Operation & Maintenance Instructions

MS Pickup Machine
Operation & Maintenance Manual

Cedarapids
A Terex Company

20575 (8/94)

Part # 49999-177

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Introduction

To the Owner & Operator:

Cedarapids, Inc. tries to provide information that gives our customers a clear understanding of equipment construction, function, capabilities and requirements. This information is based on the knowledge and experience of qualified people at our company and in our field organization. Proper use of this information rewards users of Cedarapids equipment with high efficiency, maximum service life and low maintenance costs. That is why we strongly recommend that anyone using our equipment be familiar with this manual.

This manual is not a bible. Information presented here should not be considered authoritative in every situation. Users will, as a matter of course, encounter problems and circumstances that raise questions not anticipated here. Such questions should be directed to Cedarapids, Inc.

Anyone who uses this equipment for any purpose other than that for which it was intended assumes sole responsibility for dangers encountered and injuries sustained as a result of such misuse.

Respectfully,
Cedarapids Inc.

Danger - Federal, state and local safety regulations aim to protect both people and property from accident, injury and harmful exposure. When complied with, such regulations are often effective. Hazards to life, limb and property are further reduced when this equipment is used in accordance with all operation and maintenance instructions. Generally:

1) Read and heed all danger, warning, caution and notice decals. Know what guards and protective devices are included and see that each is installed and in operation condition. Additional guards and protective devices may be required and must be installed by the user (owner) before operating.

2) Never attempt to maintain, lubricate or adjust this equipment while it is running. Lock out and tag out all energy sources before doing maintenance, cleaning, adjusting or repairing this equipment. Make it impossible for anyone to start this machine while others are working on it or in it.

3) Wear protective clothing such as hard hats and safety shoes, and use protective equipment such as ear plugs and safety glasses when operating this equipment. Do not wear loose clothing or long hair.

4) Think safety and act safely. Stay alert at all times. Eliminate or neutralize potential hazards as soon as you spot them. Never allow anyone to engage in horseplay when near this equipment.

Danger - Failure to take these precautions will result in death or severe personal injury.

The following warning applies to Cedarapids equipment supplied with lead-acid batteries:

Warning: Battery posts, 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.

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Introduction

About This Manual

We have tried to provide information which will give you a clear understanding of equipment construction, function capabilities and requirements. This information is based on the knowledge and experience of highly qualified people at our company and in our field organization. Proper use of this information will promote high efficiency, maximum service life and low maintenance.

We strongly recommend that all persons directly involved with this equipment be familiar with this manual whether or not you have experience with previous generations of pick-up machines.

Experience has shown that it is to your advantage to have a copy of this manual on site where the operators can consult it as needed and have a copy on file in your office so the supervisors can conveniently refer to it.

Danger! *This manual contains vital information essential to proper and safe operation of this equipment. Carefully read the entire manual before attempting to operate this equipment. Failure to follow instructions and warnings contained in this manual can cause severe personal injury or death or substantial property damage.*

Additional copies can be ordered through your local Cedarapids Distributor Representative.

On going improvement of product design may result in future changes to some parts. When ordering replacement parts, please be exact as possible in describing the part. Use part numbers, model number and serial number to communicate with your local Cedarapids Distributor Representative.

When you have a question about your pick-up machine or operation manual, please contact your local Cedarapids Distributor Representative.

About Cedarapids Inc.

Cedarapids is proud to manufacture this pick-up machine for your use and profit. We also take pride in the quality of our service and replacement parts.

Cedarapids Inc, located in Cedar Rapids, Iowa, USA, has been manufacturing heavy equipment for the construction industry since 1923. Our friendly, helpful people are ready and able to serve your needs.

If you have a question, a concern, or just want to talk over an idea about your equipment or application, please feel free to give us a call at (319) 363-3511 Monday - Friday 7:30 am to 4:30 PM Central Time. If you have a problem and need assistance during after hours, call our emergency service number at (319) 398- 9114. An operator will get your name and number so a service representative can return your call (usually with in 30 minutes). If your concern can not be resolved at that time a representative from engineering will be contacted. We are looking forward to serving you.

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General Information

Prior to consignment and unloading, the consignee must inspect the equipment for evidence of damage or loss. This inspection process should be thorough, because once the freight receipt is signed, complete acceptance on the part of the consignee is assumed.

Make a thorough inventory of all loose components packaged in boxes. A check list is provided in each box listing the components contained. While performing the inventory, inspect all loose components for damage which may have occurred during transit.

When evidence of damage or loss is discovered, have the driver make a notation on both the carrier's and consignees' copies of the freight bill. Prior to signing the freight bill, take pictures of the damage and identify the truck if possible. The consignee can then sign the bill to acknowledge delivery. The consignee should then have the carrier's terminal manager or his authorized representative make an official inspection of the damage or loss.

Equipment should not be moved from the original receiving point until this official inspection has been made. Good, clear photos will verify and explain damage in any claim action which may follow. When the inspection is done, the consignee should file a written damage claim with the carrier's office and should report this action to the area distributor for Cedarapids Inc.

If hidden damage is found after the carrier's representative has gone, do not continue any unpacking or in any way move the equipment.

Contact the carrier's local office and have the terminal manager or authorized representative make an immediate personal inspection of the damage. Obtain a written description of the damage, and photos if possible, signed by the representative as proof of a valid claim.

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Safety

Safety Rules

When operating the equipment, always follow the safety rules. Cedarapids makes no guarantee either expressed or implied that the equipment meets all local or federal safety regulations. It is the responsibility of the individual user to verify that all safety regulations are complied with before starting the machine.

Personal Safety Rules

Cedarapids equipment is designed with the safety of all personnel in mind. Do not attempt to change, modify, or eliminate the accident prevention devices installed at the factory. Make sure all personnel who regularly work or who might do work in the area of the equipment are familiar with the safety precautions. Owners and operators are responsible for safety information and following safe practices.

Guards, covers, and shields are installed around moving parts at the factory whenever necessary to prevent accidental injury to operators and others working on or near the equipment. Do not remove them. In some cases it is the customer's responsibility to properly guard the machine before operation.

DANGER! *This manual contains important information regarding the operation of your pick-up machine. Carefully read the entire manual before attempting to operate. Failure to read this manual and follow the instructions and warnings in it can cause severe personal injury, death or substantial property damage.*

- Only qualified and trained persons should operate, repair or maintain this equipment.
- Keep this manual for future reference.
- Federal, state and local safety regulations must be complied with to prevent possible danger to person(s) or property from accidents or harmful exposure.
- This equipment must be used in accordance with all operation and maintenance instructions.
- We strongly recommend that all persons involved with this equipment be familiar with this manual and all related engine manuals.
- Read all Danger, Warning, Caution and instruction decals.
- Know what guards and protective devices are included and see that each is used.

Hazard Seriousness Level

Signal words (DANGER, WARNING and CAUTION) are used to identify levels of hazard seriousness in this manual and on decals located on the equipment.

Definitions for identifying hazard levels are provided below with their respective signal words.

DANGER! *Immediate hazards which WILL result in severe personal injury or death.*

WARNING! *Hazards or unsafe practices which COULD result in severe personal injury or death.*

CAUTION! *Hazards or unsafe practices which COULD result in minor personal injury.*

Instructional and Informational Levels

Signal words (Notice and Important) are used to identify instructional procedures and informational suggestions or directions for Cedarapids equipment operation and maintenance

Definitions for identifying instructional or informational levels are provided below.

NOTICE! *Failure to follow proper instructional procedures could lead to serious and/or expensive damage to the equipment.*

IMPORTANT! *Informational suggestions or directions regarding operational and maintenance of equipment.*

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DANGER! *Never attempt to install or remove any part or assembly when the paver is running.*

CAUTION! *Wear protective mask when harmful air pollution exists.*

WARNING! *Wear clothing that fits snug to prevent getting caught in moving parts. Loose-fitting clothing should never be worn.*

CAUTION! *Wear safety goggles, gloves and long-sleeve shirts when in close proximity to hot asphalt materials.*

CAUTION! *Wear ear plugs if needed.*

WARNING! *Mount and dismount the machine using only the steps, handrails and walkways provided.*

WARNING! *Do Not mount or dismount the machine when it is moving.*

WARNING! *Keep all personnel clear of pick-up machine when operating.*

DANGER! *Do Not allow personnel to walk between the pick-up machine or truck.*

DANGER! *Do Not refuel the pick-up machine with the engine running. All sparks and open flames must be kept a minimum of 50 feet away from the machine when refueling.*

CAUTION! *To prevent fire hazards, keep the engine area free of oil, fuel and trash buildup.*

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Know Your Machine

Basic recommendations and suggestions are contained in this manual. Read this manual and engine manuals furnished with your machine for complete information. Instruction manuals are available upon your written request. Serial Number of the machine will be needed to acquire the correct manuals.

Become Familiar With All Controls

WARNING! *Read all caution and warning decals and become familiar with all controls and what each does before attempting to start and or operate the pick-up machine.*

Console Gauges & Switches (All models)

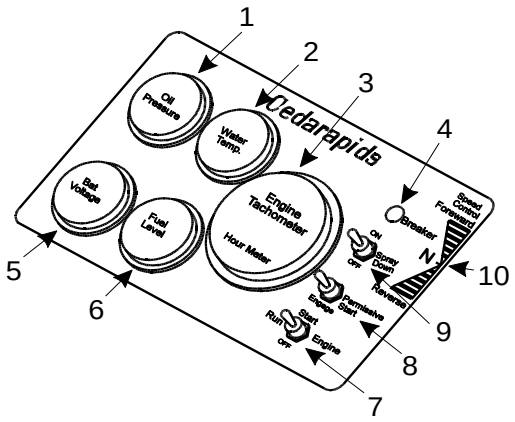

Figure 1

The following gauges and switches perform the listed functions (Figure1):

1) Engine oil pressure gauge. Registers the current engine oil pressure.
2) Engine water temperature gauge. Registers the current engine water temperature.
3) Engine tachometer reads current engine RPM. The gauge also reads number of engine hours.
4) Electrical circuit breaker: Protects the electrical system in case of a short.
5) Battery voltage. Registers the battery voltage level.
6) Fuel level gauge. Registers the amount of fuel in the fuel tank.
7) Engine Start/Stop/Run toggle switch.
8) Permissive start switch. When engaged provides electrical power to fuel solenoid for starting when oil pressure is at 0 PSI.
9) Spray-Down switch. Turns the electrical fuel pump ON for cleaning the machine (if so equipped).
10) Speed control gauge. Indicates direction conveyor control lever must move to turn the conveyor in the foreword or reverse direction.

Control Lever & Throttle (MS1 & MS2)

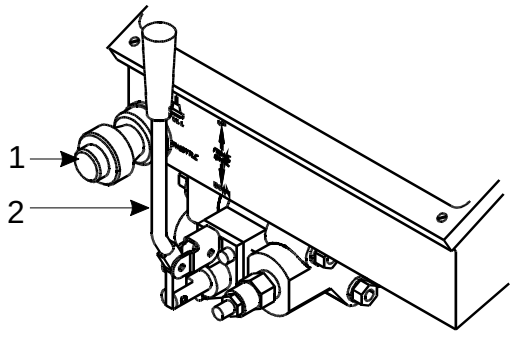

Figure 2

The following controls perform the listed functions (figure 2):

1) Throttle: When pulled out, runs the engine at Full throttle. Pushed in, runs the engine at Idle. The engine RPM can be increased or decreased in small increments by rotating the control knob. Counterclockwise increases the RPM, clockwise rotation decreases RPM.
2) Frame Raise control lever: Pulling the frame raise lever towards you causes the front bogie wheels to be retract, thereby lowering the frame. Pushing the frame raise lever in causes the front bogie wheels to be extend, thereby raising the frame.

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Control Levers & Throttle (MS3)

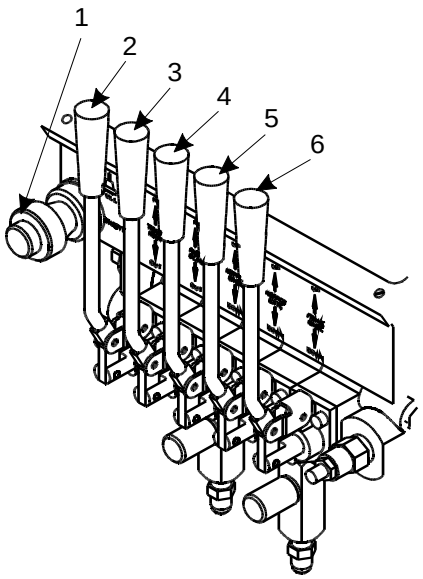

Figure 3

The following controls perform the listed functions (figure 3):

1) Throttle: When pulled out, runs the engine at Full throttle. Pushed in, runs the engine at Idle. The engine RPM can be increased or decreased in small increments by rotating the control knob. Counterclockwise increases the RPM, clockwise rotation decreases RPM.

2) Truck Hook (optional): If equipped, when you pull the lever towards you the truck hook clamp arms move out to release the truck tires. When the control is pushed in the truck hook clamp arms move in to clamp the truck tires.

3) Push Beam: The push beam control lever has 4 positions: When pulled out the push beam is extended. When pulled fully (into detent) out the push beam is in the float position. When in neutral position the push beam is in a hold position. When lever is pushed in the push beam is retracted.

4) Hopper Raise: When pulled out the hopper is lowered. When pushed in the hopper is raised.

5) Hopper Gate: When pulled out the hopper gate is lowered allowing less material to pass. When pushed in the hopper gate is raised allowing more material to pass.

6) Frame Raise control lever: Pulling the frame raise lever out causes the front bogie wheels to be retract, thereby lowering the frame. Pushing the frame raise lever in causes the front bogie wheels to extend, thereby raising the frame.

Before Starting Engine

Before starting the pick-up machine, The operator should check the following details personally.

- Be sure all Safety Items (decals, guards, walkways, and etc.) are intact.
- Engine Oil Level should be at the Full mark on the dip stick. If not add the correct amount of make up oil. Refer to SECTION 5 “Engine Oil Level”.
- Coolant Level inside the radiator should be just above the baffle. If not add the correct mixture of antifreeze and water (50/50 mixture). Do not over fill, excesses will be blown out the over flow. Refer to SECTION 5 “Coolant Level”.
- Hydraulic Oil Level should be at the Cold level in the sight gauge. If not add the correct amounts of make up oil to bring the level to the COLD level. Over filling when cold does not allow for thermal expansion when the oil is at running temperature. Excess oil will be blown out the breathers. This could cause a fire hazard. Refer to SECTION 5 “Hydraulic Reservoir & Filters”.

NOTICE! Do Not Mix Different Types of Oil, this could lead to unexpected failures.

- Engine Fuel Tank Level checked to ensure you have enough to operate the pick-up machine for the desired amount of time.

WARNING! *Perform a visual inspection of the complete machine including engine compartment, for any signs of damage or leaks. If any damage or leaks are noted Do*

Not Start the pick-up machine. Report the damage or leaks to your maintenance personnel.

Starting Engine

To start the engine perform the following actions:.

- Set all hydraulic control levers in the center position.
- Place the conveyor speed lever in the Neutral position.
- Make sure all personnel are clear of the machine.
- Push THROTTLE control in to idle position
- Press the engine OFF/RUN/START switch to the start position while holding the PERMISSIVE START switch in the override position.

NOTICE! If engine does not start in 30 seconds, allow starter to cool before trying again.

- Once engine is running, release START switch. The PERMISSIVE START switch must be held in the override position for approximately 15 seconds or until oil pressure is established.

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Checks & Adjustments

Engine Oil Level

WARNING! *Turn off engine before performing any inspections or maintenance.*

Never operate the engine with the oil level below the "L" (Low) mark or above the "H" (High) mark (figure 4). Wait at least 5 minutes after shutting off the engine to check the oil. This allows time for the oil to drain to the oil pan.

NOTICE! The engine must be level when checking the oil level to be sure the measurement is correct.

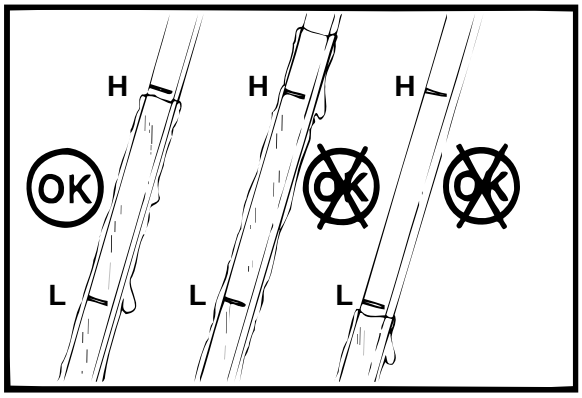

Figure 4

Fuel Filter/Water Separator

Glass fuel filter

WARNING! *Turn off engine before performing any inspections or maintenance.*

Replacement interval of the fuel filter/water separator is every 500 hour of operation. Given conditions may require replacement at shorter intervals for proper engine operation.

Check the glass sediment chamber of the diesel fuel filter for water or debris daily.

If present, drain the filter by loosening the bleed plug and removing the drain plug.

Metal spin on filter

WARNING! *Turn off engine before performing any inspections or maintenance.*

Replacement interval of the fuel filter/water separator is every 500 hour of operation. Given conditions may require replacement at shorter intervals for proper engine operation.

To replace the fuel filter, clean the area around the filter head. Remove the filter. Clean the gasket surface of the filter base.

Fill new filter with clean fuel and lubricate the o-ring seal with clean lubricating oil. Install filter and tighten.

NOTICE! Mechanical over tightening may distort the treads or damage the filter element.

Daily Maintenance

Drain the water and sediment from the separator daily.

Shut off the engine. Use your hand to open the drain valve. Turn the valve counterclockwise approximately 1-$^{1}|_{2}$ to 2 turns until draining occurs. Drain the filter sump of water until clean fuel is visible (figure 5).

NOTICE! Do not over tighten the valve. Over tightening can damage the threads.

Turn the valve clockwise to close the drain.

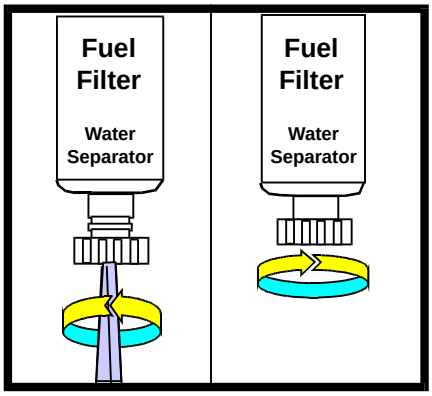

Figure 5

Engine Oil Filters

WARNING! Turn off engine before performing any inspections or maintenance.

Lubricating oil and filters should be changed at least every 250 hours of operation. Shorter intervals may be required due to operational conditions. Severe conditions require more frequent maintenance.

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Change the oil and filters to remove the contaminants suspended in the oil (figure 6). Refer to Engine Service and Maintenance manuals for recommended change interval.

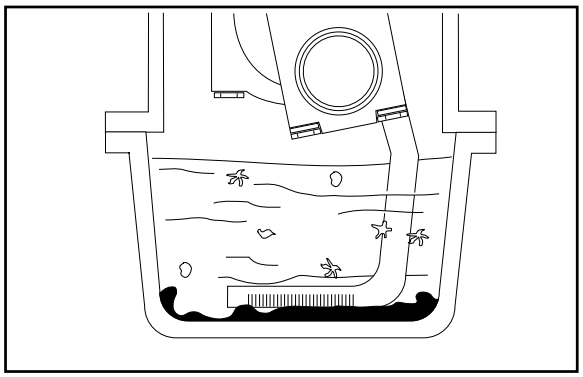

Figure 6

NOTICE! Drain the oil only when it is hot and the contaminants are in suspension.

Operate the engine until the water temperature reaches 60°C [140°F]. Shut the engine off. Remove the oil drain plug and drain into a container.

CAUTION! *Hot oil can cause personal injury. Protect the environment: handling and disposal of used engine oil can be subject to federal, state and local law regulation. Use authorized waste disposal facilities, including civic sites and garages providing authorized facilities for the receipt of used engine oil. If in doubt, contact your local authorities or the EPA for guidance as to proper handling of used engine oil.*

Refer to the engine manuals for the recommended type and grade of oil to be used.

Coolant Level

WARNING! *Turn off engine before performing any inspections or maintenance.*

The coolant level must be checked daily.

WARNING! *Do Not remove the radiator cap from a hot engine. Wait until the temperature is below 50°C [120°F] before removing the pressure cap. Failure to do so can result in personal injury from heated coolant spray or steam. Remove the filler cap slowly to relieve coolant system pressure (figure 7).*

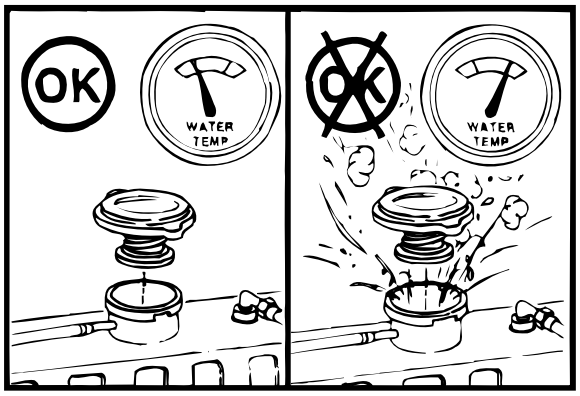

Figure 7

CAUTION! *Do Not add cold coolant to a hot engine. Engine castings can be damaged. Allow the engine to cool to below 50°C [120°F] before adding coolant.*

Fill the cooling system with coolant to the bottom of the fill neck in the radiator fill or expansion tank with a 50/50 mixture of antifreeze and clean water (Figure 8).

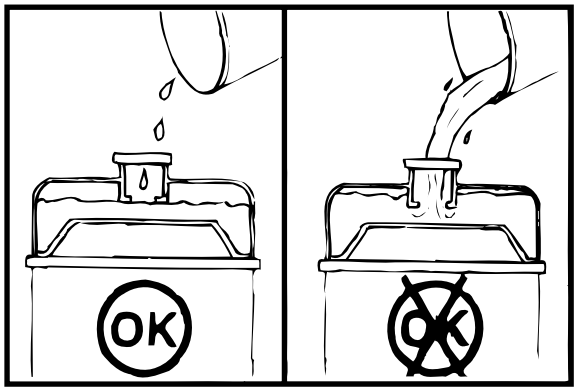

Figure 8

NOTICE! Overfilling does not leave room for thermal expansion. Excess coolant will be forced out of the overflow.

CAUTION! *Avoid prolonged and repeated skin contact with used antifreeze. Such prolonged repeated contact can cause skin disorders or other bodily injury.*

- Avoid excessive contact - wash thoroughly after contact
- Keep out of reach of children.

Protect the environment: handling and disposal of used antifreeze can be subject to federal, state and local law regulation. Use authorized waste disposal facilities, including civic sites and garages providing authorized facilities for the receipt of used antifreeze. If in doubt, contact your local authorities or the EPA for guidance as to proper handling of used antifreeze.

Clean Radiator and Oil Cooler

- The radiator and oil cooler should be checked daily for dirt and other buildup that would restrict the air flow. The paving conditions will determine how often the radiator and oil cooler require cleaning. If severe conditions exist or there are a lot of air-born contaminates the radiator and oil cooler will require more attention. Any leaks occurring from any engine compartment component, hose or tube will find its way into the radiator and oil cooler. When cleaning, check between the radiator and oil cooler for buildup.

WARNING! *Turn off engine before performing any inspections or maintenance.*

- Check for damaged hoses and loose or damaged hose clamps. Replace as required. Check the radiator and oil cooler for leaks in the upper and lower tank areas and the cores for damaged or bent fins. Clean and repair as required (figure 9).

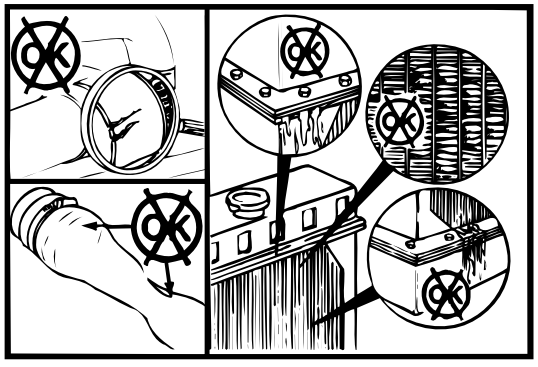

Figure 9

Engine Fan Belt

WARNING! *Turn off engine before performing any inspections or maintenance unless specifically instructed to the contrary in this manual.*

- Visually inspect the fan belt. Check the belt for cracks. Replace the belt if it is frayed or has pieces of material missing.
- Measure the fan drive belt deflection at the longest span of the belt.

Engine Fan

WARNING! *Personal injury can result from a fan blade failure. Never pull or pry on the fan. This can damage the fan blade(s) and cause fan failure.*

WARNING! *Turn off engine before performing any inspections or maintenance unless specifically instructed to the contrary in this manual.*

- Visual inspection of the cooling fan is required daily. Check for cracks, loose rivets, and bent or loose blades (figure 10). Check the fan to make sure it is securely mounted. Tighten the capscrews if necessary. Replace any fan that is damaged.

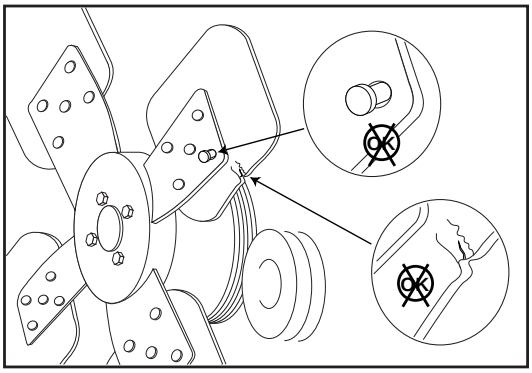

Figure 10

Engine Charging System

- Check the system voltage with the engine running at full throttle. Normal voltage is approximately 14 vdc.

Voltage readings of 15 vdc. And above are considered high and are usually an indicator of a failing alternator. Voltage readings of 13 vdc and below are considered as low and could be caused by a failing alternator, battery, loose fan belts, or bad wiring connections.

Normal battery voltage with the engine off and no system running is approximately 12.6 vdc. If voltage readings are below 12.6 vdc, it is an indicator of a failing battery or one that is not fully charged.

- The battery fluid level should be checked to ensure it at the correct level (figure 11).

WARNING! Do Not allow open flames or sparks near batteries. Battery fumes are highly flammable. Use of protective eye wear is highly recommended.

If necessary fill the battery with **clean water** to the bottom of the fill neck of each battery cell.

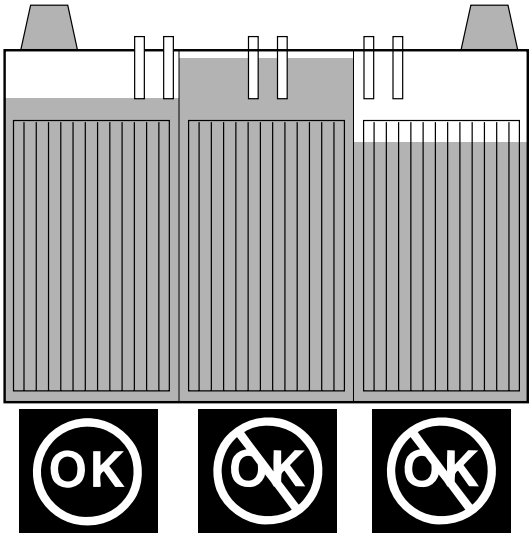

Figure 11

WARNING! Remove the negative terminal first then the positive. This will prevent sparks.

The battery terminals should be checked for corrosion buildup and tightness of connection (figure 12). If necessary remove the terminal cable and clean both the battery cable connector and the battery terminal. Reinstall the positive battery cable connector first then the negative and tighten securely. Loose and or corroded connections are a prime source of starting problems and other electrical problems.

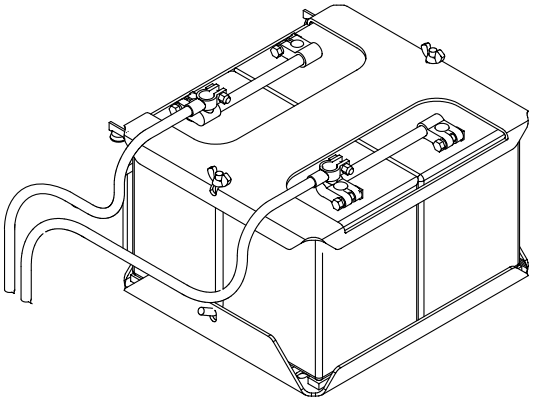

Figure 12

Cold Weather Starting

Operation in ambient temperatures below 0°C [32°F] can require special consideration be given to engine starting.

Starting fluid may be required for starting if the ambient temperatures are between 0° C [32° F] and -12° C [10° F].

WARNING! Never use starting fluid near open flame, or with a pre-heater or flame thrower equipment. This combination can cause an explosion.

WARNING! Do not breathe starting fluid fumes. Starting fluid fumes can be harmful to your health.

Oil pan and block heaters along with starting fluid may be required for starting if the ambient temperatures are between 0°C [32°F] and -24°C [-10° F]. Extra battery capacity along with starting fluid, oil pan and block heaters may be required for starting if the ambient temperatures are below -24° C [-10° F].

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Using Starting Fluid With Mechanical or Electric Metering Equipment:

- Ensure control levers are in NEUTRAL.
- Place engine stop/run/start switch to START while holding the PERMISSIVE START switch in the override position.
- While cranking the engine, inject metered amounts of starting fluid.

Using Starting Fluid Without Metering Equipment:

WARNING! *Do not use excessive amounts of starting fluid when starting an engine. The use of too much starting fluid will cause engine damage.*

- Spray small amounts of starting fluid into the air cleaner intake while another person cranks engine.

Jump Starting Machine

CAUTION! *Do not jump start the machine with anything except 12 VDC. Damage to the electrical systems or components may result.*

WARNING! *When using jumper cables to start the engine, make sure to connect the cables in parallel: positive (+) to positive (+) and negative (-) to negative (-). This will prevent sparks and possible damage to battery or electrical system.*

Engine Throttle

The engine should run smoothly after warm up, at the RPM listed in the table provided below.

An engine that does not run smoothly is an indicator that a potential problem exists. Dirty fuel filters and air cleaners are the most common cause of problems. If replacing these items does not correct the problem, further troubleshooting of the engine may be necessary. Refer to engine operation and maintenance manual for further information.

Engine Safety Shutdown System

The engine safety shutdown system consists of a water temperature sensor and a engine oil pressure sensor. This system is a safety system that will shut the engine off if the water temperature exceeds 223°F (Cummins) and 210° F (JD) or the engine oil pressure drops below 5 PSI. (Cummins) and 15 PSI (JD).

CAUTION! *Do not attempt to bypass the safety shutdown system. This could cause severe engine damage.*

Engine Air Filters

WARNING! *Turn off engine before performing any inspections or maintenance.*

The engine air cleaner is equipped with an indicator that trips red when it needs service. The indicator should be checked daily to ensure proper servicing (figure 13).

	IDLE Cummins John Deere	FULL THROTTLE (No Load) John Deere	FULL THROTTLE (Full Load) John Deere	FULL THROTTLE (No Load) Cummins	FULL THROTTLE (Full Load) Cummins
MS-1	800 to 850 RPM	2150 RPM	2000 RPM	2700 RPM	2500 RPM
MS-2	800 to 850 RPM	2150 RPM	2000 RPM	2700 RPM	2500 RPM
MS-3	800 to 850 RPM	2150 RPM	2000 RPM	2700 RPM	2500 RPM

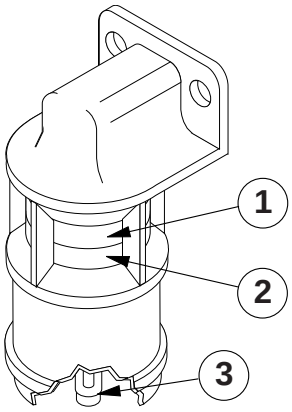

Figure 13

Change the filter element when the red indicator flag (2) is at the raised position in window (1).

After the air cleaner has been serviced, push the button (3) to reset the service indicator.

NOTICE! Never operate a machinery without an air cleaner. Intake air must be filtered to prevent dirt and debris from entering the engine and causing premature wear.

Running the machine with an air cleaner that needs replacement does not allow the engine to get the proper amount of air to burn the fuel properly, thereby reducing engine horsepower output.

When servicing an air cleaner take precautions not to allow any of the dirt or contamination that would happen to fall off the old element to remain in the filter housing or pass into the air inlet of the engine. Dirt and contamination are one of the biggest reasons for engine wear (Figure 14).

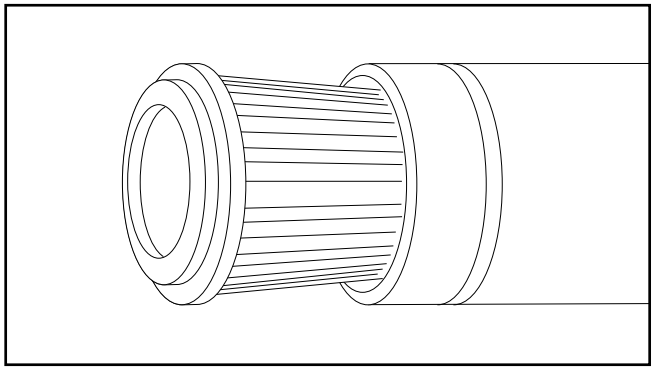

Figure 14

Improper cleaning of old air cleaner elements can damage the element and allow dirt and contamination to pass directly into an engine.

NOTICE! Do not beat or bang an element against something in an attempt to shake the dirt out. This will damage the element. Do not use high pressure air in an attempt to blow the dirt out. This will damage the element.

Engine Air Inlet Connections

WARNING! *Turn off engine before performing any inspections or maintenance.*

Inspect the inlet piping for cracked hoses, loose clamps, or punctures that can allow dirt and debris to enter the engine (Figure 15). Tighten or replace parts as necessary to make sure the air inlet system does not leak.

The air inlet system includes the piping from the air cleaner to the turbocharger and the piping from the turbo charger to the after cooler or inlet manifold depending on model.

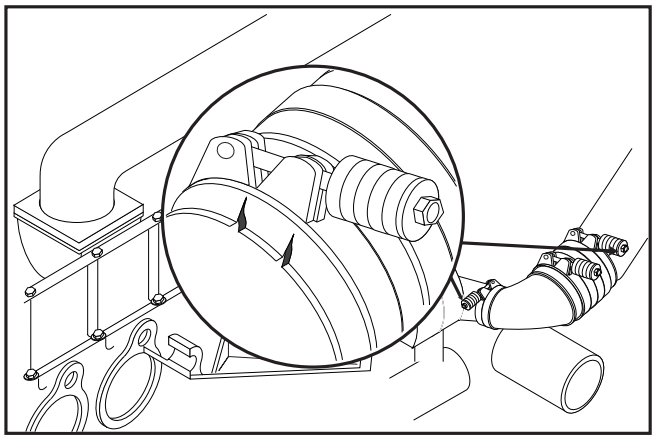

Figure 15

Hydraulic Reservoir & Filters

WARNING! *Turn off engine before performing any inspections or maintenance.*

The hydraulic oil level should be checked daily and maintained between the cold and hot levels. The oil level should be checked with the pick-up machine setting on flat, level ground.

The correct oil level is at the FULL mark when the machine is at normal running temperature (Figure 16).

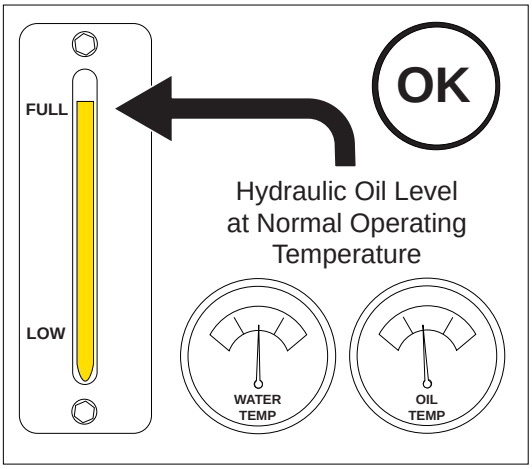

Figure 16

NOTICE! Filling to the FULL mark when the machine is cold does not leave room for thermal expansion. Excess oil will be forced out of the breather.

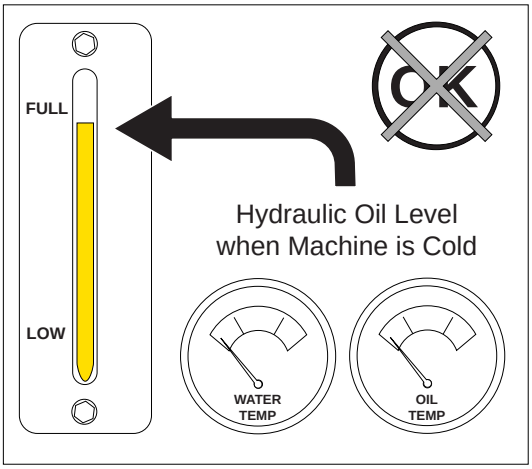

Figure 17

The hydraulic fluid should be drained and replaced with the correct fluid every 1000 hours of operation. The suction strainer located inside the reservoir, should be removed and cleaned when the hydraulic oil is changed (Figure 18).

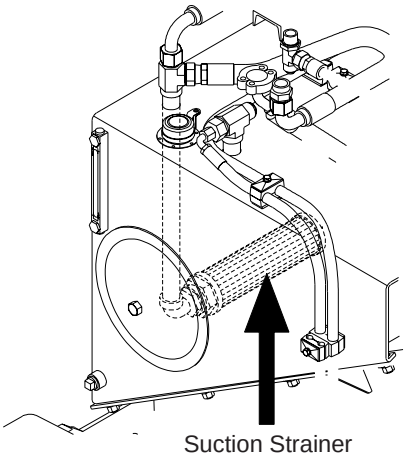

Figure 18

Hydraulic oil used should be ISO Grade 68 hydraulic oil. Typical brand names: Amoco AW68, Chevron AW68. Exxon NUTO H68, Mobil DTE26, Shell Tellus 68, and Texaco Rando HD 68.

Check all hose and tube connections daily, to ensure tight connection.

NOTICE! When replacing filters use OEM quality filters. Severe component damage may occur if sub-quality filters are used.

Charge Filter

The machine is equipped with a high pressure charge filter for the conveyor system. This filter should be replaced every 1000 hours of operation (Figure 19).

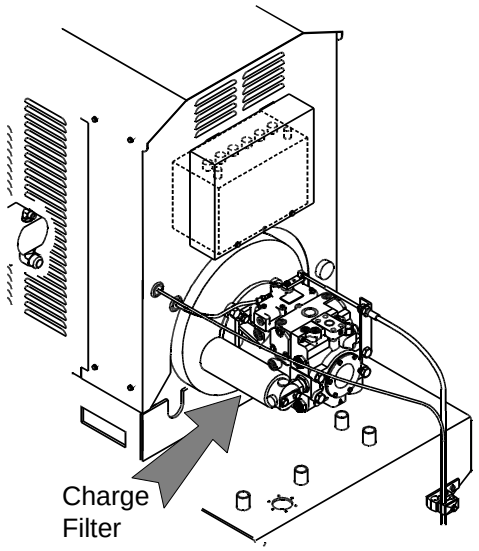

Figure 19

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NOTICE! When replacing filters use OEM quality filters. Sever component damage may occur if sub-quality filters are used.

Conveyor Chain Adjustment

The conveyor chains should be checked using a string line placed from the head shaft to the drive sprocket (Figure 20). Measure down from the string line to the chain at the point of maximum deflection. The proper adjustment range (measurement) is 6" to 8".

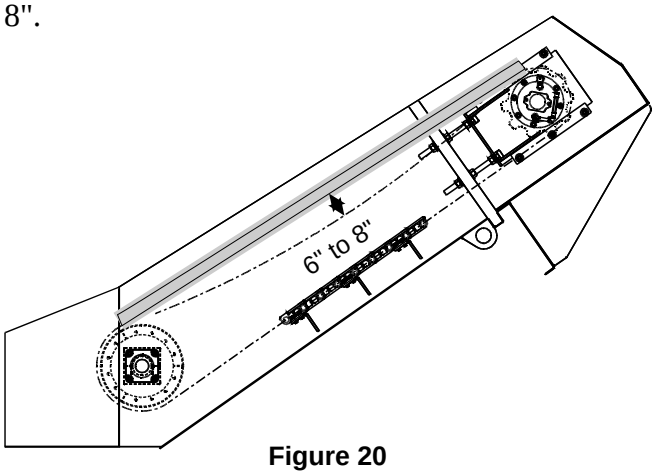

Figure 20

To adjust the conveyor, loosen the adjuster jam nuts on the side being checked. Tighten the jam nuts closest to the conveyor drive to tighten the conveyor chain. Once the correct adjustment range is achieved, tighten the bottom jam nuts to lock the adjuster (Figure 21). Repeat the same procedures on the opposite side.

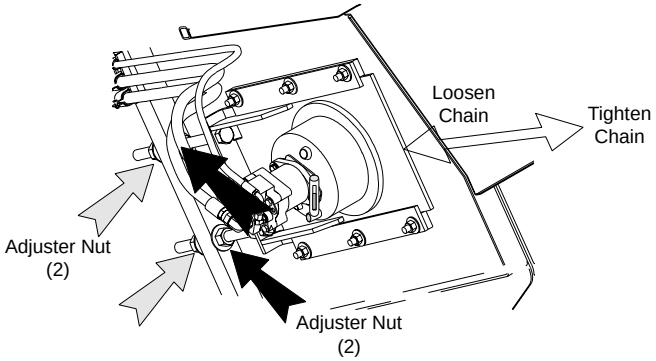

Figure 21

NOTICE! Make sure both chains are adjusted the same. Failure to do so will cause increased wear.

Conveyor Drive

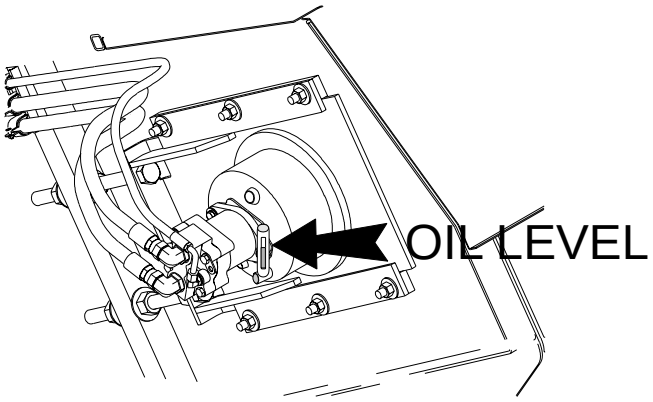

Figure 22

- Check the conveyor drive sight level gauge daily for oil level (Figure 22).

The correct level should be half up the sight gauge. Lubricating oil should be 80W-90. Typical brands: Amoco Multipurpose gear lube 80W-90, Texaco Multipurpose gear lube 80W-90, Mobilube HD 80W-90, Exxon gear oil GX 80W-90, Shell Spirax HD 80W-90.

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Operation MS-1 and MS-2

Towing Machine by Towing Tongue

WARNING! *DO NOT tow pick-up machine more than 20 miles per hour.*

CAUTION! *Check all wheel lugs for tightness after 20 miles travel. Recheck after 100 miles. Check frequently when equipment is being moved extended distances.*

IMPORTANT! MS-1 Only: Fold in rear caster to the transport position:

- Lower front of machine by using the FRAME RAISE lever 29 (Figure 23).

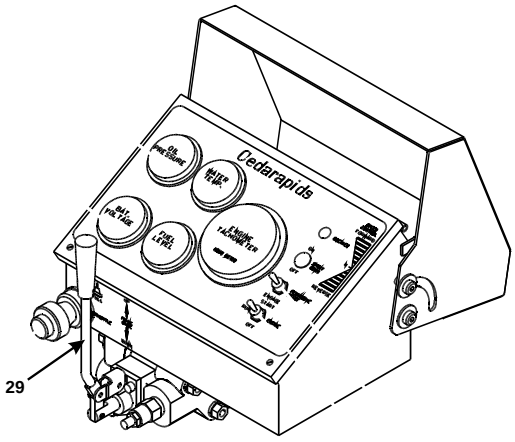


Figure 23

- Remove capscrews from red locking plate (22) on the locking linkage (23).
- Loosen jam nuts (25) on turnbuckle (24). Loosen turnbuckle and remove outboard capscrew in turnbuckle (Figure 24).

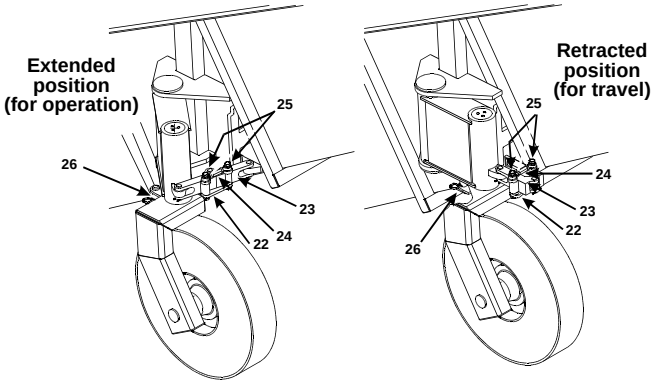


Figure 24

- Repeat this procedure for other side.

IMPORTANT! Make certain to leave rear caster locking pins (26) disengaged so casters will rotate (Figure 24 & 25).

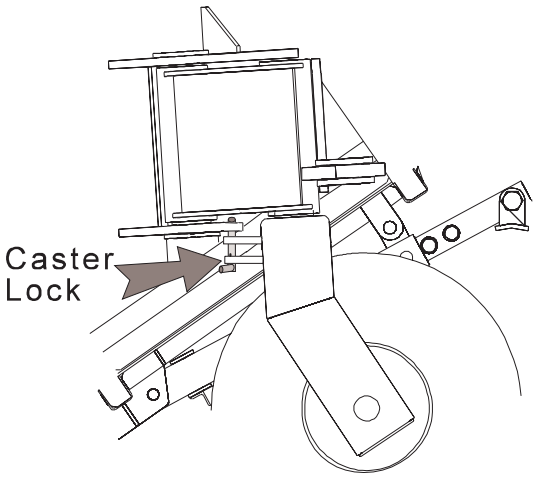


Figure 25

- Start paver and move paver forward until the casters are folded in.
- Shut off paver engine.
- Install capscrew in turnbuckle and tighten turnbuckle and set jam nuts.
- Install red locking plate and secure capscrews.
- Repeat this procedure for other side.
- Lock rear casters locking pins (26) to prevent the casters from rotating (Figure 15).

WARNING! Place blocking in front and behind the tires of the pick-up machine to prevent rolling.

- Disconnect paver attachments.
- Secure paver attachment assembly in the "UP" position 9 (Figure 26)

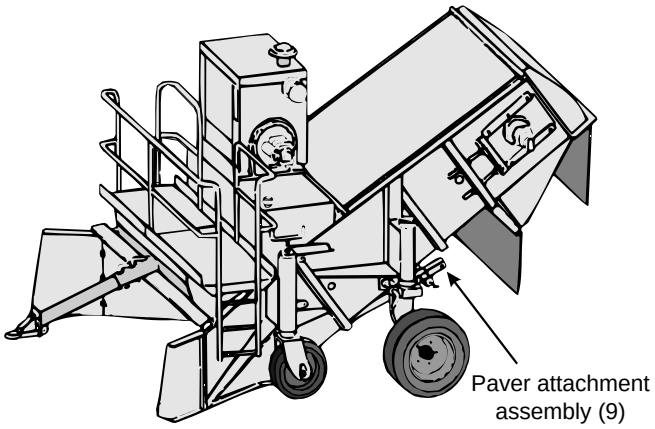


Figure 26

IMPORTANT! MS-2 Only : Lock rear casters to prevent the casters from rotating.

- Extend towing tongue (17) and lock (Figure 27).
- Close front wings and secure (16) (Figure 27).

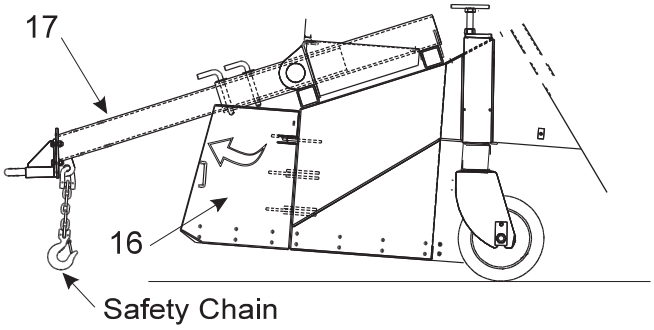


Figure 27

- Start engine (see procedure above).
- Raise front of machine to full height by using FRAME RAISE lever (29) (Figure 23).
- Position towing vehicle.
- Lower machine onto pintle hitch and raise front casters fully to provide ground clearance.
- Shut off engine.
- Secure pintle hitch and attach safety chain.

Attaching to Paver

WARNING! Always place blocking in front and behind the tires of the pick-up machine when it is not attached to a truck or paver to prevent it from rolling or moving.

- Install pick-up machine attachment brackets on paver push beam as shown.

NOTICE! Brackets are to be welded in place. Typical welds are to be $^{1}/_{4}$" all the way around.

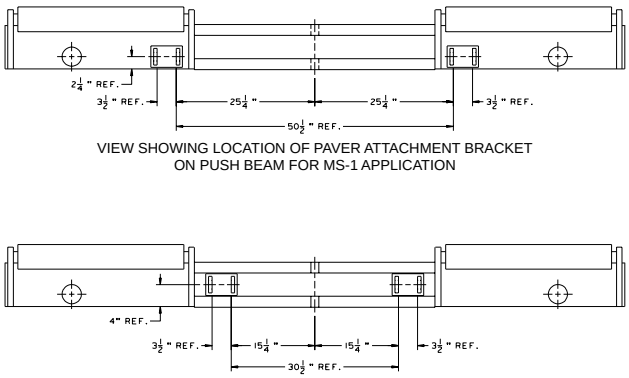


Figure 28

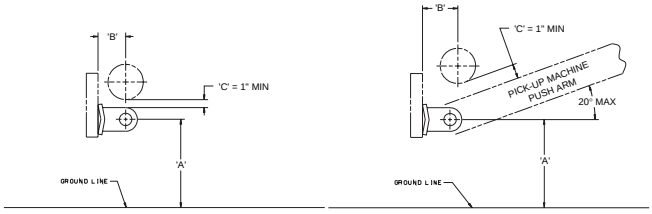


Figure 29

IMPORTANT! If 'B' Dimension is 4" or less, position bracket at largest 'A' dimension possible while maintaining 'C' dimension as shown. If 'B' Dimension is greater than 4", position bracket at largest 'A' dimension possible while maintaining 'C' dimension as shown. Care should be taken to insure that brackets DO NOT INTERFERE with truck tire when not using pick-up machine. (Figure 29)

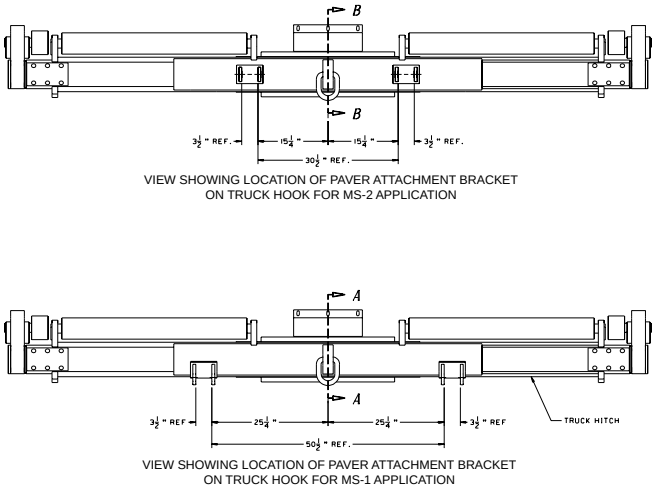


Figure 30

- Install stop blocks between push beam/truck hook and frame.

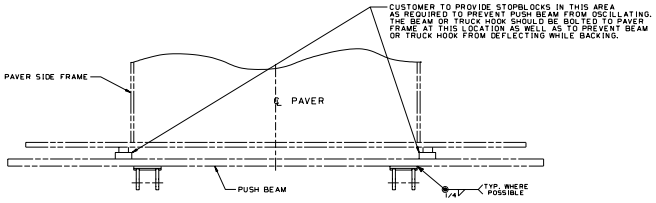
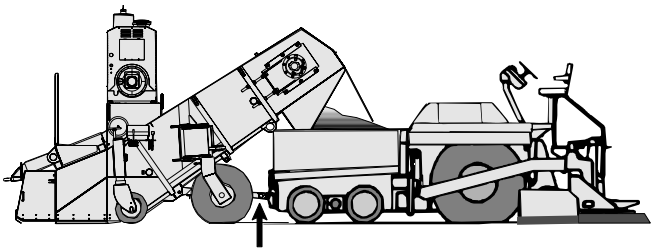


Figure 31

WARNING! Always place blocking in front and behind the tires of the pick-up machine when it is not attached to a truck or paver to prevent it from rolling or moving.

DANGER! DO NOT allow any personnel between pick-up machine and the paver when the paver is being moved in and aligned with the push-arms.

- Disconnect pick-up machine push arm assembly and block up to the same height as the attachment brackets located on the push beam of the paver.
- Remove telescoping push-arm pins so arms can be retracted.
- Align paver with pick-up machine so discharge shoot of pick-up machine is 1' to 2' inside hopper of paver.
- Lock brakes on paver and shut engine OFF.
- Extend push-arms into attachment brackets and install retainer bolts.
- Start paver and move foreword or reverse to align holes in push-arms so retainer pins can be reinstalled.
- Lock brakes on paver and shut engine OFF.
- Install retainer pins in push-arms.



Paver Attachment

Figure 32

Roading Attached to Paver

- Raise front of machine. Use the FRAME RAISE lever 29 (Figure 33) to provide ground clearance. (Maintain at least 2" of stroke in the cylinders. Do not extend front casters fully)

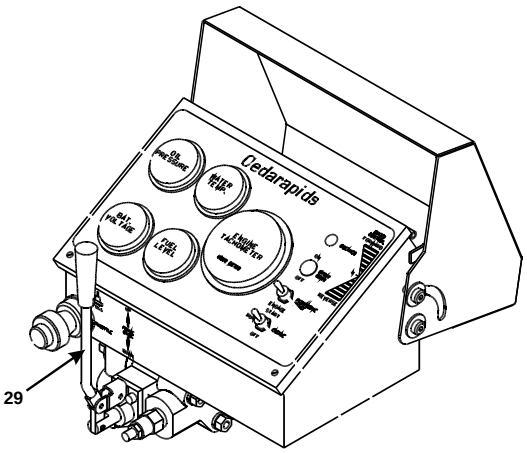


Figure 33

- Shut off engine.

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Operation

- Attach the windrow/elevator machine to the paver following instructions in Attaching to Paver section.
- Set SPEED CONTROL lever to neutral 12 (Figure 34)
- With the engine shut OFF, inspect fluid levels.
- Inspect conveyor for obstructions.
- Push in THROTTLE to set idle 30 (Figure 34).
- Advise personnel of start-up.
- For Start up: With the PERMISSIVE START switch 27 (Figure 34) in the override position, engage OFF/RUN/START switch 28 (Figure 34).

IMPORTANT: if engine does not start in 30 seconds, allow starter to cool before trying again.

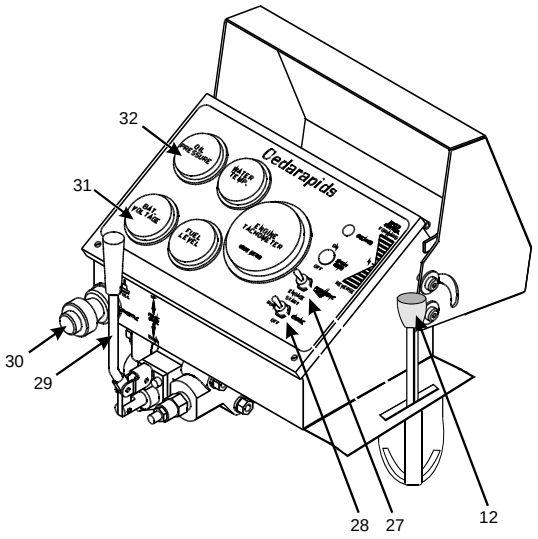

Figure 34

- Once engine is running, release OFF/RUN/ START switch. The PERMISSIVE START switch must be held in the override position for approximately 15 seconds or until oil pressure is established.
- Verify correct oil pressure (32) and alternator output (31) Figure 34. (Consult engine owner's manual).
- Pull THROTTLE out to set operating speed at 2000 rpm (30) figure 34.

MS-1 Only: Fold out rear caster to the operating position.

- Raise front of machine all the way up to aid in folding casters out by using the FRAME RAISE lever (29) Figure 34.
- Remove capscrews from red locking plate (22) on the locking linkage (23) Figure 35.
- Loosen jam nuts (25) on turnbuckle (24) figure 35. Loosen turnbuckle and remove outboard capscrew in turnbuckle.
- Repeat this procedure for other side. Make certain to leave rear caster locking pins (26) engaged (Figure 35).
- Start up paver and back up until the casters are folded out.
- Shut off paver engine.
- Install capscrew on turnbuckle and tighten turnbuckle and set jam nuts.
- Install red locking plate and secure capscrews.
- Repeat this procedure for other side. Unlock rear casters to allow the casters to rotate for the paving mode.

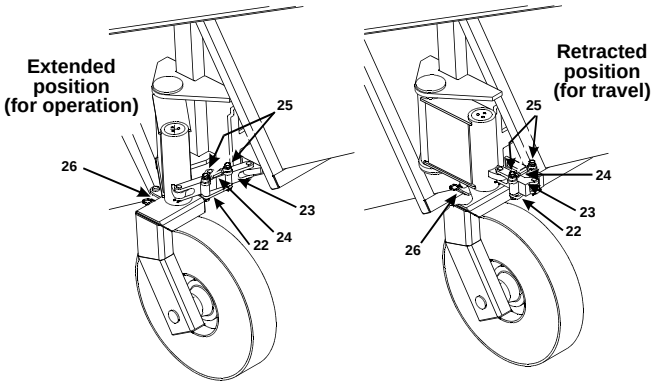

Figure 35

- MS-2 Only: Unlock rear casters to allow the casters to rotate for the paving mode.

- Adjust height of machine to carry load on casters. Use FRAME RAISE lever (29) Figure 33 to adjust height of scraper blades so they are just touching the existing surface or roadway. (This will extend the life of wear parts).
- Adjust CONVEYOR SPEED control (12) Figure 34 to a speed which is just fast enough to remove the windrow at current travel speed. (Excessive speed on the conveyor accelerates component wear).

Cleaning Machine

- Shut off engine.
- Using paver spray-down system (or optional spray-down system), spray flights, chains, sprockets and liners.
- Restart engine. Advance flights, stop engine, and spray as above. Repeat as necessary.
- Shut off engine.
- Lock instrument panel.

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Lubrication

Interval Hours	Ref No.	Identificatioin	Type of Service	Service Points	Lubricant
10	1	Radiator level coolant	Check	1	
	20	Engine oil level	Check	1	EO
	3	Fuel filter/water separator	Drain	1	
	19	Hydraulic oil level	Check	1	AW
	13	Front casters	Lube	2	MPG
	15	Idler shaft bearing	Lube	2	MPG
	6	Slat chain and flights	Clean		
50	7	Gear box oil (1/2 full)	Check	2	MPL
	10	Tire pressure 105 psi	Check	2	
	6	Chain tension 6-8" sag	Check	2	
100	2	Engine air filter	Check	1	
	21	Battery fluid level	Check	1	
250	4	Engine oil filter	Change	1	
	20	Engine oil	Change	1	EO
500	3	Engine fuel filter	Change	2	
1000	18	Hydraulic filter/suction strainer	Change	2	
	19	Hydraulic oil	Change	1	AW
	7	Gear box oil	Change	2	MPL
	11	Wheel bearings	Lube	4	MPG
	14	Caster bearings	Lube	4	MPG
	8	Wear liners	Check		
	1	Radiator coolant	Change	1	

Lubricant Key:

EO = Engine Oil

AW = Premium Anti-wear Hydraulic Oil

MPG = Multipurpose Grease

MPL = Multipurpose Gear Lubricant

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Operation MS-3

Towing Machine by Towing Tongue

WARNING! DO NOT tow pick-up machine more than 20 miles per hour.

CAUTION! Check all wheel lugs for tightness after 20 miles travel. Recheck after 100 miles. Check frequently when equipment is being moved extended distances.

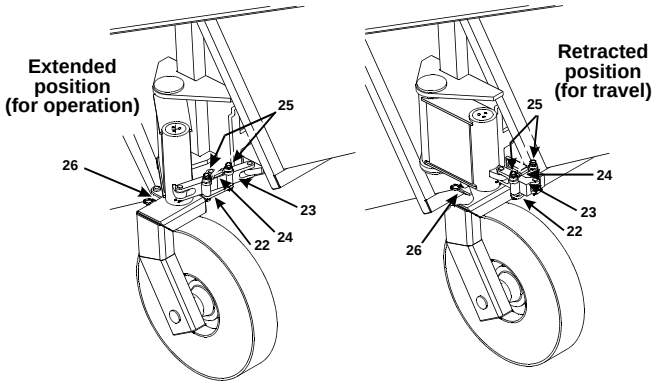


Figure 36

- Fold in rear caster to the transport position. Lower front of machine by using the FRAME RAISE lever to a very low position to aid in folding casters in.
- Remove capscrews from red locking plate (27) on the locking linkage (23) Figure 36. Loosen jam nuts (25) on turnbuckle (24) Figure 36. Loosen turnbuckle and remove outboard capscrew in turnbuckle. Repeat this procedure for other side. Make certain to leave rear caster locking pins (26) disengaged Figure 36. Start paver and move forward until the casters are folded in. Shut off engine on paver. Install capscrew on turnbuckle and tighten turnbuckle and set jam nuts. Install red locking plate and secure capscrews. Repeat this procedure for other side. Now lock rear casters to prevent the casters from rotating.
- Raise dump hopper (35) and latch (19). Pin lock in place (20) Figure 37.
- Retract PUSH BEAM or truck hook (36). Install transport pin (18) Figure 37.

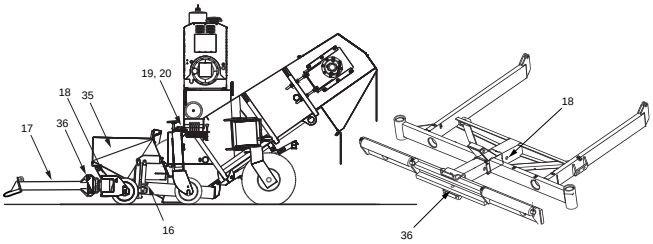


Figure 37

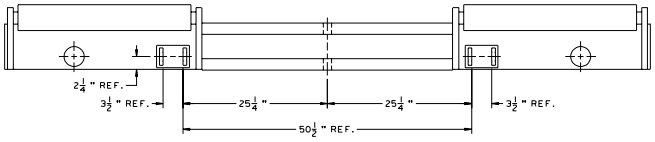
- Install towing tongue (17) Figure 37.
- Raise towing tongue to a position that will allow proper ground clearance once machine is hooked to towing vehicle. This is done by moving HOPPER RAISE lever to down position (35) Figure 37.
- Install pin in the hopper raise/lower lock (16) Figure 37.
- Raise towing tongue by raising frame.
- Position towing vehicle.
- Lower machine onto pintle hitch and raise front casters fully to provide ground clearance.
- Shut off engine.
- Secure pintle hitch and attach safety chain.

Attaching to Paver

WARNING! Always place blocking in front and behind the tires of the pick-up machine when it is not attached to a truck or paver to prevent it from rolling or moving.

- Install pick-up machine attachment brackets on paver push beam as shown.

IMPORTANT! Brackets are to be welded in place. Typical welds are to be $^{1}/_{4}$" all the way around.



VIEW SHOWING LOCATION OF PAVER ATTACHMENT BRACKET ON PUSH BEAM FOR MS-3 APPLICATION

Figure 38

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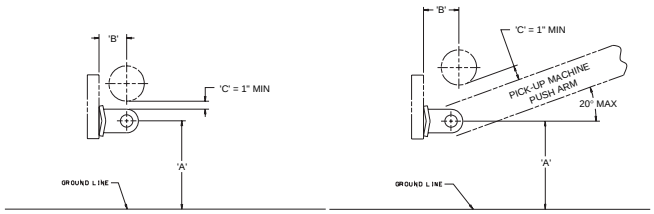


Figure 39

IMPORTANT! If 'B' Dimension is 4" or less, position bracket at largest 'A' dimension possible while maintaining 'C' dimension as shown. If 'B' Dimension is greater than 4", position bracket at largest 'A' dimension possible while maintaining 'C' dimension as shown. Care should be taken to insure that brackets DO NOT INTERFERE with truck tire when not using pick-up machine Figure 39.

- Install stop blocks between push beam and frame Figure 40.

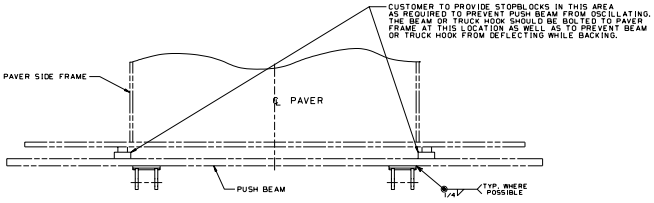
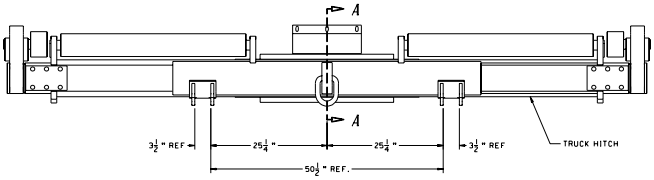


Figure 40



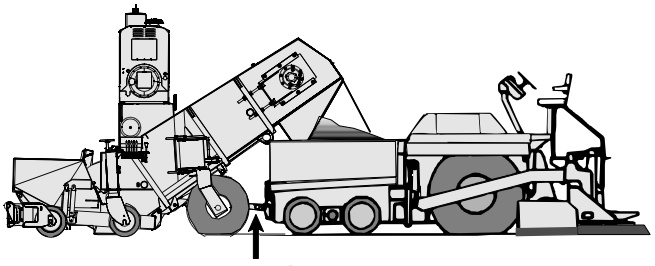
VIEW SHOWING LOCATION OF PAVER ATTACHMENT BRACKET ON TRUCK HOOK FOR MS-1 AND MS-3 APPLICATION

Figure 41

WARNING! Always place blocking in front and behind the tires of the pick-up machine when it is not attached to a truck or paver to prevent it from rolling or moving.

DANGER! DO NOT allow any personnel between pick-up machine and the paver when the paver is being moved in and aligned with the push-arms.

- Disconnect pick-up machine push arm assembly and block up to the same height as the attachment brackets located on the push beam of the paver.
- Remove telescoping push-arm pins so arms can be retracted.
- Align paver with pick-up machine so discharge shoot of pick-up machine is 1' to 2' inside hopper of paver.
- Lock brakes on paver and shut engine OFF.
- Extend push-arms into attachment brackets and install retainer bolts.
- Start paver and move foreword or reverse to align holes in push-arms so retainer pins can be reinstalled.
- Lock brakes on paver and shut engine OFF.
- Install retainer pins in push-arms.



Paver Attachment

Figure 42

Roading Attached to Paver

- For forward travel there is no need to raise the hopper chassis off the ground. Adjust height of machine to a ground clearance of 2 to 3 inches.
- If backing or maneuvering the machine, raise the hopper chassis casters off the ground by raising the hopper and latching with the hopper lock (19) Figure 37. Use HOPPER RAISE cylinders to pull the hopper chassis up off the ground. Pin lock in place (20) Figure 37 or use the FRAME RAISE lever to raise the center of machine until the hopper chassis casters are off the ground.
- Shut off engine.

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Operation

- Make proper paver attachments.
- Set SPEED CONTROL lever to neutral.
- Inspect fluid levels.
- Inspect conveyor for obstructions.
- Push in THROTTLE to set idle.
- Advise personnel of start-up.

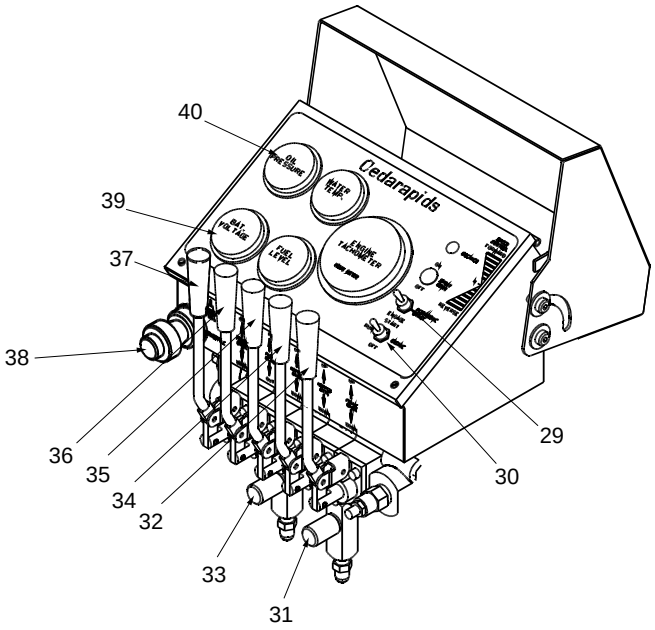

Figure 43

- For Start-Up: With the PERMISSIVE START switch (29) in the override position, engage OFF/RUN/START switch (30) Figure 43.

IMPORTANT: If engine does not start in 30 seconds, allow starter to cool before trying again.

- Once engine is running, release START switch. The PERMISSIVE START switch must be held in the override position for approximately 15 seconds or until oil pressure is established.
- Verify correct oil pressure (40) and alternator output (39) Figure 43. (Consult engine owner's manual).
- Pull THROTTLE out to set operating speed at 2000 rpm (38) Figure 43.
- Fold out rear caster to the operating position. Raise front of machine by using the FRAME RAISE lever (32) figure 43. Remove capscrews from red locking plate (22) on the locking linkage (23) figure 36. Loosen jam nuts (25) on turnbuckle (24) figure 36. Loosen turnbuckle and remove outboard capscrew in turnbuckle. Repeat this procedure for other side. Make certain to leave rear caster locking pins (26) figure 36 engaged. Start paver and back up until the casters are folded out. Shut off paver engine. Install capscrew on turnbuckle and tighten turnbuckle and set jam nuts. Install red locking plate and secure capscrews. Repeat this procedure for other side. Now unlock rear casters to allow the casters to rotate for the paving mode.
- Adjust FRAME RAISE lever (32) Figure 43 to give machine a ground clearance of 1 to 2 inches.
- If backing or maneuvering the machine, raise the hopper chassis casters off the ground by raising the hopper and latching with the hopper lock (19) Figure 37. Use HOPPER RAISE cylinders to pull the hopper chassis up off the ground. Pin lock in place (20) Figure 37 or use the FRAME RAISE lever to raise the center of machine until the hopper chassis casters are off the ground.
- Extend PUSH BEAM or truck hook (36). Set PUSH BEAM lever in neutral to use as a spring, or set in the float position to use as a shock absorber.

  To use as a spring: Place the PUSH BEAM lever (36) in the neutral position. Adjust flow control valve (33) to set recover rate of the push beam (or truck hook). This feature only works with PUSH BEAM lever in the neutral position.

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To use as a shock absorber: Place the PUSH BEAM lever (36) Figure 37 in the float position. (Pull lever toward the operator until detent locks the valve in the float position). Adjust flow control valve (31) Figure 43 to set collapse rate of the push beam (or truck hook). This feature only works with PUSH BEAM lever in the float position. When the truck backs in, let the truck collapse the cylinders until the truck is in position. Place the PUSH BEAM lever in neutral to hold the truck in position. Fully extend PUSH BEAM or truck hook. Repeat this cycle for each truck.

- Haul trucks must have end gates chained open at 12 to 18 inches before releasing gates.
- Engage TRUCK HOOK if equipped with this option.
- Adjust CONVEYOR SPEED control and hopper flow gate so mix flows smoothly. (Excessive speed on the conveyor accelerates component wear).

Cleaning Machine

- Shut off engine.
- Using spray-down system, spray flights, chains, sprockets and liners.
- Restart engine. Advance flights, stop engine, and spray as above. Repeat as necessary.
- Lock instrument panel.

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Lubrication

Interval Hours	Ref No.	Identificatioin	Type of Service	Service Points	Lubricant
10	1	Radiator level coolant	Check	1	
	23	Engine oil level	Check	1	EO
	3	Fuel filter/water separator	Drain	1	
	22	Hydraulic oil level	Check	1	AW
	13	Front casters	Lube	2	MPG
	15	Idler shaft bearing	Lube	2	MPG
	6	Slat chain and flights	Clean		
50	7	Gear box oil (1/2 full)	Check	2	MPL
	10	Tire pressure 105 psi	Check	2	
	6	Chain tension 6-8" sag	Check	2	
100	2	Engine air filter	Check	1	
	41	Battery fluid level	Check	1	
250	4	Engine oil filter	Change	1	
	23	Engine oil	Change	1	EO
500	3	Engine fuel filter	Change	2	
1000	21	Hydraulic filter/suction strainer	Change	2	
	22	Hydraulic oil	Change	1	AW
	7	Gear box oil	Change	2	MPL
	11	Wheel bearings	Lube	4	MPG
	14	Caster bearings	Lube	4	MPG
	8	Wear liners	Check		
	1	Radiator coolant	Change	1	

Lubricant Key:

EO = Engine Oil

AW = Premium Anti-wear Hydraulic Oil

MPG = Multipurpose Grease

MPL = Multipurpose Gear Lubricant

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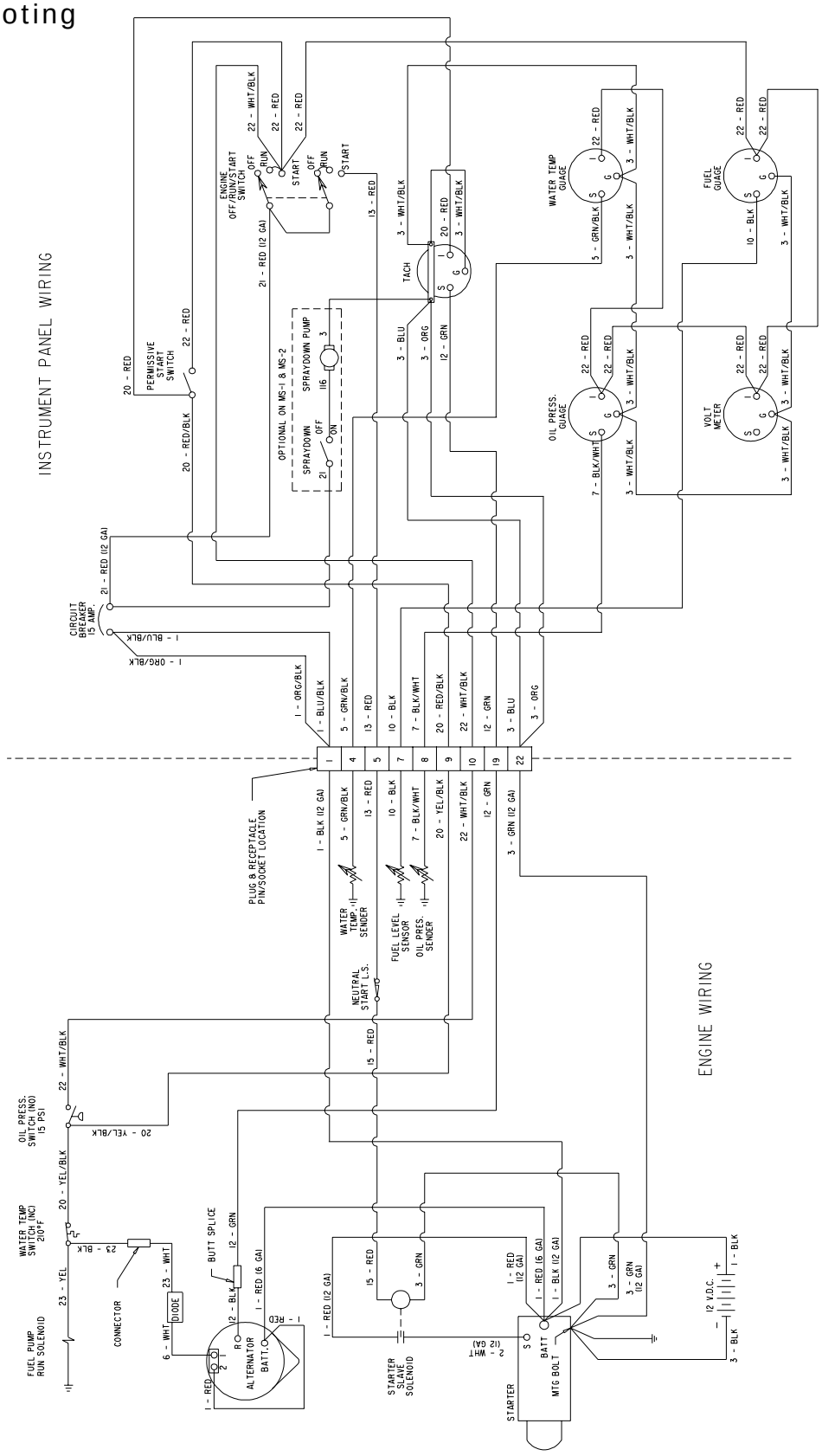
Troubleshooting

Electrical



Engine Cranks But Does Not Start

- Elevator Foreword/Reverse lever in NEUTRAL position.
- Permissive Start switch PRESSED.
- Engine Off/Run/Start switch to START position.

Check to ensure fuel tank is not empty and fuel filters are not plugged.

22 to 3 **If no voltage**, defective start switch.

20 to 3 **If no voltage**, defective permissive start switch.

23 to 3 **If no voltage,** defective water temp switch or water temp above 210°F

If voltage, defective fuel pump run solenoid or injection pump.

Engine Does Not Crank

- Elevator Foreword/Reverse lever in NEUTRAL position.
- Permissive Start switch PRESSED.
- Engine Off/Run/Start switch to START position.

Check for low battery voltage, loose or corroded battery connections, or faulty starter.

1 to 3 **If no voltage**, defective wire or cable.

21 to 3 **If no voltage**, defective or tripped circuit breaker.

13 to 3 **If no voltage**, defective start switch.

15 to 3 **If no voltage**, defective or mis-adjusted neutral start switch.

2 to 3 **If no voltage**, defective starter solenoid (Check wire #3 on starter solenoid to ensure a good ground.)

If voltage, defective starter.

Engine Shuts Off

- Engine Off/Run/Start switch in RUN position.

Check to ensure fuel tank is not empty and fuel filters are not plugged.

Check engine oil level

Check water temperature to ensure it is below 210°F.

If temperature is high, check fluid level in radiator, fan belts or plugged radiator/oil cooler.

1 to 3 **If no voltage**, defective wire or cable.

21 to 3 **If no voltage**, defective or tripped circuit breaker.

22 to 3 **If no voltage**, defective start/run/off switch.

20 to 3 **If no voltage**, defective oil pressure sensor, or low oil pressure.

23 to 3 **If no voltage**, defective water temperature sensor.

If voltage, defective fuel solenoid or injection pump.

Alternator Not Charging

- Engine running at full throttle.

Check fan belts to ensure they are not slipping.

Check battery and connections. Refer to Section 5 “Engine Charging System”.

1 to 3 **If no voltage**, defective battery or bad connection.

23 to 3 **If no voltage**, defective wire or loose connection.

6 to 3 At terminal of alternator

If no voltage, defective diode or bad connection.

If voltage, defective alternator.

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Spray Down Not Working

Check to ensure fuel tank is not empty and fuel filters are not plugged.

1 to 3 **If no voltage**, defective battery or bad connection.

21 to 3 **If no voltage**, defective or tripped circuit breaker.

116 to 3 **If no voltage**, defective spray down switch.

If voltage, defective spray down motor.

No Gauges Work

- Engine Off/Run/Start switch in RUN position.

22 to 3 **If no voltage**, defective start/run/off switch. Check wire #3 on each gauge to ensure a proper ground connection.

Water Temperature Gauge

22 to 3 **If no voltage**, defective start switch, loose connection or bad wiring.

5 to 3 1500 Ohms at 100°F, 125 Ohms at 210°F.

Oil Pressure Gauge

22 to 3 **If no voltage**, defective start switch, loose connection or bad wiring.

7 to 3 0 to 80 Ohms = 0 to 80 PSI.

Fuel Level Gauge

22 to 3 **If no voltage**, defective start switch, loose connection or bad wiring.

10 to 3 0 to 90 Ohms = empty to full.

Voltage Meter

22 to 3 **If no voltage**, defective start switch, loose connection or bad wiring.

If voltage, defective meter.

Tachometer/Hourmeter

22 to 3 **If no voltage**, defective start switch, loose connection or bad wiring.

Check continuity on wire #12 from the alternator to the tachometer.

If no open circuit, defective alternator.

If open circuit, bad wiring or loose connection.

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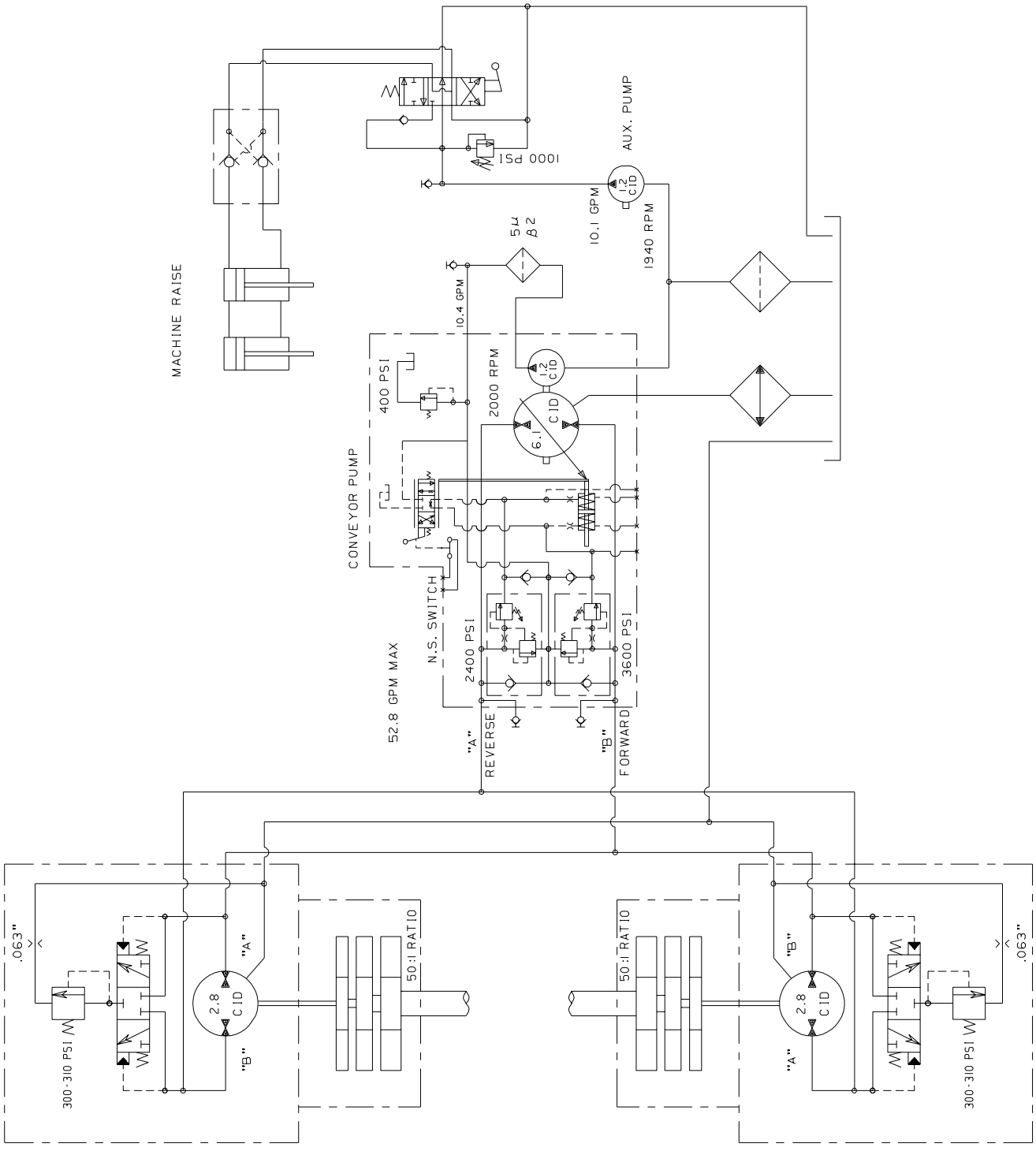
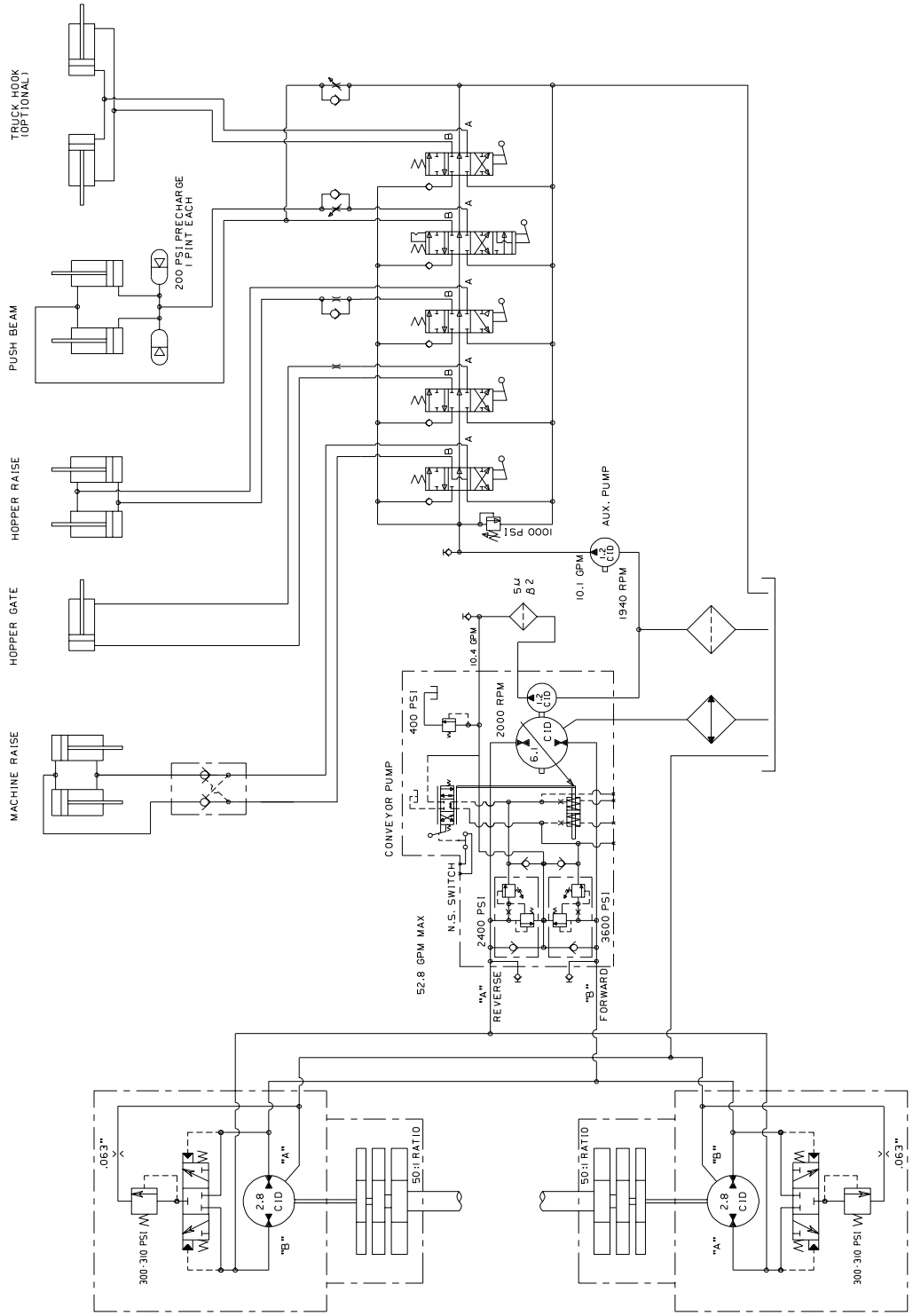
Hydraulic



Hydraulic Schematic MS 1 & 2



Hydraulic Schematic MS-3

Charge Pressure

- Check hydraulic fluid level, suction strainer and pressure filter.
- Install 600 PSI gauges in Foreword & Reverse high pressure test ports.
- Engine at FULL throttle and Foreword/Reverse lever in Neutral.

Gauge readings should be 400 PSI.

If pressure readings are LOWER than 400 PSI, adjust the charge pressure relief to obtain a 400 PSI.

If you cannot obtain a 400 PSI charge pressure.

- Shut engine OFF.

  Disconnect high pressure hoses going from the pump to T fittings. Plug hoses and cap fittings with proper steel caps and plugs.
- Start engine and bring to full throttle with Foreword/Reverse lever in Neutral.

  If pressure can now be adjusted to read 400 PSI, there is excessive case drain in one or both hydraulic motors.

  If pressure can not be obtained, defective pump.

High Pressure Settings

- Check hydraulic fluid level, suction strainer and pressure filter.
- Install 4000 PSI gauges in Foreword & Reverse high pressure test ports.
- Disconnect and swap high pressure hoses going to port A and B of one hydraulic motor. This will cause the motors to work against each other so the high pressure settings can be checked.
- Start engine and bring to Full Throttle.
- Push the Forward/Reverse lever in the Forward direction.

  Pressure reading on the foreword gauge should be 3600 PSI.
- Push the Foreword/Reverse lever in the Reverse direction.

  Pressure reading on the foreword gauge should be 2400 PSI.

  If pressure readings are incorrect, adjust the foreword or reverse high pressure relief to obtain the correct reading.

If you cannot obtain the correct pressures.

- Shut engine OFF.

  Disconnect high pressure hoses going from the pump to T fittings. Plug hoses and cap fittings with proper steel caps and plugs.
- Start engine and bring to Full Throttle.
- Recheck pressures.

  If pressure can now be obtained, there is excessive case drain in one or both hydraulic motors.

  If pressure can not be obtained, defective pump or relief valve(s).
- Be sure to swap the high pressure hoses back to their original position on the motor when finished with tests.

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Appendix

Standard Bolt & Nut Torque Specifications

Size dia (in)	Number of threads N (ths/in)	SAE Grade 2			SAE Grade 5			SAE Grade 8		
		Torque (ft-lbs)		Clamp Load (lbs)	Torque (ft-lbs)		Clamp Load (lbs)	Torque (ft-lbs)		Clamp Load (lbs)
		Dry	Lub		Dry	Lub		Dry	Lub	
1/4	20	5	4	1312	8	6	2027	12	9	2862
1/4	28	6	5	1502	10	7	2321	14	11	3276
5/16	18	11	9	2162	17	13	3341	25	19	4716
5/16	24	12	10	2393	19	15	3698	27	21	5220
3/8	16	20	15	3197	31	24	4941	44	34	6975
3/8	24	23	17	3622	35	27	5597	49	38	7902
7/16	14	32	25	4385	49	38	6777	70	54	9567
7/16	20	36	27	4896	55	42	7567	78	60	10683
1/2	13	49	38	5853	75	58	9046	106	82	12771
1/2	20	55	42	6596	85	65	10194	120	92	14391
9/16	12	70	54	7508	109	84	11603	154	118	16380
9/16	18	79	60	8374	121	93	12941	171	132	18270
5/8	11	97	75	9323	150	115	14408	212	163	20340
5/8	18	110	85	10560	170	131	16320	240	185	23040
3/4	10	172	132	13778	266	205	21293	376	289	30060
3/4	16	192	148	15386	297	229	23779	420	323	33570
7/8	9	167	128	11435	430	330	29453	606	466	41580
7/8	14	184	141	12598	473	364	32449	668	514	45810
1	8	250	192	14999	644	495	38633	909	699	54540
1	14	273	210	16409	704	542	42266	995	765	59670
1-1/8	7	354	272	18884	794	611	42347	1288	990	68670
1-1/8	12	397	306	21186	891	685	47508	1445	1111	77040
1-1/4	7	500	384	23983	1120	862	53780	1817	1398	87210
1-1/4	12	553	429	26557	1241	954	59552	2012	1548	96570
1-3/8	6	655	504	28586	1469	1130	64103	2382	1832	103950
1-3/8	12	746	574	32546	1673	1287	72983	2712	2086	118350
1-1/2	6	869	669	34774	1949	1500	77978	3161	2432	126450
1-1/2	12	978	752	39130	2194	1687	87746	3557	2736	142290
1-3/4	5	1372	1055	47025	2286	1758	78375	4988	3837	171000
2	4.5	2063	1587	61875	3438	2644	103125	7500	5769	225000
2-1/4	4.5	3016	2320	80438	5027	3867	134063	10969	8438	292500
2-1/2	4	4125	3173	99000	6875	5288	165000	15000	11538	360000
2-3/4	4	5592	4302	122018	9321	7170	203363	17794	13688	388238
3	4	7388	5683	147758	12313	9472	246263	23507	18082	470138

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Metric Bolt & Nut Torque Specifications

Size dia (mm)	Pitch (mm)	8.8 Property Class = 8.8 Torque (ft-lbs) Dry	8.8 Torque (ft-lbs) Lub	8.8 Clamp Load (lbs)	10.9 Property Class = 10.9 Torque (ft-lbs) Dry	10.9 Torque (ft-lbs) Lub	10.9 Clamp Load (lbs)	12.9 Property Class = 12.9 Torque (ft-lbs) Dry	12.9 Torque (ft-lbs) Lub	12.9 Clamp Load (lbs)
10	1.5	41	32	6263	60	46	9159	71	54	10745
10	1.25	43	33	6609	63	49	9666	74	57	11339
12	1.75	72	55	9101	105	81	13310	123	95	15614
12	1.25	78	60	9944	115	88	14543	134	103	17060
14	2	115	88	12467	168	129	18234	196	151	21389
14	1.5	124	95	13451	181	139	19672	212	163	23077
16	2	178	137	16920	260	200	24746	305	234	29029
16	1.5	190	146	18063	277	213	26417	325	250	30989
18	2.5	246	189	20787	359	276	30401	421	324	35663
18	1.5	276	212	23353	403	310	34154	473	364	40066
20	2.5	347	267	26438	507	390	38665	595	458	45357
20	1.5	385	296	29322	563	433	42884	660	508	50306
22	2.5	473	364	32767	692	532	47922	812	624	56216
22	1.5	519	399	35970	759	584	52606	891	685	61711
24	3	600	461	38070	877	674	55678	1029	791	65315
24	2	654	503	41517	956	736	60719	1122	863	71228
27	3	879	676	49616	1286	989	72563	1508	1160	85122
27	2	949	730	53540	1387	1067	78302	1627	1252	91854

Metric Conversions

Inches - Millimeters											
Inches	1/16"	1/8"	3/16"	1/4"	5/16"	3/8"	7/16"	1/2"	9/16"	5/8"	11/16"
Millimeters	1.59	3.18	4.76	6.35	7.94	9.53	11.11	12.7	14.29	15.88	17.46
Inches	3/4"	13/16"	7/8"	15/16"	1"	1-1/4"	1-1/2"	1-3/4"	2"	3"	4"
Millimeters	19.05	20.64	22.23	23.81	25.4	31.75	38.1	44.45	50.8	76.2	101.6
Millimeters - Inches											
Millimeters	1	2	3	4	5	6	7	8	9	10	11
Inches	.03937	.078874	.11811	.15748	.19685	.2362	.2756	.3150	.3543	.3937	.4331
Millimeters	12	13	14	15	16	19	18	19	20	25	30
Inches	.4724	.5118	.5512	.5906	.6299	.6693	.7087	.7480	.7874	.9843	1.1811
Millimeters	35	40	45	50	60	70	80	90	100	200	300
Inches	1.378	1.5748	1.7127	1.9685	2.3622	2.7559	3.1496	3.5433	3.937	7.874	11.811

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Common Conversion Factors

English - Metric (SI)

1 inch = 25.4 millimeters (mm)

1 gallon US = 3.785 liters (l)

1 pound (force) = 4.448 Newtons (N)

1 pound (mass) = 0.4536 kilograms (kg)

1 ton (2000 lbs) = 0.9072 tonns (metric)

1 foot-pound (ft-lbs) = 1.356 newtonmeters (N•m)

1 horespower (hp) = 0.746 kilowatts (kW)

1 pound/inch^2 (PSI) = 6.895 kilopascals (kPa)

1 PSI = 0.06895 bars (note: 1 bar = 100 kPa)

Metric (SI) - English

1 millimeter (mm) = 0.03937 inches

1 liter (l) = 0.2644 US gallons

1 Newton (force) = 0.2248 pounds

1 kilogram (mass) = 2.2046 pounds

1 tonne (1000 kg) = 1.1023 US tons

1 newtonmeter (N•m) = 0.7376 foot-pounds (ft-lbs)

1 kilowatt (kW) = 1.3141 horsepower (hp)

1 kilopascal = 0.145 pound/inch^2 (PSI)

1 bar = 14.504 PSI