Paver Pocket Guide

TEREX
Roadbuilding

First Edition - Tier II

GENUINE TEREX CEDARAPIDS PARTS

When replacement parts are needed for your equipment, it's tempting to save a few dollars by buying "will-fit" parts from the guy down the road. They claim to be as good as the factory-made items and save you money.

You know that ***Genuine TEREX Cedarapids Parts*** are identical to the originals. And you know they'll perform the same, too.

When it comes to parts, don't risk unnecessary downtime by selecting cheap copies. Instead, go for the originals. Your TEREX Cedarapids dealer has them in stock (or can get them fast) and offers factory trained service personnel.

Genuine Parts

TEREX | CEDARAPIDS

Cedarapids Paver Manuals

The following list represents the complete set of manuals available to the owner, operator, and mechanic of a TEREX Cedarapids paver. All of these manuals are included with each new paver when it ships from the factory. If your manuals are not included with your new paver or if you require additional copies of any of these manuals contact your local Cedarapids dealer.

Operation and Maintenance Manual

The Operation and Maintenance manual is intended to be used by both the operator and mechanic.

The operation portion of this manual gives detailed operating and safety instructions for both new and experienced operators. It is intended to give more detailed information than the Pocket Paver Guide.

The maintenance portion of this manual gives detailed information on component locations, test procedures, safety, and routine maintenance. This information expands on the information in Technical manual and Wear Check Guide.

Technical Manual

The Technical manual is designed primarily for use by maintenance personnel. It provides detailed troubleshooting procedures and schematics for diagnosing paver breakdowns. Once a problem has been diagnosed, refer to the Operation and Maintenance manual for information on making the repair.

Quality Paving Guide

The Quality Paving Guide should be used primarily by paver operators. This manual gives detailed information on setting up the paver to produce the mat surface needed.

Wear Check Guide

The Wear Check Guide should be used primarily by maintenance personnel. It contains detailed information for determining when parts require replacement.

About the Pocket Paver Guide

The Pocket Paver Guide is a small reference manual designed for use by experienced operators. It contains information needed by the operator for day-to-day operation, adjustment and maintenance of the paver and screed.

CIMA Safety Manual

The CIMA Safety Manual is a general manual designed to be used by everyone on a paving job site. This would include operators, laborers, mechanics, truck drivers, etc.

Identification Plate Locations

The serial number plate for current model tractors can be found on the left rear frame bulkhead. In addition, the serial number will be stamped into the bulkhead to the right of the serial number plate. On early model tractors, the serial number may be stamped into the bulkhead and covered with the serial number plate.

The serial number will also appear on the lubrication decal found on the right rear frame bulkhead.

Screed

The various Fastach and Stretch screeds carry both a serial number and a module number to simplify identification when ordering parts.

The identification plate bearing both numbers is located on the right-hand screed pull arm on the current Fastach screeds. In addition, the screed module number is stamped on the right-hand pull arm below the identification plate.

The plate is on the right-hand tipping frame on the current Stretch screeds. The module number is also stamped directly below the identification plate and on the right-hand main screed frame end plate.

On early-model Fastach and Stretch screeds where the serial number was not included on the screed, the serial number of the tractor must be used when ordering parts for the screed or tractor.

If a Fastach screed is shipped as a single item (to be mounted on a paver in the field) the serial plate will be mounted below the screed identification plate on the right-hand pull arm.

On single-item Stretch screeds the serial plate will be adjacent to the screed identification plate on the right-hand tipping frame.

Lockout Tagout

WARNING - Failure to follow good lockout and tagout procedures could result in death or serious injury.

What is the purpose of lockout /tagout?

1) Prevent the unexpected or accidental start-up of equipment and to notify other workers when a piece of equipment is unsafe to operate.
2) Prevent injury to personnel from energy that is stored in devices such as springs, accumulators, hydraulic systems, batteries, etc.

How do I lockout and tagout equipment?

1) Turn the master key to the OFF position and remove the key.
2) Disconnect the batteries.
3) Regardless of which lockout method is used, place one or more tags on machine controls or access doors to let other workers know that maintenance is being performed on the machine and/or the machine is unsafe to operate.

Who is responsible for establishing and administering a lockout /tagout program?

1) The employer must establish a lockout /tagout system of procedures, training and periodic inspection before any employee operates, services, or maintains a piece of equipment per 29 CFR part 1910 of OSHA regulations.
2) All employees are responsible for seeing that equipment is locked out and tagged out according to the employers policies.

When is lockout and tagout necessary?

1) Any time repairs or maintenance on a machine are to be performed.
2) When cleaning or lubricating the machine.
3) While clearing blocked or jammed mechanisms.
4) Any time that the equipment will be left unattended.

Who should apply a lock or tag?

1) Any maintenance person who will be working on the equipment.
2) The foreman or team leader responsible for the job.
3) Anyone who will be working on the equipment.
4) If several people will be working on a piece of equipment, each person must apply their own tag.

When can a lock or tag be removed?

1) After all safety guards are back in place.
2) After work is complete and tools are put away.
3) After workers are positioned safely for start-up.
4) After controls are positioned correctly for start-up and machine is operation ready.

Who can remove a lock or tag?

1) Only the person who applied a lock or tag can remove it.

Hazard Levels

The signal words **DANGER**, **WARNING** and **CAUTION** are used to identify hazard levels of in this manual. They will also be found on decals located on the equipment. (Figure 1)

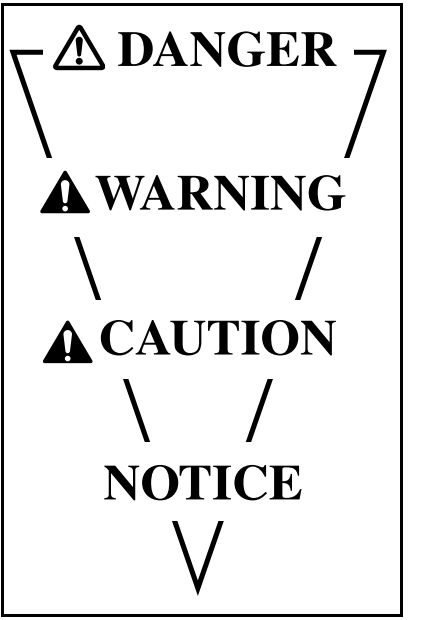


Figure 1. Hazard Level Hierarchy

Definitions for identifying hazard levels and their signal words are provided below:

DANGER - Immediate hazards which **WILL** result in death, system loss, severe personal injury, severe occupational illness or severe or major system or environmental damage.

WARNING - Immediate hazards which **COULD** result in death, system loss, severe personal injury, severe occupational illness or severe or major system or environmental damage.

CAUTION - Hazards or unsafe practices which **COULD** result in minor personal injury, minor occupational illness, or minor system or environmental damage.

The signal word **NOTICE** is used to identify installation, operation, or maintenance information which is important but not hazard related.

General safety

This manual contains important information regarding the operation of your paver. Carefully read the entire manual before attempting to operate the paver.

DANGER

1) Install all auger guards and vibrator covers before operating the paver.
2) Never attempt to install or remove any part or assembly when the paver is running.
3) Do not allow personnel to stand or walk between the front of the paver and the back of the truck while the paver is operating.
4) Attach screed safety cables or lower the screed before performing any inspections, repairs or adjustments to the screed.
5) All guards and protective devices must be in place when the paver is being operated or moved.
6) Keep all personnel clear of augers when the paver is operating.
7) Do not refuel the paver with the engine or screed heater system running. All sparks and open flames must be kept a minimum of 50 feet away from the paver when refueling.
8) Do not wash or spray down the screed or tractor with the screed heater system operating.

WARNING

1) Do not operate this equipment until you have been trained in its operation or maintenance. This equipment may only be operated or maintained by trained personnel, who have demonstrated their ability to do so safely.
2) Keep this manual for future reference.
3) Read, understand and follow all current OSHA, federal, state and local regulations that are applicable to your job and equipment.
4) This equipment must be used in accordance with all operation and maintenance instructions.
5) All persons involved with this equipment must be familiar with this manual.
6) Read, understand, and follow all DANGER, WARNING, CAUTION and instruction decals in this book and on the paver.
7) When changing the paver configuration or adding equipment to the paver, all additional guards associated with the added equipment must be installed before operating or moving the paver.
8) Any changes made to the original design of the paver must be approved by qualified personnel to ensure that the changes include appropriate guarding and provide a safe working environment for all personnel.
9) Wear clothing that fits snug to prevent getting caught in moving parts. Loose-fitting clothing should never be worn.
10) Mount and dismount the paver from the rear using only the steps, handrails and walkways provided. Always face the ladder and always have both hands and at least one foot in contact with the ladder while mounting or dismounting.
11) Do not mount the paver when it is moving.

12) Allow only the operator on the operator's platform when the paver is in operation.
13) Before starting the paver, make sure the brakes are ON, all other systems are OFF and all personnel are clear.
14) Before leaving operator's seat, always place the brake switch ON, and all other controls or switches in OFF or NEUTRAL position.
15) Reduce travel speed when going down step grades to prevent over-speeding.
16) Do not allow personnel near the hopper area when the paver is running.

CAUTION

1) Wear protective mask when fumes are present.
2) Wear safety goggles, gloves and long-sleeve shirts when working near hot asphalt materials.
3) Wear ear plugs while paver is running.
4) Keep operator's platform, steps and screed walkways clear of all obstructions, tools and other items to prevent tripping or falling.
5) To prevent fire hazards, keep the screed and engine basket area free of oil, asphalt and trash buildup.

Operator's Console

The operator's console can be positioned so that the paver can be operated from the left or right seat. To reposition the operator's console:

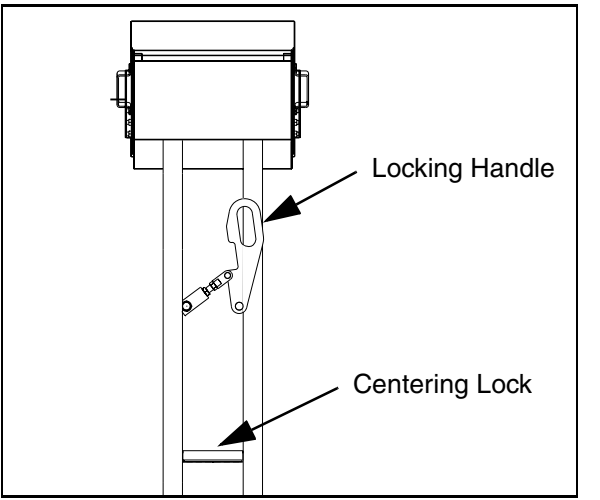


Figure 2. Repositioning Operator's Console

1) Lift the locking handle to release the console. (Figure 2)
2) Pull the operator's console toward the center of the paver. When the console is positioned vertically the centering lock will automatically engage.

   Important - When raising the hood, the operator's console must be locked in the center position to prevent the hood from hitting console.
3) Step on the centering lock to release the console and position the console to the desired side of the paver.

Refer to (Figure 3) and (Figure 4) for instructions on operating the tire paver console and (Figure 5) and (Figure 6) for instructions on operating the track paver console. See (Figure 7) for unique controls used on remix pavers.

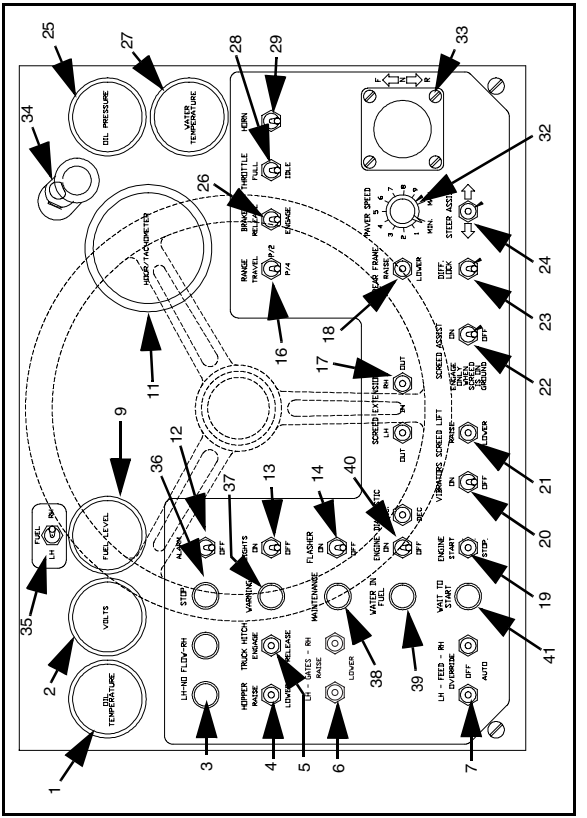


Figure 3. 452 & 552 Rubber Tire Operator's Console

1) Oil Temperature Gauge
2) Voltmeter
3) Mix Flow Lights
4) Hopper Raise/ Lower
5) Truck Hitch
6) Mix Gates

7) Material Feed

8) N/A

9) Fuel Level Gauge

10) N/A

11) Hour Meter/ Tachometer

12) Audible Alarm Silence

13) Lights

14) Flasher

15) N/A

16) Travel Range

17) Screed Extensions

18) Frame Raise

19) Engine Start

20) Vibrators

21) Screed Lift

22) Screed Assist

23) Differential Lock

24) Steer Assist

25) Oil Pressure Gauge

26) Brake

27) Engine Coolant Temperature Gauge

28) Throttle

29) Horn

30) N/A

31) N/A

32) Paver Speed Control

33) Travel Direction Lever

34) Emergency Stop Button

35) Fuel Tank Selector

36) Engine Stop Alert Light (Emergency Fault Diagnostic)

37) Engine Warning Alert Light (Maintenance Fault Diagnostic)

38) Engine Maintenance Alert Light (Low Engine Oil)

39) Water in Fuel Light

40) Engine Diagnostic Access Controls

41) Wait to Start Light

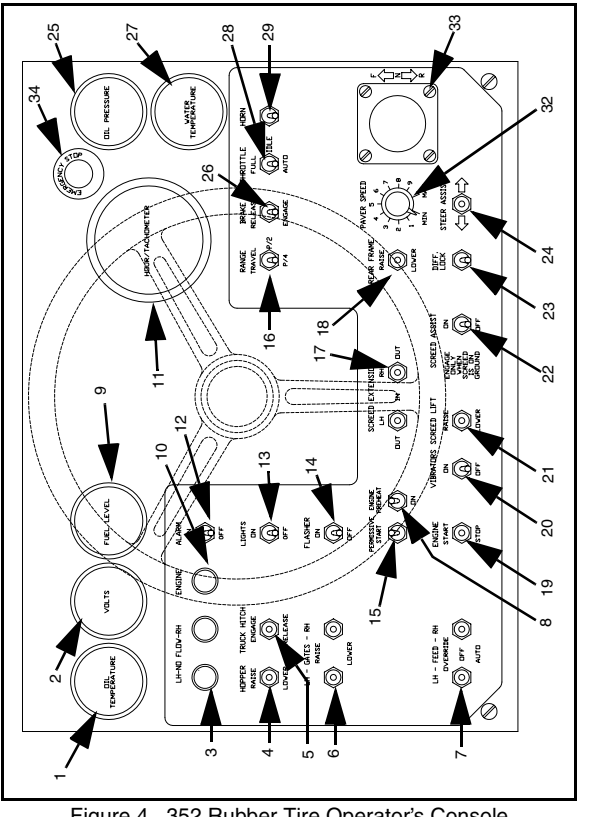


Figure 4. 352 Rubber Tire Operator's Console

1) Oil Temperature Gauge
2) Voltmeter
3) Mix Flow Lights
4) Hopper Raise/ Lower
5) Truck Hitch
6) Mix Gates

7) Material Feed

8) Engine Preheat

9) Fuel Level Gauge

10) Low Engine Oil Pressure Light

11) Hour Meter/ Tachometer

12) Audible Alarm Silence

13) Lights

14) Flasher

15) Permissive Start

16) Travel Range

17) Screed Extensions

18) Frame Raise

19) Engine Start Switch

20) Vibrators

21) Screed Lift

22) Screed Assist

23) Differential Lock

24) Steer Assist

25) Oil Pressure Gauge

26) Brake

27) Engine Coolant Temperature Gauge

28) Throttle

29) Horn

30) N/A

31) N/A

32) Paver Speed Control

33) Travel Direction Lever

34) Emergency Stop Button

35) N/A

36) N/A

37) N/A

38) N/A

39) N/A

40) N/A

41) N/A

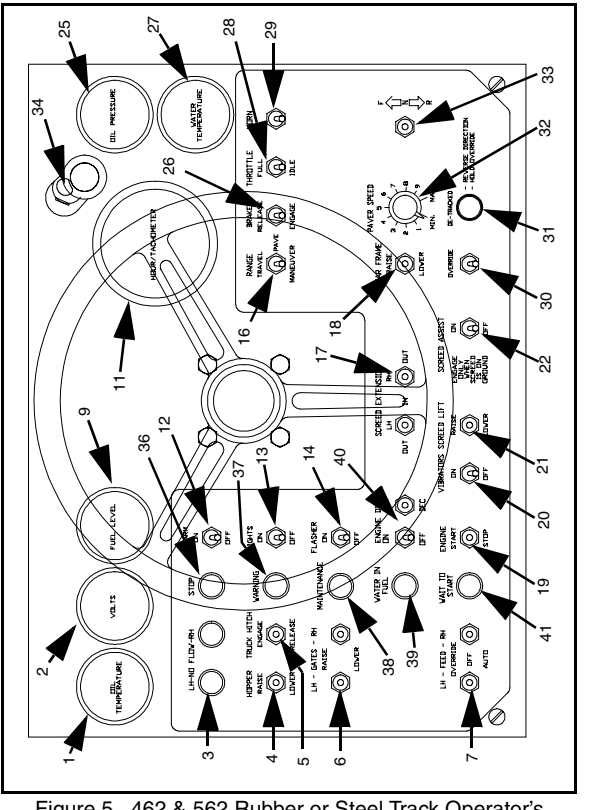


Figure 5. 462 & 562 Rubber or Steel Track Operator's Console

1) Oil Temperature Gauge
2) Voltmeter
3) Mix Flow Lights
4) Hopper Raise/ Lower
5) Truck Hitch

6) Mix Gates

7) Material Feed

8) N/A

9) Fuel Level Gauge

10) N/A

11) Hour Meter/ Tachometer

12) Audible Alarm Silence

13) Lights

14) Flasher

15) N/A

16) Travel Range

17) Screed Extensions

18) Frame Raise

19) Engine Start Switch

20) Vibrators

21) Screed Lift

22) Screed Assist

23) N/A

24) N/A

25) Oil Pressure Gauge

26) Brake

27) Engine Coolant Temperature Gauge

28) Throttle

29) Horn

30) De-Track Override

31) De-Tracked Indicator Light

32) Paver Speed Control

33) Travel Direction Switch

34) Emergency Stop Button

35) N/A

36) Engine Stop Alert Light (Emergency Fault Diagnostic)

37) Engine Warning Alert Light (Maintenance Fault Diagnostic)

38) Engine Maintenance Alert Light (Low Engine Oil)

39) Water in Fuel Light

40) Engine Diagnostic Access Controls

41) Wait to Start Light

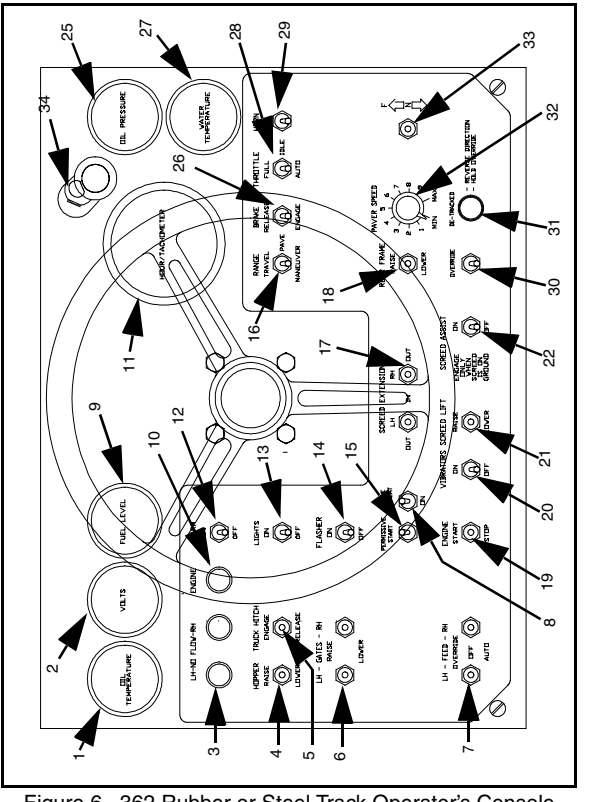


Figure 6. 362 Rubber or Steel Track Operator's Console

1) Oil Temperature Gauge
2) Voltmeter
3) Mix Flow Lights
4) Hopper Raise/ Lower
5) Truck Hitch
6) Mix Gates

7) Material Feed

8) Engine Preheat

9) Fuel Level Gauge

10) Low Engine Oil Pressure Light

11) Hour Meter/ Tachometer

12) Audible Alarm Silence

13) Lights

14) Flasher

15) Permissive Start

16) Travel Range

17) Screed Extensions

18) Frame Raise

19) Engine Start Switch

20) Vibrators

21) Screed Lift

22) Screed Assist

23) N/A

24) N/A

25) Oil Pressure Gauge

26) Brake

27) Engine Coolant Temperature Gauge

28) Throttle

29) Horn

30) De-Track Override

31) De-Tracked Indicator Light

32) Paver Speed Control

33) Travel Direction Switch

34) Emergency Stop Button

35) N/A

36) N/A

37) N/A

38) N/A

39) N/A

40) N/A

41) N/A

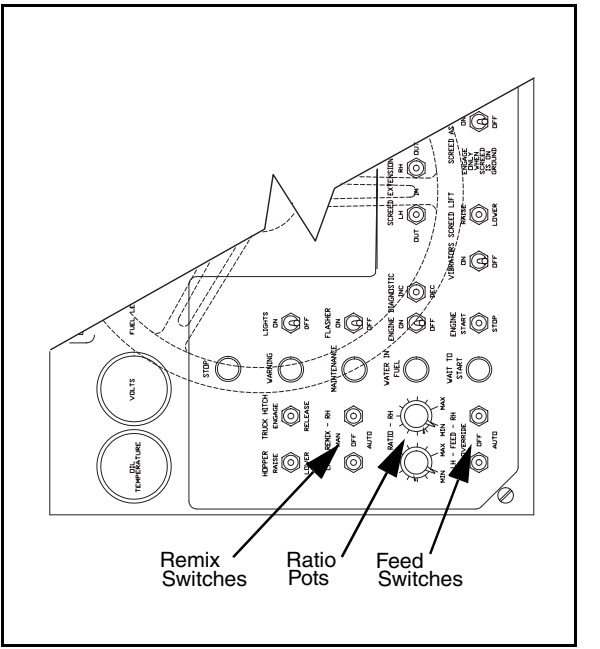


Figure 7. Remix Paver Controls - Typical Operator's Console

Remix Switches (Delivery Augers) - When these switches are set to "Off", the delivery augers are stopped. When set to "Manual", the delivery augers run at full speed. When set to "Auto", delivery auger speed is controlled by the ratio pots described below.

Ratio Pots (Delivery and Spreading Augers) - These controls adjust the the speed of the delivery augers relative to the speed of the spreading augers (used in conjunction with material "Feed" switches (item 7), described in previous illustrations).

1) **Oil Temperature Gauge -** Indicates temperature of hydraulic fluid. If fluid temperature exceeds 180° F stop paving and determine cause.

2) **Voltmeter** - Indicates battery and alternator condition. (Table 1)

Reading on Voltmeter	Engine not running or running at idle	Engine running at Full throttle
less than 10 V	Dead or disconnected battery	Dead or disconnected battery
10 V to 12 V	Low battery charge. Constant reading in this area may indicate problems with the charging system.	A voltmeter reading below 12 volts means that the current being drawn for lights, charging the battery, solenoids, etc. exceeds the output of the alternator. Check for a defective battery or a short in the wiring.
12 V to 13 V	Well charged battery in good condition.	When the engine is started the pointer may stay in this area temporarily but should gradually rise above 13 volts as alternator reaches normal output.
13 V to 15 V	Readings in this area while the engine is not running indicate defective voltmeter.	This is where the readings should be when the alternator and battery are in good condition and functioning properly.

TABLE 1 VOLTMETER INDICATIONS

Reading on Voltmeter	Engine not running or running at idle	Engine running at Full throttle
Above 15 V	Readings in this area while the engine is not running indicate defective voltmeter.	When the pointer goes above 15 volts, the alternator is putting out too much voltage and should be checked. Continued operation of the engine in this range will damage the battery and solenoid valves.

TABLE 1 VOLTMETER INDICATIONS

3) **Mix Flow Lights** - Sensors on the gates cause indicator lights on control panel to light when material is not contacting sensors. Each slat conveyor has a separate sensor and indicator.

4) **Hopper** - The hopper raise switch is spring-loaded to automatically return to the neutral position when released. It must be held in the "Raise" or "Lower" position to control the hopper wings.

5) **Truck Hitch** - The optional truck hitch holds the truck in position at the front of the paver so little or no material is spilled after a truck is captured. The truck driver does not have to ride the brakes to stay firm against the paver.

The Truck Hitch switch is spring-loaded to return to the neutral position when the switch is released. To engage the truck, hold the switch in "Engage" until the truck is in place, then let the switch return to neutral to hydraulically lock the truck. To unhitch, place the switch in the "Release" position.

The truck hitch is equipped with an adjustable needle valve on the front bulkhead which controls the speed that the truck hook engages the trucks wheels. Rotate the needle valve clockwise to reduce the engage speed and counterclockwise to engage the truck hook quicker.

6) **Mix Gates** - The hopper gates regulate the depth of mix carried to each auger. The spring-loaded switches must be held in “Raise” or “Lower” until the desired gate height is obtained. When released, the switch returns to neutral.

7) **Material Feed** - This is a 3-position switch (“Override”, “Off”, “Auto”). In the “Off” (center) position, the spreading augers do not run.

When the feed switch is in the “Auto” position, electronic sensors regulate the material feed system to keep a consistent head of material in front of the screed. Slat conveyor speed is constant. Remix auger speed is regulated by the Ratio pots (Figure 7) .

When the feed switch is set to “Overrride”, the spreading augers run at full speed.

8) **Engine Preheat** - Pull down on this spring-loaded switch to activate the engine pre-heater. Primarily used during cold weather to preheat the engine before attempting to start.

9) **Fuel Level Gauge** - Indicates fuel quantity remaining in the fuel tank.

10) **Low Engine Oil Pressure Light** - This indicator will light when the engine oil pressure falls below 5 PSI. When the engine is first started and the permissive start switch is held on, this indicator will remain lit until the engine oil pressure rises above 5 PSI. Once this indicator goes out the permissive start switch can be released.

11) **Hour Meter/ Tachometer** - Indicates engine RPM’s and operating hours. Full throttle engine speed = 2100 RPM, Idle speed = 950 RPM.

12) **Audible Alarm Silence** - When the Mix Flow Indicators light, an audible alarm will sound to make the operator aware of the problem. When this switch is activated the alarm is silenced. The audible alarm is reset each time the mix flow sensors are reactivated.

13) **Lights** - Push up to turn headlights on “High”, down for “Low”, or center for “Off”. Work lights are turned on when the switch is in “High” or “Low” setting. A rotary switch on each work light changes light from red, white, and off.

14) **Flasher** - Push up to turn flashers “On”, down to turn flashers “Off”. On 400 series pavers this switch also turns on the strobe warning light mounted in the rear center of the paver.

15) **Permissive Start Switch** - When starting the engine, this switch must be held down until the engine starts and the engine oil pressure rises over 5 PSI and the Engine indicator goes out. If this switch is release before the engine oil pressure reaches 5PSI, the engine will stop.

16) **Travel Range** - The range switch on track pavers has three positions; “Travel”, “Pave”, & “Maneuver”.

The range switch on tire pavers three positions; “Travel”, “P/2”, & “P/4”.

Select the “Travel” position on either model for roading or travelling around the job site. The paver must be stopped before changing to/from “Travel” to/from either of the other positons.

Warning: Failure to stop the paver before changing from “Travel” to “Pave” or “Pave” to “Travel” could result in serious injury to anyone riding the paver.

Track Paver - Select the “Pave” position for paving operation. Select the “Maneuver” position for moving the paver around in tight turning situations.

Tire Paver - Select the “P/2” position for paving in 2-wheel drive.

If the paver is equipped with the optional front wheel assist, switching to the “P/4” position will drive two of the front wheels in addition to the rear wheels. If the paver is not equipped with the optional front wheel assist, switching

to the “P/4” position will be the same as switching to the “P/2” position. Engaging the optional front wheel assist will reduce the paver speed by 30%. Stop the paver before switching from “P/2” to “P/4” or from “P/4” to “P/2”.

17) **Screed Extensions** - Used on Stretch model screeds to extend or retract the extensions. On Fastach screeds this switch is used to extend or retract the optional hydraulic sloping strike-off extension.

18) **Frame Raise** - Push up to “Raise” the rear of the paver, down to lower the rear of the paver.

This switch allows the operator to elevate the rear of the tractor to give maximum ground clearance for loading the paver or traveling over rough ground or obstacles. For additional traction during paving, set the clearance at about the halfway point.

When using a heavy screed with extensions or other heavy accessories, it may be necessary to lower the screed to the ground before engaging the Frame Raise system.

19) **Engine Start** - The engine will start only if the brakes are engaged, the travel lever/switch is in neutral, permissive start switch is engaged, and the Master Switch is “On”.

20) **Vibrators** - The vibrator switch will function only when the travel lever/switch is forward. Push up to turn vibrators “On”, down to turn vibrators “Off”.

21**)** **Screed Lift** - Push up to “Raise” the screed, down to “Lower” the screed, or center for “Neutral”. After the screed is raised to the desired height and the switch is released, it returns to the hold position. The screed is hydraulically locked at that height. While paving, the switch must be set in the “Lower” float position.

22) **Screed Assist** - Pavers equipped with power extending screeds (Stretch 16 or Stretch 20) have a Screed Assist system that allows adjustment of the screed bearing pressure on the mat. Once turned on, the screed assist should be left on. Do not switch the screed assist on and off

while the paver is in motion. The screed assist should only be turned on when the screed is resting on the ground and should be turned off prior to raising the screed.

> **Notice**: If the screed is raised when the screed assist switch is in the ON position the screed could drop suddenly, seriously damaging the screed.

23) **Differential Lock** - In wet or slick conditions one wheel may lose traction and begin to spin. By activating the optional differential lock switch, both rear wheels will rotate at the same speed regardless of how much traction each wheel has.

24) **Steer Assist** - The steer assist switch is spring loaded to return to center. When the switch is activated to one side or the other, the system slows the inside rear drive motor while continuing to drive the other motor at regular speed. This has the effect of abruptly seering the paver in the direction the switch is pushed.

25) **Oil Pressure Gauge** - Indicates engine oil pressure. Minimum oil pressure = 5 psi. Engine will shut down if engine oil pressure falls below 5 psi and the permissive start switch is not engaged.

26) **Brake** - The brake switch engages and releases the brakes. Brakes will not release until sufficient system pressure is built up and the switch is set to the “Release” position. Do not use for routine braking. Use only for parking and emergency stops.

27) **Engine Coolant Temperature Gauge** - Indicates engine coolant temperature. Normal operating temperature = 205° F. Engine will shut down if engine coolant temperature exceeds 223° F.

28) **Throttle** - The engine has only two speeds. Use “Idle” to start and warm up the engine, hydraulic oil, and screed. Use “Full” position for all other functions. Switch to “Full” only after engine and hydraulic oil have warmed up.

29) **Horn** - Push up to sound the horn. When the switch is released, it will return to the “Off” position.

30) **De-Track Override** - When pushed, overrides the travel switch direction commands and enables opposite direction travel, in case of de-tracking. The switch is spring-loaded to return to the off position.

31) **De-Tracked Light** - Indicates when paver de-tracked condition/ correction situation exists.

32) **Paver Speed Control** - This dial is used to govern the maximum travel speed of the paver. With the paver speed control set at “0 (min)”, the paver will not move.

Maximum speed for the wheeled paver is about 150 feet/minute paving speed (46 meters/minute) and about 12 miles/hour travel speed (20 km/hour).

The steel & rubber track pavers have a maximum paving speed in excess of 150 feet/minute and a maximum travel speed of about 5 miles/hour (9 km/hour) for steel track. The rubber track paver maximum travel speed is about 10 miles/hour (16 km/hour). A setting of five will be about half maximum speed.

33) **Travel Direction Lever/switch** - Moving the travel direction lever/switch forward or back moves the paver in the desired direction. The travel switch engages full forward or reverse respectively. On systems with the travel lever, speed is increased as the lever is moved to the full forward or reverse position. This provides a smooth start and eliminates sudden shocks to the hydraulic system. Maximum speed is set using the paver speed control above.

34) **Emergency Stop (E-Stop) Button** - When pushed, all paver systems are immediately shut down.

35) **Fuel Tank Selector** - This switch transfers fuel flow and fuel level indication between the left- and right-hand fuel tanks.

36) **Engine Stop Alert Light** - When lit, stop the paver immediately. Also used in conjunction with the Engine Diagnostics Access Controls, to flash codes to the operator - Flashes twice to alert driver to an engine emergency fault diagnostic condition.

37) **Engine Warning Alert Light** - When lit, investigate an abnormal engine condition. Also used in conjunction with the Engine Diagnostics Access Controls to flash codes to the operator - Flashes twice to alert driver to an engine maintenance fault diagnostic condition.

38) **Engine Maintenance Alert Light** - When lit, indicates a low engine oil condition.

39) **Water In Fuel Light** - When lit, moisture has been sensed in the fuel filter.

40) **Engine Diagnostics Access Controls** - These two switches allow the operator to access the engine control computer to “read” any faults stored in the system.

Diagnostics “On/Off” - Used to enter the diagnostics program. Will cause the “Stop” or “Warning” lights to flash codes stored in the diagnostic system. If no engine faults exist with this switch “On”, both the “Stop” and “Warning” lights will turn on and remain on until the switch is set “Off”.

The Diagnostics “Inc/Dec” switch is spring-loaded. This switch incrementally or decrementally identifies multiple faults, using three-digit coded, unique, numerical flashing sequences for each identified faults stored in the system.

Notice: Refer to the Operation and Maintenance manual and Cummins engine manual for complete diagnostic instructions.

41) **Wait to Start Light**- When this light is lit, not all engine prestarting conditions are met. Do not start the paver until this light goes off.

Periodic Maintenance

Raising the hood

DANGER - If the hood drops onto someone it will cause death or severe personnel injury. Do not work under the hood before the hood safety latch is engaged.

The hood on the Paver must be raised to gain access to the engine for daily maintenance. The hood is raised/lowered using a hydraulic cylinder which is activated by a lever just under the hood on the right side of the machine in front of the rear wheel or drive sprocket. (Figure 8)

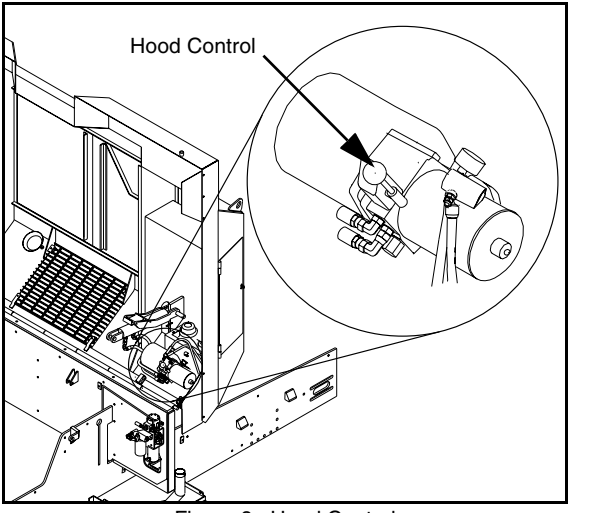


Figure 8. Hood Control

To raise the hood:

1) Position and lock the operator's console in the center position.
2) Set the Master Switch to ON before activating the hood control. Once the hood raising cylinder is fully extended, the hood safety latch will engage automatically.

If the paver's batteries become discharged, external power, via jumper cables, must be attached to the solenoid next to the hood control lever and to the paver frame (Figure 9) .See page 78 for details. This will allow the hood raising system to function in the normal manner. The Master Switch must be ON to operate the hood lift system.

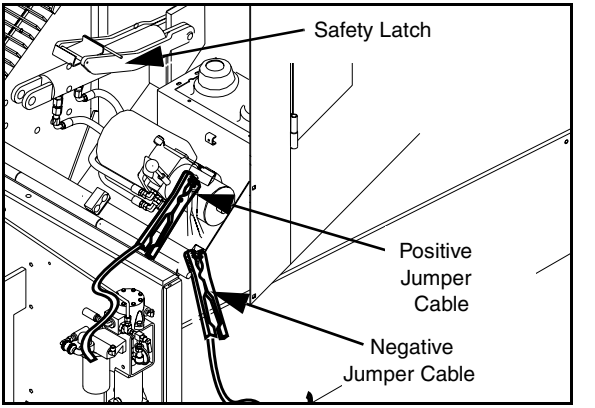


Figure 9. Connecting Jumper Cables

WARNING - Keep all personnel out from under the hood until the hood safety latch is engage. Failure to follow these instructions could result in death or serious injury.

To lower the hood, release the hood safety latch and activate the hood raising lever. (Figure 9)

Before Starting Engine

Before starting the engine, the operator should check the following details personally.

1) Verify that all decals are properly adhered to the machine, undamaged, and legible.
2) Be sure all safety items (decals, guards, walkways, fire extinguisher, etc.) are in place and properly installed.

3) Engine Oil Level should be at the “Full” mark on the dip stick. If engine oil is low, add oil to bring the level up to the “Full” mark. Refer to the engine manual for the correct oil type.
4) Coolant Level inside the radiator should be just above the baffle. If not add the correct mixture of antifreeze and water. Do not over fill as excesses will be blown out the over flow. Refer to the engine manual to find the correct antifreeze and water mixture to use for the temperatures found in your working area.
5) Hydraulic Oil Level must be checked while the hydraulic oil is cold and the machine is sitting level. If the hydraulic oil level is low, add the correct amounts of make up oil to bring the level to the COLD level on the sight glass.
6) Engine Fuel Tank Level should be checked to ensure you have enough fuel to operate the paver for the desired amount of time.

Perform a visual inspection of the complete paver including engine compartment, for any signs of damage or leaks. Do not start the paver until all damage and leaks are repaired.

Fluid Capacity Chart

The fluid capacity chart Table 2 shows approximate capacities for use when servicing your paver.

Notice - The capacities shown are subject to change without prior notice.

MODEL	352	362	452	462	552	562	LUBRICANT TYPE
Hydraulic Tank	45 Gal.	45 Gal.	75 Gal.	75 Gal.	75 Gal.	75 Gal.	ISO 68 Hyd Oil
Fuel Tank - Useable Cap: **- Total Cap:**	51 Gal. 54 Gal.	51 Gal. 54 Gal.	73 Gal. 76 Gal.	79 Gal. 82 Gal.	73 Gal. 76 Gal.	79 Gal. 82 Gal.	
Hood Raise System	2 Qt.	2 Qt.	2 Qt.	2 Qt.	2 Qt.	2 Qt.	ISO 68 Hyd Oil
Pump Drive	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Traction Drive (each)	1 Gal.	1 Gal.	1.05 Gal.	1.05 Gal.	1.05 Gal.	1.05 Gal.	80W-90
Slat Conveyor Drive (each)	N/A	N/A	1 Qt.	1 Qt.	1 Qt.	1 Qt.	80W-90
Remix Auger Drive (each)	N/A	N/A	Sight Gauge	Sight Gauge	Sight Gauge	Sight Gauge	80W-90
Engine Oil	10 Qt.	10 Qt.	15 Qt.	15 Qt.	15 Qt.	15 Qt.	SAE 15W-40
Engine Coolant	6 Gal.	6 Gal.	6.5 Gal.	6.5 Gal.	6.5 Gal.	6.5 Gal.	Glycol/Water 50/50

TABLE 2 FLUID CAPACITIES

Maintenance Checklist

Ref.	Item to be checked	8 hrs	40 hrs	250 hrs	500 hrs	1000 hrs	Yearly	As Needed
1	Fuel level	I/F						
2	Fuel Filter/Water Separator	D		R				
3	Travel Lever Alignment		C					
4	Hydraulic Fluid	I/F			R*	R		
5	Oil Cooler	I/C						
6	Suction Strainers				C			
7	Charge Filters		I		R			
8	Auxiliary Pump Filter				R			
9	Hyd. lines & components	I						
10	Air Restriction Indicator	I						
11	Air Filter							C/R
12	Engine Oil	I/F		R				
13	Engine Oil Filter			R				
14	Engine Coolant	I/F					R	

Key: I - Inspect C - Clean R - Replace A - Adjust D - Drain L - Lubricate F - Fill * - After first 40 hrs only

TABLE 3 MAINTENANCE CHECKLIST

Ref.	Item to be checked	8 hrs	40 hrs	250 hrs	500 hrs	1000 hrs	Yearly	As Needed
15	Fan Belt		I/A					
16	Radiator	I/C						
17	Engine Cooling Fan	I						
18	Battery		I/F					
19	Tire Pressure		I/F					
20	Frame Raise Eccentric				L			
21	Steel Track Tension		I					
22	Rubber Track Tension		I					
23	Track Pivot		L					
24	Fire Extinguisher			I				
25	Horn	I						
26	Pump Drive Belts		I/A					
27	Final Drive Oil		I/F*			R		
28	Steering Bogie Align/Sync							I/A
29	Steering Linkage			L			I/A	
30	Bogie Beam Bearings			L				

Key: I - Inspect C - Clean R - Replace A - Adjust D - Drain L - Lubricate F - Fill * - After first 40 hrs only

TABLE 3 MAINTENANCE CHECKLIST (CONTINUED)

Ref.	Item to be checked	8 hrs	40 hrs	250 hrs	500 hrs	1000 hrs	Yearly	As Needed
31	Front Wheel Bearings						L	
32	Bogie Wheel Toe In						I/A	
33	Slat Conveyor Chains	I/L	I/A					
34	Slat Conveyor Bearings	L						
35	Spreading Auger Bearings	L						
36	Feeder Drive Chain		I/A					
37	Delivery Auger		I					A
38	Delivery Auger Bearings	L						
39	Del. Auger Drive-Gear Drv.		I/F*			R		
40	Delivery Auger Clearance		I					A (120 hrs max)
41	Conveyor Speed Reducer		I					
42	Hood Raise Reservoir			I				
43	Op. Console Pivot Bearings			L				
44	Tow Arm Nose Roller	L						
45	Slope Beam Rod Ends			L				
46	Truck Hitch	C/L						
47	Fume Recovery System	I					I	C

Key: I - Inspect C - Clean R - Replace A - Adjust D - Drain L - Lubricate F - Fill * - After first 40 hrs only

TABLE 3 MAINTENANCE CHECKLIST (CONTINUED)

1) Fuel Level

WARNING - Keep away from sparks or open flame while working with fuel.

Check fuel level before each work period to ensure you have enough fuel to operate for the desired period of time. Refer to the engine manufacturers manual to determine what grade of fuel to use for your operating temperature and conditions.

2) Fuel/Water Separator

WARNING - Keep away from sparks or open flame while working with fuel.

Daily Maintenance

Drain the water and sediment from the separator daily. (Figure 10) . Shut off the engine. .

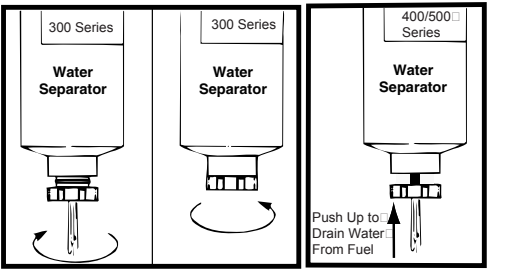


Figure 10. Draining fuel/water separator

300 Series Pavers - Turn the valve counterclockwise approximately 1-1/2 to 2 turns until liquid starts draining slowly. Turn the valve clockwise to close the drain. Drain the filter sump of water until clean fuel is visible

> **NOTICE** - Only use your hand to open or close the drain valve. Do not over tighten the valve. Over tightening can damage the threads.

400/500 Series Pavers - A sensor built into the separator actives the “water in fuel” light on the operator’s console when water is detected. Push up on the valve to open. Release to close.

Filter Replacement

Replace the fuel filter and water separator every 250 hour of operation. Some operating conditions may require replacement at shorter intervals for proper engine operation.

To replace the fuel filters:

1) Clean the area around the filter head.
2) Remove the filters.
3) Clean the gasket surface of the filter head.
4) Replace the O-ring.
5) Fill new filters with clean fuel and lubricate the O-ring seal with clean lubricating oil.
6) Install filters and tighten.

   NOTICE - Overtightening may distort the treads or damage the filter element.

3) Travel Lever Alignment

Rubber tire pavers and some track pavers (optional feature) use a travel lever to control travel speed and direction. During normal operation of a track paver, when the paver is travelling in a straight line over a flat, level surface, both travel levers should be advanced an equal amount. The travel levers need to be brought back into alignment when one travel lever is advanced more than 1/2 of the width of a travel lever more than the other lever. Refer to the Technical manual for travel lever adjustment procedures (Figure 11) .

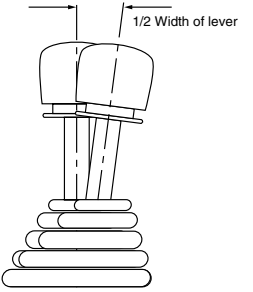


Figure 11. travel lever alignment

When travelling on a grade, on uneven terrain, or when connected to a truck or pickup machine, one travel lever may need to be advanced considerably farther than the other to maintain straight travel. Also, as the speed dial setting is varied, the travel lever position may need to be adjusted to keep the paver traveling in a straight line. In each of these cases the travel levers will need to be adjusted only if one of the travel levers is advanced to the stop before straight travel is achieved. If travel levers are consistently out of alignment in one direction or the other the travel levers should be adjusted to bring them back into alignment. Refer to the Operation and Maintenance Manual for adjustment information.

4) Hydraulic Fluid

WARNING - Turn off engine & remove key before performing any inspections or maintenance.

Hydraulic oil level must be checked while the hydraulic oil is cold and the machine is sitting level. If the hydraulic oil level is low, add the correct amounts of oil to bring the level to the COLD level on the sight glass.

NOTICE - Over filling the hydraulic tank does not leave enough room in the hydraulic system for thermal expansion when the oil is at running temperature. Excess oil will be blown out the breathers which could cause external radiator clogging.

WARNING - Mixing different types or brands of oil could cause unexpected chemical reactions which could damage the pumps. Do not mix different types or brands of oil.

The hydraulic fluid should be drained and replaced with the correct fluid every 1000 hours of operation or once each season. Cedarapids recommends use of a premium anti-wear, ISO Grade 68 hydraulic oil in all pavers. Approved

hydraulic oils in this class are - Amoco AW68; Exxon NUTO H68; Mobil DTE26; Shell Tellus 68; Chevron AW 68; Texaco Rando HD68.

5) Oil Cooler

WARNING - Turn off engine & remove key before performing any inspections or maintenance.

The 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 oil cooler requires cleaning. If severe conditions exist or there are a lot of air-born contaminates the oil cooler will require more attention. Any fluid leaking from any engine compartment component, hose or tube will find its way into the oil cooler.

Remove any dirt or debris that will restrict air flow through the oil cooler. Spray water from a garden hose from the bottom side of the oil cooler to the top to remove any dirt or grit that may have settled between the oil cooler fins. The intake grill vents are hinged in the center, and can be raised for easier access to the oil cooler.Remove any dirt or debris that has accumulated on the intake grill vents.

Check for damaged hoses and loose or damaged hose clamps. Replace as required. Check the oil cooler for leaks and the core for damaged or bent fins. Clean and repair as required.

6) Suction Strainers

The suction strainers should be removed and cleaned every 500 hours of operation. Refer to the Operation and Maintenance Manual for information on cleaning the suction strainers.

7) Charge Filters

The paver has two charge filters that protect the traction hydraulic circuits and two charge filters that protect the conveyor hydraulic circuits. Each charge filter is equipped with an indicator that operates in the green zone when the

filter is in good condition and operates in the red zone when the filter is dirty. The indicators should be checked every 40 hours with the engine at full throttle. Do not wait for the indicator to move into the red zone before replacing the filters. The filters should be replaced every 500 hours or when the indicator is operating in the red zone, which ever comes first. (Figure 12)

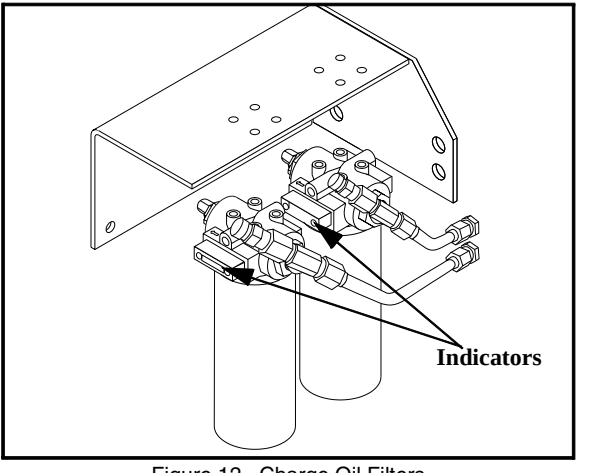


Figure 12. Charge Oil Filters

8) Auxiliary Pump Filter

Refer to the Operation and Maintenance Manual for information on replacing the auxiliary pump filter.

9) Hydraulic lines and components

WARNING - Leaking hydraulic fluid could be injected into your body causing death or severe personnel injury. Do not use your hands to search for oil leaks. Run cardboard along hydraulic lines to check for leaks.

Check all hoses, tubes, and components for leaks, damage, or loose fittings. Check the ground for signs of fluid leakage. Spots of oil soaked dust may indicate a slow leaking hydraulic component. These leaks should be identified and fixed before operating the equipment.

10) Air Restriction Indicator

WARNING - Turn off engine & remove key 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.

Service the filter element when the red indicator flag is visible in the window.

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

11) Air Filter

NOTICE - Never operate a paver without an air cleaner. Intake air must be filtered to prevent dirt and debris from entering the engine and causing serious and expensive damage.

Running the paver with an air cleaner that needs replacement does not allow the engine to get the proper amount of air to burn the fuel properly, which reduces engine horsepower and fuel efficiency.

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

Cedarapids does not recommend that air filter elements be cleaned in any way. When the air restriction indicator is operating in the red area the primary element must be replaced. The safety element must be replaced after three primary element changes.

NOTICE - Do not beat, shake, or use high pressure compressed air to remove dirt from an element. These methods can make small cuts in the element material which will allow dirt to enter the engine causing serious and expensive damage to the engine.

Engine Air Inlet Connections

WARNING - Turn off engine & remove key 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. Tighten or replace parts as needed to ensure the air inlet system does not leak. (Figure 13)

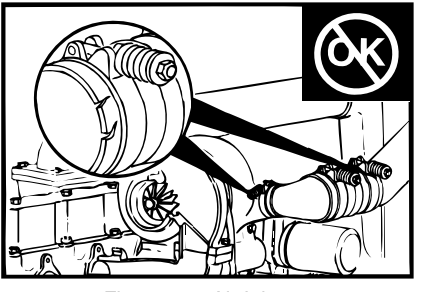


Figure 13. Air Inlets

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.

12) Engine Oil

Engine Oil Level

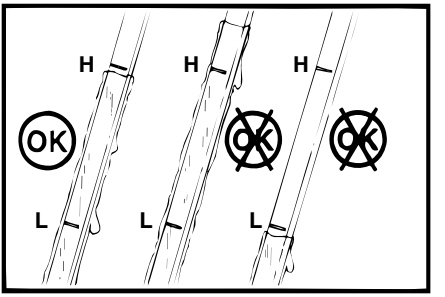


Figure 14. Checking Engine Oil Level

Never operate the engine with the oil level below the “L” (Low) mark or above the “H” (High) mark on the engine oil dipstick. 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. (Figure 14)

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

Changing Engine Oil

Refer to the paver and engine Operation and Maintenance Manuals for information on changing the engine oil.

13) Engine Oil Filter

Engine oil and filter 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.

Use the appropriate replacement filter for your engine. See your Cedarapids dealer to be sure you are getting the correct oil filter.

Refer to Engine Service and Maintenance manuals for recommended change interval and instructions.

14) Engine Coolant

The coolant level must be checked daily (Figure 15) and (Figure 16) .

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.

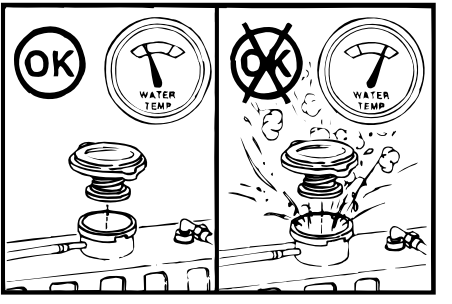


Figure 15. Hot Coolant Hazard

NOTICE - 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.

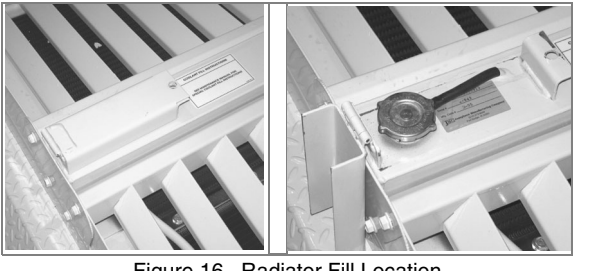


Figure 16. Radiator Fill Location

Fill the cooling system with coolant to the bottom of the fill neck in the radiator with a 50/50 mixture of antifreeze and clean water.

NOTICE - Do not overfill the radiator. Overfilling does not leave room for thermal expansion. Excess coolant will be forced out of the overflow.

To add coolant (radiator capacity is about 9.5 gallons):

1) Raise hood about six (6) inches.
2) Add coolant until coolant reaches the bottom of the fill neck.
3) Wait one minute for air to be purged out.
4) Repeat step 2 and 3 until all air is purged out and coolant remains at the bottom of the fill neck. System is full when coolant remains at the bottom of the fill neck.

15) Engine Fan Belt

WARNING - Turn off engine & remove key before performing any inspections or maintenance.

Visually inspect the drive belt. Check the belt for intersecting cracks. Transverse (across the belt width) cracks are acceptable. Longitudinal (direction of belt length) cracks that intersect with transverse cracks are not acceptable. Replace the belt if it is frayed or has pieces of material missing.

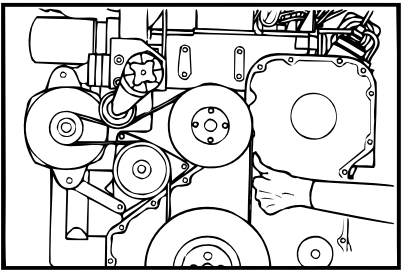


Figure 17. Checking Belt Tension

Measure the drive belt deflection at the longest span of the belt. (Figure 17)

Maximum Deflection for the Cummins 4BTA & 6BTA engines is 3/8 to 1/2 inch [9.5 to 12.7mm].

16) Radiator Cleaning/ Leak Check

WARNING - Turn off engine & remove key before performing any inspections or maintenance.

The exterior of the radiator should be checked daily for dirt and other buildup that would restrict the air flow. The radiator is accessed by lifting the two louvered panels on top of the tractor hood (Figure 18) . Remove one bolt in each corner of the louvered panels and lift the respective panel. Be careful not to remove the radiator mounting bolts.

Paving conditions will determine how often the radiator requires cleaning. If severe conditions exist or there are a lot of air-born contaminates the radiator will require more frequent attention. Any fluid leaking from any engine compartment component, hose, or tube will find its way into the radiator. When cleaning the radiator, check between the radiator and oil cooler for debris buildup.

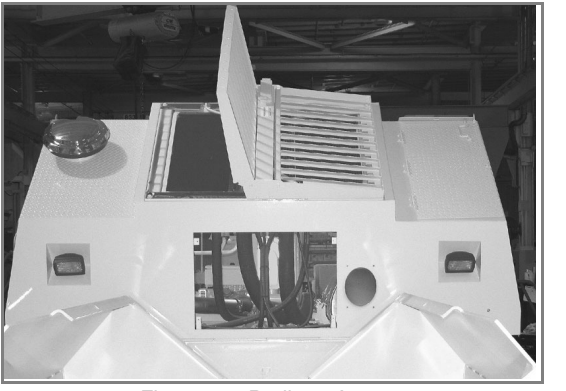


Figure 18. Radiator Access

Check for damaged hoses and loose or damaged hose clamps. Replace as required. Check the radiator for leaks in the upper and lower radiator sections. Check the radiator core for damaged or bent fins. Clean and repair as required.

17) Engine Cooling Fan

WARNING - Personal injury can result from a fan blade failure. Pulling or prying on the fan can damage the fan blade and cause fan failure.

WARNING - Turn off engine & remove key before performing any inspections or maintenance unless specifically instructed to the contrary in this manual.

A visual inspection of the cooling fan is required daily. Check for cracks, loose rivets, and bent or loose blades. Check the fan to make sure it is securely mounted. Tighten the bolts if necessary. Replace any fan that is damaged.

18) Battery

The battery fluid level should be checked to ensure it is at the correct level.

WARNING - Battery fumes are highly explosive and could cause severe personnel injury. Keep flame and sparks away from the battery while jump starting or charging.

WARNING - Sulfuric acid in batteries is a poison and could cause severe burns. Avoid contact with skin, eyes, and clothes. When you work around batteries, eye protection, gloves and long sleeved shirts must be worn.

Checking battery fluid levels

The battery fluid level should be checked to ensure it is at the correct level. If necessary fill the battery with clean water to bring the fluid level up to the bottom of the neck of each battery cell. (Figure 19)

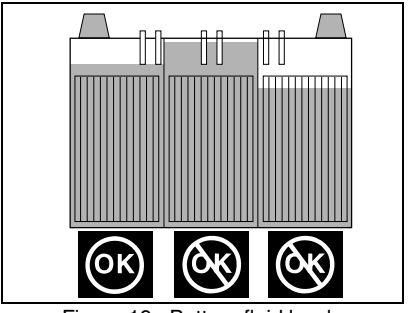


Figure 19. Battery fluid levels

CAUTION - When removing the battery cables, always remove the negative terminal first then the positive terminal. This will reduce the chance of sparking.

The battery terminals should be checked for corrosion buildup and tightness of connection. 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 or corroded connections are a prime source of starting problems and other electrical problems.

Cleaning Batteries

Make sure all the battery caps are on tight before cleaning the battery. Allowing dirt or baking soda solution into the battery will destroy the battery.

Batteries should be kept clean at all times. Wipe the outside of the battery with a cloth to remove dirt and grime.

Make sure the vent holes in the battery caps are kept open at all times to allow gas to escape from inside the battery.

To clean the battery cable and terminals, remove the battery cables and clean them with a wire brush. Soak the cables and wash the terminals in a solution of baking soda and water. Rinse the cables, battery, and battery compartment with clean water.

Refer to the Operation and Maintenance Manual for more information on care and maintenance of batteries.

19) Tire Pressure

The tire pressure should be maintained according to Table 4 and be equal on each side..

	352	452	552
Tire Pressure	32 psi	32 psi	32 psi

TABLE 4 TIRE PRESSURE

The wheel retainer bolt class is indicated on the head of the bolt. Currently, pavers use one of two size wheel retainer bolts. The 20 mm - 8.8 wheel retainer bolts should be torqued to 267 ft-lb. The 16 mm - 12.9 wheel retainer bolts should be torqued to 234 ft-lb. Apply Loctite 272 before installing bolts.

The drive tires can be filled with calcium chloride and water in accordance with the following chart if severe operational conditions are encountered.

	352	452	552
Tire Size	18.4 x 26	23.1 x 26	24.5 x 32
Calcium	246 lbs	386 lbs	445 lbs
Water	586 lbs	907 lbs	1060 lbs
US Gallons	70.3	108.7	127.02
Total Weight	823 lbs	1287 lbs	1505 lbs

TABLE 5 TIRE FLUID CAPACITY

20) Frame Raise System

The frame raise eccentric should be greased every 500 hours of operation. (Figure 20)

The track pivot should be lubricated weekly with heavy grade oil.

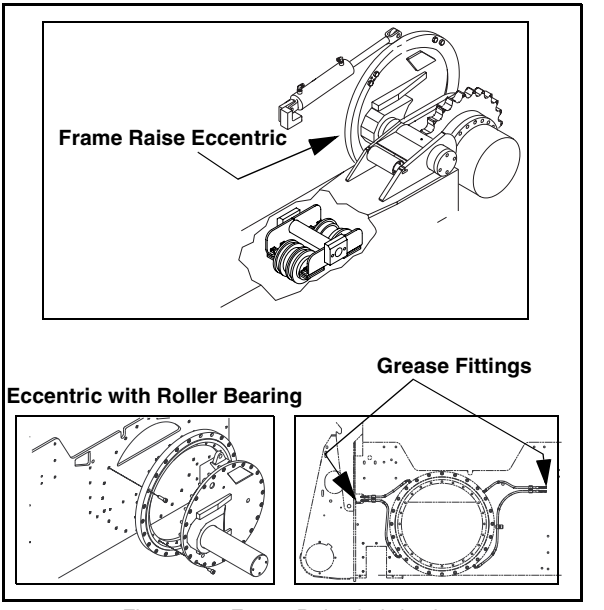


Figure 20. Frame Raise Lubrication

The paver frame raise eccentric should be greased every 500 hours of operation. (Figure 20)

If any frame raise eccentric bearing has pipe plugs, remove them, install grease fittings and grease at the 500 hour interval.

21) Steel Track Tension

The track tension on track pavers can be adjusted to provide the desired track tension. The track has an automatic recoil system that allows the tracks to recoil if a severe impact is encountered then return to previous adjustment point.

Checking steel track tension

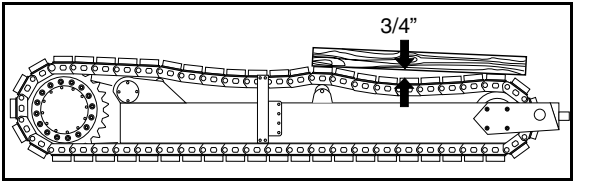


Figure 21. Checking Track Tension

Set the brake switch to ON, travel lever/switch to NEUTRAL and speed dial to MIN (0) before performing checks.

The track tension should be visually checked every day before and during paver operation. If the track looks like it may be getting loose, it can be tested by placing a board or straight edge on the track between the front idler and the first top roller. If the gap between the bottom of the board and the top edge of the track is greater than 3/4”, the track tension must be adjusted. (Figure 21)

> **NOTICE** - Perform track tension checks and adjustments when the paver is at running temperature. Adjusting track tension when the paver is cold could lead to over-tensioning of the track.

Refer to the Operation and Maintenance Manual for information on adjusting the track tension.

22) Rubber Track Tension

The tracks on rubber track pavers (Figure 22) do not require periodic adjustment. They are self-adjusted by applying a pre-set hydraulic pressure supplied by the auxiliary pump to the tensioning cylinders. The tracks have an automatic system that allows them to recoil and return to tension if a severe impact is encountered. If tracks appear loose, troubleshoot the track hydraulic system (see Operation and Maintenance Manual).

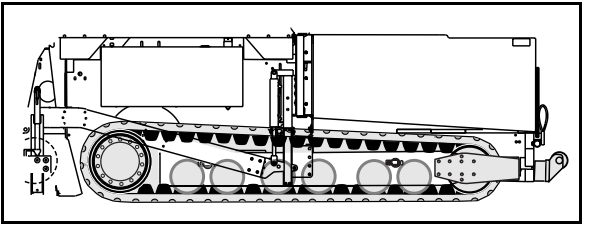


Figure 22. Rubber Track

23) Track Pivot

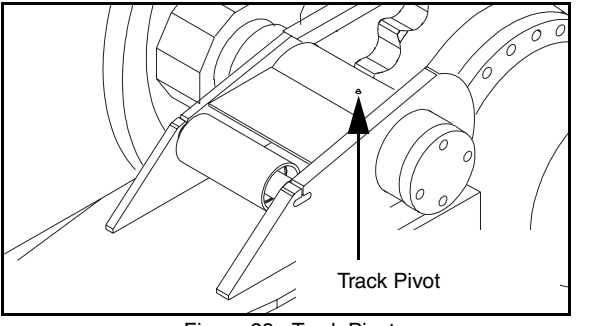


Figure 23. Track Pivot

The track pivot should be lubricated every 40 hours of operation. (Figure 23)

24) Fire Extinguisher

The fire extinguisher should be inspected every 250 hours to ensure the extinguisher is fully charged and has not been damaged.

25) Horn

It is essential that the horn is maintained in working order at all times for safety reasons. Before starting the engine each day the horn should be sounded to ensure it is in working order.

26) Pump Drive Belts

WARNING - Turn off engine & remove key before performing any inspections or maintenance.

NOTICE - Do not overtighten belts. Overtightening belts can cause premature belt and/or bearing failure.

NOTICE - Make sure the belt tension gauge is used correctly. Pushing the wrong end of the tester onto the belt will give an incorrect belt tension reading.

Tension Test Procedure

DANGER - If the hood drops onto someone it will cause death or severe personnel injury. Do not work under the hood before the hood safety latch is engaged.

1) Raise hood until hood safety latch engages.
2) Loosen belt access covers.
3) Position the bottom of the large O-ring on the tester (Figure 24) at the deflection indicated on the poly chain belt Table 6. Set the small O-ring on the tester to zero.
4) Locate the midpoint on the belt and place the belt end of the tester onto the belt.

   NOTICE - The tension tester must be inserted perpendicular to the belt to accurately measure belt tension.
5) Place a straight-edge over the belt access hole and push on the black tipped plunger until the bottom of the large O-ring is level with the straight-edge (Figure 25) .

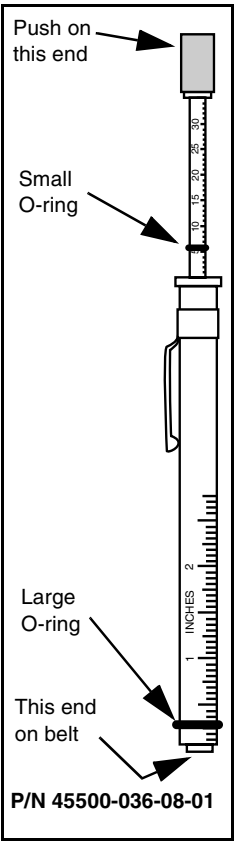


Figure 24. Belt Tension Tester

6) Remove the tester and read the belt deflection force in pounds a the small O-ring. Compare this with the values given in the appropriate table below. If the force is outside the listed limits the belt should be retensioned.

Poly Chain Belts Information/ Adjustment

Poly chain belts are designed to provide years of reliable service without stretching. As a result, adjusting the belt tension is **rarely required**. Tension values for poly chain belts are temperature-sensitive. Do not adjust Poly chain belts unless they test below the MIN (minimum) force listed in Table 6 when the machine is at normal operating temperature (minimum of two hours continuous operation). Since poly chain belts do not expand and contract during machine operation, adjusting the belts to normal operating temperature values when they are cold will result in rapid belt failure, and possibly damage to pump bearings.

> **NOTICE** - Tension values for poly chain belts are temperature-sensitive. Check poly chain belt tension only after the **entire** machine is at operating temperature (minimum of two hours of operation).

Poly Chain Belts			
	Force		Deflection
At Normal Operating Temperature	Min	18 lbs/8.2 kg	1/4" 6.4 mm
	Max	20 lbs/9.1 kg	

TABLE 6 POLY CHAIN BELT TENSION SETTINGS

When installing belts, either new or used, adjust the belts for an 8 to 10 lb force setting at 1/4 inch deflection. After running the machine for a minimum of two hours continuous operation, recheck the belt tension and adjust up to (but not exceeding) the MAX (maximum) value listed inTable 6.

All poly chain adjustments are to be made at 1/4 inch belt deflection.

The following illustration (Figure 25) demonstrates the correct way to use the belt tension tester.

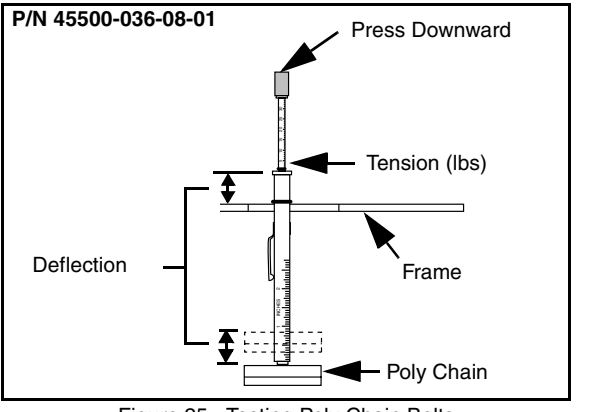


Figure 25. Testing Poly Chain Belts

27) Final Drive Oil

The final drive planetary oil level should be checked during the first 40 hours of operation and replaced at 150 hours of operation. Drain, flush and refill every 1000 hours of normal operation.

To check the oil level, rotate the drive until the fill plug is straight up and the level check plug is 90 degrees down from the fill plug. Remove the level check plug. The oil level should be even with the bottom of the level check plug hole (Figure 26) .

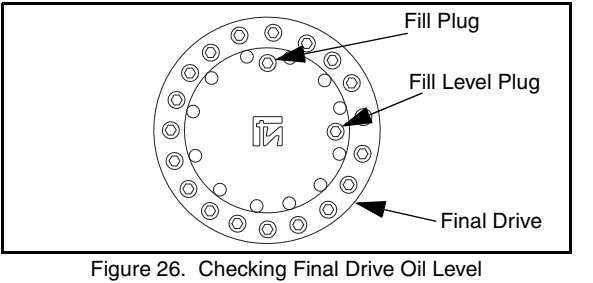


Figure 26. Checking Final Drive Oil Level

NOTICE - Use 80W-90 Gear Oil when adding or replacing final drive oil.

If oil leakage is visable on the outside of the drive unit or hydraulic oil is visable in the gear oil, refer to the Operation and Maintenance Manual for instructions on shaft seal or brake seal replacement.

28) Steering Bogie Alignment/Synchronization

Refer to the Operation and Maintenance Manual for information on aligning the bogie steering.

To synchronize the steering bogies:

1) Stop the paver and run the engine at full throttle.
2) Turn the steering wheel to the left or right until a resistance is felt. Continue turning the steering wheel for 1 to 2 more revolutions.
3) Turn steering wheel back to the center position and continue paving.

29) Steering Linkage

Lubricate the steering linkage rod ends with a few drops of oil every 250 hours.

The steering linkage, rod ends, bushings, bearings and cylinders should be checked seasonally for adjustment and possible wear.

30) Bogie Beam Bearings

Bogie beam bearings must be lubricated every 250 hrs.

31) Front Wheel Bearings

The wheel and pivot bearings should be checked and repacked with Lithium base, type EP, Grade 2 grease yearly.

32) Bogie Wheel Toe-in

Bogie wheel toe-in should be between 1/16” and 1/8”. Refer to the Operation and Maintenance Manual for instructions on checking and adjusting bogie toe-in.

33) Slat Conveyor Chains

The conveyor chain should be adjusted when 1 inch (25mm) of sag is visable between the bottom of the paver frame and the top of the conveyor chain. Adjust the chains so the top of the chain is even with the bottom of the frame. (Figure 27)

NOTICE - Over tightening the chains increases wear on the conveyor chain, front idlers, drive sprockets and all bearings.

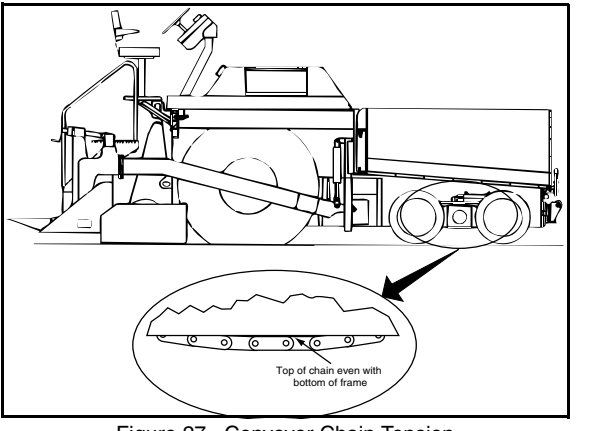


Figure 27. Conveyor Chain Tension

WARNING - Turn off engine & remove key before performing the following inspections or maintenance.

To adjust the conveyor chains:

1) Release the locking rod between the dual adjuster.
2) Using the locking rod or a wrench, rotate the left adjuster 1/2 turn.
3) Rotate the right adjuster 1/2 turn.
4) Repeat procedure of adjusting the left and then the right until the top of the conveyor chain is even with the bottom of the frame.
5) Install the locking rod after finished adjusting.

The conveyor chains should be installed in the paver as shown below. (Figure 28)

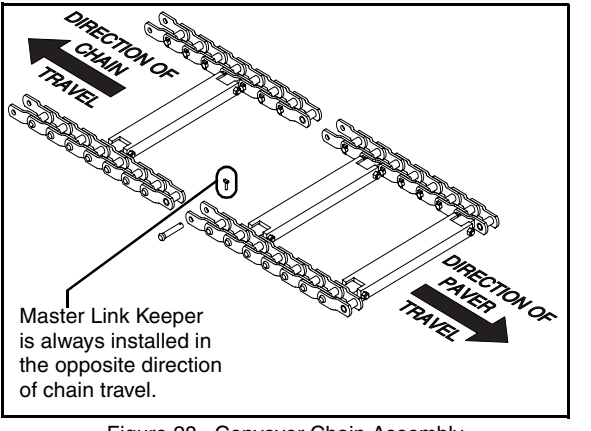


Figure 28. Conveyor Chain Assembly

34) Slat Conveyor Bearings

The four conveyor bearings on each conveyor should be lubricated every 8 hours of operation with Lithium base, type EP, Grade 2 grease. Two front conveyor bearing fittings on each side are near the bogie wheels or track idler. (Figure 30) The inner (Figure 29) and outer (Figure 31) rear conveyor bearing fittings are mounted on the front and back of the rear bulkhead.

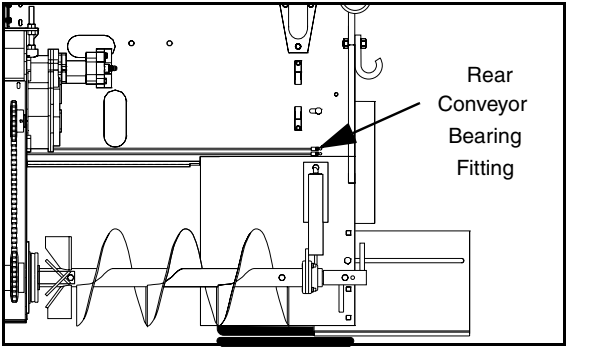


Figure 29. Rear Inner Conveyor Bearings

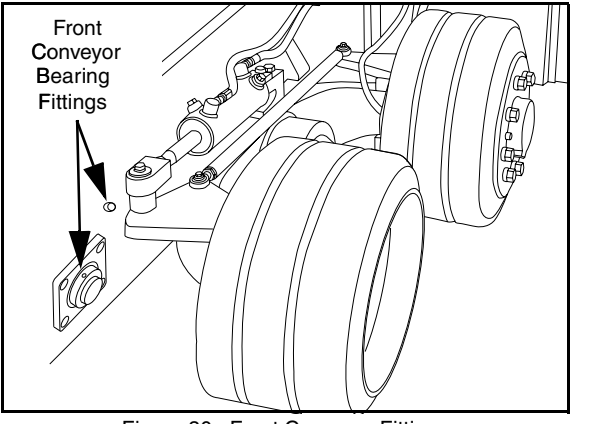


Figure 30. Front Conveyor Fittings

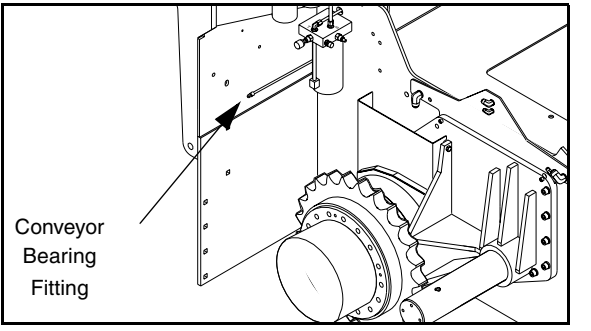


Figure 31. Rear Outer Conveyor Fittings

35) Spreading Auger Bearings (Slat & Remix)

The Auger bearings should be lubricated every 8 hours of operation with 2 to 4 pumps of Lithium base, type EP, Grade 2 grease (Figure 32) .

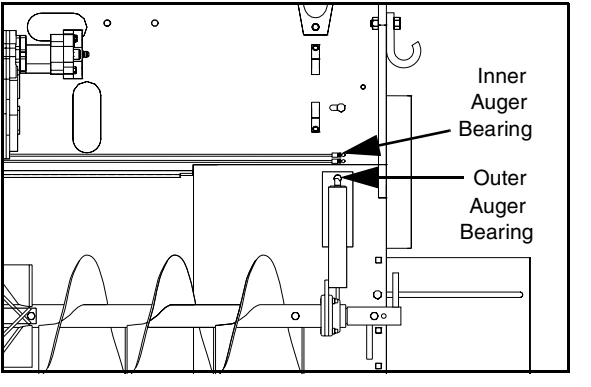


Figure 32. Auger Bearings

36) Feeder Drive Chains (Slat & Remix)

The feeder drive chains should be checked every 40 hours of operation. Check the drive chains for proper tension and wear. Check the bronze spacer washer between the auger drive sprockets for wear. Clean the housing and lubricate the chains and spacer with fuel oil from the spray-down hose or with SAE 10 motor oil. A small amount of oil may be left in the housing for lubrication between checks even though the housing is not oil tight.

WARNING - Turn off engine & remove key before performing the following inspections or maintenance.

1) Remove the cap screws holding the feeder drive chain cover. Pull the cover back and off.
2) Loosen jam nuts on feeder drive chain adjuster rods.
3) Using the adjuster rods, remove the slack from the chain, but do not over tighten. At the correct tension, the chain should move slightly under thumb pressure.
4) Tighten the jam nuts. Replace the cover.

37) Delivery Auger Bearings (Remix)

The front delivery auger bearing on each of the four augers should be lubricated every 8 hours of operation with Lithium base, type EP, Grade 2 grease (Figure 33) .

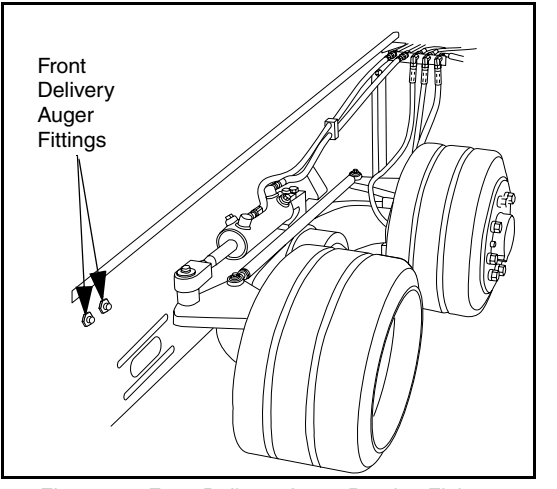


Figure 33. Front Delivery Auger Bearing Fittings

38) Delivery Auger Drive - Gear Drive (Remix)

Change oil, in each delivery auger gear drive speed reducer, the first time at 50 hours of operation. Change oil every 500 hours of operation after the first time. The oil is at the correct level when the oil is just above the sight glass (check at style A or B) (Figure 34) . Use 80W-90 gear oil in the speed reducer. 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. An ISO Grade 150 EP oil can be substituted for those given above.

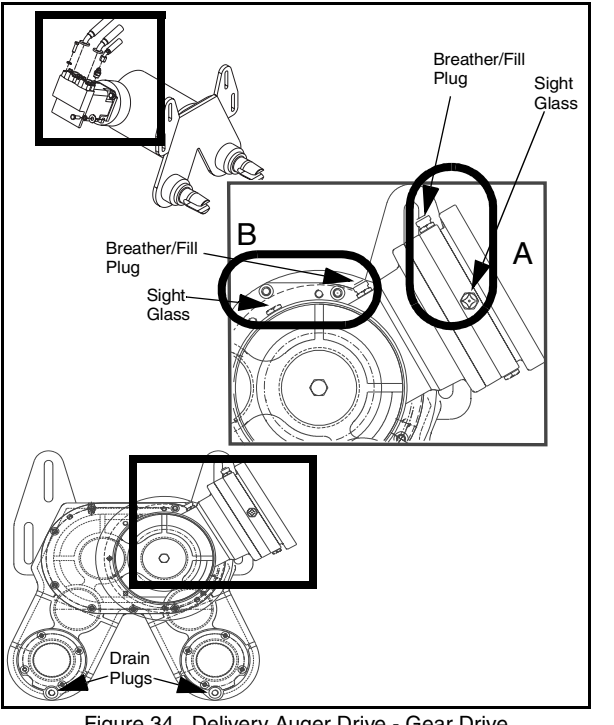


Figure 34. Delivery Auger Drive - Gear Drive

39) Delivery Auger Clearance (Remix)

As the delivery augers wear, the spacing between an auger flighting and liner will increase. This spacing should be the same on both ends and greater than the largest aggregate diameter used in the asphalt mix. Inspect at 40 hours of operation and adjust every 120 hours of operation (Figure 35) and (Figure 36) .

WARNING - Turn off engine & remove key before performing the following inspections or maintenance.

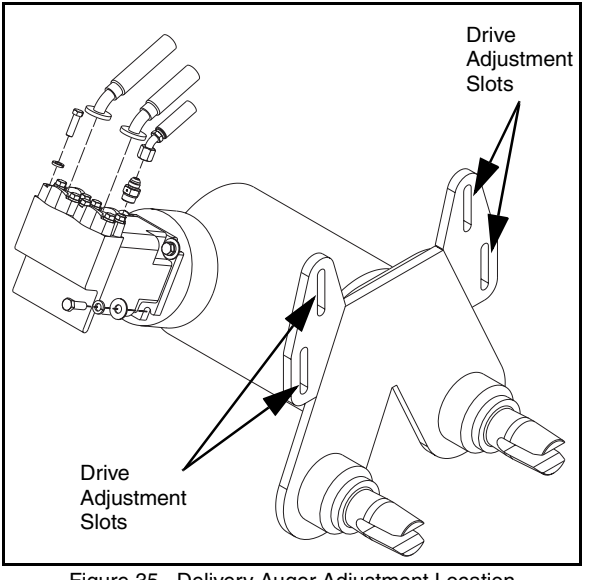


Figure 35. Delivery Auger Adjustment Location

To adjust auger spacing:**:**

NOTICE - Recommended clearance is 1-1/4" min. to 1-3/4" max.

1) Loosen four drive retaining bolts on gearbox and reposition drive end augers.
2) Loosen hopper end of augers retaining bolts and reposition augers.
3) Make sure augers are positioned to recommended clearance between 1-1/4" min. to 1-3/4" max. at both ends of augers.
4) Tighten all bolts to lock in place.

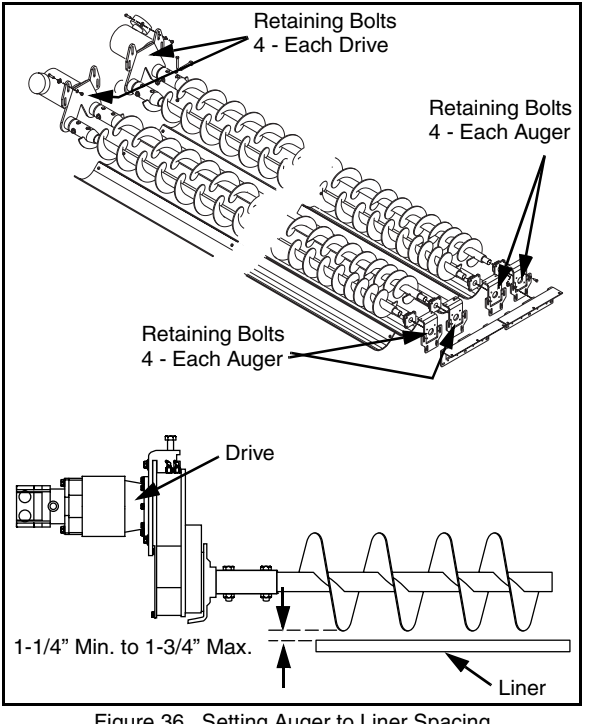


Figure 36. Setting Auger to Liner Spacing

40) Conveyor Speed Reducer (Slat & Remix)

WARNING - Turn off engine & remove key before performing the following inspections or maintenance.

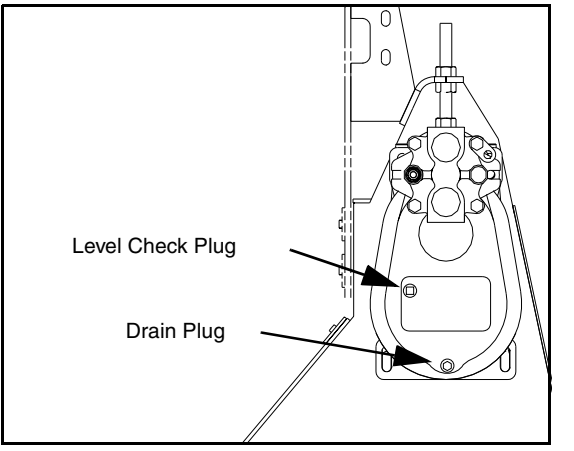


Figure 37. Conveyor Speed Reducer

The conveyor speed reducer oil level should be checked in the first 40 hours and replaced every 1000 hours of operation. The oil is at the correct level when the oil is level with the bottom threads of the level check plug. (Figure 37)

Use 80W-90 gear oil in the conveyor speed reducer. 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. An ISO Grade 150 EP oil can be substituted for those given above.

41) Hood Raise Reservoir

The hood raise reservoir oil level should be checked periodically. Use AW 68 hydraulic oil in the hood raise reservoir.

42) Operator Console Pivot Bearings

The operator console pivot should be lubricated every 250 hours of operation.

43) Tow Arm Nose Roller

The tow arm pull point roller should be lubricated every 8 hours of operation (Figure 38) .

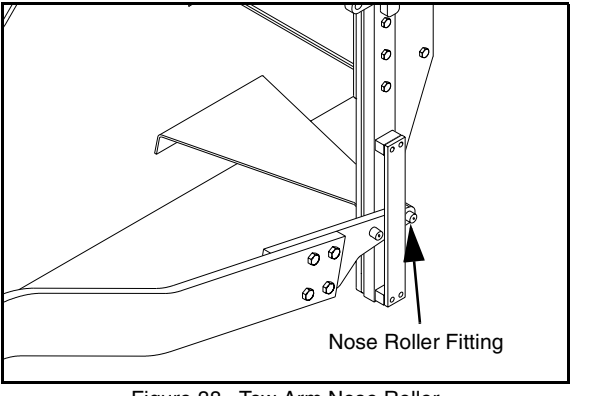


Figure 38. Tow Arm Nose Roller

44) Slope Beam Rod Ends

The slope beam rod ends should be lubricated every 250 hours of operation.

45) Truck Hitch

WARNING - Diesel fumes are explosive and could cause death or severe personnel injury. Turn off screed burners and do not smoke or have open flame in the vicinity when spraying down the truck hitch or any part of the paver.

The truck hitch should be cleaned as part of the daily cleaning to remove any asphalt that has collected on the truck hook or rollers. Spray the truck hook and rollers with diesel fuel during spraydown.

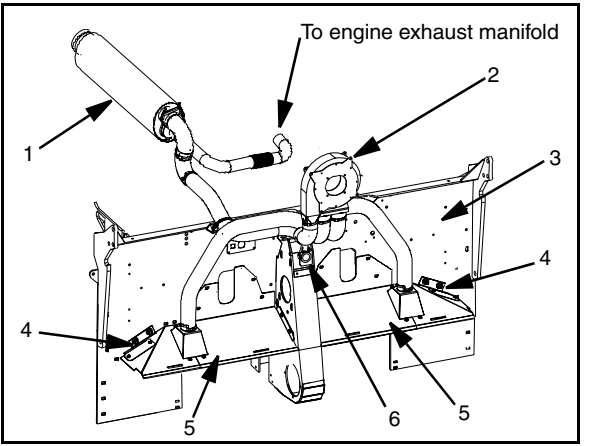
46) Fume Recovery System

The fume recovery system vacuum indicator should be checked each day before beginning operation. With the engine running at full throttle, the vacuum indicator should register a reading. When the vacuum indicator reading is too low, components of the fume recover system require maintenance. Refer to Table 7 and (Figure 39) for troubleshooting information.

NOTICE - Operating the fume recovery system while spraying down the spreading augers or front of the screed will eventually cause the fume recovery system hoses to become plugged. If the engine is running while spraying down the spreading augers or front of the screed, diesel fuel mist will be drawn into and collect on the surface of the fume recovery system hoses. The diesel fuel will mix with dust which will plug the hoses. Turn the engine OFF before spraying down the spreading augers or front of the screed.

Problem	Cause	Remedy
Low vacuum reading	Low hydraulic pressure to fume recover fan motor.	Refer to paver hydraulic schematic
	Damaged, collapsed or disconnected fume recovery hoses between fume recovery fan and muffler.	Repair, replace, or reconnect hoses
	Plugged or collapsed fume recovery hoses between fume recovery fan and muffler.	Clean or replace fume recovery hoses.
High vacuum reading	Plugged fume recovery hoses between fume recovery fan and fume recovery hoods.	Clean or replace fume recovery hoses.
Visible fumes escaping from hoods	Fume recovery system not operating properly.	Ensure fume recovery system is completely installed. Check vacuum indicator system. System should register a vacuum.

TABLE 7 FUME RECOVERY SYSTEM TROUBLESHOOTING



1 - Muffler
2 - Suction Fan
3 - Paver Rear Bulkhead
4 - Sensor Mount Hole
5 - Fixed Hood Sections
6 - Vacuum Indicator

Figure 39. Fume Recovery System Components

Operating the Tractor

WARNING - Do not operate this equipment until you have been trained in its operation or maintenance. This equipment may only be operated or maintained by trained personnel, who have demonstrated their ability to do so safely.

Starting the Engine

1) Make sure all personnel are clear of the paver and aware that the paver is going to be started.
2) Set the Master Switch to the ON position. The Master Switch is accessible through an access cover in the hood, to the left of the operator's console (Figure 40) .

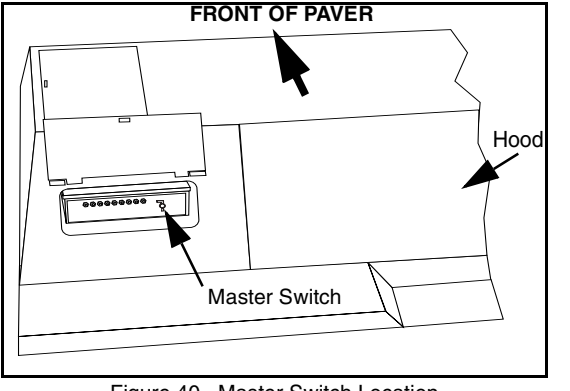


Figure 40. Master Switch Location

3) Set the console switches and controls as follows:

NOTICE - The engine will not start if the operator's console switches are not set as indicated in Table 9 .

Left and Right Feed Conveyors	Off
Vibrators	Off
Screed Assist	Off
Range	Pave
Brake	Engage
Throttle	Idle
Counter Rotate	Normal
Rear Frame Compensator	Off
Paver Speed	“0” (Min.)
Travel Direction	“N” (neutral)

TABLE 9 PRESTART SWITCH SETTINGS

4) Pull the permissive start switch (300 series pavers only) down and the engine start/stop switch up. The paver should start. If the engine does not start after 30 seconds, release both switches and let the starter cool down before cranking the engine again.

Once the engine starts, release the engine start/stop switch but continue to hold the permissive start switch engaged. If the permissive start switch is released before the engine oil pressure reaches 5 lbs. the engine will stop immediately. This system is designed to protect the engine when the engine oil pressure drops below 5 lbs. or the engine temperature rises above 223 degrees F.

NOTICE - After the engine oil pressure is above 5 lbs. and the engine temperature is below 223 degrees F, the Engine light will go out and the Permissive Start switch can be released. If the engine is turned off and started immediately, the engine oil pressure may still be above 5 psi. In this case, the engine will start WITHOUT pressing the Permissive Start switch.

Once the engine is running, allow it to idle for at least 5 minutes to warm up before bringing the engine to full throttle.

Engine Start-up After Stall

Under certain conditions the engine could stall while under load. If the operator attempts to restart the engine immediately after it stalls, the engine will be trying to start under full load. This could overload and damage the starter.

If the engine stalls under load, allow 5 to 10 minutes for the hydraulic system pressures to “leak down” before trying to restart the engine.

Jump Starting/ Charging Batteries

WARNING - Battery fumes are highly explosive and could cause severe personnel injury. Keep flame and sparks away from the battery while jump starting or charging.

NOTICE - Pavers use a 12 Volt electrical system. When jump starting or charging the paver, make sure to use a 12 Volt power source.

1) Raise the hood. See “Raising the hood” on page 33.
2) Connect the jumper cables to the power source.

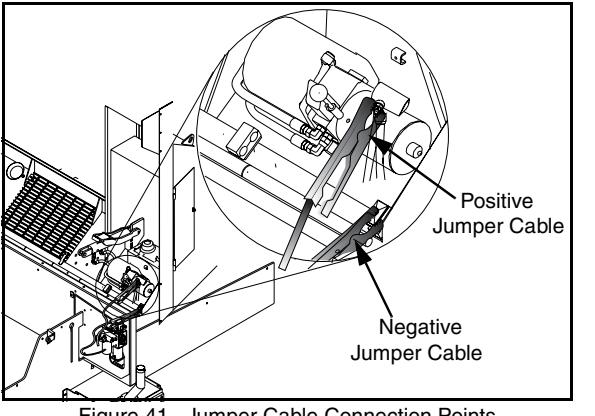


Figure 41. Jumper Cable Connection Points

WARNING - When jumper cables or a charger are connected or disconnected from a battery, a spark will be created when the first cable is disconnected

or the last cable is connected. It is critical that the first cable disconnected and the last cable connected be the negative (-) cable and that this connection be made as far away from the battery as possible to prevent explosion of hydrogen gas.

3) Connect the positive (+) jumper cable to the positive (+) cable attached to the hood raise motor solenoid.
4) Connect the negative (-) jumper cable to the paver frame. The negative (-) cable should always be connected away from the battery so that any sparks created by making the connection do not ignite the hydrogen gas that is produced by the battery.
5) Set the Master Switch to the ON position to jump start the engine or charge the batteries.
6) As soon as the engine starts, remove the jumper cables.

Electronic Controlled Fuel System

The engine control system is an electronically operated fuel control system. The control system uses inputs from the operator and various sensors to determine the fueling and timing required to operate at optimum engine performance. The electronic control module (ECM) is the control center of the system. It processes all of the inputs and sends commands to the fuel system and engine and equipment control devices. The ECM also automatically performs diagnostic tests during operation and will activate a fault code if a problem is detected in one of its circuits. A snapshot of the engine's operating parameters is also stored in memory at the time of a fault activation.

If an out-of-range condition exists and engine derate action is initiated, the operator will be alerted by lighting the "Warning" lamp. The "Warning" lamp will blink or flash when out-of-range conditions continue to worsen.

NOTICE - Engine power and speed will be gradually reduced depending on the level of severity of the observed condition until the engine suts down.

When the “Stop” lamp is lit, the operator **must** stop the equipment ,when it is safe to do so, to reduce the possibility of engine damage.

If temperature, pressure, or coolant level sensors indicate an out-of-condition exists that can damage the engine, the engine will automatically shut down. The “Stop” lamp will flash for 30 seconds prior to automatic engine shut-down to alert the operator. If necessary to move the equipment to a safe position, the operator can re-start the engine after a shutdown, but can only run for 30 seconds before another shutdown occurs.

Note that the “Water in Fuel” and “Wait to Start” lamps are also controlled by the diagnostic system, but not used in fault diagnosis.

Diagnostic Fault Codes

The electronic control system can record and show operation anomalies that present themselves as fault codes. These codes are stored and later used by the operator to make troubleshooting easier. Fault codes are defined as being either active (fault is occuring now) or inactive (fault occured at one time, but not now).

Fault codes are recorded in the ECM and can be read using the “Warning”, “Stop”, or “Maintenance” lamps located on the operator’s console (Figure 42) .

Active fault codes will light one of the lamps as follows:

Warning - This lamp is yellow and indicates the need to repair the fault at the first available time.

Stop - This lamp is red and indicates the need to stop the engine as soon as it can be safely done. The engine should remain shut down until the fault cdan be repaired.

Maintenance - Lamp not used at this time.

Inactive fault codes are stored and can be retrieved from the diagnostic system by reading a combination of flashes and pauses using both the “Stop” and “Warning” lamps.

Checking For Fault Codes

1) Set the engine switch to “Stop” and the engine diagnosticOn/Off switch switch to the “On” position.

2) Set the engine switch to the “Start” position.

If no active fault codes are recorded, both the “Warning” and “Stop” lamps will come on and stay on. If active fault codes are recorded, both lights will come on momentarily, then begin to flash the specific code of the recorded fault or faults.

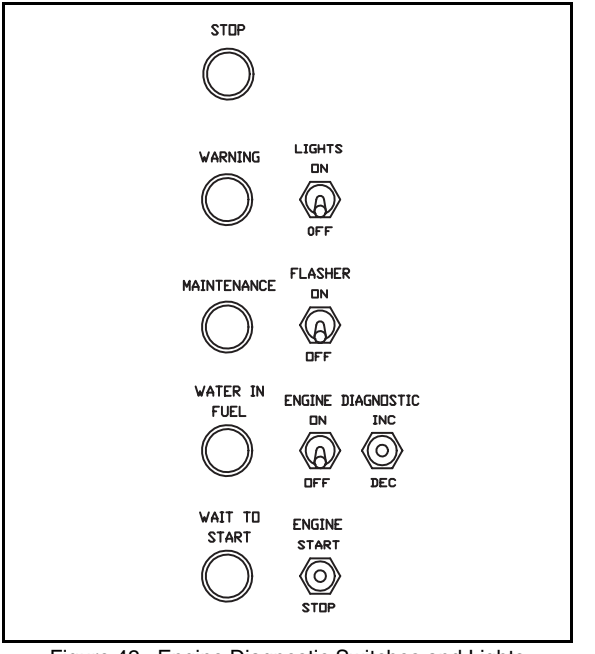


Figure 42. Engine Diagnostic Switches and Lights

Display of Fault Codes

The lamps flash each fault code out two times before advancing to the next stored code. To skip to the next fault code sooner:

1) Set the engine diagnostic switch to the “On” position.

2) Set the engine diagnostic Inc/Dec switch momentarily to the “Inc” positon. Repeat this step to advance to the next stored fault code.

To go back to the previous fault, set the switch momentarily to the “Dec” position.

If only one active fault is recorded, the control system will continuously display the same fault code, even when the switch is moved to the “Inc” or “Dec” positions.

NOTICE - When not using the diagnostic system, be sure the engine diagnostic On/Off switch is set to the “Off” position.

Fault Code Sequence Description

A fault code will flash the “Stop” and “Warning” lamps in the following sequence (Figure 43) :

1) The “Warning” lamp will flash once.

2) After a 1 to 2 second pause, the “Stop” lamp will flash out the number of the recorded fault code. There will be a 1 to 2 second pause between each digit of the fault code number.

3) When the fault code number has finished flashing, the “Warning” lamp will again light momentarily. This 3-digit code will repeat for the second time, then the next code, if available, will be displayed. If none, the sequence will stop.

Refer to the Operation and Maintenance Manual and the Cummins engine Troubleshooting and Repair Manual for the explanation and correction of fault codes.

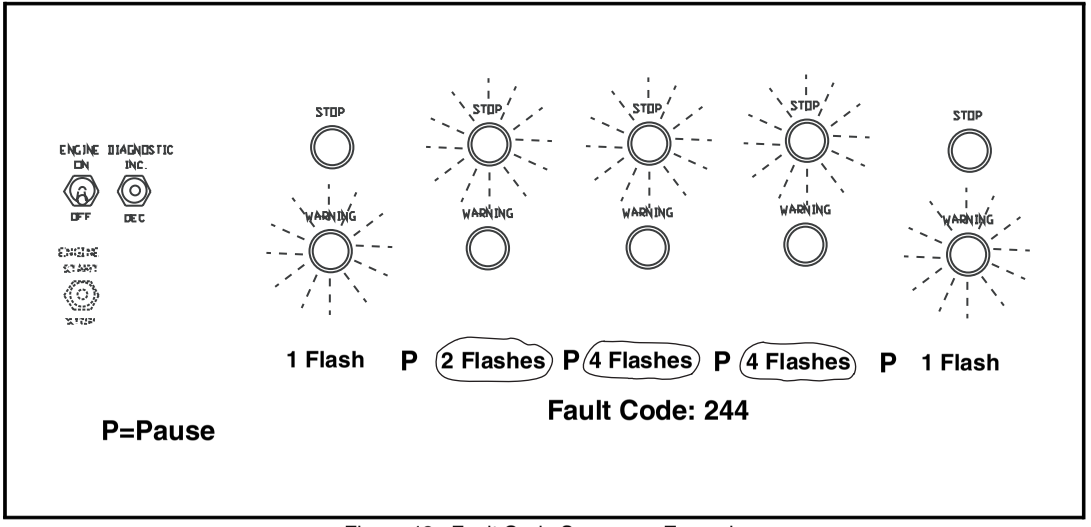


Figure 43. Fault Code Sequence Example

Emergency Towing

If your paver becomes disabled and the engine can not be started it may be necessary to tow the paver. Pavers have a parking brake that automatically engages anytime the engine is not running. Before towing a paver the brakes must be released.

WARNING - Read all of the towing instructions before starting this procedure.

WARNING - Block or restrain the paver before releasing the brakes. Failure to block or restrain the paver could result in serious injury or death.

WARNING - When towing the paver using the following procedure, the paver will not have drive, braking, or steering control. Do not travel down steep grades which could cause the paver to collide with the towing vehicle.

Towing 300 Series Pavers

1) Turn bypass valve on each travel pump counterclockwise slowly 2 turns. (Figure 44)

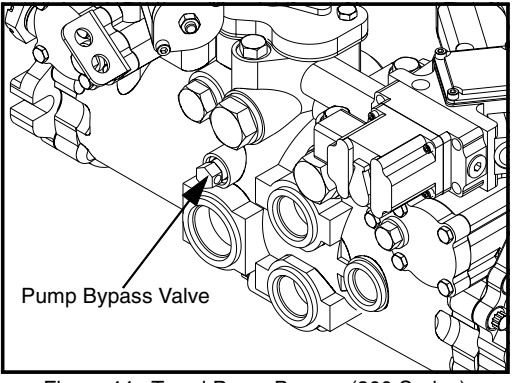


Figure 44. Travel Pump Bypass (300 Series)

2) Disconnect brake hoses from brake/range-shift solenoid valve located on right-hand rear of engine (Figure 45) and (Figure 46) . Place caps on the valve fittings to keep dirt out of the hydraulic system.

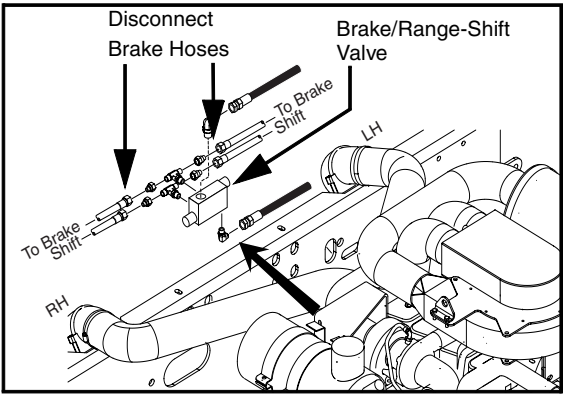


Figure 45. Preparing to Release Brakes

3) Attach a porta-power to open hose ends and pump the pressure up to at least 350 psi to release the brakes. The brakes can be reapplied by releasing the pressure at the porta-power.

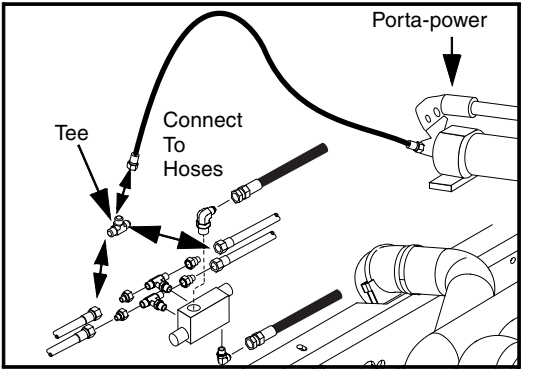


Figure 46. Releasing Brakes with Porta-power

NOTICE - Maintain a minimum of 350 psi to fully release the brakes. Do not exceed 1500 psi.

WARNING - Use a chain in good condition that is capable of pulling the paver.

4) Open the front conveyor bearing covers.
5) Run the chain through the holes shown. (Figure 47)

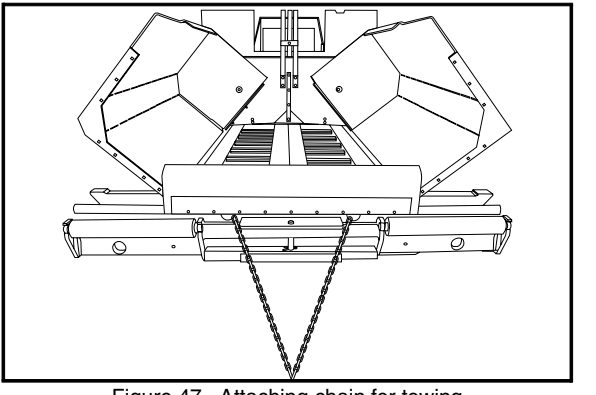


Figure 47. Attaching chain for towing

NOTICE - Attaching chains to the push roller frame or truck hook frame could result in serious and expensive damage.

6) Slowly apply tension to chains to start paver moving. Move the paver at a very slow walking pace.

   NOTICE - Pulling the paver faster than 25 feet per minute can result in serious and expensive damage to the travel system.

7) When the paver is in desired location, release the pressure at the porta-power and reconnect the hose to the brake valve.
8) Close the bypass valves on each travel pump by rotating clockwise until snug against seat. (Figure 44)
9) Tighten to 7 - 10 ft./lbs.

Towing 400/500 Series Pavers

1) Loosen bypass locking nut with 1 1/16” wrench (middle hex nut on bypass/multi-function valve). (Figure 48)
2) Insert an allen wrench into the internal hex.
3) With 1 1/4” wrench, hold the large hex portion of bypass/multi-function valve from rotating.
4) Open both travel pump bypass valves by rotating allen wrench 3 turns counter clockwise.

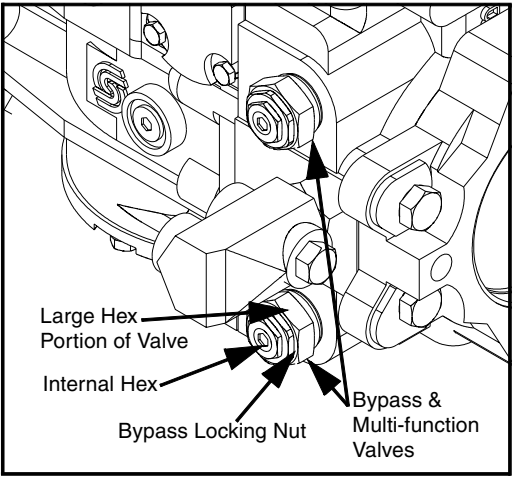


Figure 48. Travel Pump Bypass (400/500 Series)

5) Disconnect tube from brake solenoid valve located on rear bulkhead, right hand side. Place a cap on the valve fitting to keep dirt out of the hydraulic system. (Figure 49) and (Figure 50)

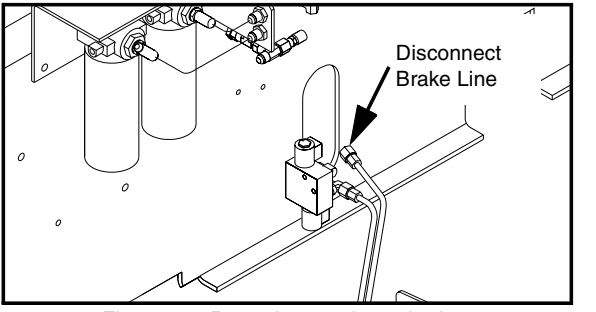


Figure 49. Preparing to release brakes

6) Attach a porta-power to open hose end and pump the pressure up to at least 350 psi to release the brakes. The brakes can be reapplied by releasing the pressure at the porta-power.

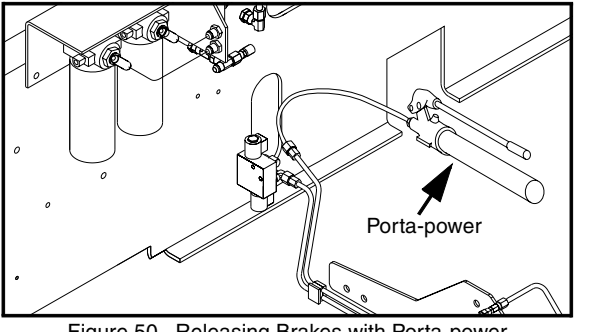


Figure 50. Releasing Brakes with Porta-power

NOTICE - Maintain a minimum of 350 psi to fully release the brakes. Do not exceed 1500 psi.

WARNING - Use a chain in good condition that is capable of pulling the paver.

7) Open the front conveyor bearing covers.
8) Run the chain through the holes shown. (Figure 51)

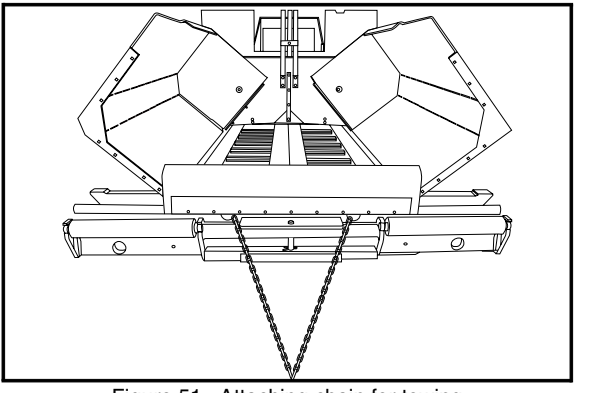


Figure 51. Attaching chain for towing

NOTICE - Attaching chains to the push roller frame or truck hook frame could result in serious and expensive damage.

9) Slowly apply tension to chains to start paver moving. Move the paver at a very slow walking pace.

   NOTICE - Pulling the paver faster than 25 feet per minute can result in serious and expensive damage to the travel system.

10) When the paver is in desired location, release the pressure at the porta-power and reconnect the hose to the brake valve.

11) Close the travel pump bypass valves by rotating clockwise until snug against seat. (Figure 48)

12) Tighten lock nuts.

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Loading/Unloading

DANGER - Paver could rollover unexpectedly during loading or unloading causing death, serious personnel injury or severe equipment damage. Stand clear of paver and truck during loading and unloading.

Driving the Paver off a Trailer

The paver can be loaded or unloaded from various kinds of trailers. When loading or unloading a paver the clearance from the ground to the auger or screed becomes a concern. Some trailers will require construction of a ramp long enough so the augers or screed will not drag on the ground.

NOTICE - Always use the frame raise system to raise the rear of the paver as high as possible before loading or unloading the paver. The screed or augers could be damaged if they drag on the ground.

Pavers have a Frame Raise feature which allows the rear of the paver to be raised during loading and unloading. The paver should be raised as high as possible during loading or unloading.

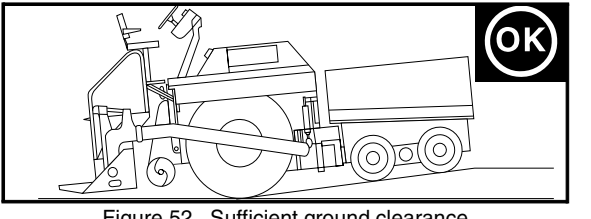

Figure 52. Sufficient ground clearance

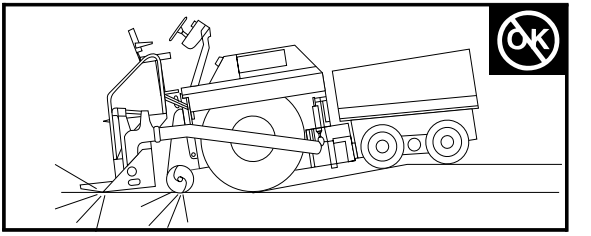

Figure 53. Insufficient ground clearance

The screed should always be raised and engage the screed lock or cables when loading or unloading the paver. If the paver cannot be loaded or unloaded without the screed dragging the ground, the screed can be removed.

NOTICE - If the screed is removed, carefully watch the augers to make sure they do not drag on the ground during loading and unloading.

NOTICE - All constructed ramps must be capable of supporting the total machine weight.

To move the paver on or off a trailer:

1) Remove all chains and binders from the paver frame.
2) Start the engine.
3) Raise the screed and engage the screed lock or cables.
4) Use the frame raise system to elevate the rear of the paver as much as possible.
5) Have a person on the ground to help guide you on or off the trailer.
6) Set the Pave/Travel switch to Pave (P2 on rubber tired models).
7) Bring the engine to Full throttle.
8) Place the Travel Direction switch in the direction needed.
9) Place the brake switch in the Release position.
10) Slowly increase the setting on the speed dial until the paver starts moving. It is safer to use a slow speed while loading or unloading.

You can use the brake switch to engage the brakes in an emergency.

WARNING - If the brakes are used to stop a moving paver, the paver will stop suddenly. The brakes should be used to stop the paver only in an emergency.

Lifting with crane

DANGER - Lifting devices could fail unexpectedly and crush anyone that is under the load being lifted. Stand clear of the paver while it is being lifted.

WARNING - Lifting devices that are not rated sufficiently to lift a paver could brake causing death or severe personnel injury. Ensure the crane and cables to be used are capable of supporting the total machine weight safely.

The paver engine should not be running while the paver is being lifted. If the engine is running, turn the engine off.

Loop a chain through the lifting eyes at the front of the paver and attach it to the crane hook (Figure 54) . Attach one cable to each of the two lifting points on the rear of the paver (Figure 55) .

The two rear cables must be of equal length and the front cable/chain must be adjusted to two equal lengths.

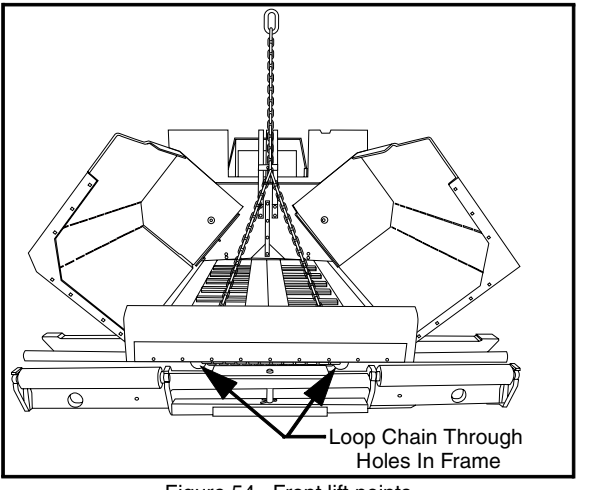

Figure 54. Front lift points

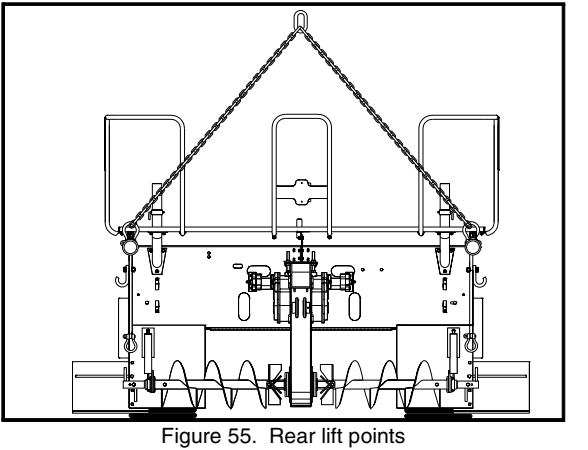

Figure 55. Rear lift points

WARNING - Each lifting cable must be hooked to the crane hook independently. Do not loop a single lifting cable through the crane hook and back to a second lifting point.

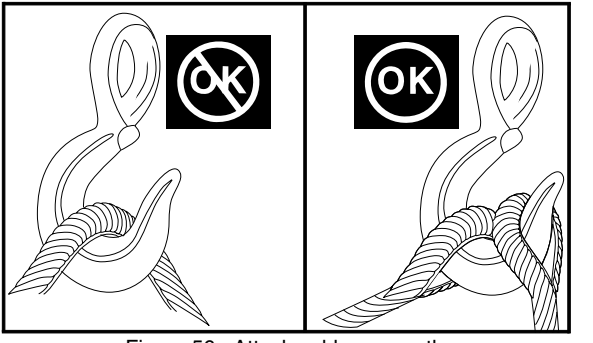

Figure 56. Attach cables correctly

Raise the screed and lock it into position. Older paver models have a cable attached to the tow arm that is hooked into the screed hooks on the rear of the tractor. (Figure 57)

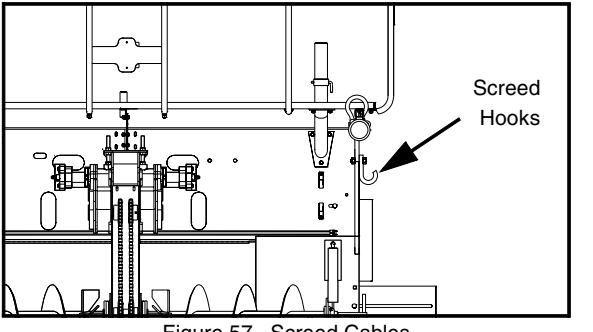

Figure 57. Screed Cables

Newer units use an integrated screed lock that engages automatically when the screed is fully raised. Stepping on the screed release pedal allows the screed to be lowered. (Figure 58)

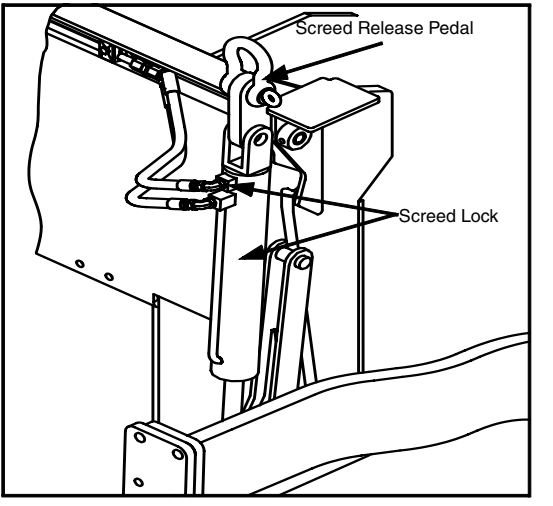

Figure 58. Screed Lock

Preparation for transport

1) Load the paver onto the trailer or truck.
2) Lower the screed onto blocks at each end and in the center of the screed (Figure 59) . Never set the screed on nails, rivets, or bolt which could damage the screed bottom.

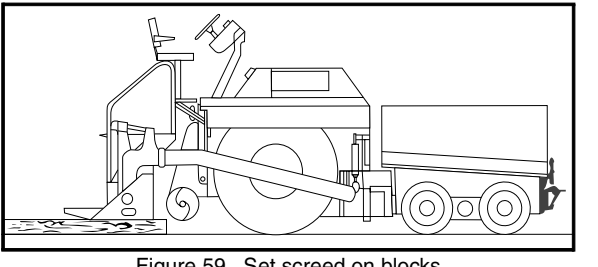

Figure 59. Set screed on blocks

3) Use the frame raise switch on the operators console to lower the rear of the paver as much as possible.
4) Use chains and chain binders to tie the paver down in the front (Figure 60) and rear (Figure 61) of the paver.

Chaining directly to the screed, truck hook, or tow arms could damage the equipment. All chains should be secured to the paver frame only.

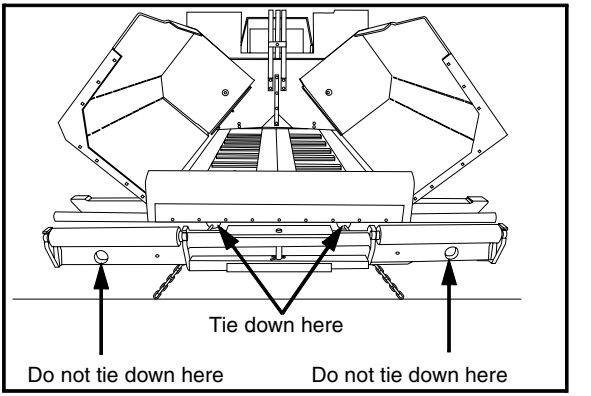

Figure 60. Front tie down points

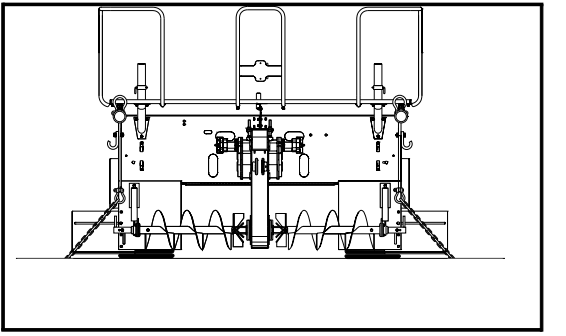
Figure 61. Rear tie down points

Spraydown and Cleaning

Paver Cleaning Procedure

Cleaning the paver is extremely important to keep the slat chains and augers free and prevent build-up of asphalt. Clean the paver thoroughly each day. The 30' spray hose permits reaching all areas that require cleaning.

DANGER - Spraying diesel fuel in the presence of open flame will cause an explosion or fire. Turn screed burners off before spraying diesel on any part of the paver. Do not spray in the presence of open flame, sparks, welding arcs. etc.

NOTICE - Keep oil spray away from all electrical components and engine compartment. Do not spray the paver when it is parked on the mat. Move it to the side of the road for drainage of oil and dissolved mix. Avoid spraying rubber hoses and cables with fuel oil as this may cause premature deterioration.

1) Turn main key switch on. If extensive cleaning is required, run engine at idle to maintain battery charge.
2) Open spray down valve. (Figure 62)

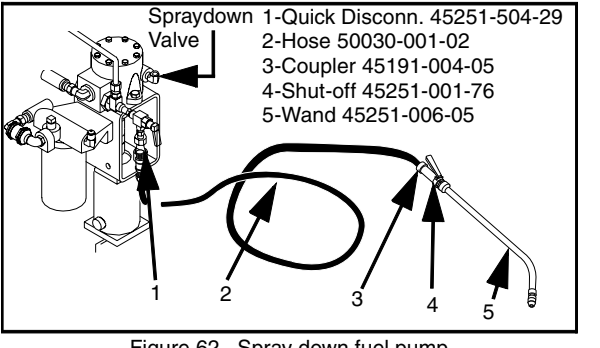

Figure 62. Spray down fuel pump

3) Set the spray down fuel pump switch to on.
4) Run the conveyors until all mix is out of the hopper. Remove any piles or large chunks of mix from the paver and screed.

5) Clean all parts which come in contact with hot mix. The paver must be completely cleaned even if the paver was used for a short time.

6) Start cleaning at the truck hook/push rollers and work your way to the rear of the machine cleaning the hopper wings, slat conveyors, hopper gates, augers, screed bottom, end gates, strike-offs, etc. (Figure 63)

   NOTICE - Operating the fume recovery system while spraying down the spreading augers or front of the screed will eventually cause the fume recovery system hoses to become plugged. If the engine is running while spraying down the spreading augers or front of the screed, diesel fuel mist will be drawn into and collect on the surface of the fume recovery system hoses. The diesel fuel will mix with dust which will plug the hoses. Turn the engine OFF before spraying down the spreading augers or front of the screed. Refer to Operation and Maintenance Manual for fume recovery system cleaning procedures.

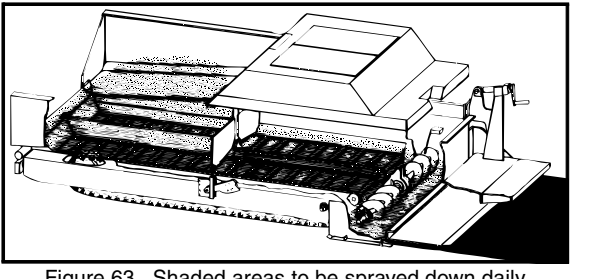

Figure 63. Shaded areas to be sprayed down daily

7) Operate slat conveyors during spray down to be sure all slats and chain links are cleaned. Fuel oil on slat conveyors provides the needed lubrication to prevent rapid wear.

8) If a mechanical feed sensor is used, clean the wand with fuel oil and wipe any asphalt off of the feed controller with a cloth dampened with fuel oil.

9) Every time the paver is cleaned, the track should be sprayed with fuel oil to lubricate the track pins to prevent them from rusting and binding.

Generation III Sonic Sensor Cleaning

1) Inspect the sensor daily for damage and material buildup. The sensor must be kept clean in order for the sonic control to function properly. The sensor is easily cleaned and if cleaned routinely, problems can be minimized.
2) Before cleaning, turn off power to the sonic control. Disconnect sensor cable from control unit and remove sensor from its mount. Install protective caps on all electrical connectors.

   NOTICE - Using a sharp or solid object to scrape material from transducer could damage the sensor. If the transducer becomes damaged it will require replacement of the complete sensor. The sensor is permanently sealed and can not be repaired.
3) Check transducer daily for material buildup. The reansducer can be cleaned with Simple Green cleaning fluid. Place cleaning fluid on a clean rag and rub transducer gently to remove any material. Wipe transducer clean and dry. (Figure 64)

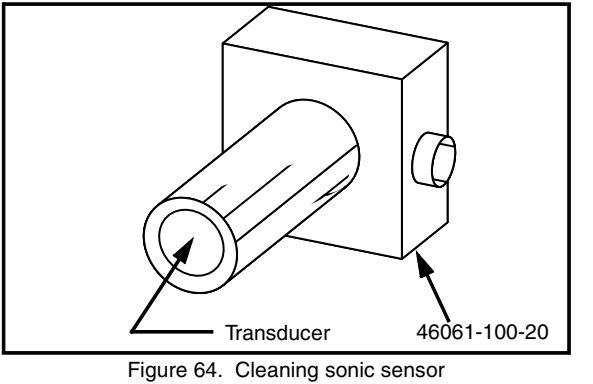

Figure 64. Cleaning sonic sensor

Pressure Cleaning

The entire paver can be pressure washed to remove dirt and grease. When pressure washing the paver:

1) Do not use a steam cleaner. Steam cleaning can damage seals, bearings, gearboxes, and electrical components.
2) Do not use an acid based solvent with the pressure washer. Use only mild detergents or degreasers.
3) Do not spray directly at electrical components, seals, bearings, gearboxes, or hydraulic cylinder rods. Water can be forced into electrical connections or the hydraulic system which could damage the system.
4) Do not spray the screed or engine until it is cool. Spraying a hot screed bottom with cold water could warp the screed bottom. Spraying cold water on a hot engine manifold could crack the manifold.
5) Use extreme caution when spraying in the engine compartment. The engine compartment is full of electrical and hydraulic components which could be damaged by high pressure water. Use a commercial engine cleaning foam to remove dirt and grease from the engine compartment.
6) If you must spray near electrical or hydraulic components, cover the components before spraying.

Fastach 8’ and 10’ Screed

DANGER - Screeds and screed extensions are heavy and will cause death or severe injury if the screed drops unexpectedly. The screed will drop sudden if the hydraulic system fails. Before climbing under or working under the screed, engage the screed lock and stack two stacks of cribbing high enough to prevent the screed from injuring someone if the screed lock fails.

Handle screed extension safely. Lift them only with a properly rated crane and lifting device. Never climb under a screed extension or put your feet or head under it.

Screed Adjustments - General

All screed adjustments in the following sections should be made only after setting the left and right tow point cylinders to the same position, nulling screed hand cranks equally and zeroing the lead and trailing crown. Use the Manual Jog switch to reposition both tow points equally (6 or center on gauge).

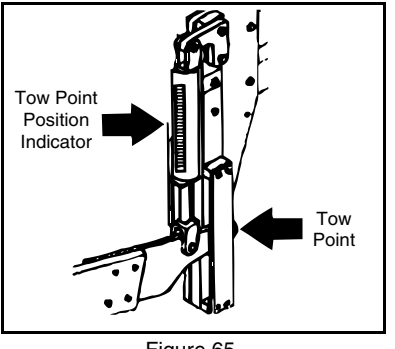

Figure 65.

To null the screed:

1) Measure the distance from the screed frame to the tow arm plate on the left side.

2) Measure the distance from the screed frame to the tow arm plate on the right side and turn the screed hand crank one direction or the other until the measurement is equal to that of the left side.

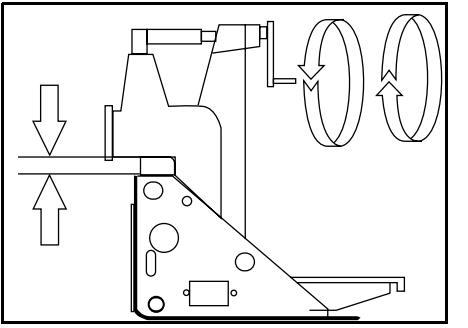

Figure 66.

Screed Bottom Removal

1) Adjust lead and tail crown to 0" (flat).
2) Install two 5/8" x 2" cap screws into the red aligning plates in the center of the screed and tighten securely.

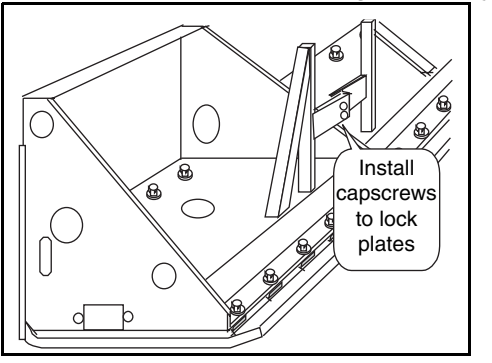

Figure 67.

3) Set the screed down on a flat level area.
4) Remove the 5/8" Gripco lock nuts and flat washers from the rear and front of the screed frame (requires 15/16 end wrench).

NOTICE - Old nylon lock nuts can not be reused as the nylon material melts. (Figure 68) If you do not have new Gripco style lock nuts, use two standard nuts on each stud.

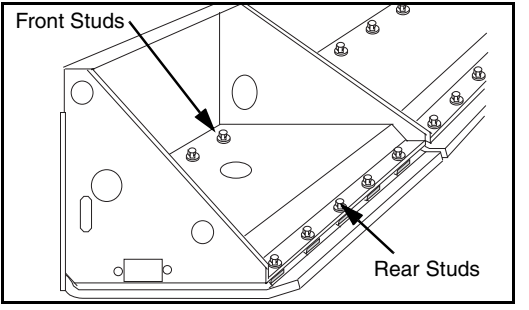

Figure 68. Discard Gripco Lock Nuts

5) Raise the screed frames up away from the screed plate. Drive the paver forward a short distance.
6) Remove the special self-aligning washers and standard washers and any shims from the old screed plate studs. These will be used when installing a new screed bottom.
7) Inspect and clean the back side of the fixed strike-offs of all built-up asphalt materials.
8) Inspect and clean the screed heater chambers.

Screed Bottom Installation

1) Place new screed bottom on a flat level surface.
2) Remove red shipping brace from front center area of new screed bottom.
3) Place a set of special self-aligning washers on the ten front studs (45890-255-27).
4) Place two 5/8 inch SAE flat washers on each rear stud.
5) Position the paver so the upper screed frames align with the studs properly.
6) Lower the screed frame slowly while ensuring the screed bottom studs are aligning with the frame mounting holes.

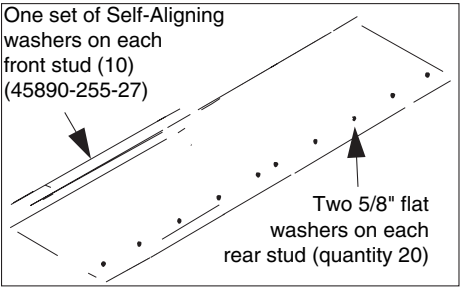

Figure 69.

7) Once the screed frames are completely down and the screed bottom studs are protruding through the frame mounting holes, place 5/8” hardened flat washers over each front and rear stud (qty. 20).

8) Start NEW 5/8” NC Gripco lock nuts on each front and rear stud.

   NOTICE - Old nylon lock nuts can not be reused as the nylon material melts. If you do not have new Gripco style lock nuts, use two standard nuts on each stud.

9) The old screed bottom may have had extra shims under some rear studs. Do not place any of them on the new screed bottom at this time.

10) Remove the two retainer cap screws that were placed in the red aligning plates in Screed Bottom Removal steps.

    NOTICE - The sequence in which the stud nuts are tightened is important in preventing screed warpage.

11) SNUG all REAR stud nuts to the point where the two 5/8 inch washers between the screed bottom and the screed frame can not be turned using your finger. This indicates the rear of the screed bottom is now in contact with the screed frame.

12) Tighten all FRONT stud nuts to 60 foot pounds torque.

13) Tighten all REAR stud nuts to 60 foot pounds torque.

NOTICE - Lubricate studs before installing lock nuts.

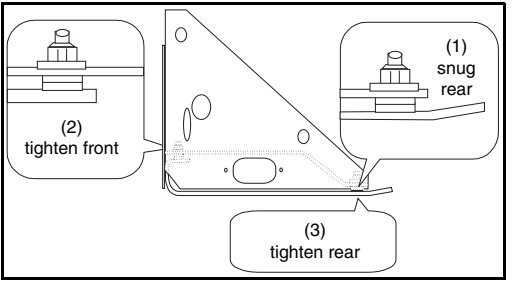

Figure 70.

14) Raise the screed fully up and engage screed lock or cables.

15) Using a straightedge, check from front to rear on the screed bottom for flatness. Several points across the width of the screed should be checked.

16) If the screed is not flat from the front to rear, loosen the adjacent stud nuts and allow screed bottom to relieve the stress in that area. Then re-torque stud nuts to 60 foot pounds.

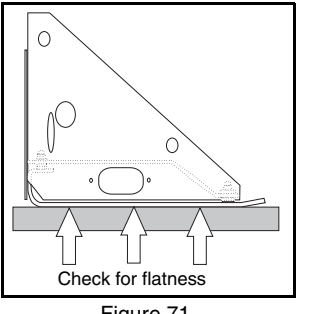

Figure 71.

Checking Trailing Edge of Screed for Flatness

1) Starting from the center line of the screed bottom, place a 5 foot straight edge from the center line to the left outside. The straight edge should be placed just before the bent up portion of the screed bottom.
2) Check the screed bottom along the length of the straight edge for flatness. If the screed bottom is not flat, shims can be added to studs between the frame and screed bottom to flatten the trailing edge. Add as many shims as required to flatten the trailing edge. Remember to re-torque nuts to 60 foot pounds.

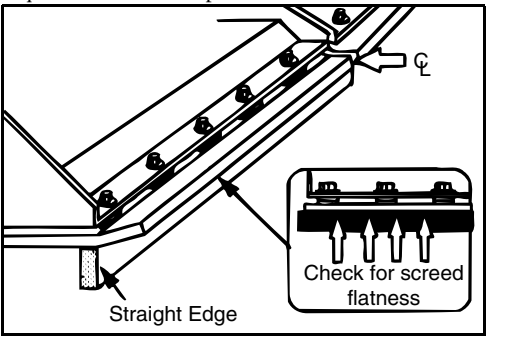

Figure 72.

Fixed Strike-Off Adjustment

The fixed strike-offs act as a material metering device to control the amount of material allowed to pass under the screed, thereby controlling or affecting the angle of attack required to produce a given depth. They also absorb wear that would have been introduced to the nose area of the screed bottom. The normal setting is 1/2 inch above the screed bottom and will work fine in most material designs currently used. There are, however, material designs that will require changing the setting to allow the screed to run with the desired 1/8 inch to 1/4 inch nose-up attitude or angle of attack.

1) Place a straight edge against bottom of screed and measure from straight edge to bottom of the strike-off.

2) Adjust it by loosening the bottom jam nut and tightening the top to raise the strike-off. Loosen the top jam nut and tighten the bottom to lower the strike-off.
3) Check both the inside and outside adjustments.

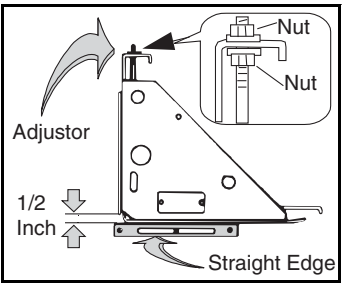

Figure 73.

Hydraulic Strike-Off Adjustment

When the vertical or screeding blades are installed and adjusted correctly they can be extended and retracted without influencing the mat directly behind the main screed. When extended, the thickness of the material placed by the Hydraulic strike-off will be thicker than that of the main screed so, the material placed by the hydraulic strike-off is struck off and isn't compacted like that of the main screed. The thickness difference should be adjusted for the material design being used.

If adjusted properly the roller will compact the thicker material placed by the hydraulic strike-off to the same elevation of the main screed mat when rolled, producing uniform density across the width of the mat. Mat texture however, will be different from that of the main screed and the hydraulic strike-off. The hydraulic strike-off provides limited surface finishing as the material is struck off at a given thickness. The amount of texture differences is dependent on the material design being placed. Screeding blades are intended for finer grade materials traditionally used in parking lots and low specification jobs, where vertical blades are intended for the courser grade materials traditionally used in general road construction.

Vertical Blade Adjustment

1) Loosen all four blade support cap screws [1], Figure 74. Allow blade to slide to bottom of its slots.

   NOTICE - Clean slots if necessary. Make sure blade [2], Figure 74, is at the bottom. Torque cap screws to 60 ft/lb.

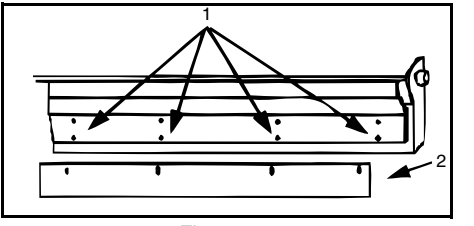

Figure 74.

2) Check slope cylinders [1] Figure 76, to see if rods have fully extended. If not, push slope toggle switch on the screed remote control until cylinders are fully extended.
3) Take level or straight edge and place in position [1], Figure 75, against bottom of main screed.
4) Adjust match height [2], Figure 75, until screeding blade is at correct adjustment. A preliminary setting of 1/4" above main screed bottom gives good results in most materials.
5) Repeat Steps 3 and 4 using position [2], Figure 76, and adjust hydraulic cylinder rod end [3], Figure 76, so same setting (1/4") is obtained as made in position [1], (Step 4).

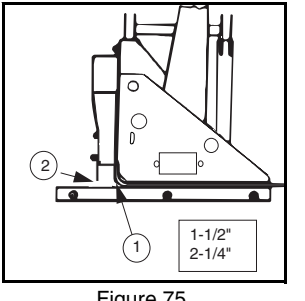

Figure 75.

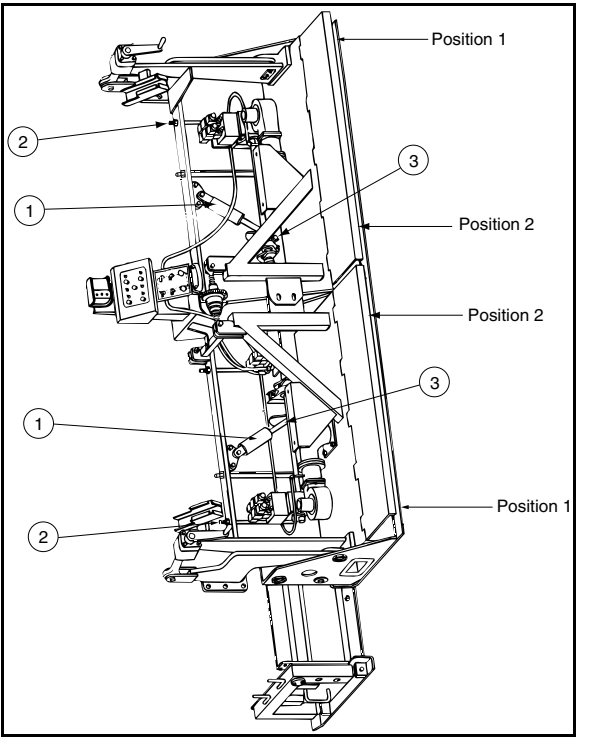

Figure 76.

Lead/Trail Crown

The main screed crown has two adjusters, the Lead and Trail. When the main screed crown needs to be set for profile specifications, both lead and trail crowns are adjusted simultaneously, by means of a connecting chain. The lead crown can be set independent of the rear, to allow a little extra material to pass into the center area of the main screed. This is necessary to compensate for the void area created by

the auger-conveyor drive case. The normal amount of lead crown is 1/16" to 1/8" above that of the rear. This range is sufficient for most materials designs.

The most common way to check the lead and trail crown is done with a strong string line, two equal thickness spacers (new 1/2" NC nuts) and a tape measure.

The first check to be performed is checking and adjusting the tail crown.

1) Place spacers inboard of the outer edge of the screed and just forward of the bent up portion at the trailing edge.

   NOTICE - A screed bottom that has been used for joint matching may have the outer few inches of the bottom worn. The spacers will have to be placed inboard of these areas to get a proper measurement.

2) Stretch a strong string line across the center of the spacers and pull tight.

3) Measure the distance from the string line to the screed bottom next to each spacer and in the center of the screed.

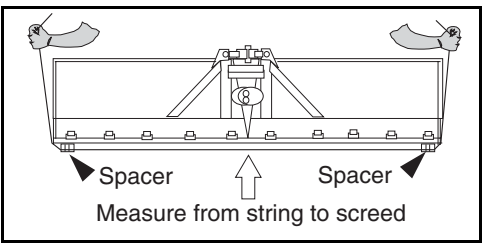

Figure 77.

4) For initial setup purposes we adjust the lead and trail crown to 0" (flat). In operation the normal amount of lead crown is 1/16" to 1/8" above that of the rear.

5) If the measurement in the center of the screed is less than or more than the thickness of the spacers, the tail crown must be adjusted.

6) To adjust, press the crown switch located on the screed burner control panel to Increase or Decrease. Adjust until measurement at center area of screed is equal to spacer thickness.
7) Once tail crown is set to 0" (flat), move spacers and string line foreword to the leading edge of the screed bottom.
8) Measure the amount of lead crown.
9) To adjust the lead crown independent of the tail crown, remove the two clevis pins in the rear crowning sprocket. Then press the crown switch to the increase or decrease position.
10) Adjust until measurement at center area of screed is equal to spacer thickness.
11) Re-install the two crown clevis pins in the rear sprocket.
12) Once the lead and tail crowns are set at 0" (flat), loosen and reset the crown indicator gauges to 0.

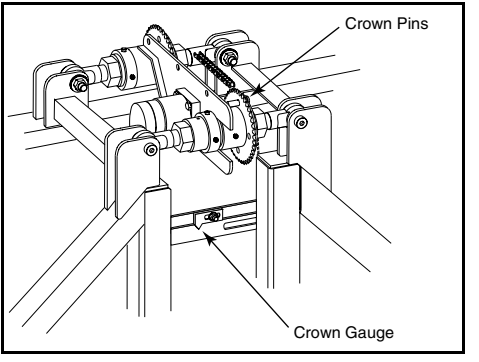

Figure 78.

Installing Screed Extensions

1) Remove heat duct cover on each end of the main screed.
2) Install mounting pegs on RH side of screed. The two tapered pegs go in the top and bottom rear holes. The straight peg goes into the bottom front hole. Leave nuts loose so pegs can be slid back and forth in slots.

3) Install alignment eccentrics in the LH side of screed extension and adjust projections as follows on both extension and main screed. Top projection (threaded) 1/4" to 5/16":Bottom rear 1/4" to 5/16".

   NOTICE - On opposite end of screed, eccentrics are installed on main screed and projections will be toward extension.

4) Make sure all mating surfaces are clean of all asphalt, dirt, or anything that would prevent these surfaces from fitting snugly together. Pay special attention to screed bottom, strike-offs and heat duct tube area.

5) If the screed extension has vibrators, they can be connected to the main vibrator shaft if desired. If not, proceed to Step 6). When putting extension on, slip drive line on main screed vibrator shaft and also slip it on extension screed vibrator shaft. Be sure to align vibrator weights in the same position as all other weights.

6) Slide extension on to pegs of right side of main screed. Allow pegs to move in their slots to align themselves with the eccentric. Put wedges into slots in each peg. Tap in lightly, just tight enough to hold extension in place.

7) Raise screed, engage screed lock and place blocking under screed.

8) Using a special wrench, turn the top alignment eccentric to raise or lower the front of the extension screed bottom. Using a straightedge to make sure bottoms are flush.

9) Repeat Step 8) at the rear bottom alignment eccentric until both front and rear edges of the screed extension match the main screed bottom.

10) Check trailing edge of screed extension. It should line up with main screed. If not, slide extension forward or backwards so trailing edge will line up with main screed.

11) Tap wedges in so they are just tight. Then tighten the nuts on the top and bottom rear pegs. If the front bottom peg is loose and the wedge won't tighten it, remove it and add a 1" washer to the peg, then re-install.
12) Next take a straight edge and lay against the bottom of the main screed to see if the extension screed has any positive or negative slope.
13) If it does, loosen the peg nut and wedges on top eccentric and turn eccentric one full turn. Turning it in will push outside edge of extension screed down. Turning it out will raise outside edge.
14) Snug wedge and tighten peg nut, check with straight edge.
15) Once extension is aligned properly, trailing edges match, bottoms match, and extension isn't sloped, check strike-off plates. They should be 1/2" above screed bottom.
16) If adjustment is needed, use the strike-off height gauge provided.
17) There are two adjusting rods on each strike-off plate. By loosening top or bottom jam nut on each and turning the other, you can raise or lower strike-offs to proper height.
18) Install heat duct cover on end of extension if additional extensions are not to be added. Install guard over vibrators.
19) Repeat procedures on all other extensions.

Crowning Mechanism Chain Tension

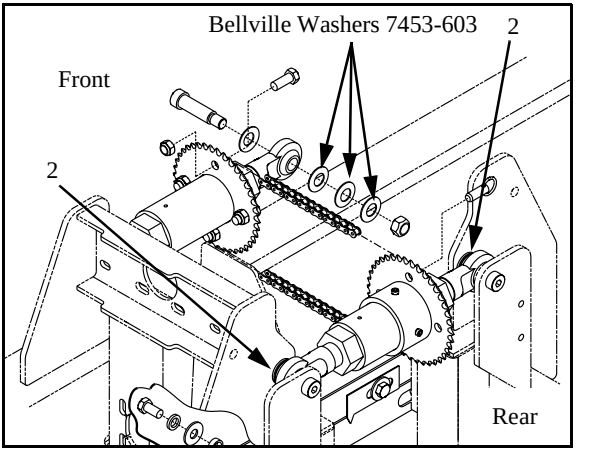

Figure 79.

The Bellville Washers are used to adjust the chain tension as well as to adjust the alignment of the turnbuckle sprockets on the crowning mechanism. Each screed is set up with three washers on the inside rod ends of the front turnbuckle and two washers on the inside rod ends of the rear turnbuckle. Additional washers are added to adjust alignment of the chain sprockets.

Lubrication

WARNING - Turn off engine & remove key before performing any inspections or maintenance.

General

Proper lubrication and daily cleaning are one of the most important factors in bearing life. Follow recommended lubrication intervals. Clean all grease zerks and grease gun tip before greasing. During daily cleaning and lubrication procedures, inspect the seal area for signs of blown seal.

Over-greasing or greasing when the bearings are cold is the biggest reason for blown seals.

Depth Cranks

The screed depth cranks assemblies have two lubrication points on each, one on the threaded link and the other on the screed depth crank bearing housing. These should be lubricated every 40 hours of operation. One to two pumps from a hand grease gun is all that is necessary.

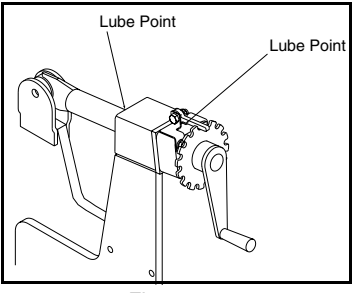

Figure 80.

Vibrator Bearings

The vibrator assemblies have four lubrication points, one on each vibrator bearing. These are remote plumbed to the upper lip of the screed frames. They should be lubricated every 8 hours of operation. One to two pumps from a hand grease gun is all that is necessary.

Crown

The crown has two lubrication points one on each turnbuckle assembly. They should be lubricated every 40 hours of operation. One to two pumps from a hand grease gun is all that is necessary.

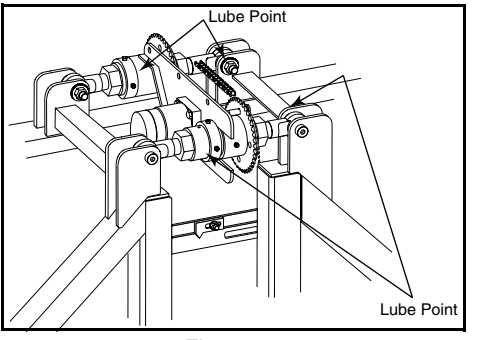

Figure 81.

Strike-Off Slides

DANGER - Spraying diesel fuel in the presence of open flame will cause an explosion or fire. Turn screed burners off before spraying diesel on any part of the paver. Do not spray in the presence of open flame, sparks, welding arcs. etc.

Screeds equipped with hydraulic strike-offs should have the slide member and slide channels cleaned and lubricated with diesel fuel from the spray-down system daily.

Stretch 16 Screed

DANGER - Screeds and screed extensions are heavy and will cause death or severe injury if the screed drops unexpectedly. The screed will drop sudden if the hydraulic system fails. Before climbing under or working under the screed, engage the screed lock and stack two stacks of cribbing high enough to prevent the screed from injuring someone if the screed lock fails.

Handle screed extension safely. Lift them only with a properly rated crane and lifting device. Never climb under a screed extension or put your feet or head under it.

Screed Adjustments - General

All screed adjustments in the following sections should be made only after setting the left and right tow point cylinders to the same position, nulling screed hand cranks equally and zeroing the lead and trailing crown.

Use the Manual Jog switch to reposition both tow points equally (6 or center on gauge).

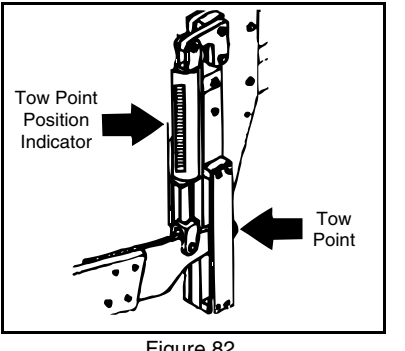

Figure 82.

To Null the screed:

1) Measure the distance from the screed frame to the tow arm plate on the left side.

2) Measure distance from screed frame to tow arm plate on right side and turn screed hand crank one direction or the other until measurement is equal to that of the left side

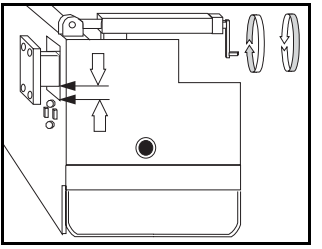

Figure 83.

Screed Bottom Removal

1) Adjust lead and tail crown to 0" (flat).
2) Install two 5/8" x 2" cap screws into the red aligning plates in the center of the screed and tighten securely.

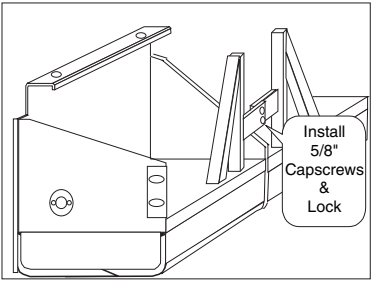

Figure 84.

3) Loosen nut on cover plate of left inside upper screed frame and rotate plate 90° as shown in Figure 85.
4) Install two 1/2" x 2" cap screws in two holes and tighten, locking front of the upper screed frames together.

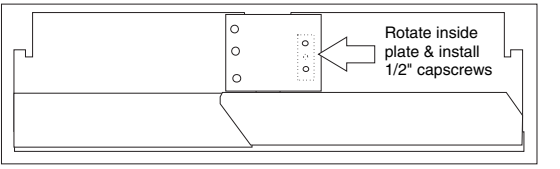

Figure 85.

5) Set the screed down on a flat level area.
6) Remove the 3/4" retaining cap screws from rear and front of upper screed frames (8 main screed, 4 per extending screed).

   NOTICE - Do not loosen or attempt to adjust the shim bolts located on the main screed. They are set at the factory so the screed bottom when installed is parallel with the upper frames.

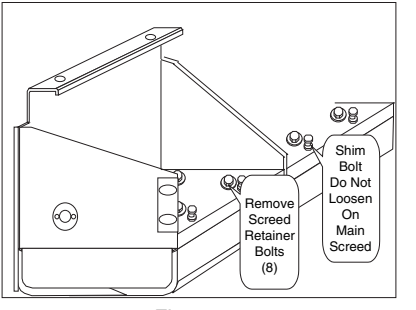

Figure 86.

7) Raise the screed frames up away from the screed plate. Drive the paver forward a short distance.
8) Inspect and clean the back side of the fixed strike-offs of all built-up asphalt materials.
9) Inspect and clean out the screed heater chambers.
10) Measure distance from screed bottom lip to screed sub-frame at both ends of each sub-frame. These measurements will be used to install sub-frames on a new screed bottom.

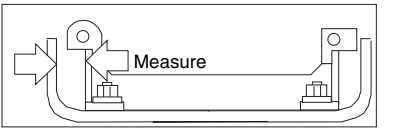

Figure 87.

11) Remove the 5/8" nuts on the rear and front of both screed sub-frames. Remove flat washers and lift sub-frames off old screed bottom.

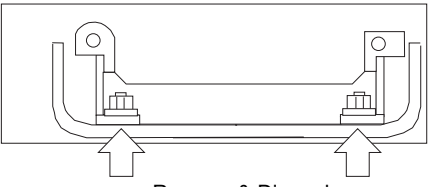

Figure 88.

12) Use same series of steps to remove extending screed bottoms.

Screed Bottom Installation

1) Place NEW screed bottom on a flat level surface.
2) Place the screed sub-frames over the studs on the new screed bottom.
3) Place one flat washer on each stud and start NEW 5/8" lock nuts.
4) Measure the distance from the screed bottom lip to the sub-frame and adjust to the dimensions previously taken when removing screed bottom.

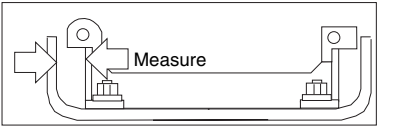

Figure 89.

5) Tighten 5/8" lock nuts to 60 foot pounds torque.
6) Position paver over screed bottom and align.

7) Lower upper screed frame onto screed bottom and sub-frame.
8) Install the eight 3/4" retaining cap screws and torque to 266 foot pounds torque.

   NOTICE - Do not loosen or attempt to adjust the shim bolts located on the main screed. They are set at the factory so the screed bottom when installed is parallel with the upper frames.
9) Use the same series of steps to install extending screed bottoms.

Fixed Strike-Off

The fixed strike-offs act as a material metering device to control the amount of material allowed to pass under the screed, thereby controlling or affecting the angle of attack required to produce a given depth. They also absorb wear that would have been introduced to the nose area of the screed bottom. The normal setting is 1/2" above the screed bottom and will work fine in most material designs currently used. There are, however, material designs that will require changing the setting to allow the screed to run with the desired 1/8" to 1/4" nose-up attitude or angle of attack.

1) Place a straight edge against bottom of the screed and measure from straight edge to the bottom of strike-off.
2) Adjust it by loosening the bottom jam nut and tightening the top to raise the strike-off. Loosen the top jam nut and tighten the bottom to lower the strike-off.

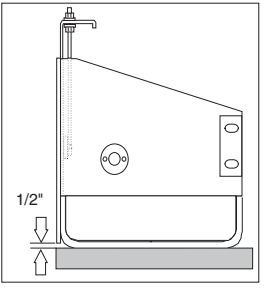

Figure 90.

Independent Angle of Attack

Extension screeds run with a increased angle of attack in relation to the main screed to provide a uniform texture across the width of the mat. This is called the independent angle of attack.

1) To check and adjust the independent angle of attack, place a straight edge on the outer edge of the main screed and protruding under the extending screed.
2) Using the MATCH HEIGHT lever raise or lower the extending screed until the extending screed just contacts the straight edge.
3) Move straight edge to center area of main screed.
4) Using SLOPE lever, increase or decrease extending screed slope until screed just contacts straight edge.
5) Re-check match height and slope, adjust until both center and outside edges just contact the straight edge.
6) With straight edge on the outer edge. There should be 1/8" gap at the leading edge of the extending screed, while the trailing edge is just touching the straight edge.

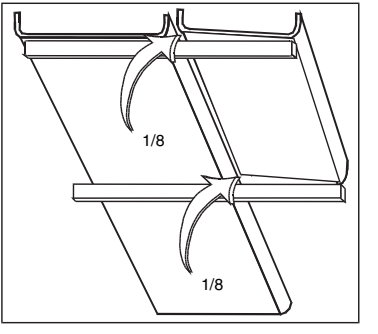

Figure 91.

7) If the adjustment is not in this range, loosen the two rear 3/4" screed bottom retaining cap screws and adjust the two shim bolt cap screws on the rear of the extending screed.

Clockwise rotation of the shim bolt presses the tail of the screed bottom downward causing an increased angle of attack.

Extending Screed Alignment

A rear screed which is out-of-parallel with the main screed may have no effect on the mat being placed. The most obvious indication will be that the extender tubes will be out-of-line. When retracting the rear screed, the tubes may rub or hit part of the structure normally cleared or be noticeably misaligned with the tubes of the opposite extension.

1) Retract both extensions.

   NOTICE - Shimming the front tipping frame block causes the inside edge of the extending screed to move away from the main screed. Shimming the rear tipping frame block causes the inside edge of the extending screed to move closer to the main screed.

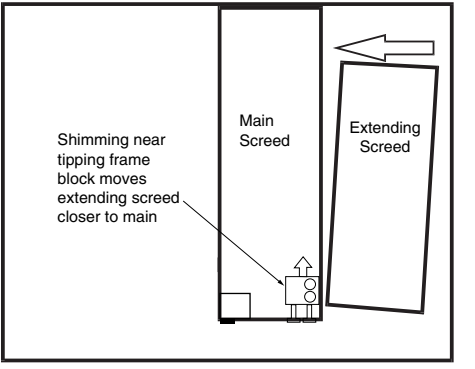

Figure 92.

2) Loosen two inner keeper bolts and two outer keeper bolts.
3) Install a press bolt in threaded hole next to the outer keeper bolts and tighten. This causes the tipping frame block and extending screed to move. Once the

extending screed is aligned, add shims between the tipping frame block and the main screed frame and tighten the keeper bolts.

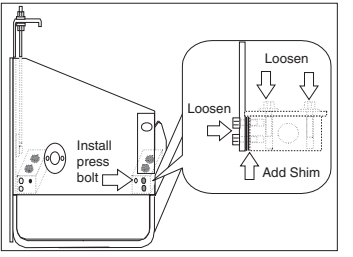

Figure 93.

Extending Screed Pre-Torque

Torque adjustment pre-loads the extending screed horizontal tubes to counteract the tendency of the extending screeds to be pushed back and downward by the pressure of the material in front of it, particularly as the screeds are extended further out. The pre-torque is factory set at 0" and normally will not require adjustment.

If the extending screeds have a tendency to flex back and downward during wide width paving operations, the pre-torque should be checked and adjusted if necessary.

1) Place a straight edge on the outer edge of the main screed and use the Match Height switch to raise or lower the extending screed until it just contacts the straight edge.
2) Place a straight edge at center area of the main screed and use Slope switch to increase or decrease extending screed slope until it just contacts the straight edge.
3) Normal pre-torque setting would be 1/8" gap at the leading edge on the inside and outside areas.

In wide width, heavy loading conditions the pre-torque can be increased to resist movement.

To adjust pre-torque

1) Extend the screed fully.
2) Loosen the four torque arm cap screws several turns.
3) On the LEFT extending screed, loosen the cam bolt nut two turns. Using a 1/2" drive breaker bar, rotate the cam CLOCKWISE TO DECREASE the pre-torque. COUNTERCLOCKWISE rotation will INCREASE the pre-torque.

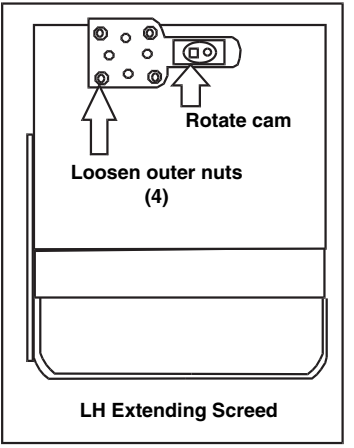

Figure 94.

4) On the RIGHT extending screed, loosen the cam bolt nut two turns. Using a 1/2" drive breaker bar, rotate the cam CLOCKWISE TO INCREASE the pre-torque. COUNTERCLOCKWISE rotation will DECREASE the pre-torque.
5) Retract the extending screeds fully in and check with a straight edge as before.
6) The setting should show the outer edge at 1/8" while the inner is now 1/16". This is indicating the extending screed now has approximately 1/16" pre-torque.

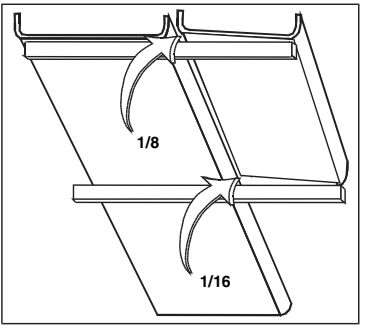

Figure 95.

NOTICE - The pre-torque should never be increased above 1/16". By doing so could cause mat texture problems and introduce increased wear to portions of the screed bottom.

Lead/Trail Crown

The main screed crown has two adjusters, the Lead and Trail. When the main screed crown needs to be set for profile specifications, both lead and trail crowns are adjusted simultaneously, by means of a connecting chain. The lead crown can be set independent of the rear, too allow a little extra material to pass into the center area of the main screed. This is necessary to compensate for the void area created by the auger-conveyor drive case. The normal amount of lead crown is 1/16" to 1/8" above that of the rear. This range is sufficient for most all materials designs.

The most common way to check the lead and trail crown is done with a strong string line, two equal thickness spacers (new 1/2" NC nuts) and a tape measure.

Checking and adjusting the tail crown

1) Place spacers inboard of outer edge of screed and just forward of the bent up portion at trailing edge.

NOTICE - A screed bottom that has been used for joint matching may have the outer few inches of bottom worn. Spacers will have to be placed inboard of these areas to get proper measurement.

2) Stretch a strong string line across center of spacers and pull tight.
3) Measure distance from string line to screed bottom next to each spacer and in center of screed.

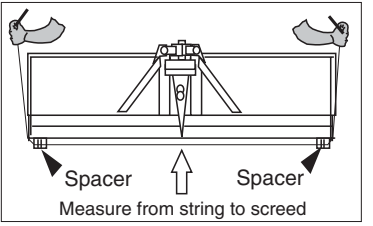

Figure 96.

For initial setup purposes we adjust the lead and trail crown to 0" (flat). In operation the normal amount of lead crown is 1/16" to 1/8" above that of the rear.

4) If the measurement in the center of the screed is less than or more than the thickness of the spacers, the tail crown must be adjusted.
5) To adjust, turn the rear crown turnbuckle to Increase or Decrease. Adjust until measurement at center area of screed is equal to spacer thickness.

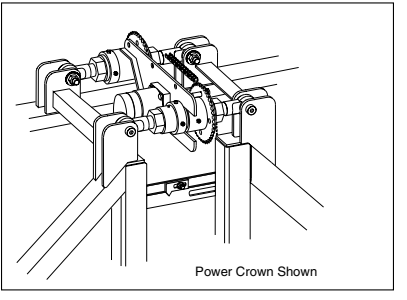

Figure 97.

6) Once tail crown is set to 0” (flat), move spacers and string line foreword to the leading edge of the screed bottom.
7) Measure the amount of lead crown.
8) To adjust the lead crown independent of the tail crown, remove the two clevis pins in the rear crowning sprocket. Then turn the front turnbuckle to increase or decrease.
9) Adjust until measurement at center area of screed is equal to spacer thickness.
10) Re-install the two crown clevis pins in the rear sprocket.
11) Once the lead and tail crowns are set at 0” (flat), loosen and reset the crown indicator gauges to 0.

Installing Screed Extensions

1) Remove end gates and end covers from ends of the extension screeds.
2) Make sure all mating surfaces are clean of all asphalt, dirt, or anything that would prevent these surfaces from fitting snugly together. Pay special attention to screed bottom.
3) If the screed extensions have vibrators, they can be connected to the main vibrator shaft if desired. If not, proceed to Step 4. When putting extension on, you need to slip drive line on main screed vibrator shaft and also slip it on extension screed vibrator shaft. Be sure to align vibrator weights in the same position as all other weights.
4) Before installing extension the first time loosen the screed bottom retaining bolts, the horizontal press bolts and the screed sub frame tension bolts.

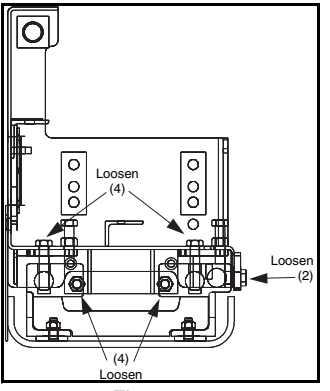

Figure 98.

5) Slide extension onto end of extending screed. Put wedges into slots in each peg. Tap in securely.
6) Raise screed, engage screed lock and place blocking under screed.
7) Check to ensure the extension screed bottom is parallel to the extending screed. If it is not remove the extension and loosen the retaining nuts that hold the extension screed bottom to the sub frame.

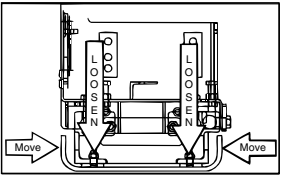

Figure 99.

8) Re-install extension and bump the screed bottom forward or reverse until it aligns with the extending screed. Tighten the outer screed bottom retaining nuts. Remove extension and tighten the inner screed bottom retaining nuts. Re-install extension.

9) Using a straightedge check to see if bottoms are flush (vertical height).
10) If the bottoms are not flush with each other, loosen the screed bottom retaining cap screws and adjust the shim bolts until the extension screed bottom is flush with the extending screed bottom
11) Tighten the screed bottom retaining cap screws and the screed sub frame bolts.

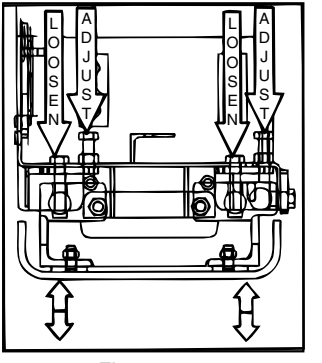

Figure 100.

12) Check to ensure extension screed fits snug against extending screed (no gap between screed bottoms). Tightening horizontal press bolts will press extension screed bottom snug against extending screed.
13) Install end covers and end gates.

Crowning Mechanism Chain Tension

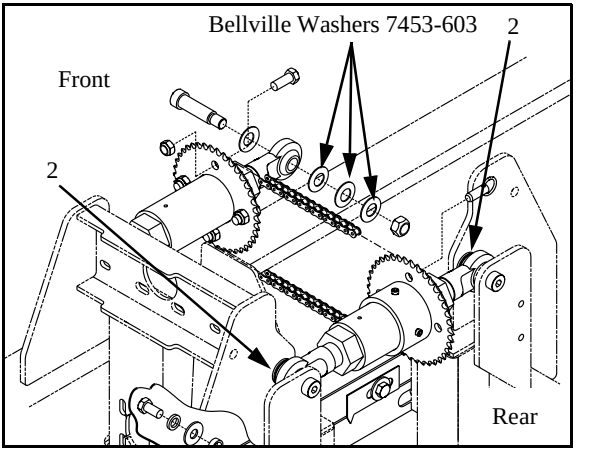

Figure 101.

The Bellville Washers are used to adjust the chain tension as well as to adjust the alignment of the turnbuckle sprockets on the crowning mechanism. Each screed is set up with three washers on the inside rod ends of the front turnbuckle and two washers on the inside rod ends of the rear turnbuckle. Additional washers are added to adjust alignment of the chain sprockets.

Lubrication

WARNING - Turn off engine & remove key before performing any inspections or maintenance.

General

Proper lubrication and daily cleaning is one of the most important factors in bearing life. Follow the recommended lubrication intervals. Be sure to clean all grease zerks and grease gun tip before greasing. During your daily cleaning and lubrication procedures, inspect

the seal area for signs of a blown seal. Over-greasing or greasing when the bearings are cold is the biggest reason for blown seals.

Depth Cranks

The screed depth crank assemblies have two lubrication points on each, on the threaded link and on the screed depth crank bearing housing. These should be lubricated every 40 hours of operation with one to two pumps from a hand grease gun.

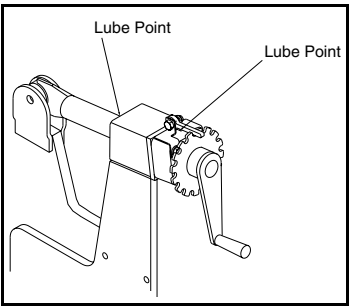

Figure 102.

Vibrator Bearings

The main screed vibrator assemblies have four lubrication points one on each vibrator bearing. The extending screed vibrator assemblies have two lubrication points, one on each bearing. All should be lubricated every 8 hours of operation with one to two pumps from a hand grease gun.

Match Height

The match height assemblies have two lubrication points on each, on the threaded link and on the match height bearing housing. These should be lubricated every 40 hours of operation with one to two pumps from a hand grease gun.

Extending Screed Slope

The extending screed slope assemblies have two lubrication points on each, on the threaded link and on the slope shaft bearing housing. These should be lubricated every 40 hours of operation with one to two pumps from a hand grease gun.

Crown

The crown has two lubrication points on each turnbuckle assembly. They should be lubricated every 40 hours of operation with one to two pumps from a hand grease gun.

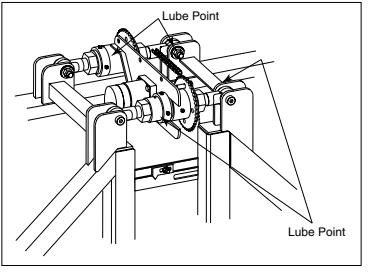

Figure 103.

Stretch 20 Screed

DANGER - Screeds and screed extensions are heavy and will cause death or severe injury if the screed drops unexpectedly. The screed will drop sudden if the hydraulic system fails. Before climbing under or working under the screed, engage the screed lock and stack two stacks of cribbing high enough to prevent the screed from injuring someone if the screed lock fails.

Handle screed extension safely. Lift them only with a properly rated crane and lifting device. Never climb under a screed extension or put your feet or head under it.

Screed Adjustments - General

All screed adjustments in the following sections should be made only after setting the left and right tow point cylinders to the same position, nulling screed hand cranks equally and zeroing the lead and trailing crown.

Use the Manual Jog switch to reposition both tow points equally (6 or center on gauge).

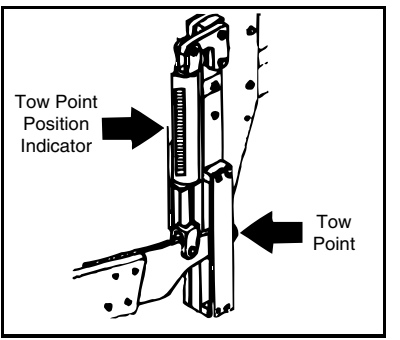

Figure 104.

To Null the screed:

1) Measure the distance from the screed frame to the tow arm plate on the left side.

2) Measure the distance from the screed frame to the tow arm plate on the right side and turn the screed hand crank one direction or the other until the measurement is equal to that of the left side.

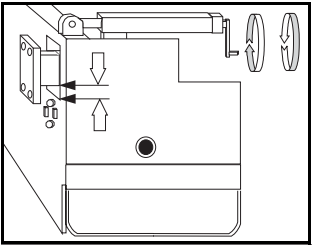

Figure 105.

Screed Bottom Removal

1) Adjust lead and tail crown to 0" (flat).
2) Install two 5/8" x 2" cap screws into the red aligning plates in the center of the screed and tighten securely.
3) Extend the two rear extension screeds out fully.
4) Raise the screed.
5) Place a floor jack under each end of the main screed. These will be used to lower and raise the screed bottom.
6) Loosen nuts on the J-bolts and work the bolts clear of the slots in the screed bottom frame work.

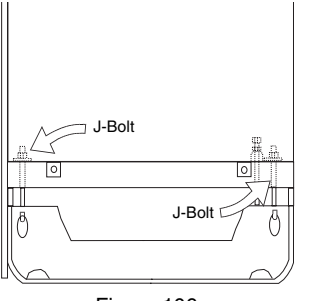

Figure 106.

7) Lower both floor jacks so screed bottom moves down away from the upper screed frames.

8) Turn plate end for end or position a new screed bottom on the jacks and lift into place.
9) Hook J-bolts in the screed bottom slots and tighten.

CAUTION - The J-bolt hook will bend if overtightened. Do not overtighten J-bolts.

Shim Bolt Adjustment

1) Starting from the center line of the screed bottom, place a 5 foot straight edge from the center line to the left outside. The straight edge should be placed along the trailing edge of the screed bottom.
2) Check the screed bottom along the length of the straight edge for flatness. If the screed bottom is not flat, loosen the adjacent J-bolt and tighten the shim bolt to flatten the trailing edge. Re-tighten the J-bolt.

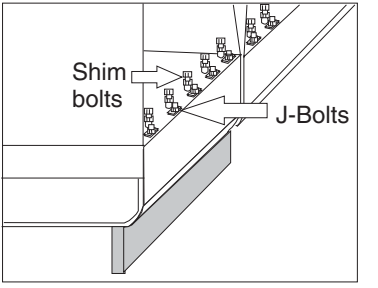

Figure 107.

Fixed Strike-Off

The fixed strike-offs act as a material metering device to control amount of material allowed to pass under screed, thereby controlling or affecting angle of attack required to produce a given depth. They also absorb wear that would have been introduced to the nose area of the screed bottom. The normal setting is 1/2" above screed bottom and will work fine in most material designs currently used. There are however material designs that will require changing the setting to allow screed to run with desired 1/8" to 1/4" nose-up attitude or angle of attack.

1) Place a straight edge against the bottom of the screed and measure from the straight edge to the bottom of the strike-off.
2) Adjust it by loosening the bottom jam nut and tightening the top to raise the strike-off. Loosen the top jam nut and tighten the bottom to lower the strike-off.
3) Check both the inside and outside adjustments.

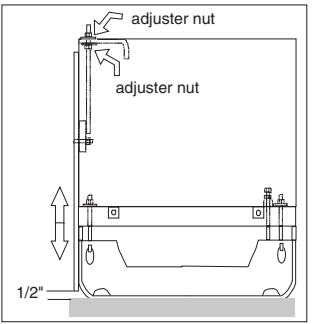

Figure 108.

Independent Angle of Attack

The extension screeds run with a increased angle of attack in relation to the main screed to provide a uniform texture across the width of mat. This is called the independent angle of attack.

1) To check and adjust the independent angle of attack, place a straight edge on the outer edge of the main screed and protruding under the extending screed.
2) Using MATCH HEIGHT switch raise or lower extending screed until extending screed just contacts straight edge.
3) Move straight edge to the center area of the main screed
4) Using SLOPE switch, increase or decrease extending screed slope until screed just contacts the straight edge.
5) Recheck match height and slope, adjust until both center and outside edges just contact the straight edge.

6) With straight edge on the outer edge. There should be 1/8" gap at the leading edge of the extending screed, while the trailing edge is just touching the straight edge.

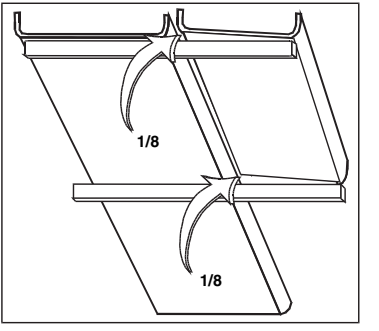

Figure 109.

7) If the adjustment is not in this range, loosen the two cap screws on the face of the main screed.
8) By loosing the bottom adjuster nut and tightening the top will increase the independent angle of attack.
9) Loosing the top adjuster nut and tightening the bottom will decrease the independent angle of attack.

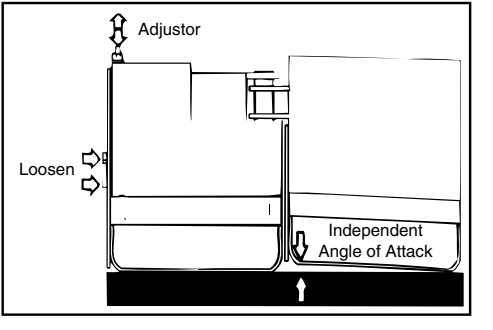

Figure 110.

10) Once the extending screed independent angle of attack is correct, tighten the two cap screws on the face of the main screed.

Extending Screed Alignment

A rear screed which is out-of-parallel with the main screed may have no effect on the mat being placed. The most obvious indication will be that the extender tubes will be out-of-line. When retracting the rear screed, the tubes may rub or hit part of the structure normally cleared or be noticeably misaligned with the tubes of the opposite extension.

1) Retract both extensions.
2) Loosen keeper bolts and wedge bolts.

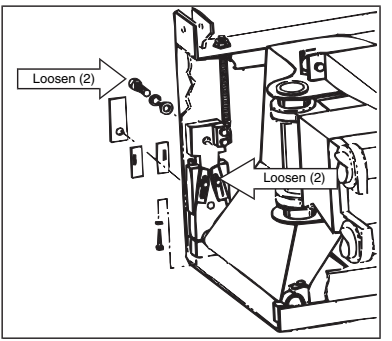

Figure 111.

3) By tapping the inner most wedge downward while tapping the outer most wedge upward, will cause the inboard end of the extending screed to move closer to the main screed.

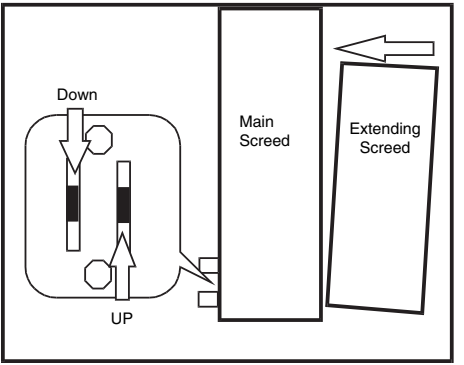

Figure 112.

4) By tapping the outer most wedge downward while tapping the inner most wedge upper ward, will cause the inboard end of the extending screed to move away from the main screed.
5) Once the extending screed is aligned with the main, make sure both wedges are snug and tighten the keeper bolts.

Extending Screed Pre-Torque

Torque adjustment pre-loads the extending screed horizontal tubes to counteract the tendency of the extending screeds to be pushed back and downward by the pressure of the material in front of it, particularly as the screeds are extended further out. The pre-torque is factory set at 0" and normally will not require adjustment.

If the extending screeds have a tendency to twist back and downward during wide width paving operations the pre-torque should be checked and adjusted if necessary.

1) Place a level on the outer edge of the screed extension. (Figure 113)
2) Note where the bubble on the level registers with paver stopped and no resistance against the screed extension.

3) Start paving and note where the bubble on the level registers with resistance against the screed extension.
4) Increase the pre-torque until the bubble on the level registers the same while paving as it does with no resistance against the screed extension.

To adjust pre-torque

1) Extend the screed fully.
2) Loosen the four torque arm cap screws several turns.

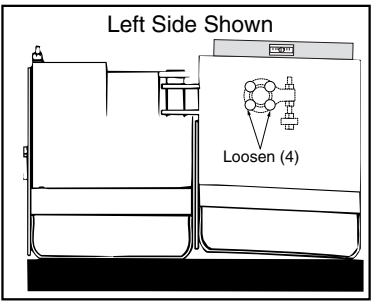

Figure 113.

3) On the left extending screed, loosen the top jam nut and tighten the bottom nut to increase pre-torque.

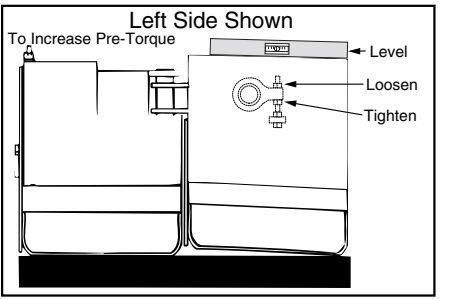

Figure 114.

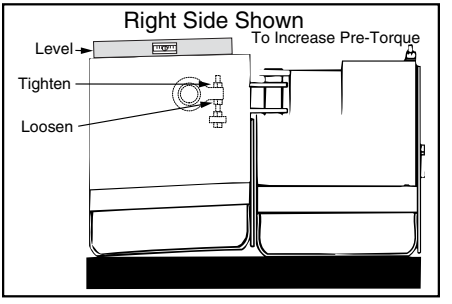

Figure 115.

4) On the right extending screed, loosen the bottom jam nut and tighten the top nut to increase pre-torque.

Test the adjustment by noting mat texture. When properly adjusted, mat texture will be consistent across the full width.

Re-adjust as necessary.

NOTICE - The pre-torque on screed extensions must be removed when normal width operation is resumed.

Lead/Tail Crown

The main screed crown has two adjusters, the Lead and Trail. When the main screed crown needs to be set for profile specifications, both lead and trail crowns are adjusted simultaneously, by means of a connecting chain. The lead crown can be set independent of the rear, too allow a little extra material to pass into the center area of the main screed. This is necessary to compensate for the void area created by the auger-conveyor drive case. The normal amount of lead crown is 1/16" to 1/8" above that of the rear. This range is sufficient for most all materials designs.

The most common way to check the lead and trail crown is done with a strong string line, two equal thickness spacers (new 1/2" NC nuts) and a tape measure.

Checking and adjusting the tail crown.

1) Place spacers inboard of the outer edge of screed and just forward of the bent up portion at the trailing edge.

   NOTICE - A screed bottom that has been used for joint matching may have the outer few inches of the bottom worn. The spacers will have to be placed inboard of these areas to get a proper measurement.

2) Stretch a strong string line across the center of the spacers and pull tight.

3) Measure the distance from the string line to the screed bottom next to each spacer and in the center of the screed.

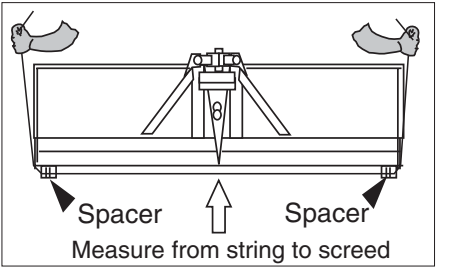

Figure 116.

For initial setup purposes we adjust the lead and trail crown to 0" (flat). In operation the normal amount of lead crown is 1/16" to 1/8" above that of the rear.

4) If the measurement in the center of the screed is less than or more than the thickness of the spacers, the tail crown must be adjusted.

5) To adjust, press the crown switch located on the screed burner control panel to Increase or Decrease. Adjust until measurement at center area of screed is equal to spacer thickness.

6) Once tail crown is set to 0" (flat), move spacers and string line foreword to the leading edge of the screed bottom.

7) Measure amount of lead crown.
8) To adjust lead crown independent of tail crown, remove two clevis pins in rear crowning sprocket. Then press crown switch to increase or decrease position.
9) Adjust until measurement at center area of screed is equal to spacer thickness.
10) Re-install the two crown clevis pins in the rear sprocket.
11) Once the lead and tail crowns are set at 0" (flat), loosen and reset the crown indicator gauges to 0.

Installing Screed Extensions

1) Remove end gates and heat duct covers from ends of the extension screeds.
2) install alignment eccentrics in the extension screeds and adjust projections as follows. Top projection (threaded) 1/4" to 5/16": Front bottom 1/4" to 5/16". Bottom rear 1/4" to 5/16".
3) Make sure all mating surfaces are clean of all asphalt, dirt, or anything that would prevent these surfaces from fitting snugly together. Pay special attention to screed bottom, strike-offs and heat duct tube area.
4) If the screed extensions have vibrators, they can be connected to the main vibrator shaft if desired. If not, proceed to Step 5). When putting extension on, you need to slip drive line on main screed vibrator shaft and also slip it on extension screed vibrator shaft. Be sure to align vibrator weights in the same position as all other weights.
5) Slide extension on to pegs of right side of main screed. Allow pegs to move in their slots to align themselves with the eccentric. Put wedges into slots in each peg. Tap in lightly, just tight enough to hold extension in place.
6) Raise screed, engage screed lock and place blocking under screed.

7) Using a special wrench, turn the top alignment eccentric to raise or lower the front of the extension screed bottom. Using a straightedge to make sure bottoms are flush.
8) Repeat Step 7) at the rear bottom alignment eccentric until both front and rear edges of the screed extension match the main screed bottom.
9) Check trailing edge of screed extension. It should line up with extending screed. If not, slide extension forward or backwards so trailing edge will line up with main screed.
10) Tap wedges in so they are just tight. Then tighten the nuts on the top and bottom rear pegs. If the front bottom peg is loose and the wedge won't tighten it, remove it and add a 1" washer to the peg, then re-install.
11) Take a straight edge and lay against the bottom of the extending screed to see if the extension screed has any positive or negative slope.
12) If it does, loosen the peg nut and wedges on top eccentric and turn eccentric one full turn. Turning it in will push outside edge of extension screed down. Turning it out will raise outside edge.
13) Snug wedge and tighten peg nut. Check with a straight edge.
14) Once extension is aligned properly, bottoms match, trailing edges match and extension isn't sloped, check the strike-off plates. They should be 1/2" above screed bottom.
15) If adjustment is needed, use strike-off height gauge provided.
16) There are two adjusting rods on each strike-off plate. By loosening top or bottom jam nut on each and turning the other, you can raise or lower strike-offs to proper height.
17) Install heat duct cover on end of extension. Install guard over vibrators.

Crowning Mechanism Chain Tension

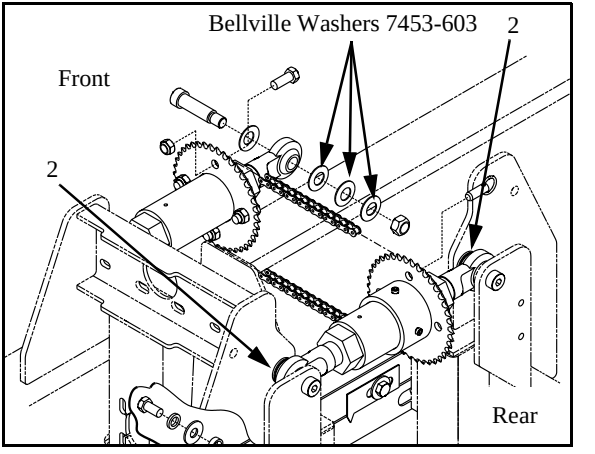

Figure 117.

The Bellville Washers are used to adjust the chain tension as well as to adjust the alignment of the turnbuckle sprockets on the crowning mechanism. Each screed is set up with three washers on the inside rod ends of the front turnbuckle and two washers on the inside rod ends of the rear turnbuckle. Additional washers are added to adjust alignment of the chain sprockets.

Lubrication

WARNING - Turn off engine & remove key before performing any inspections or maintenance.

General

Proper lubrication and daily cleaning is one of the most important factors in bearing life. Follow the recommended lubrication intervals. Be sure to clean all grease zerks and grease gun tip before greasing. During your daily cleaning and lubrication procedures, inspect

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Depth Cranks

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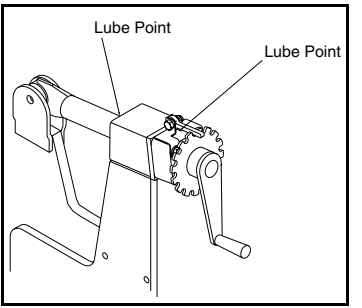


Figure 118.

Vibrator Bearings

The main screed vibrator assemblies have four lubrication points one on each vibrator bearing. The extending screed vibrator assemblies have two lubrication points, one on each bearing. All should be lubricated every 8 hours of operation with one to two pumps from a hand grease gun.

Match Height

The match height assemblies have two lubrication points on each, on the threaded link and on the match height bearing housing. These should be lubricated every 40 hours of operation with one to two pumps from a hand grease gun.

Extending Screed Slope

The extending screed slope assemblies have two lubrication points on each, on the threaded link and on the slope shaft bearing housing. These should be lubricated every 40 hours of operation with one to two pumps from a hand grease gun.

Crown

The crown has two lubrication points on each turnbuckle assembly. They should be lubricated every 40 hours of operation with one to two pumps from a hand grease gun.

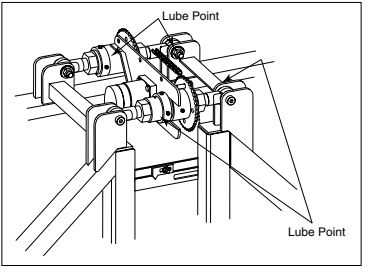


Figure 119.

Vibrator Bearings

The main screed vibrator assemblies have four lubrication points one on each vibrator bearing. The extending screed vibrator assemblies have two lubrication points, one on each bearing. All should be lubricated every 8 hours of operation with one to two pumps from a hand grease gun.

VersaScreed

DANGER - Screeds and screed extensions are heavy and will cause death or severe injury if the screed drops unexpectedly. The screed will drop sudden if the hydraulic system fails. Before climbing under or working under the screed, engage the screed lock and stack two stacks of cribbing high enough to prevent the screed from injuring someone if the screed lock fails.

Handle screed extension safely. Lift them only with a properly rated crane and lifting device. Never climb under a screed extension or put your feet or head under it.

.

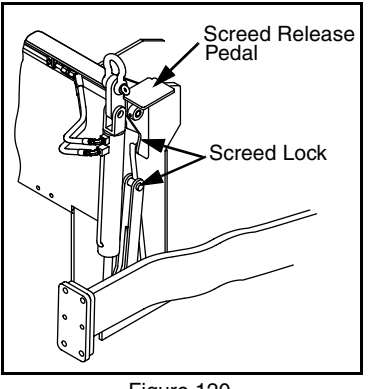


Figure 120.

Screed Adjustments - General

All screed adjustments in the following sections should be made only after setting the left and right tow point cylinders to the same position, nulling screed hand cranks equally and

zeroing the lead and trailing crown. Use the Manual Jog switch to reposition both tow points equally (6 or center on gauge).

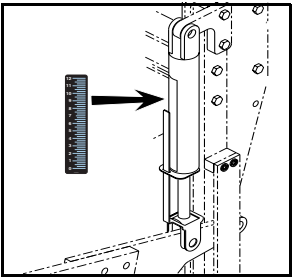


Figure 121.

To null the screed:

1) Measure the distance from the screed frame to the tow arm plate on the left side.
2) Measure the distance from the screed frame to the tow arm plate on the right side and turn the screed hand crank one direction or the other until the measurement is equal to that of the left side.

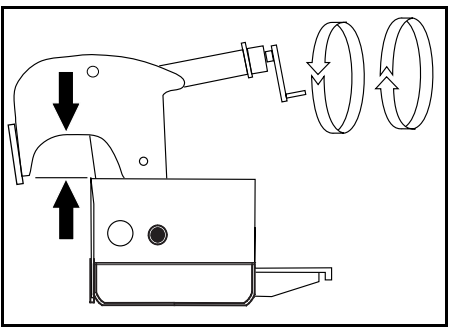


Figure 122.

Screed Bottom Removal

1) Adjust lead and tail crown to 0” (flat).
2) Install two 5/8” x 2” cap screws into the red aligning plates in the center of the screed and tighten securely.

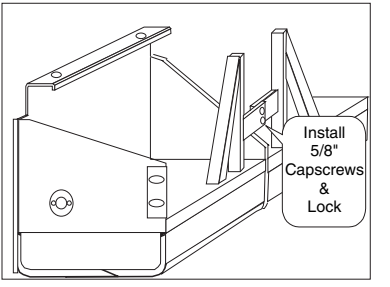


Figure 123.

3) Loosen nut on cover plate of left inside upper screed frame and rotate plate 90° as shown in Figure 85.
4) Install two 1/2” x 2” cap screws in two holes and tighten, locking front of the upper screed frames together.

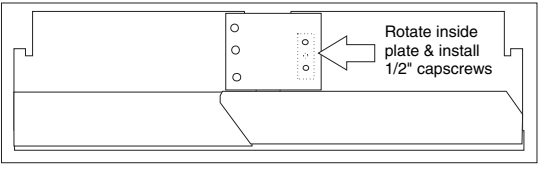


Figure 124.

5) Set the screed down on a flat level area.
6) Remove the 3/4” retaining cap screws from rear and front of upper screed frames (8 main screed, 4 per extending screed).

NOTICE - Do not loosen or attempt to adjust the shim bolts located on the main screed. They are set at the factory so the screed bottom when installed is parallel with the upper frames.

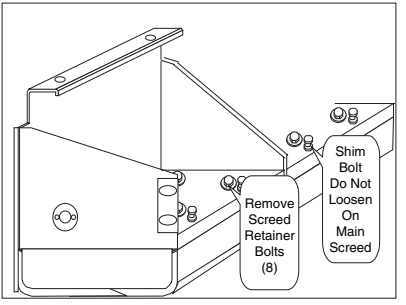


Figure 125.

7) Raise the screed frames up away from the screed plate. Drive the paver forward a short distance.
8) Inspect and clean the back side of the fixed strike-offs of all built-up asphalt materials.
9) Inspect and clean out the screed heater chambers.
10) Measure distance from screed bottom lip to screed sub-frame at both ends of each sub-frame. These measurements will be used to install sub-frames on a new screed bottom.

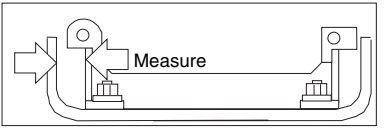


Figure 126.

11) Remove the 5/8” nuts on the rear and front of both screed sub-frames. Remove flat washers and lift sub-frames off old screed bottom.

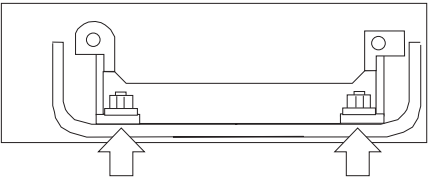


Figure 127.

12) Use same series of steps to remove extending screed bottoms.

Screed Bottom Installation

1) Place NEW screed bottom on a flat level surface.
2) Place the screed sub-frames over the studs on the new screed bottom.
3) Place one flat washer on each stud and start NEW 5/8” lock nuts.
4) Measure the distance from the screed bottom lip to the sub-frame and adjust to the dimensions previously taken when removing screed bottom.

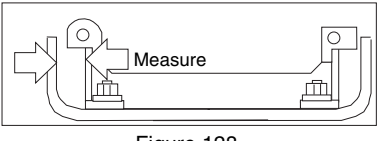


Figure 128.

5) Tighten 5/8” lock nuts to 60 foot pounds torque.
6) Position paver over screed bottom and align.
7) Lower upper screed frame onto screed bottom and sub-frame.
8) Install the eight 3/4” retaining cap screws and torque to 266 foot pounds torque.

NOTICE - Do not loosen or attempt to adjust the shim bolts located on the main screed. They are set at the factory so the screed bottom when installed is parallel with the upper frames.

9) Use the same series of steps to install extending screed bottoms.

Fixed Strike-Off

The fixed strike-offs act as a material metering device to control the amount of material allowed to pass under the screed, thereby controlling or affecting the angle of attack required to produce a given depth. They also absorb wear that would have been introduced to the nose area of the screed bottom. The normal setting is 1/2" above the screed bottom and will work fine in most material designs currently used. There are, however, material designs that will require changing the setting to allow the screed to run with the desired 1/8" to 1/4" nose-up attitude or angle of attack.

1) Place a straight edge against bottom of the screed and measure from straight edge to the bottom of strike-off.
2) Adjust it by loosening the bottom jam nut and tightening the top to raise the strike-off. Loosen the top jam nut and tighten the bottom to lower the strike-off.

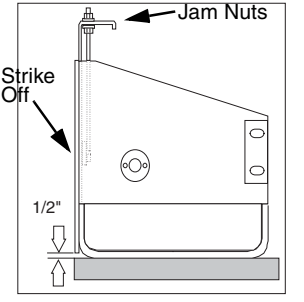


Figure 129.

Independent Angle of Attack

Extension screeds run with a increased angle of attack in relation to the main screed to provide a uniform texture across the width of the mat. This is called the independent angle of attack.

1) To check and adjust the independent angle of attack, place a straight edge on the outer edge of the main screed and protruding under the extending screed.
2) Using the MATCH HEIGHT lever raise or lower the extending screed until the extending screed just contacts the straight edge.
3) Move straight edge to center area of main screed.
4) Using SLOPE lever, increase or decrease extending screed slope until screed just contacts straight edge.
5) Re-check match height and slope, adjust until both center and outside edges just contact the straight edge.
6) With straight edge on the outer edge. There should be 1/8" gap at the leading edge of the extending screed, while the trailing edge is just touching the straight edge.

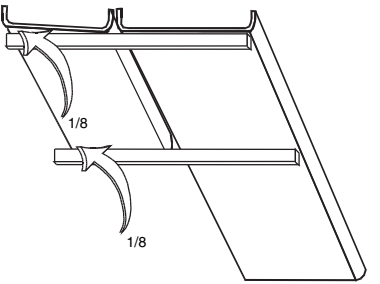


Figure 130.

7) If the adjustment is not in this range, loosen the two rear adjustment rod retaining bolts and the adjustment rod jam nuts..

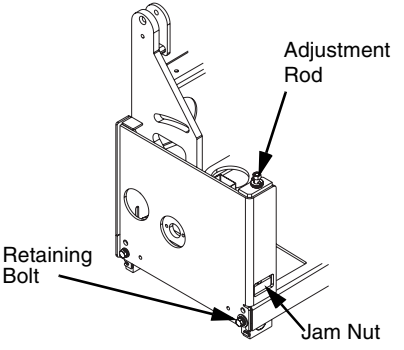


Figure 131.

8) Move the adjustment rod downward to increase angle of attach or upward to decrease angle of attack.
9) Once the desired angle is achieved, tighten the jam nuts and the retaining bolts.

Extending Screed Alignment

A rear screed which is out-of-parallel with the main screed may have no effect on the mat being placed. The most obvious indication will be that the extender tubes will be out-of-line. When retracting the rear screed, the tubes may rub or hit part of the structure normally cleared or be noticeably misaligned with the tubes of the opposite extension.

1) Retract both extensions.

   NOTICE - Shimming the front tipping frame block causes the inside edge of the extending screed to move away from the main screed. Shimming the rear tipping frame block causes the inside edge of the extending screed to move closer to the main screed.

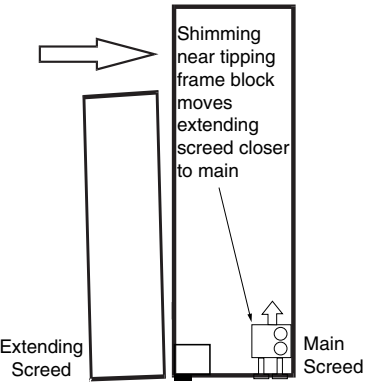


Figure 132.

2) Loosen two inner keeper bolts and two outer keeper bolts.
3) Install a press bolt in threaded hole next to the outer keeper bolts and tighten. This causes the tipping frame block and extending screed to move. Once the extending screed is aligned, add shims between the tipping frame block and the main screed frame and tighten the keeper bolts.

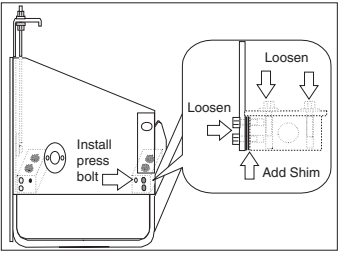


Figure 133.

Lead/Trail Crown

The main screed crown has two adjusters, the Lead and Trail. When the main screed crown needs to be set for profile specifications, both lead and trail crowns are adjusted simultaneously, by means of a connecting chain. The lead crown can be set independent of the rear, too allow a little extra material to pass into the center area of the main screed. This is necessary to compensate for the void area created by the auger-conveyor drive case. The normal amount of lead crown is 1/16" to 1/8" above that of the rear. This range is sufficient for most all materials designs.

The most common way to check the lead and trail crown is done with a strong string line, two equal thickness spacers (new 1/2" NC nuts) and a tape measure.

Checking and adjusting the tail crown

1) Place spacers inboard of outer edge of screed and just forward of the bent up portion at trailing edge.

   NOTICE - A screed bottom that has been used for joint matching may have the outer few inches of bottom worn. Spacers will have to be placed inboard of these areas to get proper measurement.

2) Stretch a strong string line across center of spacers and pull tight.

3) Measure distance from string line to screed bottom next to each spacer and in center of screed.

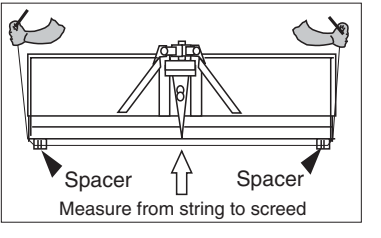


Figure 134.

For initial setup purposes we adjust the lead and trail crown to 0" (flat). In operation the normal amount of lead crown is 1/16" to 1/8" above that of the rear.

4) If the measurement in the center of the screed is less than or more than the thickness of the spacers, the tail crown must be adjusted.
5) To adjust, set the crown switch, on the screed control panel to Increase or Decrease. Adjust until measurement at center area of screed is equal to spacer thickness.

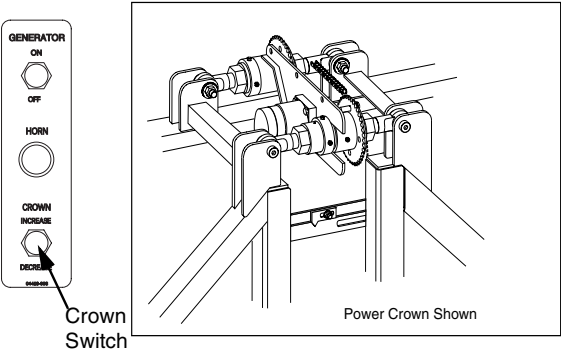


Figure 135.

6) Once tail crown is set to 0” (flat), move spacers and string line foreword to the leading edge of the screed bottom.
7) Measure the amount of lead crown.
8) To adjust the lead crown independent of the tail crown, remove the two clevis pins in the rear crowning sprocket. Set the crown switch to the increase or decrease position as above.
9) Adjust until measurement at center area of screed is equal to spacer thickness.
10) Re-install the two crown clevis pins in the rear sprocket.
11) Once the lead and tail crowns are set at 0” (flat), loosen and reset the crown indicator gauges to 0.

Vibrator Weight Alignment

Each vibrator weight consists of two plates mounted 120° apart and clamped to the vibrator shaft. There are four pairs of weights, two on each side of the screed, and two motors, one at the outer end of each shaft. In addition, each extending screed has a vibrator and a motor

If more or less compaction force is needed, the relationship of weights in each pair can be changed. Aligning the weights closer together will produce more compaction force. When both weights are exactly aligned, maximum force is obtained. Aligning the weights opposite each other counter balances the force and provides no vibratory compaction force.

1) To adjust, loosen the weight with an Allen wrench.
2) Rotate the weight to the desired position and re-tighten.

NOTICE - Alll pairs of weights must be aligned along the length of the shaft to produce a synchronized vibrating force. This is very important to remember when installing screed extensions equipped with vibrators. Misalignment will reduce vibrating force across the screed, therefore affecting the quality of mat compaction.

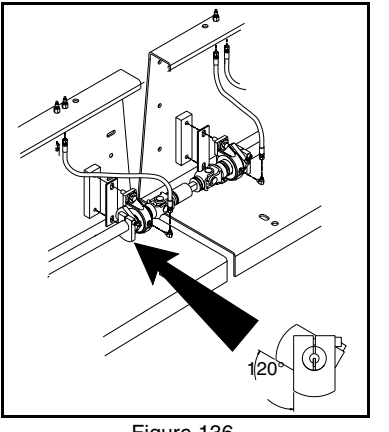


Figure 136.

Crowning Mechanism Chain Tension

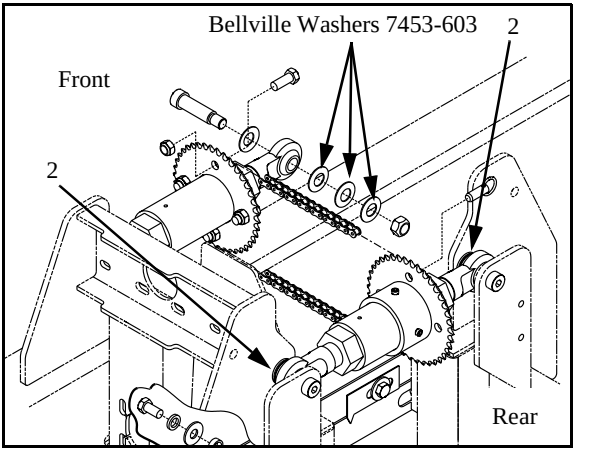


Figure 137.

The Bellville Washers are used to adjust the chain tension as well as to adjust the alignment of the turnbuckle sprockets on the crowning mechanism. Each screed is set up with three washers on the inside rod ends of the front turnbuckle and two washers on the inside rod ends of the rear turnbuckle. Additional washers are added to adjust alignment of the chain sprockets.

Lubrication

WARNING - Turn off engine & remove key before performing any inspections or maintenance.

General

Proper lubrication and daily cleaning is one of the most important factors in bearing life. Follow the recommended lubrication intervals. Be sure to clean all grease zerks and grease gun tip before greasing. During your daily cleaning and lubrication procedures, inspect

the seal area for signs of a blown seal. Over-greasing or greasing when the bearings are cold is the biggest reason for blown seals.

Depth Cranks

The screed depth crank assemblies have two lubrication points on each, on the threaded link and on the screed depth crank bearing housing. These should be lubricated every 40 hours of operation with one to two pumps from a hand grease gun.

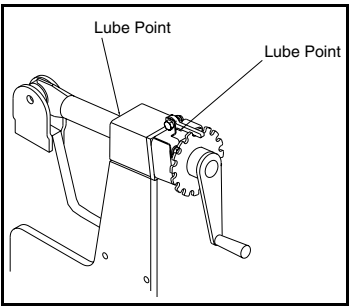


Figure 138.

Vibrator Bearings

The main screed vibrator assemblies have four lubrication points one on each vibrator bearing. The extending screed vibrator assemblies have two lubrication points, one on each bearing. All should be lubricated every 8 hours of operation with one to two pumps from a hand grease gun.

Match Height

The match height assemblies have two lubrication points on each, on the threaded link and on the match height bearing housing. These should be lubricated every 40 hours of operation with one to two pumps from a hand grease gun.

Extending Screed Slope

The extending screed slope assemblies have two lubrication points on each, on the threaded link and on the slope shaft bearing housing. These should be lubricated every 40 hours of operation with one to two pumps from a hand grease gun.

Crown

The crown has two lubrication points on each turnbuckle assembly. They should be lubricated every 40 hours of operation with one to two pumps from a hand grease gun.

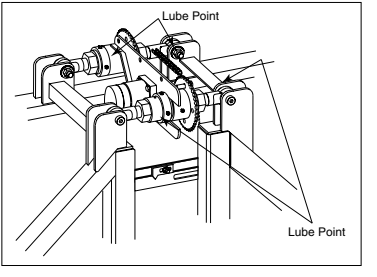


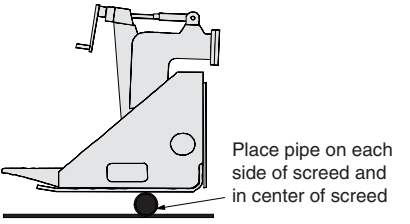
Figure 139.

Tow Point Cylinder Timing

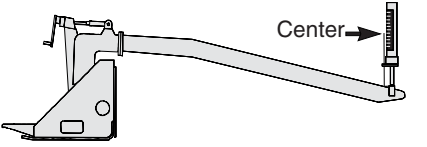
This refers to the length of time it takes to extend or retract the tow point cylinder. A dual hydraulic throttle valve is adjusted so the extend and retract stroke of the cylinder occurs in 18 seconds.

Checking Cylinder Timing

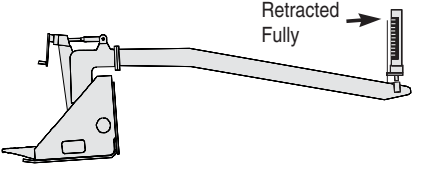
1) Acquire two pieces of pipe 2” OD or greater and 1’ in length.
2) Place the pieces of pipe under each end of the screed.



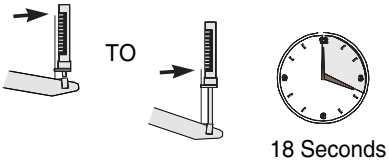
3) Center both tow point cylinders at 6 on the number scale.



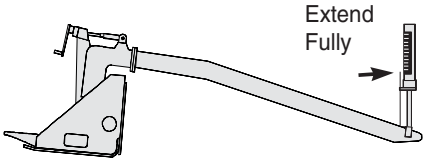
4) Start engine and run at full throttle.
5) On the right side, retract the tow point cylinder fully.



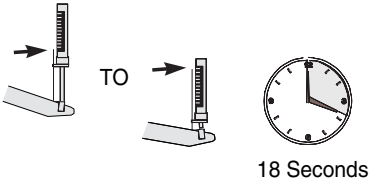
6) Extend cylinder: Using a stop watch, note the amount of time it takes to fully extend the tow point cylinder.



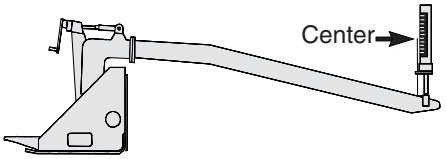
7) On the right side, extend the tow point cylinder fully.



8) Retract cylinder: Using a stop watch, note the amount of time it takes to fully extend the tow point cylinder.



9) Center right tow point cylinder at 6 on the number scale.



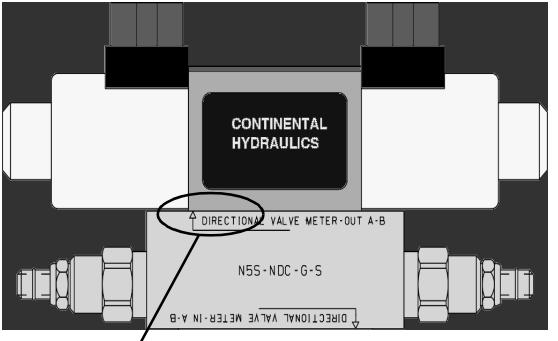
10) Repeat Steps 4 through 9 on the left side.

If either the up or down stroke time was anything other than 18 seconds, adjust tow point timing according to the "Tow Point Timing Adjustment" in this section.

Tow Point Timing Adjustment

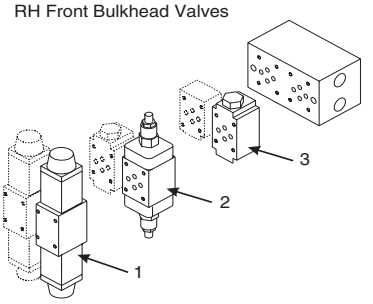
NOTICE - All checks and adjustments should be performed with engine at FULL THROTTLE and machine at operating temperature.

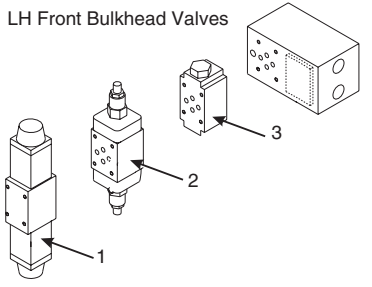
For proper operation, valve must be orientated as shown in illustration.



Assemble with label “Directional Valve Meter Out A-B” against bulkhead.

To adjust the tow point timing, locate the proper left hand or right hand dual throttle valve, in the illustration that follows.



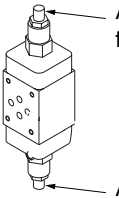


Solenoid Valve (1) : Control valve used to direct hydraulic fluid to either the rod or piston ports of the tow point cylinder.

Dual Throttle Valve (2): Used to set cylinder travel speed for both directions to 18 seconds.

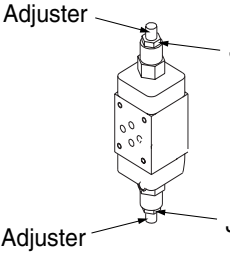
Holding Valve (3): Used to hydraulically lock the tow point cylinders

The Dual Throttle Valve adjustment points are as follows:



To adjust the proper up or down stroke time, perform the following:

1) Loosen jam nut.
2) Using an allen wrench (hex wrench), turn adjuster a slight amount.



Clockwise rotation DECREASES cylinder speed.

Counterclockwise rotation INCREASES cylinder speed.

3) Tighten jam nut.
4) Recheck tow point timing according to the above procedures and readjust if necessary.

Sundstrand Automatic Grade and Slope

Automatic screed controls provides a means to enhance a paving operation by monitoring and controlling the screed position in relation to the tractor and the reference plane. This eliminates the need for a person to manually introduce the changes that would be necessary for a uniformly smooth mat to be placed over irregular grades.

Automatic screed controls can enhance a good or proper paving operation by maintaining an established line of grade and or percentage of slope. Proper operation means controlling ALL of the factors that can adversely affect the screed. Refer to Quality Paving Manual.

If these factors are not controlled by recommended operational techniques they can introduce a change in the screeds position in relation to the established line of grade and or percentage of slope quickly enough that the automation can not correct for them. Automation can not make up for improper operational techniques. Refer to Quality Paving Manual.

Evaluation of specifications and grade conditions on a job is extremely important if the paver and automation are to be configured properly to produce the desired or required results. Failure to properly configure the screed and automation for each phase of the paving operation, or specific conditions, will result in producing a mat that is unsatisfactory or will not meet specifications. One configuration of the screed and automation will not produce superior results in all conditions and jobs.

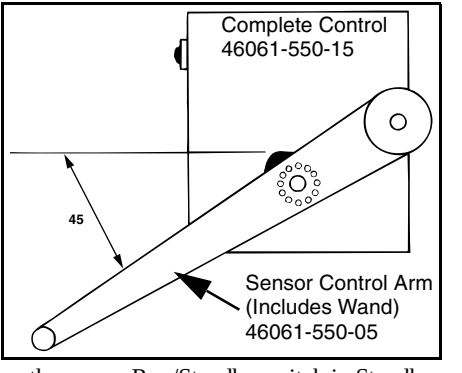
The automation consists of two basic sensory devices, the grade control and the slope system. Both systems operate independent of each other to control the angle of attack of the screed by moving the tow points up or down in relation to the reference plane of each. The reference plane for a grade sensory system can be one of three types: ski (mobile grade reference), joint matcher or fixed (established) string line. All of these reference in a plane parallel to the line of paving. The slope system uses an angular reference plane in relation to the horizon, which is perpendicular to the line of paving.

Setting Dead Band - Grade Control

The dead band of the grade sensor refers to the amount the sensing arm can move with out triggering a tow point cylinder response. A given amount of dead band is necessary to allow for normal machine vibration.

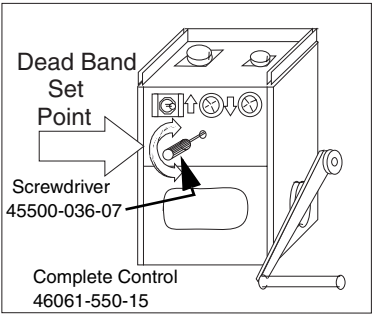
To set the deadband:

1) Assemble the grade sensor jack and mounting hardware. Place sensor on the jack and connect the electrical cable from the sensor to the tow point control connector.
2) When installing the sensor control arm, it is extremely important to install so it is trailing the sensor at 45° angle in relation to the flat on the sensor shaft.



3) Place the sensor Run/Standby switch in Standby mode.
4) Place the remote control mat thickness Manual/Setup/ Auto switch in Setup mode.
5) Adjust the sensor jack height until both lights are out when the switch on the sensor is in Standby mode and the remote control material thickness switch is in the Setup mode.
6) The Deadband is correct when a dime can be passed under the follower without triggering a light, but a nickel passed under the follower will trigger a light response.

7) If the deadband is not correct, remove the screw located on the face of the grade sensor. There is an adjustment located under the face screw.
8) Use the small screwdriver provided. Clockwise rotation will increase the amount of deadband, while counterclockwise will decrease the amount of deadband.

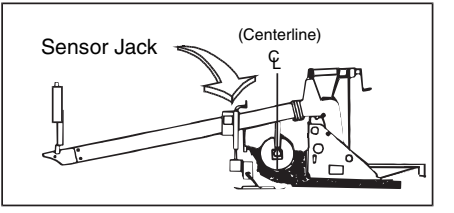


Joint Matching Skate 46061-550-06

Matching the height of the mat being placed to an existing mat or curb requires the screed to be very responsive to any changes in the elevation of the existing mat or curb. This is an application where we are building “profile” or over correcting the screed, forcing it to change depth in a very short distance. This mode is not necessarily good for rideability.

1) The grade sensor should be mounted 3/4 of the way back from the tow point, just ahead of the augers, and the sensor skate in as close to the joint as possible, taking into account the shape of the joint to be matched. If the joint being matched is distorted, it may be necessary to locate the sensor further from the joint. Keep in mind that the further the sensor is from the actual joint being matched, the less likely that an exact match will occur.

2) Place the Run/Standby switch on sensor to Standby and remote mat thickness Manual/Setup/Auto switch in Setup.



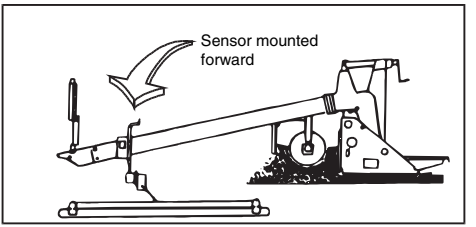
3) Adjust the sensor jack assembly until the lights go out.
4) Place Run/Standby switch on the sensor to Run and the remote mat thickness Manual/Setup/Auto switch in Auto.
5) If mat depth needs correction, turn the grade sensor jack slowly in the correct direction until the mat being placed is the correct thickness.

   NOTICE - Clockwise rotation of the grade sensor jack THICKENS the mat being placed. Counterclockwise rotation of the grade sensor THINS the mat being placed.

Ski 46061-550-07

When using automation off a ski, corrections to deviations that occur at the sensor or the screed will require the paver to travel approximately 5 lengths of the tow arm before the correction is fully completed. Deviations that occur at the tow point due to the tractor traveling over irregular grades are corrected for immediately. In effect, the sensor is correcting for deviations at the tow point before they can affect the screed's angle of attack (position). In this application, we are building "rideability", or averaging all required changes in depth over a longer area.

The grade sensor should be mounted 1/4 of the way back from the tow point.



1) Pave manually using the depth cranks until the correct depth is achieved.
2) Place Run/Standby switch on the sensor to Standby and remote mat thickness Manual/Setup/Auto switch in Setup.
3) Adjust the sensor jack assembly until the lights go out.

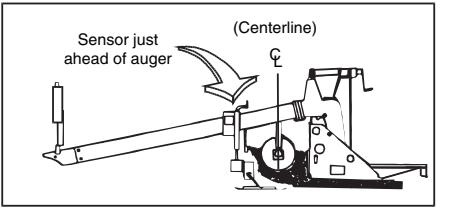
4) Place Run/Standby switch on the sensor to Run and the remote mat thickness Manual/Setup/Auto switch in Auto.
5) If mat depth needs correction, turn the grade sensor jack slowly in the correct direction until the mat being placed is the correct thickness.

   NOTICE - Clockwise rotation of the grade sensor jack THICKENS the mat being placed. Counterclockwise rotation of the grade sensor THINS the mat being placed.

Fixed String Line

When using automation off an established or fixed string line, it requires the screed to be responsive to any changes in elevation of the string line. This is an application where we are building profile, or over correcting the screed and forcing it to change depth in relation to the elevation of the string line.

The grade sensor should be mounted 3/4 of the way back from the tow point, or just ahead of the augers.



1) Pave manually using depth cranks until correct depth is achieved.
2) Place Run/Standby switch on sensor to Standby and remote mat thickness Manual/Setup/Auto switch in Setup.
3) Adjust the sensor jack assembly until the lights go out.
4) Place Run/Standby switch on sensor to Run and remote mat thickness Manual/Setup/Auto switch in Auto.

5) If mat depth needs correction, turn the grade sensor jack slowly in the correct direction until the mat being placed is the correct thickness.

NOTICE - Clockwise rotation of the grade sensor jack THICKENS the mat being placed. Counterclockwise rotation of the grade sensor THINS the mat being placed.

Slope

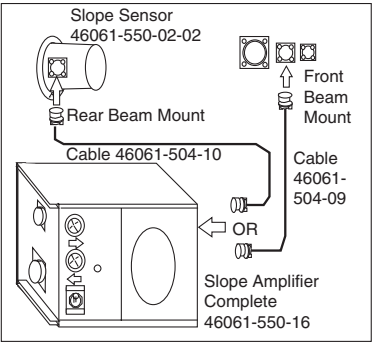
The position of the sensor whether mounted on the forward cross beam or on the rearward cross beam determines how fast the screed will react to a change of the null point at the sensor. By positioning the sensor, we can build profile or rideability. We need to evaluate job specifications and grade related conditions to determine the desired mounting position that will produce the required results.

Setting Deadband

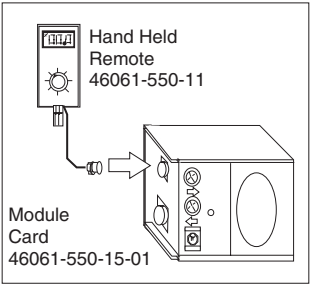
The deadband on the slope system refers to the amount of angular change that can occur on the slope beam without triggering a low point cylinder response. A given amount of deadband is necessary to allow for normal machine vibration.

To Set the Deadband

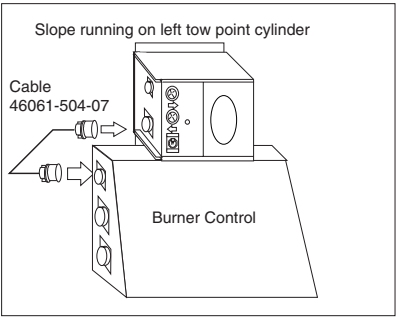
1) Connect the sensor harness form the slope amplifier to the slope sensor connection on the tractor bulkhead (slope sensor mounted forward). Or, from the slope amplifier to the slope sensor connection on the slope sensor (slope sensor mounted rearward). This step is not necessary on 300 series pavers as the slope sensor and amplifier are in the same module.

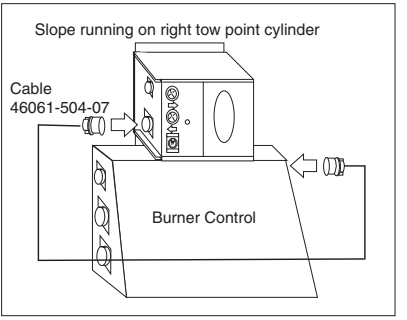


2) Connect the hand held remote control.



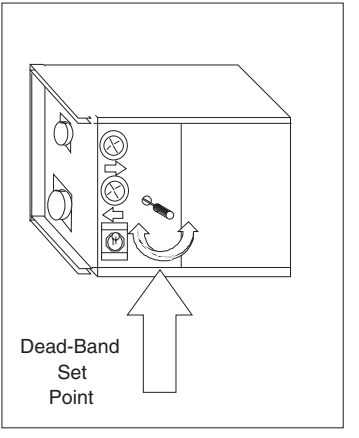
3) Connect the slope amplifier to tow point control cable from the slope amplifier to either the left or right tow point control connector.





4) Place slope amplifier run/standby switch in standby mode.
5) Place the remote control mat thickness Manual/Setup/ Auto switch in Setup mode.
6) Turn the slope set dial on the remote slope control until both lights on the slope amplifier go out.
7) Turn the remote slope control dial clockwise until a light just comes on, then turn counterclockwise until the light just goes out. Note the number readout on the LCD.

8) Turn the remote slope control dial counterclockwise until opposite light just comes on, then turn clockwise until light just goes out. Note the number readout on the LCD.
9) Subtract smaller noted number readout from the larger. Example: 2.1 - 1.7 = 0.4. The deadband is set correctly if the differential from light to light is 0.2% slope.
10) If the deadband is not correct, remove the screw located on the face of the slope amplifier. There is an adjustment located under the face screw.
11) Using the small screwdriver provided, clockwise rotation will increase the amount of deadband, while counterclockwise will decrease the amount of deadband.

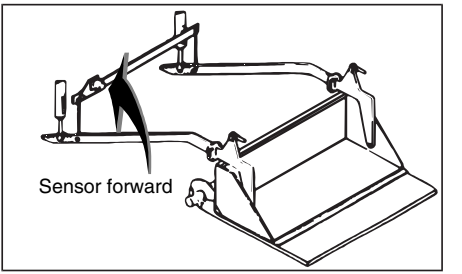


Building Rideability - Sensor mounted forward

When using a slope control system with the sensor mounted on the forward cross beam, corrections to deviations at the screed will require the paver to travel approximately 5 lengths of the tow arm before the correction is fully completed. Deviations that occur at the tow point, due to tractor traveling over irregular grades, are corrected for

immediately. In effect, the sensor is correcting for deviations at the tow point before they can affect the screed's angle of attack (position).

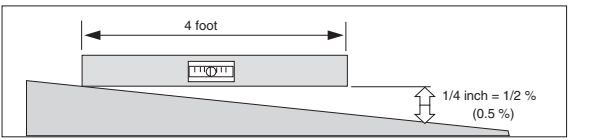
In this application we are building "rideability", or averaging all required changes in depth over a longer area.



To use the slope system:

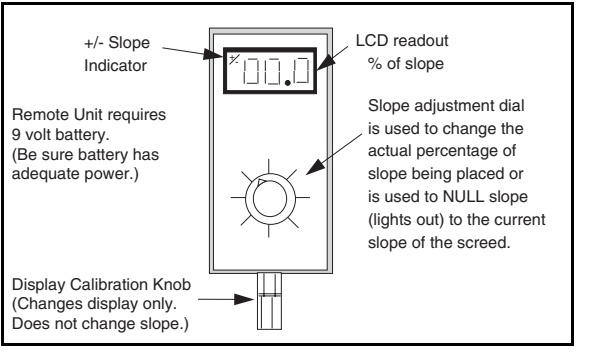
1) Connect system harnesses to control the desired left or right tow point cylinder as in Setting Deadband section.
2) Pave manually using the depth cranks until the desired slope is achieved on the mat being placed by checking with a carpenters level.

   NOTICE - With a four foot level, 1/4" rise equals 1/2% slope and 1/2" rise equals 1% slope.



3) Place the Run/Standby switch on the slope amplifier to Standby and the remote mat thickness Manual/Setup/ Auto switch in Setup.
4) Adjust slope hand held remote dial until the lights go out.
5) Remove the cover cap from the number set point potentiometer.

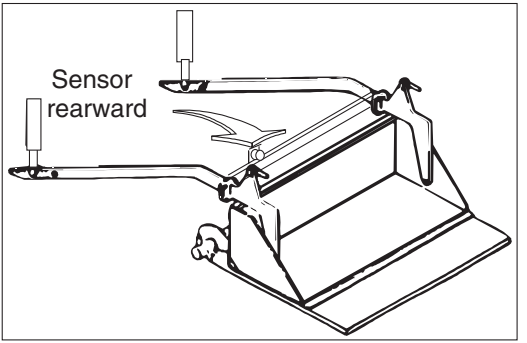
6) Adjust the number set point potentiometer until the LCD readout displays the correct percentage and fall of slope.



7) Place the Run/Standby switch on the slope amplifier to Run and the remote mat thickness Manual/Setup/Auto switch in Auto.

Building Profile - Sensor mounted rearward

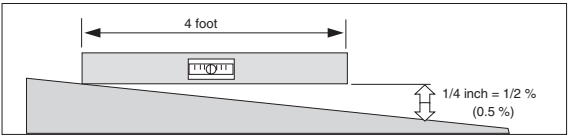
When using a slope control system with the sensor mounted on the rearward cross beam, requires the screed to be very responsive to any changes in the percentage of slope of the screed. This is an application where we are building "profile", or over-correcting the screed, forcing to change depth in a very short distance.



To use the slope system:

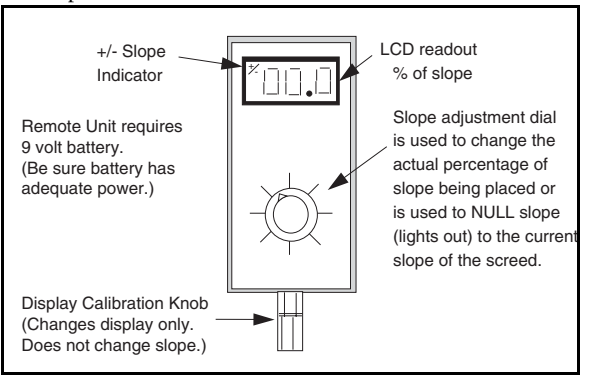
1) Connect system harnesses to control the desired left or right tow point cylinder as in Setting Deadband section.
2) Pave manually using the depth cranks until the desired slope is achieved on the mat being placed by checking with a carpenter's level.

   NOTICE - With a four foot level, 1/4" rise equals 1/2% slope and 1/2" rise equals 1% slope.



3) Place the Run/Standby switch on the slope amplifier to Standby and the remote mat thickness Manual/Setup/ Auto switch in Setup.
4) Adjust slope hand-held remote dial until the lights go out.
5) Remove the cover cap from the number set point potentiometer.

6) Adjust the number set point potentiometer until the LCD readout displays the correct percentage and fall of slope.



7) Place the Run/Standby switch on the slope amplifier to Run and the remote mat thickness Manual/Setup/Auto switch in Auto.

Troubleshooting Sundstrand Automatic Grade & Slope System

WARNING - Hydraulic cylinders may activate unexpectedly during testing which could injure someone that is not prepared for such movement. The operator and maintenance personnel must be constantly aware of who is near the paver and what mechanisms may activate during testing. Ensure that personnel are clear of mechanisms that may activate during testing.

Amplifier Module

The same amplifier module is used in both the grade and slope units. The only difference is the setting of the GRADE/SLOPE switch located on the back side of the amplifier module. If the unit is to be used as a grade control, set the Grade/Slope switch to GRADE. If unit is to be used as a slope control, set the Grade/Slope switch to SLOPE.

Grade or Slope Not Working

1) Perform checks on tractor base wiring and systems to ensure they function properly.
2) Inspect cables and connections for damage.
3) Set Manual/Setup/Auto switch to Setup, set Standby/ Run switch to Run.
4) Disconnect large cable from amplifier. Check pins A to B on cable for voltage. It should be 11 VDC or more. If low or no voltage, troubleshoot tractor wiring and/or systems.
5) Plug cable back into amplifier.
6) With the UP light on, check voltage on 155 to 3 (for LH tow point) or 165 to 3 (for RH tow point) for 12 VDC
7) With the DOWN light on, check voltage on 157 to 3 (for LH tow point) or 167 to 3 (for RH tow point) for 12 VDC.
8) If no voltage, take amplifier out of a unit known to be functioning properly and install it in system in question. Make sure slope/grade switch is set for unit to be used in.
9) If problem disappears, defective amplifier.

Automation Not Working Properly

1) Perform checks on tractor base wiring and systems to ensure they function properly.
2) Inspect all cables and connections for damage.
3) Check the deadband setting on the amplifier.
4) Check the Grade/Slope switch on the back of the amplifier. It must be in GRADE if the amplifier is used in a grade senor and in SLOPE if the unit is used in the slope system.
5) If slope system is in question, refer to Remote Slope Set.
6) Check tow point solenoid valve DIN connectors for a light. Each solenoid valve has an LED that should light when power is applied to the solenoid.

7) Take the amplifier out of a unit that is know to be functioning properly and install it in the system in question. Make sure the slope/grade switch is set for the unit used in. If problems disappear, defective amplifier.

Light Bulb Replacement

Unscrew the lens cover from the bulb. Slide a piece of 5/16" inside diameter rubber hose over the bulb. Press down and turn bulb counterclockwise. The bulb can be purchased at most local vendors as #161 (12 VDC) bulb.

Remote Slope Set - No Display

1) Check harnesses and connections for damage.
2) Check battery in backside of remote slope hand held unit and replace if necessary. A dead battery will cause the LCD to blank out.
3) Check pins A to C on the slope amplifier (connection point that remote plugs into). Voltage should be at least 2.1 VDC. If voltage is OK, defective remote slope set unit.
4) If no or low voltage, unplug the harness coming from tow point. Check pins A to B on the socket end. Voltage should be 11 VDC or more.
5) If voltage, defective amplifier.
6) If no or low voltage, check tractor base wiring or systems.

Remote Slope Set - Display Stays On Even When Unplugged

Replace remote slope set unit.

Remote Slope Set - Slope Appears to be Unstable or Oscillates

1) Check deadband setting on amplifier.
2) If deadband is OK, unplug remote slope set unit and check pins B to D for 1500 ohms.
3) If a reading shows 500 ohms, a capacitor is shorted. Replace unit.

4) Check pins A to C for 2500 ohms, then check for continuity between pins A to B and pins B to C while rotating dial. Reading should vary as dial is turned. If not, replace unit.

Slope Sensor

Disconnect cable and check ohms between pins.

A to B: 10 ohms

C to D: 300 ohms

E to F: 300 ohms

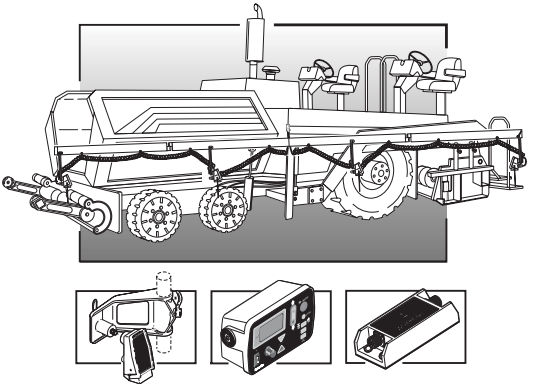
No cross continuity.

Topcon System Five Automatic Grade and Slope

System Overview

The System Five™ paver system is a complete, non-contacting control system which combines both elevation control and slope control into a simple, easy to use package.

The primary function of System Five is to provide screed control so that the paving material is placed into position at the correct elevation and slope.



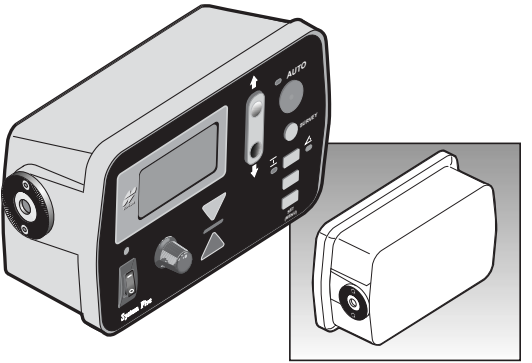
Paver System Five Components

The system includes two Control Boxes, two Sonic Trackers and a single Slope Sensor. When setup and connected, the Control Boxes control either the left or right side of the machine for either elevation or slope.

Control Box

The Control Box is the operator's interface to System Five. The Control Box receives signals from the sensors (Sonic Tracker II™, Laser Tracker, and/or Slope Sensor), and uses these signals to determine if grade or slope corrections are necessary. If a change in grade or slope is required, the Control Box sends a signal to the valve controlling the tow point cylinder on the appropriate side of the machine to raise or lower, thus maintaining correct mat thickness.

The Control Box connects to the Sonic Tracker II™, the Slope Sensor, and to the paver through electrical cables. The Control Box easily attaches to its mounting bracket with one clamp, and at the end of the day should be removed for storage.

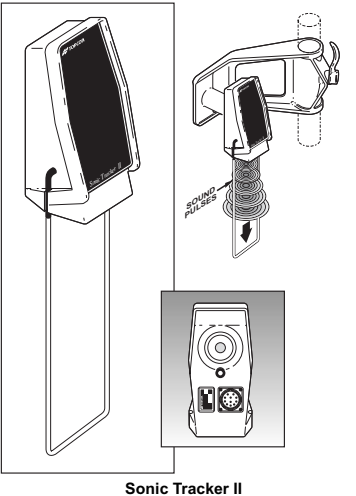


Control Box

Sonic Tracker II

The Sonic Tracker II™ measures and controls the elevations of the screed. A transducer, located in the bottom of the Sonic Tracker II™, generates sound pulses like a speaker and listens for returned echoes like a microphone. The Tracker measures the distance, and controls grade from a physical grade reference, such as a curb, stringline, or existing road surface. A bail is used to compensate for rapid air temperature changes. In paving applications a bail should always be used.

The Sonic Tracker II attaches to the system through one quick connect cable and attaches to the machine with a single bolt. At the end of the day, Sonic Tracker II should be removed for proper storage in the carrying case.

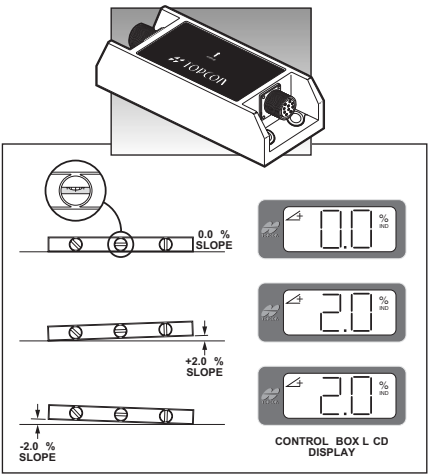


Sonic Tracker II

Slope Sensor

The slope sensor is a precision electronic sensor which functions much like a precision carpenter's level. The slope sensor reads the inclination (tilt) of the screed and sends the signal to the Control Box. The slope sensor measures slope from +20% to -20%.

The slope sensor connects to each Control Box through an electrical cable and requires no adjustments, and is the only component of System Five that can be used to control either side of the paver. The slope sensor is a sealed component, and once attached to the Paver, should not be removed.

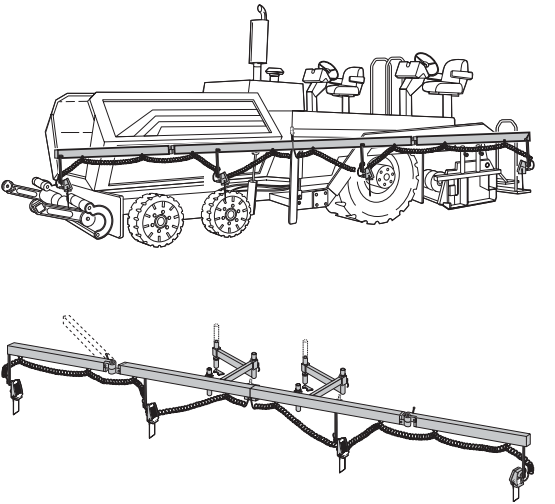


Slope Sensor

Smoothtrac Sonic Averaging System (SAS)

The Smoothtrac® SAS is an elevation control system that combines multiple sonic trackers to calculate an average of the physical reference. Each tracker sends its distance measurement to the Control Box which then averages those measurements and sends a correction signal to the tow point cylinder. The Smoothtrac replaces the mechanical ski that drags on the ground.

The Smoothtrac connects to the Control Box through the tracker cable.



Smoothtrac Sonic Averaging System (SAS)

Care and Preventive Maintenance

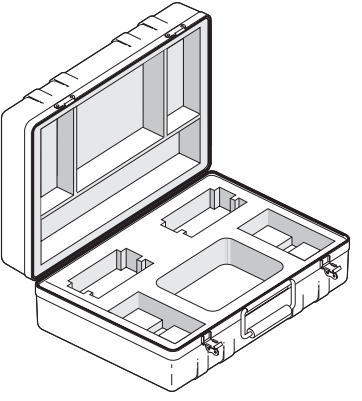
In general, follow these guidelines when using System Five:

- Always clean and thoroughly dry the removable components before storing them in carrying cases. Use a clean, soft cloth moistened with a neutral detergent or water.
- Keep carrying cases clean and dry. Do not leave them open and exposed to the elements.
- Some moisture on the Control Box and its components is acceptable during working conditions. Do not spray water or use high pressure steam cleaner hoses directly on cables and components.
- Use protective connector caps on cables when not using the System Five for a period of time. Water accumulating on the connectors can cause electrical shorts.

At the end of the day, performing general maintenance and storing mobile parts will help to keep the System Five in top condition.

- Remove the Control Box and the Laser Tracker and dust with a dry or damp non-abrasive, soft cloth.
- Insert cables into appropriate storage connectors after removing the Control Box.

A Carrying Case is provided with each System Five. The Carrying Case is lined and includes pre-cut sections for each Sonic Tracker II and the Control Boxes. A cut-out section is also provided for storing coil cords.



Carrying Case

NOTICE *NOTICE*

Keep the carrying case dry and store in a dry location. Never let the interior of the carrying case become wet. If the case does become wet, remove the components and let it dry.

Control Methods

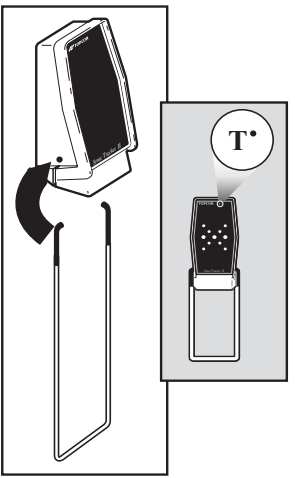
The following sections describe the two types of control possible with the Pave System Five: sonic and slope.

Sonic Control

The Sonic Tracker II™ measures and controls the elevation of the screed, controlling grade from a physical grade reference, such as a curb, stringline, or existing road surface.

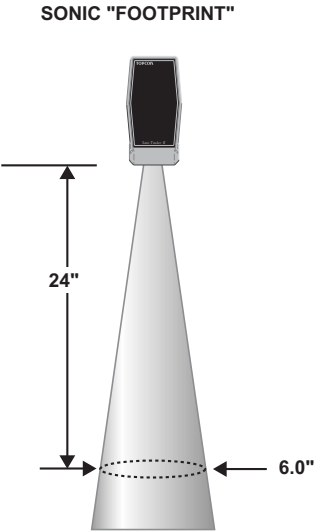
A transducer, located in the bottom of the Tracker, generates 39 sound pulses per second and listens for returned echoes like a microphone. As soon as the Tracker sends out a sound wave, it starts a stop watch. The sound waves go down, bounce off of a physical reference, and reflect back to the Tracker. The Tracker measures the time it takes for the sound wave to return to the

In the upper right hand corner of the Sonic Tracker II faceplate is a small symbol used to represent the use of the temperature bail. The LED symbol automatically illuminate when the bail is connected to the tracker. The tracker is cast with holes on each side for the bail to snap and lock into place.



Sonic Tracker and Components

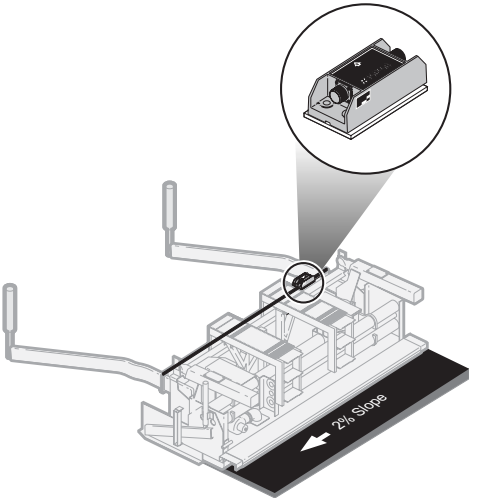
On the paver, the Sonic Tracker II will be positioned above the grade reference to maintain an exact distance from the tracker to the reference. If the Tracker is on-grade, the mat being laid will be at the desired depth.



Sonic Tracker “Footprint”

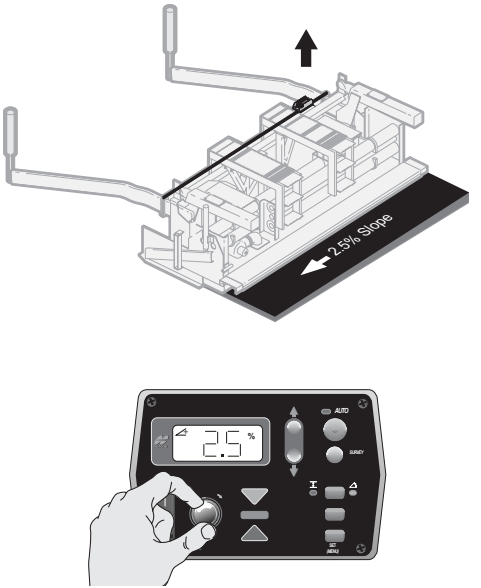
Slope Control

System Five uses a slope sensor mounted to the slope beam on the paver to measure and control the slope of the mat being laid The sensor contains an electronic level vial, that acts as a “precision carpenter's level”. Slope control with this electric level vial is very accurate and repeatable.



Position of Slope Control on Paving System

If the required slope changes, the screed operator dials the new slope into the System Five Control Box. The tow point cylinder on the slope side will raise or lower until the slope sensor measures the new slope.



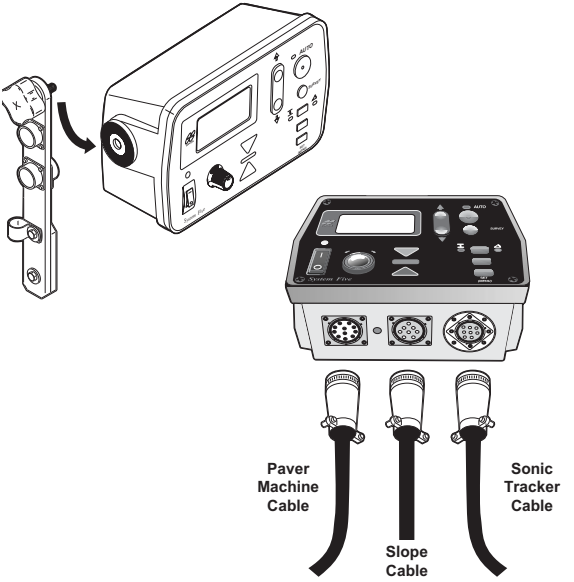
System Five Box directing the Slope Sensor position

Connections and Setup

Control Box Setup

Use the following steps to install the Control Box.

1. Attach the Control Box to its bracket.
2. Connect the cables to the Control Box.



Control Box and Connect Cables

NOTICE *NOTICE*

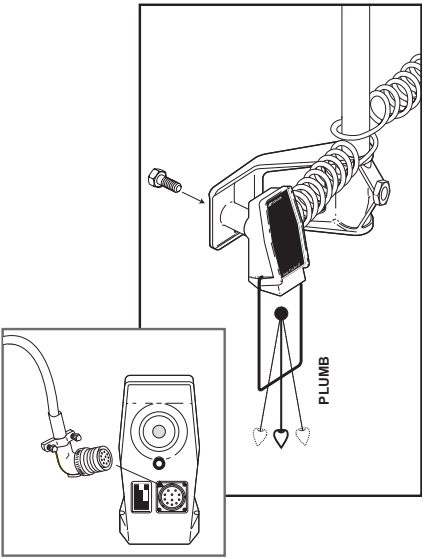
Due to different types of machine configuration, cable connections may vary.

Sonic Tracker Setup

The following steps describe installing and positioning the Sonic Tracker II on the Paver.

1. Connect the coil cord to the Tracker.
2. Bolt the Tracker to the bracket, and visually check to get the Sonic Tracker plumb.
3. Make one wrap of the coil cord around the L-Bar. This will act as a strain relief for the connector on the Tracker.

   Be sure the coil cord snap hook is in place and secure.
4. If needed, snap the temperature bail into place
5. Set the Sonic Tracker over the reference.



Sonic Tracker Setup

SAS Setup

Once the SAS has been installed, the System Five Control Box will automatically configure for SAS when powered on. The box will check to see how many trackers are connected and average over that amount. Getting the Control Box ready to pave is the same as with one tracker.

1. Connect each tracker as described in “Sonic Tracker Setup” on page 5-4, but using the SAS coil cord.
2. Place the SAS trackers over the reference: raise or lower the trackers bracket to position it at a proper height above the grade reference.
3. Push and hold the Set button while dialing in mat depth.
4. Put the Control Box in Auto and begin paving.

NOTICE *NOTICE*

It is not necessary to start paving in manual as is traditionally done when using a mechanical ski. If the setup procedures are followed correctly, paving with the SAS can and should start in automatic.

The SAS system has been designed to discontinue operating when one of the Trackers fails. When a failure occurs, the control box will flash “ERR” followed by a number from 1 to 4. The number represents the Tracker which failed, making troubleshooting easy and fast.

To reset the control box once a new tracker has been installed, or if the tracker has been removed and only three trackers will be used, turn the power off then on. The control box will reconfigure to the number of trackers. Changing the number of trackers may change the average distance. Re-survey the Control Box to lock SAS on-grade.

Once one of the Trackers has been eliminated from the averaging, the balance point of the beam will have changed. If the faulty Tracker is not replaced the beam will need to be repositioned to adjust for the new balance point. It is strongly recommended, if the first or last Tracker fails, to replace it with one of the Trackers from the middle of the beam. This will insure that the balance point is no outside of the 1/3 to 2/3 rule.

NOTICE *NOTICE*

A number reading of "1" could mean the first or last Tracker has failed depending on which side of the paver the beam has been mounted. The SAS cable is labeled with numbers at each connector for easy identification.

Tracker and SAS Placement

Whether setting up a standard Sonic Tracker II system or a Smoothtrac SAS, consider the following for each Tracker:

- The Tracker has a total working range of 14 inches to 55 inches—41 inches of adjustment—allowing the Tracker to be set over a stringline on one pass, then match grade on the next pass without moving the tracker.

  Therefore, the job application determines the position of the Tracker. For example, when using a stringline reference, keep the Tracker about two feet above the string, giving the operato about six inches of lateral movement to keep the Tracker over the string. When tracking a curb, lower the Tracker to keep it over the lip of the curb, preventing the Tracker from "seeing" the top, or face, of the curb.

- When setting up the Tracker over a grade reference, consider the size of the Sonic Cone, or the "footprint". For example, at about two feet from the Tracker, the footprint, or cone, will be about six inches.

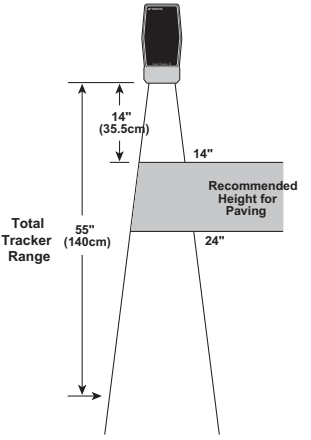
- The Tracker compensates for temperature changes only withir the bail range. Placing the Tracker too far from the reference may cause inaccurate temperature compensation.

- Temperature and atmospheric conditions affect the speed of sound. In paving applications, the air temperature can change rapidly and dramatically. A temperature bail attached to the tracker compensates for these variations. If the jobsite has higl winds and/or large temperature fluctuations, lower the Tracke closer to the reference.

The following sections detail the positioning tracker in relation to the grade reference, as well as on the machine.

Sonic Tracker Positioning in Relation to Reference

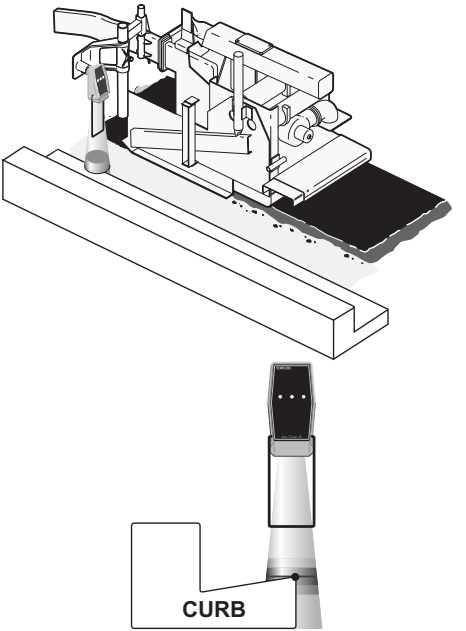
Raise or lower the tracker bracket to position the tracker at the proper height above the grade reference. The tracker has a total working range of 14 to 55 inches. For paving applications the recommended working height would be from 14 to 24 inches. At 55 inches the sonic footprint would be very large and the tracker may pick up an undesired reference. The tracker also compensates for temperature changes only within the bail range. Placing the tracker too far from the reference may not allow for accurate temperature compensation.



Recommended Tracker Placement

L-bar Positioning

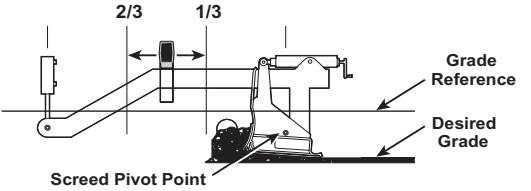
Position the L-Bar horizontally so the tracker will be over the reference. For example, when tracking a curb and gutter, place the screed or extension flush with the edge of gutter and slide the L-Bar so the Tracker is over the lip of the gutter.



Positioning the L-Bar with Tracker

Sonic Tracker Placement in Relation to Screed

As a tracker is moved closer to or further away from the screed, the response of the screed to an elevation correction changes. A rule of thumb is to place the tracker about 1/3 to 2/3 the length of the tow arm forward of the screed pivot point.

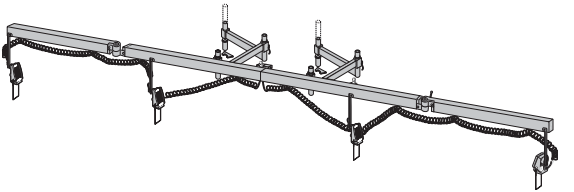


Correct Tracker Placement in Relation to Screed

If the tracker is not placed between these points, then incorrect screed responses could result. The following examples describe the possible, incorrect placements and the errors that would occur.

Smoothtrac SAS Placement and Setup

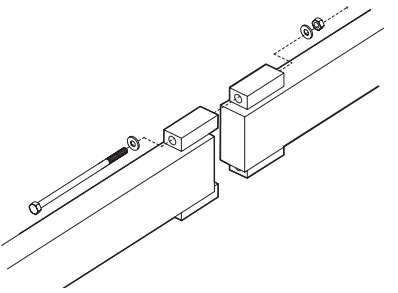
Topcon's Smoothtrac® Sonic Averaging System (SAS) is a non-contacting averaging system that uses multiple sonic trackers to smooth out the bumps and dips in a mat surface. The non-contacting design allows full maneuverability of the paver when turning around, backing up or passing over obstacles without lifting or removing the beam. The screed man can adjust mat thickness on the control box while standing on the screed. The Smoothtrac is mounted to the tow arm of the paver, and connects to System Five with the same coil cord used for the Sonic Tracker.



Smoothtrac SAS

When mounting the SAS to the paver, follow these simple steps:

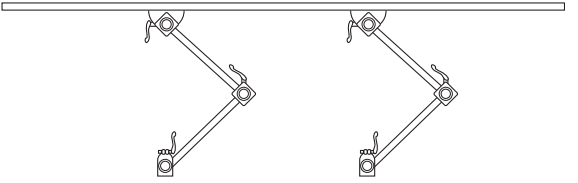
1. If the ski is in pieces, connect them together.



Connecting SAS Pieces

2. Next, mount the L-bars to the brackets on the tow arm. The outside L-bar can be attached so it points up or down. The position will depend on how tall the tow arm is off the ground.
   - For pavers with a tall tow arm, mount the L-bar in the downward position.
   - For shorter tow arms, mount in the upward position.

   Place locking collars on the bars and adjust so they are parallel with one another before tightening with an Allen wrench. This will allow the ski to move freely when adjustments need to be made without falling off.
3. Bend the L-bars so they are aligned in the same position and fold inwards so they are close to the paver. Make sure the clamp handles are loose so the bars can move.



Position of L-bars

4. Lift the ski and slide it over the L-bars. Adjust the ski so it is approximately 2 1/2 feet off the ground. Slide the locking collar up to the ski and lock in place.

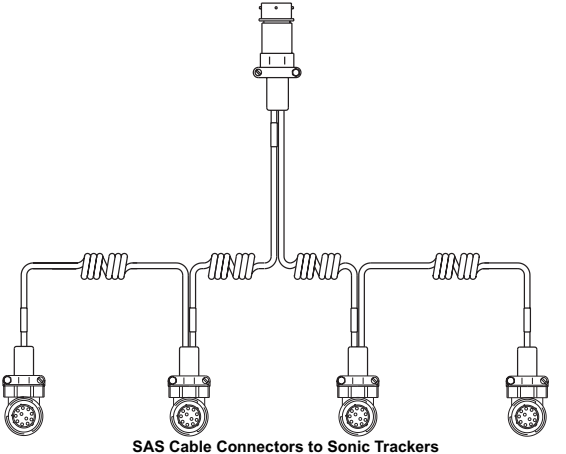
TIP

The ski will be easier to mount if the end beams are folded in. Bend the L-bars so they are aligned in the same position and fold inwards so they are close to the paver. Make sure the clamp handles are loose enough so bars can move.

5. Lower each of the Tracker hangers on the SAS and mount a Sonic Trackers using the L-handle bolt. An extra washer may need to be added so the L-handle does not block the cable connection.

Mounting Sonic Trackers to SAS

6. Connect the SAS coil cable to each tracker. Make sure to loop the coil cable through the U-hangers to keep it from getting damaged.

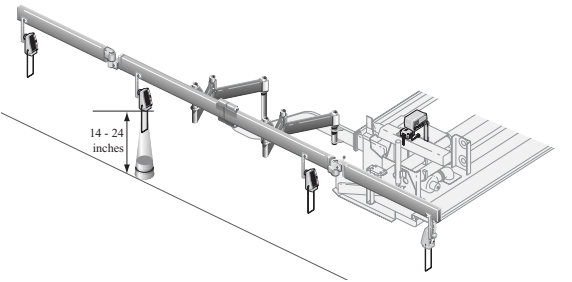


SAS Cable Connectors to Sonic Trackers

7. Attach temperature bails to each tracker and begin paving.

Positioning the SAS

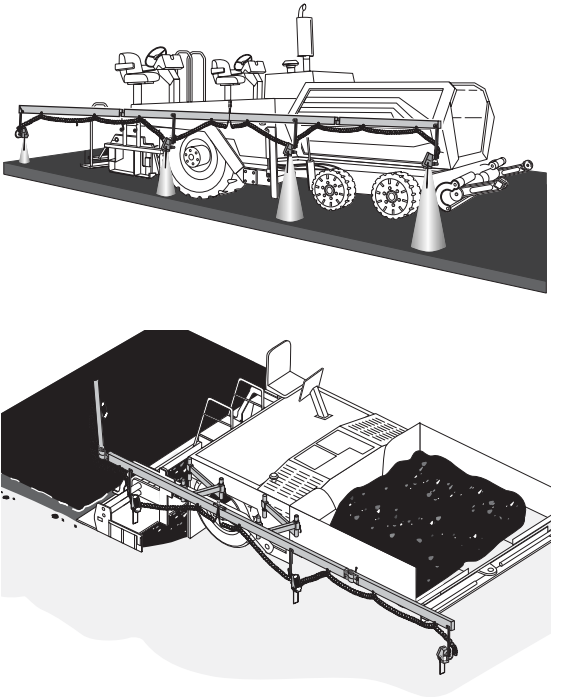
The SAS should be positioned so the Sonic Trackers are 14 to 24 inches from the grade reference. As with single tracker operation, the “lower the better” is a good rule of thumb for paving applications. This will help minimize the variable temperature conditions that can cause erratic signals. The beam does not have to be perfectly level because each tracker averages the distance to the reference individually.



Positioning SAS

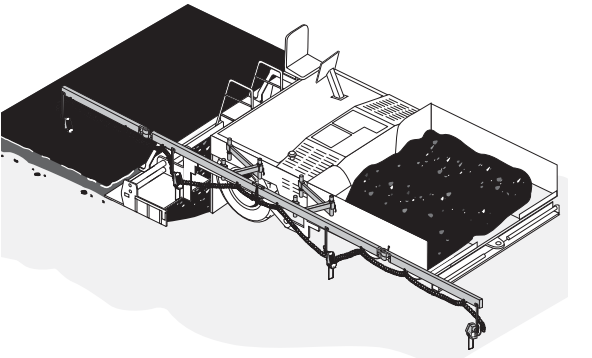
With SAS, be careful when the screed is raised that the front tracker does not hit the ground. If needed, the tracker bracket can be folded back when raising the screed to keep the tracker from hitting obstructions.

The trackers can be placed so all four are over the reference, or the back tracker can be set over the freshly laid mat. The best method is the one you are presently using or the one in which you are most comfortable.



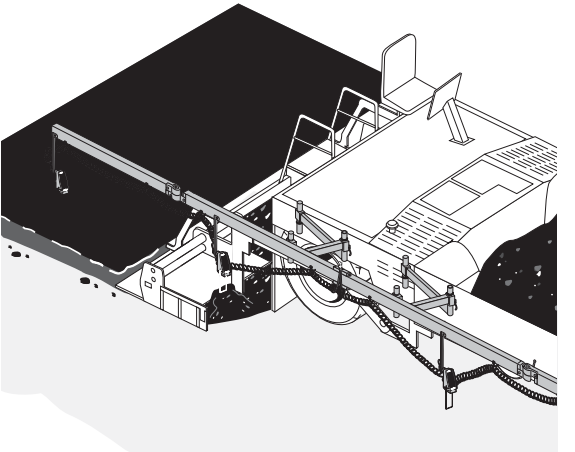
Example Placement of SAS Trackers Over Reference

In some applications, a grade reference outside the screed extension may not be in satisfactory condition, such as the shoulder of a road or the broken and warped edge of pavement. Traditionally, the screedman would manually adjust mat thickness on that side of the paver. The non-contacting SAS can be set up over the screed so full automation can be used. The first three trackers will reference the existing grade and the back tracker will reference the mat just laid.



SAS Setup when Screed Extension is Unsatisfactory

When paving with the screed extensions out, there may be a large "head of material" which could be picked up by the Sonic Tracker. If this happens, determine how far forward the tracker must be placed on the beam to not pickup the mix and drill a new mounting hold for the tracker hanger. The SAS coil cable will easily reach the tracker.



Repositioning the Sonic Tracker

Operation and Menu Settings

System Five™ uses a Control Box and Sonic Trackers to produce exceptional paving solutions. This chapter describes using the various components, including:

- The buttons, knobs, and switches on the Control Box.
- How to change settings, access information, and take readings using the various buttons, knobs, and switches.
- The menus available in the Performance Menu.
- How to access, change settings, and apply features using the Performance Menu.
- How the Sonic Tracker II™ works.

NOTICE *NOTICE*

When operating in rainy weather or in wet conditions, the Control Box, Sonic Tracker II, and cables must be thoroughly dried BEFORE placing them in the Carrying Case at the end of the day.

Any moisture in the Carrying Case will cause condensation on the inside of the components which may severely affect accurate operation during the next paving application.

Control Box

The Control Box is the operator's interface to System Five™ (Figure 1), receiving signals from the sensors, and using these signals to determine if grade or slope corrections are necessary. If the paving requires a change in grade or slope, the Control Box sends a signal to the valve controlling the tow point cylinder on the appropriate side of the paver to raise or lower, thus maintaining correct mat thickness. The operator can control and monitor the slope and thickness of the mat using the buttons and displays located on the front panel of the Control Box.

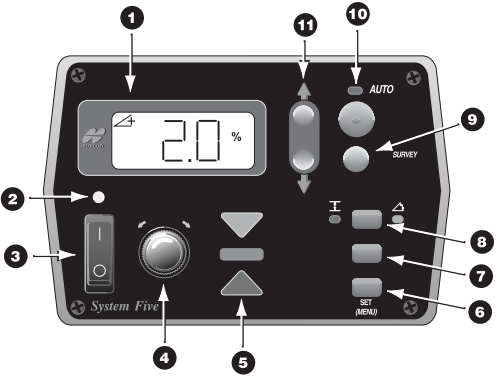


Figure 1. Control Box

1. LCD
2. Light Sensor for LED Display
3. Power Switch
4. Grade Adjustment Knob
5. Grade Adjustment LED
6. Set (Menu) Button
7. Cross Communication Button
8. Slope/Elevation Button
9. Survey Button
10. Auto/Manual Button
11. Jog Button

LCD

The LCD (Liquid Crystal Display) allows the operator to view text and graphic symbols that represent elevation or slope settings that System Five™ currently maintains for the paver (Figure 2).

Figure 2. LCD Display

Light Sensor for LED Display

The light sensor monitors ambient light to adjust the brightness of the LED display for better visibility.

The light sensor is located above the power switch.

Power Switch

The power switch (Figure 3) for the System Five Control Box turns it on and off.

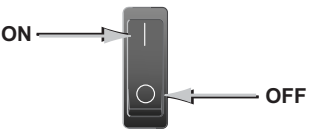


Figure 3. Power Switch

Grade Adjustment Knob

The grade adjustment knob makes measured adjustments to elevation and slope settings, or cycles through menu options.

- Knob adjusts the grade height while in elevation control (Figure 4).

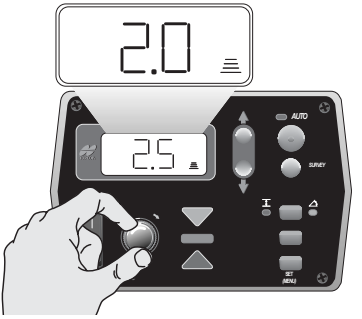


Figure 4. Adjusting Grade Height

- Knob adjusts the percentage of slope while in cross slope control (Figure 5).

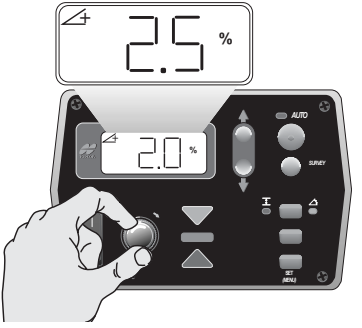


Figure 5. Adjusting Cross Slope Control

Grade Adjustment Direction Arrows

The grade adjustment arrows are located at the upper left and upper right of the grade adjustment knob.

These two arrows (Figure 6) light up in red to indicate the direction to turn the knob to reach on-grade.

Figure 6. Grade Adjustment Direction Arrows

Grade Adjustment LEDs

The grade adjustment LEDs (Figure 7) indicate raise, on-grade, and lower information and corrections.

Figure 7. Grade Adjustment LEDs

Table 1 describes grade adjustment LED indications.

Table 1. LED Indications for Elevation/Slope Control

LED Display	LED	Elevation Description	Slope Description
Slowly blinking, yellow down arrow		Out of range; beyond .2' above grade	Beyond 2% above grade
Solid yellow down arrow		Above grade; between .05' and .2'	Above grade, between 1% and 2%
Blinking yellow down arrow		Above grade; between .02' and .05'	Above grade, between .5% and 1%

Table 1. LED Indications for Elevation/Slope Control (Continued)

LED Display	LED	Elevation Description	Slope Description
Blinking yellow down arrow w/ green bar		Within .02' of grade	Within .5% of grade
Blinking green bar		On grade	On grade
Blinking red up arrow w/ green bar		Within .02' of grade	Within .5% of grade
Blinking red up arrow		Below grade; between .02' and .05'	Below grade, between .5% and 1%
Solid red up arrow		Below grade; between .05' and .2'	Below grade, between 1% and 2%
Slowly blinking red up arrow		Out of range; beyond .2' below grade	Beyond 2% below grade

Function Indicator LEDs

The function indicator LEDs (Figure 8) are located below the jog button and next to the slope/elevation, cross communication, and set/menu buttons:

- CON – indicates the box is in Control Mode.
- SUR – indicates the box is in Survey Mode.
- ELEV – indicates the LCD displays the current elevation.
- AVG – indicates the LCD displays the calculated average elevation.

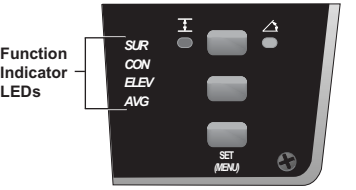


Figure 8. Function Indicator LEDs

Set/Menu Button

The Set/Menu button (Figure 9) has two functions:

- Set Mode – used to change the reference number viewed on the display to a desired value.
- Menu Mode – used to access the performance menu.

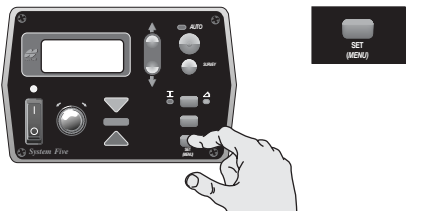


Figure 9. Set/Menu Button

Using the Set Mode

The Set mode is used to change the reference number viewed on the display to a desired value. The reference number is used to set the elevation or slope display number.

1. Press and hold the Set/Menu button.
2. Dial in the desired value using the Grade Adjustment Knob. Both the grade correction indicator lights and the double arrows light up.

3. Release the Set/Menu button and the value will be saved.

NOTICE

Using Set only changes the reference number viewed on the display, leaving the existing cutting depth unchanged.

Using the Menu Mode

The Menu mode assigns menu mode functions, allowing you to set valve offsets, units of measurements, an alarm, deadband, and other useful functions.

See “Performance Menu Settings” (Table 2) for information on using the menu settings.

Slope/Elevation Button

The elevation/slope button (Figure 10) is used to set the System Five™ for slope or elevation control

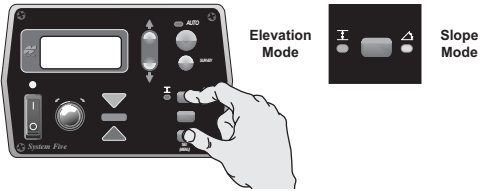


Figure 10. Slope/Elevation Button

Slope Mode

If the Control Box is connected to a slope sensor, the desired cross slope can be dialed in for automatic control.

1. Press the Slope/Elevation button: the yellow LED next to the Cross Slope Symbol illuminates.
2. Turn the Adjustment Knob to get the desired slope.

Elevation Mode

Press the Slope/Elevation button: the green LED next to the Elevation Symbol illuminates.

Survey/Indicate Button

Use the survey/indicate (Figure 11) button to lock on-grade or continuously monitor the grade or slope setting on the LCD.

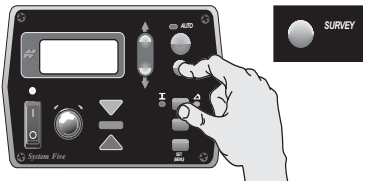


Figure 11. Survey/Indicate Button

Using the Survey Function

Survey sets the sensor to on-grade.

Hold the Survey/Indicate button for one second until the Control Box beeps and the on-grade light illuminates.

Using the Indicate Function

The grade or slope setting continuously displays on the LCD during indicate mode.

NOTICE *NOTICE*

Indicate puts the System Five in Manual Mode.

Press and hold the Survey/Indicate button for three seconds, until the Control Box emits a second beep.

"IND" briefly displays on the LCD, then the grade or slope setting. The Grade Adjustment LEDs remain dark.

To exit Indicate Mode, push either the Survey/Indicate button or the Auto button.

Auto/Manual Button

The auto/manual button (Figure 12) has three functions:

- In Automatic Mode, the tow point cylinders are automatically adjusted as needed.
- In Manual Mode, displays grade corrections without adjusting the tow point cylinders.
- Makes selections in the Performance Menu.

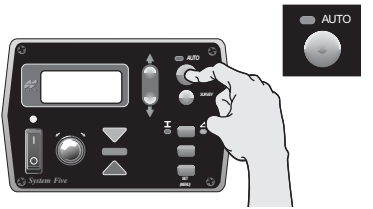


Figure 12. Auto/Manual Button

Using Automatic Mode

In automatic mode, the tow point cylinders are automatically adjusted up or down to maintain proper grade.

To enter auto mode, press the red button. The red LED lights up showing that the Control Box is in auto mode.

Using Manual Mode

In manual mode, the LED displays grade corrections without adjusting the tow point cylinders. In this mode, the operator manually adjusts the tow point cylinders to reach on-grade.

To enter manual mode, press in the red button. The red LED will goes dark (unlit), showing that the Control Box is in manual mode.

Making Selections in the Performance Menu

When using the Performance Menu, the Auto/Manual button selects settings and functions for the System Five Control Box. See “Performance Menu Settings” (Table 2) for information on the different menus available.

Jog Button

The jog button (Figure 13) manually moves the tow point up or down, and is always active when the Control Box is turned on.

- To raise the tow arm cylinder, push switch up.
- To lower the tow arm cylinder, push switch down.

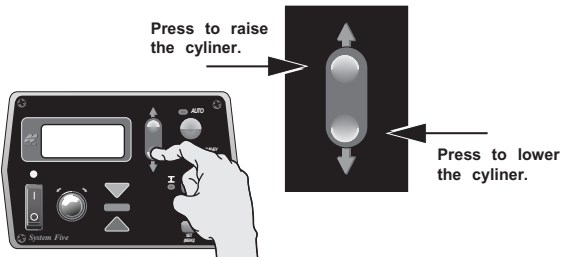


Figure 13. Jog Button

Performance Menu Settings

The System Five™ Control Box Performance Menu settings are a series of features that allow System Five to be modified for operator or performance enhancement. The Control Box automatically stores all operating information when it is turned off.

If power is interrupted to the Control Box within two seconds after making an adjustment, the new setting will not have had time to be stored and the settings will revert to previous (or original) settings.

NOTICE

NOTICE

For some machine configurations, some menu selections are inaccessible.

Table 2 lists the Control Box menus and their settings.

Table 2. Performance Menu Settings

Menu	LED Symbol	Range	Factory Setting
Gain (Elevation)		1 – 200	25
Gain (Slope)		1 – 200	25
Valve Offset		1 – 999	135
Averaging		1 – 100	50
Elevation Deadband		1 – 30 mm	3 mm
Slope Deadband		.025 % – .100 %	0.100 %

Table 2. Performance Menu Settings (Continued)

Menu	LED Symbol	Range	Factory Setting
Beeper	bEP	on/off	off
Unit	unit	in, ft, cm	in
Test	tSt	open, short, pass	no setting

Factory settings are preset values that will run most pavers. If your machine does not perform properly within those preset values, adjust the setting accordingly until you have satisfactory machine performance.

Follow these steps to access the Performance Menu.

1. Turn power off. While holding down the Set/Menu button turn the box back on (Figure 14). The Auto LED light and Grade Adjustment Direction arrows will flash.

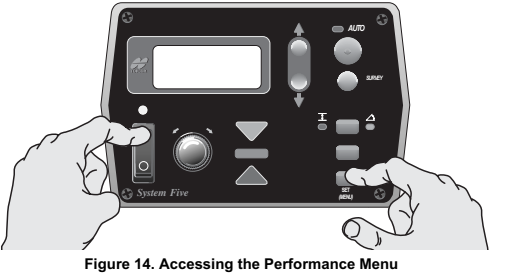


Figure 14. Accessing the Performance Menu

2. Rotate the Grade Adjustment Knob to scroll through the menu selections located on the LCD (Figure 15).

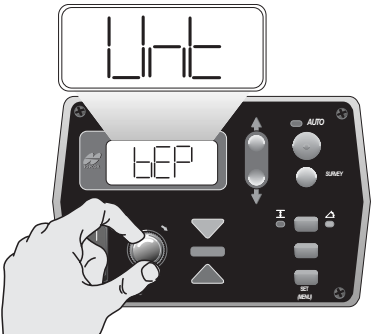


Figure 15. Scrolling through the Performance Menu

3. Press the Auto button to select a menu item (Figure 16).

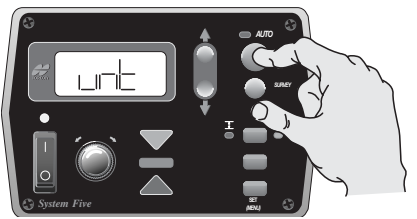


Figure 16. Selecting Performance Menu Items

4. Turn the Grade Adjustment Knob to view the options available for the Menu selection (Figure 17).

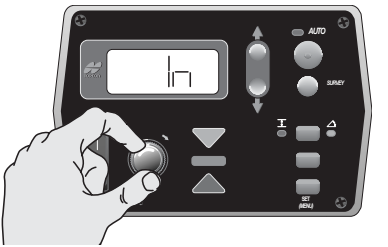


Figure 17. View Menu Options

5. Press the Auto button again to store value (Figure 18).

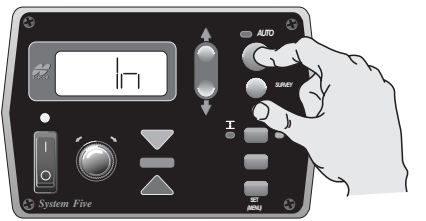


Figure 18. Storing Menu Value

6. To access other Menu settings, turn the Grade Adjustment Knob. To exit the Performance Menu, press the Set/Menu button.

See the following sections for greater detail on each menu item.

Gain (Elevation)

This setting determines the speed at which System Five allows the tow point cylinders to adjust to a change in elevation. For faster hydraulic response, increase the gain value. For slower hydraulic response, decrease the gain value.

The objective is to set the gain so the screed reacts to the change in grade quickly, but without “overshooting” the new elevation.

- Gain Elevation Value Range: 1-200
- Factory Preset: 25

Before setting the Gain, make sure the machine's hydraulic flow controls valves are adjusted for proper cylinder speed according to the manufacturer's recommendations. Typical cylinder speed is 15-20 seconds for full up or down cylinder travel.

1. From the Performance Menu, press the Auto button to select Gain (Elevation) (Figure 19).

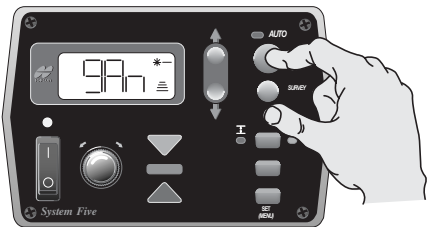


Figure 19. Selecting Gain Elevation

2. Turn the Grade Adjustment Knob to select the desired value, typically 25 for most paving applications (Figure 20).

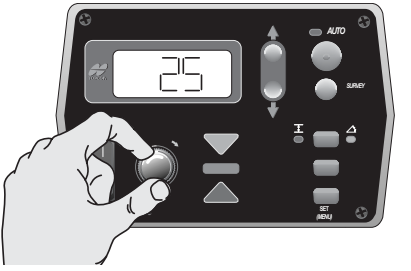


Figure 20. Selecting Gain Menu Option

3. Press the Auto button again to store value.
4. Rotate the Grade Adjustment Knob to access another item in the Performance Menu, or press the Set/Menu button to exit.

Gain (Slope Control)

This setting determines the speed at which System Five allows the tow point cylinders to adjust to a change in slope. For faster hydraulic response, increase the gain value. For slower hydraulic response, decrease the gain value.

The objective is to set the gain so the screed reacts to the change in grade quickly but without “overshooting” on-grade. Slope gain should not be set at a higher value than the elevation gain on the other side of the paver.

- Gain Elevation Value Range: 1-200
- Factory Preset: 25

Before setting the Gain, ensure the machine's hydraulic flow control valves are adjusted for proper cylinder speed according to the manufacturer's recommendations. Typical cylinder speed is 15-20 seconds for full up or down cylinder travel.

1. From the Performance menu, press the Auto button to select Gain (Slope Control) (Figure 21).

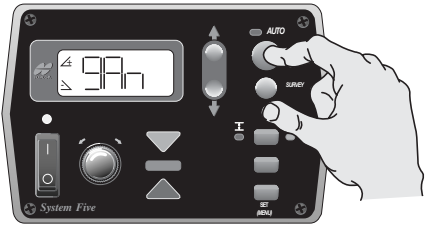


Figure 21. Select Gain (Slope Control)

2. Turn the Grade Adjustment Knob to select the desired value, typically 20% to 25% (Figure 22).

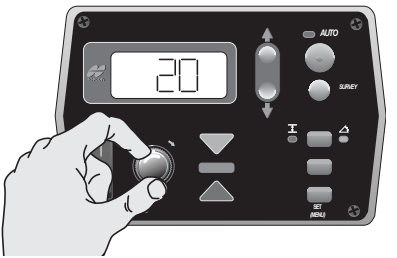


Figure 22. Selecting the Gain Value

3. Press the Auto button again to store value.
4. Rotate the Grade Adjustment Knob to access another item in the Performance Menu, or press the Set/Menu button to exit.

NOTICE

NOTICE

Do not set slope gain at a higher value than the elevation gain on the other side of the paver. A higher value may cause the slope to be over reactive.

Valve Offset

The valve offset is the minimum amount of electrical signals sent to the valve which causes the hydraulic cylinder to move. If the valve offset is too small, the sensor will not reach on-grade. Likewise, if the valve offset value is too large, the sensor will move too much and overshoot On-Grade.

NOTICE

NOTICE

Valve offsets should be the first performance menu function completed.

Valve offsets should be set before adjusting elevation and slope gains, and averaging. The paver should be run until the hydraulic oil is at normal operating temperature before the value offset function is preformed. Once they are set, valve offsets should not need to be adjusted unless the Control Box has been moved to a new paver, or the hydraulic performance has changed.

- Valve Offset value range – 1 to 999
- Factory preset – 135

Table 3 lists suggested valve offsets for different valve types.

Table 3. Suggested Valve Offsets

Valve	Offset
Solenoid	135
Proportional	350

1. From the Performance Menu, press the Auto button to select Valve Offset. This will automatically activate the value screen for Raise Offsets. The raise grade correction display arrow illuminates, and the Control Box will begin sending a raise correction signal to the valve (Figure 23).

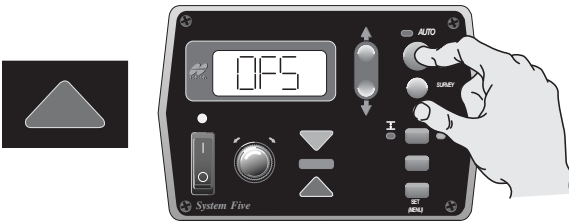


Figure 23. Select Valve Offset

2. Turn the Grade Adjustment Knob counter clockwise, decreasing the valve offset value until the hydraulic cylinder no longer moves. Then slowly rotate the Grade Adjustment Knob clockwise until the hydraulic cylinder just begins to move up (Figure 24).

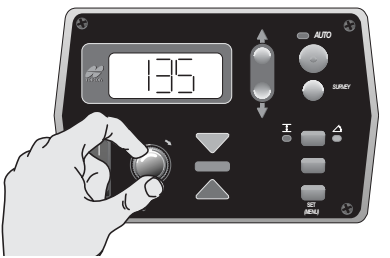


Figure 24. Setting the Raise Valve Offset Value

3. Press the Auto button to store the Raise Offset Value (Figure 25).

Pressing the Auto button also switches the box to Lower Offset. The Lower Grade Correction Display arrow will illuminate and the Control Box will begin sending a lower correction signal to the value (Figure 25).

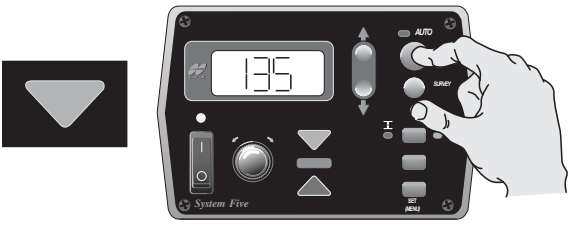


Figure 25. Storing the Raise Offset Value

4. Turn the Grade Adjustment Knob counter-clockwise, decreasing the valve offset value until the hydraulic cylinder no longer moves. Then slowly rotate the Grade Adjustment Knob clockwise until the hydraulic cylinder just begins to move down (Figure 26).

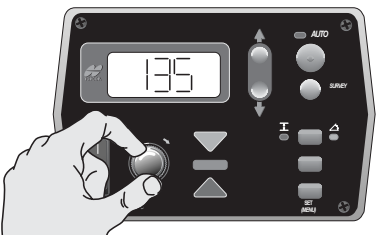


Figure 26. Setting the Lower Valve Offset Value

5. Press the Auto button to store the lower valve offset value and return to the Performance Menu.
6. Rotate the Grade Adjustment Knob to access another item in the Performance Menu, or press the Set/Menu button to exit.

Averaging

This setting changes the amount of dampening, or filtering, applied to sonic tracker and laser receiver measurements. It can be thought of as the time period over which a running average of the elevation measurement is calculated. A lower value will average fewer elevation measurements, allowing the system to react more quickly to smaller grade changes. This will make it more susceptible to fluctuations in temperature or small obstructions.

A larger value will average more elevation measurements, preventing the system from reacting to undesirable items close to the reference. This will also make it less susceptible to fluctuations in temperature or small obstructions.

- Averaging value range – 1 to 100
- Factory preset – 50

1. From the Performance Menu, press the Auto button to select Averaging (Figure 27).

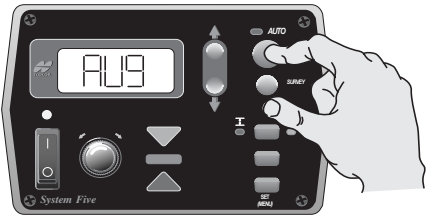


Figure 27. Select Averaging

2. Turn the Grade Adjustment Knob to select the desired value (Figure 28).

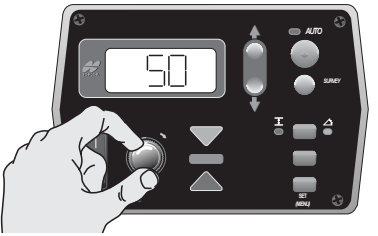


Figure 28. Select Value

3. Press the Auto button again to store the value.
4. Rotate the Grade Adjustment Knob to access another item in the Performance Menu, or press the Set/Menu button to exit.

Deadband Elevation

Deadband is the area of the Working Window that is on-grade. While the reference is within that area, the paver's valves are idle (closed). Therefore the wider the Deadband (on-grade area), the more a reference can move up or down without a correction being initiated. Once the signal from the reference is out of the deadband, System Five will drive the hydraulics to place the reference back in the CENTER of the deadband.

- Deadband Elevation value range – 1 to 30mm
- Factory preset – 3mm (01' or 1/8")

NOTICE *NOTICE*

Select the amount of Deadband carefully selected. Too small of a Deadband will cause the tow point cylinder to constantly hunt up and

down while the sensor tries to find On-Grade. Too large of a deadband will not allow the sensor to send grade corrections to the valves, causing unwanted variations in the mat thickness.

1. From the Performance Menu, press the Auto button to select Elevation Deadband (Figure 29).

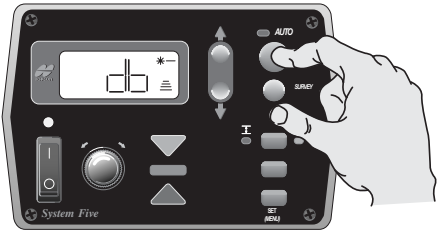


Figure 29. Select Elevation Deadband

2. Turn the Grade Adjustment Knob to select the desired value, typically 3mm (0.01') (Figure 30).

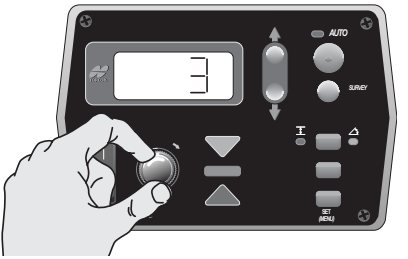


Figure 30. Select Value

3. Press the Auto button again to store the value.
4. Rotate the Grade Adjustment Knob to access another item in the Performance Menu or press the Set/Menu button to exit.

Deadband Slope

Deadband is the area of the Working Window that is on-grade. While the reference is within that area, the paver's valves are idle (closed). Therefore the wider the Deadband (on-grade area), the more a reference can move up or down without a correction being initiated. Once the signal from the reference is out of the deadband, System Five™ will drive the hydraulics to place the reference back in the CENTER of the deadband.

When the Deadband is changed, it adds or takes away from the fine correction region (1% above or below on-grade) of the slope sensor; it does not add this distance to the overall working range.

- Deadband Slope value range – .025 to .750%
- Factory preset – .100 %

NOTICE *NOTICE*

Select the amount of Deadband carefully. Too small of a Deadband will cause the tow point cylinder to constantly hunt up and down while the sensor tries to find on-grade. Too large of a deadband will not allow the sensor to send grade corrections to the values, causing unwanted variations in the mat thickness.

1. From the Performance Menu, press the Auto button to select Slope Deadband (Figure 31).

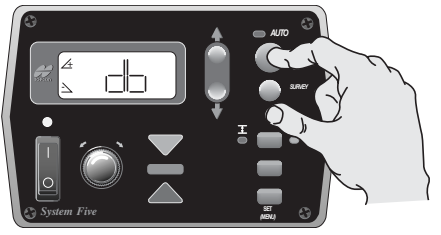


Figure 31. Selecting Slope Deadband

2. Turn the Grade Adjustment Knob to select the desired value, typically 100 (Figure 32).

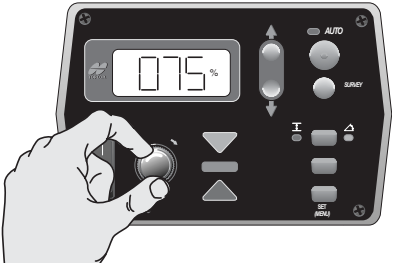


Figure 32. Select Value

3. Press the Auto button again to store the value.
4. Rotate the Grade Adjustment Knob to access another item in the Performance Menu, or press the Set/Menu button to exit.

Beeper Alarm

When in Automatic Mode and the Sonic Tracker receives a reference signal outside of the Working Window (more than 2.0" from grade), a single audible beep will be heard.

1. From the Performance Menu, press the Auto button to select Beeper (Figure 33).

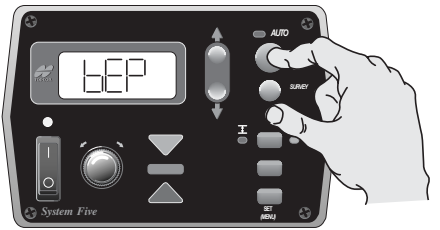


Figure 33. Select Beeper

2. Turn the Grade Adjustment Knob to turn the beeper ON or OFF (Figure 34).

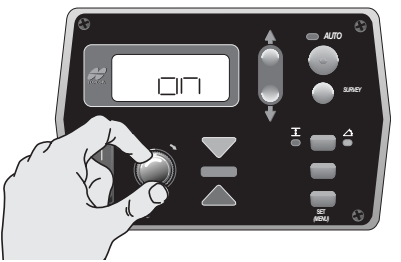


Figure 34. Turning Beeper On

3. Press the Auto button again to store the choice.
4. Rotate the Grade Adjustment Knob to access another item in the Performance Menu, or press the Set/Menu button to exit.

Units Selection

The Unit menu item sets the display to read in feet, inches, or centimeters.

NOTICE *NOTICE*

If the Unit value is changed, the working window of the Sonic Tracker will have to be reset to grade.

1. From the Performance Menu, press the Auto button to select Units (Figure 35).

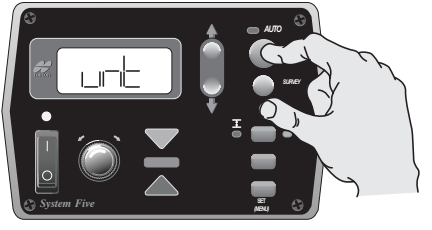


Figure 35. Select Units

2. Rotate the Grade Adjustment Knob to select a unit for measuring (feet, inches, or centimeters) (Figure 36).

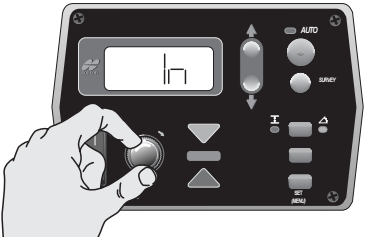


Figure 36. Select Measuring Unit

Table 4 displays and describes the three options available for the Units menu.

Table 4. Unit Measurement Descriptions

Measurement Display	Description	Numerical Display Example	Description
	Inches		2 1/2 inches
	Feet		25 hundredths of a foot
	Centimeters		2 1/2 cm (25mm)

3. Press the Auto button again to store the value.
4. Rotate the Grade Adjustment Knob to access another item in the Performance Menu or press the Set/Menu button to exit.

Test

This menu item tests the valves for shorts and disconnected valves. It test the Raise Valve first and then the Lower Valve.

1. From the Performance Menu, press the Auto button to select Test Mode (Figure 37).

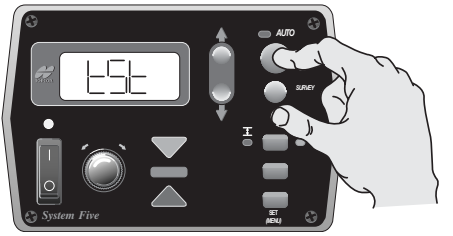


Figure 37. Select Test Mode

   The raise valves test first.

   - The display shows “Pass” if the raise valves test OK.
   - If there is a problem, the display will read “Open” or “Short”.

   Table 5 summarizes the Test solutions.

2. Press the Auto button to test the lower valves.

   - The display shows “Pass” if the lower valves test OK.
   - If there is a problem, the display will read “Open” or “Short”.

   Table 5 summarizes the Test solutions.

Table 5. Test Solutions

Test Display	Description
	Good Valve
	Valve NOT connected (OR Danfoss valve output being used) (OR connected to existing proportional control valves)
	Valve wires have shorted electronically

3. Press the Auto button once more to return to the Menu selections.
4. Rotate the Grade Adjustment knob to access another item in the performance menu or press the Set/Menu button to exit.

Maintenance

This section contains information regarding preventative maintenance and daily care of System Five™. Also included are:

- Cleaning procedures for the Sonic Tracker II™ Transducer.
- Replacement procedures for the Sonic Tracker II Transducer.

Preventative Maintenance & Daily Care

A good preventative maintenance and daily care routine will prevent many problems before they occur. The most important part of daily care for System Five™ is to clean it and keep it free of debris, and to thoroughly dry removable components (Sonic Tracker II™, the Control Box, and cables) before storing them in the Carrying Case. In addition, the following procedures will ensure trouble free operation:

1. Keep the Carrying Case clean and dry. Do not leave it open and exposed to the elements. Clean and dry all components prior to placing them into the Carrying Case.
2. Be sure cables left on the paver are attached to protective connector caps, not in use. Water accumulating on the connectors can cause electrical shorts.

3. Do not use high pressure spray water steam cleaner hoses directly on cables and components. The components can be used in the rain or light spraying.
4. Check the Sonic Tracker II™ Transducer daily to make sure the Filter Foam and Transducer are clean and free of debris. If the Filter Foam is clogged with dirt, replace it. If the Transducer appears to be covered with debris and performance is being affected (see Sonic Tracker II™ in Chapter 2: Operation) clean or replace Sonic Tracker II™ Transducer using the steps listed later in this chapter.

Sonic Tracker II Transducer Cleaning

NOTICE *NOTICE*

This procedure is not meant to be a regular maintenance procedure. Clean the Transducer only when contamination is suspected or evident.

NOTICE *NOTICE*

Cleaning the transducer too much will result in a shortened Transducer life and/or water damage to the Sonic Tracker.

1. Hold the Sonic Tracker II™ in an upright position to prevent moisture from inadvertently entering the Sonic Tracker.
2. Mix a mild detergent with water and place the mixture in a spray bottle (use Simple Green® where available).
3. With the Sonic Tracker upright, thoroughly spray the Transducer with the detergent solution.

4. After spraying the Transducer with the detergent, fill the spray bottle with clean water and rinse any residual detergent off of the Transducer.
5. Allow the Sonic Tracker to thoroughly dry.

If the ability of the Sonic Tracker II to “see” a sonic stringline or other reference continues to be impaired, the transducer may be damaged and needs replaced.

Fault Symptoms/ Codes

Control Box Symptoms

1. Control Box LCD does not Display
2. Control Box LCD displays “Error”
3. Cannot adjust to On-Grade when Elevation Control is selected.
4. Tow point cylinder does not move Up or Down
5. Tow point cylinder moves in the wrong direction
6. Tow point cylinder moves too fast or too slow.
7. System intermittently drives the cylinder all the way up or down when tracking a mechanical ski.
8. Control Box displays Error and a number from 1 to 4
9. Grade lights flash high and low and will not stay On-Grade.
10. The valve is driving the hydraulic cylinder too far overshooting grade.
11. The valve will not drive hydraulic cylinder far enough to get sensor On-Grade.
12. The Control Box displays “No Signal” when indicate is selected in elevation mode.
13. The Auto light on the Control Box intermittently flashes on and off.

Control Box Symptom 1

"The Control Box LCD does not display."

Probable Cause

No power to the Control Box.

1. Check that the machine power is on and all switches for automatic control on the paver are in the proper position.
2. Check that all cables are properly and securely connected to the System Five™ Box and the paver. Make sure cables are not still connected to Control Box bracket.
3. Disconnect cables and inspect them for damage or contamination. Clean all connections with an electrical contact cleaner.

NOTICE *NOTICE*

Do not use electrical contact cleaner to clean the Tracker's transducer.

4. Swap Control Boxes from left to right side.
5. For System Four™ bypass Junction Box by plugging coil cord from paver to J-Box directly into Control Box.

Control Box Symptom 2

"Control Box LCD shows Error" (Figure 38).

Figure 38. Error Display

Probable Cause

No communication with the sensor selected.

1. Check that all cables are properly connected to System Five™ Control Box and sensors.
2. Disconnect cables and inspect them for damage or contamination. Clean all connections with an electrical contact cleaner.

NOTICE *NOTICE*

Do not use electrical contact cleaner to clean the Tracker's Transducer.

3. If elevation has been selected, one at a time, swap the Sonic Tracker II™ and cables from the opposite side to locate the error.
4. Refer to Tracker Symptom #1.

5. If slope has been selected, check that slope has not been selected on the other Control Box. Only one box at a time can have slope turned on.
6. Swap slope cable from opposite side.
7. Disconnect cable at slope sensor and connect to other side of sensor to check slope sensor pins.

Control Box Symptom 3

"Cannot adjust to On-Grade when elevation control is selected."

Probable Cause

Tracker is too close to control reference.

1. Check that the Sonic Tracker II™ is at least 14 inches away from the control reference.
2. Check for unwanted objects within the sonic footprint.
3. Make sure tracker is not positioned in front of a gusty heat source, such as the engine fan exhaust.
4. Stop the paver, make sure the screed is on the ground and turn the vibrators off. Press Survey and hold for 2 seconds. "IND" will display on the faceplate and a number will be displayed on the LCD. The number should stay constant, or change up and down by a few numbers. If the numbers fluctuate significantly then the Transducer is probably weak or damaged.
5. Check for contamination on the Sonic Tracker II™ Transducer or foam filter. Refer to Transducer and Filter Cleaning and replacement information in the Maintenance and Parts section of this manual.
6. Swap the Tracker with the unit on the opposite side.
7. Averaging may be set too low if tracking an uneven reference. Factory setting is 50.

Control Box Symptom 4

“The tow point cylinder doesn't move up or down.”

Probable Cause

Machine electrical switches are not in the proper position, or hydraulics to the cylinder are not active.

1. Check that all locking pins have been removed and that all hydraulic blocking valves are in the open and correct position for automatic control. Refer to the paver manufacturer's manual.
2. Check that all machine electrical switches - and in motion circuits are in the correct position for automatic control. Refer to the paver manufacturers manual. Press the jog switch up and down on the Control Box to make sure there is a current going to the valve. Cylinder should move in the same direction the jog switch is pressed.
3. Check that the Auto Switch is in “Auto” and that the Auto Symbol is illuminated on the front panel.
4. Disconnect cables and inspect them for damage or contamination. Clean all connections with an electrical contact cleaner.
5. Swap the Control Box with the unit on the opposite side.
6. If a Control Box is replaced make sure the configuration and performance settings are correct.
7. If a cable is replaced make sure it is the right part number. A cable with the incorrect resistor could set the Control Box to have the wrong configuration.

Control Box Symptom 5

"The tow point cylinder is moving in the wrong direction."

Probable Cause

Machine is incorrectly wired or hydraulically connected.

1. Check that the machine is properly wired and hydraulically connected to the valve. A raised jog switch should make the cylinder go up, lowering the jog switch should make the cylinder go down.
2. Check that the proper cables have been supplied for your machine.
3. For System Four, if "OIN" setting is in the performance menu, make sure it is in the off position.
4. Make sure the screed lift cylinders are in the float position and not supporting the screed.

Control Box Symptom 6

"The tow point cylinder is moving 'too fast' or 'too slow'."

Probable Cause

The paving machine's hydraulic flow adjustment is incorrect, or the control box Valve Offsets or Gain Adjustments are not correct.

1. Refer to paver manufacturers recommended flow adjustment setting for the time it takes the hydraulic cylinder to complete a full stroke of travel. Typically between 12 to 15 seconds.
2. Adjust Gain Performance Settings.
   Factory setting is 25.
3. Adjust Valve Offsets. Refer to Valve Offset section in the Performance Section within this Manual.

Control Box Symptom 7

“System intermittently drives the cylinder all the way up or down when tracking a mechanical ski.”

Probable Cause

Tracker is intermittently picking up signals from the ski.

1. Verify string is at least 4 inches above the surface of the ski. Ski will pull away from the paver and can get in Tracker's Working Window if string is too close. Ski will also tilt to one side when traveling through a super elevation or slope transition.
2. For a multi-foot ski, make sure “foot spring pin” is not within the sonic footprint as the ski surges back and forth.

Control Box Symptom 8

“Control Box displays Error and a number from 1-4.”

Probable Cause

Defective Sonic Tracker or SAS cable.

1. Check SAS cable connections at each tracker.
2. Turn Control Box off and swap tracker showing the error number (1-4) with another tracker on the SAS. (Tracker number is on the cable at the tracker connector). Turn Control Box on to reset SAS. If the error number (1-4) has changed, the problem is the tracker. If the error number remains the same, the problem is the SAS cable.
3. If more than one error number is shown, check trackers individually by plugging sonic trackers directly into the single tracker coil cord to determine if trackers or SAS cable is source of error.
4. The defective tracker or SAS cable should be repaired, but SAS can still be operated without all four.

Remember balance point will change if a tracker is removed.

Control Box Symptom 9

"Grade lights flash high and low and will not stay On-Grade."

Probable Cause

If problem is only in automatic mode, then hydraulic Performance Settings are incorrect.

1. Verify paving machines hydraulic flow adjustments (time for hydraulic cylinder to travel full stroke) are set to manufactures recommendations.
2. Check that the Valve Offsets are set correctly.
3. Check that the Gain setting is too high. Factory setting is 25.

If problem is in manual mode, then

1. Verify that temperature bails are clean and securely attached.
2. Verify temperature bail symbol "T" is displayed on face of Tracker. If not clean or replace transducer.
3. Check that Trackers are between 14 and 24 inches from reference.
4. If there are gusty winds, lower Tracker closer to reference. Approximately 14 to 16 inches.
5. Move Tracker away from gusty heat source, such as engine fan exhaust.
6. Verify Tracker is not picking up erroneous signals from undesired reference.
   Example: Head of material, end gate, shoulder grade or material spillage from hopper.
7. If using Stringline, verify line is not bouncing.

8. Check to see if Averaging in Performance Menu is set too low. Factory setting is 50.
9. Check Deadband in Performance Menu is not less than 3mm.

Control Box Symptom 10

"The valve is driving the hydraulic cylinder too far, overshooting grade."

Probable Cause

Valve Offset in Control Box are set too high.

1. Lower the Valve Offset value till the sensor no longer overshoots grade. Refer to
2. "Setting Valve Offsets" section in this manual.
3. For Servo and solenoid valves lower the value by 2 to 5 numbers, then check the hydraulic performance.
4. For Proportional valves, lower the value by 10 to 15 numbers, then check hydraulic performances.

Control Box Symptom 11

"The valve will not drive hydraulic cylinder far enough to get sensor On-Grade."

Probable Cause

Valve offsets in Control Box are set too low.

1. Raise the Valve Offset Value till the sensor is driven to grade. Refer to "Setting Valve Offsets" section in this Manual.
2. For Servo and Solenoid valves raise the value by 2 to 5 numbers, then check hydraulic performance.
3. For Proportional valves raise the value by 10 to 15 numbers, then check hydraulic performance.

Control Box Symptom 12

"The Control Box displays 'No Signal' when indicate is selected in elevation mode."

Probable Cause

Sonic Tracker is reporting no echo.

1. Verify that the Sonic Tracker is ticking.
2. Make sure tracker is pointing at a target with the working range, recommended 14 to 24 inches.
3. Transducer may be dirty or damaged. Refer to the Transducer and Filter section within this manual.
4. Power or ground connection at transducer may be loose. Remove transducer and check wires.

Control Box Symptom 13

"The Auto light on the Control Box intermittently flashes on and off."

Probable Cause

Sonic Tracker is too far from reference for current atmospheric conditions, or Temperature Cutout is too low.

1. Verify that the Sonic Tracker is positioned 14 to 24 inches from the reference. If there are gusty winds lower the Tracker to 14 to 16 inches from the reference.
2. Move Tracker away from gusty heat source, such as engine fan exhaust.
3. Temperature Cutout is set too low. Factory setting is 7. Refer to Technicians manual.

Tracker Symptoms

1.	Sonic Tracker will not power on.
2.	Sonic Tracker is ticking, but will not adjust to Grade
3.	Tracker grade lights flash high and low and will not stay On-Grade.
4.	Sonic Tracker is not matching joint or curb.
5.	The Sonic Tracker will pick up the ground, but will not pick up a stringline.

Tracker Symptom 1

"Sonic Tracker will not power on."

Probable Cause

Defective cable or tracker.

1. Check coil cord is plugged in correctly and securely.
2. Inspect Coil cord for any physical damage.
3. Turn Control Box on and watch the tracker lights to make sure they go through the power up sequence. All the lights on the tracker should flash at once followed by a flash of an arrow pointing to the left. The "T" symbol should also be displayed in the upper right hand corner of the tracker faceplate when a Temperature Bail is attached. If the tracker does not go through this sequence then the tracker is not getting power or is defective.
4. One at a time, swap tracker and then coil cord from opposite side to determine the problem.

Tracker Symptom 2

"Sonic Tracker is ticking, but will not adjust to grade."

Probable Cause

Tracker is too close to reference, minimum working distance is 14 inches.

1. Tracker is too close to reference point. Position tracker 14 to 24 inches from grade reference.
2. Connect tracker to other side of paver to determine if problem stays with tracker.
3. If problem stays with tracker, clean or replace transducer or foam filter. Refer to the Transducer and filter cleaning and replacement information in the "Maintenance" section of this manual.
4. If problem does not move with tracker, inspect coil cord for damage and swap with cord from other side.

Tracker Symptom 3

"Tracker grade lights flash high and low and will not stay On-Grade."

Probable Cause

If problem is only in Automatic Mode, then Hydraulic Performance Settings are incorrect.

1. Verify paving machines hydraulic flow adjustments, time for hydraulic cylinder to travel full stroke, are set to manufacturers recommendations. Typically 12 to 15 seconds.
2. Check Valve Offsets are set correctly. Refer to setting valve offsets.
3. Make sure Gain Setting is not too high.
   Factory setting is 25.

If problem exists in manual mode, then Tracker is setup incorrectly or Performance Settings are incorrect.

1. Verify that temperature bails are clean and securely attached.
2. Verify temperature bail symbol “T” is displayed on face of Tracker. If not, clean or replace transducer.
3. Check that Trackers are between 14 and 24 inches from reference.
4. If there are gusty winds, lower Tracker closer to reference. Approximately 14 to 16 inches.
5. Move Tracker away from gusty heat source, such as engine fan exhaust.
6. Verify Tracker is not picking up erroneous signals from undesired reference.
   Example: Head of material, end gate, shoulder grade or material spillage from hopper.
7. If using Stringline, verify line is not bouncing.
8. Check to see if Averaging in Performance Menu is set too low.
   Factory setting is 50.
9. Check that Deadband, in Performance Menu, is not less than 3mm.

Tracker Symptom 4

“The Sonic Tracker is not matching joint or curb.”

Probable Cause

Tracker is too far forward on the tow arm.

1. Position the Tracker at 1/3rd the tow arm length (just in front of auger).
2. Gain for tracker may be set too low. Adjust Gain to a minimum of 25.

3. Brackets and L-bars have not been securely tightened. Also, check for excessive play or slop where tracker is attached to the paver. (Tow arm or end gate.)

Tracker Symptom 5

"The Sonic Tracker will pick up the ground, but will not pick up a stringline."

Probable Cause

1. Tracker is too close to a reference or transducer is weak.
2. Verify that tracker is at least 14" from the stringline.
3. Smooth, steel wire is not recommended. Use minimum 1/16" diameter string for elevated stringline or averaging ski. Use 1/8" string for Surface Stringline.

Slope Sensor Symptoms

Cross Slope reads "Error"
Cross slope drives cylinder in the wrong direction
Slope lights flash between raise and lower and will not stay On-Grade.
Cross slope will not lock On-Grade.
Cross slope being laid is not correct.

Slope Sensor Symptom 1

"Cross Slope reads 'Error'."

Probable Cause

Both Control Boxes are selected for slope or have a defective cable.

1. Cross slope operates one side at a time. Verify only one Control Box has been selected for slope.

2. Verify that the slope cable is connected securely and properly.
3. Swap slope cable from other side to check cable.

Slope Sensor Symptom 2

"Cross Slope drives cylinder in the wrong direction."

Probable Cause

Slope sensor installed incorrectly.

1. Verify the slope sensor is positioned correctly on the transverse beam. "Slope Forward" Decal must be in direction of travel.
2. Check that the machine is properly wired and hydraulically connected to the valve. Raised jog switch should make the cylinder go up, lower jog switch should make the cylinder go down. Refer to the paver manufacturers manual.

Slope Sensor Symptom 3

"Slope lights flash between raise and lower and will not stay On-Grade."

Probable Cause

Incorrect Performance Setting adjustments or a loose transverse beam.

1. Check Valve Offset for proper operation. Refer to "Setting Valve Offsets" section in this manual.
2. Check gain setting. Factory setting is 25.
3. Slope deadband set too low. Increase Slope Deadband. Factory Setting is .100 %.
4. Check for excess vibration in the Transverse Beam due to poor connection at Tow Arm.

5. Make sure slope sensor is mounted directly to the Transverse Beam and is not elevated or supported by additional brackets.

Slope Sensor Symptom 4

"Cross Slope will not lock On-Grade."

Probable Cause

Loose Transverse Beam or incorrect Performance Setting adjustments.

1. Verify that the Slope Sensor is not moving or vibrating when trying to survey slope on grade.
2. Slope deadband setting is too low, factory setting is .100 %.
3. Stop the paver, make sure the screed is on the ground and turn the vibrators off. Press Survey and hold for 2 seconds. IND will display on the faceplate and a slope value will appear in the LCD. The number should stay constant or change up or down by a few counts. If the numbers fluctuate significantly then the slope sensor is probably the problem.

Slope Sensor Symptom 5

"The Cross Slope being laid is not correct."

Probable Cause

Calibration in Slope Sensor is incorrect.

1. Calibrate the Slope Sensor as described in "Daily Cross Slope Calibration" in the Function and Operations section.
2. Check that the Transverse Beam is mounted according to the manufacturer's instructions and that it is not loose or damaged.

3. Recheck slope using a good reference such as a laser or level. Wait at least 3 tow arm lengths before checking the slope after a change has been made.
4. If the paver's mat thickness controls have been used then the slope calibration may have to be changed. This can occur after “buying back” cylinder.

SAS Symptoms

When the SAS is connected, control box displays “Error” and a number.
1 Tracker stops working
SAS will not lock On-Grade
SAS is not producing smooth surface
Tracker picking up head of material

SAS Symptom 1

“When the SAS is connected, the Control Box displays ‘Error’ and a number.”

Probable Cause

Defective tracker or cable, tracker with incorrect code.

1. Verify that all trackers are correctly and securely plugged into the SAS cable.
2. Turn Control Box off and move the Tracker to a different position on the SAS cable. Turn the Control Box on to reconfigure SAS. If error number moved positions with the swapped tracker, the tracker is the problem. See Chapter 8 to replace the transducer.
3. Check to see if a Tracker without SAS code is attached to the cable. Verify that the tracker has a SAS compatible decal near the S/N label (Figure 39).

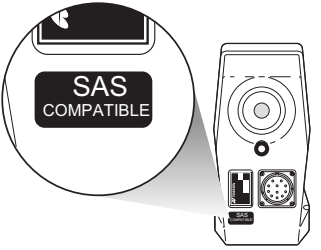


Figure 39. SAS Compatible Decal Location on Sonic Tracker

4. Tracker can also be checked by verifying code revision. Turn box off and back on. Watch the temperature bail symbol in the top right portion of the tracker (Figure 40). The “T” symbol will flash a certain number of times, pause and flash again to indicate the revision of its code.

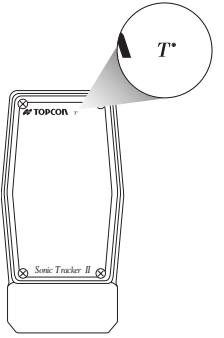


Figure 40. Temperature Bail Symbol Indicating Code Revision

Example: Flash twice, pause flash twice means the code in the Tracker is 2.2. SAS requires trackers with code of 2.2 or higher.

SAS Symptom 2

"A Tracker stops working."

Probable Cause

Defective Tracker.

1. Check SAS cable connections at each tracker.
2. Turn off Control Box and swap tracker showing error with another tracker on the SAS. (Tracker number is on the cable at the tracker connector.) Turn the Control Box back on to reset SAS. If error number moved positions with the swapped tracker, then the tracker is the problem. See Chapter 8 to replace the transducer if necessary.
3. If error continues to display for the same position even after trackers have been swapped, the tracker connector or SAS cable is the problem.
4. The defective tracker or SAS cable should be repaired, but SAS can still be operated without all four trackers operating. Remember balance point will change if a tracker is removed.

SAS Symptom 3

"SAS will not lock on grade."

Probable Cause

Tracker too close to reference or defective transducer in Tracker.

1. Verify that all cable connections are properly and securely connected.
2. Check that all trackers are sending out sound waves (transducer is making ticking sound) and grade lights are flashing.

3. If tracker is not working, check that transducer and foam filter are clean and free from damage. See Chapter 8 to replace the transducer if necessary.
4. SAS beam and trackers may be too close to reference. Bottom of tracker must be minimum of 14 inches from reference.
5. Non-SAS compatible tracker attached to cable. Verify tracker has SAS compatible decal near S/N label (Figure 41).

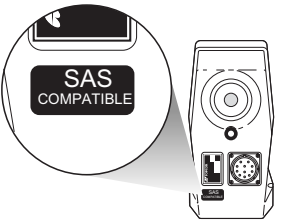


Figure 41. SAS Compatibility Label

SAS Symptom 4

"SAS is not producing smooth surface."

Probable Cause

Improper setup or Performance Menu Settings.

1. Verify that temperature bails are clean and securely attached.
2. Verify temperature bail symbol "T" is displayed on face of Tracker. If not clean or replace transducer. See Chapter 8 to replace the transducer if necessary.
3. Check that Trackers are between 14 and 24 inches from reference.
4. If there are gusty winds, lower SAS to get Trackers closer to reference.

5. Move the Tracker away from gusty heat source, such as engine fan exhaust.
6. Verify that the Trackers are not picking up erroneous signals from undesired reference.

   Example: Head of material, end gate shoulder grade or material spillage from hopper.
7. Verify that the center of the SAS beam is between the midpoint and the forward 2/3 point of the tow arm.
8. Check to see if Averaging in Performance Menu is set too low. Factory setting is 50.
9. Check that Deadband in Performance Menu is not less than 3mm.
10. Check that Valve Offsets are set properly.
11. Check that the Gain setting in the Performance Menu is not set too high.
    Factory setting is 25.

SAS Symptom 5

"Tracker picking up head of material."

Probable Cause

Improper placement of Tracker.

1. Move tracker forward of the material. Rotate Tracker to front of bracket or drill a hole in the beam far enough forward to move tracker away from material.
2. Check balance point. Balance point will shift when moving a tracker.

Notes

Approximate Mix Tonnage in 1” Mat

These tonnages are approximate and based on average width, depth, paving speed and density. Specific weights of asphalt mixes will vary. Read the speed of the paver in feet per minute down the left hand column and paving width across the top. Example: At 40 fpm, paving a one-inch, 10-foot wide mat would take approximately 146 tph.

For a 1/2-inch mat, multiply the chart figure by 0.5. This example for a 1/2-inch mat would be approximately 73 tph.

For a 2-inch mat multiply the chart figure by 2, which in the above example would be approximately 292 tph. The above chart is based on material weighing 146 pounds per cubic foot. If actual material weight is 124 pounds per-cubic-foot, the ratio would be 124 pounds per cubic foot divided by 146 pounds per cubic foot, giving 0.85 of the value shown.

Approximate Asphalt Tonnage for 1" Compacted Mat in Tons-per-Hour															
	Paving Width in Feet														
FPM	**6'**	**7'**	**8'**	**9'**	**10'**	**11'**	**12'**	**13'**	**14'**	**15'**	**16'**	**17'**	**18'**	**19'**	**20'**
10	22	26	29	33	37	40	44	48	51	55	58	62	66	69	73
20	44	51	58	66	73	80	88	95	102	109	116	124	131	139	146
30	66	77	87	99	110	120	131	142	153	164	175	186	197	208	219
40	88	102	116	131	146	161	175	190	204	219	233	248	263	277	291
50	110	128	146	164	183	201	219	238	256	273	291	310	329	347	365
60	131	153	175	197	219	241	263	285	307	328	349	372	394	416	438
70	153	179	204	230	256	281	307	332	358	383	407	434	460	485	511
80	175	204	233	263	292	321	350	380	409	437	466	496	526	555	584
90	197	230	261	296	329	361	394	427	460	492	524	558	591	624	657
100	219	256	291	329	365	4022	438	475	511	547	582	620	657	694	731
110	241	281	320	361	402	442	482	522	562	601	640	681	723	763	803
120	263	307	349	394	438	482	526	569	613	655	698	743	788	832	876

Slope Conversion Table

Slope	Actual decimal inch per ft.	Approx. fraction inch per ft.	Inch per 10ft	Inch per 11ft	Inch per 12ft	Inch per 13ft	Inch per 14ft	Inch per 15ft	Inch per 16 ft	Inch per 17ft	Inch per 18ft	Inch per 19 ft	Inch per 20ft
0.10%	0.012	1/64	1/8	1/8	1/8	1/8	1/8	1/8	1/4	1/4	1/4	1/4	1/4
0.13%	0.015	1/64	1/8	1/8	1/8	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4
0.20%	0.024	1/32	1/4	1/4	1/4	1/4	3/8	3/8	3/8	3/8	3/8	1/2	1/2
0.26%	0.031	1/32	1/4	3/8	3/8	3/8	3/8	1/2	1/2	1/2	1/2	5/8	5/8
0.30%	0.036	1/32	3/8	3/8	3/8	1/2	1/2	1/2	5/8	5/8	5/8	5/8	3/4
0.40%	0.048	1/16	1/2	1/2	5/8	5/8	5/8	3/4	3/4	7/8	7/8	7/8	1
0.50%	0.060	1/16	5/8	5/8	3/4	3/4	7/8	7/8	1	1	1-1/8	1-1/8	1-1/4
0.52%	0.062	1/16	5/8	5/8	3/4	3/4	7/8	7/8	1	1	1-1/8	1-1/8	1-1/4
0.60%	0.072	1/16	3/4	3/4	7/8	7/8	1	1-1/8	1-1/8	1-1/4	1-1/4	1-3/8	1-1/2
0.78%	0.093	3/32	7/8	1	1-1/8	1-1/4	1-1/4	1-3/8	1-1/2	1-5/8	1-5/8	1-3/4	1-7/8
0.80%	0.096	3/32	1	1	1-1/8	1-1/4	1-3/8	1-4/8	1-1/2	1-5/8	1-3/4	1-7/8	1-7/8
1.0%	0.120	1/8	1-1/4	1-3/8	1-1/2	1-2/4	1-5/8	1-3/4	1-7/8	2	2-1/8	2-1/4	2-3/8
1.5%	0.180	1/8	1-6/8	2	2-1/8	2-3/8	2-1/2	2-3/4	2-7/8	3	3-1/4	3-3/8	3-5/8

Slope	Actual decimal inch per ft.	Approx. fraction inch per ft.	Inch per 10ft	Inch per 11ft	Inch per 12ft	Inch per 13ft	Inch per 14ft	Inch per 15ft	Inch per 16 ft	Inch per 17ft	Inch per 18ft	Inch per 19 ft	Inch per 20ft
2%	0.240	1/4	2-3/8	2-5/8	2-7/8	3-1/8	3-3/8	3-5/8	3-7/8	4-1/8	4-3/8	4-1/2	4-3/4
3%	0.360	3/8	3-5/8	4	4-3/8	4-5/8	5	5-3/8	5-3/4	6-1/8	6-1/2	6-7/8	7-1/4
4%	0.480	15/32	4-3/4	5-1/4	5-3/4	6-1/4	6-3/4	7-1/4	7-5/8	8-1/8	8-5/8	9-1/8	9-5/8
5%	0.600	19/32	6	6-5/8	7-1/4	7-3/4	8-3/8	9	9-5/8	10-1/4	10-3/4	11-3/8	12
6%	0.720	23/32	7-1/4	7-7/8	8-5/8	9-3/8	10-1/8	10-3/4	11-1/2	12-1/4	13	13-5/8	14-3/8
7%	0.840	27/32	8-3/8	9-1/4	10-1/8	10-7/8	11-3/4	12-5/8	13-1/2	14-1/4	15-1/8	16	16-3/4
8%	0.960	31/32	9-5/8	10-1/2	11-1/2	12-1/2	13-1/2	14-3/8	15-3/8	16-3/8	17-1/4	18-1/4	19-1/4
9%	1.080	1-3/32	10-6/8	11-7/8	13	14	15-1/8	16-1/4	17-1/4	18-3/8	19-1/2	20-1/2	21-5/8
10%	1.200	1-3/16	12	13-1/4	14-3/8	15-5/8	16-3/4	18	19-1/4	20-3/8	21-5/8	22-3/4	24
11%	1.320	1-5/16	13-1/4	14-1/2	15-7/8	17-1/8	18-1/2	19-3/4	21-1/8	22-1/2	23-3/4	25-1/8	26-3/8
12%	1.440	1-7/16	14-3/8	15-7/8	17-1/4	18-3/4	20-1/8	21-5/8	23	24-1/2	25-7/8	27-3/8	28-3/4

SAE Torque Chart

		SAE Grade 2				SAE Grade 5				SAE Grade 8			
		Dry		Lube		Dry		Lube		Dry		Lube	
dia (in)	N (ths/in)	(ft-lbs)	N-M	(ft-lbs)	N-M	(ft-lbs)	N-M	(ft-lbs)	N-M	(ft-lbs)	N-M	(ft-lbs)	N-M
1/4	20	5	7	4	6	8	11	6	9	12	16	9	12
1/4	28	6	8	5	7	10	13	7	10	14	19	11	14
5/16	18	11	15	9	12	17	24	13	18	25	33	19	26
5/16	24	12	17	10	13	19	26	15	20	27	37	21	28
3/8	16	20	27	15	21	31	42	24	32	44	59	34	45
3/8	24	23	31	17	24	35	47	27	36	49	67	38	52
7/16	14	32	43	25	33	49	67	38	52	70	95	54	73
7/16	20	36	48	27	37	55	75	42	58	78	106	60	81
1/2	13	49	66	38	51	75	102	58	79	106	144	82	111
1/2	20	55	75	42	57	85	115	65	89	120	163	92	125
9/16	12	70	95	54	73	109	147	84	113	154	208	118	160

TABLE 1 RECOMMENDED MAX. TORQUE VALVES (+/- 5%)

		SAE Grade 2				SAE Grade 5				SAE Grade 8			
		Dry		Lube		Dry		Lube		Dry		Lube	
dia (in)	N (ths/in)	(ft-lbs)	N-M	(ft-lbs)	N-M	(ft-lbs)	N-M	(ft-lbs)	N-M	(ft-lbs)	N-M	(ft-lbs)	N-M
9/16	18	79	106	60	82	121	164	93	127	171	232	132	179
5/8	11	97	132	75	101	150	203	115	157	212	287	163	221
5/8	18	110	149	85	115	170	230	131	177	240	325	185	250
3/4	10	172	233	132	180	266	361	205	278	376	509	289	392
3/4	16	192	261	148	201	297	403	229	310	420	569	323	438
7/8	9	167	226	128	174	430	582	330	448	606	822	466	632
7/8	14	184	249	141	192	473	642	364	494	668	906	514	697
1	8	250	339	192	261	644	873	495	672	909	1232	699	948
1	14	273	371	210	285	704	955	542	735	995	1348	765	1037
1 1/8	7	354	480	272	369	794	1077	611	828	1288	1746	990	1343
1 1/8	12	397	539	306	414	891	1208	685	929	1445	1958	1111	1507
1 1/4	7	500	677	384	521	1120	1519	862	1169	1817	2463	1398	1895
1 1/4	12	553	750	426	577	1241	1682	954	1294	2012	2728	1548	2098

TABLE 1 RECOMMENDED MAX. TORQUE VALVES (+/- 5%) (CONTINUED)

		SAE Grade 2				SAE Grade 5				SAE Grade 8			
		Dry		Lube		Dry		Lube		Dry		Lube	
dia (in)	N (ths/in)	(ft-lbs)	N-M	(ft-lbs)	N-M	(ft-lbs)	N-M	(ft-lbs)	N-M	(ft-lbs)	N-M	(ft-lbs)	N-M
1 3/8	6	655	888	504	683	1469	1992	1130	1532	2382	3230	1832	2484
1 3/8	12	746	1011	574	778	1673	2268	1287	1744	2712	3677	2086	2829
1 1/2	6	869	1179	669	907	1949	2643	1500	2033	3161	4286	2432	3297
1 1/2	12	978	1326	752	1020	2194	2974	1687	2288	3557	4823	2736	3710
1 3/4	5	1372	1860	1055	1430	2286	3099	1758	2384	4988	6762	3837	5202
2	4.5	2063	2796	1587	2151	3438	4661	2644	3585	7500	10169	5769	7822
2 1/4	4.5	3016	4090	2320	3146	5027	6816	3867	5243	10969	14872	8438	11440
2 1/2	4	4125	5593	3173	4302	6875	9321	5288	7170	15000	20337	11538	15644
2 3/4	4	5592	7582	4302	5833	9321	12637	7170	9721	17794	24126	13688	18558
3	4	7388	10017	5683	7705	12313	16694	9472	12842	23507	31871	18082	24516

TABLE 1 RECOMMENDED MAX. TORQUE VALVES (+/- 5%) (CONTINUED)

1. The maximum torque values are based on 75% of the specified proof strength.

2. The term “lube” includes the application of thread lubricants, cadmium plating and the use of hardened washers regardless of whether standard or lock nuts are used.

Metric Torque Chart

dia (mm)	pitch (mm)	Property Class = 8.8				Property Class = 10.9				Property Class = 12.9			
		Dry		Lube		Dry		Lube		Dry		Lube	
		(ft-lbs)	N-M	(ft-lbs)	N-M	(ft-lbs)	N-M	(ft-lbs)	N-M	(ft-lbs)	N-M	(ft-lbs)	N-M
10	1.5	41	56	32	43	60	81	46	63	71	96	54	74
10	1.25	43	59	33	45	63	86	49	66	74	101	57	78
12	1.75	72	97	55	75	105	142	81	109	123	167	95	128
12	1.25	78	106	60	82	115	155	88	119	134	182	103	140
14	2	115	155	88	119	168	227	129	175	196	266	151	205
14	1.5	124	168	95	129	181	245	139	188	212	287	163	221
16	2	178	241	137	185	260	352	200	271	305	413	234	318
16	1.5	190	257	146	198	277	376	213	289	325	441	250	339
18	2.50	246	333	189	256	359	487	276	374	421	571	324	439
18	1.5	276	374	212	288	403	547	310	421	473	642	364	494
20	2.5	347	470	267	362	507	688	390	529	595	807	458	621
20	1.5	385	522	296	401	563	763	433	587	660	895	508	689

TABLE 2 RECOMMENDED MAX. TORQUE VALVES (+/- 5%)

dia (mm)	pitch (mm)	Property Class = 8.8				Property Class = 10.9				Property Class = 12.9			
		Dry		Lube		Dry		Lube		Dry		Lube	
		(ft-lbs)	N-M	(ft-lbs)	N-M	(ft-lbs)	N-M	(ft-lbs)	N-M	(ft-lbs)	N-M	(ft-lbs)	N-M
22	2.5	473	641	364	493	692	938	532	721	812	1100	624	846
22	1.5	519	704	399	542	759	1030	584	792	891	1208	685	929
24	3	600	813	461	625	877	1189	674	914	1029	1395	791	1073
24	2	654	886	503	682	956	1296	736	997	1122	1521	863	1170
27	3	879	1192	676	917	1286	1743	989	1341	1508	2045	1160	1573
27	2	949	1286	730	989	1387	1881	1067	1447	1627	2206	1252	1697

TABLE 2 RECOMMENDED MAX. TORQUE VALVES (+/- 5%) (CONTINUED)

1. The maximum torque values are based on 75% of the specified proof strength.

2. The term “lube” includes the application of thread lubricants, cadmium plating and the use of hardened washers regardless of whether standard or lock nuts are used.

Slope to Angle Conversion

% of Slope	Degrees & Minutes	% of Slope	Degrees & Minutes	% of Slope	Degrees & Minutes
1	0° 34’	13	7° 24’	45	24° 14’
2	1° 9’	14	7° 58’	50	26° 34’
3	1° 43’	15	8° 32’	55	28° 49’
4	2° 17’	16	9° 5’	60	30° 58’
5	2° 52’	17	9° 39’	65	33° 1’
6	3° 26’	18	10° 12’	70	34°59’
7	4° 0’	19	10° 45’	75	36° 52’
8	4° 34’	20	11° 19’	80	38° 40’
9	5° 9’	25	14° 2’	85	40°22’
10	5° 43’	30	16° 42’	90	41° 59’
11	6° 17’	35	19° 18’	95	43° 32’
12	6° 51’	40	21°þ48’	100	45° 0’

Cubic Yards of Aggregate In One Mile of Road

Width of Road (ft)		10	12	14	16	18	20
Sq. Yds. per Lineal Foot		1.11	1.33	1.55	1.77	2.00	2.22
Sq Yds per Mile		5867	7040	8213	9387	10560	11733
Loose Depth (Inch)	1	163.0	1953.6	228.2	260.8	293.4	326.0
	2	326.0	391.2	456.4	521.6	286.8	652.0
	3	489.0	586.8	684.6	782.4	880.2	978.0
	4	652.0	782.4	912.8	1043.2	1173.6	1304.0
	5	815.0	978.0	1141.0	1304.0	1467.0	1630.0
	6	978.0	1173.6	1369.2	1564.8	1760.0	1956.0

Weights and Measures - United States

Measures of Length

1 mile =	8 furlongs	1 chain =	4 rods
	80 chains		22 yards
	320 rods		66 feet
	1760 yards		100 links
	5280 feet	1 rod =	5.5 yards
1 furlong =	10 chains		16.5 feed
	220 yards	1 yard =	3 feet
1 station =	6.06 rods		36 inches
	33.3 yards	1 foot =	12 inches
	100 feet		

Square Measure

1 sq. foot =	144 sq. inches	1 acre =	48560 sq. ft
1 sq. yard =	9 sq. feet		4840 sq. yds
1 sq. rod =	30-1/4 sq. yards		160 sq. rods
1 township =	36 sq. miles	1 sq mile =	640 acres

Cubic Measure

1 cubic yard= 27 cubic feet

1 cord (wood)= 4 x 4 x 8 ft = 128 cu. feet

1 ton (shipping) = 40 cu. feet

1 cubic foot = 1728 cubic inches

1 Cubic Foot = 7.481 gallons

1 bushel = 2150.42 cubic inches

1 gallon = 231 cubic inches

Weights (Commercial)

1 long ton = 2240 lbs

1 short ton = 2000 lbs

1 pound = 16 ounces

1 ounce = 16 drams

Troy Weight (For Gold and Silver)

1 pound =	12 ounces
	5760 grams
1 pennyweight =	24 grains
1 ounce =	20 pennyweights
	480 grains

Avoirdupious Wgt (excluding drugs, gold, silver)

1 dram =	27.34 grains
1 ounce =	16 drams
1 pound =	16 ounces
1 lb avdp =	7000 grains
	453.59 grams
	1.2153 lb. troy
	1.2153 lb. apoth
1 grain = 1 grain troy = 1 grain apoth	
1 quarter =	25 pounds
1 short ton =	2000 pounds
1 long ton =	2240 pounds

Dry Measure

2 pints = 1 quart = 67.2 cu. in.

8 quarts = 1 peck = 537.6 cu. in

4 pecks = 1 bushel = 2150.4 cu. in.

1 bushel = 1.2334 cu. ft.

Liquid Measure

1 gill = 4 fluid oz.

1 pint = 4 gills

1 quart = 2 pints

1 gallon = 4 quarts

1 gallon = 231 cubic in.

1 barrel = 31.5 gallons

1 barrel = 42 gallons (Petroleum)

Measures of Area

U.S. to Metric

Square Mile x 2.59 = Square kilometers
Acres x .00405 = Square kilometers
Acres x .4047 = Hectares
Square yards x .8361 = Square meters
Square feet x .0929 = Square meters
Square inches x 6.452 = Square centimeters
Square inches x 645.2 = Square millimeters

Metric to U.S.

Square kilometers x .3861 = Square miles
Square kilometers x 247.11 = Acres
Hectares x 2.471 = Acres
Square meters x 1.196 = Square yards
Square meters x 10.764 = Square feet
Square centimeters x .155 = Square inches
Square millimeters x .00155 = Square inches

Measurement of Volume

U.S. to Metric

Cubic yards x .765 = Cubic meters
Cubic feet x .0283 = Cubic meters
Cubic inches x 16.383 = Cubic centimeters

Metric to U.S.

Cubic meters x 1.308 = Cubic yards
Cubic meters x 35.3145 = Cubic feet
Cubic centimeters x .06102 = Cubic inches

Liquid Measure

U.S. to Metric

U.S. gallons x .8333 = Imperial gallons
Gallons x 3.785 = Liters
Quarts x .946 = Liters

Metric to U.S.

Imperial gallons x 1.2009 = U.S. gallons

Liters x .2642 = Gallons

Liters x 1.057 = Quarts

Measures of Weight

Pounds x .453 = Kilograms

Kilograms x 2.2046 = Pounds

Weights and Measures - Metric

The metric system is a decimal system using the meter (39.37 inches) and gram (0.3527 ounces) as basic units. The liter (1.0567 liquid quarts or 0.9081 dry quarts) derives from meter measure. Certain prefixes denote multiples of the bases: deca- (10); hecto- (100); kilo- (1000); myria- (10,000); mega- (1,000,000). Conversely, other prefixes denote divisions of the bases: deci- (1/10); centi- (1/100); milli- (1/1000); micro- (1/1000000).

The most commonly used names are printed in bold.

Measurements of Length

10 **millimeters** (mm) = 1 **centimeter** (cm) = 0.3973 inches

10 centimeters = 1 decimeter (dm) = 3.937 inches

10 decimeters = 1 **meter** (m) = 39.37 inches or 3.28 feet

10 meters = 1 decameter (dkm) = 393.7 inches

10 decameters = 1 hectometer (hm) = 328 feet, 1 inch

10 hectometers = 1 **kilometer** (km) = 0.62137 miles

10 kilometers = 1 myriameter (mym) = 6.2137 miles

The **micron** (µ) is one millionth of a meter or one thousandth of a millimeter.

Measures of Surface

100 square millimeters (mm2) = 1 square centimeter (cm2)

100 square centimeters = 1 square decimeter (dm2)

100 square decimeters = 1 square meter (m2)

100 square meters = 1 square decameter (dkm2)

100 square decameters = 1 square hectometer (hm2)

100 square hectometers = 1 square kilometer (km2)

Land Measures

1 square meter (m2) = 1 centiare (ca) = 1550 square inches

100 centiares or 100 m2 = 1 **are** (a) = 119.6 square yards

100 ares or 10,000 m2 = 1 **hectare** (ha) = 2.471 acres

1 square kilometer (km2) = 1,000,000 m2 = .3861 sq. miles

The **square kilometer** is used in surveys on a large scale, or in maps or charts that show roads, plans of towns, contour lines, etc. The hectare is used for field measurements, like our acre. For city lots and the like, the are is generally used.

Measures of Capacity

The standard unit of capacity is the **liter**, equal to 1 cubic decimeter or 0.9081 dry quart or 1.0567 liquid quarts.

10 milliliters (ml) = 1 **centiliter** (cl) = 0.338 fluid oz.

10 centiliters = 1 deciliter (dl) = 6.1025 cubic inches

10 deciliters = 1 **liter** (l) = 0.9081 dry quart or 1.0567 liquid quart

10 liters = 1 decaliter (dkl) = 0.284 bushel or 2.64 gallons

10 decaliters = 1 **hectoliter** (hl) = 2.838 bushels or 26.418 gallons

10 hectoliters = 1 kiloliter (kl) = 35.315 cubic feet or 264.18 gallons

Weights

The standard unit of weight is the gram, equal to 15.432 grains.

10 **milligrams** (mg) = 1 **centigram** (cg) = 0.1543 grains

10 centigrams = 1 decigram (dg) = 1.5432 grains

10 decigrams = 1 **gram** (g) = 15.432 grains

10 grams = 1 decagram (dkg) = 0.3527 ounces

10 decagrams = 1 hectogram (hg) = 3.5274 ounces

10 hectograms = 1 **kilogram** (kg) = 2.2046 pounds

10 kilograms = 1 myriagram (myg) = 22.046 pounds

10 myriagrams = 1 quintal (q) = 220.46 pounds

10 quintals = 1 **metric ton** (MT) = 2204.6 pounds

Measures of Volume

The standard unit of volume is the **cubic meter**, equal to 1.308 cubic yards.

1000 **cubic millimeters** (mm3) = 1 **cubic centimeter**(cm3)

1000 cubic centimeters = 1 **cubic decimeter** (dm3)

1000 cubic decimeters = 1 **cubic meter** (m3), or 1 stere (st)

The **stere** is used for firewood. 1 stere = 0.2759 cord; 1 decistere = 1/10 stere; 1 decastere = 10 stere

Metric Equivalents of U.S. Customary

Measures and Weights

(Based on National Bureau of Standards)

Length

Centimeters = 0.3937 inches	Inch = 2.54 centimeters
Meter = 3.281 feet	Feet = 0.3048 meters
Meter = 1.0936 yards	Yard = 0.9144 meters
Kilometer = 0.6214 miles	Mile = 1.6093 kilometer

Area

Sq. cm = 0.1550 sq. in.	Sq. In. = 6.4516 sq. cm
Sq. meter = 10.764 sq. feet	Sq. Feet = 0.0929 sq. meters
Sq. kilometer = 0.3861 sq. miles	Sq. Mile = 2.590 sq. kilometers

Volume

Cubic cm = 0.06102 cu. in.	Cu. inch = 16.387 cu. cm
Cubic m = 35.31 cu. feet	Cu. foot = 0.02832 cu. meters
Cubic m = 1.308 cu. yards	Cu. yard = 0.765 cu. meters

Capacity

Liter = 61.025 cu. inches	Cu. inch = 0.0164 liters
Liter = 0.0353 cu. feet	Cu. foot = 28.32 liters
Liter = 0.2642 gallons (U.S.)	Gallon = 3.785 liters
Liter = 0.0284 bushel (U.S.)	Bushel = 35.24 liters

Liter = 1000.027 cu. cm

Liter = 1.0567 quart (liquid) or 0.9081 quart (dry)

Liter = 2.2046 pounds of pure water @ 4°C = 1 kg

Weight

Gram = 15.4324 grains
Grain = 0.0648 gram
Gram = 0.03532 oz. avdp.
Oz. Avdp = 28.35 grams
Kilogram = 2.2046 lb avdp.
Lb. Avdp = 0.4536 kilogram
Kilogram = 0.00110 ton (short)
Ton (short) = 907.2 kilograms

Pressure

Kg/cm2 = 14.223 lbs/in2
Lbs/in2 = 0.0703 kg/cm2
Kg/m2 = 0.2048 lbs/ft2
Lbs/ft2 = 4.882 kg/m2
Kg/cm2 = 0.9679 normal atmosphere
Normal atmosphere = 1.0332 kg/cm2
Normal atmosphere = 1.0133 bars
Normal atmosphere = 14.696 lbs/in2

Conversion Factors to Obtain Metric Equivalents

To Convert		Multiply By
From	to	
acre-foot	cubic meter (m^3)	1.233
acre	square meter (m^2)	4.047
barrel (42 gallon petroleum)	cubic meter (m^3)	.159
board-foot	cubic meter (m^3)	.0024
foot	meter (m)	.305
$foot^3$/minute	$meter^3$/second (m^3/s)	.0005
$foot^3$/minute	$meter^3$/second (m^3/s)	.0283
$foot^3$	$meter^3$ (m^3)	.0283
$foot^2$	$meter^2$ (m^2)	.093
foot/hour	meter/second (m/s)	.00008
foot/minute	meter/second (m/s)	.0051
foot/second	meter/second (m/s)	.305
foot-pound (force)	joule (J)	1.356
gallon (U.S. liquid)	$meter^3$ (m^3)	.0038
gallon/minute	$meter^3$/second (m^3/s)	.00006

TABLE 3 COMMON CONVERSION FACTORS

To Convert		Multiply By
From	to	
horsepower (550 ft-lbs)	Watt (W)	745.7
horsepower (U.S.)	HP (metric)	1.0139
horsepower (metric)	HP (U.S.)	.9863
inch	meter (m)	.025
$inch^2$	$meter^2$ (m^2)	.0006
$inch^3$	$meter^3$ (m^3)	.00002
mile (U.S. statute)	meter (m)	1,609
mile/hour	meter/second (m/s)	.447
mile/hour	kilometer/hour (km/h)	1.609
ounce (force)	newton (N)	.278
ounce (mass)	kilogram (kg)	.0284
ounce (fluid)	$meter^3$ (m^3)	.00003
pint (liquid)	$meter^3$ (m^3)	.0005
pound (force)	newton (N)	4.448
pound (force)-inch (torque)	newton-meter (N•m)	.113
pound (force)-foot (torque)	newton-meter (N•m)	1.356
pound (mass)	kilogram (kg)	.453
pound (mass)/$foot^2$	kilogram/$meter^2$ (kg/m^2)	4.882
pound (force)/$foot^2$	pascal (Pa)	47.88
pound (mass)/minute	kilogram/second (kg/s)	.0076
pound (mass)/$foot^3$	kilogram/$meter^3$ (kg/m^3)	16
ton (short, 2000 lb m)	tonnes	.907
ton (short, 2000 lb m)	megagram (Mg)	.91
	(Same as metric tons)	
yard	meter (m)	.914
$yard^2$	$meter^2$ (m^2)	.836
$yard^3$	$meter^3$ (m^3)	.765
$yard^3$/minute	$meter^3$/second (m^3/s)	.0127

TABLE 3 COMMON CONVERSION FACTORS

Conversions

Inches x 25.4 = millimeters
Inches x 2.54 = centimeters
Feet x 304.8 = millimeters
Feet x 30.48 = centimeters
Yard x .9144 = meters
Meters x 1.0936 = yards
Miles x 5,280 = feet
Miles x 1760 = yards
Miles x 1.6098 = kilometers
Millimeters x .03937 = inches
Meters x 3.281 = feet
Kilometers x 3280.9 = feet
Pounds x .4536 = kilograms
Kilograms x 2.2046 = pounds
Tons x .907 = metric tons
Cubic feet x .0253 = cubic meters
Cubic yards x .7645 = cubic meters

Feet	Meters	Inches
1	.3048	12
2	.6096	24
3	.9144	36
3.281	1.0	39.36
4	1.219	48
5	1.53	60
6	1.88	72
6.562	2.0	78.72
7	2.18	84
8	2.44	96
9	2.74	108
9.843	3.0	118.08
10	3.05	120

TABLE 4 METRIC EQUIVALENTS 1'-10'

Decimal Chart - Millimeters to Inches

mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch
.001	.00004	.01	.00039	.21	.00827	.41	.01614	.61	.02402	.81	.03189
.002	.00008	.02	.00079	.22	.00866	.42	.01654	.62	.02441	.82	.03228
.003	.00012	.03	.00118	.23	.00906	.43	.01693	.63	.02480	.83	.03268
.004	.00016	.04	.00157	.24	.00945	.44	.01732	.64	.02520	.84	.03307
.005	.00020	.05	.00197	.25	.00984	.45	.01772	.65	.02559	.85	.03346
.006	.00024	.06	.00236	.26	.01024	.46	.01811	.66	.02598	.86	.03386
.007	.00028	.07	.00276	.27	.01063	.47	.01850	.67	.02638	.87	.03425
.008	.00032	.08	.00315	.28	.01102	.48	.01890	.68	0.2677	.88	.03465
.009	.00035	.09	.00354	.29	.01142	.49	.01929	.69	0.2717	.89	.03504
		.10	.00394	.30	.01181	.50	.01969	.70	.02756	.90	.03543
		.11	.00433	.31	.01220	.51	.02008	.71	.02795	.91	.03583
		.12	.00472	.32	.01260	.52	.02047	.72	.02835	.92	.03622
		.13	.00512	.33	.01299	.53	.02087	.73	.02874	.93	.03661
		.14	.00551	.34	.01339	.54	.02126	.74	.02913	.94	.03701
		.15	.00591	.35	.01378	.55	.02165	.75	.02953	.95	.03740
		.16	.00630	.36	.01417	.56	.02205	.76	.02992	.96	.03780
		.17	.00669	.37	.01457	.57	.02244	.77	.03032	.97	.03819
		.18	.00709	.38	.01496	.58	.02283	.78	.03071	.98	.03858
		.19	.00748	.39	.01535	.59	.02323	.79	.03110	.99	.03898
		.20	.00787	.40	.01575	.60	.02362	.80	.03150	1.00	.03937

Common Fractions Equivalents in Inches and Millimeters

8th	16th	32nd	64th	Inches	MM	8th	16th	32nd	64th	Inches	MM	8th	16th	32nd	64th	Inches	MM	Inches	MM	Inches	MM	Inches	MM
			1	.015625	.397					.35433	9.0		11	22	44	.6875	17.463	1.00	25.4	2.08661	53	3.18897	81
		1	2	.03125	.794				23	.359375	9.128				45	.703125	17.859	1.02362	26	2.12598	54	3.22834	82
				.03937	1.0	3	6	12	24	.375	9.525					.70866	18.0	1.06299	27	2.16535	55	3.26771	83
			3	.046875	1.191				25	.390625	9.922			23	46	.71875	18.256	1.10236	28	2.20472	56	3.30708	84
	1	2	4	.0625	1.588					.3937	10.0				47	.734375	18.653	1.14173	29	2.24409	57	3.34645	85
			5	.078125	1.984			13	26	.40625	10.319					.74803	19.0	1.18110	30	2.28346	58	3.38582	86
				.07874	2.0				27	.421875	10.716	6	12	24	48	.75	19.050	1.22047	31	2.32283	59	3.42519	87
		3	6	.09375	2.381					.43307	11.0				49	.765625	19.447	1.25984	32	2.36220	60	3.46456	88
			7	.109375	2.778		7	14	28	.4375	11.113			25	50	.781250	19.844	1.29921	33	2.40157	61	3.50	88.9
				.11811	3.0				29	.453125	11.509					.7874	20.0	1.33858	34	2.44094	62	3.50393	89
1	2	4	8	.125	3.175			15	30	.16875	11.906				51	.796875	20.241	1.37795	35	2.48031	63	3.54330	90
			9	.140625	3.5272					.47244	12.0		13	26	52	.8125	20.638	1.41732	36	2.50	63.5	3.58267	91
		5	10	.15625	3.969				31	.484375	12.303					.82677	21.0	1.45669	37	2.51968	64	3.62204	92
				.15748	4.0	4	8	16	32	.5	12.700				53	.828125	21.034	1.49606	38	2.55905	65	3.66141	93
			11	.171875	4.366					.51181	13.0			27	54	.84375	21.431	1.50	38.1	2.59842	66	3.70078	94
	3	6	12	.1875	4.763				33	.515625	13.097				55	.859375	21.828	1.53543	39	2.63779	67	3.74015	95
				.19685	5.0			17	34	.53125	13.494					.86614	22.0	1.57480	40	2.67716	68	3.77952	96
			13	.203125	5.159				35	.546875	13.891	7	14	28	56	.875	22.225	1.61417	41	2.71653	69	3.81889	97
	7	14	.21875	5.556						.55118	14.0				57	.890625	22.622	1.65354	42	2.75590	70	3.85826	98
			15	.234375	5.953		9	18	36	.5625	14.288					.90551	23.0	1.69291	43	2.79527	71	3.89763	99
				.23622	6.0				37	.578125	14.684			29	58	.90625	23.019	1.73228	44	2.83464	72	3.937	100
2	4	8	16	.25	6.350					.59055	15.0				59	.921875	23.416	1.77165	45	2.87401	73	7.874	200
			17	.265625	6.747			19	38	.59375	15.081		15	30	60	.9375	23.813	1.81102	46	2.91338	74	11.811	300
				.27559	7.0				39	.609375	15.478					.94488	24.0	1.85039	47	2.95275	75	15.748	400
		9	18	.28125	7.144	5	10	20	40	.625	15.875				61	.953125	24.209	1.88976	48	2.99212	76	19.685	500
			19	.296875	7.541					.62992	16.0			31	62	.96875	24.606	1.92913	49	3.00	76.2	23.622	600
	5	10	20	.3125	7.938				41	.640625	16.272					.98425	25.0	1.96850	50	3.03149	77	27.559	700
				.31496	8.0			21	42	.65625	16.669				63	.984375	25.003	2.00	50.8	3.07086	78	31.496	800
			21	.328125	8.334					.66929	17.0							2.00787	51	.011023	79		
		11	22	.34375	8.731				43	.671875	17.066							2.04724	52	3.14960	80		

Temperature Conversion Table

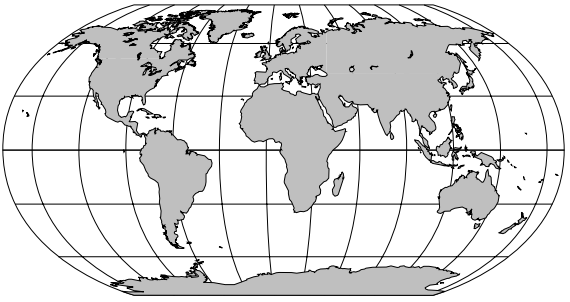
F	C/F	C	F	C/F	C	F	C/F	C	F	C/F	C
-40.0	-40	-40.0	161.6	72	22.2	359.6	182	83.3	860	460	237.8
-36.4	-38	-38.9	165.2	74	23.3	363.2	184	84.4	878	470	243.3
-32.8	-36	-37.8	168.8	76	24.4	366.8	186	85.6	896	480	248.9
-29.2	-34	-36.7	172.4	78	25.6	370.4	188	86.7	914	490	254.4
-25.6	-32	-35.6	176.0	80	26.7	374.0	190	87.8	932	500	260.0
-22.0	-30	-34.4	179.6	82	27.8	377.6	192	88.9	950	510	265.6
-18.4	-28	-33.3	183.2	84	28.9	381.2	194	90.0	968	520	271.1
-14.8	-26	-32.2	186.8	86	30.0	384.8	196	91.1	986	530	276.7
-11.2	-24	-31.1	190.4	88	31.1	388.4	198	92.2	1004	540	282.2
-7.6	-22	-30.0	194.0	90	32.2	392.0	200	93.3	1022	550	287.8
-4.0	-20	-28.9	197.6	92	33.3	395.6	202	94.4	1040	560	293.3
-0.4	-18	-27.8	201.2	94	34.4	399.2	204	95.6	1058	570	298.9
+3.2	-16	-26.7	204.8	96	35.6	402.8	206	96.7	1076	580	304.4
6.8	-14	-25.6	208.4	98	36.7	406.4	208	97.8	1094	590	310.0
10.4	-12	-24.4	212.0	100	37.8	410.0	210	98.9	1112	600	315.6
14.0	-10	-23.3	215.6	102	38.9	413.6	212	100.0	1130	610	321.1
17.6	-8	-22.2	219.2	104	40.0	417.2	214	101.1	1148	620	326.7
21.2	-6	-21.1	222.8	106	41.1	420.8	216	102.2	1166	630	332.2
24.8	-4	-20.0	226.4	108	42.2	424.4	218	103.3	1184	640	337.8
28.4	-2	-18.9	230.0	110	43.3	428.0	220	104.4	1202	650	343.3
32.0	0	-17.8	233.6	112	44.4	431.6	222	105.6	1220	660	348.9
35.6	+2	-16.7	237.2	114	45.6	435.2	224	106.7	1238	670	354.4
39.2	4	-15.6	240.8	116	46.7	438.8	226	107.8	1256	680	360.0
42.8	6	-14.4	244.4	118	47.8	442.4	228	108.9	1274	690	365.6
46.4	8	-13.3	248.0	120	48.9	446.0	230	110.0	1292	700	371.1
50.0	10	-12.2	251.6	122	50.0	449.6	232	111.1	1310	710	376.7
53.6	12	-11.1	255.2	124	51.1	453.2	234	112.2	1328	720	382.2
57.2	14	-10.0	258.8	126	82.2	456.8	236	113.3	1346	730	387.8
60.8	16	-8.9	262.4	128	53.3	460.0	238	114.4	1364	740	393.3
64.4	18	-7.8	266.0	130	54.4	464.0	240	115.6	1382	750	398.9
68.0	20	-6.7	269.6	132	55.6	467.6	242	116.7	1400	760	404.4
71.6	22	-5.6	273.2	134	56.7	471.2	244	117.8	1418	770	410.0
75.2	24	-4.4	276.8	136	57.8	474.8	246	118.9	1436	780	415.6
78.8	26	-3.3	280.4	138	58.9	478.4	248	120.0	1454	790	421.1
82.4	28	-2.2	284.0	140	60.0	482.0	250	121.1	1472	800	426.8
86.0	30	-1.1	287.6	142	61.1	500.0	260	126.7	1490	810	432.2
89.6	32	0	291.2	144	62.2	518	270	132.2	1508	820	437.8
93.2	34	+1.1	294.8	146	63.3	536	280	137.8	1526	830	443.3
96.8	36	2.2	298.4	148	64.4	554	290	143.3	1544	840	448.9
100.4	38	3.3	302.0	150	65.6	572	300	148.9	1562	850	454.4
104.0	40	4.4	305.6	152	66.7	590	310	154.4	1580	860	460.0
107.6	42	5.6	309.2	154	67.8	608	320	160.0	1598	870	465.6
111.2	44	6.7	312.8	156	68.9	626	330	165.6	1616	880	471.1
114.8	46	7.8	316.4	158	70.0	644	340	171.1	1634	890	476.7
118.4	48	8.9	320.0	160	71.1	662	350	176.1	1652	900	482.2
122.0	50	10.0	323.6	162	72.2	680	360	182.2	1670	910	487.8
125.6	52	11.1	327.2	164	73.3	698	370	187.8	1688	920	493.3
129.2	54	12.2	330.8	166	74.4	716	380	193.3	1706	930	498.9
13.28	56	13.3	334.4	168	75.6	734	390	198.9	1724	940	504.4
136.4	58	14.4	338.0	170	76.7	752	400	204.4	1742	950	410.0
140.0	60	15.6	341.0	172	77.8	770	410	210.0	1760	960	515.6
143.6	62	16.7	345.2	174	78.9	788	420	215.6	1778	970	521.1
147.2	64	17.8	348.8	176	80.0	806	430	221.1	1796	980	526.7
150.8	66	18.9	352.4	178	81.1	824	440	226.7	1814	990	532.2
154.4	68	20.0	356.6	180	82.2	842	450	232.2	1832	1000	537.7
158.0	70	21.1									

To convert from C to F, locate C in center column and read F value in column to the left. To convert from F to C, located F in center column and read C value in column to the right. For other temperatures: °C = 5/9 (°F-32); °F = 9/5 (°C-32).

Notes

Notes

Notes



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