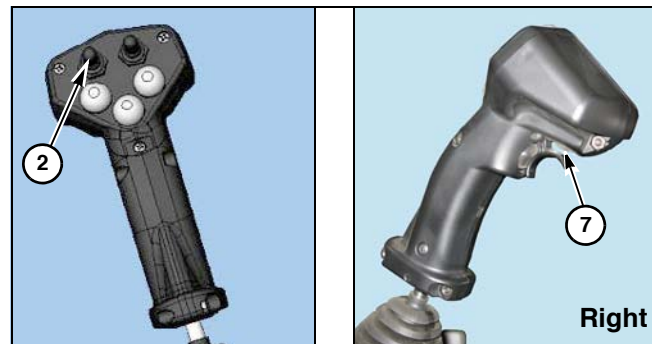
**Step 14:** Reverse rotate just enough to break rear joint.

**NOTICE:** Do not fully unthread rear joint.

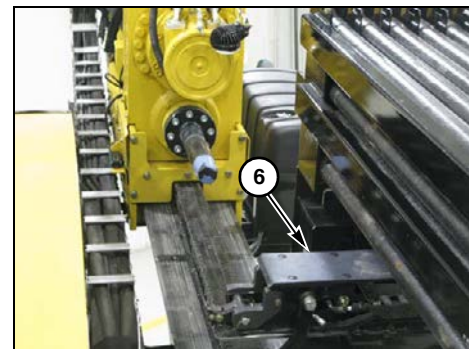
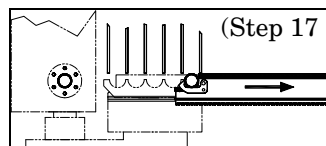
**Step 15:** Pull back rod far enough so front threads will clear vise assembly, to next stop point.

**Step 16:** Fully unthread rod from drive chuck and move carriage toward rear of rack.

**Step 17:** Push *Rear Vise Switch* (2) down to open vise.

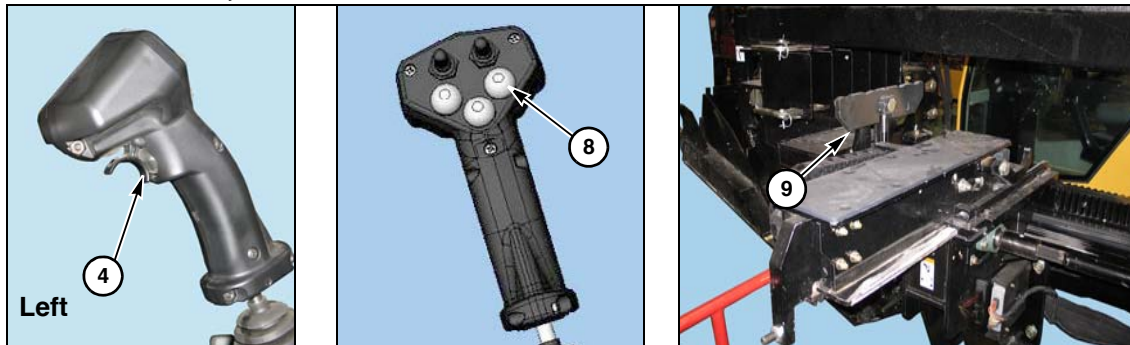


**Step 18:** Press up and hold *Rod Transfer Arm Retract Switch* (7) to move rod transfer arm (6) away from drill string to position rod under rod box row to be loaded.



**Step 19:** Open rod gripper: press *Rod Gripper Release Button (4)*.

**Step 20:** Press and hold *Rod Lift Button (8)* to raise rod lifter (9) and lift rod into rod box.



## Drill Rod Row - Select

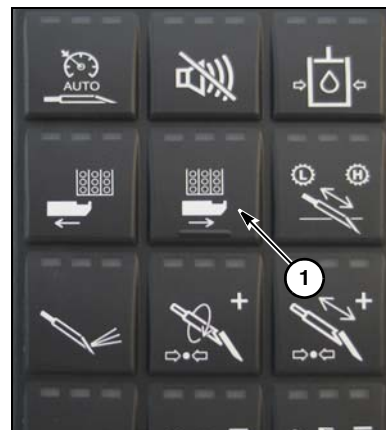
Move to next row when row has been completely filled.

**Step 1:** Extend rod transfer arm.

**Step 2:** Raise rods with rod lifter.

**Step 3:** Press *Rod Row Positioner Right Key (1)* to move rod arms to correct row.

**Step 4:** Continue adding rods to rod box.





## Breaking Rod Joints - Safety Considerations

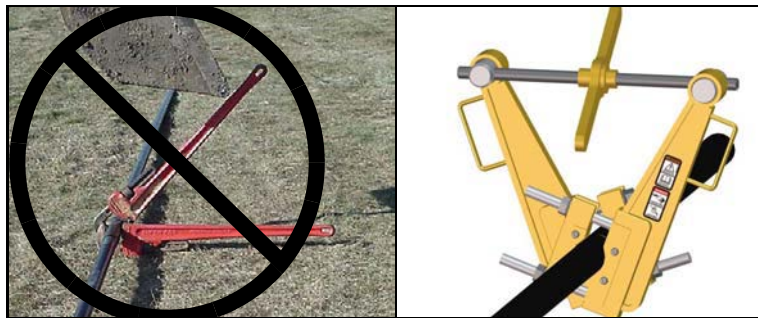
If a drill rod joint cannot be broken at the vise, repair the vise.

- Never put a pipe wrench or tong on the drill string and use drilling machine torque to break the joint.
- Never use a pipe wrench or tongs and apply force by using a backhoe. The wrench could slip off the drill string and strike you.

If a problem arises which requires making or breaking a joint between the tool and the machine, it is very important not to use a pipe wrench, but to use only a compact portable breakout system.

A compact portable breakout system is required whenever you loosen a joint away from the machine. Serious injury or death can occur if drill rod rotation starts and you are struck by a wrench.

Refer to “PBD7500 Portable Breakout Device,” [page 55-4](#).



## TRAILING ROD WHILE PRE-REAMING

Pre-reaming can be used in difficult drilling conditions when the correct bore diameter is not possible with one pullback. One or more intermediate pre-reams can be made with increasingly larger reamers until reaching the full diameter. To save time, pull in additional rod behind each pre-reaming pass. The next size reamer can then be attached to the rod already in the bore. This process can be repeated as many times as needed.

## Swivel Use

Refer to “Swivel Use,” [page 50-40](#).

**NOTICE:** Some swivels, such as a double-eye swivel, can be incorrectly aligned with the reamer. If the swivel is not straight in-line with the reamer, it might not swivel as intended. Instead it could turn like a crank, causing the product to turn and whip. Before starting rotation of the drill string, it is very important to position the reamer and product or trailing pipe so that the swivel is extended to be straight in-line with the reamer before pulling in.



---

**WARNING:** Product or trailing drill rod can turn or whip. Death or serious injury could occur if you are struck by a wrench, entangled, or struck by whipping pipe or product. Ensure swivel is straight in-line with reamer before pulling back.

---

## Short-String Method of Adding Drill Rod for Pre-Reaming

- Step 1:** Pre-assemble as many rods as practical at the exit location. These will be attached later to reamer swivel. Before assembling rod joints, clean and lubricate threads.
- Step 2:** Join rods using pipe wrenches, and apply at least 400 ft-lb (540 Nm) torque to tighten snugly. It is not necessary to tighten joints to a higher torque.



**WARNING:** Never attach a pipe wrench or tool and apply force from a machine such as a backhoe to tighten or break a connection. If the wrench slips off the bucket, the wrench could rotate or be thrown and strike you. Death or serious injury may result.

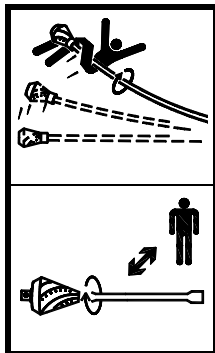
---

- Step 3:** Attach rod recycler adapter to the first drill rod and tighten snugly.
- Step 4:** Use correct lockout procedure.
- “Lockout Procedure - With Remote Lockout System,” [page 30-16](#)
  - “Lockout Procedure - Without Remote Lockout System,” [page 30-19](#)
- Step 5:** Attach rod recycler adapter to swivel.

## Resuming Operation

- Step 1:** Verify drill rod and cutting tools are ready for operation.
- Step 2:** Confirm everyone is away from the exit pit, drill string, and cutting tools, and that no wrenches are attached to the drill string or cutting tools.
- Step 3:** Warn everyone who may be exposed to the drill string or cutting tools that operation will resume.
- Step 4:** Press *Run Button* on transmitter **and hold for 2 seconds** to enable drilling operation, or return key to machine.
- Step 5:** Follow all communication requirements before resuming normal operation.

## Pulling Back with Trailing Rod



**DANGER:** Drill string and tooling can rapidly move sideways along the ground at the exit location if rotation is started when drill rod or tooling is on the ground, away from the exit hole. The larger the diameter of the reamer and the more drill string exposed the faster and farther the reamer and drill string can travel. Death or serious injury will occur if anyone is entangled or struck by drill string or tooling.

Pull tooling up to exit hole before rotating. Everyone must be well away from exposed drill string and tooling before rotation is started.

**Step 1:** Begin reaming.

**Step 2:** Crew must watch trailing rods as they are drawn into the bore. If they rotate, the swivel must be repaired or replaced.

**Step 3:** Install additional drill rod and continue pulling back until reamer reaches drill unit.



**DANGER:** Wrench on rotating drill string can strike you. Death or serious injury will result. Before installing additional drill rods and using pipe wrenches:

- Swivel must be functioning properly, and
- Machine must be locked out.

**Step 4:** Remove reamer and attach trailing drill string to drill unit.

**Step 5:** Attach a larger reamer, and continue until bore is completed.

## Push-Through Method of Adding Drill Rod for Pre-Reaming

**Step 1:** When the drill head exits the pilot bore, rotate drill head to 12:00 position.

**Step 2:** Continue adding more drill rods at the machine and pushing rods through the bore hole.



**DANGER:** Entanglement in rotating drill string or cutters can kill. Rotating trailed rods could whip and strike you. Do not rotate when the drill string and cutting tool have exited the bore. Keep everyone away from the exposed drill string.

**Step 3:** Do not rotate drill string while pushing the drill head across the ground. If needed, steer the extending rod by pushing on the side of the drill string with a backhoe bucket.

**Step 4:** After enough drill rod have been pushed through, use correct lockout procedure.

- “Lockout Procedure - With Remote Lockout System,” [page 30-16](#)
- “Lockout Procedure - Without Remote Lockout System,” [page 30-19](#)

**Step 5:** Position or support trailing drill string to relieve bending load at the joint where reamer will be installed.



**WARNING:** If there is a bending load at the joint, the drill rods on both sides of the joint could move suddenly when the joint is separated. Serious injury could occur if you are struck.

**Step 6:** Use a compact remote power breakout device to loosen joint.

## Resuming Operation

- Step 1:** Remove breakout device and tools from the drill string.
- Step 2:** Keep everyone away from entire length of the drill string.
- Step 3:** Press *Run Button* on transmitter **and hold for 2 seconds** to enable drilling operation.



**DANGER:** Wrench on rotating drill string can strike you. Death or serious injury will result. Ensure all tools are removed from the drill string before rotation is started.

- Step 4:** Use drill unit to slowly reverse rotate the drill string until the two halves are fully separated.
- Step 5:** Separate the two drill strings far enough for reamer installation.
- Step 6:** Use correct lockout procedure.
- “Lockout Procedure - With Remote Lockout System,” [page 30-16](#)
  - “Lockout Procedure - Without Remote Lockout System,” [page 30-19](#)
- Step 7:** Install reamer and swivel.
- Step 8:** Attach rod recycler adapter to drill rod and then attach to swivel.
- Step 9:** Follow Step 3 through remaining steps of “Short-String Method of Adding Drill Rod for Pre-Reaming.” Refer to [page 50-48](#).

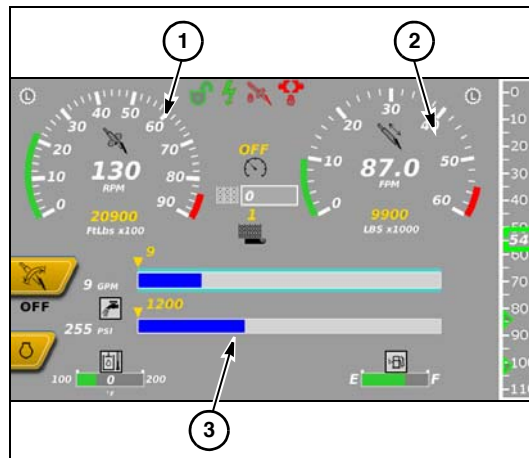
## GAUGES - MONITOR DURING PULLBACK

Monitor gauges during drilling. Ideally, the pullback pressure will remain low while the reamer mixes drilling fluid with the soil to form a good slurry flow through the annular space.

**Rotation Pressure (1)**—If rotation pressure is spiking, you may be pulling back too fast for the ground conditions. A rise in rotation pressure can also mean that the reamer has encountered harder ground.

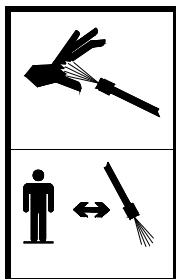
**Thrust/Pullback Pressure (2)**—A steady rise in pullback pressure could indicate a loss of fluid flow through the annular space, causing the product to become stuck or the inadvertent return of fluid.

**Drilling Fluid Pressure (3)**—The drilling fluid pressure gauge reads fluid pressure at the drilling fluid pump. Pressure can vary based on flow rates and nozzle sizes used in the tooling. A maximum pressure on this gauge could mean that flow has become restricted.



# After Each Bore

## Power Vises - Clean



**WARNING:** High pressure water can penetrate skin. Serious injury possible.

Keep nozzles away from body.

Fluid injected under the skin must be removed immediately by a surgeon familiar with this type of injury.

Flush power vise assemblies with clean water to remove accumulated polymers or dirt. Refer to “Flushing Bentonite/Polymers from Drilling Fluid System” on the next pages for information on using the wash wand. The service life of the power vise depends on correct operating techniques and cleanliness of the mechanism.

Inspect vise jaws and grips and replace worn or damaged components before the next bore. Refer to “Maintenance - As Required” section in the [Maintenance Manual](#).



## Drill Rods - Clean and Store

- Clean and lubricate drill rod threads to prevent rusting. Refer to the [Specifications](#) section, “Lubricants,” in the [Maintenance Manual](#).
- Protect drill rod from damage.
- Store drill rods in the rod box on drill unit.
- Install upper rod keeper pins to prevent drill rods from falling out during transport.

## Flushing Bentonite/Polymers from Drilling Fluid System

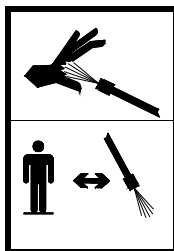
If bentonite or polymers were added to drilling fluid, flush system with fresh water before stowing equipment.

*To drain, clean, and add fresh water or antifreeze:*

**Step 1:** Fill the 6-gal (23-L) tank with clean water.

**Step 2:** Turn on water system and flush clean water through drill unit hoses and drive chuck.

**Step 3:** Shut off water system.

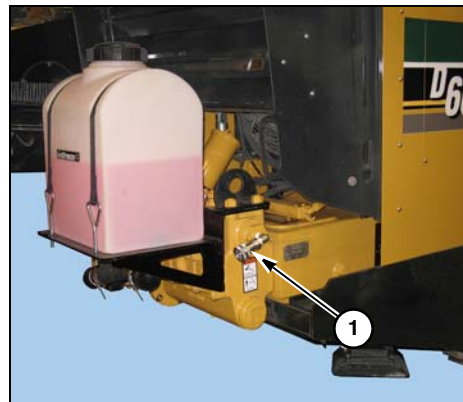


**WARNING:** High pressure water can penetrate skin. Serious injury possible. Fluid injected under the skin must be removed immediately by a surgeon familiar with this type of injury.

Keep nozzles away from body.

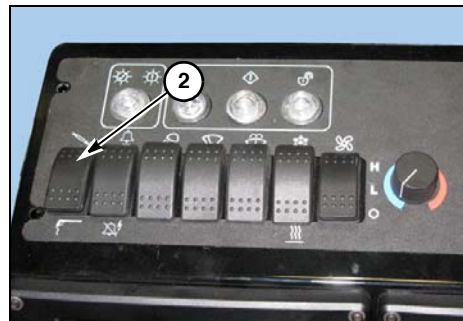
- Step 4:** Connect wash wand to drilling fluid pump quick coupler (1).
- Step 5:** Move *Wash Wand/Drill Rod Fluid Selector Switch* (2) on operator console to wash wand position.
- Step 6:** Turn on the water system and flush water through wash wand until water is clean and clear.
- Step 7:** Shut off water system.
- Step 8:** Point wash wand away from people and squeeze handle to release water pressure remaining in wand.
- Step 9:** Remove wash wand from drilling fluid pump quick coupler and store on transport vehicle.

**NOTICE:** If freezing weather is expected, remove all water from drill unit or add RV-type antifreeze. Refer to “Antifreeze - Add to Drilling Fluid System,” [page 30-43](#).

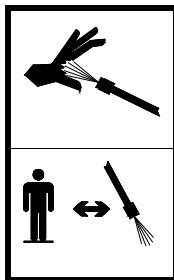


## Machine - Wash

**NOTICE:** Machine controls and electrical/electronic devices are not rated to withstand high pressure water and temperature power washers. Water intrusion will likely cause malfunction or damage to any devices hit directly by the water spray. Keep pressure washer stream away from machine controls and electrical/electronic devices. Compressed air can also push moisture through some connector and component seals. Do not point air nozzle directly at seal areas.



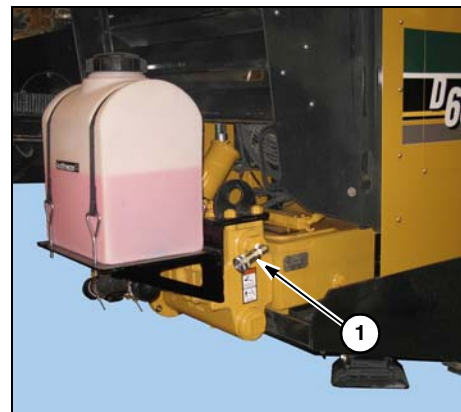
Before loading onto transport vehicle, wash drill unit with clean water to remove accumulated polymers and dirt.



**WARNING:** High pressure water can penetrate skin. Serious injury possible. Fluid injected under the skin must be removed immediately by a surgeon familiar with this type of injury.

Keep nozzles away from body.

- Step 1: Connect wash wand to drilling fluid pump quick coupler (1).
- Step 2: Move *Wash Wand / Drill Rod Fluid Selector Switch* to wash wand position.
- Step 3: Turn on the water system.
- Step 4: Wash drill unit to remove accumulated polymers and dirt.
- Step 5: Shut off water system.
- Step 6: Point wash wand away from people and squeeze handle to release water pressure remaining in wand.
- Step 7: Remove wash wand from drilling fluid pump quick coupler and store on transport vehicle.
- Step 8: Install cap on drilling fluid pump quick coupler to prevent dirt from entering high pressure fluid lines.

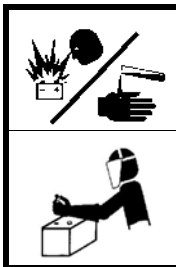


This page intentionally left blank.

# Section 55: Supplemental Operations

## Jump-Starting

### BATTERY EXPLOSION - PREVENT



**WARNING:** Battery fumes are flammable and can explode. Keep all burning materials away from battery. Battery explosion can blind. Acid can blind and burn. Tools and cable clamps can make sparks.

Do not smoke. Shield eyes and face. Read instructions.

Do not jump-start or charge a battery that is frozen or low on electrolyte.

Prevent explosion hazard. If equipped with battery caps, keep them in place and tight to reduce risk of battery explosion.

Do not allow vehicle used to jump-start to be in contact with the disabled machine. Vehicles in contact have a ground connection which allows a spark to occur at the battery when the positive jumper cable is connected or removed.

**NOTICE:** Use only a 12-volt system for jump-starting.

## BATTERY BURNS - PREVENT

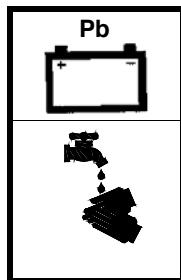
Battery contains sulfuric acid which can cause severe burns. Prevent contact with eyes, skin, and clothing.

In case of acid contact:

**External:** Flush with plenty of water. If eyes have been exposed, flush with water for 15 minutes and get prompt medical aid.

**Internal:** Drink large quantities of water or milk, then milk of magnesia, beaten egg, or vegetable oil. Call a physician immediately.

## JUMP-STARTING PROCEDURE



**WARNING:** Battery post, terminals, and related accessories contain lead and lead compounds, chemicals known to the state of California to cause cancer and reproductive harm.

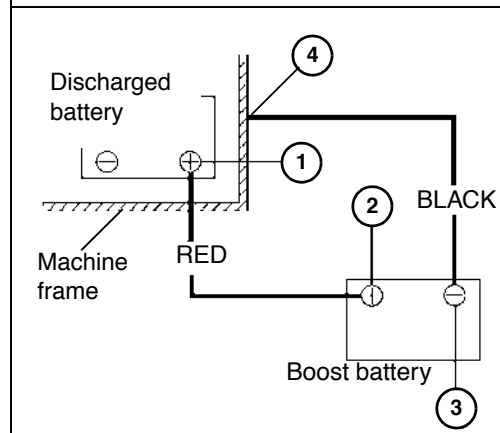
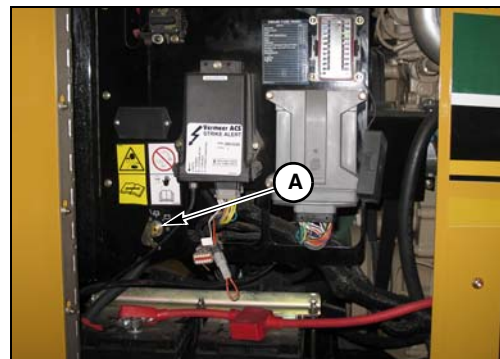
Wash hands after handling.

**NOTICE:** Review battery service safety guidelines before jump-starting machine. Refer to battery maintenance instructions in the [Maintenance Manual](#).

- Step 1:** Turn ignition switch OFF.
- Step 2:** Turn *Battery Ground Disconnect Switch (A)* counterclockwise to disconnect battery ground.
- Step 3:** Connect jumper cables in this order:
- Red to discharged battery POSITIVE (+) terminal **(1)**.
  - Red to boost battery POSITIVE (+) terminal **(2)**.
  - Black to boost battery NEGATIVE (-) terminal **(3)**.
  - Black to frame of machine with discharged battery **(4)**. Make connection away from battery, fuel lines, and moving parts. Do not attach to the negative terminal of the discharged battery.

**NOTICE:** To prevent sparks near the battery, always disconnect black jumper cable from the frame before adjusting red jumper cable.

- Step 4:** Turn *Battery Ground Disconnect Switch* clockwise to connect battery ground.
- Step 5:** Start engine.
- Step 6:** Remove cables in REVERSE order and install red cover over positive battery cable clamp.



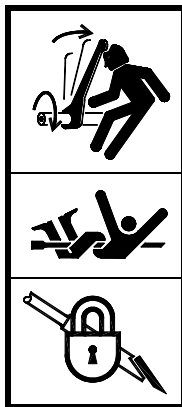
# PBD7500 Portable Breakout Device

## INTENDED USE

The Vermeer PBD7500 Portable Breakout Device is a compact breakout system, manually activated, which provides a convenient method to loosen or tighten a threaded connection. Its intended use is with drill rod with an outside diameter of 1.88–3.31" (4.8–8.4 cm) at 7500 ft-lb (10170 Nm).

Always use the device in accordance with the instructions contained in this Operator's Manual, safety signs on the device and the drill unit, and other material provided by Vermeer Corporation.

Correct maintenance and repair is necessary for safety, and for efficient operation of the device. Do not use the device if it is not in suitable operating condition.

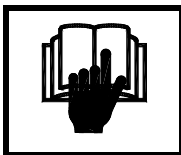


**DANGER:** Unexpected rotation of drill rod can kill.

Lock out drill unit before using a breakout device.



## BREAKOUT DEVICE OPERATION



**WARNING:** Improper use can cause device to fail.

Read Operator's Manual. Use device properly.

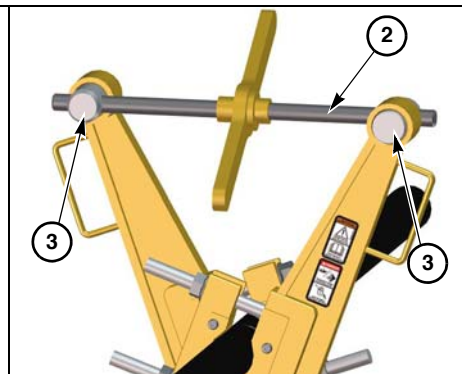
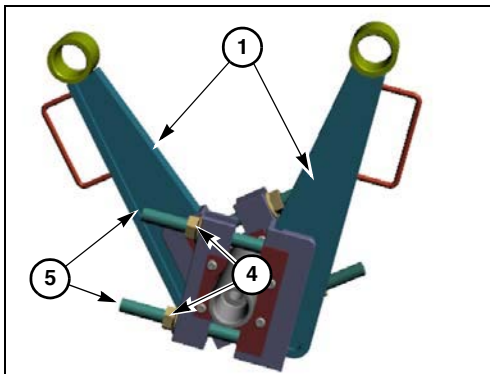
**Step 1:** Position tongs (1) on drill rod, one on each side of joint, in makeup or breakout position. Refer to "Configurations," [page 55-8](#).

Tongs should always be pushed together, not pulled apart.

Tongs should be no wider than the length of the threaded T-bar (2).

Pins (3), when assembled to the thread bar, must fit into the eyes of the handles.

If the handles are spread too far, the pins will not line up and install. The pins should always start at the widest position on the threaded rod for maximum stroke.



**Step 2:** Hand-tighten adjustment clamp jaw nuts (4). Use a 1-5/16" wrench to snug nuts, but do not tighten. Lengths of threaded portion beyond nuts (5) should be approximately equal.

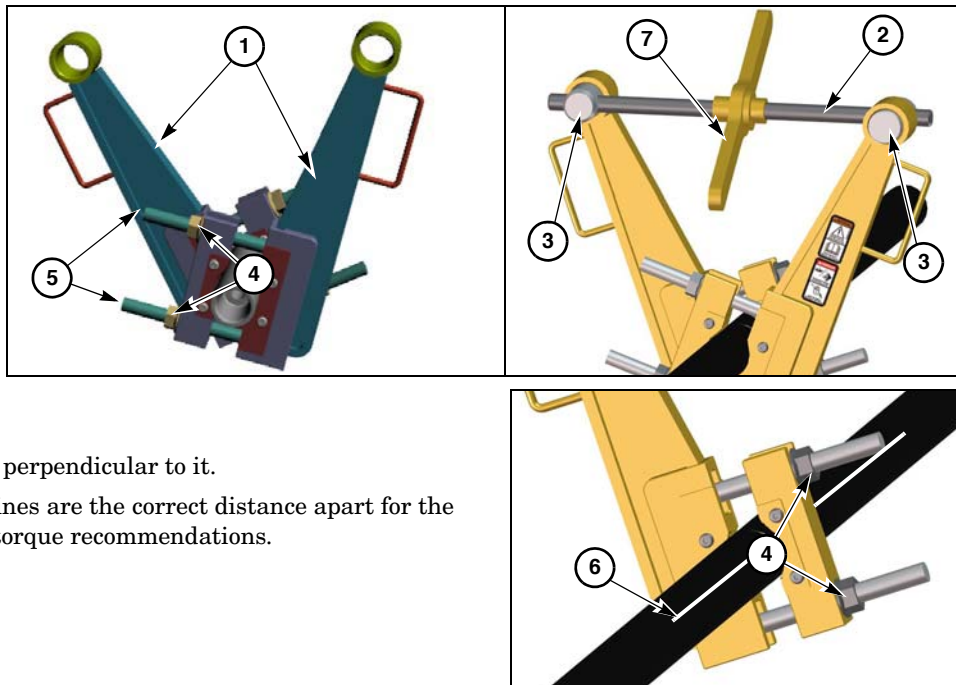
**Step 3:** Install threaded T-bar (2) and pins (3). You may need to adjust tongs.

**Step 4:** Turn T-bar to pull tong arms together slightly.

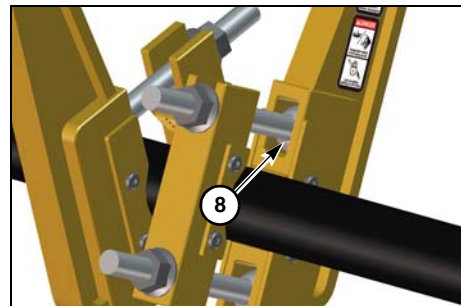
**Step 5:** Torque nuts (4) to 100 ft-lb (135 Nm).

**Step 6:** Draw a line (6) across the joint, perpendicular to it.

**Step 7:** Tighten T-bar handle (7) until lines are the correct distance apart for the torque value. Refer to table for torque recommendations.



**NOTICE:** Overtorquing will cause shear pins (8) inside tong arms to fail. Replace only with Vermeer pins, P/N 296406760.



Thread Description	Makeup Torque	Distance
FST #200	1000 ft-lb/1356 Nm	1/8"/3.2 mm
FST #250	1333 ft-lb/1807 Nm	3/16"/4.8 mm
FST #400	1733 ft-lb/2350 Nm	1/4"/6.4 mm
FST #600	2667 ft-lb/3616 Nm	1/4"/6.4 mm
FST #650	3333 ft-lb/4519 Nm	1/4"/6.4 mm
FST #700	3333 ft-lb/4519 Nm	5/16"/8 mm
FST #750	3333 ft-lb/4519 Nm	5/16"/8 mm

## Configurations

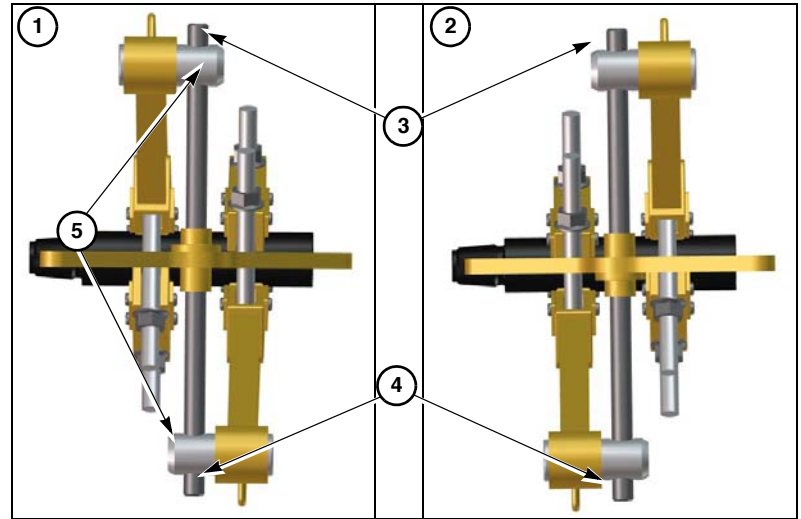
- (1) Making Configuration
- (2) Breaking Configuration
- (3) Right-Hand Thread
- (4) Left-Hand Thread

In either configuration, turn T-bar to bring tong arms together.

## Maintenance

- Inspect threaded eye bolts (5) for bends.
- Inspect tong arms and jaws for cracks.
- Inspect threaded rod on T-bar for wear or damage to threads.

Replace parts immediately if worn or damaged.  
Contact your Vermeer dealer.



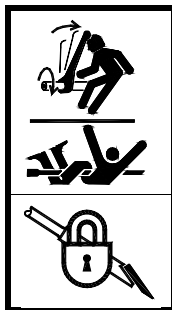
## Mud Motors

Mud motors are long, cylindrical, lobed motors which use fluid pressure to turn the drill bit. Mud motors therefore require high drilling fluid flow rates to operate consistently and without cavitation.

Because mud motor requirements can exceed capabilities of starter rod, the mud motor may require direct connection to the drill string to fully utilize the motor.

# Replacing Broken Drill Rod Underground

- Step 1:** Retract drill string back to the drill unit until broken rod exits the ground. Keep track of the length of drill rod retracted so you can determine the location of the underground break. Use power vises to break the joint and remove broken rod.
- Step 2:** Dig to the break location underground.
- Step 3:** Use a compact remote power breakout device to loosen joint of broken rod remaining in the ground. The use of a pipe wrench to continue to unthread the broken rod after it has been loosened with the breakout device is permitted.
- Step 4:** Install drill rod hole guide, such as a “football” or “balloon”, onto drill rod at the machine. Push it through pilot bore to the drill string still in the ground.
- Step 5:** Use correct lockout procedure.
- “Lockout Procedure - With Remote Lockout System,” [page 30-16](#)
  - “Lockout Procedure - Without Remote Lockout System,” [page 30-19](#)



**DANGER:** Rotating drill string can kill. Unexpected start-up possible.

Lock out before working on drill string.

Step 6: Remove football/balloon.



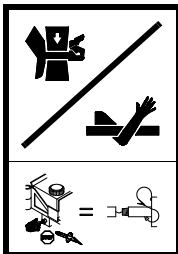
**DANGER:** Wrench on rotating drill string can strike you. Death or serious injury will result. Ensure all tools are removed from the drill string before rotation is started.

Step 7: Tell everyone to move away from the exposed drill string. Use machine to push drill rod forward until male threads have engaged the downhole rod.

Step 8: Use slow forward rotation to turn drill string together until joint is tight. Correct makeup torque will be attained due to resistance provided by cutting tool on the far end of drill string.

# Drilling with Front Load Wireline Locator System

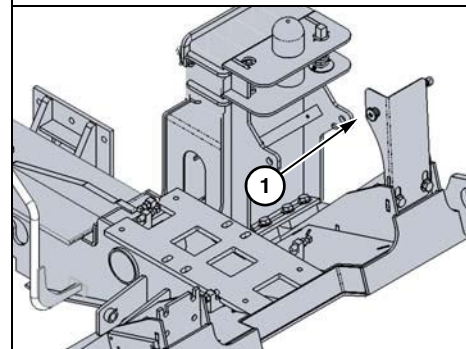
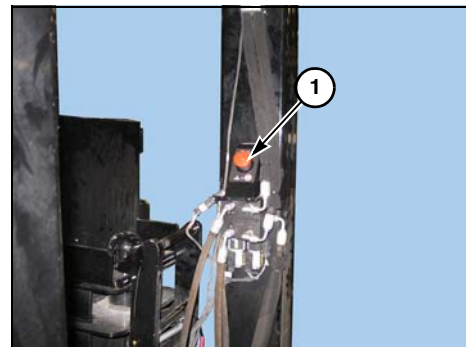
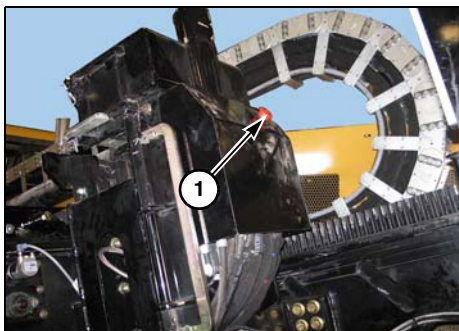
## INITIAL DRILL ROD CONNECTION



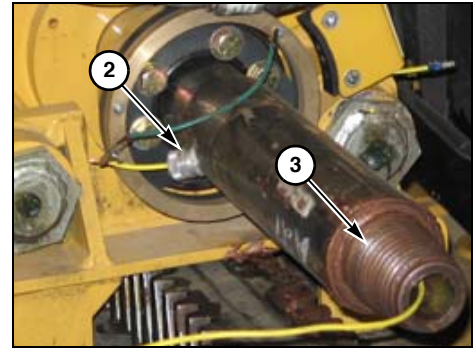
**WARNING:** Unexpected travel or rotation can crush or entangle. Serious injury or death can result.

Disable thrust and rotation before making wireline connections.

Test *Local Lockout Buttons (1)* at front and back of rack before the start of every bore. Engagement of button must disable thrust and rotation.



- Step 1:** Clamp drill head in front vise. Rotate drive chuck until line compression fitting (2) points towards the rear wireline connection station.
- Step 2:** With carriage fully back, use wireline hook to grab sonde wire from rear of drill head.
- Step 3:** Move first drill rod into position just short of being in-line with the drive chuck.
- Step 4:** Disable thrust and rotation with *Local Lockout Button*.
- Step 5:** Push fish tape from lower end of drill rod up through rod.
- Step 6:** Loosen compression fitting on drive chuck and push wire through compression fitting and out the drive chuck (3).
- Step 7:** Connect fish tape to wire pushed through drive chuck.
- Step 8:** Pull wire through drill rod.
- Step 9:** Splice the wire to the wire at the drill head. Seal with heat-shrink tubing or the like.
- Step 10:** Re-engage thrust and rotation by pulling out *Local Lockout Button*.
- Step 11:** Thread drill rod to the drill head and the drive chuck.
- Step 12:** Disable thrust and rotation with *Local Lockout Button*.
- Step 13:** At the drive chuck, pull slack out of the wireline and tighten the compression fitting. Cut and strip the end of the wire.

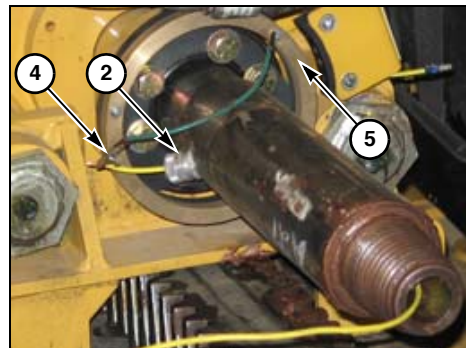




**Step 14:** Attach alligator clip (4) on wire connected to the bronze collector ring (5) to the stripped wire at the compression fitting on the drive chuck.

**Step 15:** Re-engage thrust and rotation by pulling out *Local Lockout Button*.

**Step 16:** Drill rod fully into the ground.



## ADDING DRILL ROD

**Step 1:** Disable thrust and rotation with *Local Lockout Button*.

**Step 2:** Remove alligator clip (4) and loosen compression fitting (2).

**Step 3:** Re-engage thrust and rotation by pulling out *Local Lockout Button*.

**Step 4:** Slowly disconnect drive chuck from the drill rod and move gearbox back just enough to grab wireline with wireline hook. Pull wire out.

Do not allow wireline to slide down into the downhole drill rod.

**Step 5:** Return gearbox carriage to rear of drill rack.

**Step 6:** Rotate drive chuck until wireline compression fitting points towards the rear wireline connection station.

**Step 7:** Position next drill rod just short of being in line with the drive chuck and lower rod.

**Step 8:** Disable thrust and rotation with *Local Lockout Button*.

**Step 9:** Run fish tape through the drill rod from the vise end of the rod.

**Step 10:** Push a new piece of wire through the compression fitting and out the drive chuck.

**Step 11:** Connect wire to the fish tape and pull wire through the drill rod.

**Step 12:** Splice wire to the downhole wire. Seal with heat-shrink tubing or the like.

**Step 13:** At the compression fitting, pull slack out of the wireline.

**Step 14:** Re-engage thrust and rotation by pulling out *Local Lockout Button*.

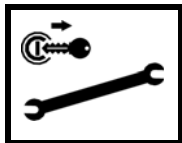
**Step 15:** Thread drill rod to the drive chuck and the downhole rod.

- Step 16: Disable thrust and rotation with *Local Lockout Button*.
- Step 17: Pull remaining slack out of wireline and tighten the compression fitting. Cut and strip end of wire, and attach alligator clip.
- Step 18: Re-engage thrust and rotation by pulling out *Local Lockout Button*.
- Step 19: Drill rod fully into the ground.
- Step 20: Continue adding rods as required.

## PULLBACK

- Step 1: At exit pit, remove drill head from drill string, leaving 18–24" (46–61 cm) of wire exposed.
- Step 2: Cut the wire from the housing leaving 12–18" (30.5–46 cm) sticking out of the drill head.
- Step 3: At rear wireline connection station, disable thrust and rotation with *Local Lockout Button*.
- Step 4: Loosen drive chuck compression fitting.
- Step 5: Pull all existing wire from the drill rod and discard.

# Section 60: Maintenance



**WARNING:** Use Shutdown Procedure before servicing, cleaning, repairing, or transporting machine. Follow [Shutdown Procedure](#), page 50-4.

Visually inspect machine daily before starting the machine.

Make no modifications to your equipment unless specifically recommended by Vermeer Corporation.

## SAFETY SIGNS MAINTENANCE

Safety signs located on your machine contain important and useful information that will help you operate your equipment safely. Refer to the [Parts Manual](#) for locations.

To assure that all safety signs remain in place and in good condition, follow the instructions given below:

- Keep safety signs clean. Use soap and water - not mineral spirits, abrasive cleaners, or other similar cleaners that will damage the sign.
- Replace any damaged or missing safety signs. When attaching safety signs, the temperature of the mounting surface must be at least 40°F (5°C). The mounting surface must be clean and dry.
- When replacing a machine component with a safety sign attached, replace the safety sign also.
- Replacement safety signs can be purchased from your Vermeer equipment dealer.

## MAINTENANCE MANUAL

Maintenance Intervals are included for reference only. Before performing any maintenance, refer to the [Maintenance Manual](#) for safety guidelines and correct procedures.

## HOURLY METER - CHECK FOR MAINTENANCE INTERVAL

The hourmeter on the machine is used to determine maintenance intervals for the machine. The hourmeter indicates the total number of hours the engine has been in operation.

Maintenance intervals are based on normal operating conditions. When operating under severe conditions, the maintenance intervals should be shortened.

## MACHINE - GREASE

As a general rule, grease machine after it is shut down for the day or at 5 service hours if required. This protects metal under seals from corrosion caused by condensation as temperature drops.

Ensure all fittings and nozzle of grease applicator are clean before applying grease. If any grease fittings are missing, replace them immediately.

## RECOMMENDED FLUIDS

Refer to the [Specifications](#) section in the [Maintenance Manual](#) for fluid and lubricant requirements.

## ENGINE MAINTENANCE INTERVALS

Refer to the Engine Operation Manual, supplied with each machine, for maintenance instructions that are not included in this manual.

## MAINTENANCE INTERVALS

Initial = Initial maintenance on new machine. Regular maintenance interval may be different.

- = Regular maintenance interval.

For Vermeer maintenance replacement part numbers, refer to the [Parts Manual](#) or call your Vermeer dealer.

Service	Maintenance Interval - Service Hours								
	10 or Daily	50 or Weekly	100	250	500	1000	3000	4500	As Required
Machine and Engine - Visual Inspection	●								
Fuel Tank - Fill	●								
Fuel/Water Separators - Check/Drain	●								
Hydraulic Fluid Level - Check	●								
Engine Crankcase Oil - Check/Fill	●								
Coolant Level - Check/Fill	●								
Air Cleaner Restriction Indicator - Check	●								
Air Intake Screens - Check/Clean	●								
Dust Discharge Valve - Empty	●								
Accumulator Pressure - Check	●								
Auto Greaser - Check/Refill	●								
Piston Wash Water Tank - Drain/Clean/Refill	●								
Rotation Gearbox Oil - Check	●								
Drill Rod Care and Inspection	●								
Water Swivel - Check	●								
Vises - Grease	●								
Front Roller Guides - Grease	●								

Service	Maintenance Interval - Service Hours								
	10 or Daily	50 or Weekly	100	250	500	1000	3000	4500	As Required
Vise Dies - Inspect/Clean	●								
Rack Frame Pivot - Grease		●							
Rack Frame Pivot Cylinders - Grease		●							
Gearbox Slide - Grease		●							
Rear stabilizers - Grease		●							
Drilling Fluid Pump Crankcase Oil Level - Check		●							
Track Planetary Gearbox Oil Level - Check		●							
Bolts - Check		●							
Engine Oil and Filter - Change/Replace			Initial						
Radiator and Oil Cooler - Clean			●						
Battery Voltage - Check			●						
Safety Signs Maintenance			●						
Overall Machine - Check			●						
Hydraulic System - Check			●						
Hydraulic Enable - Check			●						
Operator Presence System - Check			●						
Neutral Start Interlock - Check			●						
Drilling Fluid System - Check			●						
Ground Drive System - Inspect			●						
Cooling System Additive - Add				●					
Hydraulic Fluid Filters - Replace				Initial					
Engine Mounts - Check					●				

Service	Maintenance Interval - Service Hours								
	10 or Daily	50 or Weekly	100	250	500	1000	3000	4500	As Required
Automatic Belt Tensioner Spring Tension and Belt Wear - Check					●				
Crankcase Vent Tube - Clean					●				
Air Intake System - Check					●				
Electrical Ground Condition - Check					●				
Cooling System - Check/Pressure Test					●				
Engine Coolant Concentration - Check					●				
Drive Belt Wear and Tension - Check					●				
Engine Speeds - Check					●				
Engine Oil and Filter - Change/Replace					●				
Fuel Filters - Replace					●				
Battery Maintenance					●				
Hydraulic Fluid Filters - Replace					●				
Drilling Fluid Pump Crankcase Oil - Change					Initial				
Track Gearbox Oil - Change						●			
Drilling Fluid Pump Crankcase Oil - Change						●			
Hydraulic Fluid - Change						●			
Hydraulic Strainer - Remove, Clean and Inspect						●			
Engine Valve Clearance - Adjust							●		
Cooling System - Drain/Clean							●		
Cooling System - Bleed Air							●		

Service	Maintenance Interval - Service Hours								
	10 or Daily	50 or Weekly	100	250	500	1000	3000	4500	As Required
Thermostats - Test							●		
Diesel Particulate Filter (DPF) - Forced Regeneration								●	
Alternator Belt - Replace									●
Engine Compartment - Clean									●
Engine Cooling Compartment - Clean Out									●
Battery - Replace									●
Fuses - Replace									●
Air Cleaner Element - Replace									●
Rack and Pinion - Clean									●
Rod Guide Rollers - Replace									●
Vise Jaw Grips - Replace									●
Track Tension - Adjust									●
Gearbox Guides - Adjust/Replace									●
Storage									●



# Index

## A

Access, 20-63  
Accumulator Gauge, 20-50  
Accumulator Pressure - Check, 50-1  
Active Codes Screen, 21-17  
Adding Drill Rod, 55-13  
After Each Bore, 50-54  
After Utility Company Has Shut Off the Power, 50-23  
Antifreeze - Add to Drilling Fluid System, 30-43  
Armor Drill Housing Assembly, 30-21  
Armor Multi-Tool, 30-23  
Auto Steer, 21-11  
Auto Steering, 30-37  
Auto Stop, 21-13  
AutoDrill - Pause/Resume, 30-36  
AutoDrill - Set, 30-35  
AutoDrill Controls, 20-43  
AutoDrill Off, 21-6  
AutoDrill Screens, 21-6  
AutoDrill Speed Mode, 21-6  
AutoDrill, 30-35  
Automatic Functions, 30-35  
Auxiliary Engine Shutdown for Hydraulic Disable, 30-8  
Auxiliary Outlets, 20-60

## B

Backlight, 20-27  
Backup Warning Alarm, 50-6

Battery Burns - Prevent, 55-2  
Battery Condition, 30-14  
Battery Explosion - Prevent, 55-1  
Beacon (Option), 20-57  
Before Starting, 50-1  
Before the Bore, 50-24  
Begin Drilling, 50-31  
Bore Path - Walk, 50-14  
Breaking Rod Joints - Safety Considerations, 50-47  
Breakout Device Operation, 55-5

## C

Cab Controls, 20-61  
Cab Door Latch, 20-61  
Cab Machine, 20-20  
Calibration Screens, 21-16  
Carve Steering Setup, 30-38  
Changing Radio Channel, 20-27  
Changing Tools at Remote Exit Pit, 50-38  
Cold Weather Start System, 50-3  
Cold Weather Starting, 50-3  
Communication Requirements, 50-39  
Configurations, 55-8  
Console Display, 21-1  
Contrast, 20-27  
Controls Locations, 20-1  
Controls, 20-1

## **D**

- Dealer Prep, i
- Dealer/Owner Information, iv
- Delivery, iii
- Diesel Particulate Filter (DPF) Safety, 50-25
- Diesel Particulate Filter (DPF), 21-8
- DigiTrak Locating Program, 25-1
- Discharged Battery, 30-14
- DPF Controls, 21-8
- Drill Head - Connect, 50-30
- Drill Rod - Flush, 50-28
- Drill Rod - Lubricate, 50-30
- Drill Rod and Tools, 30-20
- Drill Rod Row - Select, 50-35
- Drill Rod Row - Select, 50-46
- Drill Rod, 30-20
- Drill Rods - Add to Drill String, 50-32
- Drill Rods - Clean and Store, 50-55
- Drill Screen, 21-3
- Drill Setup, 21-12
- Drill Station Controls, 20-56
- Drill Tool Assemblies, 30-21
- Drill Unit Setup, 50-14
- Drilling Controls - Rotation, 20-38
- Drilling Controls - Thrust, 20-41
- Drilling Controls, 20-38
- Drilling Fluid Controls, 20-52
- Drilling Fluid Setup, 50-18
- Drilling Fluid, 21-12
- Drilling Pressure, 21-14
- Drilling Safety, 50-20

- Drilling with Front Load Wireline Locator System, 55-11
- Driving Machine with Tethered Secondary Remote Control, 50-10
- Driving Machine with Wireless Remote Control, 50-9
- Driving the Machine with Remote Control, 50-6
- Driving the Machine, 50-5
- During the Bore, 50-31

## **E**

- Electrical Line, 50-21
- Electrical Shock Protection, 40-8
- Electrically Insulated Boots, 40-12
- Electrically Insulated Gloves, 40-10
- Electrocution Prevention, 40-9
- Engine Control Unit Identification Number - Record, vi
- Engine Controls, 20-21
- Engine Cover Latches, 20-58
- Engine Identification Number - Record, vi
- Engine Maintenance Intervals, 60-2
- Engine Operation Controls, 20-21
- Engine Screen, 21-7
- Engine Shutdown Test, 30-10
- Engine, 50-3
- Engine, ii
- Entrance and Exit Sites - Prepare, 50-19
- Exiting the Bore, 50-38

## **F**

- Fault Check/Processing Lights, 30-6
- Fiber Optic Cable, 50-23
- Fire Extinguisher, 10-4
- Flushing Bentonite/Polymers from Drilling Fluid System, 50-55

Forced Regeneration, 21-10  
Front Vise Function in Resuming AutoDrill, 30-36

## **G**

Gas, 50-23  
Gauges - Monitor During Pullback, 50-53  
Gauges - Monitor, 50-36  
Greaser, 20-50

## **H**

Horn Keys, 20-58  
Hourmeter - Check for Maintenance Interval, 60-2  
Hydraulic Fluid, 50-3  
Hydraulic Lockout or Engine Shutdown Option, 30-7  
Hydraulic Lockout Test, 30-9  
Hydraulics, ii

## **I**

Indicator Lights on Control Panel, 20-15  
Indicator Lights on Display Screen, 20-16  
Indicator Lights, 20-14  
Indicators on Display Screen, 20-11  
Inhibit Generation, 21-10  
Initial Drill Rod Connection, 55-11  
Intended Use, 15-1, 55-4

## **J**

Jobsite - Check, 40-16  
Jump-Starting Procedure, 55-2  
Jump-Starting, 55-1

## **K**

## **L**

Laws and Regulations - Check, 40-17  
Left Joystick, 20-4  
Left Panel Controls, 20-2  
Lifting Machine, 50-13  
Loading/Unloading, 50-11  
Local Lockout Buttons, 20-8  
Locating Equipment - Prepare, 50-18  
Locating Screens, 25-4  
Locator Setup Screen, 25-3  
Locator System, 30-25  
Lockout Button, 30-5  
Lockout Procedure - With Remote Lockout System, 30-16  
Lockout Procedure - Without Remote Lockout System, 30-19  
Lockout Procedures, 30-16  
Loss of Remote Transmitter Signal, 30-13  
Low Battery, 30-14

## **M**

Machine - Anchor with Stakes, 50-17  
Machine - Grease, 60-2  
Machine - Wash, 50-56  
Machine Identification Decal, v  
Machine Identification Number - Record, v  
Machine/Engine Diagnostics, 21-17  
Maintenance Intervals, 60-3  
Maintenance Manual, 60-2  
Maintenance, 55-8, 60-1  
Menu Screen, 21-2  
Mud Motors, 55-8

## **N**

Navigation Screen, 25-2

Non-Cab Machine, 20-19

## **O**

Obstructions - Investigate, 50-37

Operation, 50-1

Operator Presence System, 40-14

Operator Presence/Seat Controls, 20-56

Operator Qualifications, 40-1

Overview, 30-1

## **P**

PBD7500 Portable Breakout Device, 55-4

Personal Protection, 40-5

Planning the Bore, 40-17

Plugged Drill Rod, 50-37

Power Button, 30-4

Power Line Locator System, 40-16

Power Vise Controls, 20-51

Power Vises - Clean, 50-54

Preparation, 40-1

Preparing for Transport, 50-8

Preparing Personnel, 40-1

Preparing the Machine, 40-14

Preparing the Work Area, 40-16

Pullback - Start, 50-43

Pullback Tool - Install, 50-41

Pullback, 55-14

Pulling Back with Trailing Rod, 50-50

Push-Through Method of Adding Drill Rod for Pre-Reaming, 50-51

PVC Pipe Pulling (Option), 30-30

## **Q**

## **R**

Rack and Stabilizer Controls - Remote Controls, 20-37

Radiator Grille Cover, 20-59

Radio Communication Requirements, 40-3

Radio Communication to Resume Drilling Operation, 40-4

Radio Communication to Stop Drilling Operation, 40-4

Range - Test, 40-14

Read Overview Section, 50-20

Reamer - Connect with Manually Threaded Joint and Collar, 30-29

Reamer Carrier - Install/Remove, 30-27

Reamer Carrier - Intended Use, 30-25

Reamer Carrier - Lift, 30-27

Reamer Carrier Components, 30-26

Reamer Carrier Styles, 30-26

Reamer Carrier Use, 50-39

Reamer Carrier Wear Pads - Replace, 30-29

Reamer Installation, 30-25

Receiving and Delivery Report, i

Recharge Battery, 30-14

Recharging Pressure, 50-1

Recommended Fluids, 60-2

Remote Control Operating Range, 20-30

Remote Control, 20-5

Remote Lockout Battery Charger, 20-19

Remote Lockout Controls, 20-13

Remote Lockout Indicators, 20-17, 30-6

Remote Lockout Machine Controls, 20-15

Remote Lockout Overview, 30-1

Remote Lockout System - Shut Down, 30-15  
Remote Lockout System - Start, 30-15  
Remote Lockout System - Test, 40-15  
Remote Lockout System Component Identification, 30-3  
Remote Lockout System Intended Use, 30-1  
Remote Lockout System Preparation, 40-14  
Remote Lockout Tests, 30-9  
Remote Lockout Transmitter Registration, 30-11  
Remote Lockout Transmitter, 20-7  
Remote Lockout Use, 50-39  
Remote Registration, 20-28  
Remote Transmitter - Prepare, 40-14  
Remote Transmitter Controls, 20-13  
Remote Transmitter, 30-3  
Replacing Broken Drill Rod Underground, 55-9  
Resuming Operation after Lockout, 30-19  
Resuming Operation after Remote Lockout, 30-18  
Resuming Operation, 50-42, 50-49, 50-52  
Retrieval, 50-13  
Right Joystick, 20-4  
Right Panel Controls, 20-3  
Rod Box - Install, 30-33  
Rod Box - Load with Rod, 30-31  
Rod Box - Prepare, 30-34  
Rod Box - Remove, 30-32  
Rod Handling Components, 20-48  
Rod Loader Controls, 20-45  
Rod Loader Setup, 30-31  
Rod Wiper - Install, 50-19  
Rod Wrap, 30-41  
Rotary Stakedown Controls - Left Console, 20-36

Rotary Tooth Installation/Extraction - Gauntlet Bit, 30-24  
Run Button, 30-5

## **S**

Safe Operating Slope, 50-7  
Safety Conscious Operators and Workers, 40-1  
Safety Messages, 10-1  
Safety Precautions, 50-21  
Safety Signs Maintenance, 60-1  
Safety Symbol Explanation, 10-1  
Screen Brightness Settings, 21-19  
Setup Controls, 20-35  
Setup, 50-14  
Short-String Method of Adding Drill Rod for Pre-Reaming, 50-48  
Shutdown Procedure, 50-4  
Software Information Screen, 21-19  
Soil Conductivity, 40-13  
Sound and Vibration Levels, 40-6  
Stabilizer Controls - Left Console, 20-35  
Start/Stop Buttons, 20-7  
Starting Procedure, 50-1  
Starting the Engine, 50-2  
Step - Non-Cab Operator Station, 20-64  
Strike Alert - Indicators and Controls, 20-11  
Strike Alert Controls, 20-9  
Strike Alert System - Test, 50-15  
Strike Alert System Functions, 40-13  
Supplemental Operations, 55-1  
Swivel Use, 50-40, 50-48  
Swivel, 30-25

## **T**

Tethered Secondary Remote Control (S/N 138 -), 20-6  
Top Panel Control, 20-1  
Trailing the Machine, 50-11  
Trailing Rod While Pre-Reaming, 50-47  
Training, 40-2  
Transport Controls, 20-26, 20-31  
Transport Remote Control, 20-26  
Transport with Tethered Remote (S/N 138 -), 20-34  
Transporting the Machine, 50-5  
Turnbuckle - Adjust, 30-28

## **U**

Underground Utility Contact, 40-7  
Units Setup Screen, 25-4  
Units, 21-15  
Utility Line Contact, 50-21

## **V**

Version Screen, 25-5  
Vise Operating Guidelines, 30-42

## **W**

Warning Alarm, 30-4  
Warning Cones, 40-17, 50-20  
Warning Safety Signs and Operating Instructions, 40-2  
Wash Wand Controls, 20-54  
Welding Alert - Electronic Components, 11-1  
Welding Precautions, 11-1  
Wireline/Remote Lockout, 21-14  
Work Lights, 20-57

## **X**

## **Y**

## **Z**

Zone Steering Setup, 30-39

# Revision History

Revision	Date	Page(S)	Description
to1_00	04/11	All	Temporary Operator's Manual released.
o1_00	08/11	All	First Edition Manual released.
o1_01	09/11	Sections 20, 21, 50	Rod handling controls, engine hood latches, decals
o1_02	04/12	Warranty rider, Sections 20, 21, 25, 50, 60	Remote control range, operator station step, programming, transport safety, engine cooling area cleanout
o1_03	10/12	Sections Introduction, R&D, 11, 20, 21, 30, 50, 55, 60	Controls, software, hood design
o1_04	02/14	Warranty, Sections 20, 21, 30, 50	Software update, rotary stakedowns, Auto Steer
o1_05	07/14	Sections 20, 50	Tethered transport remote
o1_06	08/15	Introduction, Sections 10, 20, 21, 50	Notice to Owner, Notice signal word, updated software



## **WARNING**

The engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

## **CALIFORNIA**

### **Proposition 65 Warning**

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

When operated in California, any off-road diesel vehicle may be subject to the California Air Resources Board In-Use Off-Road Diesel Vehicle Regulation. It therefore could be subject to retrofit or accelerated turnover requirements to reduce emissions of air pollutants. For more information, please visit the California Air Resources Board website at <http://www.arb.ca.gov/msprog/ordiesel/ordiesel.htm>.