JT3020 Mach 1/All Terrain

Operator's Manual

CE

CMW®

Issue 5.0
Original Instruction

053-1152

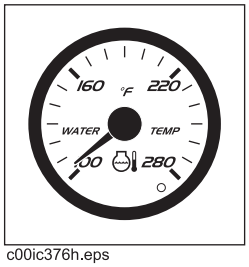
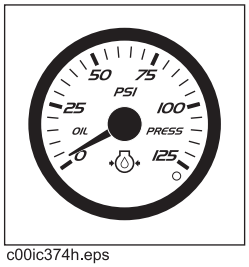
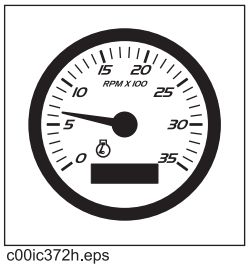
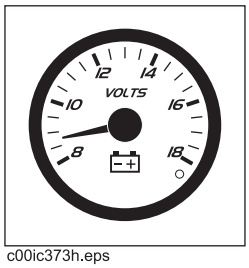
If a Fiber Optic Cable is Damaged

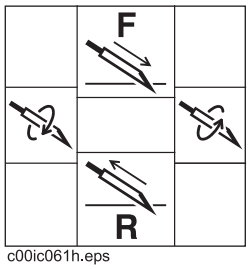
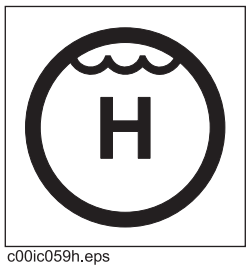
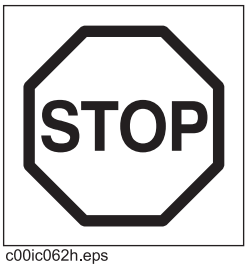
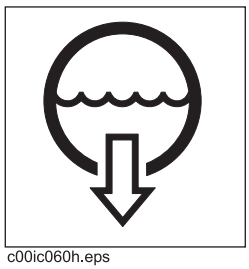
Do not look into cut ends of fiber optic or unidentified cable. Vision damage can occur.

If Machine Catches on Fire

Perform emergency shutdown procedure and then take the following actions. The order and degree of action will depend on the situation.

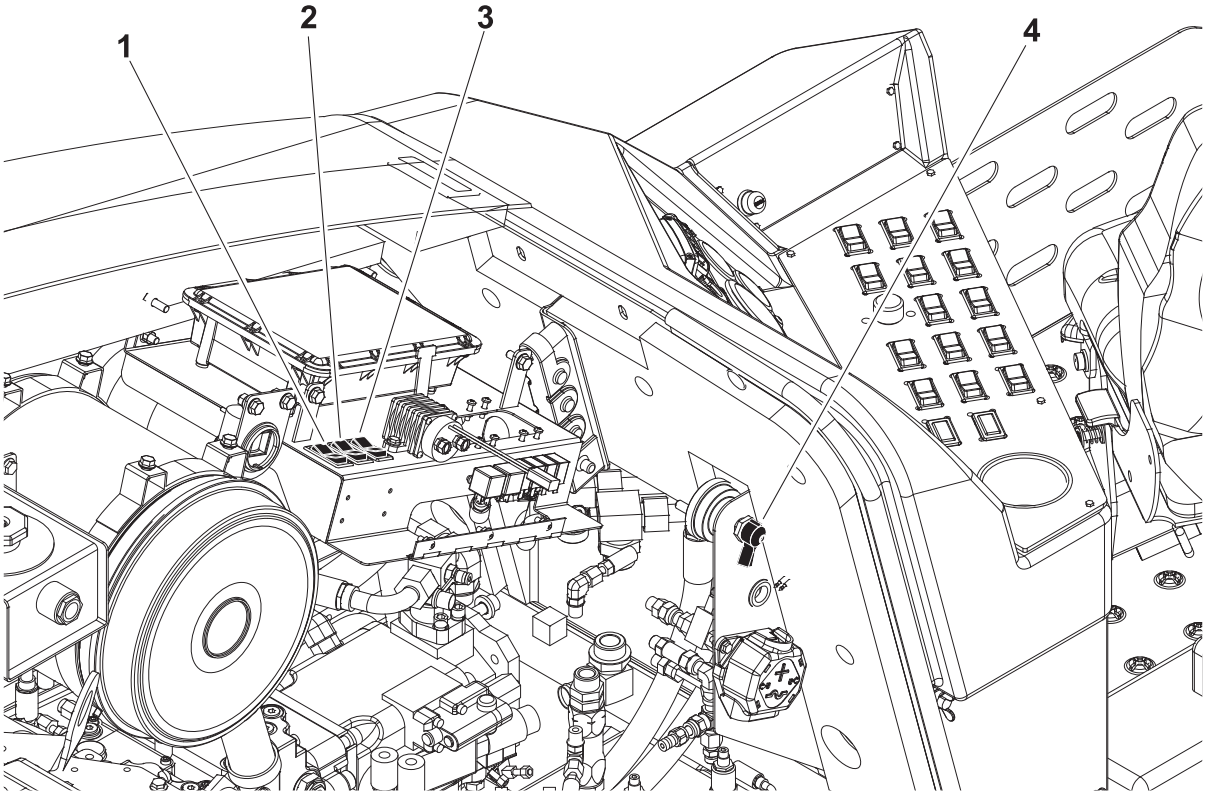
- Immediately move battery disconnect switch (if equipped) to disconnect position.
- If fire is small and fire extinguisher is available, attempt to extinguish fire.
- If fire cannot be extinguished, leave area as quickly as possible and contact emergency personnel.

Item	Description	Notes
5. Engine coolant temperature gauge  c00ic376h.eps	Displays engine coolant temperature.	Normal coolant temperature is 160°-212° F (71°-100° C).
6. Engine oil pressure gauge  c00ic374h.eps	Displays engine oil pressure.	Full load reading should be 60-80 psi (4.1-5.5 bar).
7. Selection switch	To scroll through engine statistics and diagnostic codes on diagnostic gauge display, push.	
8. Tachometer and diagnostic gauge  c00ic372h.eps	**Tachometer** Displays engine speed. **Diagnostic gauge** Displays engine hours, trip meter, engine statistics, and engine diagnostic codes. To view information, press the selection switch.	**IMPORTANT:** For more information about the engine diagnostic system and codes see "Engine Diagnostic Codes" on page 175.
9. Voltmeter  c00ic373h.eps	Displays system voltage.	Should show 13-14V with engine running.

Item	Description	Notes
1. Carriage control  c00ic061h.eps	To move carriage forward, push. To move carriage backward, pull. To rotate spindle counterclockwise (breakout), move right. To rotate spindle clockwise (makeup), move left.	**IMPORTANT:** See "Operate Carriage Control" on page 111 for more information.
2. Drilling fluid quick fill switch  c00ic059h.eps	To override fluid control setting for full pump flow, press and hold. To return fluid flow to flow control setting, release.	**IMPORTANT:** Also overrides temporary fluid shutdown when front wrench is closed.
3. Remote engine stop switch  c00ic062h.eps	To stop engine, press. To restart engine, press remote engine start switch (page 35).	**IMPORTANT:** • If this switch is used to stop drilling unit, be sure to turn ignition switch off if machine will be left unattended for long periods of time. Battery discharge can occur. • If wrenches are engaged when remote stop is pressed, wrenches will remain engaged but could gradually open.
4. Drilling fluid pump switch  c00ic060h.eps	To turn on, press once. To turn off, press once.	

Item	Description	Notes
2. ESID display	Displays the ESID information.	**IMPORTANT:** If a strike is detected, the bottom portion of the display automatically switches to the ESID information display.
3. Drilling fluid flow display	Displays the estimated GPM or LPM of drilling fluid being pumped.	
4. Outer rotation speed display	Displays the measured RPM of outer rotation pipe.	
5. Inner rotation speed display	Displays the measured RPM of inner rotation pipe (AT only).	
6. Operational message display	Displays operational status of cruise control, carve mode, drill fluid, tracker control, and diagnostic test mode.	
7. Pipeloader message display	Displays messages related to add or remove pipe cycles.	
8. Diagnostic message display	Displays messages related to diagnostic information of machine.	
9. Active display indicator	Indicates that information center display is actively updating.	**IMPORTANT:** If nothing is changing on the display except this indicator, communications may have stopped.
10. Diagnostic indicator	Indicates errors in Main dc, ESID dc and ICrt dc	Device shown is the source of the diagnostic code shown.

Engine Compartment Controls



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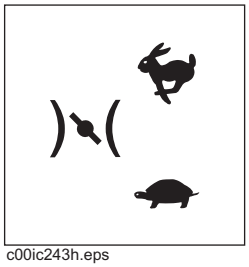
1. Throttle switch
2. AT/JT drilling mode switch (AT only)
3. High/auto fan speed switch
4. Battery disconnect switch

Item	Description	Notes
1. Throttle switch  c00ic243h.eps	To increase engine speed, press top. To decrease engine speed, press bottom. To further increase or decrease speed, press additional times (or hold until desired speed is reached).	Use this switch only if throttle switch on console does not work.

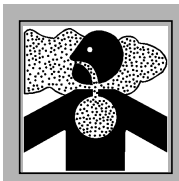
Planning

1. Gather information about jobsite. See page 75.
2. Inspect jobsite. See page 76.
3. Classify jobsite. See page 78.
4. Plan bore path. See page 81.
5. Check supplies and prepare equipment. See page 92.
6. Load equipment. See page 101.

Setting Up at Jobsite

1. Prepare jobsite. See page 91.
2. Mix drilling fluid.
3. Unload drilling unit from trailer. See page 104.
4. Assemble drill string. See page 113.
5. Position drilling unit and drill frame. See page 109.
6. Assemble strike system. See page 139.
7. Anchor drilling unit. See page 137.
8. Connect fluid system. See page 109.
9. Calibrate tracker with beacon that will be installed in beacon housing. See tracker operator's manual.

Crystalline Silica (Quartz) Dust Precautions



⚠WARNING Jobsite hazards could cause death or serious injury. Use correct equipment and work methods. Use and maintain proper safety equipment.

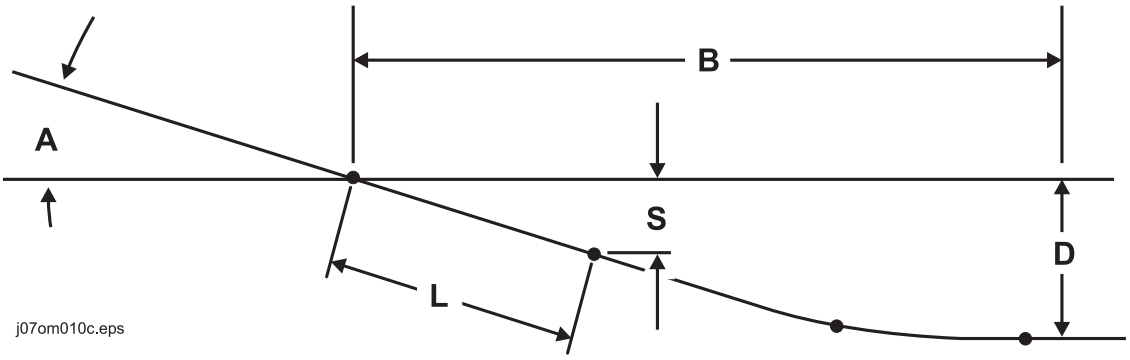
NOTICE: Cutting, drilling, or working materials such as concrete, sand, or rock containing quartz may result in exposure to silica dust. Use water spray or other means to control dust. If workers are exposed to dust they must wear appropriate breathing protection. Silica dust may cause lung disease and is known to the State of California to cause cancer.

Follow OSHA or other guidelines for exposure to crystalline silica when trenching, sawing or drilling through material that might produce dust containing crystalline silica (quartz).

Other Jobsite Precautions

You may need to use different methods to safely avoid other underground hazards. Talk with those knowledgeable about hazards present at each site to determine which precautions should be taken or if job should be attempted.

AT Cobble pipe



Minimum depth (D)	Entry pitch (A)	Setback (B)	Depth to begin steering (S)
4 ft 5 in (1.3 m)	18% / 10.2°	43 ft 5 in (13.2 m)	1 ft 1 in (0.33 m)
5 ft 4 in (1.6 m)	20% / 11.3°	47 ft 4 in (14.4 m)	1 ft 3 in (0.38 m)
6 ft 3 in (1.9 m)	22% / 12.4°	51 ft 3 in (15.6 m)	1 ft 4 in (0.41 m)
7 ft 3 in (2.2 m)	24% / 13.5°	55 ft 2 in (16.8 m)	1 ft 6 in (0.46 m)
8 ft 4 in (2.5 m)	26% / 14.6°	58 ft 11 in (18.0 m)	1 ft 7 in (0.48 m)
9 ft 6 in (2.9 m)	28% / 15.6°	62 ft 8 in (19.1 m)	1 ft 8 in (0.51 m)
10 ft 8 in (3.3 m)	30% / 16.7°	66 ft 5 in (20.2 m)	1 ft 10 in (0.56 m)

IMPORTANT: Numbers in table based on **210' (53 m) minimum bend radius**, beacon housing, EZ-Connect, connector, transition sub, and 1/3 of first drill pipe (L, totaling 6' 4" [2.6 m]) in the ground before steering.

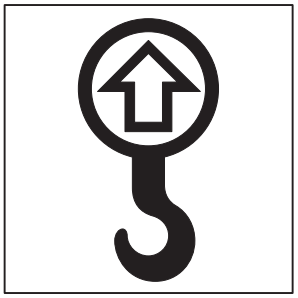
Lift

This machine is not configured for lifting. If the machine must be lifted, load machine into a container or onto a platform appropriate for lifting. See "Specifications" for weight of machine.

Pipe Box Lifting Procedure

Pipe Box lifting points are identified by lifting decals. Lifting at other points is unsafe and can damage machinery.

See "Remove/Install Pipe Box" on page 163.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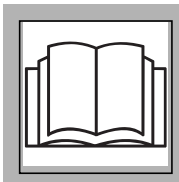
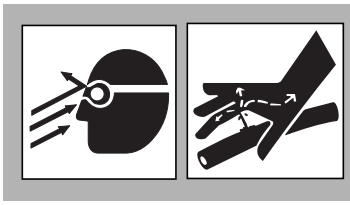
Prime Drilling Fluid Pump



⚠WARNING Incorrect procedures could result in death, injury, or property damage. Learn to use equipment correctly.

NOTICE: Failure to prime the drilling fluid pump will cause flow fluctuations, which will make it difficult to control the washwand.



⚠WARNING Pressurized fluid or air could pierce skin and cause injury or death. Stay away.

Prime drilling fluid pump each time tank is changed. To prime the pump:

1. Fill drilling fluid hose and connect hose to unit.
2. Operate mixing/transfer pump at full speed for 1 - 3 minutes to discharge air from system.
3. Return mixing/transfer pump to normal operating speed and continue the bore.
4. If drilling fluid pressure surges are observed, repeat step 2.

Add Pipe

AT Mode

1. Press top of drilling unit throttle switch. Engine will increase to full throttle.
2. Enable automated pipeloader system if desired. See "Enable Automated Pipeloader System" on page 119.
3. Break joint at saver sub.

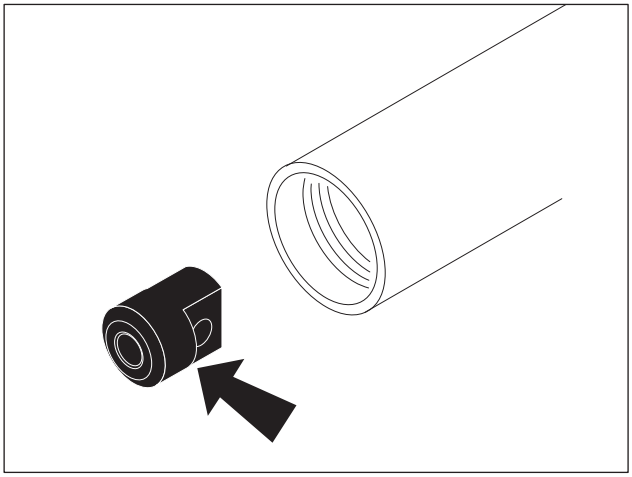
Manual Pipeloader Controls	Automated Pipeloader Control
• Turn inner rotation off and position pipe between wrenches. See "Clamp Pipe" on page 112. • If spindle brake is set, disengage it, rotate outer pipe to 3 o'clock, and close front wrench. • Locate drill head. • Rotate spindle counterclockwise. • Carriage moves back slowly as threads separate. • After threads are fully separated, stop rotation and move carriage to back of frame until rear stop indicator is lit in right console.	• Turn inner rotation off and position pipe between wrenches. See "Clamp Pipe" on page 112. • If spindle brake is set, disengage it, rotate outer pipe to 3 o'clock, and close front wrench. • Locate drill head. • Rotate spindle counterclockwise. • Carriage moves back slowly as threads separate. • After threads are fully separated, stop rotation and move carriage to back of frame until rear stop indicator is lit in right console. • While carriage is moving, grippers will grip, pipe is lubed, and information center displays corresponding messages.

4. Load pipe.

Manual Pipeloader Controls	Automated Pipeloader Control
• Ensure that lift arms are completely lowered. • Close grippers. • Move pipe in shuttles to spindle and lube threads at wrench. • Raise pipe in box.	• With carriage on rear stop switch at back of drill frame (light is on in right console), press RESUME. Display changes to "Adding Pipe". Pipe is moved to spindle, pipe in box is lifted. • Display reads "ADD PIPE waiting".

Assemble Backream String

1. Select backreaming devices. See "Backreamers" on page 155.
2. Determine fluid rate requirements and install appropriate nozzles to provide sufficient flow. See "Backream Fluid Requirements" on page 156 and "Nozzles" on page 153.
3. Attach backreamer to beacon housing if tracking backream.
4. Install beacon, following beacon instructions for:
   - battery replacement
   - beacon positioning
5. Install beacon housing lid. See page 154.
6. Follow beacon instructions to check beacon operation.
7. Follow tracker instructions to calibrate beacon.
8. If in AT mode, install inner spindle spacer (shown) onto end of lead pipe.
9. Use quick wrenches to attach transition sub to drill pipe string. See "Quick Wrench" on page 158.
10. Use quick wrenches to attach backreamer/ beacon housing assembly to transition sub. See "Quick Wrench" on page 158.
11. Attach additional pullback devices or product to end of backreamer/beacon housing assembly.



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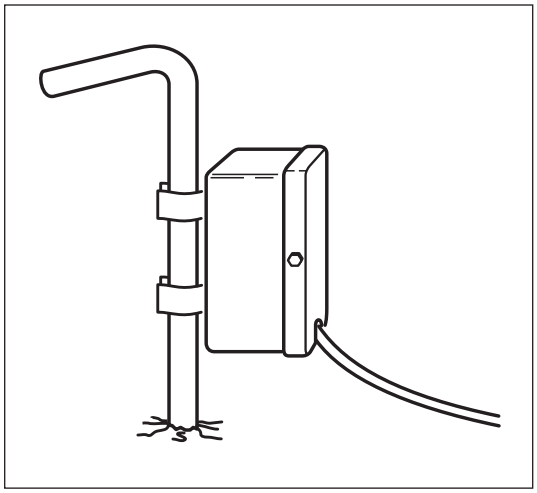
Begin Backream

1. After backream assembly is attached to pipe, tracker operator should:
   - leave pit and stand away from the exposed drill string.
   - if using tracker control, turn on tracker to enable drilling unit thrust/pullback and rotation.
   - if not using tracker control, communicate to drill operator that backream string is clear.
2. Turn on drill fluid and pressurize drill pipe. Verify that jets are open.
3. Without rotating, slowly pull back until reamer contacts bore hole opening. Do not lodge reamer in hole.
4. Begin slow rotation and pullback.
5. Increase drilling fluid flow and rotation as the backream string enters the ground.
6. If tracking backream, tracker operator may continue tracking when the backream string is no longer visible.

Assemble Voltage Detector

1. Drive voltage stake into ground at least 6' (2 m) away from any part of system.
2. Clip voltage limiter to voltage stake.



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Test Strike System

If system fails any part of this test, see "Troubleshoot Strike System" on the following page. Do not drill until test is completed successfully.

1. Turn on drilling unit.
2. ESID control module will perform internal tests which check everything but alarms and strobe.
3. On Information Center, press F2 (Module), then F4 (ESID), and then F2 (Test) to perform total test of strike system. During this test:
   - ESID bar graph in upper right corner of Information Center display should turn on (black).
   - Alphanumeric readout (ESID, Volts and Amps) should display numbers.
   - Alarms and strobes on all connected units should sound.
   - If this test is successful, no diagnostic codes will be displayed or recorded under Codes (F4) in ESID.
4. Use Electric Strike Simulator to test voltage and current sensors. See page 143.

Tracker Control

Overview

WARNING Incorrect procedures could result in death, injury, or property damage. Learn to use equipment correctly.

This mode allows the Ditch Witch Tracker operator to disable hydraulic power to drilling unit thrust and rotation.

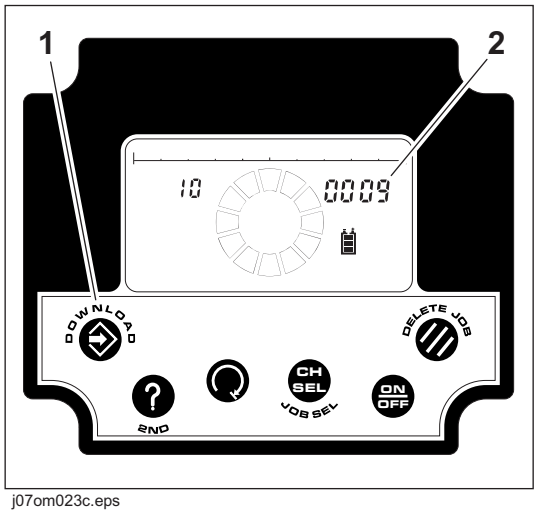
NOTICE: This mode does not disable thrust and rotation immediately. Functions are disabled within 16 seconds. Thrust and rotation are disabled when green light on drilling unit is flashing.

Use tracker control any time you change downhole tools or during other times when the drill string is exposed. Tracker control works by stopping communication between the tracker and the display. When this happens, the green tracker control light on the drilling unit comes on and thrust and rotation are disabled.

Operation

Enable Thrust and Rotation

1. Start drilling unit.
2. Turn off tracker remote display.
3. Press and hold DOWNLOAD (1) while turning on tracker remote display until a four-digit code (2) appears.



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Drill Pipe

Perform Regular Drill Pipe Care

Precondition New Pipe

Repeat this procedure **three times** for each piece of pipe before it is used the first time:

1. **Hand-lubricate** entire surface of threads and shoulders of both ends of pipe with copper base tool joint compound. See page 207 for recommended lubricant.
2. Join pipe and tighten joint.
3. Break joint.
4. Move pipe back to box.

NOTICE: Failure to follow this procedure could result in fused joints. Pipe will be damaged or destroyed.

Lubricate Joints Before Each Use

Lubricate threads and shoulders of male joints with copper base tool joint compound. This prevents rust and reduces wear on shoulders and threads. See page 207 for recommended lubricant.

Clean the Threads

Clean the threads as needed with high-pressure water and detergent.

NOTICE: Do not use gasoline or other petroleum-based solvents. This prevents tool joint compound from sticking to the joints and will reduce thread life.

Replace Worn Saver Sub

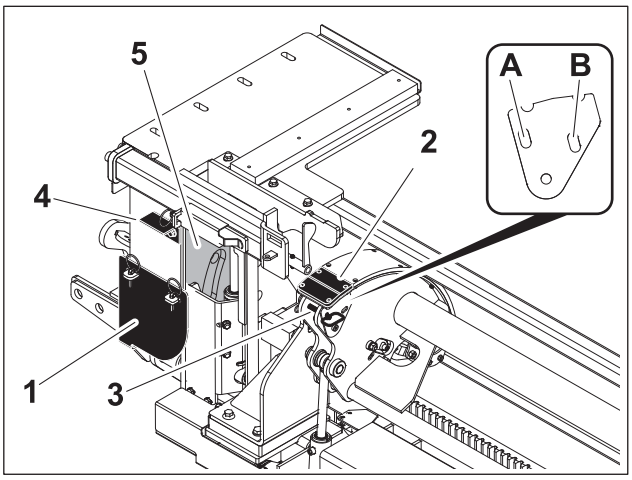
Because each pipe comes in contact with the saver sub, check saver sub regularly for wear. Compare condition of saver sub threads to condition of your drill pipe threads. Replace saver sub any time when its thread condition is not better than thread condition of your drill pipe. Failing to replace saver sub will result in damaged drill pipe. See page 237 for replacement procedure.

Precondition a new saver sub the same way you do new pipe. See “Precondition New Pipe” on page 160.

Rotate Pipe Order

Because the lead drill pipe is in the ground longer, it is subjected to higher shock loads and experiences more wear. To help spread this wear evenly over all pipe, move the lead pipe from the previous job out of the first position.

Remove Single Pipe



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Unload drill pipe loaded with auxiliary pipe loaders.

1. Ensure pipe guide is still installed and not in storage position.
2. Ensure pipe box is positioned properly. See "Remove/Install Pipe Box" on page 163.
3. Move shuttles out half way (45°).
4. Pull pin (3) from slot (A) on shuttle, rotate auxiliary pipe loader (2) down, and install pin in slot (B).
5. Repeat step 4 for rear auxiliary pipe loader.
6. Raise pipe.
7. Move shuttle in, auxiliary pipe loaders should be beneath pipe column.
8. Lower pipe into auxiliary pipe loaders.
9. Move shuttle out (shuttle stop switch will stop shuttle movement at correct position for removing pipe).

⚠WARNING Crushing weight. If load falls or moves it could kill or crush you. Use proper procedures and equipment or stay away.

10. Remove pipe from auxiliary pipe loaders and store properly.
11. Repeat steps 6-9 to unload remaining added drill pipe.
12. After all added drill pipe is unloaded with auxiliary pipe loaders:
    - Close both auxiliary pipe loaders. Pins must be inserted in slot (A) and held in place with retaining pins.
    - Place pipe guide in storage position (shown) and secure in place with retaining pins.
    - Step away from pipeloader.
    - Finish loading remaining drill pipe using standard procedure. See "Remove Pipe" on page 131.
    - If shuttle will not retract after completing single pipe operations, hold retract pipe shuttle switch and momentarily press enhanced function control button to reset shuttles to normal operation (shuttles will retract).

Two-line diagnostic code	Fault Code	Description	Possible cause
SPN 629, FMI 12	351	controller 1	injector power supply, bad intelligent device or component
SPN 1079, FMI 4	352	5 volts DC supply	sensor supply voltage 1 circuit, voltage below normal or shorted to low source
SPN 1079, FMI 3	386	5 volts DC supply	sensor supply voltage 1 circuit, voltage above normal or shorted to high source
SPN 1043, FMI 3	387	internal sensor voltage supply	accelerator pedal or lever position sensor supply voltage circuit, voltage above normal or shorted to high source
SPN 100, FMI 1	415	engine oil pressure	oil pressure low, data valid but below normal operational range, most severe level
SPN 97, FMI 15	418	water in fuel indicator	water in fuel indicator high, data valid but above normal operational range, least severe level
SPN 111, FMI 2	422	coolant level	coolant level, data erratic, intermittent or incorrect
SPN 175, FMI 2	425	oil temp	engine oil temp, data erratic, intermittent or incorrect
SPN 97, FMI 3	428	water in fuel indicator	water in fuel sensor circuit, voltage above normal or shorted to high source
SPN 97, FMI 4	429	water in fuel indicator	water in fuel sensor circuit, voltage below normal or shorted to low source
SPN 102, FMI 2	433	boost pressure	intake manifold pressure sensor circuit, data erratic, intermittent or incorrect
SPN 627, FMI 2	434	power supply	power lost without ignition off, data erratic, intermittent or incorrect
SPN 100, FMI 2	435	engine oil pressure	oil pressure sensor circuit, data erratic, intermittent or incorrect
SPN 168, FMI 18	441	electrical potential (voltage)	battery 1 voltage low, data valid but below normal operational range, moderately severe level
SPN 168, FMI 16	442	electrical potential (voltage)	battery 1 voltage high, data valid but above normal operational range, moderately severe level
SPN 1043, FMI 4	443	internal sensor voltage supply	accelerator pedal or lever position sensor supply voltage circuit, voltage below normal or shorted to low source

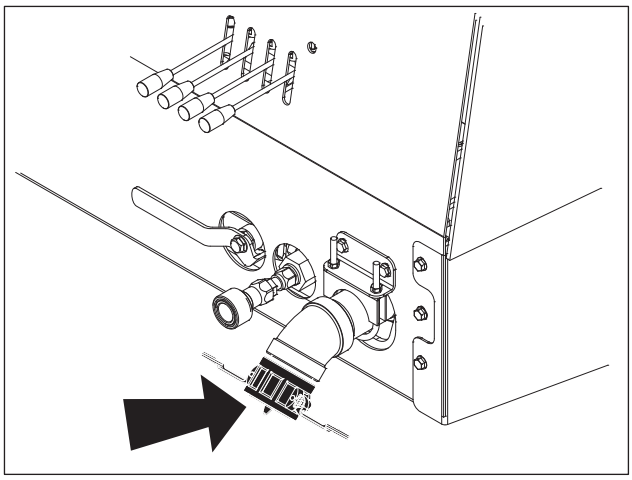
Code	Display	Condition	Result	Severity
133	SHUTTL HSW	no continuity to shuttle home switch	add pipe and remove pipe are blocked	non-essential
134	FWRNCH PSW	no continuity to front wrench switch	add pipe and remove pipe are blocked	non-essential
136	TH REAR STOP	no continuity to thrust rear stop switch	add pipe and remove pipe are blocked	non-essential
137	PIPE UP PSW	no continuity to pipe up switch	pipe box movement is blocked and code is stored	non-essential
138	FRONT BOX HSW	no continuity to front pipe box switch	code is stored	non-essential
139	REAR BOX HSW	no continuity to rear pipe box switch	code is stored	non-essential
141	ROTATE POS	no continuity to rotation position sensor	code is stored	non-essential
143	DFLUID GPM	no continuity to drilling fluid speed sensor	code is stored	non-essential
146	FLOAT POS	no continuity to float position sensor	assisted makeup is blocked and code is stored	non-essential
147	TKR CONTROL	no continuity to tracker control input	code is stored	non-essential
149	ANCHOR ON PSW	no continuity to anchor pressure switch	code is stored	non-essential
151	DRL JOY L/R	drill joystick left/right out of range	rotation, cruise control, and carve mode are blocked	essential
152	DRL JOY F/B	drill joystick forward/ backward out of range	thrust, cruise control, and carve mode are blocked	essential
153	DRV JOY L/R	drive joystick left/right out of range	drive is blocked	essential
154	DRV JOY F/B	drive joystick forward/ backward out of range	drive is blocked	essential
156	DR FLUID POT	drilling fluid potentiometer out of range	code is stored	essential
158	FAN POSN SEN	no information from engine fan pulse pickup sensor	code is stored and fan is controlled without feedback	non-essential
161	ROT PRES SEN	rotation pressure sensor out of range	code is stored	non-essential
162	THR PRES SEN	thrust pressure sensor out of range	code is stored	non-essential

Antifreeze Drilling Unit

Your drilling unit can be left overnight in freezing conditions by filling fluid lines with a polyproplyene-based antifreeze (p/n 265-644) with optional antifreeze system before shutdown.

Add Antifreeze

1. Fill antifreeze tank with 8 gal (30.3 L) of approved antifreeze.
2. Move carriage to front of drill frame.
3. Position 5-gal (18.9-L) bucket under spindle.
4. Install plug at quick coupler for drilling fluid pump (shown).



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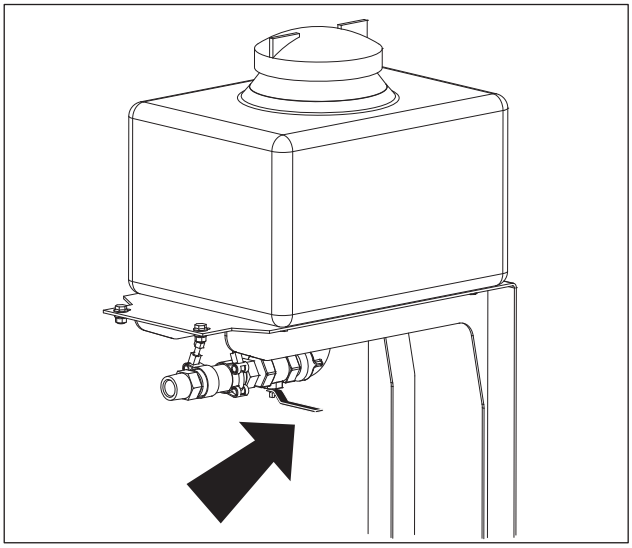
5. Open valve (shown) between antifreeze tank and head of drilling fluid pump.
6. Turn drilling fluid flow control device counterclockwise to zero position.
7. Start unit and set throttle to slow position.
8. Slowly turn drilling fluid flow control device clockwise until indicator light comes on. If light does not come on, press drilling fluid pump switch.
9. Run drilling fluid pump until antifreeze comes out of spindle.



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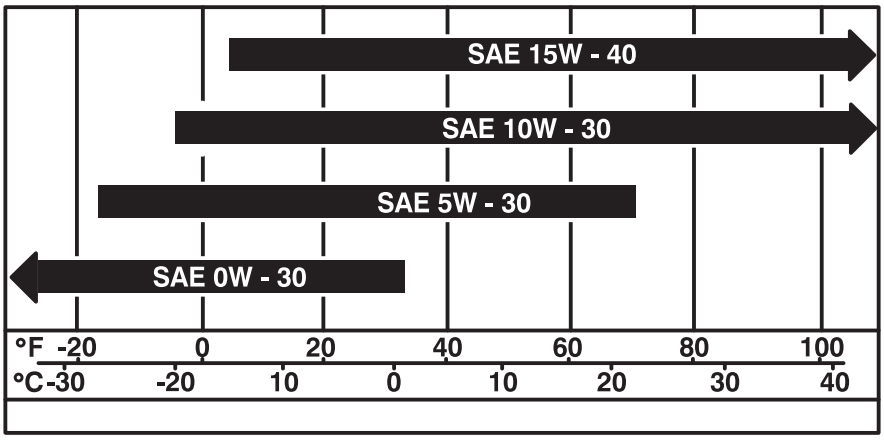
Engine Oil Temperature Chart



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Temperature range anticipated before next oil change

Approved Coolant

This unit was filled with John Deere Cool-Gard coolant before shipment from factory. Add only John Deere Cool-Gard (p/n 255-006) or any fully-formulated, ethylene glycol based, low-silicate, heavy-duty diesel engine coolant meeting ASTM specification D5345 (prediluted) or D4985 (concentrate).

NOTICE:

- Do not use water or high-silicate automotive-type coolant. This will lead to engine damage or premature engine failure.
- Do not mix heavy-duty diesel engine coolant and automotive-type coolant. This will lead to coolant breakdown and engine damage.
- Use only distilled water for mixing coolants. Do not use tap water.

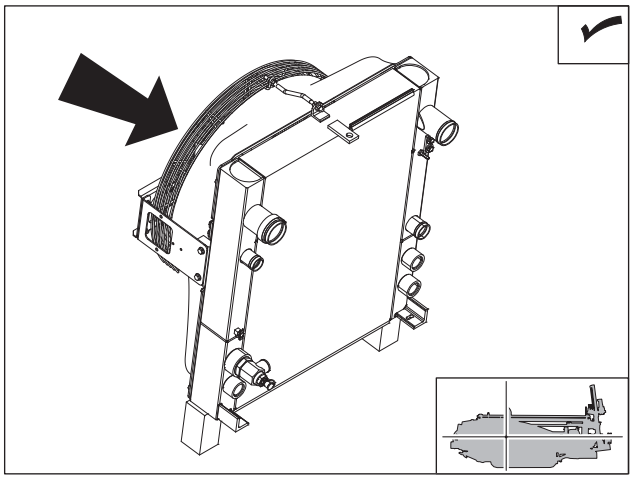
Approved Fuel

This engine is designed to run on diesel fuel. Use only high quality fuel meeting ASTM D975 No. 2D, EN590, or equivalent. At temperatures below 32° F (0° C) winter fuel blends are acceptable. See the engine operation manual for more information.

IMPORTANT: Fuel sulfur content should be less than 5000 ppm (0.5%). Worldwide, fuel sulfur regulations vary widely. Fuel used should always comply with local regulations. If using lube oil meeting API CJ-4, (or other low SAPS equivalent) and fuel with sulfur content above 15 ppm (0.0015%), ULSD in the U.S.), reduce oil change interval to 250 hours.

Biodiesel blends up to 5% (B5) are approved for use in this unit. The fuel used must meet the specifications for diesel fuel shown above. In certain markets, higher blends may be used if certain steps are taken. Extra attention is needed when using biodiesel, especially when operating in cold weather or storing fuel. Contact your Ditch Witch dealer or the engine manufacturer for more information.

Check Radiator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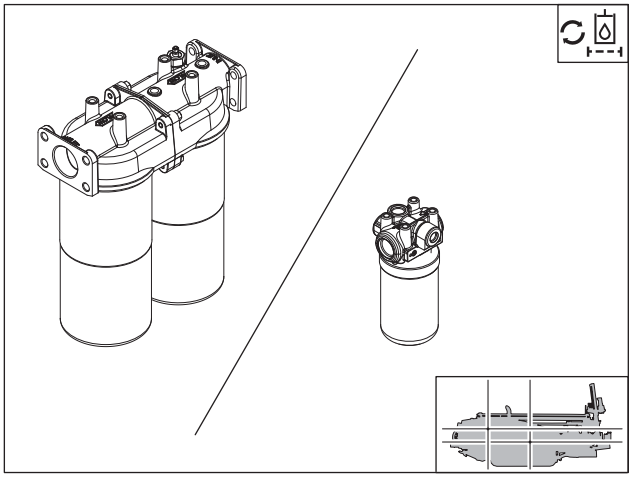
Check radiator for dirt, grass, and other debris every 50 hours. Check more often if operating in dusty or grassy conditions. Clean as needed.

To clean:

- Clean fins with compressed air or spray wash.
- Open rear hood and spray through radiator toward engine.
- If grease and oil are present on radiator, spray with solvent and allow to soak overnight.

IMPORTANT: Be careful not to damage fins with high pressure air or water.

Change Hydraulic Filters (Initial Service)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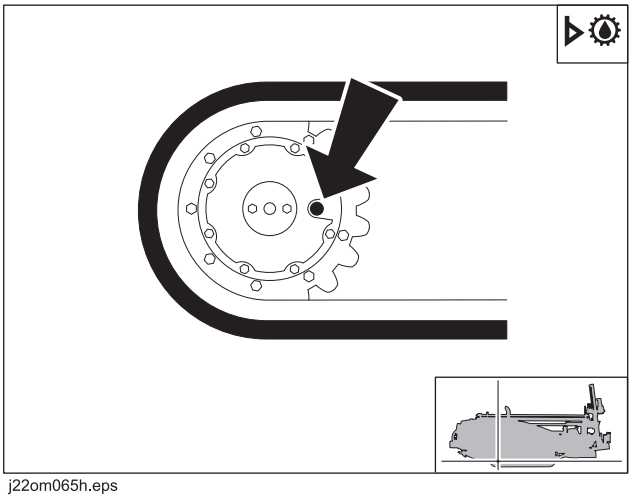
Change hydraulic filter after first 50 hours. Replace filter every 500 hours thereafter. Change filter more often if indicated by filter indicator.

IMPORTANT: If hydraulic system must be opened for repair, install new filter (p/n 153-791) for first 50 hours of operation. If this filter becomes plugged in fewer than 20 hours, replace with new filter. After 50 hours of normal operation, replace with new filter (p/n 153-792).

Check Ground Drive Gearbox Oil Level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Check oil level in both ground drive gearboxes every 50 hours. Rotate plug (shown) until level with center of gearbox. Open plug. If oil does not come out, add MPL as needed. Never fill more than halfway.

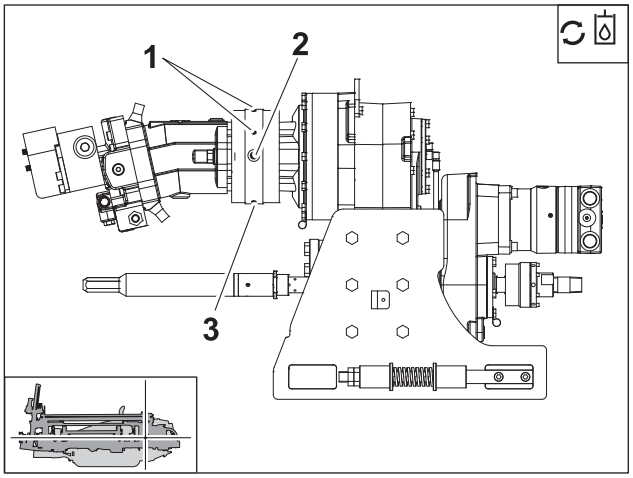
Change Spindle Brake Oil

IMPORTANT: Gearbox must be level for accurate reading.

Change spindle brake oil every 1000 hours. Capacity is 5 oz (148 mL) of THF.

To change:

1. Ensure drill frame is level.
2. Remove bottom plug on brake housing (3).
3. After all oil drains, replace bottom plug and remove either top plug (1) and side fill level plug (2).
4. Add MPL at plug (1) until it comes out oil level hole (2).



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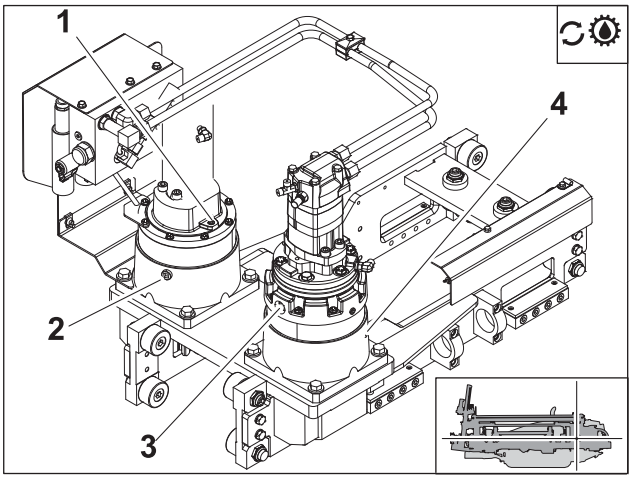
Change Thrust Drive Gearbox Oil

Change thrust drive gearbox oil every 1000 hours. Capacity is 26 oz (0.77 L) MPL per gearbox.

To change:

1. Ensure that drill frame is level.
2. Drain oil at gearbox oil drain (2, 4).
3. Fill each gearbox with MPL at fill plugs (1, 3).

IMPORTANT: Gearbox must be level for accurate reading.



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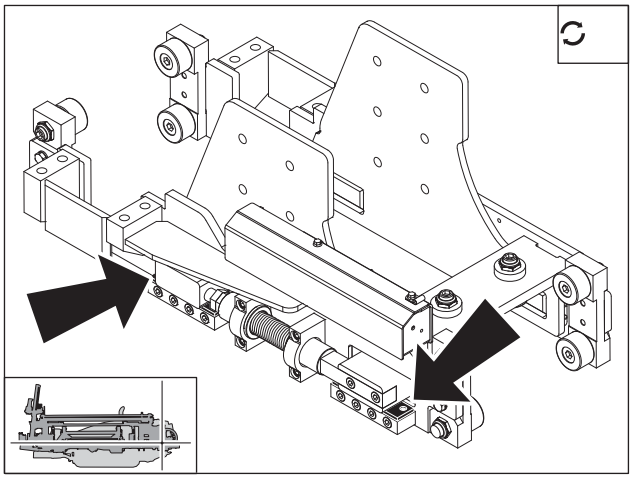
Replace Carriage Wear Bars

Check carriage wear bars for wear. Replace as needed. See your Ditch Witch dealer for replacement parts.



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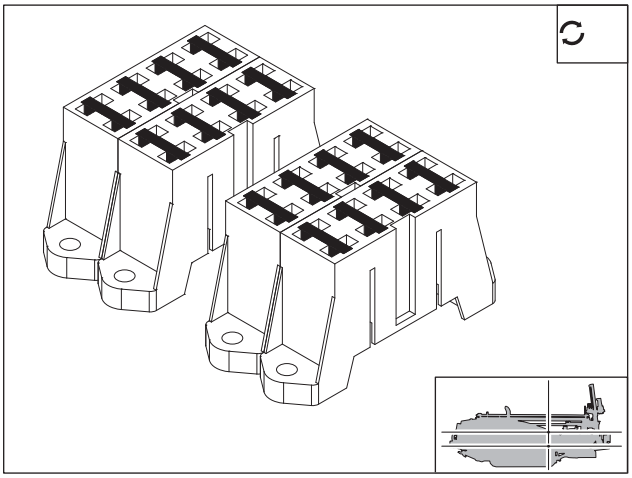
Replace Fuses

Change fuses as needed. Refer to decal inside panels to identify fuses.



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