

Sandvik Blasthole Drill Transit and Port Guide

DR412i Series Rotary Drill Equipment In Transit

Starting and Trimming Procedures and Troubleshooting

(Revision 03/29/23)



NOTE!

Place this manual in cabin of all crawler mounted equipment

SAFE OPERATING PRACTICES - TRANSIT EQUIPMENT

Introduction

SANDVIK MINING drilling equipment is carefully designed, manufactured and tested. When operated by trained and qualified personnel, this machine will give safe and reliable service. There are SANDVIK MINING offices world-wide to answer questions concerning the safe operation and maintenance of this equipment.

To minimize the risk of accidents and injuries, all persons involved in the operation of this machine **MUST** read and understand the following safety precautions.

While we believe that we have properly identified several potential hazards that could result in property damage or injury or death to personnel, there are certain hazards which may be present that we have not contemplated. It therefore is the responsibility of the drill owner, operator and crew to be certain that the drill is properly equipped and safe to operate to assure accident free operation.

Management's Responsibilities

It is the responsibility of management to:



- See that all operators of this equipment are thoroughly trained (with special emphasis on safety), competent, physically fit and if required, licensed.

- Assign specific crew members specific safety responsibilities and instruct them how to report any unsafe conditions.



- Enforce the use of protective clothing, eye and hearing equipment.



- See that the operation of this drill is in compliance with all Federal, State and local codes, regulations and standards.
- Ensure that the work area is appropriately illuminated when operation is performed at night.
- Maintain a complete first aid kit at the job site. At least two members of the crew or personnel in the area where the drill is operated should be familiar with first aid and Cardiac Pulmonary Resuscitation.
- Thorough inspection of the machine must be performed before putting into service and scheduled maintenance must be followed during its life. Due to stress of operation can vary by site and use, periodic examination of frames, masts, ladders, and all welded items should be done to ensure structural integrity is maintained.

The Operator's Responsibilities

Safety must always be the operator's most important concern. The operator must refuse to operate the drill if an unsafe condition exists. It is the responsibility of the drill operator to ensure that the drill is properly equipped, safe to operate and that the site conditions make it possible for safe operation:

- The operator must see that all emergency stops, "operational aids" and "warning signals" are functional before operating.
- The operator must be alert, physically fit, and free from the influences of drugs, alcohol and medications that might impair eyesight, hearing or reactions.



- The operator should not attempt to start or operate the drill unless he has been properly trained and read this manual.

- Report transit damage to appropriate authorities.
- Do not operate equipment that has visual signs of component or structural damage.



- The operator should not operate this equipment if any of its controls display a "lockout" tag.
- If an unsafe condition exists, the operator must place a tag, identifying this condition, on the starting controls and alert other potential users of the drill.



- The operator should not operate the drill without first checking that all personnel protection devices and machinery guards are in place.

Operator's Safety Check

The operator must make a safety check before starting to work to ensure that the machine is in proper order for accident free operation. Some things to check are:



- Check that there are no "lockouts" or "tagouts" attached to the controls.

- Ensure fluid levels are correct per the operator's manual and no leaks present prior to starting.
- After starting the engine, check all indicators, emergency stop, trip devices and gauges for serviceability.
- Check the fire extinguisher(s) for charge and accessibility.
- Clean the cab interior windows if necessary.



- Check access ladders and decking for damage and slipping hazards such as mud, oil or ice.

- The operator must properly secure the drill to prevent the machine from being operated by unauthorized individuals.
- The operator must never permit personnel to ride on the machine except in the passenger compartment.



- The operator should treat all power lines as live.

Planning the Job

The person in charge must have a clear understanding of the work to be done and consider all the hazards at the site. He must develop a plan to do the job safely and explain the plan to the crew members involved. Factors such as these should be considered:

- Are there utility lines or structures that must be moved or avoided?
- Are there unusual or extreme weather conditions expected?
- Will moving the machine be done in confined space?
- Will operating the machine be done in night hours?
- Will the machine be propelled on inclines?
- Will special transport tools be required to complete the job?

Operating Precautions



- Operating near or contacting a power line with any part of the machine can result in electrocution.

Use extreme caution when operating machine in the vicinity of electrical power lines. Check the minimum safe operating perimeter set by local, state or federal regulations when equipment is near powerlines.

- Before leaving the operator's station, all controls must be in the neutral position with all locking and safety devices engaged.

Do not allow the drill to operate unattended.

- Do not park or position the machine on grades that exceed the tilt ratings.

Park or position the machine on level ground or across (horizontal) grade

- Park or position the machine to allow the wind to carry engine exhaust fumes away from the operator.

Exhaust fumes from diesel engines are lethal.

- Accessories and decks may be attached to the mast for transit purpose.

DO Not operate the mast function with accessories secured in the mast for transit.

General Safety Practices

While operating this machine be aware of the following:



- The sudden release of a pressurized lid or hose can spray hot oil.

Do not open hydraulic tanks, air reservoirs or hydraulic connections while the machine is running or the systems are under pressure.

- Pressure in hydraulic systems can be retained for long periods of time. If not properly released before maintenance people attempt to work on the hydraulic system, this pressure can let components move or cause hot oil to spray and hose ends to shoot out at high speed.

Release system pressure before attempting to make adjustments or repairs.

- Before entering any enclosure, be sure that the door is secured open. Avoid entrapment, be sure that no one is inside any enclosure before closing and latching the doors.

Enclosures can cause suffocation.

- Before starting any service or maintenance work, always perform a safety/risk analysis of the task.

Performing maintenance work without the proper tools and personal protection equipment can cause serious injury or death.

- Climbing the mast is a crushing and falling hazard.

Climbing the mast may cause serious injury or death. Stay off the mast at all times.



- Hydraulic oil under extreme pressure from a small opening can penetrate the skin and inject oil into the body.

Do not attempt to locate a hydraulic leak by using your hand.



- Carelessness in getting on and off equipment can result in serious injuries.

Always wait until the machine has completely stopped. Do not jump on or off. Always use both hands and feet and use the 3-point contact rule.

- Riding the rotary head up and down the mast is a crushing hazard.

Never ride the rotary head for any reason!!! It was not designed to be an elevator.

When there is a need for an operator or helper to work on the rig in the working area or danger zone and this work involves activation of one or several machine functions, this work shall only be done under the following conditions:

- e. There must be two safety trained people present, one should supervise the safety of the other doing the servicing. Supervision should be done from the operator's station to ensure immediate access to an emergency stop at all times.
- f. The area where the operation is to be done should be properly illuminated.
- g. A reliable mode of communication should be establish between the operator and the supervisor.
- h. The rig must be completely shut down and all methods of starting disabled before servicing work begins.

Fire Prevention



- Clean-up any oil and fuel spills particularly around hot surfaces and heat producing components.

- Check the Fire Suppression System (FSS), if fitted, for damaged hoses or cylinders.
- Check all electrical lines and connections including battery terminals for a tight fit, wear, abrasion, and corrosion.
- Check all machine ignition points (engine block, exhaust manifolds, mufflers, turbo-chargers, etc...) to make sure they are not in contact with any hoses.
- Keep the batteries secured in their compartment and covered.



- Never inject ether or other starting aids into the engine and compressor intake filter(s). Ether or other aids drawn into the compressor can cause an explosion.

- Do not store flammable fluids on or in the immediate vicinity of the machine.



- Engine oil, hydraulic fluid and compressor oil are flammable. Do not operate a machine with leaking hoses or lines.
- Do not attempt to perform welding repairs until all flammable materials including oil and fuel spills oily rags, and rock and coal dust, have been isolated or removed from the machine.

- Disconnect the battery cables before welding on the machine.
- Keep tools away from exposed live electrical parts such as terminals, to avoid arcing.
- If charging the batteries, always turn the charger off before making or breaking connections to the battery.

1. LIFTING INSTRUCTIONS

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1.1. Lifting and Transporting the Machine

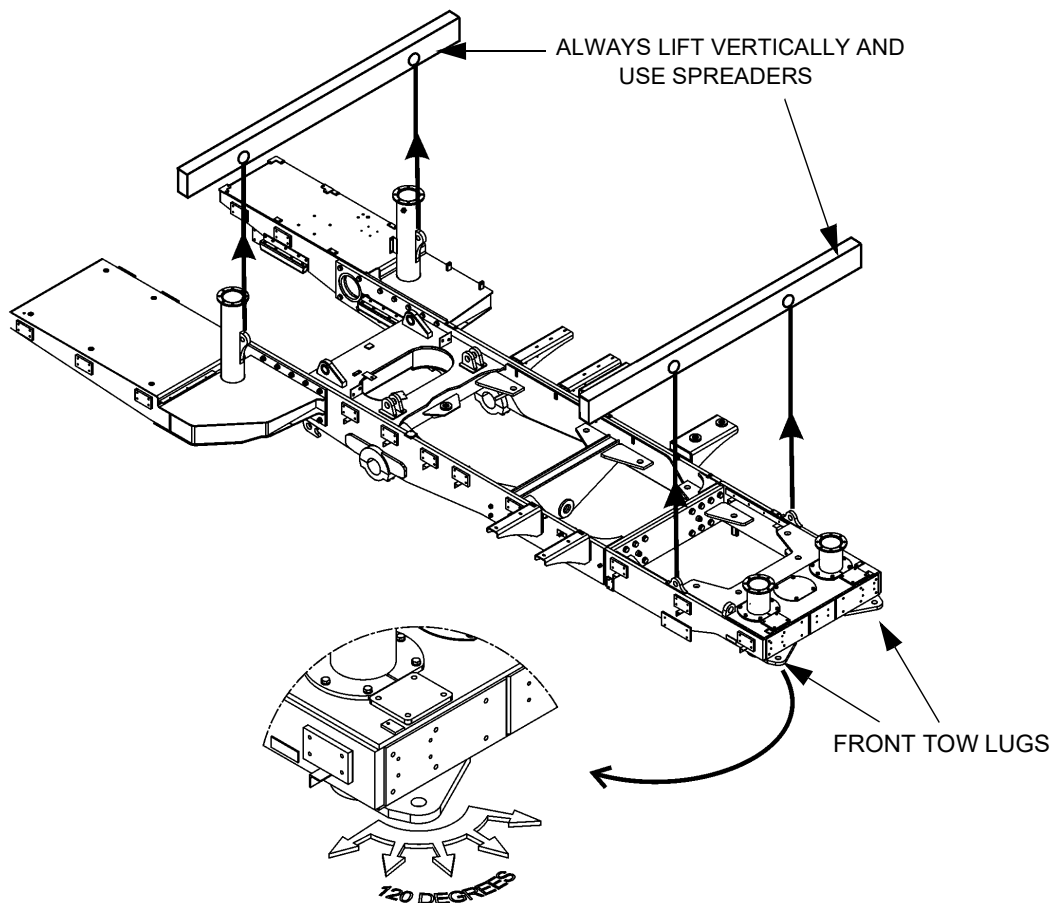
The following procedures are to be used as a guide. The equipment you have and the regulations for lifting and transporting this type of equipment will vary.

1. Clean the machine to remove any rocks or dirt that might dislodge during transporting.
2. Before lifting the machine, refer to the technical data plate to determine the machine's weight (GVW). Lifting points (4 places) are marked on the machine.

1.2. Safety First

- Always Perform Job Risk Assessment
- Always Wear Proper PPE

1.3. Lifting the Machine



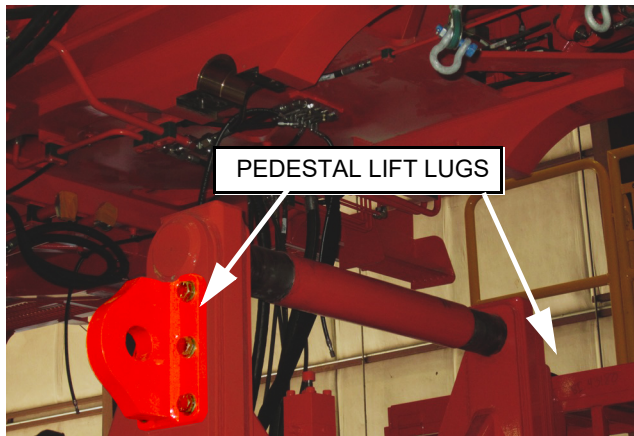
All lifts should be vertical and spreaders must be used to prevent side loads on frames or masts.

1.3.1. Removing Machine from Transport

Prepare the loading area for the machine before loading operation begins.

1. Position cranes to lift machine.
2. Position truck with machine underneath the cranes, allowing room to pull truck from under machine once lifted.
3. Ensure the shipping kit is installed on the machine.
4. Connect cranes and lifting device to machine. Lifting device should hang from crane hooks.
5. Attach lifting devices to the lift points on the machine.
 - Front lift lugs (near front tow points)
 - Pedestal lift lugs
6. Use spreaders to keep a vertical load on all lifts.
7. Lift the machine from the truck.
8. Position machine over the ship.
9. Lower the machine onto the ship.
10. Use wood blocking to stabilize the machine on the ship and to keep weight off the fuel tank.
11. Secure the machine to the ship.

All the different situation requirements cannot be given, so always consult your dealer if questions arise regarding lifting or towing this machine.



1.3.2. Loading Machine onto Transport

Prepare the loading area for the machine before loading operation begins.

1. Position cranes to lift machine from the ship.
2. Connect cranes and lifting device to machine. Lifting device should hang from crane hooks.
3. Attach lifting devices to the lift points on the machine.
 - Front lift lugs
 - Pedestal lift lugs
4. Use spreaders to keep a vertical load on all lifts.
5. Drive the transport vehicle underneath. The transport should be backed under the machine to keep the vehicle operate away from the area directly under the machine.
6. Lower the machine onto the trailer.
7. Use wood blocking to stabilize the machine on the trailer and to keep weight off the fuel tank.
8. Secure the machine to the trailer.

All the different situation requirements cannot be given, so always consult your dealer if questions arise regarding lifting or towing this machine.

1.3.3. Shipping Kit

Ensure the shipping kit is installed and secure to the machine. If not, install a shipping kit before transporting the machine.

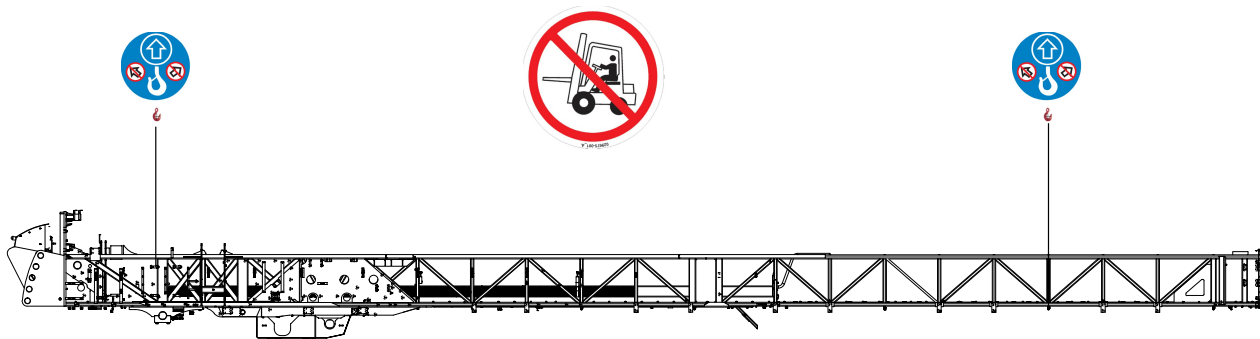


1. Install the shipping brackets.
2. Cut old remains away if necessary.
3. Use fork lift or other lifting device to hold brackets in place.
4. Weld new shipping brackets in place.
5. One bracket attaches to the frame near front of the crawler.
6. One bracket attaches to the axle.

1.3.4. Lifting the Mast

Lift the mast only at the lift locations indicated on the mast by lifting decals. Any other lifting points could damage the mast.

NOTE: Perform a risk assessment with the assembly crew and crane operator prior to lifting the mast structure. Establish crane operators and ground guides that will communicate during the lift and install process.



GENERAL

The intended purpose of this manual is to assist truck drivers and shipping dock personnel with starting and moving Sandvik rotary drill machines.

1. The procedures listed herein can be used to as a guide to operate or troubleshoot starting or operating a Sandvik rotary drill machine.
2. The procedures listed have been recorded start or operational problems and symptoms that may limit machine start or machine operation.
3. When required machine specific procedures will be noted.
4. Check and/or correct the item or items noted.

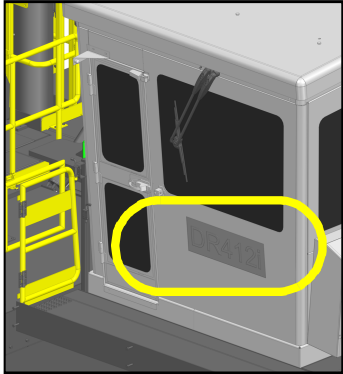

Attention Truck driver and/or dock personnel:

If you have trouble starting or operating this machine and you alter this product in any form *Please make notice inside cabin of the discrepancy* for our recipients at final destination. Someone at final destination must make necessary troubleshooting repairs. Altering this product for the purpose of transport may affect product warranty.

Sandvik Mining and Construction
Alachua, Florida USA
386-462-4100 Product Support

After hours contact:
David Gillenwalters 352-213-3069

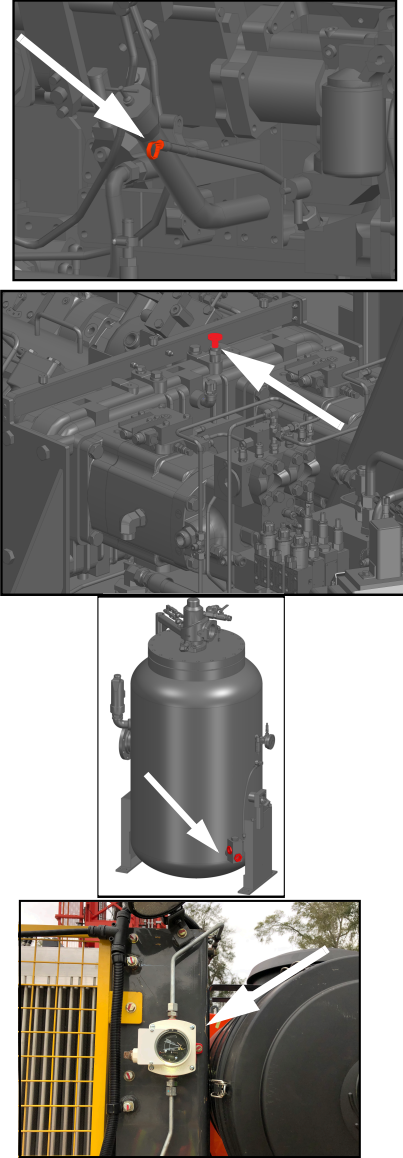
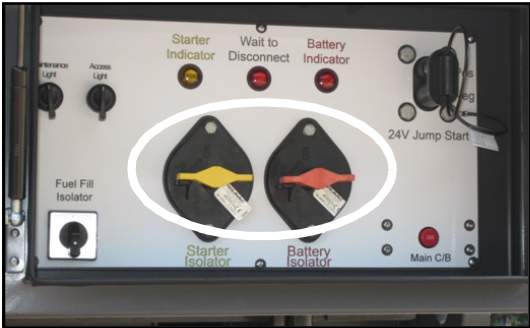
Prior to calling please note the machine model, by decal on frame, and the 6 digit numeric serial number (73xxxx) inside the cabin on the door. These two items are required so we can better assist with starting or operational problems:

| MACHINE MODEL | MACHINE SERIAL NUMBER 6 digit # |
|---|--|
|  |  |

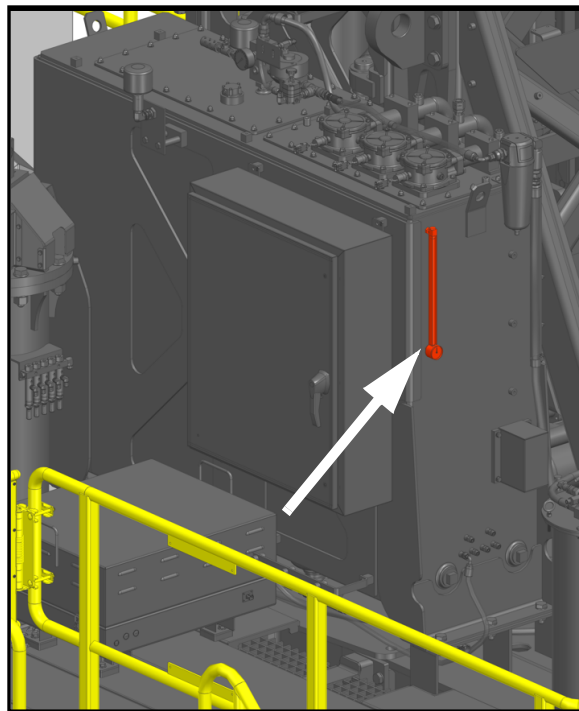
TRUCK DRIVER INSTRUCTIONS


1. Starting the drill

Use the following table as a tool for starting the machine.

| Function | Location |
|--|--|
| <p>1A. Check fluid levels.</p> <p>Engine oil (dipstick)</p> <p>Gearbox oil (dipstick)</p> <p>Compressor oil (center sight glass)</p> <p>Radiator coolant (sight glass)</p> |  <p>The first image shows the engine oil dipstick location with a white arrow pointing to a red handle. The second image shows the gearbox oil dipstick location with a white arrow pointing to a red handle. The third image shows the compressor oil sight glass location with a white arrow pointing to a red handle. The fourth image shows the radiator coolant sight glass location with a white arrow pointing to a white sight glass.</p> |
| <p>1B. Set Starter Isolator and Battery Isolator to ON.</p> |  <p>The image shows a control panel with several indicators and switches. A white oval highlights the Starter Isolator (yellow handle) and Battery Isolator (red handle) switches, both of which are in the 'ON' position. Other indicators include Starter Indicator, Wait to Disconnect, Battery Indicator, Fuel Fill Isolator, Main C/B, and 24V Jump Start.</p> |

Check Hydraulic Level

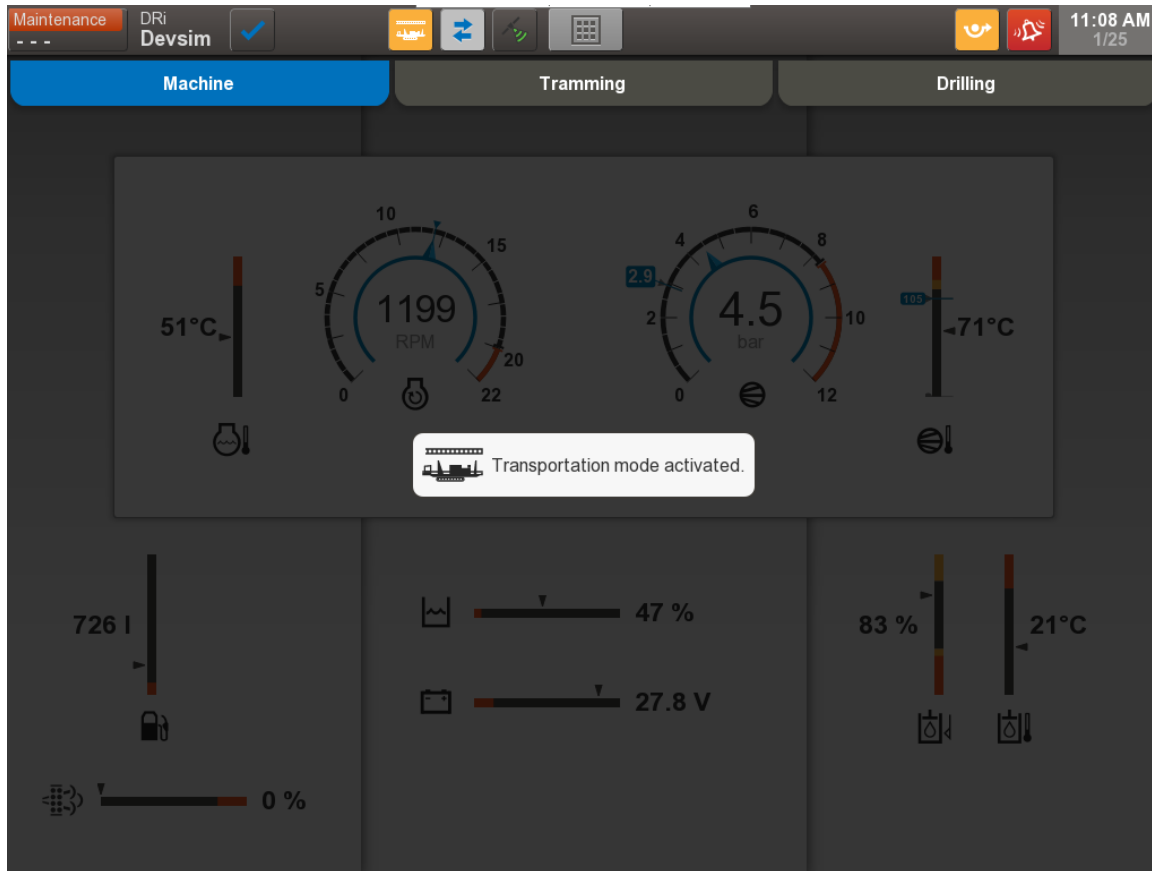


| Function | Location |
|---|---|
| <p>1C. Operator controls in neutral position</p> <p>Do not push joysticks.</p> <p>1D. Ensure that E-Stop (red button) is not depressed.</p> |  |
| |  |
| <p>1F. Key switch 'ON' and wait for display to power up prior to pressing 'START BUTTON'</p> <p>1G. Push the Start button.</p> <p><i>NOTE!</i> Some machines use an engine pre-lubrication system which activates by the START button. This function causes a slight delay before the engine begins to crank and is normal.</p> <p><i>NOTE!</i> If the engine fails to start or stay running, wait for receiver air pressure to drain to zero before attempting to restart.</p> |  <p style="text-align: center;">KEY SWITCH</p>  <p style="text-align: center;">START BUTTON SHUTDOWN BUTTON</p> |

2. Transportation Mode

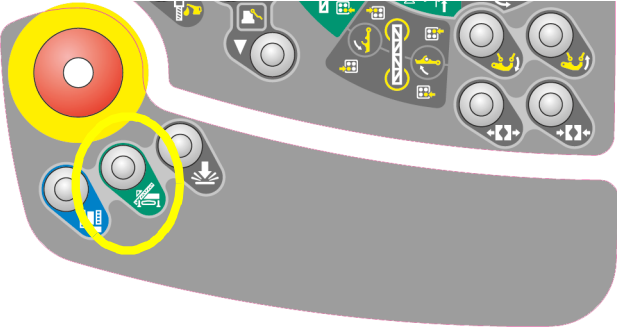
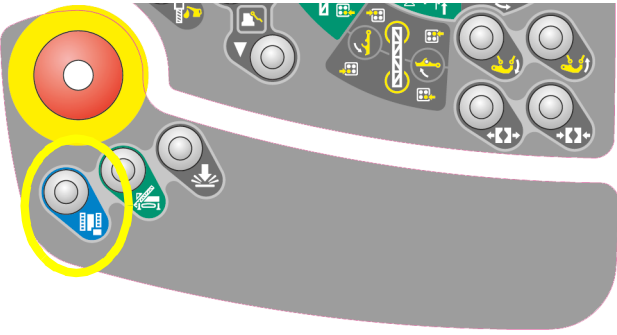
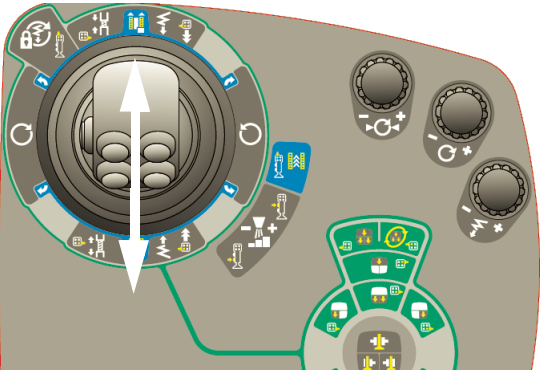
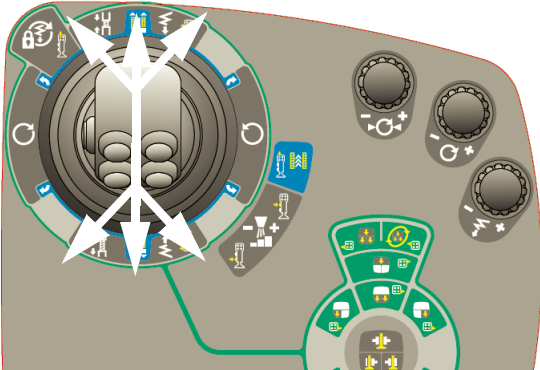
The machine is shipped from the factory with the transportation mode turned ON. In this mode, the bypasses are set to ON automatically and machine is ready for tramming.

When transportation mode is activated, home screen appears dim. Refer the image below.




3. Tramming the machine:

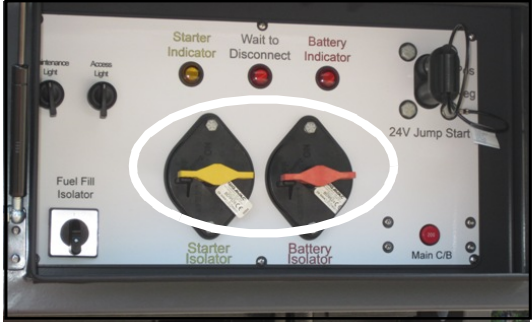
Use the following table as a tool for tramming the machine.

| Function | Location |
|---|--|
| <p>3A. Ensure the jacks are fully up before tramming. If not, press the Setup button (green) and raise the jacks before attempting to tram.</p> |  |
| <p>3B. Press the Tram Mode button (Blue button on Left Control Panel) to engage Tram mode and use joystick on Right Control Panel to move in desired direction.</p> <p>NOTE! If the machine will not tram or shows any error messages, refer to the troubleshooting in Section 5.</p> |  |
| <p>3C. Use the Right Joystick on the right armrest to tram the machine.</p> <p>3D. Push forward to tram forward on that same side. Pull rearward to tram rearward.</p> <p>NOTE! The coolers are at the FRONT of the machine. The cab is at the REAR of the machine.</p> |  |
| <p>3E. To turn the machine, use the Right Joystick.</p> <p>3F. Push the joystick forward and then push in the direction to turn. Pull the joystick rearward and then push in the direction to turn.</p> <p>NOTE! Joystick must be forward or rearward. Only pushing left or right will not turn the machine.</p> |  |

4. Shutting down the drill

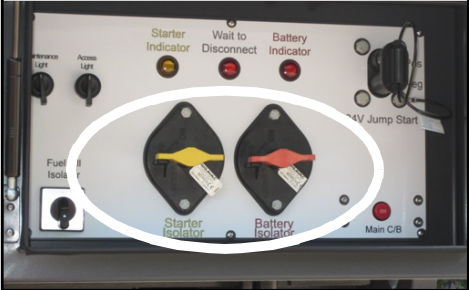

Use the following table as a tool for shutting down the machine.

| Function | Location |
|--|--|
| <p>4A. Operator controls in neutral position</p> <ul style="list-style-type: none"> • Do not push joysticks. • DO NOT press E-Stop (red button). |  |
| <p>4B. Actuate the Shutdown button.</p> <p>4C. Press and release "Shutdown Button" Wait until the engine has shut down.</p> <p>4D. Key switch to 'OFF'.</p> <p>4E. Wait for the control screen to shut down (the display will turn dark or black).</p> <p><i>NOTE!</i> The control screen will not shut down until the key switch is turned OFF.</p> |  <p style="text-align: center;"> START BUTTON SHUTDOWN BUTTON </p>  <p style="text-align: center;">KEY SWITCH</p> |

| Function | Location |
|--|---|
| <p><i>NOTE: Wait for green light (Wait to Disconnect) to go off before switching isolator switches to the off position.</i></p> <p>4F. Set Starter Isolator and Battery Isolator to OFF.</p> |  <p>The image shows a control panel with several components: a yellow 'Starter Indicator' light, a red 'Wait to Disconnect' light, and a red 'Battery Indicator' light. Below these are two large black switches with yellow and red handles, labeled 'Starter Isolator' and 'Battery Isolator' respectively. Other components include a 'Fuel Fill Isolator' button, a '24V Jump Start' button, and a 'Main C/B' (circuit breaker) button. The panel also has 'Access Light' and 'Emergency Light' indicators.</p> |

5. Troubleshooting

Use the following table as a tool for shutting down the machine.

| Problem | Items to check/correct | Location |
|--|---|--|
| <p>4A. Engine will not start</p> <p><i>NOTE!</i> No power in cab (Control screen does not come on.)</p> | <p>Battery isolator switches</p> |  |
| <p>4B. Engine will not start</p> <p>Any of up to four emergency stop push buttons interrupt starting</p> | <p>Emergency stop push button 1 on cab operator panel</p> <p>On the operator's Left Control Panel, turn red button counterclockwise to release</p> <p>Emergency stop push button 2 beside boarding ladder</p> <p>This switch may be removed from frame and tied for transit</p> <p>Turn red button counterclockwise to release</p> <p>Emergency stop push button 3 is located on Main Electrical Cabinet (MEC). Turn red button counterclockwise to release</p> |  |

4C. Engine will not start

Main circuit breaker on engine junction box
Push to reset main breaker stamped with 105 or 175

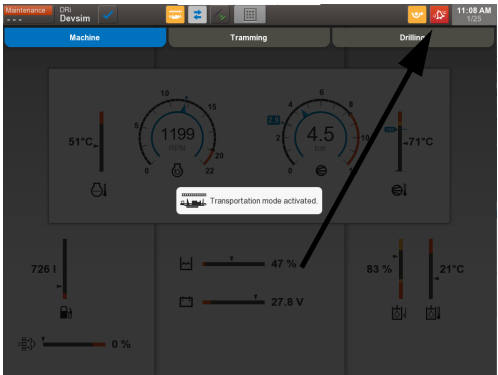


6. For Dock Personnel

Steps for starting and operating rotary drill

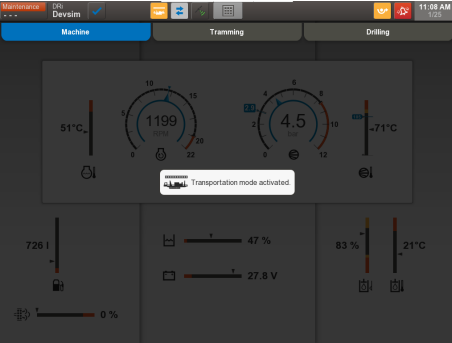
Refer to the truck driver instructions for starting and operating.

Use the following table as tool for troubleshooting the machine. This section notes technical details that may require hand tools to troubleshoot and get machine operating.

| Problem | Items to check/correct | Location |
|---|--|---|
| <p>1A. Engine will not start Engine turns over spinning fast</p> <p>No evidence of fuel</p> <p>No start condition</p> | <p>Power when key is engaged</p> <p>Check fuel level.</p> <p>After engaging Start, the machine will continue to try starting until E-Stop is pressed.</p> | <p>Reference emergency stop switches.</p> <p>Reference fire suppression switch.</p> <p>On left armrest.</p> |
| <p>1B. Engine will not start</p> <p>Engine turns over spinning fast</p> <p>No start condition</p> | <p>Check alarm log by pressing red bell icon (top right of display screen) for active alarms.</p> <p>Engine problem requires technician</p> <p>Call factory with machine model and serial number</p> |  |

Technical subjects needing technician

The following may require hand tools and technical support.

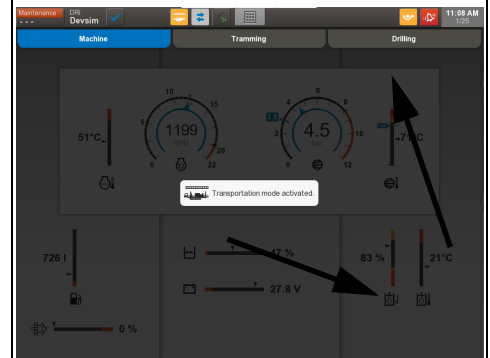
| Problem | Items to check/correct | Location |
|--|---|--|
| <p>2A. Engine starts and engine stops</p> <p>Engine starts then stops No start condition</p> | <p>Low air pressure in air receiver tank</p> <p>Check air hoses, inlet control valve, or call factory with machine model and serial number.</p> | <p>After system start air pressure will rise to 8.5 bar.</p> <p>NOTE: Should not exceed into red range on gauge</p> <p>If air pressure is in the red, tank is over-pressurizing and an alarm will notify operator of exceeding pressure within the receiver tank.</p> <p>If receiver tank pressure is below 2 bar, the system will shut down and alarm will activate notifying operator of low pressure.</p> <p>Note: Low compressor oil pressure alarm will be activated</p>  |

2B. Engine starts and engine stops

Engine starts then stops No start condition

Check fluid levels.

Turn the ignition key OFF and allow the GUI to shut down. Turn the ignition key ON, allow the GUI to reboot, and restart.





Sandvik Mining
13500 NW County Road 235
Alachua, Florida 32615 USA
ROCKTECHNOLOGY.SANDVIK